



Trailer connector for passenger cars

Pros and cons of the various connection systems

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ERICH JAEGER



7-pin connector versus 13-pin connector – in a nutshell	3
Limited usability: the 7-pin connection system according to ISO 1724	3
From development to standardization	3
7 functions limit the scope of use	4
State of the art: the 13-pin connection system according to ISO 11446	4
Standardized for road and fording vehicles	5
Wide range of applications, multiple functions	5
Additional functions	6
Mechanical rear fog light switch-off	6
Trailer identification via microswitch	6
Park-Distance Control (PDC) switch-off via microswitch	7
Rear fog lights switching via microswitch	7
Adapter or trailer recognition via reed switch	7
Operation	8
Technical data and assembly	9
Fitting the trailer socket	10
What are the connection options and how are they fitted?	10
Adapters	12
Manufacturer-specific trailer sockets	14
Not ISO-compliant: the 13-pin “Multicon” connection system	15
Legal requirements: which connector for which trailer?	15
For which trailers is the 7-pin connector suitable?	15
For which trailers do you need the 13-pin connection system?	15
Trailer indicator failure check	16
Conclusion	17



Trailer connector for passenger cars Why the 13-pin connection system is better

7-pin connector versus 13-pin connector – in a nutshell

Anyone who wants to use a car with a trailer these days must ensure that the electrical basic signals of the car are reliably transmitted to the trailer. Trailer connectors fulfill this function. In principle, there is a choice between the 7-pin connector according to ISO 1724 or the more modern, 13-pin connection system according to ISO 11446.

Affordable 7-pin connectors have long been tried and tested and are still in use today. However, in some cases, an adapter to the 13-pin standard is necessary – for example, for connecting a 7-pin trailer to a new vehicle or for transmitting all legally required signals to certain trailers. In addition, they are only permitted for trailers up to 750 kg.

The 13-pin connector, on the other hand, corresponds to the latest international state of the art. It is suitable for many types of trailers weighing more than 750 kg and meets the latest requirements of the German Road Vehicle Registration Regulations (StVZO) by transmitting more electrical signals. As a waterproof interface, it ensures that the sensitive electronics remain dry.

In the following, you will find further details on both connection systems, especially for standardization, the application areas, technical data and legal requirements.

Limited usability: the 7-pin connection system according to ISO 1724

This connector is a development from the 1970s and can only be used to a limited extent today. What does the standard govern, what functions does the connection system have and in what conditions can users still use it?

From development to standardization

The ISO 1724 industrial standard for trailer connectors was developed in the late 1970s to set a standard for the electrical connection between a towing vehicle and a trailer. It defines the internal and external dimensions of 7-pin connectors for the electrical connection between the towing vehicle and the trailer with a nominal voltage of 12V, as well as their contact arrangement and tests regarding the requirements for the connection system. This guarantees compatibility between different vehicles and trailers. The first edition of the standard was published in 1980 – the most recent version is from 2003. The purpose of the standard is to transmit the lighting functions in such a way that the trailer lighting corresponds to the lighting of the car.

The standard has the addition “Type N” for “Normal”. There is also a “Type S” for 7-pin 12V trailer connectors, which is defined in the standard ISO 3732. The “S” stands for “Supplemental”, since type S transmits additional functionalities, such as the reverse light or steady plus for a caravan. A better way to distinguish between the two: the “Type N” system has a black connector housing, whereas the “Type S” housing is white. Owing to a different arrangement within the connector, it is not possible for the user to inadvertently couple a type N connector to a type S connector.



Socket acc. to ISO 1724



Socket acc. to ISO 3732



7 functions limit the scope of use

Connectors according to ISO 1724 can only be used for simple trailers, since the 7 existing cable only transmit the basic lighting functions. It is not possible to transmit the reverse light. If the use of a reverse light is mandatory, the driver must use either a second 7-pin connector (ISO 3732) or a 13-pin connector (ISO 11446). The same applies to the operation of a caravan, since connectors according to ISO 1724 cannot transmit a steady plus.



The functions of the contact numbers of the 7-pin connector can be seen in the following diagram plus table:

Contact no.	Function	Wire cross-section	Color of wire insulation	Name acc. to DIN 72552
1	Left indicator	1.5 mm ²	Yellow	L
2	Rear fog light	1.5 mm ²	Blue	54g
3	Common return	2.5 mm ²	White	31
4	Right indicator	1.5 mm ²	Green	R
5	Right rear light, clearance light, side light and license plate light	1.5 mm ²	Brown	58R
6	Brake lights	1.5 mm ²	Red	54
7	Left rear light, clearance light, side light and license plate light	1.5 mm ²	Black	58L



Arrangement of the 7-pin connector according to ISO 1724 with color identification of the wires

State of the art: the 13-pin connection system according to ISO 11446

ERICH JAEGER developed the 13-pin trailer connection system as a successor to the 7-pin trailer connectors of the ISO 1724 and ISO 3732 standards. This is why the system is often called the JAEGER system. This connector meets the current electrical requirements of the caravan industry and has quickly established itself as the only connector of German automobile manufacturers, which is installed on the assembly line in the vehicle industry. The decisive factor was that it protects particularly well against water in the non-connected and also connected state, and thus the sensitive vehicle on-board electrical system remains dry.



