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Developer's Guide

TM-T90

Issued date	, ,
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English

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EPSON

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Caution

There is a danger of explosion if the battery is incorrectly replaced. Replace only with the battery that EPSON supplies. Dispose of used batteries according to laws or regulations of your country or region.

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ESC/POS® Proprietary Command System

EPSON took the initiative by introducing ESC/POS, a proprietary POS printer command system including patented commands and enabling versatile POS system construction with high scalability. Compatible with all types of EPSON POS printers and displays, this proprietary control system also offers the flexibility to easily make future upgrades. Its popularity is worldwide.

Revision Table

Rev.	Page	Description
Rev. A	All pages	Newly authorized
Rev. B	2-4	Add Note for DM-D
Rev. B	2-11	Add Msw 8-5
Rev. B	2-12	Add "black-color density in two-color printing"
Rev. B	4-1	Add description "Maintenance counter"
Rev. B	4-2	Add Note for Divided Head Control
Rev. B	4-7	Add Note for two-color printing
Rev. B	4-8	Add table for NV memory capacity

For Safety

Key to Symbols

The symbols in this manual are identified by their level of importance, as defined below. Read the following carefully before handling the product.

⚠ WARNING:

You must follow warnings carefully to avoid serious bodily injury.

⚠ CAUTION:

Cautions provide information that you must observe to prevent damage to the equipment or loss of data. Following caution messages will prevent:

- *The possibility of sustaining physical injuries.*
- *The possibility of causing physical damages.*
- *The possibility of causing information loss.*

✎ **Note:**
These messages provide important information and useful tips on handling the equipment.

⚠ *WARNING:*

Shut down your equipment immediately if it produces smoke, a strange odor, or unusual noise. Continued use may lead to fire or electric shock. Immediately unplug the equipment.

Only disassemble this product as described in this manual. Do not make modifications to the unit. Tampering with this product may result in injury, fire, or electric shock.

To avoid risk of electric shock, do not operate this product or handle cables during a thunderstorm.

Be sure to use the specified power source. Connection to an improper power source may cause fire or shock.

Never insert or disconnect the power plug with wet hands. Doing so may result in severe shock.

Do not allow foreign matter to fall into the equipment. Penetration by foreign objects may lead to fire or electric shock.

If water or other liquid spills into this equipment, turn off the power switch and unplug the power cord immediately. Continued usage may lead to fire or electric shock.

Do not place multiple loads on power outlet. Overloading the outlet may lead to fire. Always supply power directly from a standard domestic power outlet.

Handle the power cord with care. Improper handling may lead to fire or electric shock.

- *Do not modify or attempt to repair the cord.*
- *Do not place any heavy object on top of the cord.*
- *Avoid excessive bending, twisting, and pulling.*
- *Do not place the cord near a heating equipment.*
- *Check that the plug is clean before plugging it in.*
- *Be sure to push the plug all the way in.*

⚠ CAUTION:

Do not connect cables in ways other than those mentioned in this manual. Different connections may cause equipment damage and burning.

Be sure to set this equipment on a firm, stable horizontal surface. The product may break or cause injury if it falls.

Do not use in locations subject to high humidity or dust levels. Excessive humidity and dust may cause equipment damage, fire, or shock.

Do not place heavy objects on top of this equipment. Never stand or lean on this equipment. Equipment may fall or collapse, causing breakage and possible injury.

To ensure safety, unplug this equipment prior to leaving it unused for an extended period.

Parts on the circuit board may become hot during operation. Therefore, wait approximately 10 minutes after turning the power off before touching them.

To avoid injury, take care not to insert fingers or any part of the hand in the paper roll opening where the manual cutter is installed.

Do not open the paper roll cover without taking the necessary precautions, as this can result in injury from the autocutter fixed blade.

Modular Connector

Use the modular connectors specifically designed for the cash drawer for this product. Do not connect these connectors to an ordinary telephone line.

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About this Manual

Aim of the Manual

This manual was created to provide all information necessary for system planning, design, installation, and application of the printer for designers and developers of POS systems.

Manual Content

The manual is made up of the following sections:

Chapter 1 Product Overview

Chapter 2 Setup

Chapter 3 Description of Functions

Chapter 4 Application Development Information

Appendix A Interfaces and Connectors

Appendix B Options and Consumable Products

Appendix C Character Code Tables

Appendix D Connection of Cables and Options

Appendix E Glossary of Terms

Related Documentation

Documents related to the TM-T90 are listed below.

Name of document	Description
TM-T90 User's Manual	Provides information to enable POS operators to use the TM-T90 safely and correctly.
TM-T90 Service Manual	Describes maintenance, inspection, and repair procedures.
ESC/POS Application Programming Guide	Provides detailed ESC/POS command information.

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Appendix E ***Glossary of Terms***

Chapter 1

Product Overview

Product Structure

Models

- ❑ Product name — TM-T90 series (with serial interface)
TM-T90P series (with parallel interface)
- ❑ Printing — Thermal line

Accessories

- ❑ Printer
- ❑ Paper roll
- ❑ User's manual
- ❑ Power switch cover
- ❑ Control panel label used for vertical installation
- ❑ Rubber feet for vertical installation
- ❑ Hexagonal lock screws (2 pieces) (only for the serial interface)

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Options

- ❏ Affixing Velcro® tapes (model: DF-10)
- ❏ Wall handling bracket (model: WH-10)
- ❏ External power supply unit (models: PS-170, PS-180 (*1)). PS-180 is the power-saving type.
- ❏ Usage precautions for the PS-180 power unit (*2)
- ❏ UB series interface board (excluding the UB-P02)

Product name	Specifications	Remarks
UB-P02II	IEEE 1284	Parallel
UB-S01	RS-232	Serial
UB-S02	RS-485	Serial
UB-S09	9 pin	Serial
UB-U01	USB	Downstream hub provided
UB-U02	USB	Downstream hub not provided
UB-E01	Ethernet	

- ❏ Paper roll spacer model: PG-90 (Only the Japanese model is equipped with this as standard equipment.)

(*1) The power supply packed with the printer differs, depending on the model.

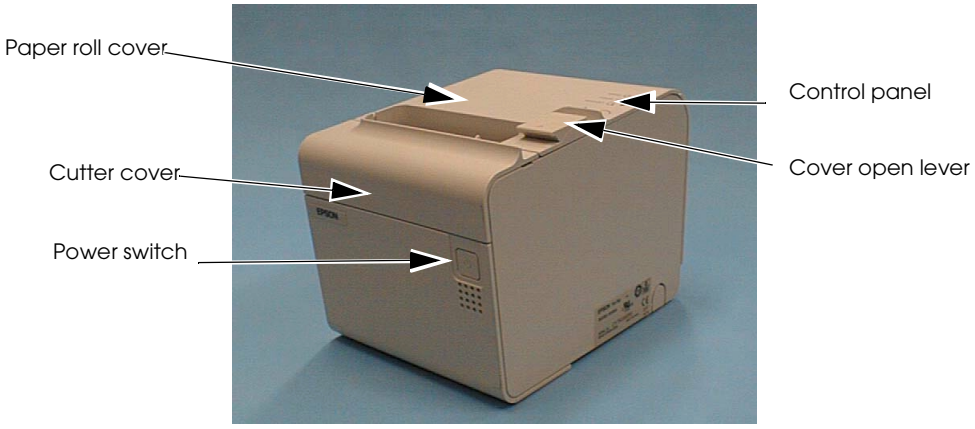
(*2) May not be included with the printer.

Consumables

- ❏ Specified paper

Part Names and Basic Operation

Part Names



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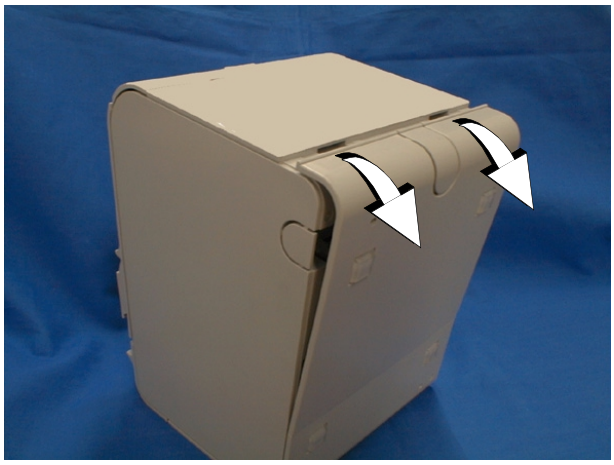
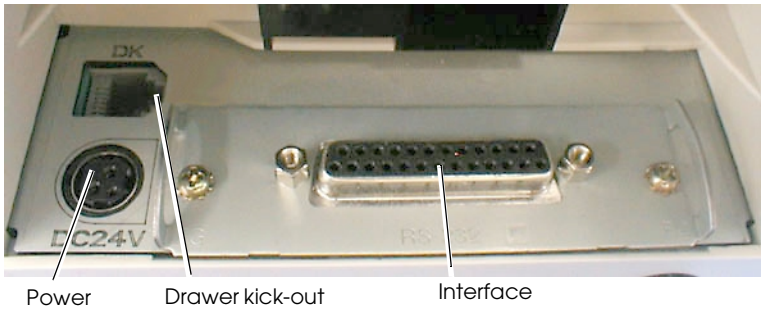
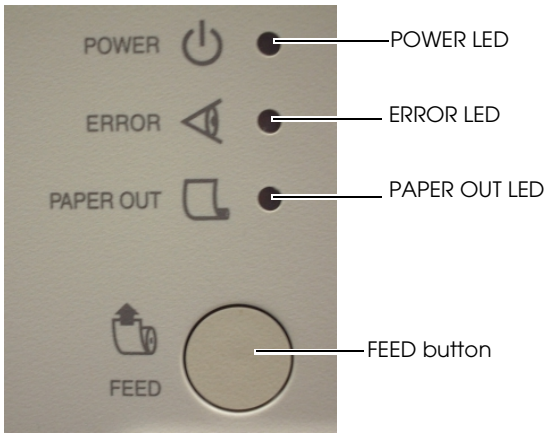
Connectors

Remove the bottom of the cover, as shown in the illustration below. All cables are connected to the connector panel in the lower rear of the printer.





