FP6120
SBC6120 FRONT PANEL
USER'S MANUAL

First Edition

CONTENTS

1   OVERVIEW

The FP6120 adds a traditional PDP-8/E style Programmer's Console to any SBC6120 system.

Twenty seven LEDS provide continuous display of the current memory address as well as memory or register contents, and a additional LED displays the running or halted state of the processor. Twelve data switches allow

Figure 1 - The SBC6120 Front Panel

for direct entry of binary data and an additional eight switches provide program control functions including *BOOT*, *ADDRESS LOAD*, *EXTENDED ADDRESS LOAD*, *CLEAR*, *CONTINUE*, *EXAMINE*, *DEPOSIT* and *HALT*.
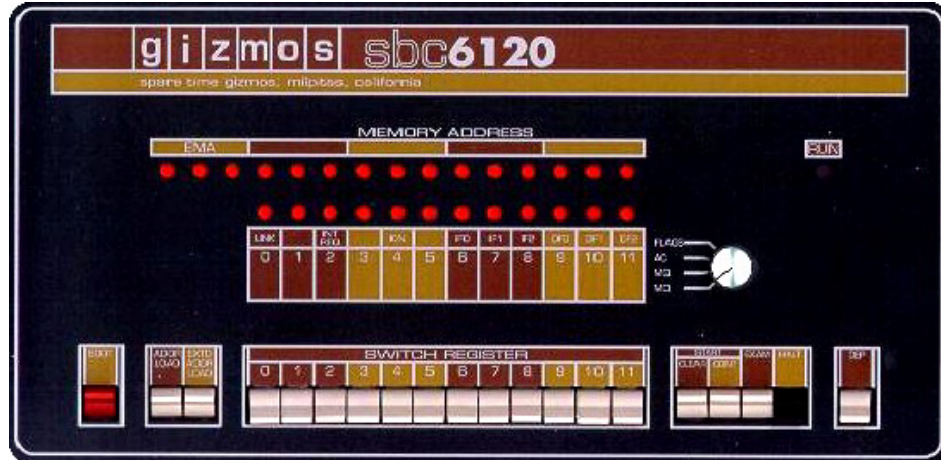

Figure 2 - Complete SBC6120/FP6120 combination hanging on the wall

The FP6120 is designed as a peripheral device which plugs into the standard SBC6120 expansion bus, however because of its physical size the SBC6120 actually mounts directly to the back of the front panel. Additional space is available on the back of the FP6120 to mount another I/O board as well as either a CompactFlash memory card or a standard 2½" laptop hard disk drive. Finally, the FP6120 contains a switching power supply which can supply all necessary power for the SBC6120, one or two daughter boards, and the FP6120 itself from a single unregulated source of +9 to +12VDC.

The front panel façade you see in these photos was professionally screen printed in five colors and then laser cut for the switch openings. The entire FP6120 and SBC6120 assembly, including a hard disk drive, is less than 2" thick and can be framed like a painting and hung on the wall. Just imagine it – a complete PDP-8/E clone, including disk drive, hanging on the wall above your desk!

1.1   REGULATORY WARNING

In the United States, the Federal Communications Commission requires that devices that use and radiate radio frequency energy be certified in accordance with CFR Title 47, Parts 2 and 15. Other countries will have different requirements.

The FP6120 design is not in finished product form and has NOT been approved by the FCC or any other regulatory agency worldwide. The user understands that approvals may be required prior to the operation of the FP6120, and agrees to utilize the FP6120 in keeping with all laws governing its operation in the country of use.

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2   CONSTRUCTION

If you haven't already, then please read the "*Assembly*" section of the <u>SBC6120 User's Manual</u> before reading this.   Many of the points made there, particularly the section on "*Sockets and Soldering*" apply equally well to the FP6120!

2.1   ERRATA

There are no known errors in Revision D of the FP6120 board.

2.2   FIRMWARE NOTES

The FP6120 requires that your SBC6120 have BTS6120 v266 or later. This version may be downloaded from the Spare Time Gizmos web site if you need to upgrade your EPROMs. The FP6120 does not require any changes to the SBC6120 PLDs.

If you intend to use the FP6120 with <u>Jim Kearney's</u> IOB6120, there are more issues you should be aware of:

- The IOB6120 requires a hardware upgrade to work reliably with the FP6120. The last few IOBs assembled and sold by Jim already had this modification, and if your IOB contains a 74HC373 part then yours should be OK. If it contains a 74ACT373, however, talk to Jim about the details of a fix.

- Early versions of the FPGA bit stream include an implementation of the PDP-8 switch register which will conflict with the FP6120 and prevent the front panel switches from working. The latest version of the FPGA bit stream has the switch register removed and can be obtained from <u>http://www.jkearney.com/sbc6120/iob6120.htm</u>.   Follow the instructions in Jim's IOB6120 manual for downloading new FPGA bits to the Flash ROM on the IOB6120.

- Although the FP6120 works with any SBC6120 PLD version, the IOB requires revision B or later of the IOT1 PLD. Spare Time Gizmos is currently shipping revision C of this part.

Contact Jim directly for more information on these IOB updates.

