

SPECIFICATION

A method for the electronic control of input pulses into an electronic store and means for carrying out said method.

The invention relates to a method for the electronic control of input pulses into an electronic store, and to means for carrying out said method. There is described herein a device, for carrying out electronic interruption of, and neutralising or cancelling of the interruption of, input pulses of a manually-rotatable pulse generator into an electronic store, said interruption being for the purpose of blocking the store state, and said device having a pulse generator, a first and a second store, a comparator which is influenced by the two stores, and an input key.

Devices wherein a comparator compares two store contents are already known. In the timepiece and the computer art, often the contents of two stores are compared with one another by a comparator, and in certain conditions, e.g. equality of the store contents, a specific function is initiated or an operation carried out.

Described in German Patent Specification No. 21 17 756 is, for example, a device in which the contents of two stores of a timer are compared and, in the event of their equality, an alarm is triggered.

Known also is, for example, the initiation or continuance of a specific computing operation in the event of equality of two numbers, which can be deposited in different stores.

In a method in accordance with the present invention the content of a store can be locked electronically when the store content corresponds with that of a second store, and in the event of coincidence of the two store contents, the pulse flow from pulse-producing means can be interrupted in such a way that the counter content can remain unchanged even when further counting pulses are produced by the input means.

A device may be provided which allows the cancellation of a time-limit in a store with input means in the form of manually a rotatable pulse generator, for said time limit store.

According to the invention there is provided a method for the electronic control of input pulses into an electronic store having the following method steps:

- (a) pulses of a manually rotatable pulse generator are fed into an electronic circuit arrangement;
- (b) the direction of rotation of a shaft or part of the pulse generator is recognised from the pulses of the pulse generator, and, corresponding to the direction of rotation, an input of a first store, formed as a forwards/backwards counter, of this circuit arrangement is activated;
- (c) the state of the first store is compared by a comparator with a preset content of a second store of said circuit arrangement;
- (d) an input switch of, or co-operating with, the electronic circuit arrangement, is set to a first position and the pulses are read into the first store until, upon correspondence of the first store state with the preset state of the second store, the content

of the first store is locked and the further feed of the pulses from the pulse generator into the store is interrupted while said switch is in the first position, for example to initiate a signal overriding a timer alarm connected to the first store;

- (e) the locking of the first store is subsequently neutralised or cancelled (with correspondence of the state of the first store with the preset content of the second store) by setting the input switch, to a second position, for example to cancel the signal which overrides the timer alarm connected to the first store.

There may be provided, for carrying out the method set forth in the last preceding paragraph a device having a manually rotatable pulse generator, an evaluation logic for recognising the direction of rotation of the pulse generator, a first and a second store, a comparator influenced by the two stores, and an input key, and wherein arranged subsequent to the comparator is a control circuit which is connected between a pulse output of the evaluation logic, and an input of the first store.

Further, according to the invention there is provided a method for the electronic control of input pulses into an electronic store comprising the electronic interruption of input pulses of a manually-rotatable pulse generator into a first store (time-limit store) of a timer, to lock the content of the first store, and the subsequent neutralising or cancelling of the locking, said method being useable in connection with cancelling one or more stored time-limits, having the following method steps:

- (a) pulses of the pulse generator are fed into an electronic circuit arrangement of the timer;
- (b) the direction of rotation of a shaft or part of the pulse generator is recognised from the delivered pulses of the pulse generator and corresponding to the direction of rotation, an input of the time-limit store, formed as a forwards/backwards counter, of this circuit arrangement is activated;
- (c) the content of this time-limit store is compared by a first comparator with a preset content of a second store of said circuit arrangement;
- (d) the pulses are, upon actuation of a time-limit key of, or co-operating with, the electronic circuit arrangement, read into the time limit store until, with correspondence of the content of the time-limit store with the preset store content, the state of the time-limit store is locked and the further supply of pulses from the pulse generator into the time-limit store is interrupted;
- (e) upon the locking of the time-limit store, an alarm transmitter actuable by a second comparator which compares the contents of a counter and of the time-limit store, is switched off in such a way that it does not come into action upon correspondence of the contents of the counter and of the time-limit store;
- (f) the locking of the time-limit store is neutralised or cancelled (with correspondence of the state of the time-limit store with the preset content of the second store) by releasing the time-limit key so that the alarm transmitter can come into action upon correspondence of the contents of the counter and time-limit store.

