JOY81

JOYSTICK PROGRAMMABLE CONTROLLER

MANUAL

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## CONTROLLER

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Sumário

NOTICE

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The manual was written for users of the JOY81 - Programmable Joystick Controller interface, for use with Sinclair ZX81 and compatible microcomputers.

The objective of the manual is to provide detailed information for the proper installation and use of the JOY81. The user is responsible for following the recommendations contained in the manual, and the author is not responsible for any damage caused to the interface and/or to the microcomputer due to misuse or non-compliance with the recommendations and instructions contained in this manual.

Toddy Software
July 2013

OVERVIEW
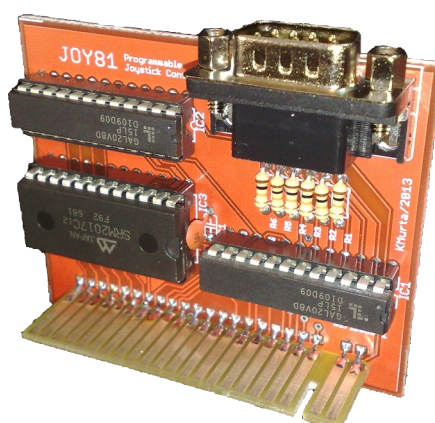
Although a few joystick interfaces have been released for the ZX81 over the years, none have become the *de facto* standard and few games support them. Consequently, ZX81 users had to make do with the membrane keyboard which, although "adequate" for typing programs, is terrible for controlling action games.

The JOY81 is a programmable joystick controller designed for the Sinclair ZX81 microcomputer and which addresses this deficiency. It includes a 2Kb static RAM to store the key codes emulated by the joystick.

Using the JOY81, any keys can be configured on the interface, which makes it possible to control any existing game using the joystick, without the need for any type of change in the game code.

COMPATIBILITY

The JOY81 is fully compatible with the ZX81, TS1000 and TS1500. The Brazilian clones TK82C, TK83, TK85 [1] and CP200 [2] require a small internal change in order to make them compatible with JOY81. This change can be made with the TKJOYMOD module, supplied separately. For other clones, compatibility must be checked on a case-by-case basis.

The JOY81 is compatible with Atari one-button joysticks and/or 2-button SMS joysticks and joypads, among others.

[1] Some TK's were manufactured with the ZX81 ULA Ferranti, in this case compatibility with the JOY81 is total.

[2] The CP200 was manufactured in several versions, with the oldest version requiring modification; other versions must be checked for compatibility.

INSTALLATION

Caution!
The installation of any device must be carried out with the computer disconnected from the power supply!

Firmly connect the JOY81 to the ZX81 expansion connector.

Use the piggy back connector of the JOY81 to connect memory expansion or any other device (ZXpander, ZX Printer, etc.).

Connect the joystick to the JOY81's DB9 connector.

TESTING

Turn on the microcomputer, which should behave normally as usual. Now move the joystick lever or press any of the buttons and notice that the editing lines at the bottom of the video will blink slightly (no characters will be displayed in response, as the JOY81 has not yet been programmed). Also try pressing any key while activating the joystick. In this case, the keyboard must remain completely inoperative as it is overridden by the action of the joystick. Test all other positions to ensure the JOY81 is fully functional.

SETTING

Before loading a game on the computer, the JOY81 must be configured, which is done with the SETJOY.P program supplied with this manual.

