

Installation element

[01] The invention relates to an installation element for electrical connectors having a base housing in which at least one electrical plug socket is arranged, and an outer housing having at least one through-opening, with a rotating closure mechanism being arranged between the outer housing and the base housing.

[02] The invention is based on electromechanical assemblies that are mainly used in the field of office and kitchen electrification. These are single-way or multi-way sockets that are recessed into the work surface. Preferably, the sections of the plug socket outlets in the unused plug socket units are covered or closed. When the plug sockets are in use, the sections of the socket outlets are released by pressing down a mechanical assembly arrangement. It is also common to release the engaging parts of the plug sockets by lifting or moving the cover sideways or twisting it.

[03] Document DE 10 2014 102959.3 A1 describes a variant in which the socket insert with the insertion slots is provided in such a way that the inner housing can be rotated by at least 180° about its longitudinal axis. In order to release the insertion slots, the inner part of the housing must be pressed into the assembly using the fingers on its outer edges. In this case, a cardioid locking is effected against the pretension of a torsion spring and the inner part can rotate into the operating position. When closing, the inner housing must then be manually pressed into the locking position by 180° against the pressure of the torsion spring and the damping element and snapped into the cardioid locking mechanism.

[04] Document DE 10 2007 063 585.2 A1 describes an electrical plug socket with a device mount on the front, in the surface of which a closure based on the shutter principle of a camera, is integrated. The closure consists of a plurality of closure elements which are guided through fixed mountings and can be moved radially inwards and outwards. Locking and opening is carried out by operating a swivel on the front of the plug socket housing.

[05] Document DE 10 2012 025 533.0 A1 discloses a plug socket arrangement with the following function. The closure is pushed into the socket housing with the finger by means of a control button, which is positioned centrally, against the pressure of the retaining spring. The control button protrudes into the cover and unlocks the cover and must be held in this position

with the finger. The cover, which is rotationally mounted on the base housing, can then be turned by hand - while simultaneously pressing the closure down - and thus opens up the access to the socket outlets. The plug sockets are also closed with the reverse direction of rotation of the cover.

[06] In DE 10 2018 009 948.3 A1 also, the centrally arranged control button is pushed into the housing by pressing a control element down against the pressure of a compression spring. Pressing down with a finger requires an internally arranged lock to be unlocked to allow the closure to rotate. At the same time, when the control button is pressed down, a switch spring is pushed onto a switch key, thereby closing a circuit which then causes an electric motor to rotate.

[07] Further exemplary embodiments of this patent application all relate to a centrally arranged control button, which must be inserted into the housing with the finger in order to open the closure.

[08] Common to all technical solutions is that the mechanical elements allow access to the plug socket by turning them by hand or by pressing down an actuating element with a finger. Essentially, a more or less skilful handling of the control elements is required to initiate the desired operation. The products are also exposed to greater contamination due to the gap dimensions in the arrangement of the control elements. The degree of contamination can adversely affect the operation of the control element and lead to malfunctions. Equally, the different force applied to the control element by different operators is detrimental to the proper operation of the mechanical sequence.

[09] A non-negligible factor is the user-friendliness, which is adversely affected by intervention in the housing. This is a problem in particular when the control element must be pushed into a housing against spring pressure, which can cause damage to longer fingernails or a clamping force of the control element can be exerted on the finger.

[10] The object of the invention is therefore to develop a plug socket element that opens and closes the closure without actuating mechanical controls by hand or with the fingers.

[11] The invention is disclosed by the features of the main claim. Embodiments and further developments are the subject matter of the additional claims following the main claim.

[12] An installation element for electrical connectors is disclosed, in particular for plug sockets of different designs, as well as USB or other connectors. This is in particular a plug socket element. The plug socket element has an outer housing with openings as well as a base housing with one or more plug sockets mounted under the exterior housing. Various options for the operating principle according to the invention of a cover of the sockets are described below.

[13] The outer housing is fixedly connected to the base housing. One or more openings are provided in the outer housing to allow access to the plug sockets. These insertion holes are sized for the connectors or plugs of consumers and are equivalent in number to the number of plug sockets installed in the socket element. More than one plug socket can also be assigned to one opening.

[14] Furthermore, the socket element has a rotatable closure that can be used to open or close the above-mentioned openings of the outer housing. The rotatable closure is arranged between the outer housing and the base housing and is a rotary disc. As an alternative to the rotary disc, the rotatable closure can be designed in any other format, for example as a rotary knob, or the like.

[15] The closure can be rotated in the base housing in such a way that the individual plug socket devices are positioned in the fixed base housing such that they correspond exactly to the corresponding openings in the outer housing, so that after the closure is opened the corresponding plugs or connectors of the consumers can be inserted into the sockets. The outer housing and the base housing are fixed together so that only the locking mechanism can be rotated.

[16] In order to create a flat surface in the closed state of the socket element, the closure is embossed in a complementary manner to the openings of the outer housing and, in the closed state, it penetrates the outer housing from the inside to the outside with the embossed portions. Thus, the openings of the outer housing are covered in a planar manner.

[17] The rotational ability of the closure mechanism can be initiated by differently generated control signals and can be achieved by different rotary mechanisms. The invention is based on a consistent sequence of mechatronic operating principles, which ensure that the closure can be rotated without having to perform a mechanical actuation by hand.

