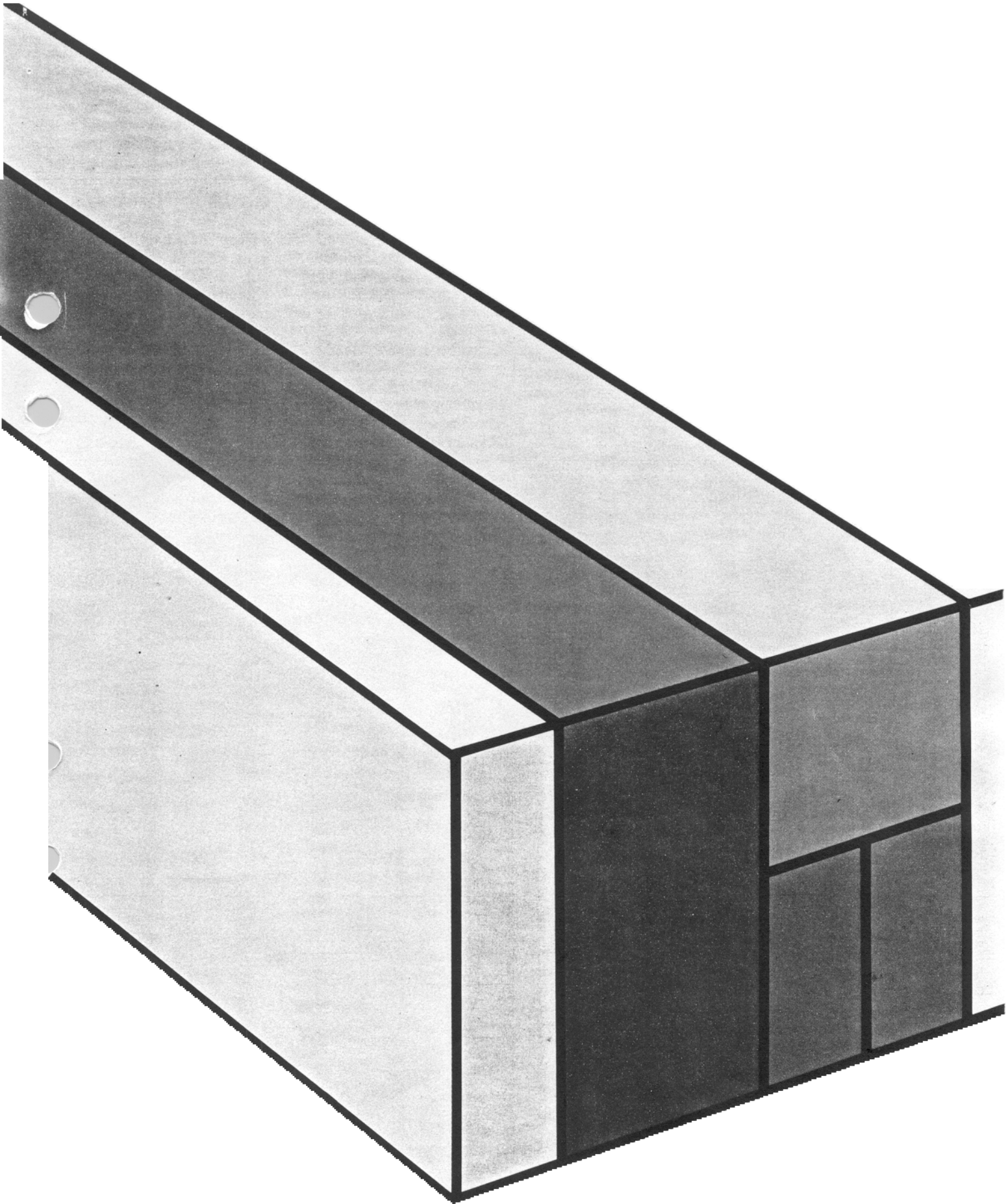
ASEA

Pamphlet RK 92 200 E Edition

COMBIFLEX®
modular system



COMBIFLEX modular system

COMBIFLEX – a practical assembly system for reliable and rapid installation, connection, testing, servicing and extension of protection and control equipment, automatic systems, etc.

COMBIFLEX provides a means of assembling complete equipment of modularised plug-in apparatus, terminal bases, connectors, branch connectors, cross-connection terminals and accessories. The apparatus and their terminals are also systematically arranged. The system offers many advantages, for example:

Great flexibility
Uniform modular dimensions and plug-in connections enable the combination of many different types of apparatus.

Convenience
Connections are made with socket-equipped leads – no screws or soldering.

Rapid wiring up
Two leads can be connected to practically any electrical connection point.

Safety
All electrical connection points are protected against inadvertent contact. Tests can be carried out without changing any connections.

