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(54) Improvements in inductive loop vehicle detectors.

(57) In a multi-channel inductive loop vehicle detection system with environmental tracking, cross-talk between the detector loops is minimised by adjusting the respective scanning periods of the different detectors to substantially eliminate the possibility of two such scanning periods being coincident long enough to produce a detectable interference signal. This is achieved by modifying the scanning period of each detector, from a nominal fixed scanning period, to ensure that no two channels are coincident to produce an interference signal long enough to exceed the environmental tracking rate. By providing an interscanning period timer with a period N calculated to exceed the normal loop oscillator running time and causing the system to wait until that period N has expired before stepping from one channel to the next it can be ensured that the loop oscillator has ceased running before stepping to the next channel occurs.

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IMPROVEMENTS IN INDUCTIVE LOOP VEHICLE DETECTORS

This invention relates to improvements in inductive loop vehicle detectors.

It is frequently the case in inductive loop vehicle detection installations, for example for operating traffic signals, that a plurality of detector loops are arranged to operate in association with one another or are coupled to a common detection signal processing network on a time-share basis.

Fixed period scanning detectors or scanning detectors with a similar scanning period can produce poor cross-talk performance when more than one detector is used in loop installations with a large amount of mutual inductance between the loops.

If a multi-channel scanning detector is employed that only energises one loop at a time, and only one such detector is used in a loop installation with inductive coupling, the cross-talk performance is good, since little energy can be transferred between the loops.

However, in a multi-detector loop installation the scanning periods from detector to detector are asynchronous. When the scanning periods are similar, channels with mutual inductive coupling can be coincident or near coincident for a long time, and this can result in a spurious signal that will nevertheless be seen by a detector as a detect signal.

It is an object of this invention to overcome that problem.

Most inductive loop vehicle detectors have an environmental tracking system whereby apparent small changes in loop inductance can be tracked and discriminated against, so that they are not seen as detect signals nor can low rate environmental changes build to a point at which the accumulated change appears as a detect signal. Nevertheless, if cross-talk coupling produces apparent changes in inductance, as seen by the scanning detector, which exceed the environmental tracking rate the detector will give spurious detect outputs.

A facility which our prior inductive loop vehicle detectors have is a detection counter. Every time the detector sees a prime detect signal it will increment this counter. If a prime detect signal is then not seen in a following period the count is decremented. When the count in the counter accumulates to a fixed preset value due to persistence of the detect signal, the detector will give a detect output. The function of this counter is to prevent spurious noise interference causing random detections.

According to the present invention, the detector scanning periods in a multi-detector inductive loop installation are adjusted so that the possibility of two scanning periods of different detectors being coincident to produce an interference signal long enough to exceed the environmental tracking rate is remote. This can be achieved by means of an adjustable interscanning period generator to modify the scanning period of each detector, as appropriate, from a nominal fixed scanning period.

In this way, the cross-talk performance of the scanning detectors can be considerably improved. Also if scanning interference nevertheless causes a prime detect signal, appearing randomly, the noise-suppression detection counter referred to above will inhibit a detect output.

An arrangement according to the invention will now be described by way of example with reference to the accompanying drawing.

The basic prior art detection technique is described in U.S. Patent No. 4,668,951, especially Figure 5 thereof, which is incorporated herein by reference. By modifying the software contained in the micro-computer of the system we obtain a flow chart as shown in the drawing hereof. A comparison between the Figure 5 flow chart of the U.S. patent and the present flow chart shows that the modifications to the program are principally at the "blocks" marked (1), (2), (3) and (4).

At (1), after each channel has been run for a fixed time and the number of loop cycles stored as in the prior system, the interscanning period timer now provided in the present system is initialised, the timer period N being calculated to exceed the ncrmal oscillator running period as provided at (4). At (2), after transfer of the detected states to the outputs, as in the prior system, a wait loop is provided simply to wait for the interscanning period N to expire before the system steps to the next channel. At (3), the required operation period is calculated as in the prior system and also the interscanning period N is calculated to exceed that operation period. At (4), the oscillator runs for a period just to exceed the required operation period as in the prior system and then it is disabled before the expiry of the interscanning period N. This greatly decreases the possibility of two interfering oscillators being time coincident thereby leading to crosstalk.

The period N to reduce crosstalk can be derived in a number of ways.

(a) From the store loop cycle number "LC".

(b) From the detection counter state of the system previously described.

(c) From on board hardware switches.

(d) From data received from serial communications to the detectors

We have constructed detectors using each of

(a), (b) and (c) of these possibilities and all have good crosstalk suppression performance. The only embodiment needing further hardware beyond that of U.S. Patent No. 4,668,951 is (c), the switches required being additional.