[18] In a first exemplary embodiment, a control signal can be generated by a touch sensor according to the following principles. The sensor is arranged on a circuit board which is connected to the metal outer housing by means of a cable connection. Touching the metal surface of the outer casing, at any point, with a finger or palm of the hand, causes a change in the field. This field change is detected by an IC circuit on the circuit board and converted into a control signal.

[19] A second exemplary embodiment uses an electric field sensor that is positioned at a defined point in the base housing, with a complementary marking placed on the outer housing, above the electric field sensor. This allows a field change to be generated in a contactless manner by simply moving the hand over it at a slight distance. This field change is also converted into a control signal as in the first exemplary embodiment. The difference from the first exemplary embodiment is that the hand does not need to touch the outer housing, but only has to be brought close to a defined area.

[20] A control signal can also be generated optically. For this purpose, an opening is formed in the outer housing and closed off with a light-permeable material. The opening can also be a material weakening that allows light to pass through the material. Below this opening, a light sensor is placed which registers a sudden light-dark change and generates a control signal via an IC element. The sudden light-dark change is generated by a finger that is passed over the closed opening. It is also possible to have a spherical lens cap that divides the opening in the outer housing into light corridors, registers a light-dark change and generates a control signal by means of an evaluation electronics.

[21] It is also possible to generate a control signal by means of a predefined acoustic system. In this case, a circuit board with a voice module equipped with a microphone and an IC processor would store the acoustic signals representing the phonetic image of words such as “Open” or “Closed” and, by means of comparisons, assign a digital value to the analogue sound images, which forms a control signal by means of an IC circuit.

[22] In a modified version the “Smart Home technology” can also be used by integrating an actuator that can be coupled with the smart home systems into the base housing and by receiving and converting the smart home commands, usually an infrared signal or a radio signal, into a control signal. This means that the plug socket element can also be integrated into a smart home system.

[23] All of the above-mentioned elements, which cannot be mechanically actuated, have the common characteristic that a control signal is generated and that this signal can be sent to the control electronics of the drive unit and exploited there.

[24] The function of the drive unit is to move the closure underneath the outer housing in a linear movement until the surface of the recess of the closure has sunk below the inner surface of the outer housing and then to rotate the closure out of the effective range of the openings for the plug guidance by means of a rotational movement. This means that the closure opens up the access to the plug sockets. In the reversible application of the closure, the drive unit rotates the closure by means of a rotational movement into the complementary position of the closure recesses with respect to the openings of the outer housing and by means of a linear movement pushes the closure upwards with the recesses into the openings of the outer housing until a plane overall surface of the outer housing is created. This closes off the openings for the plug sockets again.

[25] This combination of linear and rotational motion of the drive unit can be performed in different ways.

[26] One possible option for a drive unit consists of a direct-current electric motor, which is fed from the electrical circuit inside the plug socket element. The electric motor is stationary in the base housing and has a movement gear system between the drive shaft and the rotatable closure element. The movement gear system consists of a drive swivel that is fixedly connected to the axle of the electric motor and a movement sleeve that is fixedly connected to the closure. The drive swivel is shaped with diametrically arranged pins that protrude over the cylindrical surface of the drive swivel. The movement sleeve is provided with helix structures that penetrate the wall of the movement sleeve from the outer cylinder surface toward the centre of the axle. The pins of the drive swivel are arranged complementary to the helix structures of the movement sleeve and engage in the helix structures and create a movable axial connection to the closure.

[27] In its closed position, the closure rests against a support wall, which prevents the closure from turning when a rotation is applied to it.

[28] When the axle of the electric motor rotates, the drive part with its shaped pins rotates in the motion sleeve by the same amount. The pins press on the track of the helical structures of the movement sleeve and pull the closure linearly into the plug socket element. The support wall and

the helical structures are matched such that when a sufficient linear lowering of the closure is reached, the guide end of the support wall is reached and the movement sleeve can now rotate in the same way due to the rotating pins of the drive swivel. This causes the closure to be rotated out of the effective range of the openings for the plug guidance. This means that the closure opens up the access to the plug sockets. When the closure reaches its opening position, the stop ribs bring the rotation of the closure to a standstill, wherein a rise in current now takes place in the electric motor and the control electronics switches off the power supply for the motor and initiates the polarity reversal of the electric motor.

[29] During the closing operation, the motion sleeve is first set into rotation by the drive swivel, which now rotates with the reverse direction of rotation, and the closure is rotated against a stop rib with the opposite direction of rotation. The electric motor with its drive swivel continues to rotate and pushes the closure via the pins in the helix structure and the movement sleeve linearly outwards so that the closure comes to rest against the inside of the outer housing. When the stop is reached, the current consumption is increased again and the current is switched off by the control electronics and the electric motor polarity is reversed.

[30] A further exemplary embodiment is similar to the previous exemplary embodiment, wherein here also a drive swivel and a movement sleeve are arranged in the same way. In contrast to the first exemplary embodiment, the pin structures in the drive swivel and the helix structure in the motion sleeve are omitted. These are replaced by an external thread in the drive swivel and by an internal thread in the movement sleeve.

