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Proprietor: BRITISH TELECOMMUNICATIONS public limited company
British Telecom Centre, 81 Newgate Street
London EC1A 7AJ (GB)

Inventor: FAULKNER, David, Wynford
1 Westland Martlesham Heath
Ipswich Suffolk IP5 7SU (GB)
Inventor: RUSS, Dianne, Margaret
71 Farriers Close Martlesham Heath
Ipswich Suffolk IP5 7SN (GB)
Inventor: FORDHAM, David, Ian
"Laigh Logan" Sweffling
Saxmundham Suffolk IP17 2BL (GB)
Inventor: HUTCHISON, Alistair, Paul
4 Ashground Close Trimley St. Martin
Ipswich Suffolk IP10 0YA (GB)
Inventor: HENNING, Ian, Douglas
15 Schreiber Road
Ipswich Suffolk IP4 4NG (GB)

Representative: Semos, Robert Ernest Vickers
et al
BRITISH TELECOM Intellectual Property Unit
13th Floor 151 Gower Street
London WC1E 6BA (GB)

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Description

The present invention relates to a method of control of an optical system, a signal control system and a transceiver for use in such a control system and in particular for use with multiple access optical networks.

The use of a multiple access network allows for potentially highly efficient use of network resources. More expensive equipment for network management, for example, may be located at a central node, or exchange and its facilities shared by a large number of individual network outstations. In such circumstances the exchange may be connected via a single main line with branch feeder lines linking the network outstations to the main line. In an optical network the branching may conveniently be effected by passive optical splitters. It is therefore feasible to produce a multiple access optical network with no active components other than at the exchange and at the outstations themselves. The advantages of such a passive network include easier-maintenance and reduced overall cost.

In a multiple access network it is necessary to ensure that signals intended for, or originating from, a particular outstation are correctly identifiable. The technique of Wavelength Division Multiplexing (WDM) or Time Division Multiplexing (TDM), for example, enable this identification to be achieved.

Where TDM is used, each outstation is allocated an individual time slot or channel specifically for reception or transmission of its own signals. When a composite TDM signal is broadcast from the exchange each outstation will receive the whole of that signal from which it selects and decodes its own allocated channel. However, in the reverse direction, each outstation contributes its own signal alone and the network itself must effectively assemble all the separately originating channels into a composite TDM signal for passing back to the exchange in the correct order. The outstations are generally irregularly spaced at different distances from the exchange. It is therefore essential to provide some method of ensuring that transmissions from each outstation occupy a designated time slot in the assembled return signal irrespective of the physical position of the outstation relative to the exchange, both at the time of connection to the network and at all subsequent times.

To deal with this problem a ranging protocol may be employed. Ranging protocols are known for use in radio networks, for example from EP-A-0168051, which discloses a radio communication system comprising a central station and a number of remote subscriber stations each of which is arranged to transmit a burst of information to the central station in a pre-assigned time slot of a multiplexed return frame. The central station detects the time deviation of each burst from where it should be, and sends the detected time deviation to the respective corresponding subscriber station to control the transmission timing so that the received signal at the central station is regenerated at the optimum sampling position. Such ranging is clearly not reliable since the time slots are separated by guard regions to prevent signals from an outstation wandering and overlapping an adjacent burst time slot. However, it has been found that provision of a conventional ranging protocol is not necessarily sufficient to ensure the accurate assembly of the return TDM signal in a passive optical network as described above. Localised variations can occur in the transmission path, for example, such that the words or bits in a signal originating from an outstation may not be exactly within the boundaries of the allocated time slot in the return TDM signal. The signal from one outstation may then overlap the signal from another to the detriment of the network efficiency.

According to the present invention there is provided a method of controlling the transmission of signal pulses from an outstation in a time division multiplex multiple access networks the network being a passive optical networks, including a central node and a plurality of outstations, the method being characterised by the steps of detecting, at the central node, relative to a predetermined discrimination value the presence or absence of a received signal pulse at the central position of a time slot allocated to that outstation; detecting relative to said predetermined discrimination value the presence or absence of a received signal pulse at first and second predetermined times which define a central region within the total duration of the time slot; and determining from a logical combination of said detections whether that outstation needs to correct the timing of the transmission of the signal pulses, and if so transmitting a control signal to instruct that outstation to alter said timing for subsequent transmission from that outstation.

