

# **PLASMA DISPLAY SALES MANUAL**

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# PREFACE

## ✓ Purpose and Intended Readers

Display devices are used widely from office automation (OA) to factory automation (FA) equipment.

PDPs face other competitive devices, such as CRTs and LCDs. To overcome these competitors by promoting efficient sales, you should acquire some basic knowledge of PDPs.

This manual is intended for persons selling electronic devices; it contains many figures and tables so you can easily understand the terms necessary for conversing as equals with users. It also describes the principles and characteristics of Fujitsu PDPs, and sales know-how. You can use this manual with the *PDP Data Book and Selector Guide*.

## CHAPTER 1 GENERAL

You'll acquire basic knowledge about electronic displays and learn the position of PDPs in the classification of displays. This chapter explains the basic structure and display principles by comparing PDPs with CRTs and other flat-panel displays.

## CHAPTER 2 FEATURES OF FUJITSU PLASMA DISPLAY PANELS

You'll learn the structural characteristics of Fujitsu PDPs based on the knowledge you obtained in Chapter 1. This chapter describes the superiority of Fujitsu PDPs compared with other PDPs.

## CHAPTER 3 BASIC KNOWLEDGE

You'll acquire the minimum basic knowledge and terms for the types, specifications, and standards of PDPs to hold progressive business meetings with users. This chapter explains the types of PDPs, screen size, brightness, response speed, and RGB signals.

## CHAPTER 4 INTERFACES

You'll need knowledge of interfaces to answer questions from users in business meetings. This chapter provides the minimum knowledge necessary for explaining interfaces, the differences between CRT and PDP interfaces, and the roles of interface signals.

## CHAPTER 5 PRODUCT EXPANSION OF FUJITSU PDPs

You'll learn the Fujitsu PDP product lineup. This chapter describes the 640 x 400-dot graphics PDP unit, a product recommended for sales promotion. Color PDPs are also outlined for future sales expansion.

## CHAPTER 6 HOW TO DEVELOP BUSINESS NEGOTIATIONS

You'll acquire the know-how to promote sales on the basis of the knowledge you have acquired in the above chapters. This chapter describes how to prepare before conducting sales business, how to hold sales conversations to attract the user's attention, and how to target and treat customers by providing a flow of general sales activities.

## CHAPTER 7 APPLICATIONS OF PLASMA DISPLAY

You'll learn the hard-and-fast rule '*Find a market where there is large demand.*' to raise the rate of successful business. This chapter introduces typical PDP applications and describes the FA industry as a market where the characteristics of PDPs can be exploited.

# Using This Manual

## ✓ Construction and use

This manual is organized into seven chapters for novice to expert salespersons.

It may be used a beginners' textbook or guidebook by those of intermediate rank to raise the level of their knowledge, and by experts to reaffirm their knowledge.

Reading two facing pages enables you to understand the contents without turning the page. The summary below the title will help you understand the outline of each chapter and section. In addition, brief review exercises, called 'Challenge!!,' at the end of each section, test and reinforce your understanding of the section concepts.

Moreover, terminology is provided at the end of the manual so even beginners can understand the technical terms related to PDPs.

## ✓ How To Find Your Information

Find your information from the table of contents or the index of terms at the end of the manual.

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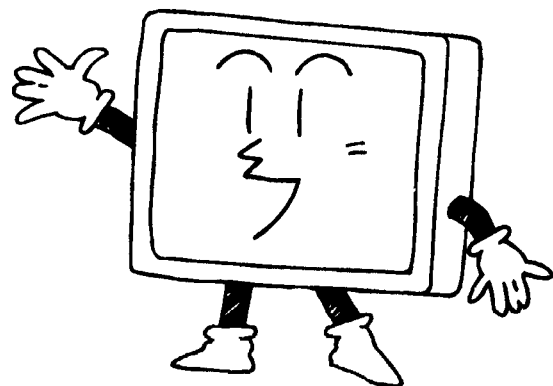


## 1. GENERAL

### Purpose:

The first step for sales is to understand the product you want to sell. You should know what an electronic display is and confirm the category for plasma display panels (PDPs) in the electronic displays. You should then understand the display mechanism and principles. These are the starting points for sales.

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## 1.1 Electronic Display

Electronic displays are used in various types of electronic equipment such as domestic TV sets, electronic calculators, and office equipment. Electronic displays are classified into active and passive types, which are all flat-panel types excluding cathode ray tubes (CRTs).

### 1. Types of Electronic Display

Electronic displays include active and passive types, which are all flat-panel types excluding CRTs.

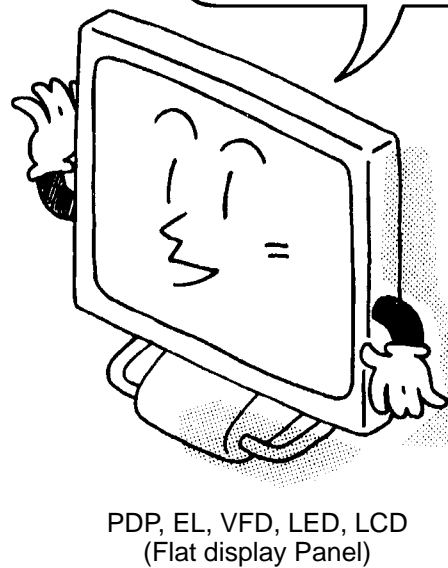
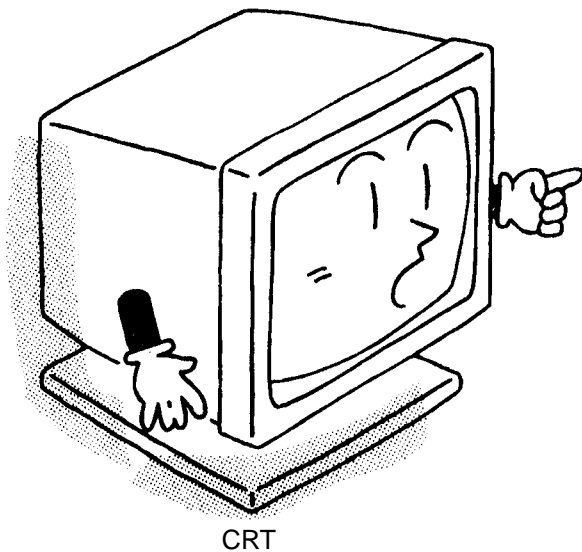
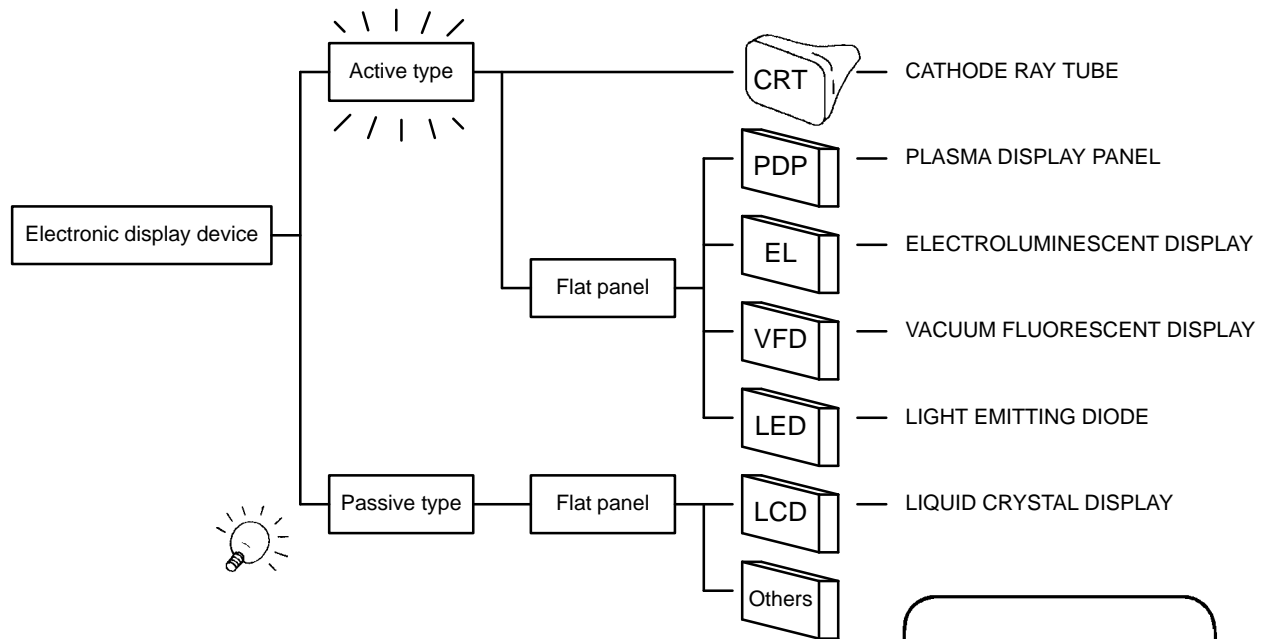
- Active type — displays by emitting light itself: CRTs, plasma display panels (PDPs), electroluminescent (EL) displays, vacuum fluorescent displays (VFDs), and light emitting diodes (LEDs)
- Passive type — displays using external light such as back light: Liquid crystal displays (LCDs)

### 2. Applications

| Type | Typical applications  |
|------|---|
| CRT  | Desktop office automation (OA) equipment, PC, Workstation, TV   |
| PDP  | Filling meter at gas station, Ticket vending machine, Medical Instrument, POS Terminal, Industrial Instrument |
| EL   | Industrial measurement instruments, Medical Instrument  |
| VFD  | Indicators of audiovisual equipment, Taxi meter, Automotive Displays  |
| LED  | Large display board at railway station and platform indicating No. and destina-                               |
| LCD  | tion  |

Laptop OA equipment, Notebook PC, Palmtop PC

## n Types of Electronic Displays



### Challenge!!

Fill the proper terms in the following blanks.

- Electronic displays are classified into [ (1) ] and [ (2) ] types.
- All electronic displays are [ (3) ] excluding CRTs.

Answers: 1. active, 2. passive, 3. flat-display panel



## 1.2 Structure of Flat Display

---

The flat display panel has two glass plates containing electrodes crossed like a grid and emits light when a voltage is applied to the electrodes.

The three primary flat panel displays are:

- PDPs
  - LCDs
  - EL displays
- 

### 1. Basic structure

Basically, the flat display panel emits light when a voltage is applied to the electrodes inserted between two glass plates.

### 2. Cell medium

The display panel contains a light-emitting medium in the cell between the electrodes.

The media are:

- Gas for PDPs
- Liquid for LCDs
- Solid for EL displays

### 3. Clearance between electrodes

The clearance between the line (horizontal) and column (vertical) electrodes facing each other are:

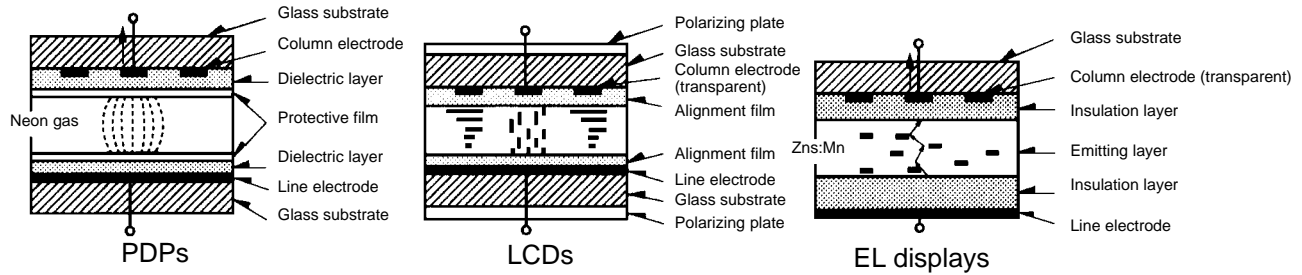
- About 100  $\mu\text{m}$  for PDPs
- About 10  $\mu\text{m}$  for LCDs
- About 1  $\mu\text{m}$  for EL displays

### 4. PDPs suited to large size

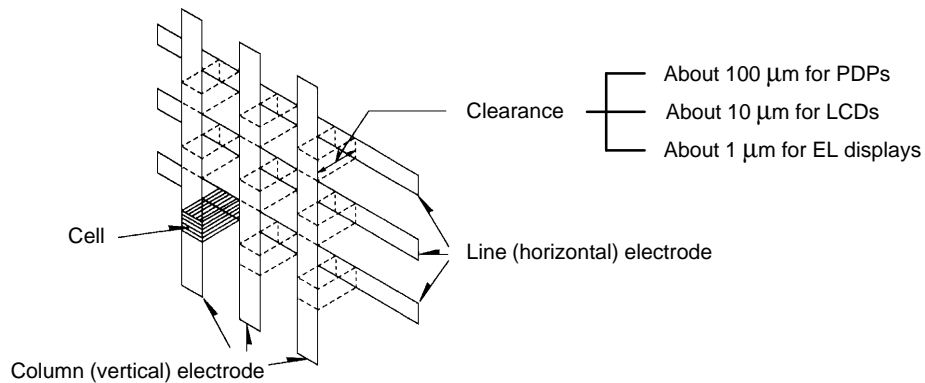
High-accuracy glass substrate is required to obtain the narrow clearance between electrodes, making it difficult to design large displays.

With PDPs, the clearance between electrodes is wider so the same glass as a common window can be used and large display panels can be designed easily.

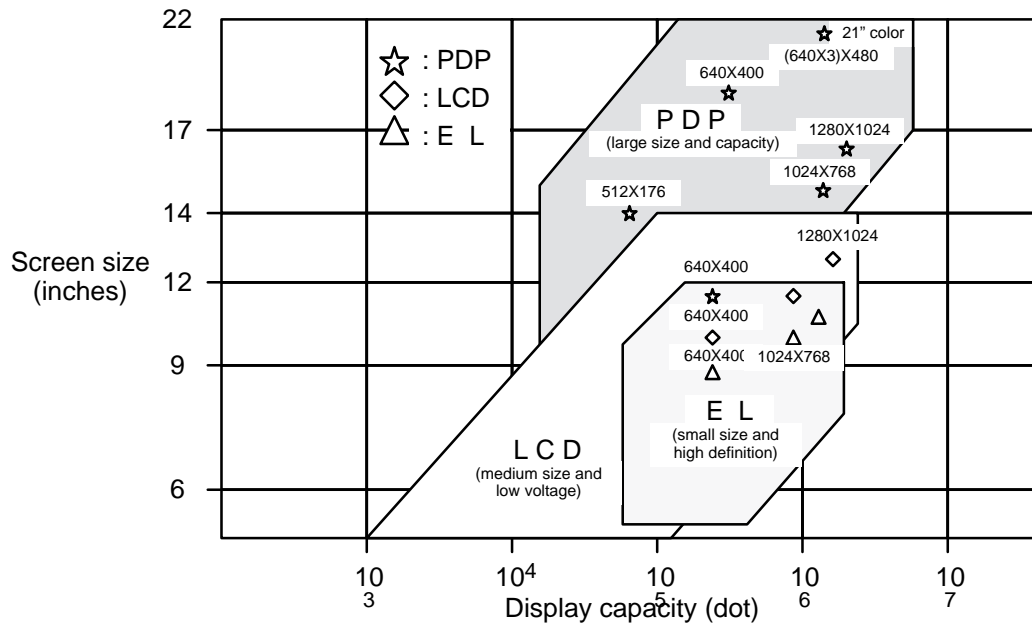
## n Typical Display Panel Structures



## n Electrode Structure



## n Usable Area of PDPs



### Challenge!!

1. What is the cell medium of PDPs?
2. How wide is the clearance between the electrodes of PDPs?

Answers: 1. Neon gas, 2. about 100  $\mu\text{m}$

## 1.3 Fujitsu PDPs

---

PDPs are flat displays using light emission by gas electrical discharge and are classified into AC and DC discharge types. The display methods include memory display and refresh display. Fujitsu PDPs use a combination of AC discharge and memory and refresh display methods. This section explains the basic structure and display principle of PDPs.

---

### 1. Display method

- AC type — Alternative current is used for the discharge. The display methods include memory display and refresh display methods. Fujitsu uses both methods.
- DC type — Direct current is used for the discharge. Only the refresh display method uses this type of display method.

### 2. Basic structure

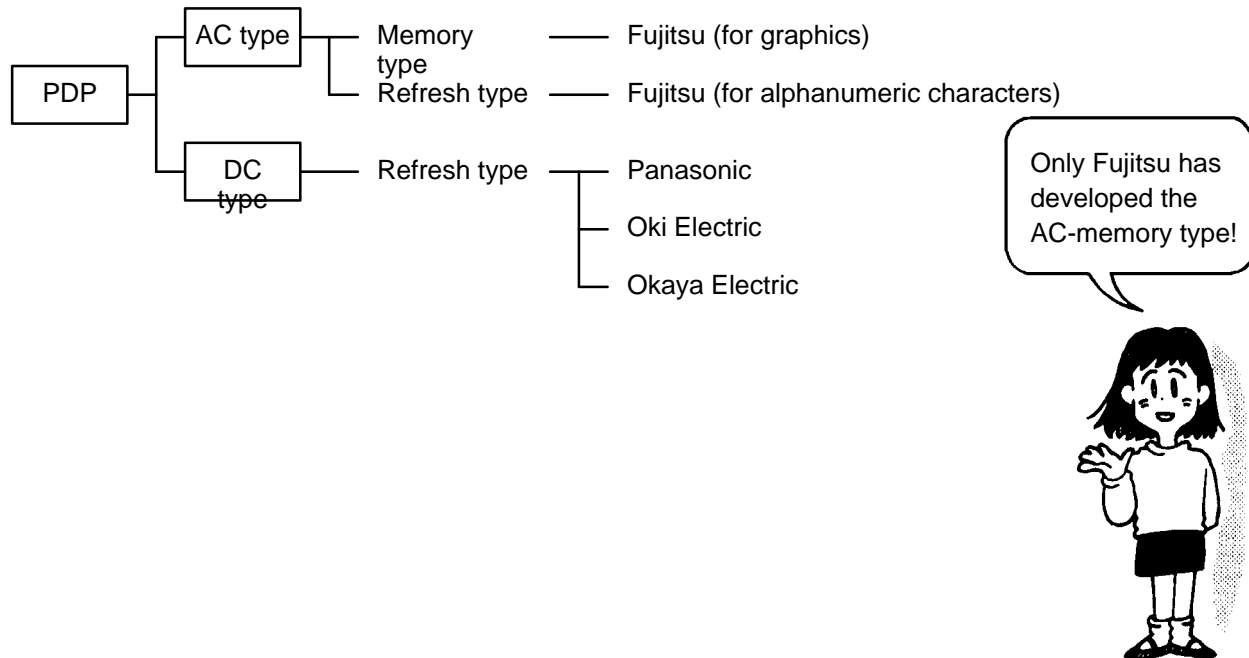
- Display panel — Two glass substrates with parallel electrodes on one side are coupled so that the electrodes face each other at 90° with a 100  $\mu\text{m}$  clearance. The panel edge is hermetically (glass bonding to glass) sealed so the neon gas in the panel cannot escape.
- Drive PCB — Drive circuit mounted on PCB to control light emission
- Power cords — Connect display panel electrodes with drive PCB
- Fitting fixture (chassis) — Fits display unit to customer equipment

### 3. Display principle

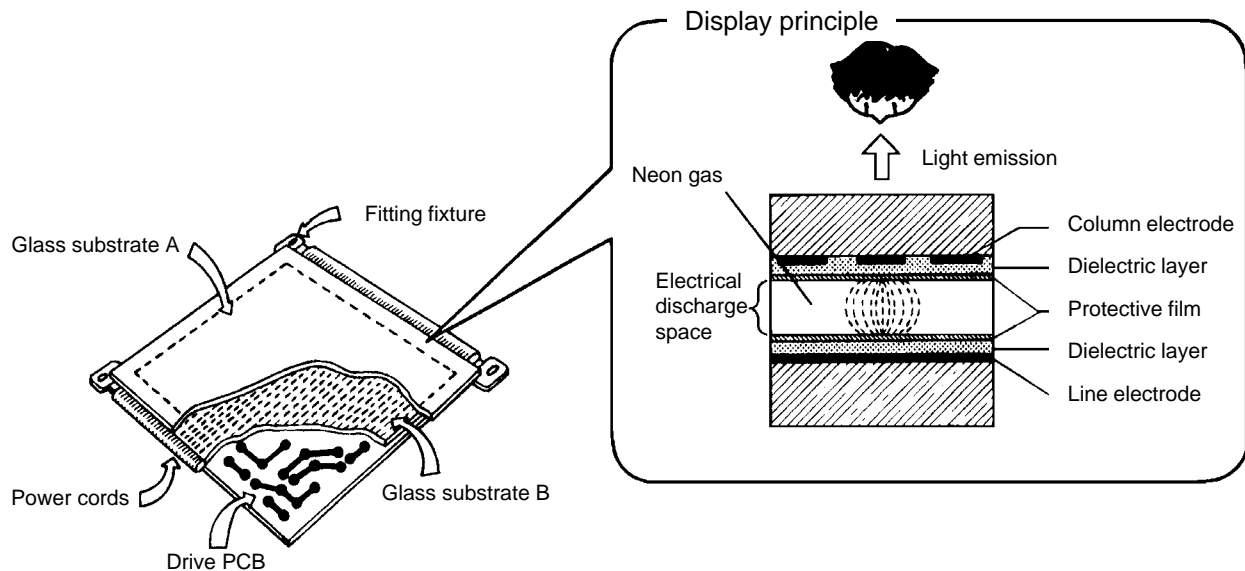
When a high voltage is applied to line and column electrodes facing each other, the neon gas between the two glass substrates emits light as a result of electrical discharge.

Neon gas emits orange light, which is specific to PDPs. The display color appearance depends on the dot light emission.

