

PHILIPS

C. Luyckx



COMPACT
disc
Interactive

Instruction Manual

CD-I
Philips Interactive Media Systems

=====
ADDENDUM
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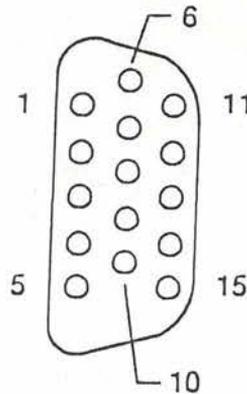
Page 3-16.

MMC module Technical Data

RGB Output:

Pin assignment RGB connector:

<u>No.</u>	<u>Name</u>
1	Red
2	Green
3	Blue
4	NC
5	NC
6	Red GND
7	Green GND
8	Blue GND
9	NC
10	GND
11	NC
12	NC
13	C sync
14	NC
15	NC



"WARNING"

This equipment generates, uses, and radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

CHAPTER 1 .

INTRODUCTION AND SYSTEM CONFIGURATION

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1. Introduction

1-1-1. CD-I

The Compact Disc Interactive (CD-I) standard for the Compact Disc offers a flexible combination of audio, video, text and data, involving for example database-oriented information and computer programs, for interactive and real-time operation on essentially self contained and easy-to-use CD-I systems, used in conjunction with domestic audio equipment and television receivers.

From a technical point of view, CD-I is a logical extension of CD-ROM. And from users point of view, it is a logical evolution of Compact Disc. It is therefore firmly based on the well known and universally accepted Compact Disc standard.

CD-I is based on a complete and self-contained specification offering full disc-player compatibility and taking into account the installed base of mass-produced video and audio products.

The CD-I standard embraces CD-DA discs, and provides for a world standard disc not tied to national television broadcasting standards.

In contrast to the disc, CD-I system have to be adapted to match the installed base of products which conform to different national standards. CD-I systems can be used in combination with the existing audio equipment and modern domestic TV receivers because the standard allows for the development of products compatible with all national broadcasting systems.

The CD-I standard does not offer compatibility with the video part of the CD-V standard. However, the digital audio tracks of CD-V discs are treated in the same way as CD-DA discs.

1-1-2. Application environment

It is difficult to find subjects not suitable for CD-I. In the ultimate, the scope is limited only by the boundaries of human imagination. Even when existing programme material is transferred to CD-I, it takes on new dimensions, greatly enhancing the printed work, audio visual programme or computer software of the original.

A CD-I encyclopedia, for example, offers voyages of exploration through picture, sound and text databases. Films, plays, ballet and opera become quite different on CD-I. The discs can feature critical reviews and essays, interviews, biographies, scripts, librettos, all revealing new and often unsuspected aspects.

The range of application opportunities is summarized below:

- Education and training

- o Do it yourself
- o Home learning
- o Interactive training
- o Reference books
- o Albums
- o "talking books"

- Entertainment

- o "Music plus" (music with text, notes, pictures etc.)
- o Action games
- o Strategic games
- o Adventure games
- o Activity simulation

- Creative leisure

- o Drawing/painting
- o Filming
- o Composing

- Work at home

- o Document processing
- o Information retrieval and analysis
- o Home shopping/home banking
- o CD-ROM peripheral

- At work

- o Information retrieval
- o Education

1-2. The CD-I System

1-2-1. General

Your CD-I sample production system, batch 0, comprises six main items:

1. CD-I player
2. Multi Media Controller (MMC) module (with CD-I remote control)
3. Mouse
4. Graphic control
5. Memory card (x 2)
6. (Optional) Expansion module (with additional System RAM and SCSI interface extension boards)

1-2-2. Hardware structure

The CD-I system is a microprocessor system which can handle audio, video and computer code data.

1. CD-I player

The CD-I player module provides the facilities for reading CD-DA and CD-I discs.

The function of the CD-I player module is to play CD-DA and CD-I tracks in combination with the Multi Media Controller (MMC) module.

This module is a CD player with basic audio functions.

When playing CD-I discs via the MMC module, the CD-I player function buttons are de-activated. CD-DA discs can be played either using the CD-I player function buttons or the CD-I remote control.

2. Multi Media Controller (MMC) module

The MMC module, including the CD-I remote control, is the heart of this CD-I system. The MMC controls all functions related to:

- o the input from the user
- o the Digital Output ("DO") signal read from the CD-I disc
- o the application software

Based on this the following outputs are generated:

- o the "RS" (control) signal to the CD-I player
- o Video signals
- o Audio signals

All CD-I user control functions are provided for in this module.

CD-I Remote Control

The main function of the CD-I remote control is as a CD-I cursor control device and a CD audio control commander for the MMC module.

The interface to the MMC module can be via an infra-red (IR) transmission or via an Input device (control) cable.

3. Mouse

This mouse can be used in combination with your CD-I system, as an alternative to the CD-I remote control. When the CD-I system is used on a desk, for instance, the mouse offers generally easier control and selection facilities.

4. Graphic Control

This Graphic Control can be used in combination with your CD-I system as an alternative to the CD-I remote control. It offers faster control and input of graphical data for graphics-based applications.

5. Memory card

The Memory card can be inserted in the MMC module. It contains an NV-RAM (non volatile) for use as an extension of the built-in NV-RAM, to personalise the system. The use is completely dependent on the application software to be developed.

6. Expansion module

The main function of the Expansion module is to enhance the CD-I system (MMC module and CD-I player module) with capabilities beyond the typical base case CD-I system.

The Expansion module incorporates two floppy disk drives to store or read data conforming to CD-RTOS (OS-9) disk format.

For connections of additional (non-system) equipment the Expansion module provides a Centronics parallel printer interface and RS-232C serial interface. The RS-232C serial interface can be applied for a modem or as a port to another data processing system.

To expand the system, two slots for extension boards are provided. These slots are connected to the CPU bus signals from the main 68070 microprocessor in the MMC module. All extension boards can be connected to either slot. System RAM extension and SCSI interface extension boards are supplied.

Within a CD-I system, only one Expansion module can be connected, to be placed directly below the MMC module.

1-2-3. Configuration rules

- Basic configuration

The basic CD-I system consists of:

- o CD-I player
- o Multi Media Controller (MMC) module
- o CD-I remote Control (supplied with MMC module)

This system needs to be connected to a display unit and audio equipment. A normal NTSC television set or an analogue RGB monitor (525 lines) and audio system can be used for this purpose (see Fig. 1.1).

The function of the system is to play CD-I discs encoded in accordance with the CD-I standard, and to play the CD-DA discs.

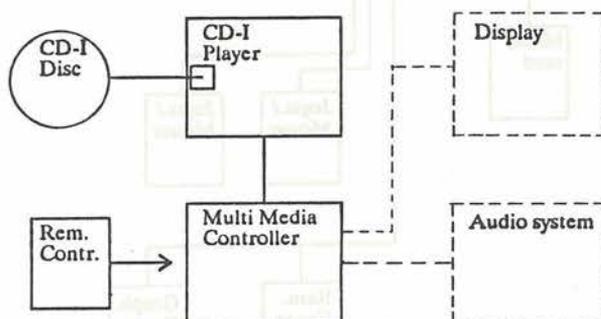


Fig. 1.1 Basic CD-I system

———— CD-I system

----- associated equipment

- Basic configuration with enhancements

The capability of the basic system to handle particular applications can be enhanced by the connection of the Mouse, Graphic control and Memory card supplied as parts of the sample production system. For the same purpose, an additional Mouse or Joystick (not supplied) can also be connected (see Fig. 1.2).

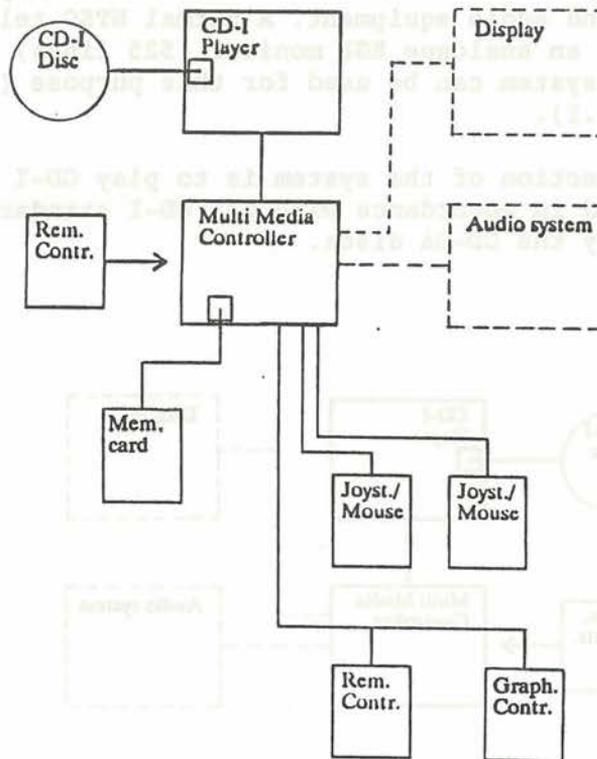


Fig. 1.2 Basic CD-I system with enhancements
 ——— CD-I system
 -----associated equipment

- Extended configuration

The capability of the system can be extended beyond that of the basic configuration, to handle more diverse applications (see Fig. 1.3). This is more achieved by connecting the Expansion module, which permits the use of:

- supplementary application software via the built-in floppy disc drives;
- extra System RAM and an SCSI interface on the extension boards supplied;
- the connection of a parallel printer via a Printer interface;
- Modem or port to another data processing system via an RS-232C interface.

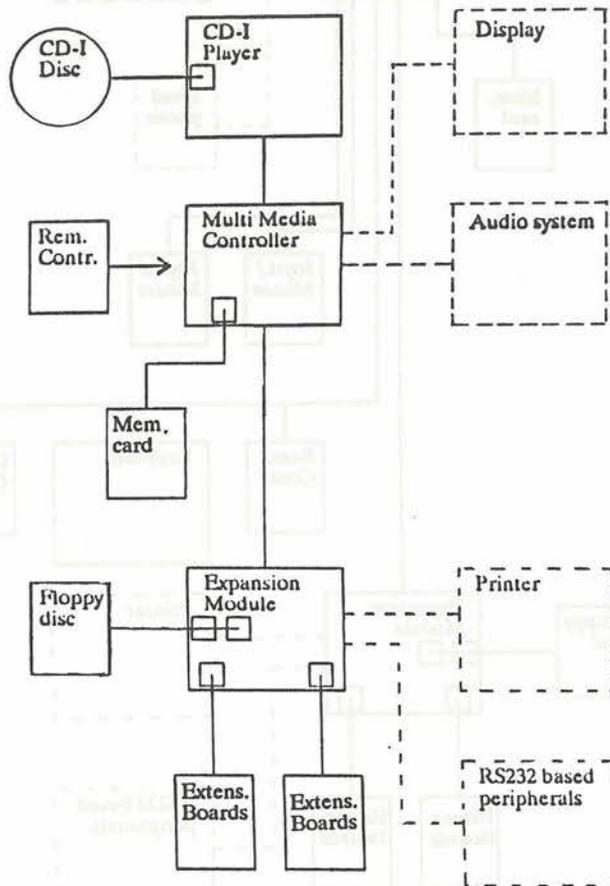


Fig. 1.3 Extended configuration

— CD-I system
 ---- associated equipment

- Future applications

The configuration structure takes account of the likely requirement of future applications to utilize further peripherals such as keyboards and hard discs (see Fig. 1.4). These are under study for possible future implementation.