Control Panel



LED

POWER LED

- ❏ Lights when the power supply is ON.
- ❏ Off when the power supply is turned OFF.
- ❏ Flashes during excution of each operation.

ERROR LED

- ❏ Lights when the printer is offline.
- ❏ Off when the printer is normal.
- ❏ Flashes when an error occurs.

PAPER OUT LED

- ❏ Lights when there is no more roll paper or there is little remaining.
- ❏ Off when there is a sufficient amount of roll paper remaining.
- ❏ Flashes when a self-test is in progress or while the printer waits for macro execution.

Buttons

FEED Button

Pressing the FEED button feeds the roll paper.

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Power Switch

The power switch is located in the upper right front of the printer. Turn on the power by holding down the POWER button 1 second or longer. Turn off the power by holding down the POWER button 3 seconds or longer. The power switch can be disabled by setting a DIP switch (see page 2-9).

Note:
Make sure to check whether the AC adapter is connected to the power supply, before turning on the printer power switch.

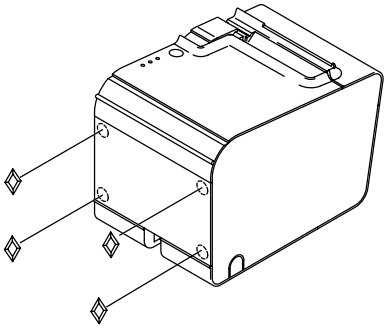
See Chapter 3 for power switch functions details.

Printer Setup Details

Installing Horizontally or Vertically

You can install the printer horizontally (with the paper exit on top), or you can install the printer vertically (with the paper exit at the front) either on by hanging it on a wall (using the optional hanging bracket set, WH-10) or a flat surface. Both the horizontal and vertical positions are shown below.

When you install the printer vertically, attach the rubber feet and the control panel label as shown in the illustrations below.



Note:
To hang the printer on the wall, see the Wall Hanging Bracket Set Installation Manual provided with the WH-10 for instructions.

Adjusting Paper Roll Near-End Detection Position

Below are two situations when paper roll near-end (NE) detector adjustment is required.

- To adjust the location of detection to suit the diameter of the paper roll core used.
- To adjust the amount of remaining paper desired.

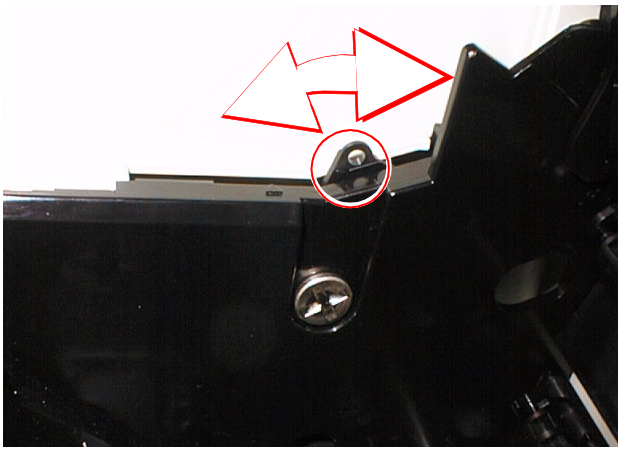
Note:
Paper roll cores are manufactured according to various specifications, making it impossible to detect the remaining volume of paper exactly.

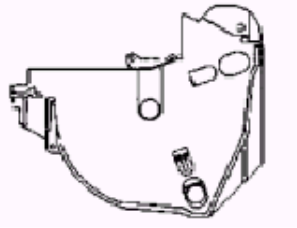
This printer is designed to use paper rolls of 3 different widths. The paper roll near-end detect adjustment function is provided for all 3 paper widths.

1. Open the paper roll cover.
2. Remove the paper roll.
3. Loosen the detector adjustment screw using a coin or similar tool.

Loosening the detector adjustment screw

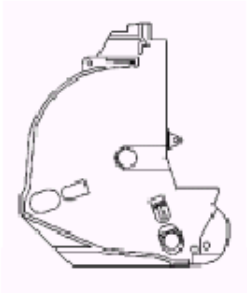
Note:
Rotate the paper roll near-end sensor position to detect the paper near-end correctly when the printer is placed horizontally.



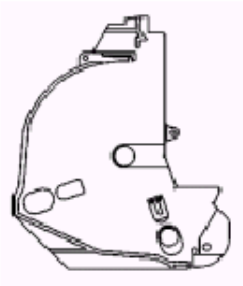


Position #1, horizontal

Position #2, horizontal



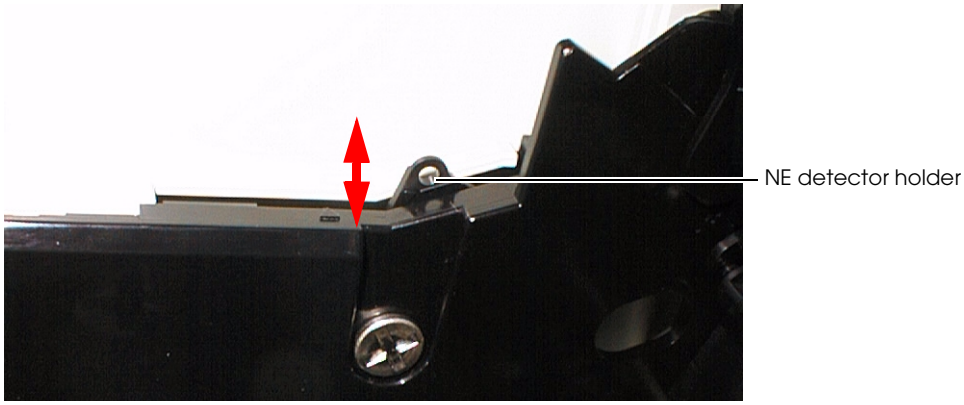
Position #1, vertical



Position #2, vertical

Adjustment positions

4. Adjust the position by moving the NE detector holder up and down slightly.



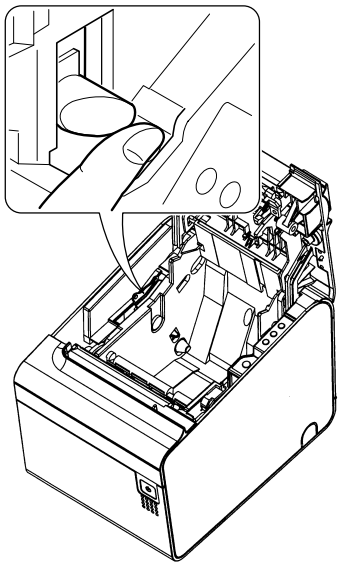
NE detector holder

Adjustment Position Scale Marks	External Dimension of Diameter of Specified Thermal Paper
#1	Approximately 23 mm {0.97"}
#2	Approximately 27 mm {1.06"}

5. Tighten the adjustor screw using a coin or similar tool.

6. Move the NE detector lever by hand (finger) to confirm that it moves freely.

Check that the NE detector lever is operating properly.



7. Load the roll paper.

8. Close the paper roll cover.

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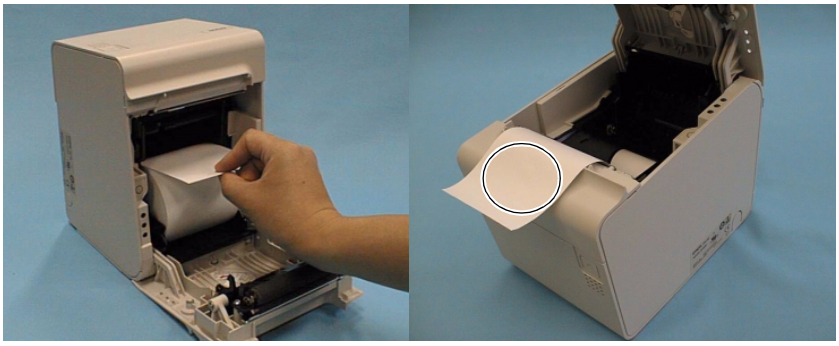
Installing or Replacing Roll Paper

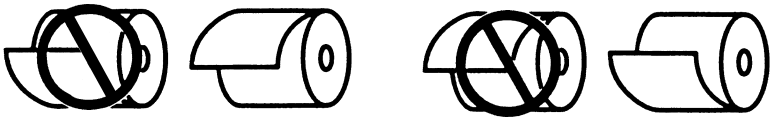
⚠ *WARNING:*

Do not touch the manual cutter with your hands when mounting or replacing roll paper. You can be injured, because the manual cutter is sharp.

Note:
Be sure to use paper rolls that meet the specifications.

1. Open the paper roll cover, using the cover open lever.
2. Insert a paper roll and pull out a small amount of paper, aligning the paper with the guide, as shown below.





3. Close the paper roll cover; then tear off the leading edge of the paper.

⚠ *WARNING:*

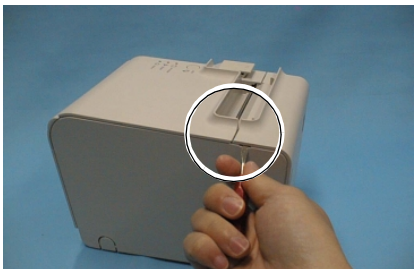
Do not leave your finger inside the paper roll cover when you close it, because you can get your finger caught inside.

Do not open the paper roll cover except when necessary, because the printer mechanism may be damaged.

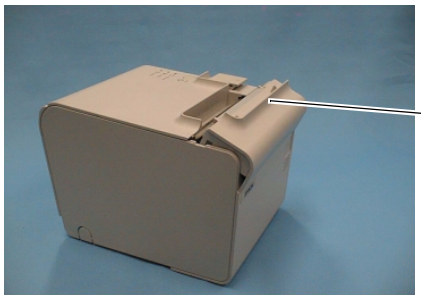
Troubleshooting the Autocutter

If the autocutter is jammed or the paper roll cover will not open

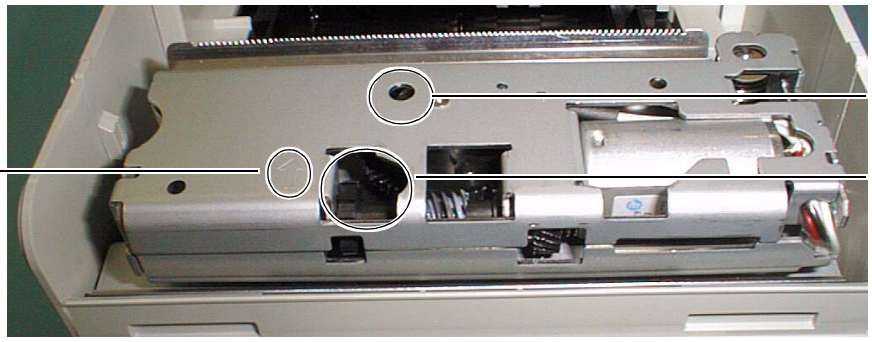
1. Turn off the power supply. To remove the cover, use a tool such as a screwdriver, insert it into one of the slots indicated by the circle in the illustration below, and push the cover upward.



