The function-controlled input unit for the IN CIRCUIT equipment

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Abstract – **In the case of *in circuit* equipment the input card has to be chosen in function of the quantity to be measured. Consequently a different type of input is needed for the linear amplifier, another one for filtering in the frequency domain, and a completely different one for the measurement of the impulse-, or signal characteristics.**
Often the traditional "manual" procedure of measurement could be better, when an answer is needed to the questions: what is there actually in the test-point and what are the characteristics of the parameters.
For solving the above stated problems an imbedded, intelligence provided electrical circuit free programmable analogue array (FPAA) can be used that can be re-programmed according to the requested function.

I. INTRODUCTION

The input degree of the universal measuring device is connected directly to the subject device to be measured. Regarding its function it is defined, -even if the measured domain is not. An interesting application is when not even the input degree is defined. Such a typical device is the *in circuit* or inboard tester, which is suitable for measuring installed printed circuit board, constructed electrical circuits or equipment. (Figure 1., 2.)
In the case of these sorts of equipment the input units have to be chosen according to the functions to be measured.

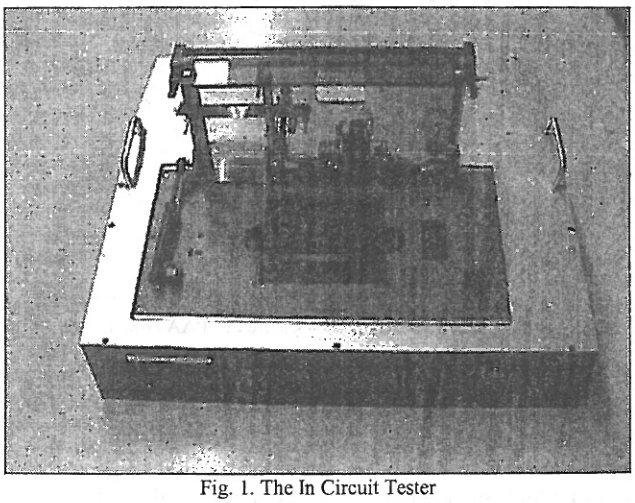

Fig. 1. The In Circuit Tester

Consequently, regarding the functions, different input unit belongs to the voltage measurement, and respectively different ones for intensity, resistance or frequency measurement. This solution makes the measuring device universal, but each measurement task involves card change for reconfiguration.
This sort of solution is obviously expensive, results in a

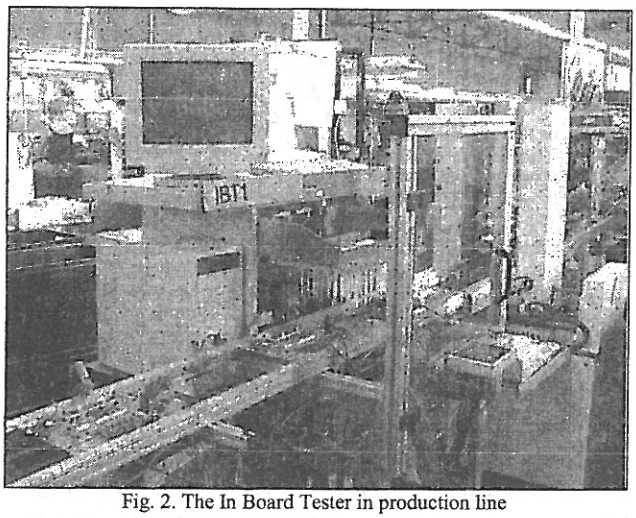

Fig. 2. The In Board Tester in production line

certain inflexibility, as only one sort of function at a given measurement point can be supervised with one sort of input unit (module). It is enough to think that using an input card for measuring voltage for instance obviously cannot be used for measuring signal-noise relation. The ideal input degree would be one that allows not only the reconfiguration of the measurement domain, but also the measuring functions itself. In order to achieve this, such an electric circuit or imbedded intelligence should be implemented that depends on a definite function and which allows the re-configuration of the input electrical circuit structure, architecture, the measurement task and naturally the domain to be measured as well.