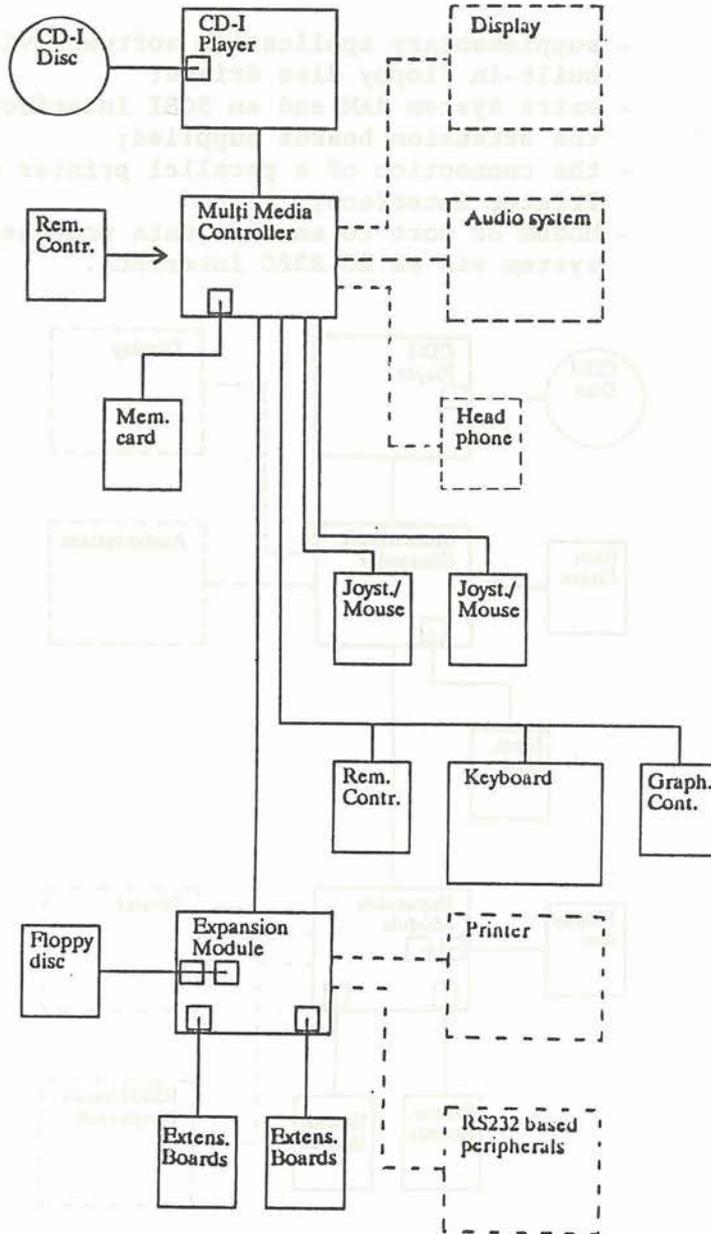


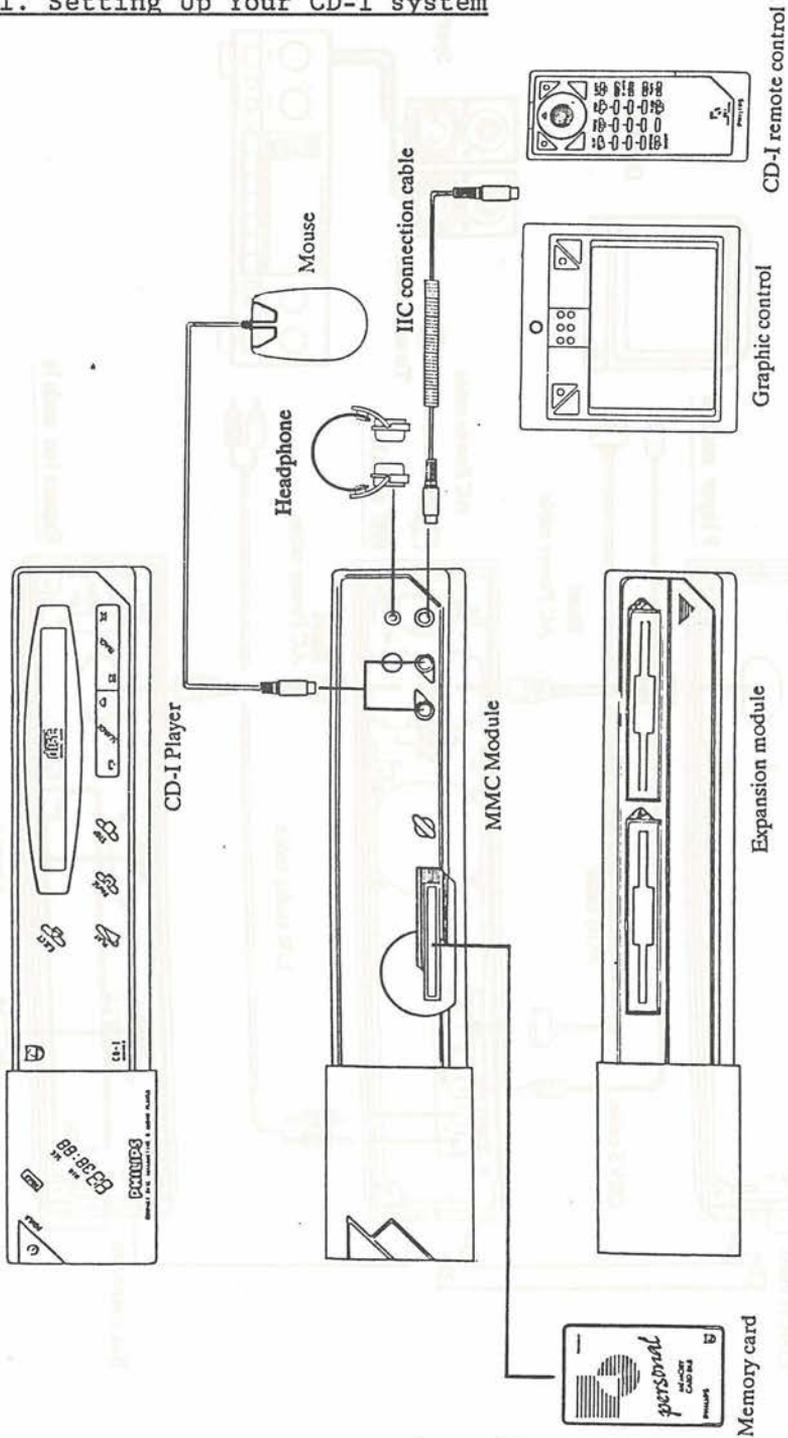
Fig. 1.4 The total configuration

—— CD-I system

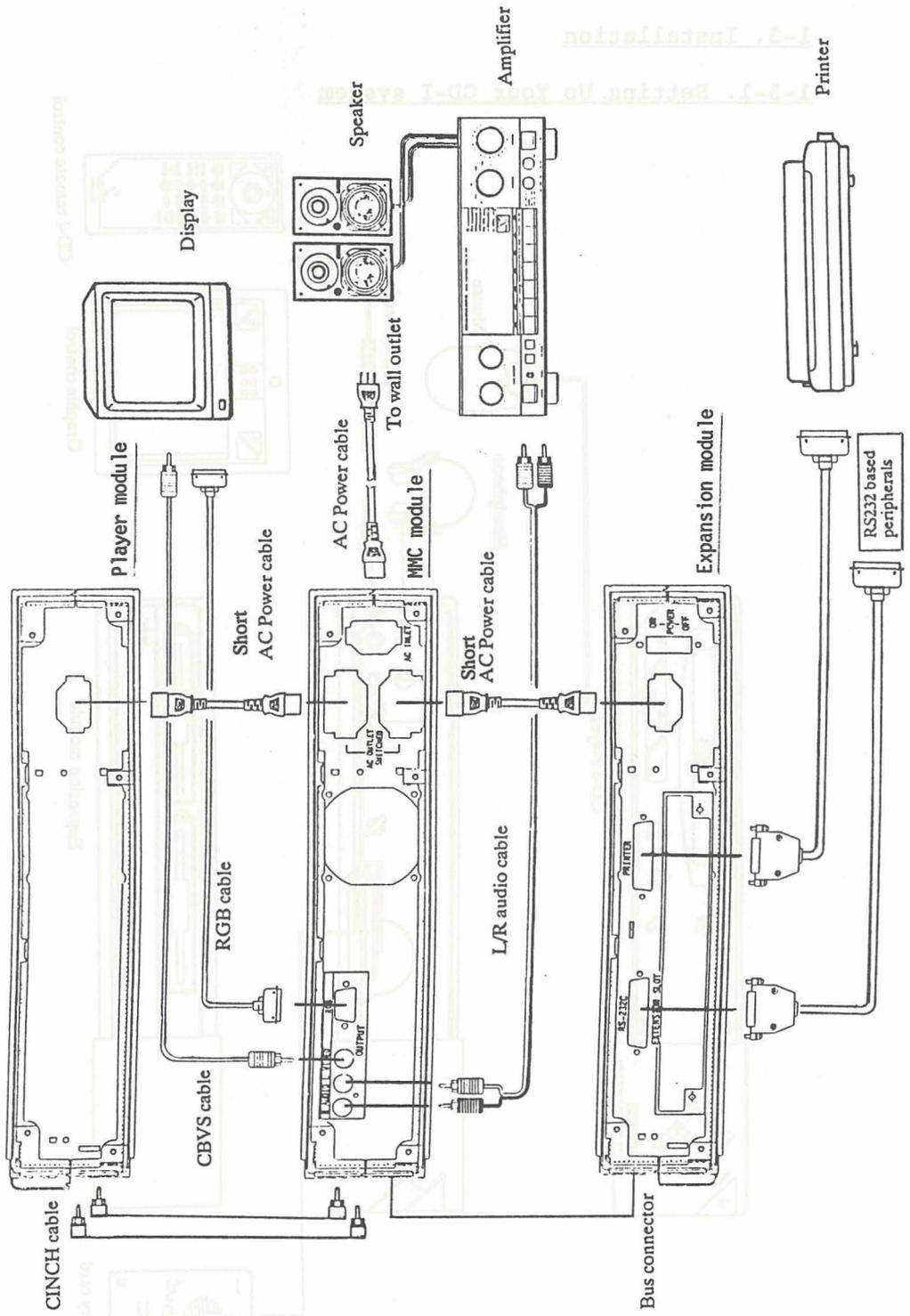
----- associated equipment

1-3. Installation

1-3-1. Setting Up Your CD-I system



System elements



System connections

Before connecting any cables or equipments to your CD-I system, check that power to all such equipments is off and that connectors are correct.

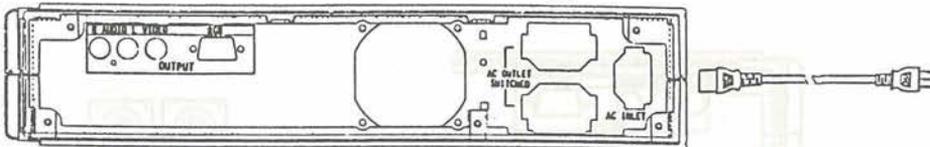
1. AC Power cable Connection

When connecting the AC power cable, make sure that the power source and the CD-I system rated voltage given on the type plate correspond.

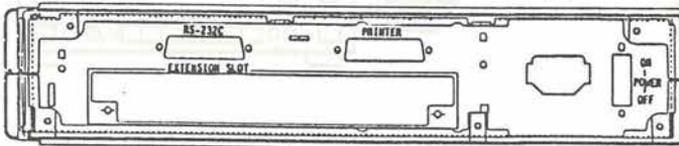
CD-I Player



MMC module



Expansion module



AC power connection

2. Connecting of Peripherals

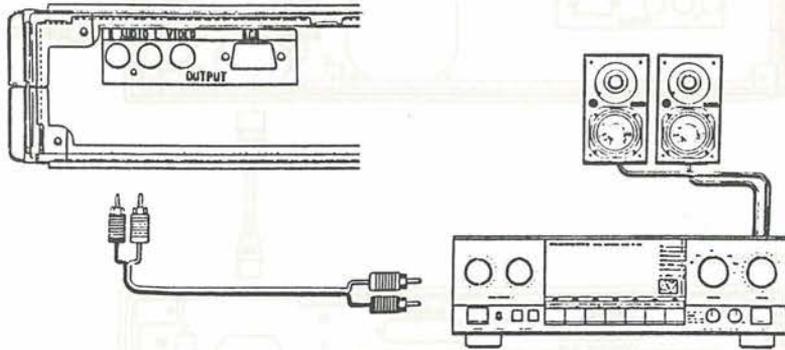
Before connecting peripherals to your CD-I system, be sure to refer to the instruction manual for each device so that you know to connect it correctly. Also make sure that the peripheral device is compatible with the CD-I system.

Typical connections between the main CD-I system units and the various peripheral devices are explained below.

- Amplifier

The sound reproduction quality of display units is in general too low to enjoy CD quality sound. Via the audio sockets provided on the MMC module a normal HiFi system can be connected.

Connect the amplifier to the Audio L/R output located at the rear of the panel of the MMC module with the L/R audio cable supplied. You may use any of the amplifier inputs except Phono. Be sure to observe the correct channel polarity.



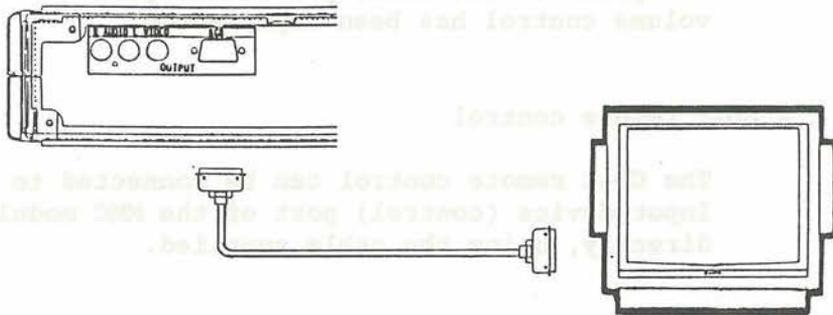
Amplifier connection

- Display

The MMC module supplies both RGB and NTSC CVBS (composite) video signals. When connecting to the display, you can use either the RGB output or the Video output.

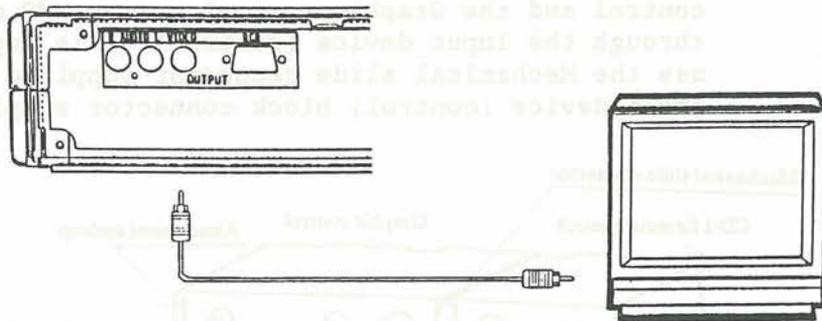
An RGB connection will give the best video quality.

1. Connect the Display via the RGB output



RGB connection

2. Connect the Display via the Video output



VIDEO connection

- Printer

The Expansion module has both a parallel printer interface and a serial RS-232C interface.

It is normally better to use the parallel printer interface for the printer, leaving the RS-232C port free for devices such as modems, and other data processing equipment.

- Headphone

The MMC module has an output for a stereo headphone on the front panel. Headphone volume control has been implemented.

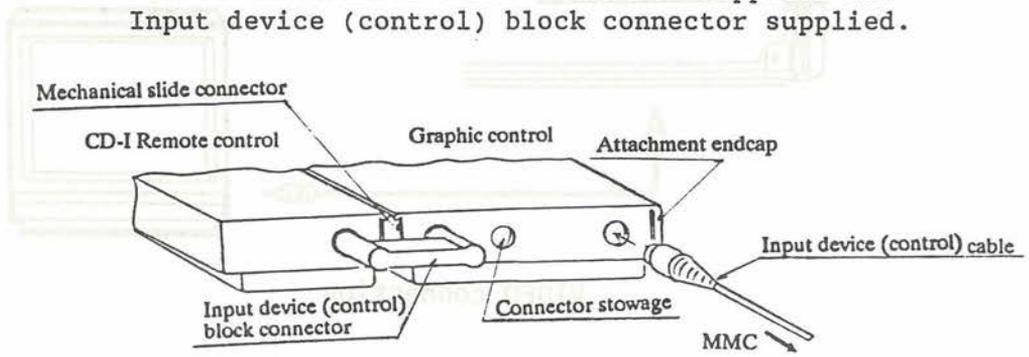
- CD-I remote control

The CD-I remote control can be connected to the Input device (control) port of the MMC module directly, using the cable supplied.

- Graphic control

The Graphic control can be connected to the Input device (control) port of the MMC module directly, using the cable supplied.

If you want to connect both the CD-I remote control and the Graphic control to the MMC module through the Input device (control) cable supplied, use the Mechanical slide connector supplied and Input device (control) block connector supplied.



Connecting CD-I remote control to Graphic control

- Mouse

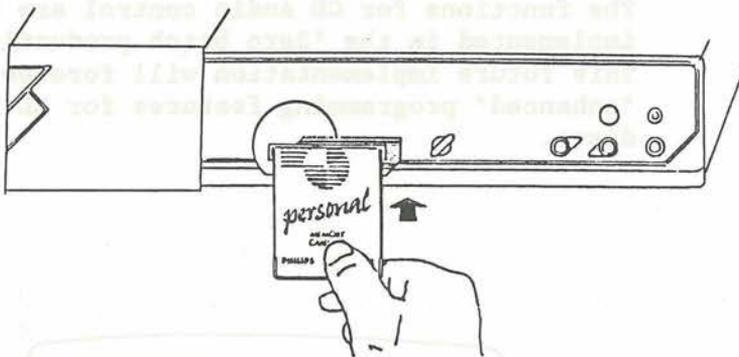
Connect to one of the Joystick/Mouse ports, located at the front of the MMC module. The ports are numbered 1 and 2. When using one device only, use port 1.

Note: A joystick is not supplied.

- Memory card

Insert the Memory card in the Memory card slot, located at the front of your MMC module with the "THIS SIDE UP" printing on the card facing you. Push it right in.

NEVER insert or remove the card when the MMC module is switched on.



Memory card insertion in MMC module

1-4. Additional information

1-4-1. Software structure

1. System software

The system software provides for a user-friendly interface and an optimised and suitable environment for the application software. The system software is stored in ROM. The main ROM is located in the MMC, with extension ROMs in the Expansion module and on the extensions boards.

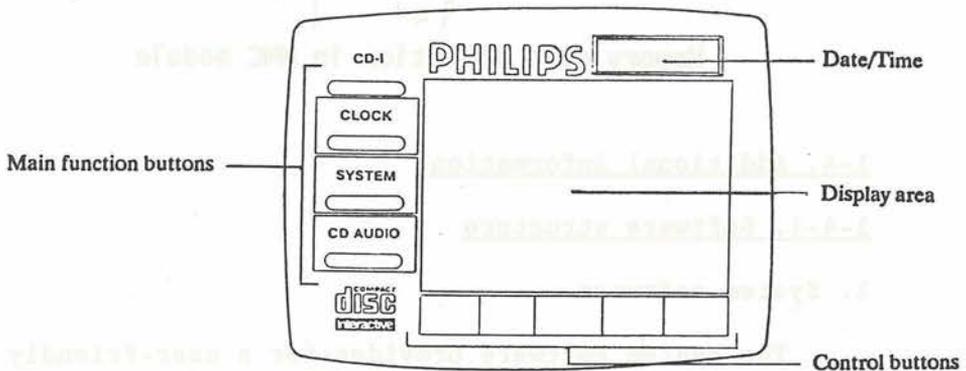
o Player shell

This software will show a small animated sequence, ultimately revealing a standard control screen. Further this software provides simple, consistent and easy to use functions to start CD-I applications, to show Clock/Calendar functions and execute some System maintenance functions, like:

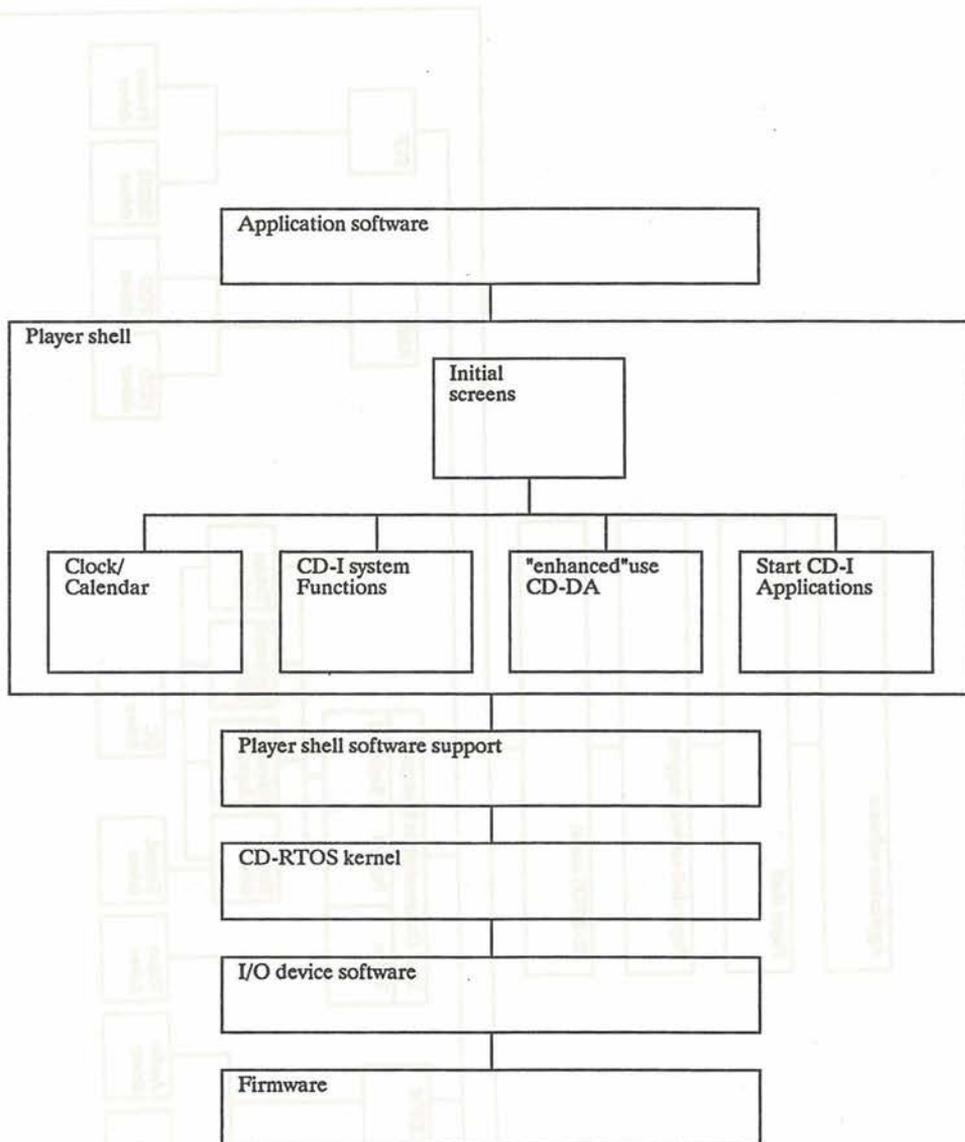
- Time, Date and Time Zone setting
- View of test pattern
- Formatting of Personal Memory card
- Naming of Personal Memory card
- Input device speed setting

These functions are operated using one of the cursor control-devices and the display.

