tem of this type is a computing system whereby data storage devices, processing hardware, power supplies, cooling fans etc are all contained in a single unit.

In such modularised systems, it is a common requirement that the different devices be interconnected with one another, and also connected to various signal and power supply lines. In a modular system with a number of separate units this can lead to a large number of signal and power cables which take up a lot of space and can make fault diagnosis difficult. A number of different electrical distribution systems have been described in the art.

EP-A-320 107 describes a conventionally packaged drawer containing a plurality of front loaded disk drives which are blind pluggable in a central bulkhead. A conventional cabling arrangement is provided for the interconnection of the disk drives and other support units in the drawer.

EP-A-328 260 describes a similar system configuration wherein data storage devices contained in individual canisters are blind pluggable into a central bulkhead. Power/control circuitry is contained in a unit located in a rear compartment behind the central bulkhead. The unit is connected to the storage devices by means of a connector located in the bulkhead. Manual connection of the power supply unit to the bulkhead connector is required.

EP-A-0 300 717 describes a interconnecting system wherein removable disk drives are blind pluggable into electrical connectors in a backplane circuit board. Other units are blind pluggable into the rear of the circuit board. Input/output signals are routed through a cable which connects directly to signal traces on the circuit board.

An article entitled "High-Power/High Density

rangements and electrical interconne
electrical devices. However, there is
quirement for modular systems in whic
devices are easily assembled in the s
minimum of manual intervention in the
nection of the devices and wherein t
readily accessible for repair and/or re

Accordingly, the present invention
ular electrical apparatus comprising a f
placeable functional units each ha
plugging connector at one end ther
group of one or more replaceable f
each having an auto-plugging connec
thereof and a further electrical conne
posite end thereof for enabling externa
nection to the apparatus, a support st
porting the two groups of functional u
cal distribution unit mounted within the
ture, the first and second group of unit
ed on respective sides thereof, the dist
cluding complementary connectors mo
site sides thereof for receiving the auto
nectors of respective groups of units ar
trical conductors between the compl
nectors for interconnecting the fu
whereby external information signals
tus are routed via at least one unit of the
and the electrical distribution unit.

In the modular configuration prov
and second group of units merge with
distribution unit to form the apparatus
cal connection between the various un
via self-docking connectors. In this
there is no tangle of power and signa
have to be interconnected by hand.

having front and rear openings. The tubular structure provides good rigidity and efficient RFI screening of the devices contained therein. Although a further aperture could be provided in the chassis, it is preferred that chassis is a adapted to receive the electrical distribution unit in the chassis via either the front or rear openings.

It is further preferred that the first group of units is mounted in a front compartment of the chassis via the front chassis opening and the second group of units is mounted in a rear compartment of the chassis, both the second group of units and the electrical distribution unit being mounted in the chassis via the rear chassis opening. Thus for apparatus in the form of a rack mounted drawer, all the components are accessible and removable from the drawer without the need to remove the drawer from the rack.

In a preferred apparatus, the complementary connectors and electrical conductors are formed into a cable assembly which is removably mounted within a cable support frame. The complementary connectors are held in slots in the frame in the correct position for the connection of the self-docking connectors on the individual units of both the first and second group.

Preferably the first group of units comprises a plurality of data storage devices e.g. disk drives, mountable in a front compartment of the support structure and accessible from the front. The second group of units preferably comprises a power supply unit and controller unit mounted in a rear compartment, both being accessible from the rear of the structure.

The invention will now be described by way of example only with reference to the accompanying draw-

Figures 1 to 3 show one embodim
ular electrical apparatus in the form
suitable for mounting in a rack containi
drawers. The drawer consists of grou
removable electrical devices which are
in a tubular chassis, the top and side
which is shown in exploded view in Fig
ted from Figures 2 and 3 for clarity. Al
ure 1 is the apparatus front cover 1
chassis takes the form of a unitary
component parts of which are permane
gether to give a chassis with only front
ings and no removable lid. As is shown
chassis is divided into three compa
contain the main components of the sy
compartment 16 is divided into four b
by the chassis walls and three partition
containing a removable data storage d
drive 22. The chassis has high structu
provides good support for the disk driv
due vibration.

Furthermore, in conjunction with
rear covers this type of chassis provide
screening of the devices. A dividing wa
the front compartment from the centra
26 which houses an electrical distributi
a pair of centrifugal cooling fans 40
forced air cooling of the drawer. Behi
compartment, the rear compartment
power supply unit 44 and controller ca
the main components and the packagi
cal interconnection of the individual de
bed in more detail below.

The disk drives are removably m

disposed below and symmetrically about the upper slot. Also included on the back surface of the rear panel are two pins 37 (seen to better effect in figure 3 and 4) which are used for guidance purposes during assembly of the drawer.

The cable assembly 50 shown in Fig. 5 takes the form of a harness to which is attached four forward facing device connectors 52, one backward facing controller connector 54 and two backward facing power supply connectors 56. The cable loom comprises a cylindrically shaped bundle of wires 57, extending upwards from which are four equally spaced extensions 58. Extending from each extension by means of forward extending conductors 59 is a device connector. Extending rearwards and inclined at an angle to the cylindrical bundle is a T-shaped arm 60 the ends of which is attached the controller connector. Below this are the two power supply connectors also connected by electrical conductors to the main bundle.