II. THE STRUCTURE OF THE TRADITIONAL MEASURING SYSTEMS

The testing devices used nowadays have basically two different architectures. Naturally, part of each is a computer, important not only for user surface but also for archiving the measured results.
In a simple case (Figure 3.) the computer not only model-

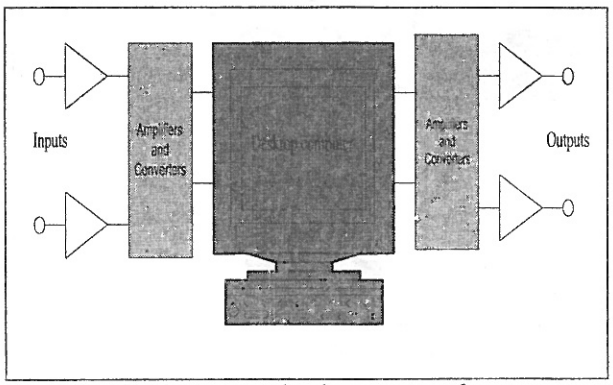

Fig. 3. Measuring thru the computer surface

ling of the process to be measured, but, through the standard surfaces, it also stimulates the inputs of the electrical circuit to be measured, i.e. asks for the inputs. In this case the measuring device implements only the signal conditioning and adjustment. The modelling of the circuit to be measured is done by the computer. So, the applications are limited by the operation speed and the parallelism implemented only conditionally.

A real-time measurement solution could be given by such an application when the measurement happens with the

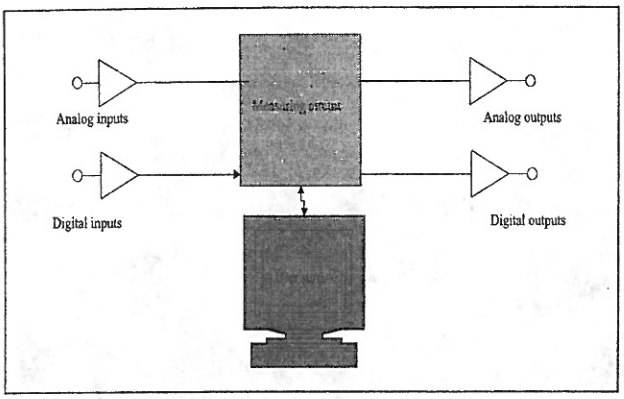

Fig. 4. Measuring by the custom circuit

help of a measuring electrical circuit. (Figure 4.) In this case the computer is the user surface and allows the storage of the measurement results. The computer also implements partly or fully the modelling. In this procedure the extension of the applications depends on the constructed measuring electric circuits.

As it can be seen from above, the spread procedures are either not enough flexible or not enough applicable.

II. THE NEW ABILITIES

The perfect procedure would be the one where the desired measuring circuit structure could be formed flexibly in relation to the desired function to be measured. (Figure 5.)

In this case the imbedded driver is not separated. It is in a sort of co-ordinated relation with the programmable circuit. The feed-back occurs from the actual value of the

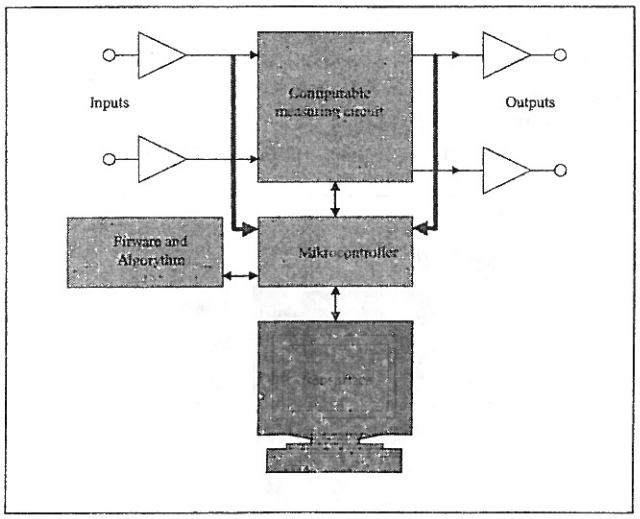

Fig. 5. Measuring by the embedded microprocessor controlled programmable circuit

measured feature (character). To achieve this, the normalized value of the appearing signal on the input and output of the measuring circuit must be used for defining the driver device.