## n PDP Classification



## n Structure of Fujitsu PDPs



### Challenge!!

1. What emission method does Fujitsu use for PDPs?
2. What does the PDP use to emit light?

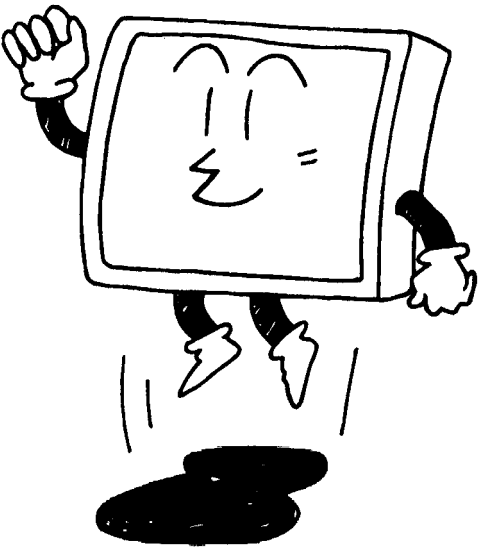
Answers: 1. AC type, 2. Neon gas



## 2. FEATURES OF FUJITSU PLASMA DISPLAY PANELS

Purpose:  
To promote PDP sales, your customers must fully understand the features of PDPs. This section gives an easy-to-understand explanation of the features of Fujitsu PDPs. You should understand why they are excellent.



|  |     |
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## 2.1 Long Service Life

Service life is important for product reliability. Fujitsu PDPs minimize electrode deterioration after repeated electrical discharge, resulting in five times more life than other DC PDPs.

### 1. Comparison of AC- and DC-type displays

| Type      | Fujitsu AC-type PDPs  | Other DC-type PDPs  |
|-----------|---|---|
| Structure | Protective film and dielectric layer covers display electrodes  | Display electrodes exposed to electrical discharge space  |
| Features  |  <ul style="list-style-type: none"> <li>• No electrode deterioration as result of electrical discharge</li> <li>• No brightness reduction</li> </ul> |  <ul style="list-style-type: none"> <li>• Electrodes worn by electrical discharge, and chips scattered</li> <li>• Scattered electrode chips became sludge adhering to inside of glass substrate, causing brightness reduction</li> </ul> |

### 2. Life

The "life" of a PDP depends on the technology employed, for example:

- AC type — When non-emitting display dots increase to more than twice warranted initial values (Fujitsu definition)
- DC type — When relative luminance becomes half initial value

Therefore, Fujitsu AC-PDP does not experience brightness reduction, or "half-life" as a DC-PDP. Fujitsu's ultimate failure mode is "missing dots".





## 2.2 Wide Viewing Angle and High Contrast



Viewing angle is critical for easy viewing from various directions.

Fujitsu PDPs have a wide viewing angle of 160° and excellent contrast without unnecessary emission by pilot discharge.

### 1. Viewing angle

| Type            | Fujitsu AC-type PDP   | Other DC-type PDP  |
|-----------------|---|--|
| Structure       | Open Structure  | Cell Structure   |
| Characteristics | <br>Wide viewing angle (160°) because no cell wall | <br>Narrow viewing angle (100°) because of cell walls |

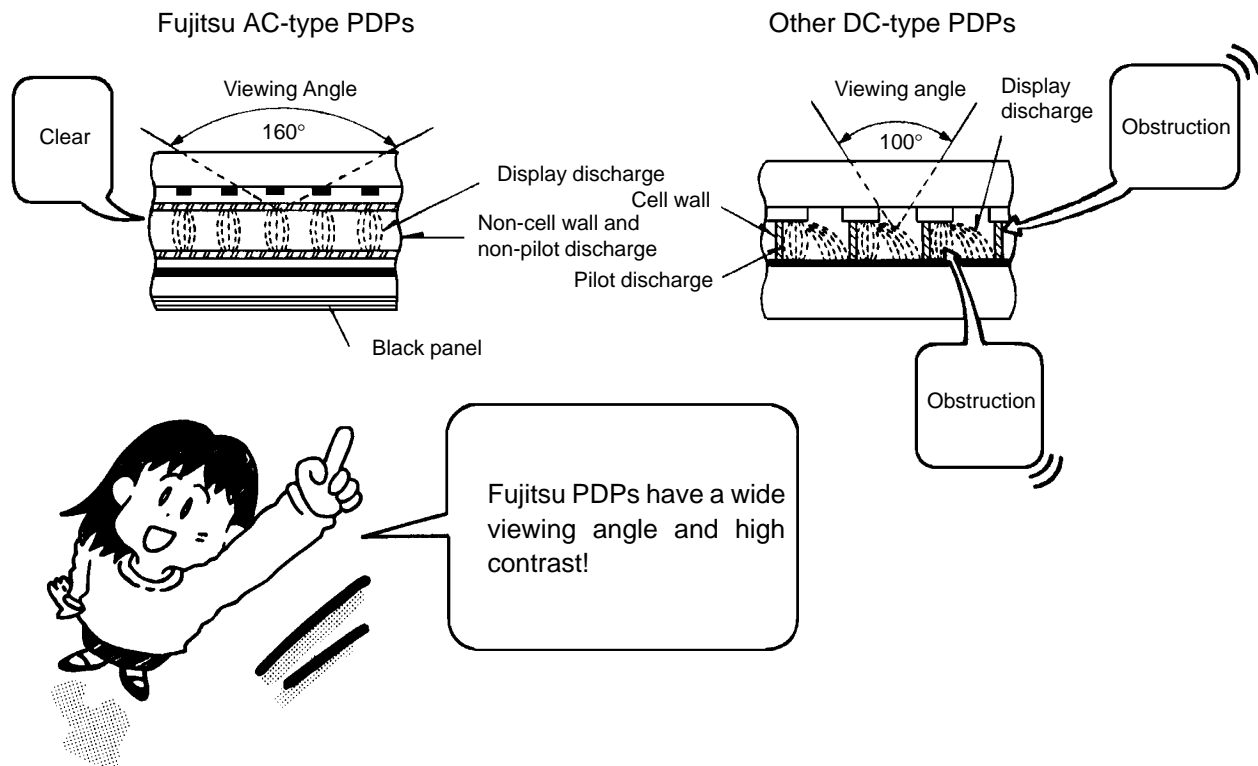
### 2. Contrast

| Type            | Fujitsu AC-type PDP   | Other DC-type PDP  |
|-----------------|---|--|
| Structure       | Open Structure  | Cell Structure   |
| Characteristics | <br>High contrast because of non-pilot discharge | <br>Low contrast because of pilot discharge |

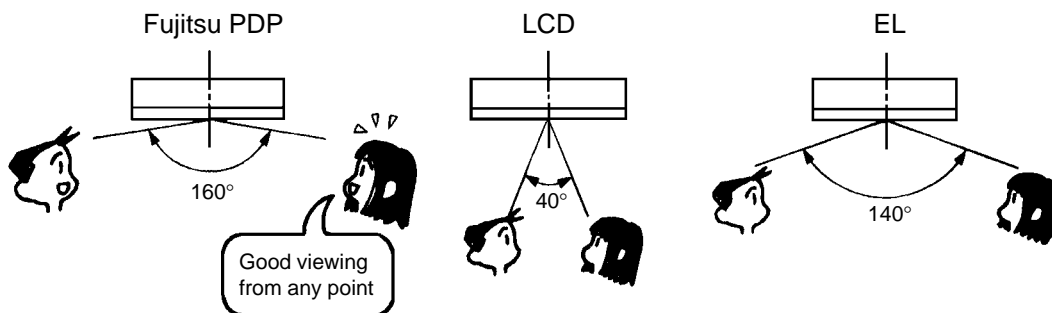
Note: With DC-type PDPs, since the discharge space is partitioned by cell walls for each display dot, pilot discharge always occurs in the individual cell to provide a stable display discharge.



## n Structure Comparison of AC- and DC-type PDPs



## Wide viewing angle compared to other device?



## Challenge!!

Fill the proper terms in the following blanks.

1. Fujitsu PDPs have a wide viewing angle because of [ (1) ].
2. Fujitsu PDPs have a high contrast without unnecessary [ (2) ].

Answers: 1. open structure, 2. pilot discharge

---

## 2.3 Flicker-Free Memory Display

---

Fujitsu PDPs use the memory display method while other flat display panels such as the DC-type PDP use the refresh display method.

This section explains the differences between the memory and refresh display methods and the characteristics of memory displays.

---

### 1. Memory Display Method

The display panel and drive circuit incorporate a function to maintain the discharge, thereby maintaining the state of the other display lines except the addressed line. Once a dot is given a signal to turn "ON", it stays ON until another signal tells it to turn "OFF".

### 2. Characteristics of Memory Display

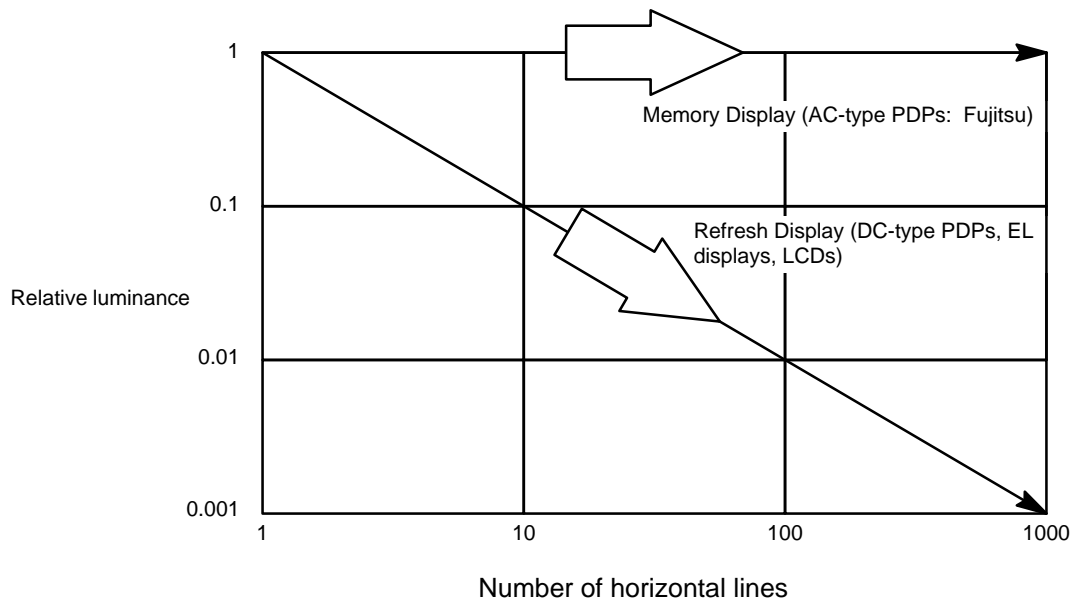
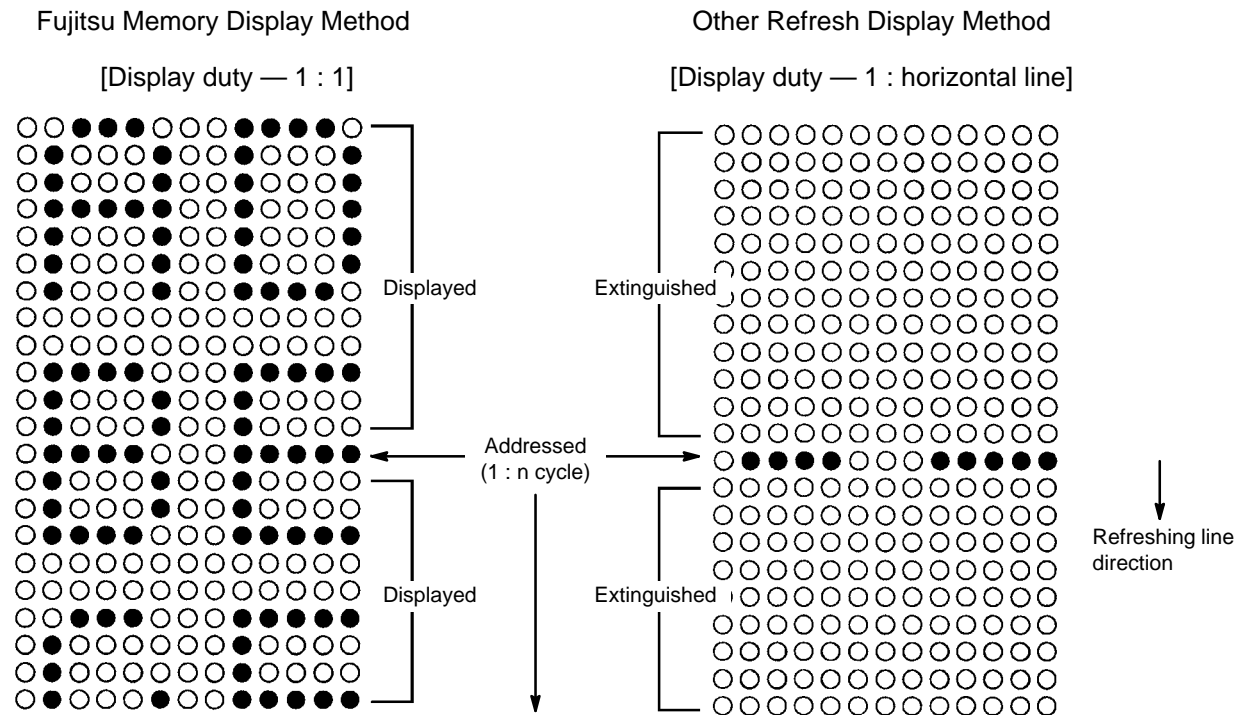
Fujitsu's AC-PDP are ergonomically designed with the operator in mind:

- High brightness — Because the display lines other than the addressed line are continuously illuminated, the emission cycle (display duty) is not affected by the refresh cycle (frame rate). And continuous emission gives high brightness.
- Flicker-free — The memory display method eliminates the flicker seen frequently in refresh-type displays which means it's easy on the eyes.
- Easily enlarged capacity — Even large screens are bright because the emission cycle (display duty) is constant, irrespective of the display capacity (the number of horizontal lines).

### 3. Refresh Display Method

In refresh-type displays, only the addressed line is illuminated. All lines are illuminated repeatedly in sequence at high speed, so when the number of the horizontal lines increases, the emission cycle (display duty) becomes extended, causing low brightness. In addition, flicker is noticeable when the addressing speed is low.

## n Display Methods



### Challenge!!

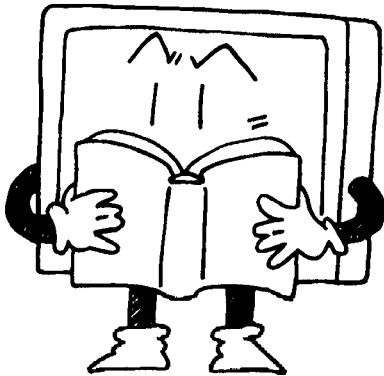
1. What display method maintains illumination of lines other than the addressed line?
2. What characteristics do memory PDPs have (three items)?

Answers: 1. Memory display method, 2. High brightness, Flicker-free, Large capacity

### 3. BASIC KNOWLEDGE

**Purpose:**  
You should stand at the same knowledge level as customers to facilitate smooth business conversations. This section explains the minimum and basic knowledge and the standard terms required to sell PDPs.

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### 3.1 Types of Display Panels

---

You must know the types of PDPs to appreciate the customer's needs and to introduce a suitable display in a business meeting.

The types of PDPs are:

- Numeric panels
  - Character panels
  - Graphics panels
  - Custom-design panels
- 

#### 1. Numeric Panels

Numeric panels have seven display segments. They are used for charge, quantity , and time displays.

#### 2. Character Panels

Character panels display  $5 \times 7$ -dot characters. They are not used recently and have been superseded by graphic panels.

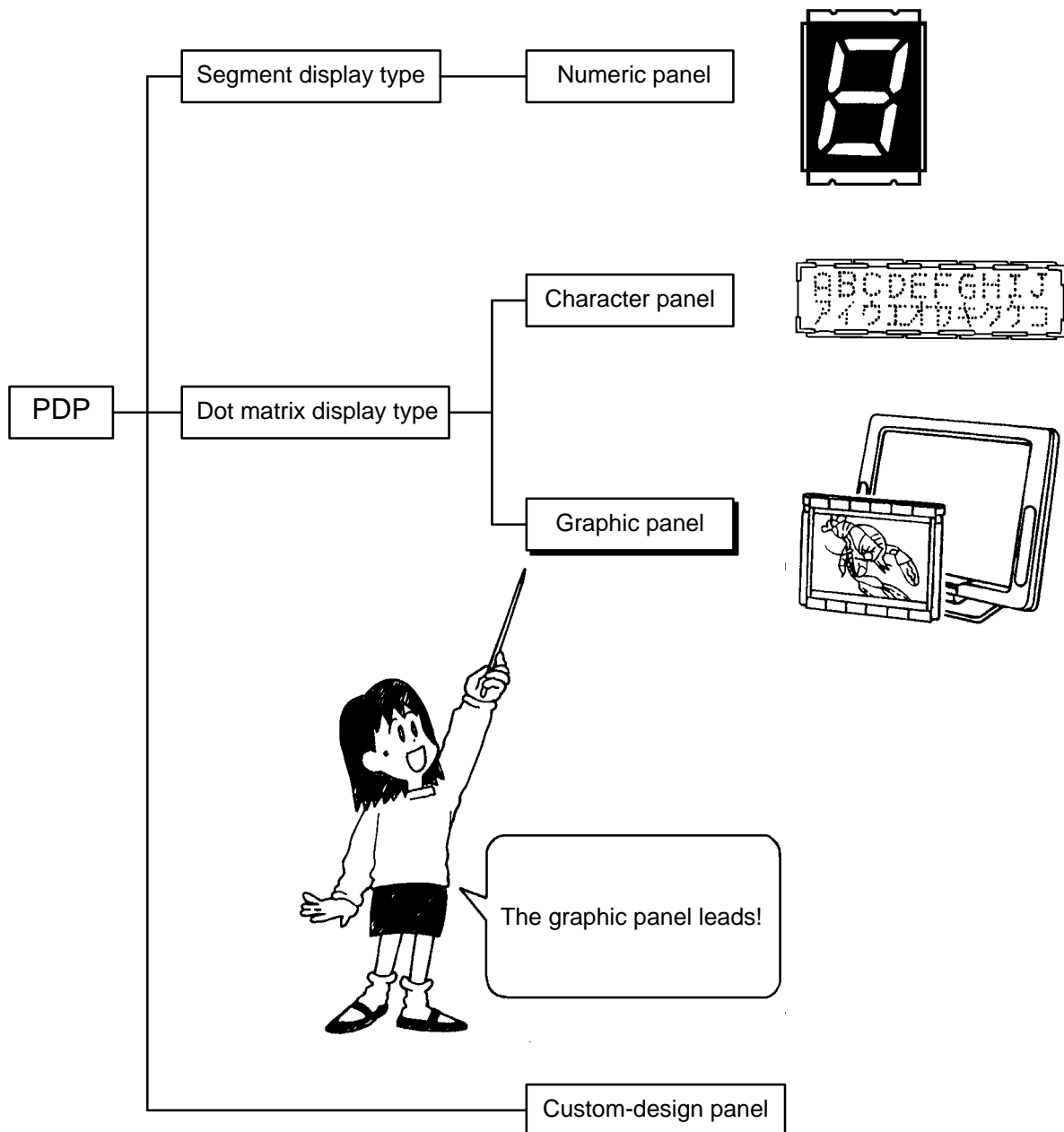
#### 3. Graphic Panels

Graphic panels are leading products and also called full-dot matrix panels. They can display various symbols including alphanumerics, Kanji, and graphics, and are widely used for new applications.

#### 4. Custom-Design Panels

Custom-design panels are based on a customer's specific needs. Typically, these are high-volume applications.

# n Types of PDPs



## Challenge!!

Fill the proper terms in the following blanks.

1. The PDP display method is classified into [ (1) ] and [ (2) ].
2. [ (3) ] is currently the leading product.

Answers: 1. segment display type, 2. dot display type, 3. graphic panel

## 3.2 Display Dimensions

Display dimensions are one topic in business meetings. Generally, the size of the flat display is represented by the diagonal length in inches like in CRTs.

The effective display size is used for flat display panels while the actual display size is used for CRTs.

### 1. Display size

The display size which can display characters and graphics is called *the effective display size*. Generally, the size is represented by the diagonal length in inches but it is represented by the width and height in millimeters at Fujitsu.

Note: How to calculate effective display dimensions

The effective display dimension is obtained from the number of vertical and horizontal dots and the dot pitch.

[Example] 640 (horizontal) x 480 (vertical) dots and 0.33-mm dot pitch

Width:  $640 \times 0.33 \text{ mm} = 211 \text{ mm}$

Height:  $480 \times 0.33 \text{ mm} = 158 \text{ mm}$

Diagonal:  $\sqrt{(211)^2 + (158)^2} \div 25.4 = 10.4 \text{ inches}$

| DOT pitch (mm) | DPI | 640 × 400<br>Screen disp.(In.) |
|----------------|-----|--------------------------------|
| 0.33           | 77  | 9.8 in                         |
| 0.30           | 85  | 8.9 in                         |
| 0.36           | 71  | 10.7 in                        |

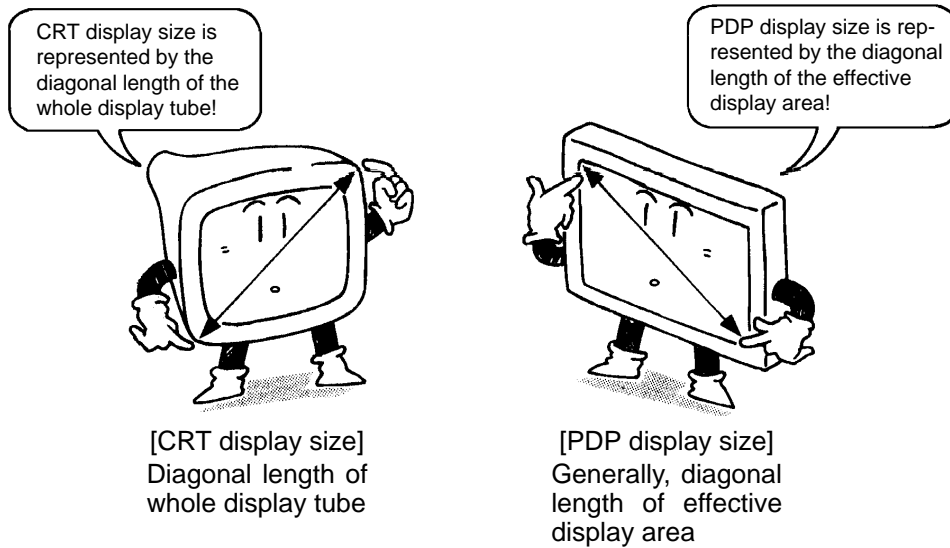
### 2. Number of display dots

This the number of dots that graphic PDPs can display. Generally, it is represented by the number of vertical and horizontal electrodes as specified values. It is also called *display capacity*.

