
Development Tools

Selector Guide

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1 Motorola Software and Development Tools

Selecting a microcontroller is the crucial first step in designing today's complex, multifaceted electronics products. Increasingly, businesses worldwide are turning to Motorola for a wide range of powerful, time-tested MCUs—and for the tools needed to develop, debug, and evaluate the code required for their embedded designs.

Whether you choose your Motorola microcontroller from the M68HC05/08, M68HC11, M68HC12, M68HC16, M68300, or MPC500 family, Motorola's software and development systems make it easier to program and test code in an integrated, economical way. Motorola provides the total system support developers need to successfully build your target applications.

Appendix A is a handy quick reference that gives you a bird's-eye view of all the software applications and development tools described in this guide.

This guide makes it easy for Motorola customers, salespeople, and Field Application Engineers to choose development environments that precisely match the specific requirements of particular projects. The guide describes software applications, development systems, and evaluation tools that support a

wide variety of MCUs. Most importantly, this guide explains which tools are compatible with which MCUs—and provides tables that help you order the components you need.

Integrated Solutions

Motorola has integrated hardware and software components into complete systems for end-to-end development. These systems are easy to implement and make development straightforward, whatever the application.

Hardware/Software Options

You can choose between two categories of integrated systems:

- **High-performance development** – A Motorola Modular Development System (MMDS) provides advanced features for designing, debugging, and evaluating code for MCUs in the M68HC05/08, M68HC11, M68HC16, and M68300 families.

- **Lower-cost development** – Motorola's Evaluation Systems (EVSS), Evaluation Boards (EVBS), and Evaluation Kits (EVKS) economically demonstrate capabilities of MCUs in the M68HC05/08, M68HC11, M68HC12, M68HC16, M68300, and MPC500 families.

Individual Software Packages

Whether you need development packages for completing embedded designs or a robust software tool for a particular project, Motorola meets all your needs with a comprehensive range of software products—such as assemblers, compilers, and debuggers—that function across multiple MCU families. In addition, Motorola provides RTEK™, a scaleable kernel, so you can choose the tested real-time operating system services you need for your embedded application.

The Key Is MODULARITY

Each MMDS features a core component, or station module, such as:

- MMDS05 core component for the M68HC05/08 families
- MMDS11 for the M68HC11 family
- MMDS1632 for the M68HC16 and M68300 families.

The modularity of Motorola tools maximizes your flexibility and convenience, saves money, and dramatically speeds time to market.

To achieve these benefits, keep the following in mind when identifying parts and ordering a development solution:

- **An MMDS core station module must be accompanied by the device-specific components needed to complete the development task.** When you initially acquire an MMDS for a particular MCU family, order the core component and the appropriate device-specific components separately. These components include:
 - emulation module/MCU personality board
 - flex cable with target head package Personality Board (PPB)
 - any other device-specific tools required for the particular MCU family

- **You need only one core station module per MCU family.** When you order a new derivative of the same family, order only additional components, and *not the core station module*. Tables in this guide help you determine which device-specific parts, if any, are required.

Note: Motorola provides modules for development tools as new MCU devices become available.

Third-party Support

Third-party firms produce a wide selection of application software and development tools. Appendix B of this guide features an extensive list of these companies, their tools, and the Motorola MCUs those tools support

Important Note about Third-party Compatibility:

Each development system available from the Motorola Microcontroller Technologies Group has been tested and verified. If you want to use a tool from another company or to mix Motorola tools with those from another firm, you must verify compatibility through direct communication with Motorola and the other firm.

Coming Soon: Industry Standards for Development Tools

Motorola recognizes the need for greater compatibility among hardware and software from various manufacturers. Accordingly, Motorola is working on a set of tool standards that will lead to many more development environment choices. One result of this effort is the Embedded Application Binary Interface (EABI) standard for the PowerPC™ architecture—a standard devised jointly by Motorola, IBM, and several other companies.

NEW! NEW! NEW!

This guide reflects some exciting changes that substantially enhance your ability to complete your MCU development projects:

PowerPC support for Windows 95, Windows NT, and the Hewlett-Packard HP 9000 Series 700

The PowerPC software development tools suite helps engineers speed the completion of their PowerPC embedded designs on IBM® RS/6000, Motorola PowerStack, and Sun Sparc4 host systems. Today, new PowerPC support for Windows® 95, Windows NT®, and HP® 9000 Series 700 systems offers the same benefits to users of these popular platforms. With the addition of Windows-based and HP PCs to the family of workstations supported by this powerful development environment, virtually all today's PowerPC designs can be taken to market faster and more efficiently than ever before. *See page 8.*

M68EB912B32 Evaluation Board

By providing the essential MCU timing I/O circuitry, this evaluation board simplifies evaluation of prototype hardware and software for the 68HC912B32 MCU. *See page 29.*

A fully scaleable RTEK real-time kernel

The Motorola RTEK real-time kernel is a powerful framework for developing embedded systems software. RTEK's flexible, reliable real-time operating system (RTOS) meets the demands of the most complex real-time applications. What's more, the latest release of the product, RTEK v2.0, is fully scaleable—allowing you to determine the precise services needed for particular embedded applications. *See page 6.*

MCUinit version 3.0 supports more MCUs

The MCUinit initialization tool lets users generate startup code, edit registers, and access online manuals for various MCUs. In addition to the MCUs already supported, MCUinit now supports 68HC12A4, 68HC16Y3, 68306, and 68307. *See page 8.*

2 Motorola RTEK Kernel

The Motorola real-time kernel is a powerful software framework for use in developing embedded systems software for the Motorola M68HC11, M68HC12, M68HC16, M68300, MPC500, and MPC821 families of MCUs. This robust, field-proven framework meets the demands of today's most complex real-time applications. It reduces development time, debug time, and maintenance time—which adds up to lower-cost project development and faster time-to-market.

RTEK Kernel Features

The RTEK kernel contains a library of services that act independently from application programs. Kernel services manage system resources, including the CPU, program tasks, memory, and time.

The RTEK kernel's flexible, reliable real-time operating system (RTOS) ensures that your system is operating as efficiently as possible all the time. Able to reside on external EPROM, Flash Memory, or ROM, this powerful framework:

- Supports three methods of scheduling tasks:
 - multitasking
 - priority and preemption
 - event-driven operation.
- Provides an extended set of more than 190 kernel services, including event synchronization, RAM/ROM management, time management, and exclusive access to system elements.
- Lets users define kernel objects statically before runtime and dynamically at runtime.
- Uses a high-level language Application Program Interface (API) with simple, understandable function names.
- Has a small memory footprint.
- Is easy to learn and use.
- Makes no assumptions about the configuration of the target system, letting the user define the target environment and insuring that all necessary peripheral devices have program support.
- Vastly streamlines code portability and reusability, leveraging your investments many times over.

NEW! Full RTEK kernel scalability!

The latest version of the RTEK kernel, v2.0, features full scalability now you can decide what services are appropriate for a particular application and scale the code accordingly resulting in dramatically improved use of both memory and data.

System Requirements

These are the computer/operating system combinations necessary to use the RTEK kernel for development on Motorola MCU families:

- For the M68HC11, M68HC12, M68HC16, M68300, and MPC800 families, an IBM PC or compatible computer running Windows 95 or Windows NT
- For the MPC500 family, a Sun Sparc running SunOS 4.1.3 or higher
- 4 MB of disk space

Selecting and Ordering

The tables on the next page assist you in ordering the RTEK kernel.

Notes: Third-party bindings and debuggers must be purchased separately.

An RTEK production license is necessary in order to manufacture products with the RTEK kernel embedded in the memory.

RTEK Software Development Kit Ordering Information

Target	Host	Bindings	RTEK Part Number	Debugger
PowerPC MPC500*	SUN OS 4.1.3	Motorola	MPPC5SRTEKDBX11	
PowerPC MPC800*	PC: Windows 95, NT	Diab Data	MPPC8SRTEKBBX12	
M68300	PC	SDS, Microtec Research	M683FSRTEKBBX20	SDS
M68HC11	PC	Introl, Cosmic, HIWARE	MHC11SRTEKBBX20	
M68HC12	PC	Introl, Cosmic, HIWARE	MHC12SRTEKBBX20	
M68HC16	PC	Introl, Cosmic, HIWARE	MHC16SRTEKBBX20	

* A scaleable version of this RTEK kernel is not yet available.

These manufacturers' debuggers provide RTEK awareness.

RTEK Production Licenses

Target	Production License
PowerPC MPC500	MPPC5PRTEKDBX11
PowerPC MPC800	MPPC8PRTEKBBX12
M68300	M683FPRTEKBBX20
M68HC11	MHC11PRTEKBBX20
M68HC12	MHC12PRTEKBBX20
M68HC16	MHC16PRTEKBBX20

Note: Appendix B contains information about how to contact third-party vendors.

3 Software Packages: Completing Embedded Designs

The Motorola software products described in this section offer customers substantial support in completing their embedded MCU applications:

- **Motorola Embedded PowerPC Development Tools Suite** – Engineers dramatically speed completion of their embedded PowerPC designs with this powerful set of tools, which includes two packages: one for compiling and one for debugging.

NEW! PowerPC support for Windows and Hewlett-Packard platforms! In addition to the IBM, Motorola, and Sun platforms supported by the PowerPC tools in the past, the software can now run on PCs running Microsoft Windows NT or Windows 95 and on Hewlett-Packard 9000 Series 700 workstations. This dramatically extends the community of users who are able to profit from this powerful development environment.

- **MCUasm™ Assembly Language Toolset** – These tools provide a path to higher performance while maintaining compatibility with existing systems and software.
- **MCUinit™ Initialization Tool** – This graphical environment lets developers generate startup code, edit registers, and access online reference manuals for various M68HC12, M68HC16, M68HC16 and M68300 MCUs.

NEW! **MCUinit version 3.0 supports more MCUs!** In addition to MCUs already supported, MCUinit now supports 68HC812A4, 68HC16Y3, 68306, and 68307.

- **TPUMASM (TPU Assembler)** – This microcode assembler supports the sophisticated on-chip Time Processor Unit for various M68HC16 and M68300 MCUs.

Motorola Embedded PowerPC Development Tools Suite

The embedded PowerPC software development tools suite dramatically speeds the completion of PowerPC embedded designs. This powerful development environment can be easily adapted to any device that complies with the PowerPC architecture definition, and it runs on today's most widely used development platforms.

The PowerPC tools include two packages:

- Motorola Embedded C Compiler (MECC)
- Motorola Embedded Debugger (MEDB)

Motorola Embedded PowerPC C Compiler Package (MECC)

The PowerPC C Compiler Package consists of the following tools:

- **Motorola Embedded Project (MEPROJ)** – Using a graphical user interface, creates and manages applications consisting of C and assembly language files. (Windows NT and Windows 95 only.)
- **Motorola Embedded C Compiler (MECC)** – Converts C or assembly language source code to linked object modules, ready for downloading to embedded PowerPC microprocessors.
- **Motorola Embedded Assembler (MEAS)** – Converts assembly language code to object code modules, using source files that are either original assembly files or files generated by MECC from C language files.
- **Motorola Embedded Link Editor (MELD)** – Combines object code modules and object libraries into a single executable module.
- **Motorola Embedded S-Record Generator (MSREC)** – Creates Motorola S-records from object files.
- **Motorola Archiver (MAR)** – Generates libraries of object files for use by the link editor (MELD).

Motorola Embedded PowerPC Debugger Package (MEDB)

MEDB streamlines the debugging of C, assembly, or mixed-language programs running on remote targets such as development/evaluation boards. MEDB offers the advantages of a graphical interface, while still allowing developers to enter commands directly if they wish.

MEDB lets developers display application and internal debugger variables, set variables and breakpoints, customize debugging sessions, and perform other tasks that streamline debugging.

System Requirements

The PowerPC tools suite requires 20 MB of disk space. The suite runs on the following platforms:

- Windows 95
- Windows NT 3.51
- Motorola PowerStack running AIX 4.1.4 or higher, or AIX 3.2.5 or higher
- IBM RS/6000 running AIX 4.1.4 or higher
- Sun Sparc4 running SunOS 5.2.5 or higher, or SunOS 4.1.3 or higher
- Hewlett-Packard HP9000 Series 700 running HP-UX 9.05 or higher (up to but not including 10)

Ordering the PowerPC Tools Suite

The embedded C compiler package and embedded debugger package can be ordered separately or together.

Notes: The parts required depend on the platform in use. Target boards supported by the Embedded PowerPC Debugger must be purchased separately.

Target Boards Supported by Embedded PowerPC Debugger

PowerPC Target	Board
MPC500	MPC505EVb
MPC603	Ultra 603 or MVME 1603

Power PC Development Tools

Component	NEW! Host System			
	Windows 95 & NT 3.51	SUN OS 5.2.5 and 4.1.3	AIX 4.1.4 and 3.2.5	HP-UX 9.05
C Compiler Package (MECC)	MPPC5SCCOMHDX20	MPPC5SCCOMDBX11	MPPC5SCCOMEBX11	MPPC5SCCOMFBX11
Debugger Package (MEDB)	MPPC5SDEBGHDX20	MPPC5SDEBGDBX11	MPPC5SDEBGEBX11	MPPC5SDEBGFBX11
Complete PowerPC Tool Suite	MPCC5SCMDBHDX20	MPCC5SCMDBDBX11	MPCC5SCMDBEBX11	MPCC5SCMDBFBX11

MCUasm Assembly Language Toolset

Motorola's MCUasm Assembly Language Toolset supports the M68HC05, M68HC08, M68HC11, M68HC12, and M68HC16 families of Motorola microcontrollers. These flexible, convenient tools provide a path to higher performance while maintaining compatibility with existing software and systems and easing upward migration.

For applications with limited memory, timing constraints, or that require access to special hardware features, the MCUasm toolset is a better solution than high-level languages.

The MCUasm integrated development environment includes a variety of powerful tools:

- **MCUproject** – Project manager used to edit files, identify options, and build projects. Also provides incremental make features—so reassembly and relinking is necessary only for out-of-date portions of a project.

- **MASM** – Includes these features:

- relocatable or absolute object modules
- symbol-table listings
- cross-reference listings
- absolute listings after relocation
- full macro capability with nesting
- option-selection processor support
- many options to control assembly listings.

Individual MCU instructions and addressing modes are optimized for high performance. MASM supports the M68HC05, M68HC08, M68HC11, M68HC12, and M68HC16 instruction sets with a common syntax and with language extensions that ease upward migration without sacrificing the speed and memory efficiency of assembly language.

- **MLink** – Arranges sections to fit into physical memory according to a user-defined directive file. For rapid development and debugging, developers can put an entire section in a file or allocate a section among several files. This linker also supports overlays, archives, and source-level debugging.
- **AR librarian** – Creates libraries of object files for use by the linker (MLink)
- **Motorola HEX S-Record generator** – Creates Motorola S-records from object files.

The MCUasm toolset includes many capabilities not found in typical assembly-level toolsets:

- symbol names with up to 128 characters
- 32K symbols per source-code file
- 256 sections per file
- 256 levels for nested macros and nested include files
- 32-bit arithmetic evaluation of all expressions
- linking and archiving of more than 500 files

System Requirements

The MCUasm Assembly Language Toolset runs on any 486-based PC running DOS 6.0 or later, Windows 3.1 or higher, Windows 95, or Windows NT 3.5.1. The toolset requires 8 MB of RAM.

Ordering an MCUasm Package

As you consult the following table, note that *all orders must specify the device family*.

MCUasm software packages

MCU family	Host	Part Number
M68HC05	PC-Windows	MHC05SASMXXBX12
M68HC08	PC-Windows	MHC08SASMXXBX12
M68HC11	PC-Windows	MHC11SASMXXBX12
M68HC12	PC-Windows	MHC12SASMXXBX12
M68HC16	PC-Windows	MHC16SASMXXBX12

MCUinit Initialization Tool

By letting users initialize code, edit registers, and access online reference manuals, this graphical environment simplifies and speeds creation of initialization software for the M68HC12 and M68HC16 and families, including these microcontrollers:

68HC812A4	68HC16Z2	68HC16Z3
68HC912B32	68HC16X1	68HC16Y1
68HC916Y1	68HC16Y3	68HC16Z1

MCUinit also supports these MCUs from the M68300 family:

68306	68307	68331
68334	68332	68360
68F333		

MCUinit's simple point-and-click user interface makes it easy to initialize and debug intermodule bus peripheral configuration registers. Users can either employ the tool as a standalone initialization code generator or connect it to a Motorola MMDS1632 Modular Development System for use as a register editor.

