

Reading and duplicating 20 pin protected PALs found on the MICRO design "R1 Serie BLU" computer

This work has been made possible by using the valuable information contained on the web page ["Reading Secured PALs"](#) created by Charles MacDonald, and the equally valuable help of users of the ["Z80NE"](#) private group on Facebook, made up of fans of the Z80 computer (made in kit form by a former Italian magazine, **NUOVA ELETTRONICA**, but in fact designed by **MICRO design** of Genoa, see appendix), just like me, and created by **Roberto Bazzano** as a complement to its excellent site ["The Home of Z80NE"](#), where you can find any sort of written information and countless resources and projects on this wonderful computer that, at least for me, made the history of information technology in Italy and with which I started my fantastic journey over forty years ago.

Warnings

This method doesn't work with the following devices:

- **"Registered"** PAL devices (PAL16R4, PAL16R6, PAL16R8, etc.)
- All GAL devices configured to be **"Registered"** (GAL16V8, etc.)
- PEEL devices (18CV8, etc.) that have a different architecture than PALs and GALs
- Non-PAL and non-GAL devices (82S153, PLS153, etc.) that have a different architecture and pinout than PALs and GALs

This work has been successfully completed so far on the **MMI** branded **PAL 16L8A-2CN** called MD002 located on the CFD011 dual density daughter card, and since the four PALs on the CPU001 board are of the same type, I assume that it will be possible to duplicate these as well, but I prefer to postpone this statement until when the aforementioned card will be able to work again and will allow me to carry out tests on the programmed PALs. Doing it before would be useless.

Successful duplication of this PAL does not imply that this is possible with protected PALs of any other brand and any other card with completely different functions, but it is equally possible to try.

Needed materials

To duplicate these PALs it is necessary to have the following materials, described on the web page ["Reading Secured PALs"](#):

1. An adapter to use with a programmer to read the PAL as if it were an 27C020 EPROM
2. The PA.EXE command line analysis program (which works well with Windows 10 too) to produce a CUPL file (text file) with the equations, starting from the binary file read with the adapter
3. The MS-DOS [PALASM version 2.23](#) program to minimize and compile the equation file to obtain the JEDEC file to be used with the PAL programmer. For the installation, it will be necessary to prepare two 1.2 MB or 1.44 MB floppy disks as I had problems putting all the files into a folder on the hard disk. On the first disk you must copy the PAL2INST.COM and PKUNPAK.EXE files and then the 223D-1. *, 223D-2. * and 223D-3. * files. The remaining files go on the second disk
4. PALASM2 manual, available [here](#) or [here](#)
5. A PAL programmer that supports the 16L8A device manufactured by MMI. I have used the old HI-LO Systems ALL-07 programmer whose software runs only in an MS-DOS environment
6. Some MMI branded PAL16L8A-2CN chips available [here](#)

Sequence

1. Read the protected PAL with the adapter and one of the programmers recommended in the article. I used the TL866 II Plus set up to read an AMD 27C020 EPROM, but I want to retry this reading with the ALL-07
2. Analyze the binary file obtained in step 1 with the PA.EXE command line program run from a Windows command prompt. This is the command line:

```
pa filename.bin >filename.txt
```

where filename.bin is the binary file read by the adapter
and filename.txt is the text file which will contain the analysis' result

3. Make a copy of the resulting text file, in case you need a backup
4. Change the extension of the text file from TXT to PDS (PALASM2 equation file)
5. Use the PALASM manual to help you create/edit your PDS file
6. Open the PDS file with Notepad and make the following changes:
 - a. Replace all the occurrences of the character "!" (NOT for WinCUPL) with "/" (NOT for PALASM)
 - b. Replace all the occurrences of the character "&" (AND for WinCUPL) with "*" (AND for PALASM)
 - c. Replace all the occurrences of the character "#" (OR for WinCUPL) with "+" (OR for PALASM)
 - d. Replace all the occurrences of the character "\$" (XOR for WinCUPL) with ":+:" (XOR for PALASM)

Check for typos. If in doubt, don't save, cancel and start anew

7. Arrange the modified text using the appropriate headers, keeping help yourself with the PALASM2 manual. When finished, save the file
8. Check the work done by loading the file in PALASM and using the following commands:
 - a. **F5**: to call the PALASM2 functions
 - b. **1**: Syntax Check