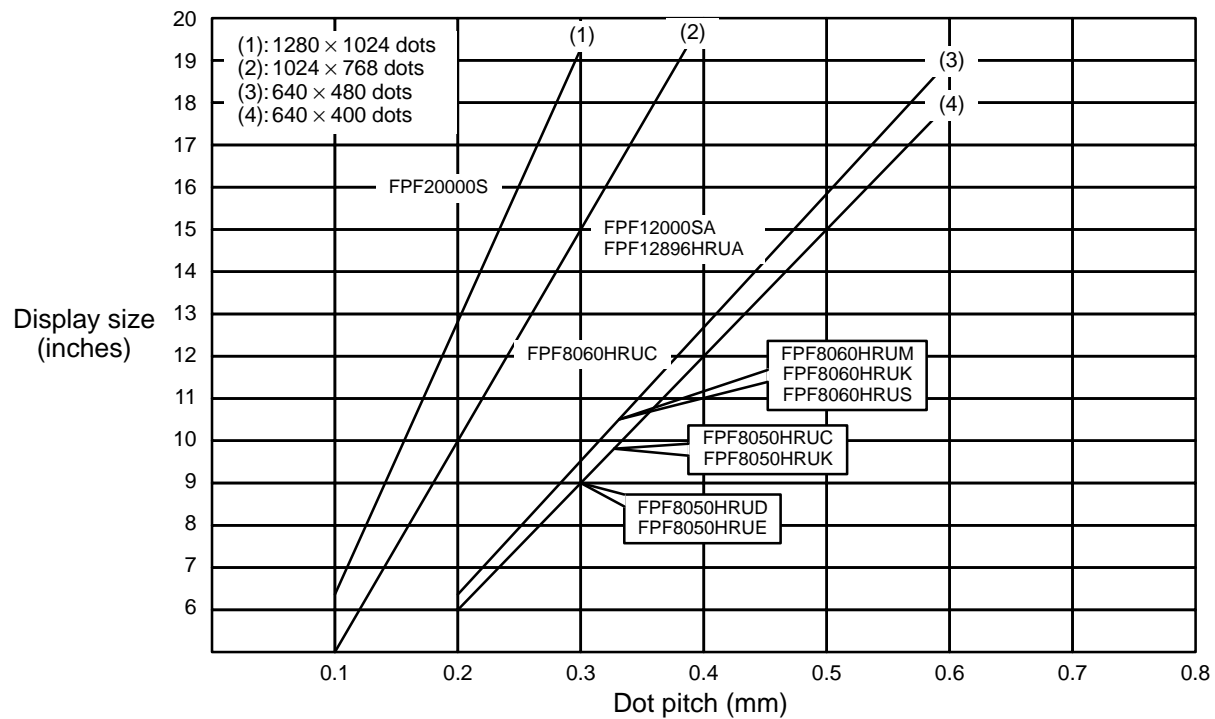
### 3. Dot pitch

This is the pitch size (mm) between the dots where the column (vertical) and line (horizontal) electrodes cross. The smaller the dot pitch, the clearer the display.

## n Size Difference between PDPs and CRTs



## n Relationship between Number of Display Dots and Display Size of Fujitsu graphic PDPs



### Challenge!!

Fill the proper terms in the following blanks.

1. The PDP display size is represented by the diagonal length of the [ (1) ] in inches.
2. The number of the display dots that the graphic display can display is called the [ (2) ].

Answers: 1. effective display area, 2. number of display dots



---

### 3.3 Brightness

---

You must understand brightness to explain the high brightness as one feature of Fujitsu PDPs. Display brightness is represented by spot or area average luminance.

---

#### 1. Spot luminance

The luminance peak of the dot center is called the spot or dot luminance. It is difficult to measure without a special instrument because the size of the display dot is too small (0.2-0.3 mm). Therefore, logical values are generally used to represent the spot luminance.

Since Fujitsu PDPs use opaque electrodes and the luminance of the dot center is low, the spot luminance is represented by the luminance peak around the dot center.

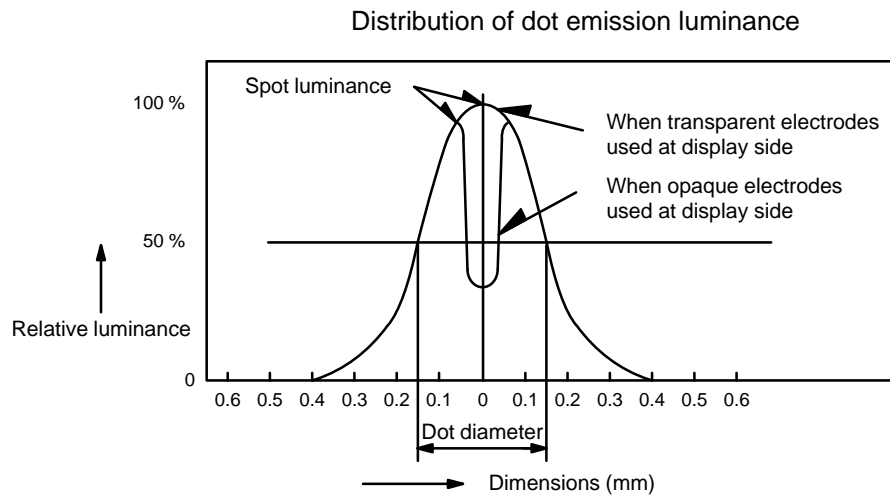
#### 2. Area average luminance

Area average luminance is represented by the averaged luminance in a viewing measurement circle including 20 or more emitting and non-emitting dots.

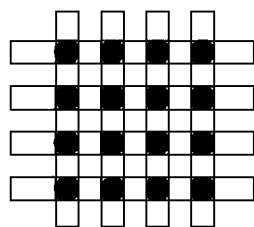
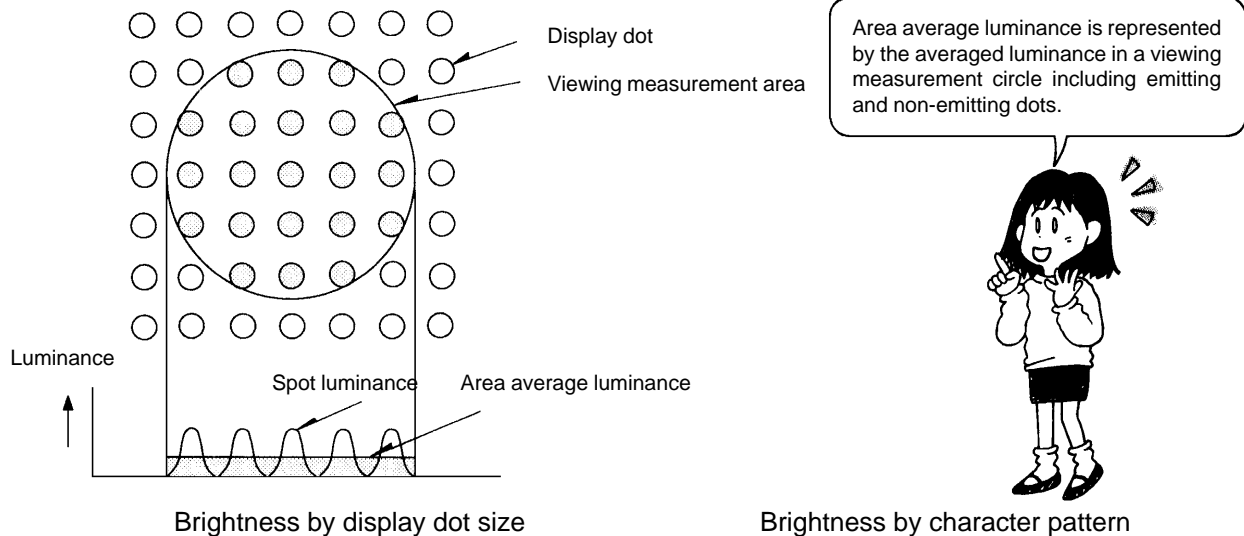
Area average luminance can be sensed by humans. Even if the spot luminance is the same, the visual impression of area average luminance differs according to the display dot size, dot pitch, and character pattern.

- Brightness by display dot size: Larger dots seem brighter.
- Brightness by dot pitch: Small dot pitch seems brighter.
- Brightness by character pattern: Characters with more dots seem brighter even if the display dot size is the same.

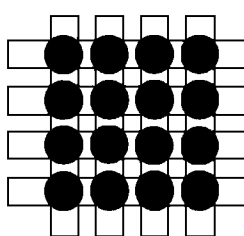
## n Spot Luminance



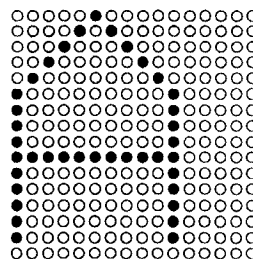
## n Area Average Luminance



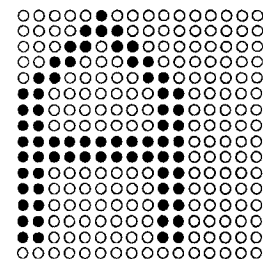
Dim



Bright



Dim



Bright

### Challenge!!

Fill the proper terms in the following blanks.

1. Luminance is classified into [ (1) ] and [ (2) ] luminance.
2. Area average luminance differs according to [ (3) ], dot pitch, and character pattern.

Answers: 1. spot, 2. area average, 3. display dot size

---

### 3.4 Response Speed

---

Response speed is one performance parameter required by displays. High response is required so that the display is stable at screen scrolling or mouse movement.

---

#### 1. Scroll function

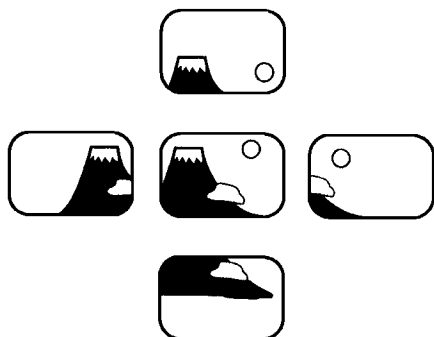
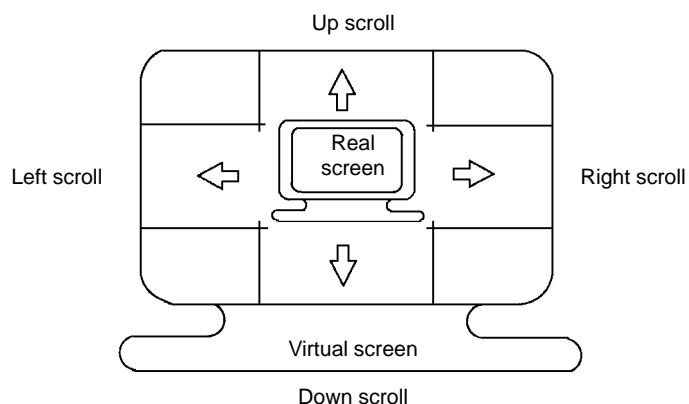
Since the display area is limited, a large quantity of data cannot be displayed simultaneously. In this case, the display screen is scrolled vertically or horizontally to see other hidden areas.

#### 2. Response speed

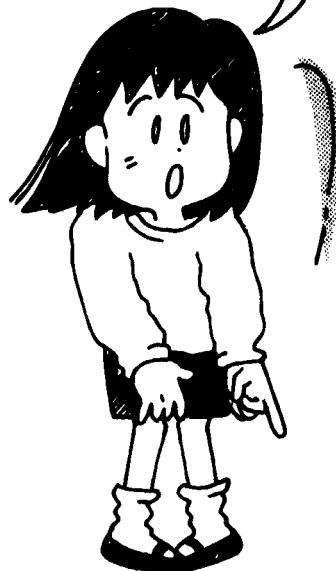
Response speed is the speed at which displayed data responds to input signals. At slow response speeds, the displayed data is not stable when the screen is scrolled. The PDP display is performed by electron movement while the LCD is by molecular action, so the response speed of PDPs is 20,000 times faster than that of LCDs. Even the most advanced active matrix LCDs cannot compete with the PDP's response speed.

- Response speed
  - PDPs: 0.01 ms max.
  - LCDs: 200 ms max.
  - AM-LCDs: 40 ms max.

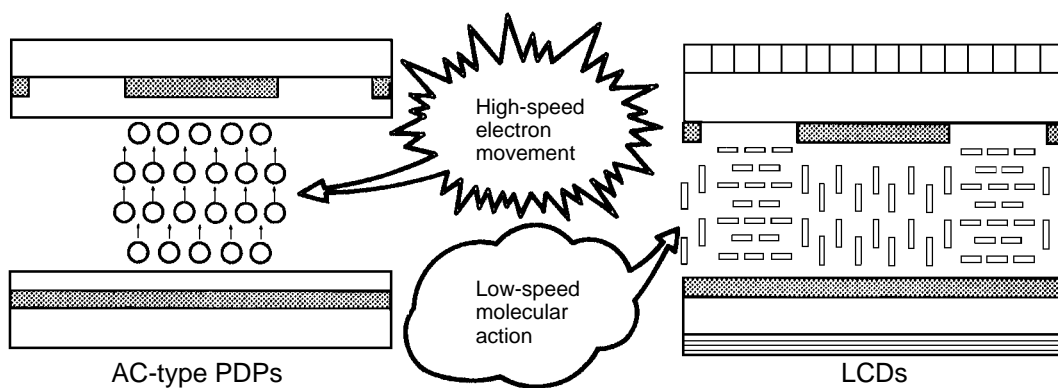
## n Scroll Function



At slow response speeds, the displayed data is not stable when the screen is scrolled!



## n Response Speeds of PDPs and LCDs



### Challenge!!

Fill the proper terms in the following blanks.

1. Moving the display screen vertically or horizontally is called [ (1) ].
2. Fujitsu PDPs achieve a high-speed response by [ (2) ].

Answers: 1. scrolling, 2. electron movement

### 3.5 Digital and Analog RGB

---

The video signal is called RGB because three signals: R (red), G (green), and B (blue) are used for data display. The video signal is classified into digital and analog signals. This section describes RGB signals and gray-scale displays.

---

#### 1. Digital RGB

In a digital RGB signal, each data for the RGB is represented by 0 and 1 (ON or OFF). Eight colors can be represented by the combination of 0s and 1s. Fujitsu PDPs are compatible with digital RGB interfaces.

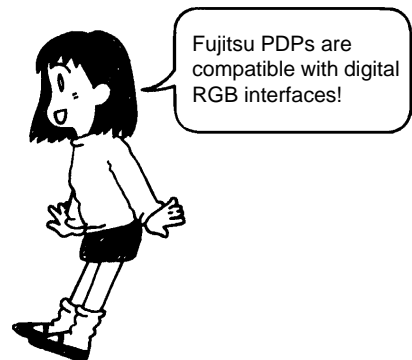
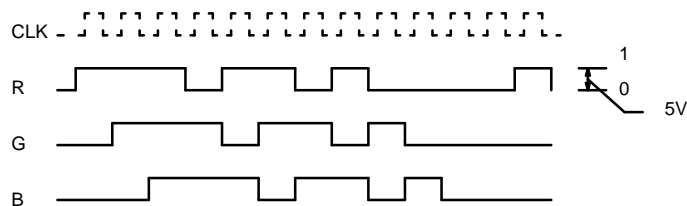
#### 2. Analog RGB

In an analog RGB signal, each data for the RGB is represented linearly. The display color is defined by the number of the RGB brightness level and their combinations. This method is suitable for multicolor displays.

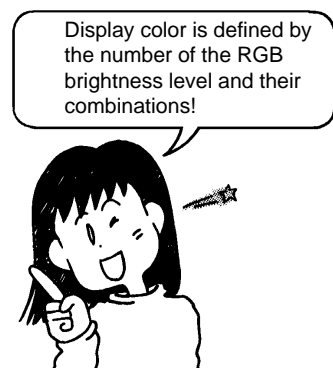
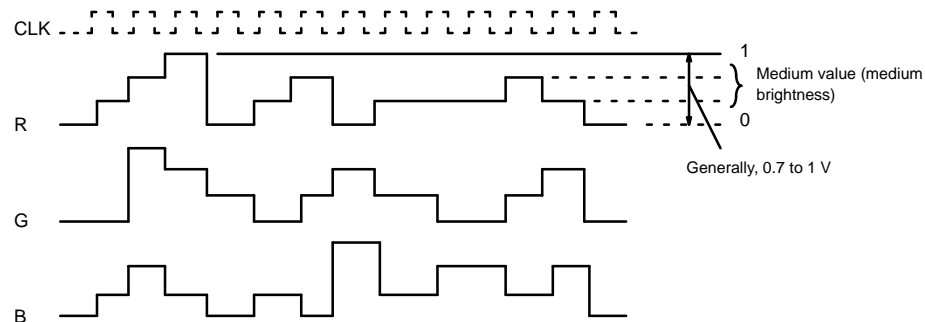
#### 3. Gray-scale display

The display brightness level is represented by a gray scale. This method is used to distinguish graphics, charts and color data on a monochrome display.

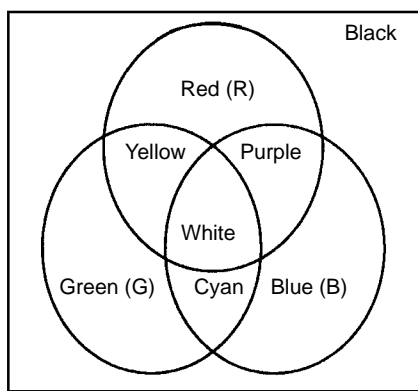
### n Digital RGB



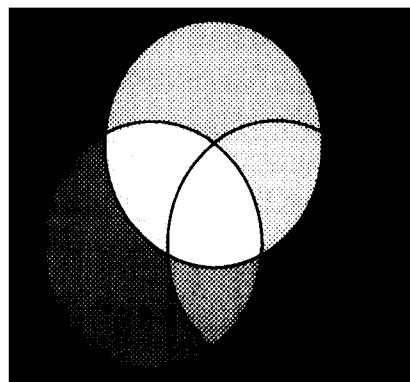
### n Analog RGB



### n Gray-scale Display



Color display



Monochrome 8 gray-scale display

### Challenge!!

Fill the proper terms in the following blanks.

1. Fujitsu PDPs meet the [ (1) ] standard.
2. The [ (2) ] is used to distinguish graphics and charts on a monochrome display.

Answers: 1. Digital RGB, 2. gray-scale display

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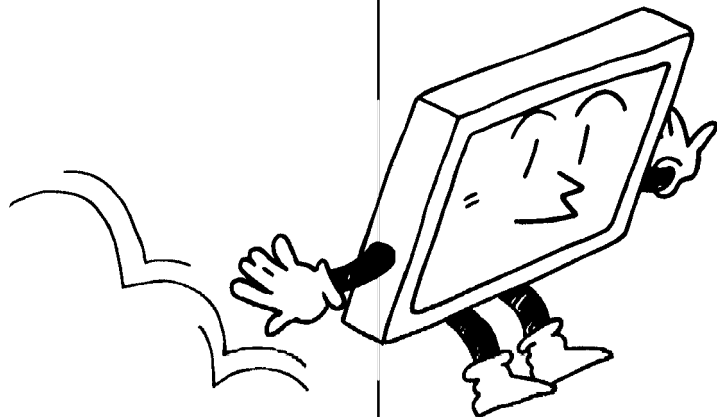
## 4. INTERFACES

Purpose:

Basically, PDPs do not work alone and are used in combination with customers' equipment. The interface is used for this purpose.

This section explains the basic knowledge about the interface. By obtaining this basic knowledge, you'll become a good PDP salesperson.

|  |     |
|--|-----|
| 4.1 What is the interface? .....         | 4-3 |
| 4.2 CRT and PDP Interfaces .....         | 4-5 |
| 4.3 Functions of Interface Signals ..... | 4-7 |
| 4.4 Other Interfaces .....               | 4-9 |



## **IV.A. What is the interface?**

---

The interfacing is important in converting the signal voltage, electrical current level, and video signal transfer timing for connection between equipment. Let's see what the interface is.

