

CASE FOR ELECTRONIC UNITS

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The present invention relates to a case for electronic units and more particularly to a case for electronic units which is especially effective when used as a case for such units as input units, output units and
10 a CPU unit forming a programmable controller.

Referring to Fig 9, there is illustrated a perspective view showing a conventional programmable
15 controller (hereinafter referred to as a PC) by way of example. In the Figure, numeral 1 designates a box-type case made from a synthetic resin material and opened at its front face, 2 a power supply unit inserted in the case 1, and 3 a CPU Unit screwed to the case 1 to adjoin
20 the power supply unit 2, with control program setting means 5 (hereinafter referred to as setting means) including a connector 6 adapted for connection to a connection portion 4 of the CPU unit 3 being mounted on the power supply unit 2 and the CPU unit 3 and fixed in
25 place with screws. Numeral 7 Designates input units, and 8 output units. The front panels of these units are

1 screwed to the case 1 in juxtaposition to the CPU 3, and
each of the units 7 and 8 includes a terminal board 9 and
a signal indicator 10 which are arranged on the front
panel for connection to a controlled system and a printed
5 wiring board 11 which is attached to the back of the front
panel and formed with the necessary electric circuit
connected to a mother board (not shown) arranged at the
bottom of the case 1.

With the PC including the above-mentioned component
10 units, the necessary control program is preliminarily
selected by the setting means 5 and it is stored in the
CPU 3. The input signals from the controlled system
are applied to the input units 7 and processed by the CPU
unit 3 so that in accordance with the processing results,
15 control signals are generated from the output units 8
thereby controlling the controlled system in accordance
with the selected program.

While the PC has an excellent control function as
mentioned above and it is presently used in a wide range
20 of applications in the industrial world, it has the
following disadvantages.

(1) The power supply unit 2, the CPU unit 3, the setting
means 5, the input units 7 and the output units 8,
25 forming the PC, are all contained in the case 1 and the
numbers of these units (particularly the input units 7

1 and the output units 8) are varied in dependence on the
intended use, the controlled system, etc. Therefore, cases
1 of various sizes (lengths) corresponding to such
varying number must be prepared thus not only making the
5 PC uneconomical but also increasing its cost.

(2) Since the input units 7 and the output units 8 are
practically the same in external appearance thus making
it to draw a distinction therebetween and there is the
10 danger of these units being mounted erroneously or
operated erroneously. As a result, the types of units are
indicated by letters, symbols or the like on the front
panels or the whole or part of each front panel is
painted in a different color by printing or the like in
15 correspondence to the type of the unit and the
inscription of letters or the like or the coloring
operation is troublesome thus causing an increase in the
cost and a problem from the design point of view.

20 (3) Since each of the units is fastened to the case 1
with two or more screws, the dismounting and mounting
operations are very troublesome not only during the
assemblage but also during the maintenance, inspection,
repair, etc., thus requiring considerable time.

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(4) The case 1 is generally made by molding a synthetic

1 resin and it expands and contracts in response to
temperature changes. On the other hand, attached to the
bottom of the case 1 is the mother board made from a
glass epoxy resin or the like which does not practically
5 expand and contract in response to temperature changes
and the printed wiring board of each unit is connected to
the mother board through the connector. As a result, the
case is expanded and contracted with changes in the
ambient temperature thereby causing troubles between the
10 mother board and the printed wiring boards.

(5) The terminal boards 9 and the printed wiring boards
11 provided on the input and output units 7 and 8 are
exposed and thus dust and dirt tend to deposit on them
thereby giving rise to the danger of causing any contact
15 failure or short-circuit.

(6) If any particular unit is removed for the purpose of
maintenance, inspection, adjustment or the like, a space
is left in this portion so that there is the danger of the
dust and dirt entering the case 1 through this space and
20 causing any contact failure, short-circuit or the like.

(7) The connecting operation of the ground terminals of
the input and output units is troublesome, particularly
where such units are mounted with greater density, the
number of ground terminals is increased thus not only the
25 cost is increased but also a considerable time is
required for their connecting operation.

The present invention has been made with a view to overcoming the foregoing deficiencies in the prior art and it is an object of the present invention to provide a case for electronic units so designed that the component parts of each unit are contained in a case and the case is mounted on a base board, thereby eliminating the use of the conventional case and making it possible to effect its assembling, maintenance and inspection easily in a short period of time.

