

Description

Circuit board plug-and-socket device

Technical field

The invention relates to a circuit board plug-and-socket device for connecting a socket-type connector's connecting leads to a circuit board's printed conductors.

Prior art

Various direct plug-in devices are known for connecting a connecting cable's leads to printed conductors on a circuit board. Said devices frequently consist of a strip-shaped socket-type connector which is plugged onto a connector board that is embodied on the edge of the circuit board and in which printed conductors are brought out through contact areas.

Direct circuit board plug-in devices of said type are used also for connecting telecommunication systems, with its possibly being required when an ISDN system is connected for either an external ISDN exchange or an internal S0 device to be connected at said system's what is termed S0 port. Both these connection configurations are described in the Service Manual for the ISDN telecommunication system of type HiPath 3000/5000 V4.0. Both connections require a modification to the 4-wire S0 interface: Connecting leads are on the one hand connected end-to-end and, on the other, crossed over in pairs. Said connecting leads have hitherto been crossed over by hand, which is to say a housing cover has had to be removed locally on the system and SR and SX wires crossed over manually in the connection socket. Crossing the leads over manually is not only time-consuming; it can also give rise to faults.

DIL switches and multiple plug-in devices are known for modifying the terminal assignment scheme of a circuit board plug-and-socket device.

Another possible solution is offered by specially designed contacting devices. These generally consist of a connector board that is embodied on the edge of the circuit board and onto which a plug-in female connector is plugged. The required terminal assignment scheme of the circuit board plug-and-socket device is predefined by a connection layout on the circuit board. A contacting device of said type is known from, for example, the applicant's unpublished patent application DE 103 17 588.

A four-wire ISDN interface circuit in the case of which switching between internal and external operation is effected automatically by means of electronic switches is known from DE 198 199 06 A1.

Modifying the terminal assignment scheme of a plug-in device is in the known prior art always associated with a more or less substantial expenditure for additional structural components. The endeavor is to minimize the expenditure for additional structural components.

Description of the invention

The object of the present invention is to provide a circuit board plug-and-socket device for connecting a socket-type connector's connecting leads to a circuit board's printed conductors in the case of which the terminal assignment scheme can be modified in a simple manner and with low production

costs.

Said object is inventively achieved by a circuit board plug-and-socket device of the type cited in the introduction having the following features:

- the socket-type connector contains contact elements that are connected to the connecting leads,
- a connector board is embodied on one edge of the circuit board for engaging with the socket-type connector in a pluggable manner,
- the connector board contains contact areas through which printed conductors are brought out on the edge, with there being present printed conductors that are brought out through one contact area and printed conductors that are brought out through at least two contact areas,
- a coding guide which defines a first plug-in position and at least one further plug-in position that is laterally offset at a distance on planes of the circuit board is embodied between the socket-type connector and connector board, with different contact areas being assigned to the contact elements in the first and the at least one further plug-in position.

A major advantage of the invention is that a terminal assignment scheme can be modified simply by laterally replugging a socket-type connector. At least two slots are provided in the connector board for the socket-type connector. Each slot is defined by a mechanical coding guide in the manner of a key-lock configuration, which is to say only specific plug-in positions are permitted on the connector board. The coding guide is produced through form closure between the socket-type connector and connector board. A connection layout connects

leads on the circuit board to contact areas on the connector board in such a way that the printed conductors and connecting leads can be assigned in a predefinable manner. Or expressed another way, the connection layout establishes the different connection possibilities between the printed conductors and connecting leads. Only a replugging operation is necessary for modifying the terminal assignment scheme, not additional structural components such as DIL switches or special coding devices. The effort required for the connection layout and mechanical coding being comparatively low, a possibility of modifying a terminal assignment scheme can be implemented in a simple manner. No costs will be incurred for additional structural components. The production costs will be low.

Advantageous embodiments of the invention are the subject of dependent claims.

A preferred embodiment of the invention is characterized in that the coding guide is formed by a coding bar that is embodied in the socket-type connector's receiving slot and acts in concert with corresponding coding recesses in the connector board. The permitted plug-in positions each correspond to a terminal assignment scheme for tapping the electric signals routed to the contact areas on the connector board.