---

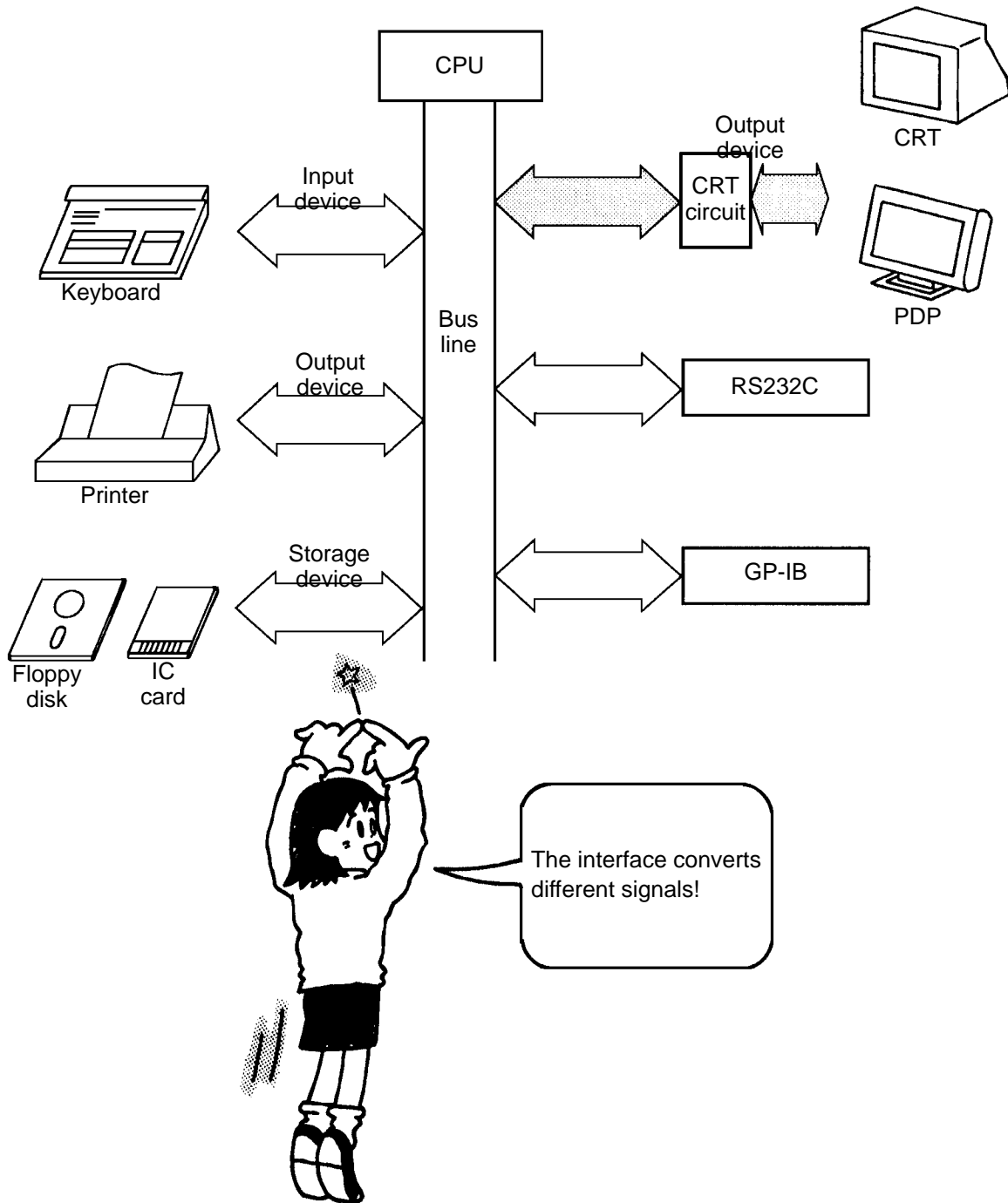
### **1. Interface**

When different signals are used by the CPU and I/O devices, an interface is used between them to make the signals compatible.

### **2. Typical display control interface**

A display signal is output to the CRT monitor linked to the PC via the CRT control circuit in the PC. This display signal is generally called the CRT signal.





Challenge!!

Fill the proper term in the following blank.

[ ] converts the different signals used for CPU and I/O devices.

Answer: The interface

## IV.B. CRT and PDP Interfaces

The PDP interface is basically compatible with the CRT interface. However, timing control by a clock signal is required to drive the PDP with a CRT interface. This section explains the differences between CRT and PDP interfaces.

### 1. CRT interface

- Synchronization signal separate input — Data (DATA), horizontal synchronization (Hsync), and vertical synchronization (Vsync) signals are separately output from the display controller and input to the electronic shutter, horizontal polarizing-coil, and vertical polarizing-coil control circuits, respectively.
- Composite signal input — The composite output signal from the display controller is separated into DATA, Hsync, and Vsync signals via a signal separation circuit and they are input to the electronic shutter, horizontal polarizing-coil, and vertical polarizing-coil control circuit, respectively.

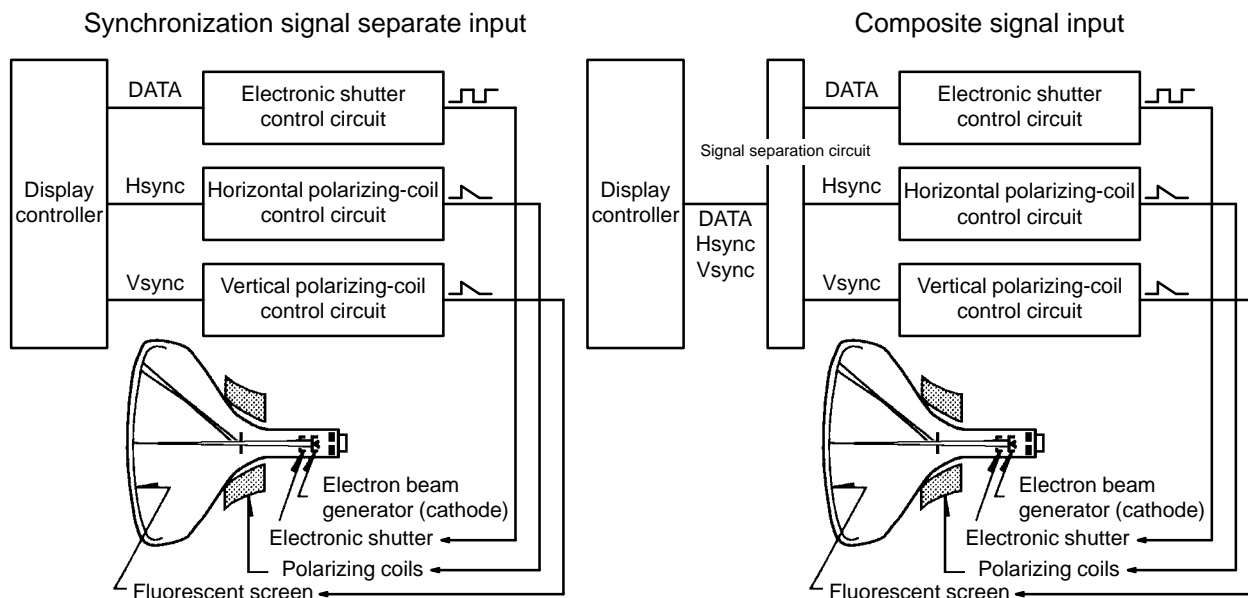
### 2. PDP interface

The PDP interface needs a clock (CLK) signal instead of a transistor-to-transistor logic (TTL) signal such as DATA, Vsync, and Hsync signals. The CLK signal is used to control the DATA signal timing.

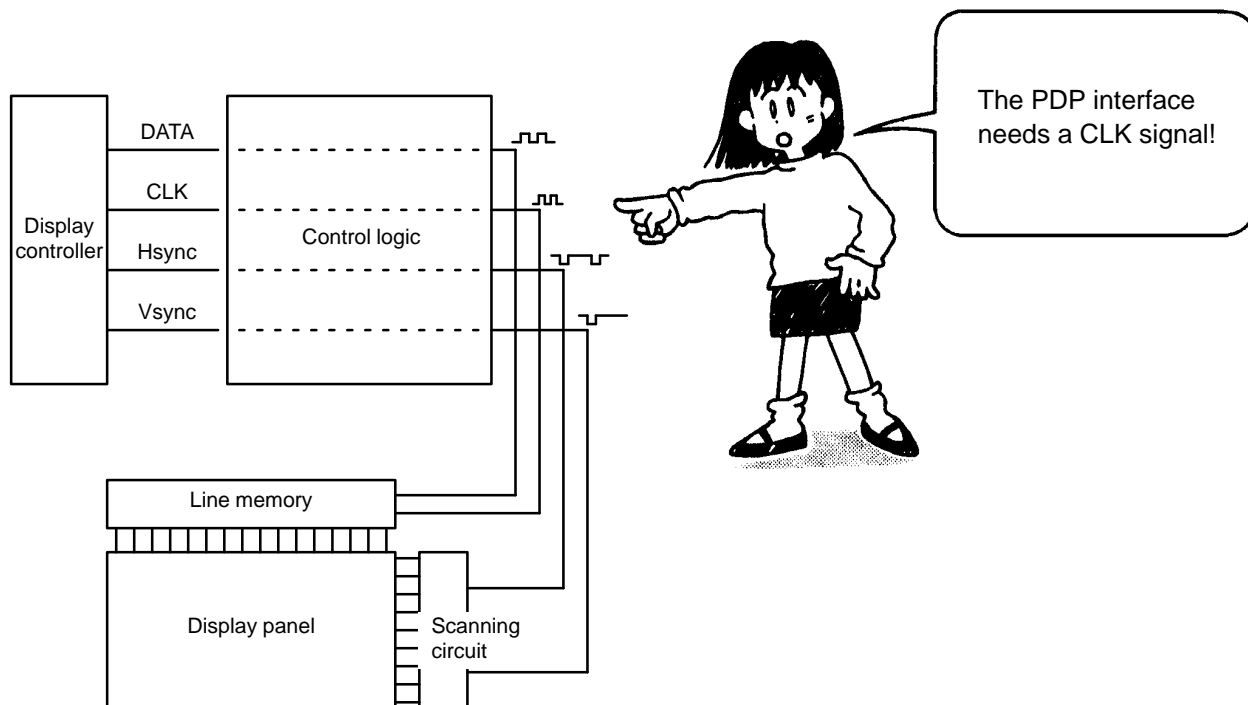
### 3. Differences between CRT and PDP interfaces

| Signal | CRT Interface | PDP Interface |
|--------|---------------|---------------|
| DATA   | Required      | Required      |
| Hsync  | Required      | Required      |
| Vsync  | Required      | Required      |
| CLK    | Not Required  | Required      |

## n CRT Interfaces



## n PDP Interface



### Challenge!!

Fill the proper terms in the following blanks.

1. The Fujitsu PDP interface is compatible with the [ (1) ].
2. The Fujitsu PDP interface needs a [ (2) ].

Answers: 1. CRT interface, 2. clock (CLK) signal

---

## IV.C. Functions of Interface Signals

---

DATA, Vsync, Hsync, and CLK signals are needed for the interface to drive the PDP. This section explains the functions of these interface signals. It is important to know the signal functions to understand the PDP interface.

---

### 1. Vsync signal

The Vsync signal controls the refresh speed for the whole display screen. The first Vsync signal input starts scanning the first display screen and the second Vsync signal input changes the display scan to the second one. The period from the first Vsync signal to the second Vsync signal is the vertical scanning time and is also generally called the frame cycle.

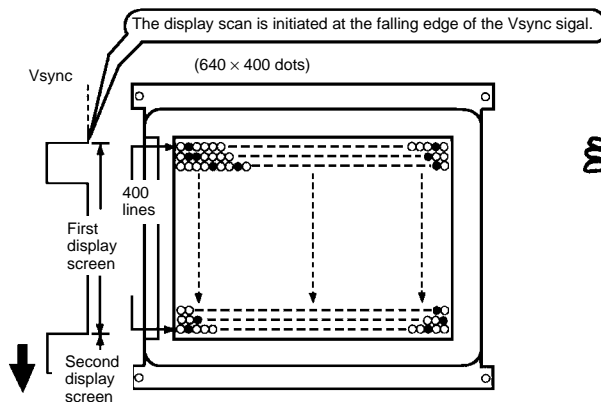
### 2. Hsync signal

The Hsync signal determines the data period for a single horizontal line and switches the addressed line to the next line in sequence. With a 640 x 400-dot PDP, the display accepts 640 data items on the first (top) line when the first Hsync signal is input. In the same way, 640 data items are accepted on every line sequentially up to the 400 (bottom) line according to the Hsync signal input.

### 3. CLK signal

The PDP driver incorporates a line memory to store display data for one single line, which transfers the data to each display dot in synchronization with the Hsync input. A CLK signal synchronized with the DATA signal is necessary for the line memory to accept the single line display data. Without a CLK signal input, the screen cannot display any data. If the CLK signal is not synchronized with the DATA signal, the display screen flickers.

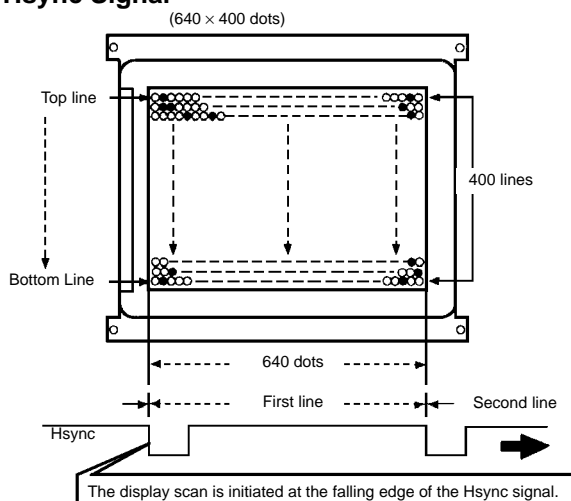
## n Vsync Signal



Ahem!

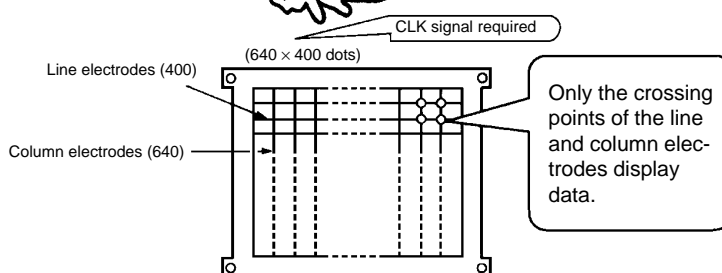
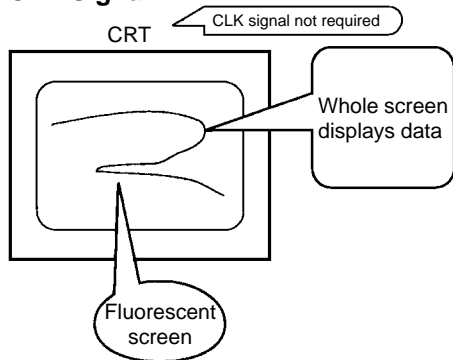
The Vsync signal controls the refresh speed while the Hsync signal determines the data period for a single horizontal line and switches the addressed line to the next line in sequence!

## n Hsync Signal



The CLK signal controls data acceptance at the crossing points of electrodes for the PDP!

## n CLK Signal



## Challenge!!

Fill the proper terms in the following blanks.

1. The signal that determines the data period for a single horizontal line and switches the addressed line is the [ (1) ] signal.
2. The PDP screen flickers when DATA signal is not synchronized with the [ (2) ] signal.

Answers: 1. Hsync, 2. CLK

## IV.D. Other Interfaces

---

Interfaces other than the CRT interface may be requested according to the customer's PDP application or interface conditions. This section explains the RS-232C interface.

---

### 1. Backgrounds in requesting RS-232C interface:

Customers need the RS-232C interface for the following reasons.

- To lengthen the signal cable
- No CRT interface
- No intent to design CRT interface circuit because no design technology or no R&D investment for small production

### 2. RS-232C interface

The RS-232C interface is standardized by the Electronic Industries Association (EIA) and is also called the modem serial interface. This interface is used mainly for communication between PCs or controllers which incorporate CPUs.

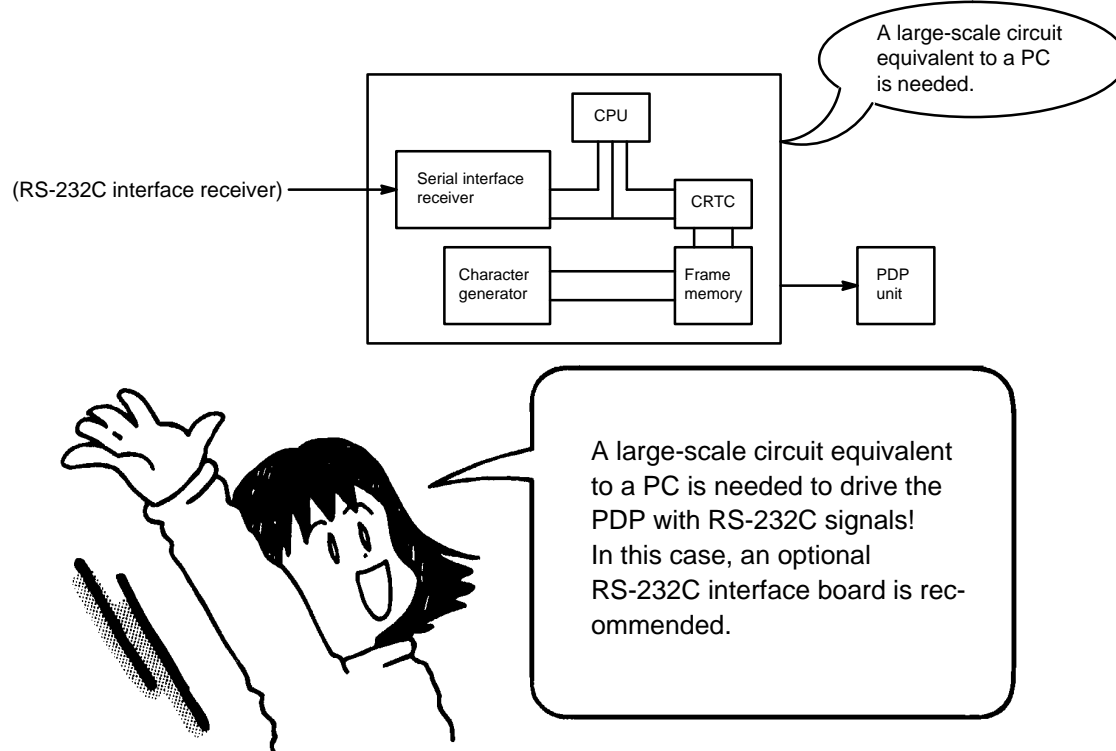
### 3. Driving PDPs with RS-232C interface

Since the RS-232C interface does not support CRT control signals such as Vsync and Hsync signals, the PDP is not activated even if it receives RS-232C interface signals directly. In this case, an interface board, which converts RS-232C interface signals to PDP display signals, is needed. Such an interface board is a large-scale circuit incorporating a CPU, CRT controller, ICs, video memory, character generator, etc.

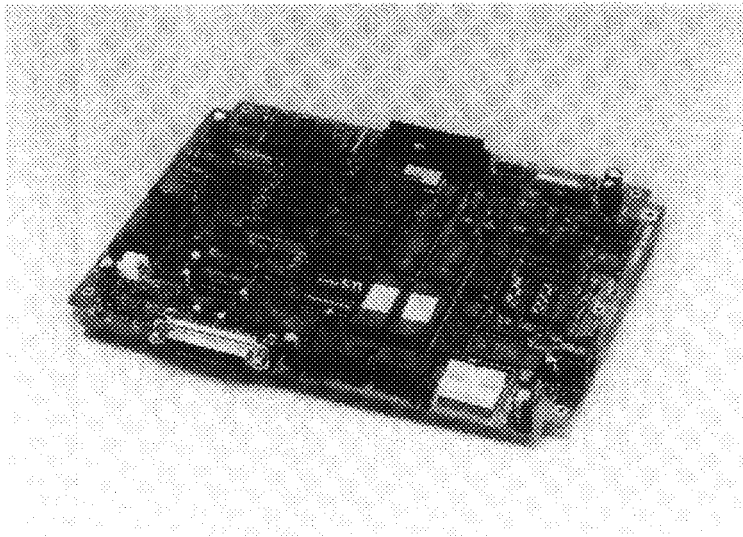
### 4. Commercially available controllers (Board-level and Chip-level)

There are several manufacturers that have developed standard flat panel display controllers that may be interfaced to Fujitsu PDPs. Such controllers are available as board-level products, for use with PCs, or chip-level products, for custom OEM equipment. For more information regarding these products, contact the factory.

## n RS-232C Interface



## n RS-232C Interface Board for PDPs (FPF07A-401)





## Challenge!!

Fill the proper terms in the following blanks.

1. The RS-232C interface is generally used for [ (1) ] between controllers.
2. To use the RS-232C interface as the PDP interface, a [ (2) ] is needed.

Answers: 1. communication, 2. large-scale interface board

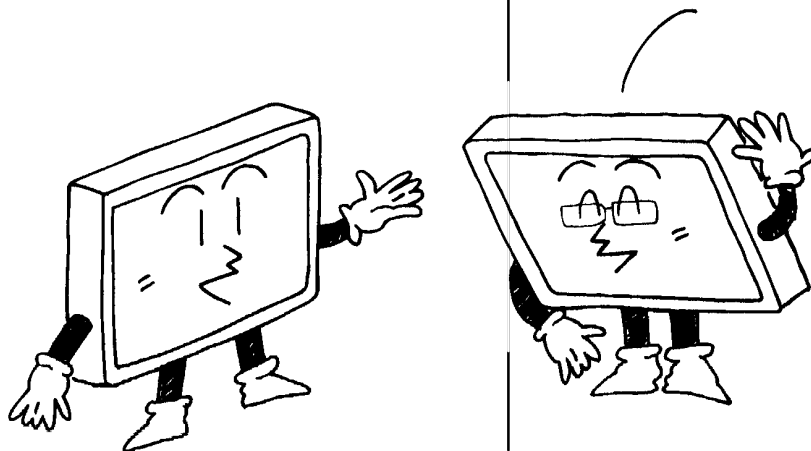
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## 5. PRODUCT EXPANSION OF FUJITSU PDPS

Purpose:

Users' needs come in many varieties. This section outlines various Fujitsu products using PDPs and explains future development trends. Sales can be broadened by complying with users' needs and introducing product to meet these needs.

|   |     |
|---|-----|
| 5.1 Product Structure of PDPs .....             | 5-3 |
| 5.2 Best Seller 640 × 400/480-Dot Graphics .... | 5-5 |
| 5.3 Plasma Display With Touch Panels .....      | 5-7 |
| 5.4 Future Color PDPs .....                     | 5-9 |



---

## 5.1 Product Structure of PDPs

---

Fujitsu PDPs serve for various products ranging from numeric units for solely displaying figures by segmented display panels, to large-capacity graphic units enabling display of graphics and graphs. Also, custom-designed products are available on request. This section introduces Fujitsu's PDP product structure.

---

### 1. Numeric PDP unit

This unit is designed to display figures by segmented display panels. There is no product expansion plan for this unit at the moment. It is available as a maintenance product.

### 2. Graphic plasma display unit

The fine dots of the PDP enable display of many images from numerics to graphics and graphs.

The graphics PDP unit is also called the Full Dot Matrix unit and is used widely to display various images. It is a recommended sales expansion item.

