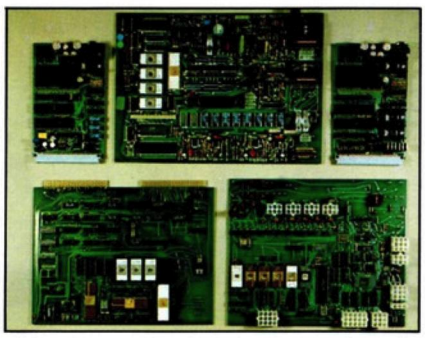
Microcomputers with the Industrial Connection...

Standard Modules

Integrated Systems



Custom Controllers

...YOUR KEY TO THE FUTURE !

DAI THE MICROCOMPUTER COMPANY

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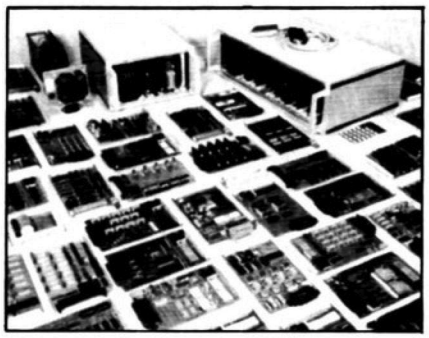
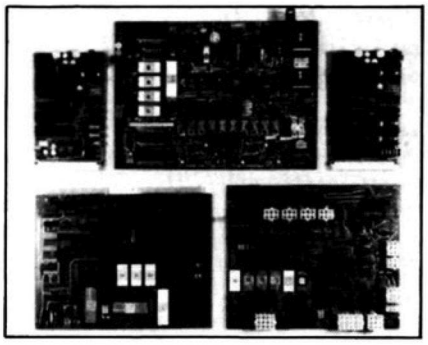


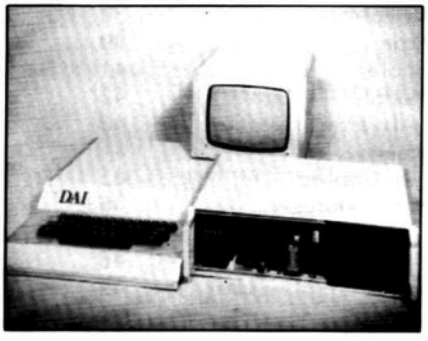
Standard Modules

The design of a special microcomputer for a particular application is completely uneconomic in small volumes. To enable economic usage of microprocessors in low volumes, DAI manufactures a complete family of standard microcomputer, interface and packaging modules. They provide a wide range of measuring, monitoring, controlling and data processing functions. With these easy-to-use building blocks a user can assemble complete operational systems in a short time. The benefits of the initial learning curve and experience is carried through to many successive applications. These pre-engineered and tested products are available off-the-shelf from DAI's world-wide distribution network. DAI Standard Modules provide the ideal set of hardware building blocks for almost any system.



Custom Controllers

Designing a special microcomputer dedicated to a particular task becomes economical in larger production volumes. DAI Custom Controllers satisfy this need. They combine all the components necessary for a specific application on a single printed-circuit card. DAI accepts complete design and engineering responsibility to deliver a programmed, assembled and tested Custom Controller performing to user specifications. A full-function automatic tester is built for each application. This minimizes card testing costs during production and subsequent field operation. System maintenance becomes a simple matter of exchanging a card, requiring no special skills. DAI Custom Controllers enable every OEM to apply microprocessors with no involvement in their technology.



Integrated Systems

DAI Integrated Systems bring the benefits of micro-processors within reach of every application. They combine standard hardware modules into fully operational systems. DAI accepts total design and engineering responsibility to deliver complete turn-key systems performing to user specifications. These are based on DAI Standard Modules, and therefore require no special development effort. System maintenance becomes a simple task of exchanging modules. The availability of these standard modules off-the-shelf from DAI's world-wide distribution network ensures local supplies of replace-ments. DAI Integrated Systems enable every user to benefit from the competitive advantages microprocessors can bring to their systems and products, without any involvement in their technology.

Table of Contents

DCE Microcomputer Family

INTRODUCTION

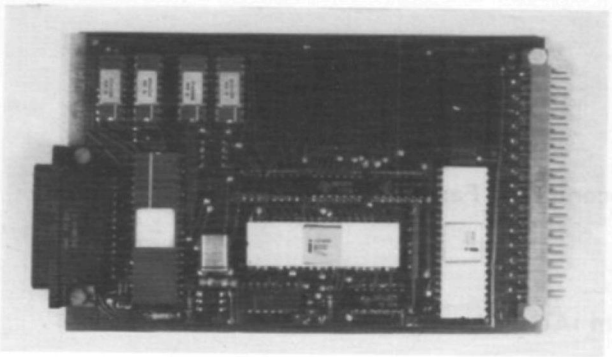
The DCE Microcomputer family provides total hardware capability to measure, monitor, control and process almost every parameter in the Real-World. These standard modules in single eurocard format include microcomputers, memory expansion cards, industrial interfaces and packaging modules. Every engineer can use these hardware building blocks to implement operational systems with minimum involvement in microprocessor technology. Even new-comers to digital computer and programming concepts can learn all the necessary design skills by attending a DAI microcomputer workshop. The benefits of the initial learning curve and operational experience are carried through to many successive applications.

A typical development cycle begins with the system definition. The problem has to be stated in terms of inputs, outputs and operational characteristics. These include the format, timing and limits of input and output parameters, the accuracy and the execution times of processes etc. The user then selects a microcomputer card, suitable interface modules to match his input/output requirements, slots them into a standard wired rack with a power-supply module, and the hardware is ready. It is then necessary to write a software program to characterize this general purpose hardware configuration to do the particular dedicated function. A large number of development assistance modules and programming languages are available for this task. In most industrial applications where the execution times and memory requirements are not critical, a high-level programming language such as DAI Industrial BASIC can minimize the software costs. Assembly language with its direct control of memory usage and execution time provides the high performance necessary for complex applications. At the end of the software development phase, the final program is transferred onto read-only EPROM memory, and the system becomes operational.

DCE MICROCOMPUTER MODULES

DCE microcomputers are programmable Digital Control Elements complete with program and data memories, serial and parallel data I/O lines, interval timers and interrupt processing capability. Some versions can be connected to several memory expansion modules via a flat-cable X-BUS connection, to provide upto 60K of memory in any EPROM/RAM combination. DCE microcomputers can control Real-World interface modules via the DCE-BUS. All DAI euroboxes and euroracks contain the parallel-wired DCE-BUS, and the modules can be inserted in any position. The Real-World interfaces provide the link between the digital computing power of the DCE microcomputer and the external world.

The manner of realization of the DCE-BUS ensures that it is not directly connected to the data, address and control lines of the DCE microcomputer CPU. The X-BUS flat-cable connection between the DCE microcomputer and memory expansion modules is kept physically separate from the DCE-BUS. This implementation philosophy of isolating the DCE microcomputer CPU from the external connections provides a safeguard against the danger of CPU malfunction resulting from the failure of an interface. If such a failure occurs, diagnostic routines included in the software can take preventive action against a total system failure. The DCE-BUS architecture thus ensures reliable system performance even under hazardous conditions.



8080 Digital Control Element

DCE-1

FEATURES:

Complete 8080 microcomputer system on a single 100 x 160 mm eurocard.

4K or 8K byte EPROM space and 512 byte RAM.

Opto-isolated serial I/O with programmable baud rates (110-9600 baud).

5 independent interval timers with 64 microsecond resolution and crystal accuracy.

2 external interrupt request lines.

8 independently vectored interrupts.

8-bit interrupt mask register.

8-bit parallel input port and output port.

3 8-bit parallel ports programmable for normal, handshake or bi-directional I/O.

Memory-mapped I/O architecture.

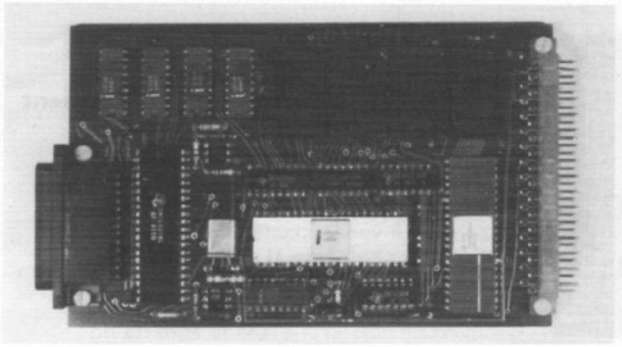
Complete range of compatible Real-World interface and packaging modules.

FUNCTIONAL DESCRIPTION:

The DCE-1 is a complete microcomputer system on a single eurocard. It provides the digital computing power of the industry-standard 8080 microprocessor, enhanced by program and data memories, fully implemented serial and parallel data I/O channels, hardware interval timers and vectored interrupts. The opto-isolated asynchronous serial data channel functions independently of the CPU, and can be interrupt driven. A wide range of ICB interface cables are available to connect any standard terminal directly to the DCE serial data channel. The 8-bit hardware timers can be combined with software counters to generate any desired time interval with crystal accuracy. The interrupt control functions enable the 8 CPU interrupt requests to be processed in vectored or polled modes. Undesired interrupts can be individually masked out via the interrupt mask register. The programmable parallel ports can be software defined for handshake operation, with automatic generation of handshake control signals. They can also be used to implement the DCE-BUS, which provides a simple interface to the family of RWC Real-World interface modules. The DCE-1 is compatible with other DCE microcomputers, and provides a standard hardware and software interface to the family of DAI Standard Modules. Each DCE-1 is fully tested, burned-in, and supported by comprehensive documentation and software.

ORDERING INFORMATION:

DCE-1	: Standard version with 4K EPROM space (4 x 2708).
DCE-1/8S	: DCE-1 with socket-mounted CPU.
DCE-1A	: Standard version with 8K EPROM space (4 x 2716).
DCE-1A/8S	: DCE-1A with socket-mounted CPU.



8080 Digital Control Element

DCE-2

FEATURES:

Complete 8080 microcomputer system on a single 100 x 160 mm eurocard.

4K or 8K byte EPROM space and 2K byte RAM.

Opto-isolated serial I/O with programmable baud rates (110-9600 baud).

5 independent interval timers with 64 microsecond resolution and crystal accuracy.

2 external interrupt request lines.

8 independently vectored interrupts.

8-bit interrupt mask register.

8-bit parallel input port and output port.

3 8-bit parallel ports programmable for normal, handshake or bi-directional I/O.

Memory-mapped I/O architecture.

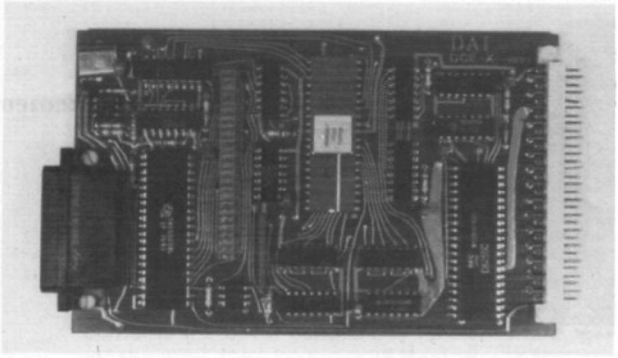
Complete range of compatible Real-World interface and packaging modules.

FUNCTIONAL DESCRIPTION:

The DCE-2 is a complete microcomputer system on a single eurocard. It provides the digital computing power of the industry-standard 8080 microprocessor, enhanced by program and data memories, fully implemented serial and parallel data I/O channels, hardware interval timers and vectored interrupts. The opto-isolated asynchronous serial data channel functions independently of the CPU, and can be interrupt driven. A wide range of ICB interface cables are available to connect any standard terminal directly to the DCE serial data channel. The 8-bit hardware timers can be combined with software counters to generate any desired time interval with crystal accuracy. The interrupt control functions enable the 8 CPU interrupt requests to be processed in vectored or polled modes. Undesired interrupts can be individually masked out via the interrupt mask register. The programmable parallel ports can be software defined for handshake operation, with automatic generation of handshake control signals. They can also be used to implement the DCE-BUS, which provides a simple interface to the family of RWC Real-World interface modules. The DCE-2 is compatible with other DCE microcomputers, and provides a standard hardware and software interface to the family of DAI Standard Modules. Each DCE-2 is fully tested, burned-in, and supported by comprehensive documentation and software.

ORDERING INFORMATION:

DCE-2	: Standard version with 4K EPROM space (4 x 2708).
DCE-2/8S	: DCE-2 with socket-mounted CPU.
DCE-2A	: Standard version with 8K EPROM space (4 x 2716).
DCE-2A/8S	: DCE-2A with socket-mounted CPU.



8080 Digital Control Element

DCE-X

FEATURES:

Memory expandable 8080 microcomputer system on a single 100 x 160 mm eurocard.

Hardware, software and pin compatible with DCE-1, 1A, 2, 2A microcomputers.

Memory expandable upto 60K bytes via MX- memory cards.

Flat-cable X-BUS connection supports 1 to 8 MX- memory expansion cards.

Opto-isolated serial I/O with programmable baud rates (110-9600 baud).

5 independent interval timers and 2 external interrupt lines.

8 independently vectored interrupts and an interrupt mask register.

8-bit parallel input port and output port.

3 8-bit parallel ports programmable for normal, handshake or bi-directional I/O.

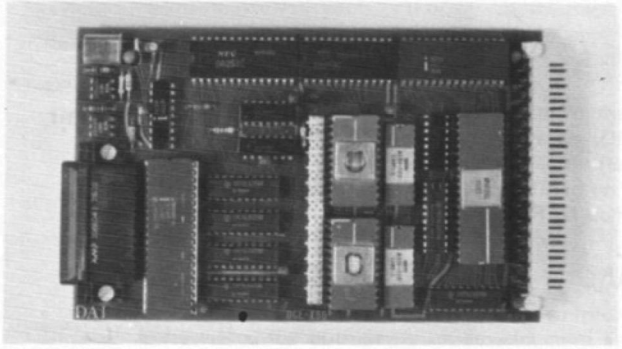
Complete range of compatible Real-World interface and packaging modules.

FUNCTIONAL DESCRIPTION:

The DCE-X is a complete microcomputer system on a single eurocard, with memory expansion capability. It is fully upward compatible with DCE-1, 1A, 2, 2A microcomputers, and has all their features plus memory expansion capability. No memory is provided on the DCE-X. Upto eight MX- memory expansion cards can be directly connected to the DCE-X via the flat-cable X-BUS connector to provide upto 60K bytes of memory in any EPROM/RAM combination. The opto-isolated asynchronous serial data channel functions independently of the CPU, and can be interrupt driven. A wide range of ICB interface cables are available to connect any standard terminal directly to the DCE serial data channel. The 8-bit hardware timers can be combined with software counters to generate any desired time interval with 64 microsecond resolution and crystal accuracy. The interrupt control functions enable the 8 CPU interrupt requests to be processed in vectored or polled modes. Undesired interrupts can be individually masked out via the 8-bit interrupt mask register. The programmable parallel ports can be software defined for handshake operation, with automatic generation of handshake control signals. They can also be used to implement the DCE-BUS, which provides a simple interface to the family of RWC Real-World interface modules. The DCE-X is compatible with other DCE microcomputers, and provides a standard hardware and software interface to the family of DAI Standard Modules. Each DCE-X is fully tested, burned-in, and supported by comprehensive documentation and software.

ORDERING INFORMATION:

DCE-X	: Standard version.
DCE-X/8S	: DCE-X with socket-mounted CPU.
X-BUS(n)	: The flat-cable X-BUS connection between DCE-X and 'n' (1 to 8) MX- memory expansion modules must be ordered separately.



8086 Digital Control Element

DCE-X86

FEATURES:

Complete 16-bit 8086 microcomputer system on a single 100 x 160 mm eurocard.

Instructions to manipulate 8 and 16-bit words with hardware multiply and divide.

1K x 16 RAM memory and 2K or 4K x 16 EPROM space, expandable up to 64K x 16 via flat-cable X-BUS connection to MX- memory expansion modules.

Opto-isolated serial I/O channel for synchronous and asynchronous communication, with software programmable baud rates (45-9600 baud).

2 programmable 16-bit timer/counters with 500 ns resolution and crystal accuracy.

8 vectored interrupts, programmable for polled, fixed or rotating priority modes.

3 external interrupt request lines.

3 8-bit parallel ports programmable for normal, handshake or bi-directional I/O.

Complete range of compatible Real-World interface and packaging modules.

FUNCTIONAL DESCRIPTION.

The DCE-X86 is a complete 16-bit microcomputer system on a single eurocard. It provides the digital computing power of the 16-bit 8086 microprocessor, enhanced by program and data memories, serial and parallel data I/O channels,hardware interval timers and vectored interrupts. The opto-isolated full duplex serial data channel functions independently of the CPU, and can be interrupt driven. It can be software defined for synchronous or asynchronous modes with programmable baud rates from 45 to 9600, and supports almost every serial communication protocol including IBM Bi-Sync. The flat-cable X-BUS connection enables memory expansion upto 64K x 16 words, via the 16-bit compatible MX- memory expansion modules. The 8 maskable and priority encoded interrupt vectors can be programmed for polled, fixed or rotating priority modes. 3 interrupt signals are available externally, The 16-bit hardware timer/counters give a resolution of 500 ns with crystal accuracy. The programmable parallel ports can be software defined for simple or handshake operation, with automatic generation of hand-shake control signals. They can also be used to implement the DCE-BUS, which provides a standard 8-bit hardware and software interface to the family of RWC Real-World inter-face modules. The DCE-X86 is fully tested, burned-in, and supported by comprehensive documentation.

ORDERING INFORMATION:

DCE-X86	: Standard version with 2K x 16 EPROM space (2 x 2716).
DCE-X86/S	: DCE-X86 with socket-mounted CPU.
DCE-X86A	: Standard version with 4K x 16 EPROM space (2 x 2732).
DCE-X86A/S	: DCE-X86A with socket-mounted CPU.
X-BUS(n)	: The flat-cable X-BUS connection to 'n' (1 to 8) 16-bit compatible MX- memory expansion modules must be ordered separately.

Available second quarter 1980.

DCE-X88

FEATURES:

Complete 8088 microcomputer system on a single 100 x 160 mm eurocard.

Instructions to manipulate 8 and 16-bit words with hardware multiply and divide.

2K byte RAM memory and 4K or 8K byte EPROM space, expandable up to 60K via flat-cable X-BUS connection to MX- memory expansion modules.

Opto-isolated serial I/O channel for synchronous and asynchronous communication, with software programmable baud rates (45-9600 baud).

2 programmable 16-bit timer/counters with 500 ns resolution and crystal accuracy.

8 vectored interrupts, programmable for polled, fixed or rotating priority modes.

3 external interrupt request lines.

3 8-bit parallel ports programmable for normal, handshake or bi-directional I/O.

Complete range of compatible Real-World interface and packaging modules.

