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Test module

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Abstract

Test module

The invention proposes a test module (1) for comparative testing of an electronic component (2) and of a simulation module (3) which simulates the function of the electronic component (2) essentially in the form of a program. The test module (1) has an input/output interface to an external module (4) interacting with the electronic component (2) to be tested and also to the electronic component (2) and the simulation module (3) itself. Equivalent input interfaces of the electronic component (2) and of the simulation module (3) are connected to one another by the test module (1). In addition, the test module (1) has a comparator (6) for comparing output signals from the electronic component (2) and from the simulation module (3) and has a log memory (7) linked to the comparator (6). The inventive test module (1) permits a rapid comparative test of the functions of the electronic component (2) and of the simulation module (3).

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. Test module (1) for comparative testing of an electronic component (2) provided with at least one input and output interface and of a simulation module (3) which simulates the functions of the electronic component (2) essentially in the form of a program and likewise has at least one input and output interface, where
   - the test module (1) has an input/output interface to an external module (4) interacting with the electronic component (2) to be tested and also to the electronic component (2) and the simulation module (3),
   - equivalent input interfaces of the electronic component (2) and of the simulation module (3) are connected to one another by the test module (1), and also
   - the test module (1) has a comparator (6) for comparing output signals from the electronic component (2) and from the simulation module (3) and has
   - a log memory (7) linked to the comparator (6).

2. Test module according to Claim 1, characterized in that the test module (1) has a splitter (9) for splitting a signal received from the external module (4) over the input interfaces of the electronic component (2) and of the simulation module (3).

3. Test module according to Claim 1 or 2, characterized in that the test module (1) contains a selection switch (8) which permits output signals from the electronic component (2) and/or