[31] Now by turning the drive axle of the electric motor the drive swivel is screwed into the movement sleeve, wherein the closure cannot be rotated at first due to the support wall and the movement sleeve pulls the closure into the inside of the housing. When a sufficient linear lowering of the closure is reached, the guide end of the support wall is also reached and the movement sleeve now starts to rotate. As in the first exemplary embodiment described above, the rotation of the closure is stopped by a stop rib and the power supply to the electric motor is interrupted in the same way and the electric motor polarity is reversed. Due to the higher current supplied, the movement sleeve is tightened on the drive swivel with a holding torque.

[32] During the closing operation, the closure rotates in the opposite direction of rotation and also runs towards the stop rib. The stop causes a higher current consumption and the holding torque is released and the drive rotating part rotates out of the movement sleeve, which is thereby

pressed linearly upwards with the closure against the inside of the outer housing. When the stop is reached, the current consumption is increased again and the current is switched off by the control electronics and the electric motor polarity is reversed.

[33] Alternatively, the following drive unit can be implemented: the electric motor has an axially movable steel axle which is surrounded by the windings of the electric motor. The axle is spring-mounted in the electric motor and is fixedly connected to the closure at the external end. When the motor is switched on via the control signal, the magnetic action of the windings on the steel axle of the electric motor causes the steel axle to move linearly into the motor against the spring action and thus the fixedly connected closure is drawn linearly into the base housing. When the bottom dead centre of the axle is reached, the electric motor starts to rotate the axle and the closure rotates into its open end position. As already mentioned above, the stop causes an increase in current, which switches off the motor and reverses its polarity. Likewise, when the closure is closed, the electric motor rotates the closure into the end position of the closure position against a stop rib. Due to the current increase, the electric motor is switched off and its polarity reversed. The switch-off also shuts off the magnetic field and the closure is pressed linearly into the outer housing by the compression spring in the electric motor by means of the steel axle and the plug socket element is thus closed.

[34] In the following, exemplary embodiments of the solution according to the invention are explained in more detail based on the accompanying drawings. Shown are:

- Figure 1 an installation or plug socket element in the closed condition in an isometric view,
- Figure 2 an installation or plug socket element in the closed condition in an isometric view,
- Figure 3 the outer housing in an isometric view with both opening holes,
- Figure 4 a base housing in an isometric view,
- Figure 5 the base housing without outer housing with the closure in the closed position in a plan view,
- Figure 6 the base housing without outer housing with the closure in the closed position in a plan view,

- Figure 7 a closure assembly in a side view with examples of movement sleeve, drive swivel and drive element,
- Figure 8 a sensor circuit board in an isometric view as a single part,
- Figure 9 the closure in an isometric view as a single part,
- Figure 10 a closure assembly in a side view with examples of movement sleeve, drive swivel and drive element,
- Figure 11 the movement sleeve with screw thread in a side view,
- Figure 12 the drive swivel with thread in a side view,
- Figure 13 a closure assembly with helix structure in a side view with examples of movement sleeve, drive swivel and drive element,
- Figure 14 the movement sleeve with helix structure in a side view,
- Figure 15 the drive swivel with helix structure in a side view,
- Figure 16 a locking assembly in a side view, as an example in a combination of a solenoid and rotary magnet,
- Figure 17 the closure assembly of the solenoid and rotary magnet in an exploded view,
- Figure 18 an example of a plug socket element in an exploded view,
- Figure 19 a half-section through the middle of the plug socket element in a closed form,
- Figure 20 a half-section through the middle of the plug socket element with the closure lowered,
- Figure 21 a half-section through the middle of the socket element with two plugs inserted,
- Figure 22 a plug socket insert in half-section,
- Figure 23 the outer housing pre-assembly with 4x mounting brackets in an isometric view and
- Figure 24 the outer housing mounting in a sectional detail view.

[35] In the following, the individual parts and the assembly illustrations are explained in more detail by reference to the figures.

[36] Figure 1 shows an installation or plug socket element as a complete assembly in an isometric view. The socket element shows the closure 1 in a closed position, wherein the recesses 7 (a, b) of the closure 1 form a plane surface with respect to the surface of the outer housing 60. The outer housing 60 is stationarily fixed to the base housing 10 and closed from below with a housing bottom 70. The entire assembly has no mechanical actuators that initiate the opening or closing of the socket element by pushing down or pulling the actuators out by hand.

[37] Figure 2 shows the installation or plug socket element as a complete assembly in an isometric view. The plug socket element is shown in an open position, with the openings 61 (a, b) of the outer housing 60 providing free access to the plug socket inserts 65 (a, b). The surface edge 62 (a, b) is the outer upward facing boundary of the socket geometry and defines, among other things, the height of the recess 7 (a, b) of the closure 1, so that a plane overall surface is obtained in the closed state.

[38] Figure 3 shows the outer housing 60 as a single part with the openings 61 (a, b) and the opening edges 62 (a, b).

[39] Figure 4 shows the base housing 10 as a single part in an isometric view. The upper base surface shows the stop ribs for limiting the rotation of the closure 1. The stop surfaces 11 (a, b) are the side faces of the guide rib 14 (a, b) and guide the closure 1 during the linear downward movement. The stop ribs 12 (a, b) and 13 (a, b) limit the rotation of the closure 1, wherein the rotation of the closure during opening is limited by the pair of ribs 13 (a, b) and the rotation of the closure 1 during closing is limited by the pair of ribs 12 (a, b). A guide recess 15 in which the movement sleeves are mounted is arranged centrally. The through holes 16 (a, b) are provided for routing cables to the outer housing 60.