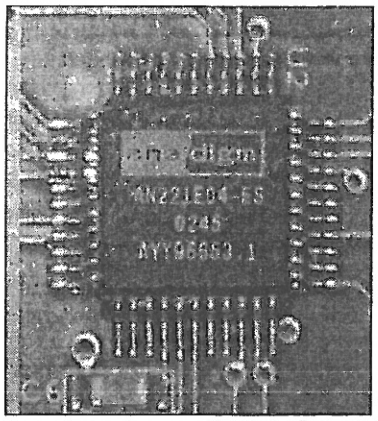

Fig. 6. On of the FPAA ICs

To implement the above mentioned tasks, an excellent possibility is given by the use of the free programmable analogue array (FPAA) as a universal input circuit. (Figure 6.)

In this case such a measuring circuit can be implemented in which a FPAA circuit and a micro-controller resulting in symbiosis produce a measurable input. The new thing in the operation of this system is the fact that the micro-controller selects from a table or an algorithm the one of, these give result in output, of which the stored architecture and the stored domain can be measured on the FPAA circuit generating greatness. The FPAA circuit is such a universal analogue cell-array one that can be configured with *C* macros or their translated bit series respectively. This way, it is possible to form: a usual amplified inverter, non-invertible amplifiers, integrators, differentiators, rectifier, etc. in these electrical circuits. Fortunately, in certain types an analogue digital converter can be found. In figure 7. a

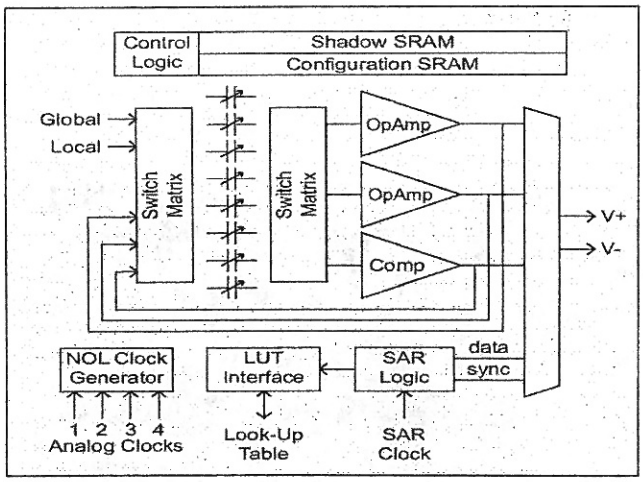

Fig. 7. The configurable analog architecture of FPAA (Anadigm)

configurable analogue block can be seen. In figure 8. an AN221E04 type of FPAA integrated circuit inside architecture is shown.

The I/O block connected to cell 4. is able of analogue-digital conversion based on gradual approach.

The FPAA circuits can be programmed in many different ways. The simplest way is by the help of a series E^2PROM, or with a connected micro-controller, through i^2c the line of which the inner structure of it can be created.

Figure 9. shows the process and operation of a *C* interpreted driver program. After starting, first we want to get

