

Figure 1. Block diagram of the MPF-1B and its add-on options.

Developing the MPF-1B Microprofessor

The MPF-1B Microprofessor, reviewed in the October 1982 issue of ETI, has enjoyed a certain 'cult' popularity among students and 'hackers'. Here's how to exploit its possibilities a little further.

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THE MFF1-B is a 280-based educational development system which may be extended to control various devices or as a compact general purpose computer. It is supplied with 4K of EPROM in which resides the monitor and a tiny 2K BASIC interpreter. The standard RAM is 2K and there is a socket for an extra 2K-4K of RAM or EPROM.

A desirable accessory for the serious assembly language programmer is the thermal printer which contains 4K of character generation ROM and PRT monitor with space for another 4K of EPROM which may be used for general programs. (Similarly, the 4K of RAM on another accessory, the EPROM programmer, may be used for general purposes.)

The printer outputs 20 characters per line and includes memory dump, disassembler and BASIC listing facilities in its ROM. Particularly useful is the disassembler as it allows one to check an assembly language program for errors after entering it in machine code.

Documentation with the MPF1-B includes a User Manual, giving the fundamentals of the Microprofessor's operation, an annotated listing of the monitor program with its subroutines and an Experment Manual which explores most of the programming avenues available on the MPF-1B.

The processor board has a six-piece 7-segment display controlled by the monitor subroutines which are user-accessible. As program is entered, the location (two bytes) and its contents (one byte) are displayed.

As an exercise in extending the capabilities of the MPF-1B towards those of a full microcomputer, a program was developed to utilise alphanumerics via the on-board key array, of which 32 are usable for such a purpose.

The two alternatives were therefore to utilise the keyboard in a QWERTY style array by means of a shift key or to delete some little-used or synomorphic characters from the 32 keys.

Initially, the second alternative was undertaken with the marked keys 0-9 and A-F taking their marked values and another 16 taking other alphabetic characters; the use of Z,K, V and O were replaced by 2,HU and O respectively. Q was temporarily deleted. As each character is entered, it is displayed on the LED array and the ASCII equivalent is deposited in a buffer.

When a line is complete it is printed out from the buffer by the thermal printer.

GHIJCDEF					
LMNP89AB					
RSTU4567					
WXY 0123					
32-CHARACTER SET					

Because the MPF·1B is programmable in machine language utilising the very powerful Z80 block instructions, with memory directly accessible, this program can be the beginnings of a primitive but very useful text editor. Note that a 7-segment display is limited in the variety of characters that it will create so artistic license is occasionally necessary.

The program may be adapted for use with 40 or 80 column printers. The files created may be written onto cassette tape using the MPF-1B's own inbuilt system, for later correction and manipulation, such as file-searching using the Z80 block instructions.

For example, one may set up a names and addresses file, entered from time to time in chronological order, and using Z80 sort programs from Rodeny Zaks' "Programming the Z80" or one of the other sources, it is possible to put the list into alphabetical order, use it to print address labels or search out particular material.



QWERTYIP ASDFGHJK ZXCVBNML		("")&<>= #\$:}*/+- 12345678		
۰.	ο.	19 0?		
56-CHARACTER SET				

Specifically, this could be used to list journal references and provide key-word searches for particular topics.

Overall therefore, there is a host of programming exercises with practical spinoff at a price that won't put you in hock for the next ten years.

The simplified version of the alphanumeric program provides the benefit of simplicity of use at the expenses of a limited ASCII character set. This program and the one using SHIFT may be entered along with other utility programs onto EPROM where it would be accessible by means of a simple CALL.

Similarly one could, with a rather a larger amount of work extend the range of the printer to such things as Japanese symbols by modifying the PRT monitor onto another EPROM utilising a homegrown character set.

One of the great attractions of the Microprofessor is the relatively easy access to its monitors, for reasons both pedagogical and practical.

PROGRAM DETAILS

Simple 32 character version.

After initialisation, which sets up buffers in the expansion RAM area, there is the setting up of a new line, setting up of a new word and it goes on to fetch the next character from the keyboard. The SCAN subroutine in the ROM monitor displays what is in the DISBUF and drops out of this subroutine when a key is pressed. A keycode is left in register A.

