TRIMOND™
MOTHERBOARDS

User Guide
FC810 microATX Motherboard

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Document History

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1.0	First release	April 99

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SAFETY AND REGULATORY NOTICES

GENERAL

Battery

This product contains a lithium battery.

Do not use a metal or other conductive implement to remove the battery. If a short-circuit is made between its positive and negative terminals the battery may explode.

Replace a discharged battery with one of the same type; another type may explode or ignite. Follow the instructions contained in section 3 of this document to replace the battery. Dispose of a discharged battery promptly and in accordance with the battery manufacturer's recommended instructions. Do not recharge, disassemble or incinerate the discharged battery. Keep discharged batteries away from children.

Anti-static precautions

Warning

Static electricity can cause permanent damage to electronic components. You should be aware of this risk, and take precautions against the discharge of static electricity.

This product is at risk from static discharge because the electronic components of the motherboard are exposed. Memory modules and replacement processors are examples of electrostatic sensitive devices (ESSDs).

All work that involves contact with the FC810 microATX Motherboard should be done in an area completely free of static electricity. We recommend using a Special Handling Area (SHA) as defined by EN 100015-1: 1992. This means that working surfaces, floor coverings and chairs must be connected to a common earth reference point, and you should wear an earthed wrist strap and anti-static clothing. It is also a good idea to use an ionizer or humidifier to remove static from the air.

Handle static-sensitive items with extreme care. Hold add-on components only by their edges, avoiding their electrical contacts. In general, do not handle static-sensitive items unnecessarily.

Keep all conductive material, and food and drink, away from your work area and the FC810 microATX Motherboard.

LEGALITIES

This product complies with the relevant clauses of the following European Directives (and all subsequent amendments):

Low Voltage Directive	**73/23/EEC**
EMC Directive	**89/336/EEC**
CE Marking Directive	**93/68/EEC**

Important

This product, when supplied, complies with the CE Marking Directive and its strict legal requirements. Use only parts tested and approved by Mitsubishi Electric Motherboard Division.

STANDARDS

Safety

This product complies with the American Safety Standard **UL1950**.

Electro-magnetic Compatibility (EMC)

This product complies with the following European EMC standards:

Emissions **EN55022 Class B**

Immunity **EN55024**

This product also complies with the following American EMC standard:

FCC Class B

FCC Compliance Statement

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Important

You are cautioned that any change or modification to the product not expressly approved by the manufacturer could void the approvals held by this product.

CONTENTS

1 OVERVIEW

FC810 microATX is a Celeron™ processor-based microATX profile motherboard.

The design of FC810 microATX is based around the following components.

- Intel Celeron™ processor in Socket 370
- Intel 810 Chipset consisting of :-
  - Graphics and Memory Controller Hub (GMCH)
  - I/O Controller Hub (ICH)
  - Firmware Hub (FWH)
- AC'97 audio controller
- Intel 82559 IEE802.3 10BASE-T / 100BASE-TX compatible LAN controller

Processor

The Celeron™ processor is based on the P6 micro-architecture and includes MMX technology. Two package styles are available – cartridge (slot 1) and pin-grid array (socket 370). FC810 requires the pin-grid array version.

Graphics and Memory Controller Hub (GMCH)

The GMCH connects the processor to the main system memory and other system logic. It has an integrated graphics controller with optional 4MB Display Cache. Supports both 66Mhz and 100Mhz system bus.

I/O Controller Hub (ICH)

The ICH contains a PCI 2.2 interface, a bus master IDE controller - Ultra ATA 33/66 (depending on build option), AC'97 2.1 interface and all the general purpose I/O ports. There are two versions detailed below -

- ICH0 – ATA33 IDE Channels, 4 PCI Devices
- ICH1 – ATA66 IDE Channels, 6 PCI Devices

AC'97 Audio Controller

The AC'97 CODEC is the analogue part of the audio system. It is connected to the ICH by a digital link.

82559 LAN Controller

The 82559 is Intel's second generation integrated 10BASE-T/100BASE-TX LAN solution. It consists of both the Media Access Controller (MAC) and the physical layer (PHY) interface combined into a single component solution. It contains a 32 bit PCI bus master interface

MOTHERBOARD FEATURES

Form factor	microATX, 9.6" wide x 7.8" deep. ATX 2.01 compliant.
Processor	Socket370 with the VRM8.2 regulator on motherboard. Accepts 66/100Mhz Celeron™ processors
Core logic	Intel 810
Cache	L2 cache included on processor module.
Memory – RAM	Memory sockets accept 168 pin un-buffered PC100 SDRAM modules.
Memory - Flash ROM	4Mb Firmware Hub
Buses	4 PCI bus master slots
VGA	Integrated Graphics controller (82810) with 2D/3D acceleration, 230Mhz RAMDAC and optional 4Mb Display Cache (82810-DC100)
Audio – controller	AC'97 2.1 compliant CODEC (Optional)
Hard Disk & CD-ROM	Dual UltraATA33 interfaces for hard disk and CD-ROM. (UltraATA66 optional with ICH1 fitted)
Floppy Disk	720kB, 1.2MB (3-mode), 1.44MB 3½ drives, 1.2MB 5¼ drives. Support for 120MB drives via ATA port.
Parallel Port	IEEE 1284 (ECP & standard) on 25-way D-type
Serial Ports	Single 16550. One 9-way D-types on rear edge of motherboard.
USB	Two ports.
Ethernet	1x RJ45 port
Keyboard & Mouse	PS/2-style connectors.
Security	Chassis intrusion detection.
Power Management	Green and deep green via system management mode. ACPI compatible. Wake-on LAN Standby option with wake-up on interrupt, serial port activity or button.
System Management	Hardware monitoring – Fan monitor (standard), Voltage/ Thermal monitor (optional - PC87366 I/O)
Plug & Play	PC98 and PC99 compliant
Battery back-up	On-board lithium coin cell with 5 years typical life.
PCB	4-layer microATX form-factor. All components on top side

CONFIGURATION OPTIONS

Build-time

The following items can be configured at build-time and cannot be modified by the user.

- Integrated Graphics Controller 4Mb Display Cache
- Ethernet controller/ connector
- MIDI / Game Port features
- AC'97 Audio
- Hardware monitoring functions (Super I/O)