2.3   SBC6120 MODIFICATIONS

SBC6120 Revision D PC boards require that a jumper be added to connect the LXMAR signal to

pin 22 of the expansion connector. Revision E and later PC boards incorporate this change and do not require modification. The revision of your PC board can be found in the etch on the solder side underneath the IDE connector – look for the words "*SBC6120-2x Copyright 200? Spare Time Gizmos*".   The letter "*x*" after the *SBC6120-2* is the revision of your board.
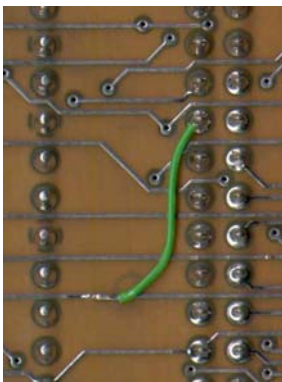
Figure 3 shows the proper way to modify a revision D PC board. Carefully count the pins on the bus connector to locate pin 22, and then count down four more pins to locate the trace that connects U8 pin 23 to U5 pin 34. This trace is LXMAR, and you need to solder a short jumper from it to pin 22 of the bus connector. Since pin 22 was previously unused, no other traces need to be cut.

Spare Time Gizmos is currently shipping Revision E of the SBC6120 PC boards. These boards, and later ones, already incorporate this

connection and do not require modification.

2.4   PARTS SELECTION

2.4.1 Finding Compatible Switches

The FP6120 is designed to use C&K P/N **7101J60V6BE1** (ON-NONE-ON) and **7108J60V6BE1** (ON-NONE-MOM) SPDT PCB mount paddle switches. It's certainly possibly to find exact matches for these part numbers, however there are a number of other switches that can also be used. It's handy to understand something about the C&K nomenclature so you can figure out possible substitutions.

J60 is the actuator style, in this case a 0.460" wide lever. Other styles in the same width, such as the **J1**, **J15** or **J50** rockers, will fit the PC board but probably won't work with the plastic front facade. It's also worth nothing that the actuators are interchangeable between the C&K paddle and rocker switches, so if you have a cheap source for ON-NONE-ON paddle switches, it's possible to remove the paddles from them and install them on the corresponding ON-NON-(MOM) rocker switches.

V6 refers to the PCB mount frame used. The **V61** frame is for our purposes identical and will work without problems. The **V3** and **V31** frames are similar but with different mounting hole spacing, however the FP6120 PC board contains extra holes so that the **V3** and **V31** frames will also fit without problems. The **V2** and **V21**, **V4** and **V41**, **V7**, **V8**, and **V9** frames will all fit the PC board *however* these frames are different heights and will not mate properly with the plastic front panel faceplate.

B refers to the contact material (gold in this case), which is unimportant as far as mechanical concerns go. The only other one you're likely to see is **Q**, silver.

The final **1** at the end of the P/N is the actuator color. **1** is White, **2** is Black, and **3** is Red. Naturally this makes to mechanical difference, but, for example, you might not like the way a row of all red switches looks!

Finally, C&K is not the only possible switch source. Other manufacturers, such as NKK, E-Switch, CTS, etc. make switches that are generally compatible with their C&K counterparts. These manufacturers usually have some sort of cross reference guide to help you find equivalent part numbers.

2.4.2 The LED Bar

The LED Bar is a piece of plastic, approximately 12.4"x1.1" and 5/8" thick with holes drilled in it for every LED. It mounts solder in swage standoffs placed on the PC board with #4-40 screws and serves two purposes. First, the LED bar serves as an "aligner" to keep the LEDs straight and lined up with the corresponding holes in the faceplate. Second, the bar isolates the LEDs so that the light from, say, the MA3 LED doesn't also leak out the opening for the MA2 or MA4 LEDs.

You can build your own LED bar, or you can purchase a nicely milled and drilled one all ready to go directly from Spare Time Gizmos, part number **FP6120-LBK**.

2.4.3 The Faceplate

The faceplate is a piece of 3/16" acrylic plastic, approximately 8 ½" by 15", silk screened with the front panel graphics and cut to clear the switches. It mounts to the front panel PC board with eight #4-40 by 5/8" standoffs which are permanently attached to the faceplate. You can purchase a faceplate separately from Spare Time Gizmos, part number **FP6120-FPK.**

In the faceplate supplied by Spare Time Gizmos the graphics are screen printed, with no less than five colors and five separate printing steps, onto a 15 mil (that's 0.015"!) polycarbonate film.

In a separate step a 3/16" thick piece of acrylic is laser cut to size and drilled for the mounting holes. The mounting hardware is then attached to the back of this panel and permanently glued into place. In yet a third separate step, a sheet of adhesive film is cut to size and then stamped with a custom made die to cut out circular openings in the exact size and position of the LED windows. Now, those three separate pieces, the film with the graphics, the adhesive, and the 3/16" panel are all laminated together into a single piece and finally the entire thing is laser cut again for the switch openings.

One nice feature of process is that the faceplate is all one piece when you get it, so there's no complex assembly required on your part (like aligning and sandwiching a film between two sheets of plastic). Another nice feature is that the silkscreen is actually printed on the back side of the polycarbonate film, so that when it's assembled all the printing is protected from wear and scratches by the 15 mil thick film. And finally, this style of assembly hides leaves the heads of the mounting screws hidden beneath the film, so there's nothing to mar the faceplate graphics.

