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DATE OF RECEIPT		9/2/98

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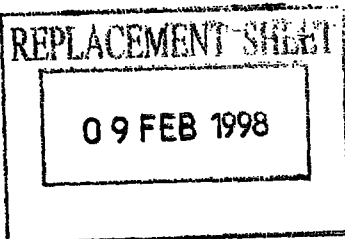
MODULE SUPPORT STRUCTURE

Description

The invention concerns a module support structure for the acceptance of plug-in modules equipped with electrical and electronic components having two parallel side walls connected to each other via at least four module rails, and having a cover plate on its upper side and on its lower side and having tracks of holes for mounting bolts on the upper and lower edges of the side walls and with at least one mounting element disposed at the track of holes to which the cover plate is mounted.

The invention can be used with all types and sizes of module support structures provided for industrial electronics use in instrument cabinets, housings, or racks.

Module support structures, configured in the manner of a rack comprising two side walls connected together by at least four profiled structure rails, are often provided with upper and lower cover plates for protection of their components. These cover plates primarily protect the components from mechanical damage during transport or during operation, but can also simultaneously function as shielding. In this role, they prevent inward and outward irradiation of radio frequency interference. The cover plates must therefore not only have sufficient mechanical stability and be properly connected to the side walls, but must also be in electrically conducting contact with both of the side walls.



The electrical contacting of cover plates and module rails in module support structures is e.g. described in DE 42 23 322 C1, due to the applicant. It is effected via cover plate edge strips which engage into module rail longitudinal grooves having resilient elements.

To date, the cover plates have simply been bolted to the side walls. The sides of the cover plates were bent and provided with threads for accepting mounting bolts. This configuration had the risk that, during assembly or due to thermal effects, the cover plate would be distorted or the side wall stressed or bent. This mounting scheme has the additional disadvantage that a plurality of differing cover plates must be used to accommodate the differing assembly possibilities for the module rails. A retroactive change in the position of the module rails can only be effected following removal of a section of the edge strip. Good radio frequency shielding can only be achieved using a large number of bolts in view of the separation between attachment locations of the mounting bolts, which are disposed next to each other in a row.

Also known in the art is mounting the cover plates to the side walls using support elements. Towards this end, plate-shaped support elements are initially mounted to the edges of the side walls using mounting bolts and the cover, having holes along its edge, is then connected to the support elements using resilient retention means and mounting bolts. This design is difficult and costly with regard to materials and assembly. There is no RF sealing of the longitudinal slot between the side walls and the cover (EP 0 453 668 A1).

In addition thereto, a module support structure is known in the art with which resilient conducting contacts having an

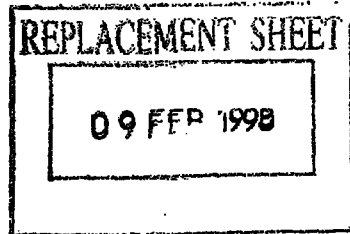
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S-shaped cross section establish a low resistance contact between the metallic aluminum side walls, connected together via module rails, and the upper or lower cover. The sideward ends of the cover plate are bent over at right angles and are surrounded by one groove-shaped half of the resilient contacts, whereas the other oppositely opening half of the resilient contacts seats, in a spring-loaded manner, about the edges of the side walls. Although the mounted resilient contacts effect a reliable RF sealing of the gap between the cover plates and the side walls, there is no mechanical connection between the plates and the walls (DE 42 37 447 A1).

Various kinds of contact strips or resilient contacts for radiation-proof connection of abutting metallic wall elements are, per se, known in the art (DE 94 01 533 U1 and DE 90 03 209 U1).

It is the purpose of the invention to configure an element for mounting the cover plates to the side walls of module support structures in such a manner that, with little technical difficulty and expense as well as with rapid assembly, an economical inwardly seating connection can be produced which secures sufficiently good radio frequency sealing, in the relevant frequency range, of the gap between the components, which can accommodate production tolerances, and which mechanically connects the components.

