The present invention relates to a system for programming domestic appliances and a method for programming assembly-line programmable domestic appliances, especially a system wherein programming occurs without the physical connection between a transmission unit and a reprogrammable processor present in a processing unit integrated into the domestic appliance. The system for programming domestic appliances comprises a remote programming unit (UR) and a reprogrammable processor (PR) present in a processing unit (UP) integrated into the domestic appliance (E_D), the remote programming unit (UR) being provided with a data transmission device (T_U) and the reprogrammable processor (PR) present in a processing unit (UP) being provided with a data receiving device (Rup), and the data transmission and reception devices (T_U, Rup) are based on a magnetic field. The remote programming unit (UR) is loaded with at least one program code (S_UR) to be transmitted by the data transmission device (T_U) of the remote programming unit (UR) to the reprogrammable processor (PR) present in the processing unit (UP) of the domestic appliance (E_D). A method for programming assembly-line programmable domestic appliances is also disclosed, which is applicable to control the system object of the present invention.
before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments. For two-letter codes and other abbreviations, refer to the “Guidance Notes on Codes and Abbreviations” appearing at the beginning of each regular issue of the PCT Gazette.
Title: "SYSTEM FOR PROGRAMMING DOMESTIC APPLIANCES AND
METHOD FOR PROGRAMMING ASSEMBLY-LINE PROGRAMMABLE
DOMESTIC APPLIANCES"

The present invention relates to a system for programming
domestic appliances and a method for programming assembly-line
programmable domestic appliances, especially a system wherein
programming occurs without the physical connection between a transmission
unit and a reprogrammable processor integrated into the domestic appliance.

Description of the Prior Art

The programming of reprogrammable processors in the
production line or in the field where the appliance is located during use, is
currently implemented by means of the physical contact of a set of needles
existing in the programming equipment, which touch specific points of the
electronic circuit containing the reprogrammable processor.

Another technique comprehends physical contact between a
connector of the programming equipment and a connector positioned at the
electronic circuit containing the reprogrammable processor. These two
techniques have the disadvantage of requiring a physical connection
between the programming equipment and the electronic control.

A third technique consists of the manual choice of configurations
in a set of mechanical selection devices, such as resistors and dip switches,
located in the electronic control. This procedure is disadvantageous because
requires physical contact between the operator that makes the configuration
and the mechanical selection devices.

In the two last techniques mentioned, it is quite common that the
physical contact requires the removal of screws and actuation in mechanical
locks, disassembly of plastic parts and disengagement of connections, to
enable access to the electronic circuit, making the large scale production
process more expensive and with lower quality.

Another alternative is the use of previously recorded
processors, with the disadvantage of not allowing changes in their configura¬
physical connection, for instance, making use of infrared or electromagnetic waves. An example of this type of solution is found in document EP1 544827, which discloses a wireless communication system for centralized programming of domestic appliances. This system, however, does not foresee the possibility of carrying out the domestic appliance programming in the production line, nor does it anticipate the possibility of using magnetic field programming, therefore, being susceptible to the interference of an electromagnetic field that may affect the equipment.

Brief Description and Objectives of the Invention

The present invention has as its objective a system and method for programming reprogrammable processors, composed of an electronic control having at least one remote programming unit provided with a data transmission device; and one reprogrammable processor, located in a domestic appliance provided with a data receiving device, these transmission and reception devices transmitting program codes through a wireless connection using a magnetic field-based transmission means.

During the process of producing domestic appliances, the electronic controls containing embedded processors may be basically of two types: fixed programming or reprogrammable.

In the case of electronic controls with fixed programming, an association must be established between the domestic appliance model and the electronic control model suitable for this equipment. This situation has the disadvantage of requiring high stock management in order to avoid errors and reprocessing.

In the case of reprogrammable electronic controls, the situation may be divided into two groups: with physical contact between the programming device and the equipment to be programmed and without physical contact between these elements. The solutions with physical contact have the disadvantages of commonly presenting inefficient electric contacts or damage caused by operator’s handling and in some cases requiring the disassembly of equipment parts, reducing quality and burdening the productive process.
On the other hand, the solution without physical contact is normally made by infrared or electromagnetic waves. The infrared technique has the disadvantage of requiring visual access between the programming device and the equipment being programmed. The use of electromagnetic waves is disadvantageous not only because it is susceptible to the influence of interferences that may generate difficulties in data transmission or even cause inappropriate programming but also because it requires higher cost electronic components that operate in high frequency.

The system and method proposed herein, based on a magnetic field with a receiver circuit tuned to low frequency and with a low amplification gain stage, is free from the disadvantages found in the abovementioned techniques.