2.4.4 Integrated Circuits

Either the 74HC366 or 74HC368 Hex Inverting Tri-State buffer may be used in this circuit.[1] The 7555 CMOS timer is known by many different part numbers depending on the manufacturer. The actual 7555 part number is used by Harris/Intersil, however the TLC555 (manufactured by Texas Instruments) is also quite common. The Power Trends (now part of Texas Instruments) switching regulator is available in either a 2A/10W version, the PT78HT205H or a 3A/15W version, the PT78HT305H. Either one will fit the PC board, and you may wish to use the 3A/15W device if you plan to also power a hard disk drive.[2]

2.4.5 Other Parts

C2 and C7 are 0.01 µF monolithic capacitors and are shown on the schematic and PC board, however they are not needed and may be omitted from the FP6120. It does no harm to install them, though, and if you already have then there's no need to remove them.

2.5 ASSEMBLY INSTRUCTIONS

In the following instructions, the "front" of the PC board refers to the component side (the one with the silk screen) and the "back" of the PC board is the solder side (opposite the silk screen). The "top" of the PC board is the edge that contains the Spare Time Gizmos logo, and the "bottom" of the PC board is the edge with all the switches.

2.5.1 Swage Standoffs

Solder in, swage, ⅛" by #4-40 standoffs are used to mount the LED bar, the SBC6120 and an I/O daughter board (if any). Some of these standoffs are mounted on the front (component) side of the PC board and some are mounted on the back (solder) side, and it's very important to identify the correct holes for each standoff.

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[1] If you purchased the kit version, either part may be supplied.

[2] The PT78HT205H is supplied with the full kit.
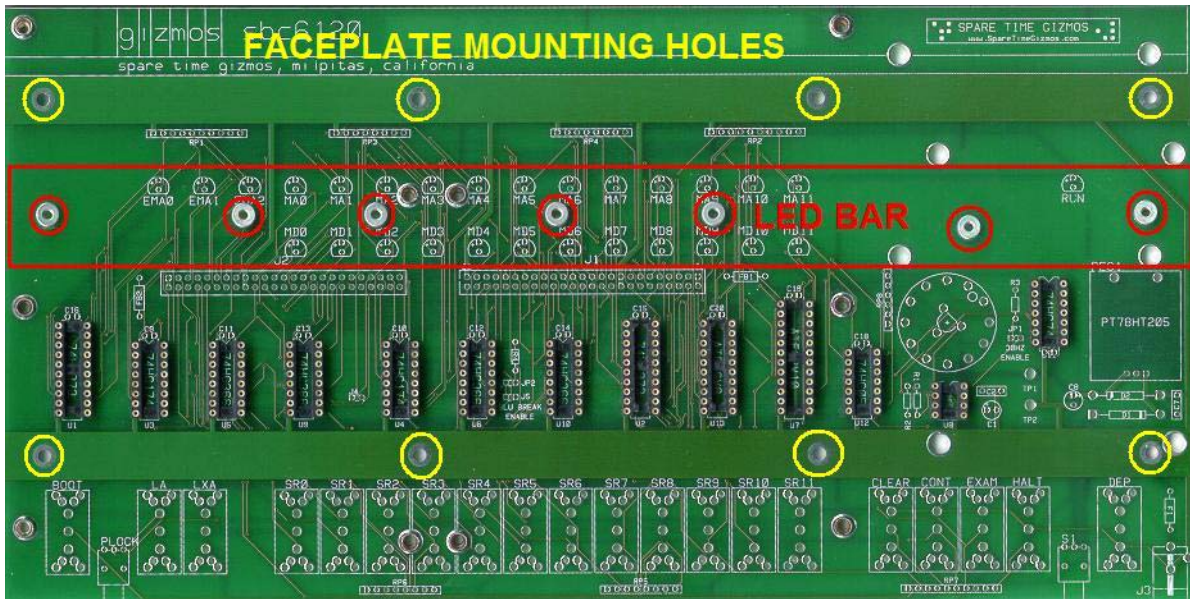
Figure 4 -Mounting Holes (Component Side)

Figure 4 shows the component side of a partially assembled FP6120 PC board. The outline of the LED bar is shown and the seven swage standoffs used for mounting the LED bar are circled. These standoffs are all mounted with their threaded parts on the front (component) side of the PC board and are soldered on the back (solder) side.

Figure 4 also shows the eight mounting holes used by the faceplate assembly. These holes do *not use* swage standoffs!

Figure 5 shows the solder side of the same FP6120 PC board and the outlines of the SBC6120 board, the I/O board, the CompactFlash adapter, and the IDE disk drive. The colored circles indicate the corresponding mounting holes for each device. The SBC6120 and I/O board each use five swage standoffs, and in this case the standoffs are installed with their threaded part on the *solder* side of the PC board and are soldered on the *component* side.