Departing from a module support structure of the above mentioned kind, this object is achieved in that the mounting element consists essentially of an angled support made from thin resilient steel sheet metal and comprising two angle legs subtending an angle of more than 90 angular degrees,



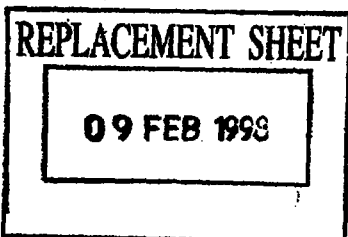
wherein the first angle leg of the angled support is placed between the side wall and the cover plate and the first angle leg has a bolt receptacle for the mounting bolt and the connecting bolt is passed through a hole in the track of holes and screwed into the bolt receptacle and the second angle leg has at least one seating for the cover plate which is produced through stamping of this angle leg and this second angle leg forms, together with the seating, a U-shaped resilient clamp which accepts the cover plate abutting the side wall.

During assembly, a plurality of the proposed mounting elements are placed onto both sides of the cover plate at those edge locations not occupied by module rails. The cover plate is then introduced between the side walls and the mounting elements are screwed-down. This can be done with little manual effort.

In order to effect simpler manufacture, the bolt receptacle can be a hole produced by punching and stamping.

It is advantageous when the first angle leg has a bent edge directed towards the second angle leg. This measure simplifies introduction of the cover plates having the mounting elements, since the slant of the bent edge guides the first angle leg past the inner edges of the side walls.

A further embodiment of the invention is characterized by angled components fashioned on the ends of the angled support and having two legs one of which has a bracket for the cover plate and the other leg forming, together with the bracket, a resilient U-shaped receptacle for the cover plate. This angled component extends the mounting elements without



requiring additional bolting to the side wall to extend the RF sealing of the gap between the cover plate and the side wall.

It is advantageous when one leg of the angled component has a contact nub on its outer side for improving the contact to the side wall.

It is advantageous when the one leg of the angled component comprises a bend directed towards the second leg. This bend simplifies introduction of the cover plate as does the bent edge of the first angle leg of the mounting element.

An intended breaking location can be provided between the angled support and the angled component for simple breaking-off of the angled component in the event that this component is not needed.

For improved production and simple adjustment to the various conditions of differing module support structures, it is advantageous when a plurality of angled supports having a plurality of angled components are connected together to form a band.

The invention will be described in greater detail below with reference to the three accompanying sheets of drawing.

Figure 1 shows a vertical cut through a module support structure as seen from the rear in reduced scale;

Figure 2 shows the encircled upper right corner of the module support structure of figure 1 with the associated components in exploded view;

Figure 3 shows an angled support in cross section in a greatly expanded representation;

Figure 4 shows a side view of the beginning portion of a band having one angled support and two placed angled components;

Figure 5 shows a plan view of the band in accordance with figure 4;

Figure 6 shows the band of figures 4 and 5 in perspective view from the side;

Figure 7 shows the band of figures 4 and 5 likewise in perspective view from the other side.

The module support structure 1 shown in figure 1 in vertical cut and in a simplified manner serves for acceptance of plug-in modules (not shown) each having a printed circuit board for electrical and electronic components and a forward front plate.

The module support structure 1 comprises two parallel side walls 2 and 3 made from aluminum sheet metal as well as four profiled structure rails made from aluminum of which the upper front and lower front module rails 4 and 5 can be seen. The side walls 2 and 3 have mounting flanges 6 having screw holes with the assistance of which the module support structure 1 can be mounted into an equipment cabinet or rack.

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The side walls 2 and 3 are bolted to the module rails 4 and 5 using bolts (not shown). For this purpose, tracks of holes 10 are disposed in the upper and lower edges 8 and 9 of the side walls 2 and 3.