To use this on our 7-segment display and in ASCII for the printer, we have to convert it to the appropriate codes. This is done by means of look-up tables which, with register HL as a pointer, uses the keycode in A as an offset to find the location holding the appropriate code.

The 7-segment character is loaded into DISBUF and the ASCII into OUTBUF. The pointer IX is decremented ready for the next character and this also means that the display on each SCAN moves one place to the left so that the words, as they are entered, pass in from the right across the display.

Register HL is incremented for the next character also; the fact that IX and HL require opposite adjustments is due to the operation of the monitor.

A space denotes the end of a word and when this occurs the free spaces left in the 20-character line are displayed for about a second before we go back for the first character of the new word.

Carriage return is by end of line or SPACE + X. Carriage return and end-ofline insert 0D (stop print) until the line is printed and this is replaced by 0A (line feed) to separate lines. Any block of text for later printing needs to have 0D inserted for termination.

This simplified version is intended for

experimentation. One may easily change the characters produced by accessing the 7-segment (7seg) and ASCII tables. With the rather more difficult job of getting into the print monitor, one may even produce new characters.

ASCON2: 56 characters with SHIFT, CR, BACKSPACE.

With this more complex program it was desired to be able to produce the (almost) full Microprofessor character set in order to create simple files, drive phoneme generators and all the other inconsequential things a computer buff desires to do without straining the pocket too much.

There is a shift key which, when pressed, exchanges the 2-character tables with two others in the pointer instructions to obtain the shifted characters.

There is a carriage return key and a backspace which allows one to make corrections. This program does not display free spaces left in the line; it is left as an exercise for the enthusiastic programmer to transfer this facility from the 32 into the 56.



Figure 2. Flow charts for the two character set programs.

Neither program is perfect; the 32 will miscount free spaces and not to return automatically if one uses the SPACE key at the end of the line. However, if all the bugs were picked off its backside and all the possible extensions incorporated this article would never see the light from the topside of a round filing cabinet!

There are certain intrinsic strengths, such as easy access to the buffer itself to play with the characters or their formatiing. The programs can be put on EPROM using the Microprofessor programmer and placed in the printer extension socket. In this case, any internal calls need to be to the appropriate 7000 location.

As previously mentioned, the program can be easily modified to accommodate 40 or 80 character lines and thus interface to larger printers. To print out the full text one can use the routine from the PRT-MPF manual:

DD CD 76	21 AC	01 65	20	LD IX, 2001 CALL MTPPRT HALT.
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For the printer to terminate, OUTBUF needs to hold 0D as its final code; this is most easily inserted by directly accessing the buffer to replace the 0A left by ASCON with 0D; the pointer to the last line is in IFFF/2000.

Useful references.

 A. R. Miller. 8080/Z80 Assembly Language, Techniques for improved programming. Wiley (About \$17.55).

 Rodney Zaks. Programming the Z80. Sybex. (Under \$16 at Tandy and D.S.E.; others \$26). William Barden Jr. TRS80 Assembly Language Programming. Tandy (\$5).
 William Barden Jr. The Z80 Microcom-

 William Barden Jr. The Z80 Microcomputer Handbook. Sams (\$11-\$15).

Joseph Carr. The Z80 User's Manual. Prentice-Hall (ETI Book Sales, \$25).
M. Sargent and R. L. Shoemaker.

 M. Sargent and R. L. Shoemaker. Interfacing Microcomputers to the Real World. Addison-Wesley. (About \$15).
 Howard Boyet. 8080 Microcomputer Ex-

periments. \$14+ • William Barden Jr. More TRS-80 As-

sembly Language Programming. Tandy \$7. (The 8080 Bugbook is also useful.)

