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FORCE COMPUTERS
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SYS68K/CPU-60

Installation Guide

P / N 215941 Revision AB
October 2001

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Page **Tab./Fig.**

Using This Manual

This section does not provide information on the product but on common features of the manual itself:

- its structure
- special layout conventions
- related documents

Audience of the Manual and Overview of the Manual

This *Installation Guide* is intended for hard- and software developers as well as support and service engineers installing the SYS68K/CPU-60. It is packaged and shipped together with the product.

Note: Please take a moment to examine the *Table of Contents* to see how this documentation is structured. This will be of value to you when looking for information in the future.

This *Installation Guide* includes the installation instructions for powering up the board, in detail:

- the default configuration of the board, for example, the default switch setting
- initialization prerequisites and procedures
- connector pinouts

The installation instructions are also published in the product's *Technical Reference Manual* – a separate manual delivered as separate price list item. The *Technical Reference Manual* includes

- an overview of the product, its specification and ordering information
- a detailed hardware description
- the circuit schematics of the board for reference purposes
- the data sheets of board components that are relevant for configuring and integrating the board in systems
- a detailed software description

Table a **History of manual publication**

Order No.	Edition	Date	Description
204074	1	May 1996	First print
204074	2	June 1996	Correcting the description of the SYSF LED and of SW10-1/10-2/ 11-1/11-2 and 12-1…4
204074	3	April 1997	Revised safety notes
204074	4	August 1997	Corrected pinout of front-panel serial I/O port and added maintenance safety note
204074	5.0	December 1998	Editorial changes, information on FH-422T added
204074	6.0	January 1999	Switch settings for RS-485 corrected
204074	7.0	September 1999	Added safety note on not using the IOBP-1 if serial port #2 is configured RS-422. Editorial changes
204074	8.0	August 2001	Added German Sicherheitshinweise
215941	AA	October 2001	Revised chapters Safety Notes and Sicherheitshinweise
215941	AB	October 2001	Editorial changes

Table b **Fonts, Notations and Conventions**

Notation	Description
	All numbers are decimal numbers except when used with the following notations:
0000.0000_{16}	Typical notation for hexadecimal numbers (digits are 0 through F), e.g. used for addresses and offsets. Note the dot marking the 4th (to its right) and 5th (to its left) digit.
0000_{8}	Same for octal numbers (digits are 0 through 7)
0000_{2}	Same for binary numbers (digits are 0 and 1)
`Program`	Typical character format used for names, values, and the like that should be used typing literally the same word. Also used for on-screen-output.
Variable	Typical character format for words that represent a part of a command, a programming statement, or the like and that will be replaced by an applicable value when actually applied.

Icons for Ease of Use: Safety Notes and Tips & Tricks

3 levels of safety notes and the following respective layouts appear in this manual. Be sure to always read and follow the safety notes of a section first – before acting as documented in the other parts of the section.

Danger



Dangerous situation: serious injuries to people or severe damage to objects.

Caution



Possibly dangerous situation: slight injuries to people or damage to objects possible.

Note: No danger encountered. Pay attention to important information marked using this layout.



1 Safety Notes

This section provides safety precautions to follow when installing, operating, and maintaining the SYS68K/CPU-60.

We intend to provide all necessary information to install and handle the SYS68K/CPU-60 in this Installation Guide. However, as the product is complex and its usage manifold, we do not guarantee that the given information is complete. If you need additional information, ask your Force Computers representative.

The SYS68K/CPU-60 has been designed to meet the standard industrial safety requirements. It must not be used except in its specific area of office telecommunication industry and industrial control.

Only personnel trained by Force Computers or persons qualified in electronics or electrical engineering are authorized to install, maintain, and operate the SYS68K/CPU-60. The information given in this manual is meant to complete the knowledge of a specialist and must not be taken as replacement for qualified personnel.

EMC

The board has been tested in a Standard Force Computers system and found to comply with the limits for a Class A digital device in this system, pursuant to part 15 of the FCC Rules respectively EN 55022 Class A. These limits are designed to provide reasonable protection against harmful interference when the system is operated in a commercial, business or industrial environment.

The board generates and uses radio frequency energy and, if not installed properly and used in accordance with this Installation Guide, may cause harmful interference to radio communications. Operating the system in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

If you use the board without a PMC module, cover empty slots with blind panels to ensure proper EMC shielding. If boards are integrated into open systems, always cover empty slots.

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Installation

Electrostatic discharge and incorrect board installation and removal can damage circuits or shorten their life. Therefore:

- **Before touching boards or electronic components, make sure that you are working in an ESD-safe environment.**
- **Before installing or removing the board, check ““Power supply” on page -9 and read “Installation” on page -9.**
- **When plugging the board in or removing it, do not press on the front panel but use the handles.**
- **Before installing or removing an additional device or module, read the respective documentation.**
- **Before installing or removing the board in a VME rack, turn off the power.**
- **Make sure that the board is connected to the VME backplane via all assembled connectors and that power is available on all power pins.**

Operation

While operating the board ensure that the environmental and power requirements are met.

When operating the board in areas of electromagnetic radiation ensure that the board is bolted on the VME system and the system is shielded by enclosure.

Make sure that contacts and cables of the board cannot be touched while the board is operating.

Replacement/Expansion

Only replace or expand components or system parts with those recommended by Force Computers. Otherwise, you are fully responsible for the impact on EMC and the possibly changed functionality of the product.

Check the total power consumption of all components installed (see the technical specification of the respective components). Ensure that any individual output current of any source stays within its acceptable limits (see the technical specification of the respective source).

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Battery

The board is designed to be maintenance-free. However, a Lithium battery is installed on the board. The battery provides a data retention of seven years summing up all periods of actual battery use. Therefore, Force Computers assumes that there usually is no need to exchange the battery except for example in case of long-term spare part handling.

- **Incorrect exchange of Lithium batteries can result in a hazardous explosion.**
- **Exchange the battery before seven years of actual battery use have elapsed.**
- **Exchanging the battery always results in data loss of the devices which use the battery as power backup. Therefore, back up affected data before exchanging the battery.**
- **Always use the same type of Lithium battery as is already installed.**
- **When installing the new battery, ensure that the marked dot on top of the battery covers the dot marked on the chip.**

RJ-45 Connector

An RJ-45 connector is used for both telephone connectors and twisted pair Ethernet (TPE) connectors. Mismatching these two connectors may destroy your telephone as well as your board. Therefore:

- **TPE connectors have to be clearly marked as network connectors.**
- **TPE bushing of the system is connected only to safety extra low voltage (SELV) circuits.**
- **The total length of the electric cable connected to a TPE bushing may not exceed 100 meters.**

If in doubt, ask your system administrator.