COMBIFLEX is a modularised system for combining plug-in apparatus and non-modular components to form complete equipment sets for protective purposes, control and supervision in power plants, substations, industries, etc. Connections between plug-in apparatus are made with ready-made socket-equipped leads. The system fulfils the requirements for h.v. equipment with regard to insulation resistance, current-carrying capacity and level of protection, and for electronic equipment with regard to compactness and low contact resistance. The system permits easy and rapid installation, service and extension of both simple and complex systems. The COMBIFLEX system applied to protective relays is illustrated in Fig. 1, which shows how plug-in apparatus and terminal bases are combined to form a protective relay which in turn is installed in an apparatus case or an equipment frame and finally in an apparatus cubicle. This cubicle may contain relay equipment for a complete protective system for a transformer or generator, for example, and is completely wired up and tested when leaving our factory. Fig. 1 also shows a panel base, for front-wiring, in which a relay is mounted. The panel base is used on ships, for example, or in other locations where the space available is limited and where front connections are required.

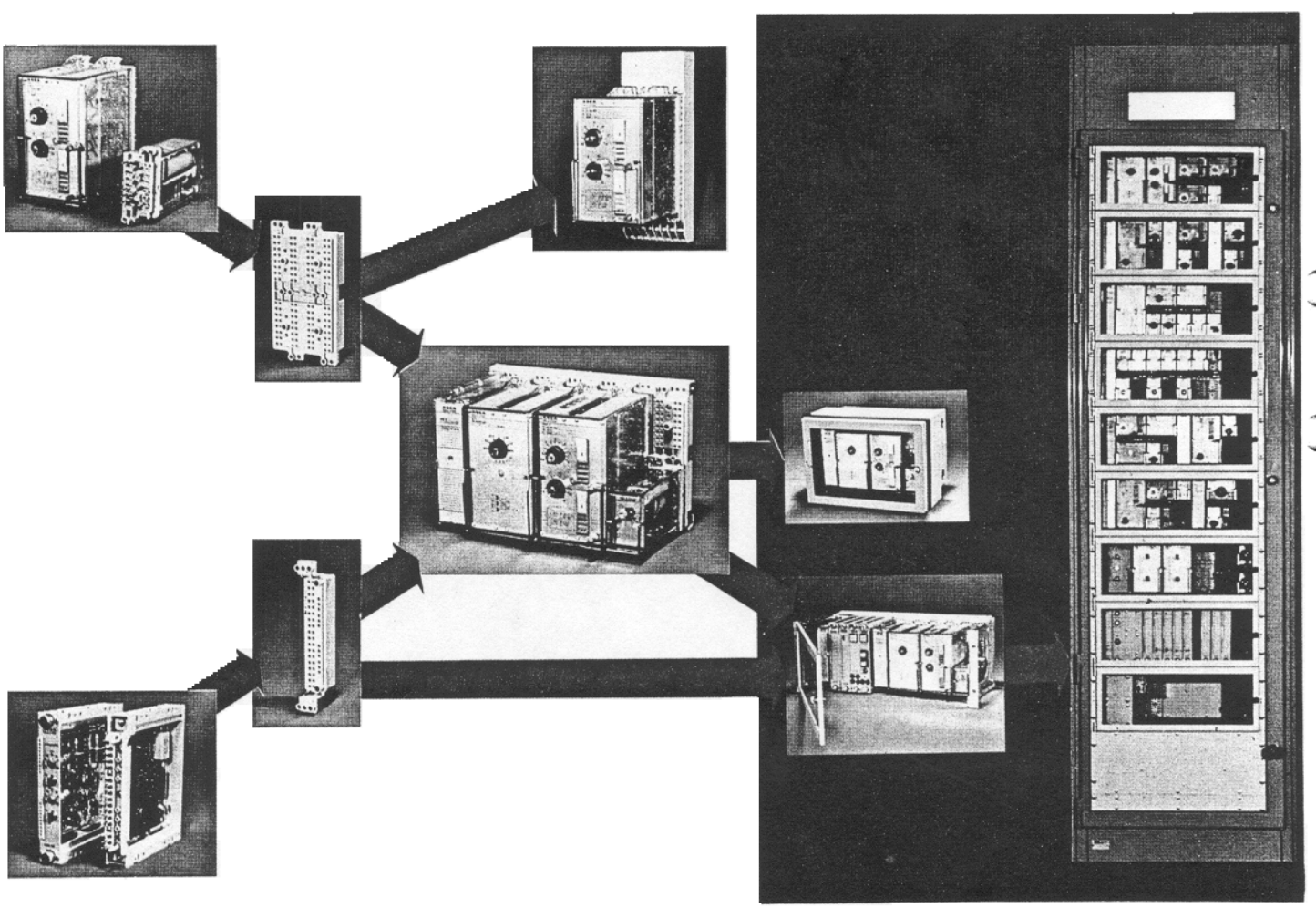


Fig. 1. The versatile COMBIFLEX system. By combining a few types of relay and other apparatus, many different protection systems and equipment sets for various installations can be assembled. (F 92629)

Electrical connections

The electrical connections depend on which apparatus or apparatus groups are combined. In Fig. 2a an example is given of a protective relay connected to a current transformer, auxiliary voltage and tripping circuit. The protective relay includes a test switch (101) and two plug-in relays (107, 307) inserted in terminal bases. This protective relay can be installed in an apparatus cubicle, for example. Designations a – e indicate the relationship between the illustration Fig. 2b and the circuit diagram. The connections between the current transformer and the current relay is made via terminals b and the short-circuit connector c (RTXK). The connection to the auxiliary supply voltage is made via terminal a and the connection to the tripping circuit is made via connector d (RTXG). From terminal 227 on the terminal base of the current relay, a signal lead is connected to branch connector e (RTXC).

