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East Europe Report

SCIENTIFIC AFFAIRS

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EAST EUROPE REPORT

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CONTENTS

ACTIVITIES OF NEW BLOOD DONATION CENTER

Tirana BASHKIMI in Albanian 1 Dec 83 pp 1, 2

[Article by Dr Albert Zhuzhuni, director of the center: "New Blood Donation Center"]

[Excerpts] The construction of the modern blood donation center shows the continuing concern of the party for the protection of the health of the people. Our work is concentrated, as before, on receiving blood from donors, studying it completely and creating special components. Experimenting with and producing by-products will make it possible for us to have components specific to the type and nature of various diseases. The experience gained by our specialists in the new center will give a new stimulus to our work and four times as much blood will be taken from donors and processed. At the present time we are working on a process for preserving blood for a period of several years. In the first phase, workers in our modern laboratory will produce 10 blood components such as thrombocytes, leukocytes, erthrocytes, anti-hemophilic plasma in moist, frozen and dry forms, anti-hemophilic cryoprecipitates, etc.

In regard to their theoretical, practical, economic, scientific and medical value, the experiments which will be carried out are up to the standards of the analyses of contemporary medicine. The state invested 5.5 million leks in the construction of this building. Some 35 percent of the equipment in the institution was produced by our own efforts. The commissioning of the new center will signify a new phase in the accuracy of the analyses and experiments carried out.

The fact that 10 blood by-products will be produced in the first phase of operation of the departments and laboratories will result not only in great economic benefits but also in better care for the sick. In addition, larger quantities of blood components which last for many years will be produced. The production of these by-products and others which will be produced in the future will be closely linked with a number of theoretical and practical issues.

The new institution has several departments, such as those for testing, giving, and processing blood, the biochemical departments, the vivarium, etc. Each section has its own laboratory with special working conditions.

CSO: 2102/3

MICROELECTRONIC COMPONENTS DEVELOPMENT IN SEVENTH 5-YEAR PLAN DESCRIBED

Prague SDELOVACI TECHNIKA in Czech No 7, 1983 pp 241-243

/Article by Eng Jiri Roudny: "Development of Microelectronic Components During the Seventh 5-Year Plan"/

/Text/ The development of the microelectronics component base can be considered from many points of view. One possibility is to focus on and evaluate the development of technical capabilities and specific types of components which can be produced. The new generation of microelectronic components increasingly incorporates the features of end-product equipment, which on the one hand involves less labor for producers of systems (for comparable electronic equipment it is less than half what it was in the previous generation), but on the other hand passes on this difficulty to the microelectronic components developers. For economic reasons this also leads to a striving for greater and greater integration. With the exception of memories, microprocessors, and circuits for consumer electronics and telecommunications, the series size in the production of LSI /large-scale integration/ circuits is decreasing, while the requirement for purchaser cooperation in the development of new circuits and purchaser provision of testing equipment is increasing.

Below, we will describe several areas of the innovation program in electronics, together with directly related problems. We will deal with the development prospects of the basic logic series; bipolar and unipolar circuits; international cooperation; and prospective types of circuits.

Among the basic types of integrated circuits, the most promising types remain SSI /small scale integration/ and MSI /medium scale integration/ circuits using TTL /transistor-transistor logic/ (series MH54, 74 and 84), Schottky TTL (series MH54S, 74S and 84S), and CMOS /complementary metal-oxide-semiconductor/ (series MHB4000/4500). By specialization agreements, our own production of TTL circuits has been supplemented by importation from Hungary, the GDR and Poland. The Soviet Union supplies TTL-LS /Low-Power Schottky TTL/, ALS /Advanced Low-Power Schottky/ and CMOS circuits.

We produce TTL circuits in two reliability categories and three temperature categories: MH54 (-55° to +125° C), MH74 (0° to +75° C), and MH84 (-25° to +85° C). These are produced here in 28 functional types, while several dozen functional types will be imported from the countries named above. In 1983 a total of 76 functional types will be available. We will not be producing the TTL-LS series; they will be imported from the Soviet Union (K555 series for temperatures between -10° and +70°). In the TTL-S (Schottky TTL) series we produce 12 functional types, all likewise in two reliability classes and three temperature classes. The selection is supplemented by importation of 18 types from the Soviet Union (K531 series for temperatures between -10° and +70° C), and we expect that this year 30 types with various logic functions will be available.

We began producing CMOS logic circuits in 1982, and this year we are producing 22 types. According to a draft specialization agreement and as part of our current commercial contacts, this year we will import an additional 17 types (K561 series) from the Soviet Union. Our output will be expanded to include 6 more types in 1983 and an additional 3 types in 1984. A total of 39 types should be available this year, 45 types next year, and 48 types in 1985. We expect to be able to expand the selection further by importation from the GDR as part of a specialization agreement. An interesting feature of CMOS circuits is their very low power consumption, which, when the working frequency is not close to the limiting frequency, is 10-30 microwatts per gate, i.e., a tenth to a thousandth the level in the MH74 series (TTL). Another advantage is the possibility of using a power supply of from +5 to +15 V, along with the better noise immunity which results from smaller power consumption and easier device design. Czechoslovak CMOS circuits have a working range from 0° to +70° C, while the Soviet UK561 series has a range from -45° to +85° C.

Analyzing the output of the various groups of integrated circuits abroad, we find that the basic types of logic circuits still remain in first place. This is natural, because the countries involved have conducted innovation work aimed at decreasing power consumption and increasing speed. During the last 3 years this has led to the creation of the ALS series by the Texas Instruments Co and the FAST series by Fairchild. Other producers too have begun to manufacture them. The ALS series (Advanced Low-Power Schottky) is the current state of the art in worldwide bipolar logic circuits. In its construction (i.e., package type, pin arrangement and climatic categories) it is closely related to the standard TTL series, of which it is actually a development. The limiting characteristics of standard TTL circuits allow their replacement with those of the ALS series; the interchangeability of the two series is limited by the smaller logic gain [logicky zisk] in the TTL series, resulting from the difference in power consumption between the two series.

