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International Classification— B01K 1/00.

Title: "MICROPROCESSOR BASED AUTOMATED CONTROL UNIT FOR MONITORING MULTI ELECTROCHEMICAL PROTECTION SYSTEM".

Applicants: COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH,
Rafi Marg, New Delhi-110001, India, an Indian
Registered body incorporated under the registration
of Societies Act (Act XXI of 1860).

Inventor(s) K. Balakrishnan, N. Krithivessan, S. Birlasekaran,
P. Subramanian, R. Meenakshisundaram & G.
Radhakrishnan.

The following specification describes the nature of this invention.

PRICE: TWO RUPEES

166188

This is an invention by Krishnaswamy Balakrishnan, Narayanaswamy Krithivasan, Sivaswamy Birlasekaran, Palani Subramanian, Ramachandra Meenakshisundaram, Ganesan Radhakrishnan, all of Central Electrochemical Research Institute, Karaikudi - 623 006, Tamil Nadu, India, all Indian citizens and relates to microprocessor based control unit for monitoring automated multi electrochemical protection system.

The Unit is useful for monitoring of magnetic amplifiers, seronated controls, silicon controlled rectifiers.

Hitherto it has been proposed to dedicate individual control units for individual systems to be given automated electrochemical protection and to dedicate a number of such control units for pipelines, each taking care of a segment.

This has a drawback that individual control units call for monitoring at users site and that centralised control, flexibility for upgrading or design modification, data logging being not possible and also that cost becomes prohibitive for multi control units.

The object of the present invention is to obviate this drawback by incorporating a microprocessor chip in the circuit of multicontrol systems and thereby exercising a centralised control over potentials of the individual systems and also annunciating the defective system/circuit.

The microprocessor based controlled system consists of an 8 bit CPU with its associated peripheral chips, battery backup unit, power circuits, DPMS and annunciator.

The following typical example is given to illustrate the invention *with reference to the drawing accompanying this specification*

5 litre beaker containing 3% NaCl solution with mild steel (30 cm x 10 cm) as cathode and graphite (cylindrical rod of 3 cm dia and 30 cm height) as anode formed the system (to be protected cathodically). Four such cells were assembled to represent a multi system, connected parallelly to the 8 bit microprocessor control unit (SS 80). I/O ports were used for sensing and monitoring. Appropriate channels were sensed sequentially using the soft ware and control was issued through output port. Potentials were sensed by saturated calomel electrodes. The microprocessor sensed the difference in cell potential with reference to a pre-set potential value in succession, of the order of micro seconds and monitored the impressed current control loop, by sending in the proportional protection current and thereby maintaining the cell potential of all the system to the present value.

The following are among the main advantages of the invention.

1. Centralised control is made possible thereby avoiding monitoring of potentials at users site.
2. Flexibility for upgrading or design modification is possible.
3. Data logging for performance history is possible.
4. Cost of control of multiple individual system is many orders of magnitude in comparison with microprocessor based multi system.

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5. Combination of anodic and cathodic protection multi systems can also be monitored to the same degree of accuracy.

6. System becoming defective due to opening of circuit either on the impressed side or on the reference side can be ann~~u~~nciated.

Dated this 20th day of May 1986.

N. R. Subbaram

(N. R. SUBBARAM)
JOINT ADVISER (PATENTS)
COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

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THE PATENTS ACT, 1970

COMPLETE SPECIFICATION

(Section-10)

Title : "MICROPROCESSOR BASED AUTOMATED CONTROL UNIT FOR MONITORING MULTI ELECTROCHEMICAL PROTECTION SYSTEM".

Applicant : COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH, Rafi Marg, New Delhi-110001, India, an Indian Registered body incorporated under the registration of Societies Act (Act XXI of 1860).

The following specification particularly describes and ascertains the nature of this invention and the manner in which it is to be performed :—

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This invention relates to a microprocessor based automated control unit for monitoring and controlling the potentials of multi-electrochemical installations.

The control unit of the present invention is useful for monitoring of magnetic amplifiers, seronated controls, silicon controlled rectifiers.

Hitherto it has been proposed to dedicate individual control units for individual systems to be given automated electrochemical protection and to dedicate a number of such control units for pipelines, each taking care of a segment.

This has a drawback that individual control units call for monitoring at users site and that centralised control, flexibility for upgrading or design modification, data logging being not possible and also that cost becomes prohibitive for multi control units.

The object of the present invention is to obviate this drawback by incorporating a microprocessor unit in the circuit of multi electrochemical installations and thereby exercising a centralised control over potentials of the individual installations and also annunciating the defective installations.

The microprocessor based control unit of the present invention consists of a microprocessor unit with its associated peripheral chips, battery backup unit, power circuit, DPMS and annunciator. Operating on A.C. power supply with provisions for battery back up, the microprocessor control unit comprises the electrode

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potentials of the electrochemical installations sequentially, under the preset required potential value displayed by the digital panel meter, for any multiple electrochemical installations. The difference between the preset potential and the electrode potentials sensed sequentially by the microprocessor through the buffer stage, sends a signal to the Trigger circuitry for triggering on/off the current, by the controlling blocks, which monitor the required protection potentials.