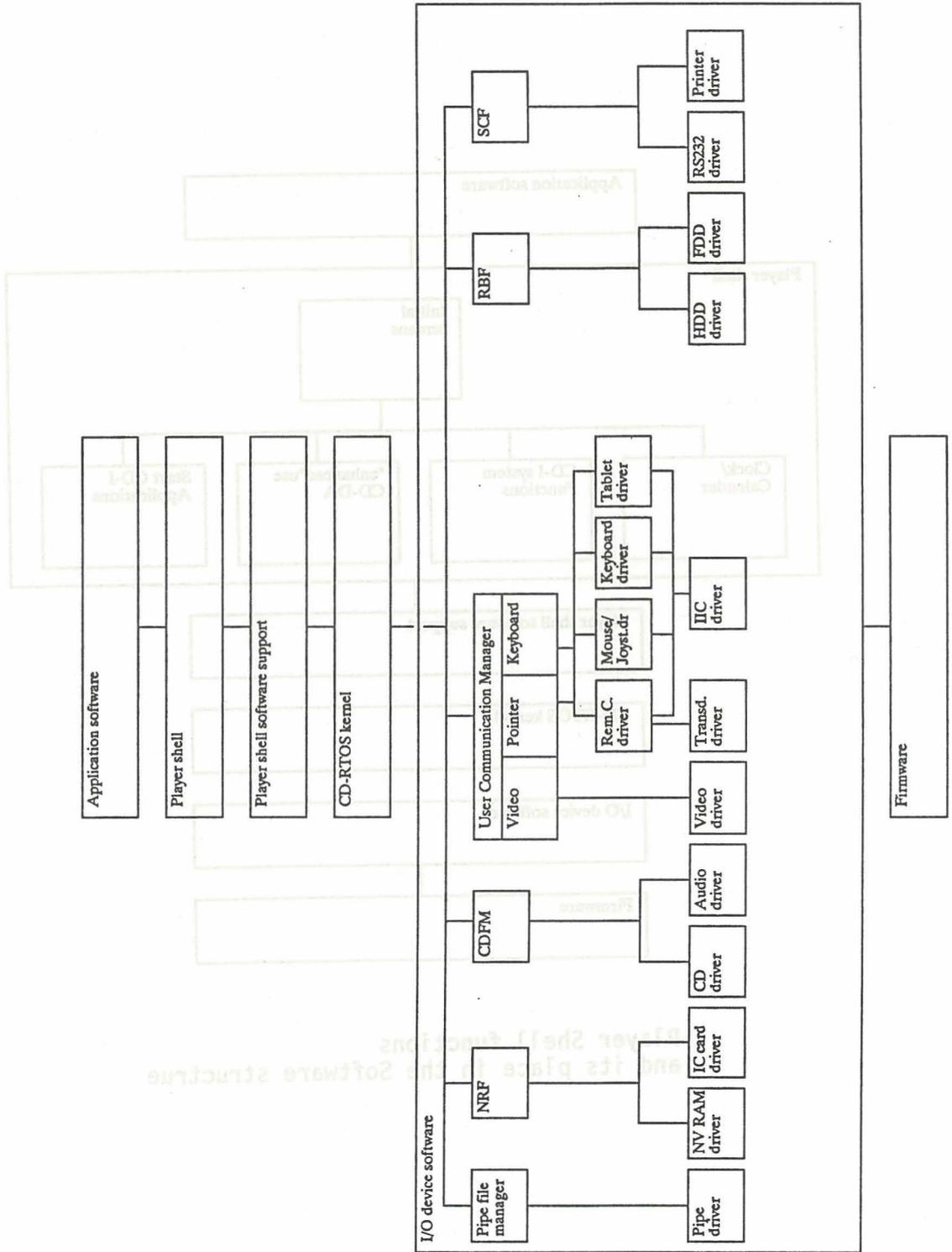
The functions for CD Audio control are not implemented in the "Zero batch production". This future implementation will foresee in "enhanced" programming features for CD Audio discs.



Standard control screen



Player Shell functions
and its place in the Software structure



Total Software structure

1-4-2. Environment

1-4-2-1. Climatic conditions.

- Operational

temperature: +5 - +35°C
humidity: 20 - 85% RH
(non condensed condition)

- Non operational

temperature: -25 - +60°C
humidity: 0 - 90% RH

1-4-2-2. Mains supply

This depends on the destination/version:

Batch 0 is based on the USA version.

Mains supply voltage: 120 Vrms +/-10%
Frequency: 60 Hz +/-2%

All the units are Class II, but with additional earth connection to conform with the radiation requirements.

Appendix 1. Reference Material

- Compact Disc Interactive:

A Designer's Overview. First edition: December 1987. Distributed by: Kluwer Technical Books, P.O.Box 23,7400GA Deventer, The Netherlands.

CHAPTER 2 .
CD - I PLAYER

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CHAPTER 2
CD-I PLAYER

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2-1. Introduction

The CD-I system, to which this CD-I Player module belongs, is a microprocessor system which can handle sound, video, graphics, text and computer code data.

The CD-I module provides the facilities for reading CD-DA and CD-I discs.

The function of the CD-I player module is to play CD-DA and CD-I tracks in combination with the Multi Media Controller (MMC) module.

2-2. Precautions

- Check that your mains supply voltage is the same as that given on the type plate on the rear of the CD-I player.
- Always stand the unit either horizontally or vertically on a flat, firm base. Allow space around for ventilation.
- Never place in a hot sunny position.
- Never allow it to get damp.
- Never attempt to repair the unit yourself.
- When the unit is to be transported or stored, handle it carefully to avoid giving it severe shocks.
- Laser Safety

This unit employs a laser. Only a qualified service person should remove the cover or attempt to service this device, due to possible eye injury.

"CAUTION" - USE OF CONTROLS OR ADJUSTMENTS OR PERFORMANCE OF PROCEDURE OTHERS THAT SPECIFIED HEREIN MAY RESULT IN HAZARDOUS RADIATION EXPOSURE.

2-3. Summary of Controls and Connections

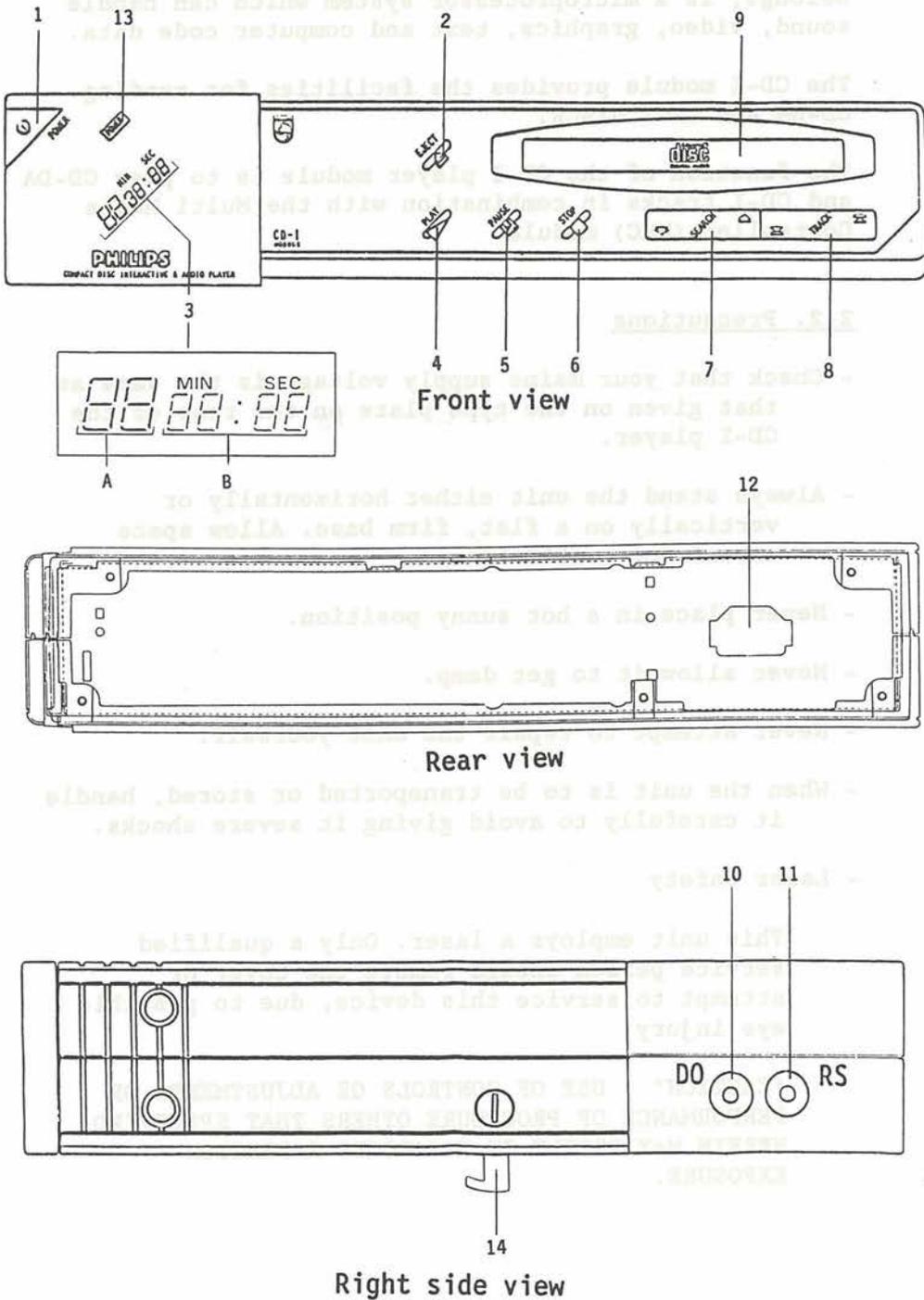


Fig. 2-1.

1. **Power switch:**
Press this switch to turn the power on, and press it again to turn it off. Leave the switch on to use the standby mode of the MMC module.
2. **EJECT button:**
Press this button to eject the disc tray. When the button is pressed, the disc tray is ejected halfway toward the front. The disc tray can then be taken out by hand.
3. **Display panel:**
This display shows the track no., playing time and playing mode of the unit.
 - (A) **TRACK indicator:**
This displays the number of tracks on a CD-DA disc, and then the number of the track being played.
 - (B) **Time (MIN/SEC) indicator:**
This displays the elapsed time of the track being played of the CD-DA disc.
4. **PLAY button:**
Press this button to start disc playback. When this button is pressed during playback, the track being played re-starts from the beginning.
5. **PAUSE button:**
When this button is pressed during playback, playback is stopped temporarily at that position. To resume playback, press this button again. The time indicator blinks during pause mode.
6. **STOP button:**
Press this button to stop playback.
7. **SEARCH button:**
 - o **Fast forward (⏭):**
When the right side of this button is held pressed during playback, the player searches forward at high speed.
 - o **Fast reverse (⏮):**
When the left side of this button is held pressed during playback, the player searches backward at high speed.

8. TRACK button:
- o Previous track button (⏮):
Each time the left side of this button is pressed during playback, one track is skipped in the backward direction, and playback is started from that track. (e.g.: When this side is pressed twice, the second previous track is played.)
 - o Next track button (⏭):
Each time the right side of this button is pressed during playback, one track is skipped in the forward direction, and playback is started from that track. (e.g.: When this side is pressed twice, the second next track is played.)
9. Disc tray insertion slot:
Insert the disc tray here. Insert it halfway, then push it in lightly: it will be drawn into the unit automatically. If no disc is in the tray, or the disc is the wrong side up, the disc tray will be ejected automatically.
10. Digital output cinch (DO):
The disc data are output in digital format from this jack. Connect this output to the DO jack of the MMC module.
11. Control signal cinch (RS):
Input of the control signals from the MMC module to the CD-I player
12. AC inlet:
Connects the CD-I player to the upper AC power outlet of the MMC module.
13. Power indicator:
Lights up "green" when POWER switch is on.

14. Mechanical hook (L/R):

For mechanical fixation to the MMC module.

2-4. Installation

Note 1. The CD-I player has to be installed together with the Multi Media Controller (MMC) module.

2. Connections and controls are shown in Fig. 2-1.

The following are supplied with your CD-I player module:

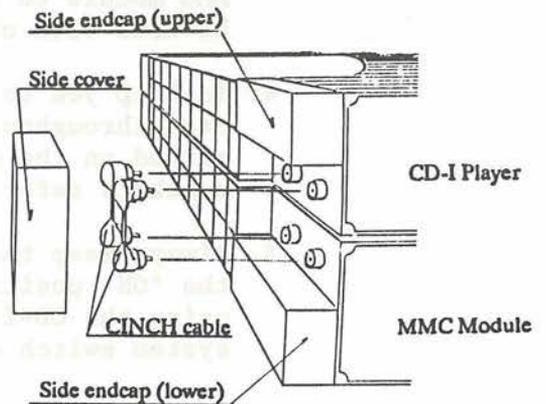
- Short AC power cable
- Side endcaps (fitted on the unit)
- Two (2) CINCH cable links
- Side cover
- Three (3) CALOT CD loading trays

1. Place the CD-I player on top of the MMC module and fix the two units together by turning the two hooks located on the sides of the CD-I player with a coin.

2. Remove the Side endcaps fitted to both the MMC module (upper) and the CD-I player (lower) by unscrewing them.

3. Connect the two (2) CINCH cables supplied between the corresponding DO and RS jacks on the MMC module and the CD-I player.

For the protection of the interfaces, you have to fit the Side cover supplied with the screws.



RS/DO connection

4. Connect the Short AC power cable between the upper AC outlet of the MMC module and the AC inlet of the CD-I player.

Note: Set the POWER switch on the CD-I player to "ON" to make full use of the power-on/stand-by system.

2-5. Using the CD-I player

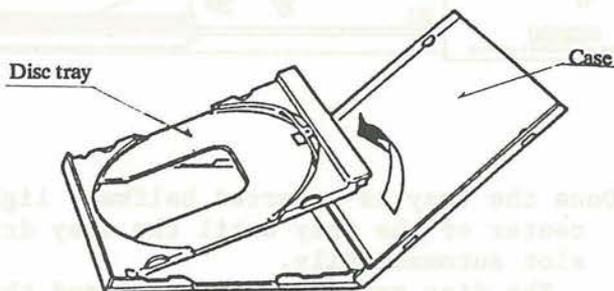
Note 1. When you start to control the player by means of the function buttons on the CD-I player, you are allowed to change to use of the CD-I remote control function buttons at any moment.

When you start to control the player by means of the function buttons on the CD-I remote control, you will not be allowed to change to use of the CD-I player function buttons, unless you STOP the disc.