Ministry plans call for gradual introduction of the main types in this country through domestic manufacture, beginning with about 10 types in the Seventh 5-Year Plan and gradually expanding to about 25 types. During 1984 and 1985 we will be importing an additional 10 types from the Soviet Union by a specialization agreement. There are also plans for inroducing ALS into the production program. For 1985, we expect about 25 ALS series circuit types to be available to Czechoslovak users, while further development during the Eighth 5-Year Plan, together with importation of the TTL-LS series, should allow replacement of the existing basic MH74 and MH74S series of TTL circuits. In addition to being marked by better characteristics (speed and power consumption), their superiority in economic terms is a consideration favoring their use as replacements.

ECL /emitter-coupled logic/ integrated circuits will be provided only by importation from the Soviet Union, the exclusive producer in CEMA, which will probably provide 30 types from its K500 series, corresponding to the Motorola MC10000 series. The gate delay is about 2 nanoseconds /ns/ and the circuits have a guaranteed working temperature range from -10° to $+75^{\circ}$ C.

Alongside the selection of basic unipolar and bipolar logic circuit series, there is a selection of other components, including programmable logic arrays, gate arrays, microprocessors, single-chip microcomputers and the like. These in turn are exerting feedback on the requirements regarding the selection of basic logic series. The basic logic series have hitherto been conceived as a closed stage preceding LSI /large scale integration/ circuits. Our selection of TTL and TTL-S bipolar series will not be further expanded: expansion will be achieved only through importation from CEMA countries.

In the innovation step in bipolar series, i.e., the creation of an ALS series, we should take account of the new generation of LSI and VLSI /very large scale integration/ circuits, although the user experience needed for careful choice of the product assortment is lacking and the currently used method of purchaser research is therefore not sufficiently reliable.

Deliveries of circuits from the CMOS MHB4000/4500 series produced by the Tesla k.p. /concern enterprise/ in Piestany will be begun this year; its production is supported by cooperation with Tesla VUST /Research Institute of Communications Technology/. We expect that adjustments in the selection will be made on the basis of user comments, so that after supplementation by importation of several types in the K561 series from the Soviet Union and by importation from the GDR we will be able to provide for the widest possible range of applications, including consumer electronics and microprocessor-based devices.

The current understanding is that in 1983 a total of 254 functional types of integrated circuits /IC/ in the basic series will be available, including 62 types of domestically produced IC's and 53 types of "logic" HIC's /hybrid integrated circuits/, i.e., a total of 115 domestically produced types. There is some question about the advisability of providing so large a selection, because putting them into production requires a wide range of measuring and testing equipment in the user's possession, and we still lack certain very effective integrated circuits for designing microprocessor-based equipment.

In evaluating the development of the components base, the usual criterion takes account of the specific types of integrated circuits available and how they compare with corresponding foreign types (including their dates of initial availability abroad and in Czechoslovakia). Let us consider the entire problem from another side, because the development of the components base is limited by social consumption by the end-product manufacturers, not simply by the interest of new-technology enthusiasts. Unfortunately, we currently have, and the FMEP [Federal Ministry of the Electrotechnical Industry] can supply, certain microelectronic components for whose mass-scale application the users are not ready, although this fact and the need to provide application workplaces were pointed out well in advance.

A critical aspect of the development of new components is mastering the processes by which they will be produced. Accordingly, the basic task includes selection of a specific technology, and one that is sufficiently universal.

Simply ordering the realization of a foreign circuit type selected without considering the technology involved would result in uneconomial variability of the producer's manufacturing process or might not be realistic at all.

The following approach will be used as the basic method of establishing specific types of promising components:

--working out a specific technology in advance and describing its characteristics;

--providing the production technology for the new generation of components, as well as the necessary process equipment and materials of the required purity;

--developing computer-aided design (CAD) of circuits in this technology, allowing rapid design of specific circuits and generation of testing programs;

--providing testing equipment in the required frequency range and geared to the complexity of the circuits and the number of pins in the package.

Let us briefly consider some preconditions. The development and description of a new technology lasts 2 to 3 years, and in addition a new generation of process equipment and testing equipment must be provided at the same time. Experience indicates that the development cycle lasts about 3 years, including the startup of production, and the time on stream is 5 years. Difficulties in providing pure materials follow a similar pattern, and in addition the ministry does not provide them itself. The development of a new LSI circuit of nonrepetitive structure containing 1,000 gates using I^2L [Integrated injection logic] technology should have a cycle of about 3 months after updating of the CAD system. The time required for design of a microprocessor or single-chip microcomputer with a complexity of about 20,000 transistors is about 1 year. In addition, about half a year must be added for modification of the masks. We should expect that the entire cycle can be shortened to about 6 months or a year. A small number of workers is usually involved in designing a new circuit (generally 3 to 5 in this country). There is no advantage in involving more persons in the work because of difficulties in communicating information to each other. Accordingly, it is apparent that the main bottleneck is providing the process equipment and pure materials.

The production lines producing LSI/VLSI circuits, from production of the silicon to the completed integrated circuits, contain about 200 types or sets of equipment; the number of units of each specific type of device in the production line is small and it sometimes happens that a device of a certain kind in the line is not fully utilized. Added to this are the price of such lines, amounting of to hundreds of millions of foreign exchange korunas, and discriminatory trade practices. Thus it is apparent that importation is not feasible and that we must produce this extremely demanding equipment ourselves, a few copies each of a wide assortment of types; an additional possibility is exchange within CEMA. Production of silicon accounts for about 10 percent of the total production expenditure, chip production for 30 to 35 percent, IC assembly for 25 to 30 percent, and measuring equipment for 30 to 35 percent. High-purity chemicals, primarily from suppliers outside the ministry, account for more than Kcs 100 million in some investment items. Production in the microelectronics industry requires packing of small amounts of high-purity chemicals in special packages, and our material is sometimes degraded by unsuitable packaging. Pure materials sometimes have to be filtered at the workplace before use. In addition, there is sometimes a need for filter materials with pore sizes smaller than 0.2 microns, and introducing their production involves an investment which is nearly comparable with that of the pure materials themselves.

In bipolar technologies, we have currently mastered a variant of the STTL technology with an integration density of 100 components (5-6 microns each) per square millimeter in peripheral microprocessor circuits and up to 100 per square millimeter in regular structures, as for example in the case of the MH82S11 1-kbit RAM [random access memory]. The BIFET [bipolar field effect transistor] technology uses several narrow-channel JFET's [junction field effect transistors]. It provides high speed, low noise, low distortion and a high input resistance. Some examples are the MAC155, 156 and 157 operational amplifiers. One type of bipolar technology with highly precise, temperature-stable low-drift resistors is used in analog-digital and digital-analog converters to provide a precise voltage reference. We may mention, for example, the MAC10 voltage reference and the MDAC08 and MDAC12 multiplying converters.