Whether there are errors or not, I recommend checking the log file created by PALASM2:

- c. **ESC**: To return to the menu
- d. **F7**: View Data
- e. **1**: Run-time Log

Any errors will be highlighted in the text and suggestions for their correction will be provided as well

9. If no errors were found, assemble the modified PDS file. At the end, the JEDEC file with which to program the PAL16L8A-2CN MMI will be available in the project folder
10. Load the obtained JEDEC file in the programmer software and start programming. I recommend you not to burn the safety fuse anymore

Alternative

Not being able to find the original PAL16L8A-2CN or a programmer which supports them (very difficult nowadays, unless you spend a lot of money), thanks to **Claudio Arnaboldi**, a user like me of the "[Z80NE](#)" group, it is possible to use an **ATMEL ATF16V8B-15** device which can be electrically erased – and is therefore reusable in case of errors – and is capable of emulating many 20-pin PALs. You can purchase this device from [RS Online](#).

To use this device, you will need:

1. The WinCUPL program to assemble the JEDEC file
2. A programmer, even a cheap one; I purchased the TL866 II Plus. As an example, on this programmer select **ATMEL** and then **ATF16V8B (DIP 20)**
3. Change the extension of the text analysis file produced by PA.EXE from ".txt" to ".pld", open it with WinCUPL and change the device type (Device) to **G16V8MA**. Save your changes
4. Assemble the modified PLD file choosing **G16V8** as the device. At the end, the JEDEC file with which to program the ATMEL ATF16V8B will be available in the project folder
5. Load the obtained JEDEC file in the programmer software and start programming. I recommend you not to burn the safety fuse, but it doesn't really matter with this device, since it is electrically erasable

Appendix

MICRO design, formerly **Micro Lg**, had its last headquarters in "Genova Pegli, via Rostan n. 1". It was an "almost" family-run company that was made up by (as far as my memory remembers):

- Bruno Bonino, who took care of the software
- Gino Duchi, who took care of the hardware
- Guido Grassi, the salesperson, from which the initial name of the company was derived:

Laboratorio Grassi → Laboratorio Lg → Micro Lg → MICRO design

MICRO design designed the computer based on the **Z80** microprocessor that was published as a kit by the historical magazine **NUOVA ELETTRONICA** in the period going from the end of 1979 to about 1986. The MICRO design "**R1 Serie BLU**" computer introduced directly by MICRO design a few years later was its natural evolution, bringing it out of its didactic dimension, enhancing and expanding it.

In addition to marketing their computer, MICRO design also became a [Digital Research](#) authorized distributor ([here](#) an interesting historical site), the manufacturer of the popular **CP/M** operating system ([here](#) and [here](#)) created by the late [Gary Kildall](#), and they adapted it for the "**R1 Serie BLU**" computer, also updating it over the years from version 2.2 to version 2.25 and adding double density (version 2.25D), doubling de facto or even more the capacity of single-sided single density floppy disks used until then, since with the new double density operating system double-sided floppy disks are seen as a single disk. To give an example, a 5-inch 80-track double-sided floppy disk has, in double density, a capacity of about 800 KB, an 8-inch double-sided floppy disk about 1.2 MB. The MICRO design adapted for the R1 computer and offered for sale also several important software packages such as DBase II, Wordstar 3, The Last One (a program to make... programs), MBasic, Macro 80, Link 80, Fortran 80, Borland Turbo Pascal 2.0 and Turbo Toolbox, the Sargon chess program and many others.

MICRO design also created for its customers and enthusiasts a monthly bulletin which reported all the news proposed by the company, technological advances, accessories, code fragments and programs created by the users themselves, CP/M User Group libraries, technical articles and much more. The bulletin has been released from January 1981 until October 1986, and thanks to the users of the "[Z80NE](#)" group it was possible to find all the original copies, thus reconstructing the complete collection that was scanned and is now available on the "[The Home of Z80NE](#)" website, in the "[Articoli](#)" section. For my part, I am slowly scanning, in addition to my complete collection of bulletins, all the manuals of the MICRO design cards that I own; both the bulletins and the manuals will, as far as possible, be cleaned of dirt and imperfections and made available for publication on the site.