It is another object of the present invention to provide such case for electronic units so designed that during the assembling of the case, a simple marking sheet is added to make it possible to easily discriminate the type of unit and make the case excellent from the design point of view.

It is still another object of the present invention to provide a ground structure for electronic units which is simple in construction and capable of connecting a ground terminal by a single touch.

In accordance with the present invention, there is thus provided a case for electronic units comprising:

a box-type case having a bottom surface, four upstanding walls comprising a pair of oppositely-disposed end walls and a pair of oppositely-disposed side walls, and an opening formed in a top portion thereof, said side walls and at least one of said end walls having a plurality of locking holes formed therein at least in the vicinity of said opening;

a panel including an indicator section formed at one end of its upper surface, a locking portion formed at the other end of said upper surface, and a terminal board mounting portion formed on its lower surface between said indicator section and said locking portion, a plurality of lock pieces depending from the lower surface of said indicator section and a plurality of projections formed on each of two lower sides of said terminal board mounting portion for engagement with said locking holes of said box-type case;

an indicator section cover for covering a part of said indicator section of said panel, and

5 a terminal board mounting portion cover having a projecting piece formed at one end thereof, said projecting piece being receivable in a hole formed in an optional intermediate member interposed between said terminal board mounting cover and said indicator section cover, or in said indicator section of said panel or in said indicator
10 section cover, and a locking member formed on a lower side of the other end of said terminal board mounting cover receivable in said locking portion of said panel.

Preferably, the intermediate member, if present, comprises a marking sheet having a colour which differs for different
15 types of units.

Advantageously, a case as claimed in either Claim 1 or Claim 2, comprises a pair of slots formed in a back surface thereof spaced one from another by a given distance, and a hole formed therethrough between said slots;

20 a ground terminal fitting including a pair of leg portions adapted for insertion into the pair of slots of said box-type case, and

a ground member attached to a printed wiring board adapted for insertion into said box-type case, said ground
25 member being positioned nearby said hole of said box-type case;

whereby the leg portions of said ground terminal fitting are fitted into the slots of said box-type case, and a screw inserted through a hole of said ground terminal
30 fitting is threaded into a threaded hole formed in said ground member through the hole formed in said box-type case.

The case for electronic units according to the present invention has the following features:

35 The indicator section cover is mounted on the indicator section and the terminal board is mounted on the terminal board mount. Then, the panel having the printed

wiring board mounted on its lower surface is fitted in the opening of the box-type case thus forming an integral unit. Then, the cover is fitted on the panel.

- 5 Also, a marking sheet having a colour which differs for different types of units may be interposed with the result that the type of the unit can be easily distinguished externally and there is no danger of causing any erroneous mounting or erroneous operation.
- 10 Further, the leg portions of the ground terminal fitting are inserted into the slots formed in the back

1 of the case proper thus aligning its engaging hole with
the hole formed through the case proper, and then the
screw is inserted through the engaging hole to threadably
fit in the threaded hole of the ground member thereby
5 combining the ground terminal fitting, the screw and the
ground member as a unit.

Fig. 1 is a perspective view showing an example of a
10 PC incorporating a case for electronic units according to
the present invention.

Figs. 2a And 2b are respectively an exploded
perspective view of an embodiment of the present invention
and a perspective view showing the back of the cover.

15 Figs. 3a, 3b and 3c are respectively a sectional
view showing the combined condition of the indicator
section cover and the marking sheet, a sectional view
showing the locked condition of the panel locking pieces
and the case proper and a sectional view showing the
20 locked condition of the cover locking piece and the case
proper.

Fig. 4 is a side view showing the assembled condition
of the embodiment of the invention.

Figs. 5a and 5b are respectively a back view showing
25 another embodiment of the present invention and a
sectional view taken along the line A-A of Fig. 5a.

1 Figs. 6a, 6b and 6c are respectively a sectional view of the ground terminal fitting forming an essential part of the second embodiment, a plan view thereof, and a side view thereof.

5 Fig. 7 is an exploded perspective view of the second embodiment.

Fig. 8 is a sectional view showing the assembled condition of the second embodiment.

Fig. 9 is a diagram useful for explaining an
10 example of a conventional PC.

