

Benchmark Family
For Microcomputer Systems



EXORciser data sheets

- The M6800 EXORciser — page 2
- M68SDT Basic EXORciser — page 4
- MEX6800 MPU Module — page 7
- MEX6812-1 2K Static RAM Module — page 10
- MEX6815-1 8K Dynamic RAM Module — page 12
- MEX6820 Input/Output Module — page 14
- MEX681C I/O Interconnection Cable — page 14
- MEX68WW Wirewrap Module — page 17
- MEX68XT Extender Module — page 18
- Resident Software — page 19



MOTOROLA Semiconductor Products Inc.

M6800 EXORciser

The M6800 EXORciser, through its ability to emulate a user's system, provides an efficient and economical means to develop M6800 Microprocessor Systems. Through its optional modules, the EXORciser saves the engineer hardware design and development time, since he can arrange these modules to represent his system rather than build a system prototype.

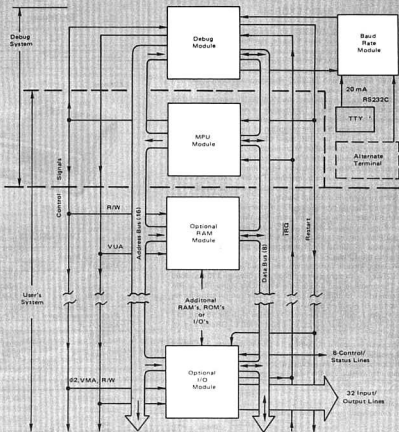
The M6800 EXORciser optional Resident Software provides the programmer with a functional system on which to develop his system software. This software permits him to edit, assemble, and modify his programs in real time on the actual hardware with his peripheral devices incorporated in the system.

The M6800 EXORciser with its EXbug Firmware enables the engineer or programmer to evaluate and debug his system — both hardware and software — in its actual working environment. It also permits the user to make any hardware and software adjustments required in finalizing his system design.

FEATURES:

- Easy To Use
- Saves System Design and Development Time
- Decreases System Design and Development Costs
- Builds Confidence in the User's System
- Modular Design Allows Exact Duplication of Final System Function and Performance
- Expandability in Design Allows Duplication of Final System Capability
- Data Terminal Connects to EXORciser Permitting Development of Software and Firmware Programs
- Evaluates and Debugs Final System Software/Firmware
- Module's Firmware Performs Tests and Diagnostics on Production Systems
- Has Dynamic Memory Refresh Capability
- Has Capability of Working with Slow Memories

SIMPLIFIED EXORCISER BLOCK DIAGRAM





MOTOROLA Semiconductors

M68SDT

Advance Information

BASIC EXORciser

The basic EXORciser (M68SDT) consists of the MPU Module, the Debug Module, the Baud Rate Module, the Power Supply and the chassis. These modules are built around the M6800 Microcomputer Family of Parts (MC6800 Microprocessing Unit, MCM6810 Random Access Memory, MC6820 Peripheral Interface Adapter, MCM6830 Read Only Memory, and MC6850 Asynchronous Communication Interface Adapter devices).

The MPU Module incorporates the MC6800 Microprocessing Unit (MPU) and the system clock. This module serves a dual function in that it provides the MPU and clock for both the EXORciser Debug and the user's system. With the exception of the EXORciser clock, the system restart and the DBE signal (delayed), the MPU Module appears exactly like the MC6800 Microprocessing Unit with unlimited TTL bus drive capability. The MPU is an 8-bit parallel device capable of addressing 65,536 bytes of memory. In addition, the MPU addresses its input and output devices as memory. The MPU also provides the EXORciser with 72 variable length instructions and the capability of responding to real time interrupt signals.

The Debug Module provides the EXORciser with the capability to evaluate and debug the user's program. The three MCM6830 ROM memories on this module contain the EXbug Firmware that provides the EXORciser with its unique software control features. The module also has two MCM6810 RAM memories to provide a scratch-pad memory to the EXbug Firmware.

The Debug Module working with the Baud Rate Module provides the EXORciser with eight standard baud rates between 110 and 9600 Baud. These modules also interface the EXORciser with a TTY or RS-232C compatible terminal and provide a reader control signal for remote control of modified manual TTY terminals.

The Power Supply provides the EXORciser with the +5 Vdc, +12 Vdc, and -12 Vdc power sources to support a full EXORciser rack of modules.

The chassis is capable of holding 14 plug-in modules. The Power Supply and Baud Rate Modules are not plug-in modules but mount directly to the chassis. Two versions of the chassis are available — the rack mounted version and the table top version.

BASIC EXORciser

EXORciser



DIMENSIONS

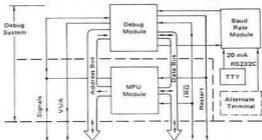
Table Top Model

M68SDT-T	
Width	19.25 in.
Depth	17.50 in.
Height	7.00 in.

Rack Mounted Model

M68SDT-R	
Width	19.00 in.
Depth	17.00 in.
Height	7.00 in.

