

Modular Terminals Technology

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Weidmüller – your partner with innovative connections

Increasing functionality, more compact designs, and increasing complexity of equipment and installations, place higher demands on the selection of the correct connection technology. Simple installation, reliability and easy maintenance of systems and equipment depend on choosing the right type of connection.

Weidmüller is a competent partner in providing professional connectivity solutions tailored to your requirements and can provide full support for all connection technology issues.

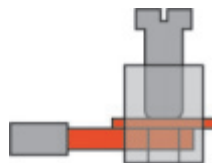
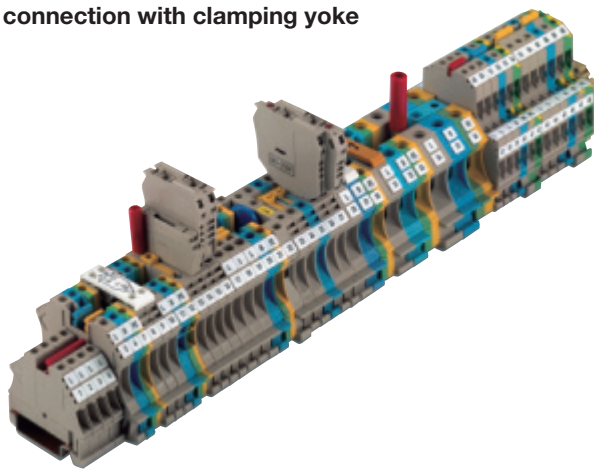
This catalogue brings together many of the fundamental concepts and selection criteria that must be considered when choosing a type of connection.

And if you need to find out more, simply contact us for individual personal advice.

W-Series

Screw connection with clamping yoke

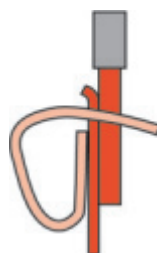
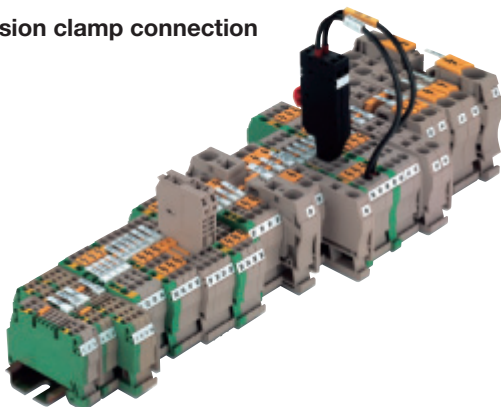
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Z-Series

Tension clamp connection

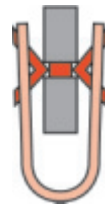
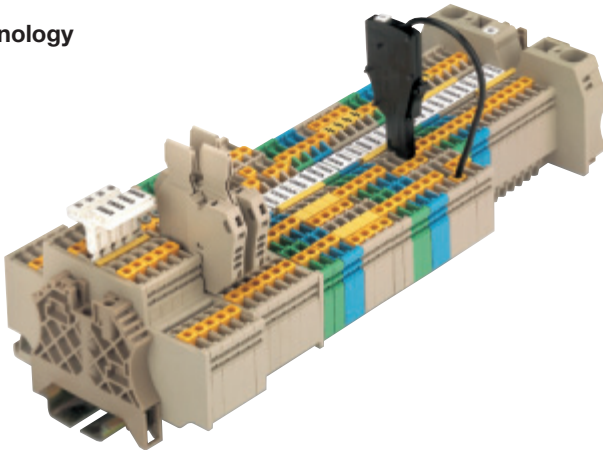
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I-Series

IDC Technology

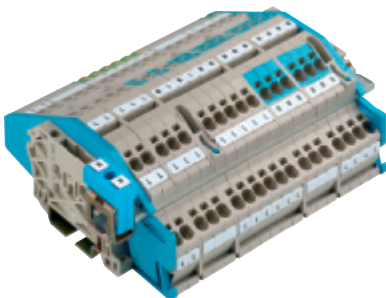
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P-Series

Push In Technology

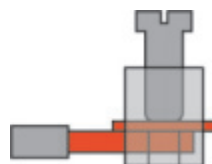
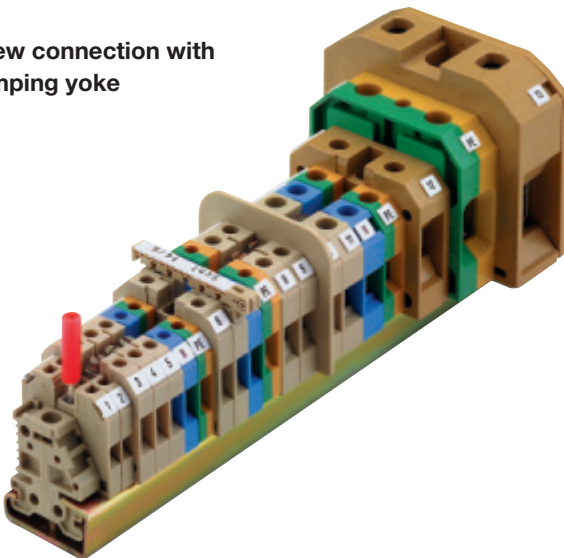
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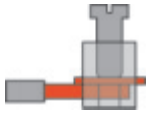
SAK-Series

Screw connection with
clamping yoke

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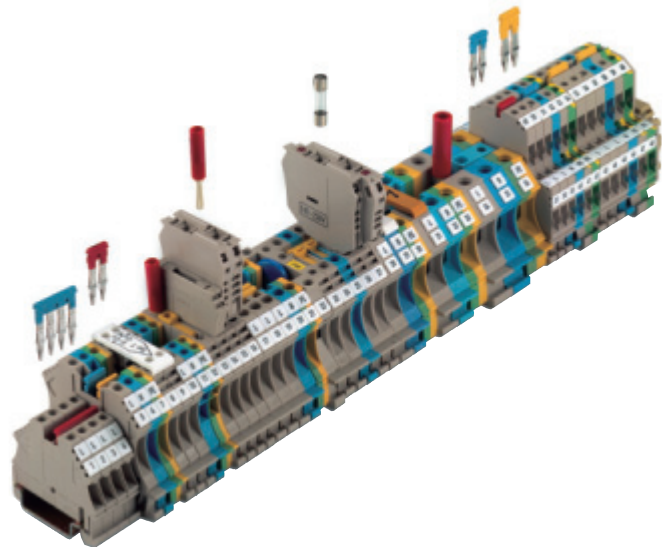
W-Series / Screw connection with clamping yoke



When you need functional perfection right down to the smallest detail, the screw connection modular terminals of the W-Series have long since been setting the standard. The combination of many benefits has still not been beaten and enables the W-Series to maintain a clear lead in the market.

The W-Series provides solutions for conductor cross-sections from 0.05 to 300 mm², and for all customary electrical functions. Plus a choice of plug-in (ZQV) or screw-in (WQV) cross-connections within one modular terminal. This leads to considerable time-savings when compared with other screw clamp terminals on the market.

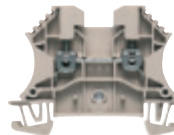
Thanks to the patented design of the Weidmüller screw connection (clamping yoke), it is easy to connect two conductors with the same cross-section at one clamping point and there are also the possibilities to connect multiple wires.



Design

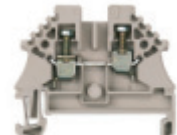
W Standard

- Common profiles for sizes from 2.5 to 10 mm²
- Conductor cross-sections from 0.05 to 300 mm²
- Large clamping range



W Compact

- Small sizes
- Recognisable by the "N" in the terminal designation
- Conductor cross-sections from 0.13 to 120 mm²



Product overview

Rated cross-section	1.5 mm ²		2.5 mm ²		4 mm ²		6 mm ²		10 mm ²		16 mm ²		35 mm ²	
	Standard	Compact	Standard	Compact	Standard	Compact	Standard	Compact	Standard	Compact	Standard	Compact	Standard	Compact
Feed-through terminals														
2 connections	•	•	•	•	•	•	•		•		•	•	•	•
3 and 4 connections	•	•	•	•	•	•			•					
PE terminals														
2 connections	•	•	•	•	•	•	•		•		•	•	•	•
3 and 4 connections	•		•	•	•	•			•					
Fuse terminals			•		•		•							
Disconnect terminals	•		•		•									
Disconnect test terminals					•		•							
3-conductor installation terminals	•		•		•									
N-conductor disconnect terminals	•		•		•		•		•		•		•	
Plug-in terminals	•		•		•									
Initiator/Actuator terminals	•		•		•									
Terminals with electronic components	•		•		•	•								
Miniature terminals for TS 15	•													
Rated cross-section	50 mm ²		70 mm ²		95 mm ²		120 mm ²		150 mm ²		240 mm ²			
	Standard	Compact	Standard	Compact	Standard	Compact	Standard	Compact	Standard	Compact	Standard	Compact		
Feed-through terminals			•	•	•	•	•	•	•		•			
PE terminals		•	•	•	•	•	•	•	•					
N-conductor disconnect terminals						•								

The connection 1

Separation of electrical and mechanical functions.

- The clamping unit (clamping yoke plus clamping screw) is made from hardened steel for excellent high contact force.
- A copper current bar for a low through resistance. The tin-plated surface guarantees minimum contact resistance.

Plug-in cross-connections also possible 2

- Screw-in or plug-in cross-connections as required.
- For screw terminals, the pluggable cross-connection (ZQV) is unique, with considerable time savings.
- Cross-connections with up to 10 poles available as standard for 2.5 and 4.
- 20-pole cross-connections (ZQV) available for custom fabrication.

Easy to use 3

- Can be clipped to or removed from the terminal rail in either direction.
- The screw is always held firmly in place even when fully unscrewed and even when mounted upside-down: specially important for mechanical screwdrivers.
- Recessed clamping screw position provides guide for screwdriver.
- All metal parts fitted captive within the terminal.
- Numerous marking options.

Wemid insulating material

- Non-tracking, CTI 600
- Thermally stable up to 120 °C
- V0 flammability rating to UL 94
- Free from cadmium, halogens and phosphor flame-retardant substances

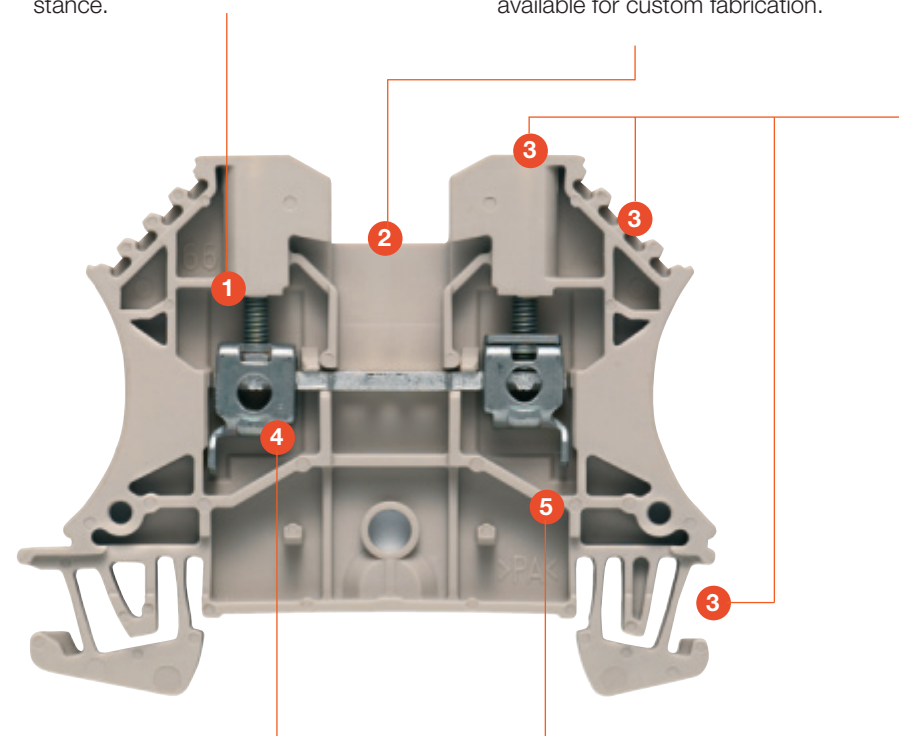
Common profiles

- Identical size from 2.5 to 10 mm²
- Minimum number of different accessories
- Easy planning

Standards and directives

The reliable contact and dependability of the Weidmüller systems are verified by:

- Type tests to IEC 60947-7-1/-2/-3.
- National and international approvals
- A huge portfolio of UL and CSA approvals
- W-Series certified for railway applications
- ATEX approval

**Reliable contact 4**

- The properties of the clamping yoke compensates for temperature-induced changes to the conductor (no gradual loosening).
- No maintenance required (no need to retighten the clamping screw).
- Vibration-resistant connection – many products of the W-Series are approved for railway applications to EN 61373.
- The highest contact force of any connection system.

Safe to use 5

- Shock protection with connected conductors – even with cross-connection.
- Terminals supplied with open clamping point. In addition, the yoke tab prevents incorrect insertion of conductors.
- Indentations on clamping yoke and current bar mesh in such a way ensures that even the smallest conductor can be securely connected, whilst large conductors, and even two or multiple conductors, are held centrally.



Z-Series / Tension clamp connection

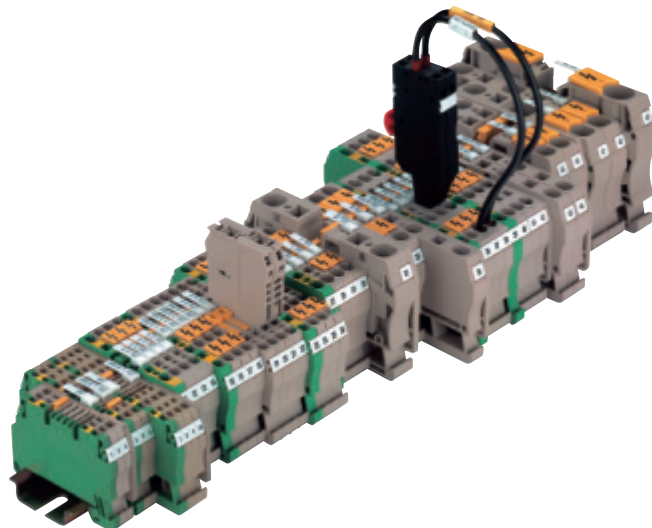


Modular terminals with tension clamp connections, the Z-Series, were specially designed to meet customers' requirements:

Compact size, generous marking surfaces, integral test point, cross-connection options within the Z-Series and to other Weidmüller modular terminals.

The Z-Series terminals have a wide clamping range and can accommodate one or two cross-connection channels.

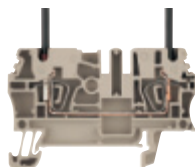
The plug-in standard cross-connections enable potentials to be distributed over any number of terminals.



Design

Z Standard

- Conductor cross-sections from 0.08 to 35 mm²
- Top-entry conductor insertion parallel with screwdriver operation



Z Roof

- Conductor cross-sections from 0.13 to 16 mm²
- Length reduced by up to 36 %
- Conductor and screwdriver inserted at an angle



Product overview

Rated cross-section	1.5 mm ²		2.5 mm ²		4 mm ²		6 mm ²		10 mm ²		16 mm ²		35 mm ²	
	Standard	Roof	Standard	Roof	Standard	Roof	Standard	Roof	Standard	Roof	Standard	Roof	Standard	Roof
Feed-through terminals														
2 connections	•		•	•	•	•	•	•	•		•	•	•	
3 connections	•		•	•	•	•	•	•	•		•			
4 connections	•		•	•	•	•								
2 x 2 connections	•		•											
PE terminals														
2 connections	•		•	•	•	•	•	•	•		•	•	•	
3 connections	•		•	•	•	•	•	•	•		•			
4 connections	•		•	•	•	•								
Fuse terminals														
			•	•			•							
Disconnect test terminals														
			•	•			•							
Power supply terminals														
							•				•	•		
N-conductor terminals														
				•		•		•		•		•		•
2-tier terminals														
	•		•	•		•		•						
3-conductor/distributor terminals														
				•										
Plug-in terminals														
			•											
Miniature block terminals														
			•											
Initiator/Actuator terminals														
			•											
Terminals with electronic components														
			•	•										

The connection 1

In accordance with the Weidmüller contact principle, the electrical and mechanical functions are also kept separate in the Tension clamp connection system.

