Updated April 2005 (Differences Between FM-7 and FM-8)

The Fujitsu FM-7

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Demo screen for the original FM-7 Computer:

The OS9 Level II Screen (for the FM-77AV computer):

The Fujitsu FM-7

The Fujitsu FM-7 was Fujitsu's first entry into the Japanese home computer market, and for their debut computer, they chose to come out with a 6809-based personal computer very similar to Radio Shack's Color Computer. I have an original FM-7 at home, and it's a lot of fun to play with.

Some Similarities:
  * Built around the Motorola 6809 CPU
  * Equivalent to a CoCo1 or CoCo2
  * Runs such CoCo Operating Systems as OS-9 (Level I) and FLEX
  * The included "F-BASIC" is just an enhanced Microsoft CoCo BASIC

Some Differences:
  * Uses TWO 6809s: one for the main CPU, and one for graphics
  * F-BASIC's additions to the standard Microsoft CoCo BASIC include the Japanese character set (katakana, and a few kanji), block graphics, three-voice music, the ability to have graphics appear on the default text screen, and some neat commands such as being able to take any string and print it out in various sizes (from tiny to huge) and directions (forward, backward, up, down, etc). While there are a multitude of new commands on the FM-7 not found in Microsoft's CoCo BASIC, it's worth pointing out that the commands that ARE found in both machines operate in exactly the same fashion. Both Microsoft and Fujitsu share the copyright on the BASIC. There are also strings for TIME$ and DATE$, which access a temporary built-in internal clock, though if the power is turned off, the time and date are lost.
  * While even the earlier CoCo motherboards seem efficient and compact, an open FM-7 is full of components and ICs inside, seemingly taking up every inch of available space.
  * Under the top "hood" are three slots for optional plug-in cards, from a Z-80 card to an RS-232 card.
  * Full-size, excellent keyboard with keys that handle multiple functions (some keys handle as many as 5 different functions, depending on what SHIFT/KANA/GRAPH/etc key is also pressed).
  * 10 Function Keys at the top, pre-programmed with shortcuts (such as LIST, etc). Also, a numeric keypad to the right, and cursor-control keys on the upper-right.
  * While the BASIC 'EDIT' command works the same as on the CoCo, the

cursor position is important on the FM-7: there's a small keypad on the upper-right of the FM-7 with cursor-control keys (arrows, INSERT & DELETE), and wherever you decide to position the cursor, it will move it there, and affect whatever is underneath it.

* Sound can be played through a built-in speaker mounted near the top of the FM-7 unit.

The FM-7 is a great little machine to tinker around with, and like die-hard CoCo fans, there are many Japanese FM-7 fans still out there, though of course Fujitsu no longer supports the machine.

Details On The FM-7

The FM-7 computer (FM standing for "Family Micro"), made by Fujitsu during the early 1980s, was a dual 6809-based home computer for the Japanese market. Like the Radio Shack Color Computer, the unit contains just the computer--with disk drives, monitors, etc. all being external.

The power requirement for the unit is Japan's standard 100V -- a bit different than America's 110/120V, but close enough to where it works OK. Japan uses the same TV standard as the U.S. (NTSC). The FM-7 has no "RF" or "RCA" video outputs like the CoCo does. Instead, it has two choices for a video-out: a 5-pin DIN jack for "green monitor" [monochrome], and an 8-pin DIN jack for "color monitor". Interestingly, monitor cords made for the Dragon computer (U.S. version) work perfectly on the FM-7's "green monitor" output.

There is a very important DIP-switch located on the back of the unit. Depending on how you set this 4-switch DIP switch, the computer will start up either in "BASIC mode" (giving you instant BASIC, like on the CoCo), or in "OS mode" (which will send the computer searching the disk drive for an OS disk, such as OS9, or Disk FBASIC).

The FM-7 is a 64k machine, but like the CoCo, only 32k is available from BASIC (with the full 64k being available from OS-9 or FLEX). OS-9 Level One was a popular OS for this computer in Japan.