The Microprofessor MPF-1B is available from Emona Computers, George St., Haymarket, Sydney and David Reid, York St., Sydney. Price of the basic machine is about \$138 and the printer, about \$105, (+ sales tar)

inger princis.	041013 0207.	Suice tux).	·	
ACCONT		1849 CD CALL 1880	188B 00	NOP
ASCONT	GHIJCDEF	184C 00 NEP	188C 00	NEP
	LMNP89AB	184D 79 LD A,C	188D 00	NEP
Initialise by nominating DE as	RSTU4567	184E CD CALL 0678	188E 00	NOP
OUTBUF pointer and clearing	WXY 0123	1851 06 LD B.50	1995 00	NDP
OUTBUF. The lead address of the		1853 CD CALL 0624	1000 00	DEC TH
which impinges on the printer stack	1900 11 LD DE-0001	1050 0D CHEE 00E4	1990.00	DEC IX
Characters per line is loaded into C.	1000 11 CD DE,2001	1856 IU DJMZ 1853	1892 F5	PUSH AF
and 1X is nominated to point to	1003 62 CD H,D	1858 00 NDP	1893 CD	CALL 1900
DISBUF for 7 segment display. Fif-	1804 6B LD L,E	1859 F1 POP AF	1896 DD	LD
teen locations are cleared within	1805 06 LD B,FF	185A CD CALL 1890	1899 00	NOP
Go to SCAN monitor subroutine	1807 CD CALL 1880	185D 18 JR 1820	1896-00	NDP
for key-in and to display anything in	180A 00 NCP	185F .00 NOP	1898 E1	POP OF
DISBUF. The keycode transferred	180B 00 NDP	1860 00 NDP	ieec ch	COLL 1940
via register A is decoded into	1800 ED ! D (1888).D	E 1861 00 NDP	1005 10	UNLL 1940
regment and ASCII via look-up	1810 OF LD C-14	1962 25 10 0 00	1091 12	CD CDEFFA
and OUTBUF.	1919 DD LD IV 0750	1062 SE LD HIU	18AU 13	INC DE
End-of-line is checked by decre-	1012 DD LD 1X,27FU	1864 12 LD (DE),A	18A1 C9	RET
menting the counter with each	1816 UU NUP	1865 DD LDIX, (1FFF)	1900 21	1 D HL . 1910
character. End-of-line or SP and X	1817 00 NOP	1869 CD CALL 65AC	1902 05	ODD O I
riace return. If SP is not followed by	1818 21 LD HL,27E0	186C 3E LD A,0A	1903 85	HDD HIL
an X the indication is for a new word;	181B 06 LD B,1F	186E 12 LD (DE),A	1904 BF	CD LAA
the number of free spaces left in the	181D CD CALL 1880	186F 13 INC DF	1905 ZE	LD A, (HL)
line is then displayed.	1820 00 NOP	1870 18 18 1900	1906 00	NEP
Ine CLHBUF subroutine at 1880	1821 00 NOP	1972 76 NOLT	1907 C9	RET
after the initial one indicated by	1922 05 2024 20	1070 00 NGD	1908 FF	RST 38H
(HL).	1922 CD COLL 0555	1074 00 NDP	1910 PD	30 0D D0
The DECODE subroutine at 1890	1026 CD CALL USPE	1874 UU HUP	1914 20	50 75 BH
points HL firstly at the 7-segment	1828 CD CHLL 1890	1875 UU NUP	1914 36	HE HF 38
in A to offset to the appropriate	1829 UU NOP	1876 00 NOP	1918 BF	BE 3F AZ
character and then the same for	182A C1 POP BC	1877 00 NCP	191C 8D	33 8F 0F
ASCII.	182B OD DEC C	1878 00 NGP	1920 B6	BS 37 AE
The LPRINT subroutine firstly	182C 28 JR Z,1860	1879 00 NCP	1924 B5	30 37 3A
into OLITRUE calls the printer sub-	182E 00 NEP	187A 00 NEP	1928 B1	00 3D 1F
routine to print out the line and then	182F 00 NCP	1878 00 NCP	1920 AD	85 1D 3A
replaces it by a line-feed character.	1830 FF CP 20	1870 00 NDP	1940 21	10 41.1950
At the beginning of each new	1832 20 IP N7-1990	1970 00 NDD	1940 21	ADD AL
the line is displayed by converting	1924 00 NEP	1975 00 500	1943 85	HDD HJC
the contents of register C to	1004 00 HEF	1075 00 HUP	1944 68	сы сэн
7-segment on the LEDs.	1835 CD CHEL USFE	1876 00 HUP	1945 7E	LD A;(HL)
Hemember: When placing these	1838 OD DEC C	1880 AF XER A	1946 C9	RET
e o in a particular chip socket any	1839 FE CP 12	1881 77 LD (HL);A	1947 FF	RST 38H
internal CALLS must be made to the	1838 28 JR 7.1860	1982 23 INC HL	1950 4F	31 32 33
correct location, i.e: to within that	183D 00 NOP	1883 10 D.INZ 1881	1954 34	35 36 37
chip's area of addresses.	183E 00 NGP	1885 C9 PET	1050 20	29 41 42
in the printer the CALL CLERIE	183F F5 PUSH AF	1996 74 4017	1956 36	37 41 4C
(CD 8018) needs to be modified to	1840 DD 1 D TX.2750	1007 AG NOD	1756 43	44 40 46
CD 8070, location 7080, which is in	1944 DD DUSH TY	1007 00 HEP	1960 59	54 58 53
the relocated program.	1044 DD FOSH IX	1888 UU NOP	1964 55	49 48 4D
	1846 E1 POP HL	1889 00 NCP	1968 4A	20 4E 50
	1847 06 LD B,04	188A 00 NCP	1960 47	40 52 57