- Tension clamp made from high-quality stainless steel for optimum contact force
- Copper current bar for minimum through resistance



Plug-in cross-connections 2

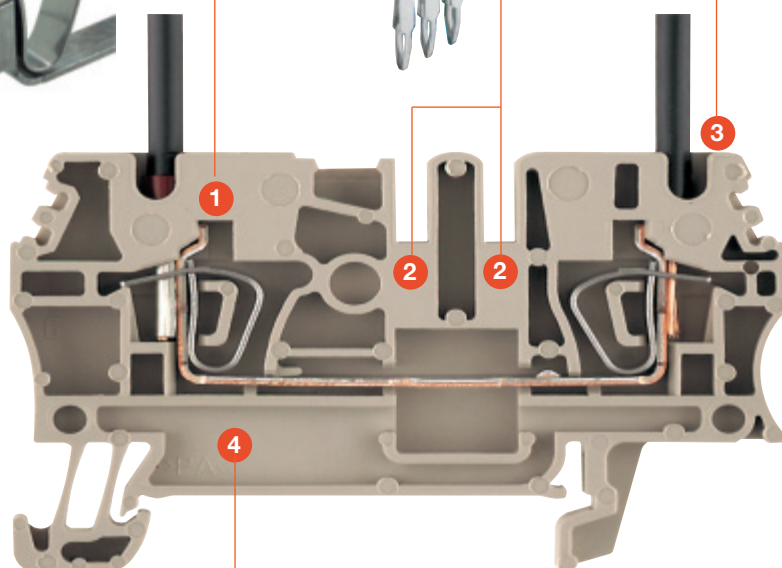
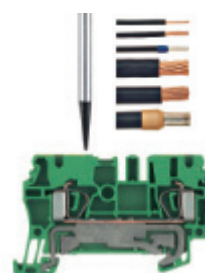
- 2- to 10-pole, or “endless” for custom fabrication
- Full rated current
- Break-out poles for excluding intermediate potentials



Easy to use 3

Practical connection thanks to parallel insertion of conductor and screwdriver

- TOP cable entry
- No special tools required
- Integral test point



The Wemid insulating material

- Non-tracking, CTI 600
- Thermally stable up to 120 °C
- V0 flammability rating to UL 94
- Free from Cadmium, Halogens and phosphor flame-retardant substances

Clarity means reliability

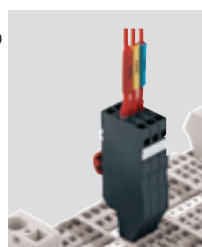
- Easy to use thanks to generous clamping space to IEC 60947-1
- Suitable for connecting conductors from 0.08 to 35 mm²
- For clamping one conductor per clamping point to IEC 60999

Reliable contact 4

- Maintenance-free connection for reliable contact throughout the lifetime of the terminal
- Gas-tight contact zone
- Surface of current bar treated to prevent oxidation
- Absolutely 100 % vibration-resistant
- High contact force

Comprehensive accessories

- Test adapter, test plug
- Can be used with standard and group markers
- End cover plates, partition plates
- Covers
- Reducing sleeves



Standards and directives

The reliable contact and dependability of the Weidmüller systems are verified by:

- Type tests to IEC 60947-7-1/-2/-3
- Supplementary Weidmüller test regimes
- National and international approvals
- ATEX approval



I-Series / IDC Technology



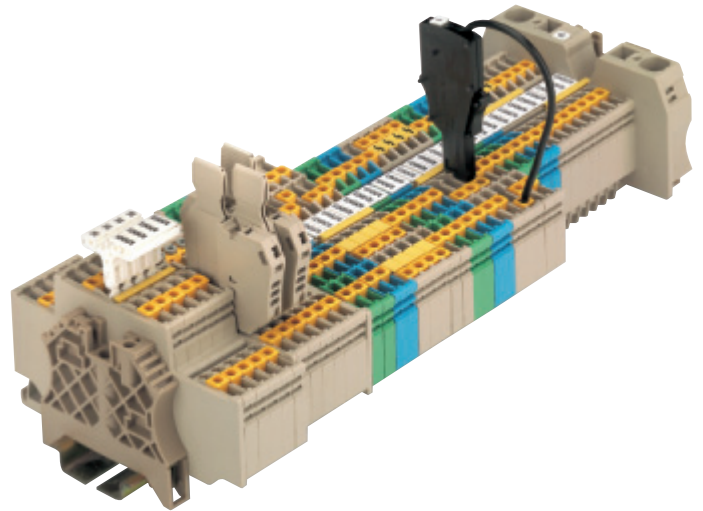
IDC stands for Insulation Displacement Connection. Innovative, more effective, offering greater cost-savings and maximum contact reliability. This method of connection, already tried and tested in telecommunications and electronics, is now available for industrial applications incorporated into modular terminals.

The IDC technology results in minimum work during installation time but still guarantees reliable contact – and all **without stripping, without screwing, without special tools**.

All standardised PVC-insulated conductors with cross-sections between 0.21 and 1.5 mm² (0.5 and 2.5 mm²) are suitable for this type of connection.

Users who wish to connect special conductors should consult Weidmüller first. For all up-to-date information about this type of connection simply visit the website **www.idc2.de**.

If it is not possible to connect a certain type of conductor, the Weidmüller hybrid terminals could represent the best solution. These terminals have an IDC on one side and either a screw or tension clamp connection on the other.



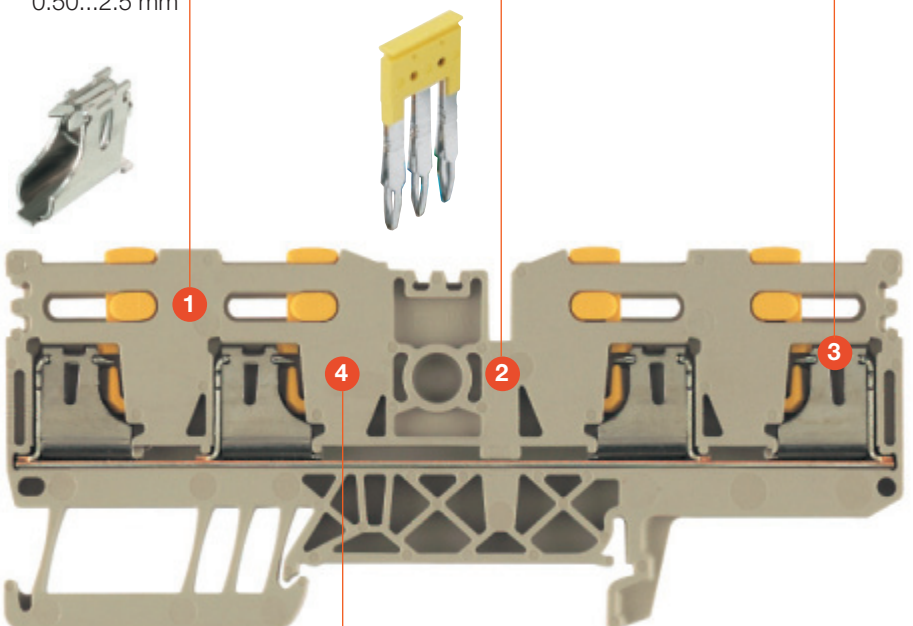
Product overview

Rated cross-section	1.5 mm ²	2.5 mm ²
Feed-through terminals		
2 connections	•	•
3 connections	•	•
4 connections	•	•
PE terminals		
2 connections	•	•
3 connections	•	•
4 connections	•	•
Fuse terminals	•	•
Disconnect terminals	•	•
2-tier terminals	•	
Initiator/Actuator terminals	•	
Plug-in terminals	•	
Hybrid terminals (IDC/screw)		
2 connections	•	•
3 connections	•	•
Hybrid terminals (IDC/clamp)		
2 connections	•	•
3 connections	•	
Terminals with electronic components	•	•

The connection 1

Separating the electrical and mechanical functions or galvanic isolation results in major advantages for this type of connection, too.

- Extremely high contact reliability thanks to the extra clamp (sprung steel)
- Copper current bar for low through resistance
- A wide clamping range for different cross-sections: 0.21...1.5 mm² and 0.50...2.5 mm²



Plug-in cross-connections 2

- 2- to 10-pole, or "endless" for custom fabrication
- Full rated current
- Break-out poles for excluding intermediate potentials
- Electric shock protection (finger-proof) to German standard VBG 4

Maximum ease of use 3

Insert the screwdriver as far as possible into the clamping point, press sideways, and the connection is complete!

A visible, reliable connection.



The Wemid insulating material

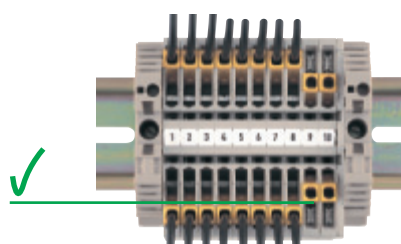
- Non-tracking, CTI 600
- Thermally stable up to 120 °C
- V0 flammability rating to UL 94
- Free from Cadmium, Halogens and phosphor flame-retardant substances

Major time- and cost-savings

- Time-savings of up to 76 % compared with conventional types of connection

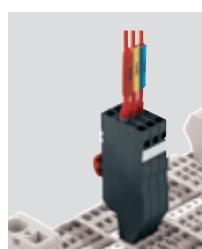
Reliable contact 4

- Reliable contact thanks to the inspection "window"



Comprehensive accessories

- Test adapter, test plug
- Can be used with standard and group marker
- End cover plates, partition plates
- Covers
- Reducing sleeves
- Fuse holder



Standards and directives

IDC2 terminals comply with standards such as:

- Modular terminal standards IEC 60947-7-1/-2/-3
- IDC standard IEC 60352-4
- More stringent Weidmüller tests
- National and international approvals, Germanic Lloyd, Lloyds Register, DNV, RINA, KEMA, KEUR
- ATEX approval



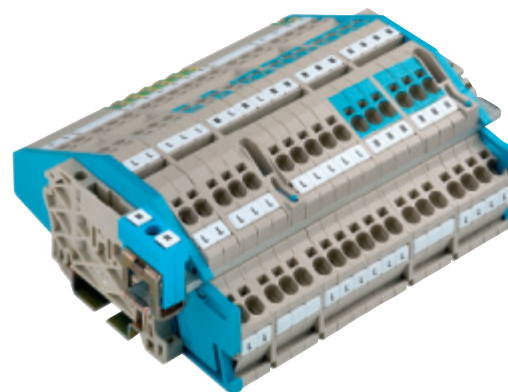
P-Series / Push In Technology



The new range of 3-conductor installation terminals with the Push In system complements our extensive range of modular terminals. Ideally suited for power distribution in building installations, this "roofstyle" terminal design offers fast wiring times and easy maintenance due to its impressive marking options. All the features of a 4 mm² terminal in the space of a 2.5 mm² model. The Push In system terminals accommodate conductor cross-sections from 0.5 to 4 mm² and is conceived as a TOP system, i.e. parallel conductor insertion and clamp actuation to release conductor (from above).

Direct connections = Direct savings

The Push In connection system is a real winner thanks to minimum wiring times plus ease of use. Compared to 3-conductor tension clamp terminals, time-savings of up to 50 % (3.5 s per conductor) are possible when connecting the conductors. The stripped solid conductor is simply pushed fully into the clamping point, and the connection is finished. No tools are required and the result is a reliable, vibration-resistant and gas-tight connection. Even fine-strand conductors with crimped wire end ferrules or ultrasonic-welded conductors can be connected without any problems.



Product overview

The new 3-conductor installation terminals with Push In connections are ideal for combining with the new single-tier installation terminals with tension clamp connections. The busbar position is identical on both types. Consequently, users have a high-performance portfolio – primarily for building installations – at their disposal!

Views with side wall of housing removed



Rated cross-section	1.5 mm ² / 2.5 mm ² / 4 mm ²	6 mm ² / 10 mm ²
3-conductor Push In installation terminals with 10 x 3 busbar		
NT / L / PE	•	
L / L	•	
N / L / PE	•	
L / L / PE	•	
N / L	•	
L	•	
3-conductor Push In installation terminals with ZQV cross-connection		
NT / L / PE	•	
L / L	•	
N / L / PE	•	
L / L / PE	•	

Z-Series installation terminals

Rated cross-section	2.5 mm ²	4 mm ²	6 mm ²	10 mm ²	16 mm ²	35 mm ²
Feed-through terminal	•	•	•	•	•	
PE terminal	•	•	•	•	•	
N-conductor terminal	•	•	•	•	•	•

Push In-Series installation terminals

Rated cross-section	1.5 mm ² / 2.5 mm ² / 4 mm ²	6 mm ² / 10 mm ²	16 mm ²
Feed-through terminal	○	○	○
PE terminal	○	○	○
N-conductor terminal	○	○	○

○ = planned for 2005

The connection 1

The pressure spring clamp for connecting the conductor is mounted separately in the housing to guarantee separation of mechanical and electrical functions in the Push In system, too.

- Rated current 32 A
- Direct connection of solid and fine-strand conductors with wire end ferrules

Plug-in cross-connections 2

Rapid, straightforward potential distribution with the ZQV plug-in cross-connection.

- Standard ZQV cross-connection
- “Endless” cross-connection for custom fabrication

Easy to use 3

The simple Push In system for solid and fine-strand conductors with wire end ferrules shortens the wiring time considerably.

- No additional tools required
- Easy to use in confined installations
- TOP connection (conductor inserted and connection secured from above)

The Wemid insulating material

- Non-tracking, CTI 600
- Thermally stable up to 120 °C
- V0 flammability rating to UL 94
- Free from Cadmium, halogen and phosphor flame-retardant substances

Easy wiring in the most confined spaces

The 3-conductor installation terminals with their Push In connections enable the wiring of AC and three-phase circuits in very confined situations. In particular, when the width available is limited, a large number of cables and wires can still be installed with ease.

Standards and directives

The reliable contact and dependability of the Weidmüller systems are verified by:

- Type tests to IEC 60947-7-1/-2.
- Supplementary test regimes
- Strict QA tests for product quality (accredited to DIN ISO 9002)

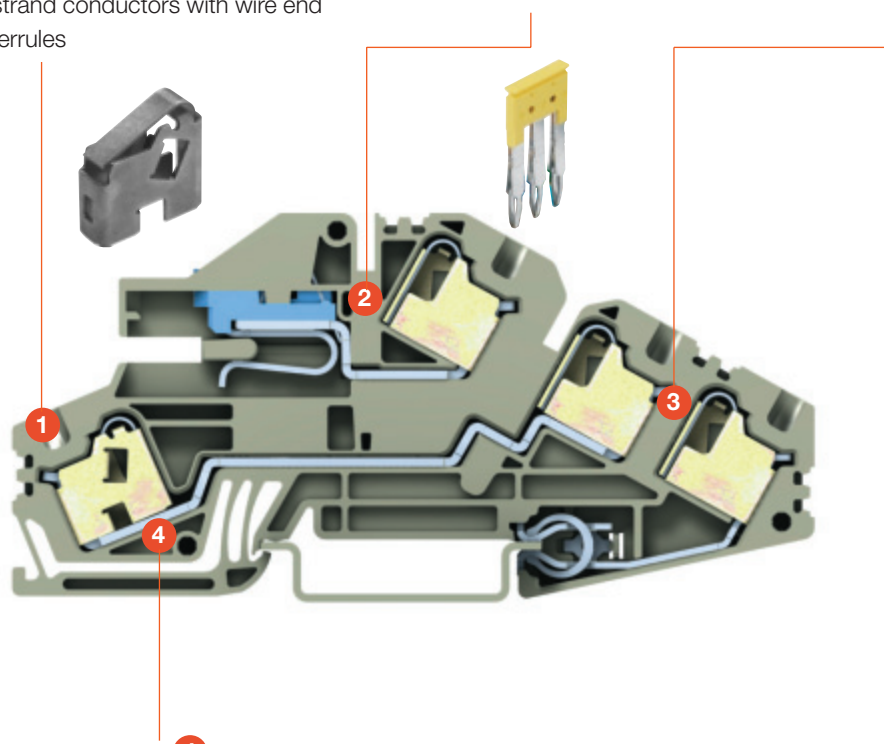
Reliable contact 4

- A stainless steel clamp ensures permanent, secure contact between conductor and current bar; higher pull-out forces required compared to tension-clamp terminals.
- The copper/tin alloy current bar makes a perfect connection with the conductor; this guarantees a very low through resistance.