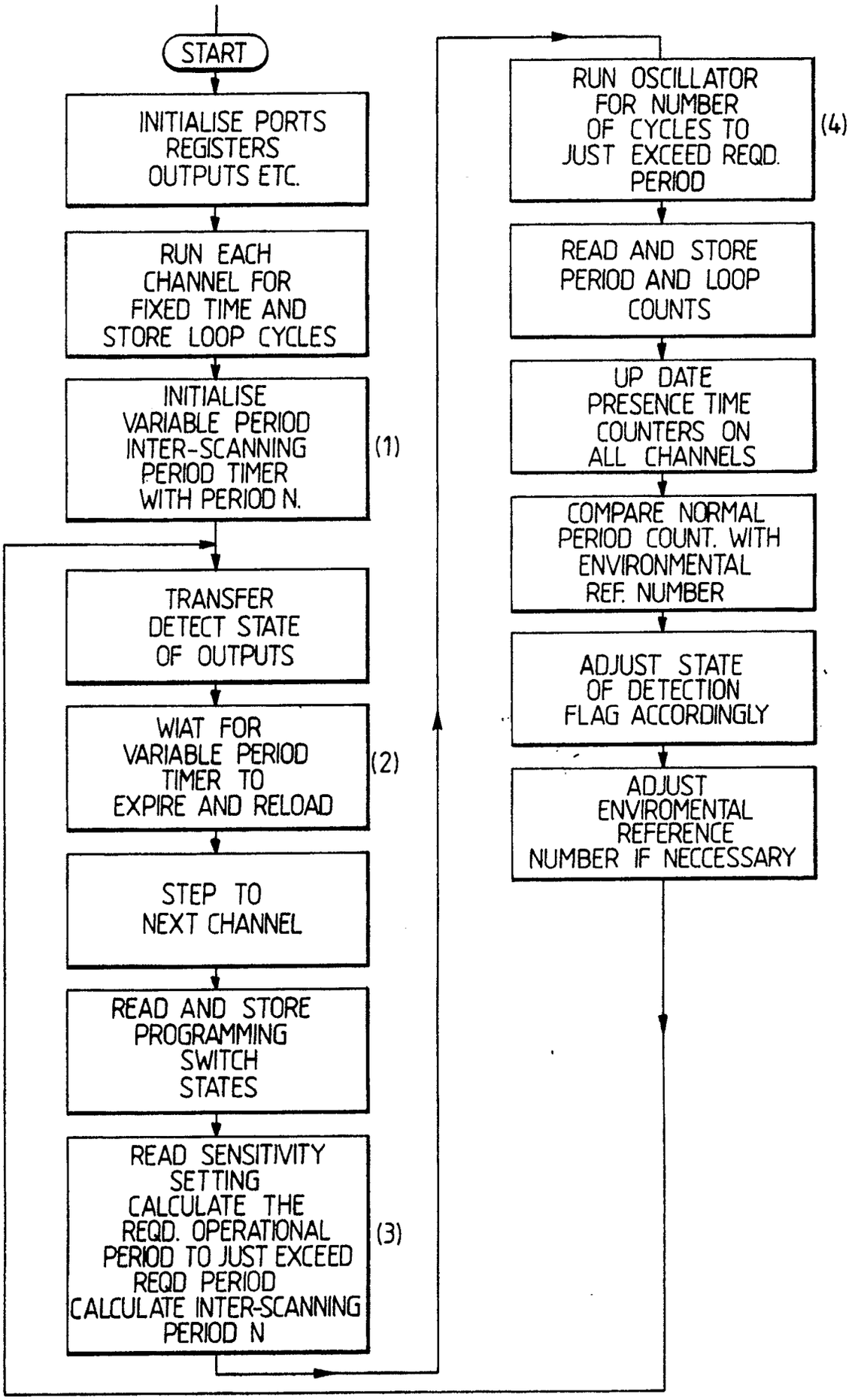
Claims

1. A method of reducing cross-talk between the plurality of detector loops of a multi-channel inductive loop vehicle detector system having environmental tracking, comprising adjusting the respective scanning periods of the different detectors, from a nominal fixed scanning period, so that the possibility of two such scanning periods being coincident to produce an interference signal long enough to exceed the environmental tracking rate is substantially avoided.

2. A method according to Claim 1, wherein after each channel has been run for a fixed time to store a number of loop cycles, an interscanning period timer is initialised having a timer period N calculated to exceed the normal loop oscillator running period, and after transfer of the detect state of the channel to the output a wait occurs while the interscanning timer period N expires before the operation steps to the next channel.

3. A method according to Claim 2, wherein a required operation period is calculated, the interscanning period N is calculated to exceed that operation period, and the loop oscillator is run for a number of cycles just to exceed the calculated operation period but is disabled before the expiry of the interscanning period N.

4. A method according to Claim 3, wherein the interscanning period N is calculated from the stored loop cycle number.


START
INITIALISE PORTS REGISTERS OUTPUTS ETC.
RUN EACH CHANNEL FOR FIXED TIME AND STORE LOOP CYCLES
INITIALISE VARIABLE PERIOD INTER-SCANNING PERIOD TIMER WITH PERIOD N.
(1)
TRANSFER DETECT STATE OF OUTPUTS
WIAT FOR VARIABLE PERIOD TIMER TO EXPIRE AND RELOAD
(2)
STEP TO NEXT CHANNEL
READ AND STORE PROGRAMMING SWITCH STATES
READ SENSITIVITY SETTING CALCULATE THE REQD. OPERATIONAL PERIOD TO JUST EXCEED REQD PERIOD CALCULATE INTER-SCANNING PERIOD N
(3)
RUN OSCILLATOR FOR NUMBER OF CYCLES TO JUST EXCEED REQD. PERIOD
(4)
READ AND STORE PERIOD AND LOOP COUNTS
UP DATE PRESENCE TIME COUNTERS ON ALL CHANNELS
COMPARE NORMAL PERIOD COUNT. WITH ENVIRONMENTAL REF. NUMBER
ADJUST STATE OF DETECTION FLAG ACCORDINGLY
ADJUST ENVIROMENTAL REFERENCE NUMBER IF NECCESSARY