EduCALC TECHNICAL NOTES

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COMBINING HP-41 MODULES TO SAVE PORTS

Which Combinations Are Best?

The four ports of the HP-41 are used for three different purposes. Modules are available for adding RAM memory, ROM memory, and interfacing HP-IL, printers, etc.[1] The HP-41 (custom) microprocessor has two memory addressing modes. One is for RAM, the other is for ROM. The maximum possible RAM address is 1024 registers or 7168 words (bytes) of mainframe memory—includes extended memory. The ROM addressing range is much larger at 16 pages of 4096 words each for a total of 65,536 words. Half of this is reserved for mainframe use and the other half is for port use. Port ROM (module) addressing is 32K (32,768) words or 4.6 times the RAM space. RAM addressing cannot be easily expanded by the user so all plug-in memory expansion efforts utilize the ROM addressing space.

When modules are combined it is important to know what is being connected to the port. Combined modules that use the same port addressing range will conflict. Some modules are hard addressed to pages below the ports. Combining these modules—the printer, timer and HP-IL modules—with regular applications modules is OK; there is no conflict. Combining two 4K applications modules will result in a conflict unless one of the modules is a ZENROM or an Auto Start/Duplication ROM. RAM modules such as the Quad module or extended memory modules can be combined with ROM modules without conflict.

Below is a list of practical combinations sold as pre-wired products from EduCALC. The number in parenthesis is the EduCALC stock number.

	Module	Restrictions
1.	HP-IL module plus Extended I/O module (41-614)	none
2.	Timer plus HP's Navigaton Pac (41-689)	HP-41CV only
3.	Math/Stat plus two Extended Memory modules (41-627)	none
4.	Double Extended Memory (41-600)	none
5.	Double Extended Memory plus Extended Functions module (41-601)	HP-41/CV only

In general, RAM may be combined with ROMs without conflict. In addition to addressing conflicts there are physical size limitations. An EPROM may fit, but it would be impossible to reprogram so EPROMs are not recommended to be used in combined modules. Some combinations are not recommended—an Extended Memory Module combined with a ROM, for example. This combination is not recommended because of the high future probability of wanting to combine extended memory modules with the extended functions module. It makes good sense to combine two memory modules if a triple is not desired.

[1] See TN #19 for a glossary of HP-41 terms.

Popular combinations are: HP-IL module with the plotter, HP-IL development, or Extended I/O modules; Advantage module with one or two extended memory modules; Timer, Quad, and extended functions module. The table below may be used to combine modules. One module from 'A' may be combined with one or two modules from 'B' with the exception of combining Auto Start/Duplication and ZENROM.

Table 1: Modules grouped to avoid conflict

A			
Extended Functions	4K		
Standard Applications	4K	Financial Decisions	4K
Home Management	4K	Real Estate	4K
Games	4K	HP-IL Development	4K
Advantage	12K	Extended I/O	4K
Clinical Lab & N. M.	4K	CCD Module	8K
Math/Statistics	4K		
Structural Analysis	4K		
Stress Analysis	4K	B	
Petroleum Fluids	8K	Quad Memory	
Circuit Analysis	4K	Extended Memory	
Thermal & Transport Science	4K	HP-IL Module*	
Navigation	8K	Time*	
Surveying	4K	Printex*	
Aviation	4K	Auto Start Duplication	
Securities	4K	ZENROM	
Aviation	4K		

*Hard Addressed ROMs that won't conflict with a 4K port addressed ROM.

Most third-party 'ROMs' are actually EPROMs which are physically larger. Contact EduCALC for details of specific combinations involving third-party 'ROMs'.

Conclusion: Combining modules to more effectively use HP-41 ports is a practical and cost effective solution to getting full use of the HP-41. Combining modules is preferred to hard wiring modules in the machine. The address used by each module being combined—3 in one package maximum—must be known to avoid conflicts. The example above cover the most popular combinations. The new IR module is not practical to combine with another module.