BLOCK DIAGRAM



BASIC EXORciser SPECIFICATIONS

Specification	Value
Power Requirements	95-135/205-250 Vac 47-420 Hz, 250 W
Word Size	8 bits
Data	16 bits
Address	8, 16, and 24 bits
Instruction	
Memory Capability	65,536 bytes
Instruction Set	72 variable length instructions
Clock Cycle Time	Selectable: 1 μ s crystal control clock or an external clock between 1 μ s and 10 μ s
Interrupt	Maskable real time interrupt
Data Terminal Interface Characteristics	
Baud Rates (Switch selectable)	110, 150, 300, 600, 1200, 2400, 4800, and 9600
Signal Characteristics	TTY (20 mA neutral current loop) or EIA RS-232C compatible
Reader Control Signal	Control signal for TTY devices modified for external control
Operating Temperature	0 to 55°C

EXORciser OPTIONS

The M6800 EXORciser derives its flexibility from its optional hardware, modules, and software. Two models of the EXORciser are available — a rack mounted model, and a table top model. When ordering, use the appropriate part number. In addition, specify the kit number for proper installation in the chosen location.

M68SDT-T	EXORciser, Table Top Model
M68SDT-R	EXORciser, Rack Mounted Model
MEX68TT	Table Top Kit
MEX68RK	Rack Mounting Kit

Optional assemblies permit the user to adapt his EXORciser to various system configurations, with memory size and input/output configuration selected to meet system needs. The optional modules include:

- MEX6812-1 2K Static RAM Module
- MEX6815-1 8K Dynamic RAM Module
- MEX6820 Input/Output Module
- MEX68IC I/O Flatribbon Interconnection Cable
- MEX68WW Universal Wirewrap Module
- MEX68XT Extender Module

Motorola supplies a variety of software programs to support the M6800 Microcomputer Family of Parts. These programs include Cross-Assemblers and Editors, Simulators, Build-Virtual Machine, and Help programs as well as the EXORciser Resident Editor and Assembler programs.

EXbug FIRMWARE

The EXbug Firmware is an integral part of the EXORciser, which provides system development program capability for debugging both the system hardware and software by enabling the user to perform the following functions:

- Load data into the EXORciser
- Verify that the data in the EXORciser or on tape is valid
- Search a tape for a specific file
- Print the contents of the memory
- Punch (record) the contents of the memory on tape
- Perform the MAID (Motorola Active Interface Debug) functions

The MAID functions enable the EXORciser to:

- Examine and, if required, change the contents in a memory location
- Examine and, if required, change the data in an MPU register
- Calculate the offset in the relative addressing mode
- Insert, display, and remove breakpoints in a user's program
- Free run or trace through a user's program under MAID control
- Stop the user's program on a specific program step
- Provide an oscilloscope trigger pulse at a selected program step
- Search memory for a specific bit pattern
- Perform decimal-octal-hexadecimal conversions



EXORciser BUS SIGNALS

The EXORciser bus interfaces the MPU Module with other modules being used in the EXORciser. This bus permits the EXORciser to be configured to meet a user's specific application.

Data Bus (D0-D7) — These eight bi-directional lines, when enabled, provide a two-way transfer of data between the MPU Module and the selected memory location. The data bus drivers on the modules are three-state logic devices.

Address Bus (A0-A15) — These 16 lines, when enabled, transfer the MPU memory address to the selected memory location. The MPU Module controls the operation of these lines through its three-state bus drivers.

Read/Write (R/W) — This MPU output signal indicates whether the MPU Module is performing a memory read (high) or write (low) operation. The normal standby state of this line is read (high). Also, when the MC6800 MPU on the module is halted, this signal will be in the read state.

Valid Memory Address (VMA) — This line, when high, indicates that the address on the bus is valid.

Valid User's Address (VUA) — This line, when high, indicates that the address on the address bus is valid and the EXORciser is not addressing its EXbug program.

Memory Clock (MEMCLK) — This is the basic clock signal used by the MPU Module to generate its $\phi 1$ and $\phi 2$ non-overlapping clock signals.

Phase 1 ($\phi 1$) Clock — This signal is derived from the Memory Clock and is present during the MPU addressing time. This signal is controlled by the MPU Module.

Phase 2 ($\phi 2$) Clock — This signal also is derived from the Memory Clock and used to synchronize the transfer of data on the data bus. This signal is controlled by the MPU Module.

Bus Available (BA) — The Bus Available signal will normally be a low level. When activated, it will go high indicating that the address bus is available. This will occur if the Halt line is low or the MC6800 MPU is in the WAIT state as the result of executing a WAI instruction. At such time, all the MPU Module three-state output drivers will go to their off state and other outputs to their normally inactive state. An interrupt command or actuating the ABORT or RESTART switch removes the MPU from the WAIT state.

Interrupt Request (IRO) — This level sensitive input, on going low, requests that an interrupt sequence be generated in the MC6800 MPU. The MPU will wait until it completes the current instruction that it is executing before it recognizes this request. At that time, if the interrupt mask bit in the MPU Condition Code Register is not set, the MPU will begin the interrupt sequence.

Non-Maskable Interrupt (NMI) — This level sensitive input, on going low, requests that an interrupt sequence be

generated within the MC6800 MPU. The MPU will wait until it completes the current instruction that it is executing before it recognizes this request. At that time, the MPU will begin its non-maskable interrupt routine.

Reset — This edge sensitive signal initiates an MC6800 MPU power-on vectored interrupt initialize routine when power is first applied to the EXORciser and each time the EXORciser's RESTART switch is actuated. This signal, in addition to resetting the module's MPU, is used to reset and initialize the rest of the EXORciser.

Three-State Control (TSC) — This input, when high, causes all of the MPU Module's Address Bus lines and R/W line to go to their off or high-impedance state. The Valid Memory Address and Valid User's Address signal will be forced low. The Data Bus is not affected by the Three-State Control. This signal is initially jumpered to ground on the MPU Module.

