

MONJANA/1 CBM

Monitor-System for CBM*

USER MANUAL

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1. Introduction

MONJANA 1 is developed from the well known PET-Monitor JANA. Besides necessary adjustments for the CBM Version, essential improvements have been made. MONJANA 1 contains additional commands, quite unique for a monitor system. MONJANA/1 offers enhanced reliability and ease of operation.

- **User Guidance**
Input of commands are easier because very often the delimiters may be used as before.
- **Debugging Aid**
The commands TRACE and EXECUTE are very powerful for debugging a machine program. Using these commands, a machine program can be tested step by step. Before each step is executed, the program counter, the registers and the stack pointer are displayed and can be changed if necessary.

In addition, the next program instruction is shown as a mnemonic. Branch instructions will be executed according to flags set by the operator or the program.
- **Correction of programs through the disassembler**
Disassembler instructions of a machine program can be immediately altered while displayed. This feature allows single instructions to be easily changed, exchanged, duplicated, inserted or deleted.

- **Relocate, Link and Addressing**
The RELOCATE command shifts and duplicates data in memory. Afterwards the LINK command adjusts all addresses, as it is necessary.
The ADDRESSING command can be used to modify the LINK command so that a where-used-list for selected addresses or subroutines can be obtained. This is a very powerful feature for the testing and debugging of machine programs.
- **Coding Aid**
 - The FEED command can be considered as a mini- assembler. Each machine instruction is immediately stored and translated into the mnemonic code. The proper instruction Address is automatically calculated and applied. Input errors are immediately given.
- **Optional printer output**
The PRINT command allows printer output. In this way listings of machine programs, memory dumps, etc. may be easily created.

2. MONJANA/1 Command List

Code	Command	Remarks
A	ADDRESSING	

(B) **BREAK AND REGISTER DUMP** with the BRK-mnemonic used after D, L and M

C CONTINUE
 D DISASSEMBLE
 E EXECUTE ONE STEP
 F FEED
 I INSTRUCTION MODIFICATION
 J JUMP
 L LINK
 M MEMORY DUMP
 N NOTE
 P PRINT
 R RELOCATE
 S SAVE
 T TRACE
 W WRITE
 X CHANGE TO BASIC

3. General Comments

MONJANA/1 is stored in a 2K byte ROM which uses the addresses \$9000 to \$97FF and can be installed into a socket on the CBM mother board. After the installation of the MONJANA/1-ROM the monitor is ready to be used without an additional load routine. It is practically impossible to hang the monitor from programming errors or wrong applications.

The monitor is started by

SYS 38000

The correct start will be indicated by

IX:MONJANA/1 ©1980 G. H. Bauer

On the screen, all output lines of MONJANA/1 are marked by a "*" in the first position. The second position is used to indicate input and processing errors, which will result in the output of a "?". The third position is to contain the MONJANA/1 command code which also marks the line types. A "*" in the last position of a line indicates a simultaneous printout of that line. In this case, the paging is executed as requested by the printer.

Upon entering MONJANA/1 the break vector of the CBM is directed automatically to the monitor. Thus, each BRK-instruction in a machine program ends in a monitor reentry. Then MONJANA/1 displays the CPU-status as it was before executing the BRK-instruction. In addition, the contents of the registers, the program counter, and the stack pointer are automatically saved.

Thus the machine program can be continued with the same CPU status after the BRK-instruction has been replaced (= recovery after break).

When leaving MONJANA/1 it restores the zero page addresses used by the monitor. So that MONJANA/1 does not interfere with other programs or the CBM operating system.

MONJANA/1 uses the stack addresses below \$60 only. Thus the stack from \$61 to \$FF is free for programs. There are no restrictions or processing errors involved with using these addresses.

All memory areas defined by a start and an end address are processed (including these addresses). This should be considered while using the commands A, L, R and S.

When an input or processing error is indicated ("?" in the second position) the monitor requires the input of a command code to continue.

Within the monitor output the following abbreviations are used:

(PC) = PROGRAM COUNTER
 SR = STATUS REGISTER
 AC = ACCUMULATOR
 XR = X-REGISTER
 YR = Y-REGISTER
 SP = STACK POINTER
 NMC-CODE = MNEMONIC CODE

4. Description of MONJANA/1 Commands

The monitor commands form the following group and are described below.