[40] Figure 5 shows the plug socket element with the closure 1 and without the outer housing 60 in the closed position in a plan view. The closure 1 rests with its stop surfaces 4 (a, b) against the stop ribs 12 (a, b), so that the stop faces 2 (a, b) of the closure 1 are located opposite the stop surfaces 11 (a, b) of the base housing 10 with a small gap. The guide surfaces 3 (a, b) of the

closure 1 are exposed in the base housing 10. In the centre of the closure an example of a sensor circuit board 52 is arranged.

[41] Figure 6 shows the plug socket element with the closure 1 and without the outer housing 60 in the open position in a plan view. The closure 1 now rests with the stop surfaces 5 (a, b) on the stop ribs 13 (a, b) of the base housing 10 and the guide surface 3 (a, b) of the closure 1 is partially covered by the guide rib 14 (a, b) of the base housing 10. The socket inserts 65 (a, b) are thus freely accessible in the assembly.

[42] Figure 7 shows an example of a drive mechanism as a pre-assembly in a side view. This pre-assembly consists of the closure 1 which is fixed in position and fixedly connected to a movement sleeve 20. The drive swivel 24 protrudes into the movement sleeve 20 such that it is coupled in turn to an electric drive unit 50 via an axial connection.

[43] Figure 8 shows a sensor circuit board 52, which can be implemented in a wide variety of designs and can occupy different positions in the overall module of the plug socket element.

[44] Figure 9 depicts the closure 1 with its functional elements as a single part in an isometric view. The outline of the closure 1 results from the complementary stop surfaces 4 (a, b) and 5 (a, b) as well as the guide surfaces 2 (a, b) and 3 (a, b) and from the recesses 7 (a, b) for a plane overall surface. A shaped body 8 for a sensor circuit board 52 is provided centrally, in which 2 mounting tabs 6 (a, b) are formed.

[45] Figures 10 to 12 show the individual parts of a possible drive mechanism and the module assignment in half-section, using the operating principle of a threaded connection. The movement sleeve 20 is connected to the closure 1 by means of the connecting pins 23 (a, b) and the mounting tabs 6 (a, b). In the interior of the movement sleeve 20, an internal thread 21 is formed. The stop surface 22 of the movement sleeve 20 is located at the inner end of the internal thread 21. Complementary to the internal thread 21, the drive swivel 24 has an external thread 25 and at the upper end also, a stop surface 26 and an internally formed opening, which is designed as a receiving hole 27 for the rotational axle 51 of the electric drive unit 50.

[46] Figures 13 to 15 show the individual parts of a possible drive mechanism and the assembly assignment in the side view, using the operating principle of a helix structure 31 (a, b) in the motion sleeve 30. The closure 1 is also attached via its mounting tabs 6 (a, b) and the connecting pins 35 (a, b) of the movement sleeve 30. Each helix structure 31 (a, b) has a top

dead centre 33 and a bottom dead centre 32. The movement sleeve 30 is cylindrically shaped in the interior and thus forms a guide surface 34 for the drive swivel 36. The drive swivel has a cylindrical external shape 3 and is designed with two diametrically arranged cylindrical pins 38 (a, b), which engage in the helical structures 31 (a, b) in the drive mechanism assembly. This drive swivel 36 also has an internally formed opening which is designed as a receiving hole 27 for the rotational axle 51 of the electrical drive unit 50.

[47] Figures 16 and 17 illustrate an alternative drive mechanism on the basis of a combined solenoid/rotary magnet technique in the side view and an exploded view. The side view shows a possible design in which the closure 1 with its mounting tabs 6 (a, b) and the connecting pins 42 of the pull rod 41 of the solenoid 40 form a positive-locking fit. A rotary magnet 45 is arranged underneath the solenoid 40. In the exploded view, the schematic structure of this drive mechanism is shown in more detail. In this case, the solenoid essentially consists of the coil body 40 in the centre of which a pull rod 41 is arranged, which is drawn into the coil body 40 against a compression spring 43 when current is applied. The solenoid 40 is fixed by means of fastening elements 48 to a connecting plate 47, which in turn is fixedly connected to the rotating body 46. The rotating body 45 is positioned centrally in the outer body of the rotary magnet 45 such that it can rotate. Mounting tabs 49 (a, b) are formed on the outer body of the rotary magnet 45, which secure the outer body of the rotary magnet 45 to the base housing 10.

[48] Figure 18 shows the structure of a plug socket element in its entirety based on an exemplary embodiment in an exploded diagram. The base housing 10 and the outer housing 60 when assembled form a cavity in which the closure 1 can execute its linear lifting and rotational movement by means of the movement sleeve 20 and the drive swivel 24. A sensor circuit board 52 can be provided in a central position. Inside the base housing 10 are the socket inserts 65 (a, b), the electric drive unit 50 and further sensor circuit boards 53 as well as the motor control circuit board 54. The end of the module is formed by the bottom of the housing 70.

[49] Figures 19 and 20 illustrate the plug socket element in half-section, with Figure 19 illustrating the plug socket element in the closed position of the closure 1. In this case, the surfaces of the recesses 7 (a, b) are plane-parallel with the surface of the outer housing 60. A gap is present between the stop surface 22 of the movement sleeve 20 and the stop surface 26 of the drive swivel 24. Figure 20 shows the linearly lowered position of the closure 1, wherein the surface of the recesses 7 (a, b) has been lowered below the level of the inside of the outer

housing 60. The stop surface of the movement sleeve 22 and the stop surface 26 of the drive swivel 24 move together.