Refresh Request (REFREQ) — This signal, when low, initiates a memory refresh operation. The MPU Module, on receiving this input, stops generating the $\phi 1$ and $\phi 2$ clock signals with $\phi 1$ high and, through the Refresh Grant command, instructs the initiating memory module to refresh itself.

Refresh Grant (REFGRANT) — The MPU Module, on receiving a Refresh Request input, generates a Refresh Grant signal to instruct the initiating module to refresh itself.

Memory Ready (MEMRDY) — This signal enables the MPU Module to work with slow memories. The MPU Module, on receiving a low level Memory Ready input, stops generating the $\phi 1$ and $\phi 2$ clock signals with $\phi 2$ high. The initiating module, on completing its memory operation, returns the Memory Ready signal to a high level.

Halt — When this input is low, all activity in the MC6800 MPU will be halted. This input is level sensitive. In the halt mode, the machine will stop at the end of an instruction. Bus Available will be high, Valid Memory Address and Valid User's Address will be low, and all other three-state lines will be in their off or high-impedance state.

Transition of the Halt line must not occur during the last 250 ns of $\phi 1$. To insure single instruction operation, the Halt line must go high for one $\phi 1$ clock pulse.

Refresh Clock (REFCLK) — This signal is generated by the dynamic memory module being used as the master refresh module. This signal is used to initiate a memory refresh operation on the dynamic modules functioning as slave refresh modules.

Stand By (STDBY) — This line is a low level during a power-fail condition and a high level during normal EXORciser operation.

BUS CONTROL

It is possible for a module other than the MPU Module to gain control of the bus. This module would place a low level Halt on the bus and monitor the Bus Available signal. When the MPU Module completes the instruction it is performing, it generates a high level Bus Available signal. The

module requesting control of the bus now must pull the Three-State Control line low, forcing the MPU Module address bus drivers to their high-impedance state. The requesting module now has control of the EXORciser bus until it elects to relinquish control.





MOTOROLA
Semiconductors

MEX6800

Advance Information

MPU MODULE

The MEX6800 MPU Module is the heart of both the EXORciser Debug system and the user's system under development. That is, the MPU Module provides both the system clock and the MC6800 Microprocessing Unit (MPU) for the EXORciser Debug and the user's system. The MPU Module also automatically initiates an EXORciser restart operation when power is first applied to the EXORciser.

The clock circuit, in addition to generating the basic EXORciser timing signals, provides the EXORciser with the capability of refreshing dynamic memories and working with slow memories. The dynamic memories are refreshed on a cycle stealing basis. In working with slow memories, the MPU Module stretches the clock pulse to allow the two-way transfer of data.

The MC6800 Microprocessing Unit is an 8-bit parallel device capable of addressing 64K bytes of memory. It addresses its input and output devices as memory. The MPU provides the EXORciser with 72 variable length instructions and the capability of responding to real time interrupt signals. With the exception of the EXORciser clock, the system restart, and the Data Bus Enable signal (delayed), the MPU Module appears exactly like an MC6800 Microprocessing Unit with unlimited drive capability.

- Provides MPU and Clock for the EXORciser Debug and User's System
- Crystal-Controlled 1 MHz Clock
- Provisions for an External Clock Input
- Automatic Restart Capability
- Dynamic Refresh Capability on a Cycle Stealing Basis
- Capable of Working with Slow Memories Through Stretching the $\phi 2$ Clock Pulse

EXORciser MPU MODULE

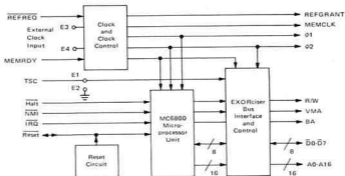
EXORciser



MPU MODULE



BLOCK DIAGRAM



MODULE SPECIFICATIONS

(Note: Positive current flow is defined as flowing into the terminal, negative current flow as flowing from the terminal.)

Specification	Value
Memory Size Capability	65,536 bytes maximum
Word Size	8 bits 16 bits 8, 16, or 24 bits
Instruction Set	72 variable length instructions
Interrupts	Maskable and non-maskable real-time interrupts Software interrupt
Clock Signal	1 MHz; provision for external clock between 100 kHz and 1 MHz
Input Control Signals Logic "0" Logic "1"	TTL Voltage Compatible 0.0-0.8 V 2.0-5.25 V
Address Bus and R/W Logic "0" Logic "1" Off-State Leakage Current	0.0-0.5 V 2.4-5.25 V -40 μ A
Data Bus Input Logic "0" Input Logic "1" Output Logic "0" Output Logic "1" Output Off-State Leakage Current	Three-state TTL voltage compatible 0.0-0.8 V (-200 μ A at 0.4 V) 2.0-5.25 V (25 μ A at 5.25 V) 0.0-0.5 V (40 mA at 0.5 V) 2.6-5.25 V (-10 mA at 2.6 V) 100 μ A at 2.6 V
Output Control Signals Logic "0" Logic "1"	TTL voltage compatible 0.0-0.4 V 2.4-5.25 V
Operating Temperature	0 to 70°C
Power Requirements	5 Vdc at 700 mA
Dimensions Width Height Thickness	9.75 in. 5.75 in. 0.062 in.