2. Remove the cutter cover.



3. Use a ballpoint pen or tweezers to turn the knob in the direction indicated by the arrow until you see a triangle in the window.



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Print Head Cleaning

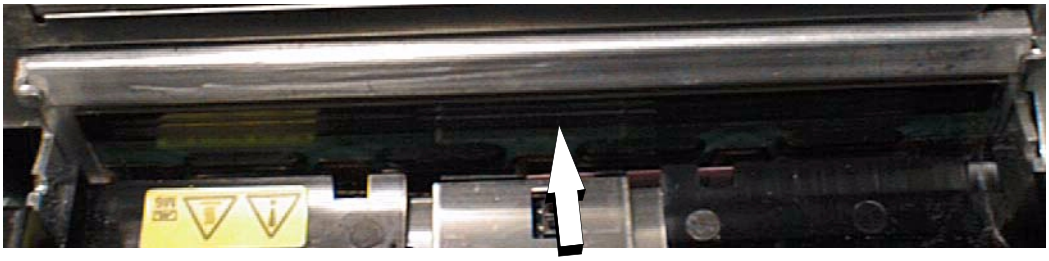
⚠ *CAUTION:*

The print head becomes very hot just after printing and is very dangerous. Be sure to allow the print head to cool down after printing before cleaning it. Also, be sure to turn off the printer power before cleaning the print head.

Paper dust on the heating elements may lower the print quality. In this case, clean the print head as follows.

1. Turn off the power and open the paper roll cover.

2. Clean the thermal elements of the print head using a cotton swab moistened with alcohol solvent (ethanol, methanol, IPA).



Print head

⚠ *CAUTION:*

- *Do not touch the print head thermal elements because dust and dirt can stick to the surface and damage the elements.*
- *Do not scratch the print head.*

3. Insert a paper roll and close the print head.

✎ ***Note:***

Depending on the paper roll used, paper dust may stick to the platen roller and paper roll end sensor. To remove the paper dust, clean the platen roller and paper roll end sensor with a cotton swab moistened with water.

EPSON recommends cleaning of the thermal head periodically (generally every three months) to maintain receipt print quality.

Since the thermal elements of the print head and driver IC are easy to break, do not touch them with any metal objects.

Thermal paper containing Na+, K+, and Cl- ions can harm the print head thermal elements. Therefore, be sure to use only the specified paper.

Shipping Procedures

Perform the following measures before shipping the printer.

1. Hold down the power switch 3 seconds or more or turn off the printer and disconnect it from the host computer.
2. Check that the POWER LED is off.
3. Remove the power supply connectors.
4. Pack the printer.

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Product Specifications

Print method	Thermal line Alphanumeric (ANK)/multilingual model: 0.141 dots/mm × 0.141 dots/mm (180 dpi × 180 dpi) Japanese model: 0.125 dots/mm × 0.125 dots/mm (203 dpi × 203 dpi)
Print width	ANK/multilingual model: 80 mm / 60 mm / 58 mm {3.15"/2.36"/2.28"} Japanese model: 80 mm {3.15"} (default setting) 58 mm {2.28"} (default setting) 58 mm {2.28"} or 60 mm {2.36"} paper width can be selected using the paper roll spacer.
Cutting method	Separated cutter blade system
Cut type	Users can choose from the following two types. ❒ Partial cut (cutting with one point in left edge left uncut) (default setting) ❒ Full cut (completely cut) is also possible as a dealer option. (Set by changing the position of the autocutter unit.)
Character sets	95 alphanumeric, 37 international characters, graphics: 128 × 11 pages. Japanese model — JIS (JIS X0208-1990): 6879; Special font: 845
Interface (compatible)	RS-232C / Bidirectional parallel Dealer options: RS-485, USB, 10Base-T I/F
Buffer	Receive buffer: 4KB/45 bytes
	User-defined buffers Downloaded bit image: Approximately 12KB (common for all models) User-defined characters: Approximately 11KB (for ANK/multilingual model) Approximately 15KB (for Japanese model)
	Macro buffer: 2KB
	Non-volatile graphics data buffer: 0 bytes through 384KB
	User NV memory: 1KB through 192KB
	Page mode area: 106KB
DKD function	2 drives
Power supply	Power supplied by an AC adapter — the PS-170 or PS-180 (option)
Operating voltage	+24 VDC ± 7%
Current consumption	Normal mode (in single-color and two-color printing) — Approximately 1.7 A Four-part energizing mode — Approximately 1 A (in single-color printing) (Both modes were tested printing character font A, A through N, capital letters, 36-character rolling pattern, full-column printing)
Peak current consumption	Approximately 7.7 A or less (with full-dot printing)
Temperature	Operating: 5 to 45 °C {41 to 113 °F} Storage: –10 to 50 °C {14 to 122 °F}
Humidity	10 to 90%
Weight (mass)	Approximately 1.8 kg {3.96 lb}

Note:
After cutting, paper must be fed approximately 1 mm {0.04"} or more, then stopped. This length corresponds to 7 dots or more for the ANK or multilingual model, and 8 dots or more for the Japanese model. If it is not done, paper may jam in the autocutter unit. To prevent dot displacement after cutting, it is recommended to feed paper for approximately 1 mm {0.04"} or more before printing.

The cutting type (partial cut or full cut) must be selected before the printer is first used. If the cutting type is changed from partial cut to full cut after the printer has been used, the printer may not be reliable because the wear level of the cutter blade differs.

Partial cut or full cut is not controlled by a software command.

Full cut by an autocutter can be used only when the printer is installed vertically or hanging on the wall, since if the printer is installed horizontally and the autocutter full cut is used, a cut sheet may drop in the paper path, which may cause a double-cut, paper jam, or autocutter error.

The manual cutter installed in the autocutter unit is used to cut the receipt (paper thickness: approximately 75 mm) manually.

Do not pull the paper out when the cover is closed.

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Print Specifications

Item	Specifications	
Model name	ANK/multilingual model	Japanese model
Printing method	Thermal line printing	
Dot density	0.141 dots/mm × 0.141 dots/mm (180 dpi × 180 dpi) (dpi: dots per 25.4 mm {1"})	0.125 dots/mm × 0.125 dots/mm (203 dpi × 203 dpi) (dpi: dots per 25.4 mm {1"})
Printing direction	Unidirectional with friction feed	
Maximum printable area	72.2 mm, 512 dots positions (when the paper width is 80 mm)	72 mm, 576 dots positions (when the paper width is 80 mm)
Characters per line	Using the default setting, font A. 42 (using font A, paper width is 80 mm) 32 (using font A, paper width is 60 mm) 30 (using font A, paper width is 58 mm)	Using the default setting, font A. 48 (using font A, paper width is 80 mm) 36 (using font A, paper width is 60 mm) 35 (using font A, paper width is 58 mm)
Print speed	Normal mode — 170 mm/s {6.69"} maximum Ladder bar code or two-dimensional code printing mode — 100 mm/s {3.94"} maximum Four-part energizing mode — 70 mm/s {2.76"} maximum Two-color printing mode — 55 mm/s {2.17"} maximum	Normal mode — 170 mm/s {6.69"} maximum Ladder bar code or two-dimensional code printing mode — 90 mm/s {3.54"} maximum Four-part energizing mode — 70 mm/s {2.76"} maximum Two-color printing mode — 50 mm/s {1.97"} maximum
Carriage return width	4.23 mm {1/6"} Programmable by command	3.75 mm {0.15"} Programmable by command

Note:

The print speed value listed above measured when the printer prints with the default print density level at 24 V and 25°C {77°F}. The print speed may change automatically with the condition of the supply voltage or the head temperature.

Print speed may be slower, depending on the data transmission speed and the combination of control commands.

The four-part energizing mode can be selected with the memory switch. If the power supply is a power-savings type with lower capacity, the printer can print with the four-part energizing mode set.

Low transmission speed may cause intermittent printing. It is recommended to transmit data to the printer as quickly as possible. For example: 19200 bps at least for printing with Font A (bps: bits per second).

Reliability

Life	When single-color thermal paper is used	20,000,000 lines
	When two-color thermal paper is used	10,000,000 lines
	Thermal head	150 million pulses 150 km {93.21 miles} (when a single-color thermal paper is used) 75 km {46.60 miles} (when a two-color thermal paper is used)
	Autocutter	2,000,000 cuts (except for KF50) 1,200,000 cuts (for KF50 (KANZAN)) (The printer is defined to have reached the end of its life when it reaches the beginning of the wear-out period.)
MTBF		360,000 hours (Failure is defined as a random failure occurring during the random failure period in the life period — 20,000,000 lines for single-color printing or 10,000,000 lines for two-color printing.)
MCBF		When a single-color thermal paper is used: 70,000,000 lines When a two-color thermal paper is used: 35,000,000 lines (This is an average failure interval based on failures relating to wear out and random failures up to the life period — 20,000,000 lines for single-color printing or 10,000,000 lines for two-color printing.)
Vibration resistance		When packed: Frequency: 5 to 55 Hz Acceleration: Approximately 19.6 m/s^2 {2 G} Sweep: 10 minutes (half cycle) Duration: 1 hour Directions: x, y, and z No external or internal damage should be found after the vibration test, and the unit should operate normally.
Impact resistance		When packed: Package: EPSON standard package Height: 60 cm {23.62"} Directions: 1 corner, 3 edges, and 6 surfaces No external or internal damage should be found after the drop test, and the unit should operate normally. When unpacked: Height: 5 cm {1.97"} Directions: Lift one edge and release it (for all 4 edges). When the printer is not printing, no external or internal damage should be found after the drop test.
Acoustic noise (operating)		Approximately 52 dB (ANSI bystander position) NOTE: The value as shown above is measured when the EPSON evaluation printing pattern is used. This value may be different, depending on the paper to be printed, the print duty, or the print conditions, such as the print speed or the print density.

