

41CL Memory Reference

12/02/17

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0x105	ADVMTRX3		24	Advanced Matrix ROM, pg 2, bnk 2	0x379659C1
0x106	NUMTHRY	NTHY	16	Number Theory ROM	0x1A82B478
0x107	DIGITPAC	DIGT	24	DigitPAC ROM	0xE8AD50A6
0x108	ILDEV2L	DEV2	22	IL Development II ROM, pg 1	0x1F8D9268
0x109	ILDEV2U		24	IL Development II ROM, pg 2	0x3A0ACD5E
0x10A	MONOPLY1	MONO	16	MONOPOLY ROM, pg 1	0x5F4A9C7D
0x10B	MONOPLY2			MONOPOLY ROM, pg 2	0xB3FBC23A
0x10C	RAMBOX32	RM32	31	RAMBox32 ROM	0xB87F92B8
0x10D	RAMPAGE	RMPG	15	RAMpage ROM	0x74520970
0x10E	SUDOKU	SUD1	16	SUDOKU ROM	0x2D95C87A
0x10F	VECTORS	VECT	14	Vector Analysis ROM	0x92859384
0x110	HDISASM	HDIS	9	HEPAX Disassembler	0x76DAFD70
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0x11D	PRTSRVC	PSRV	N/A	Printer Service ROM	0x3C5DEAF9
0x11E	441ZL	441Z	1	Library-4 HP41Z ROM, pg 1	0x8243464F
0x11F	441ZU		4	Library-4 HP41Z ROM, pg 2	0x326EE777
0x120	LIBRARY4	4LIB	N/A	Library-4	0xBF465233
0x121	RAMPGX4	4RAM	17	Library-4 RAMpage X ROM	0xA181AD52
0x122	TBOX4L4	4TBX	13	Library-4 Toolbox ROM	0x9F0989EC
0x123	ALPHA44	4ALP	6	Library-4 Alpha ROM	0x09E5FFC1
0x124	HP67_FUN	H67G	23	HP-67 Games ROM	0x830772EB
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0x12D	41ZDIAG	4DIG	8	Library-4 41Z Diagnostic ROM	0x75620288
0x12E	PPCSTATS	PPC9	9	PPC Statistics ROM	0x58799CB2
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0x165	AP550-2	TGT2	10	AP550 A2 Targeting ROM	0x28A0B775	
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0x202	ALL_FF			empty	0x53D36BD2
0x203	ALL_FF			empty	0x53D36BD2
0x204	ALL_FF			empty	0x53D36BD2
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0x207	ALL_FF			empty	0x53D36BD2
0x208	LADYBUG1	LADY	16	Ladybug ROM, pg 1	0x1C519857
0x209	LADYBUG2			Ladybug ROM, pg 2	0xD3A90581
0x20A	OS4	LDY4	N/A	Ladybug Page 4 ROM	0x96BEF43C
0x20B	ALL_FF			empty	0x53D36BD2