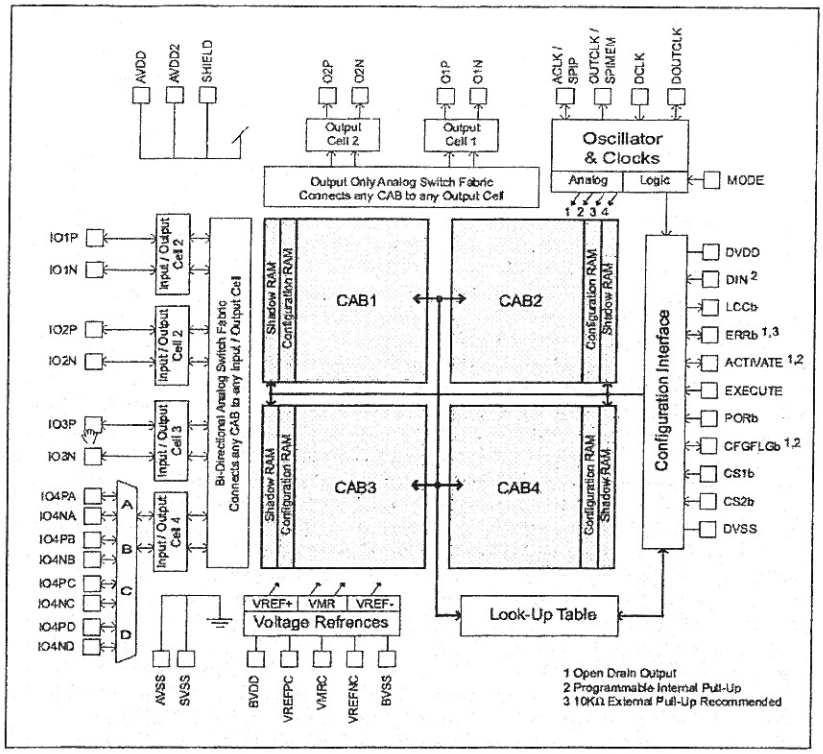

Fig. 8. The inner structure of AN221E04 FPAA's (Anadigm)

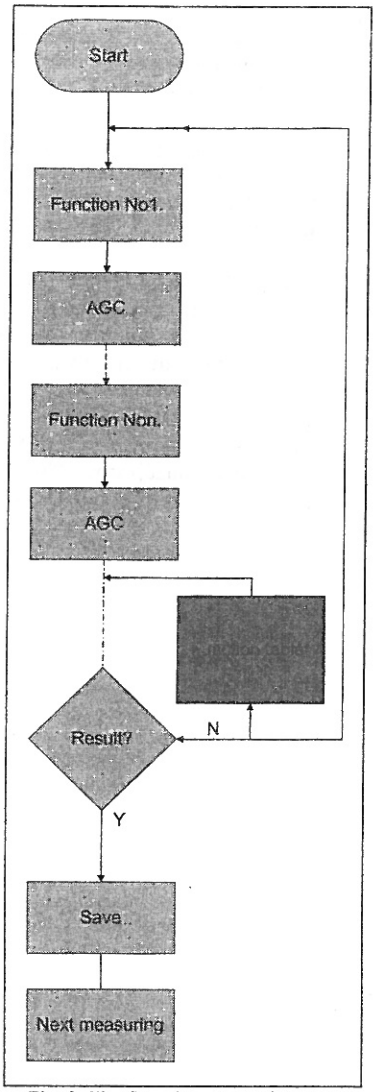

Fig. 9. The flow diagram of function selection

whatever voltage level output. To get this, we try to create the desired function with the help of an algorithm (No_1-No_n) respectively. Naturally, one download follows respectively, so we configured the FPAA. If the algorithms fail to give a result, a heuristically formed table is called for, and the configuration is done through this. Each configuration takes place at the same time with the adjustment of delicate amplifying parameters automatically gain correction (AGC).

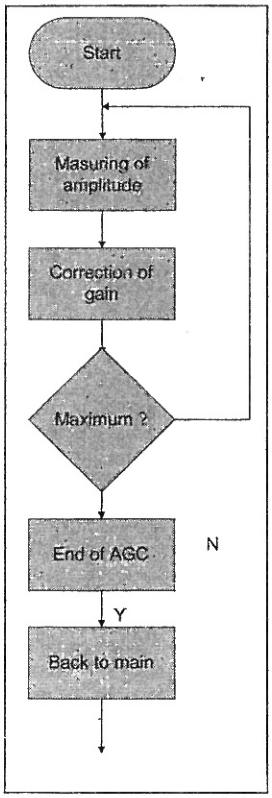

Fig. 10. The Automatically gain correction

In this case the function has to be defined, so such a driver system has to be implemented, the output parameter of which is valuable, measurable electrical quantity. An inner DAC can be used for this.

III. SUMMARY

Besides the input degree of the in-circuit measuring device application, this ordering system can be suitable (applicable) for all the inputs of measuring circuits when a „what can be measured?" question needs an answer at an actual measuring point. As a result of the measurement we can do not only the „operates - not operates" test, but also we can get full information about the characteristic of the signal at that point. We can find out the disturbance from the sinus-like signal in noise, the amplitude of the signal, the signal-noise relation, the harmonic content, in one word, the spectre.

This measuring device can extend not only the in circuit or in board tester functions as an independent unit, but it can be used for special measurements as well. This sort of measurement system involves such a FPAA and imbedded intelligence symbiosis when the desired function is created iteratively during the process of measurement. The measuring device itself, due to the implemented algorithm, means an ordering system producing output, the result of which carries the best possible information about the features of the signal at the measured point.

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