We are having very good results with I^2L technology in purchaser-specified circuits. To simplify manufacture, only a limited number of components can be used in this technology, and it has a gate delay of 20-80 ns, making it suitable for medium-fast applications. On the other hand, it has very low power consumption, about 100 microamperes per gate. A catalog of functional units has been prepared for purchasers. The purchaser can use these units to design his circuitry; the technique is similar to printed circuit design. The purchaser designs not only the interconnection of the functional units, but any needed functional tests and testing equipment. Development of working models of several purchaser-specified circuits with complexities up to 1,000 gates is currently being completed. Semi-user-specified "gate arrays" have also been developed. In addition to the bipolar technologies mentioned above, others are also being tested, as is the possibility of combiner technologies, which would be in production during this 5-year plan.

The main unipolar technologies are NMOS (n-channel metal oxide semiconductor), aluminum-gate PMOS [p-channel metal-oxide-semiconductor], silicon-gate NMOS, aluminum-gate CMOS, and silicon-gate CMOS. Some promising types are ISOCMOS and HMOS [high-performance MOS] I. Representatives of silicon-gate NMOS technology include the MHB4116 16-kbit RAM (40,000 transistors), the MHB8080A microprocessor, and such circuits as the MHB8251 and MHB8255A. A variation of this technology is used in the MHB8708 EPROM [electrically programmable read-only memory]. Aluminum-gate CMOS technology is used for production of SSI and MSI circuits and the MHB4000/4500 series, including the MHB1902 1-kbit RAM. Mastering the HMOS I technology would allow expansion of our range of LSI circuits in the 8048 single-chip microcomputer family. A typical representation of this technology is a 64-kbit RAM with 150,000 components per chip. This memory, designated the K565RU5, is produced in the Soviet Union. The 8086 mircoprocessor also uses this technology; its equivalents are also being produced in the Soviet Union.

Based on experience to date, we will be able to obtain from the Soviet Union VLSI chips for the usual applications (microprocessors, memories, calculators) before we can produce them here. Accordingly, it is advisable for us to concentrate our main efforts on the flexible design of specialized circuits which have a fundamental effect on end-product innovation in some of our traditional production sectors.

We should add that the current conception of VLSI circuits involves no precise definition; a VLSI circuit is currently considered to be one with a chip area of 20-25 mm^2 and a typical structure dimension of 3.5 microns (e.g., HMOS I) for the entire chip area. Thus this definition does not include 16 kbit RAM's but does include the 8086 microprocessor or a 64 kbit RAM.

A new feature in the development of VLSI circuits during the Eighth 5-Year Plan will be greater coordination or better cooperation of the supplier with the circuit developer, particularly in the areas of circuit design and test equipment.

Microprocessor technology has been developing for about 10 years worldwide. During this time, more than 250 different microprocessors have appeared; their great diversity has led to excessive expenditures in development, use and servicing of the final products. This is explained by the fact that in contrast to SSI and MSI circuits, the use of microprocessors determines the configuration and often even the system for incorporation of the final product. The CEMA countries have now developed and included in the list of recommended circuits for JSEP [Unified Series of Electronic Computers] and SMEP [Small Computer Series] computer equipment several sets of microprocessors with a total of 8 types of instruction codes. Because this too fails to lay the groundwork for economic cooperation, it is advisable to decrease the number of recommended sets of microprocessors sharply. It is recommended that only two types of microprocessor sets be used: the 8080/8086/8048, and microprocessor sets allowing compatibility with SMEP instruction codes.

For design of microprocessors compatible with the SMEP instruction sets it is planned to use the following sets: the MH3000 and K589 (CSSR and USSR), and the K1801, K1802, K1804-"2900", K581 and K588 (USSR). Thus our concept, oriented to the 8080 microprocessor and associated types, is in full agreement with this proposed concept.

Currently the ministry provides the MHB8080A, MHB8255A and MHB8251 circuits, while the KR580IK53 (programmable clock circuit), KR5808IK57 (programmable DMA /direct memory access circuit/ controller) and KR580IK89 (programmable interrupt controller) are imported. In addition to these MOS circuits, the bipolar MH3205, MH3212, MH3214, MH3216/26, MH8224 and MH8228 bipolar circuits are provided for use with them. Other bipolar circuits for the 8086 microprocessor, i.e., the MH8282/83 (8-bit accumulator) and MH8286/87 (8X bus receiver-transmitter) will go into production in the near future. The MHB 8035/8048 system of single-chip microcomputers with the 8243 expander are being prepared for production, and the MHB8748 microcomputer and the MHB8155 circuit are under development.

The CEMA countries will produce the 8284 (clock for 8086), 8288 (input-output controller for 8086), 8289 (Multibus controller), 8275 (programmable alphanumeric display controller) and 8279 (programmable controller for segmented digital display and keyboard) IC's for the 8080/8086/8048 series. The 8086 microprocessor now in production will be joined by the 8088 (8-bit microprocessor) and 8089.

To assure modularity of microcomputer systems, it is proposed to use CEMA standards Nos 3268-81 and 834-77 which are the point of departure for CSN's /Czechoslovak State Standard/ 18/8011 and 8010. These documents are based on international recommendation IEC 297, which specifies the dimensions of the 19-inch frame for boxes and the modular design of "1-1ZU" printed circuit boards (the so-called "Eurocard").

The FMEP is developing a uniform structural module for microprocessors and other equipment, based on the recommended Eurocard module dimensions; it will be supplied by the end of this 5-year plan. In addition, it is developing an ALMES /expansion unknown/ component.

The principles in force in Czechoslovakia regarding the method of creating future series are intended to minimize (in economic terms) the component selection produced domestically and imported from socialist countries and to eliminate ill-considered requests for the production or importation of new types of components. There are 60,000 to 100,000 types of integrated circuits worldwide, and 3,000 to 4,000 in the CEMA countries. Czechoslovakia produces about 200 types of integrated circuits with different functions. If we consider differences in certain characteristics (e.g., temperature range), the total is about 450 types.

