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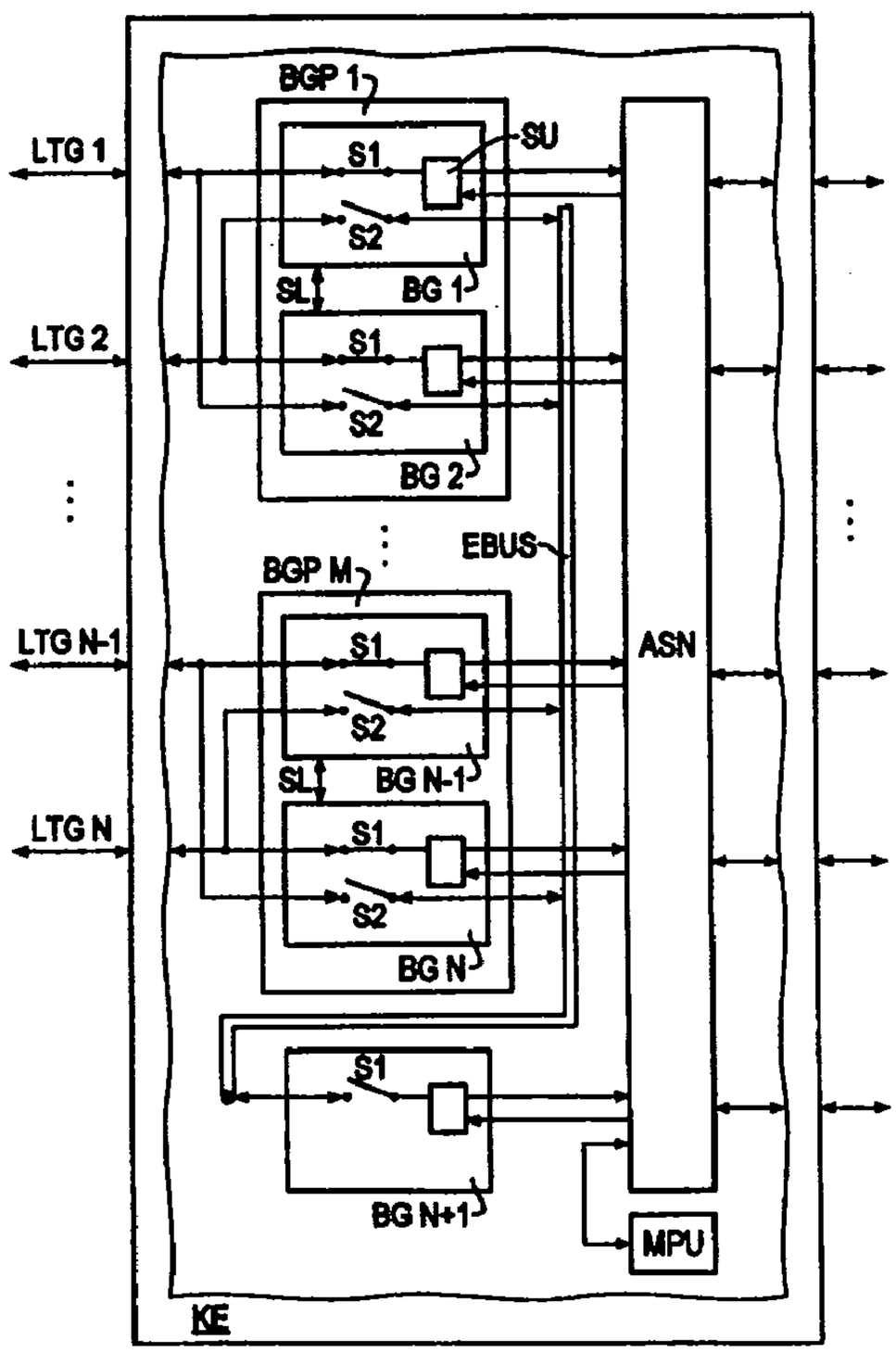
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(54) **SYSTEME DE REDONDANCE "1:N" ET "1:1" POUR SYSTEME ASN**