Floppy Drive

There are floppy drives which provide means to connect the floppy disk drive frame electrically with DC ground, e.g. by inserting a jumper on the floppy disk drive.

Before installing a floppy disk drive, make sure that the floppy disk drive is not electrically connected with DC ground.

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Bypass Removal

On the backplane, the jumper for IACKIN-IACKOUT bypass must be removed for proper operation. This is not necessary on active backplanes.

Environment

Always dispose of old boards according to your country's legislation, if possible in an environmentally acceptable way.

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2 Sicherheitshinweise

Dieser Abschnitt enthält Sicherheitshinweise, die bei Einbau, Betrieb und Wartung des SYS68K/CPU-60 zu beachten sind.

Wir sind darauf bedacht, alle notwendigen Informationen zum Einbau und zum Umgang mit dem SYS68K/CPU-60 in diesem Handbuch bereit zu stellen. Da es sich jedoch bei dem SYS68K/CPU-60 um ein komplexes Produkt mit vielfältigen Einsatzmöglichkeiten handelt, können wir die Vollständigkeit der im Handbuch enthaltenen Informationen nicht garantieren. Falls Ihnen Informationen fehlen sollten, wenden Sie sich bitte an Ihren Vertreter von Force Computers.

Das SYS68K/CPU-60 erfüllt die für die Industrie geforderten Sicherheitsvorschriften und darf ausschließlich für Anwendungen in der Telekommunikationsindustrie und im Zusammenhang mit Industriesteuerungen verwendet werden.

Einbau, Wartung und Betrieb dürfen nur von durch Force Computers ausgebildetem oder im Bereich Elektronik oder Elektrotechnik qualifiziertem Personal durchgeführt werden. Die in diesem Handbuch enthaltenen Informationen dienen ausschließlich dazu, das Wissen von Fachpersonal zu ergänzen, können dieses jedoch nicht ersetzen.

EMV

Das Board wurde in einem Force Computers Standardsystem getestet. Es erfüllt die für digitale Geräte der Klasse A gültigen Grenzwerte in einem solchen System gemäß den FCC-Richtlinien Abschnitt 15 bzw. EN 55022 Klasse A. Diese Grenzwerte sollen einen angemessenen Schutz vor Störstrahlung beim Betrieb des Boards in Geschäfts-, Gewerbe- sowie Industriebereichen gewährleisten.

Das Board arbeitet im Hochfrequenzbereich und erzeugt Störstrahlung. Bei unsachgemäßem Einbau und anderem als in diesem Handbuch beschriebenen Betrieb können Störungen im Hochfrequenzbereich auftreten. Warnung! Dies ist eine Einrichtung der Klasse A. Diese Einrichtung kann im Wohnbereich Funkstörungen verursachen. In diesem Fall kann vom Betreiber verlangt werden, angemessene Maßnahmen durchzuführen.

Wenn Sie das Board ohne ein PMC Modul verwenden, schirmen Sie freie Steckplätze mit einer Blende ab, um einen ausreichenden EMV Schutz zu gewährleisten. Wenn Sie Boards in Systeme einbauen, schirmen Sie freie Steckplätze mit einer Blende ab.

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Installation

Elektrostatische Entladung und unsachgemäßer Ein- und Ausbau des Boards kann Schaltkreise beschädigen oder ihre Lebensdauer verkürzen. Beachten Sie deshalb die folgenden Punkte:

- **Bevor Sie Boards oder elektronische Komponenten berühren, vergewissern Sie sich, dass Sie in einem ESD-geschützten Bereich arbeiten.**
- **Lesen Sie vor Einbau oder Ausbau des Boards den Abschnitt “Power supply” den Abschnitt 3 “Installation” auf Seite -9.**
- **Drücken Sie bei Ein- oder Ausbau des Boards nicht auf die Frontplatte, sondern benutzen Sie die Griffe.**
- **Lesen Sie vor dem Ein- oder Ausbau von zusätzlichen Geräten oder Modulen das dazugehörige Benutzerhandbuch.**
- **Schalten Sie den Strom vor dem Einbau des Boards in ein VME Rack oder seinen Ausbau daraus ab.**
- **Vergewissern Sie sich, dass das Board über alle Stecker an die VME Backplane angeschlossen ist und Strom an allen Spannungskontakten anliegt.**

Betrieb

Achten Sie darauf, dass die Umgebungs- und die Leistungsanforderungen während des Betriebs eingehalten werden.

Wenn Sie das Board in Gebieten mit elektromagnetischer Strahlung betreiben, stellen Sie sicher, dass das Board mit dem CompactPCI System verschraubt ist und das System durch ein Gehäuse abgeschirmt wird.

Stellen Sie sicher, dass Anschlüsse und Kabel des Boards während des Betriebs nicht berührt werden können.

Austausch/Erweiterung

Verwenden Sie bei Austausch oder Erweiterung nur von Force Computers empfohlene Komponenten und Systemteile. Andernfalls sind Sie für mögliche Auswirkungen auf EMV und geänderte Funktionalität des Produktes voll verantwortlich.

Überprüfen Sie die gesamte aufgenommene Leistung aller eingebauten Komponenten (siehe die technischen Daten der entsprechenden Komponente). Stellen Sie sicher, dass die Ausgangsströme jedes Verbrauchers innerhalb der

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zulässigen Grenzwerte liegen (siehe die technischen Daten des entsprechenden Verbrauchers).

Batterie

Das Board wurde für einen wartungsfreien Gebrauch entwickelt. Es befindet sich jedoch eine Lithium-Batterie auf dem Board. Die Batterie bietet einen Datenspeicher von bis zu sieben Jahren reiner Betriebsdauer. Daher geht Force Computers davon aus, dass die Batterie nicht gewechselt werden muss, ausser im Falle von Langzeitlagerung von Ersatzteilen.

- **Der Batteriewechsel bringt immer einen Datenverlust bei den Komponenten mit sich, die batteriegepuffert sind. Sichern Sie daher vor dem Batteriewechsel die Daten.**
- **Fehlerhafter Austausch von Lithium-Batterien kann zu lebensgefährlichen Explosionen führen.**
- **Tauschen Sie die Batterie aus, bevor eine Betriebsdauer von sieben Jahren erreicht ist.**
- **Es darf nur der Batterietyp verwendet werden, der bereits eingesetzt ist.**
- **Stellen Sie beim Batteriewechsel sicher, dass die Orientierung des Punktes auf der Batterie der Orientierung des Punktes auf dem Board entspricht.**

RJ-45 Stecker

Das CPU Board ist mit RJ-45 Steckern ausgestattet. Dieser Stecker wird sowohl für Telefonanschlüsse als auch für Netzwerkkabel (Twisted Pair Ethernet - TPE) verwendet. Die Verwechslung dieser Anschlüsse kann sowohl das Telefon als auch das Board zerstören. Beachten Sie deshalb die folgenden Punkte:

- **Vergewissern Sie sich, dass Anschlüsse deutlich als Netzwerkanschlüsse gekennzeichnet sind.**
- **Schließen Sie TPE-Stecker/Netzwerkstecker Ihres Systems nur an Sicherheitskleinspannungskreise (SELV) an.**
- **Vergewissern Sie sich, dass die an einem TPE-Anschluss angeschlossene Leitung eine Gesamtlänge von 100 Metern nicht überschreitet.**

Falls Sie Fragen haben, wenden Sie sich an Ihren Systemadministrator.