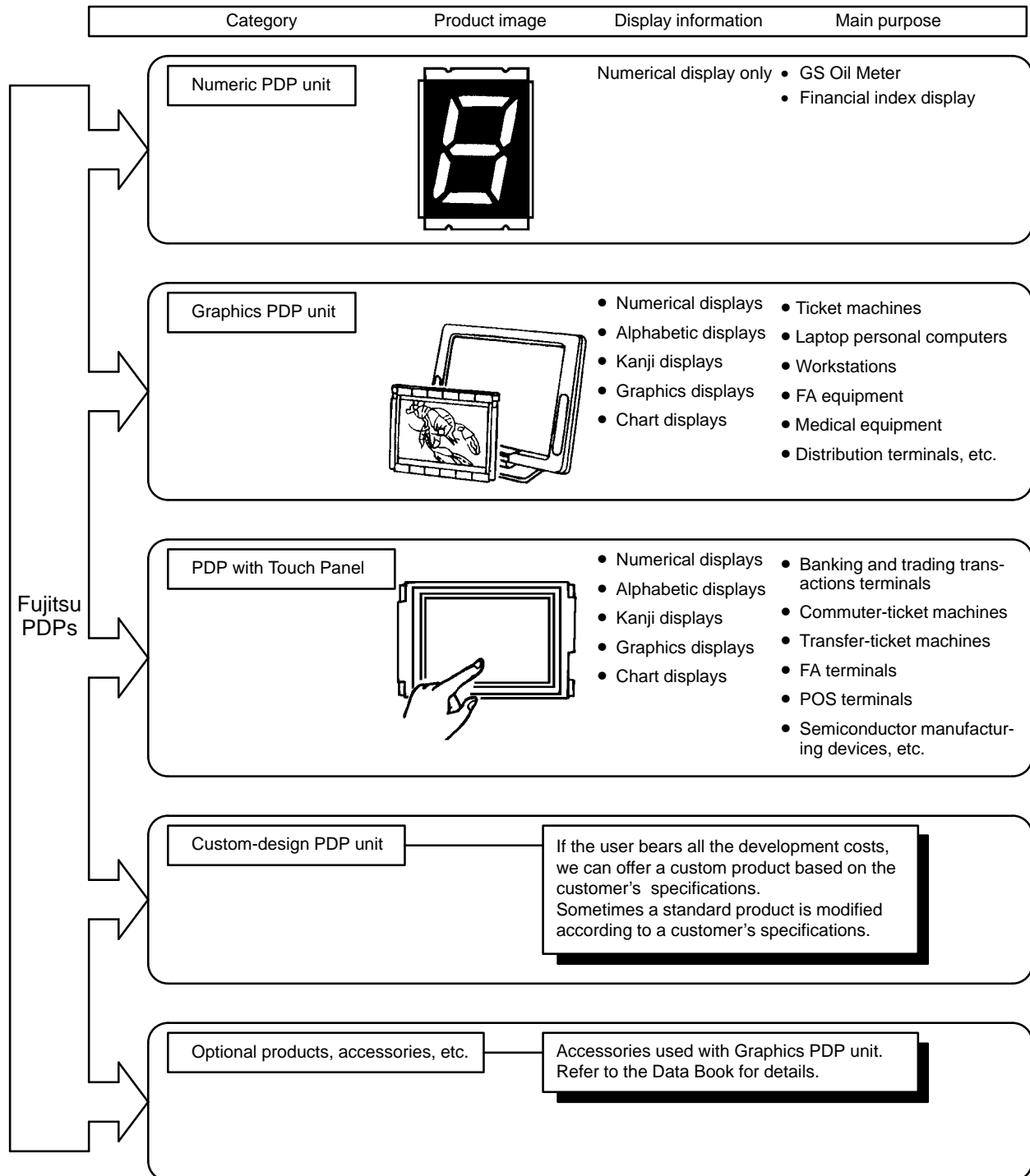
### 3. PDP with touch panels

This unit incorporates graphics PDP and optical touch panel. Fujitsu touch panel technologies include infrared (IR) and resistive types.

### 4. Custom-designed PDP

These units are designed to user specifications. All development costs are borne by the customer. This is only for volume orders.

## n Fujitsu PDP Product Components and Applications



Challenge!!

Fill the proper terms in the following blanks.

The Fujitsu Graphics PDP unit has following features: [ (1) ], [ (2) ], [ (3) ], and [ (4) ]

Answers: 1. Numerics, 2. graphics. 3. touch panels, 4. custom design.

## 5.2 Best Seller 640 × 400/480-Dot Graphics

---

Fujitsu's sales expansion product is graphics PDPs with a capacity for 640 × 400/480 dots. This section introduces a graphics PDP with a 640 × 400/480-dot display capacity. Also outlined are large-size, large-capacity graphics PDPs including power supply and interface board as options.

---

### 1. 640 × 400/480 dots graphics PDPs

A thin, lightweight 640 × 400/480-dot graphics PDP makes it possible to downsize devices and it is being used in various fields. A variety of options are also available and it is a main product for sales expansion.

Specifically, the FPF8050HRUC-001 and FPF8060HRUS PDPs feature high brightness and 16 gray scales, respectively. They are used by many customers in FA, OA, and the medical-equipment market. We strongly recommend this product. The FPF8060HRUC PDP is ideal for touchscreen applications with its ergonomic 71 dpi resolution, 11.4-inch diagonal viewing area, and 4-levels of gray scale.

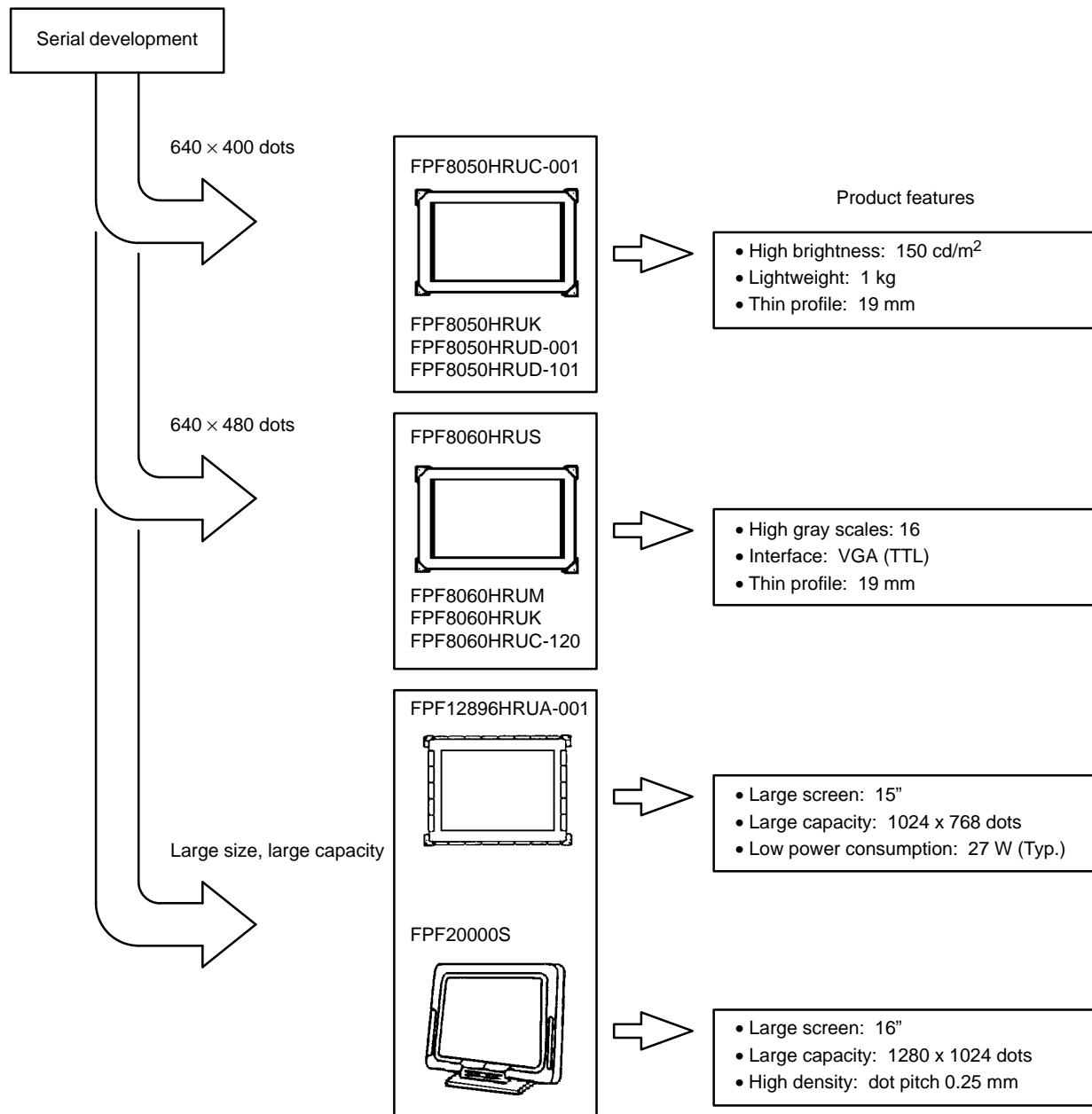
### 2. Large-size, large-capacity graphics PDPs

As office equipment including workstations and terminals become more efficient, and as multitask processing applications become more commonplace, graphics PDPs featuring a thin profile are more welcome for large-capacity information displays.

### 3. Options

- Power supply — This is a proprietary power supply that outputs the power required by PDPs, from the commercial line power. In addition to 100-220 VAC input, 200 VAC input, 48 VDC input and 24 VDC input power supply units are also available. For third party manufacturers of 12 VDC input, consult the factory.
- Interface board — The interface board connects RS-232C interface signals to the interface timing data for PDPs.

## n Serial Development of PDPs



### Challenge!!

Fill the proper terms in the following blanks.

1. Fujitsu's recommended PDP unit is Model No. [ (1) ].
2. Fujitsu's optional products for PDPs are [ (2) ] and [ (3) ].

Answers: 1. FPF8050HRUC-001, 2. Power supply unit, 3. Interface board

### 5.3 Plasma Display With Touch Panels

---

Fujitsu PDPs also have optional optical touch panels with both display and input capabilities. Fujitsu can also provide a unit with resistance-sheet touch panels for price-sensitive applications..

This section illustrates the kinds of touch panels and their features.

---

#### 1. Typical touch panels

Touch panels are classified into three detection methods: Electrostatic capacity, resistance sheet, and optical. Curved shapes for CRTs and flat shapes for flat panel displays, are also available.

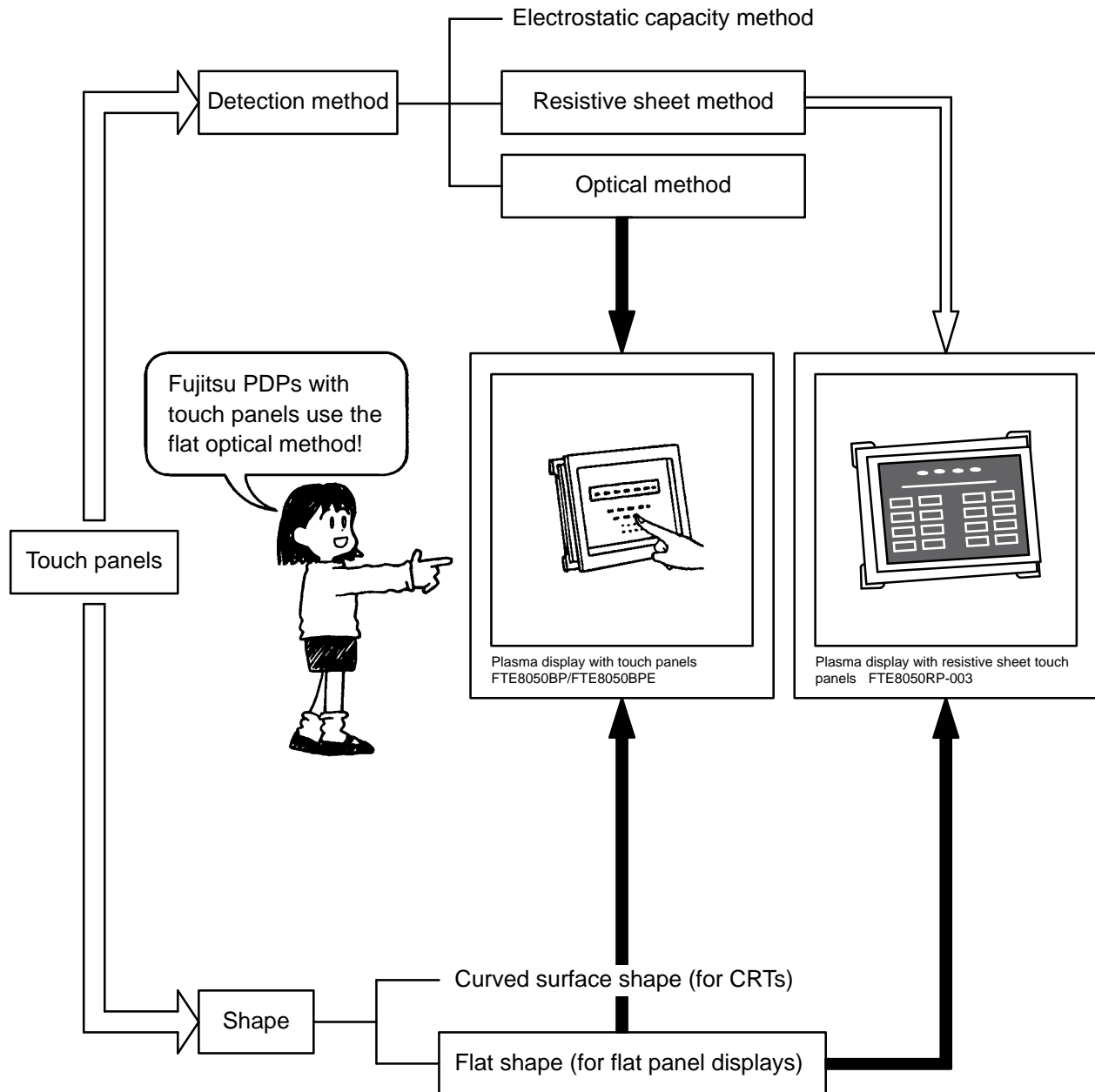
#### 2. Characteristics of Touch Panels

Touch panels feature both display and input functions in combination with a display unit.

- Electrostatic capacity method — This is used for ATMs (Automatic Teller Machines) for banks. Although it is strongly resistant to chemicals, input can only be made by touching the screen with a bare hand.
- Resistance sheet method — This is used widely for various purposes including electronic notes. It is inexpensive. Because the surface is coated with polyester film, it is easily cut or scratched if touched by a sharp edge.
- Optical method — This method is used for PDPs. It is strongly resistant to external damage and input is possible by touching the panel with other than a bare hand. It is more expensive than the resistance sheet method.



## n Classification of Touch Panels



## Challenge!!

1. What are the three touch-panel detection methods?
2. What method is used by Fujitsu PDPs?

Answers: 1. Electrostatic capacity method; Resistance sheet method; and Optical method,  
2. Optical method

## 5.4 Future Color PDPs

---

Recently, R&D of large full-color PDPs is making progress. A plan to meet high-definition wall television (HDTV) requirements in the near future is underway. This section explains the fundamentals of color PDPs.

---

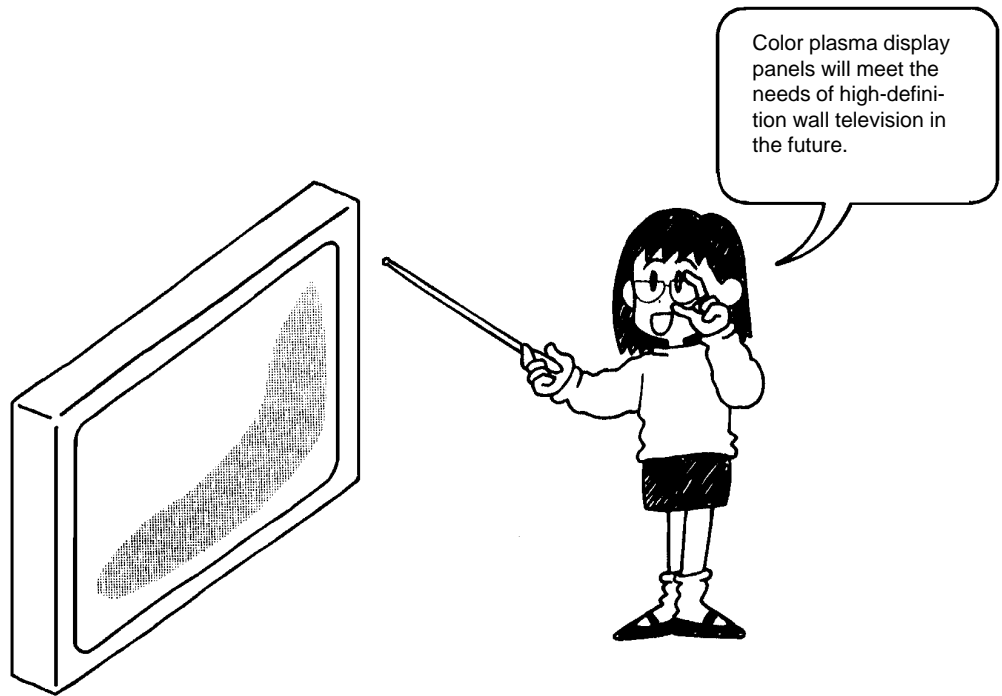
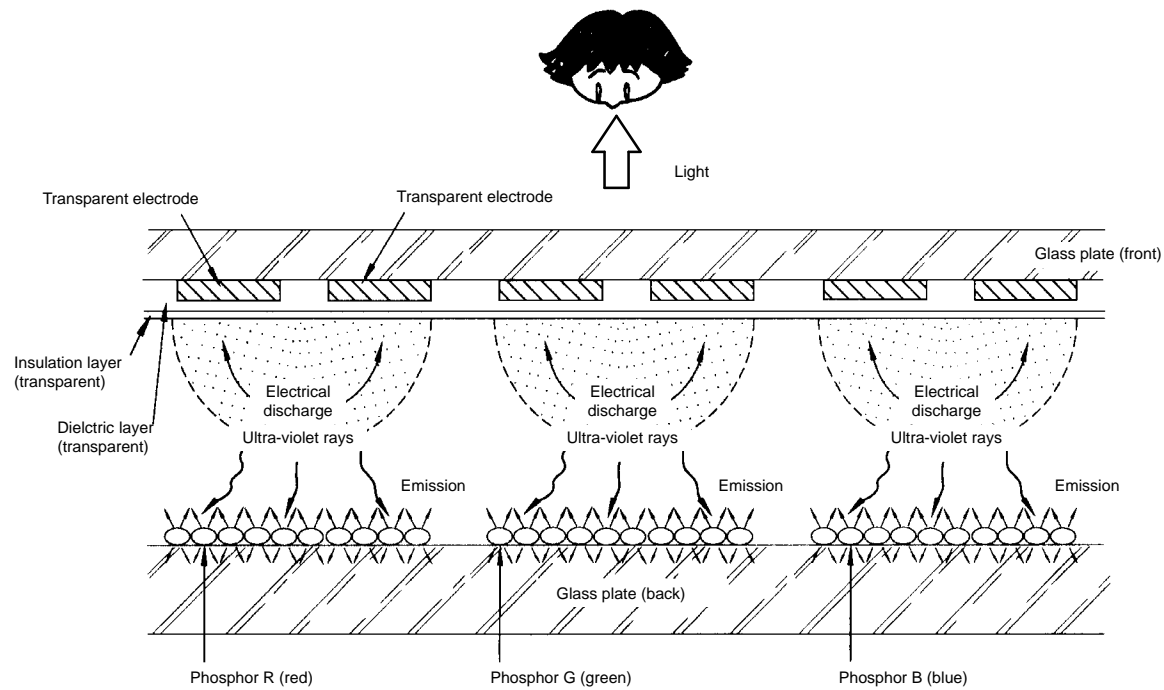
### 1. Surface discharge method color PDP

The surface discharge method PDP has all the electrodes inside the front glass panel and is sealed with rare gases. By applying voltage to electrodes, discharge (surface discharge) occurs on the same surface and generates ultra-violet rays. Fujitsu has developed a unique emission method using phosphor applied on the back glass plate by using these ultra-violet rays.

### 2. Main features of surface discharge method color PDP

- Because the PDP is designed so that the brightest surface of the emitting phosphor can be seen, the brightness is high.
- Since the phosphor emits as a result of ultra-violet rays generated by electric discharge, the phosphor does not deteriorate, which results in long life.
- The discharge surface, where the electrodes are generated, does not have unstable elements such as phosphors, so the discharge characteristics are stable.

n Color Plasma Display (Surface discharge method)



Challenge!!