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Character Specifications

Character types, configurations, and dimensions

Item		Specifications
Character type	Alphanumeric	95 characters
	International	37 types
	Extended graphics	128 characters × 11 pages (including 1 blank page)
Character configuration		See the "Character Configurations and Dimensions" table. (The default is font A.)
Character dimensions		See the "Character Configurations and Dimensions" table. (Spaces between characters are not included.)

Character configurations and dimensions for ANK / multilingual model

	Standard	Double-height	Double-width	Double-width / Double-height
	W × H (mm)	W × H (mm)	W × H (mm)	W × H (mm)
Font A 12 × 24	1.692 × 3.384 {0.066 × 0.133"}	1.692 × 6.768 {0.066 × 0.267"}	3.384 × 3.384 {0.133 × 0.133"}	3.384 × 6.768 {0.133 × 0.267"}
Font B 9 × 17	1.269 × 2.397 {0.05 × 0.094"}	1.269 × 4.794 {0.05 × 0.189"}	2.538 × 2.397 {0.1 × 0.094"}	2.538 × 4.794 {0.1 × 0.189"}
Kanji font A 24 × 24	3.384 × 3.384 {0.133 × 0.133"}	3.384 × 6.768 {0.133 × 0.267"}	6.768 × 3.384 {0.267 × 0.133"}	6.768 × 6.768 {0.267 × 0.267"}
Thai characters 12 × 72	1.692 × 10.152 {0.066 × 0.4"}	1.692 × 20.304 {0.066 × 0.799"}	3.384 × 10.152 {0.133 × 0.4"}	3.384 × 20.304 {0.133 × 0.799"}
Thai characters 9 × 51	1.269 × 7.191 {0.05 × 0.283"}	1.269 × 14.382 {0.05 × 0.566"}	2.538 × 7.191 {0.1 × 0.283"}	2.538 × 14.382 {0.1 × 0.566"}

The actual print character is smaller than the size shown in the table above, because the above size includes spaces in the font.

Characters can be scaled up to 64 times as large as the standard size.

Character configurations and dimensions for Japanese model

	Standard	Double-height	Double-width	Double-width / Double-height
	W × H (mm)	W × H (mm)	W × H (mm)	W × H (mm)
Font A 12 × 24	1.50 × 3.0	1.50 × 6.0	3.0 × 3.0	3.0 × 6.0
Font B 10 × 24	1.25 × 3.0	1.25 × 6.0	2.5 × 3.0	2.5 × 6.0
Font C 8 × 16	1.0 × 2.0	1.0 × 4.0	2.0 × 2.0	2.0 × 4.0
Kanji font A 24 × 24	3.0 × 3.0	3.0 × 6.0	6.0 × 3.0	6.0 × 6.0
Kanji font B 20 × 24	2.5 × 3.0	2.5 × 6.0	5.0 × 3.0	5.0 × 6.0
Kanji font C 16 × 161	2.0 × 2.0	2.0 × 4.0	4.0 × 2.0	4.0 × 4.0

The actual print character is smaller than the size shown in the table above, because the above size includes spaces in the font.

Characters can be scaled up to 64 times as large as the standard size.

Product specifications and supported characters

Product Specifications	Supported Characters	
ANK model	Alphanumeric Extended graphics International characters	—
Multilingual model (Simplified Chinese)		Simplified Chinese characters
Multilingual model (Traditional Chinese)		Traditional Chinese characters
Multilingual model (Thai character)		Thai characters
Multilingual model (Korean)		Korean
Japanese model		Japanese

Paper Feed Specifications

Item	Specifications
Paper feed method	Friction feed
Paper feed direction	Single-direction

lps: lines per second

Notes on Printing and Paper Feeding

- Because the TM-T90 series printer is a line printer, it automatically feeds paper after printing the data. Therefore, when the line spacing for one line is set to a smaller value than the print data, paper may be fed more than the set amount just to print the data.

  For example, when the line spacing for one line is set to 10 dots (10/180 inches) and only paper feeding is executed, paper is fed for 10 dots; however, if bit-image characters are printed, paper is fed for 24 dots. When only rotated characters are printed on one line, paper feeding is executed as shown in the table below.

Paper feed amount (ANK/multilingual model)

		Required paper feeding amount (dots)
Normal characters	Font A	24 × number of times enlarged vertically
	Font B	17 × number of times enlarged vertically
	Kanji font	24 × number of times enlarged vertically
Rotated characters	Font A	12 × number of times enlarged vertically
	Font B	9 × number of times enlarged vertically
	Kanji font	24 × number of times enlarged vertically
Bit image (**ESC ***)		24 × number of times enlarged vertically

Paper feed amount (Japanese model)

		Required paper feeding amount (dots)
Normal characters	Font A	24 × number of times enlarged vertically
	Font B	24 × number of times enlarged vertically
	Font C	16 × number of times enlarged vertically
	Kanji font A	24 × number of times enlarged vertically
	Kanji font B	24 × number of times enlarged vertically
	Kanji font C	16 × number of times enlarged vertically
Normal characters	Font A	12 × number of times enlarged vertically
	Font B	10 × number of times enlarged vertically
	Font C	8 × number of times enlarged vertically
	Kanji font A	24 × number of times enlarged vertically
	Kanji font B	20 × number of times enlarged vertically
	Kanji font C	16 × number of times enlarged vertically
Bit image (**ESC ***)		24 × number of times enlarged vertically

- When the printer goes to the standby (data-waiting) state during printing, it temporarily stops printing and feeding paper. When data is transmitted and printing is executed, paper may shift 1 to 3 dots from the print starting position, which especially affects bit-image printing.

- Interval of autocutting operation in the receipt section:
  For driving the autocutter in the receipt section, the interval should be a minimum of 10 lines of printing or paper feeding (to prevent small pieces of cut paper from dropping into the autocutter).

Paper Specifications

See “Paper specifications“ in Appendix B.

Comparison of Specifications for the TM-T90 and TM-T88II

Specifications comparison

	TM-T90 (except Japanese model)	TM-T88II
1. Dot density	0.141 mm/dot	0.141 mm/dot
2. Paper width	80 mm {3.15"} 60 mm {2.36"} (using an optional paper roll spacer) 58 mm {2.28"} (using an optional paper roll spacer)	80 mm {3.15"}
3. Print speed	Normal printing: 170 mm/s {6.69"/s} maximum Ladder bar code or two-dimensional code printing: 100 mm/s {3.94"/s} maximum Four-part energizing mode: 70 mm/s {2.76"/s} maximum Two-color printing: 90 mm/s {3.54"/s} maximum	120 mm/s {4.72"/s} maximum Ladder bar code: Approximately 42 mm {1.65"/s} Low power consumption: 70 mm/s {2.76"/s} maximum
4. Font C	None (*)	Not available
5. NV bit image buffer	0 through 384KB	256KB
6. NV user memory	1KB through 192KB	1KB

(*) Font C (8 × 16) is supported in the Japanese model.

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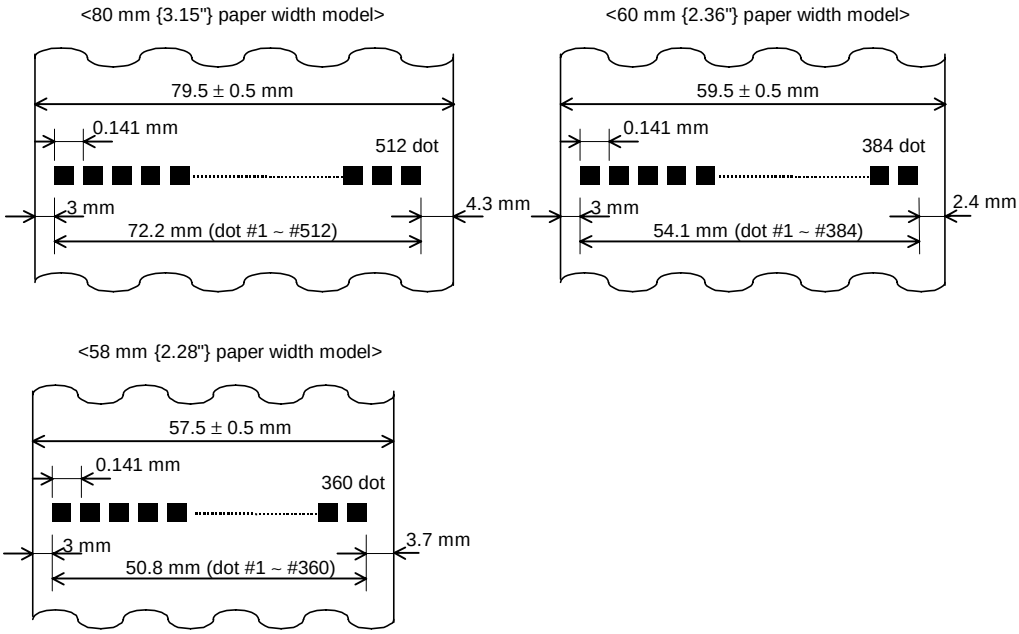
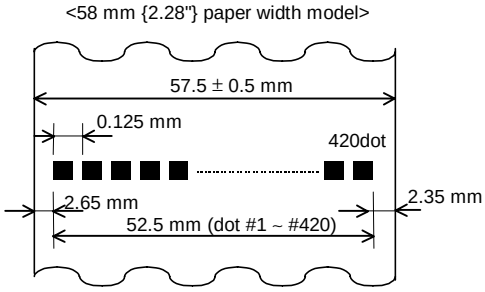
Printable Area

