

Description

Telecontrol system with data transmission via the shielding of power transmission cables

The invention relates to a telecontrol system for
5 monitoring operational devices in a power supply system
which are connected, in particular, to system points on
cable sections serving the purpose of power transmission.
Feed-in transformers, branched transformers, circuit-
breakers, converters and the like can be provided as
10 operational devices at these system points.

Telecontrol systems can be allotted the task of
monitoring the operating state of a power supply system
and, as the case may be, of initiating control measures,
in particular in the form of switching operations acting
15 on the operational devices of the system at very specific
system points. Monitoring requires the cyclic detection
of the operating state, that is to say the "status", of
all cable sections belonging to the power supply system
and of operational devices connected at system points
20 mostly to the cable ends. Thus, on the one hand, it must
be monitored whether all the cable sections are available
for power transmission, or whether individual cable
sections have failed. It is necessary, furthermore,
constantly to detect the current operating state, for
25 example, of transformers and circuit-breakers which are
connected as operational devices at system points to the
ends of the cable sections serving the purpose of power
transmission. Finally, as a rule, a telecontrol system
has the task of transmitting control commands to these
30 operational devices and subsequently of monitoring
whether the operating state of the addressed operational
device has changed in the way intended by the control
command and in the period provided therefor.

In telecontrol systems, monitoring of all cable sections and associated operational devices is performed cyclically, that is to say the interrogation of their operating state is constantly repeated after the expiry of fixed periods. There is the problem in this case that the repetition rate must not be too low for such monitoring cycles, that is to say, on the one hand, the period between the beginning and the positive termination of monitoring all cable sections and operational devices and, on the other hand, the period up to the renewed start of a monitoring cycle must not be too long. Otherwise, the controllability of the power supply system via the telecontrol system would be limited. Specifically, if the abovementioned periods were too long, it would be possible, for example, for the effect of a switching command sent to an operational device between two monitoring cycles to be observed only with a delay in one of the following monitoring cycles when detecting its current status. For the case in which the change in status, desired by a switching command, of the system operational device has not occurred, the effect of repeated switching attempts could, in turn, be observed only upon expiry of further monitoring cycles.

It is the object of the invention to configure a telecontrol system such that, on the one hand, it is possible to monitor all cable sections and operational devices of a power supply system with a high repetition rate, that is to say the current "status" of each part of the power supply system can be observed quickly by the telecontrol system. On the other hand, the configuration of the telecontrol system is nevertheless to render it possible for relatively large data volumes to be transmitted into the telecontrol system in the form of so-called status information, as far as possible without adversely affecting speed and data integrity. The duration of a monitoring cycle is thus intended to be as short as possible.

The object is achieved by means of the tele-control system specified in the patent claim. Advantageous embodiments of the invention are contained in the subclaims. The invention is explained in more detail with
5 the aid of a preferred exemplary embodiment represented in the figures set forth briefly below, in which:

Figure 1 shows the block diagram of part of a power transmission system, and the parts of the telecontrol system according to the
10 invention which serve the purpose of monitoring and controlling associated cable sections and operational devices connected thereto,

Figure 2 shows the example of a location and timing diagram, for example for a so-called short interrogation cycle during which changes in status occur in, for example,
15 two connected operational devices,

Figure 3 shows the example of a location and timing diagram for a so-called short interrogation cycle during which no changes in status occur in the connected operational devices,
20

Figure 4 shows the example of a location and timing diagram for a so-called chain interrogation cycle in which the status of all operational devices is interrogated for the purpose of initialization, and
25

Figure 5 shows the example of a location and timing diagram for a so-called test interrogation cycle by means of which the last, operational substation in the chain is determined in the event of a disturbance.
30

Represented by way of example in Figure 1 is a
35 linear system region N11 of a power supply system which is suitable, for example, for supplying towns or parts of towns. A multiplicity

of cable sections serving the purpose of power transmission are available, of which the cable sections NK1, NK2, NK3 are represented in Figure 1 by way of example. Each cable section respectively has a cable shield grounding system KE at the ends. The ground-current circuits thereby formed via the respective cable shield and ground reference plane are represented in the example of Figure 1 in the form in each case of a dashed oval ES1, ES2, ES3. The ends of the cable sections are connected to one another at system points via operational devices. Represented by way of example in the example of Figure 1 are the system point NP1 between the neighboring cable sections NK1, NK2 and the system point NP2 between the neighboring cable sections NK2, NK3. Assigned to the system point NP1 is the operational device NB1, which serves as connecting device for the ends of the neighboring cable sections NK1, NK2. This is represented symbolically as a circuit-breaker. In a corresponding way, at the system point NP2 the system operational device NB2, for example in the form of a transformer, connects the ends of the neighboring cable sections NK2, NK3.

The telecontrol system in accordance with the invention has a central control unit with a databus and at least one chain of substations which can be connected thereto in series. Each of the substations is preferably assigned to a system point and connected to the operational device there for the purpose of monitoring and controlling it. According to the invention, the telecontrol system has a databus which is respectively connected, preferably by means of coupling transformers, to the grounded cable shield at the ends of the cable sections. The coupling transformers are used to feed data into, or tap data from, the ground-current circuits of neighboring cable sections. The screens of the possibly relatively long cable sections of the power supply system are thus advantageously simultaneously part of the databus connecting the substations of the telecontrol system to the central control unit.