The unit has a nice, full-size, full-action keyboard that includes ten function keys, a separate numeric keypad, and cursor controls. The computer is capable of displaying both English, katakana (Japanese syllabary used for writing foreign words), and 10 kanji characters (for "seconds", "minutes", "hours", "days", "months", "years", "city", "area", and two more). The full Japanese katakana set can be displayed, but not hiragana (Japanese syllabary used for writing Japanese words). The computer also has quite a few block-graphic symbols in the character set (hearts, diamonds, squares filled in in varying degrees, etc.) Most of the keys have 4 characters assigned to them, and you access them by pressing SHIFT, CNTL, KANA or GRAPH along with the key. However, the top row on the keyboard (the number keys) actually handles 5 characters per key. The 10 function keys above the normal keyboard serve as shortcut keys that, when pressed, will deliver such BASIC commands as "RUN" or "LIST". The English character set includes full (real) lower-case letters (whereas the original CoCo1 had only inverse video for lower-case). There is an ESC key as well as a BREAK key. The BREAK key works the same as on the CoCo, breaking you out of whatever's going on. The ESC key, however, acts as a PAUSE key, and subsequent pressings of the ESC key advance the screen one line at a time.

The display offered is either 40x25 (default) or 80x25 with eight colors. The most interesting thing about the display is that even on the default screen, you can have text and graphics on the screen at the same time. The graphics resolution on these screens is 640x200. To draw a circle in the center of the screen, you'd do:
CIRCLE (320,100),X (with "X" being the size you want the circle).

The FM-7 supports 3-voice music in BASIC, and the sound can be heard through the FM-7's built-in speaker (mounted inside the machine, and

facing upwards). There's also a buzzer, and both the speaker and buzzer have separate volume controls on the back of the unit (adjustable with a screwdriver).

Above the keyboard, the back half of the top comes off easily. By lifting it up, you see three expansion ports: two (the same size) are for an RS232 pak and a disk controller, and the 3rd (larger) one is for a Z-80 card (to run CPM). The back of the unit has an "EXPANSION" port, as well as jacks for a printer, audio cassette, green (monochrome) monitor, color monitor, and external speaker. There's also a RESET button, separate buzzer and speaker volume controls, and the 4-position DIP switch that determines power-up mode (BASIC or OS). There are no joystick ports, but joysticks were an option (with the optional joystick/sound card sold separately).

The dual 6809s inside the machine are both Motorola 68B09P chips, (not 68B09Es). The motherboard is FULL of ICs... it's really, really crowded in there (unlike the CoCo). Every inch of space has an IC on it, and there are two (double-decked) motherboards inside.

The F-BASIC inside the FM-7 is very strong, with a lot of commands not found in CoCo BASIC. Here are just a few examples:

*AUTO: automatically line-numbers for you while programming

*SYMBOL: lets you blow up to huge size anything you can print on the screen (in Japanese or English). Doing:

```
SYMBOL (a,b), "Test!", x, y, mode, direction
```

will print "Test!" at the coordinates of (a,b), and make it larger horizontally by "x" factor, larger vertically by "y" factor, change the color (mode) if you wish, and let you set the DIRECTION it's to be drawn in (ie, left-to-right, right-to-left, top-to-bottom, bottom-to-top). This works with English, Japanese, graphics symbols, and any other type of string.

*UNLIST: a command to make all -- or part -- of a program un-LISTable. Not only can you UNLIST the entire BASIC program (so when you type LIST, nothing appears), you can also specify only specific lines you want unLISTable.

MON: This puts you into a simple system "monitor" where you can see a data dump (in HEX values), read the data, change it, and start from a certain place. The cursor becomes a "" symbol, and you have to hit BREAK in order to exit.

*TIME$: Allows you to set the time (lost when power is turned off). The default time is: 0:00:00.

*DATE$: Allows you to set the date (lost when power is turned off). The default date is: 82/12/01 (Dec 1, 1982).

There are quite a few extra commands that Fujitsu added into F-BASIC. A few more include: RANDOMIZE, TERM, CONSOLE, GCURSOR, BEEP, CONNECT, INTERVAL, SWAP, and MERGE. Again, these are but a few examples.

With the DIP-switch set to BASIC mode, with no disk drive hooked up, turning the computer on gives you this:

```
FUJITSU F-BASIC Version 3.0
Copyright (C) 1981 By FUJITSU/MICROSOFT
30530 Bytes Free
```

Additional Information on the FM-7

Below is an Email from a friend who grew up in Taiwan, but had an FM-7 (imported from Japan) and knew the machine pretty well:

There's a couple models in the FM-7 family: FM-7, FM-NEW 7, FM-77, FM-77AV, etc. The FM-7 was the first in this series, (though it came after the business-oriented FM-8). The FM-7's price was Y126,000.
The machine uses 100V for Japan. A long time ago, I saw an article in "Oh!FM" magazine (a Japanese computer magazine published by SOFTBANK) about a board for raising the graphics resolution to 640*400, up from the normal 640*200. I got most of the components, but couldn't find a 9-pin DIN connector in Taiwan. There were plenty of places carrying 8-pin DIN connectors, but none of them had 9-pin DINs.