0x20C	IMSSYS4L	IMS4	31	IMS System-4 ROM, pg 1	0x6B2D0D27
0x20D	IMSSYS4U		21	IMS System-4 ROM, pg 2	0x784349D2
0x20E	WPNEFF_L	WPNE	21	Weapon Effects ROM, pg 1	0xE4C89BC9
0x20F	WPNEFF_U		31	Weapon Effects ROM, pg 2	0xAA5B6B68
0x210	ASTRO10A	1AST	23	Astro-10000 ROM, pg 1	0xDB62655E
0x211	ASTRO10B		24	Astro-10000 ROM, pg 2	0x2554F0FB
0x212	DERIVEZ1	ZDRV	21	Z-Derive ROM, pg 1	0x4DCBD05A
0x213	DERIVEZ2		22	Z-Derive ROM, pg 2	0x866E53AB
0x214	PARDIFEQ	BPDE	19	Partial Differential Equations ROM	0xFE4B118D
0x215	ELLIPSOI	BELP	21	Ellipsoids ROM	0xD86B4618
0x216	INTGDIF1	BIDQ	21	Integration/Differentiation ROM, pg 1	0x49EE6656
0x217	INTGDIF2		22	Integration/Differentiation ROM, pg 2	0xF4C37E75
0x218	DRVITG1	BDRV	31	Derivatives and Integrals ROM, pg 1	0x66FF5FC2
0x219	DRVITG2			Derivatives and Integrals ROM, pg 2	0xBA433F26
0x21A	ALL_FF			empty	0x53D36BD2
0x21B	ALL_FF			empty	0x53D36BD2
0x21C	EPH2018A	P18E	23	Planetary Ephemerides 2018, pg 1	0xAA054808
0x21D	EPH2018B		24	Planetary Ephemerides 2018, pg 2	0xAA4816ED
0x21E	ALL_FF			empty	0x53D36BD2
0x21F	ALL_FF			empty	0x53D36BD2
0x220	RHODESII	RDII	31	RhodeSystem II ROM	0xA9C03C67
0x221	MORTAR	MRTR	31	MORTAR ROM	0xCBFBFA57
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0x223	ALL_FF			empty	0x53D36BD2
0x224	ALL_FF			empty	0x53D36BD2
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0x374	ALL_FF			empty	0x53D36BD2	
0x375	ALL_FF			empty	0x53D36BD2	
0x376	ALL_FF			empty	0x53D36BD2	
0x377	ALL_FF			empty	0x53D36BD2	
0x378	ALL_FF			empty	0x53D36BD2	
0x379	ALL_FF			empty	0x53D36BD2	
0x37A	ALL_FF			empty	0x53D36BD2	
0x37B	ALL_FF			empty	0x53D36BD2	
0x37C	ALL_FF			empty	0x53D36BD2	
0x37D	ALL_FF			empty	0x53D36BD2	
0x37E	ALL_FF			empty	0x53D36BD2	
0x37F	ALL_FF			empty	0x53D36BD2	
0x380	ALL_FF			empty	0x53D36BD2	
0x381	ALL_FF			empty	0x53D36BD2	
0x382	ALL_FF			empty	0x53D36BD2	
0x383	ALL_FF			empty	0x53D36BD2	
0x384	ALL_FF			empty	0x53D36BD2	
0x385	ALL_FF			empty	0x53D36BD2	
0x386	ALL_FF			empty	0x53D36BD2	
0x387	ALL_FF			empty	0x53D36BD2	
0x388	ALL_FF			empty	0x53D36BD2	
0x389	ALL_FF			empty	0x53D36BD2	
0x38A	ALL_FF			empty	0x53D36BD2	
0x38B	ALL_FF			empty	0x53D36BD2	
0x38C	ALL_FF			empty	0x53D36BD2	
0x38D	ALL_FF			empty	0x53D36BD2	
0x38E	ALL_FF			empty	0x53D36BD2	
0x38F	ALL_FF			empty	0x53D36BD2	
0x390	ALL_FF			empty	0x53D36BD2	
0x391	ALL_FF			empty	0x53D36BD2	
0x392	ALL_FF			empty	0x53D36BD2	
0x393	ALL_FF			empty	0x53D36BD2	
0x394	ALL_FF			empty	0x53D36BD2	
0x395	ALL_FF			empty	0x53D36BD2	
0x396	ALL_FF			empty	0x53D36BD2	
0x397	ALL_FF			empty	0x53D36BD2	
0x398	ALL_FF			empty	0x53D36BD2	
0x399	ALL_FF			empty	0x53D36BD2	
0x39A	ALL_FF			empty	0x53D36BD2	
0x39B	ALL_FF			empty	0x53D36BD2	
0x39C	ALL_FF			empty	0x53D36BD2	
0x39D	ALL_FF			empty	0x53D36BD2	
0x39E	ALL_FF			empty	0x53D36BD2	
0x39F	ALL_FF			empty	0x53D36BD2	
0x3A0	ALL_FF			empty	0x53D36BD2	