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Diskettenlaufwerk

Bei manchen Diskettenlaufwerken kann der Laufwerksrahmen elektrisch mit DC-Ground verbunden werden, z.B. indem man einen Jumper in das Diskettenlaufwerk einführt.

Vergewissern Sie sich vor dem Einbau des Diskettenlaufwerks, dass der Laufwerksrahmen nicht elektrisch mit DC-Ground verbunden ist.

Bypass Entfernung

Um korrekten Betrieb zu gewährleisten, muss der Jumper für den IACKIN-IACKOUT Bypass von der Backplane entfernt werden. Dies ist nicht nötig bei aktiven Backplanes.

Umweltschutz

Entsorgen Sie alte Boards gemäß der in Ihrem Land gültigen Gesetzgebung, wenn möglich umweltfreundlich.

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3 Installation

Note: Before powering up, check this section for installation prerequisites and requirements and check the consistency of the current switch settings (see section 3.3 “Switch Settings” on page 12).

For an overview of the safety notes to be observed refer to section 1 “Safety Notes” on page 1.

3.1 Installation Prerequisites and Requirements

The installation requires only

- a power supply
- and a VMEbus backplane with P1 and P2 connector.

Power supply

The power supply must meet the following specifications:

- required for the processor board: +5 V (3.5 A typical for a SYS68K/CPU-60D/32, 3.0 A typical for a SYS68K/CPU-60D/4)
- required for the RS-232 serial interface and the Ethernet interface:
  - +12 V (0.1 A typical – with no Ethernet MAU plugged)
  - and –12 V (0.1 A typical)

3.1.1 Terminal Connection

For the initial power-up, a terminal can be connected to the standard 9-pin D-Sub connector of serial port 1, which is located at the front panel (see section 3.6 “Serial I/O Ports – SCC” on page 18).

3.1.2 Functional and Location Overview

Figure 1 gives a functional overview, figure 2 highlights the locations of the important SYS68K/CPU-60 components.

Figure 1 Block diagram of the SYS68K/CPU-60

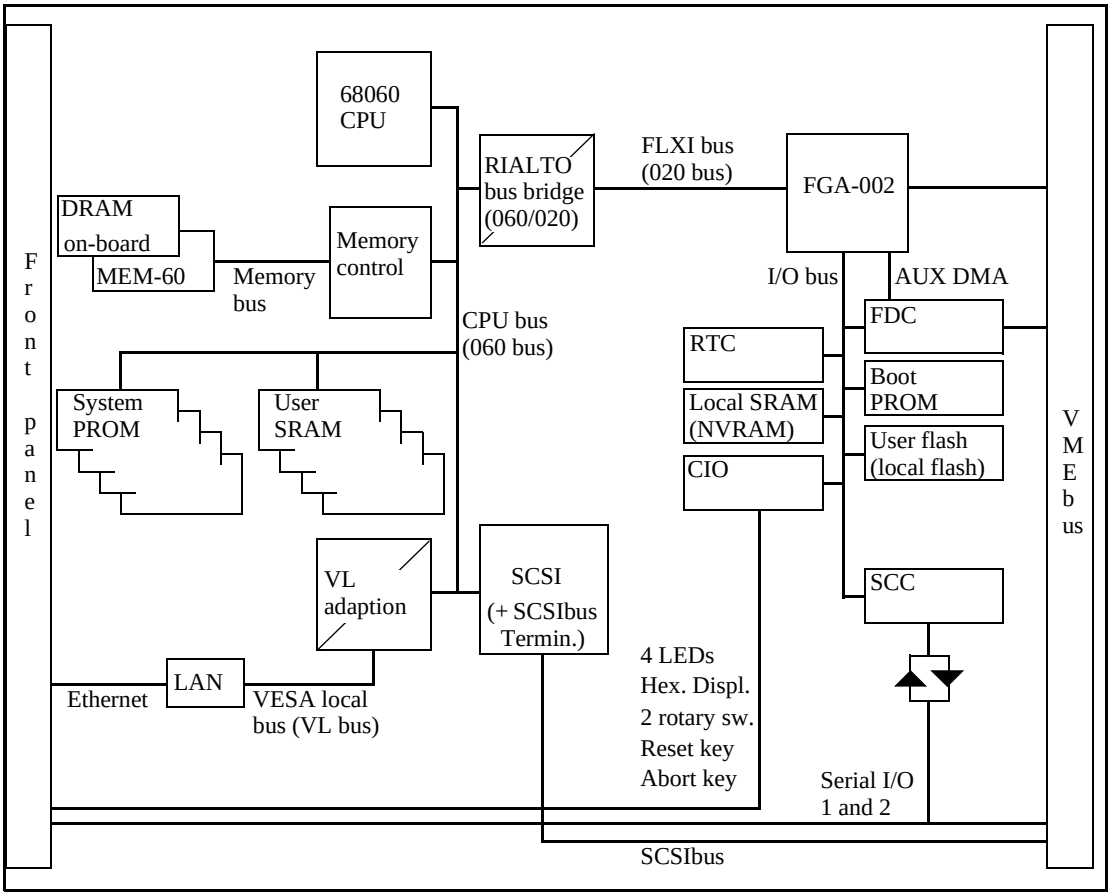
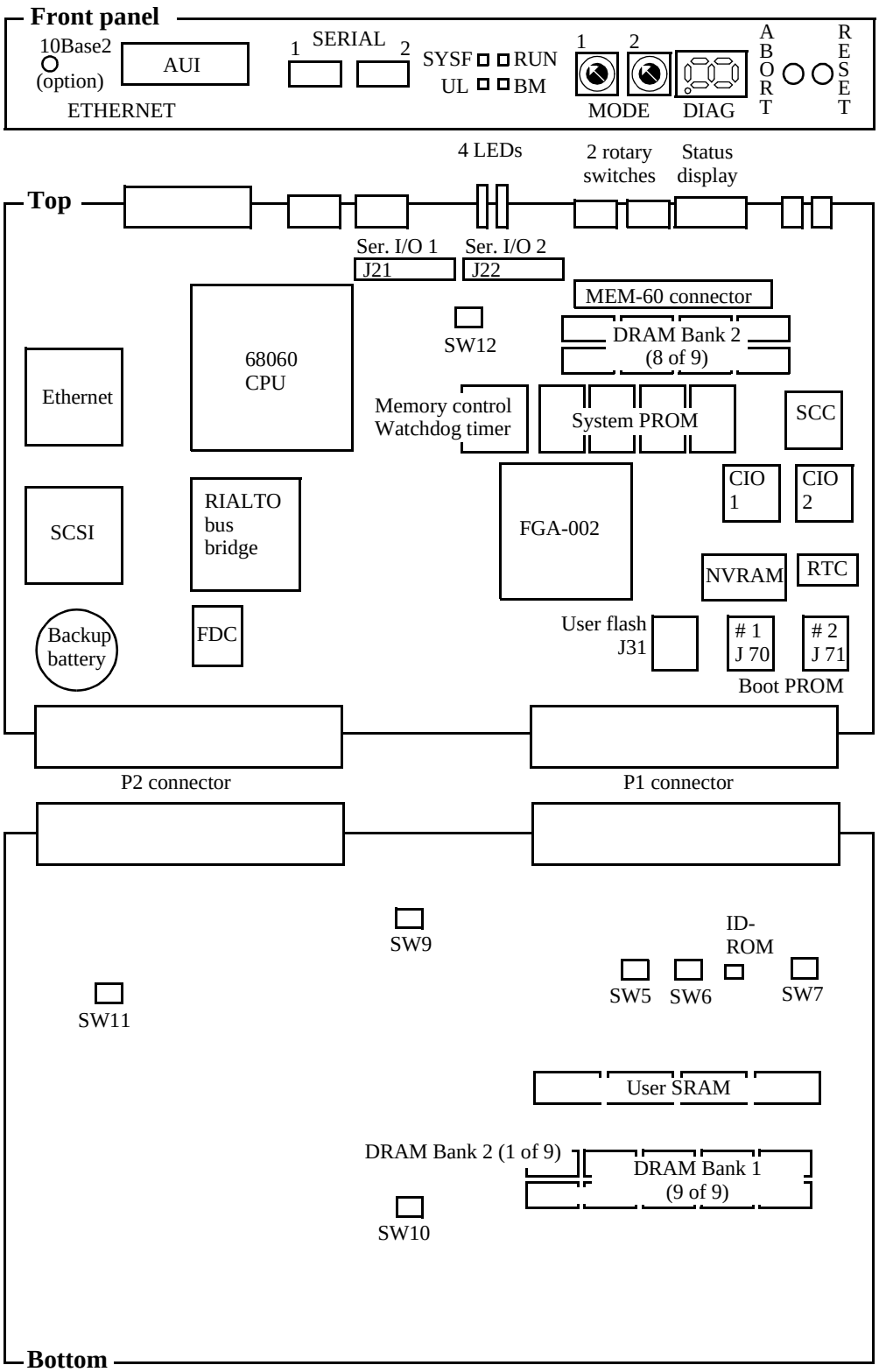