The program will show the screen below with the representation of a 2-button joystick. Initially, the position corresponding to the UP movement will contain the reverse * character, signaling that the key that will correspond to this movement must be pressed. At the bottom of the screen you can see the characters associated with the SHIFT (?), SPACE (*) keys and also for the situation with no associated key (-).
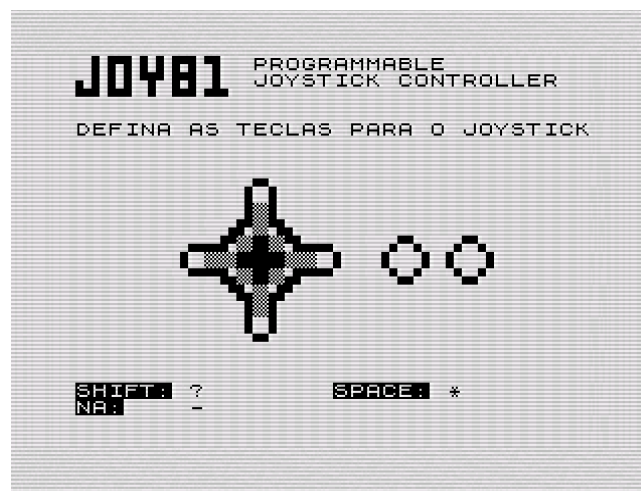
After defining the key for UP movement, choose the other keys in the sequence DOWN, LEFT, RIGHT, BUTTON 1, BUTTON 2. Then you must confirm the selection with "Y" or, in case of error in the selection, press "N" to correct.
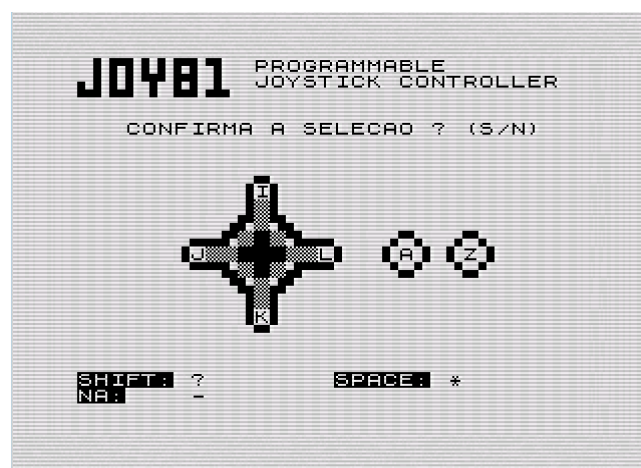
Once the selection of keys for the joystick has been confirmed, you must then press SHIFT J to proceed with loading the game with which you will use the joystick:

Before loading the game, try moving the joystick directional pad as well as pressing its buttons and on the screen above you will see a visual response for each of the commands sent by the joystick.

USING WITH ZXPAND AND ZXPAND COMMANDER

ZXPand is an interface with 32Kb of RAM and program storage on SD/MMC cards, while ZXPand Commander (hereinafter referred to as CMDR) is its official file manager.
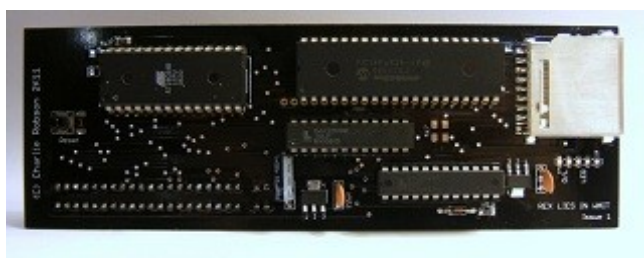
Using the JOY81 in conjunction with the ZXPand and CMDR greatly simplifies the use and configuration of the joystick controller. This is because when a program is loaded by CMDR, it is responsible for automatically configuring the JOY81 according to the parameters passed in the JOYCFG.TXT configuration file. This file must be saved in the same directory as the program to be loaded or in the root directory of the SD card.

Therefore, for each program to which you want to assign a key sequence in JOY81, you must insert

an entry in the JOYCFG.TXT file. Each entry consists of the name of the program (without the .p extension) followed by one or more spaces and the keys to be assigned, always in the sequence UP/DOWN/LEFT/RIGHT/BUTTON1/BUTTON2.

```
NCJMC81      QAOPM_
UWOL81       QAOP__
SDS          QAOP__
3DDEFDR      5FIOII
TAI          PLLP^^
BUGBURST     7658PP
MAZOGS       WSHJVY
MADJUMP      --ZBHH
MICROMOU     QZIPOO
CRUSH        QZIP##
REVENGE      QZIP##
ROCKETMA     QZBMAA
FORTY        QZBM_
BOOSTER      --^Z##
ZXTR         QZ--MB
BOUNBERT     7-1377
STARDEFE     QA1908
PIPE         QAOPKK
TETRIS       -DKLSS
TETRISHR     -DKLSS
ZBLAST81     QAOP__
MAGICFLR     7658AA
SCRMBL81     AZNMH1
DAMPER       896700
```

Example of a file JOYCFG.TXT

It is important that you always enter a sequence of 6 characters for each entry. If you do not want to assign a key to a specific joystick position, then use the - character.

For the ENTER, SHIFT and SPACE keys, the characters #, ^ and _ must be used respectively.

But note that during boot, CMDR configures the JOY81 for the following keys:

Up	7
Down	6
Left	5
Right	8
Button 1	0
Button 2	ENTER

This, in addition to allowing you to use the joystick to control the CMDR, also makes it unnecessary to include an entry in the JOYCFG.TXT file for games that make use of these keys, as when the game is loaded the JOY81 will already be properly configured.

USING JOY81 WITH O.T.L.A.