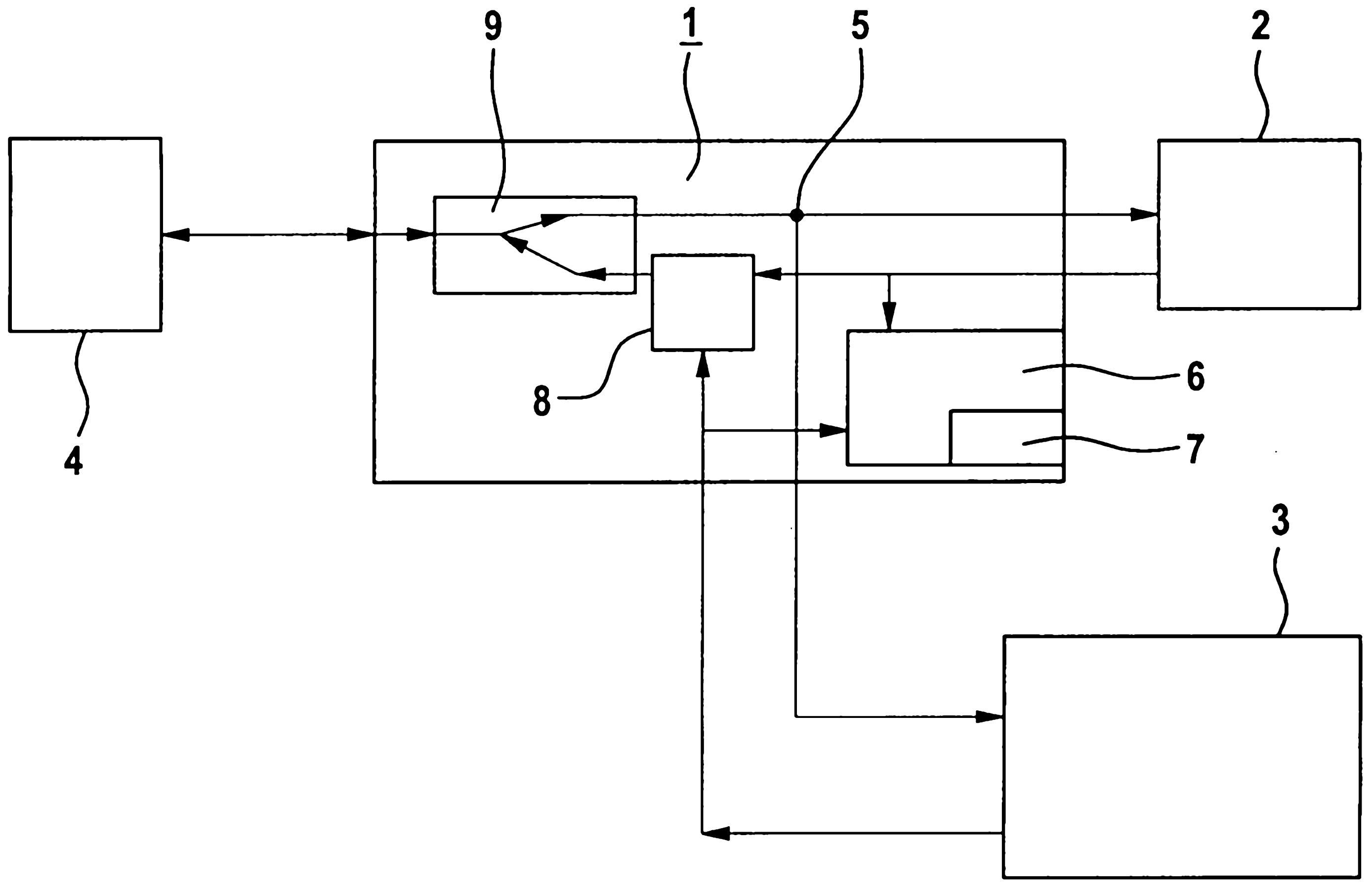

FIGURE 1

AUSTRALIA

Patents Act 1990

COMPLETE SPECIFICATION
STANDARD PATENT

Applicant(s):

SIEMENS AKTIENGESELLSCHAFT

Invention Title:

TEST MODULE

The following statement is a full description of this invention, including the best method of performing it known to me/us:

Description

Test module

The invention relates to a test module for comparative testing of an electronic component provided with at least one input and output interface and of a simulation module which simulates the functions of the electronic component essentially in the form of a program and likewise has at least one input and output interface. The invention also relates to a method for comparative testing of such an electronic component and of such a simulation module.

In many cases, the design of electronic components is computer-assisted. In this context, the whole circuit is designed and tested on the computer. The simulation module designed in the process simulates the functions of the real electronic component essentially in the form of a program. In addition, the simulation module can use input and output interfaces to interact with one or more external modules which are also provided for interplay with the real electronic component. In this context, appropriate, in particular digital, signals are interchanged between the simulation module and an external module. Only after the electronically designed circuit has responded satisfactorily is the real electronic component produced in the form of an electronic circuit and its interplay with the external module tested. In this context, discrepancies may arise in the interplay between the external module and the real electronic component and between the external module and the simulation module. These discrepancies can be caused, by way of example, by discrepancies between the real structural elements of the electronic component and the simplifying computer models in the simulation module. On the other hand, the discrepancies may also be attributable to faults in the electronic component, however. For these reasons, the timing response and the signal contents of the interplay between the external module and the electronic component and between the external module and the simulation module are checked. To this end, logs are produced and manually controlled both for the connection between the external module and the electronic component and for the connection between the external module and the simulation module. This procedure is complex, however, and may additionally result in discrepancies remaining undiscovered.

It is therefore an object of the invention to specify a test module which can be used to achieve simplified comparative testing of the electronic component and of the simulation module. Another object of the invention is to specify an automated method for comparative testing of the electronic component and of the associated simulation model.