Referring to Fig. 1, there is illustrated a perspective view of an example of a PC in incorporating a
15 case for electronic units according to the present invention. In the Figure, numeral 21 designates a base board including a mother board comprising a printed wiring board, connectors to which are connected the printed wiring boards of respective units (both of them are not
20 shown) and connectors 22 and 23 for electrical connection with other electronic controllers of the same type. Numeral 30 designates a unit containing a power supply unit and a CPU unit (hereinafter referred to as a CPU unit), 31 control program setting means fixedly mounted
25 on the surface of the CPU unit 30, 32 an indicating window, and 33 setting keys. Numerals 40 to 40b designate

1 input units mounted on the base board 21 in juxtaposition
to the CPU unit 30, and 50 to 50b output units mounted on
the base board 21 in juxtaposition to the input units 40
to 40b. Numeral 70 designate marking sheets for
5 indicating the types of units of the CPU unit 30, the input
units 40 to 40b and the output, units 50 to 50b, and the
marking sheets are colored differently (for example, white
for the CPU unit 30, blue for the input units 40 to 40b
and red for output units 50 to 50b) the units 40 to 40b
10 and the units 50 to 50b use the cases of the same type
and therefore the input unit 40 will now be explained in
greater detail.

Referring to Fig. 2 there is illustrated an exploded
perspective view showing an embodiment of a case for
15 electronic units according to the present invention. In
the Figure, numeral 41 designates a box-type case proper
which is opened at its front and including radiation holes
42 at its longitudinal ends engaging projections 43 formed
on the inner sides of the opening-side side walls to
20 project therefrom, and engaging holes formed at positions
below the engaging projections. Numeral 45 designates a
printed wiring board guide groove formed on the inner side
of the rear vertical wall of the case proper 41. This
guide groove may be formed on the front vertical wall or
25 the bottom of the case proper 41. Numerals 47 and 48
designate window holes formed in the bottom of the case

1 proper 41 to receive connectors which are mounted on an
printed wiring board that will be described later, and
connected to the mother board of the base board 21.

Numeral 51 designates a panel including a pair of
5 guide plates 52 (only one of them is shown in the Figure)
formed on the sides of its lower surface to depend
therefrom so as to be fitted in the opening of the case
proper 1, and formed on the outer surface of each guide
plate 52 are notches 53 for engagement with the engaging
10 projections 43 of the case proper 41 and projections 54
for engagement with the engaging holes 44 of the case
proper 41. Although not shown, a printed circuit board is
fixed at the inner sides of the guide plates 52. Numeral
55 designates an indicator section formed at its one end
15 with lock pieces 56 each having a lock pawl 57 hanging
down from its forward end. Numeral 58 designates an
indicator chamber formed on the upper surface of the
indicator section 55 to contain light-emitting diodes,
numerical displays or the like and including an indicating
20 window 59 in its upper surface and a fitting hole 60 in
each of its side walls. Numeral 61 designates a vertical
wall serving as a boundary between the indicator section
55 and a terminal board mount 62 which will be described
later. The vertical wall 61 is lower than the indicator
25 chamber 58 and its central portion, on the side of the
indicator chamber 58, is cut to form a recess 62. Also,

- 1 a gap g is formed between the vertical wall 61 and the indicator chamber 58. Numeral 63 designates the terminal board mount, and 64 an elongated hole for introducing the wires from the terminal board into the case proper 41.
- 5 Numeral 65 designates a vertical wall arranged on the rear portion of the terminal board mount 63 and formed with a locking hole 66 cut into a convex shape.

Numeral 67 designates an indicator section cover made from a light transmitting material and furnished with

10 numerals or signals for indicating the state of any signal indicated by the indicator. Also lock portions 68 are formed on the inner sides of the indicator section cover 67 to project therefrom for fitting into the fitting holes 60 of the indicator chamber 58 and also its rear

15 vertical wall is formed with notched holes 69. Numeral 70 designates a T-shaped marking sheet for distinguishing the input unit 40, the output unit 50 and the CPU unit 30 from one another, and it includes projections 71 formed on one side thereof so as to be fitted in the notched

20 holes 69 of the indicator section cover 67 and a hole 72 formed through its upper central portion. The marking sheet 70 has a color such as red, blue or white to show the classification such as the unit 30, 40, or 50.