Code	Command	Comments
M	MEMORY DUMP	} read and write data
W	WRITE	
D	DISASSEMBLE	} read and write instruction
I	Instruction Modification	
F	FEED	
T	TRACE	} test of machine programs
E	EXECUTE ONE STEP	
J	JUMP TO MACHINE	
R	RELOCATE	} transfer and link of data and programs
LA	LINK, ADDRESSING	
S	SAVE	save on tape

P	PRINT	printer output
N	NOTE	
C	CONTINUE	continue display
X	CHANGE TO BASIC	return to BASIC operating system

M = MEMORY DUMP

By means of this command a memory partition defined by a start and an end address can be displayed on the screen or printed out. If the end address is lower than the start address (e.g. \$ 0000) 8 bytes will be displayed beginning with the start address. Thus it is possible to output 8 bytes using the start address only.

This command is applied in two phases:

1. Phase

Input: M, RETURN

Output: The start and end address as used with the last M- or D- command (at the start of the monitor the address mask 0000-0000)

2. Phase

Input: Changing the addresses is requested. The overwriting of other characters will be ignored by the monitor as long as the command code remains unchanged. The input will be determined by RETURN.

Output: M-line: A head line with the accepted addresses
 Z-line(s): In each line 8 bytes in consecutive order.
 C-line: In case there are more Z-lines necessary, the screen length - a "C" (CONTINUE) is shown on the last line. By simply pressing the RETURN key another page is shown.

No C-line is shown on the print out option. In this case a paging is performed on the printer list.

W = WRITE

Using the W-command, data edited by a M-command can be changed. If the indicated starting address is altered, the data will be stored from this address on. Since the original data remains unchanged, they will be duplicated in this case.

Input: Changing the starting address and/or the data is requested. The overwriting of other characters will be ignored as long as the command code remains unchanged. The input will be determined by RETURN.

Output: The accepted starting address and data. If there is a difference between the input and the output, the indicated addresses are not a RAM. The end address is always adjustable to the start address.

D = DISASSEMBLE

By means of this command a program partition defined by a starting and an ending address can be displayed or printed out disassembled. If the ending address is lower than the starting address (e. g. \$ 0000) one single instruction will be displayed beginning with the starting address. By that it is possible to output one instruction using the start address only.

This command is applied in two phases:

1. Phase

Input: D, RETURN

Output: The starting and ending addresses as used with the last M- or D-command (after the start of the monitor the address mask 0000-0000).

2. Phase

Input: Changing the addresses as requested. The overwriting of characters will be ignored by the monitor as long as the command code remains unchanged. The input will be determined by RETURN.

Output: D-line: A head line with the accepted addresses

I-line(s): In each line one machine instruction in hexadecimal and mnemonic code.

C-line: In case there are more I-lines than the screen length, a "C" (CONTINUE) is shown on the last line.

By a simple pressing the RETURN key another page is shown.

No C-line is edited on the print out option. In this case a paging is performed on the printer list.

I = INSTRUCTION MODIFICATION

Using the I-command, instructions as edited by a d-command optionally can be changed. If the indicated starting address is altered the shown instruction will be stored from this address on. Since the original instruction remains unchanged, it will be duplicated in this case.

Input: Changing the start address and/or the hex code of the instruction is requested. The overwriting of characters will be ignored by the monitor as long as the command code

remains unchanged. The input will be determined by RETURN.

Output: The accepted starting address and hex code as well as the instruction in mnemonics. If there is a difference between the input and the output, the indicated address is not a RAM.

F = FEED

The function of the F-command is nearly the same as that of the I command; but with the I-command not only one line will be processed. In addition the program counter will be adjusted and the next machine instruction will be shown in hexadecimal and mnemonic code. The cursor will go the higher half-byte of the first instruction byte, thus the next instruction can be typed in immediately.

In order to end the input of instructions, the cursor has to be shifted back and the command code changed as desired. Alternatively, the cursor may be shifted to the next line and a new command code applied.

Input: Changing the start address and / or the hex code of the instruction is requested. The overwriting of other places will be ignored by the monitor as far as the command code remains unchanged. The input will be determined by RETURN.

Output: The accepted start address and hex code as well as the instruction in mnemonics. If there is a difference between the input and the output, the indicated address is not a RAM. In addition a new line will be shown with a properly adjusted starting address and the cursor ready for typing in a new instruction code immediately.

T = TRACE

By this command a program test will be prepared.

Input: T, RETURN

Output: A head line and an E-line. The indicated program counter, registers and stack pointer are the same as shown in the last E-line (after the start of the monitor the program counter and the registers are all zero).