FUNCTIONAL DESCRIPTION:

The DCE-X88 is a complete microcomputer system on a single eurocard. It provides the digital computing power of the 8-bit 8088 microprocessor, enhanced by program and data memories, serial and parallel data I/O channels, hardware interval timers and vectored interrupts. The opto-isolated full duplex serial data channel functions independently of the CPU, and can be interrupt driven. It can be software defined for synchronous or asynchronous modes with programmable baud rates from 45 to 9600, and supports almost every serial communication protocol including IBM Bi-Sync. The flat-cable X-BUS connection enables memory expansion upto 60K, via the MX- memory expansion modules. The 8 maskable and priority encoded interrupt vectors can be programmed for polled, fixed or rotating priority modes. 3 interrupt signals are available externally. The 16-bit hardware timer/counters give a resolution of 500 ns with crystal accuracy. The programmable parallel ports can be software defined for simple or handshake operation, with automatic generation of handshake control signals. They can also be used to implement the DCE-BUS, which provides a standard hardware and software interface to the family of RWC Real-World interface modules. The DCE-X88 is fully tested, burned-in, and supported by comprehensive documentation.

ORDERING INFORMATION:

DCE-X88	: Standard version with 4K EPROM space (2 x 2716).
DCE-X88/S	: DCE-X88 with socket-mounted CPU.
DCE-X88A	: Standard version with 8K EPROM space (2 x 2732).
DCE-X88A/S	: DCE-X88A with socket-mounted CPU.
X-BUS(n)	: The flat-cable X-BUS connection to 'n' (1 to 8) MX- memory expansion modules must be ordered separately.

Available second quarter 1980.

DCE-M68

FEATURES:

Complete M6808 microcomputer system on a single 100 x 160 mm eurocard.

2K byte RAM memory and 4K or 8K byte EPROM space, expandable up to 60K via flat-cable X-BUS connection to MX- memory expansion modules.

Opto-isolated serial I/O channel for synchronous and asynchronous communication, with software programmable baud rates (45-9600 baud).

2 programmable 16-bit timer/counters with 500 ns resolution and crystal accuracy.

8 vectored interrupts, programmable for polled, fixed or rotating priority modes.

3 external interrupt request lines.

3 8-bit parallel ports programmable for normal, handshake or bi-directional I/O.

Complete range of compatible Real-World interface and packaging modules.

FUNCTIONAL DESCRIPTION:

The DCE-M68 is a complete microcomputer system on a single eurocard. It provides the digital computing power of the M6808 microprocessor, enhanced by program and data memories, serial and parallel data I/O channels, hardware interval timers and vectored interrupts. The opto-isolated full duplex serial data channel functions independently of the CPU, and can be interrupt driven. It can be software defined for synchronous or asynchronous modes with programmable baud rates from 45 to 9600, and supports almost every serial communication protocol including IBM Bi-Sync. The flat-cable X-BUS connection enables memory expansion upto 60K, via the MX- memory expansion modules. The 8 maskable and priority encoded interrupt vectors can be programmed for polled, fixed or rotating priority modes. 3 interrupt signals are available externally. The 16-bit hardware timer/counters give a resolution of 500 ns with crystal accuracy. The programmable parallel ports can be software defined for simple or handshake operation, with automatic generation of handshake control signals. They can also be used to implement the DCE-BUS, which provides a standard hardware and software interface to the family of RWC Real-World interface modules. The DCE-M68 is fully tested, burned-in, and supported by comprehensive documentation.

ORDERING INFORMATION:

DCE-M68	: Standard version with 4K EPROM space (2 x 2716).
DCE-M68/S	: DCE-M68 with socket-mounted CPU.
DCE-M68A	: Standard version with 8K EPROM space (2 x 2732).
DCEM68A/S	: DCE-M68A with socket-mounted CPU.
X-BUS(n)	: The flat-cable X-BUS connection to 'n' (1 to 8) MX- memory expansion modules must be ordered separately.

Available second quarter 1980. **DCE-Z80**

FEATURES:

Complete Z80 microcomputer system on a single 100 x 160 mm eurocard.

2K byte RAM memory and 4K or 8K byte EPROM space, expandable up to 60K via flat-cable X-BUS connection to MX- memory expansion modules.

Opto-isolated serial I/O channel for synchronous and asynchronous communication, with software programmable baud rates (45-9600 baud).

2 programmable 16-bit timer/counters with 500 ns resolution and crystal accuracy.

8 vectored interrupts, programmable for polled, fixed or rotating priority modes.

3 external interrupt request lines.

3 8-bit parallel ports programmable for normal, handshake or bi-directional I/O.

Complete range of compatible Real-World interface and packaging modules.

FUNCTIONAL DESCRIPTION:

The DCE-Z80 is a complete microcomputer system on a single eurocard. It provides the digital computing power of the Z80 microprocessor, enhanced by program and data memories, serial and parallel data I/O channels, hardware interval timers and vectored interrupts. The opto-isolated full duplex serial data channel functions independently of the CPU, and can be interrupt driven. It can be software defined for synchronous or asynchronous modes with programmable baud rates from 45 to 9600, and supports almost every serial communication protocol including IBM Bi-Sync. The flat-cable X-BUS connection enables memory expansion upto 60K, via the MX- memory expansion modules. The 8 maskable and priority encoded interrupt vectors can be programmed for polled, fixed or rotating priority modes. 3 interrupt signals are available externally. The 16-bit hardware timer/counters give a resolution of 500 ns with crystal accuracy. The programmable parallel ports can be software defined for simple or handshake operation, with automatic generation of handshake control signals. They can also be used to implement the DCE-BUS, which provides a standard hardware and software interface to the family of RWC Real-World interface modules. The DCE-Z80 is fully tested, burned-in, and supported by comprehensive documentation.

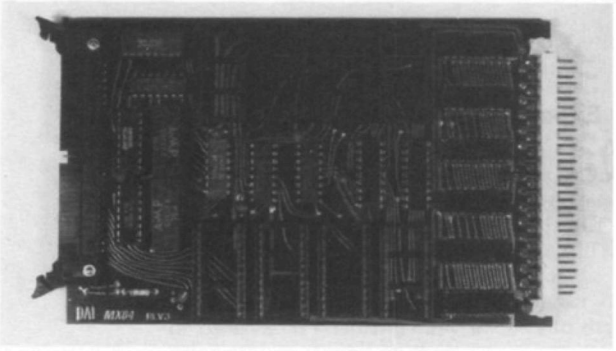
ORDERING INFORMATION:

DCE-Z80	: Standard version with 4K EPROM space (2 x 2716).
DCE-Z80/X	: DCE-Z80 with socket-mounted CPU.
DCE-Z80A	: Standard version with 8K EPROM space (2 x 2732).
DCE-Z80A/S	: DCE-Z80A with socket-mounted CPU.
X-BUS(n)	: The flat-cable X-BUS connection to 'n' (1 to 8) MX- memory expansion modules must be ordered separately.

Memory Expansion Modules

Some versions of DCE microcomputers are provided with a 50-pin flat-cable connector for memory expansion. Upto eight memory modules can be directly connected to these DCE microcomputers via the flat-cable X-BUS. They provide 8-bit word memory expansion up to 60K in any EPROM/RAM combination. When the DCE-LSA Large-System Adaptor module is used, it forms an intermediate stage between the DCE microcomputer and the memory modules. The DCE-BUS connector on the modules does not carry any data or control signals, and is used for power only. Separate base address select switches for the memory banks allow them to occupy different locations in DCE microcomputer memory address space.

Some of the memory expansion modules are designed for use with 8-bit as well as 16-bit DCE microcomputers. When used with a 16-bit DCE processor, the memory module must be assigned to either the low-order 8-bits or the high-order 8-bits of the 16-bit word. This is done by means of a component carrier which can be plugged into one of two sockets on the memory module. In one position, the module can be used either with an 8-bit DCE processor, or as the low-order byte with a 16-bit DCE. In the other position, the module provides the high-order byte for a 16-bit DCE processor. This arrangement enables the memory expansion modules to be connected in matched pairs to a 16-bit DCE processor, via the standard flat-cable X-BUS.



8K, 16K or 32K EPROM and 4K RAM

MX-84
MX-164
MX-324

FEATURES:

8K, 16K or 32K byte EPROM space and 4K byte RAM memory.

Switch selectable EPROM base address.

Switch selectable RAM base address.

Flat-cable X-BUS connection to all memory expandable 8-bit DCE microcomputers.

Single 100 x 160 mm eurocard format.

FUNCTIONAL DESCRIPTION:

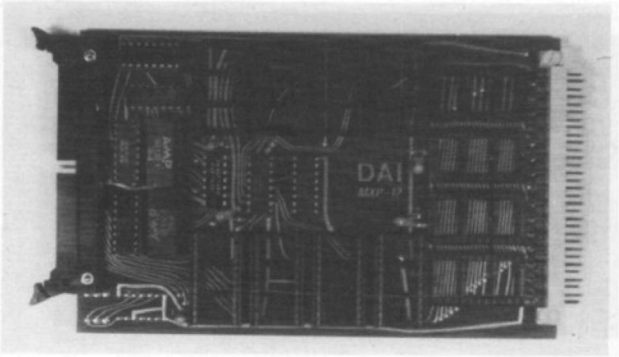
The MX-84, MX-164 and MX-324 memory modules provide 8K, 16K or 32K bytes of EPROM space and 4K bytes of static RAM, as expansion memory for DCE-X, -X88, -M68 and -Z80 microcomputer systems. Upto eight 2708, 2716, or 2732 EPROMs can be inserted into the sockets provided on MX-84, MX-164 and MX-324 cards respectively. The EPROM and RAM memory access times allow the DCE microcomputer CPU to run at full speed.

Two address select switches on each module allow the EPROM and RAM memory banks to occupy different locations in DCE microcomputer memory address space. On the MX-84 version, the 8K EPROM and 4K RAM bank base addresses can be set to any 8K and 4K byte boundaries respectively, starting at address zero. On the other two versions, the base addresses can be set to one of eight standard values.

These memory expansion modules all have a 50-pin flat-cable X-BUS connector at one end. One or more of these modules, together with other MX- memory expansion cards can be directly connected to the memory expandable DCE microcomputers via the flat-cable X-BUS connection. The DCE-BUS connector on the modules does not carry any data or control signals, and is used for power only. Each module is fully tested and supported by comprehensive documentation.

ORDERING INFORMATION:

MX-84	: Standard version with 8K EPROM space (8 x 2708).
MX-164	: Standard version with 16K EPROM space (8 x 2716).
MX-324	: Standard version with 32K EPROM space (8 x 2732).
X-BUS(n)	: The flat-cable X-BUS connection between DCE microcomputers and 'n' (1 to 8) MX- memory expansion modules must be ordered separately



12K, 24K or 48K EPROM

MXP-12
MXP-24
MXP-48

FEATURES:

12K, 24K or 48K byte EPROM space.

Switch selectable base addresses.

Flat-cable X-BUS connection to all memory expandable 8-bit DCE microcomputers.

Single 100 x 160 mm eurocard format.

FUNCTIONAL DESCRIPTION:

The MXP-12, MXP-24 and MXP-48 memory modules provide 12K, 24K or 48K bytes of EPROM space as expansion memory for DCE-X, -X88, -M68 and -Z80 microcomputer systems. Upto twelve 2708, 2716 or 2732 EPROMs can be inserted into the sockets provided on MXP-12, MXP-24 and MXP-48 cards respectively. The memory access times are fast enough to allow the DCE microcomputer CPU to run at full speed.

The 12K EPROM memory space on the MXP-12 version is organised into two banks of 4K and 8K bytes. Each bank can be assigned a separate base address by means of two address select switches on the card. The 8K bank base address can be set to any 8K byte boundary, and the 4K bank base address can be set to any 4K byte boundary, starting at address zero. On the other two versions, the base addresses can be set to one of eight standard values.

These memory expansion modules all have a 50-pin flat-cable X-BUS connector at one end. One or more of these modules, together with other MX- memory expansion cards can be directly connected to the memory expandable DCE microcomputers via the flat-cable X-BUS connection. The DCE-BUS connector on the modules does not carry any data or control signals, and is used for power only. Each module is fully tested and supported by comprehensive documentation.

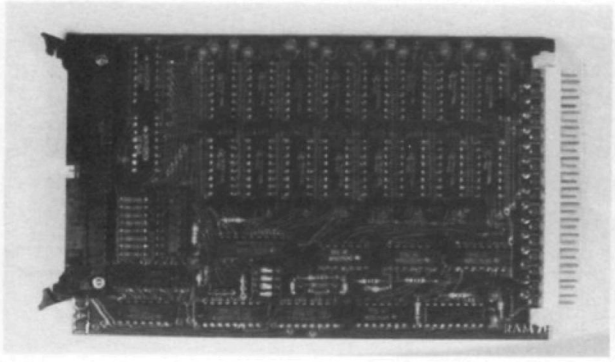
ORDERING INFORMATION:

MXP-12 : Standard version with 12K EPROM space (12 x 2708).

MXP-24 : Standard version with 24K EPROM space (12 x 2716).

MXP-48 : Standard version with 48K EPROM space (12 x 2732).

X-BUS(n) : The falt-cable X-BUS connection between DCE microcomputers and 'n' (1 to 8) MX- memory expansion modules must be ordered separately.



4K, 8K, 16K or 32K RAM

MXR-4D
MXR-8D
MXR-16D
MXR-32D

FEATURES:

- 4K, 8K, 16K or 32K byte dynamic RAM memory.
- On-board memory refresh logic.
- Refresh maintained during system Reset.
- Low power consumption.
- Runs at full CPU speed.
- Switch selectable RAM base address.
- Flat-cable X-BUS connection to all memory expandable 8 and 16-bit DCE microcomputers.
- Single 100 x 160 mm eurocard format.

FUNCTIONAL DESCRIPTION:

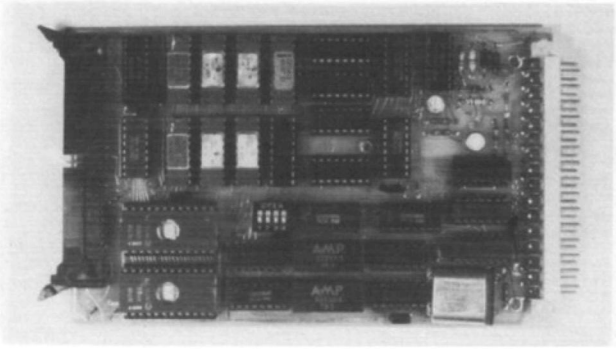
This range of modules provides dynamic RAM expansion memory for DCE-X, -X86, -X88, -M68 and -Z80 microcomputer systems. Automatic RAM refresh logic on the modules allows the CPU on the DCE microcomputers to run at full speed, and the memory appears just like static RAM to the user software.

An address select switch on each version of the module allows the base address of the RAM memory bank to be set to one of eight standard values. This enables the RAM to occupy specific ranges in DCE microcomputer memory address space.
A word-length select feature on all versions of the module enables them to be used with 8-bit as well as 16-bit DCE microcomputers. When used with a 16-bit DCE processor, this feature enables the memory modules to be configured in pairs to correspond to the low-order byte and to the high-order byte of the 16-bit word.

All versions of the module have a 50-pin flat-cable X-BUS connector at one end. One or more of these modules, together with other MX- memory expansion cards can be directly connected to the memory expandable DCE microcomputers via the flat-cable X-BUS connection. The DCE-BUS connector on the module does not carry any data or control signals, and is used for power only. Each module is fully tested and supported by comprehensive documentation.

ORDERING INFORMATION:

MXR-4D	: 4K byte version.
MXR-8D	: 8K byte version.
MXR-16D	: 16K byte version.
MXR-32D	: 32K byte version.
X-BUS(n)	: The flat-cable X-BUS connection between DCE microcomputers and 'n' (1 to 8) MX- memory expansion modules must be ordered separately.



2K, 4K or 8K EPROM and 4K CMOS RAM

MX-2C4
MX-4C4
MX-8C4

FEATURES:

2K, 4K or 8K byte EPROM space and 4K byte CMOS static RAM memory.

Crystal controlled CMOS timer with 3-month range for calendar and clock functions.

Self-charging battery back-up for maintaining RAM and timer for more than one month after system power failure.

Power-fail imminent detection on all 3 DCE-BUS supplies with automatic switch-over to battery back-up.

Automatic RAM memory lock-out upon impending system power failure.

Switch selectable EPROM and RAM base addresses.

Uses standard DCE-BUS power supplies.

Flat-cable X-BUS connection to all memory expandable DCE microcomputers.

Single 100 x 160 mm eurocard format.

FUNCTIONAL DESCRIPTION:

The MX-2C4, MX-4C4 and MX-8C4 memory modules provide 2K, 4K or 8K bytes of EPROM space and 4K bytes of CMOS static RAM, as expansion memory for all memory expandable DCE microcomputer systems. Up to two 2708, 2716, or 2732 EPROMs can be inserted into the sockets provided on MX-2C4, MX-4C4 and MX-8C4 modules respectively. A 23-bit CMOS timer with one second resolution and approximately 3-month cycle time enables DCE software to maintain time-of-day clock and calendar functions with crystal accuracy. All three DCE-BUS power supply levels are monitored on the module. If any one falls below a pre-determined level indicating an imminent power-failure, the battery back-up feature is enabled to protect the contents of RAM and to maintain the timer. The RAM memory is then immediately disabled to prevent accidental corruption during the power failure, and a power-failed status flag is set. The battery provided on the module maintains the RAM contents and the timer for over one month after the system power failure. When power returns, the battery is automatically re-harged. DCE software can then read the current contents of the CMOS timer and determine the correct time and date. One or more of these memory modules, together with other MX- memory expansion cards can be directly connected to the memory expandable DCE microcomputers via the flat-cable X-BUS connection. The DCE-BUS connector on the module does not carry any data or control signals, and is used for power only. Each module is fully tested and supported by comprehensive documentation.

ORDERING INFORMATION:

MX-2C4 : Standard version with 2K byte EPROM space (2 x 2708).

MX-4C4 : Standard version with 4K byte EPROM space (2 x 2716).

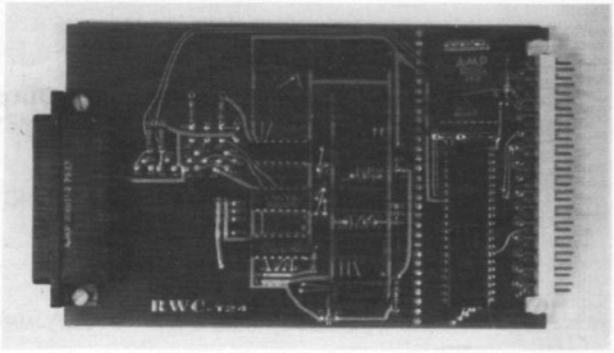
MX-8C4 : Standard version with 8K byte EPROM space (2 x 2732).

X-BUS(n) : The flat-cable X-BUS connection between DCE microcomputers and 'n' (1 to 8) MX- memory expansion modules must be ordered separately.

Real-World Interfaces

Real-World Interface Modules enable the digital DCE microcomputers to control a very wide range of parameters found in real-life environments. They provide a connection between the digital control capability of the DCE, and the real-world of analog voltages and currents, noisy industrial signals, contact closures, heavy currents, data communication, motors, weights, temperatures, pressures, humidity etc. The designer simply selects a suitable combination of these modules to meet his system requirements. Each interface module has an identification address defined by a hexadecimal switch, and up to fifteen can be directly connected to any DCE microcomputer.