For an ISDN connector, the circuit board plug-and-socket device is in a preferred embodiment characterized as follows: The connector board has 6 contact areas. Of these, a first contact area is connected to a first printed conductor and a second contact area is connected to a second printed conductor. A pair of contact areas adjacent to the first contact area are connected to a third printed conductor and a pair of contact areas adjacent to the second contact area are

connected to a fourth printed conductor. Embodied on both sides adjoining the first contact area is in each case a coding recess into which the coding bar can be inserted. Coded thereby in the connector board are two plug-in positions in which either an end-to-end connection or a connection crossed over in pairs is produced. Thus to modify the terminal assignment scheme it is necessary only for the socket-type connector to be replugged between the first and second slot. An ISDN connector's S0 port can thus in a simple manner be reconfigured between an ISDN exchange connection and an ISDN device connection. Manual crossing-over of connecting leads is dispensed with. Technical implementation is economical. The socket-type connector is produced preferably by means of plastic injection molding. The coding bar can be produced in a simple manner while the socket-type connector is being injection molded. The coding recesses in the connector board can be produced simply by milling the circuit board.

The socket-type connector's narrow width is achievable by embodying the contact areas and coding recesses in rectangular form and locating them in the connector board arranged oriented in the plugging direction mutually in parallel.

It is preferable for the coding bar to connect opposite wide surfaces of the receiving slot. As well as for mechanical coding, the coding bar will as a result simultaneously serve also as a bracing means in the receiving slot. The walls of the receiving slot can as a result be embodied as being very thin, thus requiring less material in production.

To make it as easy as possible to insert the coding bar into a coding recess when the socket-type connector is plugged in, it is favorable for the coding bar to be led up to the receiving slot's opening plane. When the coding recesses are embodied as

long holes, the dimensions can advantageously be selected so that the end surface situated within the socket-type connector's opening plane will upon insertion form a stop surface. Electric contact will not be established between the contact elements and contact areas until the socket-type connector is correctly sited in the selected insertion position.

In a particularly preferred embodiment of the invention it is provided for the receiving slot to be wider than the connector board. The dimensions are selected in such a way that in a plugged-in position an internal lateral surface of the receiving slot will be positioned against the facing lateral surface of the connector board.

To connect connecting leads already attached to a type RJ45 plug to the socket-type connector, a variant of the invention provides for the socket-type connector to have a Mini-Western socket (conforming to DIN EN 60603-7), into which can be plugged a Mini-Western plug with its connected connecting leads, on a rear side facing away from the receive slot's opening. The socket-type connector here forms an adapter whose terminal assignment scheme can be modified simply by replugging between the first and second plug-in position on the connector board.

To connect connecting leads to the socket-type connector directly, another variant provides for the socket-type connector to be furnished with terminal screws.

It is favorable in terms of the contacting properties and mechanical securing of the socket-type connector on the connector board for the contact elements to be embodied as fork-shaped contact springs. In a plugged-in position the

contact springs will as a result encompass the connector board's outer edge and hold the socket-type connector by elastic force.

To further improve said contacting properties and maintain them for as long a period of use as possible, it can be favorable for the contact springs and/or contact areas to be furnished with a corrosion-resistant coating, preferably, in particular, with a coating of gold or a gold alloy.

A fire-retardant, polymeric material is preferably employed as the material for the socket-type connector. This can be mass-produced advantageously using plastic injection molding.

The inventive circuit board plug-and-socket device is preferably applied in the case of an ISDN telecommunication system for setting up the S0 port for connecting either an (external) digital exchange or an (internal) ISDN terminal.

It is favorable for the first and second coding recess to be arranged spaced apart having a contact spacing and adjacent to the first contact area. An asymmetric arrangement of said type will insure that the socket-type connector cannot be plugged onto the connector board in a position rotated through 180 degrees.

Short description of the drawings

In the part of the description that follows the invention will be further explained with reference to the drawings from which further advantageous embodiments, specifics, and developments of the invention can be gleaned with the aid of the exemplary embodiment illustrated.

Figure 1 shows the inventive circuit board plug-and-socket device with the socket-type connector being illustrated prior to insertion into the first plug-in position;

Figure 2 shows the inventive circuit board plug-and-socket device with the socket-type connector being illustrated prior to insertion into the second plug-in position;

Figure 3 is a cross-sectional view of the socket-type connector plugged onto the connector board with the connecting cable being connected by means of an RJ45 connection;

Implementation of the invention

Figures 1 and 2 show an exemplary embodiment of the inventive circuit board plug-and-socket device, referenced overall with the reference numeral 1, as employed, for instance, in the case of an ISDN telecommunication system for configuring a terminal assignment scheme of an ISDN terminal connection.