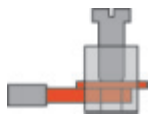
Safe use

The “Push In” contact is designed to prevent incorrect use in many cases.

- Spring path limited by **pressure spring stopper** (protects the pressure spring). This precisely defines the screwdriver position in combination with the plastic enclosure.
- The **conductor stopper** positions the end of the conductor within the connection chamber. It supports the pressure spring for large bending radii outside the terminal and secures the contact to the busbar.



SAK-Series / Screw connection with clamping yoke



Put to the test billions of times

Countless approvals, specifications and the world's most extensive range of terminals allow it to be used in a wide range of different applications.

The right materials for every application

Ambient temperatures are not an issue for the SAK-series thanks to different materials such as polyamide, thermoplastic and temperature resistant ceramic.

Best conductivity and high contact ability

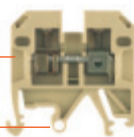
Thanks to its construction, the legendary high tensile steel screw clamp absorbs geometric changes to the connected conductor.



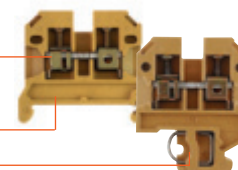
All materials are proofed by the current environmental policy and RoHS compliant.

Design

- Cross-sections from 0.5 to 35 mm²
- TS 32/TS 35 "2 in 1" combination foot



- Cross-sections from 0.5 to 95 mm²
- Special foot for TS 35
- Special foot for TS 32



Product overview

Terminal type	Rated cross-section 2.5 mm²	4 mm²	6 mm²	10 mm²	16 mm²	35 mm²	Flat-blade connection	Faston connection	Clamp Loaded	Solder connection
Feed-through terminals										
PA 6.6 / TS 32	•	•	•	•	•	•		•	•	•
KRG / TS 32	•	•	•	•	•	•	•	•	•	•
PA 6.6 / TS 35	•	•	•	•	•	•		•	•	•
KRG / TS 35	•	•	•	•	•	•	•			
PA 6.6 / combination foot	•	•	•	•	•	•				
PA 6.6 / TS 15	•	•						•		•
2-tier terminals		•								
PE terminals										
PA 6.6 / TS 32	•	•		•	•	•				
PA 6.6 / TS 35	•	•	•	•	•	•				
PA 6.6 / TS 15	•	•								
Fuse terminals										
PA 6.6 / TS 32				•						
PA 6.6 / TS 35				•						
KrG / TS 32				•	•					
KrG / TS 35				•	•					
PA 6.6 / TS 15		•								
PA 6.6 / combination foot		•								
2-tier fuse terminals										
PA 6.6 / TS 32		•								
PA 6.6 / TS 35		•								
PA 6.6 / combination foot		•								
Disconnect terminals										
TS 35		•		•						
PA 6.6 / TS 15		•								
2-tier disconnect test terminals		•						•		
Ceramic terminals		•		•						

The connection 1

Separation of electrical and mechanical functions:

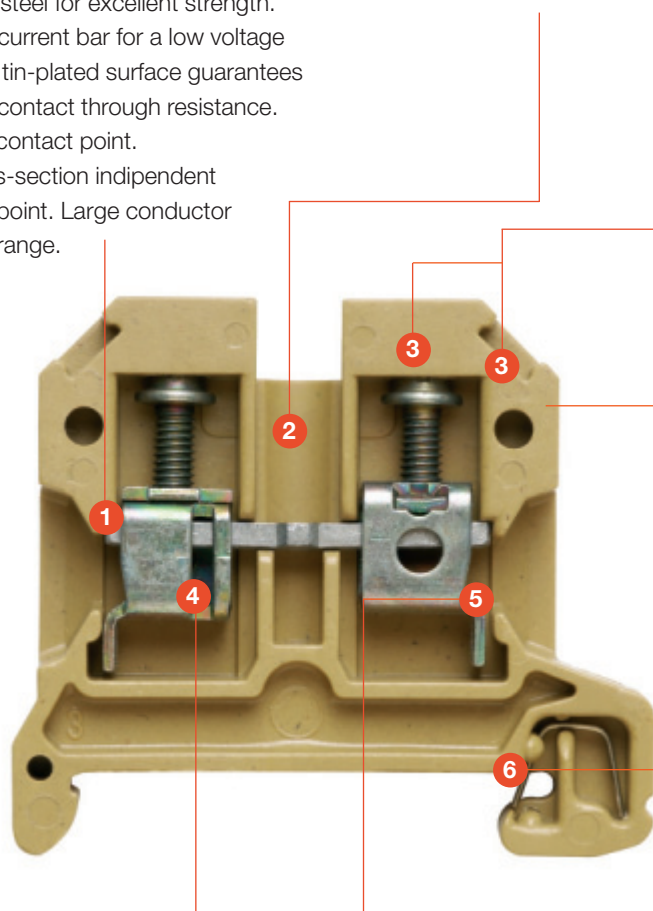
- The clamping unit (clamping yoke plus clamping screw) is made from hardened steel for excellent strength.
- A copper current bar for a low voltage drop. The tin-plated surface guarantees minimum contact through resistance.
- Gas tight contact point.
- High cross-section independent clamping point. Large conductor clamping range.

Cross-connections 2

- User defined number of poles (to extend) by stringing the pre-assembled cross-connection together any number of poles can be connected.

Easy to use 3

- Integrated idle point when loosening the terminal screws – especially important when using mechanical screwdrivers
- Screw driver guiding by countersunk arranged countersinking of clamping screws
- All parts fitted captive within the terminal.
- Numerous labelling options.

**Insulating materials and max. temperatures**

- PA – 100 °C
- KrG – 130 °C
- EP – 160 °C
- Ceramic – 250 °C

3 differing rail mounting feet styles 6**Reliable contact 4**

- The elastic properties of the clamping yoke compensates for temperature-induced changes to the conductor (no gradual loosening).
- Vibration-resistant connection – no need to retighten the clamping screw.
- The highest contact force of any connection system on minimum space.

Safe to use 5

- Terminals supplied with open clamping point.
- The yoke tab prevents incorrect insertion of conductors.

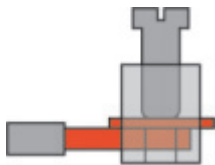
Standards and directives

The reliable contact and dependability of the Weidmüller systems are verified by:

- Type tests to IEC 60947-7-1/-2
- National and international approvals
- A huge portfolio of UL and CSA approvals
- ATEX approval

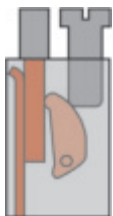


The connection systems – it's your choice



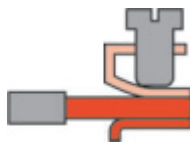
Clamping Yoke

The **Weidmüller Clamping Yoke System** is an optimum combination of the specific properties of steel and copper. This clamping yoke system has proved its worth in billions of Weidmüller products over the years. Both the clamping yoke and the clamping screw are made from hardened steel. This clamping yoke arrangement generates the necessary contact force. The clamping yoke presses the incoming conductor against a current bar made of copper or high-quality brass. The hardened Weidmüller clamping yoke ensures a gas-tight, vibration-resistant connection between conductor and current bar.



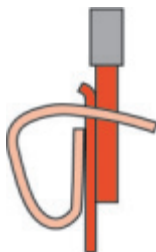
TOP Connection

The Weidmüller **TOP Connection System** ensures that the conductor can be inserted and the clamping screw tightened from the same direction. Such an arrangement eases the wiring work in certain installations, e.g. when there is little space at the sides in terminal boxes. The TOP connection system combines the specific properties of steel and copper. The hardened steel lever presses the conductor directly against a current bar made of copper or high-quality brass. The high contact force guarantees a gas-tight connection between conductor and current bar.



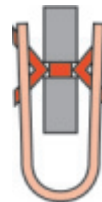
Leaf Clamp Connection

Weidmüller's patented **Leaf Clamp Connection System** is a screw connection system for large conductor cross-sections. The insertion of large conductors into the clamping point is made easier here by the fact that the clamping unit can be removed first. The conductor can then be placed directly on the current bar before re-inserting the clamping unit and tightening the screw to grip the conductor.



Tension Clamp Connection

The **Weidmüller Tension Clamp System** functions similarly to the tried-and-tested clamping yoke. Here again, the mechanical and electrical functions are kept separate. The tension clamp made from high-quality rust resistant and acid-proof steel pulls the conductor against the tinned copper current bar. Treating the copper in this way ensures low contact resistance and high corrosion resistance. The compensating effect of the tension clamp ensures a secure contact for the lifetime of the terminal.



IDC Technology

The **IDC Technology** is a type of connection for copper conductors that does not require the conductor to be prepared in any way – so no stripping and no crimping.

When connecting the conductor, the insulation of the conductor is penetrated and an electrically conductive contact between conductor and current bar produced at the same time.

The Weidmüller IDC principle, like Weidmüller's other types of connection, again keeps mechanical and electrical functions separate.

A clamp made from corrosion resistant stainless steel presses the current bar onto the conductor and therefore guarantees a low contact resistance and a gas-tight, vibration-resistant connection.



Push In Technology

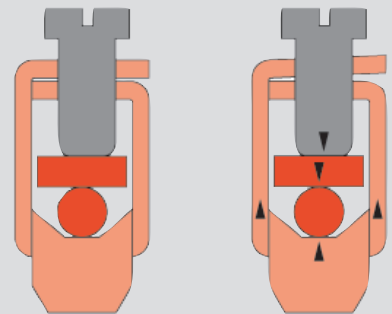
In the **Push In Technology** the stripped solid conductor is simply inserted into the clamping point as far as it will go. And that completes the connection! No tools are required and the result is a reliable, vibration-resistant and gas-tight connection. Even fine-strand conductors with crimped wire end ferrules or ultrasonic-welded conductors can be connected without any problems. A stainless steel compression clamp, which is fitted in a separate housing, guarantees a high contact force between the conductor and the current bar (tin-plated copper). The pull-out force for this system is even higher than that for the tension clamp system. Clamp and conductor stops in a steel housing ensure optimum connection conditions and a guide for the screwdriver needed to detach the conductor.

The principle of vibration resistance

Clamping Yoke

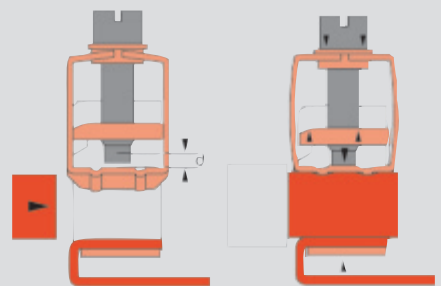
As the clamping screw is tightened, the ensuing force causes the upper threaded part to clamp back and exert a lock-nut effect on the screw.

The Weidmüller clamping yoke system is vibration-resistant. The relaxation of the conductor is compensated for by the elastic behaviour of the Weidmüller clamping yoke. It is therefore not necessary to retighten the clamping screw.



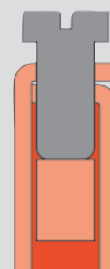
Leaf Clamp

The distance "d" between the shaft of the clamping screw and the leaf clamp causes elastic deformation of the clamp as the screw is tightened. The vibration resistance depends on the magnitude of the clamp force of the leaf clamp, and this force also compensates for relaxation phenomena in the conductor. It is therefore not necessary to retighten the clamping screw.



TOP

Like with the clamping yoke, the force exerted by the steel lever as the screw is tightened forces apart the two threaded parts of the TOP connection. This exerts a locking effect on the screw and guarantees excellent vibration resistance.



International standards



Modular terminals to IEC 60947-7-1

The contents of this standard correspond to the international standard.

IEC 60947-7-1

Low-voltage switchgear and controlgear; Part 7: Ancillary equipment; Section one – terminal blocks for copper conductors.

CENELEC has ratified this standard at European level. Therefore, the standard is valid in the following countries:

Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom.

In conjunction with this and having an overriding importance:

IEC 60947-1

Low-voltage switchgear and controlgear; Part 1: General Rules, EN 60947-1 VDE 0660 Teil 100

Low-voltage switchgear; Part 1: General provisions

Applications VDE 0611-1

(EN 60947-7-1)

(IEC 60947-7-1)

This standard specifies requirements for modular terminals with clamping points with or without screws which are primarily intended for industrial or similar applications and are mounted on a supporting rail that creates the electrical and mechanical connections between copper conductors. The standard is valid for modular terminals for connecting round copper conductors with a cross-section between 0.2 und 300 mm² (AWG 24/600 kcmil), for electric circuits up to 1000 V AC/1000 Hz or up to 1500 V DC.

Note:

This standard also serves as a guide for certain types of modular terminal, e.g. disconnect terminals, which are not covered by their own standards.

Modular terminal / Modular feed-through terminal

An insulating component that supports one or more clamping arrangements insulated from one another and which is designed to be fixed to a supporting rail.

Rated cross-section

The rated cross-section of a modular terminal is the size – as specified by the manufacturer – of the conductor cross-section that can be connected to the terminal, on which certain thermal, mechanical and electrical requirements are based, and which is intrinsic to the marking on the terminal.

The rated cross-section is selected from the following standard cross-sections:

0.2 - 0.5 - 0.75 - 1.0 - 1.5 - 2.5 - 4.0 - 6.0 - 10 - 16 - 25 - 35 - 50 - 70 - 95 - 120 - 150 - 240 - 300 mm².

The modular terminals possess a rated connection capacity that is at least two steps smaller than the rated cross-section. The conductors may be solid, multi-strand or fine-strand components,

if necessary with the ends of the conductors prepared for the connection. Verification of the rated cross-section is carried out with the plug gauges to VDE 0660 part 100.

Rated current IEC 60947-7-1

Test currents to VDE 0611-1 are assigned to the rated cross-sections. There should be no unacceptable temperature rise in the terminal at these rated currents:

mm ²	1.5	2.5	4.0	6.0
A	17.5	24	32	41
mm ²	10	16	25	35
A	57	76	101	125
mm ²	50	70	95	120
A	150	192	232	269
mm ²	150	185	240	300
A	309	353	415	520

Rated voltage IEC 60947-7-1

The rated voltage of a modular terminal is the rated insulation voltage on which the insulation tests and creepage distances are based. They are determined according to DIN VDE 0110-1. The rated voltage is intrinsic to the marking on the terminal.

Rated impulse withstand voltage IEC 60947-7-1

This is the value of a surge voltage to which the modular terminals can be subjected and on which the clearances to VDE 0660 part 100 or DIN VDE 0110-1 are based.

Pollution severity IEC 60947-7-1

The pollution severity specifies the influence of solid, liquid or gaseous foreign matter that could reduce the electric strength of the specific surface resistance.

Pollution severity 3 has been specified for modular terminals for industrial applications: the occurrence of conductive contamination or dry, non-conductive contamination which becomes conductive because condensation is expected.

The minimum clearance is defined in IEC 60947-7-1 in conjunction with the rated impulse withstand voltage.