This convenient environment offers these advantages:

- Targets the requirement analysis, coding, and debugging aspects of product development.
- Lets developers generate fully commented initialization code in C or assembly language.
- Applies automated rules and algorithms from the MCU and module reference manuals to ensure proper initialization—making code creation faster and less prone to error.
- Includes online help, which comprises user manuals, Motorola application notes, and the appropriate MCU and module reference manuals on CD.
- Lets users save and recall a session, write additional functions, and use RuleChecker, a utility that allows users to check work in progress.

System Requirements

MCUinit requires a 486-based PC (or higher) running Windows 3.1 or later, and at least 10 MB RAM for the basic application, 30 MB for the reference manuals, and a CD-ROM drive.

Ordering an MCUinit Package

There is only one version of MCUinit tool: M68FMSINITBDX30. This tool works for all the supported devices of the M68HC12, M68HC16, and M68300 families (as listed above on this page).

TPUMASM (TPU Assembler)

The Time Processor Unit (TPU) is a sophisticated on-chip peripheral built into M68HC16 and M683xx MCUs. TPUMASM assembles user-written TPU microcode into objects, which are used as a control store in the TPU's emulation module.

This language offers these features:

- Supports subinstructions for forming the micro-instructions of TPU microcode and directives that support assembly.
- Simplifies the task of writing custom TPU functions.

System Requirements

TPUMASM requires a 486-based PC running Windows 3.1 or higher.

Note: TPUMASM can be run in an MS-DOS box within Windows.

Ordering a TPUMASM Package

As you consult the following table, note that TPUMASM is not device-specific. The environment works across all the MCU devices supported.

TPUMASM software package

Target Device	Part Number
M68HC16 family	M68FMSTPASBBXXX
M6833x family with TPU	

4 M68HC05/08 Development Systems

This section provides information about systems for development on Motorola's M68HC05 and M68HC08 families of microcontrollers—flexible, general-purpose MCUs that give designers a wide range of options for powerful, low-cost 8-bit solutions.

For development on these very similar families, Motorola offers two modular system choices for real-time, in-circuit emulation:

- **Motorola Modular Development System (MMDS05, which is compatible with both the M68HC05 and M68HC08 families)** – This full-featured, high-performance emulation system incorporates Motorola's advanced debug features, along with emulation memory and bus state analysis.
- **Motorola Modular Evaluation System (MMEVS, also compatible with both families)** – This economical, modular evaluation system connects to a target system and emulates the behavior of the target device.

In addition to describing these development systems, this section provides information about pinpointing both the core and device-specific components needed to use either system in a particular project.

Note: MMDS and MMEVS development tool software is available free on the Web at <http://www.mot-sps.com/csic> and on CD-ROM (CDSCSIC2/D).

MMDS Motorola Modular Development System

The high-performance Motorola Modular Development System for the M68HC05/08 families provides these features:

- real-time, nonintrusive in-circuit emulation
- advanced bus state analyzer (BSA) and dual-port memory windows
- integrated development environment (IDE) that significantly reduces the time necessary to develop and debug an embedded MCU system

Hardware and Software Components

The MMDS05, which works with both the M68HC05 and the M68HC08 families, includes the following hardware:

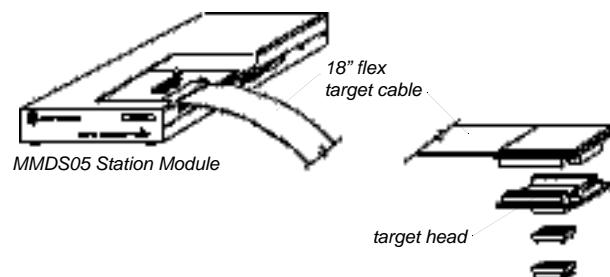
Station module – This metal case allows easy access for installing or replacing emulation modules. The station module works across all devices of the M68HC05 and M68HC08 families and once purchased, it can be used for many derivatives in these families.

The station module includes these items:

- printed circuit board (the control board)
- M68HC05P9EM emulation module

(Emulating devices not supported by the M68HC05P9EM require separately purchased, device-specific emulation modules.)

- 85- to 264-VAC internal power supply with cabling
- RS-232C serial cable (9-lead)
- RS-232C adapter (9- to 25-pin)
- 16 logic clips for selecting individual signals



Note: The following device-specific components must be purchased separately, according to the specific MCU device in use. An emulator module or a target cabling component can be used for multiple devices in the M68HC05 and M68HC08 families. Consult the table on page 15 to order a complete MMDS system.

- **Emulation module (EM)** – Attached to the MMDS control board by means of expansion connectors, the device-specific EM contains circuitry that emulates the specific features of the target M68HC05 or M68HC08 microcontroller.
- **Target cabling system** – The modular target cabling system connects the MMDS05 to the target application. The in-circuit target cable consists of a low-noise flex cable, a target head adapter, and, where appropriate, surface mount adapters. (See Appendix E.) Each of these device-specific cabling components must be ordered separately.
- **Parallel programmer (PGMR) or serial programmer** – Parallel programmer boards provide an economical and efficient means of programming prototype M68HC05 MCUs, with options to both program and verify or to simply verify device contents. Serial programmer boards are for use with the 68HC708 and device-specific programming adapters.

The MMDS05's software component is the IDE (Integrated Development Environment). The powerful, user-friendly IDE provides a combination of editor, assembler, user interface, and source-level debugger that lets you simultaneously develop and debug your MC68HC05 and MC68HC08 applications. An MS-DOS version of the MMDS05 IDE is included as part of the development system.

MMEVS Modular Evaluation System

The economical, modular MMEVS system lets you adapt functionality to any of a variety of M68HC05 and M68HC08 microcontrollers. Connected to the target system, the MMEVS system emulates the target system MCU. Emulation memory and port signals allow access to the inner workings of the MCU. An IDE is included for quick edits and changes to assembly code—making designing, debugging, and emulating the target system fast and efficient.

Hardware and Software Components

A complete MMEVS system consists of these three *separately purchased* components:

- **MMEVS platform board** – Printed circuit board that is the platform for all evaluation modules (EVMs). The board contains an MC68HC11K1 processor that performs on-board housekeeping functions. It also includes memory and an RS-232 port for communicating with the host PC.

The MMEVS platform board requires a 5V 1A external power supply. The MMEVS platform works across many devices of the M68HC05/08 families, and can be used for multiple derivatives of these families.

Note: The following device-specific components must be purchased separately, according to the specific device in use. An emulator module or a target cabling component can be used for multiple devices in the M68HC05 and M68HC08 families. Consult the table on page 15 to order a complete MMDS system.

- **Emulation module (EM)** – This board includes circuitry that emulates the specific features of the target microcontroller. The EM is device-specific and must be purchased separately; once purchased, it can often be reused across multiple derivatives.
- **Target cabling system** – The target cabling system connects the MMEVS to the target application. The in-circuit target cable comprises a low-noise flex cable, a target head adapter, and, where appropriate, surface mount adapters. (See Appendix E.) Each of these device-specific cabling components must be ordered separately.

The MMEVS IDE software, which comes with the platform board, provides an editor, an assembler, and a source-level debugger with graphical user interface—making project development faster and more efficient. The development system includes an MS-DOS version of the MMEVS IDE.

MMEVS features include:

- real-time, nonintrusive, in-circuit emulation
- new support for high-speed and low-voltage MCUs
- elimination of the EVS/EVM's software breakpoint limitations
- dual microcontrollers for faster command and code transfers
- enhanced script and new command logging capability
- true subset of the higher performance MMDS system
- new CHIPINFO command to make it easier to obtain information about the device
- software-selectable oscillator clock sources
- true source-level debugging
- enhanced on-screen, context-sensitive help via pop-up menus and windows
- latch-up resistant design, making power-sequencing unimportant
- automatic detection of user programs that access nonvalid memory locations
- online and hardcopy documentation

Because of the substantial advantages of a modular approach, Motorola recommends that any new purchases of an M68HC05/08 evaluation system be the new MMEVS. If you currently use EVM and EVS products, you can, of course, continue to use them, but you may want to take advantage of the MMEVS's new capabilities by using your existing emulation modules with the new system.

Any EM that is compatible with the MMDS05 can be used with the MMEVS.

Note: For detailed information, see *Upgrading from the EVS to the MMEVS*, Motorola part number HC05EVS2MMEVS/D.

The Key Is MODULARITY

Choosing an MMDS or MMEVS Development System

Both the MMDS05 core station module and the MMEVS platform board support the entire spectrum of devices in the M68HC05/08 microcontroller families. Motorola's modular approach makes it easy to produce hundreds of device-specific development systems—*without* involving hundreds of different products.

Here are the four easy steps for putting together a complete system. The steps assume that an MCU device has already been selected. As you follow the steps, consult the table on page 15, *MMDS05 and MMEVS Development Systems*, to learn the specifics of ordering system components.

A subsequent table on page 20, *PGMR Packages*, helps you select the appropriate Parallel Programmer board for a prototyping task.

Step 1. Identify the device to be emulated and its package type.

You get real-time, in-circuit emulation with either the high-performance MMDS05 or the economical MMEVS system. The type of application and the breadth of emulation required determine which system module to order. Both systems' core station modules support M68HC05/08 devices—so whatever the chosen device, you can select *either* the MMDS05 or the MMEVS development solution.

In the **Platform** column of the table on the next page, M68MMDS05 refers to the MMDS05 station module, and M68MMPFB0508 refers to the MMEVS platform board. Select either of these, depending on which of the development systems is required. Then move across the rows and select the appropriate components, all of which *must be ordered separately*.

Step 2. Select the emulation module that goes with the device.

Each device requires its own emulation module to act as the target device. The MMDS05 system comes with the M68HC05P9EM emulation module; for all devices requiring a different EM, *that EM must be ordered separately*. A particular EM is often reusable across multiple development projects.

Step 3. Select the device-specific target cabling.

Each of the target cabling components—flex cable, target head adapter, and (when needed) surface mount adapters—is device-specific and must be ordered separately. The component selected depends upon the package type in use. Like emulation modules, cabling components are often reusable across devices and in multiple target cabling systems, so it may not be necessary to order new components. (See Appendix E.)

Note: Each QFP target head includes one TQSOCKET with guides and one TQPACK disposal surface mount adapter. Order additional TQPACKs and TQSOCKETS (optional), using the part numbers referenced in the Surface Mount Adapters column to support multiple systems.

Step 4. For prototype work, identify the appropriate Parallel Programmer board.

Several Parallel Programmer packages are available. These boards are used for prototyping once an imbedded application is complete—not for high-volume production programming. (See the table on page 20, *PGMR Packages*.)

MMDS and MMEVS Development Systems

			In addition to the platform (station module or platform board), order these components separately			
Device	Package Type	Platform	Emulation Module	Flex Cable	Target Head Adapter	Surface Mount Adapter
68HC05A16 68HC705A24	56 SDIP-B	M68MMPFB0508 or M68MMDS05	M68EM05A24	M68CBL05B	M68TB05A24B56	
68HC08AS20 68HC708AS48	52 PLCC-FN	M68MMPFB0508 or M68MMDS05	M68EM08AX48	M68CBL05C	X68TC08AX48FN52	
68HC08AZ0 68HC08AB0	100 QFP-PU	M68MMPFB0508 or M68MMDS05	X68EM08AZ0	M68CBL05E	M68TE08AZ0PU100	M68TQS100SDG1 M68TQP100SD1
68HC08AZ32/24/16 68HC08AB32/24/16	64 QFP-FU	M68MMPFB0508 or M68MMDS05	X68EM08AZ0	M68CBL05E	M68TE08AZ32FU64	M68TQS064SAG1 M68TQP064SA1
68HC05B4/B6/B8/B16/B32 68HC705B5/B16/B32	56 SDIP-B	M68MMPFB0508 or M68MMDS05	M68EM05B32	M68CBL05B	M68TB05B32B56	M68TQS064SAG1 M68TQP064SA1
	64 QFP-FU			M68CBL05C	M68TC05B32FU64	
	52 PLCC-FN			M68CBL05C	M68TC05B32FN52	
68HC05BD3/BD5/BD7 68HC705BD3/BD7	40 DIP-P 42 SDIP-B	M68MMPFB0508 or M68MMDS05	M68EM05BD7	M68CBL05B M68CBL05B	M68TB05BD7P40 M68TB05BD7B42	
68HC05BD9/BD16/BD24 68HC705BD9/BD24	40 DIP-P 42 SDIP-B	M68MMPFB0508 or M68MMDS05	X68EM05BD9	M68CBL05B M68CBL05B	M68TB05BD9P40 M68TB05BD9B42	
68HC05BS8 68HC705BS8	44 QFP-FB 52 PLCC-FN	M68MMPFB0508 or M68MMDS05	M68EM05BS8	M68CBL05C	M68TC05BS8FB44	M68TQS044SAG1 M68TQP044SAMO1
				M68CBL05B	M68TB05BS8FN52	
68HC05C0	40 DIP-P 42 SDIP-B 44 PLCC-FN 44 QFP-FB	M68MMPFB0508 or M68MMDS05	X68EM05C0	M68CBL05B M68CBL05B M68CBL05C M68CBL05C	X68TB05C0P40 X68TB05C0B42 X68TC05C0FN44 M68TC05C0FB44	M68TQS044SAG1 M68TQP044SAMO1
68HC05C5 68HC705C5	Refer to the Configuration and Order Information for Other Motorola Development Tools section on page 18 to select a development tool for the 68HC05C5/68HC705C5.					
68HC05C4/C4A/C8A/C12A 68HC705C4A/705C8A	40 DIP-P 44 PLCC-FN 44 QFP-FB 42 SDIP-B	M68MMPFB0508 or M68MMDS05	X68EM05C9A	M68CBL05B M68CBL05C M68CBL05C M68CBL05B	M68TB05C9P40 M68TC05C4FN44 M68TC05C9FB44 M68TB05C9B42	M68TQS044SAG1 M68TQP044SAMO1
68HC05C9/C9A 68HC705C9/705C9A	40 DIP-P 44 PLCC-FN 42 SDIP-B 44 QFP-FB	M68MMPFB0508 or M68MMDS05	X68EM05C9A	M68CBL05B M68CBL05C M68CBL05B M68CBL05C	M68TB05C9P40 M68TC05C9FN44 M68TB05C9B42 M68TC05C9FB44	M68TQS044SAG1 M68TQP044SAMO1
68HC05CCV 68HC705CCV	Refer to the Configuration and Order Information for Other Motorola Development Tools section on page 18 to select a development tool for the 68HC05CCV/68HC705CCV.					
68HC05CJ4 68HC705CJ4	44 QFP-FB	M68MMPFB0508 or M68MMDS05	M68EM05CJ4	M68CBL05C	M68TC05CJ4PB44	M68TQS044SAG1 M68TQP044SAMO1

Each QFP target head includes one TQSOCKET with guides (M68TQSxxSyG1) and one TQPACK disposable surface mount adapter (M68TQPxxSy1 (1.2-mm lead length) or M68TQPxxxSyMO1 (1.6-mm lead length)). Order additional TQPACKs and TQSOCKETS (optional) using part numbers referenced in the Surface Mount Adapters column to support multiple target systems.