The configuration of the telecontrol system is represented in Figure 1 by way of example. In this case, the substations of the chain of substations which consists of the substations U1 and U2 are connected to one another in series via a data-bus DB and to a central control station ZSE. Each substation is connected at the respective system point NP1, NP2 to the operational devices NB1, NB2 there for the purpose of monitoring and control. By way of example, for this purpose Figure 1 represents control lines ST going from the respective substation to the operational device, and signal lines SE [sic] going from the operational device to the substation. Via the control lines ST, it is possible to relay to the operational device control commands which have been fed into the databus DB by the central control unit SE [sic] and received by the respective substation. Status information indicating the current operating state of the connected operational device can be read by the respective substation via the signal lines SI and fed into the databus DB in a fashion addressed to the central control unit ZSE.

The databus DB advantageously has coupling transformers KU. Thus, for example, the data interface at the output of the central control unit ZSE is connected via a coupling transformer KU to one end of the grounded cable screen KE of the cable section NK1. Furthermore, in Figure 1 the first substation U1 of the chain is connected via in each case one coupling transformer KU to the facing ends of the grounded cable screens KE of the neighboring cable sections NK1, NK2. Finally, at the system point NP2, the second substation U2 is connected via in each case one coupling transformer KU to the facing ends of the grounded cable screens KE of the neighboring cable sections NK2, NK3. In the same way, the series of the substations can be lengthened by a further coupling transformer proceeding from the other end (not represented in Figure 1) of the grounded cable screen of the cable section NK3. For example, in practice up to 12 substations U1...U12 are interconnected in series to form

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a chain, the grounded shields of cable sections, situated therebetween,

of a power supply system being utilized as part of the databus DB for data transmission. The coupling transformers KU substantially simplify the outlay on installing and the topology of the databus DB of the tele-
5 control system.

The central control unit ZSE serves as a so-called "master" for operating the so-called "slave" substations connected like a chain via the databus DB, the coupling transformers KU and the cable sections NK1,
10 NK2.... In the example of Figure 1, there is connected by way of example to the output of the central control unit a chain, arranged in series in accordance with the invention, of substations which is preferably assigned to a linear system region N11. For reasons of clarity,
15 Figure 1 represents only the beginning of the chain in the form of substations U1, U2... for the exemplary operational devices NB1, NB2... at the system points NP1, NP2....

According to the invention, the central control
20 unit feeds into the databus per processing cycle, that is to say preferably cyclically, an interrogation message addressed to the last substation of a chain. Said message is received on the way there by each substation in the chain of substations and fed in anew, changed as little
25 as possible, in the direction of the last substation. After the reception of this interrogation message by the last substation, the latter feeds into the chain a response message addressed to the central control unit. This response message can contain status information of
30 the operating devices connected to the last substation, or merely devices for transferring addresses. Upon return, this response message is likewise firstly received by each substation and fed anew into the databus. If, in the meantime, changes in status have
35 occurred in the connected operational devices of a substation, in addition to received response messages the said substation additionally feeds into the chain a dedicated response message which is addressed to the central control unit

and contains the changes in status.

In this way, the interrogation message is passed on from substation to substation on the way from the central control unit to the last substation and traverses the entire chain of substations. The databus and the operational readiness of the chain of substations are thereby checked in an advantageously quick way. Furthermore, after the receipt of at least the response telegram of the last substation, the additional dispatch of a dedicated response message is initiated in a substation only when changes in status of the connected operational devices which are to be reported to the central control unit have in the meantime occurred. Thus, the dispatch of response messages is caused only by those substations at which changes in status have occurred.

In the case in which changes in status have not occurred in any of the substations before or during the current interrogation cycle, only the response message, likewise in this case containing no status information, of the last substation is relayed unchanged from substation to substation in the direction of the central control unit. The proper receipt of this response message is monitored by the central control unit and received for the purpose of checking the operational readiness of the telecontrol system, the databus, all substations and the operational devices connected thereto.

In the case in which changes in status have occurred in one or more substations before or during the current interrogation cycle, an event-dependent number of response messages of further, affected substations is added to the response message of the last substation. These response messages are received at the end of the interrogation cycle by the

central control unit which reconstructs therefrom the current operating state of the power supply system, the substations and operational devices. This has the advantage that, with the exception of the last sub-
5 station, which feeds in the response message in each case, further response messages are generated only by those substations which have to report the changes in status of connected operational devices. The number of response telegrams per processing cycle is thus limited
10 and in many cases equal to one, since in accordance with experience changes in status of operational devices occur only at relatively large time intervals and only the response message of the last substation passes back into the central control unit.