[50] Figure 21 illustrates the plug socket element in half-section with two inserted plugs 75 (a, b) which engage in the socket inserts 65 (a, b) at different heights. The plug 75a just touches the pressure surfaces 78 (a, b) of the switch plunger 77a, so that the compression spring 79a rests on the microswitch 76 with a slight pre-tension. The plug 75b indicates the end position of the fully inserted plug 75b in the socket insert 65 and represents the switch plunger 77b in its pressed end position, wherein the switch spring 79b is also shown in its compressed position.

[51] Figure 22 is a half-section through a socket insert 65 that shows the arrangement of the microswitch with the switch plunger 77 and the pressure surfaces of the switch plunger 78 (a, b) as well as the compression spring 79 in the assembled state.

[52] Figure 23 shows the outer housing 60 in an isometric view from below as a pre-assembly with the 4 mounting brackets 63, which are fixed to the inside of the outer housing 60 and have an opening for receiving a latching element.

[53] Figure 24 is a detail cross-sectional view of the outer housing mounting when connected to the base housing 10. The latching hook 17 engages in the opening of the mounting bracket 63.

[54] In the following, the principle of operation is described in more detail based on the listed inventive solutions.

[55] Essentially, all types of signal generation without mechanical control elements can be used, such as electric field change, capacitive change, optical change by light-dark comparison, acoustic input, radio, and infrared inputs. The exemplary embodiments of the sensor circuit boards 52 and 53 are used here as examples. The sensor circuit boards 52 and 53 are arranged inside the base housing 10 and connected to the motor control circuit board 54 via cables (the cable connections have been omitted throughout the illustrations and the figure descriptions).

[56] The sensor circuit board 53 represents the receiving part in a Smart Home controlled system. Commands to open or close the plug socket element can be input via a smartphone app or via the smart speaker the Smart Home system. It is possible to address the sensor circuit board 53 via an intranet or a bus connection, or for example via the smart speaker, which sends a radio

signal or an infrared signal to the sensor circuit board 53. The sensor circuit board 53 now converts the input signal and sends a control signal to the motor control circuit board 54.

[57] Similar to the smart speaker, but much simpler in its structure, the sensor board 53 can also be designed as a stand-alone speech module. In this case, for example, one or two microphones can be inserted into the through-holes 16 of the base housing 10 and analogue commands can be stored and converted into digital signals via a programming button in the housing bottom (not shown), which in turn are sent as control signals to the motor control circuit board 54.

[58] Thus, different phonetic sound images, such as “Open” and “Closed”, can be stored for different individuals before installing the plug socket element. This means that the opening and closing of the plug socket element can be assigned to a specific group of people, thus eliminating the need for an additional mechanical child safety device for the plug sockets. The motor control circuit board 54 and the sensor circuit board 53 can be installed as separate circuit boards, but it is also possible to combine both circuits on one board, which would save additional wiring.

[59] If optoelectronic signal generation is used, the sensor circuit board 52 could be integrated centrally in the closure 1. A shaped body 8 is provided in the closure 1 for this purpose. When using optoelectronics, a reflective light barrier or a photoelectric optical sensor, the outer housing 60 must have a central opening in which the optoelectronics is placed (the opening is not shown in the illustrations or referred to in the figure description). If the light beam emitted is interrupted or else the light field detects shading, the sensor detects the change and sends a control signal to the motor control circuit board 54. As in the sensor technologies described previously, this mode of operation allows the plug socket element to be operated in a completely contactless manner.

[60] With capacitive sensor technology, an electric field is generated by the sensor and monitored for changes. Here also, the sensor 52, designed as a capacitive sensor, can be integrated into the closure 1. In the case of electrically conductive materials the capacitive sensor 52 can be designed as a touch sensor and/or can also be used as a contactless sensor with non-electrically conductive materials. In the touch version, the metallic outer housing 60 is connected to the sensor with a pair of wires. If the outer housing is touched at any point, the electric field changes and the sensor generates a control signal which it sends to the motor control circuit board 54. With non-contact capacitive sensor technology, it is only necessary to swipe through

the electric field with a finger or the whole hand, in which case the capacitance of the electric field changes, a control signal is generated and sent to the motor circuit board 54.

[61] None of the possible sensor technologies and connections to Smart Home systems require a mechanical control unit, as shown in the solution examples given under the heading prior art.

[62] After the control signal is input from the sensor circuit boards 52 or 53, the motor control circuit board 54 energizes the electric drive unit 50 and starts to rotate the rotational axle of the electric drive unit 51. On the rotational axle of the electric drive unit 51, the drive swivel part 24 is fixedly connected to the rotational axle 51 by means of the receiving hole 27. The rotation of the external thread 25 of the drive swivel 24 causes the movement sleeve 20 to be pulled axially into the plug socket element via the internal thread 21.