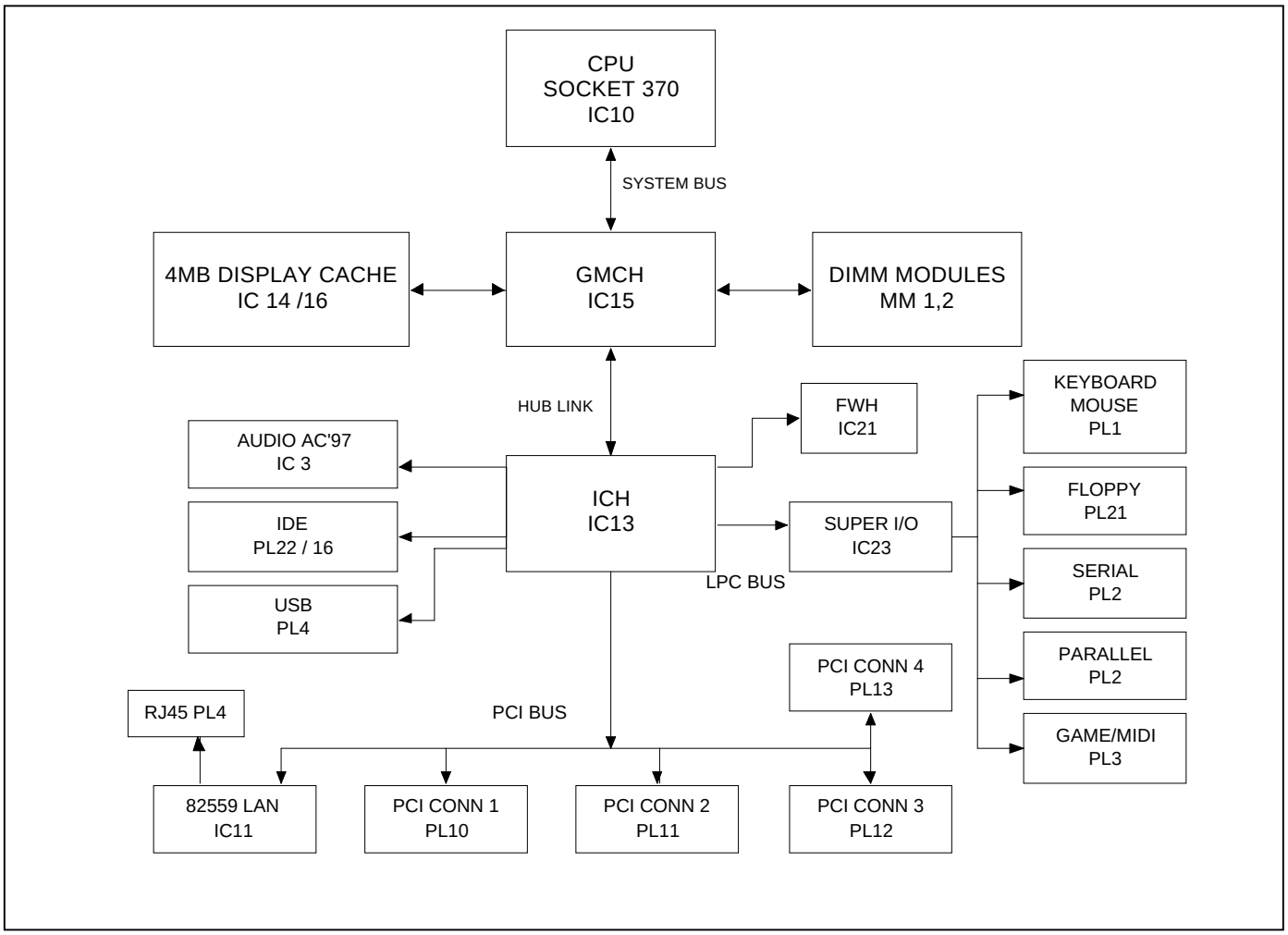
Please contact Mitsubishi Electric Motherboard Division to determine available configurations.

User Configurable

The user can configure the following items.

- Processor (Intel boxed products)
- Main memory DIMMs

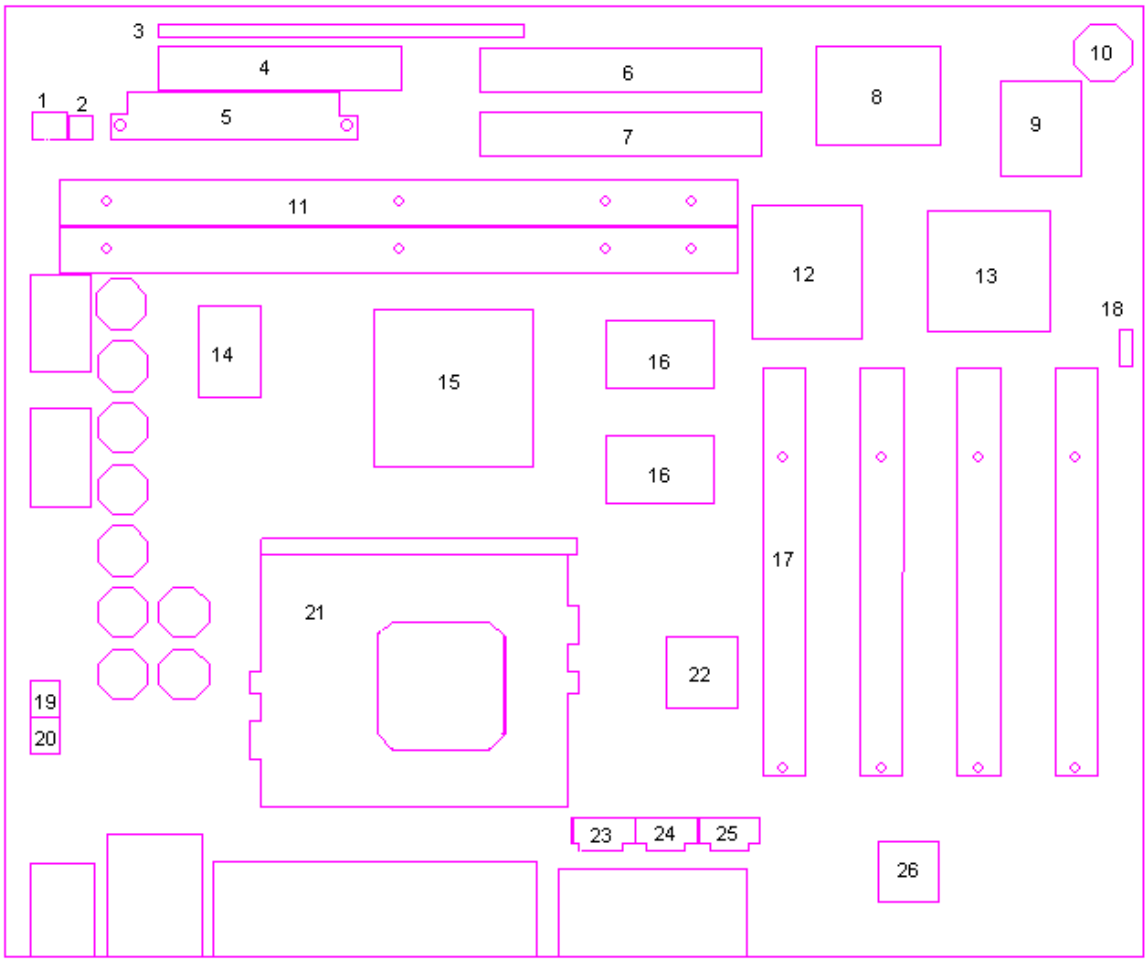
BLOCK DIAGRAM

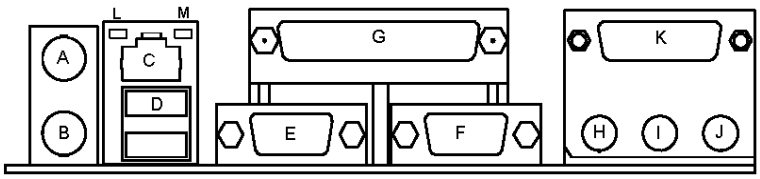


2 INSTALLATION GUIDE

Warning

Static electricity can cause permanent damage to electronic components. You should be aware of this risk, and take precautions against the discharge of static electricity.