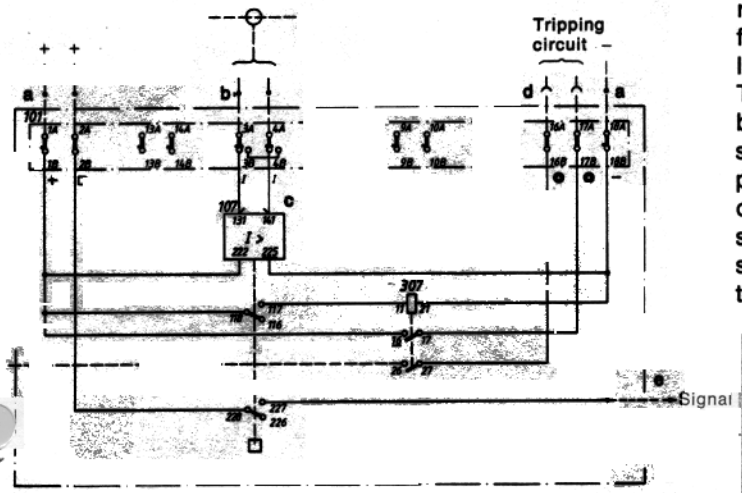


Fig. 2a. Circuit diagram for the connection illustrated below. The test switch (101) has standardised symbols which indicate where the phase current supply *I* (b) is to be connected, where the tripping pulse ● (d) is obtained and where the voltages for signal or external blocking □ (e) are connected.

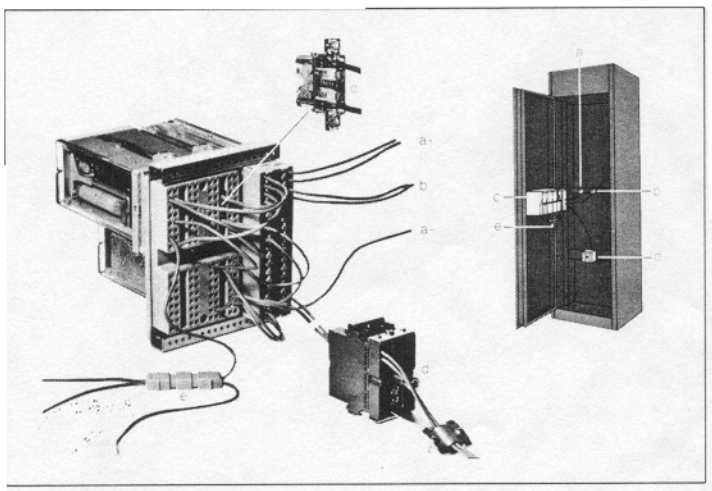


Fig. 2b. Example of electrical connection in a single-phase overcurrent relay.

Method of connection

The method of connection with socket-equipped leads is used for all COMBIFLEX units which contain contact clips. Fig. 3a illustrates this principle. When a socket lead is inserted into a terminal base as in Fig. 3b, where a plug-in apparatus has been inserted, the socket will enclose the pin on the apparatus (Fig. 4, p. 4) and is secured by the contact clip inside the terminal base, see Fig. 3c.

The socket lead can only be disconnected with the aid of a small plastic extractor (RTXD) which is inserted into the terminal of the base in such a manner that the serrated side of the extractor faces away from the socket lead, see Fig. 3d.

This method of connection is both rapid and reliable. Pins, sockets and contact clips are protected against inadvertent contact and the tensile strength of the joint between socket and lead is exceptionally high.

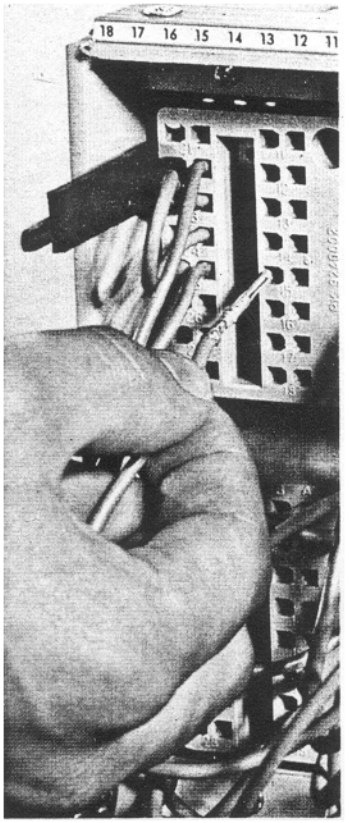


Fig. 3a. Connection on the lead side of a terminal base. The red extractor can also serve as a reminder when changing connections. (F 91777)

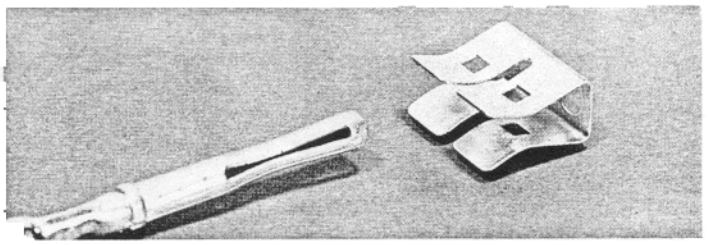


Fig. 3b. The socket-equipped lead is inserted in a terminal in the terminal base. (F 95040)