Communication between the controlling DCE processor and the Real-World interface modules is via the DCE-BUS. Each module has a 31-pin system connector, which plugs into any standard DAI eurobox or eurorack containing the parallel-wired bus. The interface modules can communicate with 8-bit as well as 16-bit DCE microcomputers via the standard DCE-BUS. The external devices are connected to each module via a device connector. A complete range of packaging accessories including connecting cables, screw terminal panels etc. are available to simplify external connections.



General TTL Interface

RWC-T24

FEATURES:

- 3 8-bit parallel ports programmable for normal, handshake or bi-directional I/O.
- Automatic generation of handshake control signals with interrupt request option.
- Sockets for standard TTL drive or termination.
- Jumper definition of input/output control signals.
- One external interrupt request line.
- Standard hardware and software interface to the DCE-BUS.
- Switch selectable module address.
- Single 100 x 160 mm eurocard format.

FUNCTIONAL DESCRIPTION:

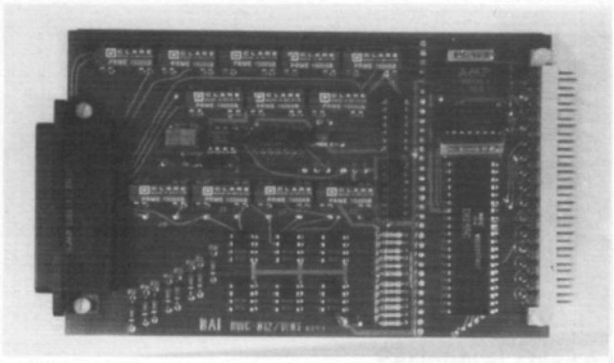
The RWC-T24 Real-World interface module enables all TTL compatible parallel devices to be interfaced to a DCE microcomputer via 24 programmable I/O lines. These three 8-bit parallel ports can be software defined for normal, handshake or bi-direction I/O. The 24 lines are brought out to the device connector at the end of the module through a network of sockets. The user must insert into these sockets component carriers with links or termination resistors for input, or standard TTL buffer/inverter devices for output drive and control signal characterization. Simple connecting links may be installed for output signals if enhanced drive and inversion are not required.

These options enable the three data ports on the RWC-T24 module to be configured to suit almost every TTL interface requirement. Port 0 can be configured for buffered output, inverted input, terminated input, or buffered bi-directional operation. Port 1 can be buffered output, or terminated input. The upper and lower 4-bit groups of Port 2 can be separately configured for buffered output or terminated input. They carry the handshake control signals when Ports 0 and 1 are configured for handshake I/O. These handshake control signals can be individually inverted by jumper selection. The two interrupt request signals associated with input/output handshake control may be gated together with an external interrupt request, to the two interrupt lines on the DCE-BUS via a jumper network.

Each module has an identification address defined by a hexadecimal switch, and up to fifteen can be directly connected to the DCE-BUS.

ORDERING INFORMATION:

RWC-T24 : Standard version.
User selectable TTL buffer/inverter devices and component carriers for termination or links are not included.



Isolated Digital Input/Output

RWC-D12
RWC-D12/WDT

FEATURES:

12 reed relay contacts.

8 optically isolated inputs.

4 optically isolated circuit monitoring inputs.

Watch-dog timer relay option.

Standard hardware and software interface to the DCE-BUS.

Switch selectable module address.

Single 100 x 160 mm eurocard format.

FUNCTIONAL DESCRIPTION:

The RWC-D12 Real-World interface module enables a DCE microcomputer to read 8 parallel opto-isolated inputs, and to switch medium power loads through 12 reed relays resident on the module. In series with each of the eight photo diodes there is a current limiting resistor for 10 to 24 volt inputs. Four additional opto-isolators are wired in series with four of the above reed relay contacts, to allow the verification of current flow through these circuits. These four circuit monitoring input photo diodes may be by-passed by links or shunt resistors.

The RWC-D12/WDT version has one of the reed relays adapted to perform a system watch-dog function. This relay is controlled by a watch-dog timer circuit on the module. The timer must be triggered at repetitive intervals by the DCE microcomputer software to maintain the watch-dog relay contacts closed. If the watch-dog timer is not re-triggered within a preset time (0,5 to 10 seconds) due to a system or power failure, the relay contact will open as a signal of system failure. The preset time interval for the trigger can be manually adjusted by a potentiometer on the module.

Each module has an identification address defined by a hexadecimal switch, and upto fifteen can be directly connected to the DCE-BUS.

ORDERING INFORMATION:

RWC-D12 : Standard version.

RWC-D12/WDT : RWC-D12 with one of the relays adapted as a system watch-dog.

Isolated Digital Input
RWC-D124

Available second quarter 1980.

FEATURES:

- 24 optically isolated digital input channels.
- Accepts A.C. and D.C. input signals.
- Automatic interrupt generation from four input lines via a jumper network.
- An Earth connection for extra safety.
- Standard hardware and software interface to the DCE-BUS.
- Switch selectable module address.
- Single 100 x 160 mm eurocard format.

FUNCTIONAL DESCRIPTION:

The RWC-D124 Real-World interface module enables the connection of up to 24 optically isolated digital inputs to the DCE microcomputer system. Both A.C. and D.C. input signals up to 24V are accepted by the module. The input signal range for any channel can be modified by changing the current limiting resistor connected to its opto-isolator.

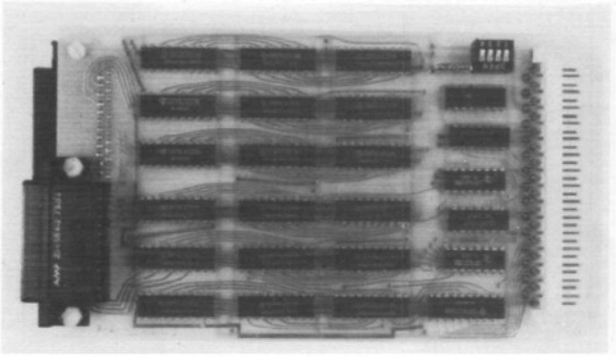
The positive end of each channel is brought to an individual pin on the device connector of the module. Each pair of channels has a shared Common line. An Earth connection is available on the device connector, which can be used to provide a protective ground between the external circuitry and the module. This can provide a further measure of safety in addition to the optical isolation, specially when using higher voltage A.C. input signals.

A jumper network enables four of the input signals to generate system interrupts automatically. They can be individually enabled, and merged by pairs to the two interrupt lines on the DCE-BUS by selection of jumper links.

Each module has an identification address defined by a hexadecimal switch, and up to fifteen can be directly connected to the DCE-BUS.

ORDERING INFORMATION:

RWC-D124 : Standard version.



Universal Digital Interface

RWC-U48

FEATURES:

6 independent 8-bit parallel input/output ports.

Each port characteristics independently defineable by insertion of port configuration modules into the sockets provided.

Standard port configuration modules available for terminated TTL input, latched TTL output, opto-isolated input.

Port characteristics independently defineable for special requirements via user-designed port configuration modules.

Standard hardware and software interface to the DCE-BUS.

Switch selectable card address.

Single 100 x 160 mm eurocard format.

FUNCTIONAL DESCRIPTION:

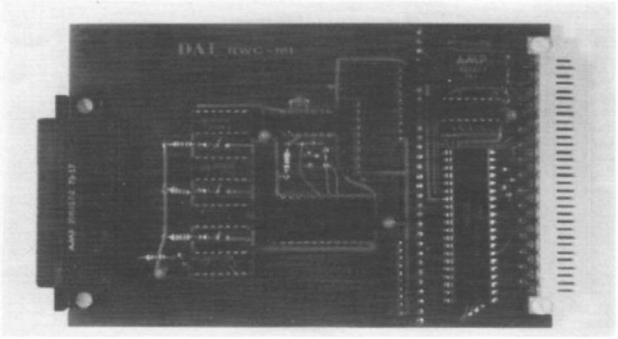
The RWC-U48 Real-World interface card has six general purpose 8-bit parallel input/output ports, and provides a universal digital interface to the DCE microcomputer. The characteristics of each port can be individually defined by the insertion of port configuration modules into sockets provided on the card.

Each of the six ports is channelled through a group of three standard 20-pin sockets, into which a set of three port configuration modules can be inserted. These three port configuration modules totally define the functions of that port, including input or output mode, and signal characteristics. Standard port configuration modules are available to characterize each 8-bit port for 8 single-ended TTL inputs with standard resistance termination, 4 individually opto-isolated input line pairs, or 8 latched TTL output lines. Each port can also be characterized for any special requirements by installing user-designed port configuration modules.

Each RWC-U48 card has an identification address defined by a hexadecimal switch, and up to fifteen can be directly connected to the DCE-BUS.

ORDERING INFORMATION:

RWC-U48	: Standard version supplied without the port configuration modules. A suitable combination of the following port configuration modules must be ordered separately:
U48-TTI	: Set of three modules for 8 single-ended Terminated TTL Input lines with 220/330Ω termination.
U48-LTO	: Set of three modules for 8 Latched TTL Output lines.
U48-OI4	: Set of three modules for 4 Optically Isolated input line pairs.



Matrix Interface

RWC-MI

FEATURES:

19 row x 16 column matrix access.

Reads up to 304 contact closures, or drives up to 304 indicators.

Rows programmable as input or output.

Column outputs definable as active-high or active-low.

Automatic time-out feature for LED protection.

Standard hardware and software interface to the DCE-BUS.

Switch selectable module address.

Single 100 x 160 mm eurocard format.

FUNCTIONAL DESCRIPTION:

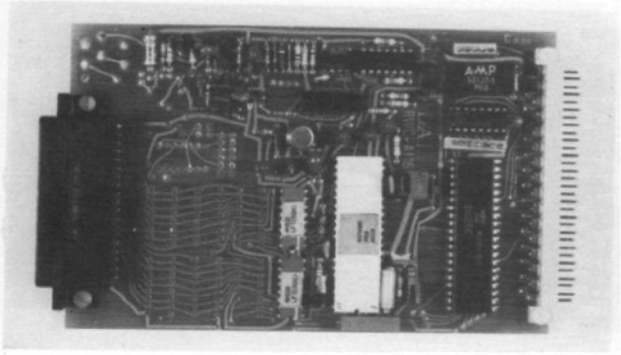
The RWC-MI Real-World interface module enables the DCE microcomputer to read up to 304 contact closures, or drive up to 304 indicators. The contacts or indicators are accessed as a matrix of up to 19 rows by 16 columns. The 19 rows can be programmed as inputs or outputs. The 16 column outputs are provided by a decoder with active-low outputs. These outputs are brought out to the device connector at the end of the module through four sockets. The RWC-MImodule is delivered with four 2-input NAND gate devices already installed in the four column driver sockets. One of the inputs to each gate is connected to logic 1 on the module, for converting the column decoder outputs to active-high. If active-low column outputs are desired, these four devices can be replaced by pin-compatible AND gates or connecting links.

The RWC-MI module has a 'time-out' safety feature to protect LED or similar indicators when operating in the matrix driver mode. If this feature is enabled via the jumper option, the column decoder has to be refreshed at least every 5 msec to prevent it from being turned-off. A jumper network allows the selection of an internal or external signal as the column decoder enable, with or without the time-out feature.

Each module has an identification address defined by a hexadecimal switch, and upto fifteen can be directly connected to the DCE-BUS.

ORDERING INFORMATION:

RWC-MI. : Standard version, including four 7400 quadruple NAND gates for column driving (active-high).



Quad-Slope Analog Input

RWC-AI/16S
RWC-AI/32S
RWC-AI/8D
RWC-AI/16D

FEATURES:

Low-cost versions for 16 or 32 single-ended voltage inputs, ± 2,5V full scale; giving 13-bit digital result including sign, with 10-bit resolution.

Standard versions with unity-gain instrumentation amplifier for 8 or 16 differential inputs; giving 13-bit digital result including sign, with 10 or 13-bit resolution.

Single-ended or differential current inputs via shunt resistors.

Temperature compensated high-precision reference for 13-bit resolution including sign.

Uses standard DCE-BUS power supplies.

Standard hardware and software interface to the DCE-BUS.

Switch selectable module address.

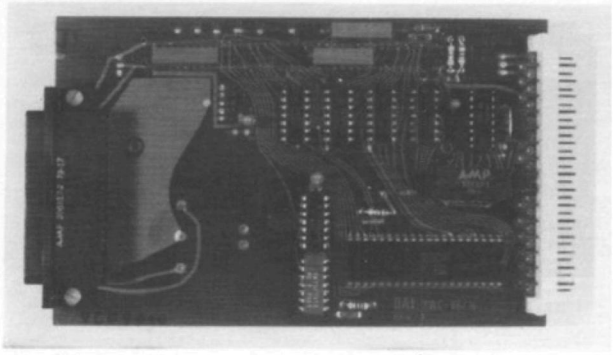
Single 100 x 160 mm eurocard format.

FUNCTIONAL DESCRIPTION:

The RWC-AI Real-World interface modules economically enable the input and conversion of analog voltages or currents to digital values, suitable for input to a DCE processor. Different versions provide channel selection and analog-to-digital conversion capability for up to 32 single-ended or 16 differential voltage or current input signals. Digital outputs are 13 bits including sign, with 10 or 13-bit resolution. The 13-bit digital result is in two's complement form, with the most significant bit acting as the sign bit. The quad-slope A/D converter provides high noise rejection with an 80 millisecond conversion time. A jumper choice enables the generation of an interrupt via the DCE-BUS, at the end of each conversion. The end of a conversion can be detected by the generation of an interrupt, or by software scanning. The digital result is then read by the DCE processor via the DCE-BUS. The RWC-AI modules contain resistor pads to enable the user to install shunt resistors for current inputs. 16-pin sockets can be soldered to these resistor pads for installing accurate shunt resistors on components carriers, to convert current inputs to voltages within the range ± 2,5V. Each module has an identification address defined by a hexadecimal switch, and up to fifteen can be directly connected to the DCE-BUS.

ORDERING INFORMATION:

RWC-AI/16S	: 16 single-ended inputs; 10-bit resolution.
RWC-AI/32S	: 32 single-ended inputs; 10-bit resolution.
RWC-AI/8D	: 8 differential inputs; 10-bit resolution.
RWC-AI/8DH	: 8 differential inputs; 13-bit resolution.
RWC-AI/16D	: 16 differential inputs; 10-bit resolution
RWC-AI/16DH	: 16 differential inputs; 13-bit resolution.



High-Speed Analog Data-Acquisition

RWC-V8/16

FEATURES:

16 single-ended or 8 differential analog voltage inputs.

Input signal ranges from ± 10 mV to ± 10V.

Resolutions of 2,4 µV to 2,4 mV (12 bits).

0,025 % full-scale range accuracy at unity gain.

Includes Sample and Hold amplifier.

Includes instrumentation amplifier for common-mode rejection, and selectable gain (1 to 1000).

Random or automatic-increment channel selection modes.

Up to 5.000 samples per second into the DCE system.

Uses standard DCE-BUS power supplies.

Standard hardware and software interface to the DCE-BUS.

Switch selectable module address.

Single 100 x 160 mm eurocard format.

FUNCTIONAL DESCRIPTION:

The RWC-V8/16 Real-World interface module provides a low-cost interface between a DCE processor and the SDM853 Burr-Brown data acquisition module. Sockets are provided for mounting the SDM853 module, and the Burr-Brown 546 dual power supply module. The SDM853 module provides many user options such as gain select, input range select etc. via external jumpers. The relevant jumper points are made available on the RWC-V8/16 card with the same numbering as on the SDM853 module.

The RWC-V8/16 module can be software configured to accept random channel addresses, or to sequence through all analog channels automatically on command. The instrumentation amplifier is a low drift differential amplifier featuring high speeds at gains above unity, and gain selection via a resistor. The A/D converter gives a 12-bit digital result in unipolar straight binary or bipolar offset binary.

Each module has an identification address defined by a hexadecimal switch, and up to fifteen can be directly connected to the DCE-BUS.

ORDERING INFORMATION:

RWC-V8/16	: Standard version, supplied without the two Burr-Brown modules.
RWC-V8/16M	: Standard version, with the Burr-Brown modules SDM853 and 546 installed and tested.

Analog Output

Available second quarter 1980.

RWC-AO2

FEATURES:

2 independent analog current and voltage output channels.

Each channel can be independently configured for voltage output (3 ranges), or current output (2 ranges).

Jumper selectable voltage and current output ranges.

Output voltage ranges of ± 1V, ± 5V and ± 10V, with a digital resolution of 11 bits and a sign bit.

Output current ranges of 0-10 mA into 1,5 KΩ and 4-20 mA into 750Ω, with a digital resolution of 12 bits.

Standard hardware and software interface to the DCE-BUS.

Switch selectable module address.

Single 100 x 160 mm eurocard format.

FUNCTIONAL DESCRIPTION:

The RWC-AO2 Real-World interface module enables two independent analog output channels to be controlled by the DCE microcomputer system. Each channel can be independently configured for voltage or current output with selectable ranges, via jumper links on the module.

The module has two independent Digital to Analog Converters. Each individual DAC output is scaled by user selectable links, and made available at the device connector as the voltage or current analog of the digital input to the DAC. The digital data for conversion can be sent to the module by the DCE microcomputer via the DCE-BUS, as 12-bit binary values. For the bipolar voltage outputs, the 12-bit digital value is interpreted as 11 data bits and a sign bit, while for the unipolar current outputs it is interpreted as 12-bit binary.

Jumper links on the module enable each analog channel output range to be independently defined for voltage and current outputs. Voltage outputs can be selected to be in the range ± 1V, ± 5V or ± 10V. Current outputs can be selected to be 4-20 mA into 750Ω, or 0-10 mA into 1,5KΩ loads.

Each module has an identification address defined by a hexadecimal switch, and up to fifteen can be directly connected to the DCE-BUS.

ORDERING INFORMATION:

RWC-AO2 : Standard version.

RWC-VO8

Available second quarter 1980.

FEATURES:

- 8 independent simultaneous analog voltage output channels.
- Selectable output voltage ranges of 0-2,5V or 0-10V.
- 8-bit digital resolution.
- Accuracy for each output channel better than 0,4 %.
- Standard hardware and software interface to the DCE-BUS.
- Switch selectable module address.
- Single 100 x 160 mm eurocard format.

FUNCTIONAL DESCRIPTION:

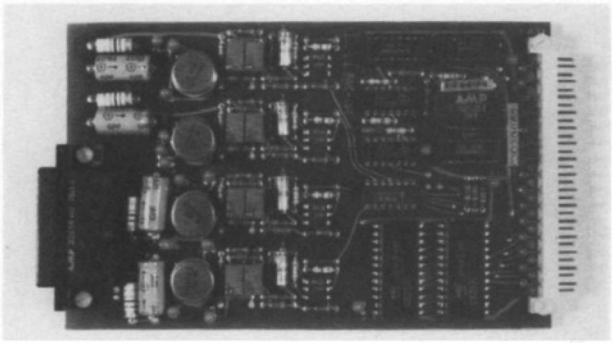
The RWC-VO8 Real-World interface module enables 8 independent analog voltage output channels to be controlled by the DCE microcomputer, with 8-bit digital resolution. It has eight independent 8-bit Digital to Analog Converters, and the voltage output of each one is scaled, buffered and made available at the device connector on the module.