It would be uneconomical, and in some cases prohibitive, for each of the CEMA members to try to meet its own microelectronic component needs by producing them all itself. Accordingly, CEMA has begun international cooperation, both multilateral and bilateral, in the components base. Multilateral cooperation among the CEMA countries via the working organs of the CEMA Standing Commission on the Radio and Electronics Industry and the Intergovernmental Commission for Cooperation Among Socialist Countries in Computer Technology, as well as other organs, is extensively used in implementing the concept of development of the electronics industry and particularly of the components base. The working organs of the CEMA Standing Commission arrange production specialization and cooperation in their area of jurisdiction, as well as scientific cooperation and standard-setting. Discussions by its various sections have resulted in a draft agreement on multilateral specialization and cooperation, an agreement on division of labor in the development of specific types of electronic components, and draft CEMA norms.

Because of the importance and complexity of the problem, the question of providing an electronic component base in accordance with the requirements of the CEMA countries' national economics has been placed on the agendas of the highest CEMA bodies. A guideline agreement on multilateral cooperation and the provision of a single uniform electronics base, including special process equipment, semiconductors, and special materials for their production, was signed at the 35th session of the CEMA council in 1981. The term "uniform electronics base" refers to a list of electronic components in production, under development, or planned, which meet CEMA technical requirements and norms for interchange between CEMA members.

The provision of a component base for JSEP and SMEP computer equipment is coordinated by the Council on the Microelectronics Component Base, part of the International Commissionon Computer Technology, which has the following sections: Special Process Equipment for Microelectronics, High-Purity Materials for Microelectronics, and Microelectronic Components for Computer Engineering.

We are involved in bilateral cooperation in microelectronics with all CEMA members, at various organizational levels and with various degrees of intensity. Our most active cooperation is with the GDR, Poland, and particularly the Soviet Union; cooperation with the Soviet Union is based on an intergovernmental agreement. Our scientific and technical cooperation with the Soviet Union is the most extensive, while cooperation with the GDR and Poland also includes production cooperation. Cooperation with the Soviet Union involves a working group for application of the components base. One of its practical results has been the importation of at least 200 types of integrated circuits from the USSR. Among the most interesting are the KR580IK53 (equivalent to the 8253), the K580IK57 (equivalent to the 8257), the KR580IK59 (equivalent to the 8259), the K573PF1 (equivalent to the 2708), and the K572PA1 (10-bit digital-analog converter, equivalent to the AD7520). Information on the entire imported selection is given in the second edition of "Perspektivne rady elektronickich soucastek" /Prospective Series of Electronic Components/ for a wide range of our users.

In addition, price policy is an instrument which affects the prospects of the microelectronic component base. A significant decrease in wholesale prices was instituted as of 1 February of this year /1983/, and another is contemplated before the end of the present 5-year plan. In addition, a list of simplified wholesale prices was also issued on that date; it set wholesale prices of all imported semiconductor components based on comparison with their price levels with those of comparable domestic components.

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EMG 7177 PROGRAMMABLE GRAPHIC CALCULATOR, CONTROL SYSTEM

Budapest INFORMACIO ELEKTRONIKA in Hungarian No 5, 1983 pp 249-252

[Article by Vladimir Krizs: "The EMG 71777 Programmable Graphic Calculator, System Control;" received 16 Aug 83]

[Text] The article describes the EMG 777, a newly developed product of the Electronic Measuring instruments Factory (EMG), with special emphasis on the user viewpoints taken into consideration in the course of design and realization.

Introduction

The title is the product catalog designation of a desk computer series manufacture of which began in 1983 at the Electronic Measuring Instruments Factory. The "programmable calculator" terminology of this official designation not only preserves the tradition used in the name of the 666 and 666/B manufactured since 1974, it also refers to one of the basic properties of the device. The programming language is extended BASIC.

It is becoming a commonplace that the 1980's are a period of explosive spread of computer technology. This spread is taking place in the form of ever more compact devices--desk computers, professional personal computers, personal computers and home computers. We use this categorization all the time, but the technical content of the several categories has far from developed in such a way that everyone means the same thing by the concepts; this is why we took courage and continue to use at the EMG the designation "programmable calculator" which has been in use for more than a decade.

With this name we would like to indicate in general that in regard to the method of using the device, the input of data (programs) and access to the results (run results) it resembles a calculator in that operating the device does not require special training but only a knowledge of the device. (Knowledge of BASIC is no longer regarded as special expertise.) In contrast to a computer this "calculator type" operation poses concrete requirements in regard to both hardware and operating software:

--The hardware must contain the operator's I/O peripherals (keyboard, display), background storage, printer unit (in combination we call these the internal peripherals) and, naturally, the processor unit with operational memory. The hardware should be placed in one mechanical unit (box) if possible but if this is not possible then in as small a number as possible and tying the units together by cable should be simple. This also pertains to the connection of additional (external) peripheral equipment.

--The operating software must ensure that the user can use the hardware and the software offering the services of the system with the aid of a small number of simple commands. In accordance with this the operating software is in constant and conversational contact with the operator, but asks from the operator only as such information as is needed to understand the command. It strictly checks the information received, but at the same time it has a great "orthographic" tolerance. The system itself performs all administration and control, giving a detailed error signal, indicating the cause, in error conditions requiring user intervention. These properties of the operating software make the entire system "friendly," having the character of a calculator.

The display unit of the 71777 is a raster cathode ray tube display with a resolution of 512 x 400 points, which can be used to display text and rasterized graphic objects, so it is a graphic calculator.

As system control the device operates two channels (666 I/O and IEC-625). To the 666 I/O bus one can connect the EMG peripherals developed earlier and to the IEC bus one can connect equipment satisfying the interface prescriptions of several international standards (IEC-625, IMR-2, GPIB and IEE 488).

Structure of the Device

In regard to its mechanical structure the 71777 programmable graphic calculator consists of three basic units: a) a control unit, b) a keyboard, and c) a mosaic printer.

These three mechanical units contain all the system elements which make the combination into a programmable calculator. Namely:

--a) The central unit contains multiprocessor type microcomputer electronics, the ROM stores containing operating system and interpreter programs, user operative memory, the raster cathods ray tube graphic and alphanumeric display unit (user output peripheral), floppy disk storage (user background storage) and the power units for all these.