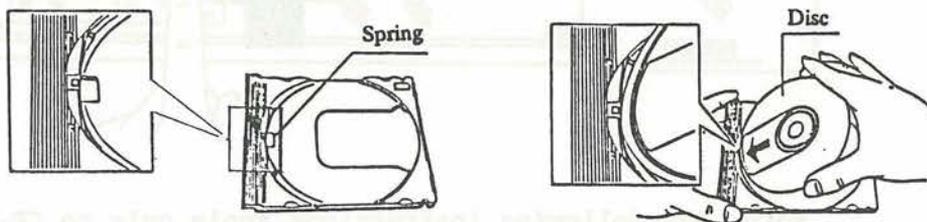
2. The function buttons of this unit operate only with CD-DA and CD-V discs. If a CD-I disc is inserted, only the EJECT button remains operative. In such a case, operate the unit from the MMC module.
3. The CD-I player module must be used with the MMC module to play CD-DA discs. It should not be used with other audio equipment.
4. To help you to locate buttons easily, the names used throughout the text are the same as those marked on the CD-I player. The numbers between brackets refer to Fig. 2-1.
5. Always keep the CD-I player power switch in the "ON" position, and control the system by using the CD-I remote control or the Stand by system switch of the MMC module.

2. Discs can only be loaded into the player by using the CALOT CD loading trays supplied. To use CD discs that do not come with CALOT CD loading trays these loading trays are needed. Use the following procedure to insert a disc into the tray.

a. Remove the loading tray from its case.



b. Hold the disc by the edge and, after depressing the spring in the case, place the disc into the tray with the disc's label side facing upward.

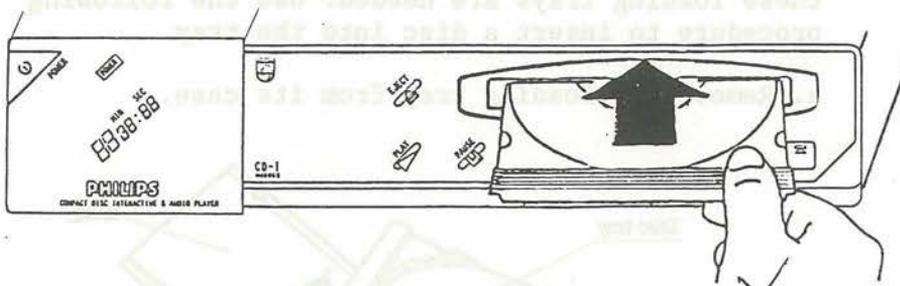


c. To remove the disc, reverse the procedure.

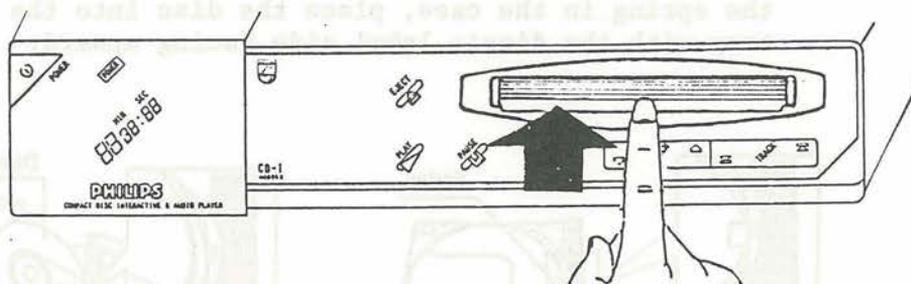
Always keep the CALOT CD loading tray in its case when not in use.

When a disc is not in use, store it in its case to protect it from scratches and dust.

3. Hold the grip of the disc tray and insert it straight into the insertion slot, horizontally.



4. Once the tray is inserted halfway, lightly push the center of the tray until the tray draw into the slot automatically.
- The disc spins for a moment and then stops.
 - The total number of tracks and total playing time of the disc are shown on the display (3).



Note: The following instructions apply only to CD-DA discs, or to the CD-DA tracks on a CD-V disc.

5. Press PLAY button (4).
- The disc starts to spin, and play starts.
 - The track and index numbers now displayed refer to the track being played starting at the beginning of the first track.
 - The elapsed playing time of the track now being played is shown on the display.

6. Control of CD-DA discs

6.1 Moving to the next track (or any later track)

Press Track (⏮) button (8).

- Play stops for a moment, then restarts at the beginning of the next track.

You can jump forward two or more tracks by pressing TRACK (⏮) two or more times in succession.

6.2 Moving to the previous track (or any earlier track)

Press TRACK (⏭) button (8).

- Play stops for a moment, then restarts at the beginning of the previous track.

You can jump back two or more tracks by pressing TRACK (⏭) two or more times in succession.

6.3 Forward or reverse search during play

1. Press SEARCH (⏪) button (7) for a forward search.
2. Press SEARCH (⏩) button (7) for a reverse search.

Keep the button pressed until you reach the required position.

6.4 Short interruption of play

1. Press PAUSE button (5).
 - The playback stops but the disc continues to spin.
2. Press PAUSE button (5) again to restart play from where it was interrupted.

6.5 Stopping play

Press STOP button (6).

- The disc stops spinning.

6.6 Returning to the start of the current track

Press PLAY button (4).

- Play stops for a moment then restarts at the beginning of the track.

After playing the last track, the player stops automatically. The player return to the start position. The total number of tracks and the total playing time of the disc are again displayed

6.7 Press the PLAY button (4).

- Play starts at the beginning of the first track.

Note: The following instructions are for all disc types.

7. Press EJECT button (2).

- The disc tray is ejected halfway.
- The information disappears from the display (3).

8. Take the disc tray from the disc tray insertion slot by hand.

9. Press the SYSTEM POWER switch on the MMC.

- The display and Power indicator goes out.
- The CD-I player is now switched off.

Chapter 2. Appendix. Technical data

1. Data transfer rate: 2.8224 Mbits/sec
Data signal levels: DO - output HCMOS
(not standard)
RS - input HCMOS
2. Access time
Max. access time: About 1.2 sec.
(0 min. 0.2 sec. 00 block -> 60 min. 00 sec. 00
block)
Average access time: About 0.6 sec.
(0 min. 0.2 sec. 00 block -> 20 min. 00 sec. 00
block)
3. Rotation speed: 200 to 530 rpm
4. Power supply
Voltage: 120 VAC (+/-10%)
Frequency: 60 Hz
Power consumption: 20 W
5. Weight: 5.5 kg
6. Outer dimensions (mm): 360 (W) x 75 (H) x 362 (D)

General 2. Appendix - Technical data

1. Data transfer rate: 2.5224 Mbits/sec
- Data signal level: 00 - output BCODE (not standard)
- 02 - input BCODE
2. Access time
Max. access time: About 1.8 sec.
(0 min. 0.1 sec. 00 block -> 00 min. 00 sec. 00 block)
- Average access time: About 0.6 sec.
(0 min. 0.2 sec. 00 block -> 00 min. 00 sec. 00 block)
3. Rotation speed: 200 to 120 rpm
4. Power supply
Voltage: 120 VAC (+/-10%)
Frequency: 60 Hz
Power consumption: 20 W
5. Weight: 3.2 kg
6. Outer dimensions (mm): 360 (W) x 12 (H) x 302 (D)

CHAPTER 3 .

MULTI MEDIA CONTROLLER (MMC)

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MULTI-MEDIA CONTROLLER (MMC)

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3-1. Introduction

The CD-I player system, to which this MMC module belongs, is a micro processor system which can handle sound, video and computer code data.

The MMC module, including the remote control, is the heart of this CD-I system. The MMC controls all functions related to :

- the input from the user
- the Digital Output ("DO") signal read from the CD-I and CD-DA disc
- the application software

Based on this the following outputs are generated:

- the "RS" (control) signal to the CD-I player
- Video signals
- Audio signals

All CD-I user control functions are provided for in this module.

3-2. Precautions

- Check that your mains supply voltage is the same as that given on the type plate on the rear of the MMC module.
- Always stand the unit either horizontally or vertically on a flat, firm base. Allow space around for ventilation.
- Never place in a hot sunny position.
- Never allow to get damp.
- Never attempt to repair the unit yourself.
- When the unit is to be transported or stored, handle it carefully to avoid giving it severe shocks.

3-3. Summary of Controls and Connections

Multi Media Controller unit

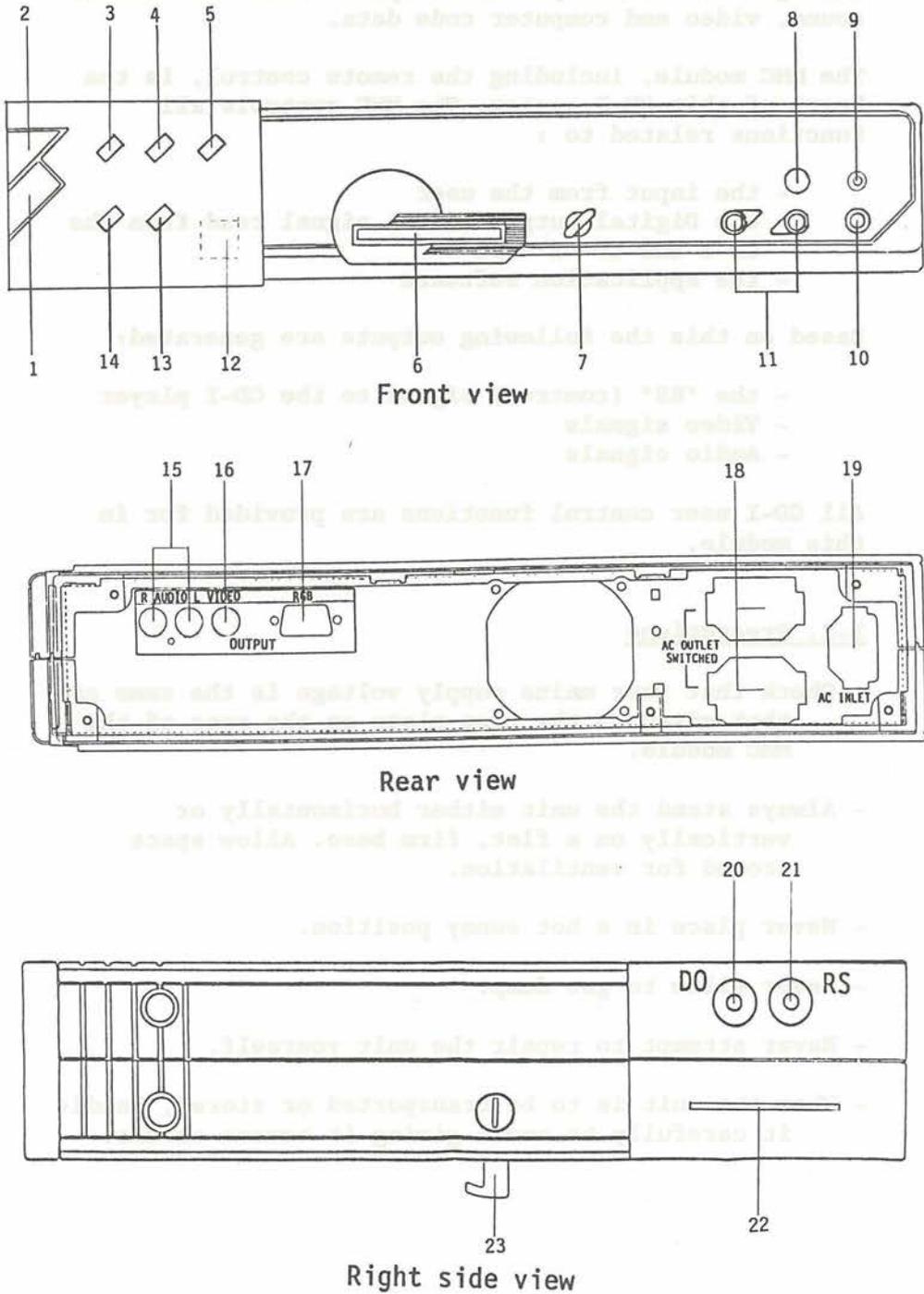


Fig. 3-1.

1. **Stand By System Switch:**
Press this switch to turn the power to the complete system ON or OFF.
2. **Power Switch :**
Press this switch to turn on the MMC module.
3. **Power LED:**
Lights up "green" when the Power switch is ON, providing that the system power switch is also ON.
4. **STAND-BY LED:**
Lights up "red" when the system is in "STAND-BY" position.
5. **IR sensor LED:**
Lights up "orange" when the IR receiver receives an IR signal from the CD-I remote control.
6. **Memory card slot:**
For inserting the Memory card supplied to store data.
7. **Abort switch:**
If control of the application program should be lost, press this button to reset the system to the initial state.
8. **Headphone VOLUME control:**
For adjusting the volume when listening with a headphone.
9. **Headphone jack:**
For private listening you can connect a (stereo) headphone to this socket.
10. **Input device (control) port:**
For connecting the remote control and/or the graphic control via Input device (control) cable supplied.
11. **Joystick/Mouse ports:**
For connecting a Joystick or Mouse. The connectors are numbered "1" and "2". When using one control only, use connector "1".
12. **IR receiver:**
For receiving infra-red signals from the CD-I remote control.

13. CD-DA LED:
Lights up "green" when a CD-DA disc is inserted in the CD-I player, and its contents have been read by the player.
14. CD-I LED:
Lights up "green" when the CD-I disc is inserted in the CD-I player, and its contents have been read by the player.
15. Audio L/R :
Connects the MMC module to a HiFi system.
16. Video output (CVBS):
Connect the MMC module with a display via the VIDEO cable supplied.
17. Video output (RGB analogue):
Connects the MMC module with a display via an RGB cable (not supplied).
18. AC outlets (2):
Connect AC power to the CD-I player and Expansion module (Short AC power cables supplied with the CD-I player and Expansion module), if present.
19. AC inlet:
Connects AC power from the mains supply via the AC power cable supplied.
20. "DO" interface:
Connects via a CINCH cable to the "DO" (digital output) cinch of the CD-I player (cable supplied with CD-I player).
21. "RS" interface:
Connects via a CINCH cable to the "RS" control cinch of the CD-I player (cable supplied with CD-I player).
22. CPU bus interface:
For the electrical interconnection of the Expansion module with the MMC module via flat cable supplied with Expansion module.
23. Mechanical hook (L/R):
For the mechanical interconnection of the Expansion module with the MMC module.

Remote Control unit

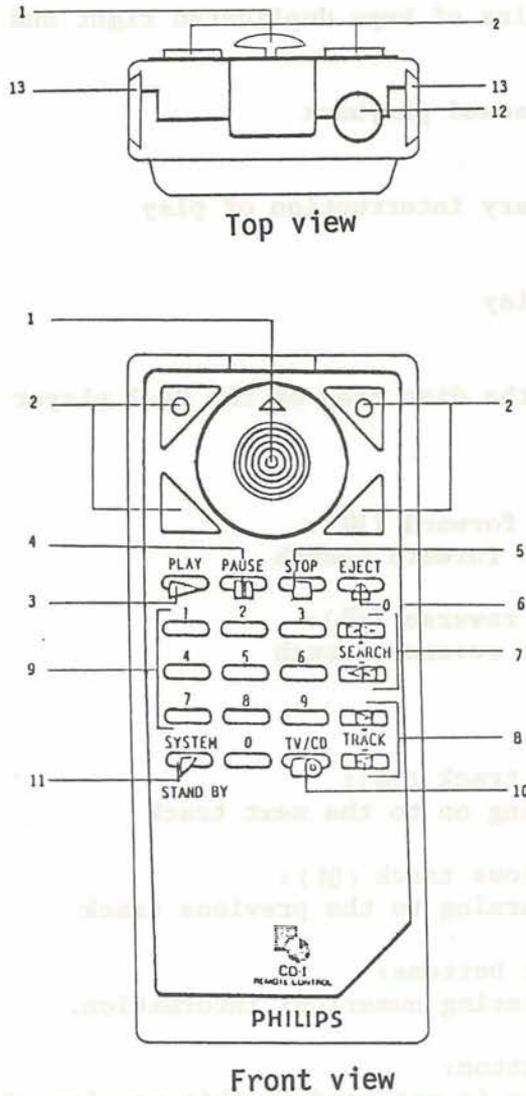


Fig. 3-2.

1. Joystick:
A cursor control device whose angle and direction control the speed and direction of cursor movement on the display screen.
2. Action keys:
Two pairs of keys duplicated right and left.
3. PLAY:
Start sound playback
4. PAUSE:
Temporary interruption of play
5. STOP:
Stop play
6. EJECT:
Eject the disc tray of the CD-I player
7. SEARCH:
 - o Fast forward (⏩):
Fast forward search
 - o Fast reverse (⏪):
Fast reverse search
8. TRACK:
 - o Next track (⏮):
Moving on to the next track
 - o Previous track (⏭):
Returning to the previous track
9. 0-9 digit buttons:
For entering numerical information.
10. TV/CD button:
This key is not used in this version of the equipment.
11. System Stand by button:
Controls the switching of the CD-I Player system from the power-on mode into the stand-by mode and back to the power-on mode.