The DCE microcomputer sends the 8-bit digital value to a selected DAC via the DCE-BUS, and the digital input to each DAC is latched. The 8 analog channels are independent, and each voltage output is held stable until DCE software sends a new digital value to that DAC. The output voltage range of each channel can be individually set to the range 0-10V or 0-2,5V via jumper links. Associated with each output channel is a 20-turn potentiometer, which can be used to adjust the maximum output voltage for the selected range. The accuracy of each digital to analog conversion stage is better than 0,5 LSB (least significant bit) , giving an overall accuracy of better than 0,4 % for each channel.

Each module has an identification address defined by a hexadecimal switch, and up to fifteen can be directly connected to the DCE-BUS.

ORDERING INFORMATION:

RWC-VO8 : Standard version.



Isolated Analog Current Output

RWC-CO4

FEATURES:

4 identical simultaneous independent current output channels.

Total optical isolation between each analog output channel and DCE system.

4 to 20 mA linear current outputs, programmable with 16-bit digital resolution.

Each channel current output held stable until changed to a new value.

Drive voltage for each output channel derived from the connecting device base supply.

One programmable 16-bit interval timer.

Standard hardware and software interface to the DCE-BUS.

Switch selectable module address.

Single 100 x 160 mm eurocard format.

FUNCTIONAL DESCRIPTION:

The RWC-CO4 Real-World interface module provides four channels for outputting precise analog currents with optical isolation, under DCE microcomputer control. Each current output channel has a linear range of 4 to 20 mA, defineable with a digital resolution of 16 bits. The four output channels are independent, and each channel current output is held stable until changed by DCE software.

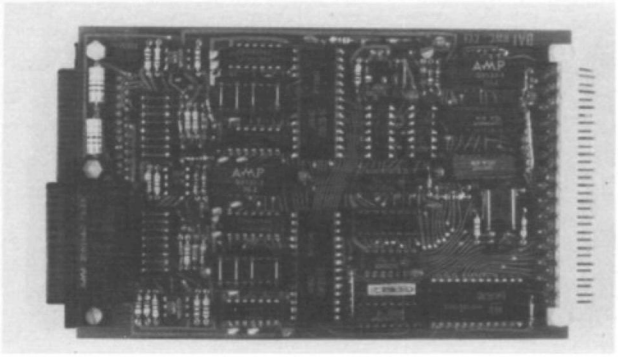
The RWC-CO4 module has the unique feature of total optical isolation between each analog output channel and the DCE system. To ensure complete isolation, the drive voltage for each current output channel is derived from the connecting device base supply. Total channel isolation makes the RWC-CO4 module ideal for precision control in industrial environments, where noise and ground loops often cause problems. The module also provides a programmable 16-bit interval timer, which can be connected to a DCE-BUS interrupt line via a jumper network.

An optional CO4-PWR module is available for converting the current outputs to voltage outputs. It mounts on the large eurobox or eurorack in place of the PSM-PCP/L panel, and produces voltage outputs in the ranges 0 to 32V, adjustable up to -7 to 25V, with 12-bit digital resolution.

Each RWC-CO4 module has an identification address defined by a hexadecimal switch, and up to fifteen can be directly connected to the DCE-BUS.

ORDERING INFORMATION:

RWC-CO4	: Standard version.
CO4-PWR	: The optional rack-mounting module for converting the isolated current outputs to voltage outputs must be ordered separately.



Serial Communication Interface

RWC-CCE

FEATURES:

2 independent serial communication channels.

Each channel independently software definable for synchronous or asynchronous communication.

Independently programmable channel baud rates (75-9600 baud).

Crystal controlled time-base.

Two separate standard V24 connectors.

Jumper selectable 20 mA current-loop or V24 channel interfaces.

Separate TTY reader relay control for each channel.

One programmable 16-bit interval timer.

Interrupt register to merge 6 status signals into a single DCE interrupt request.

Uses standard DCE-BUS power supplies.

Switch selectable module address.

Single 100 x 160 mm eurocard format.

FUNCTIONAL DESCRIPTION:

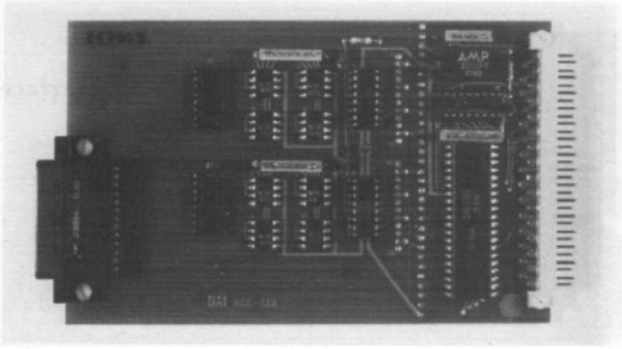
The RWC-CCE Real-World interface module enables the DCE processor to control two independent serial communcation channels, software defineable for synchronous or asynchronous communication with programmable baud rates. The two USART devices on the module implementing the two channels can be programmed for almost any serial data communication technique including IBM Bi-Sync. The two serial channels may each be configured for 20 mA current loop or V24 interface via a hexadecimal switch and connector pads on the module. All necessary signal options are provided for the V24 interface.

In addition to the status register within each USART, the module also has a general status register with six input status signals including the interval timer. These status register signals can be merged to generate a common interrupt request to the DCE processor, or they can be polled by software periodically. Following such an interrupt, DCE software can determine the Interrupt source with a Read operation to the status register.

Each module has an identification address defined by a hexadecimal switch, and up to fifteen can be directly connected to the DCE-BUS.

ORDERING INFORMATION:

RWC-CCE : Standard version.



Serial Line Monitor

RWC-SLD

FEATURES:

Monitors up to 8 current-mode serial communication channels.

Capability for independent, simultaneous, parallel distribution of each serial input channel to several different destinations.

Bipolar optically isolated Schmitt trigger inputs for complete channel isolation.

Sockets for line termination resistors allow user selectable channel load impedences.

Standard hardware and software interface to the DCE-BUS.

Switch selectable module address.

Single 100 x 160 mm eurocard format.

FUNCTIONAL DESCRIPTION:

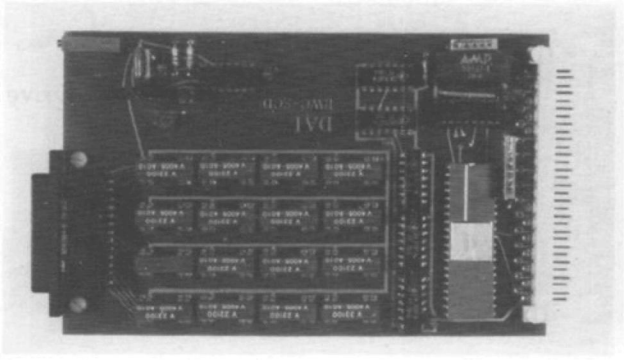
The RWC-SLD Real-World interface module enables the monitoring and distribution of up to 8 current-mode serial communication channels such as telex lines, without interaction or interference with channel operation. Each input channel is read via bipolar opto-isolated Schmitt trigger inputs for complete channel isolation with no interference. Line termination resistor sockets are provided to allow user selectable load impedences for each channel. Any of the eight input serial communication channels can be safely distributed to several destinations, by parallel connection to a selected input channel on each member of a group of RWC-SLD modules. Such a scheme can be used to implement fail-safe systems where critical messages have to be distributed in parallel to several destinations.

The eight input data lines on the RWC-SLD module can be individually jumper configured to read any one of the following conditions associated with its corresponding channel: Last detected current direction (latched); detection of forward current; detection of reverse current; or detection of current or no-current in either direction. The serial to parallel conversion of data for each channel can be done by DCE software.

Each module has an identification address defined by a hexadecimal switch, and up to fifteen can be directly connected to the DCE-BUS.

ORDERING INFORMATION:

RWC-SLD : Standard version, including component carriers with connection links.



Standard Current Driver

RWC-SCD

FEATURES:

16 constant current output channels.

Temperature compensated 10 mA constant current generator.

Current output channel switching via 16 reed relay contacts.

Standard hardware and software interface to the DCE-BUS.

Switch selectable module address.

Single 100 x 160 mm eurocard format.

FUNCTIONAL DESCRIPTION:

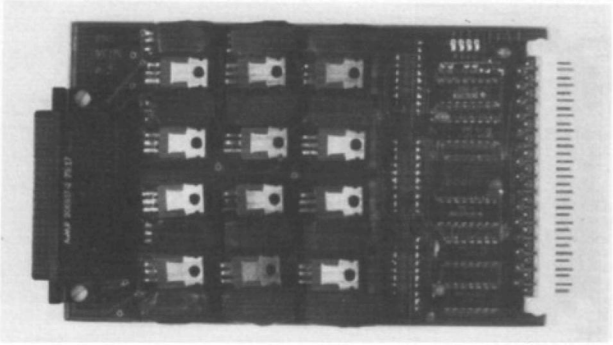
The RWC-SCD Real-World interface module switches a fully compensated 10 mA constant current through one of sixteen output channels, via 16 reed relays resident on the module. It is ideally suited for applications requiring constant-current driven variable-resistance parameter measurements, such as with platinum resistance thermometers, displacement potentiometers etc. The resulting voltage drop across the variable resistance can be read into the DCE system via an analog input module such as RWC-AI/16D. The heating effects of the 10 mA current on the variable resistance being measured is minimized by passing the current only during the conversion period.

The constant-current generator output can be switched to any one of the 16 output channels by closing the corresponding reed relay contact by DCE software. All 16 relay switching circuits can be collectively disabled by a signal controlled by DCE software. All relay switching circuits are automatically disabled on power-on reset.

Each module has an identification address defined by a hexadecimal switch, and up to fifteen can be directly connected to the DCE-BUS.

ORDERING INFORMATION:

RWC-SCD : Standard version.



Medium-Current D.C. Drive

RWC-MC/DC

FEATURES:

24 identical simultaneous independent current output channels.

Up to 300 mA D.C.current output per channel.

Total optical isolation between each pair of outputs and DCE system.

Can be configured as an opto-isolated medium current D/A converter.

Standard hardware and software interface to the DCE-BUS.

Switch selectable module address.

Single 100 x 160 mm eurocard format.

FUNCTIONAL DESCRIPTION:

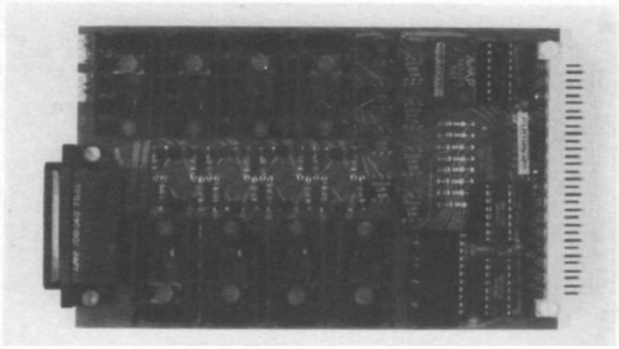
The RWC-MC/DC Real-World interface module provides 24 opto-isolated output channels, each capable of driving D.C. currents up to 300 mA. It enables DCE microcomputer control of medium current devices such as relays, lamps, small motors etc. normally found in industrial control environments, with complete isolation.

The RWC-MC/DC module has three 8-bit latches for the 24 channel-switching control signals. All output currents are automatically switched off at power-on or any subsequent system reset. After reset, the channel control outputs from the three latches can be enabled simultaneously. The 24 current output channels are grouped as 12 pairs, with each pair sharing a common return. These 12 pairs are opto-isolated from each other and from the DCE system. External power sources are required by the current drivers, and these can be separate or combined. The RWC-MC/DC module can easily be configured as an opto-isolated medium-current D/A converter with one to three channels and 8 to 24-bit resolution, by connecting binary-ratio resistance networks (R:2R:4R:8R:....) externally.

Each module has an identification address defined by a hexadecimal switch, and up to fifteen can be directly connected to the DCE-BUS.

ORDERING INFORMATION:

RWC-MC/DC : Standard version.



High-Current D.C. Drive

RWC-HC/DC

FEATURES:

8 identical simultaneous independent current output channels.

Up to 3A D.C. current output per channel.

Total optical isolation between each output channel and DCE system.

8 indicator LEDs for visually monitoring channel switching.

Can be configured as an opto-isolated high current single-channel D/A converter.

Standard hardware and software interface to the DCE-BUS.

Switch selectable module address.

Single 100 x 160 mm eurocard format.

FUNCTIONAL DESCRIPTION:

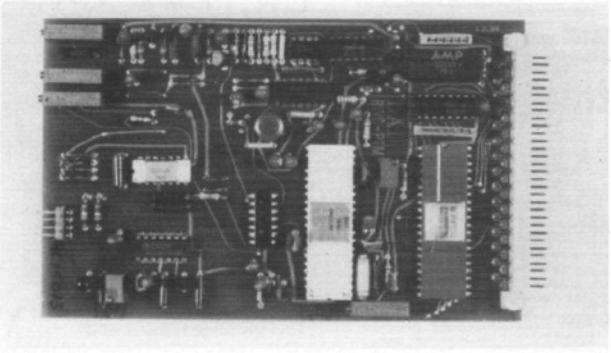
The RWC-HC/DC Real-World interface module provides eight opto-isolated output channels, each capable of driving D.C. currents up to 3A. It enables DCE micro-computer control of high current devices such as magnetic valves, solenoids, stepper motors, heating elements etc. normally found in industrial control environments, with complete isolation.

The RWC-HC/DC module has an 8-bit latch for the 8 channel-switching control signals. External power sources are required by the current drivers. Eight indicator LEDs on the module provide visual monitoring of the on/off state of each current output channel. The RWC-HC/DC module can be easily configured as an opto-isolated high current D/A converter.with 8-bit resolution, by connecting a binary-ratio resistance network (R:2R:4R:8R...) externally.

Each module has an identification address defined by a hexadecimal switch, and up to fifteen can be directly connected to the DCE-BUS.

ORDERING INFORMATION:

RWC-HC/DC : Standard version.



Position and Temperature Measurement

RWC-PTM

FEATURES:

Constant current output channel and analog voltage input channel.

Temperature-compensated high-precision 10 mA constant current generator.

Analog voltage input with $\pm$ 2,5V full scale, and 13-bit digital result including sign.

Unity-gain instrumentation amplifier for differential voltage input, and noise rejection.

Uses standard DCE-BUS power supplies.

Standard hardware and software interface to the DCE-BUS.

Switch selectable module address.

Single 100 x 160 mm eurocard format.

FUNCTIONAL DESCRIPTION:

The RWC-PTM Real-World interface module enables the DCE processor to make variable resistance parameter measurements, such as with platinum resistance thermometers, displacement potentiometers etc. It provides a fully compensated 10 mA constant current source, and a differential analog voltage input for measuring the voltage drop across the variable resistance due to the constant current.

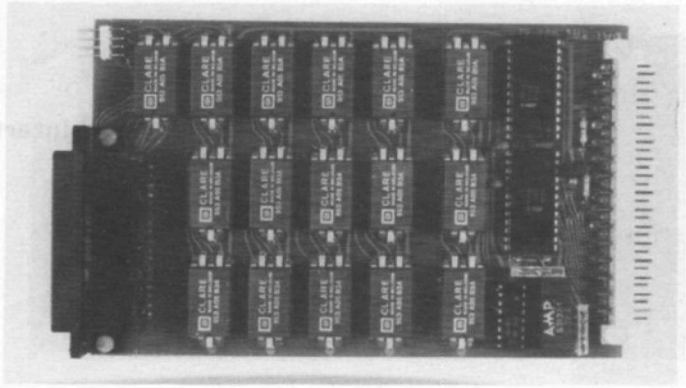
The analog voltage input is converted to a digital value of 13 bits including sign by a quad-slope A/D converter, with a conversion time of 80 milliseconds. The 13-bit digital result is in two's complement form, with the most significant bit acting as the sign bit. A jumper choice enables the generation of an interrupt via the DCE-BUS, at the end of each conversion. The end of a conversion can be detected by the generation of an interrupt, or by software scanning. The digital result, which is proportional to the value of the variable resistance, can then be read by the DCE processor via the DCE-BUS. The heating effects of the 10 mA current on the variable resistance being measured can be minimized by passing the current only during the conversion period.

The RWC-PTM module has a 4-pin connector carrying the constant current output and analog input channels, and can be used with one or more RWC-MUX multiplexer modules. Each RWC-MUX module provides 16 multiplexed channels, and upto 14 can be directly connected to the RWC-PTM module.

Each RWC-PTM module has an identification address defined by a hexadecimal switch, and up to fifteen can be directly connected to the DCE-BUS.

ORDERING INFORMATION:

RWC-PTM : Standard version.



4-Wire Multiplexer Module

RWC-MUX

FEATURES:

16 multiplex channels of 3 lines each, with one common line.

Two 4-pin male connectors for the 3 multiplexed lines and the common line.

4-wire flat-cable connection available for linking several modules in cascade.

Directly connectable to the RWC-PTM module.

Standard hardware and software interface to the DCE-BUS.

Switch selectable module address.

Single 100 x 160 mm eurocard format.

FUNCTIONAL DESCRIPTION:

The RWC-MUX Real-World interface module provides 16 multiplex channels of 3 lines each, with a common return. The 3 multiplexed lines together with the common line are brought to two 4-pin male connectors on the module. These enable two or more RWC-MUX modules to be connected together in cascade, via separate 4-wire flat-cable connection links having female connectors at the free ends. One of the 4-pin male connectors on each module can be linked to the preceding module in the chain, via the flat-cable connection.

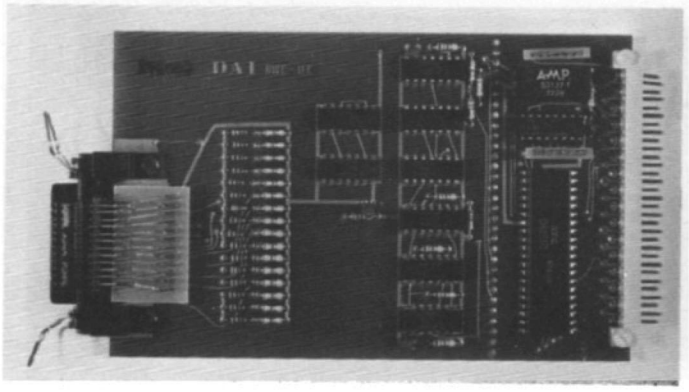
The 16 multiplex channels are activated via 16 3-contact relays. The relays are grouped into two banks of eight each, and are controlled by outputs from two latching ports. System software must ensure that only one out of the sixteen relays are active at any time.

The RWC-MUX modules are ideal for use with the RWC-PTM Position and Temperature Measurement module. Up to 14 RWC-MUX modules can be directly connected to a RWC-PTM module via the 4-wire flat-cable connection links.

Each RWC-MUX module has an identification address defined by a hexadecimal switch, and up to fifteen can be directly connected to the DCE-BUS.

ORDERING INFORMATION:

RWC-MUX	: Standard version.
PSM-FCC/4	: The 4-wire flat-cable connection links must be ordered separately.