(54) **REDUNDANCY SYSTEM WITH "1:N" AND "1:1" REDUNDANCY FOR A ASN-SYSTEM**



(57) L'installation de communication (KE) proposée présente une configuration de couplage (ASN) avec au moins un nombre N de groupes électroniques de puissance (BG 1 à BG N) actifs, reliés chacun à au moins une ligne de transmission (LTG 1 à LTG N) et formant avec un groupe électronique de puissance

(57) The communication facility (KE) described presents a coupling configuration (ASN) of at least a number N of active power electronics assemblies (BG 1 to BG N), each being connected to at least one transmission line (LTG 1 to LTG N) and forming with an additional standby power electronic assembly (BG N+1)

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supplémentaire de rechange (BG N+1) un groupe de redondance "1:N". Dans ladite installation, les groupes électroniques de puissance sont disposés par paires selon le modèle d'une redondance "1:1". Lesdits groupes électroniques de puissance disposent de moyens de commutation (S1, S2) grâce auxquels, lorsqu'un défaut apparaît dans l'un de ces groupes, un trajet de rechange est défini qui passe par le groupe-partenaire électronique de puissance respectif et le groupe électronique de puissance de rechange.

a redundancy group "1:N". In such a facility, the power electronic assemblies are arranged in pairs on the same model as a "1:1" redundancy. The power electronic assemblies in said facility have switching means (S1, S2) owing to which, when a defect occurs in one of said groups, an alternative path is defined which passes through the corresponding partner-power electronics assembly and the standby power electronic assembly.

Abstract

Communications device for the transmission of message signals

The communications device (KE) has a switching network (ASN) with at least a number N of active line assemblies (BG 1 to BG N), which are connected to in each case at least one transmission line (LTG 1 to LTG N) and form, together with an additional backup line assembly (BG N+1) a "1:N" redundancy group. The line assemblies are combined in pairs after the manner of "1:1" redundancy in such a group. In this case, these line assemblies are each provided with switching means (S1, S2) via which, in the event of an error occurring in one of the line assemblies, a backup path via the associated partner line assembly and the backup line assembly is routed.

FIG. 1

Description

Communications device for the transmission of message signals

The invention relates to a communications device according to the preamble of Patent Claim 1.

Depending on the required fail-safeness of a communications device, different redundancy structures can be provided for the peripheral line assemblies associated with the said device. Examples of this are the "1+1", the "1:1" and the "1:N" line assembly redundancy, as is described in "IEEE Journal on Selected Areas in Communications", VOL. 15, No. 5, June 1997, pages 795 to 806. In the case of a "1+1" redundancy structure, two line assemblies are operated in parallel in order to transmit message signal streams in a redundant manner via them. In this case, however, only one of these redundant message signal streams is taken into account for further handling.

In the case of "1:1" line assembly redundancy, only one of two line assemblies is used as active line assembly, a changeover being made to the remaining line assembly, serving as backup assembly, only in the case of an error in the active line assembly.

Finally, in the case of "1:N" line assembly redundancy, a single backup line assembly is provided in addition to a plurality N of line assemblies. When an error occurs on one of the N line assemblies, then the backup line assembly is used instead of this line assembly.

The communications device according to the preamble of Patent Claim 1 relates to such "1:N" line assembly redundancy. A communications device having such "1:N" line assembly redundancy is described in the German Patent Application

mentioned above. The communications device is in this case connected to a plurality N of transmission lines. The interface to these N transmission lines is formed by N line terminals of selection means of the communications device. These selection means are connected via further N+1 line terminals to N+1 line assemblies which form a "1:N" redundancy group. In this case, in the normal mode, that is to say during error-free operation of the line assemblies, these selection means are used to connect for example the first N line assemblies as active line assemblies to N transmission lines. On the other hand, the remaining line assembly N+1 serves as backup line assembly. In the event of an error occurring in one of the active line assemblies, the selection means are then changed over in such a way that the transmission path that previously ran between the defective line assembly and the associated transmission line now runs via the backup line assembly N+1.