Accordingly, in the present invention, there is provided a microprocessor based automated control unit for monitoring and controlling the potential of multi electrochemical installations which comprises a microprocessor unit (1), the output of the microprocessor unit being connected to a buffer stage (7) for sequentially sensing the potential developed in the installation through individual sensor, the output of the buffer stage being connected to the sensors of the installations which are to be protected, the cathode/anode of the said installations being connected to a power source (10), the power source being connected to the input of the said microprocessor unit through a trigger circuitry (2), the power source being directly connected to the microprocessor unit for continuous operation of the microprocessor the buffer stage (7) being provided with two digital panel meters -one (8) for displaying the preset potential and the other (9) for displaying the potential of the installation and an annunciator (11) connected to the microprocessor unit for visual display of under/over protection.

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The device of the invention is described with reference to the drawings accompanying the provisional specification. In the drawing Fig.1 represents the construction of the device in which (1) represents the microprocessor unit to control the installation, (2) represents the circuitry for switching on the power supply unit in the impressed side (3), (4), (5), (6) represents the electrochemical installation to be protected (7) represents the buffer stage (8), is the digital panel meter for digital display of the installation potentials (10) is the controlled power source with battery backup and (11) is an annunciator for visual display of under/over protection.

The potentials of the four installations to be protected (3), (4), (5) & (6) in Fig.(1) are sensed by the microprocessor through the buffer stage (7). The preset protective potential of the installation is displayed in the digital panel meter (9). After sequentially sensing the potential of the installations, the microprocessor sends a signal to the Trigger circuitry through the buffer stage to switching on/off power source (10) depending upon the potential of the installation. Thus, if the potential of the installation is less than the preset potential, the microprocessor switches on the triggering circuitry sending a signal to the power source till the installation potential reaches the preset potential. After a sequence of monitoring of all installations the operational path moves to the annunciator (11). Here the signal from the buffer stage is compared for over protection or opening of circuit for each installation. Depending on that corresponding LED and buffer will be energised

for warning. After that it moves back to the monitoring cycle.

The following typical example is given to illustrate the invention with reference to Fig.1 of the provisional specification which illustrates the layout of the control unit.

5 litre beaker containing 3% NaCl solution with mild steel (30 cm x 10 cm) as cathode and graphite (cylindrical rod of 3 cm dia and 30 cm height) as anode formed the system (to be protected cathodically). Four such cells were assembled to represent multi electrochemical cells connected parallelly to the 8 bit microprocessor control unit (SS 80). I/O ports were used for sensing and monitoring. Appropriate channels were sensed sequentially and control was issued through output port. Potentials were sensed by saturated calomel electrodes. The microprocessor sensed the difference in cell potential with reference to a preset potential value in succession, of the order of micro seconds and monitored the impressed current control loop, by sending in the proportional protection current and thereby maintaining the cell potential of all the cells to the preset value.

The following are among the main advantages of the invention.

1. Centralised control is made possible thereby avoiding monitoring of potentials at users site.
2. Flexibility for upgrading or design modification is possible.
3. Data logging for performance history is possible.

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4. Cost of control of multiple individual system in many orders of magnitude in comparison with microprocessor based multi-system.

5. Combination of anodic and cathodic protection multi systems can also be monitored to the same degree of accuracy.

6. Systems becoming defective due to opening of circuit either on the impressed side or on the reference side can be annunciated.

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1. A microprocessor based automated control unit for monitoring and controlling the potential of multi electrochemical installations which comprises a microprocessor unit (1), the output of the microprocessor unit being connected to a buffer stage (7) for sequentially sensing the potential developed in the installation through individual sensor, the output of the buffer stage being connected to the sensors of the installations which are to be protected, the cathode/anode of the said installations being connected to a power source (10), the power source being connected to the input of the said microprocessor unit through a trigger circuitry (2), the power source being directly connected to the microprocessor unit for continuous operation of the microprocessor the buffer stage (7) being provided with two digital panel meters -one (8) for displaying the preset potential and the other (9) for displaying the potential of the installation and an annunciator (11) connected to the microprocessor unit for visual display of under/over protection.

2. A microprocessor based automated control unit for monitoring and controlling the potential of multi electrochemical installation as claimed in claim 1 wherein the microprocessor unit is a 8 bit microprocessor unit.

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3. A microprocessor based automated control unit for monitoring and controlling the potential of multi electrochemical installation substantially as herein described with reference to the drawing accompanying the provisional specification.