Figure 5 - Mounting Holes (Solder Side)

2.5.2 Small Components

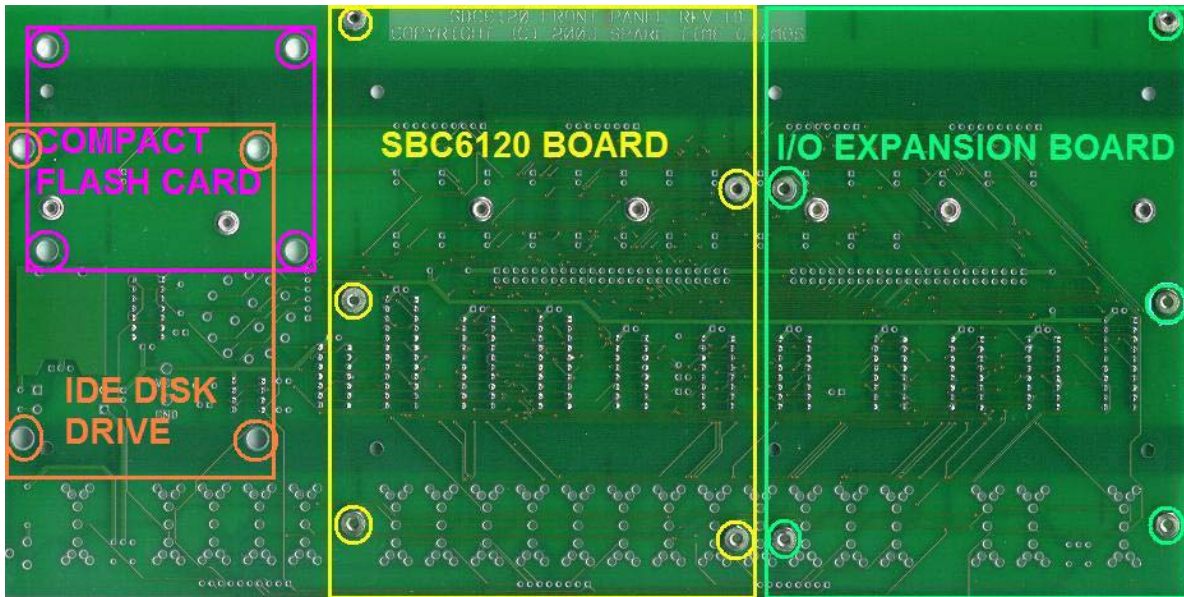✓ Mount the small components, such as the IC sockets, resistors, capacitors, and the voltage regulator **REG1**, next. Above all, *do not* mount the LEDs, switches, or connectors now.

✓ All the resistor packs used are the type that has one common pin. Be sure to mount them with the common pin as #1, which is indicated by a square pad on the PC board. You may wish to socket **RP1** thru **RP4** if you want to change them later to adjust the LED current[3]. **RP5** thru **RP8** are always 4.7K and there's no point in socketing them.

2.5.3 Power Switch, Panel Lock and Power Connector

✓ The power switch (**S1**), panel lock switch (**PLOCK**) and DC power connector (**J3**) may all be mounted directly to the PF6120 PC board. However, if you plan to install the FP6120 in an enclosure of some kind it may be more convenient to mount these switches off the PC board, or even remove them all together.

The panel lock switch (**PLOCK**) may be omitted without problems (it will default to unlocked if it is not installed) or you may connect it to an external switch (perhaps a key switch or some kind) using wire jumpers.

If you mount the power switch (**S1**) elsewhere it's probably easier to simply wire it in series with the power supply rather than connecting it to the pads for **S1** on the PC board. If you do this, be *sure to solder a wire jumper between the pads for S1* on the FP6120 PC board to provide continuity for the power circuit!

If you mount the DC power jack, **J1**, off the PC board be careful of the polarity – the center pin is *positive* and the sleeve is *negative*!

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[3] Sockets for these resistor packs are *not* included in the FP6120 full kit.

2.5.4 <u>Bus Connectors</u>

✓ **J2** is a female, non-stacking bus connector which you should mount on the *solder* side of the PC board. You will be soldering its pins on the *component* side.

✓ **J1** is a stacking bus connector which you should mount with the female part on the *component* side of the PC board. The stacking pins should extend thru the solder side, and you solder it normally, on the solder side. Try to keep the solder down around the pads when soldering this connector, and don't get any solder on the ends of the pins.

✓ **J5** is a two pin female header which mates with the console CPREQ header on the SBC6120. That's the two pin header immediately to the right of the HD6120 CPU chip. **J5** should be installed on the back side of the front panel PC board. You may also need to replace the header on the SBC6120 with one that has longer pins (the wire wrap style are plenty long) to ensure that it makes connection with J5[4].

Having said that, ***be sure that the pins aren't too long*** - you could crack the PC board when you tighten the mounting screws on the SBC6120! In particular, if you do you replace the header on the SBC6120 with a wire wrap version, ***the pins will be way too long!*** The best procedure is to insert the wire wrap header in the SBC6120 PC board *without* soldering it (you can use tape to hold it in place) and then *temporarily* mount the SBC6120 on the back of the FP6120 PC board (see section 0). You can push the pins on the wire wrap header thru the SBC6120 PC board until the correct length is achieved. Then solder them, remove the SBC6120 from the FP6120, and cut off the excess pin length.