Still further according to the invention there is provided an electronic circuit arrangement, for example a microprocessor, comprising a first store formed as a forwards/backwards counter, a comparator, a second store and an evaluation logic arranged to recognise the direction of rotation of a manually rotatable pulse generator, the comparator being arranged to compare the store contents of the first and second stores and being operatively connected to a control circuit, said control circuit being arranged between the first store and the evaluation logic, said circuit arrangement having an input switch capable of being set to two operating positions, and the circuit arrangement being operable in a time sequence manner such that the switch is capable of being set to a first one of the operating positions in which pulses are allowed to the first store until the store content of the first store corresponds with that of the second store as determined by the comparator after which the content of the first store is locked and pulses to the first store are interrupted, the content of the first store remaining locked when the switch is opened and so that the electronic circuit arrangement is reset when the switch is again closed thereby allowing pulses through to the first store again.

In the accompanying drawings, which show, by way of example, embodiments of the invention:

Figure 1 shows a block wiring diagram of a device for the interruption of, and the neutralising or cancellation of the interruption of, pulses in a store;

Figure 2 shows a block wiring diagram of a timer with a device constructed in accordance with the invention;

Figure 3 shows a block wiring diagram of a timer with a digitally-designed control circuit; and

Figure 4 shows pulse/time diagrams relating to important circuit points.

Referring to the drawings, *Figure 1* shows a pulse generator 1, evaluation logic 2, a first store 5 and a second store 6, a comparator 9, control logic in the form of a control circuit 7, a key 8 for the input of pulses of the pulse generator 1 into the store 6, and a second key 12, which is in operative connection with the control logic 7. Designated by 3 and 3' are outputs of the pulse generator and by 4 and 4' outputs of the evaluation logic. The line 11 connects the evaluation logic to the control circuit and the first store.

Pairs of pulses produced by the pulse generator 1 are fed, via the outputs 3, 3' thereof, into the evaluation logic 2 connected subsequent to the pulse generator. This evaluation logic recognises, from the phase relationship of the rising edges of the pairs of pulses, the direction of rotation of a shaft of the pulse generator and prepares, depending on the direction of rotation, a forwards or a backwards counting input of the store 5. (See also the pulse diagram lines *Figures 4 a, b*). This pre-activation of the store 5 takes place through the output 4 of the evaluation logic 2 by which, depending on the direction of rotation of the pulse generator shaft, the signals logic "O" (e.g. count backwards) or logic "1" (e.g. count forwards) are forwarded to the store 5 (see also *Figure 4*, line c). With regard to the second

output 4' of this evaluation logic, on the one hand through this output 4' counting pulses are forwarded via the key 8 to the store 6 connected subsequent thereto, and on the other hand this output 4' is connected to the input of the control circuit 7. Upon actuation of the key 8 and of the pulse generator 1, pulses are counted into the store 6 and the store state varied in accordance with the direction of rotation of the pulse generator 1.

In order to be able to vary the store state of the store 5, the pulse generator 1 and the key 12 have to be actuated. With this prerequisite, pulses are supplied, via the pulse line 11, to the store 5 until the comparator 9 recognises the equality of the contents of the stores 5 and 6 and, via an output 10, causes the control circuit 7 to interrupt the pulse flow to the store 5. This store 5 is thus electronically locked; its content is not even altered when the pulse generator 1 and the key 12 are possibly in actuated condition beyond the moment of the locking. The store 5 is unlocked again only when the key 12 is released. If this key is pressed once more and in so doing the pulse generator 1 is actuated, then the electronic locking is cancelled and the state of the store 5 can be varied from the condition which corresponds with the state of the store 6.

Such a device could, for example, be used to limit to a presettable range a digitalised controlled variable which is fed, using a rotary pulse generator, into a regulating system. For example the electronic locking could begin at a permissible high value of the controlled variable.

A further advantageous application of such a locking circuit is shown in *Figure 2*.