EXORciser INTERFACE SIGNALS

The MEX6800 MPU Interface Module interfaces directly with the EXORciser bus using the following signals. The MPU Module, through these signals, controls the operation of the EXORciser.

Data Bus (D0-D7) — These eight bi-directional lines, when enabled, transfer a two-way transfer of data between the MPU Module and the selected memory location. The data bus drivers and receivers on the MPU Module are three state devices. The data bus drivers and receiver are in their off or high impedance state except when this module is performing a memory read or write operation.

Address Bus (A0-A15) — These 16 lines, when enabled, transfer the MPU memory address to the selected memory location. The MPU Module controls the operation of these lines through its three-state bus drivers.

Read/Write (R/W) — This MPU output signal indicates whether the MPU Module is performing a memory read (high) or write (low) operation. The normal standby state of this line is read (high). Also, when the MC6800 MPU on the module is halted, this signal will be in the read state.

Valid Memory Address (VMA) — This line, when high, indicates that the address on the bus is valid.

Memory Clock (MEMCLK) — This is the basic clock signal used by the MPU Module to generate its ϕ 1 and ϕ 2 non-overlapping clock signals.

Phase 1 (ϕ 1) Clock — This signal is derived from the Memory Clock and is present during the MPU addressing time. This signal is controlled by the MPU Module.



Phase 2 ($\phi 2$) Clock — This signal also is derived from the Memory Clock and used to synchronize the transfer of data on the data bus. This signal is controlled by the MPU Module.

Bus Available (BA) — The Bus Available signal will normally be a low level. When activated, it will go high indicating that the address bus is available. This will occur if the **Halt** line is low or the MC6800 MPU is in the WAIT state as the result of executing a WAI instruction. At such time, all the MPU Module three-state output drivers will go to their off state and other outputs to their normally inactive state. An interrupt command or actuating the ABORT or RESTART switch removes the MPU from the WAIT state.

Interrupt Request (IRQ) — This level sensitive input, on going low, requests that an interrupt sequence be generated in the MC6800 MPU. The MPU will wait until it completes the current instruction that it is executing before it recognizes this request. At that time, if the interrupt mask bit in the MPU Condition Code Register is not set, the MPU will begin the interrupt sequence.

Non-Maskable Interrupt (NMI) — This level sensitive input, on going low, requests that an interrupt sequence be generated within the MC6800 MPU. The MPU will wait until it completes the current instruction that it is executing before it recognizes this request. At that time, the MPU will begin its non-maskable interrupt routine.

Reset — This edge sensitive signal initiates an MC6800 MPU power-on vectored interrupt initialize routine when power is first applied to the EXORciser and each time the EXORciser's RESTART switch is actuated. This signal, in addition to resetting the module's MPU, is used to reset and initialize the rest of the EXORciser Debug and the user's

system.

Three-State Control (TSC) — This input, when high, causes all of the MPU Module's Address Bus lines and R/W line to go to their off or high-impedance state. The Valid Memory Address signal will be forced low. The Data Bus is not affected by the Three-State Control. This signal is strapped to ground on this module, but is available for DMA.

Refresh Request (REFREQ) — This signal, when low, initiates a memory refresh operation. The MPU Module, on receiving this input, stops generating the $\phi 1$ and $\phi 2$ clock signals with $\phi 1$ high and, through the Refresh Grant command, instructs the initiating memory module to refresh itself.

Refresh Grant (REFGRANT) — The MPU Module, on receiving a Refresh Request input, generates a Refresh Grant signal to instruct the initiating module to refresh itself.

Memory Ready (MEMRDY) — This signal enables the MPU Module to work with slow memories. The MPU Module, on receiving a low level Memory Ready input, stops generating the $\phi 1$ and $\phi 2$ clock signals with $\phi 2$ high. The initiating module, on completing its memory operation, returns the Memory Ready signal to a high level.

Halt — When this input is low, all activity in the MC6800 MPU will be halted. This input is level sensitive. In the halt mode, the machine will stop at the end of an instruction, Bus Available will be high, Valid Memory Address and Valid User's Address will be low, and all other three-state lines will be in their off or high-impedance state.

Transition of the **Halt** line must not occur during the last 250 ns of $\phi 1$. To insure single instruction operation, the **Halt** line must go high for one $\phi 1$ clock pulse.





MOTOROLA
Semiconductors

MEX6812-1

Advance Information

2K STATIC RAM MODULE

The MEX6812-1 2K Static RAM Module, consisting of 16 N-channel MOS memory devices, provides the EXORciser with 2048 x 8 bits of random access memory. This memory is organized into two separate 1024 byte memory arrays. The bus driver/receivers and the base address selection switches interface the 2K Static RAM Module with the EXORciser bus. The address selection switches permit the user to select the base location address for each memory array in 1K byte increments (0000, 1024, 2048, etc.). The RAM/ROM switch for each array provides the user with the option of using each array as a RAM or pseudo ROM (protecting the memory contents by inhibiting the memory write function).

- TTL Voltage Compatible High Impedance Inputs
- Three-State Data Outputs
- 2048 x 8 Bits of Static N-Channel MOS Memory in Two 1024-Byte Arrays
- Switch-Selectable Base Location Address for Each Memory Array
- 500 ns Memory Access Time
- Each Array Switch-Selectable as a RAM or ROM (RAM Protected by Inhibiting Memory Write Function)

EXORciser
2K STATIC RAM
MODULE

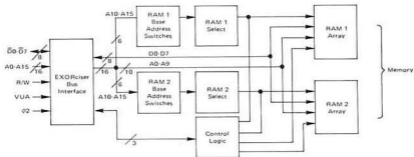
EXORciser



2K STATIC RAM MODULE



BLOCK DIAGRAM



MODULE SPECIFICATIONS

(Note: Positive current flow is defined as flowing into the terminal, negative current flow as flowing from the terminal.)