0x3A1	ALL_FF			empty	0x53D36BD2	
0x3A2	ALL_FF			empty	0x53D36BD2	
0x3A3	ALL_FF			empty	0x53D36BD2	
0x3A4	ALL_FF			empty	0x53D36BD2	
0x3A5	ALL_FF			empty	0x53D36BD2	
0x3A6	ALL_FF			empty	0x53D36BD2	
0x3A7	ALL_FF			empty	0x53D36BD2	
0x3A8	ALL_FF			empty	0x53D36BD2	
0x3A9	ALL_FF			empty	0x53D36BD2	
0x3AA	ALL_FF			empty	0x53D36BD2	
0x3AB	ALL_FF			empty	0x53D36BD2	
0x3AC	ALL_FF			empty	0x53D36BD2	
0x3AD	ALL_FF			empty	0x53D36BD2	
0x3AE	ALL_FF			empty	0x53D36BD2	
0x3AF	ALL_FF			empty	0x53D36BD2	
0x3B0	ALL_FF			empty	0x53D36BD2	
0x3B1	ALL_FF			empty	0x53D36BD2	
0x3B2	ALL_FF			empty	0x53D36BD2	
0x3B3	ALL_FF			empty	0x53D36BD2	
0x3B4	ALL_FF			empty	0x53D36BD2	
0x3B5	ALL_FF			empty	0x53D36BD2	
0x3B6	ALL_FF			empty	0x53D36BD2	
0x3B7	ALL_FF			empty	0x53D36BD2	
0x3B8	ALL_FF			empty	0x53D36BD2	
0x3B9	ALL_FF			empty	0x53D36BD2	
0x3BA	ALL_FF			empty	0x53D36BD2	
0x3BB	ALL_FF			empty	0x53D36BD2	
0x3BC	ALL_FF			empty	0x53D36BD2	
0x3BD	ALL_FF			empty	0x53D36BD2	
0x3BE	ALL_FF			empty	0x53D36BD2	
0x3BF	ALL_FF			empty	0x53D36BD2	
0x3C0	ALL_FF			empty	0x53D36BD2	
0x3C1	ALL_FF			empty	0x53D36BD2	
0x3C2	ALL_FF			empty	0x53D36BD2	
0x3C3	ALL_FF			empty	0x53D36BD2	
0x3C4	ALL_FF			empty	0x53D36BD2	
0x3C5	ALL_FF			empty	0x53D36BD2	
0x3C6	ALL_FF			empty	0x53D36BD2	
0x3C7	ALL_FF			empty	0x53D36BD2	
0x3C8	ALL_FF			empty	0x53D36BD2	
0x3C9	ALL_FF			empty	0x53D36BD2	
0x3CA	ALL_FF			empty	0x53D36BD2	
0x3CB	ALL_FF			empty	0x53D36BD2	
0x3CC	ALL_FF			empty	0x53D36BD2	
0x3CD	ALL_FF			empty	0x53D36BD2	

0x3CE	ALL_FF			empty	0x53D36BD2	
0x3CF	ALL_FF			empty	0x53D36BD2	
0x3D0	ALL_FF			empty	0x53D36BD2	
0x3D1	ALL_FF			empty	0x53D36BD2	
0x3D2	ALL_FF			empty	0x53D36BD2	
0x3D3	ALL_FF			empty	0x53D36BD2	
0x3D4	ALL_FF			empty	0x53D36BD2	
0x3D5	ALL_FF			empty	0x53D36BD2	
0x3D6	ALL_FF			empty	0x53D36BD2	
0x3D7	ALL_FF			empty	0x53D36BD2	
0x3D8	ALL_FF			empty	0x53D36BD2	
0x3D9	ALL_FF			empty	0x53D36BD2	
0x3DA	ALL_FF			empty	0x53D36BD2	
0x3DB	ALL_FF			empty	0x53D36BD2	
0x3DC	ALL_FF			empty	0x53D36BD2	
0x3DD	ALL_FF			empty	0x53D36BD2	
0x3DE	ALL_FF			empty	0x53D36BD2	
0x3DF	ALL_FF			empty	0x53D36BD2	
0x3E0	ALL_FF			empty	0x53D36BD2	
0x3E1	ALL_FF			empty	0x53D36BD2	
0x3E2	ALL_FF			empty	0x53D36BD2	
0x3E3	ALL_FF			empty	0x53D36BD2	
0x3E4	ALL_FF			empty	0x53D36BD2	
0x3E5	ALL_FF			empty	0x53D36BD2	
0x3E6	ALL_FF			empty	0x53D36BD2	
0x3E7	ALL_FF			empty	0x53D36BD2	
0x3E8	ALL_FF			empty	0x53D36BD2	
0x3E9	ALL_FF			empty	0x53D36BD2	
0x3EA	ALL_FF			empty	0x53D36BD2	
0x3EB	ALL_FF			empty	0x53D36BD2	
0x3EC	ALL_FF			empty	0x53D36BD2	
0x3ED	ALL_FF			empty	0x53D36BD2	
0x3EE	ALL_FF			empty	0x53D36BD2	
0x3EF	ALL_FF			empty	0x53D36BD2	
0x3F0	ALL_FF			empty	0x53D36BD2	
0x3F1	ALL_FF			empty	0x53D36BD2	
0x3F2	ALL_FF			empty	0x53D36BD2	
0x3F3	ALL_FF			empty	0x53D36BD2	
0x3F4	ALL_FF			empty	0x53D36BD2	
0x3F5	ALL_FF			empty	0x53D36BD2	
0x3F6	ALL_FF			empty	0x53D36BD2	
0x3F7	ALL_FF			empty	0x53D36BD2	
0x3F8	ALL_FF			empty	0x53D36BD2	
0x3F9	ALL_FF			empty	0x53D36BD2	
0x3FA	ALL_FF			empty	0x53D36BD2	