There, in addition to the pulse generator 1, the evaluation logic 2, stores 5 and 6, the comparator 9, the control circuit 7 as well as the keys 8 and 12, further function blocks or components are shown, namely, a frequency generator device, with divider stages, 13, a counter 14, a comparator 15, an alarm transmitter 16, a digital indicator 17, an AND gate 18, and a key 24. These parts form a timer, in which the cancellation of a time deposited in the store 5, which is regarded as a time-limit store, is effected with input means which is a rotary pulse generator. A timing is "cancelled" when the store content of the time-limit store 5 is locked electronically at a preselectable point, e.g. 00:00 hours, and at the same time an alarm transmitter 16 is put out of action, via an AND-gate 18 connected in advance thereof, by the comparator 9.

The function of the parts 1 to 12 corresponds to the function described with reference to *Figure 1*.

The frequency transmitter of the frequency generator device 13 drives, via a divider stage connected subsequent thereto, the counter 14. The comparator 15 checks the contents of the time-limit store 5 and of the counter for correspondence.

The alarm transmitter 16 comes into action when the contents of the time-limit store 5 and of the counter 14 are the same, except when the time-limit store 5 is in its locked position. The set time-limit can be cancelled by, via the input means 1, bringing the store state of the time-limit store 5 into a preselectable locked condition. In this case there appears at

the output 10 of the comparator 9 a signal which blocks the AND-gate 18 which is connected in advance of the input of the alarm transmitter 16.

The contents of all the counters and the stores, i.e. 5 the current time (counter 14), the limit time (store 5) as well as the "locking time" (store 6) are representable on the digital indicator 17.

If, after a switch-off, a new time-limit is to be set then only the key 12 - the locking is inoperative upon the opening of this switch - and the pulse transmitter 1 are be actuated. The key 12 is herein after referred to in this description of this embodiment as a time-limit key.

In Figure 3 the above timer is shown diagrammatically once more, but the control circuit is shown in a possible digital exemplary embodiment.

It consists substantially of two flip-flop stages 19, 20 with respective advance-connected AND-gates 21, 22, as well as a further AND-gate 23.

20 If the input key is opened and the store contents of the store 5 and 6 do not correspond (logic "0" at the output 10 of the comparator 9), the flip-flop stage 19 is set via the first AND-gate 21. The output of this flip-flop stage supplies current to one of the three 25 inputs of the second AND-gate 22, which is connected in advance of the second flip-flop stage 20. The second input of this AND-gate is supplied with current from the output of the comparator 9, and the third input is connected to the output 4 of the 30 evaluation logic 2, which, depending on the direction of rotation of the pulse generator shaft, activates either the forwards or the backwards input of the time-limit store 5. Only in the case of one of the two possible directions, e.g. the forwards direction of 35 rotation, does logic "1" lie at this output, in the other case logic "0".

In the circuit shown, the two flip-flop stages 19, 20 are set only under the following conditions:

- (a) flip-flop stage 19 when switch 12 is not closed and the store contents 5 and 6 do not correspond.
- (b) flip-flop stage 20 when flip-flop stage 19 is set, the pulse generator is rotated backwards and the store contents 5 and 6 correspond.

The output of the flip-flop stage 20 supplies 45 current to a negated input of the AND-gate 23, which lets the counting pulses, lying at the pulse output of the evaluation logic 2, through into the time-limit store only when the time-limit key 12 is pressed and the flip-flop stage 20 is not set.

50 Furthermore, the flip-flop stage 19 is reset at the instant at which the flip-flop stage 20 is set. The flip-flop stage 20, on the contrary, is reset when the time-limit key is released.

The key 24 allows the correction of the counter 14, 55 the content of which reproduces the current time. Upon pressing keys 8, 12 or 24, the state of the store or counter arranged subsequent to the respective key is indicated on the indicator 17.

A plurality of time-limit stores having a plurality of 60 time-limit keys are possible.

The circuit example shown in Figure 3 is only one of many further circuit possibilities which lie within the scope of this invention.

Advantageously the function of this circuit is taken 65 over by a microprocessor which comprises the

evaluation logic of the pulse generator, all of the store and counter devices, the comparators, the frequency standard with divider stages, and the control circuit.