--b) The keyboard is connected to the central unit by a cable so that it can be placed freely within viewing distance of the display screen and so the keys can be reached easily. The keyboard contains standard typewriter keys, number input and operational keys and functional keys controlling the operation of the system. The keyboard is a user output [as published] peripheral for writing programs, controlling runs and input of data provided by the operator.

--c) The CARO 1154 mosaic printer connected by cable to the central unit prepares point by point copies (hard copy) of the picture on the screen of the dksplay and works as the printer of the system in the alpha-numeric mode.

Both I/O channels of the device make possible chained cable connection. External peripherals, such as systems making up an automatic measurements system, can be connected to the I/O channels.

Programming Language

The programming language of the EMG 777 is extended BASIC. The extention means that the language contains additional instructions beyond the basic instruction set adopted internationally. The extension pertains to the following operations:

--a) string operations (editing operations with a series of characters);

--b) block operations (producing vectors and matrixes from data sets, operations between blocks);

--c) data file operations (creating, editing and storing files on floppy disk);

--d) graphic instructions to control the graphic display and printer unit;

--e) I/O instructions (controlling devices and measurement instruments connected to the 666 I/O and IEC-625 channels);

--f) special system functions (special instructions aiding the writing, editing, testing and correction of programs and functions supporting text editing on the screen).

Its number depiction range is 12 meaningful digits from 10^{-300} to 10^{300}, decimal exponent.

Graphic Operation

The display unit is controlled by its own microprocessor and special graphic hardware, which in combination ensure that complex picture editing operations can be carried out with simple instructions and with great speed. The built-in function hardware greatly accelerates and simplifies and transformation and display of data sets into functions.

Use of EMG 777 In Technical-Scientific Calculations

The programming language (extended BASIC) is already known and used in a broad sphere. The extensions of the language increase its efficiency on the one hand and on the other hand simplify the formulation of BASIC language programs for complex technical-scientific problems. The operating system is ROM resident, after connection into the system it "wakes up" together with the hardware and its services make it possible to program and operate the device without any special computer technology training.

System Technology Structure

Technical-scientific calculations are characterized by a large volume of floating point operations and a need for high precision standard functions (circular functions, logarithms, etc.). Given the assortment of parts there are only two ways to increase operating speed--on the one hand by developing a multiprocessor system so that peripheral operations are parallel in time and on the other hand by doing high precision floating point operations and slow translations with a high speed (microprogrammed) microcomputer. For this reason the device has a multiprocessor structure; it contains three peripheral processors and one main processor. Each internal or external peripheral works under the supervision of some peripheral processor. The assignment of a peripheral to a peripheral processor takes place at the hardware level; access to a peripheral is possible only via a peripheral processor, so every peripheral is the peripheral of some processor, is its so-called "own" peripheral.

The operating programs of the system, the interpreter programs realizing the high level programming language and the floating point operations run in the main processor. The main processor does not have its own peripherals.

The microcomputer's other "own" peripherals are the following:

a) Display processor

--built-in cathode ray tube display (VDU, video display unit),

--a key board connected from outside,

--a system printer, also connected from outside,

--a built-in loudspeaker.

b) Floppy processor

--built-in floppy disk mechanics (MOM MF 3200),

c) I/O processor

--real time clock (RTC). Board peripheral,

--peripherals connected to the 666 bus,

--peripherals connected to the IEC bus.

d) Main processor

A 16 bit, microprogrammed microcomputer built of bit sliced elements. The instruction set realized by the microprogram constitutes an instruction set of the PAL (Processor Assembly Language) language. The instruction set can be divided into five parts:

1. The basic instruction set characteristic of 16 bit microprocessors, which contains 8 and 16 bit data movement instructions, fixed point arithmetic operations, logical operations, jump instructions, etc.

2. Floating point operations;

3. Standard functions;

4. Matrix (block) operations; and

5. String operations.

The instructions and operations belonging to points 2-5 of the PAL instruction set correspond almost entirely to the BASIC instruction set. (The PAL instruction set for string operations is somewhat narrower than in BASIC.) In regard to these functions the execution of a BASIC instruction takes place almost directly at the microprograms level, and so will be at high speed.

The system programs constituting the BASIC operating system are written in the PAL language--the program supervising multiprocessor operation (monitor), the interpreter program, the dispatcher and back listing. These programs run in the main processor and are stored in ROM.

Task Districtuion

When several microcomputers are assigned their "own" peripherals this almost automatically determines task distribution also. The main processor does not have its own peripherals (or, if you like, the entire system is its peripheral), in regard to its speed and intelligence it is the control unit for the entire system, the operating system and the translator and interpreter programs of the BASIC language run in it. The other processors handle peripherals. We call the processor-handling peripherals "handlers." Depending on the complexity of the operations which can be executed by a peripheral we speak of a physical or a logical handler. The physical handler controls the most simple physical movements of the peripheral and carries out simple data transmission; the logical handler contains the physical handler, when it is started it creates complex data structures and transfers data sets to the peripheral. For example, the display processor receives from the BASIC system an instruction to draw a circle. It receives as parameters only the center point and radius of the circle; it independently calculates the coordinates of the points of the circle and controls the graphic hardware to light up the calculated coordinate points. The high speed microprocessor (8085 10 MHz clock) used in the peripheral processors and the fact that a single peripheral processor need handle few peripherals makes it possible for the logical handlers to be at a very high level, practically achieving the level of the BASIC instructions.

The display processor handler sees to the physical handling of the keyboard, executes on the screen the functions corresponding to the text editing keys of the keyboard and the PRINT instructions on the system printer and on the screen. The graphic instruction set of BASIC is realized in its entirety on the panel.

The magnetic disk processor handler realizes on the panel, in its entirety, the data file handling instructions of BASIC, in addition to physical handling of the floppy disk drive.

The I/O processor handler realizes the I/O instructions of BASIC and at the physical level handles the real time clock.

Most Important Technical Characteristics:

--Extended BASIC programming language;

--User storage area of 128 K bytes;

--A multiprocessor system ensuring high execution speed, consisting of four microcomputers. Both the microprogram and the system program are in ROM elements, thus the system is ready to go as soon as it is connected into the network; there is no need to load system programs;

--A keyboard consisting of 114 keys, the parts of which are:

--full typewriter keyboard,

--number input keys,

--text editing keys,

--keys controlling graphic functions,

--keys controlling user functions, and

--system control keys.