A further problem arises because the amplitude of the signals from each outstation depends on the power of the transmitter associated with that outstation and on the attenuation of the optical path from that outstation. Both these factors will vary from one outstation to another. Thus, unless compensating measures are taken, the composite return TDM signal may have signal levels which differ from one time slot to the next, according to whichever outstation each slot is allocated. Such a variable signal is difficult to demultiplex.

It is known from FR-A-2568431 for optical receiver circuitry to determine the long term receive level, by for example integrating receive pulses over a period of time, compare this long term receive level with a preset value and activate an alarm if that value is exceeded.

The method of the invention provides a convenient technique for automatic signal control in a multiple access system. The problems noted above are thereby avoided without recourse to time-consuming individual
calibration of each outstation at connection.

According to another aspect of the present invention there is provided a control system for use in a time division multiplex multiple access network the network being a passive optical network, including a central node and a plurality of outstations, for controlling the transmission of signal pulses from the outstations, the system being characterised by, in the central node, first detection means for detecting relative to a predetermined discrimination value the presence or absence of a received signal pulse at the central position of a time slot allocated to a particular outstation, second detection means for detecting relative to said predetermined discrimination value the presence or absence of a received signal pulse at first and second predetermined times which define a central region within the total duration of the time slot, determination means responsive to said first and second detection means for determining from a logical combination of the detections whether that particular outstation needs to correct the timing of the transmission of the signal pulses, and for generating for transmission a control signal to instruct that particular outstation to alter said timing for subsequent transmission from that particular outstation; and characterised by, in an outstation, means for identifying a control signal specific to that particular outstation and signal control means responsive to the control signal for altering the timing for subsequent transmission as instructed.

A control system according to the invention allows the problem of inter symbol interference (ISI) from spill-over of signals in adjacent time slots to be conveniently avoided.

According to the present invention there is provided a control system further comprising third detection means for detecting at the central position of a time slot the amplitude of a received signal relative to first and second reference values defining a range of acceptable values for the amplitude; and wherein said determination means includes means responsive to said third detection means for determining from a logical combination of the detections whether that particular outstation(s) needs to correct the amplitude of the transmission of the signal pulses, and is arranged to generate for transmission a control signal to instruct that particular outstation to alter the amplitude of subsequent transmission from that outstation; and wherein said signal control means includes means responsive to the further control signal for altering the amplitude of subsequent transmission as instructed. This enables the introduction of a network-wide automatic gain control facility into the network. Amplitude variations within the received multiplex at the central node may thereby be minimised.

In these circumstances, DC coupling in the central node receiver, which would otherwise be needed to maintain a given amplitude decision threshold (binary quantisation level) if the amplitudes were widely variable between signals, is not required. The performance of the exchange receiver may thereby be improved and the design simplified.

A standard transmitting laser has been found to detect signals in the above described receive mode at an error free 2.048 Mbit/s over 10km of single-mode optical fibre. A better performance is to be expected if the laser/diode combination were optimised for use as a transceiver.

A control system according to the invention further permits the optical transmitter, usually a laser, in an outstation, to be operated at power levels which are effectively the minimum required for efficient operation of the network. Consequently, the reliability of the lasers will be increased to substantially the optimum possible within the network constraints.

Additionally, the control system allows the condition of the outstation transmitter to be easily assessed. For example, the control system may be adapted to recognise the occurrence of a consistent trend in the alteration of a monitored parameter and give an early warning of a fault state before actual failure.

There is disclosed in Electronics Letters, volume 20, no. 19, 13.09.1984, pages 794 to 795, Staines, Middlesex, GB; A. Alping et al. a passive multiple-tapped optical bus employing as a tapping terminal a single laser diode forward biased to work in detection mode such that it is simultaneously a light detector and an optical amplifier.

According to a further aspect of the present invention there is provided a transmitter/receiver (transceiver) for use in an outstation of a control system according to the present invention, comprising a laser diode optical transmitter having a back-facet photodiode which forms at least part of an optical detector for detecting, in use, control signals from the central node.

This has several advantages over systems using separate transmitters and receivers. The monitor diode supplied with commercially available laser transmitters which is redundant as a controller with the control system of the present invention when controlling the laser output is utilised in a manner which means the receiver package can be dispensed with. The need for a coupler of significant cost at the customer's end which was previously necessary to connect the receiver to the network is also removed. This reduces the costs of the customer service and reduces maintenance requirements.