Numeral 75 designates a cover having a channel shape

25 in section and it includes a projecting piece 76 formed at its one end so as to be fitted into the hole 72 of the

1 marking sheet 70 and a locking piece 77 formed at its
other end, having resilience and provided at its forward
end with a locking pawl 78 as shown in Fig. 2(b) for
engagement with the locking hole 66 formed in the vertical
5 wall 65 of the panel 51.

With the construction described above, an example of
the assemblage of the case according to the present
invention will now be described.

10 (1) A numerical indicator or the like is inserted from
below into the indicator section 55 of the panel 51 and
the indicator section 55 is fixed in place at the position
of the indicator window 59. Then, the indicator section
cover 67 is fitted onto the indicator chamber 58. In this
15 case, if the rear vertical wall of the indicator section
cover 67 is inserted in the gap g formed by the indicator
chamber 58 and the vertical wall 61 and pressed down, the
lock portions 68 are fixedly fitted into the fitting holes
60 (see Fig. 3(a)).

20 (2) The leg portion of the marking sheet 70 is inserted in
to the recess 62 of the vertical wall 61 and its
projections 71 are engaged with the notched holes 69, of
the indicator section cover 67. At this time, the top of
25 the marking sheet 70 is positioned in substantially the
same plane as the upper surface of the indicator section

1 cover 67 (See Fig. 3(a)).

(3) A terminal board (not shown) is arranged on the terminal board mount 63 and fixed in place with screws.

5 Also, a printed wiring board (not shown) is mounted on the lower surface of the panel 51.

(4) With the various components mounted on it in the above-mentioned manner, the panel 51 is mounted in the opening
10 of the case proper 41. At this time, the printed wiring board mounted on the panel 51 is lowered along the guide groove 45 formed in the case proper 41 so that the projections 54 are locked in the locking holes 44 and the notches 53 are engaged with the locking projections 43.

15 Also, as shown in Fig. 3(b), the lock pawls 57 of the locking pieces 56 engage with the radiation holes 42, thereby integrally combining the two by a single touch.

At this time, the connectors arranged on the printed wiring board and connected to the connectors arranged on
20 the mother board of the base board 21, are respectively exposed to the outside through the window holes 47 and 48 formed in the bottom of the case proper 41.

(5) Lastly, the projecting piece 76 of the cover 75 is
25 inserted through the hole 72 of the marking sheet 70 and its other end is pressed down, thus locking the locking

1 piece 78 in the convex locking hole 66 as shown in Fig.
3(c) and thereby fastening the cover 75 to the panel 51.

Thus, the assembling of the input unit 40 shown in
Fig.4 is completed (any explanation of its wiring is
5 omitted).

In Fig. 4, numeral 49, designates a lock portion
formed on the lower surface of the case proper 41 to
project therefrom for fitting in the engaging portion of
10 the base board 21.

The input units 40 constructed as described above can
be mounted on the base board 21 by simply arranging them
in order by the type of unit in accordance with the
color of the marking sheets 70 displayed at the front
15 faces of cases 40 (for example, white represents the CPU
unit 30, blue the input units 40 to 40b and red the
output units 50 to 50b) locking the lock portion 49 formed
on the lower surface of each case proper 41 according to
the type of unit in the hole formed in the base board 21
20 and pressing it against the hole, inserting screws 46a.
into holes 46 formed below the radiation holes 42 and
threading the screws into the threaded holes of the base
board 21. In this way, the desired units can be mounted
at the given positions of the base board 21.

25 Also, to connect the wires and the like to the
terminal board mounted on the panel 51 only requires that

1 with the input unit 40 mounted on the base board 21, the
locking piece 77 of the cover 75 is pressed to disengage
with the locking hole 66 and thereby to detach the cover
75 from the panel 51. To effect the maintenance or
5 replacement of the printed wiring board and the like, it
is only necessary to remove the panel 51 from the case
proper 41.

Further, to remove the input unit 40 from the base
board 21 and disassemble it only requires that the
10 previously mentioned operation is performed in the reverse
order.