IEC Instrumentation Bus Interface

RWC-IEC

FEATURES:

Enables DCE microcomputer control of IEC-BUS.

Software-driven Control, Source and Acceptor functions.

IEC Service Request processable via DCE interrupt.

Includes standard IEC connector.

Standard hardware and software interface to the DCE-BUS.

Switch selectable module address.

Single 100 x 160 mm eurocard format.

FUNCTIONAL DESCRIPTION:

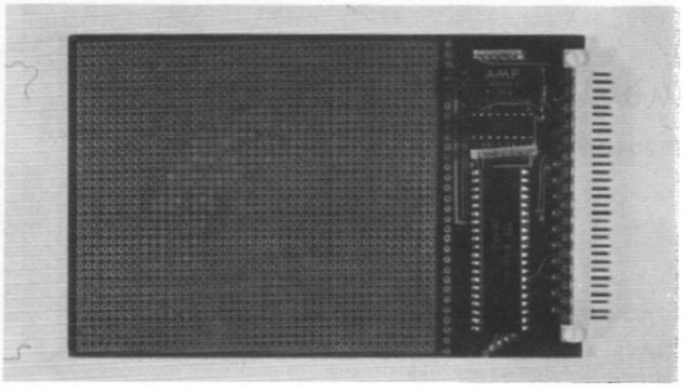
The RWC-IEC Real-World interface module enables the DCE microcomputer to control IEC bus compatible instruments, conforming to International Electrotechnical Commission recommendations. It provides a link between the DCE-BUS and the IEC-BUS by allowing the DCE microcomputer to function as an IEC-BUS controller. It enables DCE control of a cluster of IEC/IEEE Bus compatible instruments supplied by Fluke, Hewlett-Packard, Tektronix, Wavetek, Rohde & Schwarz, etc.

The eight data input-output lines for carrying interface messages to and from the IEC-BUS are provided by a bi-directional port on the module. Handshake control signals necessary for maintaining correct bus discipline are generated on the module. The IEC Service Request and the interrupt request from the bi-directional port on the module can be gated to the two DCE-BUS interrupt lines via a jumper network.

Each module has an identification address defined by a hexadecimal switch, and up to fifteen can be directly connected to the DCE-BUS.

ORDERING INFORMATION:

RWC-IEC : Standard version.



Foundation Module

RWC-F

FEATURES:

100 x 110 mm free card area with pre-drilled 0,1 inch IC grid for prototyping.

Three 8-bit parallel ports programmable for normal, handshake or bi-directional I/O.

Automatic generation of handshake control signals with interrupt request option.

Standard hardware and software interface to the DCE-BUS.

Switch selectable module address.

Single 100 x 160 mm eurocard format.

FUNCTIONAL DESCRIPTION:

The RWC-F Real-World interface module enables the user to interface custom designed circuitry to the DCE-BUS, via 24 programmable I/O lines provided on the module. It has a 100 x 110 mm free card area with a pre-drilled 2,54 mm(0,1 inch) IC grid. This area is available to the user for installing wire-wrap sockets or any components with standard 2,54 mm lead spacing. The 24 programmable I/O lines, the two DCE-BUS interrupt lines, the system Reset signal and the DCE-BUS power supplies are brought to termination at the edge of the pre-drilled grid.

The three 8-bit programmable ports can be software configured in many different ways: They can be individually configured for normal input or output. Two of the ports can be individually configured for handshake input or output, in which case, the handshake control signals will be carried by the remaining port. One of the ports can be configured for bi-directional I/O, with automatic generation of handshake control signals for maintaining correct bus discipline.

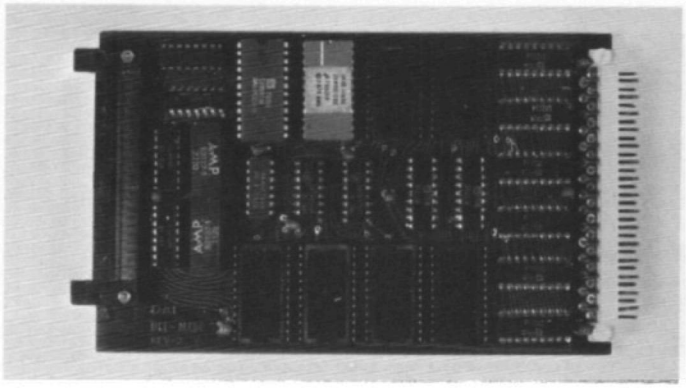
Each module has an identification address defined by a hexadecimal switch, and up to fifteen can be directly connected to the DCE-BUS.

ORDERING INFORMATION:

RWC-F : Standard version.

System Enhancement Modules

System Enhancement Modules widen the functional capability of DCE microcomputer and interface cards, by providing everything necessary to implement complete operational systems. They also enable the realization of complex high-speed system configurations, with a range of performance enhancement modules. The real-time BASIC processor provides a powerful run-time module for executing programs written in DAI Industrial BASIC. It includes a hardware math processor capable of very fast scientific math calculations. The large-system adaptor enables the realization of fast high-performance systems using the DCE-X microcomputer. The scientific math module provides hardware generated scientific floating-point math functions for all DCE microcomputers. The system bus monitor module is a useful aid during the system development phase. Power for DCE microcomputer systems is provided by simply plugging in a power supply module. A battery back-up feature allows a system to remain operational even after a mains power failure. A range of EPROM programmer cards are available for use during the software development phase. The terminal interface cables allow any standard console terminal to be directly plugged into a DCE microcomputer. A complete range of packaging support modules provide all the hardware accessories for housing and installing operational DCE microcomputer systems.



Real-Time BASIC Processor

DCE-BAS

FEATURES:

BASIC processor for DCE-X microcomputer systems.

Contains an 8K ROM resident run-time interpreter for DAI Industrial BASIC programs.

Supports real-time functions including interval timers and interrupt processing.

Hardware floating-point math processor for very fast calculations.

4K RAM memory and 12K EPROM space for user programs.

Flat-cable X-BUS connection to DCE-X microcomputer, and optional memory expansion modules.

Optional operation with DCE-LSA module.

Single 100 x 160 mm eurocard format.

FUNCTIONAL DESCRIPTION:

The DCE-BAS is a BASIC processor module for DCE-X microcomputer systems. It contains an 8K ROM resident run-time interpreter to execute the semi-compiled code generated by DAI Industrial BASIC (UBI). A hardware floating-point math processor on the module is used by the BASIC interpreter to perform calculations at very high speed. The DCE-BAS module must be connected to a DCE-X microcomputer via a flat-cable X-BUS(1) connection.

User programs are written in BASIC on a development system containing the full UBI interpreter. These may include the special real-time functions and commands supported by UBI. The source programs are semi-compiled by UBI into a very compact code before execution. At the end of the program development phase, the semi-compiled code of the final program can be programmed into EPROMs. These EPROMs are then plugged into the DCE-BAS module for execution in the final system. After power-on, the run-time interpreter on the DCE-BAS module will automatically commence execution of the user program from EPROMs.

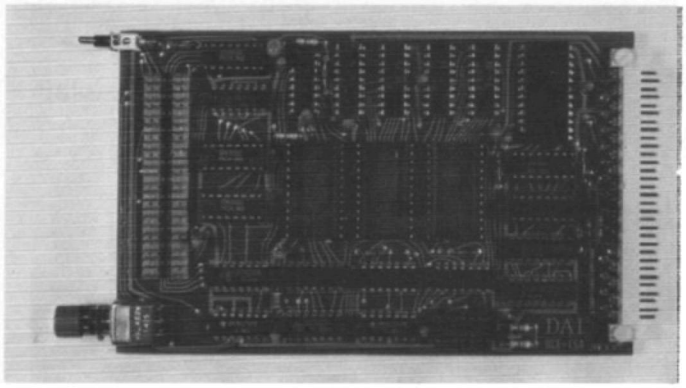
The DCE-BAS module contains 4K RAM memory and sockets for plugging in six 2716 EPROMs containing the user program. The flat-cable X-BUS connection between the DCE-X microcomputer and the DCE-BAS can be extended if necessary to include MX memory expansion modules.

The DCE-BAS module may also be connected to the DCE-X microcomputer via the DCE-LSA module. This can be useful in the final testing phase. With such a configuration, control will pass to the Utility program on the DCE-LSA on system reset.

ORDERING INFORMATION:

DCE-BAS : Standard version.

The DCE-X microcomputer and the flat-cable X-BUS(1) connection must be ordered separately.



Large-System Adapter

DCE-LSA

FEATURES:

Enables the realization of large high-performance systems based on the DCE-X microcomputer.

Reset button and hardware bootstrap feature provides automatic transfer of control to resident software in high address space on reset.

Frees lower address space starting from zero for the user.

3K byte EPROM space and 512 byte RAM in high address space for Utility or equivalent program, and system work areas.

Frees the full capacity on added memory expansion modules for the user.

Hold switch for suspending DCE-X CPU operation at will, without loss of status.

Implements normal and high-speed modes for DCE-BUS transfers.

Single 100 x 160 mm eurocard format.

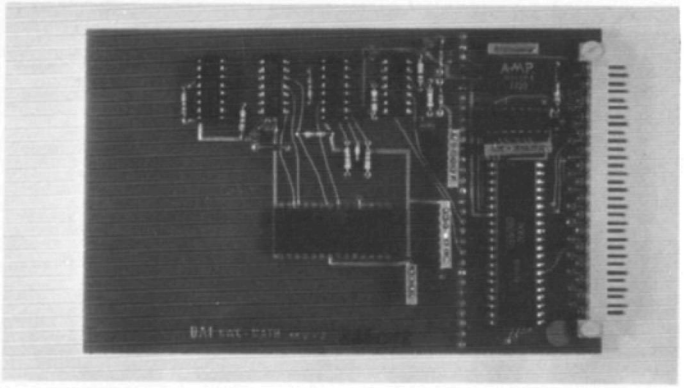
FUNCTIONAL DESCRIPTION:

The DCE-LSA module enables the realization of fast high-performance systems using the DCE-X microcomputer. It is ideally suited for implementing complex hardware configurations based on the DCE-X, such as the DAI Diskette system. The DCE-LSA module has 2 flat-cable X-BUS connectors. One is for connection to the DCE-X processor via an X-BUS(1) cable, and the other is for connection to MX- memory expansion modules via the X-BUS(n) cable. The DCE-LSA thus acts as an intermediate stage between the DCE-X, and the memory expansion modules.

512 bytes of RAM and sockets for 3K byte EPROM in high address space are provided on the module for work areas and for housing Utility or equivalent programs. A hardware bootstrap feature transfers control to the high-address EPROM memory on the module, automatically on power-on or system reset. This leaves lower address space starting from zero free for the user. Since Utility programs and their work areas can reside on the DCE-LSA module, the full capacity of up to 60K on added MX- memory expansion modules is free for the user. The DCE-LSA can be software configured to implement the DCE-BUS in memory-mapped I/O, Fast-Bus, or normal modes for accessing DCE-BUS compatible modules. A Hold switch on the module enables the DCE-X CPU to be stopped and started at any time without loss of status.

ORDERING INFORMATION:

DCE-LSA	: Standard version.
X-BUS(1)	: The flat-cable connection to DCE-X must be ordered separately.
X-BUS(n)	: The flat-cable connection to 'n' (n = 1 to 8) memory expansion modules must be ordered separately.



Scientific Math Module

RWC-MATH

FEATURES:

Scientific floating-point math functions with 8-digit mantissa and 2-digit exponent.

Includes trigonometrical, logarithmic and exponential functions.

4 register Reverse Polish Notation push-down stack.

Extra memory register.

Error flag generation.

Operates independently of the DCE CPU.

Interrupt generation on completion of calculation by jumper selection.

Standard hardware and software interface to the DCE-BUS.

Switch selectable module address.

Single 100 x 160 mm eurocard format.

FUNCTIONAL DESCRIPTION:

The RWC-MATH module provides the DCE microcomputer software with hardware generated scientific floating-point math functions, for manipulating numbers with 8-digit mantissa and 2-digit exponent. It uses a Number-Oriented Microprocessor ("Number Cruncher") for calculating the following mathematical functions: +, −, x, ÷, 1/x, $\sqrt{x}$, x^2, 10^x, e^x, y^x, π, ln x, log x, sin (x), cos (x), tan (x), $\sin^{-1}$ (x), $\cos^{-1}$ (x), $\tan^{-1}$ (x), and radian-degree, degree-radian conversions. The speed of calculation is comparable to that of a standard electronic calculator.

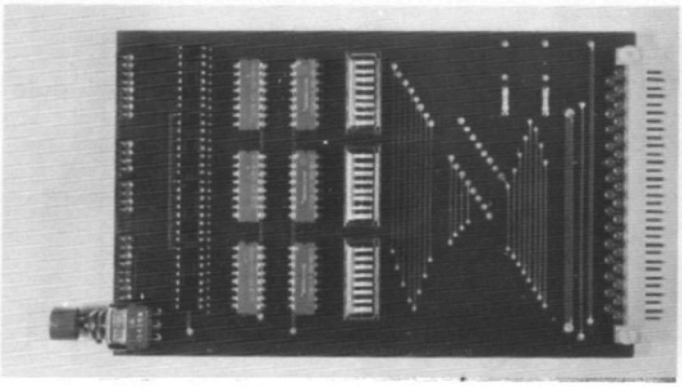
Data can be passed to the RWC-MATH module from the DCE software on a digit by digit basis. The function commands can be interspersed with the data, in the same manner as when pressing keys to enter number and function sequences into a standard electronic calculator. A special toggle command permits mode changing from decimal to scientific notation, or vice-versa, when reading back the results from the number processor.

The number processor in the RWC-MATH module functions independently of the DCE processor CPU. At the end of a calculation, the results can be read by DCE software via the DCE-BUS. The number processor outputs the data synchronously in handshake mode. Logic on the module produces the necessary handshake control signals automatically, and generates a service request signal for each data digit. This signal can be made to generate an interrupt via jumper selection or it can be software scanned.

Each module has an identification address defined by a hexadecimal switch, and up to fifteen can be directly connected to the DCE-BUS.

ORDERING INFORMATION:

RWC-MATH: Standard version.



System Bus Monitor

DCE-SBM

FEATURES:

24 LED indicator lamps displaying the status of DCE-BUS lines.

24 switches for manual input of signals to the DCE-BUS lines.

System Reset switch.

Jumper contacts for manual generation of the two DCE-BUS interrupt request signals.

Single 100 x 160 mm eurocard format.

FUNCTIONAL DESCRIPTION:

The DCE-SBM System Bus Monitor module provides 24 LED indicator lamps for monitoring the status of the address, data and control lines of the DCE-BUS. 24 switches, also connected to the DCE-BUS lines, enable manual generation of input signals to the bus. A system Reset switch enables the entire DCE microcomputer system including RWC Real-World interface modules to be reset. Two jumper contacts allow manual generation of the two interrupt request signals carried by the DCE-BUS.

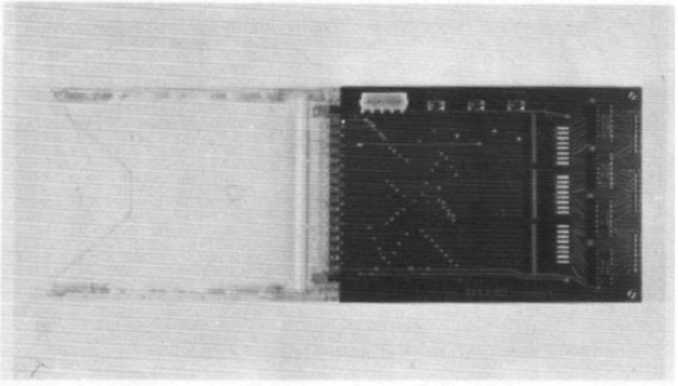
The 24 LED indicators are arranged as two groups of eight and two groups of four, to match the organisation of the three programmable ports of the DCE microcomputers. Similarly, the 24 switches are arranged as three groups of eight. When the DCE microcomputer is used as a stand-alone controller, the DCE-SBM can be used during the software development phase to simulate data inputs, and monitor signal outputs. It can also be used to drive RWC interface modules manually for testing.

The Reset switch and the LED indicators are mounted at the front edge of the module, for ease of access when plugged into a system. In order to make the switches accessible, the module should be inserted into the eurobox or eurorack, via a DCE-EX extender card. All the circuitry of the DCE-SBM module will then be completely accessible.

ORDERING INFORMATION:

DCE-SBM : Standard version.

DCE-EX : The optional extender card must be ordered separately.



Experimenter Module

DCE-EXPR

FEATURES:

Bench-top experimenting station with card-cage for plugging in any DCE microcomputer or DCE-BUS compatible module.

24 LED indicator lamps displaying the status of DCE-BUS lines.

24 switches for manual input of signals to the DCE-BUS lines.

4-pin connector for +5V, -5V, +12V power inputs and ground.

Reset switch.

Two switches for manual generation of the DCE-BUS interrupt request signals.

Two standard 16-pin sockets connected to DCE-BUS lines, for system expansion.

FUNCTIONAL DESCRIPTION:

The DCE-EXPR module provides a minimum-cost bench-top system, with a card-guide for plugging in any DCE microcomputer or DCE-BUS compatible module. It has 24 LED indicator lamps monitoring the status of the address, data and control lines of the DCE-BUS, or other equivalent signals provided by the plugged-in module. These LEDs are marked with port and line numbers to match the organisation of the three programmable ports of the DCE microcomputers. The reset and the two interrupt generation switches allow manual generation of reset and interrupt request signals. The two standard 16-pin sockets carrying DCE-BUS signal and power lines provide a bus extension for connecting external devices.

Power to the DCE-EXPR station and the plugged-in module must be provided via a 4-pin connector. It can be used in conjunction with the DCE-PWR power module, and its bench-top adaptor, PSM-PWR/B. This adaptor has a D.C. power supply cable, with a matching 4-pin connector.

When the module is used with a DCE microcomputer, it is necessary to connect a standard terminal or the low-cost hand-held keyboard/display unit PDM-KDU, for operator communication. Such a configuration, together with a standard Utility software package, enables almost all of the hardware functions of the DCE microcomputer to be exercised and monitored.

ORDERING INFORMATION:

DCE-EXPR	: Standard version.
DCE-PWR	: The plug-in power supply module must be ordered separately.
PSM-PWR/B	: The bench-top adaptor for the power-supply module must be ordered separately.

Plug-In Power Module

DCE-PWR

FEATURES:

Regulated plug-in power supply module.

Plugs into any DAI eurobox or eurorack.

Outputs of regulated +5V (2,5A), -5V (1A) and +12V (1A).

220V A.C. input.

On/off switch and power-on LED indicator.

Ripple less than 100 mV with severe dynamic load conditions.

3 mV typical ripple.