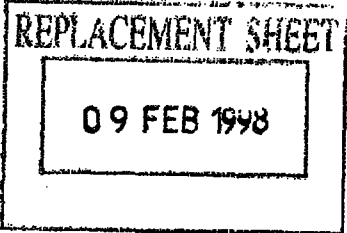
Two cover plates 11 and 12, mounted to the upper and lower sides in a detachable manner, seal the module support structure 1.

In order to mount the two cover plates 11 and 12, mounting elements are placed onto the tracks of holes 10 to hold the associated cover plate 11 or 12 at its edge.

The mounting elements connect the cover plates 11 and 12 mechanically as well as electrically to the side walls 2 and 3. These mounting elements are angled supports 13 made from thin resilient steel sheet metal, preferentially from chrome-nickel-steel, produced through a plurality of sequential punching and stamping steps.

Each angled support 13 has (see figure 3) a first angle leg 14 and a second angle leg 15. These two angle legs 14, 15 subtend an angle 16 of more than ninety angular degrees. The first angle leg 14 has a bent edge 17 directed towards the second angle leg 15 and describes an obtuse angle with respect to the first angle leg 14 of approximately one hundred seventy five angular degrees.

When the cover plate 11,12 is mounted, the first angle leg 14 is placed between the associated cover plate 11 or 12 and the adjacent side wall 2 or 3. It has a bolt receptacle 18 for a mounting bolt 19. This mounting bolt is passed from the



outside through a hole in the track of holes 10 and screwed with its thread into the bolt receptacle 18. The bolt receptacle 18 is a punched hole having two edge openings and having edges punched into the shape of two half-threads (see figures 4, 6 and 7). The bolt receptacle 18 can also be a flat nut.

The second angle leg 15 comprises two seating surfaces 20 for the associated cover plate 11 or 12 which are produced through stamping of the second angle leg 15. Together with the second angle leg 15, these two seating surfaces 20 form two U-shaped resilient clamps 21 which accept the edge of the associated cover plate 11 or 12 abutting the corresponding side wall 2 or 3. A slanted guide 22 simplifies insertion of the cover plate 11, 12 into the clamps 21.

An angled component 23 is formed on one end of the angled support 13 and has two legs 24, 25 subtending an angle of ninety angular degrees. This angle can also be somewhat larger than ninety degrees. An inwardly directed bracket 26 protrudes beyond one leg 24 and forms, together with the other leg 25, a resilient U-shaped receptacle 27 for placement onto the edge of the cover plate 11 or 12.

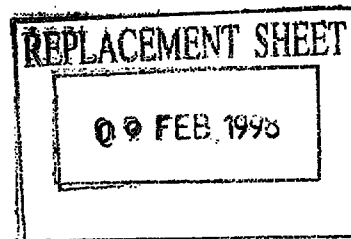
One leg 24 has, on its outer side, a contact nub 28 produced through stamping which, with mounted cover plate 11, 12, resiliently pushes onto the inner side of the associated side wall 2 or 3 due to the angular configuration of the two legs 24 and 25 of the angled component 23.

A stamped intended breaking location 29 is disposed between the angled support 13 and the angled component 23.

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The one leg 24 of the angled component 23 has a bend 30 directed towards the second leg 25.

An additional angled component 31 corresponds with and is adjacent to angled component 23 and is followed by an additional angled support 32 which is, in turn, identical to the angled support 13. A plurality of angled supports 13, 32 and a plurality of angled components 23 and 31 are connected together via intended breaking locations 29.