ANK/multilingual model



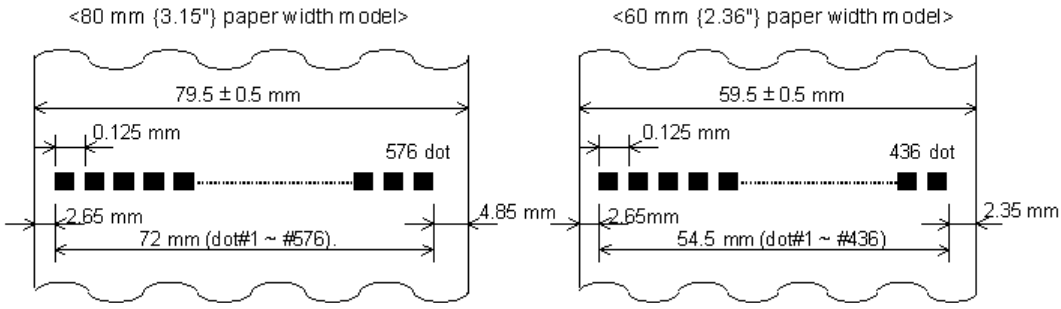
Printable area for ANK/multilingual model

Japanese model default setting



Printable area for Japanese model (for default setting)

Japanese model when the paper width is changed

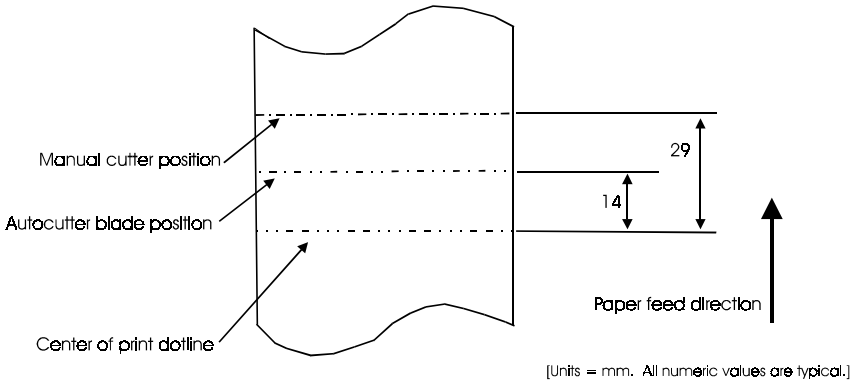


Printable area for Japanese model (when the paper width is changed)

Note:
The numeric values used here are average values to be used in designing. The printable area may be out of alignment by 2 mm {0.079"} maximum to the left or right, due to the paper position or tolerance of parts.

Print Position Versus Cutter Position

The printing position in relation to cutter position is shown in the figure below.



Print position versus cutter position

Note:
The values in the figure are average values. Slackness and differences in paper type can result in differences developing between average values and the cutter's actual paper cut position. It is important to allow for a certain margin of error when setting cutter paper cut position.

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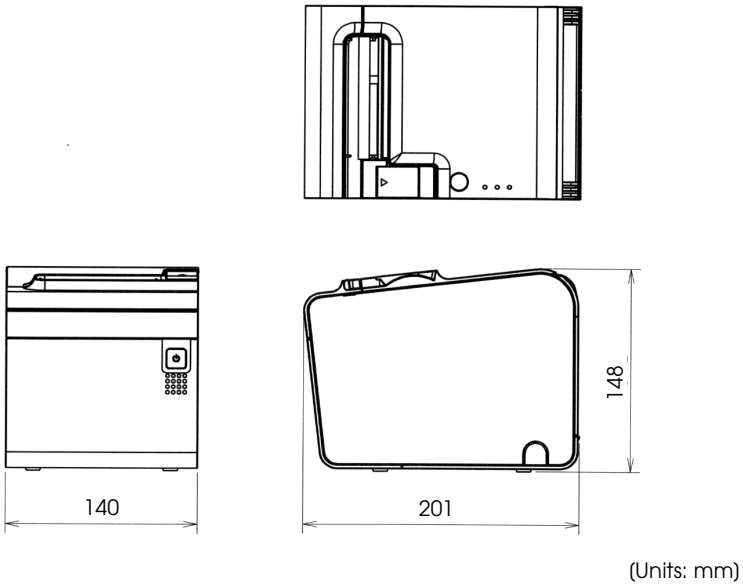
Overview of External Dimensions

- ❑ Height: 148 mm {5.83 "}
- ❑ Width: 140 mm {5.51"}
- ❑ Depth: 201 mm {7.91"}
- ❑ Weight: Approx. 1.8 kg {3.97 lb} (without paper roll)



External appearance

Note:
Because this printer uses plated steel, the cutting edges may be subject to rust. However, this does not affect the printer performance.

Chapter 2

Setup

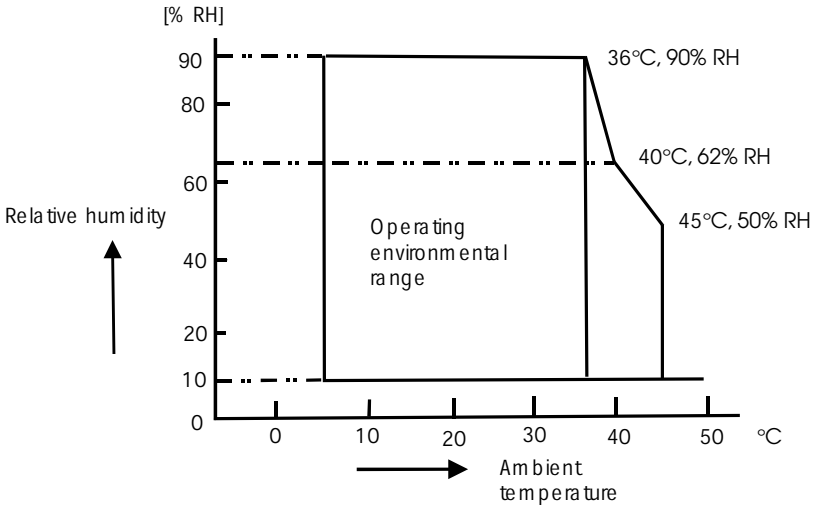
Installation Procedures

Precaution for Installation

- Install the printer so it is positioned horizontally when in operation.
- Avoid locations susceptible to dust and other foreign matter.
- Make sure to avoid bumping the printer or otherwise exposing it to strong impact during operation.
- Avoid resting the printer on the power supply or other cables or other objects.
- If you install the printer vertically, attach the rubber feet packed in the printer's box on the rear of the printer and change the location of the paper roll near-end sensor.
- Consider vibration during paper cutting and drawer usage. Take measures to prevent the printer from moving. Affixing tapes are provided as an option.

Operating specifications

Item		Specifications
Temperature	When printing	5 to 45 °C {41 to 113 °F}
	During storage	–10 to 50 °C {14 to 122 °F} (except for paper)
Humidity	When printing	10 to 90% RH
	During storage	10 to 90% RH (except for paper)



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Connection Form and Cables

Serial Connection

When the TM printer is connected to the host PC with a serial interface, the following connection forms are possible:

- Stand alone
- Y-connection
- Pass-through connection

Connections for usable serial cross cables are as follows:

Type A

D-Sub 25P(TM)			D-Sub 9P(PC)	
Pin No	Signal		Signal	Pin No
1	FG		DCD	1
2	TXD		TXD	3
3	RXD		RXD	2
20	DTR		DTR	4
6	DSR		DSR	6
4	RTS		RTS	7
5	CTS		CTS	8
7	GD		GD	5
25	RESET		RI/RESET	9

Type B

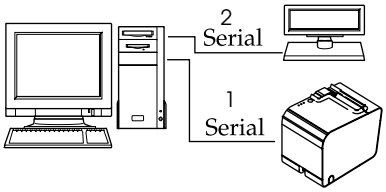
D-Sub 25P(TM)			D-Sub 9P(PC)	
Pin No	Signal		Signal	Pin No
1	FG		DCD	1
2	TXD		TXD	3
3	RXD		RXD	2
20	DTR		DTR	4
6	DSR		DSR	6
4	RTS		RTS	7
5	CTS		CTS	8
7	GD		GD	5
25	RESET		RI/RESET	9

The type of cable that should be used depends on the operation and the handshake method for the TM printer. You can operate the TM printer by Windows driver, OPOS, or ESC/POS commands. XON/XOFF, DTR/DSR, or RTS/CTS are available as handshake controls. See tables in following sections for the type cable for each connection.

See Appendix D for details of cable connection procedure.

Stand alone

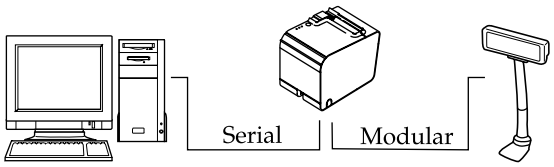
Both TM printer and customer display (DM-D) are connected to the host PC via serial port.



TM side control setting \ Application control		XON/XOFF (except OPOS)	DTR/DSR (DOS, OPOS, Visual C)	RTS/CTS (DOS, Windows driver, Visual C, Visual Basic, MSComm)
XON/XOFF	1	Type A or B	—	—
	2	DM-D500: A,B Other DM-D: not available	—	—
DTR/DSR	1	—	Type A or B	Type B
	2	—	Type A or B	Type B

Y-connection

TM printer is connected to the host PC via serial port and the customer display (DM-D) is connected to TM printer via modular connector.



TM side control setting \ Application control	XON/XOFF (except OPOS)	DTR/DSR (DOS, OPOS, Visual C)	RTS/CTS (DOS, Windows driver, Visual C, Visual Basic, MSComm)
XON/XOFF	Not available	—	—
DTR/DSR	—	Type B (*)	Type B

(*) When RTS/CTS control is used between the TM and DM.

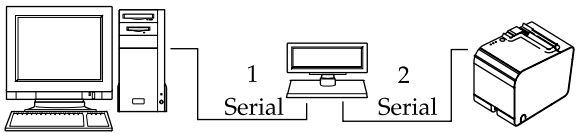
Note:
You need to use the UB-S09 interface when you use a modular connector.

On the DM-D (DM-D500 etc...) which has DIP switch to select Y-type connection, confirm that the DIP switch has been set "Y-type connection: Enable."

Pass-through connections

The TM printer is connected to the customer display (DM-D) via a serial port, and the DM-D is connected to the host PC via a serial port.