13P 12V socket and connector



Standardized for road and fording vehicles

Together with the industry and the International Organization for Standardization, the new connector has been technically specified in the ISO 11446 standard and is still the state of the art. The standard is made up of two parts: Part 1 deals with connectors for “pure” road vehicles, part 2 with connectors for fording vehicles:

ISO 11446-1:2012-03

Road vehicles – Connectors for the electrical connection of towing and towed vehicles – 13-pin connectors for vehicles with 12 V nominal supply voltage

ISO 11446-2:2012-05

Road vehicles – Connectors for the electrical connection of towing and towed vehicles – 13-pin connectors for vehicles with 12 V nominal supply voltage (intended to cross water fords)

Up to 2003, the steady plus contacts and the charging line (positive controlled via ignition) were connected via common ground contact number 13. However, since each individual supply line can lead from steady plus and charging line up to 20 A, this could lead to a maximum current of up to 40 A on the ground line and thus to overheating. Since 2004, therefore, contact no. 11, which had been free until then, was then used for the ground return of contact no. 10 (charging line). Contact number 13 is solely responsible for the ground return of contact no. 9 (steady plus). In the 2004 version, the “Trailer Detection” function is no longer available on contact no. 12. Since the industry never used this function with the ground bridge in the connector, the contact was released for “future applications”

Wide range of applications, multiple functions

Due to the increased number of contacts, the 13-pin trailer connector meets all legal requirements and also meets the demand for a comfortable power supply. Contacts 1 to 8 are sufficient to fulfill a StVO-compliant lighting system according to ECE Regulation No. 48 dated 30 January 2011. With contact number 8, the reverse light can now be transmitted to the trailer, which was previously not possible with the 7-pin system. The other contacts are used for the electrical comfort equipment and take into account the wishes of the caravan and trailer sales industry.

The following table provides information about the contact numbers and their functions:

Contact / terminal	Function / circuit	Line cross-section	Color of wire insulation
1 / L	Left indicator	1.5 mm ²	Yellow
2 / 54g	Rear fog light	1.5 mm ²	Blue
3 / 31 ²⁾	Ground	2.5 mm ²	White
4 / R	Right indicator	1.5 mm ²	Green
5 / 58R ¹⁾	Right rear light, clearance light, side light and license plate light	1.5 mm ²	Brown
6 / 54	Brake lights	1.5 mm ²	Red
7 / 58L ¹⁾	Left rear light, clearance light, side light and license plate light	1.5 mm ²	Black
8 / RF	Reverse light	1.5 mm ²	Pink
9 / 30L	Steady plus power supply	2.5 mm ²	Orange
10 / 15	Power supply switched on via ignition	2.5 mm ²	Grey
11 / 31 ²⁾	Ground for contact 10	2.5 mm ²	White-black
12	Free	-	
13 / 31 ²⁾	Ground for contact 9	2.5 mm ²	White-red

¹⁾ The license plate lighting is to be connected in such a way that no light from this device is connected to the two contacts 5 and 7.

²⁾ The three ground cables (3,11,13) must not be connected to the trailer in an electrically conductive manner.





Practical tip:

Ask about comfort functions when ordering

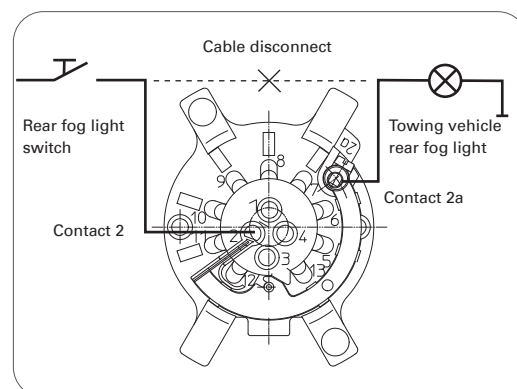
When ordering new vehicles, ask whether the trailer socket is equipped with the steady plus and charging functions in addition to the lighting functions. You should explicitly order these functions as well. In the case of retrofit solutions, care must also be taken to ensure that the electric set is fully equipped in this respect or that an extension kit for steady plus and charging cable is available as a supplement to a basic electric set.

Additional functions

Mechanical rear fog light switch-off

The rear fog light on the towing vehicle can be deactivated in the 13-pin socket via a small additional device. This is done with a contact bridge from pin no. 2 in the socket at the vehicle rear fog light.

The rear fog light signal from the towing vehicle is fed to the pin "2/54g" of the trailer socket and is fed back to the rear fog light at the rear of the towing vehicle via the additional output pin with the contact name "2a". If a trailer connector is then plugged into the socket, a mechanical switching pin opens the switching bridge and the contact to the rear fog light on the towing vehicle is disconnected, while the rear fog light on the trailer is then supplied with power by the towing vehicle.