The communications device that has been explained has the disadvantage that in the event of failure of such a selector arrangement and in the event of a resulting replacement of this selector arrangement, all of the transmission lines connected thereto and hence the connections running via the said lines are interrupted.

The abovementioned German Patent Application furthermore claims a design of a communications device according to the preamble of Patent Claim 1. This design provides for the selection means of a "1:N" redundancy group to be provided with N signal terminals on a first connection side and, on the other hand, only with one individual signal terminal, connected to the backup line assembly, on a second connection side. Line-specific switching means are inserted into each of the transmission lines, which switching means connect the respective transmission line optionally via a first switching path to the active line assembly assigned to the said transmission line

or via a second switching path to one of the N signal terminals of the selection means. In this case, the selection means and the N switching means can be controlled in such a way that, in the normal mode, the N transmission lines are connected to the N active line assemblies directly via the first switching paths of the line-specific switching means, whereas, in the backup mode of one of the N active line assemblies, the assigned transmission line thereof is connected to the backup line assembly via the second switching path of the associated switching means and the selection means.

The object of the present invention, then, is to show a way of being able to design a communications device according to the preamble of Patent Claim 1 so that the use of separate selection means can be dispensed with in the case of "1:N" line assembly redundancy.

In the case of a communications device according to the preamble of Patent Claim 1, this object is achieved by means of the circuitry features specified in this patent claim.

The invention affords the advantage of utilizing structures which are necessary for the realization of "1+1" line assembly redundancy for "1:N" line assembly redundancy as well. An arrangement of line assemblies in pairs is provided for the "1+1" line assembly redundancy, the transmission lines associated with such a pair of line assemblies each being routed to both line assemblies. In this case, the structure of the "1+1" line assembly redundancy can be utilized in such a way that the transmission lines of a line assembly, as in the case of "1+1" line assembly redundancy, are each routed to the line assembly assigned pairwise. As a result, one line assembly is able, in the event of failure of the other line assembly, to connect the transmission lines thereof to a backup switching bus.

Advantageous refinements of the invention emerge from the subclaims.

The present invention is explained in more detail below by way of example with reference to drawings.

Figure 1 shows, in the form of an extract, the schematic structure of a communications device according to the present invention, using the example of a normal mode, and

Figure 2 shows the communications device illustrated in Figure 1 for the case of a backup mode.

A communications device according to the present invention will now be explained in more detail below with reference to Figures 1 and 2. In this case, Fig. 1 illustrates the normal mode and Fig. 2, on the other hand, the backup mode of the communications device. In this case, only those elements of the communications device which are necessary for an understanding of the present invention are illustrated in these figures.

The communications device KE illustrated in Fig. 1 may be an ATM communications device which operates according to the asynchronous transfer mode and enables transmission of message signals in the form of message cells in the course of virtual circuits. Since an ATM transmission principle of this type is sufficiently known, it will not be discussed in more detail below.

As an example, the communications device KE has a central switching network ASN which is assigned, for control thereof, a central control device MPU. In the case of this communications device, what may be involved is a so-called "cross connect" for setting up permanent virtual circuits or switching equipment

("switching node") for setting up switched virtual circuits. In both cases, the connections are set up from the central control device MPU. However, since this setting up of connections is not the subject-matter of the present invention, it is not discussed in further detail below.

A plurality of line assemblies are connected to the central switching network ASN via for example bidirectional electrical terminals. A number N+1 of these line assemblies are indicated which, as will be explained in more detail below, form a "1:N" redundancy group and are designated by BG 1 to BG N+1. In this case, the line assemblies are each provided for the connection of at least one peripheral transmission line. The transmission lines are in this case designated by LTG 1 to LTG N in accordance with their assignment to the line assemblies. The remaining line assembly BG N+1, on the other hand, serves as backup line assembly.

