

Description

Circuit breaker arrangement

5 The invention relates to a circuit breaker arrangement having
a number of circuit breakers, which are each connected via
lines to a system component of a power distribution system. In
this case, circuit breakers are intended to mean in particular
10 line circuit breakers for protecting current-carrying lines in
a low-voltage system.

Such a circuit breaker arrangement is generally part, in
particular, of a switchgear cabinet of a complex assembly or
airplane power supply system having circuit breakers, which
15 are held in a control panel in the form, for example, of a
control board and whose control buttons are passed through the
control panel via corresponding leadthrough openings from the
rear side of said control panel and toward the front side.

20 The control buttons of the circuit breakers are used, in
particular, for manually tripping the respective circuit
breaker in order to switch the corresponding or affected line
path and the system component of the power distribution system
associated therewith such that they do not carry a current or
25 voltage. In addition, the control button, in general owing to
its respective position or change in position, indicates a
circuit breaker which has tripped in the event of a fault
owing to an overload of the lines to be protected of the
affected line path.

30 The invention is based on the object of developing a circuit
breaker arrangement of the type mentioned at the outset such
that, in addition to merely the control function, diagnosis
and/or parametrization functions are also made possible.

35 This object is achieved according to the invention by the
features of claim 1. In this regard, a coupling element, which
is likewise accessible from the front side of the control

panel, for the interchange of diagnosis and/or parametrization data is associated with the or each circuit breaker.

5 In this case, the invention is based on the consideration that, firstly, the circuit breakers of such a circuit breaker arrangement are increasingly equipped with local intelligence in the form, in particular, of a, for example, processor-assisted processing unit and therefore, in addition to the actual protective function, can also take on monitoring and control functions. Secondly, an access option should be made possible for the resulting diagnosis and/or parametrization functions even in the case of ready-installed circuit breakers whilst avoiding retrofitting of a data bus system, which is generally complex for such purposes. This can be achieved by virtue of the fact that diagnosis or parametrization of the circuit breakers and/or of the system components, which are coupled to said circuit breakers, of the power distribution system is made possible from the control side. As a result, designing the devices for such diagnosis or parametrization purposes is as unnecessary as a data bus system.

25 In one advantageous configuration, the coupling element, which is accessible from the front side of the control panel, for data interchange is designed for diagnosis or parametrization purposes for bidirectional data interchange. In this case, the coupling element may be in the form of a transmission and/or reception device for wireless data interchange. Here, in principle optical data transmission, for example by means of infrared, or else acoustic data transmission, for example by means of ultrasound, is conceivable. Radio data transmission can also be used. In principle, the coupling element can also be designed for data interchange using cables, lines or wires, expediently in the form of an electrical connecting connection or plug-in connection.

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As regards the geometrical arrangement, the coupling element can be provided in the control panel, preferably in the direct vicinity of the respective control button of the associated

circuit breaker, or preferably in the control button itself. Control button is in this case also understood to mean a control element in the form of an actuating button, an actuating rocker or the like.

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The breaker-internal coupling or connection of the coupling element can be provided via a processing unit, which is provided in the respective circuit breaker, for measuring and/or controlling breaker-relevant data or switching elements. The coupling element for data interchange with the power distribution system or the corresponding system component can also be connected within the breaker to a line terminal of the system component associated with the respective circuit breaker.

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In order to prevent an overvoltage, originating from the power distribution system, at the diagnosis device when a diagnosis or parametrization device is connected via the coupling element provided in the control panel, an auxiliary switching element is expediently connected into the breaker-internal connection between the coupling element and the line terminal. In this case, the auxiliary switching element (auxiliary switch) interacts with a main switching element (main switch) of the circuit breaker such that data interchange with the respective system component of the power distribution system can only take place when the main switch is open and, as a result of the coupling, the auxiliary switch is closed.

The advantages achieved by the invention consist in particular in the fact that, owing to the arrangement of a coupling element, which is accessible from the front side of a control panel of a circuit breaker arrangement, data interchange with breaker-internal components, on the one hand, and with system components, which are connected to the respective circuit breaker, of a power distribution system, on the other hand, is made possible without a bus. The data interchange expediently takes place via a diagnosis or parametrization device, which has a corresponding coupling point or interface in order to

write or read diagnosis and/or parametrization data likewise from the front side of the control panel. It is thus possible, via such bus-free data interchange via the corresponding coupling elements, for measurement and fault data, which may
5 be buffer-stored in the circuit breaker, to be read and for parametrization data for configuring the circuit breaker monitoring the respective lines of the power distribution system, such as specific line or system data, for example, to be written to the circuit breaker or, via said circuit
10 breaker, to the respective system component of the power distribution system.

Exemplary embodiments of the invention will be explained in more detail below with reference to a drawing, in which:

15 Figure 1 shows a schematic of a circuit breaker arrangement of a power distribution system having control and coupling elements arranged in a control panel and a diagnosis device for data interchange,
20 Figure 2 shows a variant embodiment having a coupling element, which is arranged in the control panel and is coupled directly to the corresponding circuit breaker, and
Figure 3 shows, in an illustration as in figure 2, an
25 embodiment having a coupling element arranged in the control element of the circuit breaker.