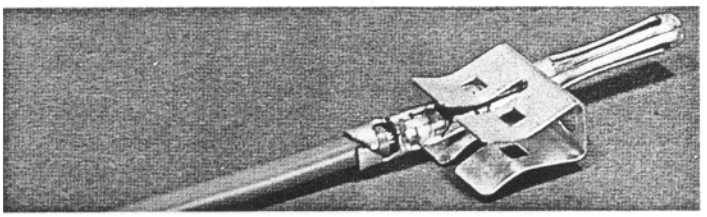


Fig. 3c. The contact clip in the base secures the socket in position. (F 95041)

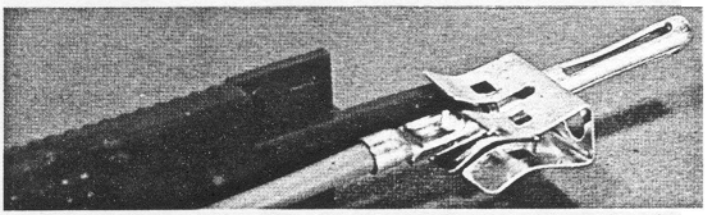


Fig. 3d. The tongue of the extractor opens the contact clip, enabling the lead to be withdrawn. (F 95042)

Plug-in apparatus

Plug-in apparatus can be of many different types; for example relays, current filters, supply units and rectifiers. Plug-in units are described with respect to their electrical design and mode of operation in separate product catalogues.
All plug-in apparatus in the COMBIFLEX system is built up in a uniform manner, with terminal pins on terminal plates and component frames and with fixed height and width dimensions, see "Modularisation" on p. 7. Furthermore, the plug-in apparatus must be installed in terminal bases to which socket-equipped leads are connected. The pins on the apparatus are normally connected in pairs with leads inside the apparatus, thus permitting the branching of each electrical point. When the apparatus is installed in terminal bases, the electrical connections with the pins are made with socket leads which are inserted in the terminals on the terminal bases, see Figs. 3b and 4.
The terminal plates and component frames, in which the requisite number of pin pairs have been inserted, have cast-in terminal designations and guide pins which correspond to the terminal designations and guide holes on the terminal bases. The apparatus can have many pairs of 10 A pins; the one shown in Fig. 4 is utilised to the full and has 16 pairs of pins. Current relays have, in addition, 20 A pins.

Plug-in apparatus which is inserted in RX 2H or RX 4 type terminal bases has a thermoplastic transparent cover, whilst plug-in apparatus inserted in RXY or RQ 04 type terminal bases is designed to give the best possible ventilation.
In the majority of cases the built-in components are connected to certain pairs of pins. Different types of relays which have the same symbol can therefore be inserted in the same place in the terminal base without necessitating any changes in the position of the socket leads. However, when it is necessary to change the connection on the terminal base, this can easily be done with the aid of an extractor RTXD, see 'Method of connection' on p. 3.

Printed circuit boards can be integrated into the COMBIFLEX system with the aid of a special connector type RTXL, see Fig. 6.
P.c. boards which have bases with wire-wrap pins can also be integrated into the system using a special contact socket with wire-wrap pin, which is inserted in the terminal base.

Other apparatus such as transformers, resistors and relays of other makes which cannot be built into COMBIFLEX type plug-in units, can normally be affixed to apparatus plates, the height and width of which correspond to the COMBIFLEX modular system. In this manner, it is possible to co-ordinate apparatus and equipment of the most varying types and retain uniformity.