12. **Input device (control) connector:**
Connects the CD-I remote control and/or graphical tablet with the MMC module by Input device (control) connection cable.
13. **Side attachment slots:**
Links the Remote Control to the Graphic control.

3-4. Installation

Note 1. The MMC module has to be installed together with the CD-I player.

2. Connectors and controls are shown in Figs. 3-1 and 3-2.

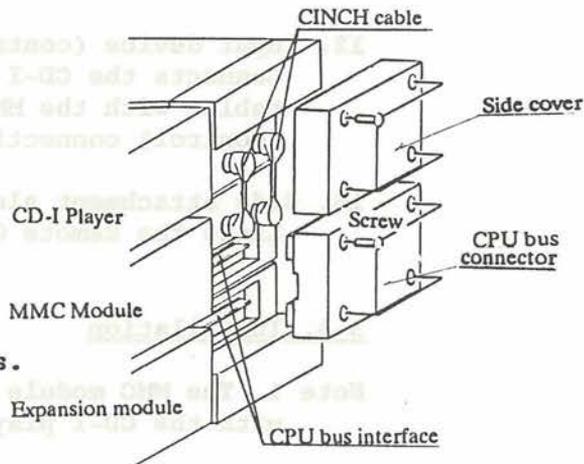
The following are supplied with your Multi Media Controller (MMC) module.

- Short AC power cable
 - Side endcaps (fitted on the unit)
 - VIDEO cable
 - L/R audio cable
 - L/R Attachment endcaps (for the remote control)
 - Input device (control) cable
 - CD-I remote control
 - Three (3) batteries (LR6) for remote control
 - Two (2) Memory cards
1. Place the MMC module under the CD-I player and fix the two units together by turning the two hooks, located on the sides of the CD-I player unit, with a coin.
 2. Remove the Side endcaps fitted to both the CD-I player (lower) and the MMC module (upper) by unscrewing them.

3. Connect the two (2) CINCH cables supplied with the CD-I player between the corresponding "DO" and "RS" cinch on the CD-I player and the MMC module.

For the protection of the interfaces, you have to screw the Side cover supplied to the both modules.

4. CPU bus connection:
See for installation of the Expansion module page 7-4.



5. Installation of the CD-I remote control:

Remove the cover plate for the battery compartment located at the back.

Insert the three (3) batteries (Philips type LR6, or equivalent) as indicated.

Replace the cover plate again.

Note: Instead of IR communication, the input device (control) cable can be used. The CD-I remote control will be powered via the Input device (control) cable and is not consuming thus battery power.

6. Connect the short AC power cable supplied, with the CD-I player to the AC power inlet of the both modules.
7. Connect a display unit (TV set, or Monitor) to the VIDEO (CVBS) output or to the analogue RGB output of the MMC module depending on the interface available on the display unit.

Note: An RGB connection provides the best video quality

8. Connect an audio system to the audio outputs terminals of the MMC module. Alternatively, a headphone can be plugged into the headphone jack on the MMC module.

9. Finally connect the AC power cable supplied with the MMC between the AC inlet of the MMC module and the wall socket.

3-5. Using the MMC module

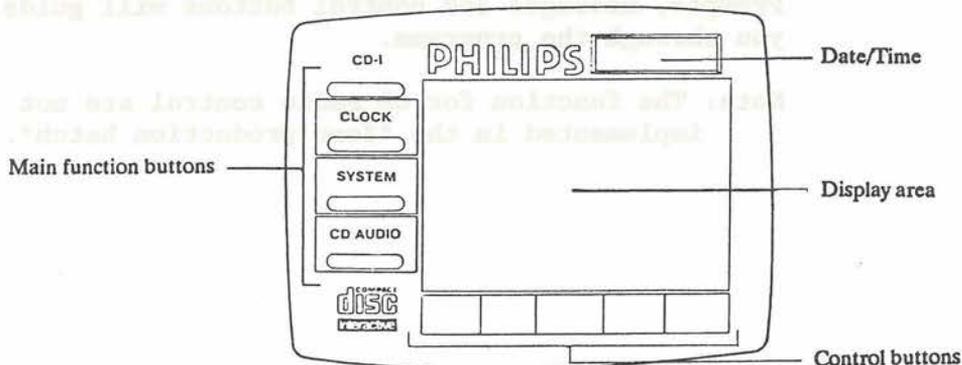
1. Press the Power switch on the CD-I player module to "ON".
2. Press the POWER switch on the MMC module to "ON" to make full use of the power-on/stand-by system.
 - The Power on LED (3) lights.

Note: When you press the System Stand-by switch (1) on your MMC module.

- The System Stand-by LED (4) lights.
- The Power on LED (3) is off.

Note: If the MMC module and the CD-I player are in the power-on mode the CD-I system will be switched-on completely, and the respective Power LEDs will light. However the TV/Display and the Hi-Fi system will have to be switched-on separately, and set up to receive the MMC output signals.

3. The system will show a small animated sequence, ultimately revealing a standard control screen.



Standard control screen

With a cursor control device we can select from this control screen:

- START CD-I APPLICATION (for which you need to load a CD-I disc).

or

- Clock/Calender functions
- System maintenance functions
- CD Audio control functions

Your choice for one of these three main functions will trigger the display of a relevant control panel with buttons. The function of each of these buttons is indicated. Prompts and messages are shown in the display area.

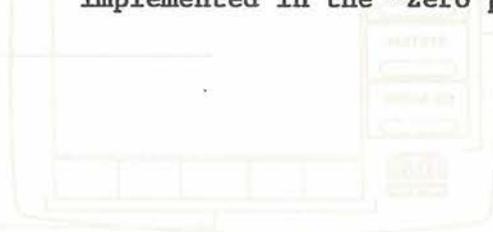
The buttons can be activated by using the action button of the cursor control devices.

The functions embedded in this program are:

- World clock
- Perpetual Calender
- Time, Date and Time Zone setting
- View of test pattern for monitor adjustment
- Formatting of Personal Memory Card
- Naming of Personal Memory Card
- Input device speed setting

Prompts, messages and control buttons will guide you through the programm.

Note: The function for CD Audio control are not implemented in the "Zero production batch".



3-6. Additional information

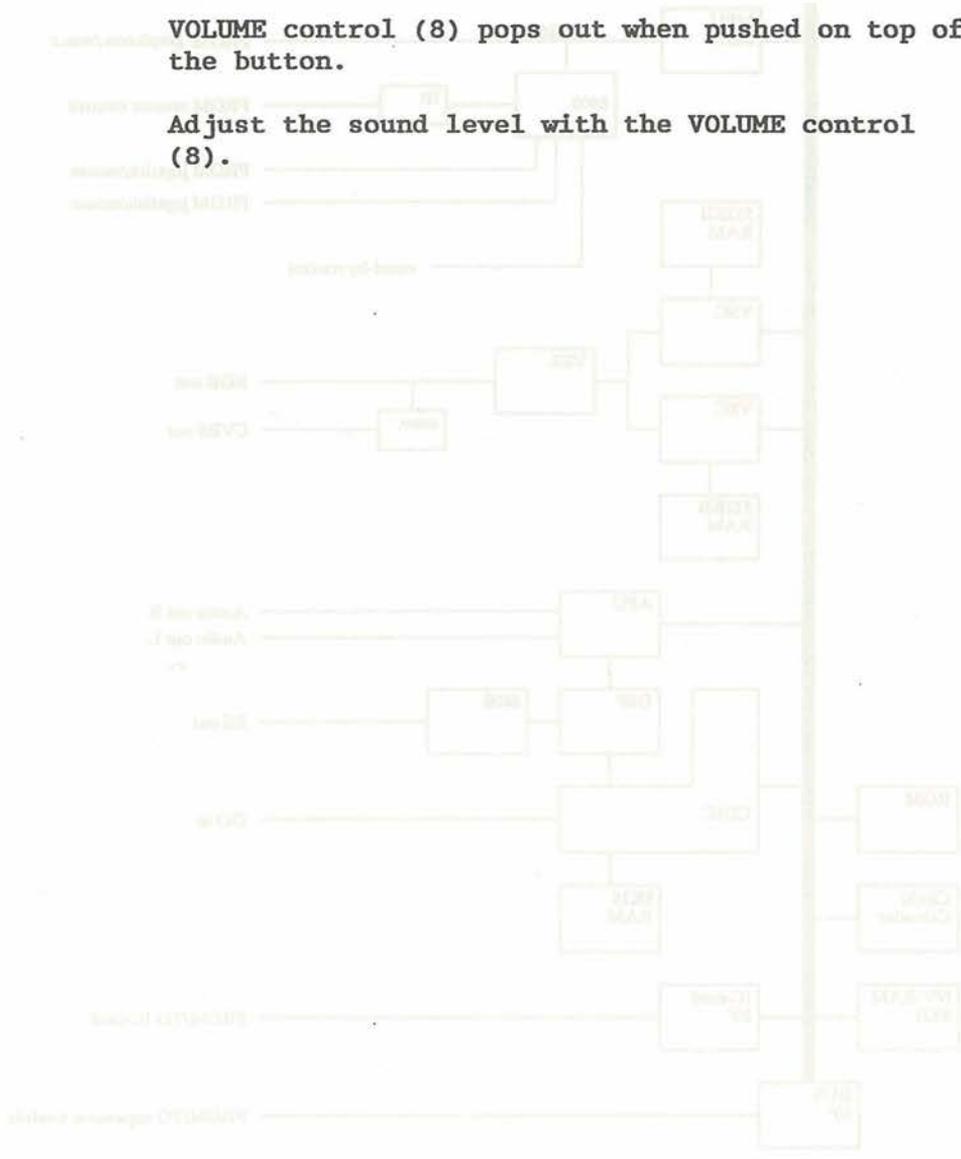
Listening with headphones

Connect a headphone to the Headphone jack (9) for private listening.

The headphones must have a 3.5 mm jack plug and an impedance between 8 and 2000 ohms.

VOLUME control (8) pops out when pushed on top of the button.

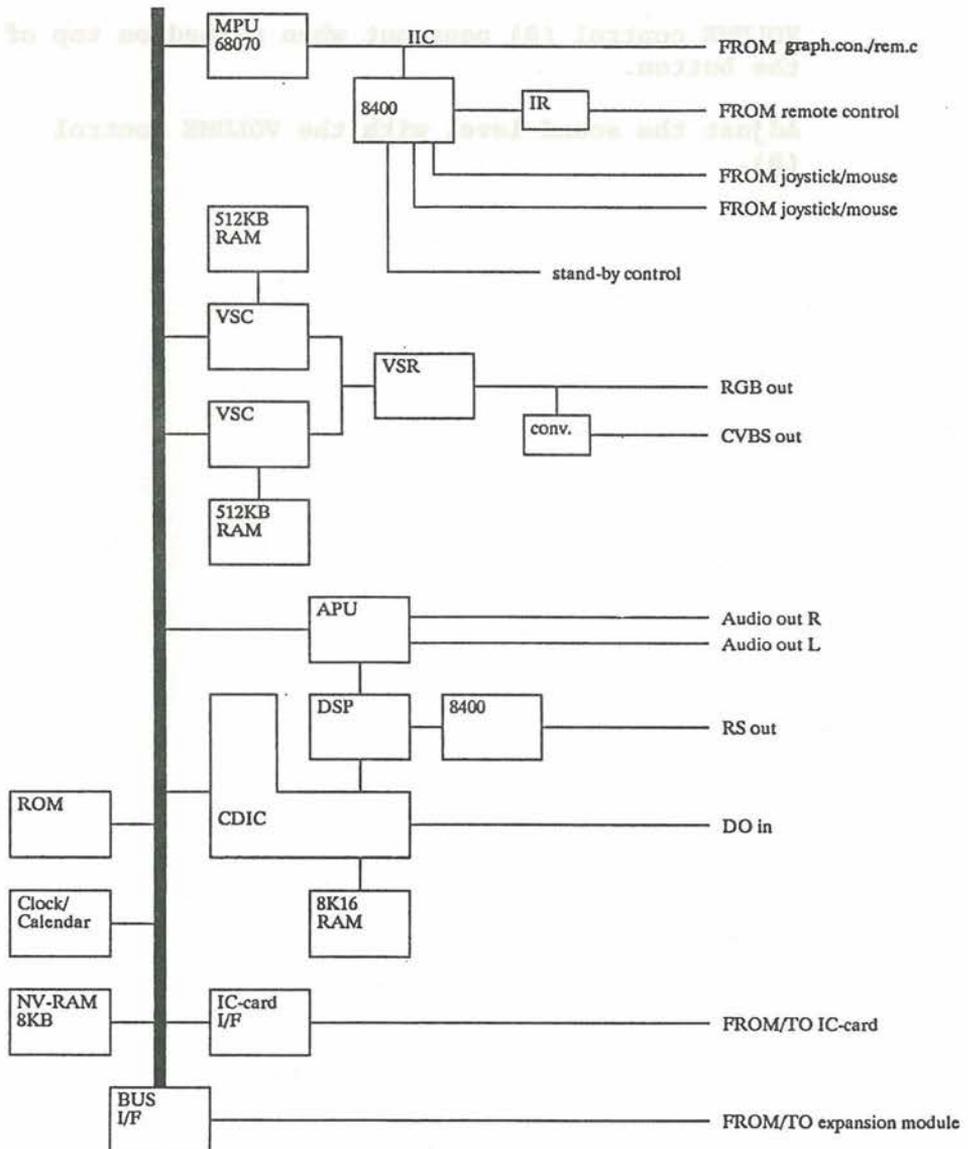
Adjust the sound level with the VOLUME control (8).



Appendix 3 - MMC module Technical Data.

1. Electrical description.

1.1. MMC Block Diagram



1.2. Microprocessor Unit.

The Multi Media Controller includes the 68070, a 16/32 bit microprocessor unit. The 68070 is functionally equivalent to the 68000, but has additional functions integrated into it. These include two DMA channels, for fastest data transfer. The clock speed is 10 MHz.

1.3. System memory

1.3.1 System address map

<u>Address</u>	<u>Name</u>
000000 - 07FFFF	System RAM (Bank 1)
080000 - 0FFFFFF	System RAM (Bank 2)
100000 - 17FFFF	Reserved for System RAM (Bank 3)
180000 - 1FFBFF	System ROM
1FFC00 - 1FFC3F	Calendar Chip
1FFC40 - 1FFC7F	Syscont Registers
1FFC80 - 1FFF7F	Reserved for Option I/O
1FFF80 - 1FFFBF	Reserved for D-RAM I/O
1FFFC0 - 1FFDF	VSC Internal Register (Slave Dual)
1FFFE0 - 1FFFFF	VSC Internal Register (Master or Slave TV)
200000 - 20FFFF	Expansion Driver ROM
210000 - 2FFFFFF	Reserved for Option ROM
300000 - 30FFFF	CD Interface
310000 - 31FFFF	NV-RAM
320000 - 32FFFF	APU. Interface
330000 - 33FFFF	FDD. Interface
340000 - 34FFFF	RS-232C Interface
350000 - 35FFFF	Printer Interface
360000 - 37FFFF	Not Used
380000 - 3FFFFF	Memory card
400000 - 4FFFFFF	Reserved for Optional Peripherals
500000 - 6FFFFFF	Reserved for Optional RAM
700000 - 77FFFF	System ROM
00780000 - 7FFFFFFF	Not used
80000000 - BFFFFFFF	68070 Internal registers
C0000000 - FFFFFFFF	Not used

1.3.2 System/video RAM.

1 MB RAM is organized in 2 separate banks, each of 512 KB. The RAM is shared by the MPU and the video controller via access controllers called VSCs. The program-, video-, and audio-related data share the same RAM area.

- Total Capacity 1 Mbyte
- Access time Max. 100 nsec
- Address
 - bank 1 000000 - 07FFFF
 - bank 2 080000 - 0FFFFFFF

1.3.3 Non-volatile RAM (NV-RAM).

The MMC module has an 8 Kbyte Non Volatile-RAM to store:

- o CD-RTOS information like the CSD table
- o Intermediate application related data.

- Address 310000 - 31FFFF
- Access byte access only(even address)
- Capacity 8 Kbyte
- Access time Max. 150 nsec.

1.3.4 Clock/calendar.

The MMC has a clock-calendar function with the following characteristics:

- o Accuracy of 1 second.
- o Stability better than 1 minute per month.
- o Counts seconds, minutes, hours, days, months, and years.
- o Handles leap years.