--Cathode ray tube display: raster picture formation (half picture change), moderate after-lighting, green color, cathode ray tube with 41 centimeter nominal picture diagonal; resolution: 512 x 400 pixels.

Alphanumeric Operation:

--64 displayed characters per line in 25 lines,

--user functions in the 25th line key addressable (MENU),

--three character sets (Hungarian lower and upper case, English lower and upper case and Cyrillic upper case),

--effect of control characters can be controlled,

--text emphasis: underlining, increased brightness, flashing, inverse character,

--flashing cursor can be moved in 8 directions,

--text editing functions,

--a dedicated alphanumeric store containing the entire text field (not used for any other purpose).

Graphic Operation:

a) One bit of the 32 KB capacity graphic store belongs to each raster point of the picture screen. The graphic store is dedicated (not used for any other purpose), thus only the graphic instructions determine its content. Vectors, and plane figures (triangles, quadrangles and polygons, circles, sectors, segments and axes) can be produced in the graphic store with one each BASIC instruction.

b) Function storage: This is a store with a capacity of 512 x 8 bits the sequential addresses of which are controlled by the horizontal raster distribution of the screen and the content of which is controlled by the vertical raster distribution. With the aid of the function storage hardware the content can be displayed as a function of the address. The function storage is write only and dedicated (cannot be used for any other purpose).

c) The graphic hardware makes possible:

--control independent of one another of display on the screen of the contents of the alphanumeric store, function storage and the graphic store (simultaneous display is possible also);

--increasing or decreasing the content of function storage, with magnification or reduction of the function displayed;

--three methods of drawing ("white pen", "black pen" and an "electronic pen" which draws the opposite of the background);

--copying into background storage the picture displayed by means of a logical connection;

--high speed production of vertical and horizontal lines; and

--fast filling of plane figures.

d) Printer: Copies by raster point can be prepared from the screen with the DARO 1154 (graphic version) mosaic printer which can be connected to the device.

Floppy Disk Storage:

--MOM [Hungarian Optical Works] made MF 3200 type mechanics,

--data carrier which can be used: 8 inch diameter, floppy disk, either hard sector or soft sector,

--organization and writing method: soft sector, IBM 3740 compatible,

--capacity: 240 K bytes.

Data File Management System:

a) File types:

--sequential access ASCII data files,

--sequential access binary data files,

--random access ASCII data files organized by record,

--BASIC program files.

b) File handling functions:

--eight data files can be opened at one time,

--automatic location occupancy (erasing a file frees its location),

--the BASIC program file can be made private,

--data file protection,

--file editing,

--file listing.

I/O Channels:

666 I/O bus:

--a maximum of 30 peripherals meeting the EMG 666 I/O bus interface prescriptions (bit parallel, byte sequential) can be connected,

--permitted chained cable length, maximum of 20 meters,

--transmission speed (depending on peripheral), maximum of 100 KB per second.

IEC bus:

--a maximum of 30 devices meeting the IEC-625 interface prescriptions (bit parallel, byte sequential) can be connected (CEMA IMR-2 corresponds to the IEC-625 prescriptions),

--one can also connect devices meeting the prescriptions of the IEEE-488 standard by means of a suitable cable (GPIB, HPIB). The functions realized are: SH1, AH1, L4, T6, SR1, C1, C2, C3, C4 and C9.

--permitted chained cable length, maximum of 20 meters.

Real Time Clock:

A built-in quartz controlled HW clock. Query and transmission can be broken down into seconds. Its services are:

--system data,

--precise time,

--waiting, and

--interrupting time intervals.

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GD 80: COMPUTER ASSISTED DEVICE FOR ENGINEERS

Budapest INFORMACIO ELEKTRONIKA in Hungarian No 5, 83 pp 253-256

[Article gy Gyorgy Szanto: "GD80: A Modern Domestic Device for Computer Aided Engineering-Technical Work;" received 13 Apr 83]

[Text] A brief description is given of a graphic display and computer family, an entirely domestic development, which can be used effectively in a number of areas of engineering work. The antecedents of the development and the goals set are covered and then the architecture and operation modes of the system are discussed. After describing the subfunctions some typical configurations are listed for solution of certain types of tasks.

Antecedents of the Development

The automation of entire processes of production is receiving an ever greater role in our constantly accelerating world, amidst external and internal economic conditions which are growing more difficult. Computer-aided design and manufacturing systems serve to accelerate every link of a complex process extending from designing to release of the product: the industry of today, and even more the modern industry of tomorrow, cannot be imagined without them.

A number of attempts have been made to solve this important task. Since the middle 1960's intensive work has been done in the MTA SZTAKI [Computer Technology and Automation Research Institute of the Hungarian Academy of Sciences], including a study of the automation of engineering work. Since the most efficient tool for computer-aided design, an interactive graphic display, could not be obtained from either domestic or socialist sources (at the time they were not manufactured anywhere here) and since capitalist import was impossible due to the embargo, the Institute set about to develop the first domestic graphic display.

The result of the developmental work was the device designated the GD'71, which was connected to a number of small computers (VT 1010B, TPA 70, KRS 4200, ESZ 1010) and tested with success in a number of applications areas not only in Hungary but in several socialist countries as well.

Taking into consideration the experiences gathered, in the course of manufacturing and using the Gd'71 and the new achievements in semiconductor technology in the meantime we began to design a new graphic display (family) which would satisfy various requirements of the several applications, satisfying most flexibly, with modern tools and methods, the possibilities of the customers.

Basic Goals

The first, and perhaps the most important, task was to create a device which could work independently or be connected to any background computer and work as a terminal of it. This was justified in part by the fact that many potential users already had some sort of computer and wanted to use the programs written for it or the experience gathered in the course of operating it in the event of use of a graphic display also. At the same time, others, who did not yet have such tools, wanted to get complete equipment capable of working independently.

At least as important was the goal of developing a system which could be expanded or modified in accordance with changing user needs so that they would have to purchase for any purpose only those subassemblies absolutely needed to carry out the tasks in the given case. In the event that the needs or possibilities of the customer expanded the services offered by the system could be expanded naturally by connecting new subassemblies or exchanging certain modules. This applies to graphic and other services and to hardware and software modules alike.

