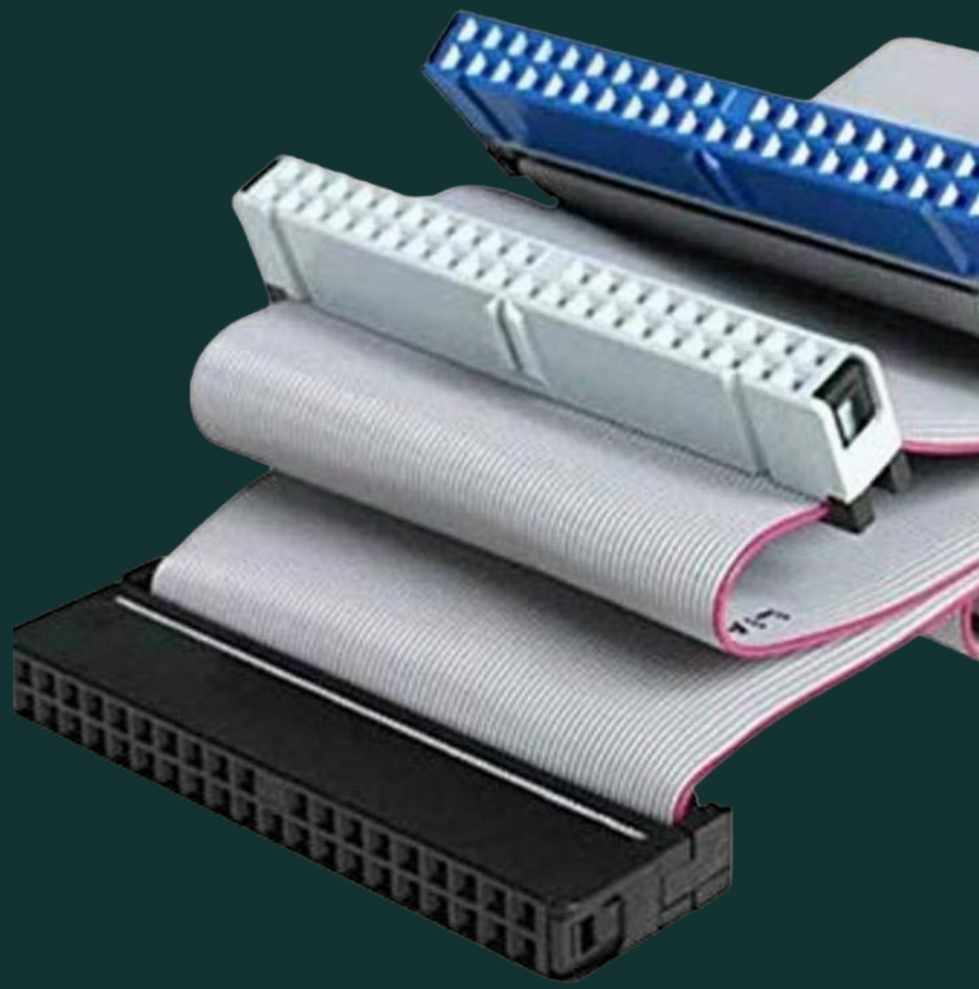
PATA: A Look Back at Parallel ATA

Parallel Advanced Technology Attachment (PATA) was a standard for connecting storage devices to motherboards, such as hard drives and optical discs.