The back-facet monitor photodiode is conventionally intended to detect the small leakage through the facet mirror when the laser emits a high output light pulse. The Applicant has found that such a device can be used in a remote outstation even when the transmission loss is about 40 dB and the amount of receive light passing
through the laser and the facet mirror thus correspondingly smaller. Furthermore, the use of a back-facet photodiode enables the laser drive circuitry and the photodiode receive circuitry to be separate and thus avoids any compromise when a single laser diode is used as a light emitter and light detector.

The method of the invention and an embodiment of a control system and a transceiver all according to the invention will now be described in detail and by way of example with reference to the accompanying drawings in which:

Figure 1 illustrates schematically a multiple access passive optical network according to the present invention;
Figure 2 illustrates an aspect of one implementation of the method according to the present invention;
Figure 3 illustrates an aspect of another implementation of the method;
Figure 4 is a schematic diagram of an embodiment of a control system according to the present invention;
Figure 5 is a schematic diagram of an embodiment of a transmitter/receiver (transceiver) according to the present invention for use with the control system of Figure 4 in which a laser back facet diode is the detector; and
Figure 6 is a schematic diagram of a second embodiment of a transceiver according to the present invention in which the laser is the optical detector.

In Figure 1, a multiple access passive optical network 1, in this case part of a telephone system, consists of a central exchange 2 connected to outstations 5 (shown as square boxes). From the exchange 2 a main optical fibre link 3 is successively branched at passive optical splitters 6 (shown circled) into branch optical fibre links 4 which ultimately link in to the individual outstations 5.

For TDM operation of the network 1 it is necessary to provide a method for synchronising the signals originating from the outstations such that these signals can be passively assembled by the network into the correct sequence for return to the exchange 2 via the main link 3. Coarse synchronism is provided by use of a suitable ranging protocol (not further described here) such as is known in radio networks.

Closer tolerances, as required in high bit-rate transmission, for example, may be obtained by using the method of the invention. A suitable adaptation of the technique is illustrated in Figure 2. A signal received at the exchange is shown in the form of a conventional eye diagram. The central position for this signal which may be set by the ranging protocol, is indicated by T. For the normal purposes-of information retrieval the signal is sampled at this instant. The signal is also monitored at two further sampling instants C and D at times t₁ and t₂ before and after T respectively.

A binary code word is then constructed according to the signal level monitored at each of these instants. The code word is then used to determine what timing adjustment, if any, is required. An appropriate logic table is given as Table 1.

<table>
<thead>
<tr>
<th>C</th>
<th>T</th>
<th>D</th>
<th>Diagnosis</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Timing correct</td>
<td>None required</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Timing correct</td>
<td>None required</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>Timing late</td>
<td>Reduce outstation N delay</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Timing late</td>
<td>Reduce outstation N-1 delay</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>Timing early</td>
<td>Increase outstation N delay</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>Timing early</td>
<td>Increase outstation N+1 delay</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Invalid</td>
<td>Code</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>Invalid</td>
<td>Code</td>
</tr>
</tbody>
</table>

The exchange control system then transmits an addressed control signal instructing the relevant outstation to increment or decrement the signal delay as may be required. Addressing techniques for control signals are
well known and will not be treated in detail here.

The method of the invention may be similarly adapted for regulating signal amplitude as shown in Figure 3.

In this case, the normal receiver decision threshold level, designated R, is used to distinguish between signal "one" and "zeros". Two additional levels defining an acceptable amplitude range are also monitored. These levels' designated A and B, are monitored to detect when the signal level falls below an acceptable minimum or exceeds an acceptable maximum respectively. These levels are conveniently set according to the signal-to-noise ratio of the weakest outstation signal expected. Both levels are set about the discrimination threshold R to allow a safety margin between that threshold and the lower monitoring level A in order to reduce the risk that a signal will ever fall below the threshold and be entirely undetected. As previously, the signal level monitored in terms of the R, A, B levels is translated into a 3 bit binary code word which can be used to determine the required amplitude adjustment according to Table 2.