MMDS and MMEVS Development Systems (continued)

Device	Package Type	Platform	In addition to the platform (station module or platform board), order these components separately			
			Emulation Module	Flex Cable	Target Head Adapter	Surface Mount Adapter
68HC05CL4 68HC705CL4	80 QFP-FU	M68MMPFB0508 or M68MMDS05	M68EM05CL4	M68CBL05E	M68TE05CL4FU80	M68TQS080SBG1 M68TQP080SBMO1
68HC05CL48 68HC705CL48	112 TQFP-FU	M68MMPFB0508 or M68MMDS05	M68EM05CL48	not available	not available	
68HC05D9/D24/D32 68HC705D9/D32A	40 DIP-P 44 PLCC-FN 44 QFP-FB	M68MMPFB0508 or M68MMDS05	M68EM05D32	M68CBL05B M68CBL05C M68CBL05C	M68TB05C9P40 M68TC05C9FN44 M68TC05C9FB44	M68TQS044SAG1 M68TQP044SAMO1
68HC05E5 68HC705E5	28 DIP-P 28 SOIC-DW	M68MMPFB0508 or M68MMDS05	X68EM05E5	M68CBL05A M68CBL05A	M68TA05P9P28 M68TA05P9P28	M68DIP28SOIC
68HC05E6 68HC705E6	28 SOIC-DW 44 QFP-FB	M68MMPFB0508 or M68MMDS05	M68EM05E6	M68CBL05C M68CBL05C	M68TC05E6P28 M68TC05E6FB44	M68DIP28SOIC M68TQS044SAG1 M68TQP044SAMO1
68HC05F4 68HC705F4	28 DIP-P 28 SOIC-DW 44 QFP-FB	M68MMPFB0508 or M68MMDS05	M68EM05F4	M68CBL05C M68CBL05C M68CBL05C	M68TC05F4P28 M68TC05F4P28 M68TC05F4FB44	M68DIP28SOIC M68TQS044SAG1 M68TQP044SAMO1
68HC05F6 68HC705F6	42 SDIP-B 44 QFP-FB 64 QFP-FU	M68MMPFB0508 or M68MMDS05	M68EM05F6	M68CBL05B M68CBL05C M68CBL05C	M68TB05F6B42 M68TC05F6FB44 M68TC05F6FU64	M68TQS044SAG1 M68TQP044SAMO1 M68TQS064SAG1 M68TQP064SAMO1
68HC05G1 68HC705G1	56 SDIP-B 64 QFP-FU	M68MMPFB0508 or M68MMDS05	M68EM05G1	M68CBL05B M68CBL05C	M68TB05G1B56 M68TC05G1FU64	M68TQS064SAG1 M68TQP064SAMO1
68HC05G3 68HC705G4	80 QFP-FU	M68MMPFB0508 or M68MMDS05	M68EM05G4	M68CBL05E	M68TE05G4FU80	M68TQS080SBG1 M68TQP080SBMO1
68HC05G11 68HC705G11	100 QFP-FU	M68MMPFB0508 or M68MMDS05	X68EM05G11	M68CBL05E	M68TE05G11FU100	M68TQS100SDG1 M68TQP100SDMO1
68HC05J1 68HC705J2	20 DIP-P 20 SOIC-DW	M68MMPFB0508 or M68MMDS05	M68HC05JPEM	M68CBL05A M68CBL05A	M68TA05J2P20 M68TA05J2P20	M68DIP20SOIC
68HC705JJ7	20 DIP-P 20 SOIC-DW	M68MMPFB0508 or M68MMDS05	X68EM05JP7	M68CBL05A M68CBL05A	X68TA05JJ7P20 X68TA05JJ7P20	M68DIP20SOIC
68HC705JP7	28 DIP-P 28 SOIC-DW	M68MMPFB0508 or M68MMDS05	X68EM05JP7	M68CBL05A M68CBL05A	X68TA05JP7P28 X68TA05JP7P28	M68DIP28SOIC
68HC05J1A 68HC705J1A	28 DIP-P 28 SOIC-DW	M68MMPFB0508 or M68MMDS05	M68EM05J1A	M68CBL05A M68CBL05A	M68TA05J2P20 M68TA05J2P20	M68DIP20SOIC

(low-cost in-circuit simulator also available for the 05/705J1A: M68HC705J1CS)

Each QFP target head includes one TQSOCKET with guides (M68TQxxSyG1) and one TQPACK disposable surface mount adapter (M68TQPxxSy1 (1.2-mm lead length) or M68TQPxxSyMO1 (1.6-mm lead length). Order additional TQPACKs and TQSOCKETS (optional) using part numbers referenced in the Surface Mount Adapters column to support multiple target systems.

MMDS and MMEVS Development Systems (continued)

Device	Package Type	Platform	In addition to the platform (station module or platform board), order these components separately			
			Emulation Module	Flex Cable	Target Head Adapter	Surface Mount Adapter
68HC05J3	20 DIP-P 20 SOIC-DW	M68MMPFB0508 or M68MMDS05	M68EM05J3	M68CBL05A M68CBL05A	M68TA05J2P20 M68TA05J2P20	M68DIP20SOIC
68HC05K0/K1/K3	20 DIP-P 20 SOIC-DW	M68MMPFB0508 or M68MMDS05	M68EM05K3	M68CBL05A M68CBL05A	M68TA05J2P20 M68TA05J2P20	M68DIP20SOIC
(low-cost in-circuit simulator also available for the 705/K1 and 805/K3: M68HC805KICS)						
68HC05L1 68HC705L1	56 SDIP-B 64 QFP-FU	M68MMPFB0508 or M68MMDS05	M68EM05L1	M68CBL05B M68CBL05C	M68TB05L1B56 M68TC05L1FU64	M68TQS064SAG1 M68TQP064SAMO1
68HC05L2	Refer to the Configuration and Order Information for Other Motorola Development Tools section on page 18 to select a development tool for the 68HC05L7/L9, 68HC05L10, 68HC05L11, or 68HC05L2.					
68HC05L5/L16 68HC705L5/L16	80 QFP-FU	M68MMPFB0508 or M68MMDS05	M68EML05L16	M68CBL05E	M68TE05L16FU80	M68TQS080SBG1 M68TQP080SBMO1
68HC05L7/L9/L11 68HC05L10 68HC05M4	Refer to the Configuration and Order Information for Other Motorola Development Tools section on page 18 to select a development tool for the 68HC05L7/L9, 68HC05L10, 68HC05L11, or 68HC05M4.					
68HC08LN56 68HC708LN56	144 QFP-PV	M68MMPFB0508 or M68MMDS05	X68EML08LN56	X68CBL08LN56	included with X68CBL08LN56	M68TQS144SDG1 M68TQP144SD1
68HC05MC4 68HC705MC4	28 DIP-P 28 SOIC-DW	M68MMPFB0508 or M68MMDS05	M68EM05MC4	M68CBL05A M68CBL05A	X68TA05MC4P28 X68TA05MC4P28	M68DIP28SOIC
68HC708MP16	64 QFP-FU	M68MMPFB0508 or M68MMDS05	X68EM08MP16	M68CBL05C	X68TC08MP16FU64	M68TQS064SAG1 M68TQP064SAMO1
68HC05P3	28 DIP-P 28 SOIC-DW	M68MMPFB0508 or M68MMDS05	M68EM05P3	M68CBL05A M68CBL05A	M68TA05X4P28 M68TA05X4P28	M68DIP28SOIC
68HC05P8	28 DIP-P 28 SOIC-DW	M68MMPFB0508 or M68MMDS05	M68HC05JPEM	M68CBL05A M68CBL05A	M68TA05P8P28 M68TA05P8P28	M68DIP28SOIC
68HC05P1/P4/P6/P7/P9 68HC705P6/705P9	28 DIP-P 28 SOIC-DW	M68MMPFB0508 or M68MMDS05	M68HC05P9EM (M68HC05P9EM included with M68MMDS05)	M68CBL05A M68CBL05A	M68TA05P9P28 M68TA05P9P28	M68DIP28SOIC
68HC05P1A/P4A/P9A 68HC705P6A	28 DIP-P 28 SOIC-DW	M68MMPFB0508 or M68MMDS05	X68EML05P6A	M68CBL05A M68CBL05A	M68TA05P9P28 M68TA05P9P28	M68DIP28SOIC
68HC05P18 68HC805P18	28 DIP-P 28 SOIC-DW	M68MMPFB0508 or M68MMDS05	X68EM05P18	M68CBL05A M68CBL05A	M68TA05P9P28 M68TA05P9P28	M68DIP28SOIC
68HC05RC8/RC16/RC17/RC18 68HC705RC16/RC17	28 DIP-P 28 SOIC-DW	M68MMPFB0508 or M68MMDS05	X68EM05RC16	M68CBL05A M68CBL05A	X68TA05RC16P28 X68TA05RC16P28	M68DIP28SOIC
68HC05SC11/SC21/SC24/SC27 Die/card	Only available with NDA. ISO Adapter Included with EM. Contact sales office.					

Each QFP target head includes one TQSOCKET with guides (M68TQSxxSyG1) and one TQPACK disposable surface mount adapter (M68TQPxxSy1 (1.2-mm lead length) or M68TQPxxxSyMO1 (1.6-mm lead length)). Order additional TQPACKs and TQSOCKETS (optional) using part numbers referenced in the Surface Mount Adapters column to support multiple target systems.

MMDS and MMEVS Development Systems (continued)

			In addition to the platform (station module or platform board), order these components separately			
Device	Package Type	Platform	Emulation Module	Flex Cable	Target Head Adapter	Surface Mount Adapter
68HC05SR3/SU3 68HC705SR3	40 DIP-P 44 QFP-FB 42 SDIP-B	M68MMPFB0508 <i>or</i> M68MMDS05	M68EM05SR3	M68CBL05B M68CBL05C M68CBL05B	M68TB05SR3P40 M68TC05SR3FB44 M68TB05SR3B42	M68TQS044SAG1 M68TQP044SAMO1
68HC05T1/T2	Refer to the Configuration and Order Information for Other Motorola Development Tools section on page 18 to select a development tool for the 68HC05T1/T2.					
68HC05T10 68HC705T10	56 SDIP-B	M68MMPFB0508 <i>or</i> M68MMDS05	M68EM05T7	M68CBL05B	M68TB05T7B56	
68HC05V7 68HC705V8	56 SDIP-B 68 PLCC-FN	M68MMPFB0508 <i>or</i> M68MMDS05	M68EM05V8	M68CBL05B M68CBL05B	M68TB05V8B56 M68TB05V8FN68	
68HC05V12 68HC705V12	68 PLCC-FN	M68MMPFB0508 <i>or</i> M68MMDS05	X68EM05V12	M68CBL05C	X68TC05V12FN68	
68HC05X4 68HC705X4	28 DIP-P 28 SOIC-DW	M68MMPFB0508 <i>or</i> M68MMDS05	M68EM05X4	M68CBL05A M68CBL05A	M68TA05X4P28 M68TA05X4P28	M68DIP28SOIC
68HC05X16/X32 68HC705X32	64 QFP-FU	M68MMPFB0508 <i>or</i> M68MMDS05	M68EML05X32	M68CBL05E	M68TE05X32FU64	M68TQS064SAG1 M68TQP064SA1
68HC08XL36 68HC708XL36	64 QFP-FU 56 SDIP - B	M68MMPFB0508 <i>or</i> M68MMDS05	M68EML08XL36	M68CBL05C M68CBL05B	M68TC08XL36FU64 M68TB08XL36B56	M68TQS064SAG1 M68TQP064SAMO1

Each QFP target head includes one TQSOCKET with guides (M68TQSxxSyG1) and one TQPACK disposable surface mount adapter (M68TQPxxSy1 (1.2-mm lead length) or M68TQPxxxSyM01 (1.6-mm lead length)). Order additional TQPACKs and TQSOCKETS (optional) using part numbers referenced in the Surface Mount Adapters column to support multiple target systems.

Configuration and Order Information for Other Motorola Development Tools (EVM/EVS/ICS)

Device	Package Type	Development Tools	In addition to the platform, order these components separately			Comments
			Flex Cable	Target Head Adapter	Surface Mount Adapters	
68HC05CCV 68HC705CCV	42 SDIP-B 44 QFP-FB	Order M68HC05CCVEM and M68HC05PFB	M68CBL05B M68CBL05C	M68TB05CCVB42 M68TC05CCVFB44	M68TQS044SAG* M68TQP044SAMO*	
68HC05J1A 68HC705J1A	20 DIP-P 20 SOIC-DW	M68HC705JICS	20 DIP ribbon cable assembly included with M68HC705JICS		M68DIP20SOIC	M68HC705JICS In-circuit Simulator. For the SOIC package, you can order M68DIP20SOIC, which is a 20-pin DIP- to-SOIC adapter.
68HC05K0/K1 68HC705K1 68HC805K3	16 DIP-P 16 SOIC-DW	M68HC805KICS	16 DIP ribbon cable assembly included with M68HC805KICS		M68DIP16SOIC	M68HC705KICS In-circuit Simulator. For the SOIC package, you can order M68DIP16SOIC, which is a 16-pin DIP- to-SOIC adapter.
68HC05L2	42 SDIP-B	M68HC05L2EVS	not available			
68HC05L7/L9	128 QFP-FT	M68HC05L9EVM2	not available			
68HC05L10	128 QFP-FT	M68HC05L10EVM	not available			
68HC05L11	100 QFP-FU	M68HC05L11EVM	not available			
68HC05M4	52 PLCC-FN	M68HC05M4EVM	not available			For the PLCC package, you have the option to order 52PLCCU, which is the old-style ribbon cable assembly wit PLCC target adapter.
68HC05T1/T2	40 DIP-P 44 PLCC-P 44 PLCC-FN	M68HC05T2EVS	not available			For the PLCC package, you have the option to order 44PLCC05M, which is the old-style ribbon cable assembly wit PLCC target adapter.

* Each QFP target head includes one TQSOCKET with guides (M68TQSxxSyG1) and one TQPACK disposable surface mount adapter (M68TQPxxSy1 (1.2-mm lead length) or M68TQPxxxSyMO1 (1.6-mm lead length). Order additional TQPACKs and TQSOCKETs (optional) using part numbers referenced in the Surface Mount Adapters column to support multiple target systems.

Order Information for Programmers: Selecting the Right PGMR Package

Consult this table to choose the Parallel Programmer product that fits your MCU prototyping needs.

Note: Appendix C provides explanations of package name abbreviations (DIP, QFP, etc.) and brief descriptions of packages.

PGMR Packages

Device	Packages Supported	Programmer Board	Comments
68HC705A24	56 SDIP-B	M68HC705UPGMR	M68HC05UPGMR requires package adapter. For 56 SDIP, order M68UPA05A24B56.
68HC708AS48	52 PLCC-FN	X68SPGMR08	Requires programming adapter: M68PA08AX48FNFU
68HC705B5/B16/B32	52 PLCC-FN 56 SDIP-B	M68HC05BPGMR	For QFP package, order M68HC705X32PGMR.
68HC705BD3/BD7	40 DIP-P 42 SDIP-B	M68HC705UPGMR	M68HC05UPGMR requires package adapter. For 40 DIP-P, order M68UPA05BD3040. For 42 SDIP-B, order M68UPA05BD3B42.
68HC705C4A/C5/C8/C8A/C9/C9A	40 DIP-P/S 44 PLCC-FN/FS	M68HC05PGMR-2	Order M68ADT05P40FB44 adapter to program 44-QFP-FB.
68HC705CL4	80 QFP-FU	M68HC705UPGMR	M68HC705UPGMR requires package adapter M68UPA05CL4FU80
68HC705D9	40 DIP-P/S 44 PLCC-FN/FS	M68HC05PGMR-2	Order M68ADT05P40FB44 adapter to program 44-QFP-FB.
68HC705E5	28 DIP-P 28 SOIC-DW	X68HC705E5PGMR	
68HC705E6	44 QFP-FB 28 SOIC-DW	M68HC705E6PGMR	
68HC705F6	64 QFP-FU/FZ 42 SDIP-B/K	M68HC705F6PGMR64	
68HC705F8	64 QFP-FU/FZ	M68HC705F8PGMR	
68HC705G1	56 SDIP-B 64 QFP-FU	M68HC705G1PGMR	
68HC705G11	100 QFP-FU	M68HC705UPGMR	M68HC705UPGMR requires package adapter M68UPA05G1FU100
68HC705J1A	20 DIP-P	M68HC705JICS	M68HC705JICS in-circuit simulator. SOIC requires user-supplied socket or adapter (available from Yamaichi, part number IC51-0282-334-1).
68HC705J2/J3	20 DIP-P/S	M68HC705J2PGMR	SOIC requires user-supplied socket or adapter (available from Yamaichi, part number IC51-0282-334-1).
68HC705JJ7	20 DIP-P 20 SOIC-DW	X68HC705JP7PGMR	

PGMR Packages (continued)

Device	Packages Supported	Programmer Board	Comments
68HC705JP6/7	28 DIP-P 28 SOIC-DW	X68HC705JP7PGMR	
68HC705K1/3	16 DIP-P/S 16 SOIC-DW	M68HC805KICS M68HC705K1GANG M68HC705K1GANGY	M68HC705K1GANG programs up to 8 78HC705K1S or P. M68HC705K1GANGY programs up to 8 68HC705K1S, P, or DW.
68HC705L1	56 SDIP-B/K 64 QFP-FU/FZ	M68HC705L1PGMR	
68HC705L5/L16	80 QFP-FU/FZ	M68HC705L5PGMR	
68HC705L2	42 SDIP-B	M68HC705L2PGMR	
68HC705L5/L16	80 QFP-FU/FZ	M68HC705L2PGMR	
68HC708LN56	144 QFP-PV	X68SPGMR08	Requires programming adapter: MC68PA08LN56PV144
68HC705MC4	28 DIP-P 28 SOIC-DW	X68HC705MC4PGMR	
68HC708MP16	64 QFP-FU	X68SPGMR08	Requires programming adapter: M68PA08MP16FU64
68HC705P3	28 DIP-P 28 SOIC-DW	M68HC705E6PGMR	
68HC705P6/P6A/P9	28 DIP-P/S	M68HC705P9PGMR	SOIC requires user-supplied socket or adapter.
68HC805P18	28 DIP-P/S	M68HC805P18PGMR	SOIC requires user-supplied socket or adapter.
68HC705SR3	40 DIP-P 42 SDIP-B 44 QFP-FB	M68HC05SR3PGMRSG	M68HC05SR3PGMRSG requires package adapter: For 40 DIP-P, order M68HC05SR3PAP40. For 42 SDIP-B, order M68HC05SR3PAB42. For 44 QFP-FB, order M68HC05SR3PAFB44.
68HC705T10	56 SDIP-B/K	M68HC705T10PGMR	
68HC705V8	56 SDIP-B 68 PLCC-FN	M68HC705V8PGMR	
68HC705V12	68 PLCC-FN	X68HC705V12PGMR	
68HC705X4	28 DIP-P/S 28 SOIC-DW	M68HC705X4PGMR	
68HC705X32	64 QFP-FU 68 PLCC-FN	M68HC705X32PGMR	
68HC708XL36	64 QFP-FU 56 SDIP-B/K	X68SPGMR08	Requires programming adapter: M68PA08XL36BFU
68HC805K3	16 DIP-P/S	M68HC805KICS	SOIC requires user-supplied socket or adapter.