The three-dimensional illustrations in figure 1 and figure 2 show a strip-shaped socket-type connector 3 in each case occupying a position before being plugged onto the connector board 4 of the circuit board 2. Attached to the socket-type connector 3 is a connecting cable 20 having connecting leads 26. The socket-type connector 3 has a cuboidal receiving slot 15 in which can be seen four contact elements 11, 12, 13, 14. Further embodied in the receiving slot 15 is a coding bar 23 extending between opposite broadsides of the receiving slot

15. Located opposite the four contact elements 11, 12, 13, 14 of the socket-type connector (3) in the instance illustrated applying to an ISDN terminal connection are six contact areas 5, 6, 7, 8, 9, 10 on the connector board 4, with said contact areas being arranged side by side in a row.

The connector board 4 projects tongue-like from an edge 24 of the circuit board 2. The contact areas 5, 6, 7, 8, 9, 10 are embodied as rectangular and connected to four printed conductors 31, 32, 33, 34 of the circuit board 2.

The connector board 4 is furnished additionally with two coding recesses 21 and 22. Said coding recesses 21 and 22 are arranged spaced apart at a distance 25 and are produced through milling work on the connector board 4. They are provided on both sides of the contact area 9 and run parallel thereto. They form a key groove for the coding bar 23.

The selected asymmetric arrangement of the coding bar 23 and coding recesses 21, 22 precludes enabling the socket-type connector 3 to be plugged in at a position turned through 180 degrees.

In the illustration in figure 1 the coding bar 23 is in an insertion position for insertion into the first coding recess 21. Figure 2 shows, by contrast, the second insertion position displaced laterally to the left. The coding bar 23 is here situated opposite the second coding recess 22. The coding bar 23 is 0.7 mm wide. The first and second coding recess 21, 22 are slightly wider than the coding bar so that the socket-type connector 3 can easily be plugged onto the connector board 4 by hand. The two coding recesses 21 and 22 and the contact areas 5, 6, 7, 8, 9, 10 are in each case spaced apart having a contact spacing (1.27 to 3.5 millimeters). The contact areas

5, 6, 7, 8, 9, 10 are in the exemplary embodiment shown brought out on a top side of the printed conductor; it is, though, also conceivable for the contact areas to be brought out on the top side and/or underside.

The connection between the contact areas 5, 6, 7, 8, 9, 10 and the printed conductors 31, 22, 33, 44 is predefined by a connection layout 30 on the circuit board 2. As can be seen from figure 1 and figure 2, the contact area 6 is in the present instance connected by said connection layout 30 only to the printed conductor 31 (ISDN signal SX2) and the contact area 9 only to the printed conductor 33 (ISDN signal SX1). In contrast to this, the printed conductor 32 conducting the ISDN signal SR2 is brought out in the connector board 4 by two contact areas 5 and 7. The printed conductor 34 conducting the ISDN signal SR1 is also brought out twice in the connector board 4, specifically by the connection to the contact area 8 and by the connection to the contact area 10. In other words, there are contact areas in the connector board which are only connected to one printed conductor (contact areas 6 and 9) and, on the other hand, there are printed conductors 32 and 34 terminating in the connector board 4 in each case in two contact areas 5 and 7 or, as the case may be, 8 and 10. As a result of said assignment, the ISDN signals SX1 and SX2 can in each case be tapped at one contact area, whereas the ISDN signals SR1 or, as the case may be, SR2 can in each case be tapped at two contact areas in the connector board 4.

In the present instance this means that if either an external ISDN exchange or an internal S0 device is to be connected at a communication system's S0 port, then the required crossing-over of connecting leads in pairs can be achieved simply by plugging the socket-type connector 3 by means of the coding bar 23 either into the first coding recess 21 or, laterally

displaced, into the second coding recess 22. The arrow 29 indicates the plugging direction in figure 1 and figure 2.

The assignment between the contact elements and ISDN signals is as follows:

In the first plug-in position the coding bar 23 has been inserted into the first coding recess 21 (figure 1).

Contact elements	Contact area	ISDN signal
11	6	SX2
12	7	SR2
13	9	SX1
14	10	SR1

In the second plug-in position the coding bar 23 has been inserted into the second coding recess 22 (figure 2).