RE: the 4-position DIP switch... it handles two settings: the bootup ROM setting (whether to boot up in F-BASIC mode or other OS), and RAM/ROM for the upper 32k address range. To run F-BASIC, set the first to F-BASIC and the latter to ROM. To run OS-9 or other OSs, set the first to 'other' and the latter to RAM. Note though, that they aren't labelled, other than with "1 2 3 4".

The 3 add-on slots... the bigger one is for a Z-80 card (in order to run CP/M), and the other two are for other I/O cards, such as a floppy disk controller card, rs232 card, and so on.

F-BASIC was really cool when the FM-7 first came out. It has a very rich set of graphics/sound commands (so you can write games easily). Its graphics was really fast. It was rated almost twice as fast in the graphics benchmark compared to its rival machine, the NEC PC-8801, whose price was twice as much.

The FM-7 has two 6809 CPUs. The main CPU runs at 2.0Mhz, and does everything except graphics. The sub CPU, running at 1.2Mhz, executes all graphics commands.

The memory map is like this:

Main CPU:
 0000 - 7FFF: (RAM) BASIC working area, user's area
 8000 - FBFF: (ROM) F-BASIC ROM
 FC00 - FC7F: Shared RAM between main and sub CPU
 FD00 - FDFF: I/O space (6809 uses memory-mapped I/O)
 FE00 - FFEF: Boot rom
 FFF0 - FFFF: Interrupt vector table

Sub CPU
 0000 - 3FFF: Video RAM bank 0 (Blue plane)
 4000 - 7FFF: Video RAM bank 1 (Red plane)
 8000 - BFFF: Video RAM bank 2 (Green plane)
 C000 - C2FF: (RAM) working area
 C300 - C37F: Shared RAM between main and sub CPU
 C400 - FFDF: (ROM) Graphics command code
 FFF0 - FFFF: Interrupt vector table

(Since it's been quite a while, I am not sure if the above

addresses are correct. But the general layout looks like that).

When you use PEEK() or POKE(), you are accessing the main CPU's memory. It's not easy to access sub CPU's memory directly (usually you do it indirectly by invoking graphics commands), because the only communication channel between main and sub CPUs is the 128 byte shared RAM. You will need to write assmebly code to talk the sub CPU to access its memory.

```
Graphics resolution:
   640*200 (8 color)
   (or you can use it as 3 separate monochrome pages)
Text mode:
   80*25 or 40*25 (Use WIDTH [width], [height] to change it).
Sound:
   3 SSG channels (triangle wave)
   3 noise channels
```

To run F-BASIC using the DRIVE, you need a DISK F-BASIC disk. The BASIC code stored in ROM doesn't contain the portion to support disk. (This means when you run DISK F-BASIC, you have only about 25k RAM free for F-BASIC mode).

Use the LOAD and SAVE commands to load/save your BASIC program to tape. The tape runs at about 1600bps. The cassette output DIN on the back of the FM-7 is an 8-pin DIN jack, different than the CoCo.

Try this command: MON. This is the system monitor. Don't expect too much... it's a very primitive monitor. You only get only four commands:

```
   R    -     display and change register values
   M [addr] - modify memory (use . to terminate M mode)
   D [addr] - dump memory
   G [addr] - execute code at [addr]
```

It doesn't even have a quit command! You have to hit the BREAK key to return to F-BASIC.

For the most part, the BASIC is the same as regular Microsoft BASIC. The main differences are in the graphics and sound related stuff. Here are some of the basics:

```
COLOR foreground,background
COLOR=(color,palette)
PSET (x,y),color,mode
LINE (x1,y1)-(x2,y2),color,box,mode
CIRCLE (cx,xy),radius,color,aspect-ratio,arc-starting,arc-ending
SYMBOL (x,y),"STRING",x-magnification,y-magnification,mode,direction
PAINT (x,y),paint-color,border-color
  color:
    0:black, 1:blue, 2:red, 3:magenta, 4:green, 5:cyan
    6:yellow, 7:white
  box:
    (nothing) - draw a line
    B - draw a box
    BF - draw a filled box
  mode:
    0:preset, 1:pset, 2:or, 3:and, 4:xor
    (I am not too sure about the order)

PLAY "CHANNEL1", "CHANNEL2", "CHANNEL3"
  The music language is like
  "V10o4cdefgabo5c"
  v - volume
  o - octave
  c,c#,d,d#,e,f,g,a,b,c,etc...
  To specify the length of a sound:
  c1, c2, c4, c8, c16, c32...
  or you can use l1,l2,l4... to set the default length
  (there are more commands, but I've forgotten them).
```

```
     To play a simple 3-note, A-major triad [A, C#, E], you'd use
     simply:  PLAY "A", "C#", "E"

  SOUND register,value
     This command is used to generate noise.  You will need the manual
  to create the sound you want because it writes to the sound chip's
  registers directly.  I forgot how to do it.

     As for joysticks, I think you had to buy a joystick card to use
  them. Fujitsu also made an FM sound card (which uses a sine wave,
  rather than the triangle wave), with a joystick port on it.
```