13-pin socket with rear fog light switch-off contact

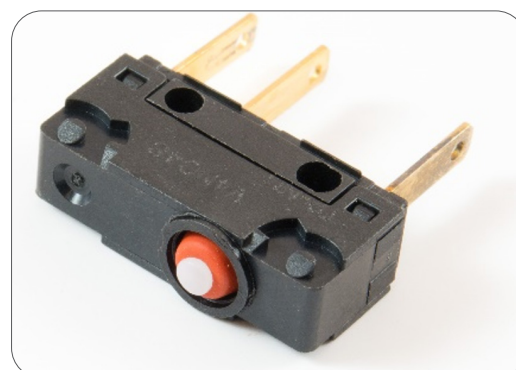
Trailer identification via microswitch

With the revision of the ISO 11446 in version 2004, contact no. 12 with the "Trailer Detection" function was released for future applications. ERICH JAEGER integrated a switch in the socket for almost all German manufacturers that offer a trailer coupling ex works. This is a waterproof microswitch which is integrated in the socket housing and actuated mechanically via a switching rocker as soon as a connector or adapter is inserted into the socket.

These switches are available in the three embodiments as a normally open contact, normally closed contact or changeover contact.

With the normally open contact, a ground signal is usually sent to a vehicle on-board electrical system control unit, which evaluates the signal "trailer connected" for further functionalities.

Recently, some car manufacturers have integrated the function of trailer detection into the trailer control unit and evaluate the lighting on the trailer. If an incandescent light or LED lighting is detected on the trailer, the trailer control unit switches to "trailer operation".



Microswitch in the form of a changeover contact



Park-Distance Control (PDC) switch-off via microswitch

With the normally closed contact, the comfort function PDC can be deactivated as soon as a trailer is connected to the towing vehicle. Thus, the annoying beeping of the reverse sensors is switched off while traveling with the trailer.

Rear fog lights switching via microswitch

Another function of the normally closed contact is the rear fog light switch-off on the towing vehicle when a trailer is connected.

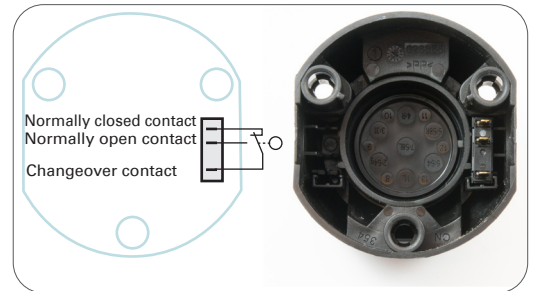
A changeover contact can be used for this. It causes the supply of the vehicle rear fog light to switch over to the trailer rear fog light when the trailer is connected.

Adapter or trailer recognition via reed switch

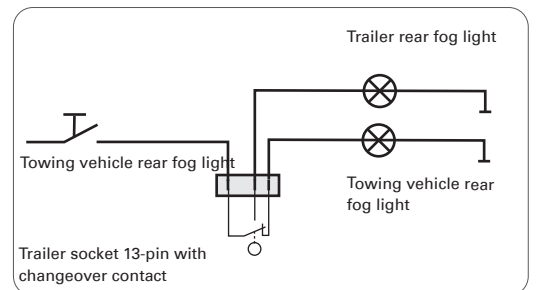
In addition to a microswitch, ERICH JAEGER integrated an electromagnetic switch (a so-called reed switch) into the socket housing. The device is switched via a solenoid which is mounted in an elastic rubber seal within the socket housing. If the user introduces an adapter or connector, the solenoid is pressed towards the switch in the rubber seal and triggers it.

With the normally open contact, a ground signal is usually sent to a vehicle on-board electrical system control unit, which evaluates the signal "trailer connected" for further functionalities.

This innovation has recently been used in systems with electrically pivotable trailer coupling systems. A connected adapter or trailer connector is thus reliably detected – even if no trailer is connected to the adapter and the vehicle electrical system is thus unable to detect any trailer load. In this way, trailer detection is ensured in each case and the pivoting function of the trailer coupling is actively prevented.