by Nika Ghaderi



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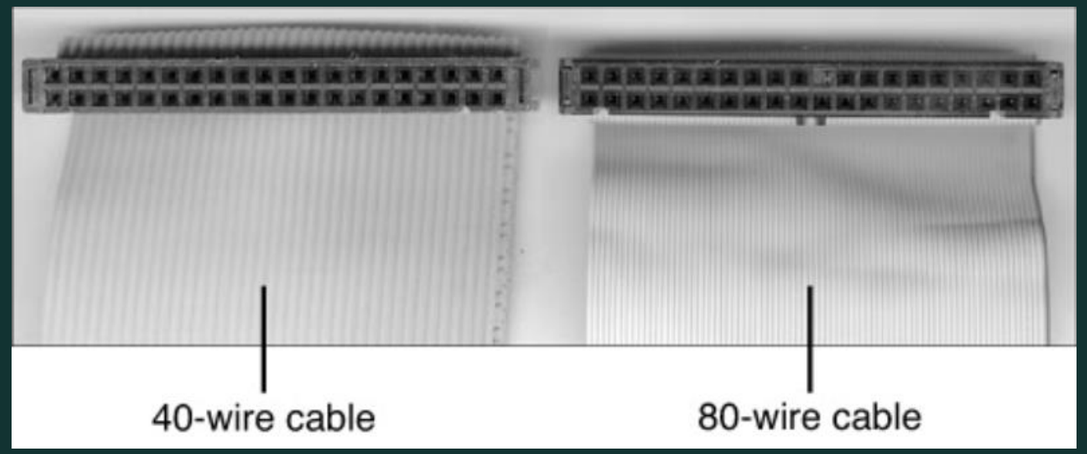
PATA's History and Evolution



Early Days

- Invented by Western Digital in 1986, originally called Integrated Drive Electronics (IDE).
- Speed up to 16 MB/s

Evolution

- ATA 1,2,4,6 and 7
- Speed up to 133 MB/s
- Support for CD-ROMs and other devices

Sample Usage

Protocol
Device reset protocol
Execute device diagnostic protocol
Device selection protocol
PIO data-in command protocol
PIO data-out command protocol
Non-data command protocol
DMA command protocol
Packet non-data and PIO data command protocol
Packet DMA command protocol
Read/write DMA queued command protocol

