Hitachi America, Ltd.

Application Engineering
TechNote

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Using the H8/325 demo board to evaluate the H8/329

The H8/325 Evaluation Board can be used as a development tool for the H8/329 sub-family microcontrollers. Although both the H8/325 and the H8/329 have identical DIP packages, they are not pin-by-pin compatible; most of the pins do not have identical functions and, in addition, about half of them are function-multiplexed differently. Hence, merely inserting the H8/329 DIP part into the H8/325 socket on the board will not work. Therefore, some kind of adapter that provides the proper pin correspondence between the 2 devices is needed.

From an architectural stand-point, both the H8/325 and H8/329 sub-families are very similar; they only differ in the aspects shown in table 1 below. The H8/325 - 322 address space maps are somewhat different from the H8/329 - 326 memory maps; however, the evaluation board ROM (that contains the HMS monitor program), RAM, DUART, and external I/O are mapped within the same boundaries in the external address space. Moreover, the on-chip registers of both devices share the same address locations.

FEATURES	DEVICE H8/325	DEVICE H8/329
16-bit Free Running Timer - input capture channels	1	4
SCI Channels	2	1 (w/ multiprocessor bit)
A/D Converter	None	8 channels
I/O Ports	53 I/O bits	43 I/O bits
Parallell Handshake Port	Yes	None
External Clock Output (E)	Yes	None

Table 1. Feature differences between the H8/325 and H8/329.

How to physically implement a H8/325-to-H8/329 adapter is up to each individual user. As a general rule, the adapter board must sit high enough so that access to the evaluation board switches and jumpers is possible. One alternative would be to have the H8/329 DIP socket rest on stand-offs on top of the H8/325 DIP socket on the evaluation board, therefore eliminating the need for the adapter board minimum height requirement.

There are 4 main factors that must be considered before starting to wire the H8/329 DIP socket pins to the H8/325 socket:

1. All chip lines that are controlled and/or used by the H8/325 evaluation board must be wired directly to the corresponding pins of the H8/329 DIP socket. They include: pins that are controlled by the board's jumpers and switches; address, data, and bus control signals used to access the external memory devices and the external UART; signals used by the on-board PAL for external device decoding; I/O port pins used by the HMS program monitor for diagnostic purposes and in the ROM/RAM switch operation; digital power and ground pins. Table 1 on the following page shows the pin-to-pin correspondence for these signals.
2. The external crystal oscillator must be connected as closely as possible to the H8/329 on the adapter board; **therefore the XTAL and EXTAL connections on the evaluation board must be removed.** Long, crossing wires to the clock input pins will most likely pick up noise resulting in all sorts of unexpected problems.
3. Analog power (AVcc) and analog ground (AVss) **must be directly supplied to the H8/329 DIP socket on the adapter board** since the H8/325 lacks this function.
4. All chip lines that are not controlled and/or used by the H8/325 evaluation board can be wired from the H8/329 DIP socket in any order and to any unused pin on the H8/325 on-board socket. Table 2 shows a connection example.

H8/325 pin no.	Function	H8/329 pin no.	Function
39, 14	Vcc	39, 14	Vcc
48, 16	Vss	48, 16	Vss
56 - 49	$P1_{0-7} / A_{0-7}$	56 - 49	$P1_{0-7} / A_{0-7}$
47 - 40	$P2_{0-7} / A_{8-15}$	47 - 40	$P2_{0-7} / A_{8-15}$
57 - 64	$P3_{0-7} / D_{0-7}$	57 - 64	$P3_{0-7} / D_{0-7}$
	13 NMI-		13 NMI-
15	STBY-	15	STBY-
8	RESET-	12	RESET-
11	MD_1	19	MD_1
12	MD_0	20	MD_0
35	AS- / $P7_4$	6	AS- / $P4_5$
36	WR- / $P7_5$	5	WR- / $P4_4$
37	RD- / $P7_6$	4	RD- / $P4_3$
23	Φ / $P4_6$	7	Φ / $P4_6$
38	WAIT- / $P7_7$	8	WAIT- / $P4_7$
1	$P6_0$ / FTCI	31	$P6_0$ / FTCI / $TMCI_0$
2	$P6_1$ / FTOA	32	$P6_1$ / FTOA
3	$P6_2$ / FTOB	33	$P6_2$ / FTIA
4	$P6_3$ / FTI	34	$P6_3$ / FTIB / $TMRI_0$
5	$P6_4$ / IRQ_0-	35	$P6_4$ / FTIC / TMO_0
6	$P6_5$ / IRQ_1-	36	$P6_5$ / FTID / $TMCI_1$
7	$P6_6$ / IRQ_2-	37	$P6_6$ / FTOB / $TMRI_1$

Table 1. H8/325-to-H8/329 pin-to-pin correspondence.

Function	H8/329 pin no.	H8/325 pin no.
$P4_0$ / ADTRG- / IRQ_2-	1	28
$P4_1$ / IRQ_1-	2	29
$P4_2$ / IRQ_0-	3	30
$P5_0$ / TxD	9	25
$P5_1$ / RxD	10	26
$P5_2$ / SCK	11	27
$P7_{0-7}/AN_{0-7}$	22 - 29	31, 32, 17 - 22
$P6_7$ / TMO_1	38	24

Table 2. H8/329 DIP socket to H8/325 recommended socket pin connections.