Figure 2 Location diagram of the SYS68K/CPU-60 (schematic)



3.2 Automatic Power Up – Voltage Sensor and Watchdog Timer

In the following situations the CPU board will automatically be reset and proceed with a normal power up:

Voltage sensor

- The voltage sensor generates a reset when the voltage level drops below 4.75 V.

Watchdog timer

- Per factory default the watchdog timer is disabled. If the watchdog timer is enabled, it generates a non-maskable interrupt (NMI) followed by a pseudo power up when it is not re-triggered. The watchdog timer can be enabled by software.

3.3 Switch Settings

The following table lists the function and the default settings of all switches shown in figure 2 “Location diagram of the SYS68K/CPU-60 (schematic)” on page 11.

Note: Before powering up the board check the current switch settings for consistency.
SW6-1, SW6-2, SW6-3, and SW6-4 will only be read on a power up.

Table 1 Switch settings

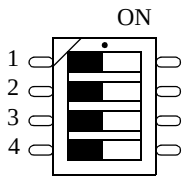
Name and default setting		Description
	SW5-1 OFF	On-board power backup from VME standby OFF = disabled ON = enabled
	SW5-2 OFF	On-board power backup from backup battery OFF = disabled ON = enabled
	SW5-3 OFF	Devices with backup OFF = RTC ON = RTC, local and user SRAM
	SW5-4 OFF	reserved: must be OFF

Table 1 **Switch settings (cont.)**

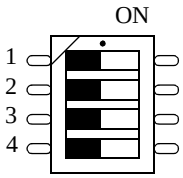
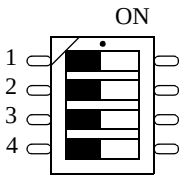
Name and default setting		Description
	SW6-1 OFF	Slot 1 auto-detection OFF = enabled ON = disabled (also called manual mode)
	SW6-2 OFF	Slot 1 manual mode: only available when SW6-1 = ON OFF = disabled ON = enabled
	SW6-3 OFF	VMEbus arbitration level (BR*x** signals) SW6-3SW6-4Level OFFOFF= level 3 (BR3*) OFFON= level 2 (BR2*) ONOFF= level 1 (BR1*) ONON= level 0 (BR0*)
	SW6-4 OFF	
	SW7-1 OFF	Boot PROM configuration OFF = Socket 1 – 0…512 Kbyte, Socket 2 – 512 Kbyte…1 Mbyte ON = Socket 1 disabled, Socket 2 from 0…1 Mbyte
	SW7-2 OFF	Abort key OFF = enabled ON = disabled
	SW7-3 OFF	Reset key OFF = enabled ON = disabled
	SW7-4 OFF	Boot PROM write protection OFF = write-protected ON = writing enabled

Table 1 Switch settings (cont.)

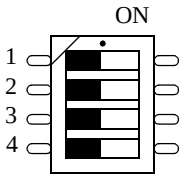
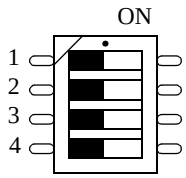
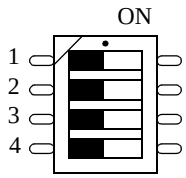
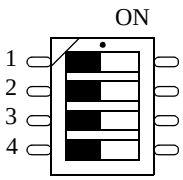
Name and default setting		Description
	SW9-1 OFF	Power up detection level OFF = conforms to VME specification ON = below VME specification
	SW9-2 OFF	The switch setting signals to software: DRAM parity check should be OFF = enabled ON = disabled
	SW9-3 OFF	VMEbus SYSRESET output OFF = enabled ON = disabled
	SW9-4 OFF	VMEbus SYSRESET input OFF = enabled ON = disabled
	SW10-1 OFF	Configuration of serial port 2 depending on SW10-1, SW12-2, and SW12-3 SwitchConfiguration 10-112-212-3 OFFOFFOFF= RS-232 async. ONONOFF= RS-232 sync. slave OFFOFFON= RS-232 sync. master ONONON= RS-422 ONONOFF= RS-485
	SW10-2 OFF	Configuration of serial port 1 depending on SW10-2, SW12-1, and SW12-4 SwitchConfiguration 10-212-112-4 OFFOFFOFF= RS-232 async. ONOFFON= RS-232 sync. slave OFFONOFF= RS-232 sync. master ONONON= RS-422 ONOFFON= RS-485
	SW10-3 OFF	System PROM write protection OFF = writing enabled ON = write-protected
	SW10-4 OFF	User flash write protection OFF = writing enabled ON = write-protected

Table 1 Switch settings (cont.)