70 The pulse/time diagram shown in Figure 4 is intended to serve to illustrate the pulses which occur at the circuit points *a* to *f*. The two circle symbols above the lines *a* to *f* make clear the directions of rotation relevant to the pulses represented therebelow. The pulses represented by the left-hand sides of the lines *a* to *f* correspond to a rotation of the pulse generator 1 "in the clockwise direction" or "forwards"; the pulses represented by the right-hand 75 sides of the lines *a* to *f* correspond to a rotation of the pulse generator "in the anticlockwise direction" or "backwards". The first two lines *a* and *b* illustrate the different phase relationship of the pulses, lying at the outputs 3 and 3' of the pulse generator, upon forwards (left-hand side) and backwards rotation of the pulse generator. The voltage, lying at the output 4 of the evaluation logic, upon forwards and backwards rotation of the pulse generator is represented by line *c*. If the time-limit key 12 is pressed (pulses in line *d*) and a coincidence pulse (*e*) appears at the 80 output of the comparator 9, then the pulse of the one direction of rotation of the pulse generator are, even after appearance of a coincidence pulse, further counted into the time-limit store (line *f*, left), but in the other direction of rotation the condition of the time-limit store 5 stands still upon coincidence with the store 6 (lines *e* and *f*, right-hand side). 95

CLAIMS

- 100 1. A method for the electronic control of input pulses into an electronic store having the following method steps:
 - (a) pulses of a manually rotatable pulse generator are fed into an electronic circuit arrangement;
 - 105 (b) the direction of rotation of a shaft or part of the pulse generator is recognised from the pulses of the pulse generator, and, corresponding to the direction of rotation, an input of a first store, formed as a forwards/backwards counter, of this circuit arrangement is activated;
 - 110 (c) the state of the first store is compared by a comparator with a preset content of a second store of said circuit arrangement;
 - 115 (d) an input switch of, or co-operating with, the electronic circuit arrangement, is set to a first position and the pulses are read into the first store until, upon correspondence of the first store state with the preset state of the second store, the content of the first store is locked and the further feed of the pulses from the pulse generator into the store is interrupted while said switch is in the first position, for example to initiate a signal overriding a timer alarm connected to the first store;
 - 120 (e) the locking of the first store is subsequently neutralised or cancelled (with correspondence of the state of the first store with the preset content of the second store) by setting the input switch, to a second position, for example to cancel the signal which overrides the timer alarm connected to the first store.
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the output 10 of the comparator 9 a signal which blocks the AND-gate 18 which is connected in advance of the input of the alarm transmitter 16.

The contents of all the counters and the stores, i.e.

- 5 the current time (counter 14), the limit time (store 5) as well as the "locking time" (store 6) are representable on the digital indicator 17.

If, after a switch-off, a new time-limit is to be set then only the key 12 - the locking is inoperative upon the opening of this switch - and the pulse transmitter 1 are be actuated. The key 12 is herein after referred to in this description of this embodiment as a time-limit key.

- 15 In Figure 3 the above timer is shown diagrammatically once more, but the control circuit is shown in a possible digital exemplary embodiment.

It consists substantially of two flip-flop stages 19, 20 with respective advance-connected AND-gates 21, 22, as well as a further AND-gate 23.

- 20 If the input key is opened and the store contents of the store 5 and 6 do not correspond (logic "O" at the output 10 of the comparator 9), the flip-flop stage 19 is set via the first AND-gate 21. The output of this flip-flop stage supplies current to one of the three 25 inputs of the second AND-gate 22, which is connected in advance of the second flip-flop stage 20. The second input of this AND-gate is supplied with current from the output of the comparator 9, and the third input is connected to the output 4 of the 30 evaluation logic 2, which, depending on the direction of rotation of the pulse generator shaft, activates either the forwards or the backwards input of the time-limit store 5. Only in the case of one of the two possible directions, e.g. the forwards direction of 35 rotation, does logic "1" lie at this output, in the other case logic "O".