FUNCTIONAL DESCRIPTION:

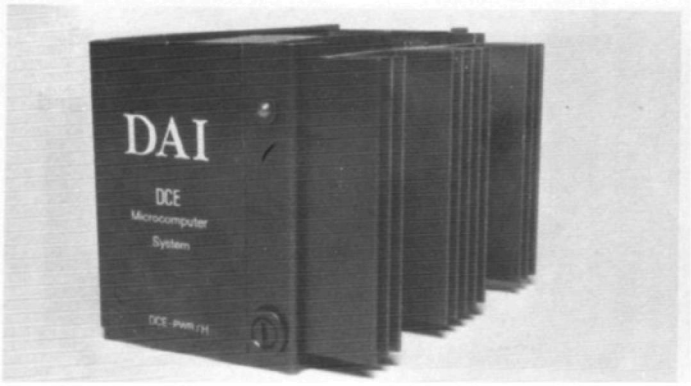
The DCE-PWR is a regulated power supply module, which simply plugs into any standard DAI eurorack or eurobox. It operates from 220V A.C. input, and supplies the DCE-BUS power rails with regulated +5V, -5V and +12V. The current outputs are sufficient for DCE microcomputer systems with medium power requirements.

It has an on/off switch, and a power-on LED indicator on the front panel. All input and output connections are brought to two male connectors at the back of the module. They plug into corresponding female connectors on the DCE-BUS motherboard at the back of all DAI euroboxes and euroracks. Mains power is derived via a separate Mains Power Adaptor module (PSM-MPA or PSM-MPA/C), usually mounted at the back of the eurorack or eurobox. This unit provides a mains power cable and connector, power line noise filter, a fuse, and an optional cooling fan.

An optional bench-top adaptor (PSM-PWR/B) is available for enclosing the DCE-PWR module and converting it to a bench-top version. This adaptor provides an enclosure for plugging in the DCE-PWR module, and has rubber feet, a fuse, a D.C. power output cable with a 4-pin connector and a mains cable.

ORDERING INFORMATION:

DCE-PWR	: Standard version.
PSM-PWR/B	: The optional bench-top adaptor must be ordered separately.
PSM-MPA/C, MPA	: The mains power adaptor module, with or without cooling fan, must be ordered separately.



Heavy-Duty Plug-In Power Module

DCE-PWR/H

FEATURES:

Heavy-duty regulated plug-in power module.

Plugs into any DAI eurobox or eurorack.

Outputs of regulated +5V (10A), -5V (2A) and +12V (2A).

Over-heating and over-voltage protection.

110 and 220V A.C. inputs.

Ripple less than 200 mV under full load.

Mains power failing signal, and 24V battery back-up capability.

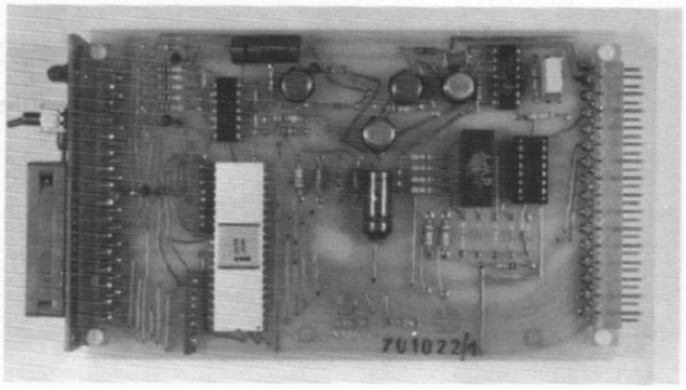
FUNCTIONAL DESCRIPTION:

The DCE-PWR/H is a heavy-duty regulated power supply module, which simply plugs into any standard DAI eurorack or eurobox. Because of it's extra width it occupies more space when plugged in, and covers one extra card guide adjacent to it. It operates from 110 or 220V A.C. input, and supplies the DCE-BUS power rails with regulated +5V, -5V and +12V. The current outputs are sufficient for powering all DCE microcomputer configurations, including the diskette system. All input and output connections are brought to two male connectors at the back of the module. They plug into corresponding female connectors on the DCE-BUS motherboard at the back of all DAI euroboxes and euroracks.

The module contains an over-heating cut-out, which will cause all the power outputs to be switched off automatically if over-heating occurs for any reason. If any of the three output voltages rise above specified limits, an over-voltage protection feature will blow the fuse, and switch off all outputs. A LED indicator on the front panel of the module provides a visual indication of active power outputs. Mains power is derived via a separate Mains Power Adaptor module (PSM-MPA or PSM-MPA/C), usually mounted at the back of the eurorack or eurobox. This unit provides a mains power cable and connector, power-line noise filter, a fuse, and an optional cooling fan. The power supply module continuously monitors the A.C. mains supply, and the absence of a half-cycle produces a mains failing signal. This is used to implement an automatic 24V battery back-up feature. A separate PSM-MPA/B module, very similar to PSM-MPA/C, provides additional connections to a 24V battery and a trickle charging supply. Another separate module, PSM-BAT, provides a 24V 1,8 Ah battery with trickle-charge circuitry on a panel, for mounting on the back of a large eurorack or eurobox.

ORDERING INFORMATION:

DCE-PWR/H	: Standard version.
PSM-MPA, MPA/B, MPA/C	: The mains power adaptor module, with or without the battery back-up and cooling fan options, must be ordered separately.
PSM-BAT	: The optional back-up battery module must be ordered separately.



EPROM Programmer Card

DCE-PRG/8
DCE-PRG/16
DCE-PRG/32

FEATURES:

Programs 2708, 2716, or 2732 EPROMs under DCE microcomputer control.

LED lamp for visual indication of programming operation.

Programming disable switch prevents accidental alteration of EPROM contents.

Includes zero-insertion-force EPROM socket.

Uses standard DCE-BUS power supplies.

Standard hardware and software interface to the DCE-BUS.

Switch selectable module address.

Single 100 x 160 mm eurocard address.

FUNCTIONAL DESCRIPTION:

The DCE-PRG/8, DCE-PRG/16 and DCE-PRG/32 modules provide all the necessary hardware functions for programming and accessing 2708, 2716 or 2732 EPROMs under DCE control. Each module has a zero-insertion-force socket for easy insertion of EPROMs. A programming disable switch on the module prevents accidental alteration of EPROM contents while in the socket. A LED lamp provides a visual indication of when a programming operation is in progress.

All DCE microcomputer Utility software packages contain routines for driving the corresponding versions of DCE-PRG modules. A Programming function enables the contents of any DCE system memory block to be transferred to one or more locations of an erased EPROM in the socket. After programming, the new contents of the EPROM locations are automatically compared with the corresponding memory contents, and any discrepancies reported. Utility commands can be used to compare contents of selected locations of an EPROM with memory, and to transfer selected locations to system RAM memory.

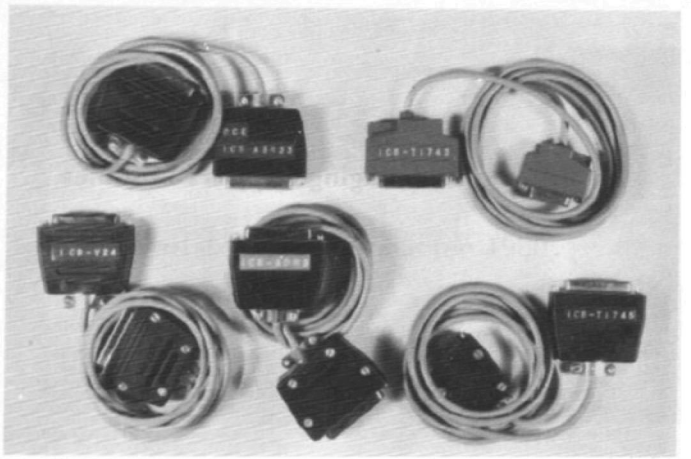
Each card has an identification address defined by a hexadecimal switch, and up to fifteen can be directly connected to the DCE-BUS. This feature enables several DCE-PRG modules to be configured together for programming several EPROMs simultaneously.

ORDERING INFORMATION:

DCE-PRG/8 : Standard version for 1K byte 2708 EPROMs.

DCE-PRG/16 : Standard version for 2K byte 2716 EPROMs.

DCE-PRG/32 : Standard version for 4K byte 2732 EPROMs.



Terminal Interface Cables

ICB

FEATURES:

Enables direct connection between any DCE microcomputer and a standard console terminal.

Different versions available for standard serial interfaces.

Serial interface circuitry contained within the cable connector housing.

Includes compatible terminal connector.

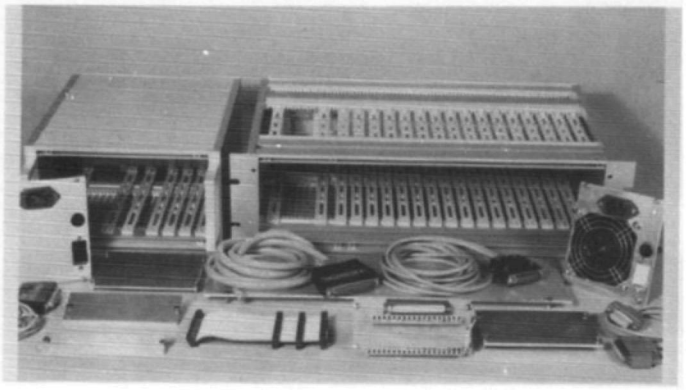
150 cm long, with an optional 10m extension.

FUNCTIONAL DESCRIPTION:

The range of ICB terminal interface cables provide a direct connection between DCE microcomputers, and standard terminals with serial interfaces. The necessary circuitry for interfacing the serial data channel of the DCE microcomputer to the selected terminal, is contained within their connector housings. Every ICB cable can simply be plugged into the device connector of any DCE microcomputer at one end, and to the corresponding type of terminal at the other.

ORDERING INFORMATION:

ICB-ASR33	: 20 mA current-loop interface to ASR33 TTY.
ICB-V24	: RS232 interface.
ICB-ADM3	: ADM-3 current interface.
ICB-733	: RS232 interface to TI733 terminal with cassettes.
ICB-743	: Current interface to TI743 terminal.
ICB-745	: Current interface to TI745 terminal.
ICB-EX	: 10m extension cable.



Packaging Support Modules

PSM

FUNCTIONAL DESCRIPTION:

The Packaging Support Modules provide a comprehensive range of hardware accessories for housing and installing operational DCE microcomputer systems.

ORDERING INFORMATION:

PSM-ERL/F : Euro-Rack Large; Front Insertion.

19-inch single-height euro-rack with DCE-BUS motherboard, space for inserting a DCE power supply module, and 16 eurocards (only 15 eurocards, if DCE-PWR/H is used). The card guides come up to the front edge of the rack for front insertion of cards. The rack has removable front handles, and side flanges for cabinet mounting. The mains power adaptor must be mounted at the back of the rack, and a cover panel can be mounted in the remaining space. A gap of 7 cm between the back edge of the rack and the motherboard, allows the mounting of suitable devices on the back panel.
The mains power adaptor (any version of PSM-MPA), and the back cover panel (PSM-PCP/L) must be ordered separately.

PSM-ERL/B : Euro-Rack Large; Back Insertion.

Similar to PSM-ERL/F, but for back insertion of cards, with the card guides set back 5 cm from the back edge of the rack. This enables screw terminal panels (PSM-STP), and similar devices to be mounted at the back of the rack. The front of the rack can be totally covered by a full-width cover panel. A gap of 3 cm between the front edge of the rack and the motherboard, allows the mounting of devices such as the PDM-DSP display module at the front. The mains power adaptor must be mounted at the back of the rack, after the power supply module has been plugged in.
The mains power adaptor (any version of PSM-MPA), and the front cover panel (PSM-PCP/F) must be ordered separately.

PSM-EBL/F : Euro-Box Large: Front Insertion.

Bench-top version of PSM-ERL/F, with top and bottom cover plates, rubber feet, and no side flanges.

PSM-EBS/F : Euro-Box Small; Front Insertion.

Half-width version of PSM-EBL/F, with space for inserting a DCE power supply module and 5 eurocards (only 4 eurocards, if DCE-PWR/H is used).

PSM-EBL/B : Euro-Box Large; Back Insertion.

Bench-top version of PSM-ERL/B, with top and bottom cover plates, rubber feet, and no side flanges.

PSM-MPA : Mains Power Adaptor.

Mains Power Adaptor module, directly mountable on all versions of DAI euroracks and euroboxes with four quarter-turn screws. It has a mains power cable and connector, power-line noise filter, on/off switch, fuse, and a connection to the DCE-BUS motherboard.

PSM-MPA/C : Mains Power Adaptor with Cooling Fan.

Similar to PSM-MPA, but with a cooling fan and guard.

PSM-MPA/B : Mains Power Adaptor for Battery Back-up.

Similar to PSM-MPA/C, but with connection terminals for a 24V back-up battery, and a trickle charging supply. The on/off switch controls the mains and battery inputs. Suitable for use with the DCE-PWR/H power supply module only.

PSM-BAT : Battery Module.

This is a 24V 1,8 Ah rechargeable battery with trickle-charge circuitry, mounted on a PSM-PCP/L cover panel. It must be used with the PSM-MPA/B module, and the DCE-PWR/H power supply.

PSM-PCP/1, /2, /4, /S, /L, /F : Plain Cover Panel.

Plain cover panels with quarter-turn screws for mounting on the front and back of all versions of euroboxes and euroracks. Available in single (/1), double (/2), or four (/4) card widths, and 3 special versions:

/S: cover panel, which together with any mains power adaptor (MPA) module, completely closes the back of the half-width euro-box.

/L: similar to version '/S', but for 19-inch euroboxes and euroracks.

/F: Full 19-inch front cover panel for use with back-loading eurobox and eurorack.

PSM-STP/25, /37, /50 : Screw Terminal Panel.

Connecting panels for external system wiring with 25, 37 or 50 screw terminals and corresponding D-type male connector. They have four quarter-turn screws for direct mounting on any version of DAI eurorack or eurobox, and can be connected to the plugged-in cards via PSM-FCC flat-cables. They can also be fitted remote from the rack or box, and connected to the cards via PSM-DCC cables.

PSM-SCC/25, /37, /50 : Single Connector Cable.

Standard 25, 37 or 50 way connecting cable, 150 cm long, with a male D-type connector at one end. Wire colours are compatible with DIN 47100 standard.

PSM-DCC/25, /37, /50 : Double Connector Cable.

Standard 25, 37 or 50 way connecting cable, 150 cm long, with D-type male and female connectors at the two ends. Wire colours are compatible with DIN 47100 standard.

PSM-FCC/25, /37, /50, /4 : Flat Connecting Cable.

Standard 25, 37 or 50 way flat connecting cable, 15 cm long, with D-type male and female connectors at the two ends. They can be used for connecting rack-mounted screw terminal panels (PSM-STP), keyboards (PDM-KBD) etc. to the cards within the rack. The '/4' version is 40 cm long, has two female connectors at the ends, and is for use with the RWC-MUX and PDM-DSP modules.

PSM-PWR/B : Bench Top Adaptor for DCE-PWR module.

This adaptor module converts the DCE-PWR power supply into a bench-top version. It contains a mains cable with connector, D.C. power output cable with a 4-pin connector, fuse, rubber feet, and space for plugging in the DCE-PWR module.

PSM-KBD/M : Keyboard Mounting Kit.

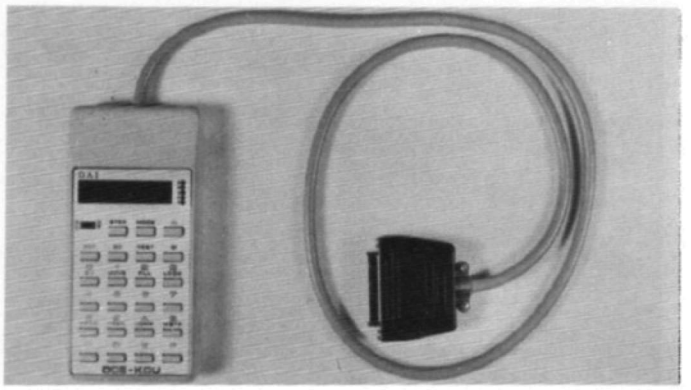
A kit with a 203 mm wide mounting panel with quarter-turn screws, and other accessories for mounting the PDM-KBD keyboard on all versions of euroboxes and euroracks.

PSM-DSP/M : Display Mounting Kit.

A kit with a 137 mm wide mounting panel with quarter-turn screws, and other accessories for mounting the PDM-DSP display on all versions of euroboxes and euroracks. The width of the mounting panel is exactly one-third that of a 19-inch rack or box.

Peripheral Device Modules

Peripheral Device Modules can be directly connected to DCE microcomputer systems, and provide a wide range of input/output functions. They include a hand-held keyboard/display unit, which provides a very low-cost alternative to a teletype or a terminal for interacting with DCE microcomputer systems. The heavy-duty keyboard and display units enable the input and output of data and control information in operational environments. The twin diskette unit is a powerful peripheral providing bulk data storage with fast access for DCE microcomputer systems. It can be configured either as a software development station, or as an operational control system. The integrated microcomputer, together with the video monitor, provide a complete functional computer with sophisticated features. It is programmable in BASIC, and can act as an intelligent peripheral to DCE microcomputer systems, or function as a powerful stand-alone computer system.



Hand-Held Keyboard/Display Unit

PDM-KDU

FEATURES:

Hand-held keyboard/display terminal for DCE microcomputer systems.

23 push switches for hexadecimal data and function input.

7-segment LED display for 9 hexadecimal digits.

5 modes of operation: Register, Memory, Vector, Function, Compare.

5 LEDs for indicating the current mode of operation.

EPROM programming functions: Program, Transfer, Compare.

Utility functions: Zero and initialize, Move, Look, Fill.

Program debug functions: enter program, single-step and program trace.

Display or modify DCE memory and CPU registers.

Direct interface to DCE microcomputers via TICC parallel ports.

Ideal for system modification in the field.

FUNCTIONAL DESCRIPTION:

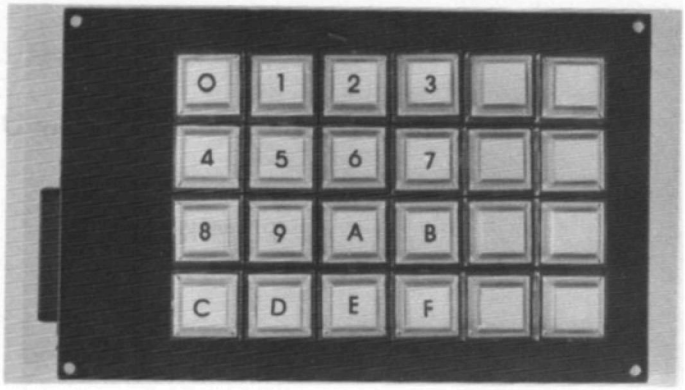
The PDM-KDU is a very low-cost alternative to a teletype or a terminal for interacting with DCE microcomputer systems. It is provided with a connecting cable, and can be plugged into the device connector of a DCE microcomputer. It interfaces directly to the TICC parallel ports of the DCE microcomputer.

The PDM-KDU driver Utility program UPK provides the following functions and facilities: system initialization, display/modify memory locations and CPU registers, move and fill memory blocks, set-up or change the RAM vector addresses of interrupt service routines, initiate program execution, single-step and trace program execution by displaying all CPU registers after each instruction execution, program EPROMs including compare-with-memory and transfer-to-memory functions.

The PDM-KDU provides all necessary functions for program modification in the field. Only an EPROM programmer card is necessary for transferring the modified program on to EPROMs. It provides complete and sophisticated facilities for developing programs in machine language at absolute minimum cost.