The assembled electrical distribution unit is shown in Fig.4. The cable assembly is held in place within the support frame by inserting each of the cable assembly connectors into apertures in the frame. The three rearward extending connectors are mounted in the three slots in the rear panel of the frame and each of the four device connectors are mounted in slots in the front vertical struts. Each of the frame apertures is slightly larger than the corresponding connector and the connectors are fixed in place while still being able to float within the apertures.

The power supply 44 is located in and takes up the lower part of the rear compartment (Fig 3). A plate 62 attached to the rear of the power supply extends above the power supply and forms part of the rear

through the rear picture frame 78 fixe
the chassis. The front panel 34 of the
passes through a central opening defi
tral picture frame 80 with the device
passing through the corresponding a
dividing wall 24. The edges of the sup
panel engage with the central picture
support frame is fixed into position
screws passing through the rear pan
responding holes in the picture frame.
and associated picture frame 80 the
partition between the central compa
the rear compartment 42. The suppor
to the dividing wall from the front als
screws passing through the dividing w
the front panel. The vertical portions
support frame straps 38 can flex to c
any discrepancy in the sizes of the ce
ment 26 and electrical distribution uni
cure fixing of the unit and correctly p
nectors as well as provide an airtigh
tween high and low pressure zones.

When the electrical distribution u
the power supply unit is inserted into t
opening 76. As can be seen most clea
fixed to the floor at each side of the rea
is a platform 82 and guide way 84. In c
the rearward extending pins on the
rear panel, these assist with the corr
of the power supply unit as it is guide
the connectors on the power supply
corresponding connectors at the bott
panel, the two pairs of pins locate in th
shown in Figure 3. The rear panel c
at' thereby providing correct alignmer

for adjusting its position thereby ensuring alignment between the corresponding electrical connectors. Electrical connection is completed when the disk drive is pushed firmly home.

In operation, all external data and control signals enter the drawer via the controller unit. This unit sends out control signals to each of the devices which are routed through the electrical distribution unit. Power to the devices is provided via the electrical distribution unit.

A control panel (not shown) is provided at the front of each device and includes a power switch and a number of indicator lights indicating device status. When the power switch is set on or off, a signal is routed via the electrical distribution unit to the power supply which then supplies or switches off power to that particular device.

If a part of the drawer malfunctions when mounted in a rack, the configuration described allows the service engineer to access any of the components from either the front or rear of the drawer. The power supply, controller unit and electrical distribution unit are all removable from the rear of the drawer and the devices are removable from the front of the drawer. A defective cable assembly, defective fans etc are easily replaced with a minimum of inconvenience to the user. All this can be done without removing the drawer from the rack.

Although the apparatus described above shows floating connectors as part of the cable assembly, it will be apparent that the desired self-docking of the devices would equally well be achieved with static connectors on the two sides of the cable assembly mating with floating connectors on each of the units. Furthermore, while the described embodiment has

complementary connectors (52
at said opposite sides for rec
plugging connectors of respectiv
and a set of electrical conducto
between the complementary c
terconnecting the functional uni
nal information signals to the ap
ed via at least one unit of the s
the electrical distribution unit.

2. Electrical apparatus as claimed i
in the electrical distribution unit
unit mounted within a central co
the support structure.

3. Electrical apparatus as claimed i
2 wherein the support structu
chassis in the form of a rectang
front and rear openings.

4. Electrical apparatus as claimed
pendent on claim 2, wherein the
ed to receive the electrical
through either the front or rear

5. Electrical apparatus as claimed i
4, wherein the chassis is adapte
of the first group in a front com
the chassis via the front chas
second group of units in the re
(42) of the chassis and the elec
unit in a central compartment (2
both via the rear chassis openi

6. Electrical apparatus as claimed

tor adjusting its position thereby ensuring alignment between the corresponding electrical connectors. Electrical connection is completed when the disk drive is pushed firmly home.

In operation, all external data and control signals enter the drawer via the controller unit. This unit sends out control signals to each of the devices which are routed through the electrical distribution unit. Power to the devices is provided via the electrical distribution unit.

A control panel (not shown) is provided at the front of each device and includes a power switch and a number of indicator lights indicating device status. When the power switch is set on or off, a signal is routed via the electrical distribution unit to the power supply which then supplies or switches off power to that particular device.

If a part of the drawer malfunctions when mounted in a rack, the configuration described allows the service engineer to access any of the components from either the front or rear of the drawer. The power supply, controller unit and electrical distribution unit are all removable from the rear of the drawer and the devices are removable from the front of the drawer. A defective cable assembly, defective fans etc are easily replaced with a minimum of inconvenience to the user. All this can be done without removing the drawer from the rack.