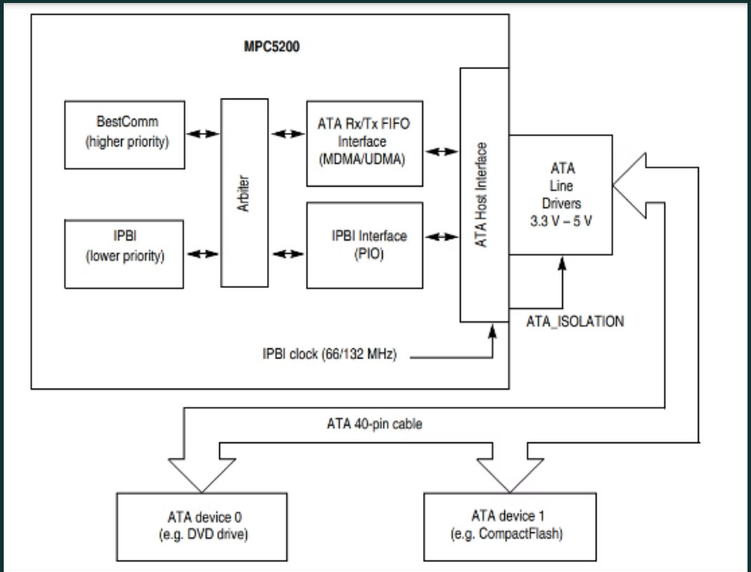
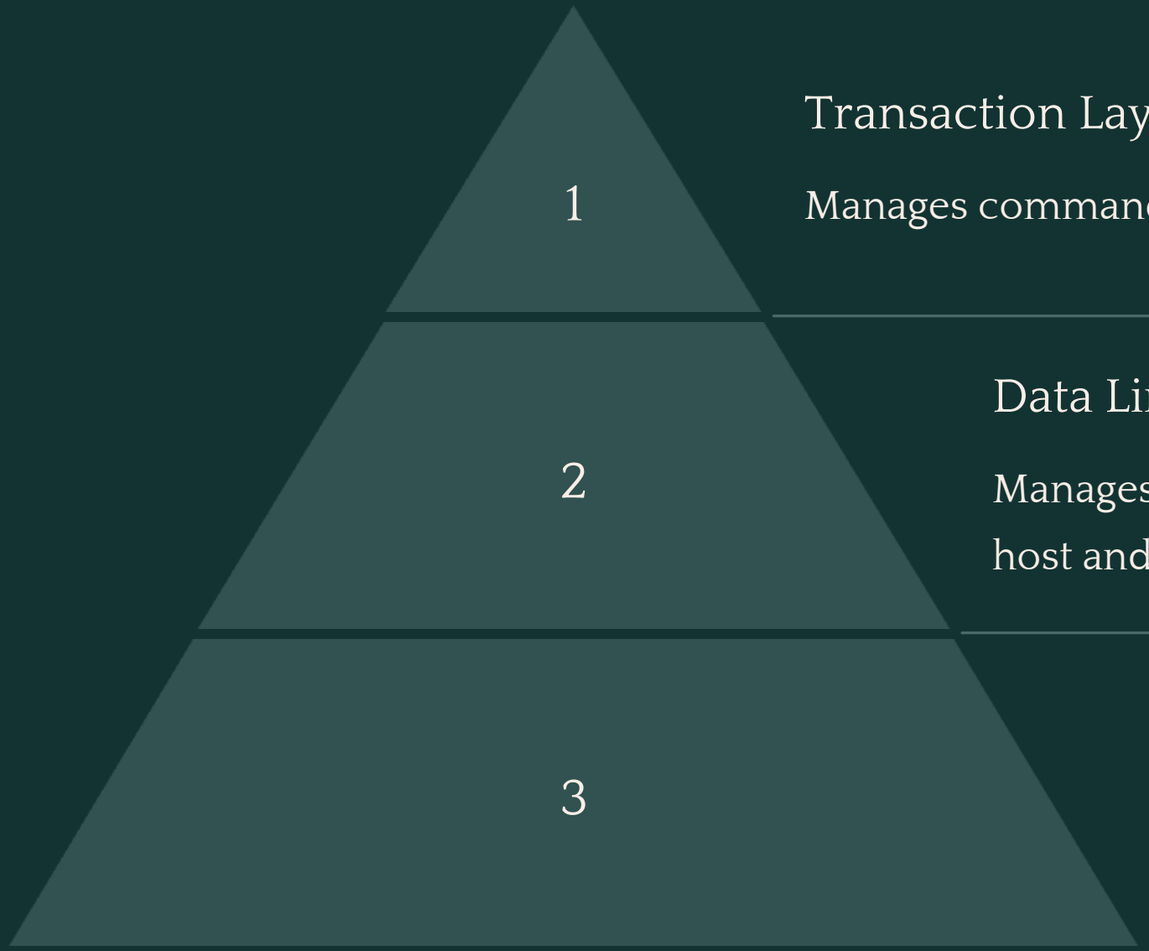


Table A4. MPC5200 ATA Drive Registers

Register	Acronym[1]	Offset	Size [Bits]	Mode
ATA drive device control	ata_drive_ctrl	MBAR+0x3A5C	8	write-only
ATA drive alternate status			8	read-only
ATA drive data	ata_drive_data	MBAR+0x3A60	16	R/W
ATA drive features	ata_drive_ftr	MBAR+0x3A64	8	write-only
ATA drive error			8	read-only
ATA drive sector count	ata_drive_sc	MBAR+0x3A68	8	R/W
ATA drive sector number	ata_drive_sn	MBAR+0x3A6C	8	R/W
ATA drive cylinder low	ata_drive_cl	MBAR+0x3A70	8	R/W
ATA drive cylinder high	ata_drive_ch	MBAR+0x3A74	8	R/W
ATA drive device/head	ata_drive_dh	MBAR+0x3A78	8	R/W
ATA drive device command	ata_drive_cmd	MBAR+0x3A7C	8	write-only
ATA drive device status			8	read-only

NOTES:
1 Acronyms use terminology such as ata.h in freely distributed software examples.