0x3FB	ALL_FF			empty	0x53D36BD2	
0x3FC	ALL_FF			empty	0x53D36BD2	
0x3FD	ALL_FF			empty	0x53D36BD2	
0x3FE	ALL_FF			empty	0x53D36BD2	
0x3FF	ALL_FF			empty	0x53D36BD2	
0x800				41C Registers 0-3FF		
0x801				Registers 400-FFF (not utilized by the OS)		
0x802						
0x803						
0x804				41CL MMU registers		
0x805		YBFR		Memory Buffer		
0x806		CFDB		Memory Buffer or CFLDB location		
0x807						
0x808						
0x809						
0x80A						
0x80B						
0x80C						
0x80D						
0x80E						
0x80F						
0x810				Page 0 of Sector Buffer		
0x811				Page 1 of Sector Buffer		
0x812				Page 2 of Sector Buffer		
0x813				Page 3 of Sector Buffer		
0x814				Page 4 of Sector Buffer		
0x815				Page 5 of Sector Buffer		
0x816				Page 6 of Sector Buffer		
0x817				Page 7 of Sector Buffer		
0x818						
0x819						
0x81A						
0x81B						
0x81C						
0x81D						
0x81E						
0x81F						
0x820						
0x821						
0x822						
0x823						
0x824						
0x825						
0x826						
0x827						

0x828						
0x829						
0x82A						
0x82B						
0x82C						
0x82D						
0x82E						
0x82F						
0x830						
0x831						
0x832						
0x833						
0x834						
0x835						
0x836						
0x837						
0x838						
0x839						
0x83A						
0x83B						
0x83C						
0x83D						
0x83E						
0x83F						
0x840						
0x841						
0x842						
0x843						
0x844						
0x845						
0x846						
0x847						
0x848						
0x849						
0x84A						
0x84B						
0x84C						
0x84D						
0x84E						
0x84F						
0x850						
0x851						
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0x855						
0x856						
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0x860						
0x861						
0x862						
0x863						
0x864						
0x865						
0x866						
0x867						
0x868						
0x869						
0x86A						
0x86B						
0x86C						
0x86D						
0x86E						
0x86F						
0x870						
0x871						
0x872						
0x873						
0x874						
0x875						
0x876						
0x877						
0x878						
0x879						
0x87A						
0x87B						
0x87C						
0x87D						
0x87E						
0x87F						

NOTES:

1. Flash memory starts at page 0x000, and RAM memory starts at page 0x800.
2. This memory map (for Flash memory only) does not apply to V2 41CL boards. Although much of the mapping is identical, there is a separate Memory Reference for V2 41CL boards.
3. **V3 and V4 41CL boards contain Flash memory with addresses 0x000000 through 0x1FFFFFF. Only V5 41CL boards contain Flash memory with addresses 0x200000 through 0x3FFFFFF.**
4. A blank page in Flash memory is different from an empty page in Flash memory. A blank page contains 0x0000 in every location, and can be safely plugged into a Port. An empty (erased or unprogrammed) page contains 0xFFFF in every location, which will lock up the 41CL when plugged into a Port. A blank page has a YCRC value of 0xD666D0E4, while an empty page has a YCRC value of 0x53D36BD2.
5. Flash memory is always erased by sectors. Normally a sector consists of eight pages, and sector boundaries are highlighted in the table. Either the the top sector or the bottom sector is unique, and is erased by subsector. Refer to the *41CL Update Functions* documentation for the details.