Summary of Reference Symbols

- 1 module support structure
- 2 side wall
- 3 side wall
- 4 module rail
- 5 module rail
- 6 mounting flange
- 7 bolt holes
- 8 upper edge (of 2,3)
- 9 lower edge (of 2,3)
- 10 track of holes
- 11 cover plate (on top)
- 12 cover plate (on bottom)
- 13 angled support
- 14 angle leg, first
- 15 angle leg, second
- 16 angle
- 17 bent edge
- 18 bolt receptacle
- 19 mounting bolt
- 20 seating surface
- 21 clamp
- 22 slanted guide
- 23 angled component
- 24 leg
- 25 leg
- 26 bracket
- 27 receptacle

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28 contact nub

29 intended breaking location

30 bend

31 angled component, additional

32 angled support, additional



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Module Support Structure

Claims

1. A module support structure for the acceptance of plug-in modules equipped with electrical and electronic components
 - with two parallel side walls connected to each other via at least four module rails,
 - with a cover plate on its upper side and on its lower side,
 - with tracks of holes for mounting bolts on the upper and lower edges of the side walls,
 - with at least one mounting element disposed at the track of holes to which the cover plate is mounted,characterized by the following features:
 - the mounting element consists essentially of an angled support (13) made from thin resilient steel sheet metal,
 - the angled support (13) comprises two angle legs (14 and 15) subtending an angle (16) of more than 90 angular degrees,

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- the first angle leg (14) of the angled support (13) is placed between the side wall (2,3) and the cover plate (11,12),
- the first angle leg (14) has a bolt receptacle (18) for the mounting bolt (19),
- the connecting bolt (19) is passed through a hole in the track of holes (10) and screwed into the bolt receptacle (18),
- the second angle leg (15) has at least one seating (20) for the cover plate (11,12) which is produced through stamping of this angle leg (15),
- this second angle leg (15) forms, together with the seating (20), a U-shaped resilient clamp (21),
- the clamp (21) serves for accepting the cover plate (11,12) abutting the side wall (2,3).

2. Module support structure of claim 1, characterized in that the bolt receptacle (18) is a hole formed through punching and stamping.

3. Module support structure of any one of the claims 1 or 2, characterized in that the first angle leg (14) has a bent edge (17) directed towards the second angle leg (15).

4. Module support structure of any one of the claims 1 through 3, characterized by an angled component (23) formed on the end of the angled support (13) and having two legs (24 and 25) one of which (24) having a bracket (26) for the cover plate (11,12) and the other leg (25) forming, together with the bracket (26), a resilient U-shaped receptacle (27) for the cover plate (11,12).





5. Module support structure of claim 4, characterized in that the one leg (24) of the angled component (23) has a contact nub (28) on its outer side.

6. Module support structure of any one of the claims 4 or 5, characterized in that the one leg (24) of the angled component (23) has a bend (30) directed towards the second leg (25).

7. Module support structure of any one of the claims 4 through 6, characterized in that an intended breaking location (29) is disposed between the angled support (13) and the angled component (23).

8. Module support structure of any one of the claims 4 through 7, characterized in that a plurality of angled supports (13 and 31) and a plurality of angled components (23 and 30) are connected together to form a band.



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Description

The invention concerns a module support structure for the acceptance of plug-in modules equipped with electrical and electronic components having two parallel side walls connected to each other via at least four module rails, and having a cover plate on its upper side and on its lower side and having tracks of holes for mounting bolts on the upper and lower edges of the side walls and with at least one mounting element disposed at the track of holes to which the cover plate is mounted.

The invention can be used with all types and sizes of module support structures provided for industrial electronics use in instrument cabinets, housings, or racks.

Module support structures, configured in the manner of a rack comprising two side walls connected together by at least four profiled structure rails, are often provided with upper and lower cover plates for protection of their components. These cover plates primarily protect the components from mechanical damage during transport or during operation, but can also simultaneously function as shielding. In this role, they prevent inward and outward irradiation of radio frequency interference. The cover plates must therefore not only have sufficient mechanical stability and be properly connected to the side walls, but must also be in electrically conducting contact with both of the side walls.