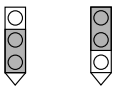




1	**Chasis Intrusion Header PL17**	**15**	**Graphics and memory controller hub (GMCH)**	**C**	**RJ45**
2	**Hard Switch PSU jumper PL18**	**16**	**4MB display cache**	**D**	**USB (Dual)**
3	**Front panel**	**17**	**PCI expansion slots PL10,11,12,13**	**E**	**Serial Port 1**
4	**Floppy disk PL21**	**18**	**Debug connector PL15**	**F**	**VGA**
5	**Main power PL19**	**19**	**System fan power PL9**	**G**	**Parallel**
6	**Primary IDE Controller PL22**	**20**	**CPU fan power PL8**	**H**	**Line output**
7	**Secondary IDE Controller PL16**	**21**	**Processor**	**I**	**Line input**
8	**Super I/O**	**22**	**LAN controller**	**J**	**Mic input**
9	**Firmware Hub (FWH)**	**23**	**ATAPI audio LINE in (natural) PL5**	**K**	**MIDI & Joystick**
10	**Buzzer**	**24**	**ATAPI CD audio in (green) PL6**	**L**	**Speed LED (Yellow)**
11	**Main memory DIMMs MM1,2**	**25**	**ATAPI telephony (black) PL7**	**M**	**Link/Activity LED (Green)**
12	**Lithium Cell (CR2032)**	**26**	**AC'97 Audio controller**		
13	**I/O controller hub (ICH)**	**A**	**Keyboard**		
14	**Clock synth**	**B**	**Mouse**		

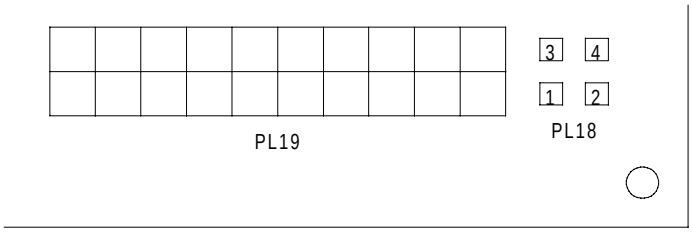
Debug Connector – PL15 (installation guide reference 18)

Not fitted	Normal operation
1-2	Forces processor to lowest multiplier (x2)
2-3	Debug Mode (To be Determined)

Normal Operation  Clear CMOS

Hard switch power supply – PL18 (installation guide reference 2)

Link 1-2 and 3-4 when 5V standby rail is not available



3 UPGRADING THE MOTHERBOARD

Caution

Care must be taken in the purchase of upgrade parts to ensure both compatibility with the system and the compliance with appropriate approvals and certification, e.g. CE marking within Europe. Using non-approved parts may invalidate your warranty and system approvals.

Upgrading the motherboard is not difficult, but if you do not feel confident about the work involved, you may wish to have your supplier or service organisation complete it for you.

Warning

Never carry out any work inside the computer with AC power applied. Turn off the computer and unplug all power cords before starting work.

ADDING MORE MEMORY

The motherboard has two DIMM (Dual Inline Memory Module) sockets, each of which accepts modules of up to 128 Mbytes, in any combination. The slot furthest from the processor (MM1) should be used first.

DIMM specification

The memory modules must meet the PC100 specification.

Fitting and removing DIMMs

Read all of these instructions through carefully before you start work.

Turn off the computer and unplug all power cords. Take suitable anti-static precautions and remove the system cover. Leave the DIMM in the anti-static packaging until the last possible moment and when you do take the DIMM out of its packaging, hold it by its ends and avoid touching the metal contacts.

Follow the diagrams and simple instructions on the following pages to insert each DIMM.

Afterwards

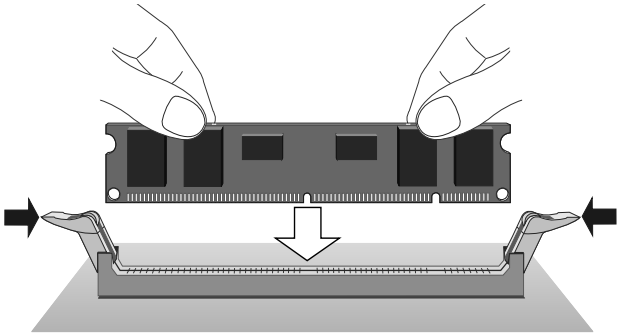
After you have fitted new modules, check that the system recognises all the memory. If not, check that you have:

- Correctly fitted the DIMMs in their slots.
- Installed DIMMs of the correct type.

It may be necessary to refit the original memory to check if there is a problem with your new modules.

Fitting a DIMM

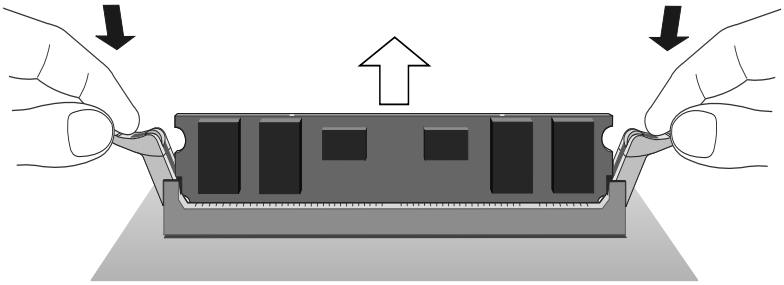
Do not use excessive force. If the module will not fit easily, remove it and start again.



The DIMM is inserted vertically and held in place by the clips at each end.

Removing a DIMM

Do not use excessive force. If the module will not come free easily, check that the holding clips are clear of the module ends.



Press the tabs on both of the socket's end clips at the same time. This releases the DIMM and lifts it partly out of the socket.

THE PROCESSOR ASSEMBLY

To remove the existing processor

1. Turn off the computer and unplug all power cords. Take suitable anti-static precautions and remove the system cover.
2. If the system was in use just before starting this procedure, the processor **may be hot**, wait until it cools
3. Unclip the heatsink/ fan from the processor and lift the clip on the side of the processor socket.
4. The processor can now be removed from the socket.

Caution

Handle the processor with care, by the body only. Avoid touching the connector at the bottom. Store in an antistatic container.

To fit a new processor

1. Hold the processor by the edges – avoid touching the pins on the underside
   - The processor and socket and keyed to ensure the processor is installed in the correct orientation. It will only fit into the socket one way.
2. When the processor is securely in place close the clip on the socket. ***Do not use excessive force.***
3. Refit the heatsink/ fan making sure it is correctly and fully seated on the processor.

Warning

The processor requires continuous airflow.

REPLACING THE BATTERY FOR THE CONFIGURATION CMOS

The computer keeps a record of its current hardware configuration in a CMOS memory chip, which is sustained by a small battery. This battery has a life of up to 5 years. If you find that you have to reconfigure the computer every time you turn it on, or the date and time seem to be dramatically incorrect, the battery is probably failing and needs to be replaced.

The battery is a 3-volt lithium type (CR2032 or equivalent) typically used in calculators, watches and other small, battery-powered electronic items.

Read carefully the following instructions before commencing work.

1. Turn off the computer and unplug all power cords.

Warning

Do not *use a metal or other conductive tool to remove the battery. If a short-circuit is accidentally made between its positive and negative terminals, it may cause the battery to explode.*

2. Using a **non-conductive** tool, release the latch that holds the battery in place. The battery will pop up allowing you to lift it out of the holder.
3. Taking care not to touch the top or bottom surface of the new battery, pick up the replacement with the positive (+) terminal upwards and press the battery into the holder using a non-conductive implement.
4. Dispose of the old battery in accordance with the battery manufacturer's instructions.

When you next turn on the computer you will have to run the BIOS Setup utility to enter the hardware configuration.