Socket housing with integrated microswitch



Rear fog light switching via microswitch

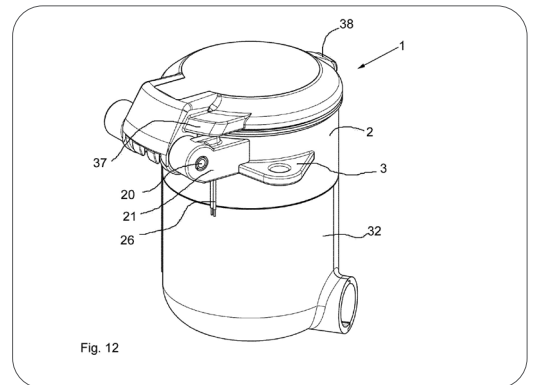


Fig. 12

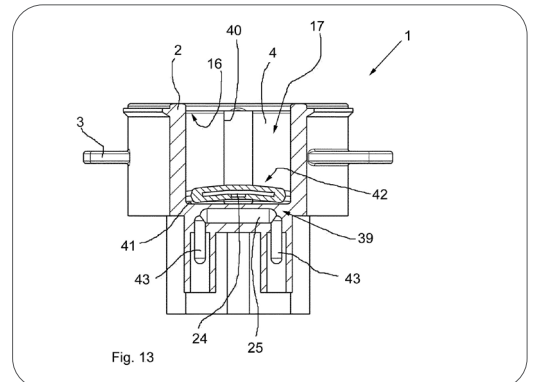


Fig. 13

Patent for reed switch EP 2 535 985 B1

Operation

The operation of the modern, 13-pin connection system is more convenient for the user compared to the handling of the 7-pin connector: whereas in the 7-pin connection system the connector of the trailer is connected with increased force straight forward into the trailer socket on the vehicle side, in the 13-pin connection system, the user only has to rotate it 90° via a bayonet geometry at the front connection area. Despite the higher number of pins, it requires significantly less force. The 7-pin connection system allows a connection force of up to 200 N, while the torque in the 13-pin connection system is max. 3.5 Nm. This bayonet system is unique in all trailer connectors worldwide.

Connection with a single rotational motion:

- 1 The rectangular coding of the connector must first be aligned with the coding groove of the socket contact insert.
- 2 In this way, the connector is attached in a 9 o'clock position relative to the open socket cover.
- 3 The front part of the connector is now screwed in with the cover support 90° to the right until the end position.
- 4 In the end position, the cover of the socket comes to rest on the cover support of the connector. The connector cover support thus protects the seal integrated in the cover from dirt.

Practical tip:

What do I have to consider when connecting the 13-pin connector?

A latching mechanism in the interior of the connector ensures that the coding remains securely in the 3 o'clock position when being disconnected. The connector may only be inserted correctly in this position.

If this latching mechanism is too easy to operate and the connector body or connected cable is rotated at the end of the connector, the coding leaves the 3 o'clock position. The result: the connector can no longer be plugged into the trailer socket.

By rotating the cable while simultaneously fixing the connector body or using a screwdriver, the coding can be brought back into the correct 3 o'clock position and the connector can be inserted again.





Technical data and assembly

The 13-pin connection system is significantly more waterproof than the old 7-pin connector. There are sealing elements in the socket in the cover and in the socket base. There is another seal seated on the connector. The socket on its own, as well as the complete connection system (socket with connected connector), must be splash-proof (IP protection class IPX4K).

In addition, they must be able to withstand the cleaning of the vehicle with high-pressure jets or in a car wash. However, according to ISO 4091, the minimum amount of water should be allowed to penetrate, since the user should be able to operate the socket opening easily, but it should be firmly closed with respect to high-pressure jets. In the last few years, the water protection at the socket has been increased by a stronger cover spring and a reduced cover tab.

current carrying capacity at 12V:

Maximum 15 A for cable cross-section 1.5 mm²

Maximum 20 A for cable cross-section 2.5 mm²

Temperature range -40° to +85°C

Number of mating cycles: 5,000

Connecting force ≤ 3.5 Nm

Dust protection class: IP5X

Water protection classes: IPX4K and IPX9K

Practical tip:

Using a parking socket

In the unplugged state, the connector has the protection class IP00, i.e. it is not protected against dirt and water. A parking socket is therefore recommended for a stationary trailer. In addition to mounting a socket housing, a simple receiving opening which securely receives the connector with the connector opening facing downwards also offers protection.



Practical tip:

A round cover support offers better protection

The 13-pin connector has a further special feature compared to the 7-pin connection system with an integrated circular cover support: when the connector in the 13-pin socket is screwed into the end position, the cover support protects the cover seal of the socket against dust and dirt. This guarantees the sealing function of the socket. Low-cost connectors and adapters with cover support which is not fully developed are not recommended. During driving, the cover seal can become wet, dirty and also damaged.