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To date, the cover plates have simply been bolted to the side walls. The sides of the cover plates were bent and provided with threads for accepting mounting bolts. This configuration had the risk that, during assembly or due to thermal effects, the cover plate would be distorted or the side wall stressed or bent. This mounting scheme has the additional disadvantage that a plurality of differing cover plates must be used to accommodate the differing assembly possibilities for the module rails. A retroactive change in the position of the module rails can only be effected following removal of a section of the edge strip. Good radio frequency shielding can only be achieved using a large number of bolts in view of the separation between attachment locations of the mounting bolts, which are disposed next to each other in a row.

Also known in the art is mounting the cover plates to the side walls using support elements. Towards this end, plate-shaped support elements are initially mounted to the edges of the side walls using mounting bolts and the cover, having holes along its edge, is then connected to the support elements using resilient retention means and mounting bolts. This design is difficult and costly with regard to materials and assembly. There is no RF sealing of the longitudinal slot between the side walls and the cover (EP 0 453 668 A1).

In addition thereto, a module support structure is known in the art with which resilient conducting contacts having an



S-shaped cross section establish a low resistance contact between the metallic aluminum side walls, connected together via module rails, and the upper or lower cover. The sideward ends of the cover plate are bent over at right angles and are surrounded by one groove-shaped half of the resilient contacts, whereas the other oppositely opening half of the resilient contacts seats, in a spring-loaded manner, about the edges of the side walls. Although the mounted resilient contacts effect a reliable RF sealing of the gap between the cover plates and the side walls, there is no mechanical connection between the plates and the walls (DE 42 37 447 A1).

Various kinds of contact strips or resilient contacts for radiation-proof connection of abutting metallic wall elements are, per se, known in the art (DE 94 01 533 U1 and DE 90 03 209 U1).

It is the purpose of the invention to configure an element for mounting the cover plates to the side walls of module support structures in such a manner that, with little technical difficulty and expense as well as with rapid assembly, an economical inwardly seating connection can be produced which secures sufficiently good radio frequency sealing, in the relevant frequency range, of the gap between the components, which can accommodate production tolerances, and which mechanically connects the components.

Departing from a module support structure of the above mentioned kind, this object is achieved in that the mounting element consists essentially of an angled support made from thin resilient steel sheet metal and comprising two angle legs subtending an angle of more than 90 angular degrees,



wherein the first angle leg of the angled support is placed between the side wall and the cover plate and the first angle leg has a bolt receptacle for the mounting bolt and the connecting bolt is passed through a hole in the track of holes and screwed into the bolt receptacle and the second angle leg has at least one seating for the cover plate which is produced through stamping of this angle leg and this second angle leg forms, together with the seating, a U-shaped resilient clamp which accepts the cover plate abutting the side wall.

During assembly, a plurality of the proposed mounting elements are placed onto both sides of the cover plate at those edge locations not occupied by module rails. The cover plate is then introduced between the side walls and the mounting elements are screwed-down. This can be done with little manual effort.

In order to effect simpler manufacture, the bolt receptacle can be a hole produced by punching and stamping.

It is advantageous when the first angle leg has a bent edge directed towards the second angle leg. This measure simplifies introduction of the cover plates having the mounting elements, since the slant of the bent edge guides the first angle leg past the inner edges of the side walls.

A further embodiment of the invention is characterized by angled components fashioned on the ends of the angled support and having two legs one of which has a bracket for the cover plate and the other leg forming, together with the bracket, a resilient U-shaped receptacle for the cover plate. This angled component extends the mounting elements without



requiring additional bolting to the side wall to extend the RF sealing of the gap between the cover plate and the side wall.

It is advantageous when one leg of the angled component has a contact nub on its outer side for improving the contact to the side wall.

It is advantageous when the one leg of the angled component comprises a bend directed towards the second leg. This bend simplifies introduction of the cover plate as does the bent edge of the first angle leg of the mounting element.

An intended breaking location can be provided between the angled support and the angled component for simple breaking-off of the angled component in the event that this component is not needed.

For improved production and simple adjustment to the various conditions of differing module support structures, it is advantageous when a plurality of angled supports having a plurality of angled components are connected together to form a band.