1. What method do color PDPs use?
2. What are the main features of surface discharge color PDPs?

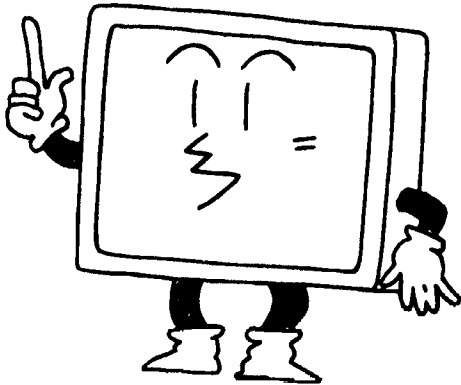
Answers: 1. Surface discharge method,  
2. High brightness, long service life, and stable discharge characteristics



**6. HOW TO DEVELOP BUSINESS NEGOTIATIONS**

Purpose:  
To develop more effective sales activities, we must acquire business communications knowledge. This section selects and outlines the important points relating to promoting effective sales activities, as well as to understanding the user's situation.

|  |     |
|--|-----|
| 6.1 Before Making A Sales Call .....         | 6-3 |
| 6.2 Sales Conversations .....                | 6-5 |
| 6.3 Check Your Customer's Requirements ..... | 6-7 |
| 6.4 Typical Sales Flow .....                 | 6-9 |



## 6.1 Before Making A Sales Call

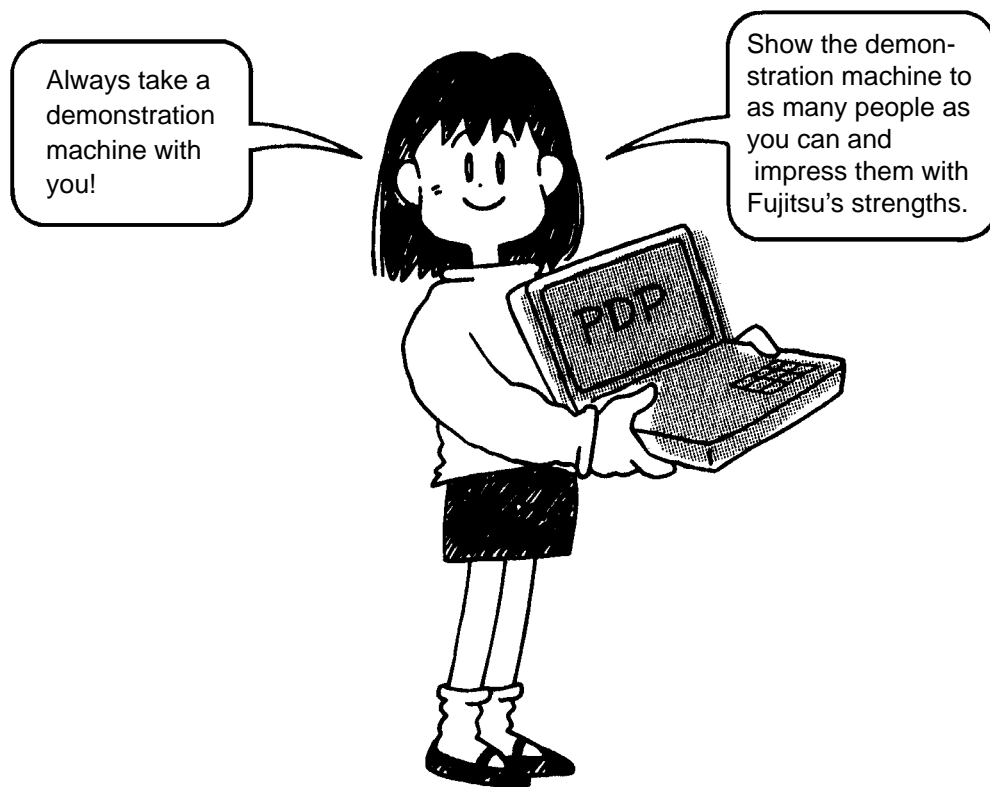
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The following summarizes the points necessary for selling PDPs in the form of a self-check. Make a complete self-check of your preliminary knowledge and develop effective sales activities.

---

### 1. Self-check before making sales call

- Sales promotion materials
  - Data book (data sheets)
  - Sales manual
  - Product specifications (In case specific package number is mentioned)
  - Demonstration machine
- Advance knowledge
  - What are customer's business line and status of new product development?
  - What display unit is being used?
  - What is the competitive device?
  - Who is the key person?
  - What level of product are you going to sell?
  - Price considerations



Challenge!!

What are the five sales promotion materials when you make a sales call for PDPs?

Answer: Data Book (data sheets), Demonstration machine, Notebook containing price list, Sales manual, and Product specifications

---

## 6.2 Sales Conversations

---

The success of your sales conversations depends on how effectively and briefly you emphasize the excellence of Fujitsu products. The outstanding points of Fujitsu PDPs are summarized below.

---

### 1. Fujitsu's Unique Memory Display Method

Since the memory display method maintains the state of other lines while displaying the addressed line, it has the following strong points.

- The high brightness obtained by a luminance of 150 cd/m<sup>2</sup> makes the display screen brighter.
- A 1:1 display duty cycle and flicker-free image is ergonomically pleasing.
- Even an increase in the number of vertical lines does not affect the stable brightness so large displays become possible.

### 2. 20:1 High Contrast

Fujitsu PDPs do not have continuous electrical discharge, and the black face images give clear and high contrast displays, even under normal office lighting conditions.

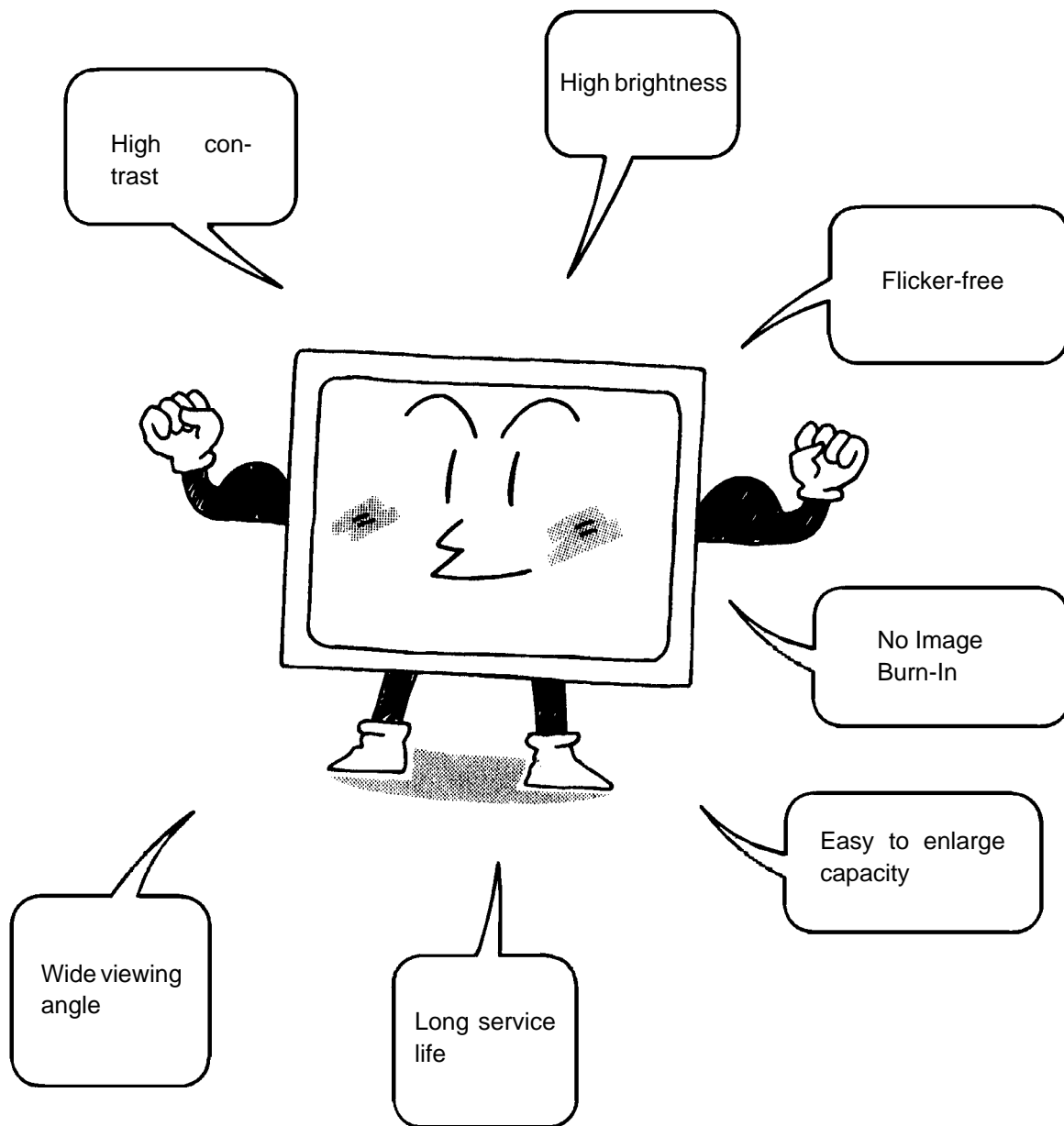
### 3. 160° Wide Viewing Angle

Fujitsu PDPs have an open structure and no barrier ribs (such as DC-PDP), so the viewing angle is wider than that of other devices.

### 4. 50,000-hour Life with No Brightness Loss, Image Burn-In or Flicker

Fujitsu PDP electrodes are protected by an insulation layer and a dielectric layer to give a long service life 5 times that of CRTs.





Challenge!!

What are main features of Fujitsu PDPs?

Answer: High brightness, high contrast, wide viewing angle, flicker-free, easy to enlarge capacity, and long life, no burn-in

### 6.3 Check Your Customer's Requirements

---

To develop the customer's interest in Fujitsu PDPs to a purchase order, it is important to confirm and meet the user's needs and technical abilities.

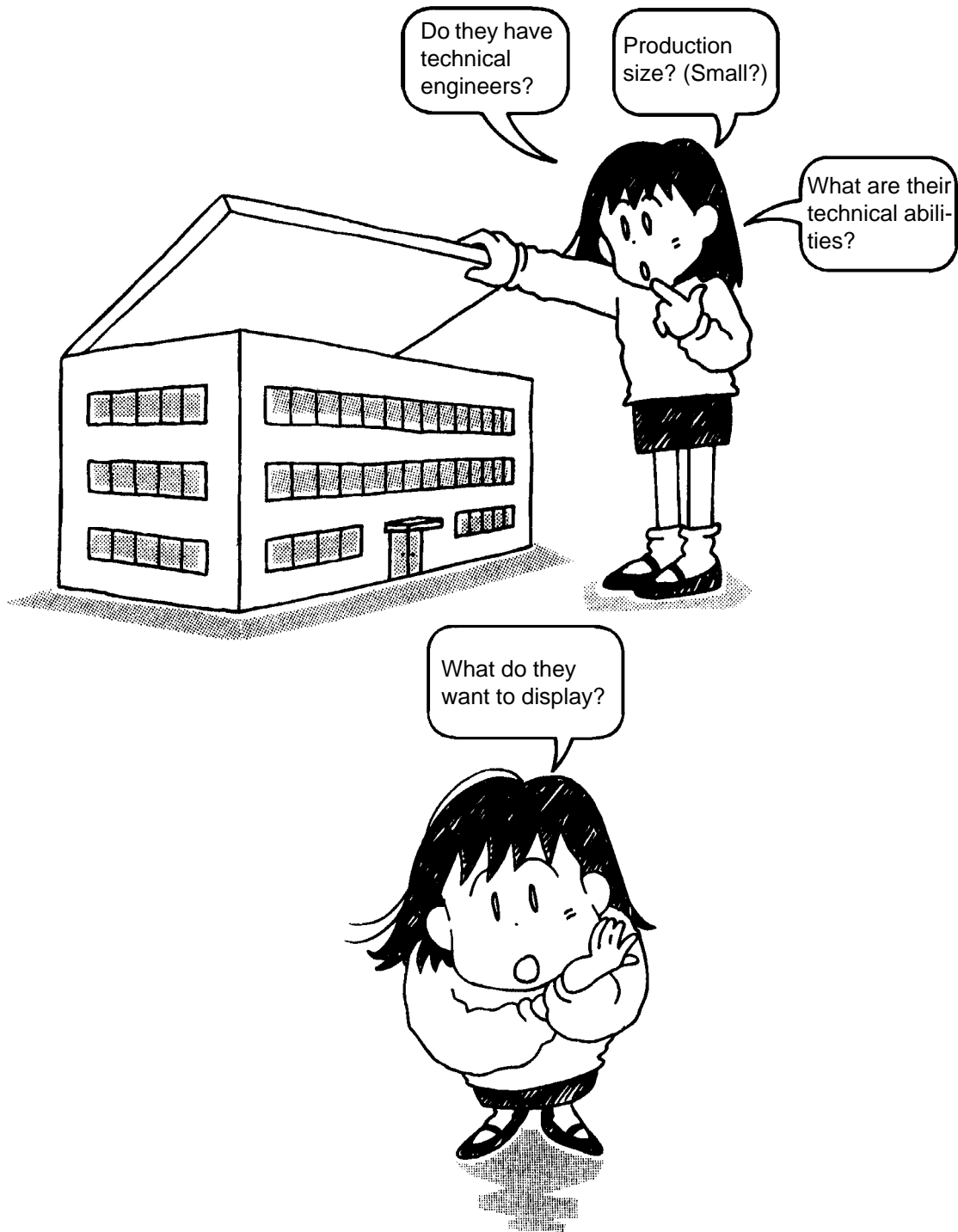
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1. Confirm user's needs.

- What do they want to display?
- What device is being used.
- What are the external dimensions?
- Are gray scales necessary?
- What are the interface conditions?

2. Confirm user's technical abilities – Can they manufacture control circuits?

- No technical abilities, nor engineers
- Technical abilities but production volume is small and no budget for R&D



Challenge!!

Fill the proper terms in the following blanks.

1. Confirm if the user has the [ (1) ] to manufacture control circuit boards.
2. Confirm that they cannot invest in R&D because of the [ (2)].

Answers: 1. Technology, 2. Production volume

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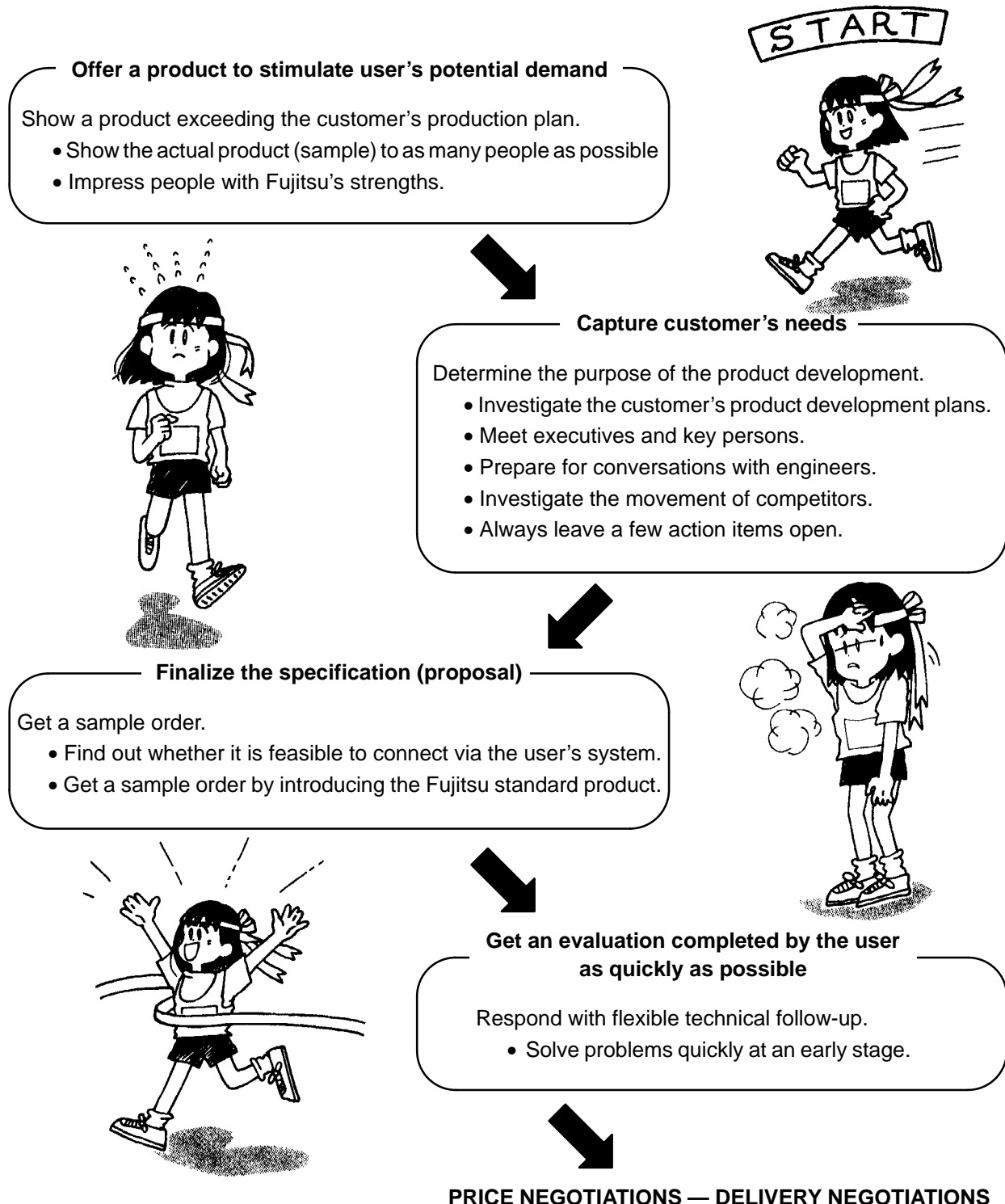
## 6.4 Typical Sales Flow

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To successfully sell PDPs, you must stimulate the user's potential demand by PR activities for the product before the user's production plan materializes, and you must explain the strong features of Fujitsu PDPs. This section outlines the typical sales flow.

---

1. Offer the product to stimulate the user's potential demand
  - Strongly recommend the product before the user's purchasing plans become firm.Demonstrate Fujitsu PDPs to as many people as possible through presentations, and by giving an exhibition of demonstration machines.
2. Capture the user's needs – Determine the purpose of the product development.
  - Find out the new product development plans for the next product from the products listed in the user's current catalogs.
  - Meet executives and key persons using the help of Fujitsu executives.
  - Acquire technical knowledge to understand the technical terminology when talking (listening) to engineers.
  - Investigate competitive devices and the activities of competitors.
  - Always leave a few action items open for the next visit.
3. Finalize the specification – Get a sample order.
  - Check the user's interface specifications to determine whether it is possible to connect via the user's system.
  - Get a sample order by introducing Fujitsu's unique interface specification for PDPs.
  - Do not offer free evaluation samples as they are very expensive.
4. Get an evaluation completed by the user as quickly as possible – Respond with flexible technical follow-up.
  - Confirm that the sample display device worked successfully.
  - If not, follow-up with technical services.



**Challenge!!**

Fill in the appropriate word in the box below.

1. To effectively promote PDPs, it is imperative to stimulate the user's needs [ (1) ].
2. Demonstrate the superiority of Fujitsu PDPs by showing an [ (2) ] to as many people as possible.

Answers: 1. Before the production plan materializes, 2. Actual sample

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## 7. USES OF PDPS

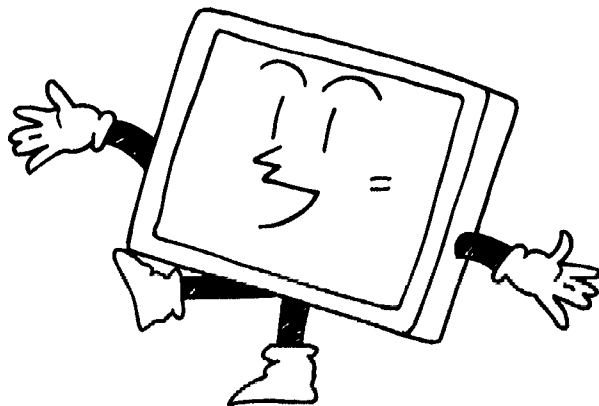
Purpose:

Introducing many applications of Fujitsu PDPs to new customers is one sales approach that has a big impact.

The object of this chapter is to introduce a considerable number of applications and to focus on target markets.



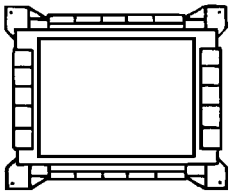
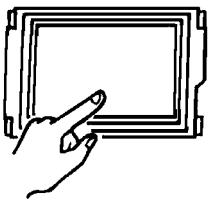

Knowledge about how PDPs are used by customers will solidify firm images of markets.