Don't confuse **J5** with **JP2** (the SLU Break Enable jumper) on the front panel PC board. **JP2** is closer to the resistor and is a standard two pin header installed on the *top* of the front panel PC board. **J5** is the pair of holes closest to the switch register.

✓ **J4** serves a similar purpose connecting to the CPREQ header on the IOB6120 board. In this case you should have installed a female header on the back side of your IOB and the male header on the back side of the front panel. This arrangement allows you to plug the IOB6120 into the SBC6120 directly, without a front panel, if you ever want to. You'll have the same problems with the length for this pair of headers that you did for the SBC6120, and you can use the same techniques to solve it.

At this point you should have all electronic components mounted EXCEPT the toggle switches, rotary switch and LEDs.

2.5.5 <u>LED Bar and LEDs</u>

✓ Mount the plastic LED spacer bar using seven #4-40 x ⅝" flathead screws into the corresponding swage standoffs. The front of the LED bar is countersunk to fit the screw heads and the back side of the LED bar is recessed to fit the swage standoffs. The LED bar should fit snugly against the PC board and the screw heads should *not* protrude above the top of the LED bar.

The LED Bar supplied by Spare Time Gizmos has five extra holes which are used to secure the piece during the machining process. These holes are easily identified because they are *not* countersunk or recessed, and they should be left empty.

✓ Mount a group of five or six LEDs by pushing them thru the light bar from the front, Be sure to get the polarity right - the long lead goes to the hole marked with a + on the silk screen,

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[4] A two pin wire wrap header for replacing the one on the SBC6120 board is included in the FP6120 full kit.

After you've installed a few LEDs, carefully (so that they don't fall out!) flip the PC board over and lay it upside down on the workbench *so that it is resting on the LED bar.*.

From the solder side, push the LEDs down until the LED face is pressing against the bench - this will ensure that the face of each LED is exactly flush with the surface of the bar. Solder one lead on each LED, flip the assembly over and double check that everything is positioned properly.

When you're satisfied with the LED position solder the other leads, and then repeat this procedure for another group of LEDs. Continue until all 26 are installed.

Figure ?? shows a picture of the FP6120 with the LED bar, LEDs and other small components installed. Notice that the LEDs are flush with the LED bar – be especially careful that the LEDs do not protrude beyond the face of the LED bar, because they might crack the plastic faceplate when it is installed.

2.5.6 <u>Switches</u>

✓ Install the paddle switches next – **SR0** thru **SR11** and **HALT** are "snap action", ON-NONE-ON switches and the rest are all momentary. The momentary switches should be installed so that their toggles point upward in the rest position; that is, you should push their levers *down* to activate them. The sole exception to this rule is the **DEP** switch which, by tradition, is installed "upside down" so that you have to *lift* the paddle to activate it.

✓ Before installing the rotary switch you will need to cut the shaft to a length of approximately 0.400"??, as measured from the top of the threaded sleeve. To improve the front panel clearance, remove the lock washer from the shaft of the rotary switch. *Do not* remove the tang washer (that's the washer with the little finger on it) and be sure to replace the nut after removing the lock washer; it prevents the tang washer from falling out. The tang washer limits the rotation of the switch to four positions, so if you do accidentally remove the tang washer, be sure to replace it with the finger in the hole marked #4.

Notice that the rotary switch has a small round plastic "post" on the top surface that serves as a key. This key is shown on the PC board silk screen and should be about the 2 o'clock position when the switch is correctly installed.

Clearance for the rotary switch is limited, so be sure it is absolutely flat against the PC board when you install it. At first solder only two terminals on opposite sides of the switch, and then use your soldering iron to re-melt the solder on those two terminals while you press the switch down against the PC board with your other hand. Visually inspect it to make sure that it is snug against the PC board before soldering the other terminals.

2.6   INSTALLING THE SBC6120 AND OTHER DAUGHTER BOARDS

The SBC6120, and any I/O daughter board such as the IOB6120 mount to the back (solder) side of the FP6120 using #4-40 ½" *nylon* spacers inserted in the swage standoffs soldered to the PC board. The ½" length of the spacer plus the ⅛" length of the swage gives exactly the correct 0.625" height for these boards that will allow the bus connectors to mate properly. #-4-40 ⅜" nylon screws are used to complete the job.

When installing either the SBC6120 or the IOB6120, be certain that the CPREQ headers mate correctly – the pins should line up with the corresponding female header and the pins must not be too long or too short. See section 2.5.4 for a complete description.