[63] The closure 1, which is connected by means of the mounting tabs 6 (a, b) of the closure 1 and the connecting pins 23 (a, b) of the movement sleeve 20 to the movement sleeve 20 in a positive-fitting manner and rests with the stop surfaces 2 (a, b) of the closure 1 against the stop surfaces 11 (a, b) of the base housing 10, wherein this pairing of surfaces prevents rotation of the movement sleeve 20, is now inserted linearly into the plug socket element by means of the movement sleeve 20. The height matching of the stop surfaces 11 (a, b) of the base housing 10 and the stop surfaces 2 (a, b) of the closure 1 is dimensioned in such a way that the recesses 7 (a, b) of the closure 1 are lowered securely below the level of the inside of the outer housing 60. If the rib depth of the stop surfaces 11 (a, b) of the base housing 10 is exceeded by the closure 1, the closure 1 with the movement sleeve 20 can rotate into the open position below the guide ribs 14 (a, b) of the base housing 10 until the stop surfaces 5 (a, b) of the closure 1 come into contact with the stop ribs 13 (a, b) of the base housing 10. The closure 1 is thus rotated out of the effective range of the socket inserts 65 (a, b) and the socket inserts 65 (a, b) can be used without restriction. The guide surfaces 3 (a, b) of the closure 1 slide under the guide ribs 14 (a, b) of the base housing and thus prevent the surface of the recess 7 (a, b) of the closure 1 from being scratched.

[64] When the closure 1 comes into contact with the stop ribs 13 (a, b), the rotation of the electric drive unit 50 is stopped, the threaded connection 21 and 25 generates a slight holding torque and the current amplitude increases to a defined value. When this value is reached, the electric drive unit 50 is switched off and its polarity is reversed in the IC circuit of the motor control circuit board 54. The plug socket element is open.

[65] When a new control signal is input, the electric drive unit 50 starts rotating in the reverse direction until the stop surfaces 4 (a, b) of the closure 1 come into contact with the stop ribs 12 (a, b) of the base housing 10. Since the electric drive unit 50 continues to rotate but the closure 1 is prevented from turning by the stop ribs 12 (a, b) of the base housing 10, the external thread 25 of the drive swivel 24 pushes the closure 1 in the movement sleeve 20 linearly towards the outer housing 60 via the internal thread 21. Thus, the recesses 7 (a, b) of the closure 1 are inserted linearly from bottom to top into the openings 61 (a, b) of the outer housing and form a plane overall surface with the surface of the outer housing 60. When the closure 1 comes into contact with the outer housing 60, the current amplitude increases again to a defined value. When this value is reached, the electric drive unit 50 is switched off and its polarity is reversed in the IC circuit of the motor control circuit board 54. The plug socket element is closed.

[66] In another exemplary embodiment, the sensors, the movement sequence of the closure 1 and the electric drive unit 50 are the same, except the drive swivel 36 and the movement sleeve 30 are designed differently. The movement sleeve 30 is a cylindrical rotary body, in the centre of which is a drilled hole 34 which is used to guide the drive swivel 36. In the upper region of the movement sleeve 30, two connecting pins 35 are formed externally, which form a positive-fitting connection when assembled with the mounting tabs 6 (a, b) of the closure 1.

[67] Two diametrically arranged helix structures 31 (a, b) are arranged in the sleeve wall, which are limited by a top dead centre 33 and a bottom dead centre 32.

[68] The drive swivel 36 is also a cylindrical rotary body, at the top end of which two cylindrical pins 38 (a, b) are formed, wherein the receiving hole 27 for the rotational axle of the electric drive unit 50 is formed centrally from below.

[69] When assembled, the drive swivel 36 protrudes with its cylindrical outer wall 37 into the movement sleeve 30 and is guided axially through the inner bore with the guide surface 34.

[70] Here, the cylindrical pins 38 (a, b) of the drive swivel 36 are located in the helical structures 31 (a, b) of the movement sleeve 30. The drive swivel is also fixedly connected to the electric drive unit.

[71] Once the rotational axle 51 of the electric drive unit 50 starts to rotate, the rotation of the closure 1 is initially prevented by the surface pairs 2 (a, b) of the closure 1 and 11 (a, b) of the base housing 10. Rotation of the drive swivel 36 lowers the movement sleeve 30 linearly into the

base housing 10 by means of the cylinder pins 38 (a, b), which move in the helical structures 31 (a, b) of the movement sleeve 30 from the bottom dead centre 32 to the top dead centre 33. When a sufficient depth of the closure 1 is reached, the rotation behaviour is the same as in the above-mentioned exemplary embodiment. The plug socket element is now open.

[72] The closing operation begins as in the previous exemplary embodiment, until the closure 1 comes into contact with the stop ribs 13 (a, b). The drive swivel 36 then continues to rotate and, by means of the cylindrical pins 38 (a, b), presses the movement sleeve 30 linearly upwards over the side walls of the helical structures 31 (a, b) until the closure 1 comes into contact with the outer housing 60. As in the previous exemplary embodiment, the end position of the closure 1 is now reached. The plug socket element is closed.

[73] A further exemplary embodiment relates to another possible implementation of the drive unit.

[74] As shown in Figures 16 and 17, this is formed by a combination of a solenoid and a rotary magnet. The closure 1 can also be fastened via the mounting tabs 6 (a, b) to the pull rod 41 of the solenoid 40 using the connecting pins 42. The solenoid 40 is fixedly connected by means of a connecting plate 47 on the rotating body of the rotary magnet 46 via the connecting bolts 48. The outer body of the rotary magnet 45 is fixed in the base housing 10 by means of lateral mounting tabs 49.

