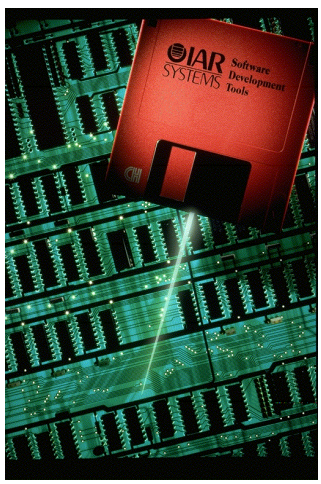
ICCH8

INTEGRATED C COMPILER

HITACHI H8S AND H8/300H DEVELOPMENT TOOLS



INTEGRATED ENVIRONMENT

The ICCH8 toolset is delivered as a complete toolset with C compiler, assembler, linker, librarian and run-time libraries. To help reduce development times and make the tools easier to use the delivery also includes a menu driven user interface with mouse control. This user interface also includes an error-sensitive editor and make utilities. Use the IAR Integrated Environment - and get to market faster.

The IAR ICCH8 development kit offers the choice of C to H8S and H8/300H applications.

ICCH8 implements the full ANSI C language, and provides extended keywords specific to the H8S architecture. With its built-in chip-specific optimizer, the IAR H8 C Compiler generates very efficient and reliable PROMable code.

Combined with fully comprehensive documentation, the IAR ICCH8 gets you started on your H8 project in no time, making the learning process fast and easy. In addition to a solid technology, our professional technical support is yet another reason engineers adopt IAR C.

COMPILER

Full ANSI C compatibility

The IAR H8 C Compiler is fully compatible with the ANSI C standard. All data types required by ANSI are supported without any exceptions (see figure 1). *float* are represented in the IEEE 32-bit precision and *double* are represented in the IEEE 32 or 64-bit precision. *Struct*, *array*, *union*, and *enum* are also supported. There is also support for 8/16/32-bit bit-field.

Full ANSI C compatibility means that the IAR C Compilers follow not only the ANSI syntax but also the less well known requirements that ANSI puts on run-time behavior such as integral promotions and precision in floating point calculations to name two specific and important areas.

DATA TYPE	SIZE (bytes)	VALUE RANGE
bit	1 bit	0 or 1
sfr	1	0 to 255
sfrp	2	0 to 65535
signed char	1	-128 to +127
char (default)	1	0 to 255
short & int	2	-32768 to +32767
unsigned short & int	2	0 to 65535
signed long	4	-2^{31} to $2^{31}-1$
unsigned long	4	0 to $2^{32}-1$
float IEEE 32-bit	4	±1.18E-38 to ±3.39E+38, 7 digits
double, long double IEEE 32-bit	4	±1.18E-38 to ±3.39E+38, 7 digits
double, long double IEEE 64-bit	8	±2.23E-308 to ±1.79E+308, 16 digits
pointer	2,3	object address

Figure 1. *Data representation supported by the IAR H8 C Compiler.*

H8 Specific extensions

To ideally suit development for embedded systems, standard C needs additional functionality. IAR Systems has defined a set of extensions to ANSI C, specific to the H8 architecture (see Figure 2). All of these extended keywords can be invoked by using the *#pragma* directive, which maintains compatibility with ANSI and code portability.

In Addition there is also a set of intrinsic functions that are specially designed for H8 (see Figure 2). These functions maps to assembler instructions that can be directly invoked in C code as a function call. The intrinsic functions shown in the table are only some of the available functions.

Efficient floating point

The compiler comes with full floating point support. It follows the IEEE 32-bit representation using an IAR Systems proprietary register based algorithm, which makes floating point manipulation extremely fast.

TYPE	KEYWORD	DESCRIPTION
Function	interrupt	Creates an interrupt function that is called through an interrupt vector. The function preserves the register contents and the processor status.
	monitor	Turns off the interrupts while executing a monitor function.
	tiny_func	Called indirectly via an exception vector.
	near_func	Access range from 0H to FFFF.
	far_func	Unrestricted access to 16MB range.
Variable	no_init	Puts a variable in the no_init segment. Does not get intialized at start-up.
	bit	Declares a bit variable.
	sfr	Maps a byte value to an absolute address.
	sfrp	Maps a word value to an absolute address.
	tiny	Data object stored in the tiny segment. Access using 8-bit addressing.
	near	Data object stored in the near segment. Access using 16-bit addressing.
	far	Data object stored in the far segment. Access using 32-bit addressing. Object size <64KB.
	huge	Data object stored in the huge segment. No restrictions on size.
Intrinsic	_args$	Returns an array of the parameters to a function.
	_argt$	Returns the type of the parameter.
	and_ccr, and_exr	ANDs to the CCR or EXR register.
	dadd, dsub	Decimal addition or subtraction.
	disable_max_time	Sets maximum interrupt disable time.
	do_byte_eepmov	Copies a sequence of bytes.
	func_stack_base	Returns the function stack base address.
	mac	Multiply and accumulate.
	macl	Multiply and accumulate logical.
	no_operation	Executes the NOP instruction.
	or_ccr, or_exr	ORs to the CCR or EXR register.
	read_ccr, read_exr	Reads the CCR or EXR register.
	rotlc, rotlw, rotll	Rotate 1-byte, 2-byte, or 4-byte data to the left.
	rotrc, rotrw, rotrl	Rotate 1-byte, 2-byte, or 4-byte data to the right.
	set_interrupt_mask	Sets the interrupt priority level.
	sleep	Executes the SLEEP instruction.
	tas	Executes the TAS instruction.
	trapa	Executes the TRAPA instruction.
	write_ccr, write_exr	Writes to the CCR or EXR register.
	xor_ccr, xor_exr	Exclusive-ORs to the CCR or EXR register.