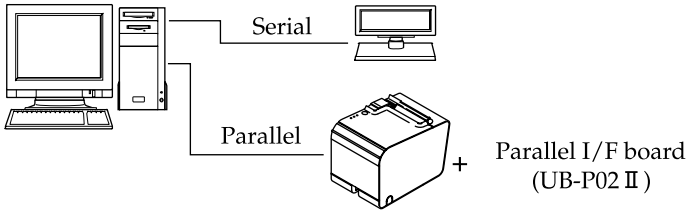
Note:
On the DM-D (DM-D500 etc...) which has DIP switch to select Y-type connection, confirm that the DIP switch has been set "Y-type connection: Disable."



Application / TM side control / control setting		XON/XOFF (except OPOS)	DTR/DSR (DOS, OPOS, Visual C)	RTS/CTS (DOS, Windows driver, Visual C, Visual Basic, MSComm)
XON/XOFF		Not available	—	—
DTR/DSR	1	—	Type A or B	Type B
	2	—	Type A or B	Type A or B

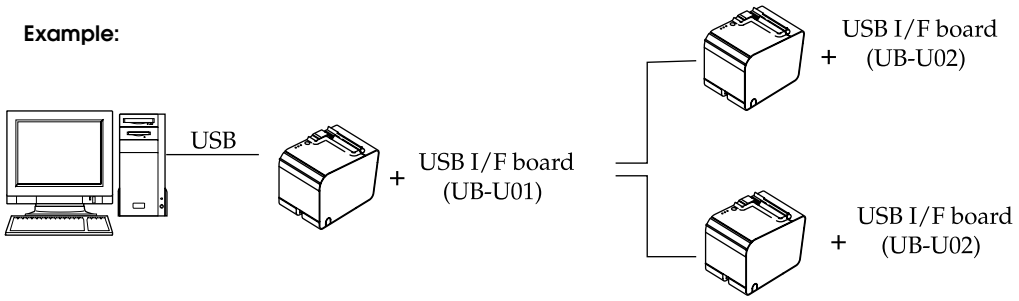
Parallel Connection

The TM printer is connected to the host PC via a parallel interface board (UB-P02II). The customer display (DM-D) is connected to the host PC via a serial port.



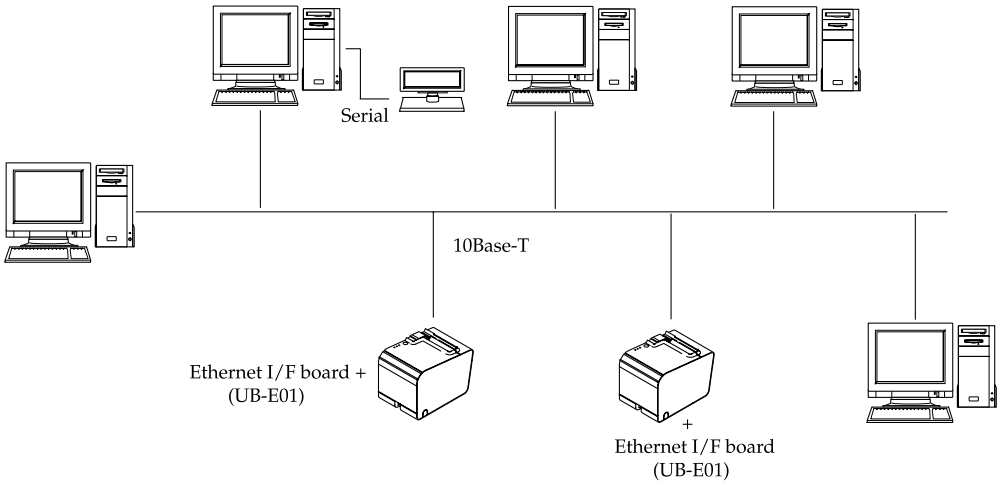
USB

The TM printer can be connected to the host PC via a USB connector, and other TM printers can be connected to the first printer via USB.



Ethernet

TM printers are connected to a network via a hub using an Ethernet cable.



Note:
If the TM printer is connected to the host PC via the Ethernet interface, a DM-D cannot be connected to the TM printer.

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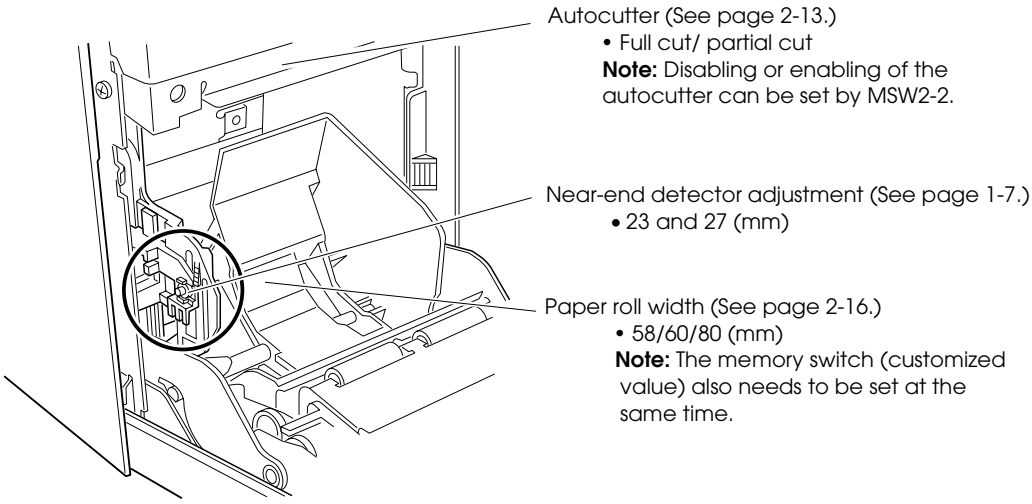
Printer Setup and Initial Settings

Setup Flow

This section describes the initial setting of the printer available for an application. The initial setting can be set up mechanically, by using DIP switches or memory switches.

- Mechanism



- DIP switches (See page 2-9.)
  A single set of DIP switches is located in the inside of the paper roll cover.

To set the DIP switches, remove the DIP switch cover.

- Memory switches
  MSW1, 2, and 8 (See page 2-10.)
  Customized value (See page 2-12.)
  Serial communication conditions (See page 2-12.)

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TM Setup Items (Summary)

The table below shows TM setup items. Refer to this table for setting items and appropriate switches.

Item	Description	How setting is made			Method to set memory switch
		Mechanical?	DIP switch	Memory switch	
Autocutter	Sets cutting type	Yes (See page 2-13 for full/ partial cut)	—	MSW2-2 to disable	Command **GS (E**, or panel operation
Paper width	Changes paper width	Yes (See page 2-16)	—	Customized value	Command **GS (E**
Adjust paper roll near end	Adjusts detector of near end paper roll	Yes (See page 1-7)	—	—	—
Enable/disable power switch (*)	Enables or disables the power switch.	—	1-1	—	—
Select serial communication condition	Sets serial communication settings either by DIP switch or memory switch. If DIP switch 2 is ON, the DIP switch setting is read; if DIP switch 2 is OFF, the memory switch setting is read.	—	1-2	—	—
Set serial communication condition	Sets handshake, bit length, presence of parity check, parity select, baud rate select.	—	1-3 to 1-8	Serial communication	Command **GS (E**, or panel operation
Send power on notification	Transmits 3 bytes of data when power is on.	—	—	MSW1-1	Command **GS (E**
Select receive buffer capacity (*)	Selects capacity of receive buffer large or small.	—	—	MSW1-2	Command **GS (E**, or panel operation
Set conditions for Busy status (*)	Selects condition for Busy.	—	—	MSW1-3	Command **GS (E**, or panel operation
Define data processing for a reception error	Selects print "?" or ignore.	—	—	MSW1-4	Command **GS (E**, or panel operation
Set automatic line feed	Disables or enables automatic line feed when CR is executed.	—	—	MSW1-5	Command **GS (E**, or panel operation
Select error type when paper roll cover is open during printing	Selects automatic recovery error or recoverable error.	—	—	MSW8-8	Command **GS (E**
Select pin #6 signal for reset	Sets serial interface reset	—	—	MSW1-7	Command **GS (E**, or panel operation
Select pin #25 signal for reset	Sets serial interface reset	—	—	MSW1-8	Command **GS (E**, or panel operation

(*) Refer to Chapter 3 for function description.

Definitions of DIP Switch and Memory Switch Settings

DIP switch settings

Switch No.	Function	ON	OFF
1	Enable/disable Power switch.	Disable	Enable
2	Select serial communication condition.	Set using DIP switch	Set using memory switches.
3	Handshake	XON/XOFF	DTR/DSR
4	Bit length	7 bits	8 bits
5	Parity check	Yes	No
6	Parity type	Even	Odd
7 8	Baud rate (bps)	7 8 ON ON 2400 OFF ON 4800 ON OFF 9600 OFF OFF 19200	

bps: Indicates the number of bits transferred per second.
DIP switches 2 to 8 are for seiral communication. Not used in parallel communication.

Memory switch functions

This printer unit has the following memory switches in NV memory.

- MSW1, MSW2, MSW8
- Customized values
- Serial communication conditions

These settings can be set by using the ESC/POS command **GS (E**. Refer to the Application Programming Guide for details on the command. Some settings for MSW2 and MSW8 also can be set by operating the printer control panel buttons. (Refer to page 3-13.)

MSW1

Bit	Function	0 (OFF)	1 (ON)
1	Send power on notification.	No	Yes
2	Select receive buffer capacity.	Large (4KB)	Small (45 bytes)
3	Conditions for Busy status.	Receive buffer full or offline	Receive buffer full
4	Data processing when a reception error occurs.	Substitute with '?'	Ignored
5	Automatic line feed	Invalid	Valid
6	Reserved	Fixed to OFF	—
7	Select pin #6 signal for reset	Not used	Used
8	Select pin #25 signal for reset	Not used	Used

MSW1-7, 1-8 are effective only when serial interface is used.

If the TM-T88II-compatible mode is selected, MSW1-1 must be set to ON (when the OPOS driver is used).

MSW2

Bit	Function	0 (OFF)	1 (ON)
1	Reserved	—	Fixed to 1 (one). Do not change settings.
2	Autocutter operation	Disabled	Enabled
3 - 8	Reserved	—	

MSW8

Bit	Function	Value	
		0 (OFF)	1 (ON)
1 - 4	Reserved	—	
5	Spacing of both sides for barcode	space not inserted	inserts a space
6	Reserved	—	
7	TM-T88II-compatible mode	Not compatible	Compatible
8	Printer cover open during operating	Errors that automatically recover	Errors that can possible recover

If the print starting position is not set when power is turned on, the print position on the first sheet may shift, or a paper layout error may occur.