5 M68HC11 Development Systems and Tools

This section helps you understand and order systems and tools for developing applications based on Motorola's M68HC11 family of microcontrollers:

- **Motorola Modular Development System (MMDS11)** – This powerful, full-featured emulation system supports the development of embedded systems based on an M68HC11 MCU.
- **Motorola HC11 Evaluation System (EVS)** – Developers can use this EVS to economically design, debug, and evaluate target M68HC11-based systems.
- **Motorola HC11 Serial Programmer (SPGMR11)** – The Serial Programmer is used to program M68HC11 devices that contain an EPROM or EEPROM array.
- **Motorola HC11 Evaluation Boards (M68HC11EVB and M68HC11EVBV)** – These low-cost boards, the M68HC11 Evaluation Board and the Universal Evaluation Board, help developers evaluate code destined for a subset of devices in the M68HC11 family of MCUs.

In addition to describing the M68HC11 development systems and tools, this section explains how to identify and order the components needed to use the systems for a particular development effort.

MMDS11 Modular Development System

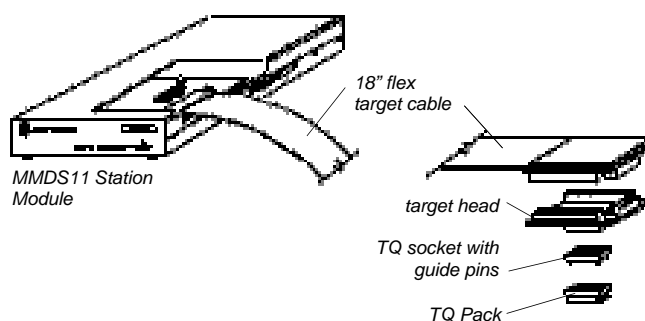
The MMDS11 features high-speed, nonintrusive in-circuit emulation, real-time read/write memory, and bus state analysis for debugging hardware and software—along with an integrated development environment that substantially speeds development and debugging tasks.

Hardware and Software Components

The MMDS11 hardware comprises four *separately purchased* hardware components:

- **Station module** – This metal case allows easy access for installing or replacing emulation modules. The station module includes these items:
 - RS-232C serial cable (9-lead)
 - RS-232C adapter (9- to 25-pin)
 - two cables and 16 logic clips for selecting individual signals

- built-in power supply (85 to 264 VAC)
- The station module works across many devices of the M68HC11 family, and once purchased can be reused for any number of M68HC11 development projects.



Note: The following device-specific components must be purchased separately from the station module. An emulator module, target head or flex cable can often be adapted to a wide range of M68HC11 devices. Consult the table on page 26 to order the appropriate MMDS11 system.

- **Emulation module** – Printed circuit board that plugs into the control board and fits inside the station module. The device-specific EM completes functionality for one or more M68HC11 MCUs.
- **Target head** – Adapter that plugs into the target system's MCU socket. Where necessary, it includes a TQ socket that aligns target-head guidepins with the target.
- **Flex cable** – Matched impedance ribbon cable that connects the EM to the target head.

The MMDS11 software component is the powerful, user-friendly IDE, which supports target system emulation and bus state analysis. The IDE's editor, assembler, user interface, and source-level debugger let users simultaneously develop and debug their M68HC11 applications.

MMDS11 Host System Requirements

A host system for use with the MMDS11 must be a 486 PC with a minimum of 650 KB RAM and at least 1 MB available hard disk space. The system must also include a 3.5-inch diskette drive.

HC11 Evaluation System (EVS)

This economical tool supports the design, debugging, and evaluation efforts necessary for developing target systems based on an M68HC11 MCU, letting developers generate, execute, and debug code in any of three modes of operation:

- single chip—I/O only
- expanded—full bus access
- special test—expanded plus additional features.

Users can either generate code with a resident on-line assembler or download the code from an external terminal into the EVS's user-evaluation RAM. The MCU I/O expansion port facilitates easy connection to the target system, and users can add a separately purchased logic analyzer for external hardware trace of code execution.

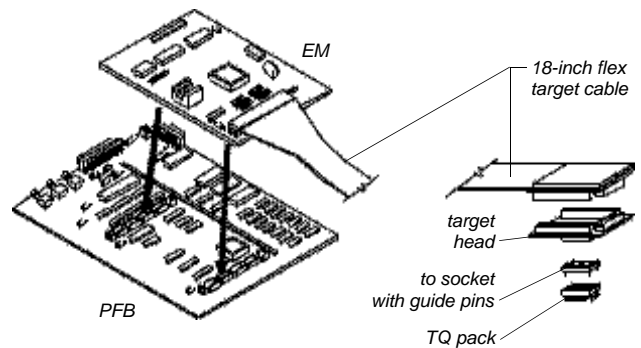
Hardware and Software Components

A complete M68HC11EVS consists of these four *separately purchased* hardware components:

- **Platform board (PFB)** – Printed circuit board that works across all devices of the M68HC11 family and which can be reused across all M68HC11 derivatives. Includes a low-cost assembler and interface software.

Note: The following device-specific components must be purchased separately from the PFB, according to the specific MCU device in use. An emulator module, a target head, or a flex cable can often be reused for multiple devices in the M68HC11 family. Consult the table on page 24 to order a complete M68HC11EVS system.

- **Emulation module** – Smaller printed circuit board that plugs onto the PFB to complete Evaluation System functionality for one or more MCUs.
- **Target head** – Special adapter that plugs into the MCU socket of a target system.
- **Flex cable** – Ribbon cable that connects the EM to the target head.



M68HC11EVS software components include:

- **IDE** – The MMEVS IDE, which comes with the platform board, provides an editor, an assembler, and a source-level debugger with graphical user interface to support target system emulation.
- **IASM11, EVM11** – The IASM11 is an absolute assembler for DOS. The EVM11 is an absolute debugger for DOS. Each is shipped with the M68HC11 PFB.

Third-party software products are also available for use with the M68HC11EVS. (Appendix B has information about how to contact third-party vendors.)

Third-party Software for the HC11EVS

Third-party Supplier	Compiler	Assembler	Debugger
Cosmic	Cosmic C	Cosmic ASM	CXDB
IAR	ICC (IAR)	ASM (IAR)	C-SPY
HIWARE	HiCross	Hiasm	Hilight

The Key Is MODULARITY

Choosing an MMDS11 or HC11EVS Development System

The key component of the M68HC11 development system is the MMDS11 station module. The key component of the M68HC11 evaluation system is the M68HC11PFB platform board. Both the station module and the platform board can be reused in multiple M68HC11 projects. Only the MCU-specific components—EM, target head, and flex cable—must be ordered separately for each project.

The following steps help you put together a complete system. A table below, MMDS11 and M68HC11EVS Development Systems, helps with the specifics.

Step 1. Identify the device to be emulated and its package type.

The components that complete the development system or the evaluation system are ordered according to the device to be emulated.

Step 2. Select the emulation module that goes with the device.

Each device requires an EM. A particular EM can be adapted for multiple devices—which means you frequently will not need to order multiple emulation modules for multiple M68HC11 development or evaluation projects.

Step 3. Select the device-specific flex cable.

Flex cables are often reusable across devices and with multiple EMs, so you may not need to reorder this component.

Step 4. Select the device-specific target head.

Like flex cables, target heads are often reusable for other devices and EMs.

MMDS11 and M68HC11EVS Development Systems

Device	Package	In addition to the M68MMDS11 station module or the M68HC11PFB platform board, order these components separately:		
		Module (EM)	Flex Cable	Target Head
68HC11A8	48-pin plastic DIP (P) 52-lead PLCC (FN) 64-lead QFP (FU)	M68EM11E20	M68CBL11B	M68TB11E20P48
		M68EM11E20	M68CBL11C	M68TC11E20FN52
		M68EM11E20	M68CBL11C	M68TC11E20FU64
68HC11D3	40-pin plastic DIP (P) 44-lead PLCC (FN) 44-lead QFP (FB)	M68EM11D3	M68CBL11C	M68TC11D3P40
		M68EM11D3	M68CBL11C	M68TC11D3FN44
		M68EM11D3	M68CBL11C	M68TC11D3FB44
68HC711D3	40-pin plastic DIP (P) 44-lead PLCC (FN)	M68EM11D3	M68CBL11C	M68TC11D3P40
		M68EM11D3	M68CBL11C	M68TC11D3FN44
68HC11E9/68HC711E9	52-lead PLCC (FN) 52-lead QFP (PB) 64-lead QFP (FU)	M68EM11E20	M68CBL11C	M68TC11E20FN52
		M68EM11E20	M68CBL11C	M68TC11E20PB52
		M68EM11E20	M68CBL11C	M68TC11E20FU64
68HC11E20/68HC711E20	52-lead PLCC (FN) 64-lead PLCC (FU)	M68EM11E20	M68CBL11C	M68TC11E20FN52
		M68EM11E20	M68CBL11C	M68TC11E20FU64
68HC811E2	48-pin plastic DIP (P) 52-lead PLCC (FN)	M68EM11E20	M68CBL11B	M68TB11E20P48
		M68EM11E20	M68CBL11C	M68TC11E20FN52
68HC11F1	68-lead PLCC (FN) 80-lead TQFP (PU)	M68EM11F1	M68CBL11C	M68TC11F1FN68
		M68EM11F1	M68CBL11C	M68TC11F1PU80
68HC11G5/68HC11G7	84-lead PLCC (FN)	M68EM11G5	M68CBL11D	M68TD11G5FN84
68HC11K4/68HC711K4	80-lead TQFP (FU) 84-lead PLCC (FN)	M68EM11K4	M68CBL11E	M68TE11K4FU80
		M68EM11K4	M68CBL11D	M68TD11K4FN84
68HC11KA2 /68HC711KA2	68-lead PLCC (FN)	M68EM11KA4	M68CBL11C	M68TC11KA4FN68
68HC11L6/68HC711L6	64-lead QFP (FU) 68-lead PLCC (FN)	M68EM11L6	M68CBL11C	M68TC11L6FU64
		M68EM11L6	M68CBL11C	M68TC11L6FN68
68HC11P2/68HC711P2	84-lead PLCC (FN)	M68EM11P2	M68CBL11D	M68TD11K4FN84

Serial Programmer for HC11 MCUs (SPGMR11)

The SPGMR11 programs M68HC11 family devices that contain an EPROM or EEPROM array. Using plug-in programming adapters to accommodate a variety of MCU devices and packages, the SPGMR11 can *either*:

- Operate as a standalone programmer connected to a host computer. (In this case, a 5-volt power supply must be connected to the SPGMR11.)
- Connect a host computer to the MMDS11 station module. (In this instance, the MMDS11 supplies 5-volt power.)

An on-board programming-voltage circuit eliminates the need for an external 12-volt supply. The SPGMR11 also includes a +5-volt power cable and a DB9-to-DB25 connector adapter, along with programming software that runs on the host computer. One or two standard DB9 male/female cables are required to make the system connections.

Hardware and Software Components

A complete SPGMR11 system consists of two *separately purchased* hardware components:

- **Serial programmer base unit (M68SPGMR11)** – This small, lightweight box connects to the host computer's serial communication port via a standard 9-lead cable. If used as a standalone programmer, the base unit connects directly to a +5-volt DC power supply. If used with an MMDS11, the base unit connects to the MMDS with a 9-lead cable and a +5-volt power cable. (The +5-volt power cable is included with the MMDS11.)

Note: This base unit can be used across all the M68HC11 MCU devices that contain an EPROM or EEPROM array. Only the programming adapter must be ordered separately.

- **Programming adapter** – Device-specific programming adapters enable the Serial Programmer to program a variety of M68HC11 microcontroller devices in various package configurations. Connectors on the programming adapter plug into connectors in the top of the serial programmer case. The programming adapter is ordered separately from the serial programmer base unit.

The PROG11 programming software included with the serial programmer base unit (M68SPGMR11) runs on the host computer. Neither the software nor the programmer affects host system operation until MCU programming begins. Commands allow the user to blank check, erase, program, and verify memory bytes and memory ranges, as well as display and upload memory contents and reset the MCU.

Putting Together an HC11 Serial Programmer

To devise a complete M68HC11 Serial Programmer system, follow these simple steps. The table on page 26, **Selecting an SPGMR11 Adapter Kit**, is a useful guide for ordering the correct components.

Step 1. Order the Serial Programmer base unit.

Regardless of the type of device to be programmed, the Serial Programmer base unit—**M68SPGMR11**—is required. The M68SPGMR11 is used across the full spectrum of devices that contain EPROM or EEPROM arrays.

Step 2. Select the device-specific programming adapter kit.

Device-specific programming adapters must be purchased separately from the base unit.

Selecting an SPGMR11 Adapter Kit

Device	Package	In addition to the M68SPGMR11 base unit (order adapter separately):
		Programming Adapter
M68HC11A8	48-pin plastic DIP (P) 52-lead PLCC (FN) 64-lead QFP (FU)	M68PA11A8P48 M68PA11E20FN52 M68PA11E20FU64
M68HC11D3	40-pin plastic DIP (P) 44-pin QFP (FB) 44-lead PLCC (FN)	M68PA11D3P40 M68PA11D3FB44 M68PA11D3FN44
M68HC711D3	40-pin plastic DIP (P) 44-lead QFP (FB)	M68PA11D3P40 M68PA11D3FB44
M68HC11E9/M68HC711E9	52-lead PLCC (FN) 52-lead QFP (PB) 64-lead QFP (FU)	M68PA11E20FN52 M68PA11E20PB52 M68PA11E20FU64
M68HC11E20/M68HC711E20	52-lead PLCC (FN) 64-lead PLCC (FN)	M68PA11E20FN52 M68PA11E20FU64
M68HC811E2	48-pin plastic DIP (P) 52-lead PLCC (FN)	M68PA11A8P48 M68PA11E20FN52
M68HC11F1	68-lead PLCC (FN) 80-lead TQFP (PU)	M68PA11F1FN68 M68PA11F1PU80
M68HC11G5 M68HC11G7	84-lead PLCC (FN)	M68PA11G5FN84
M68HC11K4/M68HC711K4	80-lead TQFP (FU) 84-lead PLCC (FN)	M68PA11K4FU80 M68PA11K4FN84
M68HC11KA2/M68HC711KA2	68-lead PLCC (FN)	M68PA11KA4FN68
M68HC11KA4/M68HC711KA4	68-lead PLCC (FN)	M68PA11KA4FN68
M68HC11L6/M68HC711L6	64-lead QFP (FU) 68-lead PLCC (FN)	M68PA11L6FU64 M68PA11L6FN68
M68HC11P2/M68HC711P2	84-lead PLCC (FN)	M68PA11K4FN84
M68HC11PH8	84-lead PLCC (FN) 100-lead TQFP (PU)	M68PA11PH8FN84 M68PA11PH8PU100

HC11 Evaluation Boards (EVB/EVBU)

This M68HC11 Evaluation Board (EVB) and Universal Evaluation Board (EVBU) are economical boards for evaluating code destined for the following members of the M68HC11 family:

- MC68HC11A8
- MC68HC11E9
- MC68HC711E9
- MC68HC811E2

The EVB comes with an on-board MC68HC11A8, and the EVBU comes with an on-board MC68HC11E9.