In the circuit shown, the two flip-flop stages 19, 20 are set only under the following conditions:

- 40 (a) flip-flop stage 19 when switch 12 is not closed and the store contents 5 and 6 do not correspond.
(b) flip-flop stage 20 when flip-flop stage 19 is set, the pulse generator is rotated backwards and the store contents 5 and 6 correspond.

- The output of the flip-flop stage 20 supplies 45 current to a negated input of the AND-gate 23, which lets the counting pulses, lying at the pulse output of the evaluation logic 2, through into the time-limit store only when the time-limit key 12 is pressed and the flip-flop stage 20 is not set.

- 50 Furthermore, the flip-flop stage 19 is reset at the instant at which the flip-flop stage 20 is set. The flip-flop stage 20, on the contrary, is reset when the time-limit key is released.

- The key 24 allows the correction of the counter 14, 55 the content of which reproduces the current time. Upon pressing keys 8, 12 or 24, the state of the store or counter arranged subsequent to the respective key is indicated on the indicator 17.

- A plurality of time-limit stores having a plurality of 60 time-limit keys are possible.

The circuit example shown in Figure 3 is only one of many further circuit possibilities which lie within the scope of this invention.

- Advantageously the function of this circuit is taken 65 over by a microprocessor which comprises the

evaluation logic of the pulse generator, all of the store and counter devices, the comparators, the frequency standard with divider stages, and the control circuit.

- 70 The pulse/time diagram shown in Figure 4 is intended to serve to illustrate the pulses which occur at the circuit points *a* to *f*. The two circle symbols above the lines *a* to *f* make clear the directions of rotation relevant to the pulses represented therebelow. The pulses represented by the left-hand sides of the lines *a* to *f* correspond to a rotation of the pulse generator 1 "in the clockwise direction" or "forwards"; the pulses represented by the right-hand sides of the lines *a* to *f* correspond to a rotation of the pulse generator "in the anticlockwise direction" or "backwards". The first two lines *a* and *b* illustrate the different phase relationship of the pulses, lying at the outputs 3 and 3' of the pulse generator, upon forwards (left-hand side) and backwards rotation of the pulse generator. The voltage, lying at the output 4 of the evaluation logic, upon forwards and backwards rotation of the pulse generator is represented by line *c*. If the time-limit key 12 is pressed (pulses in line *d*) and a coincidence pulse (*e*) appears at the 90 output of the comparator 9, then the pulse of the one direction of rotation of the pulse generator are, even after appearance of a coincidence pulse, further counted into the time-limit store (line *f*, left), but in the other direction of rotation the condition of the 95 time-limit store 5 stands still upon coincidence with the store 6 (lines *e* and *f*, right-hand side).

CLAIMS

- 100 1. A method for the electronic control of input pulses into an electronic store having the following method steps:
(a) pulses of a manually rotatable pulse generator are fed into an electronic circuit arrangement;
105 (b) the direction of rotation of a shaft or part of the pulse generator is recognised from the pulses of the pulse generator, and, corresponding to the direction of rotation, an input of a first store, formed as a forwards/backwards counter, of this circuit arrangement is activated;
110 (c) the state of the first store is compared by a comparator with a preset content of a second store of said circuit arrangement;
(d) an input switch of, or co-operating with, the 115 electronic circuit arrangement, is set to a first position and the pulses are read into the first store until, upon correspondence of the first store state with the preset state of the second store, the content of the first store is locked and the further feed of the pulses from the pulse generator into the store is interrupted while said switch is in the first position, for example to initiate a signal overriding a timer alarm connected to the first store;
(e) the locking of the first store is subsequently 125 neutralised or cancelled (with correspondence of the state of the first store with the preset content of the second store) by setting the input switch, to a second position, for example to cancel the signal which overrides the timer alarm connected to the first store.
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2. A method for the electronic control of input pulses into an electronic store comprising the electronic interruption of input pulses of a manually-rotatable pulse generator into a first store (time-limit store) of a timer, to lock the contents of the first store, and the subsequent neutralising or cancelling of the locking, said method being useable in connection with cancelling one or more stored time-limits, having the following method steps:

- 10 (a) pulses of the pulse generator are fed into an electronic circuit arrangement of the timer;
- (b) the direction of rotation of a shaft or part of the pulse generator is recognised from the delivered pulses of the pulse generator and corresponding to the direction of rotation, an input of the time-limit store, formed as a forwards/backwards counter, of this circuit arrangement is activated;
- (c) the content of this time-limit store is compared by a first comparator with a preset content of a
- 20 second store of said circuit arrangement;
- (d) the pulses are, upon actuation of a time-limit key of, or co-operating with, the electronic circuit arrangement, read into the time limit store until, with correspondence of the content of the time-limit store
- 25 with the preset store content, the state of the time-limit store is locked and the further supply of pulses from the pulse generator into the time-limit store is interrupted;
- (e) upon the locking of the time-limit store, an
- 30 alarm transmitter actuable by a second comparator which compares the contents of a counter and of the time-limit store, is switched off in such a way that it does not come into action upon correspondence of the contents of the counter and of the time-limit
- 35 store;
- (f) the locking of the time-limit store is neutralised or cancelled (with correspondence of the state of the time-limit store with the preset content of the second store) by releasing the time-limit key so that the
- 40 alarm transmitter can come into action upon correspondence of the contents of the counter and time-limit store.

3. A method as claimed in claims 1 or 2 in which said electronic circuit arrangement is a microprocessor.

4. A device for carrying out the method claimed in claim 1 with a manually rotatable pulse generator, an evaluation logic for recognising the direction of rotation of the pulse generator, a first and a second

50 store, a comparator influenced by the two stores, and an input key in which arranged subsequent to the comparator is a control circuit which is connected between a pulse output of the evaluation logic, and an input of the first store.

5. A device as claimed in claim 4, in which the control circuit is arranged to interrupt the pulse flow from the output of the pulse generator to the first store when both the input key is actuated and the comparator, upon correspondence of the two store

60 contents, emits a signal.

6. A device as claimed in claim 4 or 5, in which both the two stores are forwards/backwards counters.

7. A device as claimed in any one of claims 4 to 6, in which the second store is able to be supplied from

the pulse generator upon actuation of a further input key.

8. A device as claimed in any one of claims 4 to 7, in which only in the case of one direction of rotation of a shaft or part of the pulse generator (e.g. backwards direction of rotation) does the control circuit interrupt the pulse flow from the pulse generator to the first store upon correspondence of the two contents of the stores.

9. A device for carrying out the method claimed in claim 2, with a manually rotatable pulse generator, an evaluation logic for recognising the direction of rotation of the pulse generator, a time-limit store and a second store, a first comparator which can be influenced by these two stores, a counter, a second comparator which can be influenced by the state of the counter and the time-limit store, a frequency transmitter with divider, which is in operative connection with the counter, and an alarm transmitter, in which arranged subsequent to the first comparator is a control circuit which is connected between the pulse output of the evaluation logic, and the input of the first store and has an output for blocking the alarm transmitter.

10. A method for the electronic control of input pulses into an electronic store, substantially as herein described with reference to Figure 1, or Figure 2, or Figures 3 and 4, of the accompanying drawings.

11. A device for the interruption of, and neutralising or cancelling the interruption of, input pulses, substantially as herein described with reference to Figure 1 of the accompanying drawings.

12. A timer substantially as herein described with reference to Figure 2 or Figure 3 of the accompanying drawings.

13. An electronic circuit arrangement, for example a microprocessor, comprising a first store formed as a forwards/backwards counter, a comparator, a second store and an evaluation logic arranged to recognise the direction of rotation of a manually rotatable pulse generator, the comparator being arranged to compare the store contents of the first and second stores and being operatively connected to a control circuit, said control circuit being arranged between the first store and the evaluation logic, said circuit arrangement having an input switch capable of being set to two operating positions, and the circuit arrangement being operable in a time sequence manner such that the switch is capable of being set to a first one of the operating positions in which pulses are allowed to the first store until the store content of the first store corresponds with that of the second store as determined by the comparator after which the content of the first store is locked and pulses to the first store are interrupted, the content of the first store remaining locked when the switch is opened and so that the electronic circuit arrangement is reset when the switch is again closed thereby allowing pulses

125 through to the first store again.