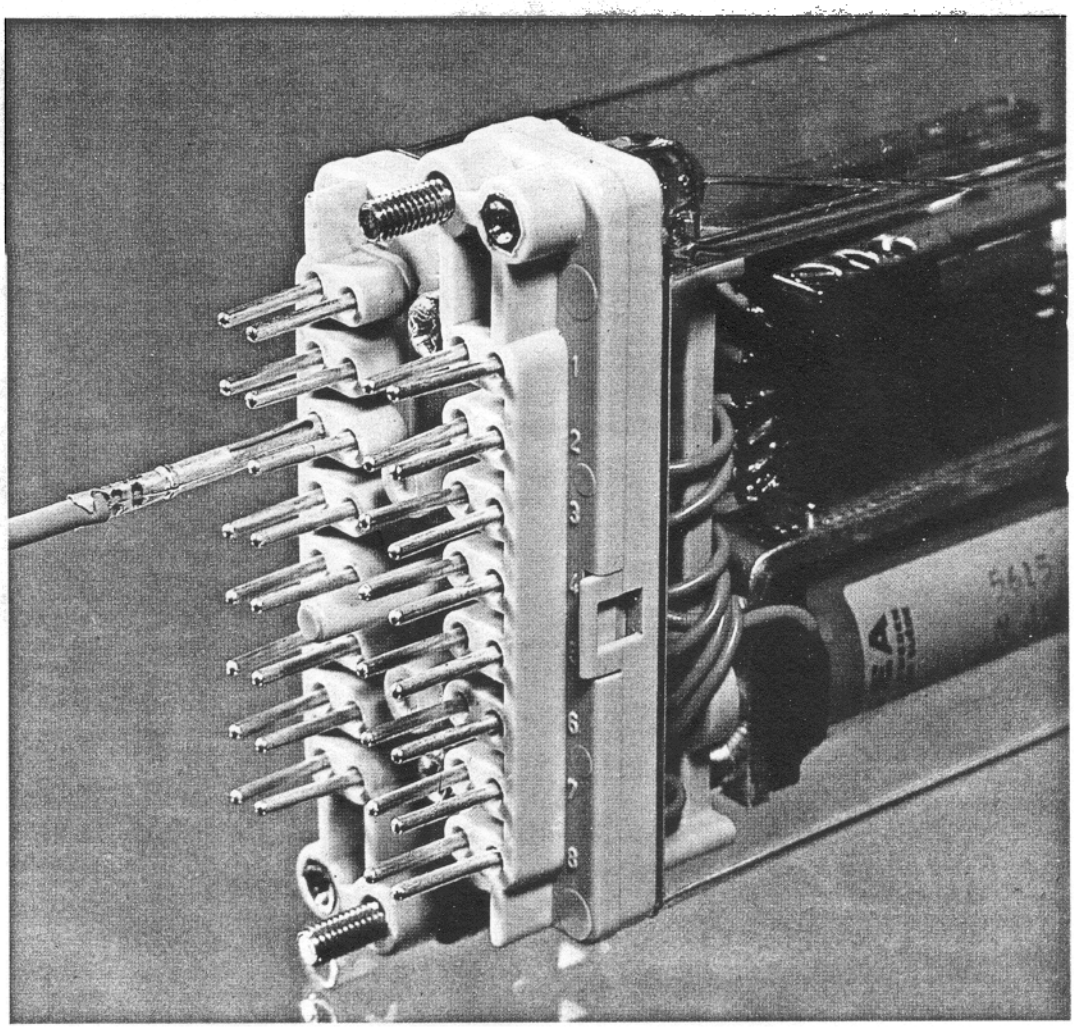
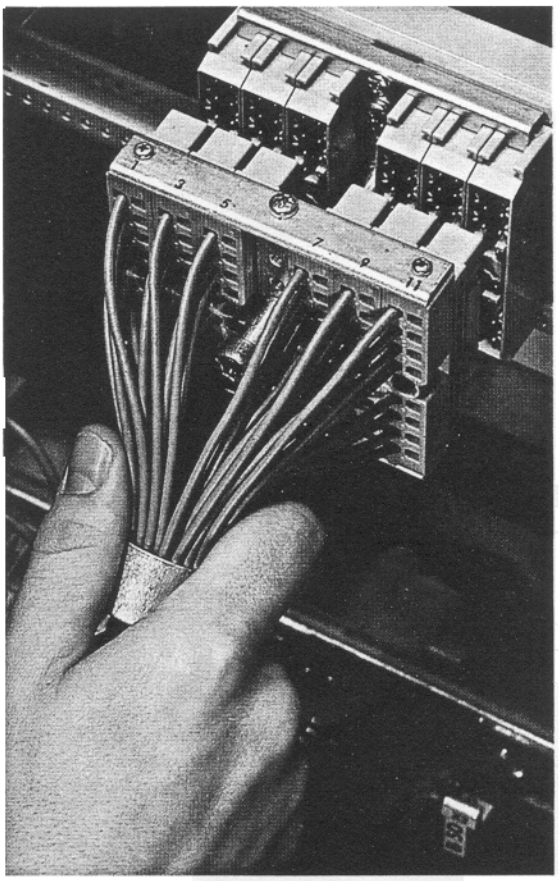


Fig. 4. When an apparatus is plugged into the terminal base, the pins of the apparatus enter the sockets which are secured in the base, compare Fig. 3. (F 94833)