Mutually corresponding parts are provided with the same reference symbols in all of the figures.

30 Figure 1 shows a schematic of a circuit breaker arrangement having a number of line circuit breakers $LS_{1...n}$, which are connected via lines $L_{11}...L_{1m}$ to in each case one system component $SK_{1...n}$ of a power distribution system or power
35 supply system EN.

A control element $BE_{1...n}$, which will be referred to below as a control button, is associated with each line circuit breaker

LS_{1...n}, which will be referred to below as a circuit breaker. The respective control button BE_n, which may also be in the form of an actuating button or an actuating rocker, is coupled to the respective circuit breaker LS_n mechanically via a
5 corresponding switching element SE_n. The control button BE_n of the respective circuit breaker LS_n is arranged in a control panel BF and is passed there to the outside toward an outer side in a manner which is not illustrated in any more detail,
10 via through-openings from a housing or device inner side IS, for example the interior of a switchgear cabinet or power supply system cabinet, and is therefore accessible and capable of being actuated from the front side FS of the control panel BF.

15 In the exemplary embodiment shown in figure 1, a coupling element KE_{1...n} is provided physically adjacent to the or each control button BE_{1...n}, which coupling element is likewise accessible from the front side FS of the control panel BF. The respective coupling element KE_n is device-internal, i.e. is
20 connected to the respective circuit breaker LS_n, for example via a connecting line VL_n, on the inner side IS, which is opposite the front side FS, of the control panel BF.

The coupling element KE_n is used for data interchange with a
25 schematically illustrated diagnosis device DG. This diagnosis device has a coupling part KT, which is complementary to the respective coupling element KE_n, wherein, as illustrated symbolically, an electrical connection L_D using cables or lines or else a wireless connection IR_D, F_D can be realized
30 via correspondingly designed coupling elements KE_n or coupling parts KT for data interchange. Optical data interchange via an infrared path IR_D with, for example, coupling elements KE_n in the form of infrared transmitters and receivers or else radio data interchange via a radio path F_D can therefore take place.
35 For this purpose, the coupling elements KE_n are then in the form of corresponding transmission and reception devices.

Figures 2 and 3 show the basic design of a circuit breaker LS_n having a mechanical, electromechanical or electronic switching mechanism SH and having a main switching element or main switch HS, which is coupled to said switching mechanism, in the form of mechanical switching contacts or of an electronic or semiconductor switch, for example in the form of a field effect transistor. A further component part of the circuit breaker LS_n is expediently a processing unit VE. This processing unit is used, on the one hand, for controlling the switching mechanism SH and/or the main switch HS and, on the other hand, for picking up, storing and processing measured values detected within the circuit breaker.

The main switch HS is connected, via the lines L_{nm} to be monitored, to the respective system component SK_n , which is symbolized by a generator G and a load L. In general, the output of the circuit breaker LS_n facing the supply of the system component SK_n is in this case referred to as a LINE terminal, while the terminal of the circuit breaker LS_n which faces the consumer or the load L of the system component SK_n is referred to as LOAD.

Illustrated using dashed lines in figure 2 is also an auxiliary switching element HE, which is provided within the breaker and is connected into a breaker-internal connecting line VL_L to the LOAD terminal of the circuit breaker LS_n . The connecting line VL_L is passed to the coupling element KE_n provided in the control panel or front panel BF via the processing unit or logic VE of the circuit breaker LS_n . A direct connection from the coupling element KE_n via the auxiliary switching element HE to the LOAD terminal of the circuit breaker LS_n can also be provided, as illustrated by dashed lines. The auxiliary switching element HE, which is also referred to below as the auxiliary switch, and the main switch HS are in this case coupled to one another, in particular via the processing unit VE or via a separate front-side additional contact, such that the auxiliary switch HE is only closed when the main switch HS is open. An overvoltage at

the coupling element KE_n and, via this, at the diagnosis device DG is therefore reliably avoided.

In the exemplary embodiment shown in figure 2, the coupling element KE_n is coupled directly to the circuit breaker LS_n . For this purpose, a direct connecting contact between the coupling element and the circuit breaker LS_n , in particular via its breaker housing, may exist in a manner which is not illustrated in any more detail.

Data interchange with the circuit breaker LS_n and, possibly via said circuit breaker, with the respective system component SK_n and via the coupling element KE_n takes place with the diagnosis and/or parametrization device DG, which can likewise be operated from the front side FS of the control panel BF. In this case, the data interchange can take place, as symbolized by the double arrow in figure 3, optically, acoustically or by radio and therefore in wireless fashion or, as symbolized by the dashed-line connection in figure 2, using cables or lines. For this purpose, the diagnosis device has the corresponding coupling point or interface KT for such wireless data interchange or data interchange using wires.