In accordance with modern principles we grouped the functions used in the course of interactive engineering-technical activity in such a way that we could provide them most efficiently. Thus we use different microprocessors to carry out sets of services differentiated on the basis of the speed or frequency of the several functions and the complexity of the tasks.

Last but not least we had to take into consideration during design the domestic manufacturing possibilities in regard to the technology used and the possibility of obtaining parts. Thus the crucial viewpoint in selection was to use parts which could be obtained from domestic sources or socialist import or which figure in manufacturing programs for the near future.

General Systems Architecture of the GD80

In order to satisfy the above listed goals or requirements we developed an architecture which is common for every member of the GD80 family. The general diagram of this (in the event of a maximum system) can be seen in the figure. The chief elements of the system are built around two collection buses operating with identical principles but serving different goals, the U1 and the U2 bus. The U1 bus serves data transmission between processors and central storage and information exchange among processors. The display of graphic information is realized with the aid of the U2 bus (without bothering traffic on the U1 bus).

The dual access central storage (DPMEM) can contain programs and related data for any processor in addition to the picture description. The read only memory (UPROM) connected to the U1 bus serves to store the basic system and test programs.

A GPC containing an Intel 8080A microcomputer handles the conversational input devices for the graphic display (alphanumeric and functional keyboard, positioning knob, joystick, potentiometers, control panel, etc.) via a graphic peripheral bus (GPIB). Its own storage (maximum 15 K bytes RAM and 46 K bytes EPROM) can be connected to the internal bus of the GPC (MIPROBUS), as well as control units to drive the peripherals (P104 punch tape I/O, graphic device and line printer, FDC 3200 floppy disk unit, ESZ 5017 magnetic tape unit, etc.) and an arithmetic processor (APU) to carry out floating point operation.

The HIF for communication with an external computer is a processor of identical construction. In general its architecture is more limited; indeed, the GPC can take over the functions assigned to it. In general, data transmission takes place with standard CCITT V24 (EIA RS 232-C) interface signals (maximum 9,600 Baud), but communication faster than this is possible with the aid of a coaxial cable fitting (2652).

Carrying out the tasks connected with picture refresh (evaluating the picture program, controlling thepicture generating units, carryint out certain limited arithmetic operations) and handling the light pen require substantially greater speeds than can be obtained with the above processors. Thus we carry out these tasks with a fast horizontally microprogrammed processor (DCU) based on bipolar bit sliced microprocessors (Am 2900 family). The DCU microprogram handles the 16 bit arithmetic unit (16 accumulator, 256 word fast register store) and the picture drawing units as peripherals.

The members of the GD80 family now being sold are of the vector drawing type. The vector generator can operate on the digital or analog principle, with a resolution of 1024 x 1024 or 4096 x 4096 points. Four types of line, four colors and at most 16 intensits levels are possible: the values of these can be set by instructions in thepicture program.

The character generator can be of two types also, raster or vector. The basic character set is 128 ASCII characters (the control characters also have a graphic version), which can be expanded by 128 optional (RAM) characters which can be programmed during operation and an additional 3 x 128 fixed programmable (PROM) characters. Special services are: 4 character sizes, 4 step distances, 4 writing directions, tilt, 90 degree turn, size which can be reduced in 1/16 steps as compared to the base size, upper and lower index, etc.

The GD80 Display Processor (DPU) serves to run applications programs. The architecture of the DPU is similar to DCU, but with a different microprogram and different peripherals. In the present versions the microprogram makes possible execution of the instruction sets of the TPA 70 or the TPA 11/40. The microprogram of the DPU treats as peripherals the magnetic disk background storage (5 M byte exchangeable disks such as the IZOT SZM 5400, CDC 9427H, DRI 4043, etc. or the IZOT ESZ 5061 with an actual capacity of 20 M bytes) and the microprogrammed Transformation Processor (TPU). The latter is a unit serving swift execution of floating point arithmetic instructions and graphic (picture) transformations, which also uses bit sliced elements. By using it picture modifying operations can be carried out very quickly, in most cases with real time speed.

In the line drawing (random scan) mode the graphic unit displays text and line drawings. The display is made in two sizes and with three types of phosphor coatings. The small screen device can be obtained with a 20 x 25 centimeter squared screen with a P31 green phosphor coating. The screen of the larger device is round with a diameter of 50 centimeters; the phosphor types which can be chosen are P31 short after illumination green, P39 medium long after illumination yellow-green and a P49 penetration type coating capable of displaying information in two basic colors (green and red) and two intermediate colors (yellow and orange).

Basic Configurations

Thanks to the modularity expandable architecture the members of the GD80 family can satisfy very many types of user needs. Four basic configurations and a wide variety of optional units which can be added serve to satisfy the concrete requirements.

The simplest member of the family is the GD80 BT, a simple graphic terminal. When it is used the user programs run on a background computer; the picture produced as a result of the calculations goes to the graphic terminal with the aid of a graphic protocol. In addition to storing and displaying the picture the simple terminal handles the interactive graphic peripherals. Asynchronous communication corresponding to the line algorithm takes place through a standard EIA RS 232-C surface, which in the simplest case can be done by a peripheral handling processor (GPC). In a more complex case one can use a special communications processor (HIF) for this purpose. The optional units are: a parallel connecting unit for connecting 4 character type peripherals (P104) and a floating point arithmetic unit (APU).

The GD80 SGS satellite graphic system is the member in the GD80 family with the largest architecture. It can contain all the units listed in the foregoing and is suitable for running a significant part of the user programs. Use of a background computer is needed primarily to handle large data bases and to carry out tasks requiring a great deal of computation (for example calculations with the method of finite elements). The transmission of general information is possible via the fully bi-directional data transmission channel; thus both programs and data can be accessed. Thanks to the communications processor (HIF) interpreting and controlling execution of the graphic protocol both synchronous and asynchronous data transmission are possible. The DPU-TPU processor pair make possible conversion of high level geometric models into a linear graphic program, effective execution of operations and swift display of them. In addition to using background storage (magnetic disk and magnetic tape) one can connect to the system graphic and traditional peripherals (punch card, punch tape, line printer, etc.).