Although the apparatus described above shows floating connectors as part of the cable assembly, it will be apparent that the desired self-docking of the devices would equally well be achieved with static connectors on the two sides of the cable assembly mating with floating connectors on each of the units. Furthermore, while the described embodiment has

complementary connectors (52,5
at said opposite sides for recei
plugging connectors of respective
and a set of electrical conductors
between the complementary con
terconnecting the functional units
nal information signals to the appa
ed via at least one unit of the sec
the electrical distribution unit.

2. Electrical apparatus as claimed in
in the electrical distribution unit is
unit mounted within a central com
the support structure.

3. Electrical apparatus as claimed in
2 wherein the support structure
chassis in the form of a rectangul
front and rear openings.

4. Electrical apparatus as claimed in
pendent on claim 2, wherein the ch
ed to receive the electrical di
through either the front or rear ch

5. Electrical apparatus as claimed in
4, wherein the chassis is adapted t
of the first group in a front compa
the chassis via the front chassis
second group of units in the rear
(42) of the chassis and the electri
unit in a central compartment (26)
both via the rear chassis opening.

6. Electrical apparatus as claimed in

* C L

Patentansprüche

1. Modulares elektrisches Gerät, enthaltend:
eine erste Gruppe austauschbarer funktioneller Einheiten (22), die jeweils einen selbsteinsteckbaren Steckverbinder (48) an einem Ende aufweisen,
eine zweite Gruppe von einer oder mehreren austauschbaren funktionellen Einheiten (44, 46) mit jeweils einem selbsteinsteckbaren Steckverbinder (66, 72) an einem Ende und einem weiteren elektrischen Steckverbinder (88, 90) am anderen Ende, um einen externen elektrischen Anschluß an das Gerät zu ermöglichen,
eine Trägerstruktur (10) zum Tragen der zwei Gruppen funktioneller Einheiten,
eine elektrische Verteilereinheit (30), die in der Trägerstruktur angeordnet ist, wobei die erste und die zweite Einheitengruppe an deren einander gegenüberliegenden Seiten montiert sind, wobei die Verteilereinheit Gegensteckverbinder (52, 54, 56) aufweist, um die selbsteinsteckbaren Steckverbinder der entsprechenden Einheitengruppen aufzunehmen, und ein Satz elektrischer Leiter (57, 58, 59, 60) zwischen den Gegensteckverbindern zum Zusammenschalten der funktionellen Einheiten vorgesehen ist, wobei externe Informationssignale an das Gerät über mindestens eine Einheit der zweiten Gruppe und die elektrische Verteilereinheit geführt werden.

2. Ein elektrisches Gerät gemäß Anspruch 1, in dem die elektrische Verteilereinheit eine austauschbare Einheit ist, die in einem mittleren Abteil 26 im Tragerahmen montiert ist.

Verteilereinheit (30) eine Kabela
einschließlich der Gegensteckv
elektrischen Leiter enthält, die au
nem Halterahmen (32) montiert ist
gensteckverbinder in entsprechen
in einander gegenüberliegenden F
des Rahmens montiert sind.

7. Elektrisches Gerät gemäß einem
Ansprüche 2 bis 6, das ferner Küh
hält, die innerhalb des Kabelhalter
tiert sind, um eine Zwangsluftumw
de Gruppen funktioneller Einheite

8. Elektrisches Gerät gemäß einem
vorstehenden Ansprüche, in dem
pe der funktionellen Einheiten aus
von Datenspeichervorrichtungen
die zweite Einheitengruppe aus
und einer Steuereinheit (46) beste
ten- und Steuersignale von außen
Steuereinheit geführt werden.

Revendications

1. Appareil électrique modulaire com
un premier groupe d'unités
nelles remplaçables ayant chacu
teur (48) à auto-enfichage à une d
tés,
un second groupe d'une ou
tés (44, 46) fonctionnelles rempl
chacune un connecteur (66, 72) à s
à une de ses extrémités et un aut

* C L

unité remplaçable montée à l'intérieur d'un compartiment (26) dans la structure de support.

3. Appareil électrique selon la revendication 1 ou la revendication 2 dans lequel la structure de support comporte un chassis se présentant sous la forme d'un tube rectangulaire ayant des ouvertures frontale et arrière.

4. Appareil électrique selon la revendication 3 lorsqu'elle dépend de la revendication 2, dans lequel le châssis est adapté pour recevoir l'unité de distribution électrique à travers soit l'ouverture frontale du châssis soit l'ouverture arrière.

5. Appareil électrique selon la revendication 3 ou la revendication 4, dans lequel le châssis est adapté pour recevoir les unités du premier groupe dans un compartiment frontal (16) du châssis par l'ouverture frontale du châssis, le second groupe d'unités dans le compartiment arrière (42) du châssis et l'unité de distribution électrique dans un compartiment central (26) du châssis, les deux par l'intermédiaire de l'ouverture arrière du châssis.

6. Appareil électrique selon l'une quelconque des revendications précédentes, dans lequel l'unité (30) de distribution électrique comporte un assemblage de câbles (50), comprenant les connecteurs complémentaires et les conducteurs électriques, qui est monté de manière amovible dans un cadre (32) de support, les connecteurs complémentaires étant placés dans des ouvertures correspondantes pratiquées dans des pan-

* C L M