The first object mentioned is achieved by a test module for comparative testing of an electronic component provided with at least one input and output interface and of a simulation module which simulates the functions of the electronic component essentially in the form of a program and likewise has at least one input and output interface, where the test module has an input/output interface to an external module interacting with the electronic component to be tested and also to the electronic component and the simulation module, equivalent input interfaces of the electronic component and of the simulation module are connected to one another by the test module, and also the test module has a comparator for comparing output signals from the electronic component and from the simulation module and has a log memory linked to the comparator.

The inventive test module supplies both the electronic component and the simulation module with the same signals, transmitted from the external module, for example via a bus. Both the electronic component and the simulation module then generate the appropriate response signals, which are supplied to a comparator and are automatically compared there. The comparator is connected to a log memory which is able to store the results of this comparison. In one preferred refinement of the invention, only those results for which the comparator has detected a difference in the output signals from the electronic components and from the simulation module are stored. In this case, the log memory stores a fault log which is particularly simple to evaluate.

The electronic component is, in particular, a digital electronic circuit which receives digital input signals and generates digital output signals. One specific form of use of the invention is the testing of electronic components for motor vehicles, for example those which are part of audio and navigation systems and communicate via a bus customary in motor vehicle applications.

In one particular refinement, the test module contains a selection switch which permits output signals from the electronic component and/or from the simulation module to be forwarded to the external module. This allows different scenarios to be produced. By way of example, the selection switch can connect the output signal from the electronic component directly to the external module while the simulation module runs concurrently for control purposes and the differences in the output signals from the electronic component and from the simulation module are recorded in the log memory.

In a second position of the selection switch, the output signals from the simulation module are connected directly to the external module, and the electronic component runs concurrently for control purposes, the differences in the output signals from the simulation module and from the electronic component again being recorded. By contrast with the first variant, in this case, the reactions of the external component are conditioned by the output signal from the simulation module.

In a third position of the selection switch, both the electronic component and the simulation module are connected to the external module, but the output signals from the simulation module are sure to be forwarded to the external module only if the response messages from functions in the electronic component are not or are not correctly implemented.

In an inventive method for comparative testing of an electronic component provided with at least one input and output interface and of a simulation module which simulates the functions of the electronic component essentially in the form of a program and likewise has at least one input and output interface, equivalent input interfaces of the electronic component and of the simulation module are connected to one another for receiving signals from an external module interacting with the electronic component to be tested, and output signals from the electronic component and from the simulation module are automatically compared with one another and are stored in a log memory if there are discrepancies.

Other advantageous refinements of the invention are specified in the subclaims.

The invention is explained in more detail below using an exemplary embodiment and with reference to the drawing. The single figure shows an inventive test module having an electronic component connected thereto, a simulation module and an external module.

In the exemplary embodiment, the test module 1 is connected by means of interfaces (not shown in more detail) to the electronic component 2 to be tested and to the simulation module 3 and also to an external module 4. The simulation module is designed in the form of a program which runs on a computer having the necessary input/output interface. Signals are interchanged between the electronic component 2 and the external module 4 and between the test module 3 and the external module 4. Equivalent input interfaces of the electronic component 2 and of the simulation module 3 are supplied with the same input signals, and, in accordance with the exemplary embodiment, this is effected by the node 5. The output signals generated on the basis of the input signals for the electronic component 2 and for the simulation module 3 are supplied to a comparator 6. The comparator 6 compares these two output signals with one another and, if there are discrepancies, an appropriate entry is made in a log memory 7. The content of the log memory 7 can be read or printed using an interface (not shown). The test module 1 also contains a selection switch 8 which is linked both to the output interface of the electronic component 2 and to that of the simulation module 3. The selection switch 8 can be used to connect the output signals from the electronic component 2 and/or from the simulation module 3 to the external module 4.

In a first operating mode of the test module 1, the selection switch 8 is used to forward the output signals from the electronic component 2 to the external module. In this case, the interplay between the electronic component 2 and the external module 4 is thus tested directly, with output signals also being generated by the simulation module 3 as comparison values and being supplied to the comparator 6 and compared there with the output signals from the electronic module 2.