Operating conditions

The modular terminals can be used in the following standard conditions:

- Ambient temperature -5 °C...+40 °C, average value over 24 h: +35 °C
- Attitudes up to 2000 m above sea level

- Relative humidity 50 % at +40 °C, 90 % at +20 °C

CE marking

The CE marking is carried out by the manufacturer according to the EU directive. Such marking confirms compliance with the directive and is intended for the regulatory authorities. It guarantees the unhindered movement of goods throughout Europe.

Conductor connectors ≥ 50 V~/75 V- comply with the fundamental safety requirements specified in the Low-voltage Directive 73/23/EEG (amended by 93/68/EEG).

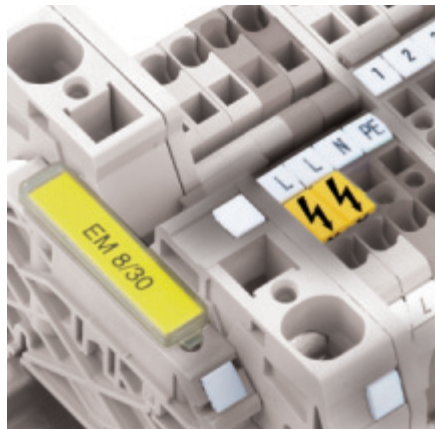
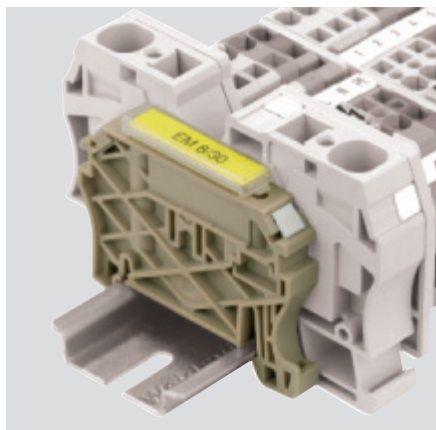
The CE marking according to the CE Marking Directive 93/68/EEG has been compulsory since 1 Jan 1997. The marking must be visible on the packaging. Declarations of conformity are available for inspection by the national regulatory authorities responsible – within the scope of the technical documentation.



The installation of terminal strips

Assembly and end brackets

- Assemble terminal strips from left to right.
- Closed side on the left, open on the right.
- Always close off the open side of a modular terminal with an end cover plate or partition plate (WAP/TW, ZAP/TW and IAP).
- Fit end brackets to both ends of a terminal strip.
- End brackets can be omitted adjacent to PE terminals, with the exception of WDK/PE and ZPE + WPE 1.5 / R 3.5.

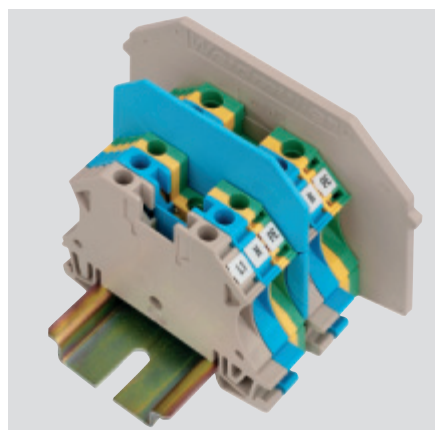


Dimensions

The dimensions specified are those of the enclosing housing to the modular terminal, including fixing components but excluding tolerances. A mounting tolerance of 0.2 mm on the specified terminal width should be allowed for in the planning.

Partition plate

A partition plate is required to create a visual distinction between electric circuits, or to ensure electrical isolation between neighbouring cross-connections.



Separation plate

Separation plates can be retrofitted between cross-connections or sockets on modular terminals up to a terminal width of max. 12 mm.

Maintaining the rated insulation voltage

The required stripping length is specified in mm for every Weidmüller product. These lengths, e.g. 6 ± 0.5 mm, $\geq 10 \pm 1$ mm, must be maintained. This also applies when using wire end ferrules. The outside dimensions of crimped wire end ferrules must comply with IEC 60947-1, 1999 edition.



Combinations of various terminals

- Always fit an end cover plate or partition plate (WAP/WTW, AP/TW and IAP) at changes of profile.
- Always fit end cover plates or partition plates (WAP/WTW, AP/TW and IAP) between adjacent terminals with different rated voltages in order to maintain the respective voltages.
- When a PE terminal is required adjacent to or between associated feed-through terminals of the same series and size, the rated voltage and rated impulse withstand voltage of the feed-through terminals are not affected.

Working on electrical connections with non-insulated screwdrivers



The use of non-insulated screwdrivers is only permitted on electrical systems that have been isolated. To ensure that the electrical components have been disconnected from the power supply, the following five safety rules must be

adhered to before carrying out any work and guaranteed for the duration of the work:

- **Isolation**
- **Prevention of reconnection**
- **Verification of disconnection**
- **Earthing and short-circuiting**
- **Covering or guarding of adjacent parts still connected to the power supply**

These five safety rules represent the safety measures to be taken when working on electrical systems and equipment. The individual measures to be carried out taking into account the operational and local conditions, e.g. exposed high-or low-voltage lines, cables or switchgear, are specified in VDE 0105 part 100.

Tightening torques for clamping screws

Tightening the clamping screw with the appropriate torque guarantees:

- A secure and gas-tight connection,
- No mechanical damage to the clamping parts,
- A voltage drop well below the permissible limit.

The test torque to IEC 60947-1, supplemented by Appendix C1 of IEC 60947-1-7, or the torque as specified by the manufacturer is the lower value of the permissible torque range. This ensures that all tests are satisfied.

The upper value of the permissible torque range is the maximum torque that may be applied by the user.

Unused clamping points connected to the power supply

Suitable covers, e.g. ADP 1...4, must be fitted to prevent electrical shock caused through accidental contact with unused clamping points that could conduct electricity. The clamping screws of all unused clamping points, even those isolated from the electricity supply, must be screwed fully home.

VDE 0105 part 100 Operation of power supplies: work on such systems

Perform troubleshooting operations with a 2-pole voltage tester including test prod to IEC 61243-3.



Products with screw with slotted head		
Thread	Tightening torque	
	Non-ferrous screws	
	Cu 2 (CuZn)	Cu 5 (CuNi 60)
	[Nm]	[Nm]
M 2.5	0.4...0.45	...
M 3	0.5...0.6	0.5...1.0
M 3.5	...	0.8...1.6
M 4	1.2...1.9	1.2...2.4
M 5	2.0...3.0	2.0...4.0
M 6	...	2.5...5.0

Products with screw with slotted head		
Thread	Tightening torque	
	Steel screws	
	min. 8.8	A 2/A 4-80
	[Nm]	[Nm]
M 2.5	0.4...0.8	0.4...0.8
M 3	0.5...1.0	0.5...1.0
M 3.5	0.8...1.6	0.8...1.6
M 4	1.2...2.4	...
M 5	2.0...4.0	...
M 6	2.5...5.0	...

Products with screw with hexagon socket	
Thread	Tightening torque
	Steel screws
	[Nm]
M 4	1.2...2.4
M 5	2.0...4.0
M 6	3.0...6.0
M 8	6.0...12
M 10	10.0...20
M 12	14.0...31
M 16	25.0...60

Making the connection

Two conductors at one clamping point

The optimum solution for allocation of individual circuits, labelling and the breakdown into separate functional units is best achieved by connecting just one conductor at every clamping point.

However, if it is necessary to connect two conductors with the same cross-section at one clamping point, then this is possible with the modular terminals of the W-Series (screw connection).

According to DIN IEC 60999-1, twin wire end ferrules must be used when connecting two conductors at one clamping point in modular terminals of the Z-Series (tension clamp).

But DIN IEC 60999-1 prohibits the connection of two conductors at one point in the screwless IDC system (I-Series).

▪ Continuous current rating with two conductors

The total current of two conductors may not exceed the continuous current rating of the modular terminal. The continuous current rating is the maximum current that a modular terminal can accommodate without the temperature rise exceeding 45 K.

▪ Rated insulation voltage

The rated insulation voltage of the modular terminal does not change when two conductors are connected properly.

Cross-connections systems

Weidmüller can supply the cross-connections WQV and ZQV – fully insulated against electric shock – with various numbers of poles (2- to 20-pole).

Please note that the rated voltage is reduced when using cross-connections.

Protection against electric shock is not provided at the ends of shortened cross-connections.

These cross-connections must be used with partition plates or end cover plates in order to maintain the rated voltage.

Clamping yoke conductor connection for large cross-sections

It is no longer the case that conductors with large cross-sections have to be forced into the clamping point. Instead, they can now be easily laid in the modular terminal.

In addition to the individual form, every type of terminal can also be supplied in the form of 3-, 4- and 5-pole blocks. All the blocks are permanently screwed together and therefore guarantee additional rigidity.

Direct mounting is possible thanks to the elongated holes on the underside of the terminals. Terminal blocks can be screwed directly to mounting plates with a 25 mm pitch.

The other advantages are:

- Constant force transfer through self-adjusting connection system
- Mounting in any direction
- Electric shock protection (finger-proof) to German standard VBG 4, also with cross-connections
- Extremely resistant to distortion



Open cover and remove screw assembly.



Insert conductor and replace screw assembly.



Close cover and tighten screw with Allen key.

The use of aluminium conductors

Weidmüller modular terminals are suitable for the direct connection of **solid round and sector aluminium conductors**.

In contrast to copper, aluminium exhibits certain characteristics that must be taken into account when using this material as a conductor in electrical engineering.

A thin, non-conductive layer of oxide forms immediately on the unprotected surface of the aluminium as soon as it is exposed to the air. This layer increases the contact resistance between the aluminium conductor and the current bar of the modular terminal. And that, in unfavourable conditions, can lead to poor contact which in turn can create a "hot-spot" in these conditions.

And in multi-strand conductors the contact resistances of the individual strands are added together. Despite these disadvantages, aluminium conductors can be connected to Weidmüller modular terminals, provided the reduced rated currents for aluminium conductors and the following installation instructions are adhered to.

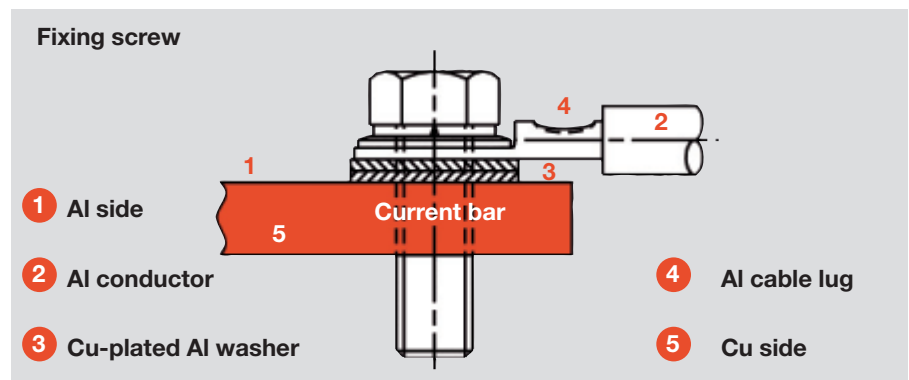
1. Scrape the stripped end of the conductor carefully, e.g. with a knife, to remove the layer of oxide.
Caution: Do not use brushes, files or emery paper because particles of aluminium can be deposited on other conductors.
2. After removing the layer of oxide, coat the end of the conductor with a neutral grease, e.g. acid- and alkali-free Vaseline, and connect it to the terminal immediately.
3. Repeat the above procedure if at any time the conductor is disconnected and reconnected.
4. The above installation instructions are valid for solid round or sector aluminium conductors only.

Solid round and sector conductors				
Terminal type	Rated cross-section	Reduced rated current when connecting an aluminium conductor	Clamping screw thread size	Tightening torque
W-Series	mm ²	"A"		Nm
WDU 2.5	2.5	20	M 2.5	0.5-0.8
WDU 4	4	27	M 3	0.6-1.0
WDU 6	6	35	M 3.5	1.2-1.6
WDU 10	10	48	M 4	2.0-2.4
WDU 16	16	64	M 5	3.0-4.0
WDU 35	35	105	M 6	4.0-6.0
WDU 70	70	163	M 8	10.0-12.0
WDU 120	120	230	M 10	15.0-20.0
SAK-Series				
SAK 2.5	2.5	20	M 2.5	0.5-0.8
SAK 4	4	27	M 3	0.6-1.0
SAK 6	6	35	M 3.5	1.2-1.6
SAK 10	10	48	M 4	2.0-2.4
SAK 16	16	64	M 4	2.0-2.4
SAK 35	35	105	M 6	4.0-6.0
Multi-strand conductors				
W-Series				
WFF 35	35	105	M 6	3.0-6.0
WFF 70	70	163	M 8	6.0-12.0
WFF 120	120	230	M 10	10.0-20.0
WFF 185	185	300	M 12	15.5-31.0
WFF 300	300	409	M 16	30.0-60.0

Installation advice when using flat cable lugs:

When tightening the terminal it is advisable to hold the conductor to prevent deformation of the terminal rail and to avoid twisting the foot of the terminal. When connecting **multi-strand aluminium conductors** to modular terminals, it is advisable to use an aluminium cable lug chosen to match the type of conductor and connected according to the instructions of the cable

lug manufacturer. It is necessary to fit a copper-plated aluminium washer between the aluminium cable lug and the copper current bar of the modular terminal. This is the only way of guaranteeing a reliable transition between the copper and the aluminium. Fit the washer in such a way that the copper side is in contact with the current bar, and the aluminium side in contact with the cable lug.



Derating curve (current-carrying capacity curve)

The **derating curve** shows which currents may flow continuously and simultaneously via all possible connections when the component is subjected to various ambient temperatures below its upper limit temperature.

The **upper limit temperature** of a component is the rated value determined by the materials used. The total of the ambient temperature plus the temperature rise caused by the current load (power loss at volume resistance) may not exceed the upper limit temperature of the component, otherwise it will be damaged or even completely ruined.

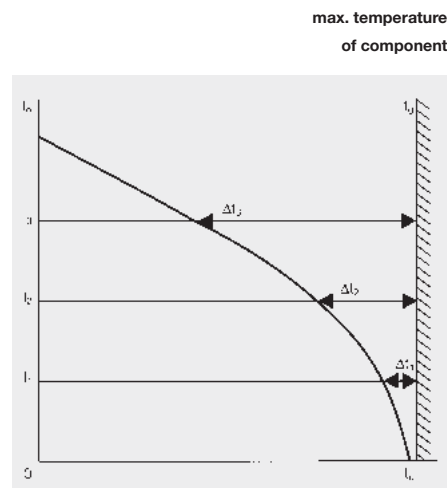
The current-carrying capacity is hence not a constant value, but rather decreases as the component ambient temperature increases. Furthermore, the current-carrying capacity is influenced by the geometry of the component, the number of poles and the conductor(s) connected to it.

The current-carrying capacity is determined empirically according to DIN IEC 60512-3. To do this, the resulting component temperatures t_{b1} , t_{b2} , t_{b3} and the ambient temperatures t_{u1} , t_{u2} , t_{u3} are measured for three different currents I_1 , I_2 , I_3 .

The values are entered on a graph with a system of linear coordinates to illustrate the relationships between the currents, the ambient temperatures and the temperature rise in the component.

The **loading currents** are plotted on the

Base curve



tg = maximum temperature of component
tu = ambient temperature
In = current

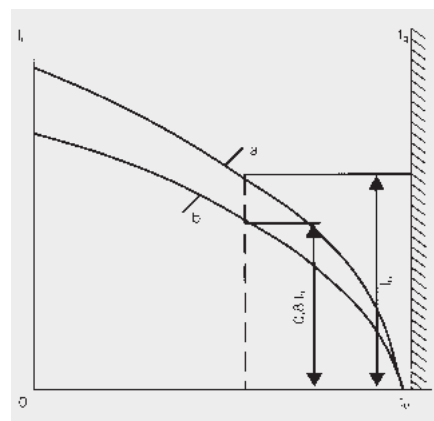
y-axis, the **component ambient temperatures** on the x-axis.