Specification	Value
Memory Type	N-channel MOS static RAM
Memory Organization	2048 x 8 bits organized into two 1024 x 8 bit arrays
Access Time	500 ns
Input Signals Logic "0" Logic "1"	TTL voltage compatible 0.0-0.85 V (-200 μ A max at 0.4 V) 2.0-5.25 V (25 μ A max at 5.25 V)
Data Bus Input Logic "0" Input Logic "1" Output Logic "0" Output Logic "1" Output Off-State Leakage Current	Three-state TTL voltage compatible 0.0-0.85 V (-200 μ A max at 0.4 V) 2.0-5.25 V (25 μ A max at 5.25 V) 0.5 V max at 40 mA through a resistor to ground 2.6 V min at -10 mA through a resistor to V_{CC} 100 μ A max at 2.6 V
Operating Temperature	0 to 70°C
Power Requirements	5 Vdc at 1 A max
Dimensions Width Height Thickness	9.75 in. 5.75 in. 0.062 in.

EXORciser INTERFACE SIGNALS

The MEX6812-1 2K Static RAM Module interfaces directly with the EXORciser bus using the 8-bit bi-directional data bus, the 16-bit address bus, read/write line, ϕ 2 clock line and valid user's address line. These lines permit the EXORciser to have complete control over the 2K Static RAM Module.

Data Bus (D0-D7) – These eight bi-directional lines, when enabled, provide a two-way transfer of data between the MPU Module and the 2K Static RAM Module. The data bus receivers on the 2K Static RAM Module are continually enabled to receive data. The data bus drivers on this module are in their off or high impedance state except when the module is selected during a memory read operation.

Address Bus (A0-A15) – These 16 lines, when enabled, transfer the selected memory address to the 2K Static

RAM Module. The MPU Module controls the operation of these three-state lines.

Read/Write (RAW) – This MPU Module output signal indicates to the 2K Static RAM Module whether the EXORciser is performing a memory read operation (high) or write operation (low). The normal standby state of this signal is read (high). Also, when the MC6800 MPU on the MPU Module is halted, this signal will be in a read state.

Valid User's Address (VUA) – This signal indicates that the address on the address bus is valid and the EXORciser is not addressing EXbug (upper 4K bytes of memory).

Phase 2 (ϕ 2) Clock Signal – This signal is between 100 kHz and 1 MHz, and is used to synchronize the transfer of data on the data bus. This signal is controlled by the MPU Module.





MOTOROLA
Semiconductors

MEX6815-1

Advance Information

8K DYNAMIC RAM MODULE

The MEX6815-1 8K Dynamic RAM Module, consisting of 16 MCM6605L-1 N-Channel memory circuits, provides the EXORciser with 8192 x 8 bits of dynamic random access memory. This memory is organized into two separate 4096-byte memory arrays. The module base memory address selection switches permit the user to select the base memory address for each memory array in 4K byte increments (0000, 4096, 8192, etc.). The RAM/ROM switch for each memory array permits its respective memory array to be used as RAM or pseudo ROM (protecting the memory contents by inhibiting the memory write function). The module refreshes its dynamic memory devices on a cycle stealing basis approximately once every 60 μ s.

In systems using multiple 8K Dynamic RAM Modules, one module (master refresh module) is used to control the memory refresh operation of the other modules (slave refresh modules).

The 8K Dynamic RAM Module can be used with an external battery backup circuit to provide refreshing when power is removed from the primary of the EXORciser power supply transformer. This refresh capability enables the module to retain its data during a power off condition.

- TTL Voltage Compatible
- Three-State Data Bus
- 8192 x 8 Bits of Dynamic MOS Memory in Two 4096-Byte Arrays
- Switch-Selectable Base Location Address for Each Array
- Each Array Switch-Selectable as a RAM or ROM (RAM Protected by Inhibiting Memory Write Function)
- Cycle-Stealing Memory Refresh
- Memory Refresh Capability During Power-Fail Condition when Using External Battery Backup
- Bus Driver Capability

**EXORciser
8K DYNAMIC RAM
MODULE**

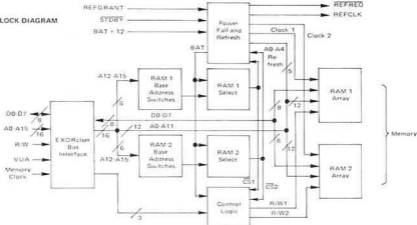
EXORciser



8K DYNAMIC RAM MODULE



BLOCK DIAGRAM



MODULE SPECIFICATIONS

(Note: Positive current flow is defined as flowing into the terminal, negative current flow as flowing from the terminal.)