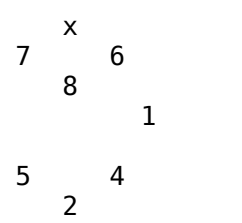
More Information on the DIP Switch and Monitors

EMAIL from a Japanese FM-8 user on the internet:

I received an email from a Japanese FM-8 user on the internet (the FM-8 is a similar machine to the FM-7), and he sent me the wiring chart for the monitor DIN pinouts, as well as more information on the 4-position DIP switch:

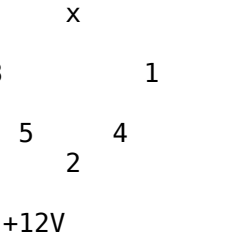
Monitor Pinouts

COLOR CRT (DIN8):



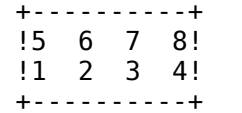
1: +12V
2: GND
3: Video clock (2Mhz)
4: horizontal sync signal
5: vertical sync signal
6: red
7: green
8: blue

MONOCHROME CRT (DIN5):



1: +12V
2: GND
3: composite video signal
4: horizontal sync signal
5: vertical sync signal

color CRT cable, CRT side digital 8pin (I-shape 8pin connector, S1308-SB)



1:open
2:red
3:green
4:blue

```
5:ground
6:ground
7:horizontal sync
8:verticle sync
```

4-position DIP switch info

```
(1) ROM mode/DISK mode* (FBASIC mode)
1=ON, 2=ON, 3=OFF, 4=OFF
(ON=UP, OFF=DOWN.  Number is sequential from left to right)
*when external floppy disk is available

(2)DOS Mode
1=ON, 2=OFF, 3=OFF, 4=OFF

CLOCK Freq.
      MAIN CPU   SUB CPU
4=ON   1.2Mhz    1.0Mhz (FM-8 compatible mode)
4=OFF  2.0Mhz    2.0Mhz
```

Differences between FM-7 and FM-8

Here's part of an email from a friend, explaining the differences between the home-targeted FM-7, and the business-targeted FM-8:

The FM-8 actually came out before the FM-7.
The FM-8 was marketed as a "business" machine whereas the FM-7 was clearly a "hobby" machine. The FM-8 ran at 1.2MHz, slower than the FM-7's 2MHz, but it had a socket for "bubble memory", a sort of memory card at the time (the capacity was much smaller, though, something like 16KB or 32KB). The FM-8 was much more expensive (listing at around 200,000YEN) than the FM-7, which was 126,000YEN. In fact, though the FM-7 was cheaper and more hobby-oriented, functionally-wise it's fully compatible with the FM-8. Other than the bubble memory, there was nothing the FM-8 could do that the FM-7 couldn't. And the FM-7 did it better and faster. The FM-7 had nice graphics and sound capability at a very affordable price, so you can imagine how quickly it seized a good portion of the home market. In comparison, its rival NEC PC-8801 was sold at around 200,000YEN.

Detailed Pictures Inside the FM-7

These pictures were taken off a Japanese-language FM-7 page.
Click on a thumbnail to see the corresponding full-size image.

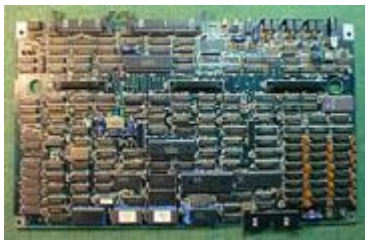
The Fujitsu FM-7...

Another view of the FM-7

The FM-7 with the top cover off. The AC power transformer is under the black metal...

The place to plug in a Z-80 or RS232 card...