Each two of the abovementioned line assemblies BG 1 to BG N form partner line assemblies of an assembly pair. Two of these assembly pairs are designated by BGP 1 and BGP M in Figures 1 and 2. The assembly pair BGP 1 in this case comprises the partner line assemblies BG 1 and BG 2, while the assembly pair BGP M is formed from the partner line assemblies BG N-1 and BG N. The transmission lines associated with the two partner line assemblies of an assembly pair, these are the transmission lines LTG 1 and LTG 2 in the case of the assembly pair BGP 1, for example, are routed to the two partner line assemblies after the manner of "1+1" line assembly redundancy.

The line assemblies BG 1 to BG N each have, at the interface to the associated transmission line (LTG 1 to LTG N), a line-specific switch which is designated by S1 and is designed as a relay in the exemplary embodiment.

The respective line assembly is connected to the associated transmission line via the closed switching path of the respective switch, which is indicated for the individual line assemblies in Fig. 1.

In addition, the line assemblies BG 1 to BG N each have, at the interface to the transmission line of the associated partner line assembly, a switching contact of a line-specific switch which is designated by S2 and is again designed as a relay, for example. A backup switching bus EBUS is connected to the remaining switching contact of the respective switch S2; the backup line assembly BG N+1 already mentioned is also connected, by one side, to the said backup switching bus EBUS. The other side of this backup line assembly is connected to the central switching network ASN via a switch S1 which corresponds to the abovementioned switches S1.

Furthermore, the two partner line assemblies belonging to an assembly pair are each connected via a bidirectional control line SL, the function of which will be discussed in more detail below.

The switches S1 and S2 are initially controlled, for example in the course of a connection set-up, from the central control device MPU. For this purpose, the requisite control signals are transmitted in the form of message cells in the course of permanently set-up virtual circuits towards the individual line assemblies BG 1 to BG N, an internal transport protocol (ITP) being used for this.

Moreover, in the present exemplary embodiment, the line assemblies BG1 to BG N+1 specified in Figures 1 and 2 each have an arrangement for signal conversion, which is designated by S4 using the example of the line assembly BG1, on the connection path between the line assembly and the switching network ASN.

As already specified above, Fig. 1 illustrates the case where the communications device KE is operating in the normal mode, that is to say where in particular the line assemblies BG 1 to BG N are functioning free from errors. In this normal mode, closure of the line-specific switches S1 means that the transmission lines LTG 1 to LTG N are connected via the line assemblies BG 1 to BG N to the switching network ASN in order to perform normal transmission of message signals (message cells) within the communications device KE.

As already mentioned previously, the partner line assemblies of the assembly pairs (BGP1 to BGP M) are in each case connected directly via a bidirectional control line SL. In the event of an error occurring in one of the partner line assemblies, on the one hand the switch S1 present in this assembly is opened and hence the connection to the switching network ASN is interrupted. On the other hand, a control signal is transmitted via the relevant control line SL towards the partner line assembly. In response to the reception of such a control signal, the switch S2 of this partner line assembly is then closed and, as a result, the backup mode is activated for the defective partner line assembly.

Such a backup mode is explained below with reference to Figure 2, where the partner line assembly BG 1 shall represent a defective line assembly, as an example.

According to Figure 2, the switch S1 assigned to the partner line assembly BG 1 is controlled such that its switching path is open and, consequently, the connection path between the transmission line LTG 1 and the switching network ASN is interrupted. Furthermore, the switch S 2 within the partner line assembly BG 2 is controlled in such a way that a closed connection path now exists from the transmission line LTG 1 via the backup switching bus EBUS towards the backup line

assembly BG N+1, the associated switch S1 of which is in the closed state in this backup mode. As a result, message signals (message cells) can then be transmitted via this backup line assembly BG N+1 as a backup for the defective partner line assembly BG 1 assumed as an example. Such a backup mechanism also applies to any other of the partner line assemblies BG 2 to BG N.

A modification of the communications device KE may consist in forming a plurality of independent redundancy groups from the line assemblies in the manner described above when there are a multiplicity of line assemblies present, which redundancy groups are each provided with a specific number of active line assemblies and a backup line assembly assigned thereto.