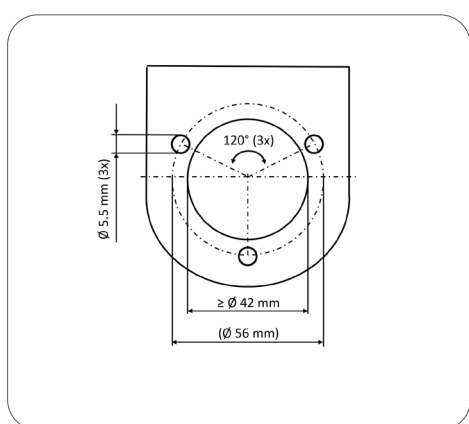




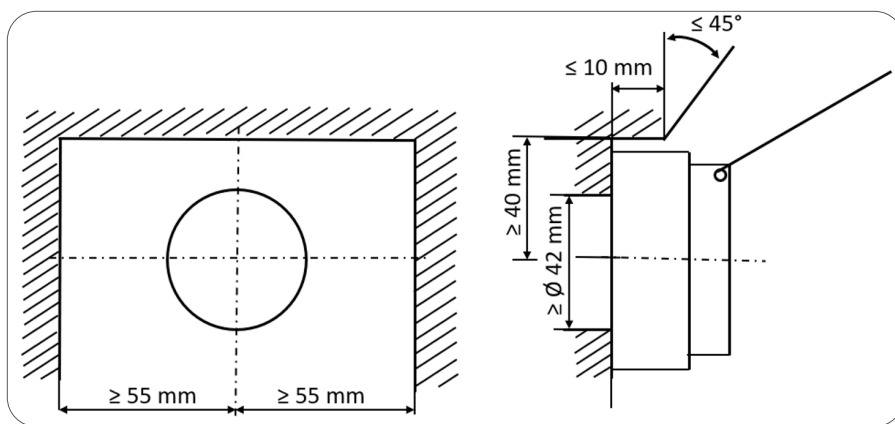
Fitting the trailer socket

The maximum height of the 13-pin trailer socket is described according to the standard as 60 mm. In the market, there are also a few versions of <math><40\text{ mm}</math>, these were mostly produced according to specific requirements of the automobile manufacturers.

These are fitted to standard mounting plates using three M5 screws. This is identical to the dimensions for mounting the 7-pin socket according to ISO 1724. During assembly, you should manually ensure that the left and right of the socket have enough space to hold the connector securely and firmly, as the connector is inserted into the outlet with a 90° rotation. There should also be sufficient free space for the cover opening at the top. According to the standard, the degree of opening of the lid can be up to 135° .



Hole pattern for socket support plate 13-pin



Clearance drawing for 13-pin socket

Practical tip:

Allow sufficient clearance to the exhaust

The socket and electrical connecting cables should not be fitted directly on or very close to the vehicle exhaust system. Localized heat could damage the individual components of the connection system.

Screw connection

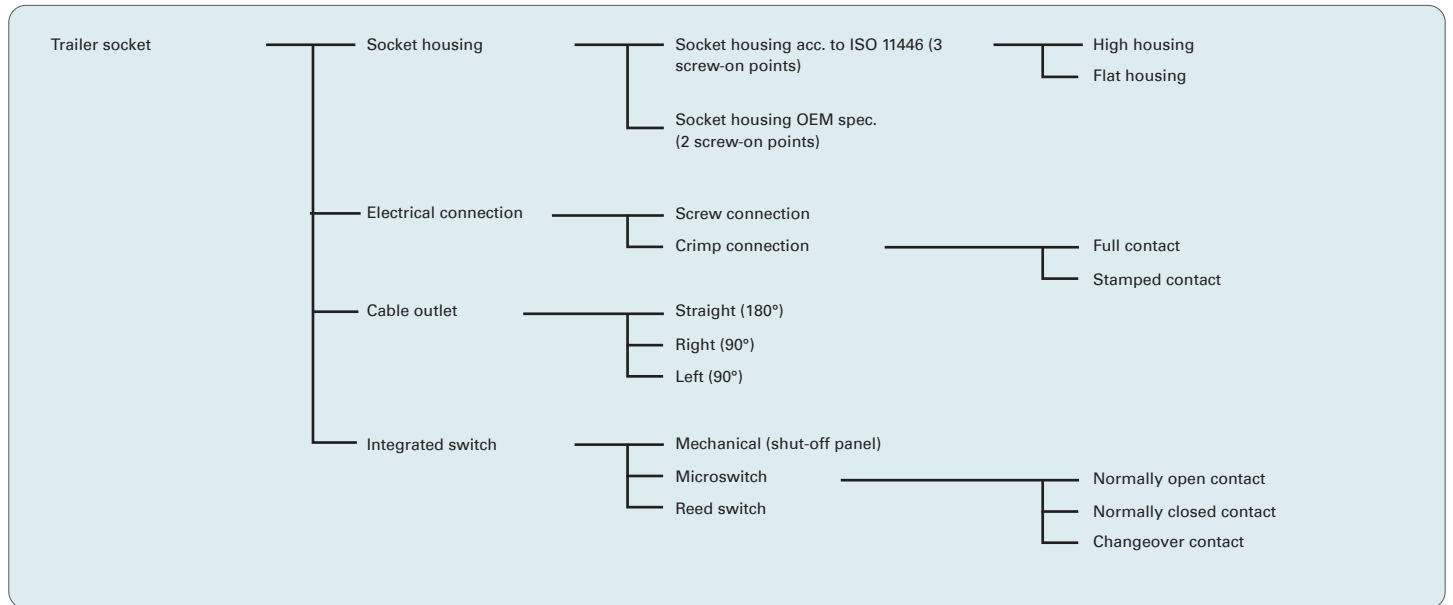
The screw connection is the simplest design for the electrical connection. A screwdriver is the only tool required. For the vehicle standard cables based on FLY-B and according to ISO 6722-1-B with the fine copper strands, a wire end sleeve is absolutely recommended.

Owing to the simple installation without special tools, this type of connection is particularly advantageous when retrofitting or for repairs.