4 ELECTRONICS

PROCESSOR

The FC810 microATX motherboard accepts the following Celeron™ processors operating at a bus speed of 66 or 100MHz.

Processor Speed (MHz)	***Core/bus ratio***	***Bus speed MHz***
266	4.0	66
300	4.5	66
333	5.0	66
366	5.5	66
400	6.0	66
433	6.5	66
466	7.0	66
500	5.0	100
550	5.5	100
600	6.0	100

The processor core voltages are generated by switched-mode regulators on the motherboard to the Intel VRM8.2 specification.

CORE LOGIC

The core logic is based around the Intel 810 Graphics and Memory Controller Hub (GMCH) and the I/O Controller Hub (ICH). The features of each are summarised below.

Graphics and Memory Controller Hub (GMCH)

- 66/100Mhz system bus frequency
- DRAM controller supporting 100Mhz SDRAM main memory 8MB – 256MB and suspend to RAM (PC100)
- Integrated graphics controller with 2D/3D H/W acceleration
- 3D graphics visual/ textural enhancements
- Integrated 24-bit 230MHz RAMDAC
- Integrated graphics memory controller with display cache interface – 100Mhz SDRAM
- Advanced power management functions - ACPI / APIC

I/O Controller Hub (ICH)

- PCI Bus – supports Rev 2.2 spec and 4/ 6 (optional) master devices
- Dual UltraDMA33/ 66 (optional) IDE controller
- Dual USB controller (12Mbps or 1.5Mbps)
- AC'97 link for audio/ telephony CODEC's
- SMbus controller (motherboard management)
- Interrupt Controller – integrated I/O APIC capability
- GPIO functions – TTL, Open-Drain, Inversion
- Enhanced DMA controller
- Real-time clock – 256 byte battery-backed CMOS RAM
- ACPI power management logic
- Low Pin Count (LPC) interface (Super I/O connection)

LEVEL 2 CACHE

The second level cache is contained within the processor module. There is no provision for a third level cache. Cache size is determined by the type of CPU fitted, refer to your CPU manufacturer for this information.

MEMORY

DIMM

There are two DIMM sockets on the motherboards that accept 168-pin un-buffered SDRAM modules to the Intel PC SDRAM un-buffered memory module specification. PC100 modules are required. All modules must support SPD (serial presence detect) to allow the BIOS to determine the memory configuration and set up the chipset optimally. These modules contain a small EEPROM that describes the module capabilities in detail - including speed, capacity and organisation. EDO and registered DIMM modules are not supported.

- 64-bit or 72-bit ECC modules.
- 2 or 4 bank organisation
- Asymmetric or symmetric memory addressing.
- Single or double-sided modules.

BIOS

The BIOS is contained in a flash ROM device – Firmware Hub (FWH) soldered directly to the motherboard and includes the code listed below. The motherboard will automatically perform a BIOS recovery operation if it detects a valid recovery disk during the boot sequence. The BIOS ROM is accessed as a single linear region in the memory space from 4GB-128kB (0FFFE0000 - 0FFFFFFFFh) and copied at the top of ISA memory (0E0000 - 0FFFFh).

- USB
- DMI
- Setup-in-ROM
- Intel microcode update support and code
- Power and system management code

VIDEO

The FC810 microATX motherboard contains an integrated graphics controller. However an alternative adapter can be used and fitted to one of the expansion slots. This may be a PCI product.

AUDIO

The audio system is based around an AC'97 compliant controller. When not fitted, the standard PC beep function remains.

AC'97 CODEC

- AC-link digital interface with ICH
- 16-bit stereo full-duplex codec with fixed 48K sampling rate
- 3 analog line-level stereo inputs for connection from LINE IN, CD, AUX
- 2 analog line-level mono inputs for connection from PHONE, PC BEEP
- Mono MIC input switchable form two external sources
- Stereo line level output
- Mono output for speakerphone
- Programmable power management
- Tone, loudness, 3D stereo enhancements

One power amplifier is used - a National Semiconductor LM4881 'Boomer' to drive the LINE-out jack socket and the optional internal speaker. The microphone input provides power to enable condenser microphones to be used.

The following audio connectors are supported.

- Rear 3.5mm jack microphone input with phantom power
- Rear 3.5mm jack LINE in
- Rear 3.5mm jack LINE out (also suitable for 32 ohm headphones)
- Internal CD-ROM stereo audio on 4-pin ATAPI connector
- Internal stereo LINE input on 4-pin ATAPI connector
- Internal telephony connection (mono input and output) on 4-pin ATAPI connector

REAL TIME CLOCK

The real time clock is located in the ICH and includes 256 bytes of battery backed RAM with two lockable ranges. The clock includes a date alarm and operates from a 32.768kHz crystal. The 3V lithium cell provides data retention for up to 5 years of normal use. Note that the battery is used only when AC power is not applied to the system (or a standby 5V rail is not provided).

NETWORK

The Intel 82559 LAN controller is an optional feature to provide networking to the FC810.

The rear combined RJ45 / USB connector displays two LED's which have the following functions :-

- SPEED LED (Yellow)

  ON if operating at 100Mbps

  OFF if operating at 10Mbps
- LINK / ACTIVITY LED (Green)

  ON if link established and cable present

  FLASHING if data activity occurs

STANDARD I/O

The National Semiconductor PC87363/ PC87366 Super IO controller provides standard I/O. This comprises the four functions described below. It is packaged in a 128-pin PQFP and is PC99 and ACPI compliant.

Keyboard and Mouse

PS/2 style keyboard and mouse ports are provided on the rear panel. The ports are interchangeable.

Floppy Disk Interface

The motherboard supports both 2-mode and 3-mode 3½" floppy disk drives.

Serial Ports

There is one standard COM port, which is wired to a standard 9-way D-type connector on the rear panel. The maximum Baud rate is 115K bits per second.

Parallel Port

This is EPP 1.9 and IEE1284 (ECP) compliant and is compatible with a standard (output only) PC parallel port as well as a bi-directional (PS/2 style) parallel port. There is a 25-way D-type connector on the rear panel.

ADDITIONAL I/O

IDE Disk Controller

Two UltraDMA33/ (66 - ICH1) IDE ports are provided with the controller integrated into the ICH. This allows for a maximum of four drives to be connected - two to each port. Normally the primary port would be used for hard disk drives and the secondary port for CD-ROM or DVD drives. 120MB floppy drives have IDE interfaces.

Both IDE controllers are independent and both can bus-master data into memory for improved performance. The interfaces are also, of course, compatible with standard ATA drives.

Universal Serial Bus (USB)

The motherboard has two USB ports at the rear with the controller integrated into the ICH.

SECURITY

There is chassis intrusion detection available on motherboards with the 87366 fitted. This is capable of detecting an intrusion even when AC is disconnected (the logic is powered from the 3V lithium cell).

MOTHERBOARD POWER

Processor Power

A voltage regulator conforming to the Intel VRM8.2 standard supplies power for the processor core. The motherboard automatically selects the correct processor voltage.

Battery

An IEC-type CR2032 3V lithium coin cell and holder are fitted to the board. Note that when the motherboard is powered off but the AC remains connected (the standby rail is active) the battery is not used.

POWER MANAGEMENT

Standby Switch

The motherboard supports an ACPI-compliant standby switch for use with a soft-switch power supply. The action of the switch is under a combination of hardware and software control and is summarised in the table below. The motherboard will power off regardless of the state of software if the switch is held down for more than 4 seconds.