<table>
<thead>
<tr>
<th>Binary levels</th>
<th>Diagnosis</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>R  A  B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0  0  0</td>
<td>&quot;Zero received&quot;</td>
<td>None</td>
</tr>
<tr>
<td>1  1  0</td>
<td>&quot;One&quot; received</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Amplitude acceptable</td>
<td></td>
</tr>
<tr>
<td>1  1  1</td>
<td>&quot;One&quot; received</td>
<td>Instruct outstation N</td>
</tr>
<tr>
<td></td>
<td>Amplitude excessive</td>
<td>to decrease transmitter power</td>
</tr>
<tr>
<td>1  0  0</td>
<td>&quot;One&quot; received -</td>
<td>Instruct outstation N</td>
</tr>
<tr>
<td></td>
<td>Amplitude too low</td>
<td>to increase</td>
</tr>
<tr>
<td></td>
<td></td>
<td>transmitter power</td>
</tr>
</tbody>
</table>

    0  0  1   Invalid code
    0  1  0   Invalid code
    0  1  1   Invalid code
    1  0  1   Invalid code

As described above the method for position control (Figure 2) and for amplitude regulation (Figure 3) may be implemented separately. However, the signal detection at T in the time slot and the amplitude measurement can be viewed as interdependent. Detection of a signal at T, for example depends on the signal amplitude exceeding the threshold R at that time. Furthermore, whereas it is possible to monitor the amplitude throughout the duration of the time slot and irrespective of whether or not the threshold R is exceeded at T, as a desirable alternative the amplitude measurement may itself be made dependent on the detection of a signal at time T. This latter strategy can avoid mistaken measurement of the amplitude of a signal overlapping from another time slot, for example for the purposes of analysis using Tables 1 and 2 the logical states for R and T are then identical for any given signal and may be determined together from a single measurement. The remaining variables A, B, C, D are determined individually as before.

A control system for a TDM multiple access passive optical network and combining position and amplitude control by the method of the invention is shown schematically in Figure 4. For ease of illustration only the relevant components only of the exchange 2 and one outstation 5, connected by the passive network 3, 4, 6, are indicated in the Figure.

In the outstation 5, date from a data source 56 passes for return signal transmission to the exchange 2 by a laser 51 under control of a modulator 52. The return signal transmission is timed by a clock control which is initially set by a ranging protocol as mentioned previously. A variable delay 55 allows fine-tuning of the timing according to the method of the present invention.
The return signal amplitude is adjusted wing an amplitude control register 58 and digital-to-analog converter 59 to control the drive current supplied by the modulator 52 to the laser 51.

In the exchange 2 the return signal arrives at the TDM receiver 21, which passes the signal, in its appropriate time slot, via five D-type flip-flops 22, 23, 24, 26, 27 which perform the signal position and amplitude monitoring functions as detailed below.

To monitor the signal position relative to the time slot the signal from the receiver 21 gated through the three D-types 22, 23, 24 is at the relevant times (cf. Figure 2). Thus D-type 22 monitors the centre of the acceptable period within the time slot as defined by the gating of D-types 23 (for C) and 24 (for D). According to the states of these position D-types 22, 23, 24 the time slot combinatorial logic 25 then provides the appropriate code word (cf. Table 1) to the control bus 31.

The D-type 22 which monitors the central position of the signal within the time slot is set to trigger at the minimum signal discrimination threshold R. The state of this D-type therefore is also used to provide the base detection reference for the amplitude measurement.

The acceptable amplitude range (cf. Figure 3) is determined by the two further D-types 26, (for A) and 27 (for B). The signal is proportionately attenuated by the level adjusters 28 and 29 before being applied to the D-types 26 and 27 respectively. Consequently these D-types will only be triggered by a signal whose amplitude exceeds the preset higher levels A, B above the basic discrimination threshold R. The amplitude combinatorial logic 30 monitors the state of the relevant D-types 22, 26, 27 and provides the appropriate amplitude code word (cf. Table 2) to the control bus 31.

The code words for both position and amplitude are passed by the bus to the control processor 32 with associated memory 33. The processor 32 analyses the code words to determine the required action and generates a corresponding control signal which is then specifically addressed to the relevant outstations and transmitted accordingly.

In the outstation 5, a local controller 53 is provided with a telemetry decoder to check the addressing of any control signals arriving from the network and to identify and decode those intended for the particular outstation.

If the instructions in the control signal are to alter the timing of signal transmission, for example, the controller 53, via the local bus 60, increments or decrements the delay latch register 54 to vary the variable delay 55 as appropriate.

If the instructions are to alter the signal amplitude, the controller 53, again via the local bus 60, increments or decrements the amplitude latch register 58. The count in the amplitude register 58 is then converted via the D/A converter 59 in order to control the drive current supplied to the laser 51 by the modulator 52.

Although the method and control system of the present invention have been specifically described with reference to a TDM passive optical network, it will be appreciated that the application of the invention is not restricted. The principles of the invention may equally be applied, for example, to a WDM network.