For those who do not have ZXPand, an alternative is to use **O.T.L.A.** (http://code.google.com/p/otla/) to generate audio files for programs and load them into the TK via the EAR port. Below we will see an example of how to prepare a wav file for the SCRMBL81.P game.

The first step is to load the LOADER.P program into an emulator and edit line 20 to include in the variable J$ the keys that will be associated with the joystick, always in the sequence UP/DOWN/LEFT/RIGHT/BUTTON1/BUTTON2:

```
 0 REM
10 SAVE "LOADER"
20 LET J$="AZNMH1"
30 RAND USR 16514
40 LOAD ""
```

Note: To represent the **SHIFT**, **ENTER** and **SPACE** keys, the characters ?, < and * must be used respectively. If you do not want to associate any key, use the character -, but always be careful to assign 6 characters to the J$ variable.

Then, run the program with **RUN** and generate the LOADER.P file. As you can imagine, this program will configure the JOY81 and then load the program in which the joystick will be used.

In the next step, run the **O.T.L.A.** program. and select the "**New+Add**" option in the "**File**" menu to load the LOADER.P file. Select "OK" on the next screen ("Adding blocks").

Finally, select the "**SBB => WAV**" option to generate the wav file, which will be saved by default in the "output" subdirectory within the **O.T.L.A.** installation directory.

Repeat the procedure, now for the SCRMBL81.P file. At this point, we will have the two files LOADER.wav and SCRMBL81.wav in the "output" subdirectory and then we will use the **Audacity** program (or another wav editor of your choice) to concatenate the two wav files into one.
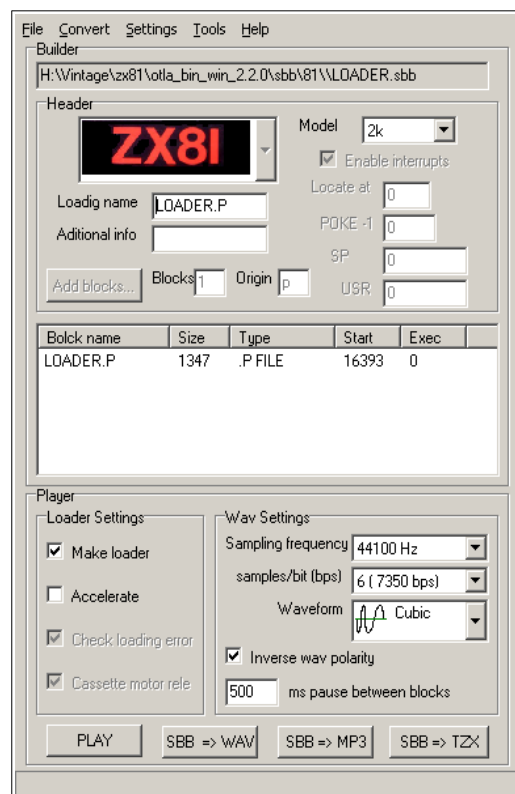
Open Audacity and load the LOADER.wav file. Then type "CTRL+O", select the SCRMBL81.wav file and load it. With the SCRMBL81.wav file already open, type "CTRL+A" to select everything, followed by "CTRL+C" to copy the selection.
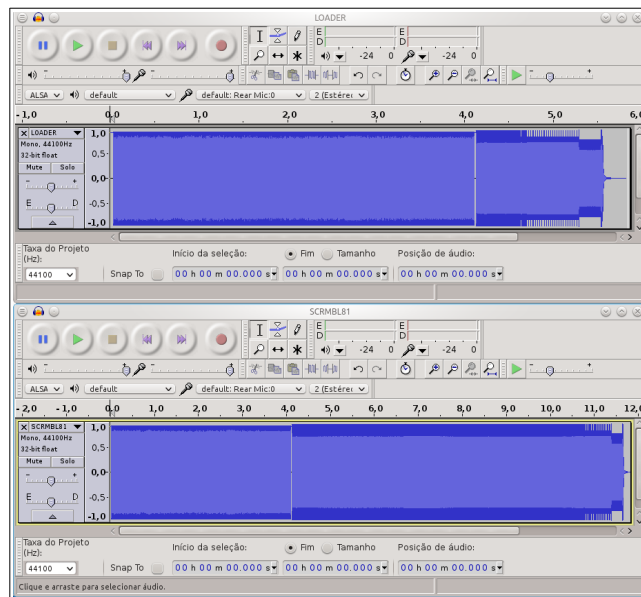
Return to the LOADER.wav window, position the cursor at the end of the wav and type "CTRL+V" to paste the SCRMBL81.wav. We will then have the two files concatenated:
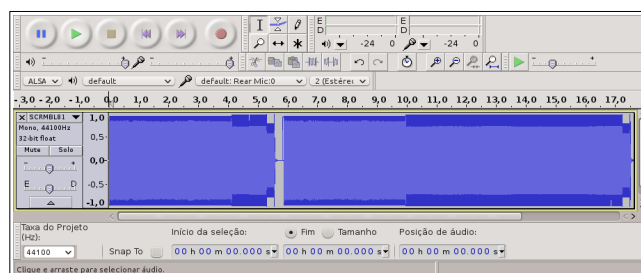
To save the new wav, select the "**File/Export...**" menu, name the file SCRMBL81.wav and click "**Save**", overwriting the original file.
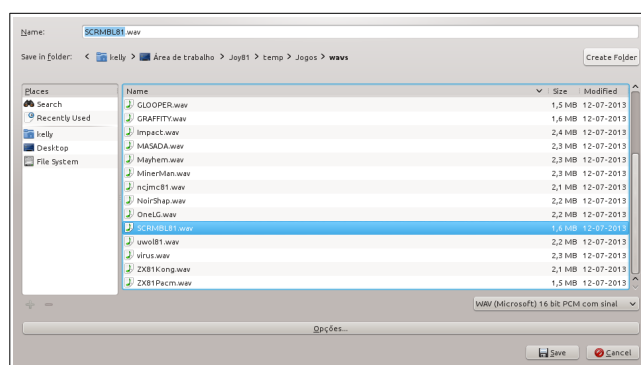
Now, when you load this file into TK, JOY81 will be configured and then the game will be loaded, all transparently.