The GD80 GC is an intelligent desk computer which is capable of various graphic services. In this system the GPC handles the peripherals and the tasks connected with graphics and offers the possibility of high level program development. The arithmetic processor (APU) option significantly accelerates execution of floating point and trigonometric calculations. The background storage of the system is a dual floppy disk store on which one can run a user operating system.

The GD80 AGS configuration is a version of the SGS system intended for completely independent operation; thus it lacks the subassemblies connected with communications. In regard to the possibilities for its use it is capable of carrying out tasks a good bit more complex than on the GC, but it lacks the services offered by a directly connected background computer.

Software

Many-sided use of every member of the GD80 family is supported by a software system of modular construction similar to the hardware. The basis for the graphic software is the GSS80 line drawing subroutine package, which follows current international graphics standards in structure and in its services. The version running in the smaller configurations is the MGSS80 while a separate HOST GSS80 can be used when a background computer is used; this prepares data for display on the GD80 in a form corresponding to the graphic protocol. It can handle the data of the user pictures in two and three dimensions, in full and floating point form; the various transformations on them are performed before display. These services can be used under any single user operating system in a similar way, even on a configuration with background storage. The operating system contains an efficient file handling system, makes possible interactive text editing and supports the development of user programs in many ways. The graphic services can be obtained in a similar way in all programming languages. The programming languages which can be used in the larger configurations are FORTRAN and GESAL (a system programming language) and the BASIC and Assembly which can be used on the smaller machines also. It serves better utility of the terminal types that a number of background machines can be programmed with the GESAL system programming language (IBM 3031, TPA 11/40, CDC 3300, TPA 70, ESZ 1010) and one can generate code on these machines which can be run on the graphic terminal also.

Application Areas

In conclusion let us list a few application areas in which one or another member of the GD80 graphic display family could be an efficient tool in the swift solution of problems arising. Naturally we do not strive here for completeness but will talke primarily about uses where certain concrete efforts are being made to use the GD80 already.

Electronics:

--designing and checking the wiring of printed circuit cards;

--designing masks for integrated circuits;

--design and analysis of ladder networks.

Machine industry:

--graphic checking of the working program of NC machine tools;

--tool design for rotation symmetric parts;

--solving design and scale problems for press machines;

--interactive design of free form surfaces and control of NC working;

--designing casting and press tools.

Process control:

--study of flow and pressure relationships of pipelines;

--process simulation.

Traffic control:

--air traffic and flight simulator for training air traffic controllers.

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INSTITUTE ACHIEVEMENTS IN MAN-MACHINE RELATIONS

Budapest INFORMACIO ELEKTRONIKA in Hungarian No 5, 83 pp 257-261, manuscript received 10 Jan 82 [as published], based on a talk given in Paris 27 Sep 82 at the Hungarian Technical Documentation Center

DENES, Jozsef, Dr, Computer Technology Coordination Institute

[Abstract] In the future computer technology will become a public utility requiring no special expertise from the user. In preparation for this the SZKI [Computer Technology Coordination Institute] is engaged in development of equipment, programs and systems. Small computers and microcomputers of Hungarian manufacture are being equipped with picture and sound I/O devices. A Color Display Processor (CDP) is part of a microcomputer system which includes digitized sound I/O equipment. Programming, in the Assembly language, now runs to several hundred thousand lines, making use of a TPA 11/40 central unit with 256 K bytes of operational memory. Program packages prepared for the small computer picture processing system include one for the National Meteorological Service and another for the Urban Construction Science and Planning Institute to automate the preparation of maps. The meteorological programs were described at the COSPAR conference in Budapest 2-14 June 1980. These use data from the TIROS and METEOSAT satellites. Another device prepared at the SZKI uses a TV camera to control a conveyor belt; the computer can recognize symbols on the packages, reporting on them to the operator in a human voice. The COGRAPH and IMAGE systems are for independent use of the CDP. COGRAPH is a program package used to generate and color simple pictures. The IMAGE program package (the new version is called KEP-IR) handles all the most frequently occurring picture processing tasks. Two medical applications have been developed also, to facilitate evaluation of X-rays and to prepare thermographic analysis pictures. The CDP has been used to generate displays in different alphabets (e.g., Hindi) and to evaluate meteorological radar pictures. The CDP could be used for nondestructive testing of materials, for computer-aided design of circuits and to prepare animated films. The COMPVOX program (Hungarian, Russian, French, English and Vietnamese versions have been prepared) permits the querying of a large computer data bank from any pushbutton telephone, the answers being given in voice. The SZKI has also prepared a music processing program, MIXONG. To facilitate remote access to central processing equipment the SZKI has developed a data compression process which has been patented in six countries (Hungary, GDR, USA, FRG, France and England). Figure 6, references 13.

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BRIEFS

ARMED FORCES AWARD FOR COMPUTER SPECIALISTS--At the recommendation of REVA [Rendszerszervezesi, Vezetesgepesitesi es Automatizalasi Szolgalat, Systems Designing, Control Mechanization and Automation Service], the Ministry of Defense has awarded the Medal of Merit for Service to the Homeland, gold degree, to Sandor Farago, deputy managing director of SZAMALK [Computer Technology Applications Center]; Laszlo Pal, main department head of the OMFB [National Technical Development Committee] and Gyorgy Paris, director of the Institute of Science Organization and Information [Tudomanyszervezesi es Informatikai Intezet] in recognition of their long and successful work in promoting the applications of computer technology in the Hungarian People's Army. The awards were made on the occasion of Armed Forces Day. [Text] [Budapest DZAMITASTECHNIKA in Hungarian Oct 83 p 2]

CSO: 2502/25

BRIEFS

NEW LABORATORY PROCESS, REACTOR--Recently, workers in the Institute for Chemical and Biochemical Energetics in the ICECHIM [Institute for Chemical Research] perfected a laboratory process for the production of peroxidase and the first quantities intended for highly-purified peroxidase tests have been obtained. Also, a biological reactor with a high performance level has been devised and put into operation. Completely automated and suitable for coupling with an electronic computer of the FELIX-M C family, the reactor is intended for experimenting with and devising a pilot process for biosynthesis technologies for obtaining enzymes, enzymatic preparations, etc. Achieving great savings in hard currency, the biological reactor, the second model of which has been produced, provides researchers in the field with an extremely useful work tool. [Text] [Bucharest REVISTA DE CHIMIE in Romanian Oct 83 p 872]

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