ORDERING INFORMATION:

PDM-KDU	: Standard version including connecting cable to DCE microcomputer.
UPK	: The PDM-KDU oriented Utility program must be ordered separately (specify for which DCE microcomputer).



Heavy-Duty Keyboard

PDM-KBD

FEATURES:

24 keys arranged in a 6 x 4 matrix.

Series diode with each key for column isolation during scanning.

Parallel interface connection to DCE microcomputer, or suitable Real-World module.

4-pin connector for driving the PDM-DSP display module, or similar device.

Removable transparent key tops, for user definition of key symbols.

Keys assembled on a 100 x 160 mm metal mounting plate.

Optional kit for direct mounting on any DAI eurobox or eurorack.

FUNCTIONAL DESCRIPTION:

The PDM-KBD heavy-duty keyboard module provides 24 momentary-contact type keys, arranged in a 6 x 4 matrix. It includes a 25-pin connector with lines providing access to the matrix of switches, for monitoring their status. Each key has a diode in series with it, for column isolation during scanning. All the columns can be activated together to determine if any keys have been pressed, before scanning to identify them individually.

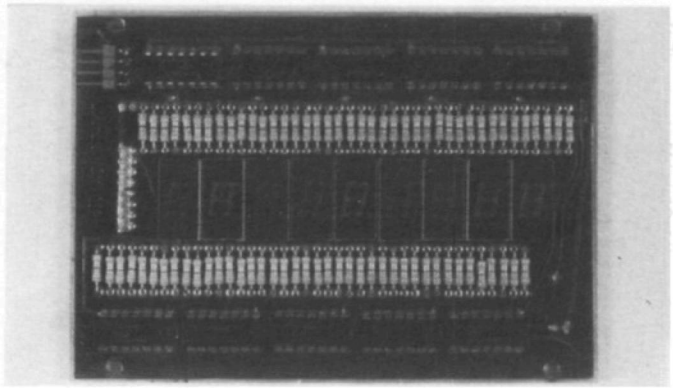
The module also provides a 4-pin male connector, which enables an external device to be physically linked to it. These 4 lines are directly routed to the 25-pin connector, and can be used in any manner. The module can be driven directly from the parallel input and output ports available at the device connectors of DCE-1, 1A, 2, 2A and X microcomputers. Two of the output lines together with +5V and ground are then available at the 4-pin connector. If the PDM-DSP display module is connected as the external device, the two output lines must be used to carry a clock signal and serial data to it. The keyboard module and any connected external device can also be driven via the Real-World interface modules with parallel interfaces.

An optional kit enables the keyboard module to be directly mounted at the front or back of any DAI eurobox or eurorack, with four quarter-turn screws. The keyboard is mounted horizontally, with 4 rows of 6 keys, using a 203 mm wide panel.

ORDERING INFORMATION:

PDM-KBD : Standard version.

PSM-KBD/M : The optional packaging kit for mounting the keyboard on any DAI eurorack or eurobox must be ordered separately.



Large-Digit Display

PDM-DSP

FEATURES:

9 large 7-segment LED displays with decimal points.

8 LED indicators.

4-pin connector for serial interface and power.

Static operation with no data refresh requirements.

Directly connectable to the PDM-KBD keyboard module.

Red cover filter for enhanced legibility and protection.

Optional kit for direct mounting on any DAI eurobox or eurorack.

FUNCTIONAL DESCRIPTION:

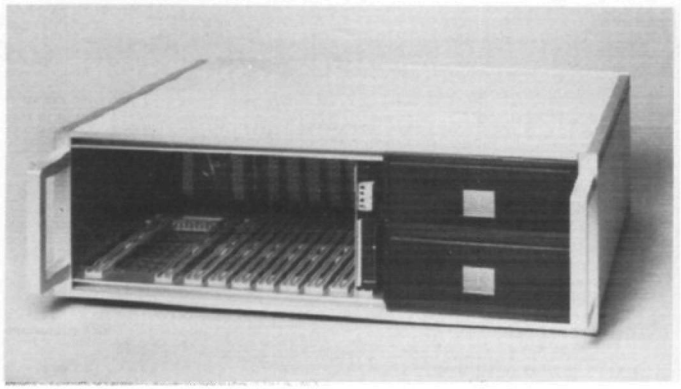
The PDM-DSP display module provides nine large 7-segment LED displays with decimal points, and eight LED indicators. The LED digits are each 7,62 mm high and 4,78 mm wide. They can be used to display hexadecimal data, and a limited character set. The eight LED indicators are mounted in a line, and can be used to identify different modes of operation etc. The entire module is covered by a thick red filter mounted in front, for protection and enhanced display legibility.

The module must be driven serially by data and clock signals, supplied via the 4-pin male connector. The remaining two pins are for a +5V supply and ground. The clock signal is used to transfer the serial data to an 80-bit shift-register on the module. The seven segments and the decimal point of each of the nine digits, and the eight indicators are driven in accordance with the data bits stored in this shift register. Once the shift-register is loaded with the necessary bit pattern, the corresponding display will remain stable until new data is clocked into the shift-register by driver software.

The display module can be directly connected to the PDM-KBD keyboard, or to any other suitable interface, via a separate 4-wire flat-cable connection. An optional kit enables the display module to be directly mounted at the front or back of any DAI eurobox or eurorack, with four quarter-turn screws. The width of the mounting panel is 137 mm, which is exactly one-third that of a 19-inch rack or box.

ORDERING INFORMATION:

PDM-DSP	: Standard version, with red filter plate.
PSM-FCC/4	: The 4-wire flat-cable connection must be ordered separately.
PSM-DSP/M	: The optional packaging kit for mounting the display module on any DAI eurorack or eurobox must be ordered separately.



Twin Diskette System

PDM-DSK

FEATURES:

Mini-floppy diskette configuration providing bulk data storage with fast access for DCE microcomputer systems.

Fully modular architecture with DCE-BUS compatibility.

Can be configured for specific system requirements by using standard memory, interface and EPROM programmer modules, providing up to 60K bytes of memory.

Consists of a 19-inch eurobox with two mounted mini-floppy disk drives, diskette controller card, DCE-BUS motherboard, and card guides for a heavy-duty power supply module and 6 eurocards.

Intelligent diskette controller card with a resident slave operating system, and RAM buffers for file access.

Low-address system memory locations starting from zero free for the user.

Special recovery feature enables deleted diskette files to be restored.

Includes a system diskette with utility, text editor and macro assembler.

Diskette utility with EPROM programming commands, and debug functions including program trace with automatic CPU register display after each instruction execution.

Diskette text editor with insertion, deletion, substitution and string search commands.

Diskette macro assembler with full macro and conditional assembly functions.

Supports DAI FORTRAN and real-time BASIC programming languages.

Optional battery back-up feature for file protection in case of mains power failure during disk access.

FUNCTIONAL DESCRIPTION:

The PDM-DSK dual-drive diskette station provides bulk data storage with fast access for DCE microcomputer systems. It has a modular architecture based on the DCE-BUS, and is compatible with all modules in the DCE microcomputer family. This modularity enables it to be configured either as a powerful software development station, or as an operational control system. The user can select memory and interface modules to configure the system for specific requirements. It provides sophisticated functions for editing, assembling, compiling, debugging and executing user programs. In the software testing phase, the relevant interface modules can be inserted directly into the system for checking the hardware/software interfaces. This approach enables final verification of total system performance, without requiring an in-circuit emulator. Data is stored on diskettes as Files, and may be transferred to or from a peripheral device, or system RAM memory, using the Diskette Operating System (DOS). DOS performs all diskette data and file management tasks for the user, and takes care of the physical positioning of data on the diskettes. The diskette controller card included in the PDM-DSK is intelligent, and has its own CPU. A slave DOS resident on this controller card performs diskette housekeeping functions such as positioning the read/write heads at the correct track on the diskette etc.

The remaining part of DOS resides on the system diskette, and is loaded for execution at the top 6K of the first contiguous block of system RAM memory. During the execution of some commands, DOS uses up to 2K more of memory adjacent to this 6K block. Configuring the PDM-DSK diskette unit as an operational system requires a DCE-X microcomputer, DCE-LSA, and at least about 16K RAM memory starting at address zero. The user can select a suitable combination of MX memory expansion modules, to provide up to 60K memory. A 3K byte diskette utility program (UPD) must be inserted into sockets on the DCE-LSA card. The 512 byte RAM memory in the DCE-LSA is used for system work areas. As a result, all the memory provided via the MX memory expansion modules is free for the user, except the 6K DOS load area at the top of the first contiguous block, and the 2K work area adjacent to it. A parallel-interface printer, paper-tape reader and punch can be connected to the system via two RWC-T24 TTL interface modules. EPROM programming functions are provided by inserting one or more DCE-PRG cards into the eurobox. The Utility package on the system diskette has commands for programming 2708, 2716 and 2732 EPROMs, comparing with memory, and transferring to memory. Power to the diskette system is supplied by plugging in the heavy-duty power supply module DCE-PWR/H, and installing a PSM-MPA/C mains power adaptor with a cooling fan. The power module provides a 24V battery back-up option for the system. A problem common to all diskette systems is the danger of file corruption when a mains power failure occurs while the read/write heads are engaged on the diskette. The battery back-up option in the DAI diskette system provides total security against such diskette failures. A 24V battery mounted at the back of the eurobox will be automatically switched in to maintain system operation and complete the current disk access, after such a mains power failure.

A typical configuration with 32K RAM memory, and the battery back-up feature is given below:

PDM-DSK	: 19-inch eurobox with two mini-floppy disk drives, diskette controller card with resident slave DOS, DCE-BUS motherboard, and card guides for a DCE-PWR/H and 6 eurocards. Includes a system diskette and a blank diskette.
DCE-PWR/H	: Heavy-duty plug-in power supply module.
PSM-MPA/B	: Mains power adaptor with mains cable and connector, power line noise filter, on/off switch, fuse, cooling fan, and terminals for 24V battery and trickle-charge supply.
PSM-BAT	: A panel with 24V battery and trickle-charge circuitry, for mounting on the back of the eurobox.
DCE-X	: Memory expandable DCE microcomputer.
DCE-LSA	: Large-system adaptor with 3K byte EPROM space, 512 byte RAM, and a bootstrap to its high-address EPROM space on reset.
UPD	: 3K DCE-LSA utility on EPROMs.
MXR-32D	: 32K byte dynamic RAM module.
X-BUS(1)	: Flat-cable connection between DCE-X and DCE-LSA.
X-BUS(1)	: Flat-cable connection between DCE-LSA and MXR-32D.
RWC-T24	: Parallel TTL interface card for connecting a printer and a paper-tape reader.
RWC-T24	: Parallel TTL interface card for connecting a paper-tape punch.
DCE-PRG/16	: 2716 EPROM programmer card.
ICB-...	: Serial interface cable to a standard terminal.
Console device	: Standard terminal such as VDU, TTY, DCE-IM1 etc.

After power-on, control passes to the UPD Utility in high-address space on the DCE-LSA. With the UPD Utility, the user can test system RAM, assign physical peripherals to the logical channels, display/modify memory and CPU registers, move and fill memory blocks, initiate program execution, single-step and trace program execution with automatic display of all CPU registers after each instruction execution, read and write paper-tape files etc. These commands are available to the user even when the diskettes are not operational. A utility command loads DOS from the system diskette into high-address RAM memory. With DOS loaded, the user has a large set of commands enabling easy access to the two diskettes loaded into the drives, and the information stored on them.

Each diskette normally contains 35 concentric tracks, each containing 18 sectors of 128 bytes each. The first track is used to store the Directory containing information about all files on the diskette. The remaining 34 tracks are available to the user, giving a total of more than 75K bytes per diskette. Once DOS has been loaded into memory, both drives are free for the user, providing a total capacity of more than 150K bytes of storage. Data is stored on diskettes as Files, and may be transferred to or from a peripheral device or system RAM memory, with the aid of DOS commands. Upto five different diskette files may be open at any one time, each assigned to either input or output mode for data transfer. A list of DOS commands is given below:

ASSIGN	COPY	FORMAT	MERGE	RESET
BACKUP	CREATE	FREE	MERGEADJ	RUN
CLOSE	DELETE	GOTO	OPEN	SAVE
CLOSEADJ	DIR	JOB	PROTECT	UTILITY
CLOSEALL	DUMP	LIST	RECOVER	VERIFY
COMPACT	FILES	LOAD	RENAME	

DOS provides a Job file facility which allows console commands to be submitted from a diskette file. This feature allows complete job streams to be setup for execution without operator intervention. An extension command facility allows the name of any executable object file to be used as a DOS command. The specified file will then be automatically loaded and executed. System files such as the text editor and assembler are loaded and executed in this manner. When a diskette file is deleted the data still remains on the diskette, and only the directory entry is flagged as deleted. Deleted files can be restored by using a Recover command with the correct file-name. This facility enables the user to create private files, accessible to authorised personnel only. All deleted files can be removed and their space freed for new files via a Compact command.

DOS supports a number of DAI systems programs including Utility, Text Editor, Macro Assembler, FORTRAN Compiler, Real-World BASIC interpreter etc. The system diskette supplied with PDM-DSK includes DOS, utility, editor and assembler programs. FORTRAN and BASIC are available on separate diskettes. The Editor provides all the facilities for creating and modifying source programs and ASCII data files on diskettes. Source programs written in assembler language or FORTRAN are translated by the DOS Assembler or FORTRAN compiler into object code, suitable for direct execution on any DCE microcomputer system. The DOS and DCE-LSA utilities provide all the necessary functions for program testing and subsequent storage on EPROMs. The DAI Real-World BASIC interpreter with its special real-time functions enable the development of software for industrial control applications, very quickly and easily.

ORDERING INFORMATION:

PDM-DSK : Standard version consisting of a 19-inch eurobox with two mini-floppy disk drives, diskette controller card with resident slave DOS and connections to the two drives, DCE-BUS motherboard, and card guides for a heavy-duty power supply module and 6 eurocards. A pre-formatted blank diskette, and a system diskette containing DOS, utility, text editor and macro assembler are included.

All the plug-in eurocard modules, power supply, mains adaptor, FORTRAN, BASIC etc. must be ordered separately.

Video Monitor

Available second quarter 1980.

PDM-CRT

FEATURES:

High resolution video monitor.

Bright 9-inch CRT display.

Connects directly to the DCE-IM1 integrated microcomputer.

Standard versions for colour and black & white.

Produces 16 colours or grey shades when used with the DCE-IM1.

Separate synchronisation signals ensure a steady image under all picture conditions.

Minimum operator fatigue after long viewing periods.

Separate red, green and blue drive signals in the colour version for high image quality.

FUNCTIONAL DESCRIPTION:

The PDM-CRT is a high performance video monitor, specially suitable for use with the DCE-IM1 integrated microcomputer. It matches the appearance as well as the capabilities of the DCE-IM1, and displays the character and graphical outputs with high image quality.

Separate synchronisation and direct video drive signals ensure image sharpness and picture stability. As a result, operator fatigue is reduced to a very low level, even after long viewing periods. Image sharpness and quality enables the use of high-resolution graphics right up to the extremities of the screen area.

Separate red, green and blue colour drive signals are used in the colour version of the monitor. This overcomes the bandwidth limitations normally associated with subcarrier encoding of the colour information. The resulting image is very sharp even at the colour boundaries.

The PDM-CRT module is complete with an interconnection cable to the corresponding version of the DCE-IM1, and a mains power cable.

ORDERING INFORMATION:

PDM-CRT	: Black & White version, for use with DCE-IM1.
PDM-CRT/C	: Colour version, for use with DCE-IM1/C.

Integrated Microcomputer

Available second quarter 1980.

DCE-IM1

FEATURES:

Complete stand-alone microcomputer system with resident software.

ASCII keyboard with upper and lower case characters, cursor control and reverse-shift keys.

Video monitor interface for direct connection to monochrome or colour monitors.

Standard RS232 serial interface with programmable baud rates.

3 programmable 8-bit parallel ports for DCE-BUS implementation.

5 independently programmable hardware interval timers.

Dual audio cassette interfaces with connector.

High-speed hardware scientific floating-point math processor.

48K RAM memory starting from address zero.

24K ROM-resident system software including a high-speed semi-compiling BASIC interpreter and machine language Utility.

Three modes of graphics with maximum resolution of 255 x 335 pixels.

4 or 16 colours/grey-shades for graphics and text.

Split-screen mode for combining graphics with text.

24 x 60 character screen, with upper and lower ASCII characters.

Resident screen editor with up, down, left, right scrolling.

Program execution trace facility for BASIC and machine code programs.

Compatible with PDM-DSK diskette unit, and all RWC Real-World interface modules.

FUNCTIONAL DESCRIPTION:

The DCE-IM1 is a complete microcomputer system, with resident software for program development. It can be used as a powerful stand-alone computer with scientific floating-point math and graphics functions, or as a controller for systems configured with RWC interface modules. Without any additional hardware or software, the DCE-IM1 can be used to develop programs in DAI high-speed semi-compiling BASIC, or 8080 machine code. The BASIC interpreter and machine code Utility are included in the 24K ROM-based system software. A special screen edit feature enables very easy correction of programs and ASCII data files. BASIC and machine code programs, and data arrays can be stored on two standard audio cassette recorders. The DCE-IM1 works with the PDM-CRT colour or black & white video monitors to produce very high quality text and graphics displays. The hardware math processor performs scientific floating-point math calculations at very high speed. Subroutines written in machine code can be called by BASIC program statements.

The addition of a DAI diskette system further enhances the capabilities of the DCE-IM1 computer. A Diskette Operating System (DOS) program is automatically loaded from the diskette. The full set of DOS commands then become available to the user, enabling the efficient manipulation of files maintained on diskettes. Special versions of diskette based macro-assembler, and FORTRAN compiler are available for software development using the IM1/PDM-DSK combination.

A general purpose RS-232 interface is available with programmable baud rates. Normally this is used to drive a line-printer enabling hard-copy printing capabilities to be added for both program development and/or execution.

Five programmable timers operating through the system's maskable interrupt structure enable the user to employ real-time functions in his application program.

Upon program completion, the user may commit the application program onto EPROMs. These, when installed onto an optional EPROM card, and fitted into the IM1, may configure the IM1 into a stand-alone, dedicated turn-key controller.

SUMMARY OF IM1 COMMANDS:

BASIC Commands:

CALLM	CHECK	CLEAR	COLORT	CONT	CURSOR
DATA	DIM	EDIT	END	FOR	GOSUB
GOTO	IF...GOTO	IF...THEN	IMP	INPUT	LET
LIST	LOAD	LOADA	MODE	NEW	NEXT
ON...GOSUB	ON...GOTO	OUT	POKE	PRINT	READ
REM	RESTORE	RETURN	RUN	SAVE	SAVEA
STEP	STOP	TRON	TROFF	UT	WAIT

Special Graphical Commands:

```
COLORG  Colour-1, Colour-2, Colour-3, Colour-4.
DOT     X,Y  Colour
DRAW    X,Y  X,Y  Colour
FILL    X,Y  X,Y  Colour
```

BASIC Functions:

ABS	ACOS	ALOG	ASC	ASIN	ATN	CHR$	COS
CURX	CURY	EXP	FRAC	FRE	GETC	HEX$	INP
INT	LEFT$	LEN	LOG	LOGT	MID$	PEEK	PI
RIGHT$	RND	SCRN	SGN	SIN	SPC	SQR	STR$
TAB	TAN	VAL	VARPTR	XMAX	YMAX		

Operators:

+, -, *, /, MOD, ↑, =, <, >, <> , <=, >=,
AND, IAND, IOR, IXOR, INOT, OR, SHL, SHR

Variables may be either integer, floating point, or string. Variable names may consist of upto 14 characters.