Crimp connection

Other socket options are available by varying different housings, cable outlets and switch options:



Options for 13-pin sockets



13P socket with screw connection



13P connector with screw connection



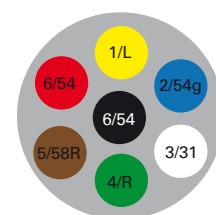
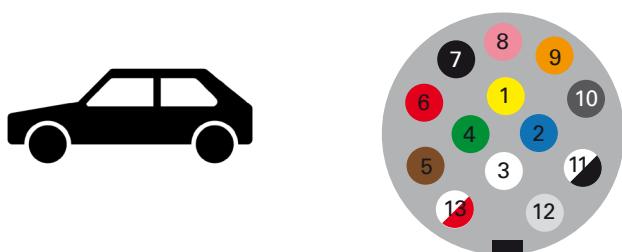
13P socket with crimp contacts



Adapters

There are a number of adapters to adapt from the 13-pin socket system to the old 7-pin system. When the 13-pin connection system was introduced, adapters were of enormous importance, because all trailers on the market with the 7-pin connector would not have been able to be connected from one day to the next. This is why every car was equipped with a 13-pin trailer socket with an adapter. The first adapters were so-called cable adapters, because a 13-pin connector on one side and a 7-pin connector on the other side were connected to a cable.

With this adapter, the 7 channels and functions of the 7-pin connection system according to ISO 1724 are transmitted like all lighting functions, except for the reverse light – see also the following assignment table:



Contact	Function / circuit
1 / L	Left indicator
2 / 54g	Rear fog light
3 / 31	Ground
4 / R	Right indicator
5 / 58R	Right rear light, clearance light, side light and license plate light
6 / 54	Brake lights
7 / 58L	Left rear light, clearance light, side light and license plate light
8 / RF	Reverse light
9 / 30L	Steady plus power supply
10 / 15	Power supply switched on via ignition
11 / 31	Ground for contact 10
12	Free
13 / 31	Ground for contact 9

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5 / 58R	Right rear light, clearance light, side light and license plate light
6 / 54	Brake lights
7 / 58L	Left rear light, clearance light, side light and license plate light



The following adapters are available on the market today:

Cable adapter

A cable adapter can be fixed to the trailer with a 7-pin connector and used via the 13-pin connector on the vehicle.

Short adapter

A short adapter is connected to the 13-pin vehicle socket and provides the 7-pin socket on the other side. Here, the trailer can be connected with the 7-pin trailer connector.

If not in use, the adapter should be removed from the socket.

UK adapter

The UK adapter is specifically designed for the UK market and can be adapted from the on-board 13-pin socket on the vehicle to the two 7-pin sockets to accommodate a trailer with a 7-pin normal connector (ISO 1724) and a 7-pin additional connector (ISO 3732).



Cable adapter



13P to 7P short adapter (center of image)



13P to 2 x 7P adapter

Practical tip:

Only use the adapter while traveling with a trailer

Adapters from the 13-pin socket to a 7-pin connector must only be used while traveling with the trailer. If the adapter remains plugged into the socket (with an integrated switch) also when traveling without a trailer, the following malfunctions may occur:

- The rear fog light on the towing vehicle remains deactivated and cannot be switched on.
- The PDC function remains deactivated and is without function during reverse travel.
- The trailer detection is still active and signals to the vehicle that a trailer is connected. Vehicle-specific faults such as PDC switch-off, rear fog light switch-off, double flashing frequency etc. may result.
- With electrically pivotable trailer coupling systems, the trailer coupling can no longer be pivoted.



Adapter in trailer socket

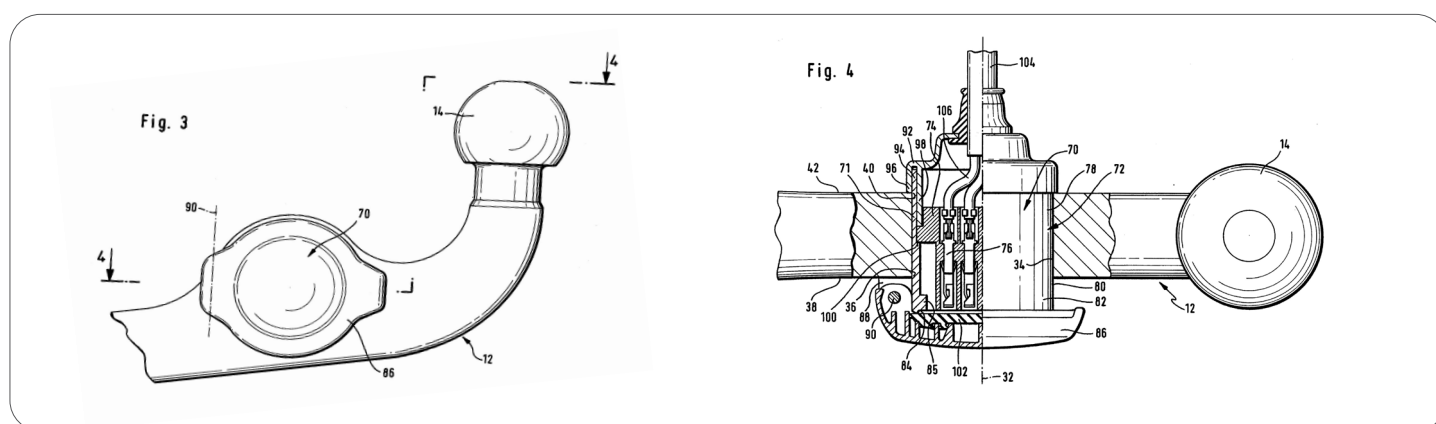


Manufacturer-specific trailer sockets

Removable and rigid trailer couplings are installed as the original equipment, but especially in retrofitting. In these types of couplings, standard trailer sockets are usually mounted onto a mounting plate to the left of the trailer coupling rod with three metric screws.