PATA's Architecture and Signaling



Transaction Layer

Manages command execution, data transfers, and device coordination.

Data Link Layer

Manages data framing, error detection, and flow control between host and device.

Physical Layer

Defines electrical and mechanical characteristics, including signaling, cabling, connectors, and timing.

PATA's Architecture and Signaling (cont'd)

Physical Layer

Signaling

- **Single-ended signaling** (not differential).
- Voltage levels: **5V (older)** or **3.3V (newer)**.
- Susceptible to noise and crosstalk.

Cabling

- **40-pin ribbon cable**: 16 data lines + control/ground.
- **80-conductor cable**: Reduced crosstalk (ATA/66+).
- Max length: **18 inches (45 cm)**.

Connectors

- **40-pin IDC connector**.
- Master/Slave configuration via jumpers.

Timing

- Synchronized using strobe signals (**DIOR#**, **DIOW#**).
- Data rates: **16.6 MB/s (ATA-1)** to **133 MB/s (ATA-7)**.

PATA's Architecture and Signalingv (cont'd)

Physical Layer

PATA's Architecture and Signaling (cont'd)

Data Link Layer

Data Framing

- **16-bit** parallel transfers.
- Block transfers (512-byte sectors).

Error Detection

- **CRC** for data integrity.
- Optional parity checking.

Flow Control

- **IORDY** signal for pausing host.

Protocol Commands

- Basic commands: **Identify Device, Read/Write Sector**

PATA's Architecture and Signaling (cont'd)

Transaction Layer

Command Execution

- ATA commands via **Task File Registers**.
- Parameters: Sector count, LBA (3), operation type.

Data Transfer Modes

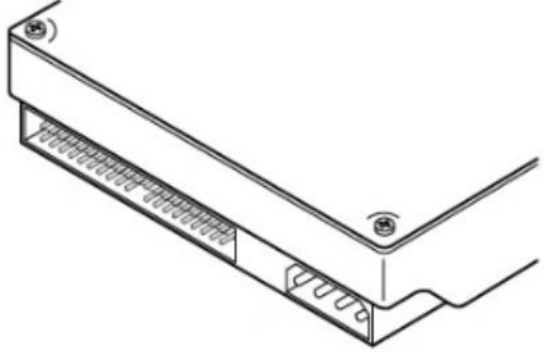
- **PIO**: CPU-managed (slower).
- **DMA**: Direct to memory (faster).
- **UDMA**: Enhanced DMA with CRC.

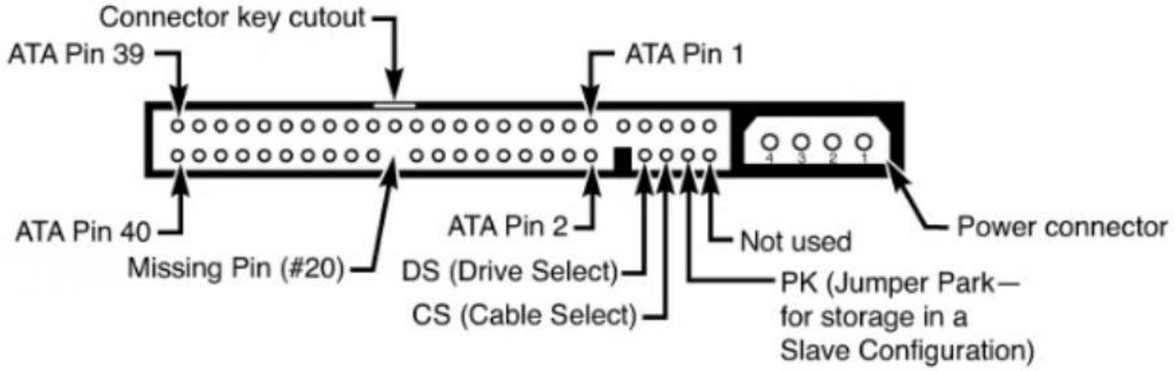
Task File Registers

- Configure commands (e.g., Read Sector).