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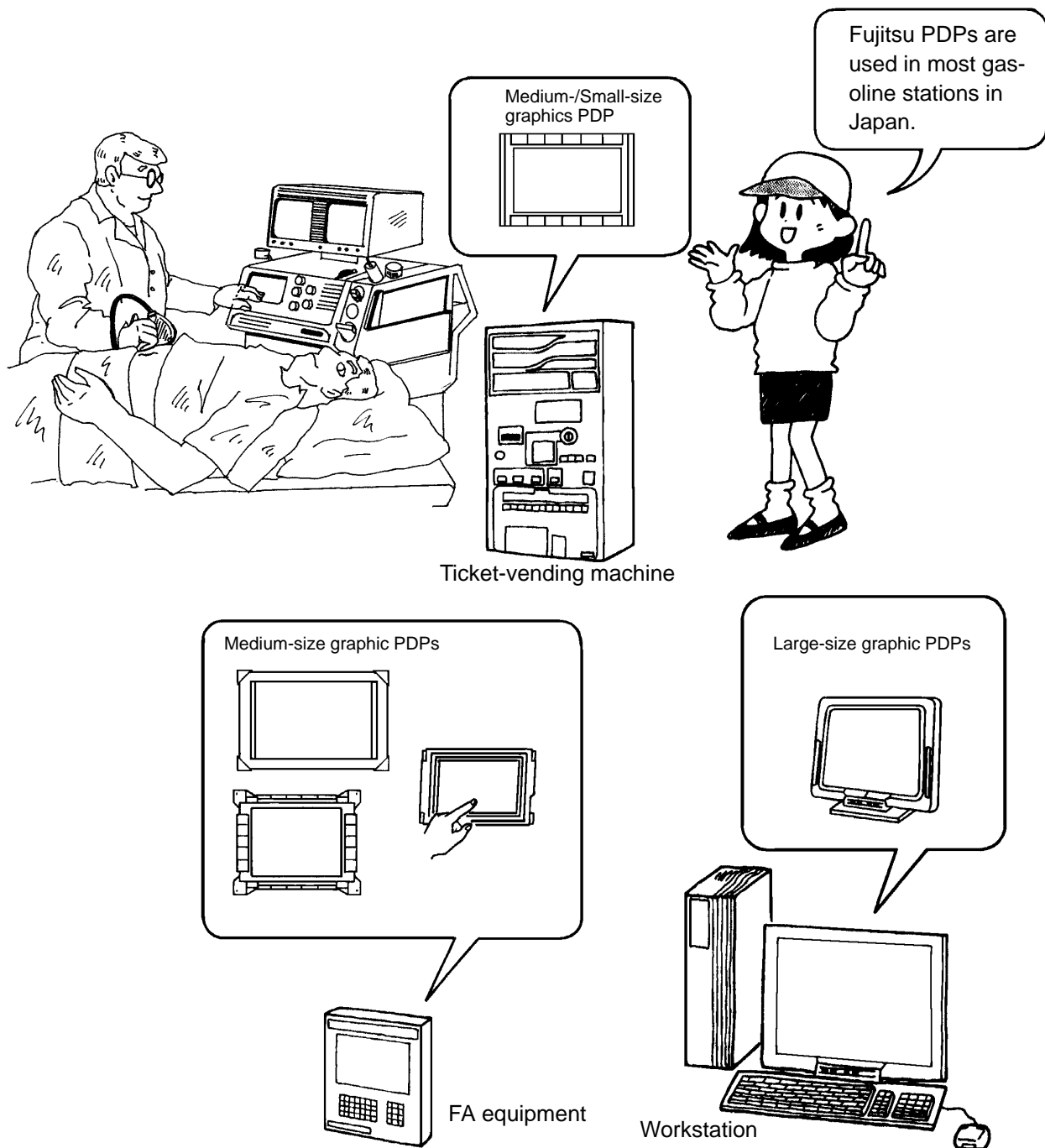


## 7.1 Types of Display Panels

An enormous number of Fujitsu PDPS are used in gasoline meters in gas stations and in ticket-vending machines in railroad stations. Fujitsu has a monopoly of gasoline meters in Japan. This section summarizes the applications by product series and the advantages of each product series. Make your sales conversations more advantageous by using numerous examples of applications as a sales approach.

| Product family   | Main usages (applications)   | Advantages  |
|--|--|---|
| <p>Numerics PDP</p>   | <ul style="list-style-type: none"> <li>Gasoline meters in gas stations (gasoline quantity and charge)</li> <li>Bill display boards (stock prices and exchange rates)</li> <li>Bus display boards (fare display)</li> <li>Displays in passenger cars (speed display)</li> <li>Industrial weighing machines (weight and amount)</li> <li>Power supply controls and monitor boards (power demand and supply unit)</li> <li>Large clocks in airports, terminals (time display)</li> <li>Production line display boards (production count display)</li> </ul>   | <ul style="list-style-type: none"> <li>High brightness and high contrast</li> <li>Large-size line display</li> <li>Wide viewing angle</li> <li>Long life</li> </ul>   |
| <p>Medium-/Small-size graphics PDP<br/>(640 x 480 dots or less)</p>    | <ul style="list-style-type: none"> <li>Ticket-vending machines (sum bought, card remainder)</li> <li>Totalizer terminals (ticket issuing information display)</li> <li>Operating cabin in trains (service information display)</li> <li>Portable personal computers (OA processing, spreadsheet and text display)</li> <li>Medical display terminals (chart, administration information display, MRI, Xray)</li> <li>POS terminals (item, sales and stock information display)</li> <li>Distribution terminals (item, customer, order and sales information display)</li> <li>Post office and bank ATMs (deposit and withdrawal information display)</li> <li>Dealing terminals (information communication one-touch dialer display)</li> <li>Telephone switching board terminals (number inquiry operation information display)</li> <li>Stock control terminals (item, warehousing and delivering information display)</li> <li>Building control terminals (in-building equipment operation information display)</li> <li>FA display terminals (factory equipment control information display)</li> <li>Inspection line terminals (test and inspection information and data information)</li> <li>Sequence controllers (control flow and condition information display)</li> <li>NC programming units (NC unit programming and information display)</li> <li>NC controllers (machine-tool control information display)</li> <li>Robot controllers (operation guide and condition information display)</li> <li>Semiconductor manufacturing machines (operation guide and operation information display)</li> <li>Various machine-tools (operation guide and operation information display)</li> <li>CT scanners (operation guide and condition information display)</li> <li>Data loggers/analyzers (measured waveform and measured data information display)</li> </ul> | <ul style="list-style-type: none"> <li>High visibility (high brightness, high contrast)</li> <li>Wide viewing angle</li> <li>No brightness loss or screen burn</li> <li>Thin and space-saving</li> <li>Quick response</li> <li>Graduation characteristics offering good visibility</li> <li>Long life</li> <li>Environment-safe (temperature)</li> <li>Compatible with standard CRT</li> <li>Ability to operate in a high magnetic field environment</li> </ul> |
| <p>Large-size graphics PDP<br/>(1024 x 768 dots or more)</p>    | <ul style="list-style-type: none"> <li>UNIX-WS/X terminals (software development, X-window DTP/WP, spreadsheet, electronic filing, database, etc.)</li> </ul>  | <ul style="list-style-type: none"> <li>Thin and space-saving</li> <li>Large size and large memory</li> <li>Quick response display</li> <li>High visibility</li> <li>Long life</li> </ul>  |

n Applications of Fujitsu PDPs



Challenge!!

Fill the proper terms in the following blanks.

1. Fujitsu's numerical PDP monopolize [ (1) ].
2. [ (2) ] are one Fujitsu PDP family which has a large number of applications.

Answers: 1. Meters in gas stations, 2. Medium-/small-size graphics PDPs



## 7.2 Promising Markets

To obtain a larger market share for PDPs, we must penetrate markets where the advantages of Fujitsu PDPs are most appreciated. In this sense, FA is a promising market which should be opened up.

This section gives examples of uses of PDPs in FA and ME.

### 1. Definition of ME

ME means Medical Equipment or Medical Electronics and pertains to all equipment for medical use from diagnosis to medical systems for treatment and preserving life.

### 2. Examples of use of PDPs in ME

The PDP market is growing in the following ME equipment.

- X-ray diagnostic units
- MRI
- Ultrasonic diagnostic units
- Cardiac pacemakers programming and charting
- ICUs
- Various medical equipment

### 3. FA

FA means Factory Automation and pertains to total automated systems for automation of manufacturing and assembly, labor-saving, and automation of technical and management information.

### 4. FA equipment

FA equipment is a general term for all equipment and apparatus pertaining to FA. FA equipment is classified roughly into five families although their scope is large and not well-defined.

- Automating/labor-saving equipment

[NC machine tools, robots, unmanned carts, automatic warehouses, etc.]

- Control/monitor equipment

[CNC (Computer Numerical Control) units, PCs (Programmable Controller), FA personal controllers]

- Design/control equipment

[CAD/CAM, production control systems]

#### d. FA components

[Servomotors, detection switches]

- Other FA equipment

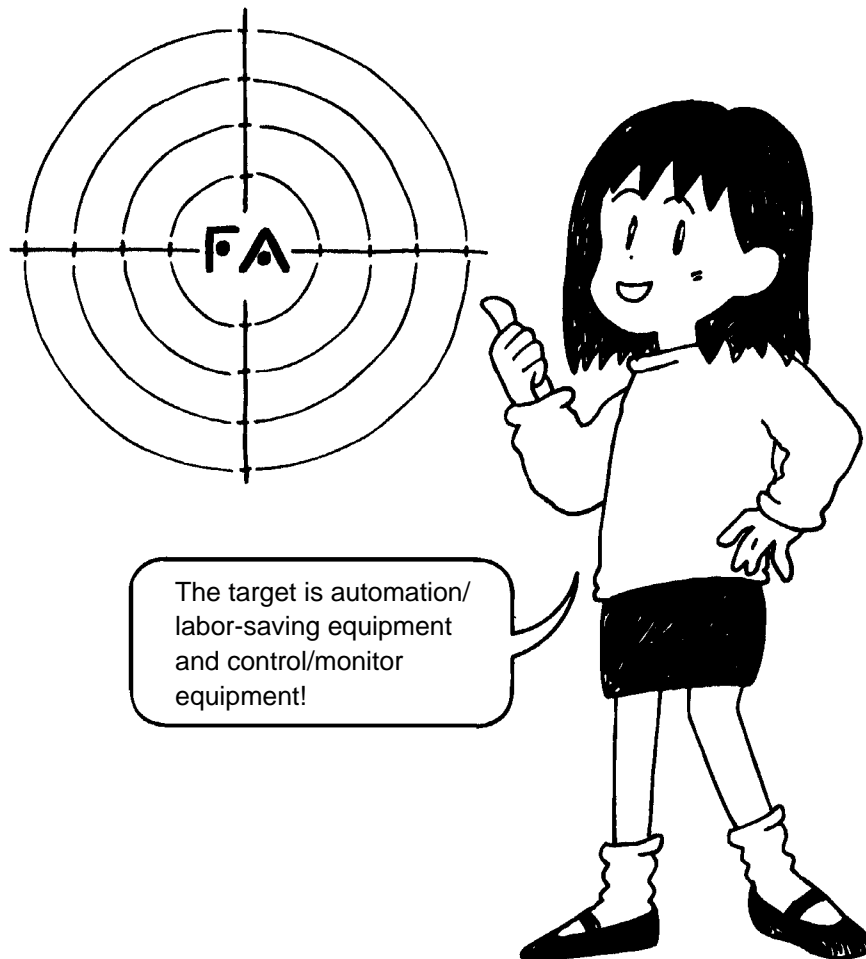
Note: Of the various FA equipment families, automation/labor-saving equipment and control/monitor equipment constitute the most promising markets.

## 5. Examples of uses of PDPs in FA equipment

Some typical examples of uses in automation/labor-saving equipment and control/monitor equipment, which are the main markets for PDPs, are described below.

- FA terminals
- Semiconductor manufacturing machines
- Looms
- Automatic SMT part-mounting machines

Watch the trend in uses of PDPs and remember adaption of PDPs to promote efficient sales.



Emphasize Fujitsu PDP's ability to operate under severe environmental conditions that are typical in FA applications.

### Challenge!!

Fill the proper terms in the following blanks:

1. [ (1) ] pertains to total automated systems.
2. The sales promotion target is automation/labor-saving equipment and [ (2) ].

Answers: 1. FA, 2. control/monitor equipment

## 7.2.1 Examples of uses in ME

The medical field is experiencing increasing sophistication of diagnostic and care technologies. Medical equipment is also highly sophisticated. Thin displays for downsizing and touch-panel displays for easier operation are part of this sophistication. 640 x 400- or 640 x 480-dot displays are mainly used.

### 1. Appeals to customers

- Downsizing — Thin displays allow equipment downsizing. Use of a thin display with a touch-panel, which unifies input and display, permits a high degree of downsizing.
- High-quality display — High contrast and wide viewing angle allow more than one operator and doctor to monitor a screen, thus minimizing monitoring errors, which are not permissible in the medical field.
- Improved operability — A one-touch panel allows easier operation such as setting diagnostic conditions.
- High brightness — The very bright screen overcomes surface reflection of the resistance-sheet touch panel.
- Long life — Long-life PDPs suffer no brightness loss and are beneficial for medical equipment requiring high-quality displays.

### 2. Display color

Neon orange feels strange only at the initial stage.

Major medical-equipment manufacturers recognize the advantages of AC PDPs. A lot of customers who initially used EL displays because of the color have switched to AC PDPs due to AC PDP demonstrated reliability.

Explain the advantages of Fujitsu PDPs.

### 3. Adaptable PDPs

(PDP unit)

FPF8050HRUC-001

FPF8050HRUD

FPF8050HRUK

FPF8060HRUM

FPF8060HRUK

FPF8060HRUC-120

FPF8060HRUS

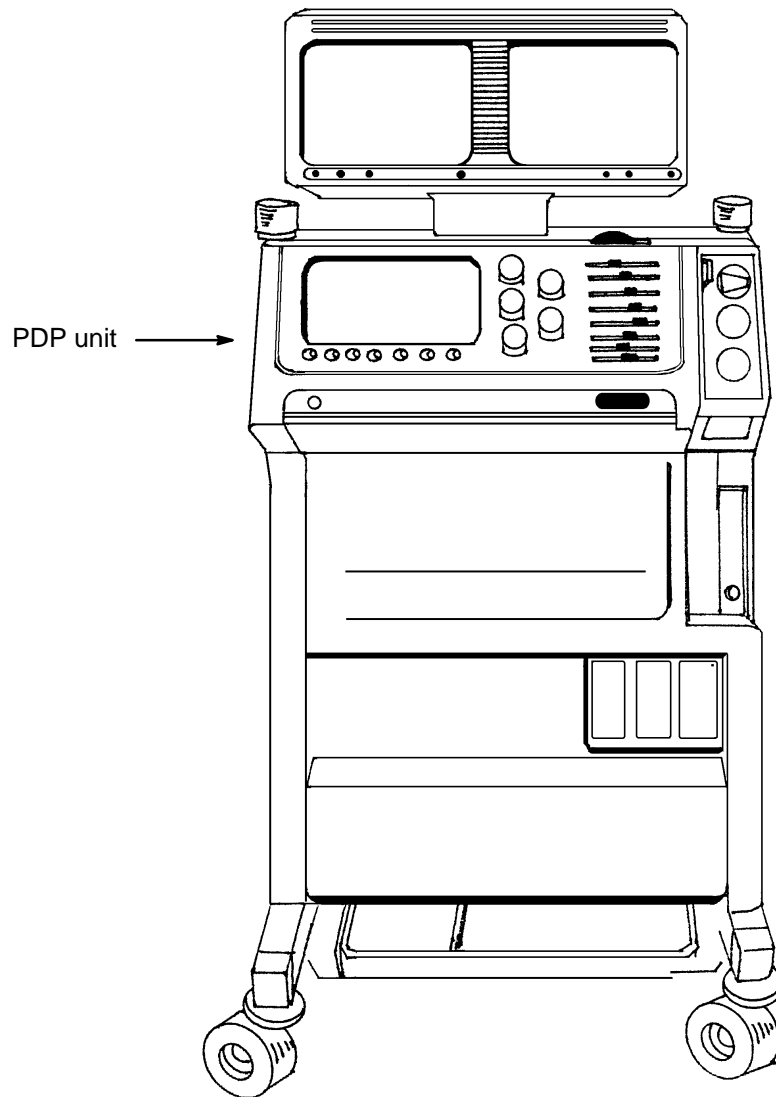
(Touch-panel PDP unit)

FTE8050BP

FTE8050RP-003

FTE8050BPE

n Example of use in Ultrasonic Diagnostic Machine



## 7.2.2 Examples of uses in FA terminals

Production shops must meet today's requirements for small-lot production of various product types and a high degree of rationalization. Therefore, FA terminals, which provide a new man-machine interface, are spreading rapidly and demand will increase. They mainly use 640 x 480-dot displays.

### 1. Appeals to customers

- Downsizing — Use of a thin display with a touch panel unifies the input and display sections and permits a high degree of downsizing.
- Improved operability — A one-touch panel allows easier operation such as setting operating conditions.
- High brightness — The very bright screen overcomes surface reflection of the resistance-sheet touch panel.
- High-quality display — The high contrast and wide viewing angle offer a clear image to distant operators.
- Long life — The long-life PDP is advantageous for FA equipment with high operation rates and requiring high endurance.

### 2. Adaptable PDPs

(PDP unit)

FPF8050HRUC-001

FPF8050HRUD

FPF8050HRUK

FPF8060HRUM

FPF8060HRUK

FPF8060HRUS

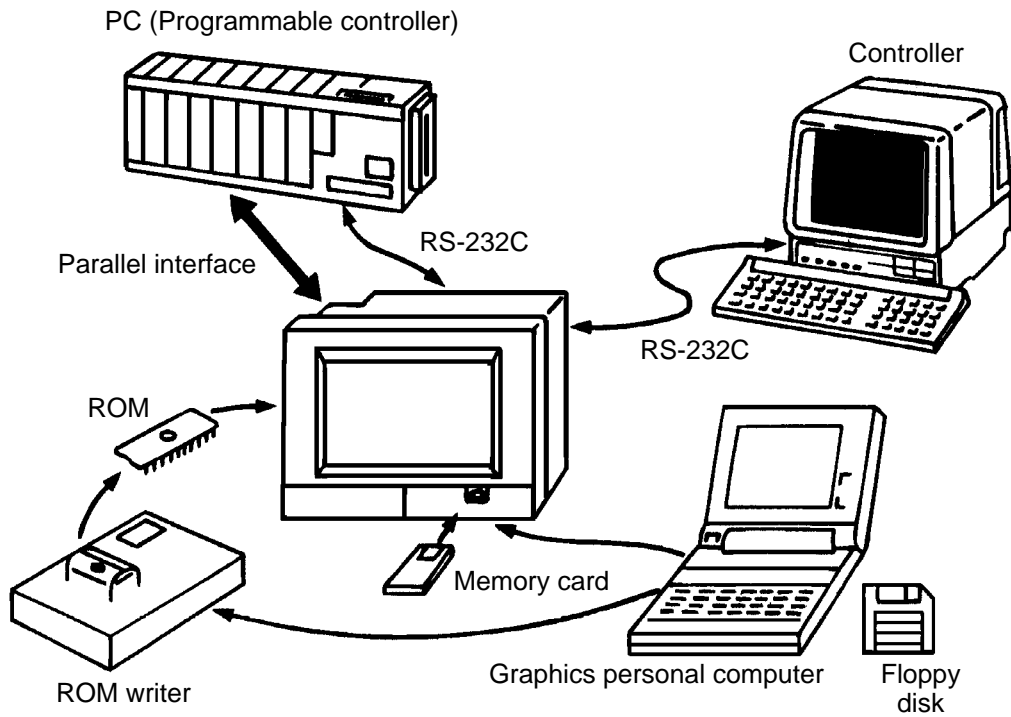
(Touch-panel PDP unit)

FTE8050BP

FTE8050RP-003

FTE8050BPE

n **Man-Machine Interface Unified by Touch Panel**



### 7.2.3 Examples of uses in semiconductor manufacturing machines

Two major needs: higher integration of LSIs, and larger-diameter wafers, are pushing semiconductor manufacturing machines to intense development.

In contrast to conventional CRT displays, today's displays are experiencing two major trends: flat displays for clean-room space-saving, and touch panels for easier operation.

#### 1. Example of application

Spinner, CVD, etching, test handler, laser positioning for disk drive partitioning.

#### 2. Appeals to customers

- Downsizing — The reduced installation area allows reduction of the clean-room building costs. Also, use of a thin display with a touch panel unifies the input and display sections and permits a high degree of downsizing.
- Improved operability — A one-touch panel allows easier operation such as setting conditions.
- High-quality display — The high brightness, high contrast and wide viewing angle offer a clear image to distant operators.
- Long life and high resistance — The long-life PDP is advantageous for semiconductor manufacturing equipment calling for high operation rates and high endurance.  
PDPs offer stable displays even in strong magnetic fields.

#### 3. Adaptable PDPs

(PDP unit)

FPF8050HRUC-001

FPF8050HRUD

FPF8050HRUK

FPF8060HRUM

FPF8060HRUK

FPF8060HRUS

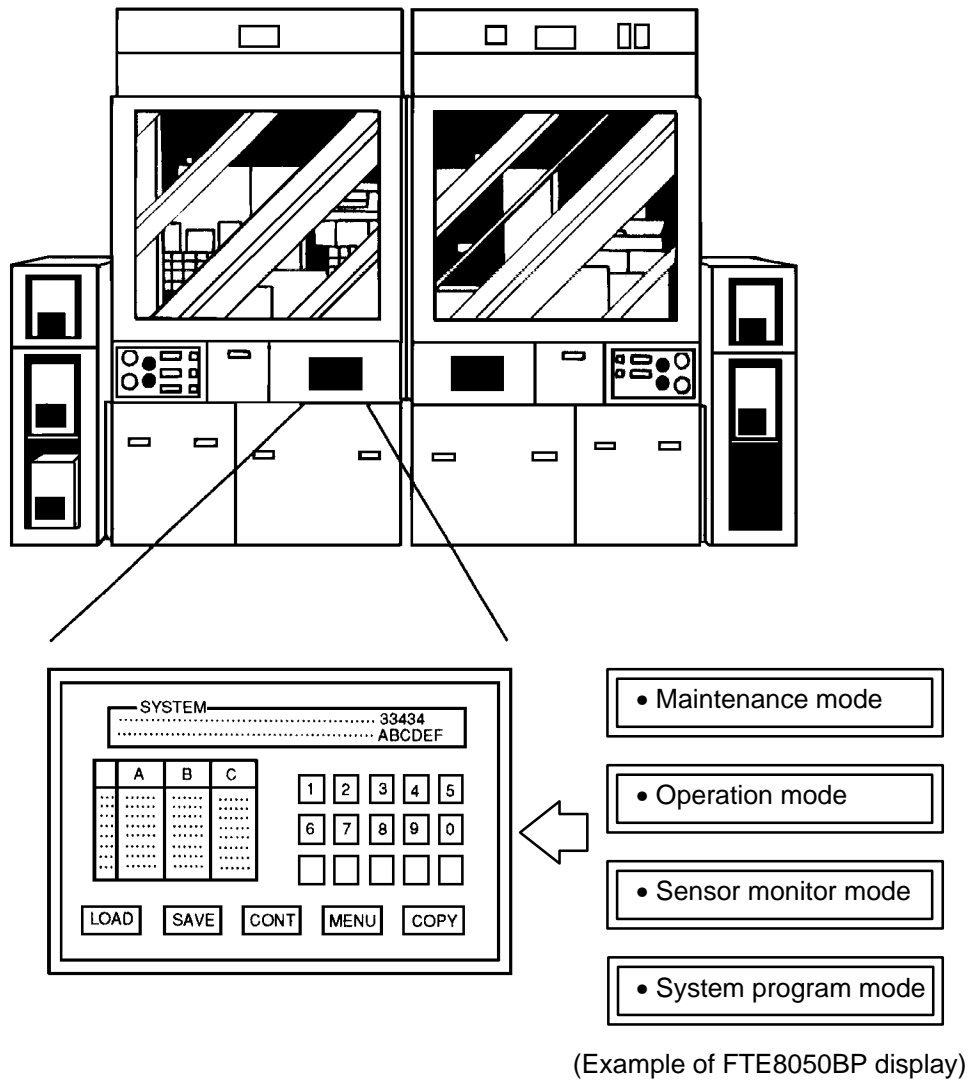
(Touch-panel PDP unit)

FTE8050BP

FTE8050RP-003

FTE8050BPE

n Example of Use in Spinner





## 7.2.4 Examples of use in loom

In parallel with the steady increase in production year-by-year, looms are becoming more sophisticated and their operability is becoming greatly improved.