[75] When the control signal is input, the motor control circuit board 54 first energizes the solenoid and pulls the closure downwards toward the base housing 10 against the compression spring 43 using the pull rod 41. Thus, the recesses 7 (a, b) are lowered below the level of the underside of the outer housing 60. The rotation of the rotary magnet 46 now starts after a time delay and turns the closure 1 towards contact with the stop ribs 13 (a, b) into the “Open” position and the motor control circuit board 54 de-energizes the magnets 40 and 45 in the end position and reverses the direction of rotation of the rotary magnet 45. The plug socket element is open.

[76] If the control signal is now input via the sensors, the solenoid 40 is re-energized and the rotary magnet 45 turns the closure 1 into a position such that the closure 1 comes to rest against the stop rib 12 (a, b) of the base housing 10. Now the motor control circuit board 54 de-energizes the magnets 40 and 45 in the end position and the return spring 43 of the solenoid 40 presses the

closure 1 linearly against the outer housing 60 by means of the pull rod 41, so that the recesses 7 (a, b) form a plane surface with the outer housing 60.

[77] To prevent incorrect operation of the closure 1 when a plug 75 is plugged in, a microswitch 76 is arranged in the bottom of the socket insert 65. The microswitch 76 is designed as a break contact and is inserted in the circuit between the sensors 53 and the motor control circuit board 54. The engagement of the plug 75 in the socket insert 65 applies a force to the pressure surfaces 78 (a, b) of the switch plunger 77 by means of the plug pins of the plug 75, and the switch plunger 77 is moved in the direction of the microswitch 76 so that the compression spring 79, located between the switch plunger 77 and the pressure point of the microswitch 76, is compressed and the microswitch 76 opens and switches off the sensors 53, so that no control signal can be generated as long as a plug 75 is inserted. If the plug 75 is withdrawn, the compression spring 79 relaxes and the switch 76 closes the circuit of the sensors 53 and the motor control circuit board 54.

[78] The outer housing 60 is connected to the base housing 10 via fastening hooks 63. When fitted, the fastening hooks 63 of the outer housing 60 form a positive-fitting connection to the latching hooks 17 of the base housing 10. For inspection purposes and for easier disassembly during recycling operations, four inspection holes 18 are located on the cylindrical outer side of the base housing 10. By inserting a suitable tool, the 4 latching hooks of the base housing 10 are pressed into the interior of the base housing 10 and the positive-fitting connection to the outer housing 60 is released. The outer housing can now be removed.

[79] In summary, it should be noted that the inventive disclosure describes a plug socket element that does not require any mechanical control elements, opens the closure simply by, for example, moving the plug or a hand near to the socket element, and automatically closes the plug socket element again when the plug is removed. A linear movement and the rotational movement of the closure is implemented fully automatically in a logical sequence. The surface on the operator side is therefore made more dirt-resistant, the operation is considerably simplified and the mechanism is protected against human error. The risk of injury during operation is eliminated and the possibility of automation and integration into a Smart Home System is implemented.

List of reference signs

- 01 closure
- 02 stop surfaces for linear movement on the closure (a, b)
- 03 guide surface on the closure (a, b)
- 04 stop for “Closed” rotational movement on the closure (a, b)
- 05 stop for “Open” rotational movement on the closure (a, b)
- 06 mounting tabs on closure (a, b)
- 07 recess (a, b)
- 08 shaped body in the centre of the closure

- 10 base housing
- 11 stop surfaces for linear movement on the base housing (a, b)
- 12 stop rib for “Closed” rotational movement on the base housing (a, b)
- 13 stop rib for “Open” rotational movement on the base housing (a, b)
- 14 guide rib on the base housing (a, b)
- 15 guide opening for the movement sleeve in the base housing
- 16 through holes
- 17 latching hook 4x
- 18 inspection hole 4x

- 20 movement sleeve with internal thread
- 21 internal thread
- 22 stop surface of movement sleeve
- 23 connecting pins (a, b)
- 24 drive swivel with external thread
- 25 external thread
- 26 stop surface of drive swivel
- 27 receiving hole for rotational axle

- 30 movement sleeve with helix structure
- 31 helix structure (a, b)

- 32 bottom dead centre of helix structure
- 33 top dead centre of helix structure
- 34 guide surface for the drive swivel
- 35 connecting pin
- 36 drive swivel with cylindrical pin
- 37 guide surface of drive swivel
- 38 cylindrical pins (a, b)

- 40 outer body of solenoid (coil body)
- 41 pull rod
- 42 connecting pin
- 43 compression spring
- 45 outer body of rotary magnet
- 46 rotating body of rotary magnet
- 47 connecting plate
- 48 connecting bolt
- 49 mounting tabs

- 50 electric drive unit
- 51 rotational axle of the electric drive unit
- 52 sensor circuit board (Hall, optoelectronic)
- 53 sensor circuit board (capacitive, infrared, radio)
- 54 motor control board

- 60 outer housing
- 61 openings for socket access (a, b)
- 62 surface edge of openings (a, b)
- 63 latching bracket 4x
- 65 plug socket inserts (a, b)

- 70 housing bottom
- 75 plugs (a, b)
- 76 microswitch break contact

- 77 switch plungers (a, b)
- 78 pressure surfaces of switch plungers (a, b)
- 79 switch compression spring