RAM Memory Details

Physical Address	Contents	Used for
0x800000 - 0x800003	Register 000	T register
0x800004 - 0x800007	Register 001	Z register
0x800008 - 0x80000B	Register 002	Y register
0x80000C - 0x80000F	Register 003	X register
0x800010 - 0x800013	Register 004	L register
0x800014 - 0x800017	Register 005	ALPHA register 1-7
0x800018 - 0x80001B	Register 006	ALPHA register 8-14
0x80001C - 0x80001F	Register 007	ALPHA register 15-21
0x800020 - 0x800023	Register 008	ALPHA register 22-28
0x800024 - 0x800027	Register 009	temp ALPHA scratch
0x800028 - 0x80002B	Register 00A	OS functions
0x80002C - 0x80002F	Register 00B	
0x800030 - 0x800033	Register 00C	
0x800034 - 0x800037	Register 00D	
0x800038 - 0x80003B	Register 00E	FLAG register
0x80003C - 0x80003F	Register 00F	OS functions
0x800040 - 0x8000FF	Registers 10 - 3F	not visible to OS
0x800100 - 0x800103	Register 040	X-Memory
0x800104 - 0x800107	Register 041	
.	.	
.	.	
0x8002F8 - 0x8002FB	Register 0BE	
0x8002FC - 0x8002FF	Register 0BF	
0x800300 - 0x800303	Register 0C0	
0x800304 - 0x800307	Register 0C1	
.	.	
.	.	
0x8007F8 - 0x8007FB	Register 1FE	Key Assign Buffer, Alarm Buffer, I/O Buffers, Program memory Data
0x8007FC - 0x8007FF	Register 1FF	
0x800800 - 0x800803	Register 200	
0x800804 - 0x800807	Register 201	
0x800808 - 0x80080B	Register 202	X-Memory
.	.	
.	.	
0x800BB8 - 0x800BBB	Register 2EE	
0x800BBC - 0x800BBF	Register 2EF	

0x800BC0 - 0x800C03	Registers 2F0 - 300		not visible to OS
0x800C04 - 0x800C07	Register 301		X-Memory
0x800C08 - 0x800C0B	Register 302		
.	.		
0x800FB8 - 0x800FBB	Register 3EE		
0x800FBC - 0x800FBF	Register 3EF		
0x800FC0 - 0x800FFF	Registers 3F0 - 3FF		not visible to OS
0x801000 - 0x801FFF	Registers 400 - 7FF		Expanded Memory 1
0x802000 - 0x802FFF	Registers 800 - BFF		Expanded Memory 2
0x803000 - 0x803FFF	Registers C00 - FFF		Expanded Memory 3
0x804000	41C Register Address		REGADD
0x804001 - 0x80400B	reserved		
0x80400C	Page 0 MMU registers (only one bank)	set 0	Page 0 MMU data
0x80400D		set 1	
0x80400E		set 2	
0x80400F		set 3	
0x804010 - 0x804017	41CL Extra/Extreme functions internal use		
0x804018	Turbo Mode storage location		Light Sleep
0x804019	41CL Extra/Extreme functions internal use		
0x80401A	CPU ST[14:8] storage location		Light Sleep
0x80401B	reserved		
0x80401C	Page 1 MMU register (only one bank)	set 0	Page 1 MMU data
0x80401D		set 1	
0x80401E		set 2	
0x80401F		set 3	
0x804020 - 0x80402B	41CL Memory Functions internal use		
0x80402C	Page 2 MMU register (only one bank)	set 0	Page 2 MMU data
0x80402D		set 1	
0x80402E		set 2	
0x80402F		set 3	
0x804030	Page 4 MMU register dynamic storage		
0x804031 - 0x80403B	41CL Update Functions internal use		
0x80403C	Page 3 MMU register (only one bank)	set 0	Page 3 MMU data
0x80403D		set 1	
0x80403E		set 2	
0x80403F		set 3	