State	***Action after switch pressed***
Standby (soft power off)	Machine powers up and executes POST
POST, DOS or APM O/S	Machine powers off into standby state

Behaviour After AC-Disconnect

The 'Wake on AC connect' BIOS option and the state of the lithium cell determine the behaviour of the motherboard after an AC-disconnect. The table below describes this.

Conditions	***Action on AC Reconnect***
CMOS RAM cleared. This is the state of a new motherboard before assembly. This also occurs after battery removal or failure.	Motherboard waits for standby switch to be pressed.
CMOS RAM not cleared and 'Wake on AC connect' was set to 'Enabled'.	Motherboard fully powers up without intervention.
CMOS RAM not cleared and 'Wake on AC connect' was set to 'Disabled'. This is the default state. Resume events will be lost if an AC power failure occurs.	Motherboard waits for standby switch to be pressed.

Sleep State Indication

Indication of the power state is via the power LED. When a standard LED is fitted, it is illuminated when power (main 5V) is on. Three states can be indicated by using a two-colour LED which is biased in the reverse direction to indicate a sleeping state. The table below assumes the use of a yellow/green bi-colour LED with the green anode connected to the LED+ pin.

State	***LED Colour***
Power off	Off
Normal operation	Green
Sleeping	Yellow

SYSTEM MANAGEMENT

There are three main elements to the optional system management hardware.

- MAX1617 Thermal Monitor
- PC87366 Super I/O
- Processor thermal diode ADCs

MAX1617

A precise digital thermometer that reports both the CPU temperature and the temperature of itself – system temperature. It is accessed via the ICH SMbus interface.

PC87366 System Monitoring

The National Semiconductor PC87366 provides the system monitor functions as described below. It provides the following functions.

- Fan monitoring. The two inputs to the PC87366 device monitor the first two ATX "fantach" signals.
- Monitoring of system +12V, -12V, +5V, +3.3V, VCPU, +2.5V, +1.8V and +1.5V power rails
- Monitoring of chassis intrusion (top cover)

FAN CONTROL

The system fan is controlled by the motherboard such that it stops rotating when the system is in 'Suspend' mode. FC810 microATX motherboard supports variable fan speed control in which the speed of the fan is raised as the temperature of the processor increases. This considerably reduces fan noise in normal operation.

The variable fan speed option can only be used with an ACPI-aware operating system (such as Windows 98). This feature requires separate programming and you should contact Mitsubishi Electric Motherboard Division for further details.

EXPANSION SLOTS

Peripheral Component Interconnect (PCI)

Four PCI bus master slots are available.

BUS RESOURCE UTILISATION

PCI Interrupts

Channel	***Device***
INTA#	Slots
INTB#	Slots
INTC#	Slots
INTD#	LAN & Slots

PCI Device Selection (motherboard devices)

Bus number	***Device number (decimal)***	***Function number***	***Address line***	***Function***
0	0	0		Host-hub interface Bridge/ DRAM controller
0	1	0		GMCH internal graphics device
0	4	0	20	82559 LAN Controller
0	9	0	25	Slot 4
0	11	0	27	Slot 3
0	13	0	29	Slot 2
0	15	0	31	Slot 1
0	30	0		Hub interface to PCI Bridge
0	31	0		PCI to LPC Bridge
0	31	1		IDE Controller
0	31	2		USB Controller
0	31	3		SMBus Controller
0	31	4		Reserved
0	31	5		AC'97 Audio Controller
0	31	6		AC'97 Modem Controller

PCI Arbitration

ICH request level	***Bus***	***Function***
0	0	PCI slot 1
1	0	PCI slot 2
2	0	PCI slot 3
3	0	PCI slot 4
4	0	82559 LAN Controller

Note that the arbiter implements a round robin scheme and thus no request level has fixed priority over another.

5 BIOS SETUP & POST

BIOS (pronounced "bye-oss") stands for 'basic input/output system'. The BIOS mediates between the computer's hardware – the processor, memory, and so on – and its software – the operating system and your programs. The BIOS program is kept in permanent, read-only memory or ROM (although if necessary it can be upgraded by an authorised maintainer).

BIOS Setup is a helpful utility that forms part of the BIOS program. It allows you to view and alter the computer's hardware configuration. It is also used to configure various security and power-saving options. Configuring the computer is necessary to ensure that the software you use can recognise and exploit the hardware's capabilities.

The current configuration is kept in a special area of memory, called CMOS memory, and maintained by a battery so that the configuration is preserved even while the computer is switched off.

Whenever the computer is turned on, the BIOS power-on self-test (POST) routine tests various hardware components, including memory, and compares the actual configuration of the computer with that recorded in permanent (CMOS) memory.

A configuration discrepancy could arise if you have just installed or removed a hardware option (for example, if you have added or replaced an expansion card).

BIOS SETUP

To start the BIOS Setup utility:

1. Turn on or restart your computer.
2. When you see

   'Press <F2> to enter setup'

   appear on the screen, press the F2 key.
3. If you have previously defined a Supervisor password, you are prompted for it before BIOS Setup starts.

Control keys

Use the keys listed in the legend bar at the bottom of the BIOS Setup screen to make your selections or exit the current menu.

Sub-menus are marked by a ▶ pointer. To display a sub-menu, use the arrow keys to move the cursor to the sub-menu you want, then press ENTER.

Changeable fields are enclosed in square brackets. To select an item, use the arrow keys to move the cursor to the field you want. Then use the PLUS (+) and MINUS (–) keys to select a value for that field.

Press	***To***
F1 or **Alt-h**	View a general help topic. Press esc to close the help window.
Esc	Exit the current menu.
Left or **Right** arrow	Select a different menu.
Up or **Down** arrow	Select fields on the current menu.
Plus **(+)** or **F6** or **Spacebar**	Select the next value for the current field.

Press	***To***
Minus **(-)** or **F5**	Select the previous value for the current field.
Enter	Make a selection from the menu bar or enter a sub-menu.
Home or **End**	Move the cursor to the top or bottom of the current menu.
Page up or **Page down**	Move the cursor to the next or previous page of the current menu.
F9	Restore the default settings for the fields on the current menu.
F10	Save the changes you've made and exit from BIOS Setup.

Caution
The default BIOS settings may not be appropriate for your particular system. Make a note of the current settings before pressing F9 or using the Load Setup Defaults option of the Exit menu.

Getting help in BIOS Setup

You can at any time get general help about the control keys by pressing the F1 key.

The help window on the right-hand side of each menu displays help text for the currently-selected field. It changes as you move the cursor from one field to another.

MULTI-BOOT FACILITY

Immediately after the first screen, a second screen displays various POST messages such as the memory test. While this screen is on display, a message at the bottom says: '`Press <F2> to enter setup`'. Even if this message is not displayed, you can press the <ESC> key and this menu will appear just before booting:

```
        Boot Menu
1. Diskette Drive
2. Removable Devices
3. Hard Disk Drive
4. ATAPI CD-ROM Drive
5. Network Boot
    < Enter Setup>
```

This menu can be used to temporarily use another drive or device to boot your system, for example a bootable CD-ROM, without having to enter the BIOS setup. Simply use the up and down arrows to make a selection. This change will not be permanent and the system boot will revert to the normal BIOS setting the next time you switch on your system.

POWER-ON SELF-TEST

Recoverable POST errors

Whenever a recoverable (non-terminal) error occurs during POST, the BIOS displays an error message describing the problem (the most usual are described below). After some messages, you may be prompted to **`Press <F1> to resume, <F2> to enter Setup`** or just **`Press <F2> to enter Setup`**.