Contact elements	Contact area	ISDN signal
11	5	SR2
12	6	SX2
13	8	SR1
14	9	SX1

As can be seen by comparing the two tables, the ISDN signals tapped by the contact elements 11, 12, 13, 14 of the socket-type connector 3 are crossed over in pairs in the respective plug-in positions, which is equivalent to manually changing over connecting wires.

Because the socket-type connector 3 can only be plugged in said first or, as the case may be, second plug-in position

onto the connector board 4, errors during configuring of the ISDN connection, such as can occur when the connecting wires are changed over manually, are precluded.

As shown in figure 1 and figure 2, the cuboidal receiving slot 15 of the socket-type connector 3 has lateral walls 16 and 17. The receiving slot 15 is wider than the connector board 4. The coding bar 23 divides the receiving slot 15 non-symmetrically into - as seen in the viewing direction - a larger left-hand and a smaller right-hand partial slot. The contact elements 11, 12 and 13 are located in the left-hand partial slot. One contact space is free between the contact elements 12 and 13; the outer space abutting the inner surface 16 or, as the case may be, 17 has also been left free in each partial slot. The contact elements 11, 12 and 13, 14 as well as the contact areas 5, 6, 7, 8, 9, 10 and coding recesses 21, 22 are in each case arranged next to each other spaced apart at a distance 25 (contact spacing).

In the first insertion position shown in figure 1 the inner lateral surface 16 aligns with the corresponding lateral surface 18 of the connector board 4. The dimensions have been selected in such a way that the surface 16 will be positioned against the surface 18 during the plugging operation (arrow 29). That will produce additional guiding during insertion. The same applies to the second insertion position shown in figure 2. Upon insertion into this slot the - as seen in the viewing direction - right-hand lateral surface 17 of the socket-type connector 3 will be positioned against the lateral surface 19 of the connector board 4. Said positioning against each other of the surfaces 17 and 19 will provide additional guiding here, too.

The coding bar 23 has an end surface 35 that is flush with the

opening plane of the receiving slot 15. The depth of the coding recess 21 or, as the case may be, 22 is dimensioned in such a way that the end surface 35 will act as a stop during insertion.

The connecting leads 26 of the cable 2 can be either pluggable into the socket-type connector 3 or permanently connected thereto. The cross-sectional drawing in figure 3 shows, in a first variant, connecting of the connecting cable 20 by means of an RJ45 plug connector 27. In a second variant, shown in figure 4, the connection is established by means of a terminal screw 28. The plug connector 27 or, as the case may be, terminal screw 28 is embodied in each case on a side of the socket-type connector 3 facing away from the receiving slot 15. As can be seen from the cross-sectional illustration, the contact elements are embodied as fork-shaped.

The mechanical coding 23, 21, 22 can, of course, also be implemented using differently embodied shape pairing between the connector board 4 and receiving slot 15. For example, the coding recesses can be formed by means of grooves embodied in the connector board 4 and oriented in the plugging direction 29. Instead of the coding bar 23, a coding strip projecting in the receiving slot in the direction of the connector board, or a means embodied according to a similar, congruent approach to coding, will then engage with said grooves.

Reference numerals used

1	Circuit board plug-and-socket device
2	Circuit board
3	Socket-type connector
4	Connector board
5, 6, 7, 8, 9, 10	Contact areas
11, 12, 13, 14	Contact elements
15	Receiving slot
16	Lateral surface in 15
17	Lateral surface in 15
18	Lateral surface of 4
19	Lateral surface of 4
20	Connecting cable
21	First coding recess
22	Second coding recess
23	Coding bar
24	Edge of 2
25	Distance between 21 and 22
26	Connecting leads of 20
27	RJ45 plug
28	Terminal screw
29	Arrow indicating plugging direction
30	Connection layout
31	Second printed conductor
32	Fourth printed conductor
33	First printed conductor
34	Third printed conductor
35	End surface