These boards feature:

- The BUFFALO ROM monitor program, which resides in the on-board MC68HC11, provides one-line assembly, disassembly, and debugging commands to simplify debugging and evaluation of M68HC11 MCUs.
- Either expanded mode of operation, with full bus access for debugging and evaluation (EVB), or single-chip (I/O only) mode of operation (EVBU).
- Built-in RS-232C I/O port circuitry that supports communication and data transfers between the EVB/EVBU and the external terminal or host computer.
- In the EVBU, a wire-wrap area for MCU custom interfacing, with a hole pattern that allows installation of most DIP sockets, strip sockets, headers, and connectors. This interfacing takes advantage of the MCU I/O port connector.

System Requirements

Both the EVB and the EVBU use an RS-232C I/O-compatible external terminal or a host computer running such a terminal program. For the EVBU, a +5-volt DC power supply is needed; for the EVB, the power supply must provide +5-volt DC, +12-volt DC, and -12-volt DC.

Selecting and Ordering the Right Board

To order the EVB or EVBU for evaluation of one of the four M68HC11 devices for which they can be used, simply indicate the required part number:

- **MC68HC11EVB** – Includes one flat-ribbon cable for target use.
- **MC68HC11EVBU** – Contains a wire-wrap area for system development use.

6 M68HC12 Development Tools

In this section you'll learn about the development tools used to design, debug, and evaluate embedded systems based on MCUs in the M68HC12 family of microcontrollers. Currently, there is one device in this family—the MC68HC12A4. Additional M68HC12 derivatives are in the works, as are additional development tools.

The tools presented here include:

- **Motorola 68HC812A4 Evaluation Board (M68HC812A4EVB)** – This low-cost board supports the evaluation of code destined for the 68HC812A4.
- **Motorola 68HC912B32 Evaluation Board (M68EVB912B32)** – This economical tool enables programmers to design and debug code for the 68HC912B32 MCU, and to evaluate the MCU's operation.
- **Serial Debug Interface (SDI)** – The SDI can be used for development on 68HC812A4 and 68HC912B32 devices and for all devices within the 68HC16 and 68300 MCU families. SDI makes use of the background debug mode (BDM) provided on these microcontrollers to dramatically reduce development time.

M68HC812A4 Evaluation Board

The M68HC812A4 EVB is used to design, debug, and evaluate embedded systems based on the 68HC812A4. By providing the essential MCU timing and I/O circuitry, the EVB simplifies user evaluation of prototype hardware and software.

Features

- A prototype area that enables custom interfacing with the MCU's I/O and bus lines. These connections are broken out via on-board headers, which are immediately adjacent to the prototype area.
- Optionally, the ability to accommodate various types and configurations of external memory to suit a particular application's requirements.
- An EPROM-resident monitor program, DBug12, which is completely factory-configured and ready to use with an RS-232C-compatible terminal for writing and debugging user code.

- Two Serial Communications Interface (SCI) ports for environments in which the MCU's single-wire background debug mode (BDM) interface serves as the user interface. This mode requires a tool such as the SDI for background debugging, along with a host computer running the appropriate interface software.
- Two methods for generating EVB user code:
 - For small programs or subroutines, DBug12 can be used to place object code directly into memory.
 - For larger programs, the Motorola MCUasm assembler (described on page 9) can be used on a host computer to generate S-Record object files that DBug12 then loads into memory.

The DBug12 monitor program is included with the 68HC812A4 EVB package. DBug12 is an EPROM-resident monitor program that enables writing, debugging, and programming of the 68HC812A4's on-chip EEPROM through commands that directly alter memory.

Note: DBug12 does not use the BDM interface.

M68HC812A4 EVB System Requirements

The M68HC812A4 EVB requires:

- RS-232C compatible terminal or a 486-based or higher host PC capable of running an RS-232C compatible terminal program
- a serial communication port
- RS-232C compatible cables
- +3.5 to +5-volt external power supply

Ordering an M68HC812A4 Evaluation Board

To order the evaluation board for the MC68HC812A4 MCU device, simply specify the following part number: **M68HC12A4EVB**. Orders will include all the tool's hardware and software components.

M68EVB912B32 Evaluation Board

The M68EVB912B32 is used to design, debug, and evaluate code for the 68HC912B32 MCU. By providing the essential MCU timing and I/O circuitry, the EVB simplifies user evaluation of prototype hardware and software.

Features

The tool features a prototype area that enables custom interfacing with the MCU's I/O and bus lines. These connections are broken out via on-board headers, which are immediately adjacent to the MCU.

The M68EVB912B32 includes these additional features:

- +3 to +5-volt DC operation
- RS-232C interface
- 32 kilobytes MCU internal FLASH EEPROM with resident DBug12 monitor/debugger program
- four operational modes:
 - EVB
 - JUMP-EEPROM
 - POD-BDM
 - BOOTLOAD

Note: If the M68HC912B32's background debug mode (BDM) interface serves as the user interface, the SCI port becomes available for user applications. This mode requires a background debug development tool, such as Motorola's SDI interface, and a host computer with the appropriate software or another B32EVB.

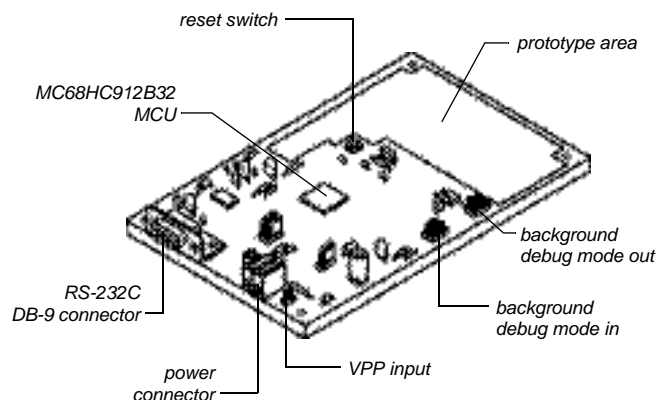
- header connectors for access to the MCU's I/O and bus lines
- on-board prototype area for customized interfacing with the MCU
- low-voltage inhibit protection
- full support for either dumb terminal or host computer terminal interface
- file transfer capability from a host computer, allowing off-board code generation

- Two methods for generating EVB user code:
 - For small programs or subroutines, DBug12 can be used to place object code directly into memory.
 - For larger programs, the IASM12 assembler can be used on a host computer to generate S-Record object files. DBug12 can then be used to load the S-Record files into the EVB's memory.

Hardware and Software Components

The M68EVB912B32 evaluation board comprises three main components:

- **Hardware** – The board is a multilayered printed circuit board that provides interface and power connections to the 68HC912B32 MCU chip, which is mounted on the board. Board dimensions are 5.15 x 3.4 inches (13.08 x 8.63 centimeters).



- **Firmware** – DBug12, the EVB's firmware-resident monitor program, lets programmers write, evaluate, and debug user programs. DBug12 requires no configuration — it comes from the factory ready to use with an RS-232C terminal. DBug12 allows programming of the MC68HC912B32's on-chip FLASH EEPROM through commands that directly alter memory.

Note: DBug12 does not use the BDM interface.

- Software – The IASM12 assembly language toolset provides an integrated development environment, including:

- project manager (MCUproject)
- relocatable macro-assembler (MASM)
- linker (MLINK)
- librarian (AR)
- Motorola S-Record generator (HEX)

M68EVB912B32 System Requirements

The M68EVB912B32 evaluation board requires:

- RS-232C compatible terminal or a 386-based or higher host PC capable of running an RS-232C compatible dumb terminal emulator.
- a serial communication port
- RS-232C compatible, 6-pin BDM target cable
- +3 to +5-volt DC @ 100 mA (maximum) external power supply

Ordering an M68EVB912B32 Evaluation Board

To order the evaluation board for the 68HC912B32 MCU device, specify the following part number: **M68EVB912B32**. Orders will include all the tool's hardware and software components.

Serial Debug Interface (SDI)

Motorola's SDI is a serial in-circuit debugger that uses the background debug mode (BDM) on M68HC12, M68HC16, and M68300 microcontrollers, allowing quick verification and updating of embedded software applications. When used with compatible debug software, the SDI allows users to view and modify applications on the fly—reducing development time and speeding time to market.

BDM is a feature of Motorola's M68HC12, M68HC16, and M68300 MCU embedded breakpoint and trace hardware.

A user connects the SDI in-line between the computer's serial port and the target system's BDM connector. The tool is available in 5-volt-only and low-voltage (2.7–5.5-volt) versions.

Hardware and Software Components

The SDI comes with:

- 6-pin interface connector for M68HC12 MCU devices
- 10-pin interface connector for M68HC16 or M68300 MCU devices
- SDBug software, which supports source-level debugging and on-board device and flash EEPROM programming

Note: SDBug is ordered separately.

System Requirements

The SDI requires:

- 486-based or higher PC running DOS 5.0 or higher
- RS-232C serial port for communications I/O
- +5-volt power supply (when the low-voltage version is being used).

Selecting and Ordering the SDI

Choosing the correct SDI for a particular development project depends on two factors:

- the **MCU device family** upon which the target application is based
- the **SDI voltage version** that is needed.

Note: The SDI hardware and software are ordered separately.

MCU family	Voltage	Hardware	SDBug Software
M68HC12	5V	M68SDI	M68SDBUG12AB
M68HC12	2.7 5.5V	M68SDIL	M68SDBUG12AB
M68HC16	5V	M68SDI	M68SDBUG16AB
M68HC16	2.7 5.5V	M68SDIL	M68SDBUG16AB
M68300	5V	M68SDI	M68SDBUG32AB
M68300	2.7 5.5V	M68SDIL	M68SDBUG32AB

7 M68HC16 and M68300 Development Systems and Tools

The following systems and tools for use with Motorola's M68HC16 and M68300 microcontroller families are described in this section:

- **Motorola Modular Development System (MMDS1632)** – This powerful, full-featured development system supports hardware and software emulation for target systems based on an MCU of either family.
- **Modular Evaluation Board (MEVB1632)** – Developers can economically design, debug, and evaluate target M68HC16- and M68300-based systems using this MEVB.
- **Serial Debug Interface (SDI)** – Suitable for development for all devices within the M68HC16 and M68300 MCU families, the SDI makes use of the background debug mode (BDM) to dramatically reduce development time.
- **M68300 development system products** – These systems provide low-cost solutions for evaluating the M68331, M68332A, and M68332G devices of the M68300 family.

In addition to describing the M68HC16 and M68300 development systems and tools, this section explains how to identify and order the components needed to use the systems for a particular development effort.

MMDS1632 Modular Development System

The MMDS1632 enables complete MCU emulation, including analog and digital functions. It uses an active probe with a variety of microcontroller personality modules to emulate different devices. An integrated development environment (IDE) significantly reduces the time required for developing and debugging an embedded MCU application.

The MMDS1632 features:

- real-time, nonintrusive, in-circuit emulation at the MCU's operating frequency
- real-time bus state analysis
- real-time read/write emulation memory
- complete MCU emulation, including reset and analog/digital functions
- four hardware breakpoints
- background debug mode operation
- C source-level debug with HI-CROSS C compiler

- two cables and 16 logic clips for individual signal selection
- built-in power supply
- power-on self test

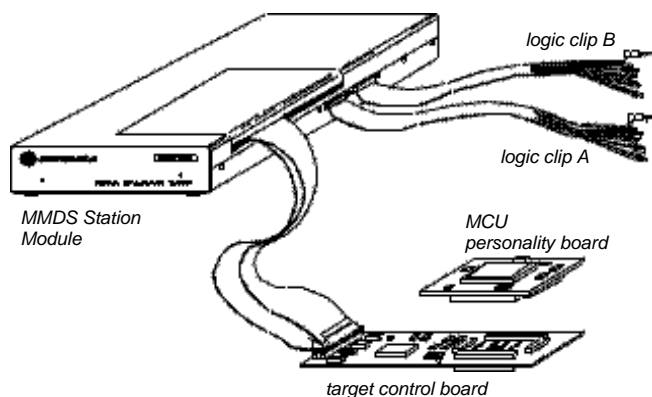
Hardware and Software Components

The MMDS1632 hardware comprises three *separately purchased* components:

- **Station module (M68MMDS1632)** – This metal case contains the target control board (TCB) and a 90- to 264-volt AC internal power supply. The station module comes with this equipment:
 - two TCB ribbon cables
 - two logic clip cable assemblies
 - RS-232C serial cable (9-lead)
 - RS-232C adapter (9- to 25-pin)
 - an AC power cable.

A connector on the enclosure provides +5-volt DC power.

The station module works across all devices of the M68HC16 and M68300 families, and once purchased it can be used to develop any number of applications based on an MCU of these families.

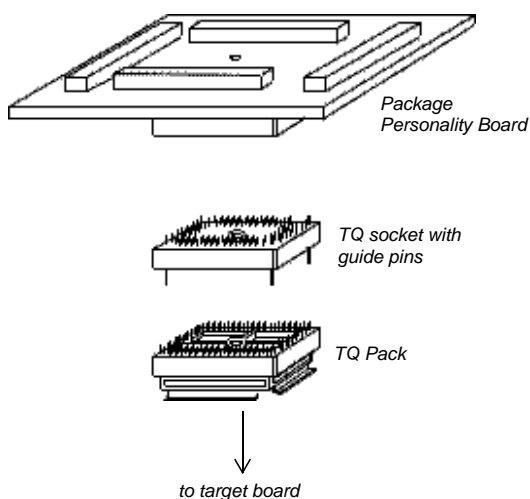


- **MCU personality board (MPB)** – A device- and package-specific board that defines the MCU to be evaluated. *The MPB must be purchased separately.*

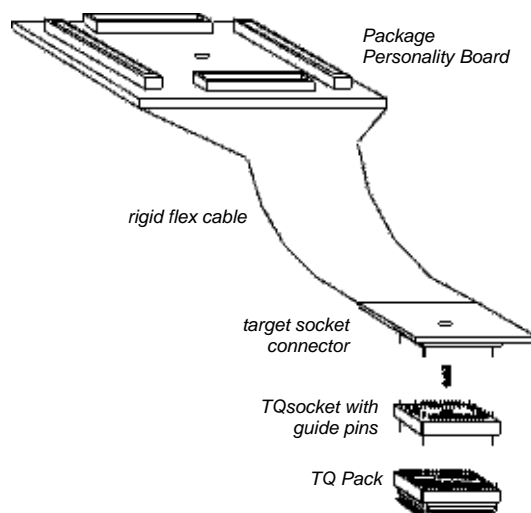
Note: The following components must be purchased separately from the station module. Consult the table on page 33 to correctly order the appropriate MMDS1632 system.

- **Package-specific personality board (PPB)** – The PPB provides the connection between the station module and the target system. Two types of PPB are available, each using a different connection method:

- **Direct Connect** – The most economical PPB



- **Rigid flex cable** – The most advanced PPB, providing optimal impedance advantages



MMDS1632 software components, which come with the system, include:

- **HIWARE** integrated design environment (IDE). An editor, assembler, and graphical C source-level debugger significantly reduce development time.
- **MCUinit** register initialization software lets developers generate startup code, edit registers, and access online reference manuals.

System Requirements

The MMDS1632 requires a 486-based PC running DOS 5.0 or later or Windows 3.1 or later. The software requires about 20 MB hard disk space. Also required are 8 MB RAM and a serial communication port (COM1, COM2, COM3, or COM4).

The Key Is MODULARITY

Devising an MMDS1632 Development System

The MMDS1632 core station module covers the entire spectrum of devices in the M68HC16 and M68300 microcontroller families and can be reused for multiple development projects involving these devices. The modular components—the MPB and the PPB—must be ordered separately.

Here are the steps for putting together a complete MMDS1632 system. The table below, **Selecting MMDS1632 Components**, helps with the details. Using the table as a guide, follow these steps:

Step 1. Order the MMDS1632 station module.

Regardless of which M68HC16 or M68300 MCU is right for a project, the core station module is always the same: the M68MMDS1632.

Step 2. Select the microcontroller personality board (MPB) that goes with the device.

Each device requires its own MPB, which is used *only* with that device. Each time a different MCU of either family is emulated, a new MPB must be ordered.

Step 3. Decide which connection method is most appropriate.

Choose from among the lowest-cost Direct Connect, the higher-speed woven cable, and the most advanced rigid flex connection methods.

Step 4. Pick the PPB that provides the desired connection method.

Note: As you consult this table, remember that all MMDS1632 systems require the core station module: M68MMDS1632. Choose other components based on the device to be emulated and the appropriate connection method.