15 Such a configuration of the telecontrol system according to the invention represents an optimum compromise between as short a cycle time as possible, that is to say quick system reaction time, on the one hand, and data transmission which is free from disturbance, on
20 the other hand. Specifically, at any instant there is always only one message, be it an interrogation or one of a plurality of possible response messages, located on the databus part situated between two substations. This virtually eliminates the risk of loss of data, for
25 example by crosstalk. A further message is fed in by a substation only when, on the basis of the known message transfer times, the message previously fed in has certainly been received by the substation which is adjacent in the direction of the central control unit or
30 is adjacent to the last substation. On the other hand, however, the total duration of such a message transfer is limited by the above-explained event-dependent number of possible response messages such that an interrogation cycle can be concluded in a relatively short time.

35 The invention and further advantageous embodiments of the same are, furthermore, explained in more detail with the aid of the location and timing diagrams represented in Figures

2 to 5. It may be assumed by way of example in this case that 12 substations U1...U12 inter-connected in series form a chain, and that an operational device NB1...NB12 is connected to each of these substations. This is plotted in the figures on the horizontal axis, which serves as path axis. The downwardly plotted vertical axis serves as time axis.

Thus, in the location and timing diagram represented in Figure 2, an interrogation message, for example of the abbreviated interrogation message KAB type or of the chain interrogation message GAB type, is fed into the databus by the central control unit ZSE. It is addressed to the last substation U12 of the chain and is received on the way there by each of the preceding substations U1...U11 and fed into the chain again in the direction of U12. The transmission of the interrogation message KAB (GAB) between two substations is represented by an arrow inclined to the time axis and has a message transfer time denoted by TL. The interrogation message is thus passed on by repeated reception and transmission as far as the last substation U12. The latter thereupon feeds into the chain a response message which is addressed to the central control unit ZSE and is, for example, of the abbreviated response message KAT type or of the "dedicated" substation-specific response message AT12 type. Said message is then received by the substations U11, U10, U9 and fed in again in the direction of the central control unit ZSE, since no changes in status are to have occurred in the operational devices NB11, NB10, NB9 of these substations.

It may be assumed in the example of Figure 2 that a change in status has occurred in the operational device NB8 connected to the substation U8. As a consequence thereof, after receiving the response message KAT(AT12) from the last substation U12, in addition to this the substation feeds into the chain a dedicated response telegram AT8 which is addressed to the central control unit ZSE and contains the changes in state.

The two messages AT8 and KAT(AT12) are received by the substations U7, U6 and fed in again in the direction of the central control unit ZSE, since it is likewise the case that no changes in status are to have occurred in the operational devices NB7, NB6 of these substations.

Furthermore, it may be assumed in the example of Figure 2 that a change in status has occurred in the operational device NB5 connected to the substation U5. As a consequence thereof, after receiving the response messages AT8 and KAT(AT12) from the earlier substations U8 and U12, in addition to this the substation U5 feeds into the chain a dedicated response message AT5 which is addressed to the central control unit ZSE and contains the changes in status. The three response messages AT5, AT8 and KAT(AT12) are received by the substations U4, U3, U3 [sic], U2, U1 and fed in again in the direction of the central control unit ZSE, since it is also the case that no changes in status are to have occurred in the operational devices of this substation. At the end of the interrogation cycle represented in Figure 3, the central control unit ZSE receives, for example, three response messages and can thereby, the [sic] accepting the changes in status contained therein, update the information on the current operating state of the power transmission system and the operational devices thereof.

The advantage of the invention becomes clear from this example. It is seen herein that only the absolutely necessary number of response messages is generated, depending on events. Given the absence of changes in status in operational devices connected to substations, it is, as it were, only the last substation of a chain which is entitled to send a response message, in this case preferably of the abbreviated response message type, to the central control unit. All other substations are themselves permitted to dispatch a dedicated response message only when changes in status have occurred in the connected operational devices.

An interrogation cycle as represented in Figure 2 is therefore as short as possible so as to achieve short cycle times.

5 A further advantage is seen in that the "advance" of an interrogation message KAB(GAB) is separate from the "return" of the response message KAT(AT12) of the last substation U12 and of possible further response messages AT11...AT1 from substations U11...U1 for the operational devices of which changes in status have occurred. 10 Furthermore, it is advantageously ensured that both in the advance direction and in the return direction it is always only one message, an interrogation message or a response message of any type, which is transferred between two substations. A very high degree of data 15 integrity is thereby ensured, with the result that information losses, for example occasioned by so-called crosstalk, are virtually completely avoided. The device according to the invention thus represents an optimum compromise between speed of transferring the message, on 20 the one hand, that is to say the speed of transfer of changes in status from the affected substations to the central control unit, and a high transfer reliability, on the other hand.

25 In the location and timing diagram represented in the example of Figure 2, an interrogation message of the abbreviated interrogation message KAB type can be fed in by the central control unit ZSE if at least in the preceding interrogation cycle none of the substations U12...U1 has sent to the central control unit ZSE a 30 response message AT12...AT1 containing changes in status information of connected operational devices. An abbreviated interrogation message preferably contains essentially only regions in which addresses can be entered. These are, in particular, the address of the 35 last substation in the chain, the address of the current substation which has just received the abbreviated interrogation message, and the address of the substation following this substation in the chain,

that is to say to which the abbreviated interrogation message will be dispatched. Such a cycle can be termed a short interrogation cycle.