A simple, low-cost electronic receiver circuit is used, which may thus be added to each product unit produced in large scale. This receiver circuit has a resonating inductor-capacitor structure, which senses the presence of a magnetic field generating an induced voltage. At the resonating frequency, this voltage has maximum amplitude. A common-emitter configuration amplifier stage receives this induced voltage, amplifies it and makes it available to a rectification and filtering circuit, which eliminates the high-frequency component. At last, a voltage equalization stage receives the induced signal that was treated by the previous stages, generating voltage values suitable for processors' digital inputs.

These objects are achieved by means of a system for programming domestic appliances comprising a remote programming unit and a processing unit integrated into the domestic appliance which contains a reprogrammable processor, the remote programming unit being provided with a data transmission device, and the processing unit containing the reprogrammable processor being provided with a data receiving device, these transmission and reception devices being based on a magnetic field, and the remote programming unit being loaded with at least one program code to be transmitted by the data transmission device of the remote programming unit to the data receiving device of the processing unit...
containing the domestic appliance reprogrammable processor.

The objects of the present invention are further achieved by means of a method for programming assembly-line programmable domestic appliances, characterized in that it is applicable to a system comprising a remote programming unit and a reprogrammable processor provided in a processing unit integrated into the domestic appliance, said method comprising the steps of loading the remote programming unit with at least one program code from a program code library and transmitting data of the program code(s) to the reprogrammable processor of the processing unit through a magnetic field as a plurality of domestic appliances is passed on front of the remote programming unit.

Brief Description of the Drawings

The present invention will be further described in more details based on one example of embodiment represented in the drawings. The figures show:

Figure 1 represents an electronic circuit of the data receiving device according to one of the embodiments of the present invention; and

Figure 2 is a schematic drawing of the domestic appliance programming system in the production line, which is the object of the present invention.

Detailed Description of Drawings

As may be seen in Figures 1 and 2, the domestic appliance programming system, object of the present invention, comprises a remote programming unit UR and a reprogrammable processor PR that is integrated into the domestic appliance EN-

As may be seen in Figure 2, the remote programming unit UR is provided with a data transmission device TUR, and each one of the processing units UP contains one or more reprogrammable processors PR connected to a data receiving device RUP, the data transmission and reception devices (TUR, RUP) being based on magnetic field.

The system further provides a library $SLIB$, which stores several program codes $SN$ that can be transmitted by the remote programming unit
UR to the reprogrammable processor PR of the processing unit UP through the data transmission and reception devices (TUR, RUP).

In this sense, it is possible, for instance, that one or more of the several program codes S i, S2...S N of library SLIB is loaded into the remote programming unit UR, which can transmit these codes to the reprogrammable processor PR of the processing unit UP, for example, during the manufacture of the domestic appliance or even after its manufacture, so that the program code S N is updated, when needed. Figure 2 schematically illustrates that domestic appliances E i, E 2, E 3...E N may be programmed at the assembly line phase, only by positioning the remote programming unit UR properly.

With regard to the configuration of the data transmission and reception devices (TUR, RUP), these are based on a magnetic field, considering the advantages that this type of transmission brings to the present invention. As can be seen in Figure 1, one embodiment of the data receiving device Rup provides a topology comprising a passive circuit sensitive to magnetic fields 11 and an active circuit for the treatment of signals 234, the active circuit for the treatment of signals 234 being responsible for converting the electric signals provided by the passive circuit sensitive to magnetic fields 11 into electric signals compatible with the reprogrammable processor PR of the processing unit UP.

The passive circuit sensitive to magnetic fields 11 comprises a resonating inductor-capacitor topology being composed of inductor Li and capacitor C 1, configured to be tuned to low frequency and, more preferably, to the frequency range of 1 kHz to 530 kHz.

The sytony of the circuit sensitive to magnetic fields 11 of the data receiving device RUP is particularly advantageous in the present application, because the magnetic field has a rapidly decaying intensity, at the ratio of:

\[ \text{decay} = \frac{1}{f^3} \]

Hence, the circuit sensitive to magnetic field 11 of the data receiving device RUP has a typical sensitivity of only up to 10 cm, making it
resistant against the influence of electromagnetic waves, because these act at a higher frequency range, considering that, for tuning an electromagnetic wave to low frequency, the antenna would have to be sized in kilometers, which is unfeasible in practice.

The active circuit for the treatment of signals 234 comprises an amplification stage in the common-emitter configuration 12 composed of a transistor Qi, resistors R1, R2, R3 and R4 and capacitor C3; a rectification and filtering stage 13 composed of a diode D-1, resistor R5 and capacitor C4 to convert the signal read in the data receiving device RUP at DC level and further cut off the high frequencies; and an equalization stage of voltage levels 14 composed of a transistor Q2 and resistors R6 and R7, which is configured to work with the cut-off and saturation of transistor Q2, so as to have logic level 1 or 0 as input for the reprogrammable processor PR of the processing unit UP.

Furthermore, the active circuit for the treatment of signals 234 should be configured to have low amplification gain and, preferably, to have an amplification gain in a range of 10 to 20.