In general, you should respond to these errors as follows:

- Shut down the computer, wait 20 to 30 seconds, and then turn it on again to see if the problem is still reported.
- Check that all external cables are securely connected.
- Try running the BIOS Setup utility to reconfigure the system. If the computer will not BOOT after you make changes in BIOS Setup, try returning to the original settings.
- Open up the system unit and check that all internal signal and power cables are securely connected.
- If the problem persists, contact your supplier or authorised maintainer.

System Configuration Data updated

This message indicates that the system configuration has changed (such as an expansion card has been added) and that the configuration data has therefore been updated.

System Configuration Data Write Error

This message indicates that the system configuration has changed (such as an expansion card has been added) but the configuration data could not be updated.

Invalid System Configuration Data – run configuration utility

The data describing the system configuration is incorrect and should be updated. This can be done by checking the 'Reset Configuration Data' in BIOS Setup followed by 'Save and Exit'.

Diskette drive A error

Drive A: is present but fails the POST diskette tests. Check that the drive is defined correctly in BIOS Setup. If necessary, open the system unit and check that the drive's signal (ribbon) cable is connected.

System/Extended/Shadow RAM failed at offset: *xxxx* Failing bits: *yyyy*

System, extended or shadow memory is not working, or not configured properly, at offset *xxxx*. The hexadecimal number *yyyy* is a map of the bits at the address that failed the memory test. Each "1" in the map represents a failed bit.

Fixed disk *X* failure or **Fixed disk controller failure**

A fixed (hard) disk drive is not working or not configured properly. Check that the drive is defined correctly in BIOS Setup. If necessary, open the system unit and check that the drive's signal (ribbon) cable is connected.

Incorrect drive A type - run SETUP

The diskette drive is not correctly specified in BIOS Setup.

Invalid NVRAM media type

Problem with NVRAM (non-volatile random-access memory).

Keyboard error [*nn*] or **Keyboard controller error**

There is a problem with the keyboard or (less likely) the standard I/O controller on the motherboard. If POST discovers a stuck key it displays its scan code.

Operating system not found

An operating system cannot be located either on a system diskette or on a hard disk. Start BIOS Setup and check that the diskette and/or hard disk drives are specified correctly.

Parity check 1 *xxxx* or **Parity check 2 *xxxx***

Parity error found on the system (1) or I/O (2) bus. The BIOS attempts to locate and display the address *xxxx*. If it cannot locate the address, it displays "????".

Previous boot incomplete - default configuration used

The previous POST did not complete successfully. POST loads default values and offers to start BIOS Setup. If the failure was caused by incorrect values and they are not corrected, the next boot will likely fail too.

Real-time clock error

Enter BIOS Setup and check the System Time and System Date settings on the Main menu.

System battery is dead - replace and run Setup

Replace the configuration battery as instructed in the previous chapter, then use BIOS Setup to reconfigure the system.

System cache error - cache disabled

The RAM cache failed POST and BIOS disabled it.

System CMOS checksum bad - run Setup

System CMOS has been corrupted or modified incorrectly, perhaps by an application program that changes data stored in CMOS. Run BIOS Setup and reconfigure the system either by getting the default values or by making your own selections.

Terminal POST errors and beep codes

There are several POST routines that shut down the computer if they fail. If possible, the BIOS sounds a sequence of beeps to identify the point at which POST failed. The most usual errors are listed below.

The BIOS also issues one long tone followed by two short tones if the video system is faulty or if an external ROM module fails.

Turn off the computer for 30 seconds and then try again. If the fault persists, make a note of the error code (if any) and call your supplier or authorised maintainer.

Beeps	***Test which failed***
1-2-2-3	BIOS ROM checksum
1-3-1-1	DRAM refresh.
1-3-1-3	8742 keyboard controller
1-3-4-1	RAM failure on address line.
1-3-4-3	RAM failure on data bits of low byte of memory bus.
1-4-1-1	RAM failure on data bits of high byte of memory bus.
2-1-2-3	Check ROM copyright notice
2-2-3-1	Test for unexpected interrupts
1-2	Video configuration failure, or option ROM checksum failure. (One long, two short beeps.)

The BIOS also issues Port 80h codes that can be displayed using a suitable diagnostic card. The codes can be used to determine the failure.

Code	POST Routine Description
02h	Verify Real Mode
03h	Disable Non-Maskable Interrupt (NMI)
04h	Get CPU type
06h	Initialise system hardware
08h	Initialise chipset with initial POST values
09h	Set IN POST flag
0Ah	Initialise CPU registers
0Bh	Enable CPU cache
0Ch	Initialise caches to initial POST values
0Eh	Initialise I/ O component
0Fh	Initialise the local bus IDE
10h	Initialise Power Management
11h	Load alternate registers with initial POST values
12h	Restore CPU control word during warm boot
13h	Initialise PCI Bus Mastering devices
14h	Initialise keyboard controller
16h	BIOS ROM checksum
17h	Initialise cache before memory autosize
18h	8254 timer initialisation
1Ah	8237 DMA controller initialisation
1Ch	Reset Programmable Interrupt Controller
20h	Test DRAM refresh
22h	Test 8742 Keyboard Controller
24h	Set ES segment register to 4 GB
26h	Enable A20 line
28h	Autosize DRAM
29h	Initialise POST Memory Manager
2Ah	Clear 512 KB base RAM
2Ch	RAM failure on address line
2Eh	RAM failure on data bits of low byte of memory bus
2Fh	Enable cache before system BIOS shadow
30h	RAM failure on data bits of high byte of memory bus
32h	Test CPU bus- clock frequency
33h	Initialise Phoenix Dispatch Manager
34h	Test CMOS RAM
35h	Initialise alternate chipset registers.

Code	POST Routine Description
36h	Warm start shut down
37h	Reinitialise the chipset (MB only)
38h	Shadow system BIOS ROM
39h	Reinitialise the cache (MB only)
3Ah	Autosize cache
3Ch	Advanced configuration of chipset registers
3Dh	Load alternate registers with CMOS values
42h	Initialise interrupt vectors
44h	Initialise BIOS interrupts
45h	POST device initialisation
46h	Check ROM copyright notice
48h	Check video configuration against CMOS
49h	Initialise PCI bus and devices
4Ah	Initialise all video adapters in system
4Bh	Display QuietBoot screen
4Ch	Shadow video BIOS ROM
4Eh	Display BIOS copyright notice
50h	Display CPU type and speed
51h	Initialise EISA board
52h	Test keyboard
54h	Set key click if enabled
56h	Enable keyboard
58h	Test for unexpected interrupts
59h	Initialise POST display service
5Ah	Display prompt "Press F2 to enter SETUP"
5Bh	Disable CPU cache
5Ch	Test RAM between 512 and 640 KB
5Eh	Base address
60h	Test extended memory
62h	Test extended memory address lines
64h	Jump to UserPatch1
66h	Configure advanced cache registers
67h	Initialise Multi Processor APIC
68h	Enable external and CPU caches
69h	Setup System Management Mode (SMM) area
6Ah	Display external L2 cache size
6Bh	Customise defaults
6Ch	Display shadow- area message
6Eh	Display possible high address for UMB recovery