APENDICE

WHEN THINGS DON'T GO AS EXPECTED

The JOY81 allows you to mimic any key on the ZX81 using the joystick. However, on some rare occasions, the joystick may not return the expected key. To understand why this occurs and how to overcome the situation, it is necessary to understand the keyboard reading mechanism and the JOY81's performance when reading the keys.

The ZX81 reads the keyboard through the $FE port, when 5 keys are read at a time. Imagine the keyboard as a matrix of 8 rows by five columns (see figure below). Each line corresponds to a sector of five keys linked to one of the lines from A8 to A15 of the computer's address bus. In turn, each column of the matrix is interconnected to lines KBD0 to KBD4, accessible through the $FE port (bits D0 to D4).
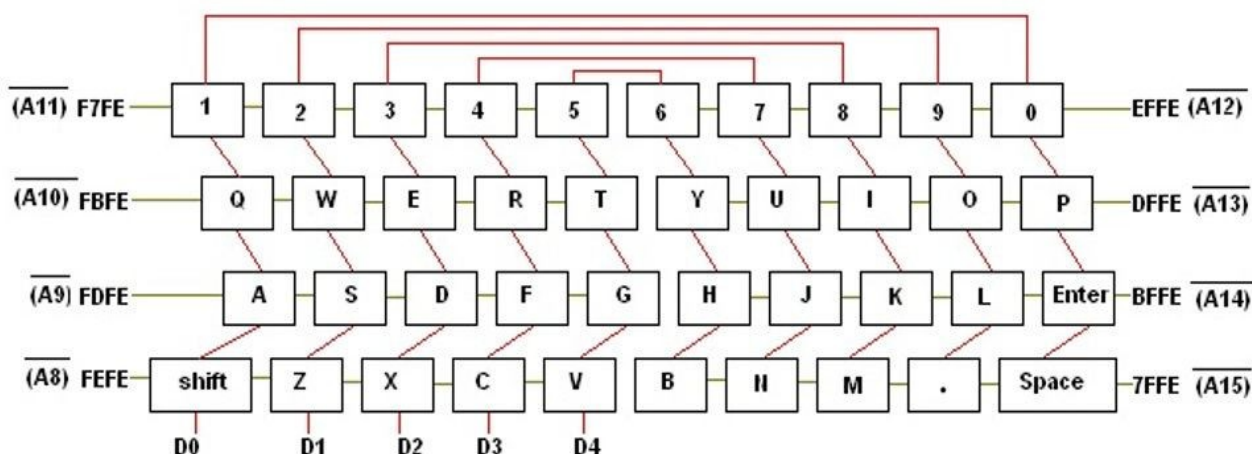
Port	Bin	Address line	Setor	D0	D1	D2	D3	D4
$FEFE	%1111 1110 1111 1110	A8	0	SHIFT	Z	X	C	V
$FDFE	%1111 1101 1111 1110	A9	1	A	S	D	F	G
$FBFE	%1111 1011 1111 1110	A10	2	Q	W	E	R	T
$F7FE	%1111 0111 1111 1110	A11	3	1	2	3	4	5
$EFFE	%1110 1111 1111 1110	A12	4	0	9	8	7	6
$DFFE	%1101 1111 1111 1110	A13	5	P	O	I	U	Y
$BFFE	%1011 1111 1111 1110	A14	6	ENTER	L	K	J	H
$7FFE	%0111 1111 1111 1110	A15	7	SPC	.	M	N	B