With the configuration presented in the system of the present invention, the objects of the invention are achieved since the cited configuration has a low-cost system and eliminates wired connections, uses a dip switch, eliminates the risks of interference by electromagnetic signals and is able to effectively program domestic appliances in the production line or afterwards.

With regard to the methodology to control the system object of the present invention, the following steps should be foreseen, especially in case of programming assembly-line programmable domestic appliances. The steps comprise:

- loading the remote programming unit UR with at least one program code SN from a library of program codes SN;
- transmitting data of the program code(s) SNI through a magnetic field to a reprogrammable processor PR of the processing unit UP as a plurality of domestic appliances EN is passed on front of the remote
programming unit UR.

Thus, it is possible to program large quantities of domestic appliances EN in a fast and cheap manner.

Furthermore, it is possible to foresee that the data transmission and reception devices (TR, RUP) will operate both ways in order not only to program the domestic appliances EN but also receive status information.

Having described examples of the invention with reference to its preferred embodiments, it is to be understood that the scope of the present invention embraces other possible variations, being limited solely by the appended claims, including the possible equivalents therein.
CLAIMS

1. A system for programming domestic appliances, characterized by comprising:
   a remote programming unit (UR); and
   a processing unit (UP) integrated into the domestic appliance (EN) containing a reprogrammable processor (PR);
   the remote programming unit (UR) being provided with a data transmission device (TUR); and the processing unit (UP) containing the reprogrammable processor (PR) being provided with a data receiving device (RUP);
   the data transmission (TUR) and reception (Rup) devices being based on a magnetic field; and
   the remote programming unit (UR) being loaded with at least one program code (SN) to be transmitted by the data transmission device (TUR) of the remote programming unit (UR) to the data receiving device (RUP) of the processing unit (UP) containing the reprogrammable processor (PR) of the domestic appliance (EN).

2. A system for programming domestic appliances according to claim 1, characterized in that the data receiving device (RUP) is comprised by a passive circuit sensitive to magnetic fields (11) and an active circuit for the treatment of signals (234), the active circuit for the treatment of signals (234) converting the electric signals provided by the passive circuit sensitive to magnetic fields (11) into electric signals compatible with the reprogrammable processor (PR) of the processing unit (UP).

3. A system for programming domestic appliances according to claim 2, characterized in that the passive circuit sensitive to magnetic fields (11) comprises a resonating inductor-capacitor topology.

4. A system for programming domestic appliances according to claim 2, characterized in that the active circuit for the treatment of signals (234) comprises an amplification stage in the common-emitter configuration (12), a rectification and filtering stage (13) and an equalization stage of the voltage levels (14).
5. A system for programming domestic appliances according to claim 3, characterized in that the passive circuit sensitive to magnetic fields (11) is configured to be tuned to low frequency.

6. A system for programming domestic appliances according to claim 5, characterized in that the passive circuit sensitive to magnetic fields (11) is configured to be tuned to the frequency range of 1 kHz to 530 kHz.

7. A system for programming domestic appliances according to claim 4, characterized in that the active circuit for the treatment of signals (234) is configured to have low amplification gain.

8. A system for programming domestic appliances according to claim 7, characterized in that the active circuit for the treatment of signals (234) is configured to have amplification gain in a range of 10 to 20.

9. A method for programming assembly-line programmable domestic appliances, characterized in that it is applicable to a system comprising a remote programming unit (UR); and

a reprogrammable processor (PR) provided in a processing unit (UP) integrated into the domestic appliance (EN), said method comprising the steps of:

loading the remote programming unit (UR) with at least one program code (SN) from a library of program codes (SUB);

transmitting data of the program code(s) (SN) through a magnetic field to a reprogrammable processor (PR) of the processing unit (UP) as a plurality of domestic appliances (EN) is passed on front of the remote programming unit (UR).

10. A method according to claim 9, characterized in that the data transmission of the program code(s) (SN) to the reprogrammable processor (PR) of the processing unit (UP) is done with a circuit tuned to low frequency.

11. A method according to claim 10, characterized in that the data transmission of the program code(s) (SN) to the reprogrammable processor (PR) of the processing unit (UP) is done with a circuit tuned to the frequency range of 1 kHz to 530 kHz.

12. A method according to claim 9, characterized in that the data
transmission of the program code(s) \( S_N \) to the reprogrammable processor (PR) of the processing unit (UP) is done with low amplification gain.

13. A method according to claim 12, characterized in that the data transmission of the program code(s) \( S_N \) to the reprogrammable processor (PR) of the processing unit (UP) is done with an amplification gain in a range of 10 to 20.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

According to International Patent Classification (IPC) or to both national classification and IPC

INV. G08C17/02 G05B19/042

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G05B G08C G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Form PCT/ISA/210 (second sheet) (April 2005)
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