- Address 1FFC00 - 1FFC3F
- Access byte access only (even address)

- Internal register

<u>Address</u>	<u>Bank 0</u>	<u>Bank 1</u>
1FFC00	1 sec. counter	Clkout select register
1FFC02	10 sec. counter	Adjust
1FFC04	1 min. counter	Alarm 1 min. register
1FFC06	10 min. counter	Alarm 10 min. register
1FFC08	1 hour counter	Alarm 1 hour register
1FFC0A	10 hour counter	Alarm 10 hour register
1FFC0C	Day counter	Alarm day register
1FFC0E	Date counter	Alarm date register
1FFC10	10'th date counter	Alarm 10'th date register
1FFC12	Mon. counter	Alarm mon. register
1FFC14	10'th mon. counter	Alarm 10'th mon. register
1FFC16	Year counter	Alarm year register
1FFC18	10'th year counter	Alarm 10'th year register
1FFC1A	Mode register	Mode register
1FFC1C	Test register	Test register
1FFC1E	Reset control etc.	Reset control etc.

- Interrupt

The calendar interrupt register in the syscont-registers must be set to the interrupt level and the vector number before an interrupt is generated.

- Battery back up

The clock/calender is always supplied with power, either by the power supply or the back-up battery.

1.4. CD interface.

The MMC has a DO (Digital Output) input connector and RS (Remote Control) output connector in order to communicate with the CD-I player module.

1.5. Audio processing.

1.5.1 ADPCM decoding

CD-I audio data is decoded from ADPCM into 16 bit PCM. The CD interface subsystem can also process the CD-I audio data coming from system RAM memory to the ADPCM decoding function. The kinds of CD-I audio data are:

- o 8-bit ADPCM (level A) mono/stereo
- o 4-bit ADPCM (level B) mono/stereo
- o 4-bit ADPCM (level C) mono/stereo

1.5.2 Audio processing unit.

The audio processing unit converts PCM audio data coming from the ADPCM decoder to the analog audio outputs. It can process PCM data from CD-DA tracks not only on a CD-I disc but also on a CD-DA disc.

It supports audio mixing and attenuation in order to control both the volume and balance for a stereo signal, and both the volume and panning for 2 mono signals.

The analog audio outputs are finally fed to 2 connectors (stereo left and right), and also to a headphone jack with volume control on the front panel.

1.6. Interrupt.

Touching the Abort switch generates an interrupt. This interrupt invokes a system function, which forces the currently running program to stop.

1.7. SYSCONT Registers

There are 8 registers so called Syscont registers in order to support the video and interrupt functions.

- Register address

<u>Address</u>	<u>Reg.</u>	<u>Width</u>	<u>Note</u>
1FFC40	SSR	Word	System support register
1FFC42	AIR	Word	Abort interrupt register
1FFC44	CAIR	Word	Calendar interrupt register
1FFC46	NVIR	Word	VSC interrupt register
1FFC48	CDIIR	Word	CDIC interrupt register
1FFC4A	PRIR	Word	Printer interrupt register
1FFC4C	DUAIR	Word	DUART interrupt register
1FFC4E	FDDIR	Word	FDD. interrupt register
1FFC50	EXIR4	Word	Ext. interrupt register 4
1FFC52	EXIR3	Word	Ext. interrupt register 3
1FFC54	EXIR2	Word	Ext. interrupt register 2
1FFC56	EXIR1	Word	Ext. interrupt register 1
1FFC58	-	-	
1FFC5A	-	-	
1FFC5C	-	-	
1FFC5E	-	-	

- System support register

Software can read and write this register at the same address.

bit assignment

<u>Bit</u>	<u>Name</u>	<u>Active</u>	<u>Note</u>
D15	-	-	not used
D14	-	-	not used
D13	-	-	not used
D13	-	-	not used
D12	-	-	not used
D11	-	-	not used
D10	CA-	L	IC card cassette acknowledge
D09	OD-	L	output disable
D08	M/S-	L	master/slave
D07	-	-	not used
D06	-	-	not used
D05	-	-	not used
D04	-	-	not used
D03	-	-	not used
D02	OP2	H	out port 2
D01	OP1	H	out port 1
D00	OP0	H	out port 0
CA-:			IC card cassette acknowledge
	H		IC card not connected
	L		IC card connected
			read only
OD-:	VSR OD-		pin select
	H		RGB output enable
	L		RGB output disable
			low after reset
M/S-:	VSC(master) M/S-		pin select
	H		master
	L		slave
			high after reset
OP2:			SCC68070 DMA channel 2 control
	H		dual address
	L		single address
OP1:			Green LED control
	H		On
	L		Off
OP0:			Red LED control
	H		On
	L		Off

- Abort interrupt register
Software can read and write this register at the same address.

bit assignment

<u>Bit</u>	<u>Name</u>	<u>Active</u>	<u>Note</u>
D15	-	-	not used
D14	-	-	not used
D13	-	-	not used
D12	-	-	not used
D11	VECEN	H	Vector enable
D10	IPL2	H	Interrupt priority level(IPL0-IPL2)
D09	IPL1	H	
D08	IPL0	H	
OD07	V7	H	Vector number(V0-V7)
D06	V6	H	
D05	V5	H	
D04	V4	H	
D03	V3	H	
D02	V2	H	
D01	V1	H	
D00	V0	H	

VECEN set to 0 after reset
1: vector number is valid.
0: vector number is not valid.

IPL0-IPL2 Interrupt priority level
0 no interrupt
1 not used
2 interrupt level 2
3 not used
4 interrupt level 4
5 interrupt level 5
6 not used
7 interrupt level 7

Interrupt priority level is set to "no interrupt" after reset. Interrupt vector number is set to "0" after reset.

These following registers have same bit assignment and interrupt priority level as the abort interrupt register

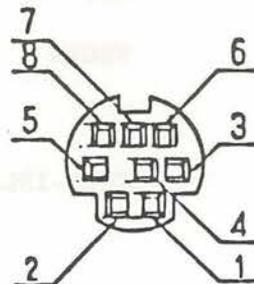
- Calendar interrupt register
- VSC interrupt register
- CDIC interrupt register
- Printer interrupt register
- DUART interrupt register
- FDD interrupt register
- Ext. interrupt register 4
- Ext. interrupt register 3
- Ext. interrupt register 2
- Ext. interrupt register 1

1.8. Input device (Control) interface (IIC)

Connector: mini DIN 8-pin female

Pin assignment

<u>Pin</u>	<u>Symbol</u>	<u>Signal</u>	<u>Direction</u>
1	SCL	Serial clock line	input/output
2	DC5V	5VDC power input	-
3	GND	Ground	-
4	GND	Ground	-
5	SDA	Serial data line	input/output
6	GND	Ground	-
7	NC	No connection	-
8	DC5V	5VDC power input	-



CHAPTER 4 . MOUSE

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CHAPTER 4 . MOUSE

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4-1. Introduction

This mouse can be used in combination with your CD-I player system, as an alternative to the remote control. When the CD-I player system is used on a desk, for instance, the mouse offers generally easier control and selection facilities.

4-2. Precautions

- The mouse is a very precise mechanical device, so handle with care. Do not drop or hit it.
- Do not use the mouse in locations subject to extreme temperatures (either high or low), humidity, dust and vibration.
- Be sure that you place the mouse on a clean flat surface.
- Do not carry the mouse by holding the cable.
- Do not disconnect the mouse from the MMC module by simply pulling the cable. You have to pull out the connector. It may cause damage to the cable and/or the connector.

4-3. Installation

Ensure that the MMC is switched off, and connect the connection cable to one of the Joystick/Mouse ports, located at the front of the MMC module. The ports are numbered 1 and 2. When using one hand control only, use port 1.

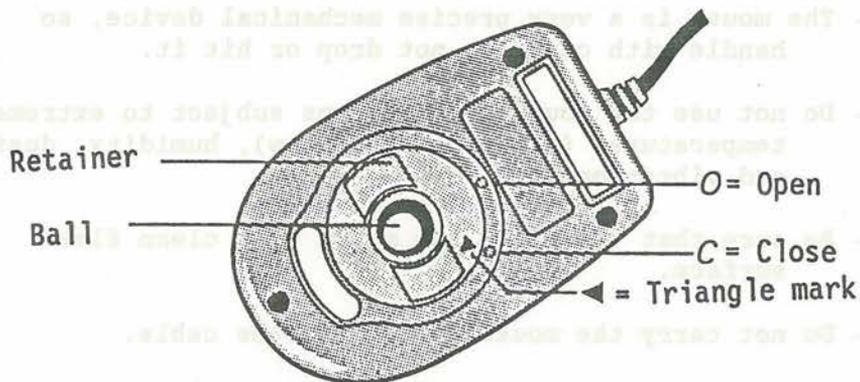
4-4. Using the mouse

1. The mouse can most easily be used on a level surface where it can be moved about 25 cm (10") in all directions.

2. If the mouse cannot be moved as far as desired due to space limitations, it can be picked up and moved to an appropriate place to complete the movement.

4-5. Additional information

In order to ensure optimal operation of the mouse, periodic cleaning is necessary. This operation is very simple, by the following steps.



1. Turn the mouse upside down in your hand with the cable pointing towards you.
2. Place two fingers on either side of the roller opening on the bottom of the mouse and rotate triangle mark from C to O.
3. Hold one hand under the mouse and turn it over so the ball drops into your other hand.
4. Use a clean, soft, and dry cloth to wipe the ball clean. Never use a cleaning fluid or tissue.
5. Gently wipe inside the mouse housing to remove any dust or dirt.
6. Replace the ball in its housing, then reinsert the retainer and lock it by turning from mark "O" to "C".

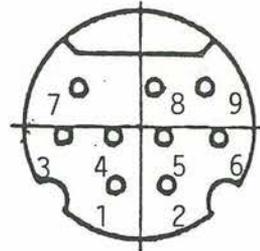
Appendix 4. Mouse Technical Data

- Sensor : Optical rotary encoder
- Resolution of encoder : 24 pulse per rotation
- Resolution : 0.52mm per pulse
0.26mm per count
- Maximum tracking speed : 200mm per sec.
- Outer dimensions (mm) : 64 x 99 x 38.5 (WxDxH)
- Cable length : 1,200 mm +/- 50 mm
- Weight : 100 g (without cable
and connector)

Connector cable

- Mini DIN 9 pin male connector
- Pin connections

<u>pin nr.</u>	<u>signal</u>
1	D0 (up)
2	D1 (down)
3	D2 (left)
4	D3 (right)
5	Vcc (5V +/- 10 %)
6	Left trigger switch
7	Right trigger switch
8	STROBE
9	GND



Appendix A - Mouse Technical Data

- Sensor
- Resolution of encoder
- Resolution
- Maximum tracking speed
- Outer diameter (mm)
- Cable length
- Weight
- Optical rotary encoder
- 74 pulses per rotation
- 0.5mm per pulse
- 0.5mm per count
- 100mm per sec.
- 44 x 97 x 38.2 (Width)
- 1,200 mm +/- 50 mm
- 100 g (without cable and connector)

Connector cable

- Mini DIN 9 pin male connector
- Pin connections

Pin no. signal

- 1 D0 (up)
- 2 D1 (down)
- 3 D2 (left)
- 4 D3 (right)
- 5 Vcc (5V +/- 2V)
- 6 Left trigger switch
- 7 Right trigger switch
- 8 GROUND
- 9 GND



CHAPTER 5 .

GRAPHIC CONTROL

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2-5	Graphic control	2-5

5-1. Introduction

This Graphic control can be used in combination with your CD-I system as an alternative to the CD-I remote control. It offers faster control and input of graphical data for graphics-based applications.

5-2. Precautions

- Avoid direct sunlight, humidity and dust when using and/or storing the Graphic control.
- Put the Graphic control on a flat, firm table or desk.
- Make sure that your MMC module is turned off before connecting the Graphic control.
- Only use the touch pen supplied when you use the Graphic control.
- Never disconnect the Graphic control from the MMC module by simply pulling the cable. You have to pull out the connector.
- Never carry the Graphic control when fixed to the CD-I remote control by the mechanical connector.
- Do not use solvents such as benzine or alcohol since they may cause damage to the surface. If your Graphic control becomes dirty, wipe it with a soft cloth or use a neutral cleaning liquid.

5-3. Summary of controls and connections

1 and 2. Action buttons:

The same functions as the equivalent action keys on the CD-I remote control.

3. Panel: Characters, graphics, patterns and pictures are drawn on the panel and the coordinates are entered.

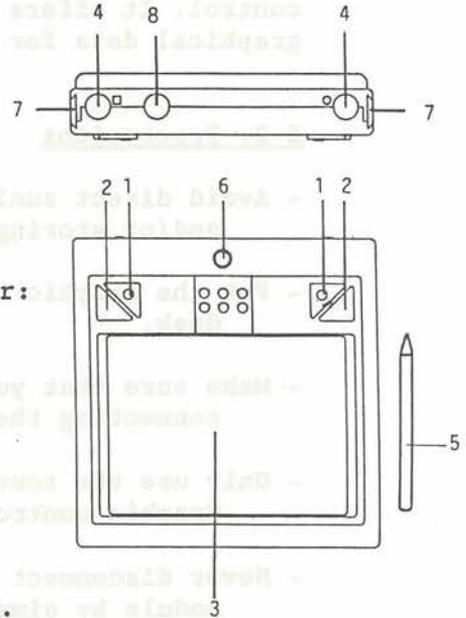
4. Input device (control) connector: Connects the Graphic control with the MMC module.

5. Touch pen: A special purpose pen which is used to draw the characters, graphics, patterns and pictures.

6. Pen holder: Storage for your touch pen when it is not in use.

7. Side attachment slots: Use this to joint mechanically with the CD-I remote control.

8. Connector stowage: Stowage for your Input device (control) block connector when it is not in use.



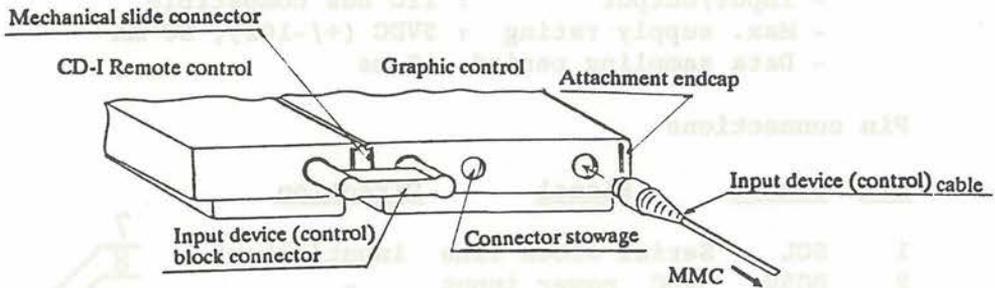
5-4. Installation

The following are supplied with your Graphic control:

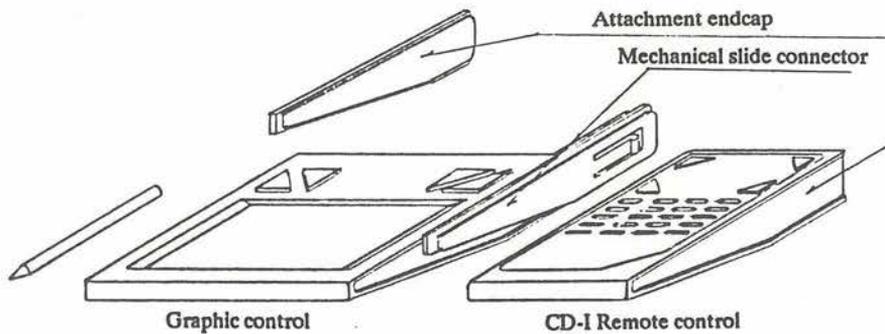
- Mechanical slide connector
- Input device (control) block connector
- L/R attachment endcaps

1. Making sure that the MMC is switched off, connect the Input device (control) cable to the Input device (control) port, located at the front of the MMC module.

- When both Graphic Control and CD-I remote control are to be connected to the MMC through the Input device (control) cable, connect the CD-I remote control to the Graphic Control, using the mechanical connector supplied and the Input device (control) connector supplied.



- When the Graphic control is used as single input device, the attachment endcaps supplied should be used. These are fitting into the side attachment slots. These endcaps are supplied for the left and right side.