Terminal bases

Connectors

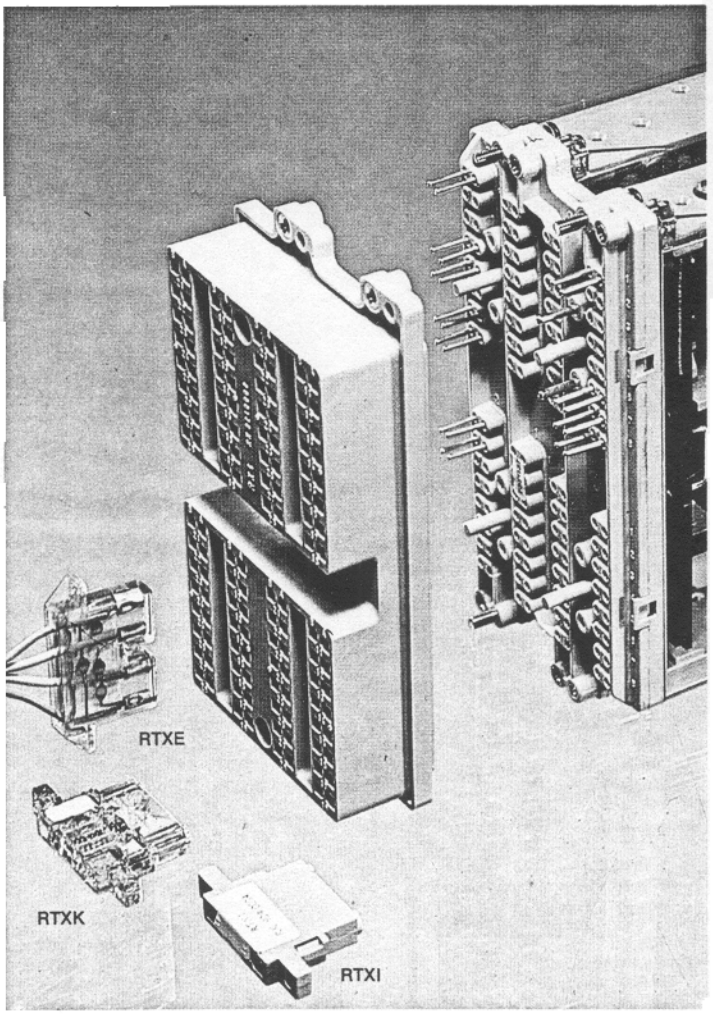
The purpose of the terminal bases is to support the plug-in apparatus and bring about electrical contact between this apparatus and the socket-equipped leads. The terminal bases have rows of terminals for socket leads. Furthermore, certain bases have component pockets for short-circuiting connector RTXK, shunt connector RTXI or component block RTXE, see Fig. 7.
The RTXK short-circuiting connector (for a.c.) and the RTXI shunt connector (for d.c.) are used when apparatus with 20 A pins is to be inserted in the terminal bases. Component block RTXE is used when it is required to provide an apparatus with an additional function, e.g. a time lag.



The RTXG type connector is used to facilitate simple and rapid connection and disconnection of bunched leads, see Fig. 5.

The RTXL connector is used for the connection of bunched leads to p.c. board assemblies, see Fig. 6.

Fig. 5. With connector RTXG, many connections can be made or broken simultaneously. (F 94533)



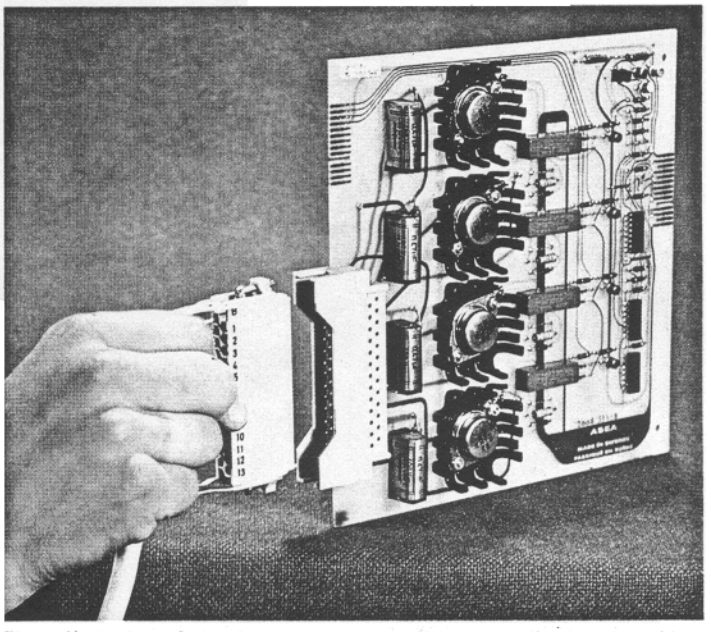


Fig. 6. Up to 26 leads can be simultaneously connected or disconnected with connector RTXL. (F 91347)

Fig. 7. A terminal base with component pockets in which RTXE component blocks can be inserted to provide the plug-in apparatus with an additional function, e.g. time lag, voltage division and rectification. The component pockets are also used for the short-circuiting connector RTXK and connector RTXI, both of which have 20 A terminals. (F 94832)

Branch connector and cross-connection terminals

Branch connector type RTXC is used for making branch connections of one lead, e.g. one incoming and three outgoing leads, see Fig. 8.

Branch connectors can also be supplied built together to form larger blocks of cross-connection terminals, see Fig. 10.

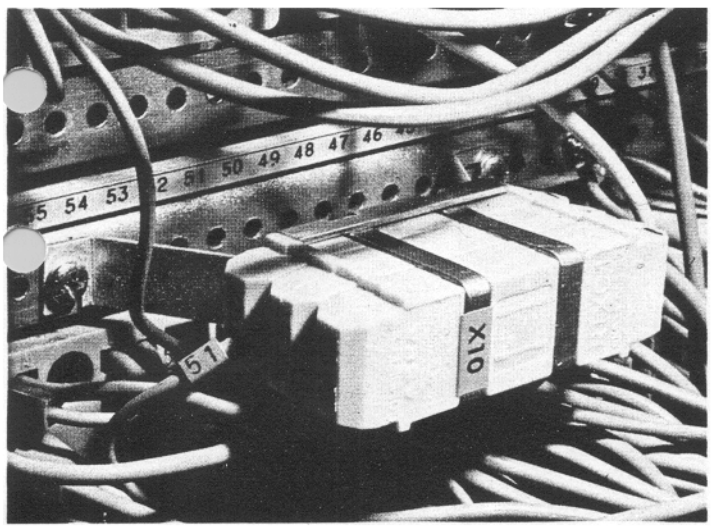


Fig. 8. Branch connections of, for example, signal or measuring circuits are made in a simple manner with branch connector RTXC. (F 94105)