In the preferred embodiment, in particular in the case of tight physical or spatial conditions with a correspondingly small-area control panel BF, as shown in figure 3, the coupling element KE_n is integrated in the control button BE. The breaker-internal line connection VL_n can in this case, as illustrated by dashed lines, also take place via the mechanical switching element SE_n in the connection between the control button BE and the switching mechanism SH. In this embodiment, an auxiliary switching element HE is not shown, in which case the breaker-internal design with or without auxiliary switching element or auxiliary switch HE and with or without processing unit VE, both in the embodiment with a separate through-opening for the coupling element KE_n through the control panel BF and in the embodiment with a coupling

element KE_n integrated in the control button BE can be provided.

The data interchange via the respective coupling element KE_n preferably takes place bidirectionally. For this purpose, control data and parameters or parametrization data D_{DP} can be transmitted from the diagnosis device DG, via the respective coupling element KE_n , into the processing unit VE of the respective circuit breaker LS_n and/or via said circuit breaker to the respective system component SK_n . The control, diagnosis or parametrization data D_{DP} can in this case be stored or buffer-stored in the processing unit VE and/or passed on from there to the system component SK_n and also read from the diagnosis device DG again. Line parameters can also be buffer-stored in the processing unit VE. Measured values and diagnosis data, in particular also from the system or the system component SK_n , such as coupling impedances and system-specific parameters, for example, can likewise be buffer-stored in the processing unit VE and read, by means of the diagnosis device DG.

In addition, data or parameters can be read from the system component SK_n and therefore system states queried by means of the diagnosis device DG via the coupling element KE_n . In this case, too, system-specific data, fault messages and/or measured values can in turn be buffer-stored in the processing unit VE of the circuit breaker LS_n and read at the given time via the coupling element KE_n by means of the diagnosis device DG.

Diagnosis and/or parametrization data D_{DP} are therefore written and read in a bus-free manner via the coupling element KE_n of the respective circuit breaker LS_n from the control or front side FS without intervention in the installation side of the circuit breaker LS_n , i.e. on the inner side IS of the device or housing which is opposite the front side FS, being required for this purpose.

List of reference symbols

BE _n	Control button
BF	Control panel
DG	Diagnosis device
D _{DP}	Diagnosis/parametrization data
EN	Power distribution system/power supply system
F _D	Radio connection
FS	Front side
G	Generator
HE	Auxiliary switching element/auxiliary switch
HS	Main switching element/main switch
IR _D	Infrared path
IS	Device/housing inner side
KE _n	Coupling element
KT	Coupling part/interface
L	Load
L _D	Connection
L _{nm}	Line
LS _n	Line circuit breaker
SE _n	Switching element
SH	Switching mechanism
SK _n	System component
VE	Processing unit
VL _n	Connecting line

Claims

1. A circuit breaker arrangement having a number of circuit
breakers (LS_n), which are each connected via lines (L_{nm})
5 to a system component (SK_n) of a power distribution
system (EN) and each have a control button (BE_n),
 - wherein the control button (BE_n) for the purpose of
tripping the respective circuit breaker (LS_n) is
passed through a control panel (BF) and can be
10 actuated from the front side (FS) of said control
panel, and
 - wherein a coupling element (KE_n), which is likewise
accessible from the front side (FS) of the control
panel (BF), for the interchange of diagnosis and/or
15 parametrization data (D_{DP}) is associated with the or
each circuit breaker (LS_n).
2. The circuit breaker arrangement as claimed in claim 1,
wherein the coupling element (KE_n) is designed for
20 bidirectional data interchange.
3. The circuit breaker arrangement as claimed in claim 1 or
2, wherein the coupling element (KE_n) is in the form of a
transmission and/or reception device for data
25 interchange.
4. The circuit breaker arrangement as claimed in one of
claims 1 to 3, wherein the coupling element (KE_n) is
arranged in the control panel (BF).
- 30 5. The circuit breaker arrangement as claimed in one of
claims 1 to 4, wherein the coupling element (KE_n) is
arranged in the vicinity of or in the control element
(BE_n) of the respective circuit breaker (LS_n).
- 35 6. The circuit breaker arrangement as claimed in one of
claims 1 to 5, wherein the coupling element (KE_n) is
connected to a breaker-internal processing unit (VE) of

the circuit breaker (LS_n) for measuring and/or controlling breaker-relevant data or breaker elements (SH, HS, HE).

- 5 7. The circuit breaker arrangement as claimed in one of
claims 1 to 5, wherein the coupling element (KE_n) for
data interchange with the power distribution system (EN)
is connected within the breaker to a line terminal
10 (LOAD) of the system component (SK_n) associated with the
respective circuit breaker (LS_n).
8. The circuit breaker arrangement as claimed in claim 7,
wherein an auxiliary switching element (HE) is connected
into the breaker-internal connection (VL_n) between the
15 coupling element (KE_n) and the line terminal (LOAD).
9. The circuit breaker arrangement as claimed in claim 7,
wherein the auxiliary switching element (HE) is coupled
to a main switching element (HS) of the circuit breaker
20 (LS_n) such that data interchange with the respective
system component (SK_n) only takes place when the main
switching element (HS) is open.
10. The circuit breaker arrangement as claimed in one of
25 claims 1 to 9, wherein the data interchange takes place
without a bus.