Name and default setting		Description
	SW11-1 OFF	SCSI-termination SW11-1SW11-2SCSI-termination for OFFOFF=wide and 8-bit SCSI OFFON=only upper 8 bits of wide SCSI ONOFF=only 8-bit SCSI ONON=none
	SW11-2 OFF	
	SW11-3 OFF	reserved: must be OFF.
	SW11-4 OFF	reserved: must be OFF.
	SW12-1 OFF	Configuration of serial port 1 depending on SW10-2, SW12-1, and SW12-4 (see SW10-2)
	SW12-2 OFF	Configuration of serial port 2 depending on SW10-1, SW12-2, and SW12-3 (see SW10-1)
	SW12-3 OFF	
	SW12-4 OFF	Configuration of serial port 1 depending on SW10-2, SW12-1, and SW12-4 (see SW10-2)

3.4 Front Panel

The features of the front panel are described in the following table. For a location diagram see figure 2 “Location diagram of the SYS68K/CPU-60 (schematic)” on page 11.

Note: Toggling the reset key and the abort key at the same time has a special function which is described in the boot software description of the Force Gate Array FGA-002 User’s Manual.

Table 2 Front panel features

Device	Description
RESET	Mechanical reset key: When enabled and toggled it instantaneously affects the CPU board by generating a reset. Depending on SW9-3 the reset generates a VMEbus SYSRESET (see “SW9-3” on page 14). A reset of all on-board I/O devices and the CPU is performed when the reset key is pushed to the UP position. RESET is held active until the key is back in the DOWN position but at least 200 ms guaranteed by a local timer. Power fail (below approximately 4.7 Volts) and power up – both lasting at minimum 200 ms to 300 ms – also force a reset to start the CPU board. For information on enabling the key, see “SW7-3” on page 13.
ABORT	Mechanical abort key: When enabled and toggled it instantaneously affects the CPU board by generating an interrupt request (IRQ) on level 7 via the FGA-002. The abort key is activated in UP position and deactivated in DOWN position. This allows to implement an abort of the current program, to trigger a self-test or to start a maintenance program. For information on enabling the key, see “SW7-2” on page 13.
DIAG	Software programmable hexadecimal display for diagnostics: It can be accessed via the CIO2 port B data register.

Table 2 Front panel features (cont.)

Device	Description
MODE 1 MODE 2	2 hexadecimal rotary switches, each decoded with 4 bit. The status of the rotary switch can be read in the CIO1 port A data register (including MODE x status register). Default for both rotary switches: F_{16}
RUN	68060 CPU status: green normal operation red the processor is halted or reset is active
BM	VME busmaster LED: green if the CPU board accesses the VMEbus as VMEbus master off otherwise
SYSF	SYSFAIL LED: red if SYSFAIL is asserted from the FGA-002 off otherwise
UL	User LED: Software programmable by the RIALTO Bridge configuration register (BCR). Possible status: green or off.
SERIAL 1	2 standard 9-pin D-Sub connectors for serial interface (see section 3.6 “Serial I/O Ports – SCC” on page 18)
SERIAL 2	
ETHERNET (AUI or 10base2)	15-pin AUI Ethernet connector for thick-wire Ethernet (802.3/10base5, see section 3.9 “Ethernet – LAN” on page 24); as factory option Cheapernet (802.3/10base2) is available via an SMB connector instead of the Ethernet AUI interface. An adapter from SMB type to BNC type connector is available from Force Computers..

3.5 SYS68K/CPU-60 Parameters and 16-bit Timers – CIO

Devices: 2 CIO Z8536	
Frequency	4 MHz
Package	44-pin PLCC
Accessible from	68060 CPU
Access address for device #1 for device #2	 $FF80.0C00_{16}$ $FF80.0E00_{16}$
Port width	Byte
Interrupt request level	Software programmable
FGA-002 interrupt	Local IRQ #4

Configurable parameters

Via the two CIO Z8536 devices several parameters can be configured or read, respectively: front panel rotary switch setting, front panel status display, on-board and MEM-60 DRAM size code, CPU-board code, availability of VME A24 extension, AUX DMA direction, programming voltage V_{PP}, configuration of FDC 37C65C control signals, ID-ROM (serial EEPROM), and the six 16-bit timers.

Timers

Six 16-bit timers with a resolution of 500 ns are available.

3.6 Serial I/O Ports – SCC

Device: SCC AM 85C30	
Frequency	8 MHz, 14.7456 MHz
Package	44-pin PLCC
Accessible from	68060 CPU
Access address	$FF80.2000_{16}$
Port width	Byte
Interrupt request level	Software programmable
FGA-002 interrupt	Local IRQ #5

The two serial I/O ports are available via 9-pin standard D-Sub connectors at the front panel. The SERIAL 1 front-panel port is also available on the VMEbus P2 connector (see section 3.10 “VMEbus P2 Connector Pinout” on page 25). All ports may be configured for RS-232, RS-422, and RS-485 standard conformance via installing the respective Force Computers hybrids FH-00*x*.

Factory option

As factory option the SERIAL 2 front-panel port is also available on the VMEbus P2 connector (see section 3.10 “VMEbus P2 Connector Pinout” on page 25). The SERIAL-2-on-P2 and the wide-SCSI factory option are not available simultaneously.

Jumpers and terminations

There are no on-board jumpers to configure the serial ports and no line terminations for RS-422 and RS-485 interfaces. If termination resistors are required to compensate various cable lengths and to reduce signal reflections, they must be installed externally to the SYS68K/CPU-60 (e.g. via a cable connector). The resistor value is application dependent, but a recommended value is 1000 Ω.

Connector availability

Both serial I/O ports 1 and 2 are available via a front-panel 9-pin D-Sub connector, per factory default only serial I/O port 1 is available via the P2 connector:

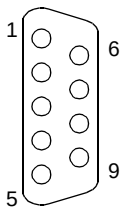
- serial I/O port 1 is wired to the front-panel connector labeled SERIAL 1 and to the VMEbus P2 connector with 7 lines,
- serial I/O port 2 is wired to the front-panel connector labeled SERIAL 2. As a factory option, serial I/O port 2 may also be wired to the VMEbus P2 connector (not available together with wide-SCSI factory option).