With the development of mechanically or electrically pivotable trailer couplings, the German vehicle manufacturers brought another comfort feature to the market.

With the European patent EP 0 872 364 from 1998, an opening in the ball neck for receiving the trailer socket came onto the market.



The trailer socket sits at 90° offset from the ball rod and pivots completely behind the rear apron of the vehicle when it is not needed.

Although the 13-pin connection has a connection chamber that complies with the ISO standard, the mounting dimensions are manufacturer-specific. In the case of a replacement, it is no longer possible to use standard components and you usually have to replace the complete, specific cable set from the manufacturer.



13P socket on the coupling neck



13P socket on the coupling neck



Not ISO-compliant: the 13-pin “Multicon” connection system

For the sake of completeness, the “Multicon” system is mentioned briefly. It is a 13-pin connection system according to the Dutch standard NEN 6120. The contact assignment is identical to the connection system according to ISO 11446, but not connection-compatible.

Today, this system plays only a minor role, as it is no longer used for new vehicles and trailers. For repair purposes, however, sockets, connectors and adapters are still available on the market.



13-pin “Multicon” connection system according to NEN 6120

Legal requirements: which connector for which trailer?

Trailers are also subject to the regulations of the German Road Traffic Regulations (StVO). This includes specifications for the trailer lighting, which vary according to the type of trailer. In order to meet these requirements, it is important to select the appropriate connection – 7-pin or 13-pin – based on the type of trailer. It is clear that users with the 13-pin connection are always on the safe side, because it meets the requirements for the lighting of every trailer type for passenger cars and is therefore legally compliant in every respect.

For which trailers is the 7-pin connector suitable?

For trailers with a maximum permissible weight of 750 kg, the reverse light is optional. For this reason, a 7-pin connector is sufficient for this trailer class. The connector cannot transmit a reverse light.

For which trailers do you need the 13-pin connection system?

Simply put, the 13-pin connector is required for all classes of car trailers that are heavier than 750 kg and also for load carriers such as bicycle carriers. The regulation on load carriers is contained in Section 49a of the German Road Vehicle Registration Regulations (StVZO): these state that the rear fog light switch-off is mandatory for the load carrier and that the function of the rear fog light is prescribed.

Note:

- For all car trailers > 750 kg, the reverse light is required
- The reverse light is only transmitted to the trailer if a 13-pin electric set is used
- The 13-pin electric set is particularly suitable for bicycle carriers, caravans and horse boxes
- Addition: The reverse light is not necessary for agricultural and forestry machinery (these are exempt from the regulation according to Section 52a para. 6 StVZO)



Trailer indicator failure check

The trailer indicator failure check is not a function integrated into the trailer connector. However, at this point we would like to mention it, since it has an important function in the lighting control or in the retrofitting of a trailer coupling with a cable set.

The function of the indicator lights on the trailer is the only function where the display is to be monitored according to Section 54 Road Vehicle Registration Regulations (StVZO) and, if this function should fail, this must be displayed to the driver. This is also stated in Regulation No. 48 of the United Nations Economic Commission for Europe (UN/ECE).

There are different systems on the market for the trailer indicator failure check:

- 1) An additional output with the designation "C2"; a small light or LED is installed on an old, ticking indicator relay. It flashes in the instrument cluster when the trailer is connected and the trailer indicator light is intact. If this additional check light remains dark, one of the trailer indicator lights is defective.
- 2) Acoustic warning device: a beeper or warning buzzer is installed on a trailer control unit. If the trailer control unit has detected the trailer and the trailer indicator light is switched on, the additional beeper will sound. Another version is the warning buzzer, which sounds when the trailer control unit has detected the trailer and the indicator light on the trailer is defective.
- 3) This version is often used in retrofitting for cable assemblies with trailer control units. In this case, the indicator lights are also guided from the vehicle to the trailer control unit. If the trailer control unit has detected the trailer and a trailer indicator light is defective, the trailer control unit supplies the indicator on the vehicle side. The vehicle's on-board electrical system control unit recognizes that the rear indicator light is not supplied and indicates this to the driver in the display via an error message, or by doubling the flashing frequency.
- 4) In this version, the trailer control unit is connected via the vehicle bus, monitors the trailer lighting and informs about possible errors via the display in the instrument cluster.

Practical tip:

- 1) Remove an adapter in the trailer socket if you are traveling without a trailer. If the adapter detects a trailer, faulty trailer lighting can be signaled.
- 2) If faults are displayed in a trailer with functioning LED trailer indicator lights, the trailer control unit interprets the low power consumption of the modern LED lights as a defect. Ask your reseller for options.