Note that the SBC6120 is installed in the center of the FP6120 "face down" – that is, with the component of the SBC6120 facing the solder side of the FP6120. The I/O expansion board, if any, installs on the right side of the back of the FP6120 "back to back" – that is, with the solder side of the expansion board facing the solder side of the FP6120. Figure 6 illustrates the correct installation of the SBC6120 and an IOB6120 daughter card.
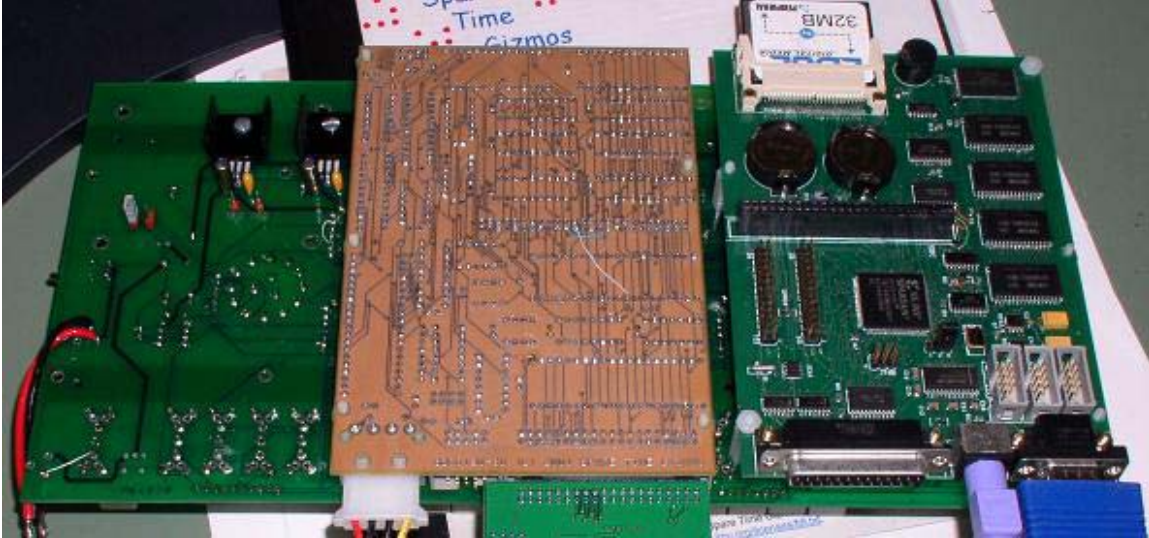
Figure 6 - Assembled FP6120, SBC6120 and IOB6120

3   OPERATION

3.1   INDICATORS

The FP6120 contains a total of twenty eight LED indicators. These indicators provide a continuous display of the memory address, memory data and the contents of several internal processor registers, as described in table Table 1.

MEMORY ADDRESS	Displays the currently addressed memory location while the processor is running, the contents of the program counter when the processor stops, and the address of the location corresponding to the memory data displayed when the rotary switch is set to the **MD** position.
EMA	These LEDs are unused in conjunction with the **MEMORY ADDRESS** LEDs to display a full fifteen bit memory address.
DATA	These twelve LEDs can display either the contents of the memory location indicated by the **MEMORY ADDRESS** and **EMA** LEDs, or the contents of the internal processor accumulator or multiplier quotient registers, or the processor status flags, as selected by the position of the rotary switch.
RUN	This LED is ON when the processor is executing a main memory program and it is OFF when BTS6120 has control.

Table 1 - Front Panel Indicators

3.2   SWITCHES

The FP6120 contains a total of twenty paddle switches for memory modification, program control and data entry functions. Most switches are effective only when the **RUN** LED is OFF (i.e. BTS6120 is in control) and only the switch register, **SR0**..**SR11,** the rotary switch, and the **HALT** switch are enabled when the **RUN** LED is ON. Table 2 describes the function of each switch.

SR0 ... **SR11**	These switches can be used to enter twelve bits of data directly into the PDP-8 program. They may be read by the standard **OSR** or **LAS** instructions. These switches are also used in conjunction with other front panel switches to load memory addresses, data, or flags.
BOOT	Pressing this switch twice executes the default bootstrap which searches for a valid boot block on the **ID** and **VM** devices. This action is exactly equivalent to typing the BTS6120 **B** command without arguments.

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NOTE

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The **BOOT** switch must be pressed *twice*, without any other intervening switch or command, to take effect.

ADDR LOAD	Pressing the **ADDRESS LOAD** switch loads the contents of the switch register into the program counter. The address is displayed on the **MEMORY ADDRESS** LEDs and, if the rotary switch is set to the **MD** position, the contents of the corresponding memory location is displayed on the **DATA** LEDs.

EXTD ADDR LOAD	Pressing the **EXT**ended**D ADDR**ess **LOAD** switch loads the contents of switch register bits 6..8 into the instruction field register and switch register bits 9..11 into the data field register. The remaining bits of the switch register are ignored. The **EMA** LEDs will display the new instruction field and, if the rotary switch is set to the **MD** position, the contents of the corresponding memory location is displayed on the **DATA** LEDs.
CLEAR	Pressing the **CLEAR** switch clears the internal processor registers including the **AC**, **MQ**, **IF**, **DF**, **LINK**, **SP1** and **SP2**. It also initializes all peripheral devices by executing the equivalent of a **CAF** (Clear All Flags) instruction. Note that the **CLEAR** switch does *not* change the contents of the program counter.
CONT	Pressing the **CONT**inue switch starts the main memory program running at the location contained in the program counter. All processor registers retain their original contents. This switch is exactly equivalent to the BTS6120 **C** command. The **RUN** LED is turned on by this switch.
EXAM	Pressing the **EXAM**ine switch increments the program counter and then displays the new address on the **MEMORY ADDRESS** LEDs. If the rotary switch is set to the **MD** position then the contents of this location will be displayed on the **DATA** LEDs.

