M-40 Instruction Set

Ref : Compagnie des Machines Bull N°17.10.002

Registers visible from user program are:

- *A and B accumulators (24-bits)*
- *R0-R15 registers (3 of them being indexes and R8 being top of stack)*
- *RC comparison result indicator (2-bits)*
- *Overflow indicator*
- *IB boolean indicator (1-bit)*

45	LDA	Load A register from memory
55	LDB	Load B from memory
51	LDE	Load A-B from memory double word
22	STA	Store A into memory
23	STB	Store B into memory
21	STE	Store A-B into memory double word
0522	PRR	Load register from register
0527	PRA	Load A from register
0501	PAR	Store A into register
0506	ERA	Exchange A and register contents
0001	EPA	Load A (0-16) with constant
0000	EPB	Load B (0-16) with constant
0405	CAA	Load content of A –as an address- in A
0520	CRR	Load content of register –as an address- in register
0406	EBA	Exchange B and A contents
0525	EZR	Store zero in register
0256	TCW	Transfer n words from contents of A in contents of B –as addresses-
56	LAD	Load A(0-14) address from memory
57	SAD	Store A(0-14) in memory
47	CAD	Compare A(0-14) with memory
20	ENI	Load Index with address from memory
33	STI	Store index in memory
37	ADI	Add memory content to index
26	SBI	Subtract Index from memory content
34	DNI	Decrement index
35	DTI	Decrement index by two
30	INI	Increment index
31	ITI	Increment index by two
32	JINZ	Branch if index not zero
17	SINE	Skip if index not equal to memory content
76	INM	Increment memory
77	DEM	Decrement memry
0440	SES	Store accumulators into stack (R8 controlled)
0436	SRS	Store registers (R0-R15) into stack
0441	LES	Load accumulators from stack
0437	LRS	Load registers from stack
0442	TWS	Store words into stack
0445	TSW	Load words from stack

1601	LSRS	Branch and store return address in stack
0549	JADS	Branch on return address stored in stack
40	XAD	Fixed point add in A
42	XSB	Fixed point subtract in A
44	XIS	Fixed point inverse subtract A
60	XTM	Fixed point multiply with truncation
74	XMU	Fixed point multiply
54	XPM	Fixed point partial multiply A * M(9-22)
46	XDV	Fixed point divide (A-B / m) into A remainder in B
62	XCP	Fixed point comparison
0416	SSP	Absolute value of A
0413	CHS	Change sign of A
50	XDA	Fixed point double add
52	XDS	Fixed point double subtract
64	FAD	Floating point add
66	FAR	Floating point add rounded
65	FSB	Floating point subtract
67	FSR	Floating point subtract rounded
41	FMU	Floating point multiply
61	FMR	Floating point multiply rounded
43	FDR	Floating point divide rounded
42	NOR	Floating point normalise
0422	FSP	Floating point plus sign
0403	FCS	Floating point change sign
0100	JAZE	Branch if A zero
0101	JANZ	Branch if A non zero
0102	JANN	Branch if A non negative
0103	JANP	Branch if A non positive
0600	JAPO	Branch if A positive
0601	JANE	Branch if A negative
1102	JEZE	Branch if A-B zero
1103	JENZ	Branch if A-B non zero
1200	JENN	Branch if A-B non negative
1203	JENP	Branch if A-B non positive
0602	JCZE	Branch if RC (0-1) = 00
0603	JCNZ	Branch if RC (0) =1
0722	JCNN	Branch if RC(1) = 0
0703	JCNP	Branch if RC (0) = RC(1)
0700	JCPO	Branch if RC(0) = 1 and RC(1)= 0
0701	JCNE	Branch if RC(0-1) = 11
1000	JLZE	Branch if A(0-23)= 0
1402	JAZN	Branch if A(0-22)=0 and A(23)=1
1001	JLNZ	Branch if A(0-23) not zero
1002	JSNE	Branch if A(23)=1
1003	JBZE	Branch if IB= 0
1100	JBZN	Branch if IB=1
1101	JOVR	Branch if overflow (ID= 1)

1202 JUMP	Unconditional branch
1203 JSRA	Branch and store return address in memory
1403 JAMA	Branch on address indexed by A
75 EXEC	Execute instruction
0523 JARE	Branch on address in register
1603 NOP	No operation (void)
1300 LSA	Load character in A(0-5)
1301 SSA	Store character from A (0-5)
0231 TCL	Move character string from [A] into [B]
0221 TCR	reverse Move character string
0211 TBT	Translate character string by Table
0374 TSL	Move character string until symbol detection
0364 TSR	reverse Move character string until symbol detection
0334 LAL	Locate absence of symbol in character string from left
0324 LAR	Locate absence of symbol in character string from right
0314 LSL	Locate symbol in character string from left
0304 LSR	Locate symbol in character string from right
0354 SFS	Symbol fill in zone
0201 CMS	Compare character strings
0212 ADS	Add decimal strings
0232 SBS	Subtract decimal strings
0202 TCE	Move and Edit strings (for space and @)
71 ORA	logical “or” in A
72 ANA	logical “and” in A
73 EXA	logical “exclusive or” in A
0410 NGA	inverse logical value of A
0401 CBA	count bits equal to 1 in A
0400 FBA	find first bit equal to 1 in A
0257 OAB	logical “or” of A and IB
0287 AAB	logical “and” of A and IB
0277 EAB	logical “exclusive or” of A and IB
0247 PAB	Load bit of A in IB
0248 PBA	Store IB in bit of A
0411 SBO	Set IB to 1
0412 SBZ	Reset IB to 0
0210 ALS	Left shift of A
0200 ARS	Right shift of A
0230 XLS	Left shift A(0-22)
0220 XRS	Right Shift A(0-22)
0233 ALR	Left rotate A
0223 ARR	Right rotate A
0214 ELS	Left shift of A-B
0203 ERS	Right shift of A-B
0224 LXLS	Left shift of A-B (0-22)
0204 LXRS	Right shift of A-B (0-22)
0234 ELR	Left rotate A-B
0213 ERR	Right rotate A-B
0414 CGB	Gray to Binary convert in A

0415	COM	2's complement of A
1401	LWE	Locate word in string
1500	LEE	Locate double word in string
0205	SCB	Store word [B] in string
63	LCP	Compare word in memory with A

0422	PHA	Load H (program number) in A(0-3)
0404	PDGA	Load demands DG in A
0425	PIA	Load DP (interrupts) in A
0424	PMA	Load MP (interrupts mask) in A
	SPI	Set Program Interrupt
	TES	Check end of operation on simultaneous channel
0423	PPA	Read memory protection register in A
0435	RSC	Read consoles switches in A(0-5)
0432	SON	Set sound
0433	SOF	Reset Sound

(supervisor mode only)

0420	ZDG	Reset DG
0430	ZDP	Reset DP
1502	LDM	Store A into MP
1501	SCI	Scan interrupt
0426	RAI	Return after interrupt
0434	PAP	Load memory protection register
0422	ETM	End of Trace mode
0431	HLT	Halt
0446	CTI	Unlock typewriter keyboard
0447	TPI	Read character from typewriter in A(0-5)
0444	TPO	Write character to typewriter
0450	CTR	Unlock paper tape reader
0452	RTE	Read paper tape reader (even parity)
0453	RTO	Read paper tape reader (odd parity)
0451	RPT	Read paper tape reader (ignore parity)
0407	PCH	Punch character on tape punch
0250	CDC	Check channel availability
0240	RQI	Read channel status
0260	LCE	Locate channel interrupt
1602	ECI	Start channel operation