Four (4) pins on the H8/325 socket will always be left unconnected to the H8/329 DIP socket. In this case, they are pin 9 (XTAL), 10 (EXTAL), 33 and 34. Figure 1 on the next page shows the Expansion Bus I/O Header (J1 and J2) new pin assignments, and effectively replaces the figure on page 20 in the H8/325 Evaluation Board User's Guide.

Additional precautionary actions must be taken if the H8/325 HMS monitor program (which is contained in the board's external ROM between H'0000 - H'7FDF), is to be used with the H8/329. The HMS allocates ROM memory area between H'00 - H'BF to the interrupt vector table and JMP/JSR vector addresses. Every time an interrupt will occur during the execution of the user's program, the HMS monitor program notifies the user which interrupt has occured by accessing the corresponding vector location in the interrupt vector table. Since this table correponds to the H8/325 interrupt vector locations, and since these locations, for the most part, correspond to different interrupts in the H8/329 address space map, the HMS monitor will indicate that a wrong interrupt has occurred. In addition, since the monitor maps the JMP/JSR vector addresses starting at location H'0040, the A/D conversion end (ADI) interrupt located at H'0046 will not even be recognized. Only the first 4 interrupts (NMI and IRQ0 - 2) share the same vector locations for both chips. To avoid this, the user should relocate the interrupt vector table in the external RAM space (between H'8000 - H'F97F) by executing the **"V"**

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command as indicated in the H8/325 HMS User's Manual **before running his program.** As a result, interrupts will continue execution as programmed by the user.

As for H8/325 operation, the 5 on-board LEDs (DS7 - 3) should light in quick succesion upon applying power to the evaluation board indicating that the HMS power-on self test routines (that check the HMS monitor EPROM and test the external and internal RAM) have passed the tests successfully.

Finally, it should be noted that the PROM version of the H8/329 cannot be programmed by using the H8/325 programming adapter included with the evaluation board since the connections between the HN27C256 and the microcontroller socket do not entirely correspond to the pins used by the H8/329 during the programming process. Therefore, the user will need to obtain the recommended DIP socket adapter HS328ESS02H for the H8/329.
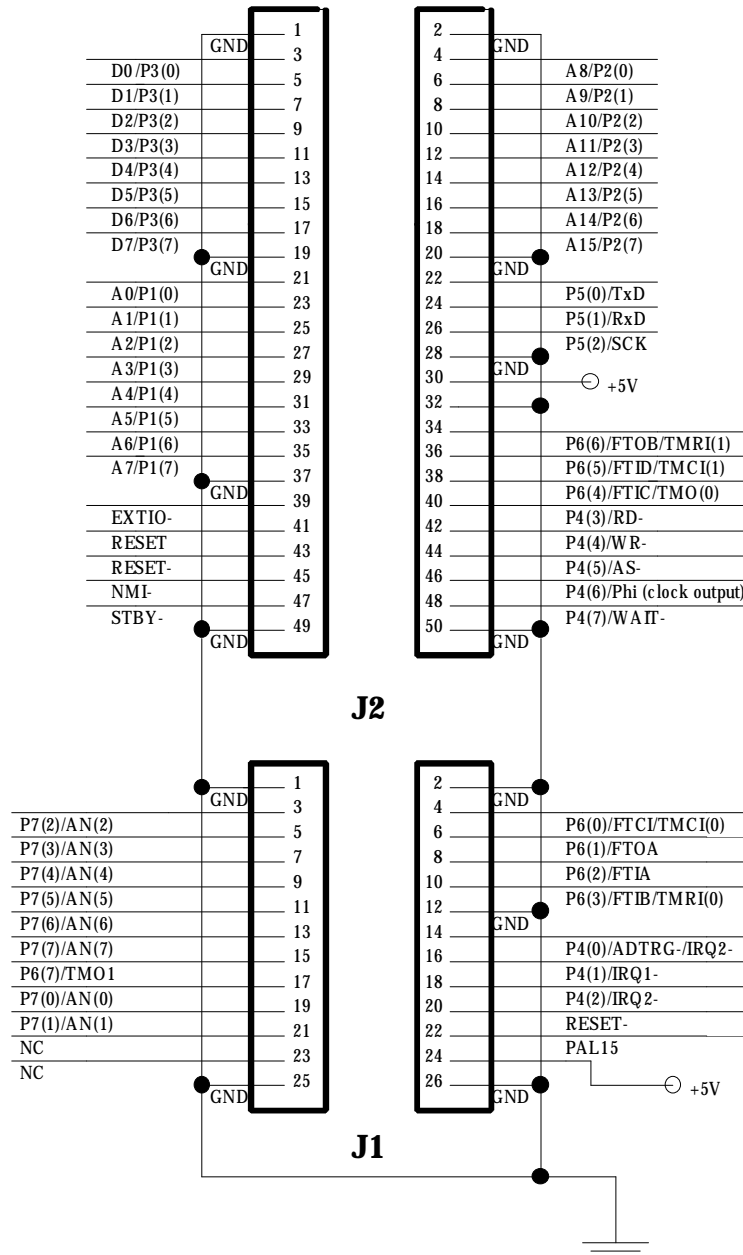

Figure 1. Expansion Bus I/O Headers new pin assignments.

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