Referring now to Figure 5, there is shown the optical link and subscriber sections of the network of Figure 4 in which the laser 51 is arranged to operate as both a transmitter and a receiver.

A bias current supply 62 supplies a bias current to the laser 51 sufficient to forward bias it below the lasing threshold to act as a laser amplifier when no signal is supplied by the modulator 52. Optical signals arriving from the network 3, 4, 6 are amplified as they pass through the laser diode 51 and fall on the laser diode's back facet photodiode 63 which acts as a detector. The output from the photodiode 63 is applied to the amplifier 64. A switch 65 is arranged so that the amplifier 64 is connected to the controller-telemetry decoder 53 only when no signal is being output from the variable delay 55, i.e. when the subscriber is in receive mode. The decoder 53 acts on received signals as it does in the arrangement of Figure 4.

The laser 51 operates in transmit mode as described above with reference to Figure 4. The current from the modulator 52 will be less than before because of the effect of the bias current supply but will be controlled in the same manner to fix the laser output.

The laser 51 in the transceiver of Figure 5 is permanently forward biased in receive mode and so requires only a change in bias current amplitude to take it above threshold to cause it to lase and enter the transmit mode. Because the laser 51 operates in a low duty cycle mode and is always forward biased, recovery time problems are minimised when changing between the receive and transmit modes of laser operation. The laser transmit mode is only required for one time slot out of many and one can afford to lose a time slot each side of that time slot as the laser transfers to receive mode without affecting the received signal.

If it is found not necessary to gate out the receiver 72 during the transmit bursts in a particular network the switch 82 may be omitted and the receiver 64 permanently connected to the decoder 53.

Other arrangements in which the transmitter is also used as a receiver are possible. Referring to Figure 6 the laser diode 51 as unbiased in receive mode with the back-facet photodiode being used as in Figure 5 to detect unamplified signals from the network. The laser diode 51 is considered a passive part of the optical
detector guiding light to the photodiode.

In yet another arrangement the laser diode 51 itself may be connected to the amplifier 64 so it acts as detector itself. In such an arrangement other opto-electronic devices may be used to serve as both transmitters and receivers, for example light emitting diodes.

Claims

1. A method of controlling the transmission of signal pulses from an outstation (5) in a time division multiplex multiple access network, the network being a passive optical network (1), including a central node (2) and a plurality of outstations (5), the method being characterised by the steps of detecting, at the central node (2), relative to a predetermined discrimination value (R) the presence or absence of a received signal pulse at the central position (T) of a time slot allocated to that outstation; detecting relative to said predetermined discrimination value (R) the presence or absence of a received signal pulse at first and second predetermined times (C, D) which define a central region within the total duration of the time slot; and determining from a logical combination of said detections whether that outstation (5) needs to correct the timing of the transmission of the signal pulses, and if so transmitting a control signal to instruct that outstation (5) to alter said timing for subsequent transmission from that outstation (5).

2. A method according to claim 1, including the further steps of detecting at said central position (T) the amplitude of a received signal relative to first and second reference values (A, B) defining a range of acceptable values for the amplitude, determining from a logical combination of said detections at said central position (T) whether that outstation (5) needs to correct the amplitude of the transmission of the signal pulses, and if so transmitting a control signal to instruct that outstation (5) to alter the amplitude of subsequent transmission from that outstation (5).

3. A method according to claim 1 or claim 2, including the further steps of, at the central node, noting over a period, for each instance of instructing an outstation (5) to make an alteration, whether the instruction is an increment or a decrement, recognising in accordance with a predetermined criterion whether the noted increments or decrements are symptomatic of an abnormal condition, and indicating the recognition of such a condition.

4. A control system for use in a time division multiplex multiple access network, the network being a passive optical network, (1) including a central node (2) and a plurality of outstations (5), for controlling the transmission of signal pulses from the outstations (5), the system being characterised by, in the central node (2), first detection means (22) for detecting relative to a predetermined discrimination value (R) the presence or absence of a received signal pulse at the central position (T) of a time slot allocated to a particular outstation (5), second detection means (23, 24) for detecting relative to said predetermined discrimination value (R) the presence or absence of a received signal pulse at first and second predetermined times (C, D) which define a central region within the total duration of the time slot, determination means (25, 32) responsive to said first and second detection means for determining from a logical combination of the detections whether that particular outstation (5) needs to correct the timing of the transmission of the signal pulses, and for generating for transmission a control signal to instruct that particular outstation (5) to alter said timing for subsequent transmission from that particular outstation (5); and comprising, in an outstation, means (53) for identifying a control signal specific to that particular outstation (5) and signal control means (53, 54, 55) responsive to the control signal for altering the timing for subsequent transmission as instructed.

