



5

TELEPHONE EXCHANGE SYSTEM TEST EQUIPMENT

10

This invention relates to an electronic monitoring device, for continuously monitoring the operation of an electronic system, such as a telephone exchange.

15

According to the invention there is provided an electronic monitoring device for monitoring the occurrence of an operation intended to occur at preset intervals of time, wherein there is a first monostable device which receives an input signal on each occurrence of said operation, which input signal sets the monostable device to, or maintains it in, a first non-stable state, wherein if a first preset interval of time elapses without the occurrence of said operation the monostable switches to the second stable state, wherein the switching of the monostable to said second state is noted as a fault condition, wherein a second monostable device is provided which receives said input signal on each occurrence of said operation, which input signal sets the second monostable device to, or maintains it in, its first non-stable state, wherein the time-out period of said second monostable is long compared with that of the first monostable circuit, and wherein if said longer time-out period elapses without a said input signal the second monostable times-out and an alarm is given in response to it assuming its second state, which alarm indicates that the operation being monitored has not occurred for said second and relatively long period.

(12)

- 2 -

An embodiment of the invention, developed for use in a small telephone exchange, will now be described with reference to the accompanying highly schematic drawing.

5 The monitoring device to be described herein is suitable for use in conjunction with a variety of electronic systems of the type in which during correct operation certain operations occur regularly at specified intervals. However, the invention is described herein as
10 applied to a telephone exchange, and especially to an exchange such as that described and claimed in an Application No. ~~82.28206~~ (G. A. Sarson et al 5-4-1).

 The exchange for which the monitoring device is described is a small "business-type" exchange in which
15 calls are set up in TDM manner using PCM to convey speech, and also data if the exchange serves any data terminals. It has subscriber line ports each of which serves two subscriber lines and a smaller number of trunk line ports each of which serves a trunk to a local
20 exchange. Each port has a local processor with, in the case of analogue lines and trunks, analogue-to-digital and digital-to-analogue conversion circuitry. Where a line or trunk is of the digital type, naturally no conversion circuitry is needed. The exchange has a
25 central processor, with its associated memories and interfaces.

 The ports and the central processor are interconnected by an intelligence bus, referred to as the PCM bus, and by a signalling bus. The PCM bus has separate
30 conductors for the two directions of transmission. The central processor and the port processors co-operate in call setting, with all inter-processor communications taking place over the signalling bus. During operation, the central processor polls the ports' processors via the
35 signalling bus in search of ports needing the services of the central processor. This polling technique is also used for the transmission of information from the central

processor to the ports, this of course including call setting information.

To set up a call between two lines, or a line and a trunk, two time slots in the TDM cycle are
5 allocated to that call by the central processor, one for each direction of transmission. By this time the central processor will have identified the calling line from the time slot in the polling cycle in which the calling line was identified. It will also have received
10 the identity of the wanted line or trunk. Note that the operation is similar if the calling condition was detected on a trunk. Call release is effected when, in the course of polling, the central processor detects that one of the parties to the call has hung up.

15 With the use of a standard 32 time slot PCM system, two of the time slots are permanently allocated to the emission of tones (e.g. calling tone, busy tone, etc.) and the other 30 slots are available for call setting. Thus if the system is to be non-blocking the
20 total number of lines and trunks served is 15, e.g. 10 lines and 5 trunks. Two such exchanges can be coupled by linking their busses to give a double capacity exchange. Note that the number of lines and/or trunks served can be increased if some blocking is tolerated.

25 As will have been seen, a major feature of the above-described exchange is that call signalling and other transmissions needed for call setting and control are effected over the signalling bus. Thus the intelligence bus only conveys the PCM codes for speech
30 (or data if there are data terminals) and tones.

The exchange is provided with two conference circuits, each of which can be used to set up a three-party conference, as will be described later. It also has a so-called watch dog controller which
35 continuously monitors the working of the exchange and gives an alarm if certain fault conditions are detected. The operation of the conference circuit is

14

- 4 -

described and claimed in our Application No. 82.28844
(G.A. Sarson 1-1).

The watch dog controller monitors the operation of the exchange's central processor by checking for
5 regular ones of the polls, which should occur within a preset time-out period. If the time-out period is exceeded, the watch-dog controller generates a hardware reset, and if an indication that a poll has occurred is still not received, a second time-out occurs, and an
10 alarm lamp is lit.

The watch dog controller includes two retriggerable monostable circuits MS1 and MS2. Of these MS1 has a time out period of 100ms, and is polled by the main processor via its SOD (Serial Output Data) pin.
15 The output from this pin occurs at the same time as the commencement of a polling cycle for the exchange, as mentioned above. This output resets the monostable MS1 to its rest state. Hence if a polling cycle is missed, the monostable MS1 has time to change its state to its
20 stable state, which gives an output to the processor's TRAP input. Hence the failure of the exchange to poll within 100ms causes a TRAP interrupt of the central processor. If only one such poll is missed, MS1 returns to its other state. Thus the omission of one poll is
25 noted in the processor, and this can be used to give an indication, e.g. by lighting an error indication lamp and/or recording that an error has happened. However, if the error only occurs once in isolation it is regarded as a "soft" error and ignored.

30 The second monostable MS2 has a one-second time out period, and is kept on by the polling signals from the processor's SOD pin. This monostable is connected to an alarm, such as a fault lamp. Hence if there is no poll for one second, MS2 times out and operates the
35 fault lamp to indicate the presence of the fault to the maintenance personnel. The monostable MS2 is also provided with a reset button, to reset it when the fault

(15)

has been cleared.

The watch dog controller also includes an RC network (not shown) via which a power-on reset is provided for the processor.

5

10

15

20

25

30

35



CLAIMS :

1. An electronic monitoring device for monitoring the occurrence of an operation intended to occur at preset intervals of time, wherein there is a first
5 monostable device which receives an input signal on each occurrence of said operation, which input signal sets the monostable device to, or maintains it in, a first non-stable state, wherein if a first preset interval of time elapses without the occurrence of said operation the
10 monostable switches to the second stable state, wherein the switching of the monostable to said second state is noted as a fault condition, wherein a second monostable device is provided which receives said input signal on each occurrence of said operation, which input signal
15 sets the second monostable device to, or maintains it in, its first non-stable state, wherein the time-out period of said second monostable is long compared with that of the first monostable circuit, and wherein if said longer time-out period elapses without a said input signal the
20 second monostable times-out and an alarm is given in response to it assuming its second state, which alarm indicates that the operation being monitored has not occurred for said second and relatively long period.
2. A device as claimed in claim 1, wherein the
25 monitored operation is a sequential poll of a number of portions of a telephone exchange.
3. An electronic monitoring device substantially as described with reference to the accompanying drawing.