Figs. 5(a) and 5(b) show another embodiment of the
present invention, with Fig. 5(a) showing a back view of
the case proper 41 and Fig. 5 (b) an enlarged sectional
15 view taken along the line A-A of Fig. 5(a). In the
Figures, numeral 80 designates a recess formed in the back
surface of the case proper 41 on one side thereof, (on
the side of the indicator section 55 in this embodiment)
and slots 82 and 82a are respectively formed between the
20 inner sides of the side walls of the case proper 41 and
projections 81 and 81a. Also, a hole 83 is formed on one
side of the center of the recess 80 and a circular recess
84 is formed on the other side of the center.

Figs. 6(a), 6(b) and 6(c) are respectively an
25 enlarged sectional view of a ground terminal fitting 85,
its plan view and its side view. The ground terminal

- 1 fitting 85 includes a body 86 and leg portions 87 and 87a formed by bending its ends at substantially right angles so as to be inserted into the slots 82 and 82a, respectively, of the recess 80 of the case proper 41, and
- 5 the body 86 includes engaging holes 88 and 88a having their peripheral edges projected inwardly (to the side of the leg portions 87 and 87a, respectively) and positioned to respectively align with the hole 83 and the recess 84 in the recess 80 of the case proper 41. Numeral
- 10 88b designates an inclined surface formed at the inner edge of each of the engaging holes 88 and 88a, and 89 and 89a contacts projected from the outer surface of the body 86 to contact with the ground wiring of the mother board. Numerals 90 and 90b designates lock pawls formed on the
- 15 sides of each of the leg portions 87 and 87a.

Referring now to Fig. 7, numeral 91 designates a printed wiring board mounted on the lower surface of the panel 51, and a ground member 92 connected to the grounding wiring pattern formed on the printed wiring

20 board 91 is mounted at a position where it aligns with the hole 83 formed in the recess 80 of the case proper 41 when the printed wiring board 91 is inserted into the case proper 41. Numeral 93 designates a threaded hole formed in the ground member 92.

- 25 In the present embodiment constructed as described above, as mentioned previously, the panel 51 having the

1 indicator section cover 67 mounted thereon is first fitted into the case proper 41.

Then, as shown in Fig. 7, the leg portions 87 and 87a of the ground terminal fitting 85 are respectively
5 inserted into the slots 82 and 82a of the recess 80 formed in the back surface of the case proper 41 and the protruding portions of the engaging holes 88 and 88a are respectively fitted into the hole 83 and the recess 84, thereby effecting the positioning. At this time, the lock
10 pawls 90 and 90a formed on the leg portions 87 and 87a bite into the side walls of the slots 82 and 82a, thereby firmly fixing the ground terminal fitting 85 in place.

In this condition, a screw 94 is threaded through the engaging hole 88 of the ground terminal fitting 85 such
15 that the screw 94 is threaded into the threaded hole 93 of the ground member 92 which is positioned on the inner side of the hole 83 in the case proper 41, thereby fastening the two together integrally.

The resulting condition is shown in Fig 8. As will be
20 seen from the Figure, the head of the screw 94 is pressed against the inclined surface 88b of the engaging hole 88 and thus the ground member 92 is positively connected electrically to the ground terminal fitting 85 through the screw 94.

25 Then, finally the cover 75 is fastened to the pannel 51.

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When the input unit constructed as described above is mounted on the base board, the contacts 89 and 89a formed on the ground terminal fitting 85 contact with the ground pattern (not shown) formed on the mother board 21 as shown in Fig. 8, thereby informing a ground circuit including the printed wiring board 91, the ground member 93, the screw 94, the inclined surface 88b of the engaging hole 88, the ground terminal fitting 85, the contacts 89 and 89a and the ground pattern.

While, in the foregoing description, a case for electronic units according to the present invention is used as a case for the input units of a PC, the case can be similarly used as a case for the output inputs and the CPU unit and also it can be mounted as a case for any other electronic units and equipment.

Further, where the marking sheet 70 is not needed, the hole into which the projecting piece 76 of the cover 75 is inserted may be effectively formed in the vertical wall 61 or the indicator section cover 67. Also, where the case proper 41 need not be formed with the radiation holes 42, the holes adapted for engagement with the lock pawls 57 of the locking pieces 56 may be formed in the vertical walls of the case proper 41.