Appendix 5. Graphic Control Technical Data

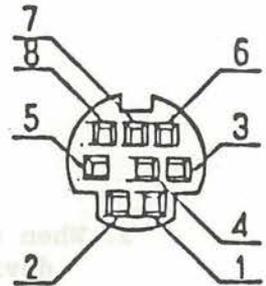
- Effective tablet area : 123 x 92 mm
- Outer dimensions : 163(L) x 159(W) x 35(H) mm
- Weight : approx. 720 g

CD-I system interface

- Input/output : IIC bus compatible
- Max. supply rating : 5VDC (+/-10%), 50 mA
- Data sampling period: 40 ms

Pin connections

<u>Pin</u>	<u>Symbol</u>	<u>Signal</u>	<u>Direction</u>
1	SCL	Serial clock line	input/output
2	DC5V	5VDC power input	-
3	GND	Ground	-
4	GND	Ground	-
5	SDA	Serial data line	input/output
6	GND	Ground	-
7	NC	No connection	-
8	DC5V	5VDC power input	-



CHAPTER 6 . MEMORY CARD

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CHAPTER 6 . MEMORY CARD

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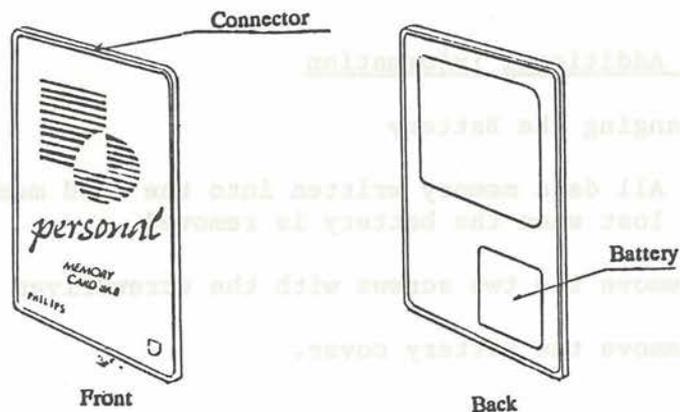
6-1. Introduction

This Personal Memory card is mentioned to be used as an extension of the so-called "Non-Volatile Memory" built-in your CD-I system. This external NV-RAM card enables you to store your intermediate scores (depending on application programme used) and makes the CD-I system usage more personal.

6-2. Precautions

- Do not expose the card to high temperature and direct sunlight.
- Do not bend or drop the card, or subject it to severe shock.
- Do not get the card wet, or keep it in highly humid places.
- Do not take the card apart, or touch the connector part.
- To protect the card from static electricity and dust, store it in its case when not in use.
- The card contains a lithium battery. Do not attempt to dispose of it by burning.

6-3. Names of the parts



6-4. Installation and use

The following are supplied with your Memory card:

- Lithium battery (CR 2016)
- Screwdriver
- Protection case

To install a battery:

1. Remove the two screws with screwdriver supplied.
(They are quite tiny so take care not to loose them.)
2. Remove the battery cover
3. Put in a lithium battery (CR2016) supplied, positive (+) side outward and push it all the way in
(Battery life is about five years.).
4. Screw the cover to the Memory card again.

Insert the Memory card in the Memory card slot, located at front of your MMC module with "THIS SIDE UP" printing on the card facing you. Push it right in until fix into the connector in the Memory card slot.

Note: Before using the Memory card, remove a protection film on the card.

WARNING: NEVER INSERT OR REMOVE THE CARD WHEN THE MMC MODULE IS SWITCHED ON.

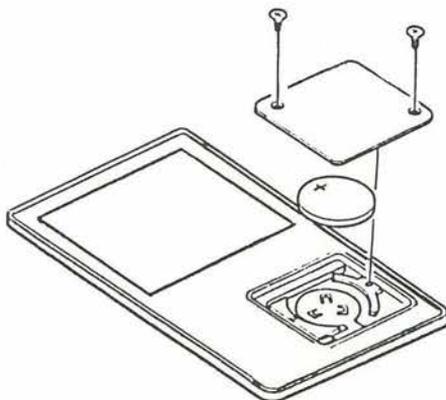
6-5. Additional information

- Changing the Battery

All data memory written into the card memory is lost when the battery is removed.

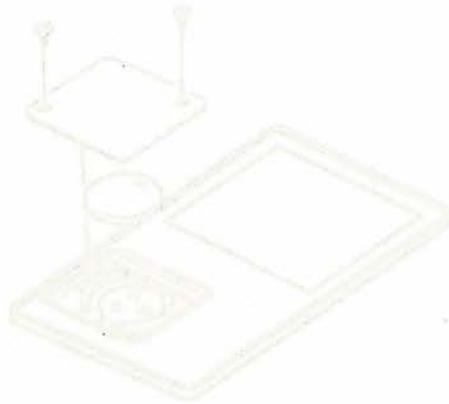
1. Remove the two screws with the screwdriver supplied.
2. Remove the battery cover.

3. Remove the battery by gently slapping the open cover in the palm of your hand. The battery should easily fall out.
4. Replace with new battery.
5. Screw the cover to the case again.



Appendix 6. Memory Card Technical Data

- Size : 86(W) x 54(D) x 2.2(H) mm
- Connector : 40-pin two-piece Connector
- Memory : 8 Kbyte S-RAM
- Power : DC3V, Lithium battery (DATA BACK-UP)
- Address map : 380000 - 3FFFFFF



CHAPTER 7 .

EXPANSION MODULE

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CHAPTER 7
EXPANSION MODULE

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7-1. Introduction

The CD-I player system, to which this Expansion module belongs, is a microprocessor system which can handle sound, video and computer code data.

The main function of this Expansion module is to enhance the CD-I player system (MMC module and CD-I player module) with capabilities beyond the typical base case CD-I system.

Within a CD-I player system, only one Expansion module can be connected, to be placed directly below the MMC module.

The Expansion module incorporates two floppy disk drives to store or read data conforming to CD-RTOS disk format.

For connection of additional (non-system) equipment the expansion module provides a Centronics parallel printer interface and RS-232C serial interface. The RS-232C serial interface can be applied for a modem or a printer, or as a port to another data processing system.

To expand the system, two slots for extension boards are provided. These slots are connected to the CPU bus signals from the main 68070 microprocessor in the MMC module. All extension boards can be connected to either slot.

7-2. Precautions

- Check that your mains supply voltage is the same as that given on the type plate in the rear of the Expansion module.
- Always stand either horizontally or vertically on a flat, firm base. Allow space around for ventilation.
- Never place in a hot sunny position.
- Never allow to get damp.
- Never attempt to repair the unit yourself.
- When the unit is to be transported or stored, handle

it carefully to avoid giving it severe shocks.

7-3. Summary of Controls and Connectors

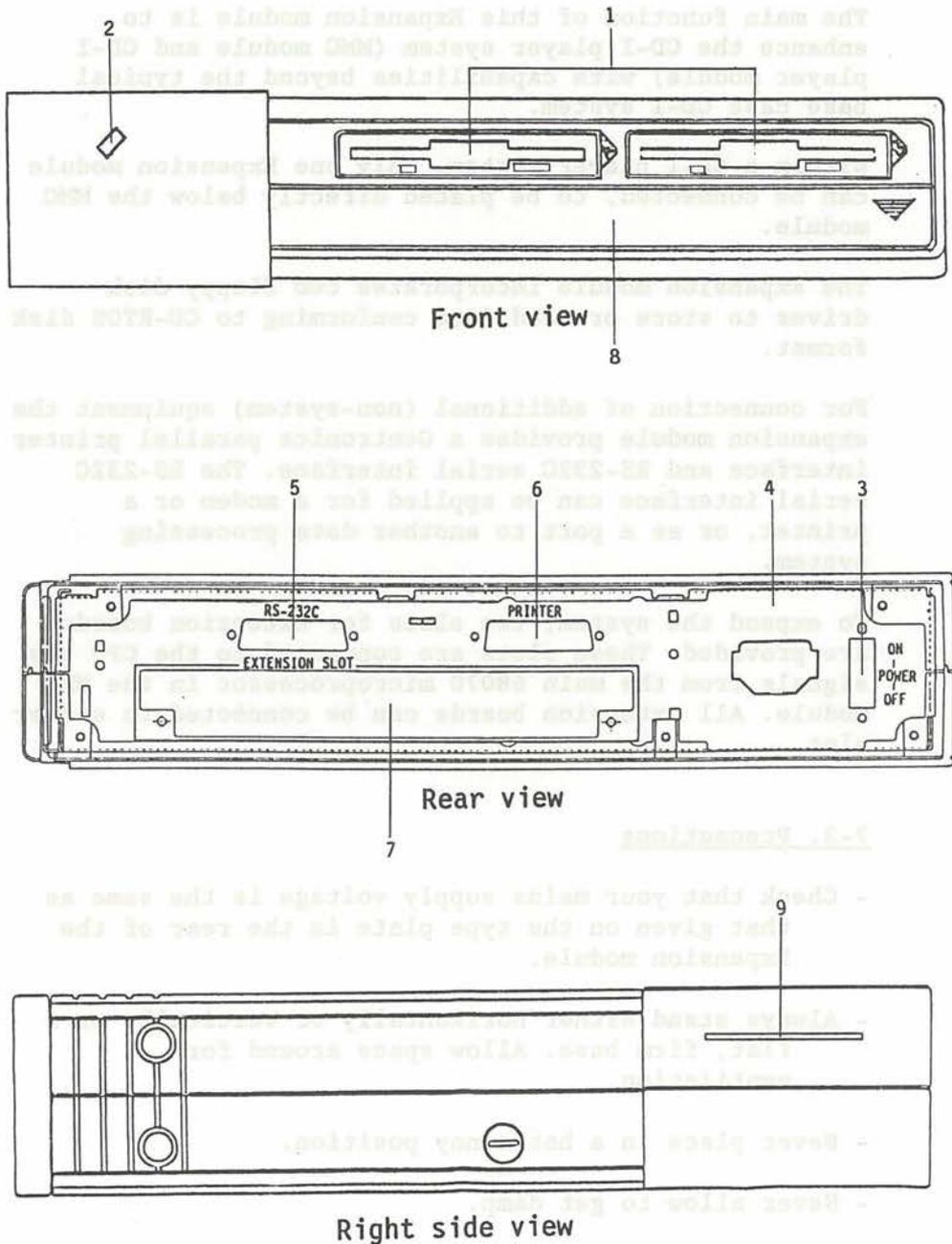


Fig. 7-1.

1. Floppy Disc Drive:
Two high density (2 MB (Megabyte) unformatted) floppy disc drives are built in and the Expansion module can read or write data or programs on discs inserted in the disc drives.
2. POWER LED:
Lights up "green" when the power switch is ON.
3. POWER switch (rear side):
Turns the Expansion module on or off. Leave the switch on all the time. Use always stand by system switch on the MMC module.
4. AC inlet:
Connects the Expansion module to the lower AC power outlet of the MMC module.
5. Printer Connector:
A printer cable can be plugged into this connector. This interface is fully compatible with the IBM PC implementation.
6. RS-232C Connector:
An RS-232C cable can be plugged into this connector when using a modem or as a port to another data processing system.
7. Extension slots:
Two slots for extension boards are built in, and these slots provide CPU bus signals from the main processor located in the MMC module.
8. Front extension slot door:
Open this door when using the front extension slot.
9. CPU bus interface
For the connection of the Expansion module with the MMC module.

7-4. Installation

- Note:**
1. The Expansion module has to be installed together with the MMC module and CD-I player module.
 2. Connections and controls are shown in Fig. 7-1.

The following are supplied with your Expansion module.

- Short AC power cable
- Side endcaps (fitted on the unit)
- CPU bus connector
- System RAM extension board (already built-in)
- SCSI I/F extension board (already built-in)
- Floppy disc with source code hard disc driver

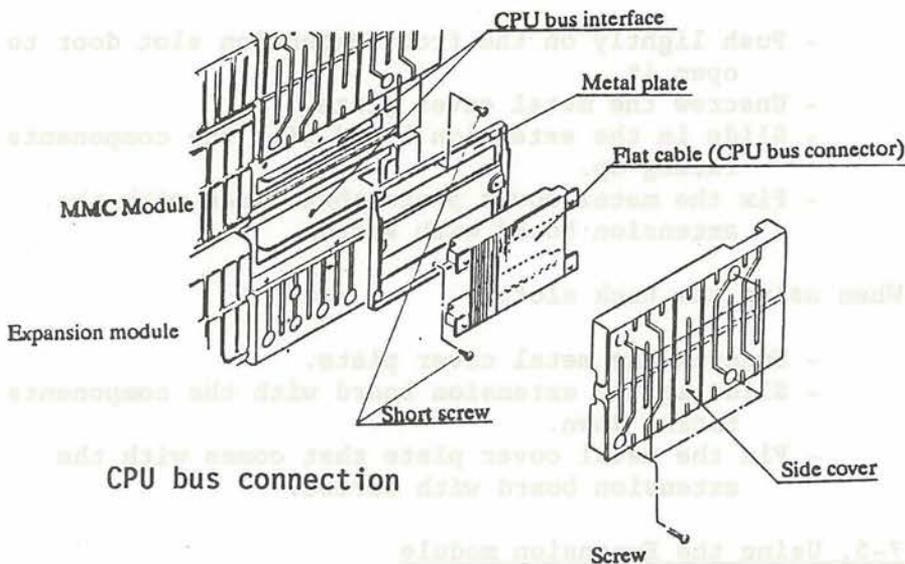
Note: Ensure that the MMC Stand by system switch is set to OFF.

1. Place the Expansion module under the MMC module and fix the two units together by turning the two hooks located on the sides of the MMC module with a coin.
2. Remove the Side endcaps fixed to both the Expansion module (upper) and the MMC module (lower) by unscrewing them.
3. Connect the MMC module and Expansion module as follows: (temporary solution)
 - Mount the metal plate with the short screws on the chassis of MMC module and Expansion module. The slots in the metal plate will leave free both CPU bus interface connectors.

- Interconnect the CPU bus interfaces on MMC module and Expansion module with the flat cable (CPU bus connector). Push the connectors firmly into position.

Note: The metal plate is required for shielding to comply with FCC class A regulations.

- For the protection of the interfaces, you have to screw the Side cover (incl. second metal shielding plate) to the both modules.



4. Connect the short AC power cable between the lower AC outlets of the MMC module and the AC inlet of the Expansion module.

Note: Set the POWER switch on the Expansion module to "ON" to make full use of the power-on/stand-by system.

5. Connection of peripherals:

- 1) As required, to the printer port or to the RS-232C port, with the power switched off.
- 2) Secure the connection cables by fixing the

screws.

- 3) Follow the instructions that come with the peripherals and the software application package to ensure correct functioning.

6. Extension boards

WARNING: For installation of the Extension boards the whole CD-I system must be disconnected from the mains.

When using the front slot:

- Push lightly on the front extension slot door to open it.
- Unscrew the metal cover plate.
- Slide in the extension board with the components facing up.
- Fix the metal cover plate that comes with the extension board with screws.

When using the back slot:

- Unscrew the metal cover plate.
- Slide in the extension board with the components facing down.
- Fix the metal cover plate that comes with the extension board with screws.

7-5. Using the Expansion module

By switching the MMC module into the system power-on mode the CD-I system will be switched on completely.

The operation of the expansion module and its elements is completely controlled by the software.

1. Set the POWER switch on the Expansion module (rear side) to "ON" to make full use of the power-on/stand-by system.

2. Press the Stand by system switch on your MMC module.
 - POWER indicator (2) of the Expansion module lights (together with the POWER indicator on the MMC module).

Note: Always keep the Expansion module POWER switch in the on position and control the system by using the CD-I remote control or the SYSTEM POWER switch of the MMC module.

3. Floppy disks

- As this Expansion module is equipped with HD floppy (2 MB unformatted) disk drives you are advised to use 3.5" disks with the indication 2HD. 2DD disks can be used too, but in the 1 MB mode only.
- When you need to change to a 2HD (2DD) disk after using a 2DD (2HD) type, you should re-establish the specified directory by using "chd" command.
- Please note that new disks have to be "formatted" before they can be used. Also note that 3.5" disks have a write protect switch.
- To take the floppy disk out of the drive use the EJECT button. Do not exchange the disks during an application unless the application asks you to do so.

Note: Never change a disk when the 'busy' indicator is on.

Appendix 7. Expansion Module Technical Data

1. Hardware Specifications

1.1.1 Expansion ROM

In this ROM the following are stored:

- o Floppy disk drive driver
- o Printer driver
- o RS-232C driver
- o RBF manager

- Address 200000 - 20FFFF
- Access time Max. 150 nsec.