Code	POST Routine Description
70h	Display error messages
72h	Check for configuration errors
74h	Test real- time clock
76h	Check for keyboard errors
77h	SMBus init devices
78h	Initialise system monitor and check for intrusion
79h	PCI audio init
7Ah	Test for key lock on
7Ch	Set up hardware interrupt vectors
7Eh	Initialise coprocessor if present
80h	Disable onboard Super I/ O ports and IRQs
81h	Late POST device initialisation
82h	Detect and install external RS232 ports
83h	Configure non- MCD IDE controllers
84h	Detect and install external parallel ports
85h	Initialise PC- compatible PnP ISA devices
86h	Re- initialise onboard I/ O ports.
87h	Configure Motheboard Configurable Devices
88h	Initialise BIOS Data Area
89h	Enable Non- Maskable Interrupts (NMIs)
8Ah	Initialise Extended BIOS Data Area
8Bh	Test and initialise PS/ 2 mouse
8Ch	Initialise floppy controller
8Eh	Autotype
8Fh	Determine number of ATA drives
90h	Initialise hard- disk controllers
91h	Initialise local- bus hard- disk controllers
92h	Jump to UserPatch2
93h	Build MPTABLE for multi- processor boards
95h	Install CD ROM for boot
96h	Clear huge ES segment register
97h	Fixup Multi Processor table
98h	Search for option ROMs. One long two short beeps on checksum failure
99h	Check for SMART Drive
9Ah	Shadow option ROMs
9Ch	Set up Power Management
9Dh	Security init
9Eh	Enable hardware interrupts
9Fh	Determine number of ATA and SCSI drives

Code	POST Routine Description
A0h	Set time of day
A2h	Check key lock
A4h	Initialise typematic rate
A8h	Erase F2 prompt
AAh	Scan for F2 key stroke
ACh	Enter SETUP
AEh	Clear IN POST flag
B0h	Check for errors
B1h	ROMPilot unload
B2h	POST done - prepare to boot operating system
B4h	One short beep before boot
B5h	Terminate QuietBoot
B6h	Check password (optional)
B7h	ACPI initialisation
B8h	Clear global descriptor table
B9h	Clean up all graphics
BAh	Initialise DMI parameters
BBh	Initialise PnP Option ROMs
BCh	Clear parity ch+ eckers
BDh	Display MultiBoot menu
BEh	Clear screen (optional)
BFh	Check virus and backup reminders
C0h	Try to boot with INT 19
C1h	Initialise POST Error Manager (PEM)
C2h	Initialise error logging
C3h	Initialise error display function
C4h	Initialise system error handler
C5h	Dual cmos init
C6h	Dock init
C7h	Dock init late
C8h	Force recovery check
C9h	Extended checksum check of bios
D2h	Unknown\unexpected interrupt
E0h	Initialise the chipset
E1h	Initialise the bridge
E2h	Initialise the CPU
E3h	Initialise system timer
E4h	Initialise system I/ O
E5h	Check force recovery boot

Code	POST Routine Description
E6h	Checksum BIOS ROM
E7h	Go to BIOS
E8h	Initialise Multi Processor
E9h	Set Huge Segment
EAh	Initialilze OEM special code
EBh	Initialise PIC and DMA
ECh	Initialise Memory type
EDh	Initialise Memory size
EEh	Shadow Boot Block
EFh	System memory test
F0h	Initialise interrupt vectors
F1h	Initialise Run Time Clock
F2h	Initialise video
F3h	Initialise beeper
F4h	Initialise boot
F5h	Clear Huge segment
F6h	Boot to Mini DOS
F7h	Boot to Full DOS

The following codes are produced during the BIOS recovery sequence.

Code	POST Routine Description
14h	Read file
16h	Erase sector
17h	Program sector
18h	Verify sector
E0h	Memory allocation error
E1h	File not found
E2h	Path not found
E3h	No handles available
E4h	Access denied
E5h	Invalid access code
E6h	Undefined file open error
E7h	Access denied on file read
E8h	Invalid handle
E9h	Undefined file read error
EAh	File close failure
EBh	Chip ID failure
ECh	Sector erase failure
EDh	Sector protect failure
EEh	Sector program failure
EFh	Sector verify error
88h	Video not found
FFh	Incorrect parameters

6 ELECTRICAL

POWER REQUIREMENTS

The motherboard power requirements are heavily dependent on system configuration and the software being used. The table below can be used as a guide to the likely power supply requirements. They are measured using a 400MHz Intel Celeron Processor and 2 memory modules running stress test software designed to yield worst case results. They should not, however, be regarded as maximum values.

Supply	***+5V standby***	***+5V***	***+3.3V***	***+12V***	***-12V***	***-5V***
Voltage Tolerance	± 5%	± 5%	± 4%	± 5%	± 10%	± 10%
Maximum Current (in above configuration)	20mA	4.6A	1.9A	360mA	30mA	0mA

Note that these figures do not cover cards plugged into the slots.

When operating this motherboard with a power supply that does not provide a +5V standby output, the PL8 jumpers (installation guide reference 2) must be fitted.

Advisory

Mitsubishi has found that some power supplies generate damaging voltages on their main outputs when their +5V standby output is over-loaded.

PCB

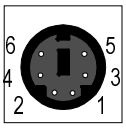
The PCB is a four-layer design measuring W7.8” x L9.6”. It is ATX 2.01 compliant. The inner power planes are arranged so that the ground plane is nearest the top component layer.

The PCB has a UL flammability rating of 94V-0.

7 CONNECTOR ASSIGNMENTS

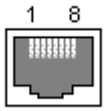
Keyboard and Mouse (PS/2 Mini-DIN)

(Installation guide references A and B)



Pin	*Signal*	*Direction*	*Description*
1	CLK	I/O	Data clock
2	VCC	O	+5V Power
3	GND	-	Signal ground
4	NC	-	No connect
5	DATA	I/O	Serial data
6	NC	-	No connect

LAN (RJ45)

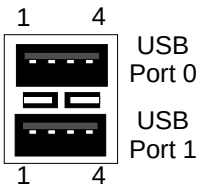


(Installation guide reference C)

Pin	*Signal*	*Direction*	*Description*
1	TX+	O	Transmit Data +
2	TX-	O	Transmit Data -
3	RX+	I	Receive Data +
4	NC	-	Not connected
5	NC	-	Not connected
6	RX-	I	Receive Data -
7	NC	-	Not connected
8	NC	-	Not connected

USB Ports 0 and 1

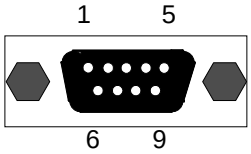
(Installation guide reference D)



Pin	*Signal*	*Direction*	*Description*
1	VCC	O	+5V Power
2	DATA-	I/O	Differential Serial Data -
3	DATA+	I/O	Differential Serial Data +
4	GND	-	Signal ground

Serial Port 1 (9 way D-type)

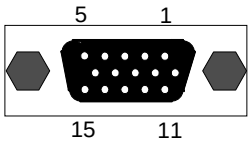
(Installation guide reference E)



Pin	*Signal*	*Direction*	*Description*
1	DCD	I	Data Carrier Detect
2	RXD	I	Receive Data
3	TXD	O	Transmit Data
4	DTR	O	Data Terminal Ready
5	GND	I	Signal ground
6	DSR	I	Data Set Ready
7	RTS	O	Request to Send
8	CTS	I	Clear to Send
9	RI	I	Ring Indicate

VGA (15 way D-type)

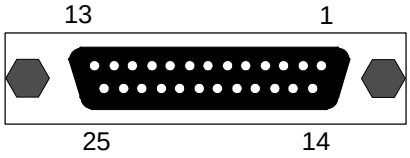
(Installation guide reference F)