The main, middle-layer circuit board, with dual Motorola 6809s and lots of other ICs. Note how crowded the board is with ICs (and it's not the only board in the computer either -- there's another circuit board underneath it)...

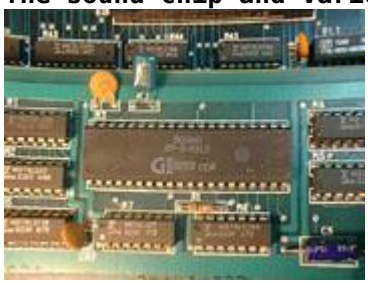


A similar picture with the dual MC6809 CPUs pointed out...

The bottom layer (covered by protective grey metal housing) and speaker, on top of which the main (middle layer) circuit board sits...

Some of the many, many ICs on the middle-layer board (including one of the two Motorola 6809 CPUs)...

The sound chip and various other ICs...



Screen Shots of FM-7 Games Softwares

Click here to see screen shots
of various FM-7 Games.

FM-7 Emulator (XM-7) Project

There is an FM-7 Emulator that has been written for seven different
platforms (including 32-bit Windows) by a Japanese FM-7 affcianado...
its name is "XM-7", and the latest version can be found by going to
the author's homepage (link below). I've included the October 2001
release here on my page, but you might also want to check the author's
homepage (in Japanese) for the latest version, as it's constantly
being updated (note that the original Japanese downloads use LZH for
compression; I changed it to ZIP for download on my page, as ZIP is
a more popular format in the US).

Below is the ZIP file I made containing the October 2001 release of the
emulator (32-bit Windows version), as well as a set of various ROM files.
After unZIPping everything, put all the files (originally located in 3 separate
folders) into ONE folder, and run the emulator (XM7.EXE). F-BASIC will boot up,
and it seems to work fine, but the emulator pull-down menus are in Japanese
(which look like ASCII garbage on non-Japanese PCs) so you'll have to do
trial-and-error to figure out things such as load/save and other features.
Once F-BASIC boots up, you can type in this simple program to see the ROM
character set (English, Japanese katakana, numbers, symbols, and a few kanji):

```
10 for x=0 to 255
20 print chr$(x);
30 next
```

However note that the keyboard layout for the emulator/FM-7 is different
than on a PC: for instance, the left parenthesis is a SHIFT-8, not a SHIFT-9.

Click here to download the XM-7 Emulator.

Click here to read an interview with the author of the XM-7 emulator on
the project (presented in both Japanese and English... if your browser can't
support Japanese, you should still be able to make out the English half).

FM-7 Links

The FM-7 was an extremely popular home computer in Japan, with many different versions throughout the years, so there are plenty of web pages devoted to the machine. I myself am more interested in the first model (the original FM-7) rather than the later models (FM-77, FM-77AV, etc.), but there are plenty of pages out there for anyone interested in these as well. Note that most of the pages are in Japanese, and if you don't have Japanese on your web browser (why not spend a bit of time and download Japanese support for your browser?) the pages will most likely appear as ASCII junk rather than the proper JIS codes. However you can still look around the pages by trial-and-error, and find lots of interesting information.

There are a lot of pages on the FM-7 (just try "www.google.co.jp" and type in "FM-7") but below are a few good places to start:

The main page of the XM-7 Emulator's author is here. The page dealing with the emulator itself (for seven different computer platforms including Windows32) is here.

Yoshimi's Home Page is an extremely good source of information on the FM-7, especially his FM-7 World section (the sub-links here include pages on the FM-7 hardware, FM-7 Game List, FM-7 I/O Map, F-BASIC error messages, 6809 instruction codes, etc.)

Emulation 9 is a Japanese emulation site covering everything from the FM-7 to NeoGeo, NeoGeo Pocket, MAME, HP Calculators, GameBoy, MSX, and other systems. The author of this page interviewed the FM-7 emulator author and translated it into English (available above in my EMULATOR section, or on his page, by clicking here).

Retro PC Network is a page dealing with Japanese Retro PCs. While it's in Japanese, there is a box to click at the upper-left corner of the main page to translate it (loosely) into English. The FM-7 portion of the page (with various tools, files and info on the XM-7 emulator project) is here.

An English-language site in the UK dedicated to emulating Japanese machines is the Japanese Computer Emulation Centre. A download page with the XM-7 emulator and FM-7 System Files is located here.

Though not FM-7 specific, the Old-Computers.Com website is interesting to browse through, and includes a download page for the XM-7 emulator.

Click here to return to the 8-Bit Computer Page,
or click here to return to the main page.