Figure 2 *IAR Systems embedded C extensions.*

Processor mode	Memory model	Code Area	Data Area	Default func call	Default Data Pointer
Normal	Small (-ms)	<64KB	<64KB	near_func	Near
Advanced	Large (-ml)	<16MB	<4GB	far_func	Far
tiny, near, far and huge extended keywords could be used to override defaults					

Figure 3. *Memory models. The two different memory models allow a best fit selection.*

Memory models for any hardware design
Every design has its own memory requirements. The ICCH8 compiler has two different memory models to allow a best fit selection (see Figure 3).

ASSEMBLER

Macro-Assembler for time-critical routines
The IAR C Compiler kit comes with a relocatable structured assembler. This provides the option of coding time-critical sections of the application in assembly without losing the advantages of the C language. The preprocessor of the C compiler is incorporated in the assembler, thus allowing use of the full ANSI C macro language, with conditional assembly, macro definitions, if statements, etc. C include files can also be used in an assembly program. All modules written in assembly can easily be accessed from C and vice versa, making the interface between C and assembly a straightforward process.

Powerful Set of Assembler Directives
The assembler provides an extensive set of directives to allow total control of code and data segmentation. Directives also allow creation of multiple modules within a file, macro definitions and variable declarations.

LINKER

The IAR XLINK Linker supports complete linking, relocation and format generation to produce H8 PROMable code (see Figure 4).

The XLINK generates over 30 different output formats and is compatible with most popular emulators and EPROM burners.

The XLINK is extremely versatile in allocating any code or data to a start address, and checking for overflow. Detailed cross reference and map listing with segments, symbol information, variable locations, and function addresses are easily generated.

Examples of linker commands	Description
-Z seg_def	Allocates a list of segments at a specific address.
-F format_name	Selects one of more than 30 different absolute output formats.
-x -l file_name	Generate a map file containing the absolute addresses of modules, segments, entry points, global/static variable, and functions.
-D symbol=value	Define a global symbol and equates it to a certain value.

Figure 4. *Example of different linker commands*

LIBRARIAN

The XLIB Librarian creates and maintains libraries and library modules. Listings of modules, entry points, and symbolic information contained in every library are easily generated.

XLIB can also change the attributes in a file or library to be either conditionally or unconditionally loaded, i.e. loaded only if referred to or loaded without being referred to.

ANSI C LIBRARIES

The IAR C Compiler kit comes with all libraries required by *ANSI free standing implementation of C*. Additionally, ICCH8 comes with low-level routines required for embedded systems development (see Figure 5).

C LIBRARY FUNCTIONS
DIAGNOSTICS<assert.h> assert
CHARACTER HANDLING<ctype.h> isalnum, isalpha, iscntrl, isdigit, isgraph, islower, isprint, ispunct, isspace, isupper, isxdigit tolower, toupper
VARIABLE ARGUMENTS<stdarg.h> va_arg, va_end, va_list, va_start
NON LOCAL JUMPS<setjmp.h> longjmp, setjmp
INPUT/OUTPUT<stdio.h> getchar, gets, printf, putchar, puts, scanf, sscanf, sprintf
GENERAL UTILITIES<stdlib.h> abort, abs, atof, atol, atoi, bsearch, calloc, div, exit, free, labs, ldiv, malloc, rand, realloc, srand, strtod, strtol, strtoul, qsort
STRING HANDLING<string.h> memchr, memcmp, memcpy, memmove, memset, strcat, strchr, strcmp, strcoll, strcpy, strcspn, strerror, strlen, strncat, strncmp, strncpy, strpbrk, strrchr, strspn, strstr, strtok, strxfrm
MATHEMATICS<math.h> acos, asin, atan, atan2, ceil, cos, cosh, exp, exp10, fabs, floor, fmod, frexp, ldexp, log, log10, modf, pow, sin, sinh, sqrt, tan, tanh
LOW-LEVEL ROUTINES<iccbutl.h> _formatted_write, _formatted_read

Figure 5. *Library functions. IAR C Compiler comes with all libraries required by ANSI.*

UTILITIES & EXTRAS

User interface, editor and Make utility installation is easy and straight forward due to the installation program which will check for other IAR installations. ICCH8 comes with a mouse-controlled menu-driven user interface that includes an error-sensitive ASCII editor. An easy-to-use Make utility is also integrated in the interface environment.