E = EXECUTE

By this command the program counter, the registers and the stack pointer may be changed and the instruction indicated by the program counter will be executed using the CPU status. In order to avoid errors the stack pointer should not be lower than \$80.

Input: Changing the following data is requested: PC, SR, AC, XR, YR and SP. The overwriting of other places will be ignored by

the monitor as far as the command code remains unchanged. The input will be determined by RETURN.

Output: The accepted PC, SR, AC, XR, YR and SP as well as the instruction indicated by the program counter in mnemonics. This instruction will be executed using the CPU status as shown and the result will be indicated in a new E-line.

J = JUMP

By this command the program counter, the registers and the stack pointer may be changed and a machine program will be executed starting with the instruction indicated by the program counter and using the CPU status as shown. As soon as there is a BRK instruction in the tested program the monitor takes over the control again and indicates that by showing a "B" (= BREAK) and indicating in an E-line the CPU status as it was before the break. In order to avoid errors, the stack pointer should not be lower than \$80.--.

Input: Changing the following data is requested: PC, SR, AC, XR, YR and SP. The overwriting of other characters will be ignored by the monitor as long as the command code remains unchanged. The input will be determined by RETURN.

Output: The accepted PC, SR, AC, XR, YR and SP as well as the instruction indicated by the program counter in mnemonics. The machine program to be tested will be executed starting with the instruction indicated by the program counter and using the CPU status as shown.

A BRK instruction will cause a monitor re-entry.

Then a "B" (= BREAK), a head line and an E-line are shown. The indicated CPU status gives the situation before executing the BRK-instruction

R = RELOCATE

This command serves to transfer data in the memory. The memory area to be removed is limited by starting and ending addresses. To determine the target area the starting address is sufficient, since the ending address will be calculated by the monitor. The transferred data will remain unchanged as long as there is no overlapping. If there is any overlapping the data in the target area will be correct in any case.

If as start address of the target area "0000" is chosen, there will be no transfer at all.

An error will be indicated if

- the ending address of the memory area to be transferred is lower than the corresponding start address.
- the target area would exceed "FFFF"
- the target area is not a RAM

This command is applied in two phases:

1. Phase

Input: R, RETURN

Output: The addresses as used with the last R- or A-command (after the start of the monitor the address mask 0000 - 0000 to 0000 - 0000)

2. Phase

Input: Changing the addresses is requested. The overwriting of the fourth address (=end address of the target area) and of other places will be ignored by the monitor as long as the command code remains unchanged. The input will be determined by RETURN.

Output: The accepted addresses as well as the calculated end address of the target area.

L & A = LINK & ADDRESSING

The L-command adjusts all the relative addresses in a machine program, as it is necessary after the relocation of a machine program. The link area will be defined by the pair of addresses used with the L-command.

The monitor searches the link area for valid instructions and tests if these instructions contain addresses, which relate to the transferred memory area. If such an instruction was found the monitor adjusts the address in correspondence to the relocation and shows in an I-line the instruction changed in this way.

The link area should not contain texts or tables, as the monitor could find valid instructions and change them. But by showing all changed instructions such errors could easily be detected and corrected.

Before executing the L-command the monitor shows in an A-line the addresses as used with the last R- or A-command. By the A-command these addresses may be changed on request. By that there are additional features of the L-command.

As it was explained with the R-command, no data is changed if the starting address of the target area is "0000". By that it is possible to obtain a where-used-list for selected addresses or subroutines. All instructions will be shown, which are in the link area and contain an address referring to the memory area defined by the first two addresses of the A-line.

This command is applied in three phases:

1. Phase

Input: L, RETURN

Output: The start and end addresses are used with the L-command (after the start of the monitor the address mask 0000)

2. Phase

Input: Changing the addresses is requested. The overwriting of characters will be ignored by the monitor as far as the command code remains unchanged.

Output: L-line: The accepted addresses
A-line: The addresses as used with the last R- or A-command (after the start of the monitor the address mask 0000 - 0000 to 0000 - 0000).

3. Phase

Input: Changing the addresses is requested. The overwriting of the fourth address (= end address of the target area) and of other places will be ignored by the monitor as long as the command code remains unchanged. The input will be determined by RETURN.

Output: A-line: The accepted addresses as well as the calculated ending address of the target area.

I-line: Each instruction, which is in the link area is shown in an I-line. The address within this instruction is changed according the defined target area. In case there is no target area defined (third address in the A-line = "0000") the instruction remains unchanged (address-where-used-list)

C-line: In case there are more I-lines necessary, then on the screen length can be shown, a "C" (CONTINUE) is shown in the last line.
By a simple pressing the RETURN key another page is shown.