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ASCON 2	1.850	¢D'	CALL 05FE	1866	0.0	NOP	1899	F1	PDP AF
ASCONZ	1823	FE	CP 03	1867	00	NEP	189A	СЭ	CALL 1900
Similar to ASCON 1, but in-	1825	28	JR 2,1870	1868	0.0	NOP	189D	12	LD (DE) A
stead of carriage return being	1827	0.0	NOP	1869	0.0	NOP	189E	13	INC DE
SPACE + X, there is a CR key	1828	FE	CP 1F	186A	0.0	NOP	189F	C9	RET
the line	1824	20	JR NZ,184D	1863	0.0	NUP	18A0	00	00 00 00
After initialisation the pro-	1820	00	NUP	1860	00	NOP	1864	00	00 00 00
gram checks the keyboard,	1820	2H DO	LD HL (18AC)	1860	00	NOP	18A8	00	00 00 00
branches if the key-in is a CR to	1021	20	LD HL CLOOLS	1965	00	NUP	1840	30	19 E0 18
key except SHIFT it branches	1834	22	LD (1900)-H	1970	25	LD O-OD	1880	21	LD HL,18C0
to 184D where the check for a	1837	ng	EVV (IGHC),HL	1070	10	LD HAND	1883	85	ADD A,L
BACKSPACE and consequent	1838	22	LD (1901).HL	1872	72	LD CDEFRH	1884	6F	LD L,A
BACKSBACE it cope on to de-	183B	0.0	NEP	1877	CD.	COLL 6500	1885	7E	LD A; (HL)
code the character and deposit	1830	28	LD HL (180E)	1870	35	17 0.00	1886	00	NOP
it in OUTBUF. If this is space it	183F	D9	EXX	1870	12	LD (DE) .A	1887	С9	RET
goes back to NEWWORD in-	1840	28	LD HL + (1881)	187D	13	INC DE	18E0	00	BD 5B 00
If the key was a SHIFT the	1843	22	LD (18AE),HL	187E	18	JR 180C	18 <u>E</u> 4	AE	AF 38 BF
pointer in the program to	1846	D9	EXX	1880	AF	XER A	1858	07	13 32 02
lookup tables is changed so as	1847	22	LD (1881),HL	1881	77	LD (HL) A	18EC	EF	83 A2 82
to look at the shifted char-	184A	18	JR 181D	1882	23	INC HL	18F0	BE	3A 70 9B
aciers.	184C	0.0	NOP	1883	10	DJNZ 1881	18F4	36	14.10 EE
1800 11 LD DE,2001	184D	FE	CP 19	1885	C9	RET	1858	BB	00 90 28
1803 62 LD H,D	184F	20	JR NZ,1858	1886	76	HALT	18FC	8D	A3 30 FF
1804 6B LD L.E	1851	1 B	DEC DE	1887	0.0	NOP	1900	21	LD HL,1910
1805 06 LD B,FF	1852	DD	INC IX	1888	0.0	NEP	1903	85	ADD A.L
1807 CD CALL 1880	1854	18	JR 1820	1889	0.0	NOP	1904	6F	LD L.A
180A 00 NDP	1856	00	NOP	188A	0.0	NEP	1905	7E	LT A. (HL)