A line drawn perpendicular to the x-axis at the upper limit temperature t_g of the component completes the system of coordinates.

The associated average values of the temperature rise in the component, $\Delta t_1 = t_{b1} - t_{u1}$, $\Delta t_2 = t_{b2} - t_{u2}$, $\Delta t_3 = t_{b3} - t_{u3}$ are plotted for every current I_1 , I_2 , I_3 to the left of the perpendicular line. The points generated in this way are joined to form a roughly parabolic curve.

As it is practically impossible to choose components with the maximum permissible volume resistances for the measurements, the base curve must be reduced.

Derating curve



tg = maximum temperature of component
tu = ambient temperature
In = current
a = base curve
b = reduced base curve (derating curve)

Reducing the currents to 80 % results in the **“derating curve”** in which the maximum permissible volume resistances and the measuring uncertainties in the temperature measurements are taken into account in such a way that they are suitable for practical applications, as experience has shown. If the derating curve exceeds the currents in the low ambient temperature zone, which is given by the current-carrying capacity of the conductor cross-sections to be connected, then the derating curve should be limited to the smaller current in this zone.

The maximum current that a modular terminal can accommodate depends on:

- The temperature rise in the terminal
- The ambient temperature
- The cross-section of the conductor connected to the terminal

An upper limit temperature that may not be exceeded in continuous operation is specified for every Weidmüller modular terminal.

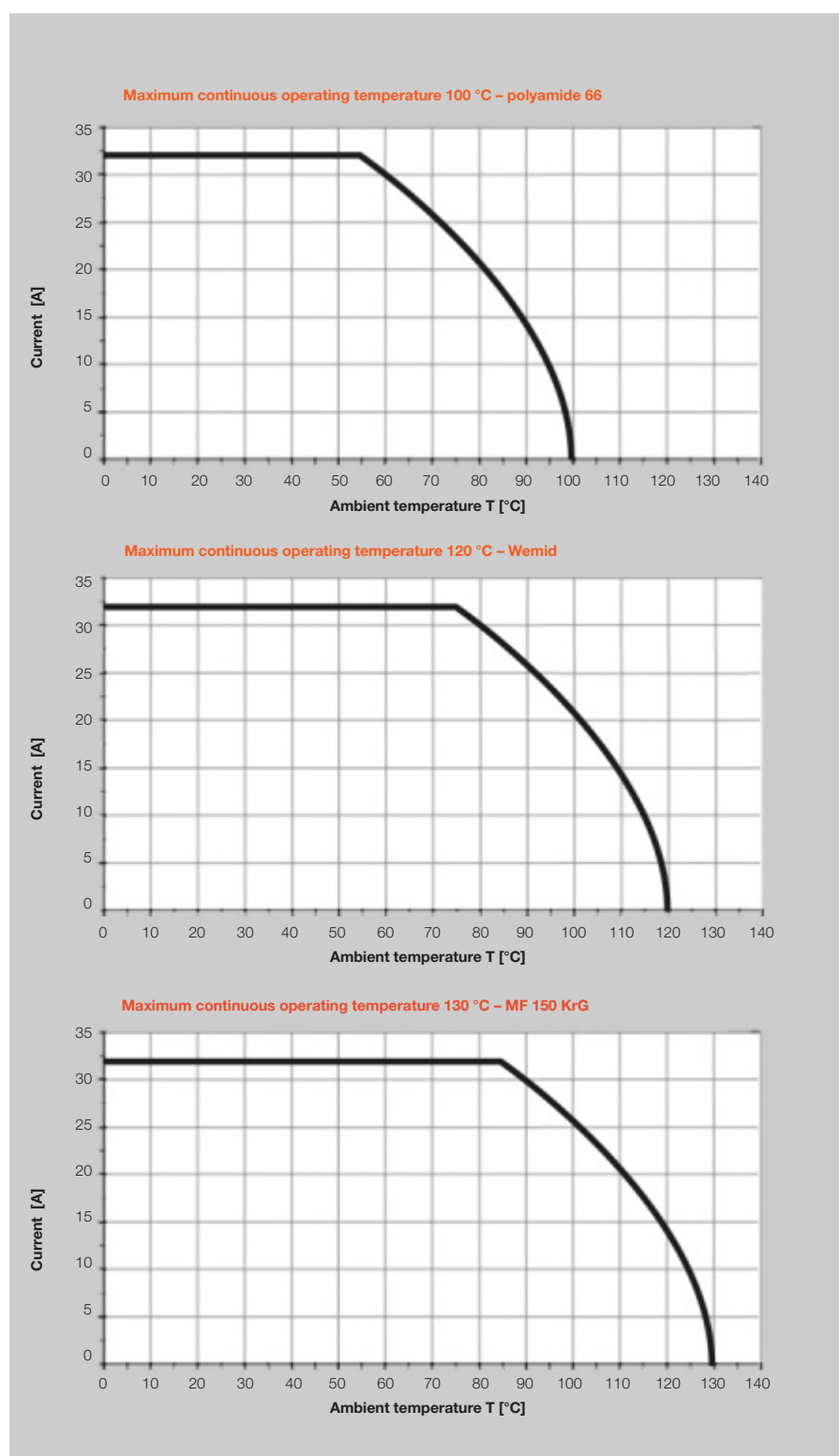
The continuous operating temperature depends on the insulating material used for the modular terminal. According to EN 60947-7-1 the maximum permissible temperature rise of a modular terminal is 45 K.

The continuous operating temperature governed by the insulating material, reduced by the maximum permissible temperature rise in the terminal as given by EN 60947-7-1 results in a maximum ambient temperature in which the modular terminal can be loaded with its rated current at least. The graphs on the right are the current-temperature rise curves for a rated current of 32 A and the following three insulating materials:

- Thermoplastic (polyamide 66)
- WEMID
- Thermosetting plastic (MF 150 KrG)

Depending on the insulating material used, the rated current can be carried up to an ambient temperature of 55 °C for PA 66, 75 °C for the Weidmüller insulating material WEMID, or 85 °C for thermosetting plastic insulating materials (KrG). Above these temperature limits, the current should be reduced as shown on these graphs.

Derating curves



Insulating materials

In order to do justice to the most diverse requirements placed on our products, it is necessary to use different insulating materials tailored to the needs of the applications. None of the insulating materials used by Weidmüller contain any hazardous substances. Above all they can be considered RoHS compliant in accordance with the Restriction of Hazardous Substances in Electrical and Electronic Equipment Directive 2002/95/EC. Furthermore, our insulating materials contain neither pigments based on heavy metals nor lead to the formation of dioxin or furan.

Plastic Abbreviation	Ceramics	Thermosetting plastics	
	Ceramics	Gemin KrG	Epoxy resin EP
	<p>Ceramics are excellent materials for electrical engineering because they fulfil all the requirements. Ceramics are resistant to heat, fluid and sparks, and are tested for leakage currents. Thanks to their high mechanical strength, low losses and good heat resistance, these materials have a very high chemical stability and are preferred because of their very low wear.</p>	<p>Thermosetting plastics exhibit high dimensional stability, low water absorption, extremely good resistance to leakage currents and excellent fire resistance.</p> <p>The continuous operating temperatures are higher than those of thermoplastics. At higher thermal loads the deformation resistance of thermosetting plastics is better than that of thermoplastics.</p> <p>The disadvantage in comparison with thermoplastics is the reduced flexibility of thermosetting plastics.</p>	
	Insulating material	Melamine resin moulding compound, MF Type 156 (DIN EN ISO 14 528) inorganic filler	Epoxy resin with inorganic filler
Colour	white	medium yellow	black
Description	<p>highest continuous operating temperature</p> <p>high fire resistance</p> <p>fluids-repellent</p> <p>high resistance to leakage currents</p> <p>inherently flame-retardant</p>	<p>high continuous operating temperature</p> <p>high fire resistance</p> <p>high resistance to leakage currents</p> <p>inherently flame-retardant</p>	<p>very good electrical properties</p> <p>very high continuous operating temperature</p> <p>resistant to high-energy radiation</p> <p>halogen- and phosphor-free flame-retardant agent</p>
Properties			
Specific volume resistance to IEC 93	$\Omega \times \text{cm}$	-	10^{11}
Electric strength to IEC243-1	kV / mm	>10	10
Tracking resistance (A) to IEC 112	CTI	≥ 600	≥ 600
Upper max. permissible temperature	°C	250	130
Lower max. permissible temperature, static	°C	-60	-60
Flammability class to UL 94	V-0 (5 V-B)	V-0 (5 V-A)	V-0
Fire behaviour to railway standard			

Thermoplastics

Wemid	Polyamide PA	Polyamide PG GF	Polybutylene terephthalate, PBT	Polycarbonate PC
<p>Wemid is a modified thermo-plastic whose properties have been specially devised to suit the requirements of our connectors.</p> <p>The advantages in comparison with PA are the better fire protection and the higher continuous operating temperature. Wemid fulfils the strict requirements placed on applications for railway rolling stock to NF F 16-101.</p>	<p>Polyamide (PA) is one of the most common commercial plastics. The advantages of this material are its very good electrical and mechanical properties, its flexibility and resistance to breakage. Furthermore, owing to its chemical structure PA achieves good fire resistance even without the use of flame-retardant agents.</p>	<p>Glass fibre-reinforced polyamide (PG GF) offers excellent dimensional stability and very good mechanical properties. That makes this material ideal for use in end brackets. Compared with unreinforced PA, this material can achieve UL 94 flammability rating HB.</p>	<p>This thermoplastic polyester (PBT) offers excellent dimensional stability (and is therefore ideal for plug-in connectors) and a high continuous operating temperature. But the resistance to leakage currents is lower than other insulating materials.</p>	
special Weidmüller insulating material	insulating material	insulating material	with or without glass fibre reinforcement depending on application	with or without glass fibre reinforcement depending on application
dark beige	beige	beige	orange	grey
<p>higher continuous operating temperature</p> <p>improved fire resistance</p> <p>halogen- and phosphor-free flame-retardant agent</p> <p>low smoke development in fire</p> <p>certified for railway applications to NF F 16-101</p>	<p>flexible, virtually unbreakable</p> <p>good electrical and mechanical properties</p> <p>self-extinguishing behaviour</p>	<p>excellent dimensional stability</p> <p>very good mechanical properties</p>	<p>high dimensional stability</p> <p>good electrical and mechanical properties</p> <p>flame-retardant substances do not lead to the formation of dioxin or furan</p>	<p>high dimensional stability</p> <p>high continuous operating temperature</p> <p>high electrical insulation capacity</p> <p>halogen-free flame-retardant agent</p>
10 ¹²	10 ¹²	10 ¹²	10 ¹³	10 ¹⁶
25	30	30	28	≥ 30
600	600	500	200	≥ 175
120	100	100	115 / 130	115 / 125
-50	-50	-50	-50	-50
V-0	V-2	HB	V-0	V-2 / V-0
I2 / F2 *)				I2 / F2
*) also certified to LUL E 1042				

Testing the contact stability

Requirements

IEC 60947-7-1 calls for clamping points to guarantee a permanent and reliable mechanical and electrical connection.

Tests

Standardised tests ensure that the conductor connections fulfil the provisions specified in the standards. IEC 60947-7-1 prescribes a number of tests for conductor connections in modular terminals. One or more terminals of a certain type are tested to ensure conformity with certain limiting values.

- Insulation test
- Verification of voltage drop
- Short-time withstand current test
- Ageing test for modular terminals with tension clamps and IDCs

Special tests

Further tests can be carried out that exceed the prescribed scope of the standard tests. These can be performed either according to the judgement of the manufacturer or as agreed between manufacturer and user. For instance, Weidmüller carries out tests for:

- **Vibration resistance**
- **Self-resonance vibration behaviour**
- **Shock resistance and vibration**
- **Cold**
- **Dry heat**
- **Damp heat**
- **Salt spray**
- **Sulphur dioxide**
- **Hydrogen sulphide vapour**
- **Gas-tightness**

Contact stability

The high contact stability and reliability of the Weidmüller systems are verified by:

1. Type tests to IEC 60947-7-1
2. More stringent Weidmüller tests
3. National and international approvals
4. Practical applications, i.e. the use of our systems in tough industrial conditions, e.g. potentially explosive conditions

Contact stability

1. Type tests to IEC 60947

2. More stringent Weidmüller tests

2.1 Mechanical tests

Vibration test to Weidmüller specification

Self-resonance vibration behaviour to IEC 60068-2-6

Shock and vibration test to IEC 61373

2.2 Operating environment tests

Cold to EN 60068-2-1

Dry heat

to IEC 60512-6 test 11c

Steady-state damp heat

to IEC 60068-2-30

Cyclic damp heat

to IEC 60068-2-30

Salt spray to IEC 60068-2-11

Sulphur dioxide SO₂

to IEC 60068-2-42

Hydrogen sulphide vapour H₂S

to IEC 60068-2-43

Gas-tightness to IEC 60512-6 test 11n

Designing the clearances and creepage distances of electrical equipment



Since April 1997 the provisions of DIN VDE 0110-1 "Insulation coordination for electrical equipment in low-voltage installations" have applied to the design of clearances and creepage distances.

DIN VDE 0110-1 includes the modified version of IEC report 664-1 (see also IEC 664-1/Oct 1992).

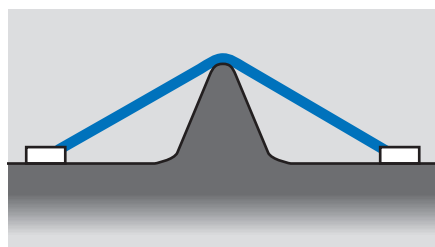
The rated data resulting from these provisions – where applicable – are given in this catalogue for each product.

The following relationships result from the insulation coordination provisions when designing the clearances and creepage distances:

Clearances

The design of the clearances depends on the following factors:

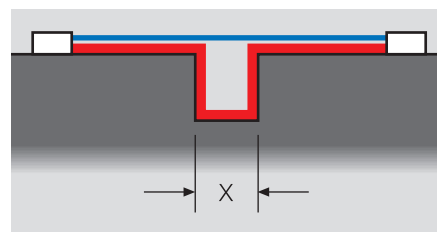
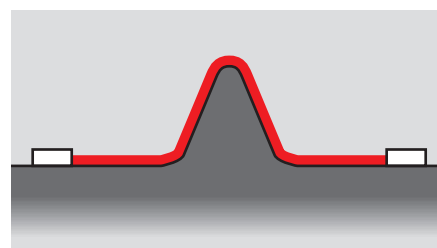
- The overvoltage expected
impulse withstand voltage
- **Overvoltage precautions** taken
- Protective measures against soiling
pollution severity



Creepage distances

The design of the creepage distances depends on the following factors:

- the intended
rated voltage
- the insulating materials used
insulating materials group
- protective measures against soiling
pollution severity



Slots are taken into account when measuring creepage distances if their minimum width x is as given in the following table:

Pollution-severity	min. width x [mm]
1	0.25
2	1.0
3	1.5
4	2.5

If the associated clearance is < 3 mm, the smallest slot width may be reduced to $1/3$ of this clearance.