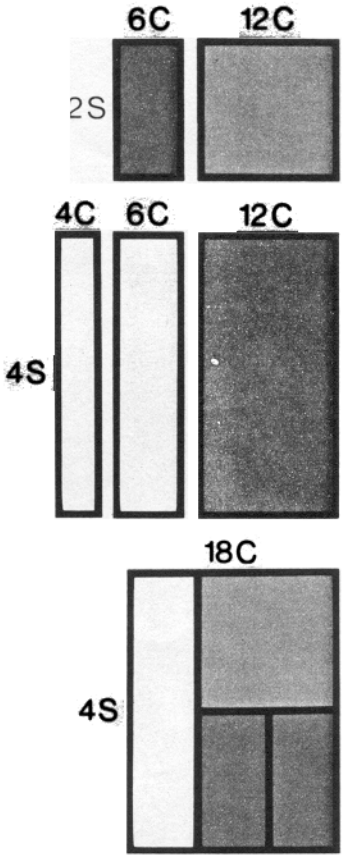


Fig. 9. Example of modularisation.

Modularisation

Modularisation is based upon the recommendations of IEC (International Electrotechnical Commission) publication 297 for dimensions of racks and panels.
Plug-in apparatus, terminal bases and connectors have their height and width dimensions divided into modules, see Fig. 9.
The height module S=44.45 mm corresponds to the vertical spacing between the groups of mounting holes.
The width module C = 7 mm corresponds to the horizontal spacing between the fixing holes in the equipment frame.
These modules are also used for equipment frames and apparatus plates, etc. A 19″ equipment frame has a width of 60C = 420 mm for installation of apparatus.
Due to this modularisation, it is a simple matter to combine apparatus and to apply a consistent item designation (which is based upon IEC publication 113-2), facilitating the identification of each apparatus and terminal. ASEA Information Bulletin RK 924-100 E describes the item designation system applied to relay cubicles.

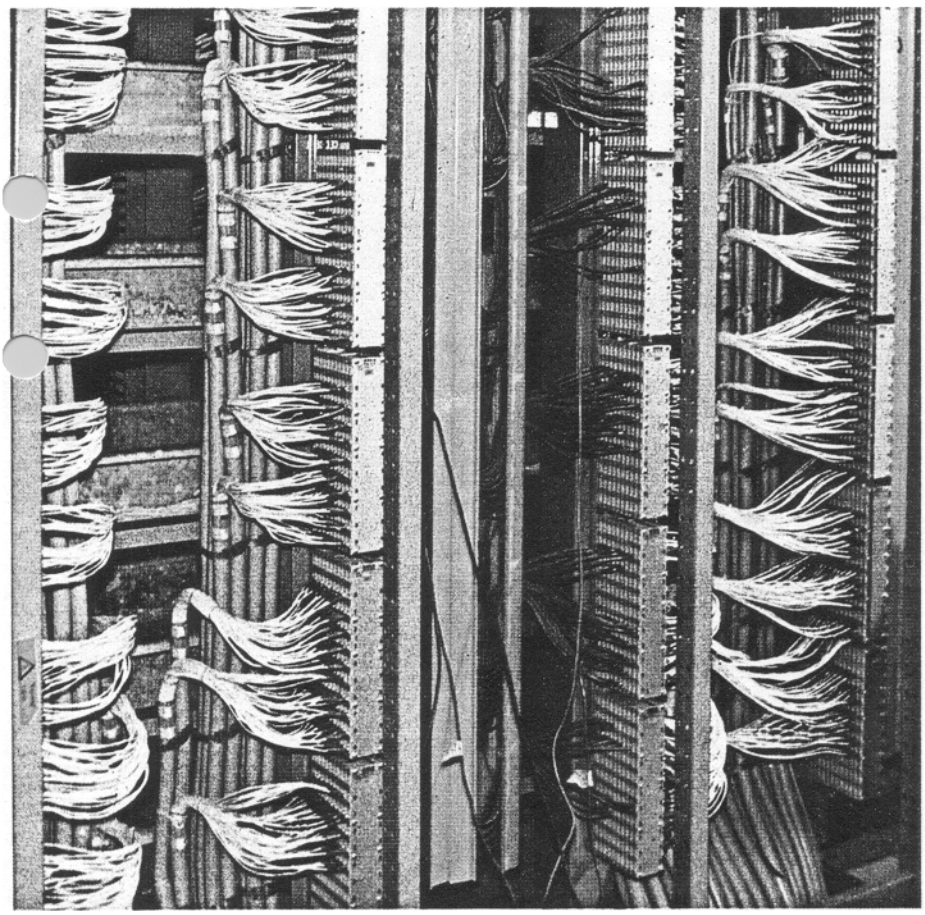


Fig. 10. To save cable and to facilitate connections of instrument transformers, circuit breakers, disconnectors and tap changers to relay cubicles, control cubicles and instrument cubicles, use is made of cross-connection terminals RTXC 100. (F 94305)