5 In the location and timing diagram represented in the example of Figure 2, the central control unit ZSE can also feed in an interrogation message of the chain interrogation message GAB type, in particular, when at least one of the substations U12...U1 has sent to the central control unit ZSE in the preceding interrogation cycle a response message AT12...AT1 containing status information. By comparison with an abbreviated interrogation message KAB, such a chain interrogation message GAB additionally contains a field in which a so-called acknowledgment bit is provided for each of the
10 substations contained in a chain. Such a bit is activated for a substation if in the preceding interrogation cycle the central control unit has obtained from this substation a response message containing status information. It signals the positive content of the response message to
15 the corresponding substation by means of the central control unit, with the result that any possibly repeated dispatch of the response message by the substation is not required.

In the location and timing diagram represented in
25 example of Figure 2, a response message of the abbreviated response message KAB type can be fed in by the last substation 12 as a response to an interrogation message KAB(GAB) of the central control unit ZSE if the last substation U12 itself does not have to dispatch to
30 the central control unit ZSE any response message AT12 containing status information. The abbreviated response message essentially contains only regions in which addresses can be entered, in particular the address of the central control unit ZSE at the start of the chain,
35 the address of the current substation which has just received the abbreviated response message, and the address of the substation following this substation in the chain, that is to say to which the abbreviated response message

will be dispatched. This abbreviated response message KAT of the last substation is represented in Figure 2 by a dashed line. Of course, given the presence of changes in status in the connected operational device NB12, instead
5 of the abbreviated response message KAT the last substation U12 can feed into the chain a dedicated full-value response message AT12 which is addressed to the central control unit ZSE and contains the changes in status.

According to a further embodiment of the tele-
10 control system according to the invention, this further embodiment already being represented in the example of Figure 2, it is advantageous if, given the presence of changes in status in the connected operational devices NB11, NB10...NB1, after dispatch of the response message
15 of the KAT or AT12 type of the last substation U12, the further substations U11, U10...U1 again respectively firstly feed into the chain the dedicated response message AT11...AT1 addressed to the central control unit ZSE and not until after that the received response
20 messages AT12, AT11... of earlier substations U12, U11...U1, as far as possible in the sequence of the preceding reception. Thus, for example, in Figure 2 the substation U5 feeds into the chain in a fashion addressed to the central control unit ZSE firstly the dedicated
25 response message AT5, then the response message AT8 first received from substation U8 and, finally, the response message KAT(AT12) last received from substation U12. This has the advantage that the central control unit receives a response message, if available, in a sequence corres-
30 ponding to the sequence of the substations of the chain U1...U12. As a result, the internal processing is facilitated. Furthermore, the monitoring of run times in the central control unit ZSE is also simplified. Thus, the central control unit monitors the correctly timed
35 reception of the response message from the last substation, since at least this must in any case be received in the central control unit at the end of an interrogation cycle.

A short interrogation cycle is represented in the example of Figure 3. The central control unit feeds in an interrogation message, preferably of the abbreviated interrogation message KAB type. Since no changes in status have occurred in any substation with operational devices connected, according to the invention only the abbreviated response message KAT generated by the substation U12 arrives in the central control unit. If this is received within a monitoring time, which can be precisely determined by the known message transfer times from substation to substation, the databus, and thus the entire telecontrol system including connected operational devices, is in order for controlling the power supply system. Further short interrogation cycles advantageously follow such an interrogation cycle until response elements are generated during an interrogation cycle by substations other than the last substation. Following this, the central control unit feeds in at least one chain interrogation message with acknowledgment bits, as has already been explained.

It is advantageous for the case of a system start-up, in particular, if the interrogation message addressed to the last substation U12 is likewise a chain interrogation message GAB, which advantageously additionally contains an identifier, for example in the form of a start-up bit. As a result, not only the last substation U12, but also, after the receipt of response messages AT12, AT11... of earlier substations U12, U11... in each case, each further substation U11...U1 is caused to feed in a response message AT12...AT1 which is addressed to the central control unit ZSE and contains at least the current status of the respectively connected operational devices NB12, NB11...NB1.

Such a case is represented in the example of Figure 4. The chain interrogation message GAB initiates the generation of a dedicated response message in each substation. At the end of such an interrogation cycle, the substation U1 thus transmits

a complete packet of response messages AT1...AT12 of all substations U1...U12 to the central control unit. The latter can thus reconstruct the status of the power transmission system and in so doing at the same time
5 check the proper functioning of the telecontrol system. It is also advantageous in this case if, after receiving the response messages from each substation, which messages contain the current status of all connected operational devices, the central control unit ZSE in turn
10 feeds in a chain interrogation message GAB which is addressed to the last substation U12 and in which an acknowledgment bit addressed to each of the substations U1...U12 is respectively activated.

