



# CHRISTIANI MIKROPROZESSOR LABOR USAGE NOTES

Addr	Name	Comment
<b>After Power-On</b>		
The status register has arbitrary contents after a power-up, the IE flag might be active, which triggers an interrupt (jump to (P3)) if SENSEA (the interrupt input) goes high. This crashes the system. Init the status register after every power-on with 0409 AD IN which also clears the interrupt enable flag.		

<b>The Keys</b>	
PC, P1, P2, P3, AC, EX	Display the contents of the named register. The registers are updated only after a single step or a breakpoint was hit.
BP	Insert a breakpoint (XPPC3, 3F) instruction at the displayed address. When the breakpoint is hit, it is replaced with the original instruction, all registers are saved and a return to the monitor occurs. Breakpoints do not work if the program uses P3 for its own purposes.
PT	Start printing. The modes are explained below.
SI	Do a single step from current PC. Make sure the IE flag is reset, otherwise an interrupt is triggered if SENSEA is high and a jump to (P3) is done. This happens if the printer is ready or SENSEA is pressed. Single step cannot be used for PC relative load and store instructions (LD, ST, DLD).
GO	Start program from 0420 (independent of displayed address) in realtime.
AD	Decrement displayed address and show new address and data. If an address was entered before, this address is shown. Also used to set a breakpoint.
ME	Increment displayed address and show new address and data.
IN	Store entered data at displayed address. If no data was entered, 0 is written. Increments the address.
0..F	Used to enter addresses and data.

<b>Printing</b>	
Print register contents:	Press PT at any time in input mode. The contents are actualized after each single step (SI) or after hitting a breakpoint. One line is printed with this content: PC P1 P2 P3 AC ST EX xxxx xxxx xxxx xxxx xx xx xx
Print program listing:	Enter <address> AD, <number of instructions> 01 PT Addr Instruction aaaa ii [ii]
Print HEX dump:	Enter <address> AD, <number of bytes> 02 PT Addr Data bytes aaaa dd dd dd dd dd dd dd
Print ASCII string:	Enter <address> AD, <number of characters> 04 PT. A LF (0A) inserts a line feed TEXT STRING

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### Audio Cassette Interface

To be able to save and load programs from tape, a interface board must be added inside the main case which holds the signal shapers and a DIN socket is required to connect the recorder. The mounting hole for it is already present on the main board.

The firmware for the audio interface is in a separate 512 byte ROM on the CPU board, which is normally unpopulated. It's the third socket from top (ROM C).

The tape recorder Philips D6625 can be used in data mode, so the volume setting is irrelevant.

### Operating save and load

Start Tape Firmware (Jump to 0600, ROM C)				
0420	C4 05		LDI #05	P1=05FF
0422	35		XPAH1	
0423	C4 FF		LDI #FF	
0425	31		XPAL1	
0426	3D		XPPC1	jump to 0600
[GO] (display does not change)				

Start Tape Firmware or Userprogram (GO -> 0430, GO+SenseB -> 0600)				
0420	06		CSA	Jump to user program if SenseB is not pressed.
0421	D4 20		ANI #20	
0423	98 0B		JZ USRAPP	
0425	C4 05		LDI #05	Jump to tape firmware if SenseB is pressed. If the taperecorder is in play-pause mode, SenseB is likely to be active due to noise (SB LED is lit). Stop recorder first, otherwise a jump to the tape firmware occurs.
0427	35		XPAH1	
0428	C4 FF		LDI #FF	
042A	31		XPAL1	
042B	3D		XPPC1	Align user program to 0430
042C	08		NOP	
042D	08		NOP	
042E	08		NOP	
042F	08		NOP	
[GO] Jumps to User Program or Tape Firmware				
0430	xx xx	USRAPP:	xxxx	User program starts here

Start and End Addresses (must be set prior to saving to tape)				
041C	xx			Startaddress hbyte
041D	xx			Startaddress lobyte
041E	xx			Endaddress+1 hbyte
041F	xx			Endaddress+1 lobyte

Tape Firmware Keyboard Functions	
O. . F, AD, ME, IN	Used for input of start and end addresses as long as save or load has not been started. They work the same way as in the operating system mode.
AC	Moves memory block from (Startaddress) to (Endaddress) up one address. (Startaddress and (Endaddress) are incremented.
GO	Store memory range to tape. A leading 2.4kHz synch signal is output, which should be recorded for about five seconds. After presseng SENSEA, data is shifted out over F0, visible on the F0 LED. If F0 LED stays static, the recording is done. Terminate with RESET. If the program to save is stored at 0420, the first seven program bytes must be entered again before the save is started, they were used by the Jump-to-Firmware program. Note: The printer may not be connected or must be turned off, it sets SENSEA high if it's ready to print. In this case shifting out data begins immediately after GO is pressed.
SI	Load memory range from tape. The data is stored at (startaddress). Start tape, wait until the sync signal is visible on the SOUT LED. Then press SI. Loading starts. On success, the display shows 0420 xx, on error EEEE EE. Error can be a checksum or length mismatch (the read length does not agree with (endaddress) - (startaddress)).
All others	Jump to 0000, reset

Addr	Name	Comment
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**PROM Programmer**

The firmware for the PROM programmer is in a separate 512 byte ROM on the CPU board, which is normally unpopulated. It's the third socket from top (ROM C).

Only programming is supported, no reading.

Start and End addresses, Loader and jump to user program are the same as with Tape Firmware, see above.

**Programming a PROM**

Programmer Firmware Keyboard Functions	
0 . F, AD, ME, IN	Used to input RAM start and end addresses at 041C to 041F. They work the same way as in the operating system mode.
PT	Start Programming. Display gets dark, start with SENSE A. The PROM start address is always 000 or 100, depends on the switch setting on the programmer. If programming is successful, a return to the monitor occurs. In case of error, the error-address is displayed in the form aaaa EE.
PC	Displacement Calculator - Display shows 0000 00 - Enter start address, for jumps address of jump instruction +2 - Press IN, display again shows 0000 00 - Enter target address, terminate with any function key, except IN - The displacement is shown - If the printer is ready it is printed as [Start] -> [Target] : V R [Displacement] where V=Forward, R=Backward. An F is printed instead on invalid input, difference between start and target not between 127 and -128 - Repeat process or terminate with RESET

**PROM Reader**

This is a program which should be loaded from tape. It reads 255 bytes per run and stores the data from 0500 to 05FF. Low or Hi part can be selected using the switch on the programmer. It can be used to make copies of ROMs to tape or to load self-made programs to RAM. The source listing is in a separate document, RomRead.pdf

With an adapter socket, the reader can also be used to read a standard 2716 EPROM.

**Operating the Reader**

- Connect the programmer the same way as for programming.
- Load the program from tape. It includes the loader described in the tape section. Program code starts at 0430.
- Insert the PROM to read and select low or high range.
- Press GO
- PROM data is now at 0500-05FF.
- Modify loader to jump to the loaded program at 500 by changing 426 from 05 to 04. GO with pressed SENSEB will now jump to 500.