Selecting MMDS1632 Components

Device	Package	MMDS Station Module	MPB	PPB (Connection Method)
68HC16S2	100 TQFP (PU)	M68MMDS1632	M68MPB16S2B	X68PPB16PUBG (Rigid-Flex)
68HC16Y1	160 QFP (FT)	M68MMDS1632	M68MPB16Y1B	X68PPB16FTAD (TQ PACK) M68PPB16FTAG (Rigid-Flex)
68HC16Z1	132 PQFP (FC)	M68MMDS1632	M68MPB16Z1B	X68PPB16FCAD (TQ PACK) M68PPB16FCAG (Rigid-Flex)
68331	132 PQFP (FC)	M68MMDS1632	M68MPB331B	M68PPB32FCAD (TQ PACK) M68PPB32FCAG (Rigid-Flex)
68332A	132 PQFP (FC)	M68MMDS1632	M68MPB332AB	M68PPB32FCAD (TQ PACK) M68PPB32FCAG (Rigid-Flex)
68332G	132 PQFP (FC)	M68MMDS1632	M68MPB332GB	M68PPB32FCAD (TQ PACK) M68PPB32FCAG (Rigid-Flex)
68F333C	160 QFP (FT)	M68MMDS1632	M68MPBF333C	X68PPB32FTAD (TQ PACK) M68PPB32FTBG (Rigid-Flex)
68376	160 QFP (FT)	M68MMDS1632	M68MPB376GB	M68PPB32FTCG (Rigid-Flex)

MEVB Modular Evaluation Board

The MEVB is an integrated solution for designing, debugging, and evaluating MCU operations of the M68HC16 and M68300 families. It also helps developers evaluate and debug code to be programmed into these MCUs. To simplify and speed evaluations, the MEVB provides microcontroller timing and port replacement circuitry.

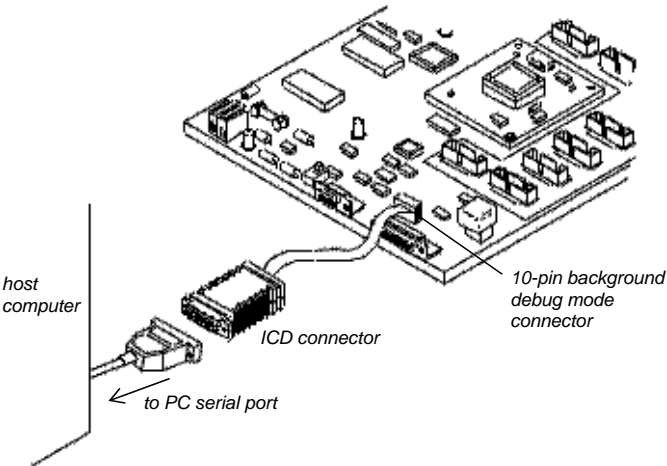
Additional MEVB features include:

- support for several sizes and types of memory device (RAM, EPROM, flash EEPROM), selectable via jumpers.
- seven software breakpoints
- logic analyzer connection for all MCU pins
- on-board MCU and flash EEPROM programming
- wire-wrap area
- background debug mode operation

Hardware and Software Components

A complete MEVB consists of three components, all of which come with the package (ordered with a single part number—see the table on page 35):

- **Modular Platform Board (MPFB1632)** – Printed circuit board that provides interface and power connections for the MPB. The MPFB is not device-specific; it works with the full spectrum of devices of the M68HC16 and M68300 MCU families. Moreover, an MPFB can be reused in multiple projects involving different devices in these families.
- **MCU Personality Board (MPB)** – A device- and package-specific board that defines the MCU to be evaluated. A plastic overlay is also included, which labels pin-outs for the MPFB logic analyzer connectors specific to the MCU.
- **In-circuit debugger (ICD16 and ICD32)** – Full background debugger, also not device-specific, which consists of a printed circuit board, a cable, and development software. The circuit board and cable connect a host computer’s parallel port to the MPFB background debug mode connector. ICD16 is for MCUs in the M68HC16 family; ICD32 is for M68300 MCUs.



The M68HC1632 MEVB ICD software lets users:

- single-step through code
- trace instructions
- modify memory
- set and count passes through breakpoints
- measure time between breakpoints
- step through RAM
- debug source code

MEVB System Requirements

The MEVB requires a 386-based or higher host PC running DOS 3.3 or later, at least 1 MB RAM, at least 10 MB hard disk space, a parallel communication port, and this external power supply: +5-volt DC ($\pm 10\%$) @ 1.0 amp (max.) current limited @ 1.5 amps.

ICD type	MCU family used with	Programmer included	Assembler included
ICD16	M68HC16	PROG16	IASM16
ICD32	M68300	PROG32	IASM32

Ordering an MEVB1632 Modular Evaluation Board

The MPFB core module covers the entire spectrum of devices in the 68HC16 and 68300 microcontroller families and can be used for multiple development projects involving these devices. The modular components—the MPB and the ICD—must be ordered separately.

To put together a complete MEVB1632 system, consult the table below, **Ordering an MEVB1632 Modular Evaluation Board**, as you follow these steps:

Step 1. Order the M68MPFB1632 core module.

Regardless of which 68HC16 or 68300 MCU is right for a project, the core module is always the M68MPFB1632.

Step 2. Select the microcontroller personality board (MPB) that goes with the device.

Each device requires its own MPB, which is used *only* with that device. Each time a different MCU of either family is emulated, a new MPB must be ordered.

Step 3. Select the appropriate in-circuit debugger (ICD).

The ICD16 is for use with the M68HC16 family of microcontrollers. The ICD32 is for use with the M68300 family of microcontrollers.

Ordering an MEVB1632 Modular Evaluation Board

Emulated MCU (Package)	In addition to the MPFB (M68MPFB1632):	
	MPB	ICD
68HC916X1 [120 PQFP (FH)]	M68MPB916X1C	M68ICD16
68HC16S2 [100 TQFP (PU)]	M68MPB16S2B	M68ICD16
68HC16Y1 [160 PQFP (FT)]	M68MPB16Y1B	M68ICD16
68HC16Z1 [132 PQFP (FC)]	M68MPB16Z1B	M68ICD16
68331 [132 PQFP (FC)]	M68MPB331B	M68ICD32
68332A [132 PQFP (FC)]	M68MPB332AB	M68ICD32
68332G [132 PQFP (FC)]	M68MPB332GB	M68ICD32
68F333 [160 PQFP (FT)]	M68MPBF333C	M68ICD32
68334 [132 PQFP (FC)]	M68MPB334B	M68ICD32
68336 [160 PQFP (FT)]	M68MPB336GB	M68ICD32
68376 [160 QFP (FT)]	M68MPB376GB	M68ICD32

Serial Debug Interface (SDI)

Motorola's SDI is a serial in-circuit debugger that makes use of the background debug mode (BDM) on M68HC12, M68HC16, and M68300 microcontrollers, allowing quick verification and updating of embedded software applications. When used with compatible debug software, the SDI allows users to view and modify applications on the fly—reducing development time and speeding time to market.

For a full description of this powerful debugging tool with ordering information, see “Serial Debug Interface (SDI)” on page 30.

M68300 Development Systems

The 68300 development systems provide low-cost solutions for evaluating the 68331, 68332A, and 68332G devices of the M68300 family.

Hardware and Software

M68300 development system hardware comprises these components, *all ordered separately*:

- **Platform board (PFB)** – Printed circuit board that has connectors for the Business Card Computer (BCC), an external power connector, two RS-232C I/O ports, a background debug mode interface port, an M68881 or an M68882 coprocessor, and a logic interface. Sockets on the PFB allow the user to increase BCC memory via RAM or EPROM.
- **Business Card Computer (BCC)** – Small printed circuit board that plugs into the PFB. The BCC contains this equipment:
 - microcontroller
 - on-board memory
 - serial-level converter circuitry
 - 4-pin serial-communication connector
 - RS-232C terminal/host computer I/O port
 - background debug mode interface port.

Two types of BCC are available:

- M68BCC331, which includes:
 - MC68331 MCU
 - 65K x 16-bit MCU
 - 32K x 16-bit byte-addressable RAM
- M68BCC332A and M68BCC332G, which include:
 - MC68332A or MC68332G MCU
 - 64K x 16-bit RROMs, programmed with the Debug Monitor
 - 32K x 16-bit byte-addressable RAM

Development software for use with the M68300 family is the **Debug Monitor**. Contained in the BCC EPROM, Debug Monitor is a software evaluation and debug tool. The developer can enter commands at the computer or at a to perform these actions:

- display and modify memory
- control breakpoint
- assemble/disassemble code (useful for patching programs)
- verify system integrity (a powerful self-test feature)
- debug software
- customize parameters

System Requirements

Using an M68300 development system requires a terminal or a host computer with terminal emulation. Also required are an RS-232C communications cable and a +5-volt DC at 500 MA power supply.

Ordering M68300 Development System Components

First, order the M68300PFB platform board. Then order BCCs as follows:

Device	In addition to the M68300PFB:
	BCC
68331	M68BCC331
68332A	M68BCC332A
68332G	M68BCC332G

8

MPC500 Development Tools

This section describes the components of the **Motorola MPC505 Evaluation Board (MPC505EVB)** and the **MPCbug Monitor Program**. The MPC505EVB is a low-cost board that supports the evaluation of code destined for a device of the MPC500 family of RISC PowerPC microcontrollers. The MPC505 MCU is an advanced single-chip device with on-chip memory and peripheral functions.

MPC505 Evaluation Board (MPC505EVB)

The MPC505EVB is used to evaluate code destined for a device of Motorola's MPC500 family of microcomputers. The EVB features:

- on-board circuitry including Flash Memory, synchronous Static RAM, background debug interface, and Dual Universal Asynchronous Receiver/Transmitter (DUART) with control timer
- serial port connections to the host computer and other external units, in addition to logic analyzer connections
- in-circuit programming capability for Flash memory
- on-board monitor program
- expansion connectors to attach external circuitry
- optionally, a Small Computer Systems Interface version 2 (SCSI 2) port controller

Hardware and Software Components

The MPC505EVB hardware comprises these components:

- MPC505 MCU running at 4 to 33 MHz (default is 4 MHz)
- 512 KB flash memory (can be upgraded to 2 MB)
- 128 KB synchronous static RAM (can be upgraded to 1 MB)
- RS-232 serial port
- MC68681 DUART that provides two serial interfaces for RS-232 evaluation
- MC68HC711 MCU for the background debug mode port interface
- two-port SCSI interface (optional)
- expansion connectors for MPC505 MCU signals
- 5-volt to 3.3-volt converter for MPC505 and signal buffers operation

- reset data configuration switches
- crystal or crystal oscillator operation

Software for the MPC505EVB is used to evaluate how an MPC505 device will perform in the target application, and to generate and evaluate code for embedding in the target system.

Note: All software for the MPC505 is ordered separately (Motorola Embedded PowerPC C Compiler Package and Motorola Embedded PowerPC Debugger). See *Motorola Embedded PowerPC Development Tools Suite* on page 8.

The MPC505EVB comes with the **MPCbug Monitor Program**, which evaluates and debugs systems built around the MPC505EVB. MPCbug includes these features:

- facilities for loading and executing user programs
- routines to handle input/output, data conversions, and string functions
- commands for displaying and modifying memory
- breakpoint capabilities
- assembler/disassembler (useful for patching programs)
- power-up self-test feature that verifies system integrity
- command-driven user-interactive software debugger
- user interface that accepts commands from the host console terminal.

MPC505EVB System Requirements

In order to use the MPC505 evaluation board with its associated software tools, the system must include:

- One of these operating systems:
 - SunOS 5.2.5 or higher
 - SunOS 4.1.3 or higher
 - HPUX 9.05 or any higher version up to, but not including, 10.0
 - AIX 4.1.4 or higher
 - AIX 3.2.5 or higher

Note: The MPCbug monitor program does not run on Windows systems.

- RS-232C compatible I/O port on the host
- RS-232C cable
- power supply

A MCTG Quick Reference

The tables in this appendix give you a quick visual overview of all the MCTG development systems, tools, and applications described in this guide.

Note: Modular, device-specific components must be ordered separately.

Hardware Systems

Product	Supports...	Hardware	Software	See page...
HC05/08 Motorola Modular Development System (MMDS05/08)	M68HC05 family M68HC08 family	MMDS05 Station Module M68HC05P9EM (P9 Emulator Module) Modular, device-specific components:* - Emulation Module (EM) - Target Cabling System: flex cable, target head adapter, surface mount adapter - Parallel Programmer (PGMR) board * Only devices not supported by the P9EM require separately-purchased, device-specific EMs.	IDE, featuring: editor assembler source-level debugger bug-state analyzer with graphical user interface	page 12
HC05/08 Motorola Modular Evaluation System (MMEVS05/08) Modular version replaces the EVS05/08. (For detailed information, see Upgrading from the EVS to the MMEVS, Motorola part number HC05EVS2MMEVS/D.)	M68HC05 family M68HC08 family	MMEVS Platform Board (PFB) Modular, device-specific components: - Target Cabling System: flex cable, target head adapter, surface mount adapter - Emulation Module (EM) - Parallel Programmer (PGMR) board	IDE, featuring: editor assembler source-level debugger with graphical user interface	page 13
HC11 Motorola Modular Development System (MMDS11)	M68HC11 family	MMDS11 Station Module Modular, device-specific components: - flex cable - target head - Emulation Module (EM)	IDE, featuring: editor assembler source-level debugger with graphical user interface	page 22
HC11 Evaluation System (EVS)	M68HC11 family	Platform Board (PFB) Modular, device-specific components: - flex cable - target head - Emulation Module (EM)	IDE, featuring: editor assembler source-level debugger with graphical user interface	page 23
HC11 Serial Programmer	M68HC11 family	Serial Programmer Modular, device-specific component: - Programming Adapter	Software for PC-compatible computers. Allows users to blank check, erase, program, and verify memory bytes and ranges. Users can also display memory contents, upload memory contents, and reset the MCU.	page 25

Hardware Systems (continued)

Product	Supports...	Hardware	Software	See page...
HC11 Evaluation Board (EVB)	M68HC11 devices: 68HC11A8 68HC11E9 68HC711E9 68HC811E2	M68HC11EVB with 68HC11A8 installed	BUFFALO Monitor Program (in ROM)	page 27
HC11 Universal Evaluation Board (HC11EVB)	M68HC11 devices: 68HC11A8 68HC11E9 68HC711E9 68HC811E2	M68HC11EVB with 68HC11E9 installed	BUFFALO Monitor Program (in ROM)	page 27
HC12 Evaluation Board (HC12EVB)	M68HC12 device: 68HC812A4 68HC912B32	M68HC12A4EVB M68EVB912B32	DBug12 IASM12	page 28
M68HC16 and M68300 Motorola Modular Development System (MMDS1632)	M68HC16 family M68300 family	MMDS1632 Station Module Modular, device-specific components: - Microcontroller Personality Board (MPB) - Package Personality Board (PPB)	HIWARE IDE: - editor - assembler - graphical source-level debugger MCUinit register initialization software	page 31
M68HC16 and M68300 Motorola Modular Evaluation Board (MEVB)	M68HC16 family M68300 family	Modular Platform Board (MPFB) Modular, device-specific components: - Microcontroller Personality Board (MPB) - In-circuit Debugger (ICD)	ICD Software: single step, instruction trace, memory modify, breakpoints with counters, time between breakpoints, step-through RAM, and source-code debugging.	page 34
Motorola MPC505 Evaluation Board (MPC505EVB)	MPC500 family	Evaluation Board (EVB)	Monitor Program (MPCbug)	page 37
M68300 development systems	68331, 68332A, and 68332G devices	Platform Board (PFB) Modular, device-specific component: - Business Card Computer (BCC)	Debug Monitor	page 35
Serial Debug Interface	M68HC12 family	SDI	SDBug 12, 16, 32 (must be ordered separately)	page 30
	M68HC16 family M68300 family	SDIL (low voltage)		page 35

Note: Modular, device-specific components must be ordered separately.

