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NATIONAL µSPEC 6

MICROPROGRAM DEVELOPMENT SYSTEM (MDS)

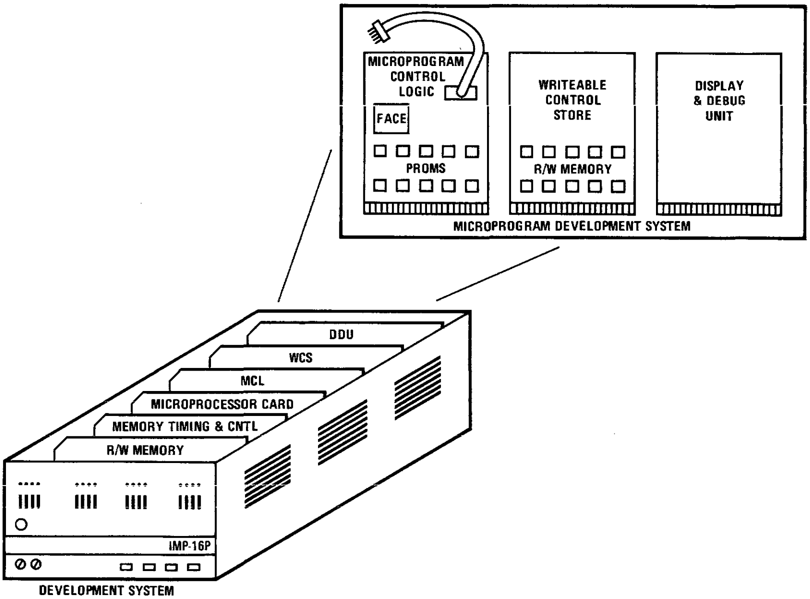

Figure 1. Microprogram Development System, as it would be used with a Development System during Microprogram Development.

FEATURES

- THREE-DIMENSIONAL FLEXIBILITY – extend the basic instruction set, modify the basic instruction set, or generate a whole new set of instructions – with MDS, the choice is yours.
- SUPER EFFICIENCY AT LOW COST – customized data management means better hardware utilization, higher throughput, and an optimum work-versus-effort ratio.
- ALL-PURPOSE ADAPTABILITY – with an MDS, you can forget about expensive add-ons, additional-cost options, and that old bugaboo "obsolescence." Simply customize your general-purpose microprocessor system and go about doing your job – efficiently, economically, and reliably.

INTRODUCTION

No doubt, you are familiar with the family of general-purpose controller-processors designed and manufactured by National Semiconductor. You probably know the basic building blocks of these microprocessors can be assembled to yield anything from a simple 4-bit controller/processor to a powerful 32-bit computer system. But, maybe you don't know the best part of all – that, with an MDS (Microprogram Development System), you, the user, can custom-design the software and we, at National Semiconductor, will custom-design the hardware to fit.

The basic microprocessor system is built around two chips, one to do the "muscle" work (RALU – Register and Arithmetic Logic Unit) and the other to do the "brain" work (CROM – Control and Read Only Memory). As with most think-and-do relationships, the work efficiency is largely determined by the part that does the thinking. The microprocessor is no different – the data flow between various elements of the system is controlled by the microprogram (basic instruction set) residing in CROM. For many applications, the basic "CROM-brain" is more than adequate; however, for those jobs that require optimum efficiency in data movement, memory storage, and calculating speed, a custom-designed CROM is desirable and, with MDS, it is economically feasible. So if your application requires a *custom* model, don't settle for less – GET AN MDS.

B15M65/Printed in U.S.A.

TECHNICAL DESCRIPTION

Although the Microprogram Development System consists of the Microprogram Control Logic, the Writable Control Store, and the Display/Debug Unit, the heart of the system is a Field-Alterable Control Element (FACE). The FACE chip, located on the MCL board, works with ROM or Read/Write memory and replaces CROM during the development phase of the microprogram.

With the CROM removed and the MCL board cable connected to the empty socket, the RALUs and other processor elements communicate with the FACE in exactly the same way they previously communicated with the CROM. However, now the user can substitute his own microcode (in PROMs) for the standard microcode residing in the CROM. Typical data flow within FACE and functional interface with the outside world is shown in Figure 2.

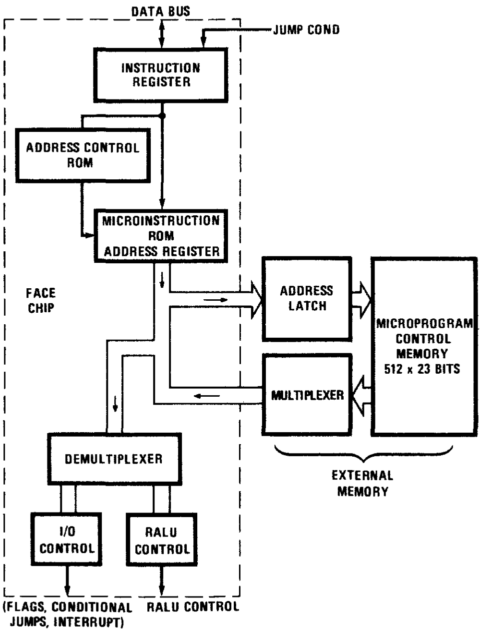

Figure 2. FACE in the Microprogram Development System (FACE is Cable-Connected to a Standard CROM Socket)

Just as the MCL board contains 512-by-23 bits of bipolar PROM memory, the WCS board contains a read/write memory of the same capacity in which the user microcode is written. The microcode is inputted with symbolic language, assembled with a micro-assembler, and loaded via control flags from main memory into the WCS read/write memory. The WCS now becomes the Microprogram Control Memory to which control is transferred so that the new microinstructions can be executed and debugged. During the debugging process, the microcode can easily be altered until a high level of confidence is reached. It can then be transferred to PROM for final evaluation – with the microcode in the MCL/PROM, real-time production runs can be made before the new code is committed to a CROM mask.

The DDU board permits the user to observe and interact with his new microcode – stepping through and displaying each microinstruction to debug the code. In conjunction with the MCL and WCS boards, the DDU provides a debug capability not unlike that used by assembly language programmers to debug software.

SPECIFICATIONS:

- Interface Characteristics:
  - Power – from card cage of development system
  - Timing and Control – via cable from empty CROM socket
  - WCS Flags – one for data and one for clock to load the read/write memory; one user jump condition to read memory
- Input Power:
  - MCL – +5 V at 1.5 A; -12 V at 100 mA (typical)
  - WCS – +5 V at 5.5 A (typical)
  - DDU – +5 V at 3 A (typical)
- Input Connector: 144-pin/0.125-inch pin spacing (each of three cards)
- Temperature:
  - Operating – 0°C to +50°C
  - Storage – -20°C to +125°C
- Humidity: 90% maximum (without condensation)
- Dimensions:
  - MCL and WCS Cards – 8½ inches high by 11 inches long
  - DDU Card – 12½ inches high by 11 inches long
- Shipping Weight: Approximately 5 pounds

ORDERING INFORMATION

To expedite delivery of your Microprogram Development System, order Part Number IMP-16P/803B.

For further information on this product, contact the nearest National Semiconductor Sales/Service Representative or communicate directly with our World Headquarters:

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