Conventionally, these looms are fitted with 2- or 3-line message displays and LEDs. Today, touch-panel flat displays are used increasingly because of their sophistication (pattern setting with memory card, networking with extended communication function, etc.).

### 1. Example of uses

Automatic loom, air jet loom, water jet loom, etc.

### 2. Appeals to customers

- Downsizing — Use of a thin display with a touch panel unifies input and display sections and permits a high degree of downsizing.
- Improved operability — A one-touch panel allows easier operation such as setting diagnostic conditions.
- High-quality display — The high brightness, high contrast and wide viewing angle offer a clear image to distant operators.
- Long life — Long-life PDPs are advantageous for looms calling for a high operation rate and high endurance.

### 3. Adaptable PDPs

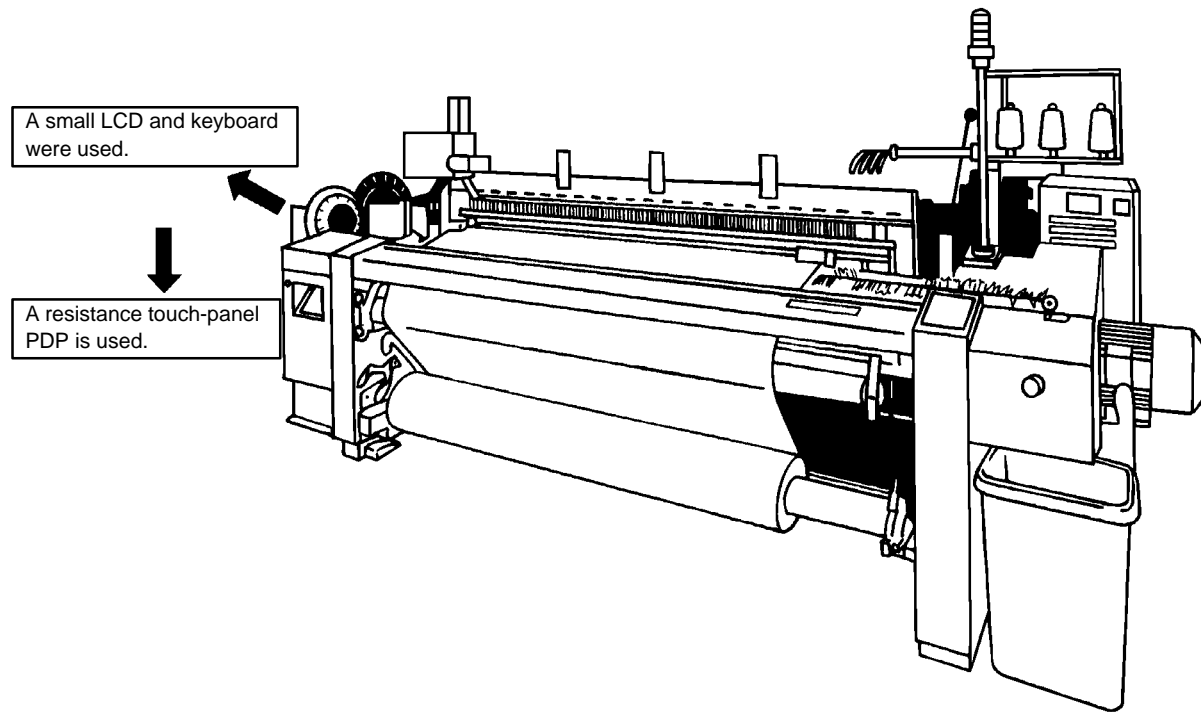
(PDP unit)

|                 |             |
|-----------------|-------------|
| FPF8050HRUC-001 | FPF8060HRUM |
| FPF8050HRUD     | FPF8060HRUK |
| FPF8050HRUK     | FPF8060HRUS |

(Touch-panel PDP unit)

|               |            |
|---------------|------------|
| FTE8050BP     | FTE8050BPE |
| FTE8050RP-003 |            |

n Example of use in new air-jet loom



### 7.2.5 Examples of use in automatic SMT part mounter

The demand for SMT part mounters increases constantly year-by-year because of the need for cost reduction by reducing assembly man hours.

In contrast to conventional CRT displays, touch-panel flat flat displays are being increasingly used for space saving and easier operation.

#### 1. Example of use

Chip mounter, solder screen printer, etc.

#### 2. Appeals to customers

- Downsizing — Use of a thin display with a touch panel unifies input and display sections and permits a high degree of downsizing.
- Improved operability — A one-touch panel allows easier operation such as setting conditions.
- High-quality display — The high brightness, high contrast and wide viewing angle offer a clear image to distant operators.
- Long life — Long-life PDPs are advantageous for SMT part mounters calling for a high operation rate and high endurance.

#### 3. Adaptable PDPs

(PDP unit)

FPF8050HRUC-001

FPF8050HRUD

FPF8050HRUK

FPF8060HRUM

FPF8060HRUK

FPF8060HRUS

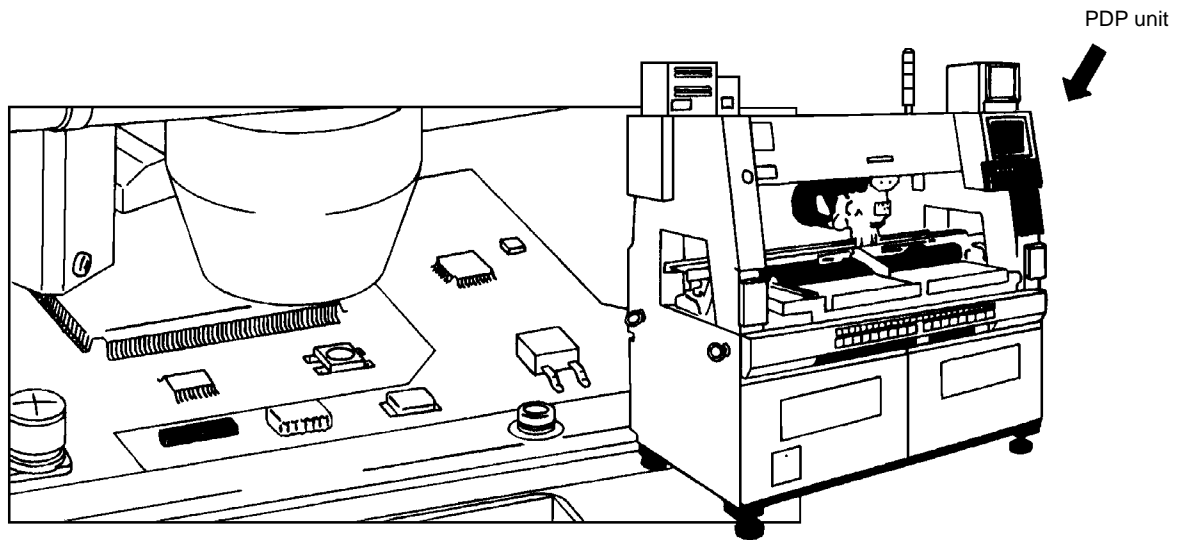
(Touch-panel PDP unit)

FTE8050BP

FTE8050RP-003

FTE8050BPE

n Example of Use in Multifunction Chip Mounter



# TERMINOLOGY

## A

- Alignment Layer

The film for arranging the molecules of liquid crystal materials enclosed in the liquid crystal display (LCD) in the initial arrangement. Polyimide is the usual material used for the alignment layer. Rubbing the surface of the polyimide in a special manner called 'rubbing' arranges the molecules of the liquid crystal materials regularly.

## B

- Black Face

The popular name meaning that the display of the AC-type PDP has high contrast. Since the AC-type PDP does not have a pilot discharge, parts other than the currently-lit dots are black, creating a striking contrast between illuminated and non-illuminated parts. Black face is a popular term to denote that there is no pilot lamp, and the non-illuminated part is black. Since the DC-type PDP has a pilot discharge, parts having no connection with the information also light dimly, so it cannot be called 'black face.'

## C

- Cell Structure

The name of the structure used in the DC-type PDP. The antonym of the open structure in the AC-type PDP. In the DC-type PDP, the discharge space and electrodes forming a display dot are compartments formed by partitions. With the open structure, a wide viewing angle is available since there are no partitions, but with the cell structure, only a narrow viewing angle is available since there are partitions.

- Cell Wall

The wall that partitions the discharge space of the electrodes forming DC-type PDP display dots. This wall prevents discharge interference occurring between adjacent electrodes. Also, this partition narrows the viewing angle compared to AC-type PDPs.

- Contrast

The ratio between the brightness of the illuminated portion (dot) to the non-illuminated portion (dot). Contrast is affected by the ambient brightness. In a luminescent display, the contrast is high in a dark room, and low in a bright place such as next to a window. Generally, the higher the contrast, the clearer the vision.

- CRT Control Circuit

The name for the circuit controlling the display of the CRT. The circuit consists of a controlling IC for the CRT controller, etc., character generator, Kanji ROM, image memory, etc.

The CRT control circuit outputs Vsync (vertical synchronizing signal), Hsync (horizontal synchronizing signal) and display data, allowing the CRT to display information such as letters or images on the screen. Most of the graphics PDPs manufactured by Fujitsu operate with signals controlled by the CRT controller circuit.

## D

- Dielectric Layer

In the AC-type PDP structure, the layer concealing the surface of the electrodes from the discharge space. This layer is unique to the AC-type PDP, and transparent glass paste is used for the dielectric layers. It operates as an insulator when the PDP is operating, and prevents the surface of the electrodes from discharge wear or deterioration. Also, the electrons and ions created during discharge, and which accumulate on the surface of the dielectric layer as a wall charge, are necessary for the AC-type PDP memory display function.

- Discharge Space

Space inside PDP where inert gases, primarily neon, are enclosed. Electrodes are formed on the glass substrate surrounding this space, and when a voltage is applied to these electrodes, discharge occurs causing the neon to illuminate orange.

- Display Discharge

The discharge from illumination (light-up) that conveys the information to the viewer is called the 'display' discharge, and is distinguished from the pilot discharge (or auxiliary discharge) belonging to the DC-type PDP. Since the AC-type PDP does not use a pilot discharge, all dots that are currently illuminated are illuminated by the display discharge. Since the DC-type PDP has a pilot discharge, parts having no connection with the original information (dots that are off) will light dimly.

- Display Dot Diameter

Specification representing size of one display dot. When an illuminating dot in a PDP is zoomed-up from the front, a circular neon discharge can be observed. The diameter of one discharging dot is called the display dot in the product specifications, etc.

The Fujitsu PDP dot pitch is 0.33 mm, arranged in 640 x 400 dots, and has a dot diameter of 2 mm.

- Dot Display

A method of display or a type of display panel used to convey information in the form of a letter or pattern to the viewer by regularly arranging a large number of dots in matrix form to represent the desired pattern or letter, and the switching on or off of dots. Compared with the segment display designed to display a particular pattern or letter, the dot display is a screen in which dots are arranged in matrix form. Since the dot display can be used widely in terms of an information display, it represents today's current display devices.

## E

- EL Display

Abbreviation for electroluminescent display. The display utilizes the luminescence produced by application of an electric field to a dielectric phosphor when a high voltage is applied to a thin film of fluorescent material (luminescent layer) deposited on a glass substrate. ZnS:Mn (a combination of zinc sulfide and manganese) with a high luminescence efficiency is usually used as the fluorescent material. The luminescent layer emits orange yellow when an electric field is applied to the dielectric phosphor. As of 1992, SHARP Corp. is the only manufacturer mass-producing and supplying EL displays in Japan. Two other companies, (Planar in the USA and Lohja in Finland (an affiliate enterprise of Planar)) are mass-producing and supplying EL displays worldwide. The EL display is excellent for high resolution on a small screen. Since it must have a uniformly-thin luminescent layer of approx. 1  $\mu\text{m}$  over the entire screen, it is unsuitable for larger screens.

## F

- Flicker

Visual perception of fluctuation in brightness occurring on CRTs of domestic TVs and OA CRTs. A refresh-type display uses high-speed scanning lines to re-write the screen. However, when viewed in minute fractions of a second, only particular parts light with display dots repeatedly turning on and off. If the speed of this on/off repetition is slow, the display dots start fluctuating and the viewer experiences 'flicker.'

## I

- Illuminating Frequency (Display Duty)

The frequency at which a dot is illuminated in one particular horizontal line from all the horizontal lines of a screen display plane. With a refresh-type display, only the specific line which is currently being re-written is illuminated; the other lines are off. The frequency at which a specific line is illuminated can be represented as 1 : total horizontal lines. However, the PDP manufactured by Fujitsu has a memory display function, so horizontal lines other than the one currently being re-written also maintain a discharge, and all lines are illuminated to maintain the illumination frequency as '1'. In a refresh-type display, the time period required to illuminate one line becomes shorter as the number of horizontal lines increases, so the brightness of the display tends to become darker in proportion to the number of horizontal lines. The Fujitsu PDP, which uses a memory display system, maintains high brightness irrespective of the number of horizontal lines.

- Illuminating Layer

In a broad sense, illuminating layer means a layer of fluorescent substance which illuminates with application of an electric field. For the purpose of this document, however, it represents part of the structure of the electroluminescent (EL) display. An EL display uses luminescence produced by application of an electric field to a dielectric phosphor when high voltage is applied to a thin-film fluorescent material formed on a glass substrate. The thin-film fluorescent material which illuminates upon application of the electric field to the dielectric phosphor is the illuminating layer. The fluorescent materials used for the EL illuminating layer typically include ZnS:Mn (a combination of zinc sulfide and manganese). When an electric field is applied to an illuminating layer of this material, it illuminates orange yellow.

- Insulation Layer

When used in a broad sense, an insulating substance to insulate electricity, or a layer formed by an insulator. For the purpose of this document, it means part of the structure of the electroluminescent (EL) display. In an EL display, the illuminating layer is subject to a high voltage field of at least  $1 \times 10^6$  V/cm, and is formed so that the illuminating layer is held between thin-film insulation layers on which high-voltage-proof materials are deposited so the insulation of the illuminating layer is not damaged. This insulation layer is a thin film of approx. 2300 - 2500 Angstrom in thickness.  $\text{Si}_3\text{N}_4$  is usually used. Note that the dielectric layer in the AC-type PDP structure can also be called an insulation layer.

## L

- LCD

Abbreviation for Liquid Crystal Display. The liquid crystal is a substance with a viscosity similar to liquid, but has regularly-arranged molecules like those found in crystals. Most liquid crystal substances are organic compounds whose molecules are thin long bars or flat plates, and the molecules forming the crystal maintain a regular arrangement parallel with each other. However, the molecular arrangement is not fixed as found in crystals; it can be readily re-arranged by external stimuli such as an electric field, temperature, or stress. A

display in which crystal materials having such characteristics are enclosed between two glass plates containing transparent electrodes is called a liquid crystal display. An electric field is applied via the electrodes to change the molecular arrangement so that it obstructs or transmits external light -- similar to a camera shutter. LCDs are used widely for small numeric display products such as watches and calculators, as well as for portable word processors and personal computers.

- LED

Abbreviation for Light Emitting Diode. It is a semiconductor diode device which radiates in the visible region where the element has a structure in which an n-type semiconductor crystal and a p-type semiconductor crystal are connected. Applying a voltage across the anode formed on the p-type crystal and the cathode formed on the n-type crystal allows electrons to be injected/re-connected across the n-type region and p-type region, and the energy created is thereby converted into light.

Crystals used for the LED element belong to the semiconductor III-V family of compounds; typical examples include GaP, GaAsP, and GaAlAs. The LED itself is formed as a chip, and they are widely used for applications such as pilot lamps and indicators. Also, another popular use of LEDs (usually 16 x 16) is to gather them in a module which is then modelled into a large display.

## M

- Missing Point

A missing point is an inferior dot included in a large number of display dots forming the display screen that does not illuminate (light up) when the proper voltage is applied, or that does not turn off (remains lit) when the whole screen is switched off. A missing point can be caused by dust, foreign matter, or a scratch in the film when a thin film, such as the electrode or insulating layer, is applied to the display screen glass substrate. In the case of Fujitsu PDPs, which have 256,000 dots (640 hor. x 400 ver.), there are guaranteed to be less than ten (10) inferior dots at manufacturing (1-2 dots actually).

## O

- Open Structure

The name for an AC-type PDP structure without partitions. The antonym of the DC-type PDP cell structure. The electrodes form display dots. PDPs are not partitioned by partitions, so the whole space inside the glass panel is open. It has the advantage of a wide viewing angle.

- Optical Touch Panel

The name for a touch panel using semiconductor light emitting elements and euphotic elements. The four corners of the screen are connected to a touch panel having a large number of light emitting elements and euphotic elements arranged in a matrix. Infrared rays scan across the light emitting elements and euphotic elements. When an object such as a finger touches a particular point on the screen, the infrared rays from the light emitting element(s) are intercepted, allowing the position of the corresponding light emitting/euphotic element(s) to be detected in the X- and Y-directions. The positional information of the light emitting/euphotic element(s) is usually output as the touch coordinates.



## P

- Photometric Field of Vision

If a commercial luminance meter is used to measure the brightness of a display, it is impossible to measure the spot brightness of a dot with a diameter of less than 1 mm. A commercial luminance meter is used to measure the mean surface brightness of a circular region -- diameter up to approx. 20 - 30 mm or including at least 20 dots -- in which the mean value of the illuminated and non-illuminated parts is taken. The photometric field of vision is a circular region measured using the luminance meter to obtain the mean surface brightness.

- Pilot Discharge

Another name for the auxiliary discharge which is always discharging to insure a stable display discharge with DC-type PDPs. In the DC-type PDP with a cell structure, the discharge space for display dots is formed by partitions. If discharge voltage is applied to the electrodes without an auxiliary discharge, variations occur in the time period before discharge starts, thereby resulting in a delay in the discharge, misfiring, uneven brightness, etc. To control such variations in the display discharge and obtain a stable display, the pilot discharge first supplies charged particles and/or excited atoms to each individual discharge space.

- Polarizer

Natural light has waves which vibrate in the horizontal and vertical phase directions. The polarizer is an element which transmits light of a certain directional phase. It is located in the front and rear of the glass substrate of a TN (Twisted Nematic) LCD, thereby transmitting/intercepting polarized or straight light. The two polarizers can be located in two ways: Polarized light beams will cross at right angles, and polarized light beams will be parallel. When an electric field is applied to the TN liquid crystal causing the molecular axis to twist by 90°, the external light passes through the display or is intercepted by the display depending on the arrangement of the polarizers.

- Protective Layer

For the purpose of this document, the MgO (magnesium oxide) film of the AC-type PDP is called the 'protective' layer. The AC-type PDP protective layer is designed to protect the dielectric layer from shock due to charged particles created by the discharge. MgO is used since it has excellent ion shock resistance, and the secondary electron emission ratio is high.

## R

- Rare Gas

A general term for six rare elements: Helium, neon, argon, krypton, xenon, and radon, present in air. They are inert with no color or smell, and do not tend to combine with other elements.

Neon and a small amount of xenon are enclosed in the PDP. This is called the Penning Mixture.

- Refresh Cycle

The cycle used to re-write the entire screen display. Most displays other than Fujitsu PDPs do not have memory display functions. To re-write the entire display screen, they light only the addressed horizontal lines, shifting (scanning) successive horizontal line addresses so fast that the human eye cannot follow.

Sometimes, the eye sees the scanning of horizontal lines as flicker if the refresh cycle is less than 50 Hz. For this reason, most OA displays use a refresh cycle of approx. 60 Hz. The Fujitsu PDP, with its memory display function, allows horizontal lines other than those currently being re-written to maintain a discharge. Therefore, even if the cycle at which the entire screen is re-written is slow, it does not flicker.

## S

- Segment

A fragment or part which represents the basic component forming a particular pattern or letter. For the purpose of this document, it is limited to the basic display electrode consisting of a number displayed on the numeric panel. Usually, one number is displayed on the numeric panel using seven segments.

- Segment Display

A display of combined segments that displays particular patterns or letters. When compared with the dot display, which is the antonym of the segment display, it is limited to displayable letters and patterns and is thereby restricted for general use.

- Signal Segregation Circuit

The electric circuit component that separates (or disassembles) hybrid signals or combined signals consisting of several signals into an individual signal. For the purpose of this document, it is limited to an electric circuit component that separates composite signals -- in which three different signals representing Vsync (vertical synchronizing signal), Hsync (horizontal synchronizing signal), and display data are combined -- into three TTL signals.

## T

- Transparent Electrode

The electrodes formed on the display glass substrate by transparent conductive film are called transparent electrodes. They are often used for illumination in the panel or to transmit external light. The standard materials used for the transparent conductive film include ITO (Indium Tin Oxide) and SnO<sub>2</sub> (common name: Nesa). They are usually formed on the glass substrate using deposition or sputtering. However, the graphics PDP produced by Fujitsu has a low-resistance conductor using opaque electrodes made of Cr-Cu-Cr (chrome-copper-chrome).

## V

- VFD

Abbreviation for Vacuum Fluorescent Display. A VFD is a display made of fluorescent materials using the excitation illumination phenomenon caused by low-speed electron beams. This type of self-illuminating display was invented and developed in Japan, and is only manufactured in Japan for worldwide distribution. Its basic structure is a thermoelectron tube similar to a triode valve. Thermoelectrons are released from a cathode with oxide cathode materials and collide into an anode of ZnO- or ZnS-fluorescent material while grids operate to control the electrons allowing excited fluorescent material to illuminate. Initially, a display using only a single-digit tube displaying one 7-segment number was available. Later development has allowed the manufacturer to use graphic VFDs which are available for displaying patterns and/or Kanji. The currently-used types are popular for the sound pressure displays of audio instruments, speed displays of automobiles, amount displays of cash registers, and operation panel displays of copiers. However, since high resolution is not available, these devices are not suited to OA.

- Viewing Angle

The name for the angle at which information displayed on the screen can be viewed. It is also called the angle of visibility. Fujitsu AC-type PDPs feature a wide viewing angle of 160° from right to left, and up and down. LCDs offer a limited viewing angle depending on the left and right, or up and down direction, allowing only 20° or 30° of visibility at best. In FA applications such as factories, the display is often viewed from a distance so the viewing angle is an important factor along with brightness and contrast.

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