Software Systems

Product	Supports...	Ordering hints	System requirements	See page...
RTEK Real-Time Kernel <i>NEW: Fully scaleable v2.0</i>	M68HC11 family M68HC12 family M68HC16 family M68300 family MPC500 family MPC800 family	RTEK is fully scaleable for these families of microcontrollers: M68HC11 M68HC12 M68HC16 M68300	MCU families host platforms: M68HC11 PC M68HC12 PC M68HC16 PC M68300 PC MPC500 Sun MPC821 PC	page 6
Motorola Embedded PowerPC Development Tools Suite	Any device that complies with the PowerPC architecture definition	Power PC Compiler Package, which consists of:* - MEPROJ for Windows 95 and NT - Motorola Embedded C Compiler (MECC) - Motorola Embedded C Assembler (MEAS) - Motorola Embedded Linker (MELD) - Motorola Embedded S-Record Generator (MSREC) - Motorola Archiver (MAR) Motorola Embedded Debugger Package (MEDB)* * Select tools based on operating system in use.	Host platforms and operating systems: Sun Sparc4 Sun OS 4.1.3 IBM RS/6000 AIX 3.2.5 AIX 4.1.4 Motorola PowerStack <i>NEW: Also supports Hewlett-Packard HP 9000 Series 700, HP-UX 9.05, Windows 95 and Windows NT</i>	page 8
MCUasm Assembly Language Toolset	M68HC05 family M68HC08 family M68HC11 family M68HC12 family M68HC16 family	Must specify device family when ordering.	Host: PC-Windows	page 9
MCUinit Initialization Tool	M68HC12 family M68HC16 family M683xx family	M68HC812A4 device: - 68HC812A4 M68HC16 devices: - 68HC16X1 - 68HC16Y1 - 68HC916Y1 - 68HC16Y3 - 68HC16Z1 - 68HC16Z2 - 68HC16Z3 M683xx devices: - 68306 - 68307 - 68331 - 68332 - 68334 - 68360 - 68F333	Host: PC-Windows 3.1 or later	page 10
TPUMASM Assembler	M68HC16 family M6833x microcontrollers	Used for MCUs in the M68HC16 and M683xx families that have TPUs.	Host: MS-DOS 6.1 or later	page 11

B Third-party Development Tools

This appendix provides a list of optional applications and development tools provided by third-party firms. Included are tables that identify, by Motorola MCU device, the tools that are available and the companies that produce them. This appendix also lists third-party distributors and provides information about how to contact them.

An Important Note about Third-party Compatibility

Each development system available from the Motorola Microcontroller Technologies Group has been tested and verified. If you prefer to use a tool from another company or to mix Motorola tools with those from another firm, you must verify compatibility through direct communication with Motorola and the other firm.

Third-party Support for Specific MCUs

Third-party Developers for 68HC(7)05 and 68HC(7)08 MCUs

Company	ICE/Evaluation Boards	Programmer	Assemblers/ Linkers/ Debuggers	Compiler/ Real-time Kernel	Misc Software & Hardware Support
2500 Software, Inc.			✓		
Advin Systems, Inc.		✓			
American Arium	✓		✓		
AMP, Inc.					✓ (sockets)
Archimedes Software, Inc.			✓	✓	
Ascend Systems, Inc.		✓			
Ashling Microsystems	✓				
Avocet Systems, Inc.			✓	✓	
BP Microsystems		✓			
BSO Tasking			✓	✓	
Byte Craft Ltd.			✓	✓	
Bytek		✓			
Circuit Equipment Corp.		✓			
Cosmic Software			✓	✓	
Data I/O		✓			
Dr. Krohn & Stiller	✓				
E.E. Tools, Inc.		✓			
Embedded System Products, Inc.				✓	
Emulation Technology, Inc.		✓			✓ (sockets)

Third-party Developers for 68HC(7)05 and 68HC(7)08 MCUs (continued)

Company	ICE/Evaluation Boards	Programmer	Assemblers/ Linkers/ Debuggers	Compiler/ Real-time Kernel	Misc Software & Hardware Support
Hi-Tech				✓	
HIWARE			✓	✓	
IAR Systems			✓		
Introl Corp.			✓		
iSYSTEM GmbH	✓				
Lauterbach, Inc.	✓				
Logical Devices		✓			
McKenzie (now part of Berg Electronics)					✓ (adapters, sockets)
MetaLink Corp.	✓				
Micro Enhanced Technology (PEP programmers)		✓			
Nash Electronics		✓			
Needham s Electronics		✓			
Orion Instruments	✓				
Pentica Systems	✓				
P & E Microcomputer Systems, Inc.			✓		
PseudoCorp			✓		
SMS		✓			
Software Development Systems (SDS)			✓		
Sophia Systems	✓				
Stag Programmers Ltd.		✓			
Sunrise Electronics		✓			
System General Corp.		✓			
TECI		✓	✓		
Tribal Microsystems, Inc.		✓			
USAR Systems, Inc.					✓ (keyboard encoders)
Vel Electronic	✓	✓			
Yamaichi Elec., Inc.					✓ (sockets)
Yokagawa Digital Computer Corp.	✓				

Third-party Developers for M68HC11 MCUs

Company	Emulator	Programmer	Adapter	Compiler	Assembler	Debugger	RTOS
2500AD Software				✓	✓	✓	
Accelerated Technology							✓
American Arium	✓			✓	✓		
Archimedes Software				✓	✓	✓	✓
Articus Systems AB							✓
Ashling Microsystems	✓	✓				✓	
Avocet Systems				✓	✓		
B&C Microsystems		✓					
BP Microsystems		✓					
BSO/Tasking	✓			✓	✓	✓	
Cactus Logic	✓						
CMX Company	✓					✓	✓
Cosmic Software				✓	✓	✓	✓
Dr. Krohn & Stiller	✓					✓	
Elan Systems		✓	✓				
Embedded System Products							✓
Emulation Technology, Inc.	✓	✓	✓				
ENEA DATA							✓
Eris Systems, Inc.				✓ (Windows)	✓		
Fabius Software Systems				✓	✓		
FORTH, Inc.				✓			
Hitex, GmbH	✓						
HIWARE				✓	✓	✓	✓
Huntsville Microsystems, Inc.	✓				✓	✓	
IAR Systems				✓	✓	✓	
ImageCraft				✓			
Intermetrics				✓			
Introl Corporation				✓	✓	✓	
Ironwood Electronics			✓				
iSYSTEM GmbH	✓	✓					
Laboratory Microsystems				✓			
Lauterbach	✓						

Third-party Developers for M68HC11 MCUs (continued)

Company	Emulator	Programmer	Adapter	Compiler	Assembler	Debugger	RTOS
Logical Systems			✓				
Metalink Corporation	✓						
Nash Electronics		✓ (Gang)					
P&E Microcomputer Systems					✓	✓	
PseudoCorp					✓		
Sierra Systems				✓			
Signum Systems	✓						
Sophia Systems Company	✓					✓	
System General Corporation		✓					
TECI	✓	✓			✓		
Thorson Engineering	✓						
Trace Technology	✓						
Wytec Company	✓						
Yokogawa Digital Computer Corporation	✓	✓				✓	

Third-party Developers for MC68HC12 MCUs

Company	Emulator	Programmer	Adapter	Compiler	Assembler	Debugger	RTOS
Archimedes Software				✓		✓	
Ashling Microsystems	✓					✓	
Cosmic Software				✓		✓	
Embedded System Products							✓
IAR Systems				✓			
iSYSTEM GmbH	✓						
Lauterbach	✓					✓	
Logical Devices		✓					
Nohau Corp.	✓						
Pentica Sytems, Inc.	✓						
P & E Microcomputer Systems		✓				✓	
System General Corp.		✓					
U.S. Software							✓

Third-party Developers for MC68HC16 MCUs

Company	Emulator	Programmer	Adapter	Compiler	Assembler	Debugger	RTOS
2500AD Company				✓	✓	✓	
Accelerated Technology							✓
Advanced Electronic Diagnostics			✓				
AMP, Incorporated			✓				
Archimedes Software	✓	✓		✓	✓	✓	✓
Articus Systems AB							✓
CMX Company	✓					✓	✓
Cosmic Software				✓	✓		✓
Embedded Support Tools	✓					✓	
Embedded System Products							✓
Emulation Technology, Inc.	✓		✓				
Eris Systems, Inc.				✓	✓		
HIWARE		✓		✓	✓	✓	✓
Huntsville Microsystems, Inc.	✓				✓	✓	
IAR Systems				✓	✓	✓	
Intermetrics				✓			
iSYSTEM GmbH	✓						
Lauterbach	✓					✓	
Microtek International	✓					✓	
Nohau Corporation	✓					✓	
Orion Instruments	✓						
Pentica Systems	✓					✓	
P&E Microcomputer Systems		✓			✓	✓	
Softaid	✓			✓		✓	
System General Corporation		✓					
Yokogawa Digital Computer Corporation	✓					✓	

Third-party Developers for M68300 MCUs

Company	Emulator	Programmer	Adapter	Compiler	Assembler	Debugger	RTOS
Accelerated Technology							✓
Advance Electronic Diagnostics			✓				
AMP, Incorporated			✓				
Applied Microsystems Corporation	✓					✓	
Archimedes Software				✓	✓	✓	✓
Articus Systems AB							✓
Avocet Systems				✓	✓	✓	
BSO/Tasking	✓			✓	✓	✓	
CAD-UL GmbH				✓	✓	✓	
CaseTools						✓	
CMX Company	✓					✓	✓
Cosmic Software				✓	✓	✓	✓
Cygnus Support				✓	✓	✓	
Diab Data				✓			
Embedded Support Tools	✓					✓	
Embedded System Products							✓
Emulation Technology, Incorporated	✓		✓				
ENEA DATA							✓
Eyring Corporation				✓	✓	✓	
FORTH, Incorporated				✓			
Green Hills Software, Incorporated				✓		✓	
GreenSpring Computers						✓	
Hewlett Packard	✓						
HIWARE		✓		✓	✓	✓	✓
Huntsville Microsystems, Incorporated	✓					✓	
Integrated Systems, Incorporated				✓		✓	✓
Intermetrics				✓			
Introl Corporation				✓	✓	✓	
Ironwood Electronics			✓				
JMI Software System						✓	✓
KADAK Products Ltd.						✓	✓
Laboratory Microsystems				✓			

Third-party Developers for M68300 MCUs (continued)

Company	Emulator	Programmer	Adapter	Compiler	Assembler	Debugger	RTOS
Lauterbach	✓					✓	
Manx Software				✓	✓	✓	
Microtec Research					✓	✓	✓
Microtek International	✓					✓	
Microware Systems Corporation				✓			
Nohau Corporation	✓						
Orion Instruments	✓						
Pentica Systems	✓						
P&E Microcomputer Systems		✓			✓	✓	
Raven Computer Systems				✓	✓	✓	
Sierra Systems				✓			
Softaid	✓					✓	
Software Development Systems (SDS)				✓	✓	✓	
Wind River Systems				✓	✓		
Yokogawa Digital Computer Corp.	✓					✓	
ZAX Corporation	✓						

Third-party Developers for MPC500 MCUs

Company	Emulator	Programmer	Adapter	Compiler	Assembler	Debugger	RTOS
Accelerated Technology							✓
Diab Data				✓			
ENEA DATA							✓
Green Hills Software, Incorporated				✓		✓	
Integrated Systems, Incorporated							✓
Ironwood Electronics			✓				
Software Development Systems (SDS)				✓		✓	
Wind River Systems						✓	✓

How to Contact Third-party Vendors

The following table lists the locations, phone numbers, distributors, and Web sites of third-party vendors.

Third-party Contact Information

Company	Office Location	Phone Number	Distributor	Web Site
2500AD Software, Inc.	USA France UK	719 395 8683 +33 7443 8045 +44 1364 654100	CK Electronique Greymatter	http://www.2500AD.com/index.htm
Accelerated Technology	USA	800 468 NUKE		http://www.atinucleaus.com
Advanced Electronic Diagnostics, Inc.	USA	602 861 9359		http://www.sales@aed.com
Advin Systems, Inc.	USA Canada (Eastern) (Western) France Germany	408 243 7000 800 627 2456 416 609 8396 604 986 1286 33 13961 1414 49 89 7459 1271		http://www.advin.com
American Arium	USA	714 731 1661		http://www.arium.com
AMP Incorporated	Asia/Pacific Brazil Canada Europe Mexico USA	81 44 813 8502 55 1 861 1311 905 475 6222 44 753 676 800 525 729 0400 800 52AMP52		http://www.amp.com
Applied Microsystems Corporation	Europe Japan USA	44 0 1296 625462 81 3 3493 0770 206 882 2000		http://www.amc.com
Archimedes Software, Incorporated	USA	206 822 6300		http://www.archimedesinc.com
Articus Systems AB	Sweden	46 8 36 06 06		
Ascend Systems, Inc.	USA Austria/Germany France	510 606 2000 800 541 3526 +43 2772 54581 +33 148619528		
Ashling Microsystems	UK USA France Germany	+44 1256 811998 800 729 7700 408 747 0440 +33 14666 2750 +49 8233 32681	Orion Instruments	http://www.ashling.com
Avocet Systems, Incorporated	USA	207 236 9055 800 448 8500		http://www.midcoast.com/~avocet

Third-party Contact Information (continued)

Company	Office Location	Phone Number	Distributor	Web Site
BP Microsystems	USA	800 225 2102		http://www.bpmicro.com
	UK	713 688 4600		
	Japan	+44 1280 700262 81 3 3817 4980		
BSO Tasking	Germany	49 71 5222090		http://www.tasking.com
	UK	44 1252 510014		
	USA	617 894 7800 800 458 8276		
Byte Craft Ltd.	USA	519 888 6911		http://www.bytecraft.com
Bytek	USA	407 994 3520		http://www.bytek.com
	France	+33 16930 2880		
	Hong Kong	852 29198282		
Cactus Logic	USA	818 337 4547		
CAD UL GmbH	Germany	731 937 6027		http://www.cadul.com
	UK	44 0 117 986 0400	Great Western Instr.	
CaseTools	USA	408 685 0336		http://www.casetools.com
CGN	USA	408 720 1814	www.cgntech.com	
Circuit Equipment Corp.	USA	216 951 8840		
	UK	+44 1734 575666		
	France	+33 6185 5767		
CMX Company	Israel	972 3 648 4121	Agam Cross Systems Ltd.	http://www.cmx.com
	South Africa	27 12 660 2752	Kiberlab PTY Ltd.	
	UK	441 932 829460	Computer Solutions Ltd.	
	USA	508 872 7675		
Cosmic Software	Europe/Intl	33 143 995390		http://www.cosmic/index.html
	USA	617 932 2556		
	UK	44 1734 880241		
Cygnus Support	USA	415 903 1400		http://www.cygnus.com
Diab Data	Europe	+49 89 9393 1191		http://www.diabdata.com
	USA	415 571 1700		
Data I/O	USA	206 881 6444		
		800 426 1045		
	Canada	905 678 0761		
	France	+35 80502 3300		
	Japan	81 3 3779 2151		
Dr. Krohn & Stiller	Germany	+49 896100 0022		
	UK	+44 1235 861461		
	USA	320 617 9400		
E.E. Tools, Inc.	USA	408 734 8184		http://www.eetools.com
	France	+33 16930 2880		
	Japan	81 538 322822		

Third-party Contact Information (continued)

Company	Office Location	Phone Number	Distributor	Web Site
Embedded Support Tools Corp.	Europe Japan USA	33 130 57 3200 81 3 5688 6800 617 828 5588		http://www.estc.com
Embedded System Products, Inc.	USA Europe	713 728 9688 33 143 995 390	Cosmic Software	
Emulation Technology, Inc.	USA France UK	408 982 0660 33 16941 2801 44 1234 266455		http://www.emulation.com
ENEA Data	France Israel UK	33 1 39 56 81 31 972 3 492 001 11 44 1494 46 59 07	MB Electronique Telsys Ltd. Reflex Technology	
Eyring Corporation	USA	800 937 7367		http://www.eyring.com
Fabius Software Systems	USA	800 6 FABIUS		http://www.fabius.com
FORTH, Incorporated	USA	800 55 FORTH		http://www.forth.com
Green Hills Software Incorporated	USA	805 965 6044		http://www.ghs.com
Green Spring Computers	USA	415 327 1200		http://www.greenspring.com
Hewlett Packard	USA	800 447 3682		http://www.hp.com
Hi-Tech	UK Germany USA	44 0734 792 101 49 7147 3085 800 448 8500 207 236 9055	Pentica Pentica Avocet Systems	
Hitex-Systementwicklung GmbH	France Germany Japan USA	1 47 88 50 63 0721 96 28 0 02 785 3753 408 451 3986	Conviergie S.A Moda Technology HiTOOLS Incorporated	http://www.hitex.com
HIWARE	France Germany Japan Switzerland UK USA	33 1 6013 3668 41 61331 7151 81 3 3293 4716 41 61 331 71 51 44 1734 792101 44 1962 733140 206 827 4832	CK Electronique Avnet HIWARE Lifeboat Pentica Nohau Archimedes Software	http://www.hiware.com
Huntsville Microsystems, Inc. (HMI)	USA	205 881 6005		http://www.hmi.com
IAR Systems	France Japan UK USA	1 39 61 14 14 03 293 4711 44 71 924 3334 415 765 5500	LIFEBOAT JAPAN	http://www.iar.com