Dated this ^{19th}.....day of ^{March}.....1987

N. R. Subbaram

(N.R. SUBBARAM)
JOINT ADVISER (PATENTS)
COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

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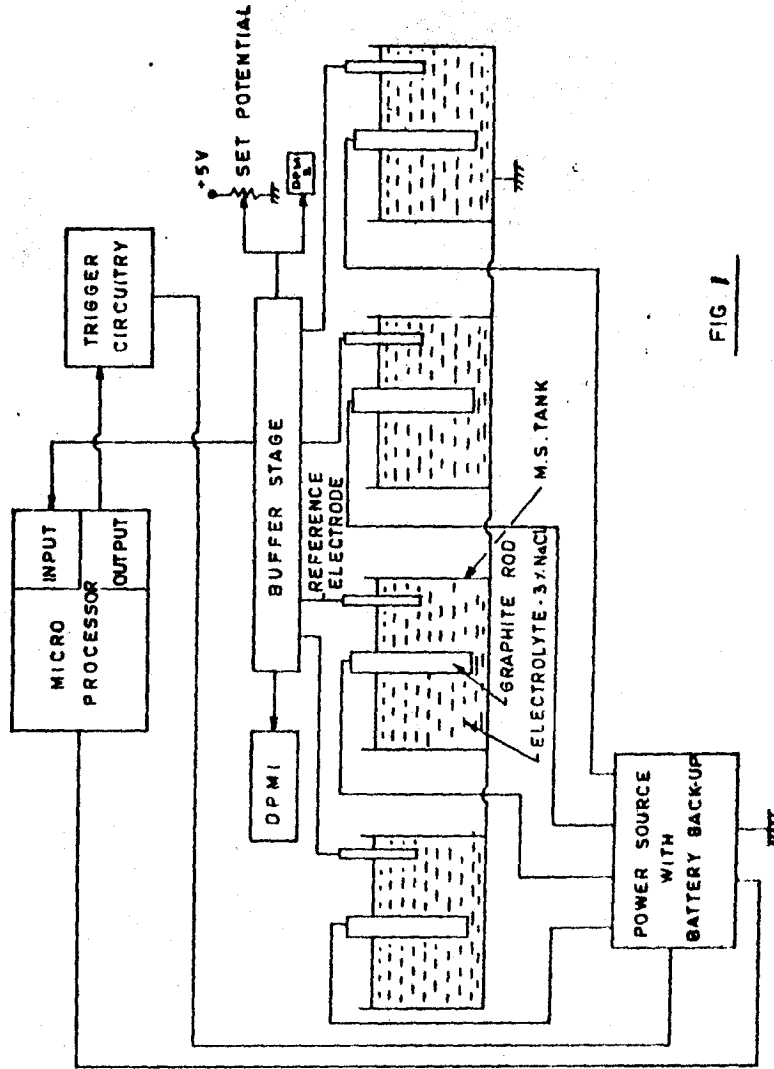


FIG 1

B. K. S. R.
PATENTS OFFICER
C.S.I.R.

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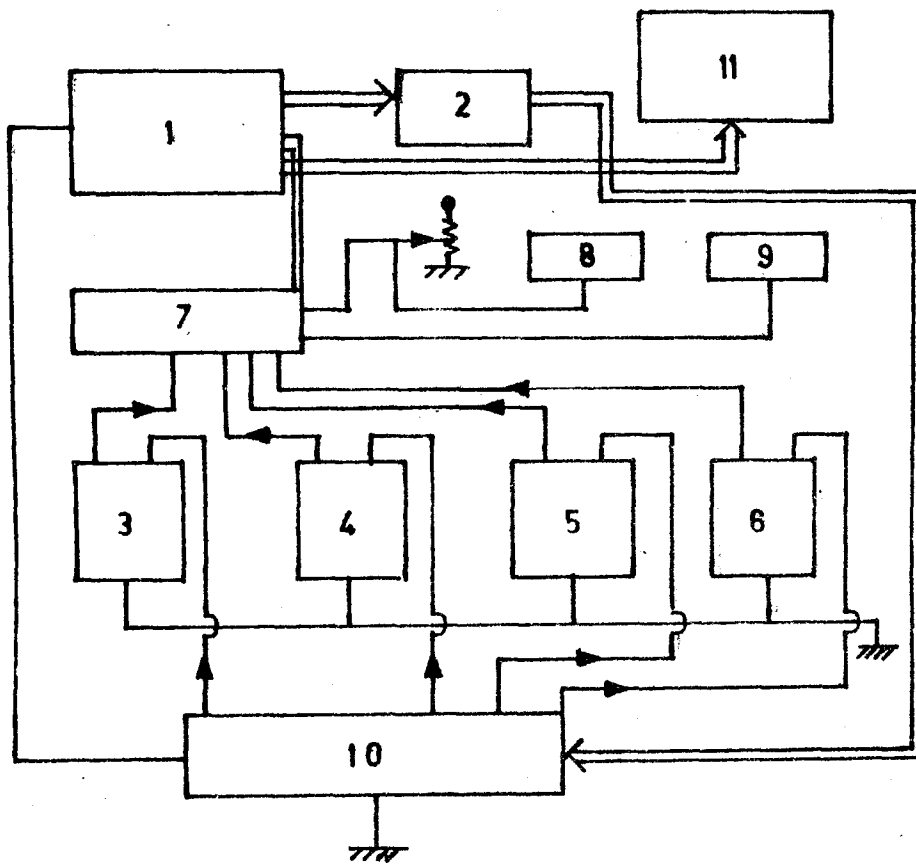


FIG.1

Balashmi
(Applicant)
CSIR