<div align="center">

NOTE

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The **EXAM**ine switch always increments the PC regardless of the rotary switch setting, however the memory data can be displayed only if the rotary switch is set to **MD**.

HALT	Flipping the **HALT** switch down causes the main memory program to stop execution and control returns to BTS6120. The **RUN** LED is turned off. Flipping the HALT switch up allows the main memory program to continue, however *it does not actually start the main memory program running* until the **CONT**inue switch is pressed.
	Pressing the **CONT**inue switch while the **HALT** switch is down executes a single instruction each time the **CONT**inue switch is pressed. This action is equivalent to the BTS6120 **TR** or **SI** commands.
DEP	Lifting the **DEP**osit switch (it is "upside down" from the other spring loaded switches) will deposit the contents of the switch register into the memory location addressed by the program counter. After the data is deposited the program counter is incremented, the **MEMORY ADDRESS** LEDs are updated and, if the rotary switch is set to the **MD** position, the contents of the new location are displayed.

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Table 2 - Front Panel Switches

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3.3 ROTARY SWITCH

This four position rotary switch designates which of four possible registers are displayed on the adjacent twelve **DATA** LEDs.

MD	The **DATA** LEDs display the contents of the memory location indicated by the **MEMORY ADDRESS** and **EMA** displays.
MQ	The **DATA** LEDs display the contents of the Multiplier-Quotient register.

AC	The **DATA** LEDs display the contents of the Accumulator.
FLAGS	The **DATA** LEDs display the current processor flags as follows:

Bit 0	ON if the **LINK** bit is set
Bit 2	ON if an **INT**errupt **REQ**uest is asserted
Bit 4	ON if interrupts are enabled
Bits 6..8	Displays the current contents of the instruction field register
Bits 9..11	Displays the current contents of the data field register

Table 3 - Rotary Switch Positions

3.4 POWER AND PANEL LOCK SWITCHES

If the **Power** switch, **S1**, and **Panel Lock** switch, **PLOCK**, are mounted on the PC board then they will be two tiny toggle switches along the lower edge of the front panel. **Power** is on the right and **Panel Lock** is on the left.   Frequently these switches will be mounted off the PC board; see section 2.5.3.

The **Power** switch, of course, switches power on and off for the entire SBC6120/FP6120 assembly.

The **Panel Lock** switch will disable all front panel switches except for the switch register (**SR0** .. **SR11**) and the rotary switch. **Panel Lock** has no effect on the data displayed by the LEDs.

3.5 DIFFERENCES BETWEEN THE FP6120 AND THE PDP-8/E

The operation of the **EXAM**ine switch on the FP6120 is subtly different from a real PDP-8/E. A real PDP-8/E *post-increments* the address register. This means that on a real PDP-8/E the **DATA** LEDs display the contents of location **(n)**, however at the same time the **MEMORY ADDRESS** LEDs show **n+1**! In the FP6120 the **MEMORY ADDRESS** and **DATA** displays are always synchronized; i.e. the data displayed is always the contents of the address displayed.

In a real PDP-8/E it's not possible to use the **EXAM**ine switch to step thru a sequence of locations, find one that you want to change, load the new data into the switch register, and press **DEP**osit. That's because a real PDP-8/E post-increments after the **EXAM**ine switch is pressed and the **MEMORY ADDRESS** displayed is actually one more than the corresponding data displayed. If you press **DEP**osit at this point you'll actually change the location *after* the one you wanted to change! The FP6120 doesn't have this problem, and you can mix the **EXAM**ine and **DEP**osit switches without any unexpected consequences.

The rotary switch on the FP6120 has two fewer positions than a PDP-8/E – the missing options are **BUS** and **STATE**. Also, the FLAGS position of the FP6120 omits a few bits that are displayed on the PDP-8/E; in particular, the **USER MODE**, **INTERRUPT INHIBIT** and **GREATER THAN FLAG** bits are absent.

In a real PDP-8/E the **BOOT** switch was actually labeled **SW** (the "**SWITCH**" switch!) and was intended as a generic OMNIBUS control signal. To the best of my knowledge it was never used for any purpose *other* than to trigger the MI8E bootstrap loader, which is consistent with the **BOOT** label on the FP6120. Also, in the FP6120 it is necessary to press the **BOOT** switch *twice* before it has any effect; this is to prevent an accidental activation of this switch.[5]

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[5] The PDP-8/A (not the /E!) Programmer's Console has a button labeled "**BOOT**" which has exactly the same effect as the **SW** switch on the 8/E. In the case of the PDP-8/A, however, the BOOT button also must be pressed *twice* before it has any effect.

The PDP-8/E front panel also had a **SING**le **STEP** switch which would execute a *single memory cycle*. The SBC6120 has no equivalent function, however note that the PDP-8/E **SING**le **STEP** switch *did not* execute a single instruction! In the PDP-8/E a single instruction was executed by leaving the **HALT** switch down while pressing **CONT**inue, which is exactly the same method used by the SBC6120/FP6120.