Insulation test

Testing the short-time withstand current

Standards:

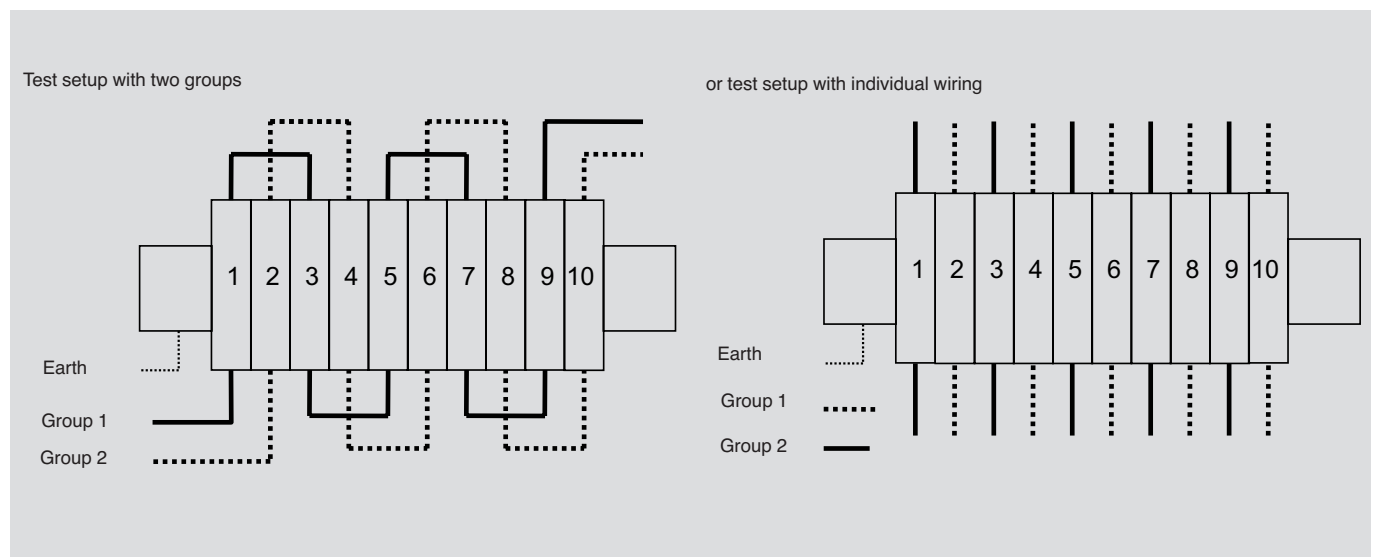
DIN EN 60947-1 section 8.3.3.4.1 / Dec 2002
 DIN EN 60947-7-1 section 8.4.3 / Jul 2003
 LPV 2203

Implementation:

Mount five new modular terminals on a terminal rail and wire them with the most unfavourable combination of conductors and cross-sections. Tighten screws with the torques given in

Table 4 of DIN EN 60947-1. The sine-wave test current (50 Hz) should comply with Table 12 A of DIN EN 60947-1. Connect the voltage initially between two neighbouring modular terminals and then between all the interconnected terminals and the mounting rail. Increase the voltage with max. 200 V/s and apply it for at least 5 s.

Tighten unused clamping screws to simulate the clamping of a conductor with the maximum possible cross-section. (The practical, but most unfavourable mounting conditions must be considered.)



Testing the short-time withstand current

EN 60947-7-1 section 7.2.3 / Jul 2002

For this test, connect the maximum possible conductors to the modular terminals.

Via the conductor apply a current of 120 A/mm² for a duration of 1 s to the cross-section connected.

Example of a 35 mm² modular terminal with a rated connection of 35 mm² to 1k with I = 4200 A.

In addition, determine the voltage drop before and after the test.

Standard

IEC 60947-7-1 section 7.2.3 / Jul 2002

Implementation

Subject the specimens to a 120 A/mm² current surge for a duration of 1 s related to the cross-section connected.

Verification of impulse withstand voltage

Temperature rise test

Thermal short-circuit rating

Impulse withstand voltage

1. Method

Method for verifying the impulse withstand voltage strength for electrical equipment in low-voltage installations.

2. Test specimens

At min. 10 contact points, using accessories if these reduce the clearances.

3. Means of testing

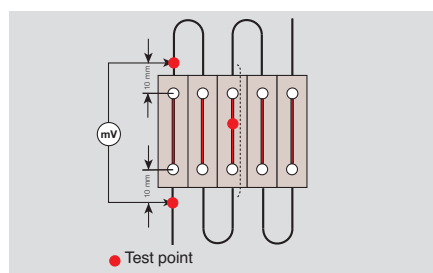
Hafely impulse generator type PU 12, plus oscilloscope if necessary.

4. Implementation

Wiring: Wire the contact points with the largest possible solid conductor (rated cross-section). If the clearances are reduced when using conductors with wire end ferrules, carry out the electric strength test with corresponding conductors and ferrules. In the case of PCB plug-in connectors or PCB terminals, do not solder these to the PCB.

Temperature rise test

IEC 60947-7-1 section 7.2.1 / Jul 2003
Perform the test simultaneously on five adjacent modular terminals. Connect these in series with PVC-insulated conductors with the rated cross-section. Carry out the test with a single-phase AC supply until a constant temperature is reached.



The test current is specified in amperes (A).

It corresponds to the rated current of the terminal.

During the test, no part of the modular terminals in the middle may exhibit a temperature rise exceeding 45 K.

Rated cross-section mm ²	Test current A
0.2	4
0.5	6
0.75	9
1	13.5
1.5	17.5
2.5	24
4	32
6	41
10	57
16	76
25	101
35	125
50	150
70	192
95	232
120	269

Verification of thermal short-circuit strength

IEC 60947-7-1 section 8.3.4

The purpose of this test is to prove the ability to withstand a thermal shock, e.g. triggered by a short-circuit. The test is carried out on a modular terminal mounted according to the instructions of the manufacturer, wired with a solid or multi-strand conductor with the largest possible cross-section for this terminal.

A modular terminal must be in a position to withstand the rated short-time current for a duration of 1 s. The short-time current corresponds to a current density of 120 A/mm² related to the rated cross-section.

Thermal short-circuit

Test	Requirements
Nominal cross-section	2.5 mm ² /1.5 mm ²
AC test current	
120 A/mm ²	300 A/180 A
Clamping screw torque	0.4 Nm
Conductor-conductor voltage drop	
DC test current	2.4 A/1.75 A
U 1 before test	3.2 mV
U 2 after test	1.5 x U1
Mounting rail considered	TS 35

Testing the voltage drop

Voltage drop test

DIN EN 60947-1 section 8.4.4

Besides the temperature rise test already mentioned, measuring the voltage drop is another important factor in the recording and publication of the rated data.

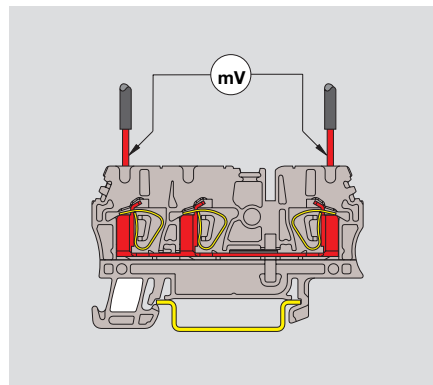
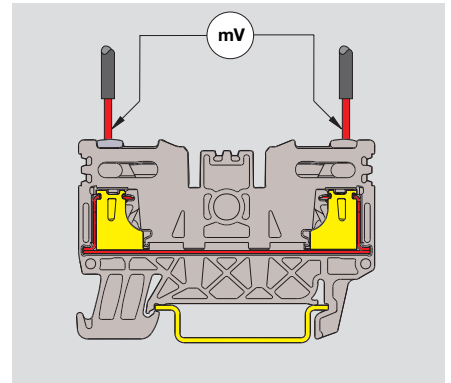
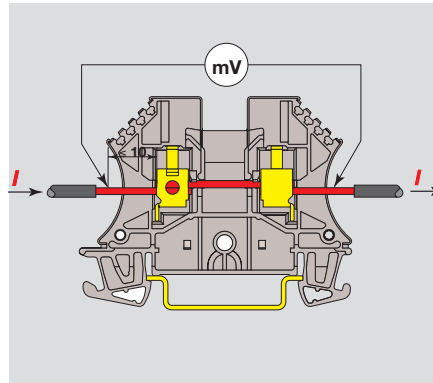
The voltage drop is determined via the input and output of a modular terminal, in other words from conductor to conductor.

The power supply is 10 % of the rated current of the conductor.

The maximum permissible conductor-conductor voltage drop is 3.2 mV. The conductor-conductor voltage drop of modular terminals from Weidmüller is on average < 1 mV.

The maximum permissible change is 50 % of the first value.

Measuring the voltage drop is another way of determining and assessing the quality of the actual clamping point when subjected to loads such as shock and vibration, rapid temperature fluctuations in cold conditions as well as dry or damp heat, industrial atmospheres such as locating in hazardous SO₂ and H₂S gases, and salt spray, in order to verify the gas-tightness of a contact point. The temperature rise test is necessary for investigating the terminal connection as a whole, i.e. including the insulating housing, considering the rated current and overcurrent, plus the short-circuit condition.



Automatic test station for voltage drop measurements

- Measurement of voltage drops
- Measurement of volume resistances (millivolt method) before and after every electrical/mechanical/environmental test



Verifying the tightness of the conductor in the clamping assembly

Verifying the tightness of the conductor in the clamping assembly

The tightness of the conductor must be assessed using two tests:

1. the flexural test
2. the tensile test

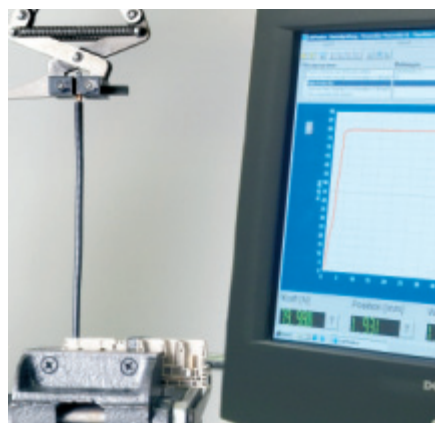
Flexural test

IEC 60947-7-1 section 8.2.2.1 – Test for damage and unintentional loosening. This applies to connections with round copper conductors, i.e. solid, multi-strand and fine-strand conductors with wire end ferrules. Tension clamp connections and IDCs must also withstand this test (where specified). The test involves moving the conductor 135 times continuously with a suitable testing apparatus. During this test the conductor may not slip out of the connection nor break in the vicinity of the terminal.

Tensile test

IEC 60947-7-1 section 8.2.2.2

The conductor must be loaded with the tensile force given in the table below for 1 min evenly and opposite to the direction of insertion.



Test values for flexural and tensile tests on round copper conductors

Conductor cross-section		D** mm	Distance H ± 13 mm mm	Load kg	Tensile force N
mm ²	AWG/MCM				
0.08	28	6.4	260	0.2*	5*
0.13	26	6.4	260	0.2*	10*
0.2	24	6.4	260	0.3	10
–	22	6.4	260	0.3	20
0.5	20	6.4	260	0.3	30
0.75	18	6.4	260	0.4	30
1.0	–	6.4	260	0.4	35
1.5	16	6.4	260	0.4	40
2.5	14	9	279	0.7	50
4.0	12	9.5	279	0.9	60
6.0	10	9.5	279	1.4	80
10	8	9.5	279	2.0	90
16	6	12.7	298	2.9	100
25	4	12.7	298	4.5	135
–	3	14.3	318	5.9	156
35	2	14.3	318	6.8	190
–	1	15.9	343	8.6	236
50	0	15.9	343	9.5	236
70	00	19.1	368	10.4	285
95	000	19.1	368	14	351
–	0000	19.1	368	14	427
120	250	22.2	406	14	427

* values specified by manufacturer

D** diameter of insertion hole



Testing the mechanical strength of connections

The following applies to all tests according to IEC 60947-7-1:

- If the manufacturer calls for a special form of preparation to the end of the conductor, the form of preparation used must be specified in the test report.
- The tests are carried out with the types of conductor specified by the manufacturer.

The following tests must be carried out in order to verify the characteristic mechanical features:

- Tightness of the modular terminal on its mounting (normally a terminal rail)
- Mechanical strength of the connections
- Tightness of the conductors
- Rated cross-section

Tightening torques for clamping screws

Tightening the clamping screw with a torque within the specified range guarantees:

- A secure and gas-tight fixing
- No mechanical damage to the clamping parts
- A voltage drop well below the maximum value permitted

The test torque to IEC 60947-1, supplemented by Appendix C1 of IEC 60947-1-7, or the torque as specified by the manufacturer is the lower value of the tightening torque range.

This will ensure that all test requirements are satisfied. The upper value of the tightening torque range is the maximum torque that may applied to the screw by the user. An electric screwdriver should preferably be set to a torque in the middle of the range.

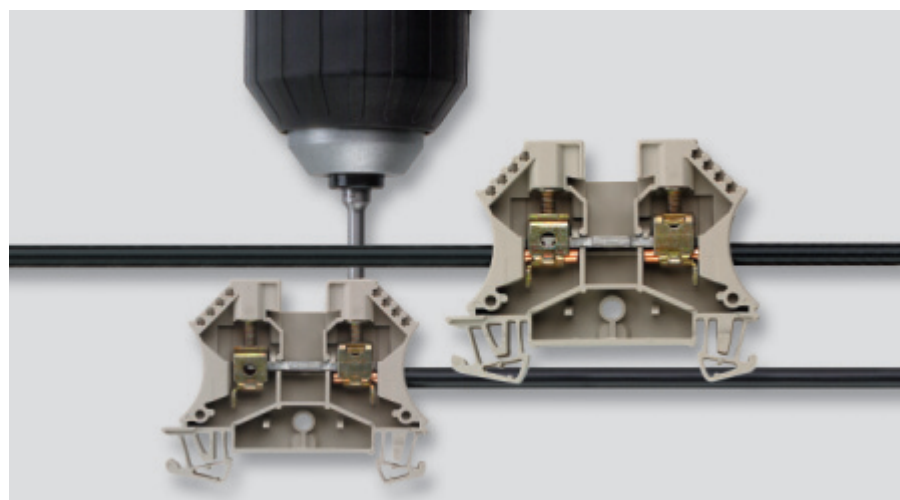
The values given in the table are general figures. Torques specific to the products have been specified directly for each product.

Products with screw with slotted head		
Thread	Tightening torque	
	Steel screws	
	min 8.8	A 2/A 4-80
	[Nm]	[Nm]
M 2.5	0.4...0.8	0.4...0.8
M 3	0.5...1.0	0.5...1.0
M 3.5	0.8...1.6	0.8...1.6
M 4	1.2...2.4	...
M 5	2.0...4.0	...
M 6	2.5...5.0	...

Products with screw with slotted head		
Thread	Tightening torque	
	Non-ferrous screws	
	Cu 2 (CuZn)	Cu 5 (CuNi 60)
	[Nm]	[Nm]
M 2.5	0.4...0.45	...
M 3	0.5...0.6	0.5...1.0
M 3.5	...	0.8...1.6
M 4	1.2...1.9	1.2...2.4
M 5	2.0...3.0	2.0...4.0
M 6	...	2.5...5.0

Products with screw with hexagon socket	
Thread	Tightening torque
	Steel screws
	[Nm]
M 4	1.2...2.4
M 5	2.0...4.0
M 6	3.0...6.0
M 8	6.0...12
M 10	10.0...20
M 12	14.0...31
M 16	25.0...60

Testing the mechanical strength of connections



Implementation

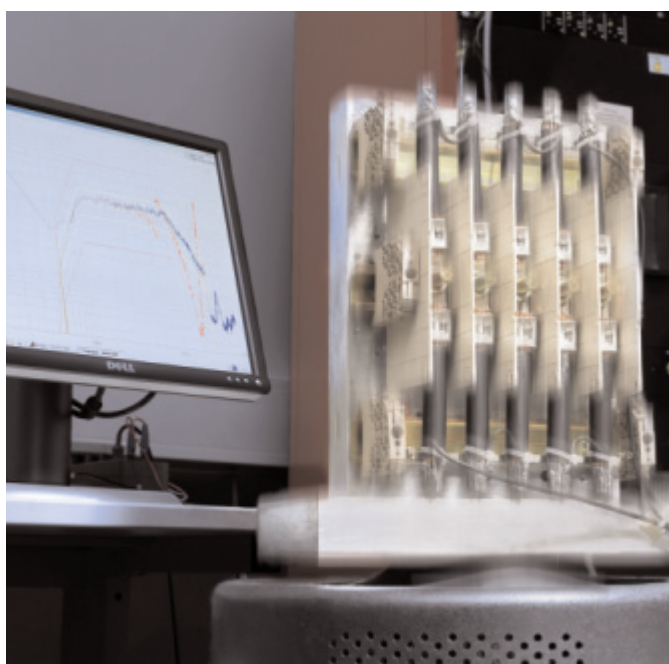
Mount five new modular terminals together in a row on a terminal rail. Connect and disconnect a conductor of the rated cross-section five times. Use a new conductor each time. Tighten the clamping screws with the IEC torque or 110 % of the torque specified by the manufacturer. Measure the voltage drop before and after loading the smallest fine-strand cross-section and the rated cross-section (solid or multi-strand).