For the connection to the IOBP-1 back panel, see section 3.11 “SYS68K/IOBP-1” on page 29.

Pinout

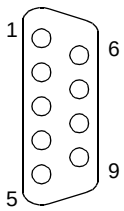
For the front-panel pinout of the serial lines, see below. For the P2 pinout see section 3.10 “VMEbus P2 Connector Pinout” on page 25.

Table 3 **Pinout of the front panel serial I/O ports config. for RS-232**



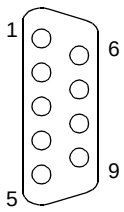
Pin	Signal
1	DCD (Data Carrier Detect, input)
2	RXD (Receive Data, input and output)
3	TXD (Transmit Data, output)
4	DTR (Data Terminal Ready, output)
5	GND (Ground)
6	DSR (Data Set Ready, input and output)
7	RTS (Request to Send, output)
8	CTS (Clear to Send, input)
9	GND (Ground, output): supplied by FH-002 hybrid

Table 4 **Pinout of the front panel serial I/O ports config. for RS-422**



Pin	Signal
1	TXD– (Transmit Data, output)
2	RTS– (Request to Send, output)
3	CTS+ (Clear to Send, input)
4	RXD+ (Receive Data, input)
5	GND (Signal GND)
6	TXD+ (Transmit Data, output)
7	RTS+ (Request to Send, output)
8	CTS– (Clear to Send, input)
9	RXD– (Receive Data, input)

Table 5 Pinout of the front panel serial I/O ports config. for RS-485



Pin	Signal
1	RX-, TX-
2	GND
3	To be connected to GND via RS-485 cable
4	n.c.
5	GND
6	RX+, TX+
7	To be connected to GND via RS-485 cable
8	GND
9	n.c.

Note: In case of the RS-485 configuration connect the pins 3 and 7 to GND via the RS-485 cable, e.g. by connecting them to the pins 2 and 8, respectively.

Default port setup

- FH-002 installed for RS-232 support
- Asynchronous communication
- 9600 Baud, 8 data bits, 1 stop bit, no parity
- Hardware handshake protocol

Interface options

To easily vary the serial I/O interfaces according to the application's needs Force Computers has developed RS-232, RS-422, and RS-485 hybrid modules: the FH-002, FH-003/FH-422T, and FH-007. The difference between FH-003 and FH-422T is that FH-422T has internal termination resistors. For each serial I/O port one of these 21-pin single in-line (SIL) hybrids is installed on-board:

- serial I/O port 1: hybrid installed in location J21
- serial I/O port 2: hybrid installed in location J22

After installing the correct hybrid for the port under consideration the port has to be configured accordingly by using the appropriate switch setting. Thereby, the following options are selectable:

- FH-002 installed:
  - RS-232 asynchronous
  - RS-232 synchronous master
  - RS-232 synchronous slave
- FH-003/FH-422T installed:
  - RS-422
- FH-007 installed:
  - RS-485

Switches selecting serial I/O options

The following switches apply to the port configuration:

- port 1: SW10-2, SW12-1, SW12-4 (see “SW10-2” on page 14),
- port 2: SW10-1, SW12-2, SW12-3 (see “SW10-1” on page 14).

3.7 SCSI

Device: SCSI 53C720SE	
Frequency	CPU bus frequency
Package	PQ160
Accessible from	68060 CPU
Access address	$\texttt{FFF8.0000}_{16}$
Port width	Long
Interrupt request level	Software programmable
FGA-002 interrupt	Local IRQ #6

The SCSI 53C720SE provides an 8-bit SCSI interface which is routed to the VMEbus P2 connector. The 8-bit SCSI interface at the VMEbus P2 is pinout compatible to the CPU-30 and CPU-40 (with EAGLE-01 or EAGLE-10/11).
The local bus interface is 32-bit wide and able to transfer data via the DMA controller of the SCSI 53C720SE.

The active termination can be selected by means of switches (see “SW11-2” and “SW11-1” on page 15). TERMPWR is supported.

Factory option

A 16-bit single-ended SCSI interface (wide SCSI) which is routed to the VMEbus P2 connector is available as factory option (see section 3.10 “VMEbus P2 Connector Pinout” on page 25). The wide-SCSI and the SERIAL-2-on-P2 factory option are not available simultaneously.

SCSI Bus Termination

Note: According to the SCSI specification, the interconnecting flat cable must be terminated at both ends.

- Before connecting SCSI devices ensure correct SCSI bus termination:
  - If the CPU board is not located at either end of the cable, the termination must be disabled.
  - If the CPU board is located at the cable’s end, the termination must be enabled.

On the SYS68K/CPU-60 the termination of the SCSI bus is done by active terminators with a disconnect feature. This allows the outputs to be shut down to remove the terminator from the SCSI bus. It also reduces the standby power.
The disconnect input of the terminators is controlled by SW11-1 and SW11-2: default “OFF OFF = wide and 8-bit SCSI”, see page 15.

SCSI bus terminator power

The power for the terminator of any SCSI device will be provided from the CPU board directly, or from the SCSI bus itself. If the termination power is not delivered from any other SCSI device, it is delivered from the CPU board.
The TERMPWR (terminator power) supply from the CPU board is protected by a self-resetting fuse (1A max.) and a diode in series, as defined in the SCSI specification.
The on-board terminators draw power from the SCSI bus TERMPWR.

3.8 Floppy Disk – FDC

Device: FDC 37C65C	
Frequency	16 MHz
Package	44-pin PLCC
Accessible from	68060 CPU
Access address	$FF80.3800_{16}$
Port width	Byte
Interrupt request level	Software programmable
FGA-002 interrupt	Local IRQ #1

The FDC signals are available at the VMEbus P2 connector (see section 3.10 “VMEbus P2 Connector Pinout” on page 25).
An I/O back panel can be plugged onto the rear side of the backplane to interface to standard FDC connectors (see section 3.11 “SYS68K/IOBP-1” on page 29).

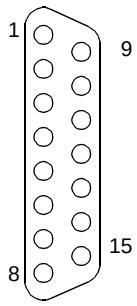
3.9 Ethernet – LAN

Device: LAN AM 79C965A	
Frequency	68060 CPU bus frequency
Package	PQ160
Accessible from	68060 CPU
Access address	$FFF0.0000_{16}$
Port width	Word only in 16-bit mode, long in 32-bit mode
Interrupt request level	Software programmable
FGA-002 interrupt	Local IRQ #7

The Ethernet AUI interface is available at the front panel via a 15-pin D-Sub connector. As factory option Cheapernet is available via an SMB connector instead of the Ethernet AUI interface.