MSW8-7 is not defined in the Japanese model.

Customized values

Item	Value
Selection of NV user memory capacity	1KB 64KB 128KB 192KB
Selection of NV graphics memory capacity	None 64KB 128KB 192KB 256KB 320KB 384KB
Paper width selection	58/60/80 mm
Print control selection	One-part energizing Two-part energizing Three-part energizing Four-part energizing
Print density selection	x 0.7 x 0.75 x 0.8 x 0.85 x 0.9 x 0.95 x 1.0 x 1.05 x 1.1 x 1.15 x 1.2 x 1.25 x 1.3 x 1.35
Print color selection	Single-color Two-color
Selects the black-color density in two-color printing	Loght Midium Dark

Note:

The maximum print speed can be achieved only in one-part energizing mode. However, with the ANK/ multilingual model, even if one-part energizing mode is selected, print speed decreases automatically if the print duty ratio is high. However, in the Japanese model, head energizing is not divided regardless of any print control setting.

Four-part energizing mode can reduce power consumption.

Serial transmission conditions

Item	Selection
Baud rate	115200 bps 9600 bps 57600 bps 4800 bps 38400 bps 2400 bps 19200 bps
Parity	None/ odd/ even
Flow control	DTR/DSR control XON/XOFF control
Data length	7-bit/8-bit

Setting Autocutter Type

When the printer is new, users may choose between "partial cut" and "full cut" by adjusting the cutter unit to the desired dowel position. The steps below show the setting for the type of cut.

Note:
To disable the autocutter, change the memory switch setting (MSW2-2).

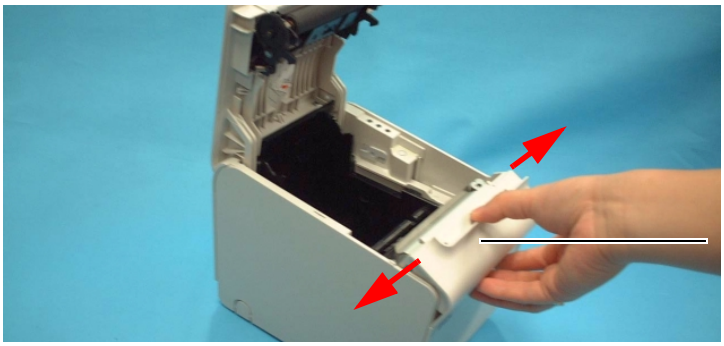
If the printer is not brand-new and the cutting type is changed from partial cut to full cut, the cutter unit and the fixed blade must be replaced with a new one, since the ends of the blade are worn, even though they have not been used.

The partial cut and full cut methods cannot be selected using switches or software commands.

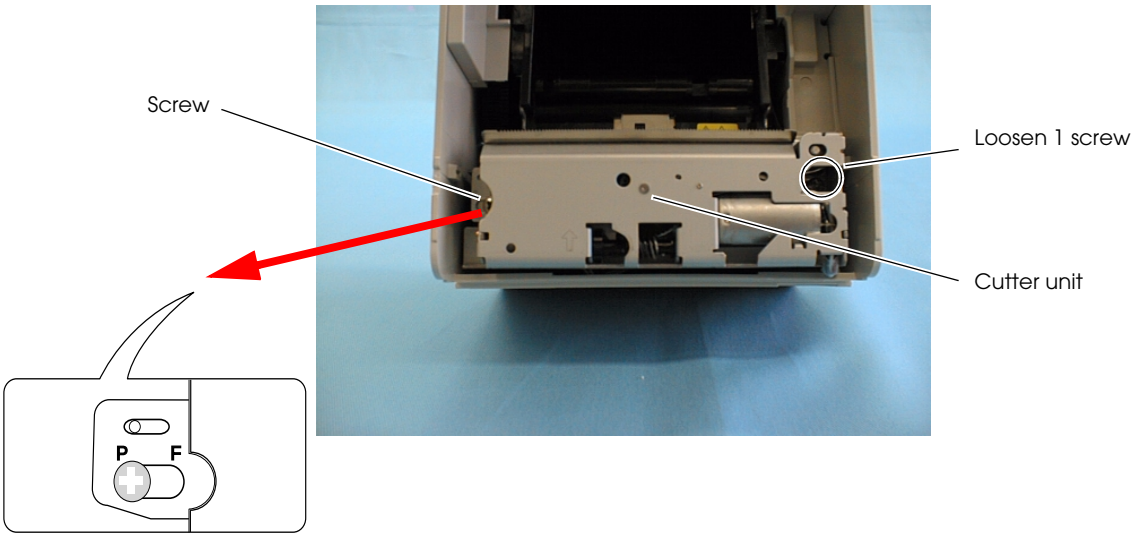
Setting procedure

1. Turn off the power supply and open the paper roll cover.

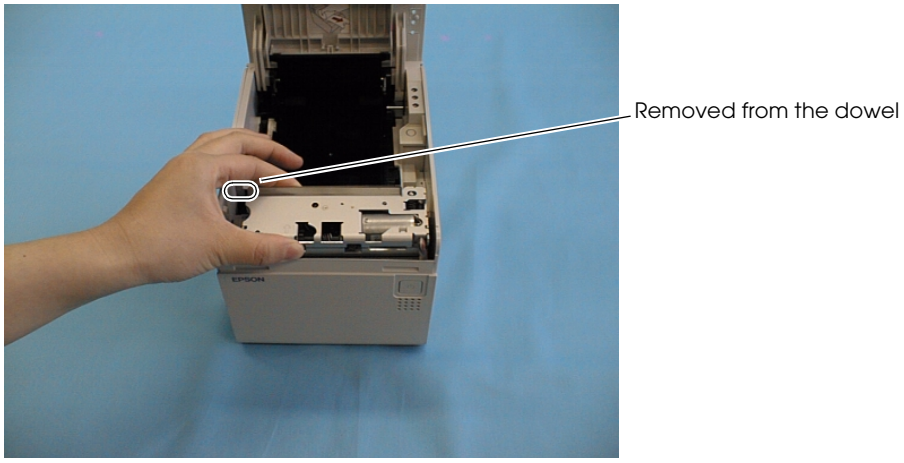
2. Push the body case outward (in the direction of the 2 arrows), and remove the cutter cover.



3. Remove 1 screw retaining the cutter unit and loosen the screw indicated by a circle in the illustration below.

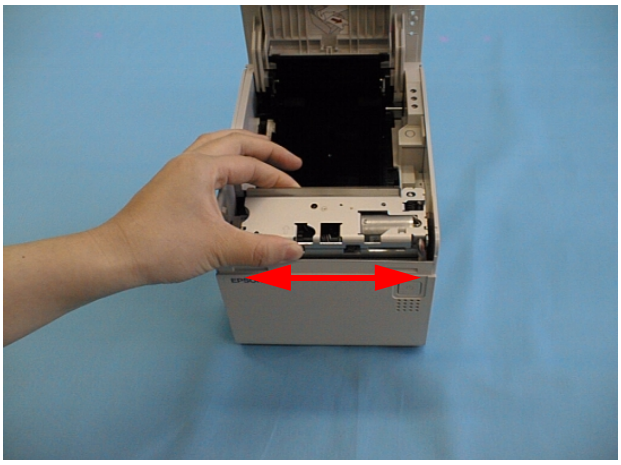


4. Lift the top of the cutter unit upward towards you and remove from the dowel.



5. Moving the cutter unit in a lateral direction, shift to the dowel position of the desired cutting method.

Shift to dowel position for the desired cutting method



6. Secure the cutter unit using the 2 screws.
7. Install the cutter cover.
8. Close the paper roll cover.

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Setting the Roll Paper Width

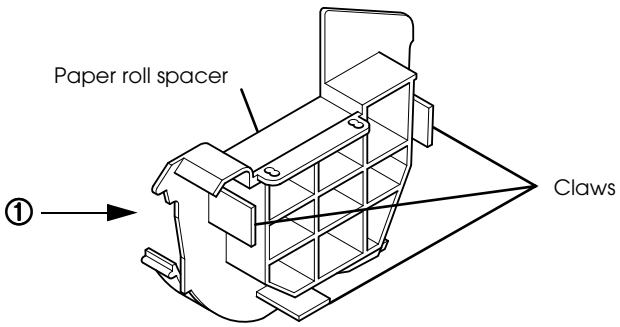
If you want to use the 58 mm or 60 mm {2.28 or 2.36"} width paper roll, attach the paper roll spacer to the printer, as described below.

Note:
Once the printer is used, do not change the paper width from narrow to wide. Otherwise, printing problems and paper cutting problems may occur. There are two reasons for this restriction, as follows.

- The area on the print head where the paper does not pass can be worn out, since the platen directly contacts the head.
- The wear rate on the cutter blades differs between the areas where the paper passes and does not pass, which can result in paper-cutting problems.

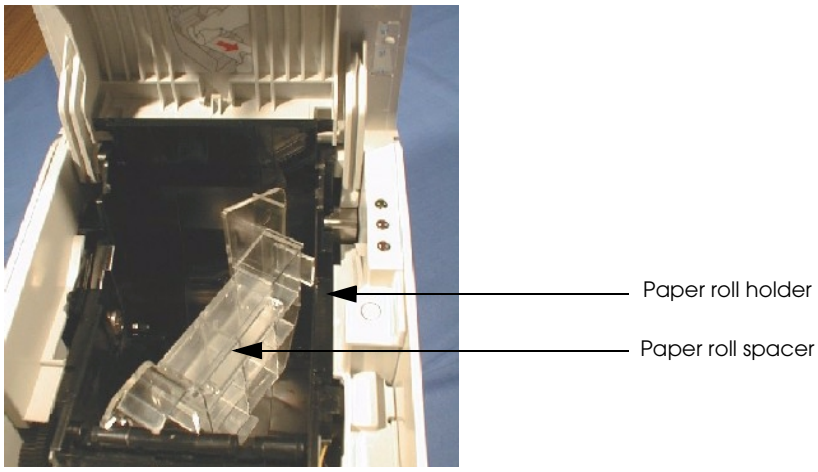
However, if the printer is new, you can change the paper width from narrow to wide.