0x804040	Page 4, Bank 1 MMU registers	set 0	Page 4 MMU data
0x804041		set 1	
0x804042		set 2	
0x804043		set 3	
0x804044	Page 4, Bank 3 MMU registers	set 0	
0x804046		set 1	
0x804046		set 2	
0x804047		set 3	
0x804048	Page 4, Bank 2 MMU registers	set 0	
0x804049		set 1	
0x80404A		set 2	
0x80404B		set 3	
0x80404C	Page 4, Bank 4 MMU registers	set 0	
0x80404D		set 1	
0x80404E		set 2	
0x80404F		set 3	
0x804050 - 0x804053	Page 5, Bank 1 MMU registers	sets 0-3	Page 5 MMU data
0x804054 - 0x804057	Page 5, Bank 3 MMU registers	sets 0-3	
0x804058 - 0x80405B	Page 5, Bank 2 MMU registers	sets 0-3	
0x80405C - 0x80405F	Page 5, Bank 4 MMU registers	sets 0-3	
0x804060 - 0x804063	Page 6, Bank 1 MMU registers	sets 0-3	Page 6 MMU data
0x804064 - 0x804067	Page 6, Bank 3 MMU registers	sets 0-3	
0x804068 - 0x80406B	Page 6, Bank 2 MMU registers	sets 0-3	
0x80406C - 0x80406F	Page 6, Bank 4 MMU registers	sets 0-3	
.	.		.
0x8040E0 - 0x8040E3	Page E, Bank 1 MMU registers	sets 0-3	Page E MMU data
0x8040E4 - 0x8040E7	Page E, Bank 3 MMU registers	sets 0-3	
0x8040E8 - 0x8040EB	Page E, Bank 2 MMU registers	sets 0-3	
0x8040EC - 0x8040EF	Page E, Bank 4 MMU registers	sets 0-3	
0x8040F0 - 0x8040F3	Page F, Bank 1 MMU registers	sets 0-3	Page F MMU data
0x8040F4 - 0x8040F7	Page F, Bank 3 MMU registers	sets 0-3	
0x8040F8 - 0x8040FB	Page F, Bank 2 MMU registers	sets 0-3	
0x8040FC - 0x8040FF	Page F, Bank 4 MMU registers	sets 0-3	
0x804100 - 0x804FFF	41CL functions internal use		
0x805000 - 0x805FFF	Memory Buffer (1 4Kx16 page)		
0x806000 - 0x806FFF	CFLDB location		
0x807000 - 0x80FFFF	User RAM (9 4Kx16 pages)		
0x810000 - 0x817FFF	Sector Buffer (8 4Kx16 pages)		
0x818000 - 0x87FFFF	User RAM (104 4Kx16 pages)		

NOTES:

1. Each seven-byte 41C register is stored in four successive memory locations:

bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
addr lsb																
00	Byte 1								Byte 0							
01	Byte 3								Byte 2							
10	Byte 5								Byte 4							
11	unused								Byte 6							

2. Each MMU entry is stored in a single memory location:

bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	EN	LCK	MULTI	A23	A22	A21	A20	A19	A18	A17	A16	A15	A14	A13	A12	

Bit 15 is the Enable (EN) bit. If this bit is zero, the MMU entry is ignored and the corresponding page and bank will be fetched from a Port.

Bit 14 is the Lock (LCK) bit, used only with the 41CL Extreme Functions. If this bit is set to one the entry cannot be changed, except with either the **UNLOCK** function or the **MMUCLR** function.

Bits 13 and 12 are the Multi-page Image (MULTI) bits, used only with the *41CL Extreme Functions*. These bits are managed automatically by the **PLUG** and **PPLUG** functions, with the following meanings:

13	12	MULTI
0	0	Not part of a multi-page image
0	1	First page of a multi-page image
1	1	Middle page of a multi-page image
1	0	Last page of a multi-page image

Bits 11-0 hold the twelve address bits to be substituted for the Page address (bits 15-12) portion of the logical address, to create the physical address.

3. MMU register sets 1-3 are used only by the *41CL Extreme Functions*.