Pin	*Signal*	*Direction*	*Description*
1	RED	O	Analog Video Output (Red)
2	GREEN	O	Analog Video Output (Green)
3	BLUE	O	Analog Video Output (Blue)
4	NC	-	Not Connected
5	GND	-	Ground
6	RRTN	-	-
7	GRTN	-	-
8	BRTN	-	-
9	+5V	0	5V Fused
10	GND	-	-
11	NC	-	Not connected
12	SDA	I/O	Monitor DDC Interface Data
13	HSYNC	O	Horizontal Synchronisation
14	VSYNC	O	Vertical Synchronisation
15	SCL	I/O	Monitor DDC Interface Clock

Parallel Port (25 way D-type)

(Installation guide reference G)



Pin	*Standard mode*	*ECP mode*	*Direction*
1	STB#	STB#	
2	DATA0	DATA0	I/O
3	DATA1	DATA1	I/O
4	DATA2	DATA2	I/O
5	DATA3	DATA3	I/O
6	DATA4	DATA4	I/O
7	DATA5	DATA5	I/O
8	DATA6	DATA6	I/O
9	DATA7	DATA7	I/O
10	ACK#	ACK#	I
11	BUSY	BUSY	I
12	PE	PE	I
13	SLCT	SLCT	I
14	AFD#	AFD#	O
15	ERR#	ERR#	I
16	INIT#	INIT#	O
17	SLIN#	SLIN#	O
18	GND	GND	-
19	GND	GND	-
20	GND	GND	-
21	GND	GND	-
22	GND	GND	-
23	GND	GND	-
24	GND	GND	-
25	GND	GND	-

Line Input and Output (3.5mm stereo jack)

(Installation guide references I and H)

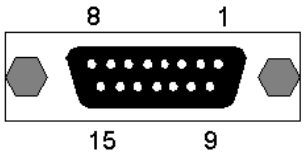
Pin	***Signal***
Sleeve	GND
Tip	Left channel
Ring	Right channel

Microphone Input (3.5mm stereo jack)

(Installation guide reference J)

Pin	***Signal***
Sleeve	GND
Tip	Mono input
Ring	Electret bias voltage

MIDI/Joystick (15 way D-type)



(Installation guide reference K)

Pin	***Signal***	***Pin***	***Signal***
1	+5V Power	2	+5V Power
3	JAB1	4	JBB1
5	JACX	6	JBCX
7	GND	8	MIDI OUT
9	GND	10	JBCY
11	JACY	12	JBB2
13	JAB2	14	MIDI IN
15	+5V Power	16	Key

Chassis Intrusion Switch (2 pin single row 0.1" header)

(Installation guide references 1)

Pin	***Signal***
1	Switch input. Switch should be open when chassis is closed.
2	GND

Primary and Secondary IDE Disk (40 way dual row 0.1" header)

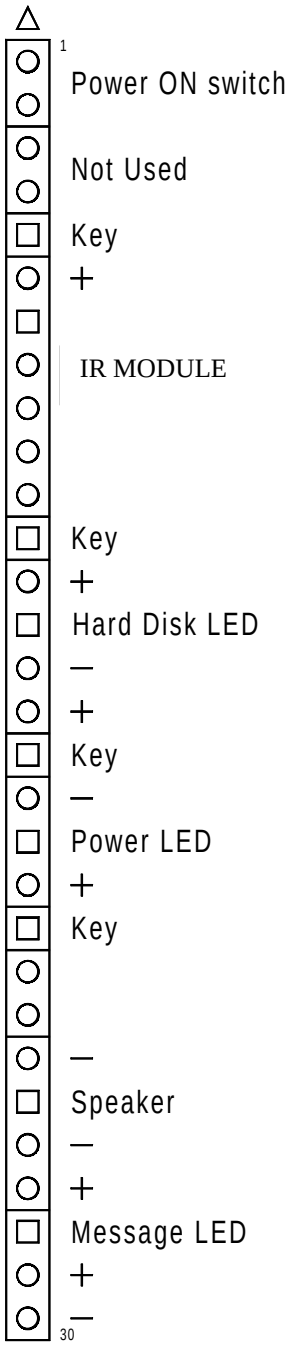
(Installation guide reference 6 and 7)

Pin	***Signal***	***Pin***	***Signal***
1	RESET#	2	GND
3	DATA7	4	DATA8
5	DATA6	6	DATA9
7	DATA5	8	DATA10
9	DATA4	10	DATA11
11	DATA3	12	DATA12
13	DATA2	14	DATA13
15	DATA1	16	DATA14
17	DATA0	18	DATA15
19	GND	20	Key
21	DMAREQ	22	GND
23	IOW#	24	GND
25	IOR#	26	GND
27	IORDY	28	SPS_CSL
29	DMACK#	30	GND
31	INTRQ	32	IOCS16#
33	A1	34	PDIAG#
33	A0	36	A2
33	CS1FX#	38	CS3FX#
33	DASP#	40	GND

Front panel connectors (single row 0.1" header)

(Installation guide reference 3)

Pin	***Signal***
1	Power switch. (momentary)
2	GND
3	Not used
4	Not used
5	Key (pin missing)
6	+
7	Key (pin missing)
8	Receive
9	GND
10	Transmit
11	+
12	Key (pin missing)
13	+
14	Key (pin missing)
15	Hard disk activity LED -
16	+
17	Key (pin missing)
18	Power LED -
19	Key (pin missing)
20	Power LED +
21	Key (pin missing)
22	Not used
23	Not used
24	GND
25	Key (pin missing)
26	GND
27	Internal speaker drive
28	Key (pin missing)
29	Message LED +
30	Message LED -



Floppy Disk (34 way dual row 0.1" header)

(Installation guide reference 4)

Pin	*Signal*	*Pin*	*Signal*
1	GND	2	MODE
3	GND	4	DENSEL#
5	Key	6	DS3#
7	GND	8	INDEX#
9	GND	10	DS0#
11	GND	12	DS2#
13	GND	14	MOTOR#
15	GND	16	DIR
17	GND	18	STEP#
19	GND	20	WRDATA#
21	GND	22	WE#
23	GND	24	TRK0#
25	GND	26	WP#
27	GND	28	JBB2
29	GND	30	RDDATA
31	GND	32	HDSEL
33	GND	34	DSKCHG#

Processor and System Fan (3 way header with locking ramp)

(Installation guide reference 20 and 19)

Pin	*Signal*	*Direction*	*Description*
1	GND	-	Signal ground
2	+12V Power	O	DC fan drive voltage
3	FAN_TACH#	I	Tacho sense from fan

Internal LINE in (4 way natural colour ATAPI header)

(Installation guide reference 23)

Pin	*Signal*	*Direction*	*Description*
1	LEFT	I	Left audio input
2	GND	-	Signal ground
3	GND	-	Signal ground
4	RIGHT	I	Right audio input

Internal CD audio (4 way green ATAPI header)

(Installation guide reference 24)

Pin	*Signal*	*Direction*	*Description*
1	LEFT	I	Left audio input
2	GND	-	Signal ground
3	GND	-	Signal ground
4	RIGHT	I	Right audio input

Internal telephony (4 way black ATAPI header)

(Installation guide reference 25)

Pin	*Signal*	*Direction*	*Description*
1	Input	I	Input from MODEM
2	GND	-	Signal ground
3	GND	-	Signal ground
4	MIC	O	Microphone output to MODEM