In the text above it was assumed only as an example that each of the line assemblies is assigned only one transmission line. The line assemblies and the backup switching bus mentioned may alternatively be designed such that a plurality of transmission lines are connected to the individual line assemblies and the backup switching bus, for the transmission of message signals, has a bus width corresponding to this plurality of transmission lines.

Finally, it may also be pointed out that although the present invention was explained using the example of an ATM communications device in the text above, the invention is not restricted to that. Rather, this invention can also be applied in communications devices that differ from the ATM principle, if a "1:N" redundancy structure for the line assemblies is to be provided in the said devices.

Patent Claims

1. Communications device (KE) for the transmission of message signals via transmission lines (LTG 1, ..., LTG N) with a central switching network (ASN) and line assemblies (BG 1, ... BG N), which are associated with the said switching network, are each connected to at least one of the transmission lines and form at least one "1:N" redundancy group comprising a number N of active line assemblies and an additional backup line assembly (IB N+1), each of the N active line assemblies within such an "1+N" redundancy group being able to be substituted by the associated backup line assembly,

characterized

in that two neighbouring line assemblies (BG 1 and BG 2; ...;BG N and BG N+1) from the N line assemblies (BG 1 to BG N) of the respective "1:N" redundancy group in each case form partner line assemblies of an assembly pair (BGP 1, ..., BGP M),

in that the transmission lines (for example LTG 1 and LTG 2) which are individually assigned to the partner line assemblies of an assembly pair are in each case routed to the other partner line assembly as well, after the manner of "1+1" line assembly redundancy,

in that the partner line assemblies of an assembly pair are each designed in such a way that the transmission line (LTG 1) which is individually assigned to the respective partner line assembly (for example BG 1) can be connected via first switching means (S1) to the switching network (ASN), and the transmission line (LTG 2) which is individually assigned to the other partner line assembly (BG 2) can, on the other hand, be connected via second switching means (S2) to a backup switching bus,

and in that the first and second switching means (S1 and S2) of the partner line assemblies (for example BGP1) of an assembly pair (for example BGP1) can be controlled in such a way that, in the normal mode, the

individually assigned transmission lines are connected via the first switching means (S1) to the switching network (ASN),

whereas in the backup mode of one of the partner line assemblies (for example BG 1), the individually assigned transmission line (LTG 1) thereof can be connected to the switching network (ASN) via the second switching means (S2) of the other partner line assembly, the backup switching bus (EBUS) and the backup line assembly (BG N+1).

2. Communications device according to Claim 1, characterized
in that the said device is designed as an ATM communications device which operates according to an asynchronous transfer mode and enables the transmission of message signals in the course of virtual circuits, and in that the switching network (ASN) is assigned a central control device (MPU) which controls the setting up and clearing down of virtual circuits.

3. Communications device according to Claim 2, characterized
in that the central control device (MPU) is furthermore designed in such a way that the first and second switching means (S1, S2) of the individual partner line assemblies can initially be set to the normal mode from the said central control device in the course of fixedly set virtual circuits.

4. Communications device according to one of Claims 1 to 3,
characterized
in that the partner line assemblies (for example BG1 and BG2) of an assembly pair (for example BGP1) are connected to one another via a control line (SL) for the outputting of an error message, and the partner line assemblies are designed in such a way that, in response to such an error message, on the receiving partner line assembly the closing of the second switching means (S2) and hence the activation of the backup mode for the defective partner line assembly are effected.

5. Communications device according to one of Claims 1 to 4,
characterized
in that the first and second switching means (S1, S2) of the individual partner line assemblies are designed as relays.