No C-line is shown on the print out option. In this case a paging is performed on the printer list.

S = SAVE

By means of this command a memory partition defined by a starting and an ending address can be saved on tape using a file name up to 14 bytes long. The monitor uses the corresponding BASIC-routines. Therefore the proce-

dure is quite similar to the BASIC save routine. The output device is tape recorder #1.

This command is applied in two phases:

1. Phase

Input: S, RETURN

Output: The starting and ending addresses as used with the last S-command (after the start of the monitor the address mask 0000 - 0000) as well as the corresponding file name.

2. Phase

Input: Changing the addresses and the file name as requested. The overwriting of other places will be ignored by the monitor as long as the command code remains unchanged. The input will be determined by RETURN.

Output: The accepted addresses and file name as well as the known BASIC messages of the save procedure.

P = PRINT

In the print out state all output devices with a device number between 4 and 7 and connected with the IEEE-bus are controlled by the monitor. If there is no output device in the ready mode, the monitor omits the external output while containing the output on the screen.

Input: P, RETURN

Output: "ON," or "OFF"

-N = NOTE

By means of this command lines any remarks can be outputted on the printer. This command is independent of the actual printer state (ON/OFF). Thus the printer output may be completed with supplementary comments.

This command is applied in two phases:

1. Phase

Input: N, RETURN

Output: A blank line

2. Phase

Input: Writing into the blank line from position 5 thru 39. The overwriting of characters will be ignored by the monitor as long as the command code remains unchanged. The input will be determined by RETURN.

Output: The contents of the N-line are given on the printer.

C = CONTINUE

See the comments given with the description of the following commands.

M = MEMORY DUMP

D = DISASSEMBLE

L & A = LINK & ADDRESSING

X = CHANGE TO BASIC

This command exits the monitor and returns the control to the BASIC operating system.

Input: X, RETURN

Output: "END" and the BASIC statement "READY"

5. Author's Rights

The MONJANA/1 monitor is protected by a copyright. MONJANA also is a registered trademark.

The purchaser of the MONJANA/1 ROM with this user manual is not allowed to copy, duplicate or reproduce this material.

The purchase of the MONJANA/1 software does not convey any license to manufacture, modify and/or copy this product. Providing copies of this software without authorization is a violation of Federal Law.

6. Final Remarks

The MONJANA/1 monitor has been extensively tested and is believed to be entirely reliable. In case you should have any reclamation, we are only able to handle it, if we get written notice containing

— serial number of the ROM

— date and place of purchase

— serial number of the CBM-3001, in which the ROM is installed.

We will be developing another very powerful CBM-monitor in the future. Therefore, we would appreciate any suggestion for improvements.

ELCOMP

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ASCII CHARACTER CODES

<u>DECIMAL</u>	<u>CHAR.</u>	<u>DECIMAL</u>	<u>CHAR.</u>	<u>DECIMAL</u>	<u>CHAR.</u>
000	NUL	043	+	086	V
001	SOH	044	,	087	W
002	STX	045	-	088	X
003	ETX	046	.	089	Y
004	EOT	047	/	090	Z
005	ENQ	048	0	091	[
006	ACK	049	1	092	\
007	BEL	050	2	093]
008	BS	051	3	094	^
009	HT	052	4	095	_
010	LF	053	5	096	`
011	VT	054	6	097	a
012	FF	055	7	098	b
013	CR	056	8	099	c
014	SO	057	9	100	d
015	SI	058	:	101	e
016	DLE	059	;	102	f
017	DC1	060	<	103	g
018	DC2	061	=	104	h
019	DC3	062	>	105	i
020	DC4	063	?	106	j
021	NAK	064	@	107	k
022	SYN	065	A	108	l
023	ETB	066	B	109	m
024	CAN	067	C	110	n
025	EM	068	D	111	o
026	SUB	069	E	112	p
027	ESCAPE	070	F	113	q
028	FS	071	G	114	r
029	GS	072	H	115	s
030	RS	073	I	116	t
031	US	074	J	117	u
032	SPACE	075	K	118	v
033	!	076	L	119	w
034	"	077	M	120	x
035	#	078	N	121	y
036	\$	079	O	122	z
037	%	080	P	123	{
038	&	081	Q	124	
039	'	082	R	125	}
040	(083	S	126	~
041)	084	T	127	DEL
042	*	085	U		

LF=Line Feed

FF=Form Feed

CR=Carriage Return

DEL=Rubout

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