The invention will be described in greater detail below with reference to the three accompanying sheets of drawing.

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The module support structure 1 shown in figure 1 in vertical cut and in a simplified manner serves for acceptance of plug-in modules (not shown) each having a printed circuit board for electrical and electronic components and a forward front plate.

The module support structure 1 comprises two parallel side walls 2 and 3 made from aluminum sheet metal as well as four profiled structure rails made from aluminum of which the upper front and lower front module rails 4 and 5 can be seen. The side walls 2 and 3 have mounting flanges 6 having screw holes with the assistance of which the module support structure 1 can be mounted into an equipment cabinet or rack.



The side walls 2 and 3 are bolted to the module rails 4 and 5 using bolts (not shown). For this purpose, tracks of holes 10 are disposed in the upper and lower edges 8 and 9 of the side walls 2 and 3.

Two cover plates 11 and 12, mounted to the upper and lower sides in a detachable manner, seal the module support structure 1.

In order to mount the two cover plates 11 and 12, mounting elements are placed onto the tracks of holes 10 to hold the associated cover plate 11 or 12 at its edge.

The mounting elements connect the cover plates 11 and 12 mechanically as well as electrically to the side walls 2 and 3. These mounting elements are angled supports 13 made from thin resilient steel sheet metal, preferentially from chrome-nickel-steel, produced through a plurality of sequential punching and stamping steps.

Each angled support 13 has (see figure 3) a first angle leg 14 and a second angle leg 15. These two angle legs 14, 15 subtend an angle 16 of more than ninety angular degrees. The first angle leg 14 has a bent edge 17 directed towards the second angle leg 15 and describes an obtuse angle with respect to the first angle leg 14 of approximately one hundred seventy five angular degrees.

When the cover plate 11,12 is mounted, the first angle leg 14 is placed between the associated cover plate 11 or 12 and the adjacent side wall 2 or 3. It has a bolt receptacle 18 for a mounting bolt 19. This mounting bolt is passed from the



outside through a hole in the track of holes 10 and screwed with its thread into the bolt receptacle 18. The bolt receptacle 18 is a punched hole having two edge openings and having edges punched into the shape of two half-threads (see figures 4, 6 and 7). The bolt receptacle 18 can also be a flat nut.

The second angle leg 15 comprises two seating surfaces 20 for the associated cover plate 11 or 12 which are produced through stamping of the second angle leg 15. Together with the second angle leg 15, these two seating surfaces 20 form two U-shaped resilient clamps 21 which accept the edge of the associated cover plate 11 or 12 abutting the corresponding side wall 2 or 3. A slanted guide 22 simplifies insertion of the cover plate 11, 12 into the clamps 21.

An angled component 23 is formed on one end of the angled support 13 and has two legs 24, 25 subtending an angle of ninety angular degrees. This angle can also be somewhat larger than ninety degrees. An inwardly directed bracket 26 protrudes beyond one leg 24 and forms, together with the other leg 25, a resilient U-shaped receptacle 27 for placement onto the edge of the cover plate 11 or 12.

One leg 24 has, on its outer side, a contact nub 28 produced through stamping which, with mounted cover plate 11, 12, resiliently pushes onto the inner side of the associated side wall 2 or 3 due to the angular configuration of the two legs 24 and 25 of the angled component 23.

A stamped intended breaking location 29 is disposed between the angled support 13 and the angled component 23.



The one leg 24 of the angled component 23 has a bend 30 directed towards the second leg 25.

An additional angled component 31 corresponds with and is adjacent to angled component 23 and is followed by an additional angled support 32 which is, in turn, identical to the angled support 13. A plurality of angled supports 13, 32 and a plurality of angled components 23 and 31 are connected together via intended breaking locations 29.

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- 21 clamp
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- 25 leg
- 26 bracket
- 27 receptacle

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28 contact nub

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30 bend

31 angled component, additional

32 angled support, additional

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