Claims

1. A circuit board plug-and-socket device for connecting a socket-type connector's connecting leads to a circuit board's printed conductors, characterized by the following features:
 - a) the socket-type connector (3) contains contact elements (11, 12, 13, 14) that are connected to the connecting leads (26),
 - b) a connector board (4) is embodied on one edge (24) of the circuit board (2) for engaging with the socket-type connector (3) in a pluggable manner,
 - c) the connector board (4) contains contact areas (5, 6, 7, 8, 9, 10) through which printed conductors (31, 32, 33, 34) are brought out on the edge (24), with there being present printed conductors that are brought out through one contact area and printed conductors that are brought out through at least two contact areas,
 - d) a coding guide (21, 22, 23) which defines a first plug-in position and at least one further plug-in position that is laterally offset at a distance (25) on planes of the circuit board (2) is embodied between the socket-type connector (3) and connector board (4), with different contact areas being assigned to the contact elements in the first and the at least one further plug-in position.
2. The circuit board plug-and-socket device as claimed in claim 1, characterized in that the coding guide (21, 22, 23) is formed by a coding bar (23) which is embodied in the receiving slot (15) of the socket-type connector (3) and can be inserted into either a first coding recess (21) or a second coding recess (22) embodied in the connector board (4).

3. The circuit board plug-and-socket device as claimed in claim 2, characterized in that the connector board (4) has six equidistantly spaced contact areas (5, 6, 7, 8, 9, 10) of which a first contact area (9) is connected to a first printed conductor (33) and a second contact area (6) is connected to a second printed conductor (31), with a first pair of contact areas (8, 10) adjacent to the first contact area (9) being connected to a third printed conductor (34) and a second pair of contact areas (5, 7) adjacent to the second contact area (6) being connected to a fourth printed conductor (32), further in that the first coding recess (21) is embodied between the first contact area (9) and the adjacent contact area (10) and the second coding recess (22) is embodied between the first contact area (9) and the adjacent contact area (8), and further in that four contact elements (11, 12, 13, 14) are arranged in the receiving slot (15) in such a way that an electric connection between connecting leads (26) and printed conductors (31, 32, 33, 34) that is crossed over in pairs can be produced by replugging the socket-type connector (3) between the first and second coding recess.
4. The circuit board plug-and-socket device as claimed in claim 2 or 3, characterized in that the contact areas (5, 6, 7, 8, 9, 10) and the first and second coding recess (21, 22) are embodied in rectangular form and arranged oriented in the plugging direction (29) mutually in parallel.
5. The circuit board plug-and-socket device as claimed in one of claims 2, 3, or 4, characterized in that the coding bar (23) connects opposite wide surfaces of the receiving slot (15).

6. The circuit board plug-and-socket device as claimed in one of claims 2 to 5, characterized in that an end surface (35) of the coding bar (23) is flush with the opening plane of the receiving slot (15) so that the end surface (35) will during insertion form a stop in a coding recess (21, 22) embodied as a long hole.
7. The circuit board plug-and-socket device as claimed in one of claims 2 to 6, characterized in that the receiving slot (15) has internal lateral surfaces (16, 17) which in a plugged-in position will in each case be positioned against respective adjacent lateral surfaces (18, 19) of the connector board (4).
8. The circuit board plug-and-socket device as claimed in one of claims 1 to 7, characterized in that the connecting leads (26) are attached to a Mini-Western plug (27) engaging in a pluggable manner with a Mini-Western socket (RJ46 socket) embodied on the socket-type connector (3).
9. The circuit board plug-and-socket device as claimed in one of claims 1 to 7, characterized in that the socket-type connector (3) has terminal screws (28) to which the connecting leads (26) are attached.
10. The circuit board plug-and-socket device as claimed in one of the preceding claims, characterized in that the contact elements (11, 12, 13, 14) are embodied as fork-shaped contact springs which in a plugged-in position are held against assigned contact areas (5, 6, 7, 8, 9, 10) by elastic force.
11. The circuit board plug-and-socket device as claimed in one of the preceding claims, characterized in that the contact

elements (11, 12, 13, 14) and/or the contact areas (5, 6, 7, 8, 9, 10) are coated with a corrosion-resistant coating, in particular a gold alloy.

12. The circuit board plug-and-socket device as claimed in one of the preceding claims, characterized in that the socket-type connector (3) has been produced using plastic injection molding from a fire-retardant, polymeric material.
13. The circuit board plug-and-socket device as claimed in one of the preceding claims, characterized in that signals of an ISDN S0 interface (SX1, SX2, SR1, SR2) have been routed to the contact areas (5, 6, 7, 8, 9, 10).
14. The circuit board plug-and-socket device as claimed in one of the preceding claims, characterized in that the contact areas (5, 6, 7, 8, 9, 10), the contact elements (11, 12), and the contact elements (13, 14), as well as the coding recesses (21, 22) are in each case spaced apart having a contact spacing.