A further operating state of the telecontrol
15 system according to the invention is explained by the example of Figure 5. In this case, the central control unit feeds into the chain a response message of the test interrogation message TAB type, since the central control unit ZSE received no interrogation message at all at the
20 end of the preceding interrogation cycle. This is a sign that either the databus is mechanically damaged or one of the substations is faulty. There is now the task of identifying the last substation which is still operational, that is to say situated immediately up-stream of
25 the disturbance. For this purpose, the test interrogation message TAB is fed in by the central control unit. As a result of this, a dedicated response message AT1, AT2... addressed to the central control unit is automatically fed into the chain by that substation U1, U2... of the
30 chain [lacuna] which no response message has been received from an earlier substation U12, U11 within a block time TW1, TW2..., depends on the position of the respective substation in the chain. This is then the last substation which can still be reached in the chain, and
35 is therefore situated directly upstream of the fault location. A test interrogation message thus entitles a substation of the chain other than the last

automatically to send a dedicated response message under the boundary conditions represented above.

This is explained in more detail with the aid of the example represented in Figure 5. It is to be assumed in this case that, because of the disturbance, the test in-terrogation message TAB can no longer be received by the substation U8 despite feeding from the substation U7 in the direction of the last substation U12. A transmission blocking time TW(U7) begins to run in the substation U7 with this feeding in. Because of the position of the substation U7 in the chain, said time is so long that, in the case of an undisturbed further transmission of the test interrogation message TAB from the substations U8...U12, one of the response messages KAT, AT11...AT8 would have to be received before termination of said transmission. Since, in accordance with the present example, this is not possible because of the disturbance, the substation U7 feeds into the chain a dedicated response message, for example of the AT7 type, addressed to the central control unit. This is received by the substations U6...U1 before their transmission block times TW(U6)...TW(U1) have expired. As a result, the feeding in of dedicated response messages AT6...AT1 of these substations is suppressed. Consequently, in the present example, only the response message of the substation U7, which is situated as the last reachable station immediately upstream of the assumed fault location, reaches the central control unit, which, thereupon, can identify the fault location.

It is to be seen from the representation in Figure 5 that the transmission block times TW(U11)...TW(U7)...TW(U1) of the substations become respectively longer between two substations in the direction of the central control unit ZSE by an amount which corresponds as far as possible. This ensures that only the last still reachable substation in the chain, which thus no longer receives any response messages from substations situated further on in the direction of the last substation, dispatches a dedicated response message. This

renders it possible to locate a disturbance in the databus or one of the substations of the chain in a reliable and quick way.



Patent claims

1. A telecontrol system for monitoring operational devices (NB1...NB12) of a power supply system (N11), having

- 5 a) a databus (DB) which comprises a chain of substations (U1...U12) which are respectively connected to at least one operational device (NB1...), which are connected at system points (NP1..) to grounded cable shields (KE) of
- 10 neighboring cable sections (NK1...) serving the purpose of power transmission, and which feed data into, or tap data from, the ground-current circuits (ES1, ES2) of the neighboring cable sections (NK1, NK2), having
- 15 b) a central control unit (ZSE) which feeds an interrogation message (GAB, KAB, TAB) into the databus (DB) per processing cycle, it being the case that
- c) the interrogation message (GAB, KAB, TAB) is addressed to the last substation (U12) of the chain, received by each substation (U1, U2...) and fed in
- 20 anew in the direction of the last substation (U12) of the chain,
- d) after receiving the interrogation message (GAB, KAB, TAB), the last substation (U12) feeds into the chain
- 25 a response message (KAT; AT12) addressed to the central control unit (ZSE), and
- e) given the presence of changes in status in the case of connected operational devices (NB11...NB1), after receiving at least one response message (KAT; AT12, AT11...)
- 30 of earlier substations (U12, U11...U1), each further substation (U11, U10...U1) feeds into the chain, in addition to the at least one received response message, a dedicated response message (AT11...AT1) addressed to the central control unit



(ZSE) and containing the changes in status.

2. The device as claimed in claim 1, in which the response message (AT12) addressed to the central control unit (ZSE) by the last substation (U12) either contains
5 current changes in status of connected operational devices (NB12) or, given the absence of changes in status, is an abbreviated response message (KAT), whose receipt is monitored by the central control unit (ZSE) (Figures 3, 4).

10 3. The device as claimed in claim 1 or 2, in which the interrogation message addressed by the central control unit (ZSE) to the last substation (U12) is an abbreviated interrogation message (KAB) if, in response to an interrogation message (GAB), no substation has
15 addressed to the central control unit (ZSE) a response message (AT12...AT1) containing changes in status in the case of connected operational devices (NB11, NB10...NB1) (Figures 3, 4).

4. The device as claimed in claim 1, in which the
20 interrogation message addressed to the last substation (U12) is a chain interrogation message (GAB), in accordance with which the last substation (U12) and, after receiving response messages (AT12, AT11...) of earlier substations (U12, U11...), each further substation
25 (U11...U1) is caused to feed in a response message (AT12...AT1) which is addressed to the central control unit (ZSE) and contains at least the current status of the respectively connected operational devices (NB12, NB11...NB1) (Figure 2).