5. A control system according to claim 4, further comprising third detection means (26, 27, 28, 29) for detecting at the central position of a time slot the amplitude of a received signal relative to first and second reference values (A, B) defining a range of acceptable values for the amplitude; and wherein said determination means (25, 32) includes means (30) responsive to said third detection means (26, 27, 28, 29) for determining from a logical combination of the detections whether that particular outstation (5) needs to correct the amplitude of the transmission of the signal pulses, and is arranged to generate for transmission a control signal to instruct that particular outstation (5) to alter the amplitude of subsequent transmission from that outstation (5); and wherein said signal control means (53, 54, 55) includes means (58, 59) responsive to the further control signal for altering the amplitude of subsequent transmission as instructed.

6. A control system according to either claim 4 or claim 5, in which said first and said second detection means comprise respective bistable flip-flops (22, 23, 24) arranged to latch the logical state representative of said detected presence or absence at said central position (T) and at said first and second predetermined times (C, D), respectively.

7. A control system according to any one of claims 4 to 6, further comprising means (32) for noting, over a period, for each instance of instructing an outstation (5) to make an alteration, whether the instruction is an
increment or a decrement, for recognising in accordance with a predetermined criterion whether the noted increments or decrements are symptomatic of an abnormal condition, and for indicating the recognition of such a condition.

8. A transceiver for use in an outstation of a control system as claimed in claim 4, comprising a laser diode optical transmitter (51) having a back-facet photodiode (63) which forms at least part of an optical detector (51, 63, 64) for detecting, in use, control signals from the central node (2).

**Patentansprüche**

1. Verfahren zur Steuerung der Übertragung von Impulsignalen, die von einer Außenstation (5) in einem Zeitmultiplexnetzwerk (1) mit Mehrfachzugriff ausgesandt werden, wobei das Netzwerk ein passives optisches Netz mit einem zentralen Knoten (2) und einer Vielzahl von Außenstationen (5) ist, und wobei das Verfahren durch folgende Schritte gekennzeichnet ist: Erfassen des Vorhandenseins oder Fehlens eines empfangenen Signalimpulses in der zentralen Position (T) einer der Außenstationen zugeteilten Zeitschlitze auf Seiten des Zentralknotens (2), relativ zu einem vorbestimmten Diskriminationswert (R); Erfassen des Vorhandenseins oder Fehlens eines empfangenen Signalimpulses, relativ zum vorbestimmten Diskriminationsimpuls (R) in einem ersten und einem zweiten vorbestimmten Zeitpunkt (C, D), die zwischen sich einen zentralen Bereich innerhalb der gesamten Dauer des Zeitschlitzes definieren; und Ermitteln anhand einer logischen Kombination der genannten Erfassungen, ob die betreffende Außenstation (5) die Zeitgabe der Übertragung der Signalimpulse korrigieren muß, und falls dies der Fall ist, Übermitteln eines Steuersignals zum beweisen der Außenstation (5), daß sie für ihre nachfolgenden Übertragungen die Zeitgabe ändert.

2. Verfahren nach Anspruch 1, das weiter die folgenden Schritte umfaßt: Erfassen der in der zentralen Position (T) auftretenden Amplitude eines empfangenen Signals relativ zu einem ersten und einem zweiten Bezugswert (A, B), die zwischen sich einen akzeptablen Wertebereich für die Amplitude definieren; Ermitteln anhand einer logischen Kombination der Erfassungen in der zentralen Position (T), ob die Außenstation (5) die Zeitgabe der Übertragung der Signalimpulse korrigieren muß, und falls dies der Fall ist, Übermitteln eines Steuersignals zum beweisen der Außenstation (5), daß sie für ihre nachfolgenden Übertragungen die Zeitgabe ändert.

3. Verfahren nach Anspruch 1 oder 2, das weiter folgende Schritte aufweist: Feststellen auf Seiten des zentralen Knotens, während einer bestimmten Zeitdauer, ob bei jeder Anweisung an die Außenstation (5), eine Änderung vorzunehmen, die Anweisung ein Inkrementieren oder Dekrementieren betrifft; Erkennen, in Übereinstimmung mit einem vorbestimmten Kriterium, ob die festgestellten Inkrementieren oder Dekrementierungszuständen symptomatic für einen anomalen Zustand sind; und Anzeigen der Erkennung des Vorliegens eines solchen Zustandes.