Installation

The installation of COMBI-FLEX apparatus is facilitated by the modularised design and the uniformity of the electrical connections. To arrange a protective relay, for example, use is made of apparatus bars, on which terminal bases are secured with screws. For mounting in relay cubicles or boxes, equipment frames are used, and for installation in boards or on panels, cases are employed. For installation of RTXG connectors in a cubicle use is made of an apparatus frame with a modular height of 2S which is intended to be attached to the rear plane of the cubicle.
Further particulars with respect to installation are given in Information Bulletin RK 926-100 E, which also includes instructions for testing and maintenance of relays.

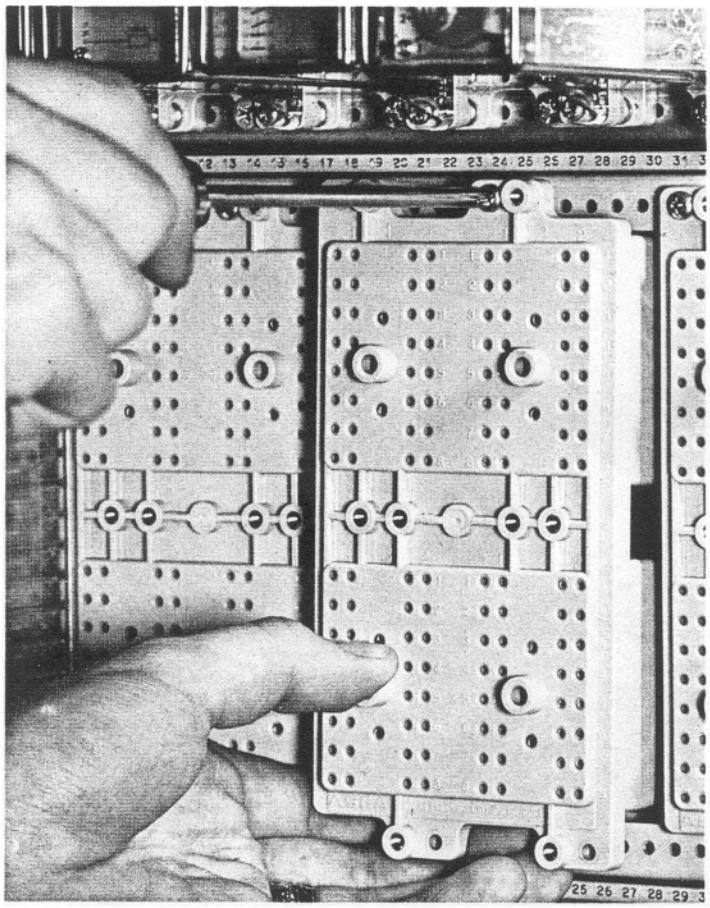


Fig. 11. The terminal bases are screwed to apparatus bars. (F 94535)

Testing

Fig. 12. Relays can be tested without having to make tedious changes to connections in the relay. (F 94544)

For testing of a protective relay fitted with a test switch, for example, a special test-plug handle (Fig. 12) is used, to which test leads are connected from the testing equipment. The test switch and test-plug handle constitute the main parts of the COMBITEST testing system.
For fine adjustment of the operational values of certain relays and apparatus with p.c. board assemblies, use can be made of an extension base, which permits simultaneous measurement and adjustment without necessitating repeated insertions and removals of the apparatus.
For installation and testing purposes, a tool box is available which contains all the necessary tools and testing items. The tool box also includes a stripping and a contact crimping tool.

Technical data

Material

The material in insulated and supporting parts of plug-in apparatus and connection parts consists mainly of grey, blue or translucent thermoplastic, which is not influenced by normal changes in temperature or by moisture. It has excellent insulation strength.

The material in pins, sockets and contact clips consists of copper alloys that fulfil the requirements for electrical conduction, resilient qualities and hardness.

Data for connection parts

Max. voltage between lines	500 V a.c., 600 V d.c.
Test voltage, connectors RTXL	1500 V, 50 Hz, 1 min
other parts	2500 V, 50 Hz, 1 min
Current carrying capacity	
10 A socket-pin, continuously	10 A
for 1 s	150 A
20 A socket-pin, continuously	20 A
for 1 s	350 A
Contact resistance, socket-pin	
silver plated	< 5 mΩ
gold plated	< 2 mΩ

Data for socket-equipped leads

		Conductor area mm²			
		0.5	0.75	1.0–1.5	2.5
Rated voltage	V	400	400	750	750
Test voltage at 50 Hz for 15 min.	V	1500	1500	2500	2500
Rated current	A	7	10	10	20
Max. continuous operating temperature	°C	70	70	70	70
Tensile strength between socket and lead	N/mm²	> 150	> 150	> 150	> 150

ASEA
Relay Division
S-721 83 VÄSTERÅS, SWEDEN
Tel. +46 21 100000

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