30 5. The device as claimed in claim 1, in which the response message is a test interrogation message (TAB) if the central control unit (ZSE) has received no response message (KAT; AT12...), whereupon a substation (U1...) feeds into the chain a dedicated response message
35 (AT1...) addressed to the central control unit if, within a block time (TW1...), which depends on the position of the respective substation in the chain,



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no response message has been received from an earlier
substation (U12...).

Abstract

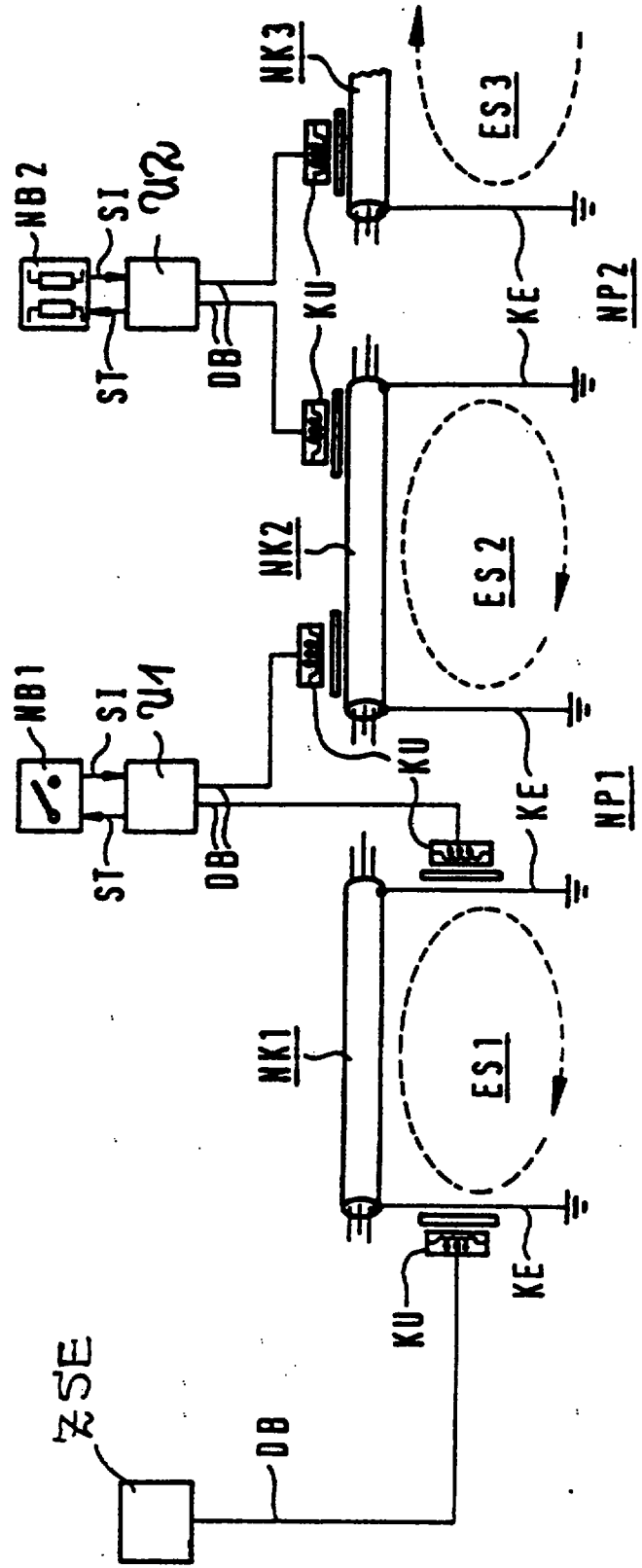
Telecontrol system with data transmission via the shielding of power transmission cables

A databus (DB) contains a chain of substations (U1-U12) which are connected to operational devices (NB1...), and which are connected at system points (NP1..) to grounded cable shields (KE) of neighboring power transmission cable sections (NK1..). They feed data into, or tap data from, the ground-current circuits (ES1, ES2). A central control unit (ZSE) feeds in the interrogation message (GAB, KAT, TAB) addressed to the last substation (U12) of the chain. Said interrogation message is relayed from each substation in the direction of the last substation. After receiving the interrogation message, the last substation feeds in a response message (KAT; AT12) addressed to the central control unit. It is only given the presence of changes in status in the case of connected operational devices that, after receiving at least one response message, each further substation feeds in a dedicated response message containing the changes in status.