In a second operating mode of the test module 1, the selection switch 8 is used to supply the output signals from the simulation module to the external module 4. In this case, there is thus interplay between the external module 4 and the simulation module 3, while the electronic component 2 runs concurrently as comparison unit. The output signals from the electronic component 2 are supplied to the comparator 6 and are compared there with the output signals from the simulation module 3. This operating mode is particularly suitable when the interplay between the simulation module 3 and the external module 4 is satisfactory whereas the electronic component to be tested is still increasingly generating fault signals. In this operating mode, different operating states can be run through relatively quickly in this case, and the faults in the electronic component which arise in the process can be recorded.

In a third operating mode of the test module 1, the external module 4 is supplied with both output signals from the electronic component 2 and from the simulation module 3. In this operating mode, it is thus also possible to test functions which have not yet been implemented in the electronic component 2, so that the electronic component 2 does not generate a corresponding output signal.

In the exemplary embodiment shown, the test module 1 has, as a further component, a splitter 9 in the reception and transmission path, which splitter is used for signal splitting.

The invention has been explained using an exemplary embodiment. Specific refinements of individual function groups of the test module, such as of the comparator 6, the selection switch 7 or the splitter 9, are known to the person skilled in the art and may be provided in a wide variety of ways.

For the purposes of this specification it will be clearly understood that the word "comprising" means "including but not limited to", and that the word "comprises" has a corresponding meaning.

It is to be understood that, if any prior art publication is referred to herein, such reference does not constitute an admission that the publication forms a part of the common general knowledge in the art, in Australia or any other country.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. Test module (1) for comparative testing of an electronic component (2) provided with at least one input and output interface and of a simulation module (3) which simulates the functions of the electronic component (2) essentially in the form of a program and likewise has at least one input and output interface, where

   - the test module (1) has an input/output interface to an external module (4) interacting with the electronic component (2) to be tested and also to the electronic component (2) and the simulation module (3),
   - equivalent input interfaces of the electronic component (2) and of the simulation module (3) are connected to one another by the test module (1), and also
   - the test module (1) has a comparator (6) for comparing output signals from the electronic component (2) and from the simulation module (3) and has
   - a log memory (7) linked to the comparator (6).

2. Test module according to Claim 1, characterized in that the test module (1) has a splitter (9) for splitting a signal received from the external module (4) over the input interfaces of the electronic component (2) and of the simulation module (3).

3. Test module according to Claim 1 or 2, characterized in that the test module (1) contains a selection switch (8) which permits output signals from the electronic component (2) and/or

from the simulation module (3) to be forwarded to the external module (4).

4. Method for comparative testing of an electronic component (2) provided with at least one input and output interface and of a simulation module (3) which simulates the functions of the electronic component (2) essentially in the form of a program and likewise has at least one input and output interface, where equivalent input interfaces of the electronic component (2) and of the simulation module (3) are connected to one another for receiving signals from an external module (4) interacting with the electronic component to be tested, and output signals from the electronic component (2) and from the simulation module (3) are automatically compared with one another and are stored in a log memory (7) if there are discrepancies.

5. Method according to Claim 4, characterized in that output signals from the electronic component (2) are forwarded to the external module (4).

6. Method according to Claim 4, characterized in that output signals from the simulation module (3) are forwarded to the external module (4).

7. Method according to Claim 4, characterized in that both output signals from the electronic component (2) and output signals from the simulation module (3) are forwarded to the external module (4).

8. Method according to Claim 7, characterized in that output signals from the simulation module (3) are forwarded to the external module (4) only if a

corresponding output signal from the electronic component (2) is not available.