The CPU bus interface is 32-bit wide and able to transfer data via the DMA controller of the AM 79C965A.
The following table shows the pinout of the factory default Ethernet connector:

Table 6 15-pin AUI-Ethernet connector



Pin	Signal
1	GND
2	Collision +
3	Transmit data +
4	GND
5	Receive data +
6	GND
7	n.c.
8	GND
9	Collision –
10	Transmit data –
11	GND
12	Receive data –
13	+12 V DC
14	GND
15	n.c.

Ethernet address

The CPU board's Ethernet address is displayed in the banner when entering FGA Boot.

3.10 VMEbus P2 Connector Pinout

I/O signals

The I/O signal assignment on the VMEbus P2 connector allows interconnections using

- the SYS68K/IOBP-1 (8-bit SCSI, floppy disk, and serial I/O – see section 3.11 "SYS68K/IOBP-1" on page 29)
- and the IOPI-2 (8-bit SCSI, floppy disk, and serial I/O – see the *IOPI-2 User's Installation Manual*).

Note: In the following 2 figures unbracketed signals are available as factory default.

Additionally,

- "*" marks the signals which are available with the wide SCSI factory option. They are implemented via 0-Ohm resistors.
- "**" marks the signals which are available with the FDC eject factory option.
- "***" marks the signals which are available with the SERIAL-2-on-P2 factory option.
- FDC DSEL1 is also available at C7 to provide backward compatibility to FDC DESL3.
- FDC DSEL2 is also available at C3 to provide backward compatibility to FDC DESL4.
- Instead of FDC DCHG, there formerly was FDC READY. However, the manufacturers of floppy disk drives have agreed upon not supporting the FDC READY signal any longer and using FDC DCHG (disk change) only.

Figure 3 P2 connector pinout with serial I/O config. for RS-232

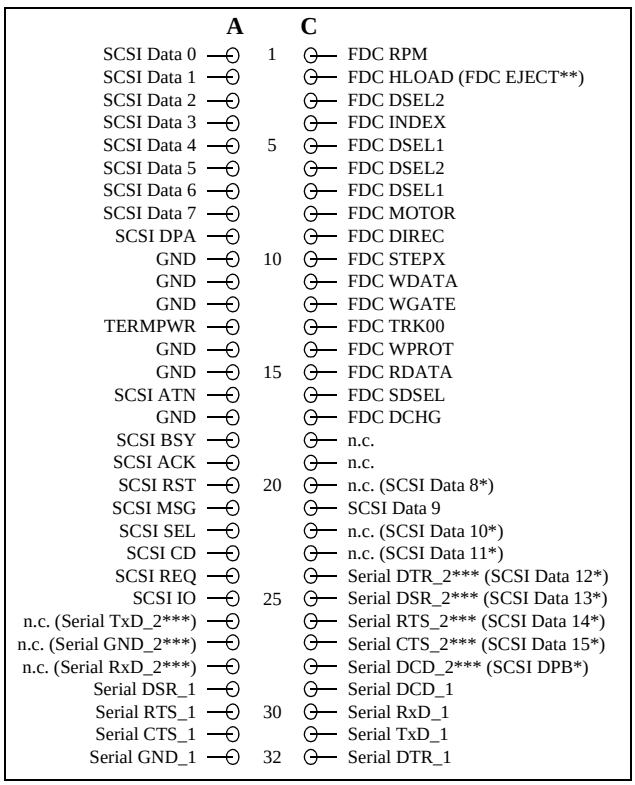


Figure 4 **P2 connector pinout with serial I/O config. for RS-422**

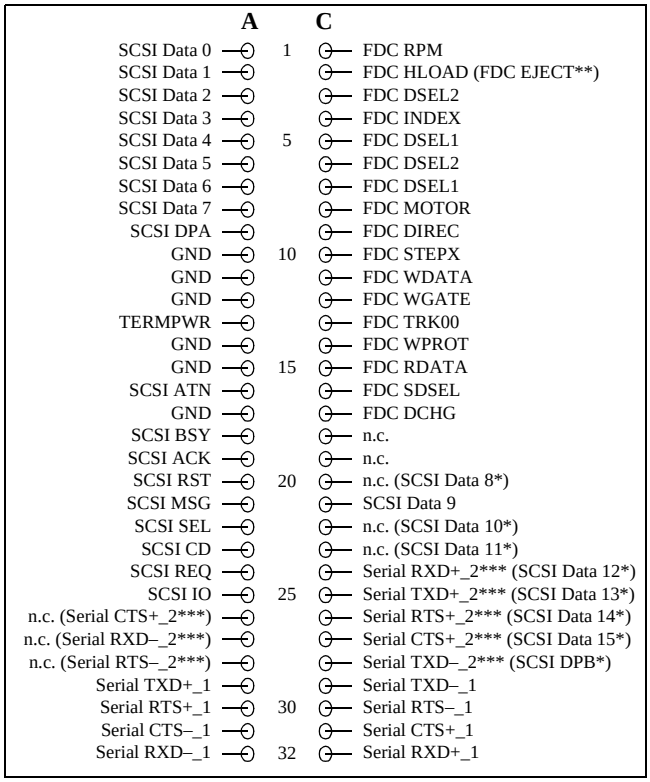
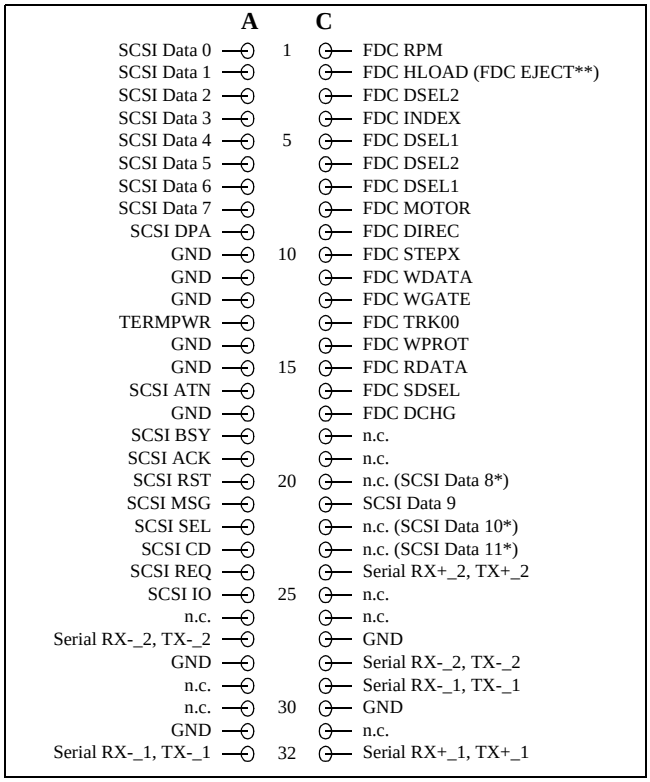


Figure 5 **P2 connector pinout with serial I/O config. for RS-485**



Note: Serial 1, 2: Note that the pins A30 and C31 must be connected to GND externally in case of the serial-1 RS-485 configuration and that the pins A26 and C26 must be connected to GND externally in case of the serial-2 RS-485 configuration.