FIGURE 2

FIG 1

N11



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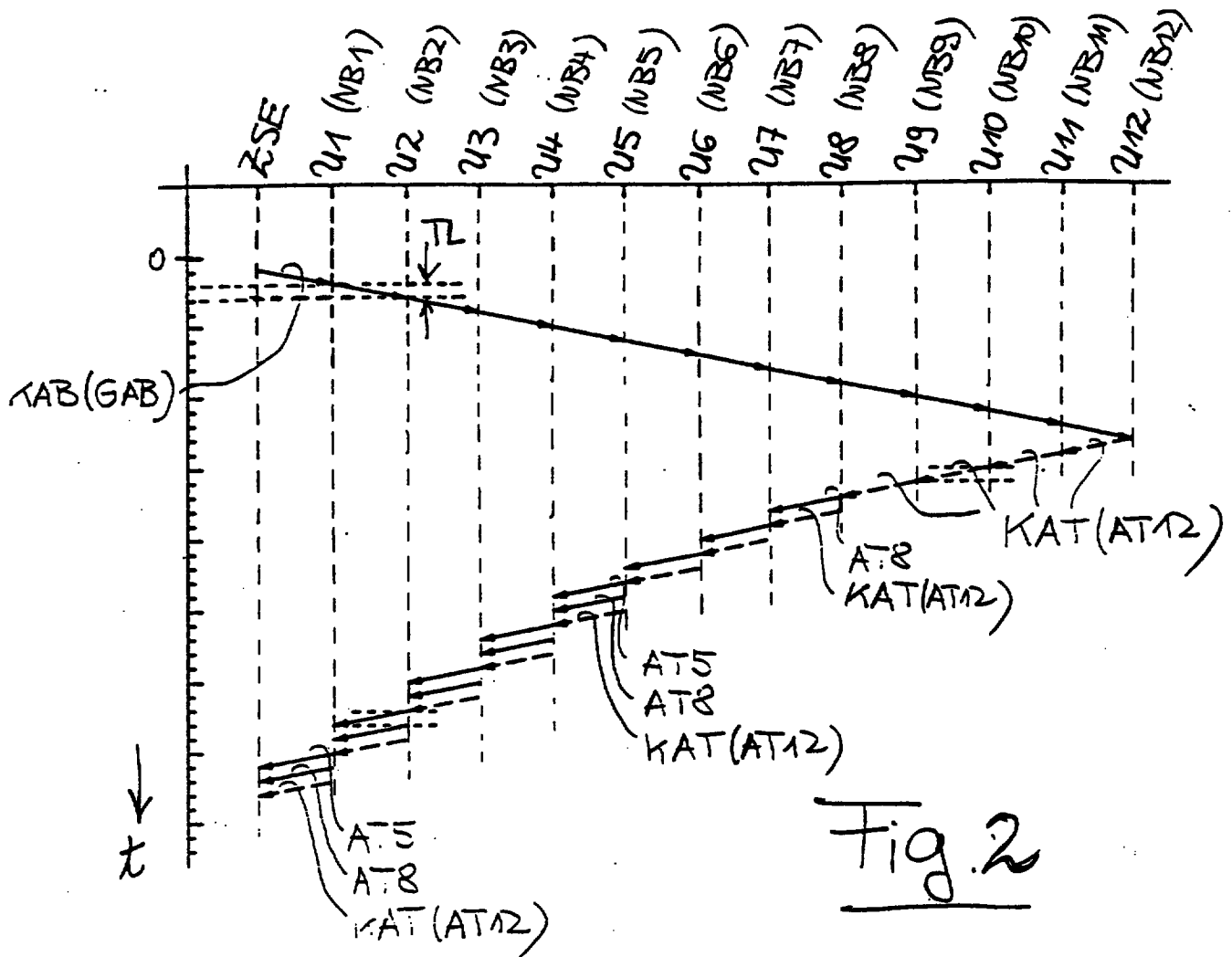


Fig. 2

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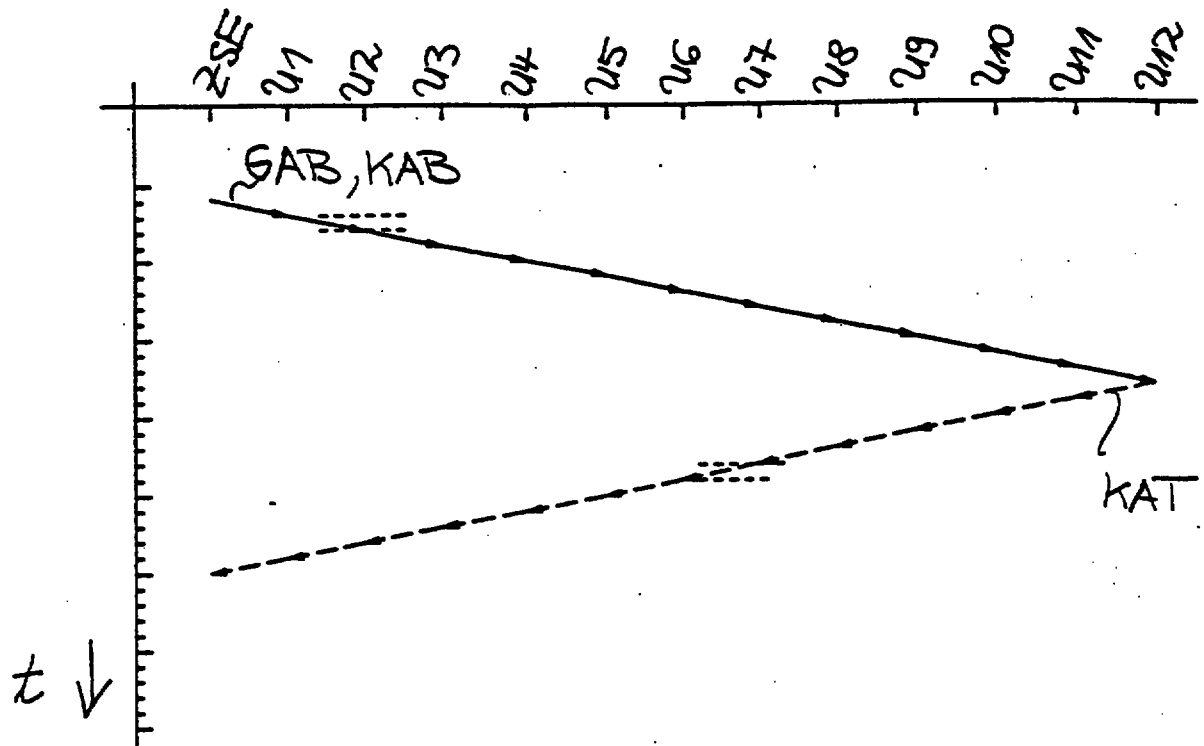