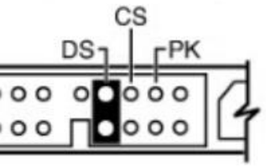
Master/Slave Arbitration

- Manages communication for shared cables.



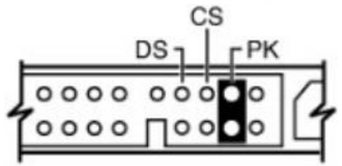


Master Drive Configuration (standard cable)



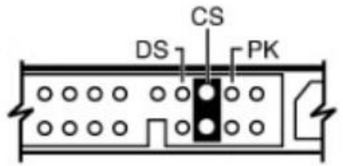
the Master Drive
figuration for the first
nly) drive on a
dard (non-cable select)
e.

Slave Drive Configuration (standard cable)



Use the Slave Drive Configuration for the second drive on a standard (non-cable select) cable; note that for a Slave Configuration, the jumper can be stored in the PK (Jumper Park) position, removed entirely, or stored on one of the DS Pins in a flag arrangement.

Cable Select Drive Configuration



For Cable Select Drive Configurations, one or bo
drives are configured the
same; the cable automat
determines which is Mas
Slave by which connecto
the drive is plugged into.

PATA Dual-Drive Configurations

1

Device Designation

- Device 0 (Master) and Device 1 (Slave). (No priority and dependance)
- Share the same bus.
- Only one controller responds to commands at a time. (DRV)

2

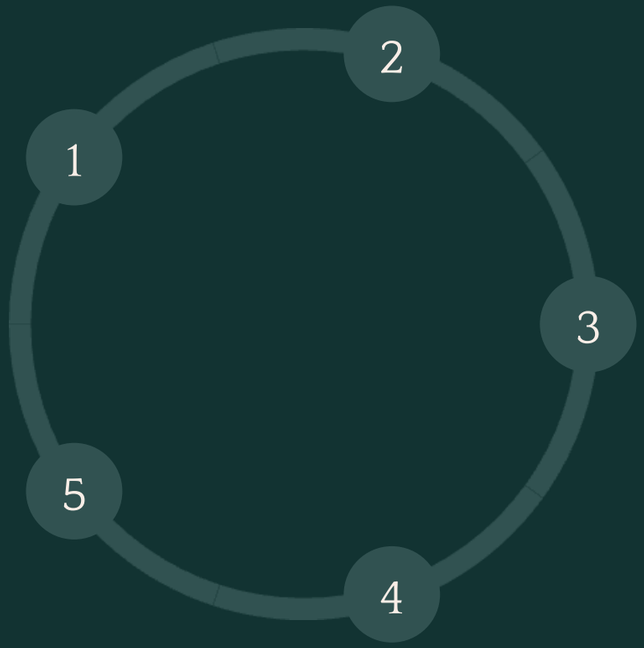
Jumper Settings

- Device 0/1 or Cable Select (CS).
- CS: Automatically assigns device based on cable position.
- Default: Usually Cable Select (if no jumpers are set).

PATA vs SATA

Transfer Speed: SATA > PATA.

Versatility: PATA connects 2 devices per cable; SATA has 2 ports.



Cable Length: SATA (1m) > PATA (46cm).

Performance: SATA supports hot-swapping; PATA does not.

Compatibility: SATA supports forward/backward compatibility.

PATA's Legacy

PATA played a crucial role in the development of computer storage technology, paving the way for faster and more versatile interfaces like SATA. While PATA is no longer widely used, its impact on the evolution of computer hardware remains significant.

Thank you for your attention!

Under the guidance of **Dr. Foshati**

Interface Circuits Design

Sharif University of Technology

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