Shock and environmental tests

Shock resistance

BV 0440 and BV 0430 shock and vibration tests have been specially designed for maritime conditions.

- Vibration tests to BV 0440, diagrams 2 & 3, for all surface craft
- Shock test to BV 0430, diagram 9, for all surface and under water craft



The climatic influences on electrical components

Electrical components are subjected to a very diverse range of environmental influences. The most significant of these is the climate. But it is not the natural climate that is critical here, rather the climate in the immediate vicinity of an electrical device; influences such as:

- Temperature
- Relative humidity of the air
- Condensation water
- Chemicals
- Composition of the atmosphere
(e.g. corrosive or radioactive gas constituents, particles, rain)

To make sure that electrical equipment and installations operate properly despite climatic influences, standardised environmental tests have been devised.

Environmental tests relevant for connection elements

- Thermal stability
- Industrial atmosphere
- Stress corrosion cracking (SCC)
- Sulphur dioxide SO₂
- Hydrogen sulphide
- Cold
- Dry heat
- Humid, fluctuating climate
- Salt spray

Operating conditions

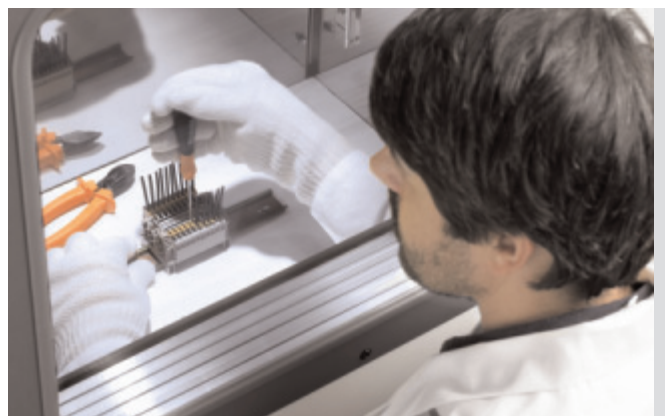
The modular terminals can be used in the following standard conditions:

- Ambient temperature -5 °C...+40 °C,
average value over 24 h: +35 °C
- Altitudes up to 2000 m above sea level
- Relative humidity 50 % at +40 °C,
90 % at +20 °C
- Pollution severity 3

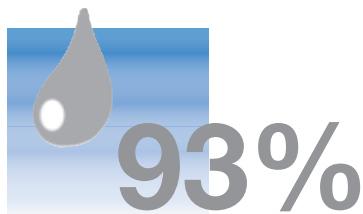
Operating conditions for Weidmüller modular terminals with screw and tension clamp connections

Weidmüller products may be used in operating conditions that exceed the normal conditions stated above, e.g.:

- Ambient temperatures as low as -60 °C
- Ambient temperatures > +55 °C,
and depending on the material
even up to +115 °C
- Current values corresponding to the derating curve



Environmental tests to IEC 60068-2 / IEC 60512-6



Damp heat, steady state

Test to IEC 60512-6 test 11c

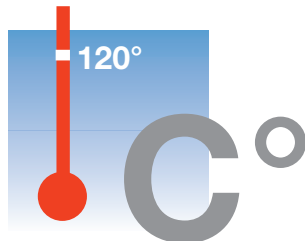
The test verifies whether a component still functions in the prescribed way under defined conditions of “high relative humidity”.

Test method:

Constant temperature of +40 °C at a humidity of 93 %.

Duration: 10 days

Afterwards, the products undergo voltage drop and function tests plus a visual inspection.



Dry heat

Test to IEC 60512-6 test 11i

The test verifies whether a component still functions in the prescribed way under defined “dry heat” conditions.

Test method:

Dry temperature depends on material and can be up to 130 °C.

Duration: 7 days

Afterwards, the products undergo voltage drop and function tests plus a visual inspection.



Sulphur dioxide

Test to IEC 60068-2-42

The purpose of the test is to assess

- The corrosive effects of sulphur dioxide on contact surfaces made from noble metals,
- The tightness and the functional behaviour of electrical connections.

Test method:

10 ppm concentrated SO₂ gas at

+25 °C and 75 % humidity

Duration: 10 days

Stored for 48 h at +80 °C

Afterwards, the products undergo voltage drop and function tests plus a visual inspection.



Cold

Test to IEC 60068-2-1

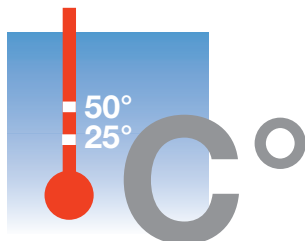
The test verifies whether a component still functions in the prescribed way after being subjected to defined “low-temperature” conditions.

Test method:

Temperature of -65 °C

Duration: 2 days

Afterwards, the products undergo voltage drop and function tests plus a visual inspection.



Damp heat, cyclic

Test to IEC 60068-2-30

The test verifies whether a component still functions in the prescribed way under defined conditions of “high relative humidity in conjunction with cyclic temperature fluctuations”.

Test method:

Cyclic temperature fluctuations:

12 h, +50 °C, 93 %, humidity

12 h, +25 °C, 97 % humidity

Duration: 10 days

Afterwards, the products undergo voltage drop and function tests plus a visual inspection.



Hydrogen sulphide

Test to IEC 60068-2-43

The purpose of the test is to assess the corrosive effects of hydrogen sulphide, as a constituent of polluted air, on contacts, plug-in electrical connections and non-soldered electrical engineering products.

Test method:

1 ppm concentrated H₂S gas at +25 °C and 75 % humidity

Duration: 10 days

Stored for 48 h at +80 °C

Afterwards, the products undergo voltage drop and function tests plus a visual inspection.

Salt spray

Test to IEC 60068-2-11

The purpose of the test is to assess the component's resistance to a salt-laden mist.

Test method:

Salt spray NaCl 50 g/l \pm 10 g/l

at +35 °C \pm 10 °C

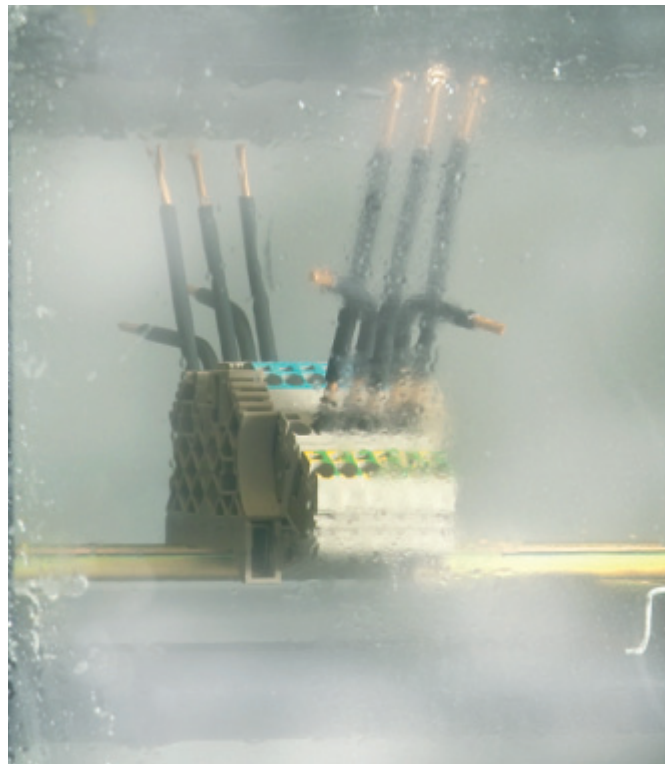
Duration: 2 days

Afterwards, the products undergo voltage drop and function tests plus a visual inspection.

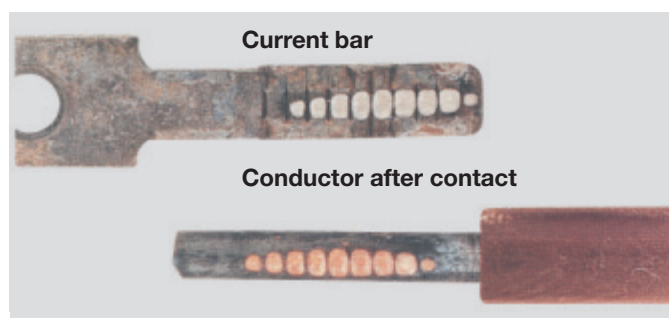
Gas-tightness

IEC 60512-6 test 11n

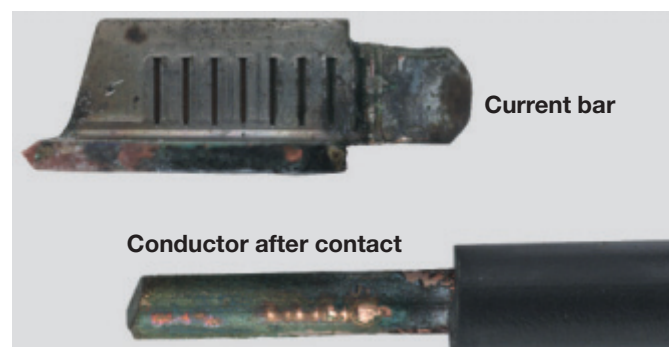
The connection must exhibit gas-tight zones over at least 75 % of the points at which the current bar makes contact with the conductor. The gas-tight zones appear as light-coloured areas contrasting sharply with the areas that have discoloured during the storage period in the test atmosphere.



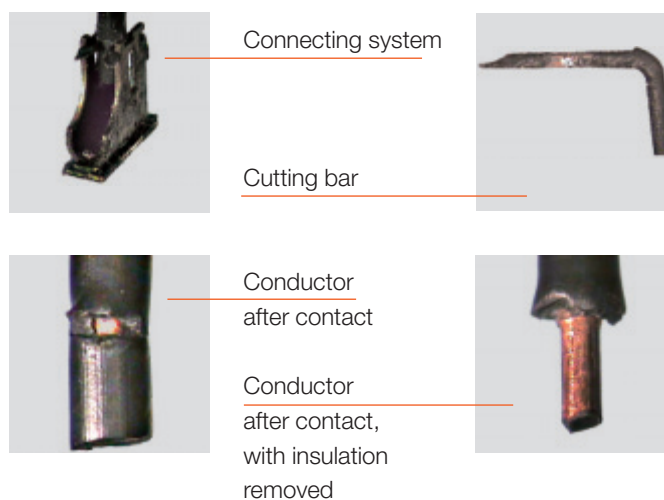
Clamping yoke connection



Tension clamp connection



IDC system



This system ensures additional protection against corrosion because the end of the conductor remains protected by the insulation.

Checking the service life

Mount five new modular terminals together in a row on a terminal rail and wire these with the rated cross-section. Tighten the clamping screws with the IEC torque. According to the voltage drop test, the disconnection parts of the test specimens are subjected to 50 operating cycles in succession without voltage and without load.

Afterwards, store the complete test setup in a dry atmosphere at +130 °C for 168 h.

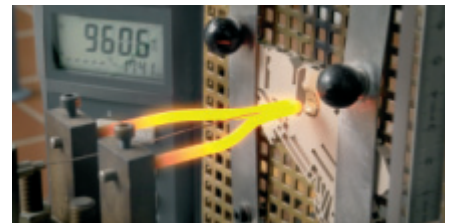
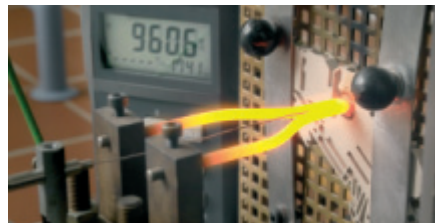
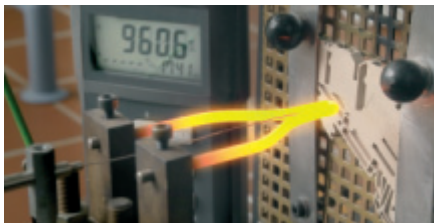
At the end of the test the test specimens must pass the voltage drop test after being allowed to cool down to the ambient temperature.

Thermal test

Glow-wire test (GWT)

DIN EN 60695-2-11/Nov 2001. For contact support components/insulating parts that hold electrical connections with $I > 0.2$ A in position, the flammability must comply with at least GWT 750°C to IEC 60695-2-11 with extinguishing within 2 s.

Unless otherwise specified in the individual provisions, the test specimen passes the glow-wire test when no flames ensue, no glowing occurs, or both of the following conditions are fulfilled:



In order to assess the fire propagation behaviour, e.g. due to burning or glowing parts falling from the test specimen, place below the specimen a fixed underlay to IEC 60695-2-10, section 5.3, or one made from the material or the components that normally surround or are positioned below the test specimen. The distance between the test specimen and the underlay as specified above must correspond to that of the actual installation of the component in the final electrical product.

- a) Flames or glowing processes are extinguished within 30 s after removing the glowing wire, i.e. $t_e \leq t_a + 30$ s, and
- b) If an underlay of tissue paper has been used, the tissue paper may not be ignited.

Needle-flame test

DIN EN 60695-2-2/Apr 1991. The flame must be applied for 10 s, but 5 s for wall thicknesses < 1 mm or areas < 100 mm². After removing the flame, the length of time for which the specimen continues to burn is measured (if ignition has taken place at all).

The specimen is deemed to have passed the test when the burning ceases within 30 s and the tissue paper is not ignited by any burning or glowing particles falling from the specimen.