4. Steuersystem zur Verwendung in einem Zeitmultiplexnetzwerk mit Mehrfachzugriff, wobei das Netzwerk ein passives optisches Netz (1) mit einem zentralen Knoten (2) und einer Vielzahl von Außenstationen (5) ist, wobei das System die Übertragung der von den Außenstationen (5) ausgesandten Signalimpulse steuert, dadurch gekennzeichnet, daß das System im zentralen Knoten (2) aufweist: erste Erfassungseinrichtungen (22), zur Erfassung, relativ zu einem vorbestimmten Diskriminationswert (R), des Vorhandenseins oder Fehlens eines empfangenen Signalimpulses in der zentralen Position T einer bestimmten Außenstation (5) zugeteilten Zeitschlitze; zweite Erfassungseinrichtungen (23, 24) zur Erfassung, relativ zu dem vorbestimmten Diskriminationswert (R), des Vorhandenseins oder Fehlens eines empfangenen Signalimpulses in einem ersten und einem zweiten vorbestimmten Zeitpunkt (C, D), der innerhalb der Gesamtdauer des Zeitschlitzes einen zentralen Bereich definiert; Ermittlungseinrichtungen (25, 32), die auf die ersten und zweiten Erfassungseinrichtungen ansprechen, zur Feststellung anhand einer logischen Kombination der Erfassungen, ob die betreffende Außenstation (5) die Zeitgabe der Übertragung der Signalimpulse korrigieren muß, und zur Erzeugung eines zu übertragenden Steuersignals mit der Anweisung an die betreffende Außenstation (5), die Zeitgabe für nachfolgende Übertragungen durch die betreffende Außenstation (5) zu ändern; und Einrichtungen (53) in einer Außenstation zum Identifizieren eines für die betreffende Außenstation (5) spezifischen Steuersignals; sowie Signalsteueleinrichtungen (53, 54, 55), die auf das Steuersignal zur weisungsgemäßen Änderung der Zeitgabe für nachfolgende Übertragungen ansprechen.

5. Steuersystem nach Anspruch 4, das weiter aufweist: dritte Erfassungseinrichtungen (26, 27, 28, 29) zur Erfassung der Amplitude eines empfangenen Signals in der zentralen Position eines Zeitschlitzes relativ zu einem ersten und einem zweiten Bezugswert (A, B), die einen Bereich zulässiger Werte für die Amplitude definieren; wobei die genannten Ermittlungseinrichtungen (25, 32) Einrichtungen (30) aufweisen, die auf die dritten Erfassungseinrichtungen (26, 27, 28, 29) ansprechen und aus einer logischen Kombination der Erfassungen feststellen, ob die betreffende Außenstation (5) die Amplitude der Übertragung der Signalimpulse kor-
Revendications

1. Un procédé de commande de la transmission d’impulsions de signaux à partir d’une station asservie (5) d’un réseau (1) à accès multiples à multiplex à division de temps, le réseau étant un réseau optique passif, comprenant un noyau central (2) et plusieurs stations asservies (5), le procédé étant caractérisé par les étapes consistant à détecter, au noyau central (2), en fonction d’une valeur de discrimination prédéterminée (R) la présence ou l’absence d’une impulsion de signal reçue à la position centrale (T) d’une trame de temps allouée à cette station asservie; détecter en fonction de ladite valeur de discrimination prédéterminée (R) la présence ou l’absence d’une impulsion de signal reçue aux premier et deuxième instants prédéterminés (C, D) qui définissent une région centrale à l’intérieur de la durée totale de la trame de temps; et déterminer à partir d’une combinaison logique desdites détectations s’il faut que la station asservie (5) corrige la synchronisation de la transmission des impulsions de signaux et, s’il en est ainsi, transmettre un signal de commande pour donner à cette station asservie (5) une instruction de modifier ladite synchronisation pour une transmission ultérieure provenant de cette station asservie (5).

2. Un procédé selon la revendication 1, comprenant les étapes additionnelles consistant à détecter à ladite position centrale (T) l’amplitude d’un signal reçu en fonction d’une première et une deuxième valeurs de référence (A, B) définissant une plage de valeurs acceptables pour l’amplitude, déterminer à partir d’une combinaison logique desdites détectations à ladite position centrale (T) s’il faut que la station asservie (5) corrige l’amplitude de la transmission des impulsions de signaux et, s’il en est ainsi, transmettre un signal de commande pour donner à cette station asservie (5) l’instruction de modifier l’amplitude de transmission ultérieure à partir de cette station asservie (5).