Specification	Value
Memory Type	N-channel MOS dynamic RAM
Memory Organization	8192 x 8 bits organized into two 4096 x 8 bit arrays
Read Access Time	350 ns from memory clock typical, 400 ns maximum
Cycle Time	750 ns typical, 1 μ s minimum
Input Signals	TTL voltage compatible
A0-A11	
Logic "0"	0.0-0.8 V (-400 μ A max at 0.5 V)
Logic "1"	2.0-5.25 V (10 μ A max at 4.5 V)
A12-A15 and Control Lines	
Logic "0"	0.0-0.85 V (-200 μ A max at 0.4 V)
Logic "1"	2.0-5.25 V (25 μ A max at 5.25 V)
Data Bus	Three-state TTL voltage compatible
Input Logic "0"	0.0-0.85 V (-200 μ A max at 0.4 V)
Input Logic "1"	2.0-5.25 V (25 μ A max at 5.25 V)
Output Logic "0"	0.5 V max at -40 mA through a resistor to ground
Output Logic "1"	2.6 V min at -10 mA through a resistor to V _{CC}
Output Off-State Leakage Current	100 μ A max at 2.6 V
Operating Temperature	0 to 70°C
Power Requirements	5 Vdc at 860 mA 12 Vdc at 300 mA*
Powerfail Refresh	5 Vdc not used 12 Vdc at 25 mA maximum
Dimensions	
Width	9.75 in.
Height	5.75 in.
Thickness	0.062 in.

*Power consumption is dependent on the number of memory accesses of the module.

EXORCiser INTERFACE SIGNALS

The MEX6815-1 8K Dynamic RAM Module interfaces directly with the EXORCiser bus using the following signals. These signals permit the EXORCiser to have complete control over the 8K Dynamic RAM Module.

Data Bus (D0-D7) — These eight bi-directional lines, when enabled, provide a two-way transfer of data between the MPU Module and the 8K Dynamic RAM Module. The data bus drivers and receivers on the 8K Dynamic RAM Module are three-state devices. The data bus drivers and receivers are in their off or high-impedance state except when this module is selected in a memory read or a memory write operation.

Address Bus (A0-A15) — These 16 lines, when enabled, transfer the selected memory address to the 8K Dynamic RAM Module. The MPU Module controls the operation of these three-state lines.

Read/Write (R/W) — This MPU Module output signal indicates to the 8K Dynamic RAM Module whether the EXORCiser is performing a memory read (high) or write (low) operation. The normal standby state of this line is read (high). Also, when the M68800 MPU on the MPU Module is halted, this signal will be in the read state.

Valid User's Address (VUA) — This signal indicates that the address on the address bus is valid and the EXORCiser is not addressing its EXbug program (upper 4K bytes of memory).

Memory Clock (MEMCLK) — This is the basic clock signal used by the MPU Module to generate its ϕ 1 and ϕ 2 clock signals. The 8K Dynamic RAM Module uses this signal to control its timing.

Refresh Clock (REFCLK) — This clock signal is generated by the 8K Dynamic RAM Module to refresh its memory. In systems using multiple 8K Dynamic Modules, the master refresh module uses this signal to refresh the slave refresh modules.

Stand By (STDBY) — This line is a low level during a powerfail condition and a high level during normal EXORCiser operation.

Refresh Request (REFREQ) — This signal, when present, initiates a memory refresh operation. The MPU Module, on receiving this input, stops generating the ϕ 1 and ϕ 2 clock signals with ϕ 1 high and, through the Refresh Command, instructs the 8K Dynamic RAM Module to refresh its memories. The 8K Dynamic RAM Module generates this pulse approximately once every 60 μ s.

Refresh Grant (REFGRANT) — This signal, when present, instructs the 8K Dynamic RAM Module to refresh its memories.

Battery + 12 (BAT + 12) — This is the 12-volt source for the MCM6805-1 memory circuits.





MOTOROLA
Semiconductors

MEX6820
MEX681C

Advance Information

INPUT/OUTPUT MODULE AND I/O INTERCONNECT CABLE

The MEX6820 Input/Output Module and the MEX681C I/O Interconnection Cables provide the user with an integral means of interfacing his defined process or peripheral device to the EXORciser.

- Four 8-Bit Input/Output Ports for Peripheral Interfacing
- Eight Individually Controlled Interrupt Lines – Four of Which May Be Used as Peripheral Control Output Lines
- Three-State TTL Voltage Compatible Inputs and Outputs
- Switch-Selectable Base Location Address for Each of the Two MC6820 Peripheral Interface Adapter Devices
- Program Controlled Maskable Interrupt Capability
- Four Programmable Control Registers
- Four Programmable Data Direction Registers
- Each MC6820 Peripheral Interface Adapter Addressed as Memory
- Bus Drive Capability
- Predrilled Wirewrap Area on Module for 14, 16, and 24-Pin Wirewrap Sockets with 300 or 600 Mil Spacing on Pin Centers

EXORciser INPUT/OUTPUT MODULE and I/O INTERCONNECT CABLE



EXORciser

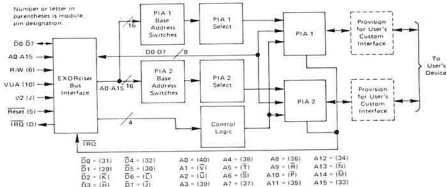
I/O MODULE



ORDERING INFORMATION

Order two MEX681C Input/Output Interconnection cables with each MEX6820 Input/Output Module.

BLOCK DIAGRAM



MODULE SPECIFICATIONS

(Note: Positive current flow is defined as flowing into the terminal, negative current flow as flowing from the terminal.)