Fig. 3

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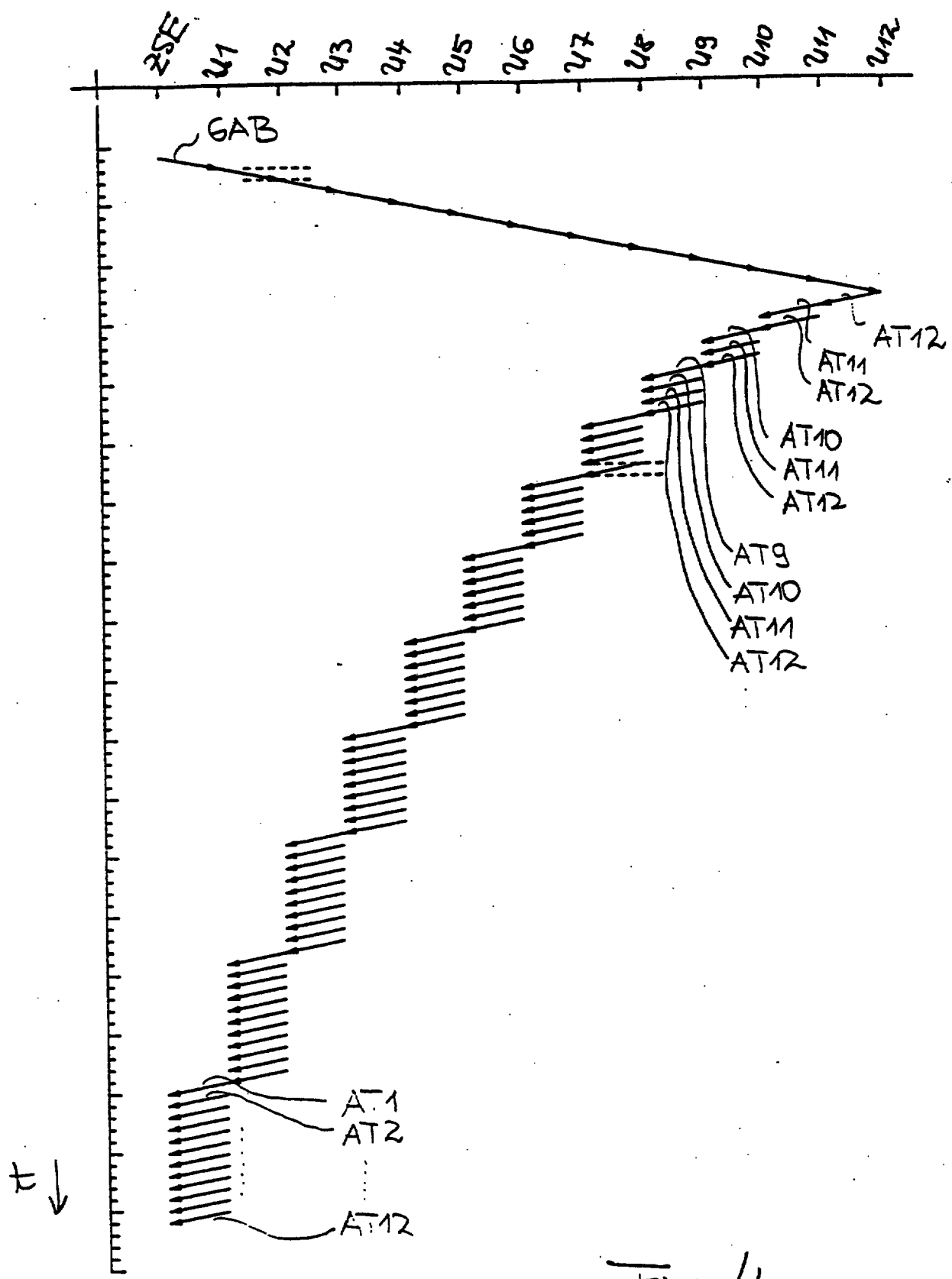


Fig. 4