180B OU NEP	1857	0.0	NOP	188B	0.0	NEP	1906	C9	RET
180C ED EDCIFFF),DE	.1858	CD	CALL 1890	1880	0.0	NEP	1930	20	30 3F 00
1810 UE LD C,14	185B	0D	DEC C	1880	0.0	NDP	1934	35	36 37 38
1916 00 NDP	1850	28	JR Z,1870	188E	0.0	NEP	1938	2A	SE 58 50
1817 21 1 D HL . 27E0	LOPE	00	NUP	1881	00	NOP	1930	26	3C 3E 3D
1810 06 ID B.1F	1061	20	UP NT 4000	1890	DD	DEC IX	1940	39	33 21 32
181C CD CALL 1880	1061	10	JR 12,1820	1892	FS	PUSH AF	1944	34	22 27 24
181F 00 NDP	1865	10	NEP	1893	CD	CALL 1850	1948	29	00 3A 3B
		00	110.	1896	ממ	LD(1X+00),A	1940	28	23 31 FF
		-							
MEMORY LOAD 56 CH	RACTI	ER							
1800 11 01 20 62	1854	18	CA 00 00	1888	0.0	00 00 00	18FC	SD	A3 30 FF
1804 6B 06 FF CD	1858	CD	90 18 OD	18AC	10	19 CO 18	1900	21	30 19 85
1808 80 18 00 00	1850	28	12 00 FE	1880	21	E0 18 85	1904	6F	7E C9 FF
1800 ED 53 FF 1F	1860	20	20 BD 18	884	6F	7E 00 C9	1908	FB	FF BB FF
1810 UE 14 DD 21	1864	82	00 00 00	1888	FF	FF EE FF	1900	FE	FF BF FF
1014 10 27 00 21	1868	00	00 00 00	1880	DF	PF F5 FF	1910	20	4F 2E 00
1010 EU 2/ US 1F	1860	00	00 00 00	1900	00	3D 40 00	1914	42	46 40 40
1920 CD EE 05 EE	18/0	3E	05 12 DD	1804	HZ OF	30 BH 85	1918	4/	48 48 48
1924 02 29 49 00	18/4	e H	FF 1F CD	1900	DO DO	PC 20 15	1920	54 EE	59 49 50 42 30 EP
1828 FF 1F 20 21	1870	12	13 18 8C	1800	85	8D 01 37	1924	56	45 57 52
182C 00 20 AC 18	1880	45	77 23 10	1804	ES	SE BA AF	1928	52	00 44 46
1830 D9 2A 01 19	1884	FC	09 76 00	1808	1 D	00 B3 0F	1920	51	41 50 FE
1834 22 AC 18 D9	1888	0.0	00 00 00	1800	FD	3F 9B 00	1930	20	30 3F 00
1838 22 01 19 00	1880	0.0	00 00 00	18E0	0.0	BD 5B 00	1934	35	36 37 38
1830 2A AE 18 D9	1890	DD	28 F5 CD	18E4	AE	AF 38 BF	1938	28	2F 23 2D
1840 2A 31 18 22	1894	BO	18 DD 77	18E8	07	13 32 02	1930	26	3C 3E 3D
1844 AE 18 D9 22	1898	0.0	F1 CD 00	1SEC	EF	83 A2 82	1940	39	33 21 32
1848 B1 18 18 D1	1890	19	12 13 09	18F0	BE	3A 70 9B	1944	34	22 27 24
184C 00 FE 19 20	1880	0.0	00 00 00	18F4	36	14 10 EE	1948	29	00 3A 3B
1850 07 13 DD 23	1884	0.0	00 00 00	18F8	BB	00 90 28	194C	28	23 31 FF