While, in the above-described embodiment, the ground terminal fitting 85 is provided at the end of the back

- 1 surface of the case proper 41 to extend in the width direction, it may be arranged at any suitable position depending on the position and shape of the printed wiring board 91 to be incorporated.
- 5 Still further, while the recess 80 is formed in the back surface of the case proper 41 and the ground terminal fitting 85 is fitted to the recess 80, the recess 80 may be omitted. Also, while the ground terminal fitting 85 is formed with the two engaging holes 88 and 89a each having
- 10 its edge protruded inwardly, it is possible to use only that engaging hole whose edge fits in the hole 83 of the case proper 41, and the invention is not limited to the number of contacts 89 and 89a. It is to be noted that where the recess 80 not formed in the case proper 41,
- 15 the contacts may be eliminated.

From the foregoing description it will be seen that the present invention has the following remarkable effects.

- 20 (1) Since each of the units is contained in the case and mounted on the base board, there is no need to prepare cases of different sizes in correspondence to different numbers of units as previously, thereby not only ensuring economy but also reducing the cost.

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- (2) When making maintenance, inspection, adjustments and

1 the like, it is only necessary to remove the cover or
the panel and moreover non-use of any screws makes it easy
to perform these operations.

5 (3) Since the numerals, symbols, etc., for representing
states of signals indicated by the indicator are provided
on the separate indicator section cover by such means as
printing,, the panel can be used in common with the
input and output units. This has the effect of reducing
10 the product cost.

(4) During the assembling of the case, the marking sheet
of a color which differs for different types of units is
added so that it is possible to easily draw a
15 distinction between for example the input and output units
which are the same in external appearance but different
in type of unit and thus there is no danger of making any
erroneous mounting or operation.

20 (5) since the terminal board is covered by the cover,
there is no danger of the deposition of dust and dirt
causing any contact failure or short-circuit.

(6) Even if the panel is removed for the purpose of
25 maintenace, inspection, adjustment or the like, only the
case of this unit produces an empty space and therefore

1 there is no danger of any dust and dirt entering the other
units.

(7) Also, by virtue of the fact that the ground terminal
5 fitting connected electrically to the ground terminal of
the printed wiring board incorporated in the case proper
is attached to the back surface of the case proper, when
mounting the electronic unit on the mother board, the
ground terminal provided on the mother board and the
10 ground terminal of the electronic unit can be connected by
a single touch. This has the effect of greatly reducing
the number of man-hours for connecting the ground
terminals and the cost as well.

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CLAIMS



1. A case for electronic units comprising:

a box-type case having a bottom surface, four upstanding walls comprising a pair of oppositely-disposed end walls and a pair of oppositely-disposed side walls, and an opening formed in a top portion thereof, said side walls and at least one of said end walls having a plurality of locking holes formed therein at least in the vicinity of said opening;

a panel including an indicator section formed at one end of its upper surface, a locking portion formed at the other end of said upper surface, and a terminal board mounting portion formed on its lower surface between said indicator section and said locking portion, a plurality of lock pieces depending from the lower surface of said indicator section and a plurality of projections formed on each of two lower sides of said terminal board mounting portion for engagement with said locking holes of said box-type case;

an indicator section cover for covering a part of said indicator section of said panel, and

a terminal board mounting portion cover having a projecting piece formed at one end thereof, said projecting piece being receivable in a hole formed in an optional intermediate member interposed between said terminal board mounting cover and said indicator section cover, or in said indicator section of said panel or in said indicator section cover, and a locking member formed on a lower side of the other end of said terminal board mounting cover receivable in said locking portion of said panel.

2. A case as claimed in claim 1 wherein the intermediate member, if present, comprises a marking sheet having a colour which differs for different types of units.

3. A case as claimed in either Claim 1 or Claim 2, including a pair of slots formed in a back surface thereof spaced one from another by given distance, and a hole



formed therethrough between said slots;

a ground terminal fitting including a pair of leg portions adapted for insertion into the pair of slots of said box-type case, and

a ground member attached to a printed wiring board adapted for insertion into said box-type case, said ground member being positioned nearby said hole of said box-type case;

whereby the leg portions of said ground terminal fitting are fitted into the slots of said box-type case, and a screw inserted through a hole of said ground terminal fitting is threaded into a threaded hole formed in said ground member through the hole formed in said box-type case.

4. A case for electronic units substantially as herein described with reference to Figures 1 to 8 of the drawings.