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FIG 1

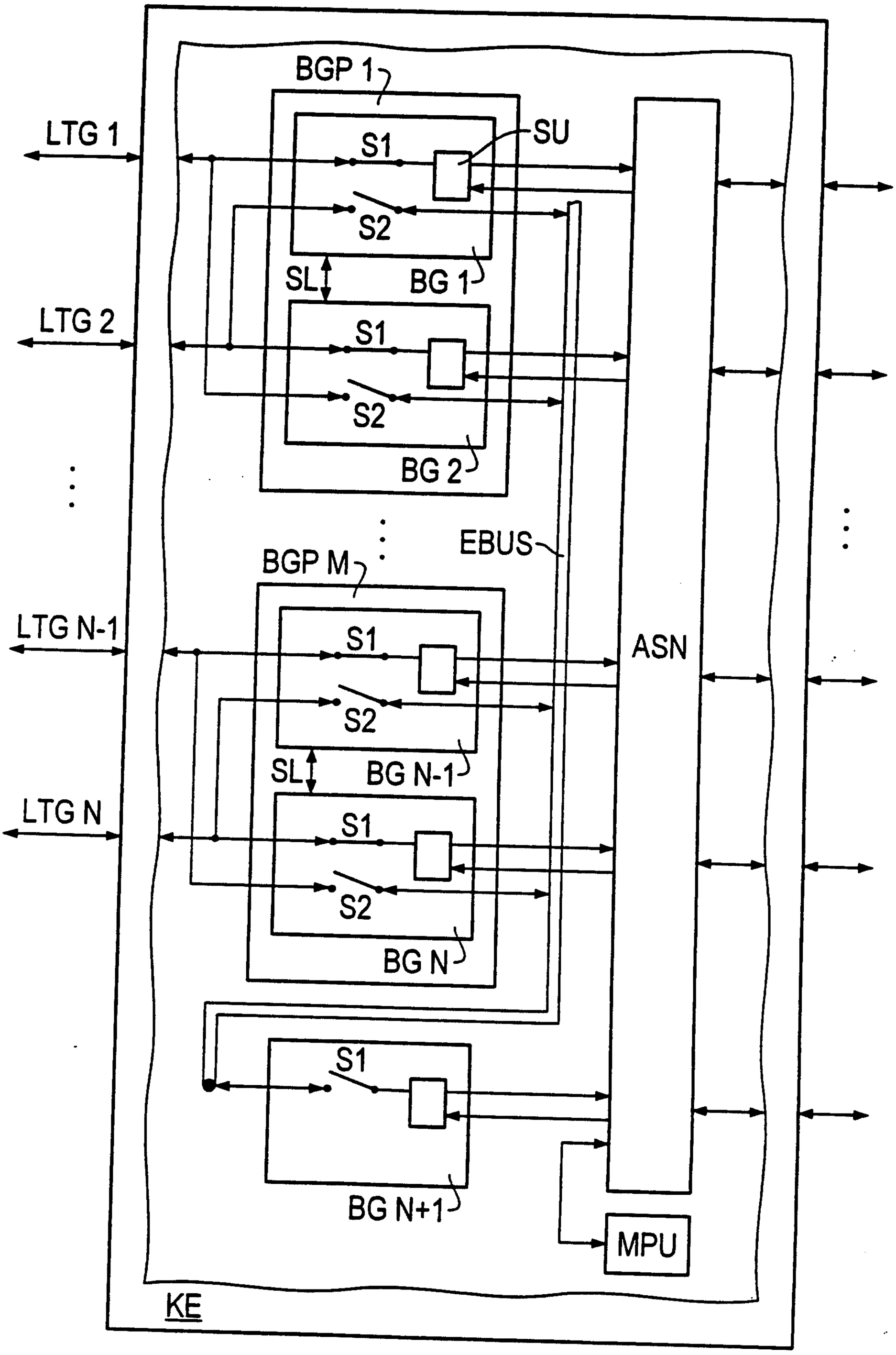
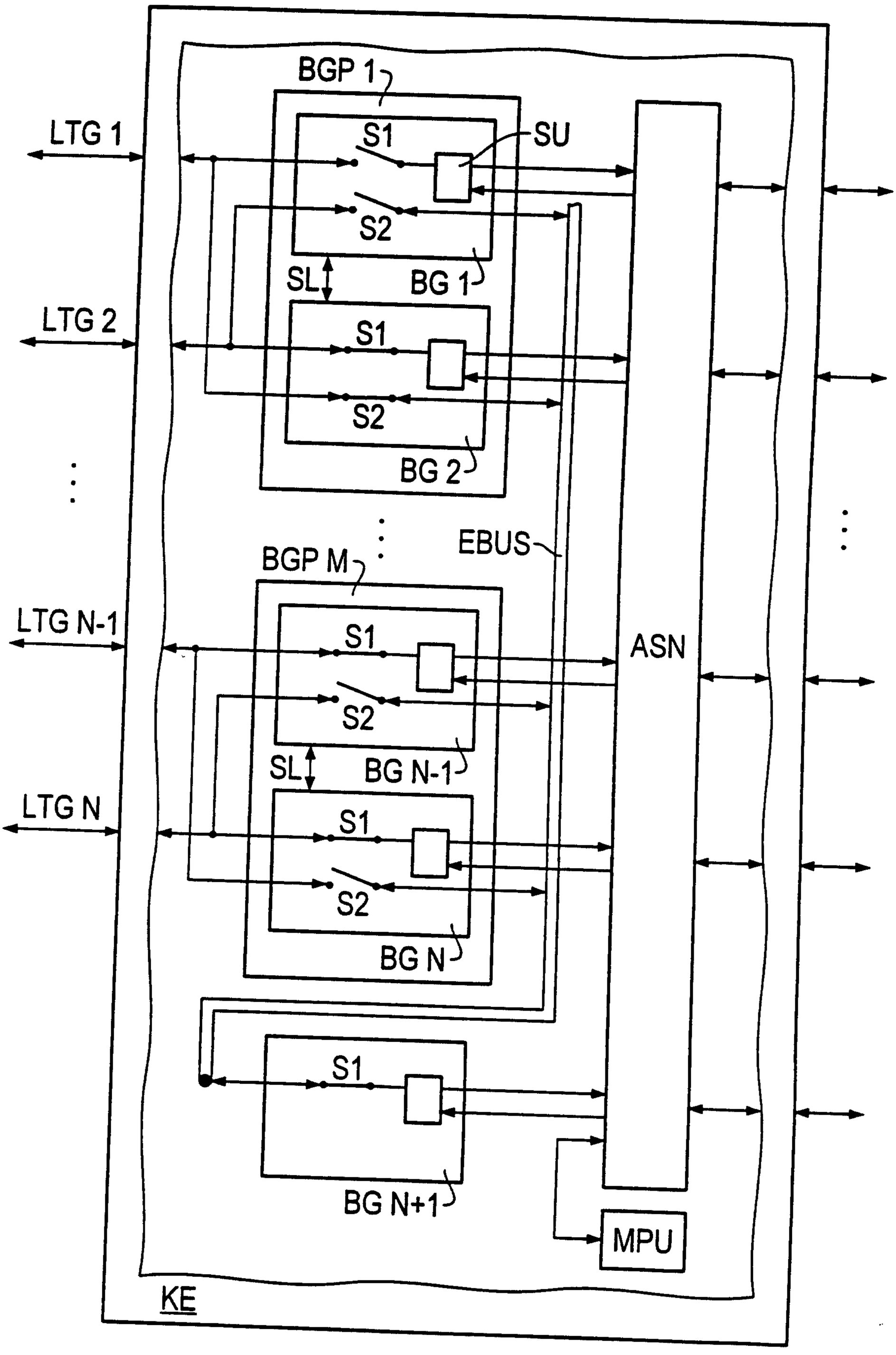

BGP 1
LTG 1
S1
SU
S2
SL
BG 1
LTG 2
S1
S2
BG 2
EBUS
BGP M
LTG N-1
S1
ASN
S2
SL
BG N-1
LTG N
S1
S2
BG N
S1
BG N+1
MPU
KE

FIG 2


BGP 1
LTG 1
S1
SU
S2
SL
BG 1
LTG 2
S1
S2
BG 2
EBUS
BGP M
LTG N-1
S1
ASN
S2
SL
BG N-1
LTG N
S1
S2
BG N
S1
BG N+1
MPU
KE