Dated this 2nd day of August 2001
SIEMENS AKTIENGESELLSCHAFT
By their Patent Attorneys
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Trade Mark Attorneys of Australia

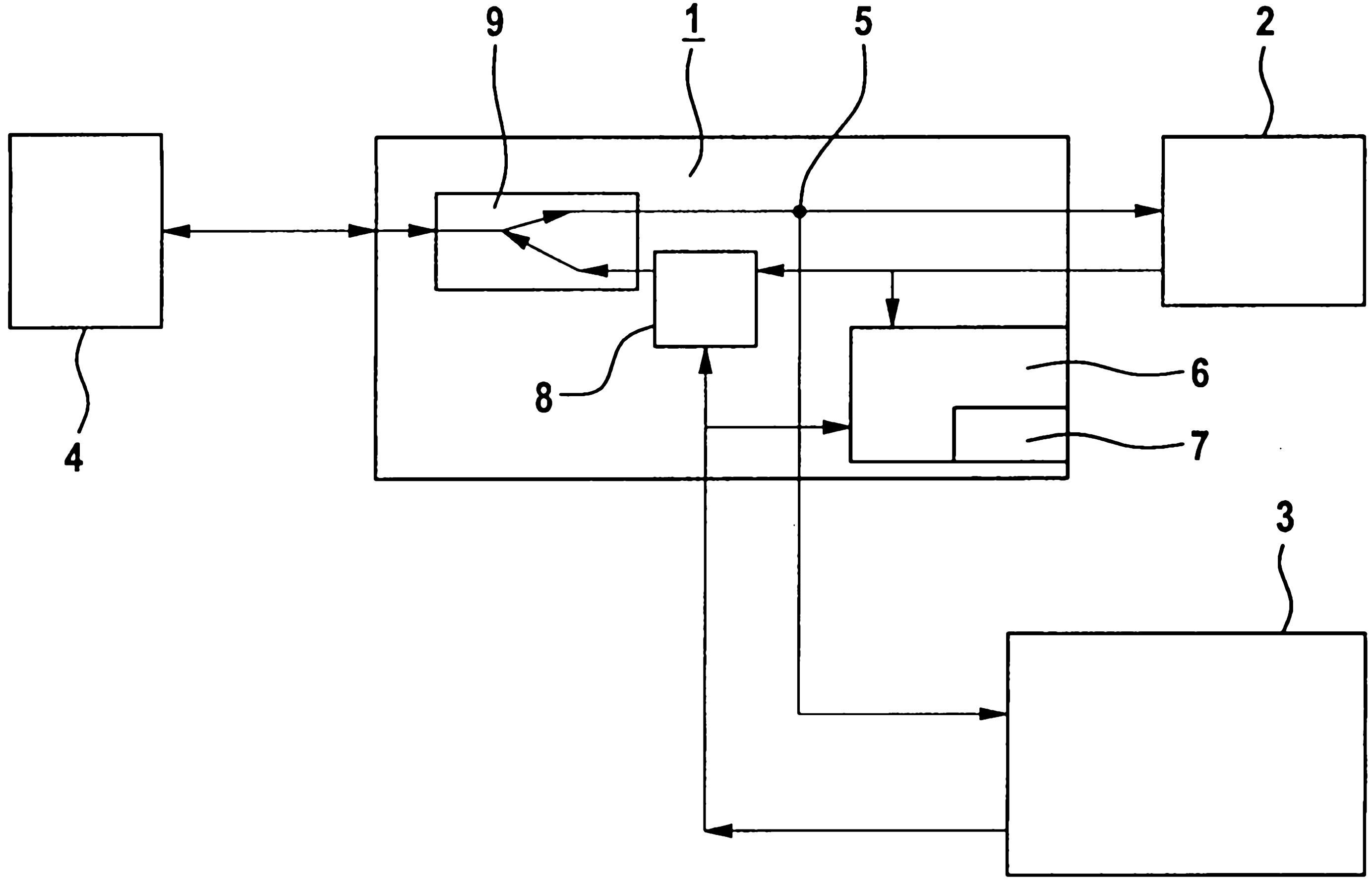

FIGURE 1