Specification	Value
Input Signals Logic "0" Logic "1"	TTL voltage compatible 0.0-0.85 V (-200 μ A max at 0.4 V) 2.0-5.25 V (25 μ A max at 5.25 V)
Data Bus Input Logic "0" Input Logic "1" Output Logic "0" Output Logic "1" Output Off-State Leakage Current	Three-state TTL voltage compatible 0.0-0.85 V (-200 μ A max at 0.4 V) 2.0-5.25 V (25 μ A max at 5.25 V) 0.5 V max at 40 mA through a resistor to ground 2.6 V min at -10 mA through a resistor to V_{CC} 100 μ A max at 2.6 V
MC6820 Peripheral Interface Adapter Signals* PA0-PA7 Input/Output Lines PB0-PB7 Input/Output Lines CA1, CA2, and CB1 Control Signals CB2 Control Signal IROQA and IROB Signals	TTL voltage compatible Three-state TTL voltage compatible TTL voltage compatible Three-state TTL voltage compatible TTL voltage compatible
Operating Temperature	0 to 70°C
Power Requirements	5 Vdc at 2 A max
Dimensions Width Height Thickness	9.75 in. 5.75 in. 0.062 in.

* See MC6820 data sheet for specifications on these signals.

INPUT/OUTPUT MODULE

The MEX6820 Input/Output Module provides the user with a flexible means of interfacing the EXORciser with his defined process or peripheral device, either by directly interfacing with the two MC6820 Peripheral Interface Adapters (PIAs) in the module or by constructing customized interface circuits between the PIA and the user's device. This interface is simplified by the TTL voltage compatibility of the PIA's dual 8-bit input/output lines. The module has provisions for mounting 14, 16, or 24-pin sockets, permitting the user to add the custom interface circuitry directly on the module.

The EXORciser's MC6800 Microprocessor addresses each PIA on the Input/Output Module as if it were memory. Switches on the module allow the user to select the base memory address for each PIA.

I/O INTERCONNECT CABLE

The MEX681C I/O Interconnect Cable permits the user to connect an Input/Output Module to a peripheral. One end of this flatribbon cable is terminated with a 50-pin flatribbon connector; the other end is not terminated. Each I/O Module requires two cables.

EXORciser INTERFACE SIGNALS

The MEX6820 Input/Output Module interfaces directly with the EXORciser bus using the eight-bit bi-directional data bus, the 16-bit address bus, an interrupt request line, read/write line, ϕ 2 clock line, valid user's address line and

reset line. These lines permit the EXORciser to have complete control over the Input/Output Module.

Bi-Directional Data Bus (D0-D7) - These eight bi-directional lines, when enabled, provide a two-way transfer of data between the MPU Module and the I/O Module. The data bus drivers and receivers on the I/O Module are three-state logic devices. The data bus drivers and receivers are in their off or high-impedance state except when this module is selected in a memory read operation or memory write operation.

Address Bus (A0-A15) - These 16 lines, when enabled, transfer the selected memory address to the I/O Module. The MPU Module controls the operation of these three-state lines.

Read/Write (R/W) - This MPU Module output signal indicates to the I/O Module whether the EXORciser is performing a memory read (high) or write (low) operation. The normal standby state of this signal is read (high). Also, when the MC6800 MPU on the MPU Module is halted, this signal will be in the read state.

Valid User's Address (VUA) - This signal indicates that the address on the address bus is valid and the EXORciser is not addressing its EXbug program.

Phase 2 (ϕ 2) Clock Signal - This signal is between 100 kHz and 1 MHz and is used to synchronize the transfer of data on the data bus. This signal is generated by the MPU Module.



Reset – This signal is used to restart the MC6800 MPU and reset the EXORciser from a power down condition or when the EXORciser RESTART switch is actuated. This signal resets and initializes the two MC6820 PIAs on the I/O Module.

Interrupt Request (IRQ) – This level-sensitive input, on going low, requests that an interrupt sequence be generated within the machine. The MC6800 MPU will wait until it completes the current instruction that it is executing before it recognizes the request. At that time, if the interrupt mask bit in the MPU condition code register is not set (interrupt masked), the MPU will begin the interrupt sequence. The two PIAs on the I/O Module, at the

user's option, are capable of generating an $\overline{\text{IRQ}}$ signal.

PERIPHERAL INTERFACE LINES

The user has the option of connecting the MC6820 PIA interface lines directly to the user's peripheral device or of constructing custom interface circuitry between the PIA and the user's peripheral device. These lines are the eight peripheral input/output lines PB0-PB7, and the four control lines CA1, CA2, CB1, and CB2 for each PIA. Refer to the MC6820 Peripheral Interface Adapter data sheet for a description and detailed specifications of these signals.





MOTOROLA
Semiconductors

MEX68WW

Advance Information

UNIVERSAL WIREWRAP MODULE

The MEX68WW Universal Wirewrap Module permits the user to construct and incorporate his custom circuits into an EXORciser emulated system. The power bus and ground bus printed wiring are incorporated on the module. The power bus connects to pins A, B, C, 1, 2, and 3. The ground bus uses pins \bar{W} , \bar{X} , \bar{Y} , 41, 42, and 43.

The module has provision for standard 14, 16, and 24-pin wire-wrap sockets with 300 mil spacing on pin centers. These sockets may be installed in any combination including 75 14-pin sockets. The module also has provision for mounting two 50-pin flatribbon wire-wrap connectors.