ORDERING INFORMATION:

DCE-IM1 : Standard version with interface for the black and white video monitor PDM-CRT.

DCE-IM1/C : Standard version with interface for the colour video monitor PDM-CRT/C.

Support Software

GENERAL FEATURES:

All DCE microcomputer systems have a modular architecture based on the DCE-BUS. System configuration normally involves selecting a suitable eurobox or eurorack, plugging in a DCE microcomputer, optional MX memory expansion modules, RWC interface cards and a power supply. Software development can be done on the same hardware configuration, by the addition of development assistance modules. These include EPROM resident software packages such as Utility, Text Editor, Assembler and Real-World BASIC interpreter; hardware modules such as EPROM programmer and system bus monitor; and interface cards for connecting standard peripherals such as printer, paper-tape reader and punch. The DAI diskette station provides bulk data storage with fast access, and diskette based software packages for program development. In the software testing phase, the relevant interface modules can be inserted directly into the system for checking the hardware/software interfaces. This approach enables final verification of total system performance directly, without requiring an in-circuit emulator.

DCE UTILITY.

The DCE Utility is a 2K byte software package normally resident on 2708 or 2716 EPROMs. It plugs directly into sockets on the DCE microcomputer or memory expansion module, and provides the user a powerful set of commands for program loading, testing and transferring to EPROMs. Different versions are available for use with standard console devices such as TTY or VDU, (UPT), and with the low-cost keyboard/display unit PDM-KDU, (UPK). A special 3K byte version (UPT/L) on 2708 EPROMs is available for the DCE-LSA. Another 3K byte version (UPD) is used by the Diskette System. Utility commands enable the user to display or modify memory and CPU register contents, fill a memory block with a constant value, move the contents of one memory block into another, initialize the devices on the DCE microcomputer, read a file of data from an input peripheral into memory, write a file of data from memory to an output peripheral etc. With the use of Utility commands, the user can load an object program including interrupt service routines into RAM memory, set up initial register and memory values, transfer control to a selected starting point in the program, and trace its execution within a selected window. The Utility interrupt handler enables interrupt service routines to be placed anywhere in RAM or EPROM memory. The program trace function automatically displays the contents of all CPU registers after execution of each instruction in the program under test. The Utility contains driver software for the EPROM programmer cards, and provides commands for programming EPROMs, comparing with memory, and transferring to memory.

ASSEMBLER/EDITOR.

The 2K byte assembler/editor on EPROMs works in conjunction with the UPT Utility, and provides a very low-cost aid for developing programs in assembly language. It requires a console device with bulk data storage capability, such as a TTY with paper-tape reader and punch. The text editor operates in off-line mode, requiring an edit file containing the necessary corrections to the program text. The assembler allows the user to write programs for DCE-1, 1A, 2, 2A and X microcomputer systems, using 8080 assembly language including the special GIC and TICC macros.

EDITOR.

The 2K byte text editor on EPROMs works in conjunction with the UPT Utility, and provides powerful on-line edit functions. It requires a console device with bulk data storage capability, such as a TTY with paper-tape reader and punch. The text editor provides all the necessary functions for the creation and modification of source programs and data files. It contains commands for reading data from an input peripheral into RAM memory, making suitable modifications, and saving it by writing to an output peripheral. Editing commands enable the user to insert, delete, substitute and search single characters or strings of text.

ASSEMBLER.

The 2K byte assembler on EPROMs works in conjunction with the UPT Utility. It enables the user to write programs for DCE-1, 1A, 2, 2A and X microcomputer systems, using 8080 assembly language including the special GIC and TICC macros. A special Relocate package included with the assembler enables object programs assembled for a particular start address to be relocated to run from any other start address.

DISKETTE OPERATING SYSTEM.

The PDM-DSK dual-drive diskette station includes a powerful Diskette Operating System, DOS. Data is stored on diskettes as Files, and may be transferred to or from a peripheral device or system RAM memory, using DCS. A complete description of DOS functions and a list of commands is given in the section titled 'Twin Diskette System'.

DISKETTE EDITOR.

The diskette based text editor included in the PDM-DSK unit provides comprehensive facilities for creating and modifying source programs and ASCII data files. Programs can be entered from the console keyboard, system reader device, or diskette. The text is loaded in blocks into the edit buffer in RAM memory, suitably modified, and saved on diskette or system punch device for future use. Edit commands enable the user to insert, delete, substitute and search single characters or strings of text.

DISKETTE ASSEMBLER.

The diskette based macro assembler supplied with the PDM-DSK unit translates symbolic 8080 assembly language instructions into executable machine code at high speed. Full macro capability eliminates the need to rewrite similar sections of code repeatedly within a program. A conditional assembly feature enables the assembler to include or ignore sections of code, which may vary depending on the final hardware configuration etc.

REAL-WORLD BASIC INTERPRETER.

This is a 3K byte real-time BASIC interpreter, specially developed by DAI for writing software for DCE microcomputer systems. It is available on 2708 or 2716 EPROMs (UBR), or on diskette (DSK-UBR). DAI Real-World BASIC is a variation of tiny-BASIC, with special commands and functions for implementing real-time control systems built with DCE microcomputers and RWC interface modules. These special features enable the user to access RWC interface cards, execute data I/O directly from memory locations and memory-mapped devices, maintain a 24-hour clock, stop program execution for a specified time, control a hardware interval timer, process an external interrupt request, logically manipulate data at the 'bit' level, communicate with console terminal for data I/O, save BASIC programs on EPROMs for direct execution on DCE microcomputers, load programs from EPROMs back into RAM memory, and check if an EPROM is correctly erased. All numbers are integers held in 2 bytes, and must be in the range -32768 to +32767. There are 26 variables denoted by letters A to Z, each occupying 2 bytes. There is also a single array (1), whose dimension is set to make use of all free memory space. Being an application oriented high-level programming language, DAI Real-World BASIC reduces the learning-curve and costs for writing software to a minimum. It is ideal for relatively simple real-time control applications where the execution time is not critical.

INDUSTRIAL BASIC INTERPRETER.

This is a 16K byte semi-compiling high-speed BASIC interpreter with real-time functions, specially developed by DAI to simplify software writing for DCE microcomputer systems. It is available on diskette (DSK-UBI), for developing software on the Diskette System. The source programs are semi-compiled into a compact intermediate code, which executes at very high speed. At the end of the development phase, the program can be transferred to EPROMs and executed on the run-time module DCE-BAS, under DCE-X microcomputer control. The diskette based interpreter provides 9-digit integer or 6-digit (10^{-18} to 10^{18}) floating-point scientific math functions. It also supports the hardware math processor on the DCE-BAS, which provides very high-speed math calculations. DAI industrial BASIC contains the usual commands, functions and operators of extended BASIC, together with all the real-time features of Real-World BASIC.

FORTRAN COMPILER.

DAI FORTRAN is a subset of ANSI standard FORTRAN IV, adapted for 8080 CPU based DCE microcomputer systems. The compiler is available on diskette (DSK-FOR), for developing software on the Diskette System. It requires only 14K bytes of RAM memory for compiler and minimum workspace, but the workspace expands to take maximum advantage of available memory. It is a very fast compiler producing highly optimized 8080 machine code, estimated at only 1,5 times as much as with assembly language. The generated object code can be loaded into EPROMs and directly executed on a DCE microcomputer, without needing any run-time package. DAI FORTRAN has special enhancements for processing interrupts, defining the final placement of programs and data areas in DCE microcomputer memory, linking machine code subroutines, using 8080 CPU flags as FORTRAN keywords, and accessing memory locations and memory-mapped I/O devices. It provides 1 and 2 byte integer arithmetic, and single or double precision floating-point arithmetic. Floating-point mode provides for a 7-bit exponent plus sign (10^{-78} to 10^{78}), and 24-bit single precision or 56-bit double precision mantissa.

ORDERING INFORMATION:

When ordering software resident on EPROMs, it is necessary to specify one or more of the following codes. These codes are added to the end of the product model number.

Card Code:

-1	= DCE-1	-X88	= DCE-X88		
-1A	= DCE-1A	-X88A	= DCE-X88A		
-2	= DCE-2	-M68	= DCE-M68		
-2A	= DCE-2A	-M68A	= DCE-M68A		
-X	= DCE-X	-Z80	= DCE-Z80		
-X86	= DCE-X86	-Z80A	= DCE-Z80A		
-X86A	= DCE-X86A				

Baud-rate Code:

.11	= 110				
.15	= 150				
.30	= 300				
.12	= 1200				
.24	= 2400				
.48	= 4800				
.96	= 9600				

Terminal Code:

/STD	= TTY, VDU etc.				
/733	= TI 733				

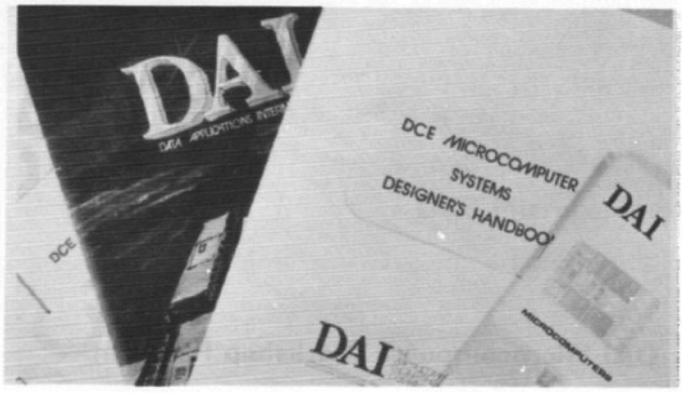
EPROM Code:

/08	= 2708				
/16	= 2716				
/32	= 2732				

UPT : 2K byte Utility for terminals, on EPROM.
UPT-L : 3K byte Utility for DCE-LSA (and DCE-X), on 2708 EPROMs.
UPD : 3K byte DCE-LSA Utility for the diskette system, on 2708 EPROMs.
UPK : 2K byte Utility for PDM-KDU keyboard/display unit, on EPROM.
UAE : 2K byte Assembler and off-line Editor, on EPROM. Runs with the UPT.
UED : 2K byte on-line Editor, on EPROM. Runs with the UPT. Compatible with UAS.
UAS : 2K byte Assembler with Relocate, on EPROM. Runs with the UPT.
UBR : 3K byte Real-World BASIC interpreter, on EPROM.
DSK-UBR : Real-World BASIC interpreter on diskette, for use on DAI Diskette System.
DSK-UBI : Industrial BASIC interpreter on diskette, for use on DAI Diskette System.
DSK-FOR : FORTRAN compiler on diskette, for use on DAI Diskette System.

UPT, UBR : Specify card, baud-rate, terminal and EPROM codes when ordering.
UPK, UAE, UED, UAS : Specify card and EPROM codes when ordering.
UPT-L : Specify baud-rate and terminal codes when ordering.
UPD : Specify baud-rate code when ordering.

Examples: UPT-2A.11/STD/16, UPT-L.30/733



Documentation

GENERAL DESCRIPTION:

Every product in the DAI Standard Module family is supported by comprehensive documentation. The "DCE Microcomputer Systems Designer's Handbook" contains complete hardware specifications of all the modules. The "DCE Microcomputer Software Designer's Handbook" contains detailed specifications of all the support software packages and programming languages available for the DAI Standard Module family.

DCE MICROCOMPUTER SYSTEMS DESIGNER'S HANDBOOK.

This is a comprehensive manual of more than 400 pages containing detailed specifications of DCE microcomputers, MX memory expansion modules, RWC real-world interfaces, and PSM packaging modules. It describes the DCE-BUS in detail, with timing diagrams and specifications for designing bus-compatible modules.

The DCE microcomputer specifications include detailed block diagrams, memory and register configurations, system and device connector pin definitions, electrical specifications and power requirements. The sections on MX memory expansion modules contain X-BUS specifications, physical layout diagrams, address selection details and power requirements. Each RWC Real-World interface module is fully specified with functional block diagram, hardware configuration details, programming specifications including initialization and device addressing, format and interpretation of data, communication protocol with the DCE-BUS, user options including jumper selection, connector pin definitions, power requirements and a complete test program. The sections on PSM packaging modules describe all the hardware accessories available for housing and installing complete DCE microcomputer systems.

DCE MICROCOMPUTER SOFTWARE DESIGNER'S HANDBOOK.

This is a comprehensive manual of more than 300 pages containing detailed specifications of all support software packages available for programming DCE microcomputer systems. It describes the DAI Utility packages in detail, including all the commands for program loading, testing and saving on EPROMs. The sections on the DAI diskette system contain detailed descriptions of the Diskette Operating System commands, text editor and assembler functions. DAI Real-World BASIC interpreter and FORTRAN compiler are specified in detail with programming exercises, and complete program development sequences. The manual also includes a complete case study of a simple control application, including flow charting, program development, de-bugging and prototyping.

ORDERING INFORMATION:

Designer's Handbook	: Hardware reference manual.
Software Handbook	: Software reference manual.

DAI Microcomputer Workshop Program

FEATURES:

Teaches all the skills necessary to complete operational systems, using DAI Standard Modules.

Suitable for engineers from all disciplines.

Only prerequisites are a knowledge of binary and hexadecimal number systems, and basic logic functions.

Includes comprehensive hands-on experience on DCE microcomputer systems.

Limited to 16 attendees.

Regularly held by DAI representatives in almost every country.

On-site workshops tailored to customer requirements.

GENERAL DESCRIPTION:

DAI workshops teach all the skills necessary to implement operational systems using standard microcomputer modules. Even complete new-comers to digital computer and programming concepts find that they can complete working systems during the course. The only course prerequisites are a knowledge of binary and hexadecimal number systems, and basic logic functions. Each workshop is limited to sixteen attendees to ensure personal attention and maximum benefit for every one. All theory sessions are reinforced by comprehensive hands-on training on DCE microcomputer systems. Many practical examples are implemented during the course to ensure an in-depth knowledge of important concepts, and their application in practical situations.

These microcomputer workshops are arranged regularly by DAI representatives in almost every country, in the local language. Special on-site workshops tailored to customer requirements have helped many organisations to bring microcomputers into their applications. To date DAI workshops have taught over 5000 engineers how to use microcomputers.

WORKSHOP OUTLINE:

DAY ONE.

Introduction to stored program computers.

Detailed analysis of stored program computer operation.

Introduction to DCE microcomputer family.

Detailed analysis of the 8080 CPU instruction set.

Simple programming examples in assembly language.

Programming arithmetic operations.

Introduction to DCE microcomputer systems and support software.

Practical programming exercises on DCE systems.

DAY TWO.

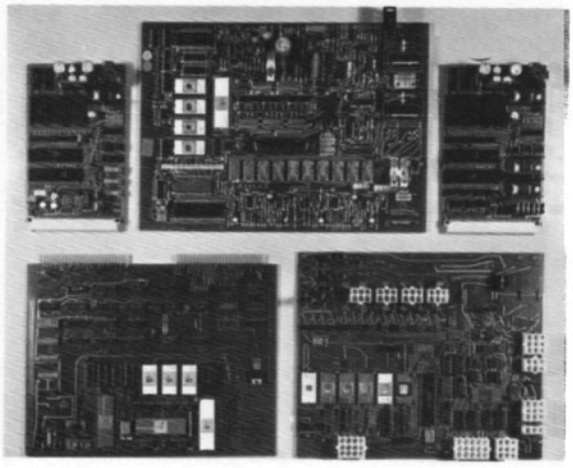
Analysis of the interface and communications sub-systems in DCE microcomputers.
Practical exercises to illustrate their functions.
Interrupt processing.
Programming input/output operations.
Introduction to DAI Diskette System.
Introduction to Diskette Operating System DOS.
Program development on the DAI Diskette System.
Introduction to text editor and assembler.
Practical examples in editing, assembling and de-bugging programs.
Program structuring and subroutines.
Design and documentation of programs.

DAY THREE.

DCE-BUS description.
Introduction to RWC interface modules and driver software.
Practical programming exercises for interface functions.
Economic usage of microcomputers in different volume segments.
Guidelines for practical microcomputer systems design.
Design examples illustrating hardware/software trade-offs.
Introduction to high-level programming languages.
Advantages and disadvantages of high-level programming languages.
Introduction to DAI Real-World BASIC.
Detailed analysis of Real-World BASIC commands.
Practical programming exercises.

DAY FOUR.

Exercises in driving interfaces, processing interrupts and programming EPROMs.
Programming exercises for practical real-time control.
Design of a complete microcomputer application for real-time control.
Practical implementation on DCE systems using Real-World BASIC.



Custom Controllers

INTRODUCTION

As production volumes increase, components begin to have a greater influence on total system costs than the distributed development cost. As a result, systems configured from standard hardware modules become economically less attractive due to component redundancy and module interconnection costs. In such cases, a special development to produce a dedicated controller becomes worthwhile. DAI Custom Controllers satisfy this need. They combine all the components necessary for a particular application on a single printed-circuit card.

Such designs are suitable for specific product development requirements in larger volumes. They can also be used in successful standard module applications where larger production quantities now make the original approach less economical. DAI accepts complete design, engineering and production responsibility to deliver a programmed, assembled and tested Custom Controller performing to user specifications. A full-function automatic tester is built for each application. This minimizes card testing costs during production and subsequent field operation. All cards are guaranteed, and can be easily returned to DAI for repair. System maintenance becomes a simple matter of exchanging one card, requiring no special skills.

Since the inception of microprocessors, DAI has been totally dedicated to the application of their technology. As the world's first microcomputer engineering company, DAI holds a unique position in designing and producing microcomputers to customer specifications. The accumulated know-how and experience of DAI in microcomputer engineering is available to OEMs all over the world via DAI Custom Controllers. The systems engineering, test and manufacturing staff at DAI have produced simple as well as sophisticated microcomputers quickly, reliably and in large volumes. DAI's close association with every major semiconductor manufacturing company, while retaining total independence from them, enables DAI to select the best available components for each design. Every company which builds products in volume can use DAI Custom Controllers to ensure a fast development cycle, optimum design, a reliable production base and financial benefits. DAI Custom Controllers are ideal for OEMs who want to apply microprocessors with no involvement in their technology.

REAL-WORLD CONTROL SYSTEMS

The RCS family is a special low-cost variation of custom controllers, providing complete microcomputer control systems on single 100 x 160 mm eurocards. They combine an 8085 based microcomputer, hardware generated scientific floating-point math functions, different analog and digital I/O functions and a power supply on a single card. A standard kernel module contains the CPU, memory, hardware math processor and a power supply operating from 24V unregulated D.C. Different analog and digital I/O functions are then designed in with the standard kernel hardware to meet user requirements. This approach minimizes the development effort, and provides a custom designed control system economically, even at low production volumes. The RCS family brings the performance and maintenance advantages normally associated with high-volume single-card custom designs, within economic reach of lower-volume users.

DAI THE MICROCOMPUTER COMPANY

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