3. Un procédé selon la revendication 1 ou la revendication 2, comprenant les étapes additionnelles consistant à noter sur une période au noyau central, pour chaque cas d’instruction envoyée à une station asservie (5) d’effecuter une modification, si l’instruction est un incrément ou un décroît, reconnaître conformément à un critère prédéterminé si les incrément ou les décroît notés sont symptomatiques d’une condition anormale et indiquer la reconnaissance d’une telle condition.

4. Un système de commande à utiliser dans un réseau (1) à accès multiples à multiplex à division de temps, le réseau étant un réseau optique passif, comprenant un noyau central (2) et plusieurs stations asservies (5), pour commander la transmission d’impulsions de signaux provenant des stations asservies (5), le système étant caractérisé par, au noyau central (2), un premier moyen de détection (22) pour détecter, en fonction d’une valeur de discrimination prédéterminée (R), la présence ou l’absence d’une impulsion de signal reçue à la position centrale (T) d’une trame de temps allouée à une station asservie particulière (5), un deuxième moyen de détection (23, 24) pour détecter, en fonction de ladite valeur de discrimination prédéterminée (R), la présence ou l’absence d’une impulsion de signal reçue à un premier et un deuxième instants prédéterminés (C, D) qui définissent une région centrale à l’intérieur de la durée totale de la trame de temps, un moyen de détermination (25, 32) sensible auxdits premier et deuxième moyens de détection pour déterminer à partir d’une combinaison logique de détection s’il faut que cette station asservie particulière (5) corrige la synchro-
nisation de la transmission des impulsions de signaux, et pour engendrer en vue de sa transmission un signal de commande donnant instruction à cette station asservie particulière (5) de modifier ladite synchronisation pour une transmission ultérieure à partir de cette station asservie particulière (5); et comprenant, dans une station asservie, un moyen (53) pour identifier un signal de commande spécifique à cette station asservie particulière (5) et un moyen de commande de signaux (53, 54, 55) sensible au signal de commande pour modifier selon les instructions la synchronisation en vue d’une transmission ultérieure.

5. Un système de commande selon la revendication 4, comprenant en outre un troisième moyen de détection (26, 27, 28, 29) pour détecter à la position centrale d’une tranche de temps l’amplitude d’un signal reçu en fonction d’une première et une deuxième valeurs de référence (A, B) définissant une plage de valeurs acceptables de l’amplitude; et dans lequel ledit moyen de détermination (25, 32) comprend un moyen (30) sensible au troisième moyen de détection (26, 27, 28, 29) pour déterminer à partir d’une combinaison logique de détection s’il faut que cette station asservie particulière (5) corrige l’amplitude de la transmission des impulsions de signaux, et est agencé pour engendrer, en vue de le transmettre, un signal de commande donnant instruction à cette station asservie particulière (5) de modifier l’amplitude d’une transmission ultérieure à partir de cette station asservie (5); et dans lequel ledit moyen de commande de signaux (53, 54, 55) inclut un moyen (58, 59) sensible à l’autre signal de commande pour modifier selon les instructions l’amplitude d’une transmission ultérieure.

6. Un système de commande selon la revendication 4 ou la revendication 5, dans lequel lesdits premier et deuxième moyens de détection comprennent des bascules respectives bistables (22, 23, 24) agencées pour verrouiller l’état logique représentatif de ladite présence ou absence détectée à ladite position centrale (T) et auxdits premier et deuxième instants prédéterminés (C, D), respectivement.

7. Un système de commande selon l’une quelconque des revendications 4 à 6, comprenant en outre un moyen (32) pour noter sur une période, pour chaque cas d’instruction envoyée à une station asservie (5) d’effectuer une modification, si l’instruction est un incrément ou un décroissement, reconnaître conformément à un critère prédéterminé si les incrément ou les décroissants notés sont symptomatiques d’une condition anormale et indiquer la reconnaissance d’une telle condition.

8. Un émetteur-récepteur à utiliser dans une station asservie dans un système de commande selon la revendication 4, comprenant un émetteur optique (51) à diode laser comportant une photodiode (63) à facette arrière qui forme au moins une partie d’un détecteur optique (51, 63, 64) pour détecter, en utilisant, des signaux de commande provenant du noeud central.