- Standard Size EXORciser Plug-In Module
- Compatible with the EXORciser Bus
- Standard Pin Spacing for 75 14-Pin Wirewrap Sockets
- Provisions for Two 50-Pin Flatribbon Cable Connectors
- Permits User to Incorporate Custom Circuits into a System

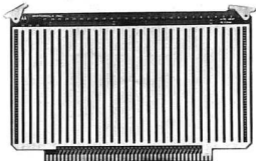
EXORciser
WIREWRAP
MODULE

EXORciser



MODULE SPECIFICATIONS

Width	9.75 in.
Height	5.75 in.
Thickness	0.062 in.





MOTOROLA
Semiconductors

MEX68XT

Advance Information

EXTENDER MODULE

The MEX68XT Extender Module permits the user to extend any EXORciser Plug-in Module for servicing, testing, troubleshooting, or debugging. This module has clip-on test points to provide the user access to the EXORciser bus.

- Extends Any EXORciser Plug-in Module for Testing, Troubleshooting, and Debugging
- Interfaces with All EXORciser Plug-In Modules
- Compatible with the EXORciser Bus
- Provides Clip-on Test Points for All EXORciser Bus Signals

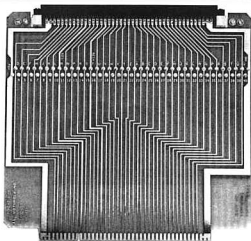
EXORciser
EXTENDER
MODULE

EXORciser



MODULE SPECIFICATIONS

Width	9.75 in.
Height	9.00 in.
Thickness	0.062 in.





MOTOROLA
Semiconductors

M6800 RESIDENT SOFTWARE

Advance Information

M6800 RESIDENT SOFTWARE

The optional M6800 Resident Software, along with the M6800 EXORciser's EXbug Firmware, allows the EXORciser user to develop his system software in real-time with his peripheral devices incorporated into the system. This means that the user can prepare, assemble, and debug his system software in its actual working environment. The M6800 Resident Editor and Assembler are used to prepare and assemble the user's system software, while the EXORciser's EXbug Firmware is used to debug the system hardware as well as the software.

EXORciser RESIDENT EDITOR and RESIDENT ASSEMBLER

EXORciser



M6800 RESIDENT EDITOR

The M6800 Resident Editor may be used to create or modify alphanumeric text. In particular, the Editor gives the user an easy means to create and modify source programs for input into the M6800 Resident Assembler. This interactive Editor offers character, line, and character string commands.

- Memory Sizing Capability
- Insert or Delete Lines
- Insert, Delete or Modify Character Strings
- Command Chaining
- Co-Resident with the M6800 Assembler or Stand Alone

M6800 RESIDENT ASSEMBLER

The M6800 Resident Assembler may be used with the M6800 EXORciser to translate M6800 Source Programs to machine language. This assembler is a two-pass assembler; that is, the Resident Assembler reads a user's program twice — once to build a symbol table and a second time to produce the assembled output. Only pass two of the assembler is needed with programs having no forward references and with short programs. In the case of short programs, the forward references will be flagged with an error and the user is required to patch in the correct addresses after the symbol table is printed at the completion of the assembly. The Resident Assembler is compatible with the Cross Assemblers available from Motorola.

- Two-Pass Assembler
- Limited One-Pass Capability
- Can Be Co-Resident with the M6800 Resident Editor or Stand Alone
- Compatible with Motorola's Cross Assemblers

EXbug FIRMWARE

The EXbug Firmware is an integral part of the M6800 EXORciser. This firmware allows the user to load the M6800 Resident Assembler and Editor into the EXORciser and to verify that the Resident Software was correctly loaded, and to debug the user's system hardware and software. Also, this Firmware is used to print and/or punch the data stored in the EXORciser memory.

RESIDENT SOFTWARE REQUIREMENTS

- EXORciser
- 8K bytes of RAM minimum
- TTY (20 mA neutral loop current) or RS-232C data terminal with automatic reader/punch control

ORDERING INFORMATION

The user has the option of ordering the Resident Software in a stand-alone package or ordering the software with 8K bytes of memory. The user can also select the media on which he wishes to receive his Resident Software. Table 1 shows the complete range of options, and the Part Number to be used when ordering.

TABLE 1 - M6800 RESIDENT SOFTWARE OPTIONS

Option	Description	Media	Part Number
1	Resident Assembler/Editor (Stand Alone)	Cassette	M68XAE6812A0
2	Resident Assembler/Editor with four 2K Static RAM Modules	Cassette	M68XAE6812A2
3	Resident Assembler/Editor with one 8K Dynamic RAM Module	Cassette	M68XAE6812A8
4	Resident Assembler/Editor (Stand Alone)	Paper Tape	M68XAE6812B0
5	Resident Assembler/Editor with four 2K Static RAM Modules	Paper Tape	M68XAE6812B2
6	Resident Assembler/Editor with one 8K Dynamic RAM Module	Paper Tape	M68XAE6812B8
7	Resident Assembler/Editor (Stand Alone)	G.E. Timeshare	M68XAE6812C0
8	Resident Assembler/Editor with four 2K Static RAM Modules	G.E. Timeshare	M68XAE6812C2
9	Resident Assembler/Editor with one 8K Dynamic RAM Module	G.E. Timeshare	M68XAE6812C8
10	Resident Assembler/Editor (Stand Alone)	Floppy Disk	M68XAE6812D0
11	Resident Assembler/Editor with four 2K Static RAM Modules	Floppy Disk	M68XAE6812D2
12	Resident Assembler/Editor with one 8K Dynamic RAM Module	Floppy Disk	M68XAE6812D8