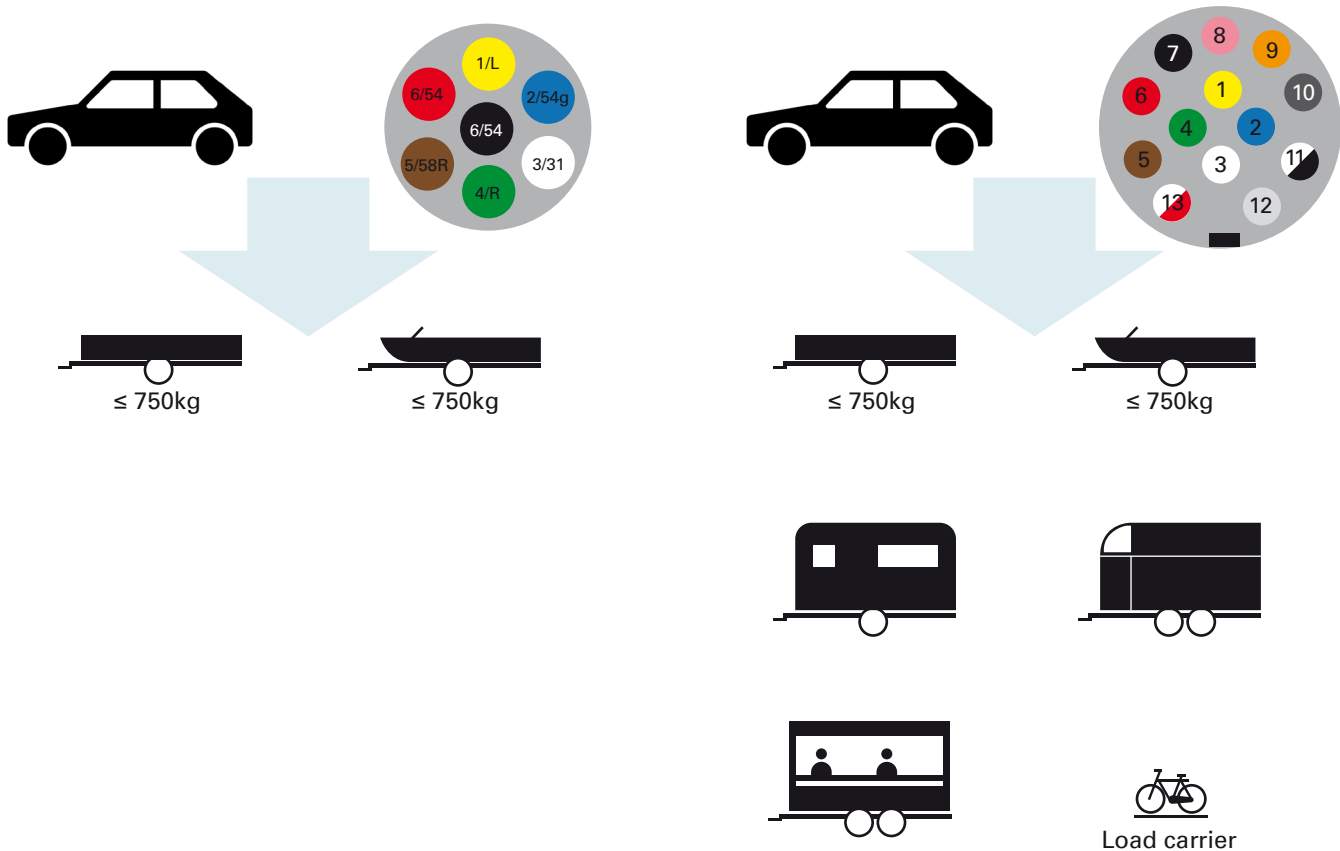


Conclusion

The 13-pin trailer socket replaced the old 7-pin socket system 30 years ago and is still the latest state of the art today. It ensures that users meet the requirements of the StVO for trailer lighting, offers a waterproof interface to the trailer as well as to the vehicle on-board electrical system and also offers the greatest freedom of application, since it is suitable for all types of trailer. If you are still using a 7-pin socket system, the usage is very limited, or you have to connect an adapter. For retrofitting or for the question of which type of socket should be ordered when the vehicle is reordered, the preference is clearly with the 13-pin trailer socket.

Finally, we have summarized the pros and cons of both systems for you, at a glance:

7-pin connector	13-pin connector
+/- Suitable for light trailers up to 750 kg	+ Suitable for all trailer types
+ Low-cost system	- Less of a low-cost system
- High connection and removal forces	+ Low connection forces
- Not waterproof	+ Waterproof connection
- Channel missing for reverse light	+ Transmits the reverse light to the trailer
- No additional functions	+ Additional loading functions for caravans or industrial trailers





Erich Jaeger GmbH + Co. KG

Strassheimer Straße 10
61169 Friedberg
Germany

Phone +49 6031-794 - 0
Fax +49 6031-794 - 100
info@erich-jaeger.de
www.erich-jaeger.com

Orders

Phone +49 6031-794 - 0
Fax +49 6031-794 - 149
orders@erich-jaeger.de