3.11 SYS68K/IOBP-1

As a separate price list item Force Computers offers a SYS68K/IOBP-1 I/O panel which is plugged into the VMEbus backplane from its rear.

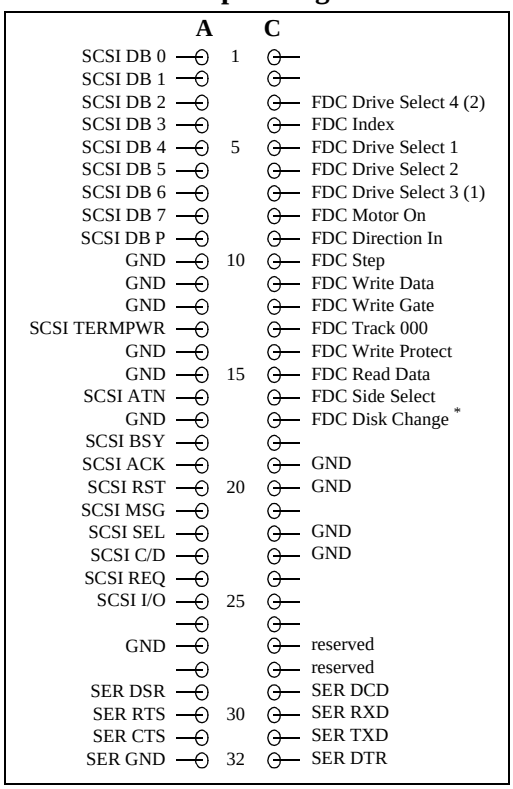
Caution



To avoid damage to the board, do not use the SYS68K/IOBP-1 for the SYS68K/CPU-60 if serial port #2 is configured as RS-422.

The SYS68K/IOBP-1 enables easy connection to the I/O signals which are available on the CPU board's P2 connector.

Figure 6 **SYS68K/IOBP-1 pin assignment for VME P2**



* Instead of FDC DCHG, there formerly was FDC READY (see note on page 26).

The SYS68K/IOBP-1 contains the following connectors:

- P2 for the standard SCSI interface,
- P3 for the floppy disk interface,
- and P5 for the serial I/O port 1.

All row A and C pins of the VMEbus P2 connector are routed to the 64-pin male P4 connector on SYS68K/IOBP-1. However, the P4 connec-

tor pinout differs from the VME P2 connector by the counting direction: pin 1 of P4 = pin 32 of P2, …, pin 32 of P4 = pin 1 of P2.

3.12 Testing the CPU Board Using VMEPROM

VMEPROM is a firmware providing a real-time multitasking multiuser monitor program. It is stored in the on-board system PROM.

Booting up VMEPROM

To start VMEPROM automatically during power up or reset, the MODE 1 and MODE 2 rotary switches must both be set to F_{16}. During booting FGA Boot is executed. After the successful pass of the self-test routine, the front-panel 7-segment hexadecimal display is switched off and its decimal point is periodically switched on and off.

POST codes

If the SYS68K/CPU-60 fails during booting, the following POST (Power On SelfTest) codes indicate the status at the time of failure. The POST codes are displayed as status information during boot on the front-panel 7-segment hexadecimal display. The following table lists the POST codes in the order they occur during booting.

Table 7 POST codes indicating boot status

POST code	Description
cryptic code	When a 'cryptic' code is displayed, a general hardware error occurred. FGA Boot cannot be started.
<Off>	Read board ID from port and initialize 7-segment hexadecimal display.
0	Initialize the 68060 CPU registers CACR, ITT*x*, and DTT*x*, disable caches. FGA Boot has already left the boot-mode in this state.
1	Initialize the front-panel serial I/O port 1.
2	Initialize the CIO devices.
3	Identify board features and pre-select initialization sequence to follow. Read serial ID-ROM.
4	Determine CPU clock frequency (with cache enabled).
5	Determine capacity of main memory.
6	Verify local SRAM contents and store default values if checksum is wrong.
7	Perform auto-configuration (check hardware for special conditions such as being plugged in slot-1). If need, update SRAM value.

Table 7 POST codes indicating boot status (cont.)

POST code	Description
8	Test for EAGLE modules (not applicable for SYS68K/CPU-60).
9	Read front-panel rotary switches and store to SRAM.
A	Check for firmware to start (default VMEPROM).
b	If the abort key is asserted or if there is no firmware to start, display the FGA Boot banner and start the shell.
C	Initialize FGA-002, arbiter, user LED and other hardware. Set up VMEbus A32 slave window (and A24 if enabled).
d	Clear DRAM (fill with 0) to initialize parity.
E	Call user program.
F	Try to execute the firmware.
<Off>	Left FGA Boot, started firmware.

System controller

If the board is configured as system controller (i.e. SYS68K/CPU-60 is installed in slot 1), FGA Boot automatically enables the FGA-002 arbiter and switches on the user LED.

Starting a test after booting

To test the CPU board for correct operation enter the following command after the ? prompt:

```
? SELFTEST
```

SELFTEST does not provide a full-featured power-on self-test. However, it tests some I/O devices, the main memory, and the system timer tick interrupt. The time **SELFTEST** takes for testing depends on the main memory's size. Allow approximately one minute per Mbyte.

Correct operation

After all tests have been done, the following message is displayed:

```
VMEPROM Hardware Selftest
-------------------------
I/O test ........ passed
Memory test ..... passed
Clock test ...... passed
```

Product Error Report

PRODUCT:	SERIAL NO.:
DATE OF PURCHASE:	ORIGINATOR:
COMPANY:	POINT OF CONTACT:
TEL.:	EXT.:
ADDRESS: _____ _____ _____	
PRESENT DATE:	
AFFECTED PRODUCT: ❑ HARDWARE ❑ SOFTWARE ❑ SYSTEMS	AFFECTED DOCUMENTATION: ❑ HARDWARE ❑ SOFTWARE ❑ SYSTEMS
ERROR DESCRIPTION: _____ _____ _____ _____ _____ _____ _____ _____ _____ _____	

THIS AREA TO BE COMPLETED BY FORCE COMPUTERS:

DATE:

PR#:

RESPONSIBLE DEPT.: ❑ MARKETING ❑ PRODUCTION
ENGINEERING ➠ ❑ BOARD ❑ SYSTEMS

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