Because of the missing key switch and **SING**le **STEP** switch, the switches on the FP6120 have been re-arranged slightly to keep the panel "balanced". In particular, the **LOAD ADDR**ess and **EXT**ende**D ADDR**ess **LOAD** switches have been moved from the right side of the switch register to the left.

A. PARTS LIST

REFERENCE DESIGNATOR	MANUFACTURER	PART NUMBER	SUPPLIER	STOCK NUMBER	QTY	DESCRIPTION
U1, U2		74HC373	JDR		2	Octal D Tri-State Latch
U3, U4		74HC174	JDR		2	Hex D flip-flop
U5, U6, U9, U10		74HC366 or 368	JDR		4	Hex Tri-State Inverting Buffer (either the 74HC366 or 74HC368 may be used!)
U7	Atmel	ATF22V10B15PC	Arrow		1	CMOS PLD (Flash)
U8		7555	JDR		1	CMOS Timer (may be TLC555)
U11		74HC74	JDR		1	Dual D flip-flop
U12		74HC05	JDR		1	Hex Open Drain Inverting Buffer
U13	Atmel	ATF16V8B15PC	Arrow		1	CMOS PLD (Flash)
REG1	TI	PT78HT205H	Digikey	PT78HT205H	1	5V 2A Switching Regulator 3 pin SIP Horizontal (Can use PT78HT305H for extra current)
D1		1N5820	Digikey	1N5820GICT	1	Schottky Diode 3A 20V DO-201
D2		1N5339	Digikey	1N5339BMSCT	1	Zener Diode 5.6V 5% 5.0W T-18
F1	Littelfuse	473.003	Digikey	F1204CT	1	3A picofuse
R1			Digikey	BC10.0KXCT	1	10.0K 1% 1/8W carbon resistor
R2			Digikey	BC17.4KYCT	1	17.4K 1% 1/8W carbon resistor
R3, R4					2	10K 5% 1/8W carbon resistor
RP1, RP2			Digikey	4310R-1-561	2	560 ohm 10 Pin SIP Resistor
RP3, RP4			Digikey	4308R-1-561	2	560 ohm 8 Pin SIP Resistor
RP5, RP6			Digikey	4308R-1-472	2	4.7K ohm 8 Pin SIP Resistor
RP7			Digikey	4310R-1-472	1	4.7K ohm 10 pin SIP Resistor
RP8			Digikey	4306R-1-472	1	4.7K ohm 6 pin SIP Resistor
C1			Digikey	399-1429	1	1uF 25V radial lead tantalum capacitor
C2, C7			Digikey	399-1906	2	Unused (0.01uF 10VDC Mono ceramic capacitor)
C8			Digikey		1	100uf 25V radial lead aluminum electrolytic
C9, C10, C11, C12, C13, C14, C15, C16, C18, C19, C20, C21					12	0.1uF 50V mono ceramic capacitor (0.1" lead spacing)
J1	Comm Con	1184-50G2	STG	1184-50G2	1	50 pin Male / Female Stackable connector
J2	Comm Con	1185-50G	STG	1185-50G	1	50 pin Female connector

REFERENCE DESIGNATOR	MANUFACTURER	PART NUMBER	SUPPLIER	STOCK NUMBER	QTY	DESCRIPTION
J3	CUI Stack	PJ-102AH	Digikey	PJ-102AH	1	PCB Mount Jack 2.1 x 5.5mm High Current
J4						2 pin male header (see section 2.5.4)
J5						2 pin female header (see section 2.5.4)
JP1, JP2			Jameco	SMH02	2	2 pin header (Jumper)
FB1, FB2					2	Ferrite Bead (0.400" Lead spacing)
S1, PLOCK	C&K	T101MH9ABE	Digikey	CKN1067	2	SPDT Tiny Toggle Switch, PCB Mount Right Angle
	C&K	7101J60V6BE1			13	SPDT PCB mount paddle switch, ON-NONE-ON
	C&K	7108J60V6BE1			7	SPDT PCB mount paddle switch, ON-NONE-MOM
	Lorlin	10WA346	Mouser	10WA346	1	3 pole 4 position PCB mount rotary switch
	Kingbright	L53ID	Mouser	604-L53ID	28	Red LED, T1-3/4 high efficiency
	Keystone	8555	Digikey	8555K	1	Knob, round 0.7" diameter
	Keystone	1560A	Mouser	534-1560A	20	4-40 solder in stand offs, 0.125" high, 0.250" diameter
			Spare Time Gizmos	FP6120-1D	1	FP6120 PC board, revision E
			Spare Time Gizmos	FP6120-FPK	1	FP6120 Faceplate Kit
			Spare Time Gizmos	FP6120-LBK	1	FP6120 LED Aligner/Spacer Bar Kit
					1	24 Pin Machined Pin DIP Socket (0.300")
					3	20 Pin Machined Pin DIP Socket
					6	16 Pin Machined Pin DIP Socket
					2	14 Pin Machined Pin DIP Socket
					1	8 Pin Machined Pin DIP Socket
					5	#4-40 1/2" round nylon M/F spacers
					5	#4-40 1/4" nylon screws

Table 4 – FP6120 Parts List