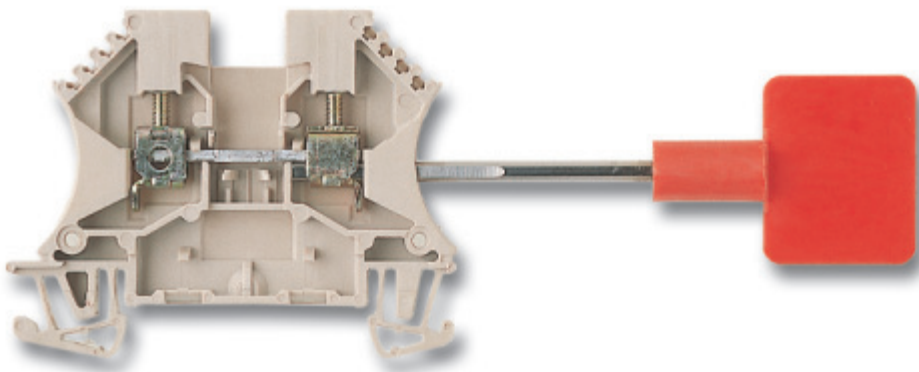


Terminal test with plug gauge

Plug gauge to IEC 60947-1 section 8.2.4.5.2 table 7

Insertion of unprepared round conductors with the largest prescribed cross-section

Test with defined gauge, insertion simply under self-weight



Conductor cross-section	Plug gauge					
	Form A			Form B		
Rigid conductor (solid or multi-strand) mm²	Designation	Diameter a mm	Width b mm	Designation	Diameter a mm	Permissible deviation for a and b mm
1.5	A 1	2.4	1.5	B 1	1.9	0 - 0.05
2.5	A 2	2.8	2.0	B 2	2.4	
4	A 3	2.8	2.4	B 3	2.7	
6	A 4	3.6	3.1	B 4	3.5	0 - 0.06
10	A 5	4.3	4.0	B 5	4.4	
16	A 6	5.4	5.1	B 6	5.3	
25	A 7	7.1	6.3	B 7	6.9	0 - 0.07
35	A 8	8.3	7.8	B 8	8.2	
50	A 9	10.2	9.2	B 9	10.0	
70	A 10	12.3	11.0	B 10	12.0	0 - 0.08
95	A 11	14.2	13.1	B 11	14.0	
120	A 12	16.2	15.1	B 12	16.0	
150	A 13	18.2	17.0	B 13	18.0	

Modular terminals for explosive conditions

Modular terminals for explosive conditions – complying with the European ATEX Directive 94/9/EC

Principles

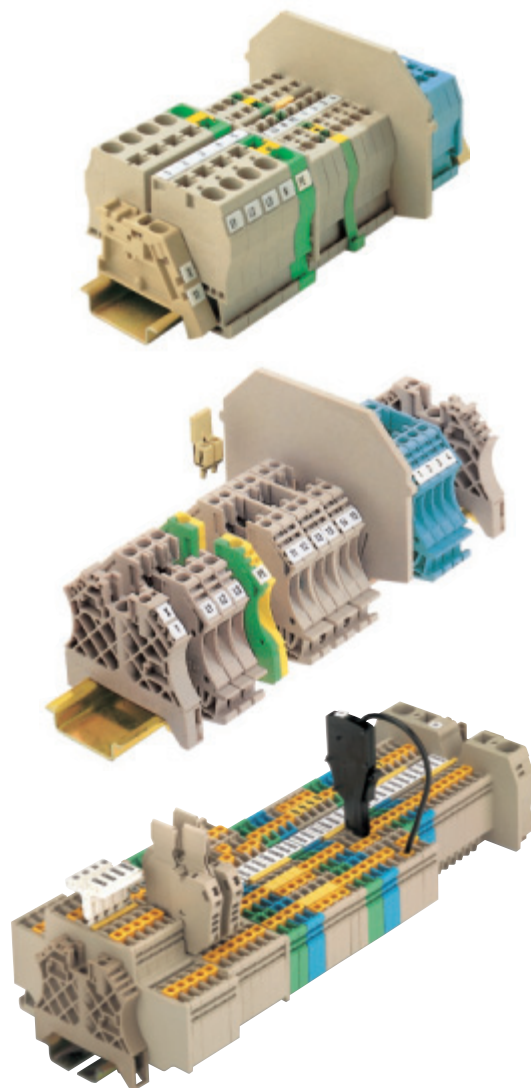
IEC 60947-7-1 (EN 60947-7-1/VDE 0611 part 1) and IEC 60947-7-2 (EN 60947-7-2/VDE 0611 part 3) specify the basic provisions for modular terminals or PE terminals. In addition, EN 60079-0 (IEC 60079-0/VDE 0170/0171 part 1), and for increased safety “e” EN 60079-7 (IEC 60079-7/VDE 0170/0171 part 6), cover their use in potentially explosive areas.

According to EN 60079-7, modular terminals for explosive conditions are so-called explosion-proof components. Components are those parts and assemblies that are necessary for the safe operation of devices and protective systems without themselves fulfilling an autonomous function. According to the European ATEX Directive 94/9/EC, modular terminals for explosive areas are not marked with the CE symbol. Modular terminals for explosive areas are certified for the increased safety “e” type of protection.


The European offices nominated in the ATEX Directive 94/9/EC, have been issuing EC Type Examination Certificates for the so-called ATEX generation complying with EN 60079-0/60079-7 and the ATEX Directive 94/9/EC since 1997. The condition for this is registration of the manufacturer's quality control system. Weidmüller has been registered since 1997. Copies of the EC Type Examination Certificate, the certification document and the declaration of conformity can be supplied in electronic format upon request.


The earlier certificates (A to D generations) issued according to the Explosive Atmospheres and Gassy Mines Directive 76/117/EEC have not been valid since 1 July 2003. However, existing installations are not affected by this.

The clamping yoke, tension clamp and IDC systems of the modular terminals ensure enhanced protection against gradual loosening and are designed in such a way that the ends of fine-strand conductors do not need to be prepared.



Marking

ATEX Directive 94/9/EC:  II 2 G D

-  Equipment for explosive conditions
- II 2 G Equipment group II category 2 (Zone 1 equipment)
- II 2 D Equipment group II category 2 (Zone 21 equipment)

EN 50014/19: EEx e II

- E Conformity with EN standards
- Ex Explosion protection
- e Increased safety
- II Equipment group

KEMA 97ATEX4677U (example)

- KEMA Notified body
- ATEX Conformity with 94/9/EC
- U Component

Confirmed according to the European ATEX Directive 94/9/EC

Electrical data

The values for current-carrying capacity as stated in the catalogue are based on an ambient temperature of 40 °C. When loaded with the rated current +10 %, the temperature of the current bar of the modular terminal may not rise more than 40 K. Taking into account a further safety factor according to EN 60079-0, we reach the following definitions:

Temperature class	Ambient temperature
T6, T5	–50 °C to +40 °C
T4 to T1	–50 °C to +55 °C

If the actual ambient temperature is higher, then the permissible rated current must be reduced accordingly.

The continuous operating temperature according to EN 60079-0 is 130 °C for the Wemid and KrG materials, 80 °C for PA.

Accessories

The accessories listed can be used and is included in the ATEX certification. In order to maintain the creepage distances and clearances for the EEx e category, end cover plates and/or partition plates should be used as specified.

Design for EEx i

Modular terminals for intrinsically safe circuits “i” are said components whose temperature rise behaviour is specified just like their electrical data. Therefore, they do not need a EC Type Examination Certificate when used in intrinsically safe circuits. To enable unambiguous marking and ready identification, the use of blue terminals is recommended. These terminals comply with the requirements of category EEx e.

Accessories

The accessories listed can be used and comply with EN 60079-11 (IEC 60079-11/VDE 0170/0171 part 7).

Current-carrying capacity of cables and lines

Rated currents

Cross-section	VDE 0298 part 4 (IEC 364-5-523) Current-carrying capacity of lines		EN 50019. 2nd edition Type of ignition “increased safety” Connection terminals Ambient temperature 40 °C, 40 K temperature rise Current equivalent to the conductor connected A
	Ambient temp. 30 °C, Factor 1.0, Instal. type C + 3 current-carrying wires PVC 70 °C A	Ambient temp. 40 °C, Factor 0.87, Instal. type C + 3 current-carrying wires PVC 70 °C A	
1.5	17.5	15.225	15
2.5	24	20.88	21
4	32	27.84	28
6	41	35.67	36
10	57	49.59	50
16	76	66.12	66
25	101	87.87	88
35	125	108.75	109
50	150	130.5	131
70	192	167.04	167
90	232	201.84	202
120	269	234.03	234
150	309	268.83	267
185	353	307.11	307
240	415	361.05	361
300	520	452.4	452

The current-carrying capacity of cables and lines in the installation is defined by VDE 0298 part 4 as normal at an ambient temperature of 30 °C. At 40 °C the operating current must be reduced by a factor of 0.87.

Installation

The general statements regarding standard applications are also valid for EEx i applications. In particular, the EEx i requirements always apply to the entire circuit, i.e. also to parts in areas not at risk of explosion.

Clamping of two conductors in EEx e applications

It is generally permitted to connect two conductors per clamping point in all the terminals of our W-series. However, please make sure that these have the same cross-section and do not exceed the rated cross-section.

ATEX directives

The old directive Explosive Atmospheres and Gassy Mines Directive 76/117/EEC was superseded by the new directive 94/9/EC, also known as ATEX 95 (ATEX: ATmosphère EXplosive = potentially explosive atmosphere), on 1 July 2003. Only the new directive is now valid, which is one of the so-called “New Approach” directives. It applies in all the countries of the European Union plus Iceland, Liechtenstein and Norway. In all these countries the directive applies to the sale and operation of products that have been specially developed for use in potentially explosive atmospheres in which gases, vapours, mists or dusts prevail. A new development is the inclusion of mining operations and purely mechanical devices.

The ATEX directive has been in force since March 1996. Its use up until 30 June 2003 (transitional period) was optional and existing directives remained applicable as well. But since 1 July 2003 all new installations and equipment for use in potentially explosive areas must comply with the ATEX directive and be certified accordingly. However, the previous breakdown into zones (Zone 0, 1 or 2) and classes of protection (e.g. “i”: intrinsic safety, “e”: increased safety) still remains in force.

Class of protection

Type of protection	Code	CENELEC EN	IEC	Product category explosion prot.
General requirements	–	50014	60079-0	–
Oil immersion	o	50015	60079-6	2
Pressurised apparatus	p	50016	60079-2	2
Powder filling	q	50017	60079-5	2
Flameproof enclosure	d	50018	60079-1	2
Increased safety	e	50019	60079-7	2
Intrinsic safety	ia	50020	60079-11	1
Intrinsic safety	ib	50020	60079-11	2
Equip. for zone 2 (EEx n)	n	50021	60079-15	3
Encapsulation	m	50028	60079-18	2

Classification for potentially explosive areas

CENELEC classification IEC60079-10	Presence of potentially explosive atmosphere	Product category	US classification NEC 500	Combustible media
Zone 0	permanent, long-term	1G	Class I, Div 1	gases, vapours
Zone 20	or frequently	1D	Class II, Div 1	dust
Zone 1	occasionally	2G	Class I, Div 1	gases, vapours
Zone 20		2D	Class II, Div 1	dust
Zone 2	rarely and briefly	3G	Class I, Div 2	gases, vapours
Zone 22		3D	Class II, Div 2	dust

Explosion groups

Gas (e.g.)	CENELEC	NEC 500
Propane	IIA	D
Ethylene	IIB	C
Hydrogen	IIC	B
Acetylene	IIC	A
Methane (mining)	I	mining (MSHA)

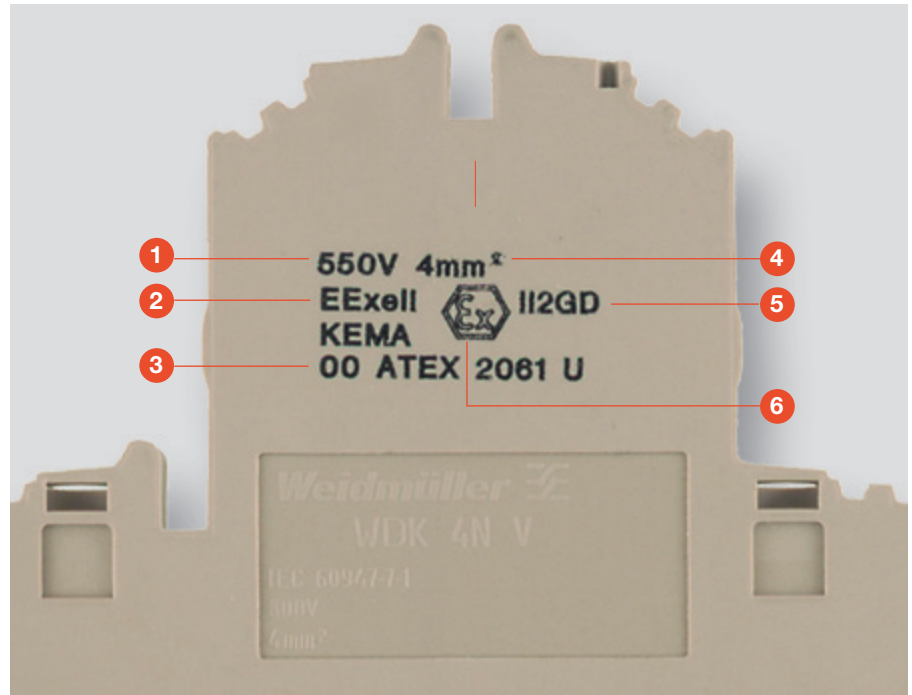
Temperature classes

Max. surface temperature (°C)	Temperature class CENELEC	Temperature class NEC 500-3
450	T1	T1
300	T2	T2
280	–	T2A
260	–	T2B
230	–	T2C
215	–	T2D
200	T3	T3
180	–	T3A
165	–	T3B
160	–	T3C
135	T4	T4
120	–	T4A
100	T5	T5
85	T6	T6

ATEX codes

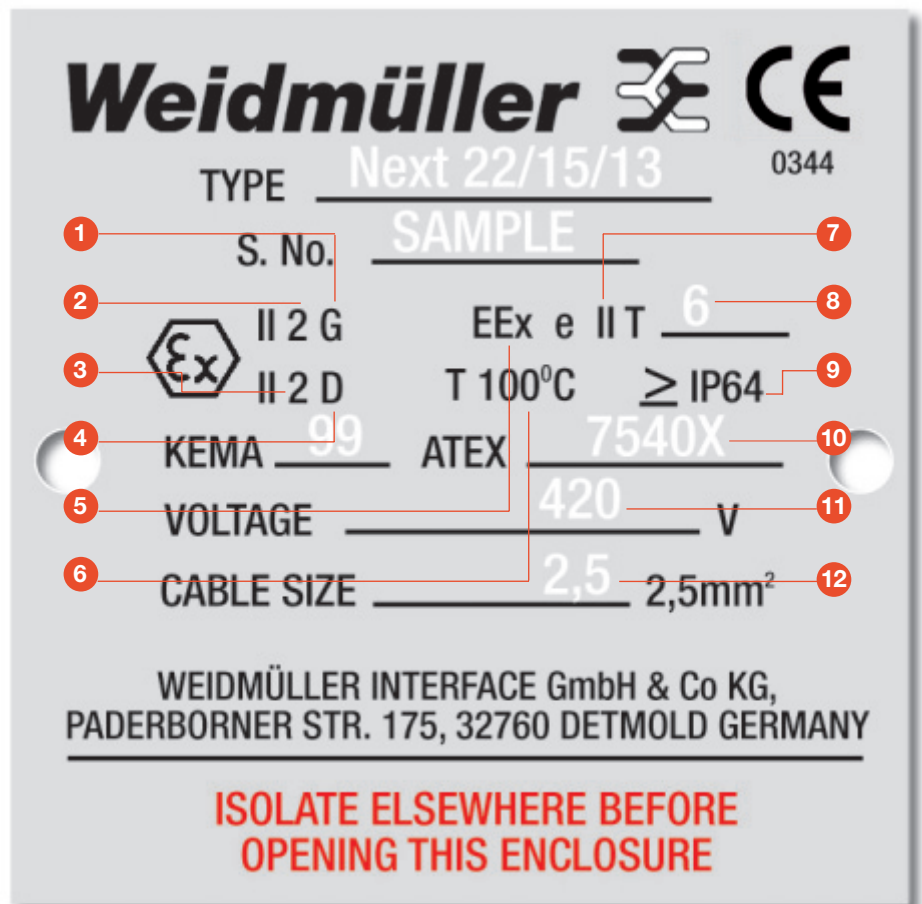
Example of marking – modular terminal WDK 4 N V

- 1 ▪ Rated voltage
- 2 ▪ CENELEC type of protection “e” – increased safety
- 3 ▪ Equipment group II – above ground (gases, vapours, mists, dusts)
- 4 ▪ Certificate number
- 5 ▪ Rated conductor cross-section
- 6 ▪ Equipment group II – above ground (gases, vapours, mists, dusts)
- 7 ▪ Product category 2 – for use in zone 1 or 21
- 8 ▪ Approved for use in gases “G” and/or dusts “D”
- 9 ▪ European symbol for explosion protection



Example of marking – enclosure fitted with components for enhanced safety

- 1 ▪ Approved for use in gases “G”
- 2 ▪ Product category 2 – for use in zone 1
- 3 ▪ Product category 2 – for use in zone 1
- 4 ▪ Approved for use in dusts “D”
- 5 ▪ CENELEC type of protection “e” – increased safety
- 6 ▪ Max. surface temperature without ignition of dust 100 °C
- 7 ▪ Equipment group II – above ground (gases, vapours, mists, dusts)
- 8 ▪ Temperature class T6
- 9 ▪ Class of protection of housing > IP 64
- 10 ▪ Certificate number
- 11 ▪ Rated voltage
- 12 ▪ Rated conductor cross-section



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