Third-party Contact Information (continued)

Company	Office Location	Phone Number	Distributor	Web Site
Introl Corporation	USA	800 327 7171 414 327 7171		http://www.introl.com
	UK	44 171 8331022	System Science	
	France	33 7443 8045 33 14622 9988	CK Electronique Micro Sigma S.A.	
	Japan	81 3 256 5881	Soft Mart, Inc.	
	Germany	49 8104 9074	Lauterbach GmbH	
Integrated Systems, Incorporated	USA	800 458 PSOS		http://www.isi.com
Intermetrics Microsystems Software, Inc.	Japan	03 5389 0721		http://www.tasking.com
	UK	01703 334774		
	USA	617 661 0072		
Ironwood Electronics, Incorporated	USA	612 431 7025		
iSYSTEM GmbH	Asia-Pacific Ltd.	+82 2 783 8750		http://www.isystem.com
	Germany	+49 8131 70610		
	USA/Canada	207 236 9055 or 800 448 8500		
JMI Software Systems	Europe	441624623841	RTS	http://www.mcb.net/JMI/
	India	91 80 3430219	Software Development Sys.	
	Japan	81 3 3576 5351	Advanced Data Controls	
	Korea	82 2 784 7841	Zeus Computer	
	USA	215 628 0840		
KADAK Products Ltd.	Canada	604 734 2796		http://www.kadak.com
	France	33 1 698 55044	OMNITEL	
	UK	44 117 9860400	Great Western Instrument	
Lauterbach Datentechnik GmbH	Germany	08104 8943 0	Electro Systems	http://www.lauterbach.com
	USA	508 303 6812		
Logical Devices	USA	800 331 7766		http://www.logicaldevices.com
Logical Systems	USA	315 478 0722		http://www.logicalsyst.com
Manx Software Systems	USA	908 308 3800		http://www.manx@monmouth.com
McKenzie (now part of Berg Electronics)	USA	510 6512700	Green Components	http://www.bergelect.com/mckenzie/mdefault.html
	France	33 14594 1424		
MetaLink Corporation	USA	602 926 0797		http://www.metaice.com
	Canada	613 226 2365		
	Hong Kong	896 2 501 6699		
	Germany	+49 8091 55950		
Micro Enhanced Technology	USA	708 352 3910		
Microtec Research	France	33 1 30 12 02 10		http://www.mri.com
	Japan	81 3 5210 3050		
	USA	408 980 1300		

Third-party Contact Information (continued)

Company	Office Location	Phone Number	Distributor	Web Site
Microtek International	France	33 1 30 61 14 14	Antycip CC&I GMBH Pacific Basin	http://www.microtek.com
	Germany	49 89 8509718		
	Taiwan	886 2 501 6699		
	USA	503 645 7333		
Microware Systems Corporation	France	33 42 58 63 00		http://www.microware.com
	Japan	81 3 3257 9000		
	UK	44 1628 667578		
	USA	800 475 9000		
Nash Electronics, Incorporated	USA	501 289 6111		
Needham s Electronics	USA	916 924 8037		http://www.needhams.com
Nohau Corporation	Canada	514 689 5889		http://www.nohau.com
	France	1 69 41 28 01		
	Germany	07043 40247		
	UK	01962 735 408		
	USA	408 866 1820		
Orion Instruments	Australia	011 61 2 364 1777	Warburton Franki Multitest Electronics Inc. BSO France S.A.	http://www.oritools.com
	Canada	416 609 8396		
	France	+33 1 30 54 2222		
	USA	408 747 0440		
		800 729 7700		
P & E Microcomputer Systems, Inc.	USA	617 353 9206		http://www.pemicro.com
Pentica Systems	Germany	+49 7147 3085		http://www.pentica.com
	UK	+44 01734 792101		
	USA	800 PENTICA 617 275 4419		
PseudoCorp	USA	541 683 9173		http://www.teleport.com/~rhowden
Sierra Systems	USA	510 339 8200		
Signum Systems	USA	510 353 1616		http://www.signum.com
SMS	USA	415 298 8041		http://www.sms/sprint.com
	Germany	+49 7522 9728 0		
	Japan	+81 3 3317 9911		
Softaid	France	33 62 07 29 54	Ingenierie/Solns en Test AK Elektronik Vertriebs Gmb Hardware Ltd. Tekelec Airtronic B.V. Zeus Computer Co., Ltd.	http://www.softaid.com
	Germany	49 8250 7430		
	Japan	31 79 310100		
	UK	82 02 784 7841		
	USA	800 433 8812		

Third-party Contact Information (continued)

Company	Office Location	Phone Number	Distributor	Web Site
Software Development Systems (SDS)	Asia/Pacific	61 0 3 720 5344	Walter Rekirsche Elektronische	http://www.sasi.com
	Austria	43 0 1 259 72 700		
	Denmark	45 0 4824 1204		
	Finland	45 0 4824 1204		
	Germany	49 0 25 34 800170	H S P GmbH	
	Italy	39 0 2 90 72 24 41		
	Japan	81 0 3 3493 7981		
	Norway	46 0 8 86 84 44		
	Sweden	46 0 8 86 84 44		
	UK	44 1442 876065		
	USA	708 368 0400		
Sophia Systems	Japan	044 989 7000		
	USA	800 824 9294		
Stag Programmers Ltd.	UK	+44 1707 332148		http://www.logicaldevices.com
	USA	800 331 7766		
Sunrise Electronics	USA	909 595 7774		
System General Corp.	USA	800 967 4776		http://www.sg.com.tw
		408 263 6667		
	Japan	81 3 3441 1510		
	France	+33 2015 1133		
	Germany	+41 1982 2050		
TECI	USA	800 336 8321		http://www.tec-i.com
		802 525 3458		
Tribal Microsystems, Inc.	USA	510 623 8859		http://www.tribalmicro.com
	Asia	886 2 764 0215		
U. S. Software	USA	503 641 8446		http://www.ussw.com
USAR Systems, Inc.	USA	212 226 2042		http://www.usar.com
Vel Electronic	Germany	+49 851 751427		
Wind River Systems	Asia/Pacific	81 03 5467 5900		http://www.wrs.com
	Germany	49 0 89 96 24 45 0		
	Japan	81 03 5467 5900		
	UK	44 0 121 359 0981		
	USA	510 748 4100		
Wytec Company	USA	708 894 1440		http://www.wytec.com
Yamaichi Elec., Inc.	USA	408 456 0797		http://www.yeu.com
Yokogawa Digital Computer Corporation	Japan	81 422 56 9101	Orion Instruments	
	USA	408 747 0400		
ZAX Corporation	USA	714 474 1170		

C Definitions and Terms

This appendix lists and defines the abbreviations and acronyms that frequently appear in this guide and in other Motorola literature.

A/D. Analog-to-digital converter

BCC. Business card computer

BUFFALO. On-board debug monitor program

CLCC. Ceramic leaded chip carrier

DIP. Dual in-line package

EABI. Embedded Application Binary Interface. Standard for PowerPC tools—a standard devised jointly by Motorola, IBM, and several other companies.

EEPROM. Electrically Erasable Programmable Read Only Memory

EM. A personality board that emulates one or several MCUs. The EM is ordered separately to complete HC11 Evaluation System or MMDS11 solution functionality.

EPROM. Erasable Programmable Read Only Memory (ROM)

EVB. Evaluation board

EVBU. Universal evaluation board

Evaluation System. An evaluation system consisting of a platform board (PFB), an MCU family-specific daughter board called an emulation module (EM), and a target head.

EVK. Evaluation kit

IASM11. Integrated Assembler for M68HC11.

ICD. Full background in-circuit debugger for the M68HC16 and M68300 (ICD16 and ICD32). It consists of a printed circuit board, an associated cable, and development software.

IDE. Integrated development environment

I/O port. Input/output port

LDC. Literature Distribution Center

LIM. Lite Integration Module

MCU. Microcontroller unit

MCUasm. Motorola assembly language that provides a path to higher performance while maintaining compatibility with existing software and systems.

MCUinit. Graphical environment for generating MCU initialization code, editing registers, and accessing on-line reference manuals. This software program simplifies and speeds creation of initialization software for M68HC16 and M68300 MCUs.

MEAS. Motorola embedded PowerPC assembler. This flexible tool can operate as a stand-alone assembler, or can be invoked by another development tool, such as the embedded C Compiler.

MECC. Motorola embedded PowerPC C compiler. The C compiler offers maximum flexibility with a complete set of command line options.

MEDB. Motorola embedded debugger support for C language programs, assembly language programs or mixed languages programs.

MELD. Motorola embedded PowerPC linker. This flexible tool takes input from object files and referenced object members from library files and combines them into one object file.

MEVB. Motorola modular evaluation board. A low-cost evaluation system for the M68HC16 and M68300 families. A complete MEVB solution includes a MPFB, MPB, and an ICD.

MMDS11. Motorola's modular development system for the M68HC11 family. The MMDS11 station module is ordered separately from the target cable, EM, and target head that are required for emulating a specific MCU.

MMDS1632. Motorola's modular development system for the M68HC16 and M68300 families. A complete MMDS solution includes the MMDS station module, a device-specific MPB, and PPB.

MPB. Device-specific Microcontroller Personality Board

MPFB. Modular platform board

MSREC. Motorola S-Record generator. This tool generates Motorola S-records from object files. The S-records may be used to program EPROMs or may be downloaded to target boards.

OTPROM. One-time programmable ROM

PFB. Platform board

PLCC. Plastic leaded chip carrier

PPB. Package personality board

PQFP. Plastic quad flat pack

QFP. Quad flat pack

RAM. Random access memory

RAPID. Integrated Development Environment for M68HC11

RS-232C. Standard PC compatible communications port

RTEK. A real-time embedded kernel that delivers a robust, field-proven framework for embedded system software development. It utilizes the performance and integration of the MPC500, M68HC16 and M68300 microcontrollers.

ROM. Read only memory

RTOS. Real-time operating system

SDI. Full background serial in-circuit debugger

SDK. Software development kit for RTEK

SM. Station module

TPU. Time processor unit (16 programmable channels)

TPUMASM. This tool supports assembly language for TPU microcode. It assembles object code to be loaded into RAM and used as a control store in the TPU's emulation mode.

TQFP. Thin quad flat pack

VAC. Volts alternating current

D Additional Product Information

This appendix lists Motorola brochures and other documents that provide more information about the development applications and tools presented in this guide.

Literature available from the Literature Distribution Center

Title	Part Number
MCUasm Assembly Language Development Toolset	MCUASM/D Rev 1
MCUinit Initialization Tool	MCUINIT/D
Motorola Embedded PowerPC Debugger	MEDB/D
Motorola Embedded PowerPC C Compiler Package	MECCPKG/D
RTEK Real-Time Kernel	RTEK/D Rev 1
RTEK Technical Summary	RTEKTS/D
M68HC12A4 Evaluation Board	M68HC12A4EVB/D
MEVB1632 Modular Evaluation Board	MEVB1632/D
General Information for HC05 and HC08	FLDR19/D

MCU information available from the Literature Distribution Center

Title	Order Number
Advanced Microcontroller Division Device Selection Guide	SG166/D Rev 13
CSIC Microcontroller Selection Guide	SG165/D

Other information available from the Literature Distribution Center

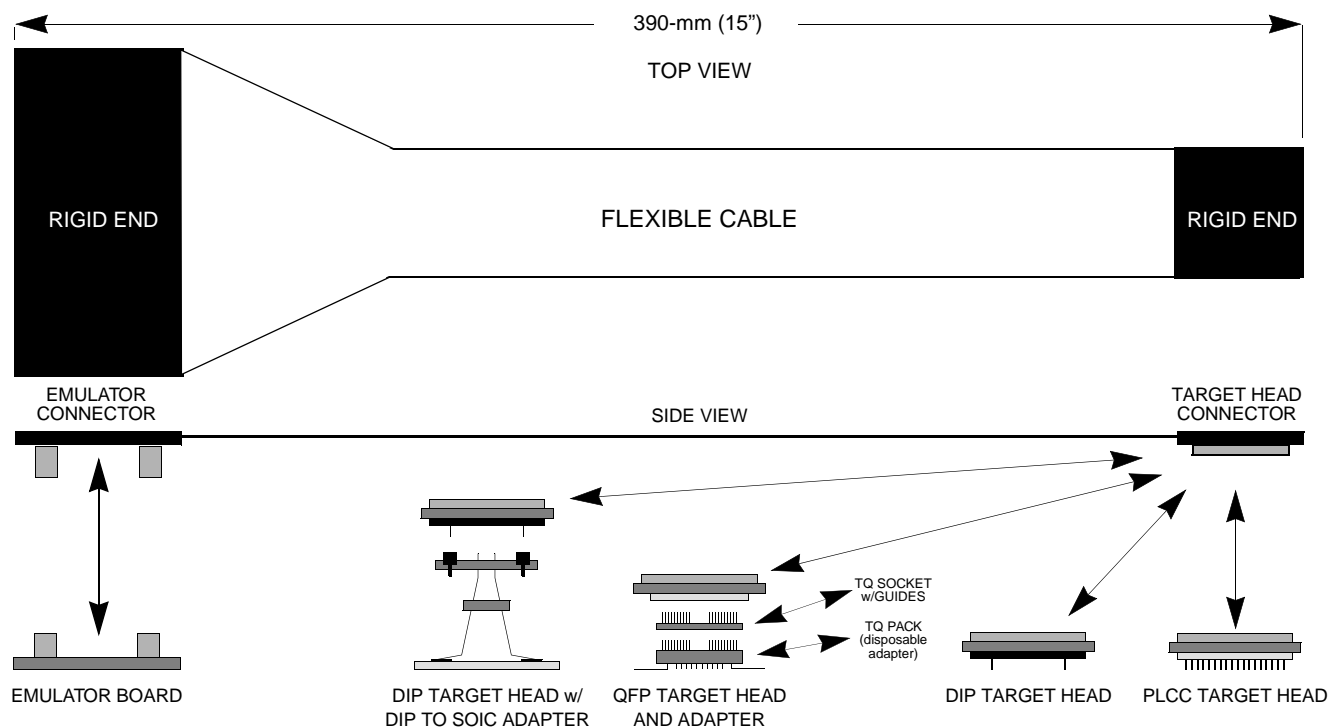
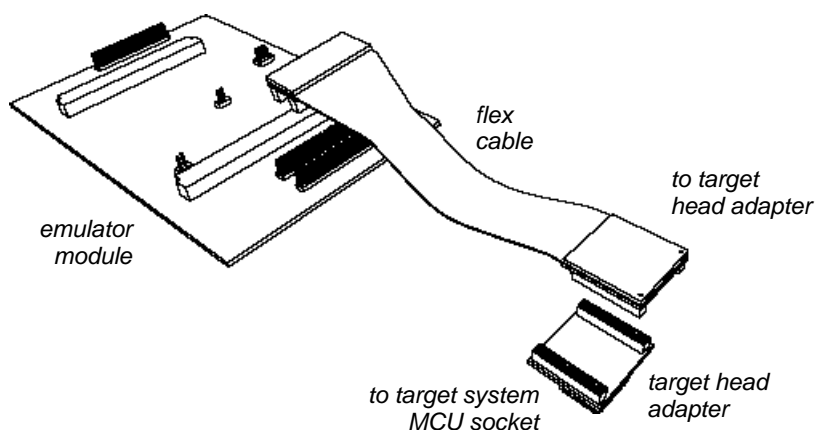
Title	Order Number
Hardcopy version of information available on the HC05/HC08 website	CDCSIC2/D

Websites

Type of Information	Website
HC11, HC12, HC16, 68300 families	http://www.mcu.motsp.com
HC05 and HC08 families	http://design-net.com/csic

To contact the Literature Distribution Center, call 800-441-2447 or send email to: ldcformotorola@hibbertco.com.

E Modular Cable Structure



Note: Each QFP target head adapter includes one xxx pin TQSOCKET with guides (M68TQxxxSyG1) and one TQPACK disposable adapter (M68TQPxxxSy1, 1.2 mm-lead length, or M68TQPxxxSyM01, 1.6 mm-lead length.) One additional TQPACK must be purchased for each additional target system. The TQSOCKET is reusable, but can also be purchased separately. Refer to the surface mount adapter column in the configuration and order information table for Motorola Modular Tools (MMDS/MMEVS) for the TQSOCKET and TQPACK part numbers specific to the MCU in your target application.

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Motorola M68HC11 Serial Programmer,

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Motorola M68HC12 Evaluation Board,

see *M68HC12A4EVB*

Motorola Modular Development System,

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