1.1.2 System address map

<u>Address</u>	<u>Name</u>
000000 - 1FFFFFF	Reserved for MMC module
200000 - 20FFFF	Driver ROM
210000 - 2FFFFFF	Reserved for option ROM
300000 - 32FFFF	Reserved for MMC module
330000 - 33FFFF	FDD interface
340000 - 34FFFF	RS-232C interface
350000 - 35FFFF	Printer interface
360000 - 37FFFF	Not Used
380000 - 3FFFFFF	Reserved for MMC module
400000 - 4FFFFFF	Reserved for optional peripherals
500000 - 6FFFFFF	Reserved for optional RAM
700000 - 77FFFF	Reserved for MMC module
00780000 - 7FFFFFFF	Not used
80000000 - BFFFFFFF	68070 internal registers
C0000000 - FFFFFFFF	Not used

1.2. Floppy disk drives and interface

1.2.1 Floppy Disk Interface

The floppy disk interface supports two floppy disk drives using DMA transfer.

- Address 330000 - 33FFFF
- Access Byte access only (odd addresses)
- Internal registers

<u>Address</u>	<u>Read</u>	<u>Write</u>
330001	status register	command register
330003	track register	track register
330005	sector register	sector register
330007	data register	data register

- Support register

<u>Address</u>	<u>Read</u>	<u>Write</u>
330009	drive status reg.	drive command reg.

- Drive status register

<u>Bit</u>	<u>Name</u>	<u>Active</u>	<u>Note</u>
D7	-	-	not used
D6	-	-	not used
D5	-	-	not used
D4	-	-	not used
D3	Disk out	H	Disk out status
D2	INT	H	interrupt status
D1	2HD/2DD-	H	high density
D0	DCHG	H	disk charge status

Remarks : INT bit will be automatically reset when the CPU reads the Drive status register.

- Drive command register

Address 330009
 Access byte write
 Bit assignment

Bit	Name	Active	Note
D7	INTEN	H	Interrupt enable
D6	2HD/2DD-	H	High density select
D5	DDEN-	L	Double density enable
D4	MOTORON	H	Motor on
D3	INUSE	H	In use
D2	SIDSEL	H	Side select
D1	DS1	H	Disk select 1
D0	DS0	H	Disk select 0

Disk select

2HD/2DD-	DDEN-	Type
0	0	2DD MFM
0	1	2DD FM
1	0	2HD MFM
1	1	2HD FM

- Interrupt

The interrupt level and the vector number have to be loaded into the SYSCONT register before the interrupt is generated.

Two floppy disk drives are built into the Expansion module as standard.

Floppy disk/disk drive specification:

- Disk

Disk size 3.5 inch
 Surface Double sided
 Disk quality needed 2DD 2HD

- Recording capacity

Unformatted 1 2 Mb

- Data transfer rate

250 500 Kbits/sec.

- Density

Recording density 8717 17434 bpi
 Track density 135 tpi

- Number of tracks

160

1.3. Printer interface (IBM PC Compatible).

This interface permits the attachment of external devices that accept 8 bit parallel data at standard TTL levels. This interface is not fully compatible with Centronics, but compatible with the IBM PC implementation.

- Connector

Type D-sub 25 pin connector: female type

- Pin assignment

<u>No.</u>	<u>Name</u>	<u>I/O</u>	<u>No.</u>	<u>Name</u>	<u>I/O</u>
1	STB-	O	14	-	-
2	PD0	O	15	ERROR	-
3	PD1	O	16	-	-
4	PD2	O	17	-	-
5	PD3	O	18	GND	-
6	PD4	O	19	GND	-
7	PD5	O	20	GND	-
8	PD6	O	21	GND	-
9	PD7	O	22	GND	-
10	ACK-	I	23	GND	-
11	BUSY	I	24	GND	-
12	PE	I	25	GND	-
13	SELECT	I			

1.4. RS-232C interface.

This interface is fully compatible with RS-232C standard.

- Connector

Type D-sub 25 pin connector: Male type

- Pin assignment

No.	Name	I/O	No.	Name	I/O
1	FGND	-	14	-	-
2	TXD-	O	15	-	-
3	RXD-	I	16	-	-
4	RTS	O	17	-	-
5	CTS	I	18	-	-
6	DSR	I	19	-	-
7	SGND	-	20	DTR	O
8	DCD	I	21	-	-
9	-	-	22	RI	I
10	-	-	23	-	-
11	-	-	24	-	-
12	-	-	25	-	-
13	-	-			

*bandrate
stopbits
etc.*

- Internal registers

Read

<u>Address</u>	<u>Register</u>	<u>Note</u>
340001	MR1A,MR2A	mode register A
340003	SRA	status register A
340005	-	reserved
340007	RHRA	RX holding register A
340009	IPCR	input port change register
34000B	ISR	input status register
34000D	CTU	counter/timer upper
34000F	CTL	counter/timer lower
340011	MR1B,MR2B	mode register B
340013	SRB	status register B
340015	-	reserved
340017	RHRB	RX holding register B
340019	IVR	interrupt vector register
34001B	-	input port
34001D	-	start counter command
34001F	-	start counter command

Write

<u>Address</u>	<u>Register</u>	<u>Note</u>
340001	MR1A,MR2A	mode register A
340003	CSRA	clock select register A
340005	CRA	command register A
340007	THRA	TX holding register A
340009	ACR	auxiliary control register
34000B	IMR	interrupt mask register
34000D	CTUR	counter/timer upper
34000F	CTLR	counter/timer lower
340011	MR1B,MR2B	mode register B
340013	CSRB	clock select register B
340015	CRB	command register B
340017	THRB	TX holding register B
340019	IVR	interrupt vector register
34001B	OPCR	output port control register
34001D	-	set output port bits command
34001F	-	reset output bits command

- Bit assignment

CPU	D7	D6	D5	D4	D3	D2	D1	D0
SCN68681	D7	D6	D5	D4	D3	D2	D1	D0

- Port assignment

<u>Mark</u>	<u>Name</u>	<u>Active</u>	<u>I/O</u>	<u>Note</u>
OP0	RTS-	L	O	request to send
OP1	-	-	-	-
OP2	DTR-	L	O	data terminal ready
OP3	-	-	-	-
OP4	-	-	-	-
OP5	-	-	-	-
OP6	-	-	-	-
OP7	-	-	-	-
IP0	CTS-	L	I	request to send
IP1	-	-	-	-
IP2	DSR-	L	I	data set ready
IP3	-	-	-	-
IP4	DCD-	L	I	carrier detect
IP5	RI-	L	I	ring indicator
TXDA	TXD	H	O	transmitted data
TXDB	-	-	-	-
RXDA	RXD	H	I	receive data
RXDB	-	-	-	-

- Interrupt

The interrupt level has to be put in the DUART interrupt register of the syscont and the vector number has to be set before the interrupt is generated.

1.5. Extension slots.

Two extension slots provide access to a limited CPU bus coming from MMC module.

For the two extension slots, identical connectors are provided which accept a board edge connector.

- Connector

Type KEL 8800-100-170S or equivalent

- Pin assignment

<u>No.</u>	<u>Name</u>	<u>Act.</u>	<u>I/O</u>				
1	GND	-	-	22	A5	H	I/O
2	A23	H	I/O	23	A4	H	I/O
3	A22	H	I/O	24	A3	H	I/O
4	A21	H	I/O	25	A2	H	I/O
5	A20	H	I/O	26	A1	H	I/O
6	A19	H	I/O	27	GND	-	-
7	A18	H	I/O	28	AS-	L	I/O
8	A17	H	I/O	29	GND	-	-
9	A16	H	I/O	30	DS1-	L	I/O
10	GND	-	-	31	GND	-	-
11	A15	H	I/O	32	DS0-	L	I/O
12	A14	H	I/O	33	GND	-	-
13	A13	H	I/O	34	WRITE-	L	I/O
14	A12	H	I/O	35	GND	-	-
15	A11	H	I/O	36	DTACK-	L	I/O
16	A10	H	I/O	37	GND	-	-
17	A9	H	I/O	38	CPUCLK	H	0
18	A8	H	I/O	39	GND	-	-
19	GND	-	-	40	D15	H	I/O
20	A7	H	I/O	41	D14	H	I/O
21	A6	H	I/O				

<u>No.</u>	<u>Name</u>	<u>Act.</u>	<u>I/O</u>	<u>No.</u>	<u>Name</u>	<u>Act.</u>	<u>I/O</u>
42	D13	H	I/O	83	GND	-	-
43	D12	H	I/O	84	Not used	-	-
44	D11	H	I/O	85	Not used	-	-
45	D10	H	I/O	86	Not used	-	-
46	D9	H	I/O	87	Not used	-	-
47	D8	H	I/O	88	Not used	-	-
48	GND	-	-	89	EXDSA-	L	I
49	D7	H	I/O	90	RESERVED	-	-
50	D6	H	I/O	91	RESERVED	-	-
51	D5	H	I/O	92	RESERVED	-	-
52	D4	H	I/O	93	RESERVED	-	-
53	D3	H	I/O	94	+12V	-	-
54	D2	H	I/O	95	-12V	-	-
55	D1	H	I/O	96	GND	-	-
56	D0	H	I/O	97	+5V	-	-
57	GND	-	-	98	+5V	-	-
58	EXBR2-	L	I	99	+5V	-	-
59	EXBR1-	L	I	100	GND	-	-
60	EXBG2-	L	O				
61	EXBG1-	L	O				
62	BBUSY-	L	I/O				
63	GND	-	-				
64	Not Used	L	I				
65	Not Used	L	I				
66	Not Used	L	I				
67	INTEX4-	L	I				
68	INTEX3-	L	I				
69	INTEX2-	L	I				
70	INTEX1-	L	I				
71	GND	-	-				
72	Not Used	L	O				
73	Not Used	L	O				
74	Not Used	L	O				
75	IACKEX4-	L	O				
76	IACKEX3-	L	O				
77	IACKEX2-	L	O				
78	IACKEX1-	L	O				
79	GND	-	-				
80	SYSRESET-	L	O				
81	HALT-	L	O				
82	BERR-	L	O				

- Pin lay-out extension slot

99 97 95 93 - - - - - - - - - 5 3 1

100 98 96 94 - - - - - - - - - 6 4 2

1.6. RAM extension board

This RAM is only used as the extension of the system RAM. The capacity is 1 MB.

1.7. SCSI interface extension board

The main purpose of the SCSI interface board is to connect a hard disc unit. The SCSI interface has been tested with a Rodime 20 MB hard disc drive.

Note: The source code of the driver for this Rodime drive has been stored on floppy and bypacked with your system.

Change of the driver in order to suit other hard disc drives are to be done by the user at his own risk.

1.7.1 Hardware specification SCSI interface board

The SCSI interface board has the following features

- single ended (cable length: maximum 6m)
- asynchronous data transfer
(maximum transfer rate: 1.5 Mbyte/sec.)
- initiator role
- built-in DMA controller
(DMA transfer from SCSI to Memory)
- programmable interrupt handling for SCSI to CPU68070
- hardware bus arbitration
- disconnect/reconnect
- on-board ROM socket with selectable addressing capacity
- Rodime hard disc driver in ROM
- shielded 50 pin connector

1.7.2 Connector of SCSI interface

Shielded 50 pin amphenol
(2.54 mm pitch, female type)

1) Device

NCR5380

2) Data transfer mode

DMA transfer

- channel : channel 1 of HD68450
- address mode : single address
- external request mode : cycle steal
- device type : ACK/RDY device
- operand size : Byte

3) Internal register of NCR5380

Address	R/W	Register
410000	R	current SCSI data
410000	W	output data
410002	R/W	initiator command
410004	R/W	mode
410006	R/W	target command
410008	R	current SCSI bus status
410008	W	select enable
41000A	R	bus and status
41000A	W	start DMA send
41000C	R	input data
41000C	W	start DMA target receive
41000E	R	reset parity/interrupt
41000E	W	start DMA initiator receive

4) Interrupt register bit assignment of NCR5380

CPU68070	D15	D14	D13	D12	D11	D10	D09	D08

NCR5380	D07	D06	D05	D04	D03	D02	D01	D00

5) Interrupt handling to CPU68070

The external interrupt register 4 in the system control register of the CPU68070 should be set before the interrupt is asserted. For the interruption, INTEX4- an DIACKEX4- signal are used.

1.7.3 DMA controller

1) Clock frequency

10.0 Mhz

2) Channel

channel 1 : SCSI interface
channel 2 : not used
channel 3 : not used
channel 4 : not used

3) Internal registers of DMA controller

channel 1:

Address	Register	Length	Note
400000	CSR	Byte	channel status register
400001	CER	Byte	channel error register
400004	DCR	Byte	device control register
400005	OCR	Byte	operation control register
400006	SCR	Byte	sequence control register
400007	CCR	Byte	channel control register
40000A	MTC	Word	memory transfer counter
400014	MAR	1 Word	memory address register
40001A	DAR	1 Word	device address register
40001C	BTC	Word	base transfer counter
400025	BAR	1 Word	base address register
400027	NIV	Byte	normal interrupt vector
40002D	CPR	Byte	channel priority register
400029	MFC	Byte	memory function code
400031	DFC	Byte	device function code
400039	BFC	Byte	base function code
4000FF	GCR	Byte	general control register

4) Interrupt handling to CPU68070

The external interrupt register 1 in the system control register of the CPU 68070 should be set before interrupt is asserted.

For the interruption, the INTEX1- and the IACKEX1- are used.

1.7.4 Pin assignment SCSI interface

Nr.	Name	I/O	Nr.	Name	I/O
1	GND	-	26	DB0-	I/O
2	GND	-	27	DB1-	I/O
3	GND	-	28	DB2-	I/O
4	GND	-	29	DB3-	I/O
5	GND	-	30	DB4-	I/O
6	GND	-	31	DB5-	I/O
7	GND	-	32	DB6-	I/O
8	GND	-	33	DB7-	I/O
9	GND	-	34	DBP-	I/O
10	GND	-	35	GND	-
11	GND	-	36	GND	-
12	GND	-	37	GND	-
13	GND	-	38	TERMPWR	-
14	GND	-	39	GND	-
15	GND	-	40	GND	-
16	GND	-	41	ATN-	0
17	GND	-	42	GND	-
18	GND	-	43	BSY-	I/O
19	GND	-	44	ACK-	0
20	GND	-	45	RST-	I/O
21	GND	-	46	MSG-	I
22	GND	-	47	SEL-	I/O
23	GND	-	48	C/D-	I
24	GND	-	49	REQ-	I
25	GND	-	50	I/O-	I

2. Software specifications

The elements included in the Expansion module are:

- o 2 Floppy disk drives, high density
- o Printer interface
- o RS-232C interface
- o Extension board for 1 MB RAM extension
- o Extension board with SCSI interface

From the system point of view, these elements are treated as CD-I extensions. It is essential for each CD-I extension to make available to the system its own Device Status Descriptor (DSD), device driver and file manager (if applicable). This data will reside in the Expansion Module.

2.1 Floppy disk drive.

The floppy disk drive is classed as a CD-IX peripheral, as described in Appendix VII.2, of the CD-I Full Functional Specification. Conforming to the recommendation, a 3.5 inch floppy disk drive is used. The standard OS-9 disk format is used.

2.2 Printer interface.

The interface will be used for a printer.

2.3 RS-232C interface.

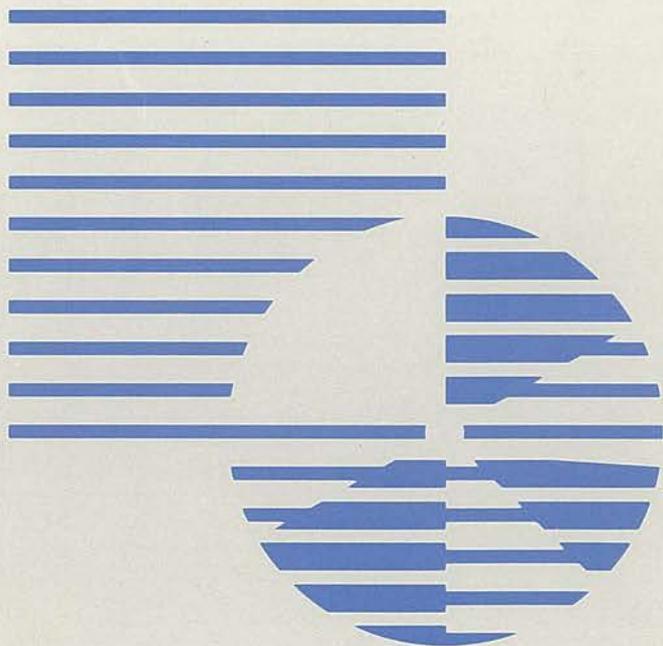
This serial, bi-directional interface is designed for a modem or printer, or as a port to another data processing system.

2.4 Two slots for extension boards.

All extension boards can be connected to either slot, and have their connections and physical interfaces on their front panels. They also all have their own system ROM, comprising Configuration Status Descriptor information, with relevant managers, drivers and user interface software.

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