Patent claims

1. Installation element for electrical connectors having a base housing (10), in which at least one electrical plug socket is arranged, and an outer housing (60) having at least one through-opening, with a rotating closure mechanism being arranged between the outer housing (60) and the base housing (10), ***characterized in that*** said installation element has a drive unit (50) which moves the locking mechanism linearly and rotationally when initiated by a control signal.
2. Installation element according to Claim 1, ***characterized in that*** in order to open the through-opening the drive unit (50) moves the closure mechanism first linearly and then rotationally.
3. Installation unit according to any one of the previous claims, ***characterized in that*** in order to close the through-opening the drive unit (50) moves the closure mechanism first rotationally and then linearly.
4. Installation unit according to any one of the previous claims, ***characterized in that*** when opening the closure mechanism the drive unit (50) tensions a spring which supports or causes the movement when closing the through-opening.
5. Installation unit according to any one of the previous claims, ***characterized in that*** when closing the closure mechanism the drive unit (50) tensions a spring which supports or causes the movement when opening the through-opening.
6. Installation unit according to any one of the previous claims, ***characterized in that*** the drive unit (50) moves the closure mechanism linearly and rotationally by means of a rotational movement.
7. Installation unit according to any one of the previous claims, ***characterized in that*** the drive unit (50) has an electromagnet which moves the closure mechanism linearly.
8. Installation unit according to any one of the previous claims, ***characterized in that*** the outer housing (60) is reversibly connected to the base housing.
9. Installation unit according to any one of the previous claims, ***characterized in that*** a plurality of electrical plug sockets are arranged in the base housing and the outer housing

- (60) has a plurality of through-openings, wherein the drive unit (50) is arranged between the plug sockets.
10. Installation unit according to any one of the previous claims, **characterized in that** the control signal is generated by an electric field change.
 11. Installation unit according to any one of the previous claims, **characterized in that** the control signal is generated by simply touching the outer housing (60).
 12. Installation unit according to any one of the previous claims, **characterized in that** the control signal is generated by an acoustic input.
 13. Installation unit according to any one of the previous claims, **characterized in that** the control signal is generated by a light sensor.
 14. Installation unit according to any one of the previous claims, **characterized in that** the control signal is generated via a connection to a Smart Home application.
 15. Installation unit according to any one of the previous claims, **characterized in that** when a plug is inserted the initiation of the drive unit (50) is interrupted by a control signal.
 16. Installation unit according to any one of the previous claims, **characterized in that** the closure (10) has stop surfaces (2 a,b) and guide surfaces (3 a,b) and the base housing (10) has stop surfaces (11 a,b) and guide ribs (14 a,b) and, when the closure (1) is opened, the stop surfaces (2 a,b) of the closure (1) execute a translational downward movement complementary to the stop surfaces (11 a,b) of the base housing (10) until the guide surfaces (3 a,b) of the closure (1) can protrude under the guide ribs (14 a,b) of the base housing (10).
 17. Installation unit according to Claim 16, **characterized in that** during a rotational movement of the closure (1) the guide surfaces (3 a,b) of the closure (1) slide along under the guide ribs (14 a,b) of the base housing (10).
 18. Installation unit according to any one of Claims 16 or 17, **characterized in that** the closure (1) has a recess (7 a,b), the height of which is less than the thickness of the guide ribs (14 a,b) of the base housing (10).

19. Installation unit according to any one of Claims 17 or 18, ***characterized in that*** the base housing (10) has stop ribs (13 a,b), which limit the rotational movement of the closure (1) during opening.
20. Installation unit according to any one of the previous claims, ***characterized in that*** the base housing (10) has stop ribs (12 a,b), which limit the rotational movement of the closure (1) during closing.
21. Installation unit according to any one of the previous claims, ***characterized in that*** the closure (1) has stop surfaces (4 a,b) and guide surfaces (3 a,b) and the base housing (10) has stop surfaces (12 a,b) and, upon closing the closure (1), the stop surfaces (4 a,b) of the closure (1) come into contact in a complementary manner to the stop surfaces (12 a,b) of the base housing (10) and the closure (1) executes a translational downward movement until the guide surfaces (3 a,b) of the closure (1) come into contact with the inside of the outer housing (60).
22. Installation unit according to any one of the previous claims, ***characterized in that*** the base housing (10) has through holes (16) and a sensor circuit board (53), which is arranged in the base housing (10) in the region of said through holes (16) outside the active circle of the movable closure (1).
23. Installation unit according to Claim 22, ***characterized in that*** the outer housing (60) is metallic and connected to the sensor circuit board (53) in an electrically conductive manner.
24. Installation unit according to any one of the previous claims, ***characterized in that*** the closure (1) has an electronic timer element which closes automatically after a specified time without actuation.
25. Installation unit according to any one of the previous claims, ***characterized in that*** it has a microswitch (76) and the outer housing has plug socket inserts (65) for a plug (75) and the insertion of a plug (75) into one of the plug socket inserts (65) opens the microswitch (76), which interrupts the control circuit of the electronics and thus prevents the closure from being closed when the plug (75) is inserted.

26. Installation unit according to Claims 24 and 25, ***characterized in that*** the removal of the plug (75) from one of the plug socket inserts (65) closes the microswitch (76) and thus activates the control circuit of the electronics and automatically closes the closure (1) via the timer element without actuation.