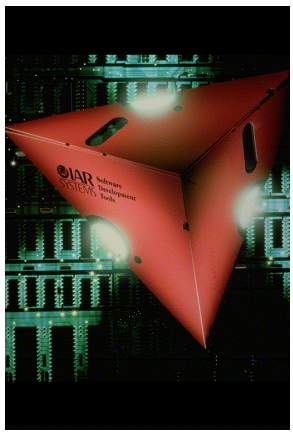
SUPPORT & UPDATES

IAR H8 toolkit comes with the following benefits:

- Updates released within 90 days after purchase free of charge.
- On-line free technical support.

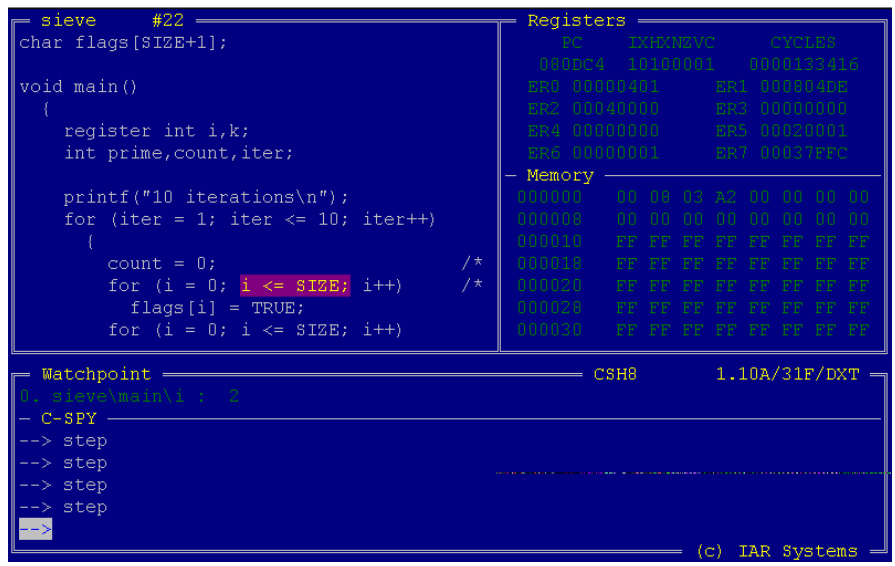
HOSTS

- IBM PC and compatibles. Minimum 386, DOS 4.x, and 4 MB of RAM.
- Windows 3.1x, 95 and NT 3.51 or later in a DOS window.
- SUN 4 (SPARC): SUN-OS, Solaris.
- HP 9000/700: HP-UX.



C-SPY H8 SIMULATOR/DEBUGGER

FOR HITACHI H8S AND H8/300H



The IAR H8 C-SPY is a high level language simulator/ debugger. C-SPY combines the detailed control of execution needed for embedded development debugging with the flexibility and power of the C language.

USER INTERFACE

Short learning curve
C-SPY is a window-oriented simulator/debugger which provides a friendly and easy-to-navigate debugging environment.

No set-up problems
C-SPY does not need to be set-up to offer powerful debug features. All functionality is present from start-up. The C-SPY screen could be reduced to only two windows (Source and Command) for simplicity or be divided into the following user-selectable windows:

C/ASM source code. Displays source code on C or assembly levels, and highlights the line being executed. Allows placement of breakpoints directly on the C or ASM source line.
Registers. Displays register contents and the cycle count.
Memory. Simulates memory space of the cpu. Displays the content of a user selectable address range, ROM, RAM or stack.
Watchpoint. Displays the content of variables and expressions. Globals, locals, structures, arrays, and pointers are all supported.
Terminal I/O. A unique C-SPY feature where the screen becomes the output and the keyboard becomes the input. A very useful feature for debugging embedded applications when logical flow is of interest or the target is not yet ready.

A Powerful Command Set
A powerful yet easy to use command set; includes all that is needed for embedded debugging environments. Frequently used commands are invoked via function keys.

Built-in Assembler & Disassembler
In addition to modifying variables and symbol values, C-SPY H8 also provides the flexibility of modifying the code during a debugging session. This feature is often needed while debugging embedded applications.

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