To read the keys of a given sector, the bit corresponding to the address line of that sector is reset to zero and the IN instruction is executed as follows:

　　1- The A register is loaded with the sector address (bits A8~A15)
　　2- The IN instruction is executed through the $FE port

For example, to read the QWERT keys (sector 2), the sequence to be executed is as follows[1]:

```
ld a,$FB        ; carrega Acumulador com end. do setor
in a,($FE)      ; lê a porta $FE e armazena em A
```

The status of each key is then determined by bits 0 to 4 of the accumulator. A 0 bit means that the corresponding key was pressed; a bit 1, the key was not pressed.

The JOY81 will work perfectly with any program that reads the keyboard one sector at a time. Problems will arise with some rare programs in which key reading is done through more than one sector simultaneously. This is done by clearing more than one of bits A8 to A15 of the address bus.

One of these programs is the game 1K Breakout from Macronics. The instructions inform that the game is controlled by keys 5 (left) and 8 (right), but if the JOY81 is configured for these keys, the joystick will not work properly. So, how to proceed in this case?

Trying with other keys you will discover that the game also responds to keys 6 (left) and 3 (right), which makes us intuit that the game reads sectors 3 and 4 simultaneously (bits A11 and A12 reset). This means that the program does not distinguish between keys 3 and 8 (right) or 5 and 6 (left). You can then try another combination of these keys with JOY81: 5 and 3 or 6 and 3 or 6 and 8, and you will find that the correct combination will be 5 and 3.

Another example occurs with the game FORMULA-86, published in the Brazilian magazine Micro Sistemas. According to the instructions, the game control keys are 6, 7, 9 and 0, but these keys do not work with the JOY81. Trying with other keys, you discover that the game responds equally to V/C/Z/SHIFT, G/F/S/A, T/R/W/Q, 5/4/2/1, Y/U/O/P, H/J/L/NL and B/N/./SPC. In other words, all sectors are being read simultaneously. Trying these 5 combinations you discover that the JOY81 will respond to the first one, that is, V/C/Z/SHIFT keys.

So if you encounter a similar situation, after determining all the keys that the game responds to, start configuring the JOY81 with the keys in the smaller sectors, until you find the ones that will work.

---

1   Another way to read the keyboard in Z80 assembly would be:
```
ld bc,$FBFE     ; B = end. do setor / C = porta $FE
in a,(c)        ; lê a porta $FE e armazena em A
```

CONFIGURING AUTOBOOT ON ZXPAND

The latest versions[1] of the ZXPand firmware and ROM have implemented the autoboot feature, in which the MENU.P program stored in the root directory of the SD card is executed during computer startup.

Autoboot behavior is determined by a configuration byte assigned via the CONFIG command. The options are:

- Factory default configuration: requires holding down the SHIFT key during startup to auto-load the MENU.P program. It is defined with the command

> **CONFIG "C=FF"**

- Alternative configuration: does not require pressing the SHIFT key to autoload the MENU.P program, on the contrary, pressing SHIFT will prevent autoboot. It is defined with the command

> **CONFIG "C=7F"**

Note: This configuration is persistent, once made it remains even after the computer is turned off and is only changed with a new CONFIG command.

Therefore, to auto-load ZXPand Commander during startup, you must rename it to MENU.P, save it in the root directory and adopt one of the two configuration alternatives above.

[1] The latest firmware and ROM versions can be obtained from the following address:

> http://www.sinclairzxworld.com/viewtopic.php?f=13&t=913

JOYSTICK CONNECTOR PINOUT

The JOY81 accepts joysticks from the Atari 2600 (in this case without the 2nd button functionality) and also from the Sega Master System. Megadrive joysticks should also work, but only two buttons will be used. Below is the pinout used in the joystick connector.
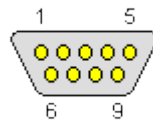
Male DB9

Pino	Sinal
1	Up
2	Down
3	Left
4	Right
5	+5V
6	Button 1
7	N/C
8	GND
9	Button 2