1. If you use 60 mm roll paper, break off the three claws shown below. (If you plan to use 58 mm paper, leave the tabs on.)

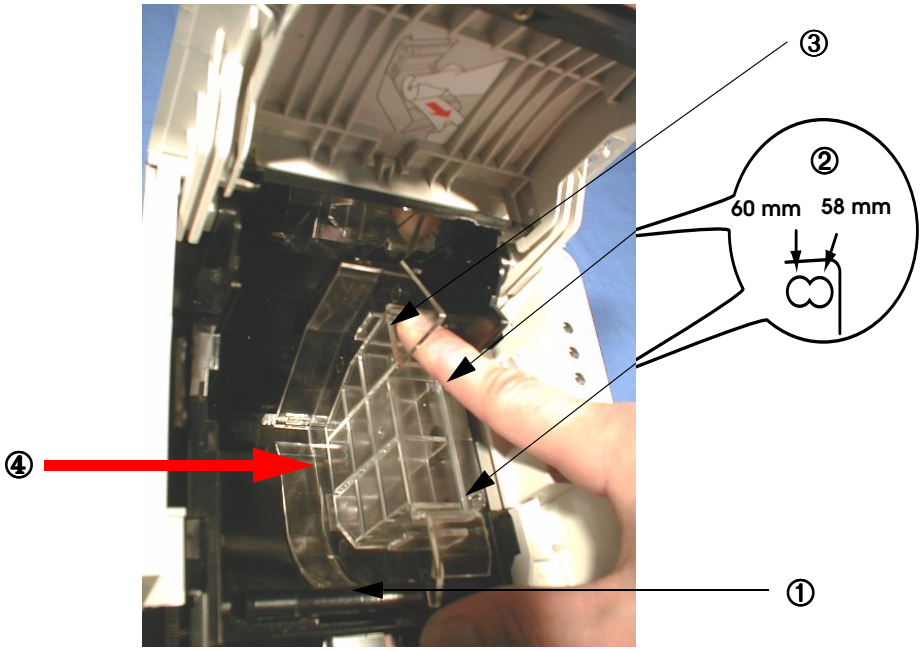


2. Open the paper roll cover.

3. Insert the paper roll spacer into the paper roll holder diagonally, as shown in the illustration below:



4. Lift the paper roll spacer a little and, at the same time, press it against the right edge of the paper roll holder (① in the illustration). Then push the point (② in the illustration) and two holes (③ in the illustration) with the protrusion of the paper roll holder. The position of engagement varies, depending on the paper width.



5. Press and engage the paper roll spacer (① in the drawing) till you hear it engage.

6. Set the NV memory for the desired paper width.

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Chapter 3

Description of Functions

Switch and Button

FEED Button

The FEED button can be disabled with the **ESC c 5** command. When it is disabled, the FEED button cannot function.

The printer feeds paper based on the line spacing set by the **ESC 2** or **ESC 3** command. However, paper feeding using the FEED button cannot be performed under the following conditions:

- When the paper roll cover is opened.
- During cleaning.
- During self-test printing, pressing the FEED button stops the self-test temporarily and pressing it again and restarts the self-test.
- When the FEED button has a defined function in a macro definition command.

Power Switch

Normal operation is to turn the power on and off using this switch. You can enable or disable this power supply switch using DIP switch 1-1.

Power switch enabled

- ❑ When the TM is off and the power switch is pressed more than 1 second, the TM is powered ON.
- ❑ When the TM is on and the power switch is held down more than 3 seconds the TM is powered OFF. If for some reason pressing the power switch even more than 10 seconds does not turn the power off, you can execute a forced power off by unplugging the printer.

Power switch disabled

When the power switch is disabled, the circuit is in the same condition as always having the power switch on. If power is supplied to the printer, the TM is on, and if power is not supplied to the printer, the TM is forced off. In this case, the printer is powered off without the power off process (*). Therefore, execute the software power off process by a command from the system (use **DLE DC4**).

When the power switch is disabled, power off through the command process. The power LED will start to blink. Then you can power the printer off by turning off the power supply or power outlet. If the power switch is disabled and an unrecoverable error occurs, press the power switch more than 3 seconds to reset the TM only. This works for both recoverable and unrecoverable errors.

(*) Power off process: The TM stores the latest TM condition and locks the head carriage before power down.

Power switch cover

If the power switch is disabled, the power switch cover is not necessary. However, you can prevent tampering and improve the printer appearance by installing the cover. When you want to reset the TM only, push the power switch through hole in the power switch cover.

User operation and TM operation

	Power switch enabled	**Power switch disabled**
When you want to power on the TM	Press the power switch more than 1 second.	1. Power on the printer power supply. 2. Turn on the power breaker or outlet.
When you want to power off the TM	Hold down the power switch more than 3 seconds.	Execute the software power off process using a software command, and wait until the power LED starts blinking. Then power off the printer power supply.
When there is a power outage	The TM is powered off.	The TM is powered off.
When the power outage is over	The TM power remains off. Press the power switch more than 1 second to turn the printer on.	The TM is powered on.
When there is an unrecoverable error	Press the power switch more than 3 seconds to turn the power off; then turn the power on again.	Hold down the power switch over 3 seconds to reset the TM.

Power off control by the host

The power can be turned off using **DLE DC4** (***n*** = 2). When using the printer with the power switch disabled (DIP switch 1-1 is ON), be sure to turn off the printer using the command before turning off the host. Power off operation varies depending on DIP switch settings as follows:

When the power switch is enabled:
The TM is powered OFF after processing the command.

When the power switch is disabled:
The POWER LED blinks after processing the command, and the printer waits for the power supply or power outlet to be turned off. See the following procedure. Refer to page 3-4 for further information about the POWER LED blinking pattern.

❑ Power off procedure

1. Transmit the last print command (**LF**, **ESC d**, etc.).
2. Transmit **GS (D *pL pH m a b*** (***pL*** = 3, ***pH*** = 0, ***m*** = 20, ***a*** = 2, ***b*** = 1).
3. Transmit **GS r *n*** (***n*** = 1).
4. Wait for transmission of paper detector status from the printer by **GS r *n***.
5. Transmit **DLE DC4 *n a b*** (***n*** = 2, ***a*** = 1, ***b*** = 8).
6. Wait for transmission of power supply off status.

   Note:
   *Within 10 seconds after transmitting **DLE DC4 n a b**, the power supply off procedure is carried out and power supply off status is transmitted.*

7. If power supply off status is not confirmed, wait 10 seconds or more after transmitting **DLE DC4 *n a b***.

   Note:
   The process varies depending on the interface.

Interface	Countermeasure
Serial interface	Status is transmitted regardless of the state of the host.
Parallel interface	The host should carry out negotiation immediately after transmitting **DLE DC4 *n a b*** so that status from printer can be received.

8. At this time, printer software carries out an internal process in the printer.
9. After processing:
   a. When the power switch is enabled, the printer turns off.
   b. When the power switch is disabled, the POWER LED blinks and the printer is in the waiting state.

After confirming that, turn off the power breaker or the outlet.

Note:
*Do not reset the printer during the period before turning off the printer power supply and after transmitting the **DLE DC4** (**n**=2) command.*

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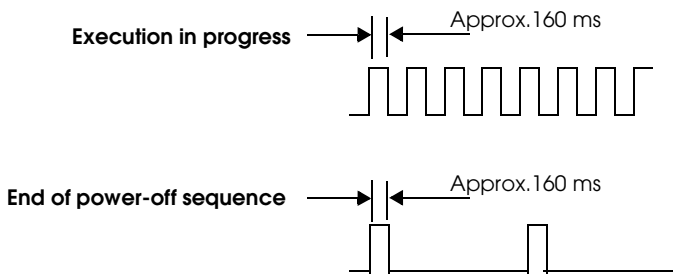
Panel LEDs

Power (POWER) LED

Item		Specifications
LED color		Green
On states	On	Power is supplied
	Off	Power is not supplied
	Flashing with short intervals *1	Execution in progress
	Flashing with long intervals *1	Powering down

*1: The power (POWER) LED flashes using the following patterns.



No Roll Paper (PAPER OUT) LED

Item		Specifications
LED color		Red
ON states	On	Paper roll near-end (only a small amount of paper left on roll) or paper end (no paper left) is detected.
	Off	Plenty of paper left on roll.
	Blinking	Self-test standby state or macro standby state when the macro execution command is used.

Error (ERROR) LED

Item		Specifications
LED color		Red
On states	On	Offline (excludes paper feeding using PAPER FEED button and self-test)
	Off	Normal operation
	Flashing	Error status

Note:
When an unrecoverable error occurs, turn off the power supply immediately.

Error Codes

Three types of error are possible: automatically recoverable errors, which can be corrected without any action by the user, recoverable errors, which can be corrected by the action of a user, and unrecoverable errors, which cannot be corrected by a user.

Automatically recoverable errors

Although normal printer operation is no longer possible when automatically recoverable errors occur, they do not represent a printer failure. They are easily corrected through use of the printer's controls, or they are automatically corrected when the temperature of the head returns to normal or when the cover is closed.

Note:
The print head temperature error is not an abnormality.

Automatically recoverable errors

Error name	Type of error	Error LED Flash code Approx.320 ms	Recovery measure
Paper roll cover open error (when the recoverable error is selected) (*1)	Printing on the paper roll is not performed correctly due to a cover-open.		Recovers automatically when the cover is closed.
Print head temperature error (*2)	The temperature of the print head is extremely high.		Recovers automatically when the print head cools.

Note:
*(*1): The printer cover open error operation can be selected with a memory switch.*

*(*2): If an abnormal temperature is detected, the printer generates a CPU execution error as an unrecoverable error.*

Recoverable errors

Although normal printer operation is no longer possible when recoverable errors occur, they do not represent a printer failure. They are easily corrected through user actions and/or the use of ESC/POS® commands.

Recoverable errors

Error name	Type of error	Error LED flash code Approx.320 ms	Recovery measure
Paper roll cover open error (*1)	Printing on the paper roll is not performed correctly due to a cove open		Recovers when **DLE ENQ 1** or **DLE ENQ 2** is sent after the cover is closed.
Autocutter error (*2)	The autocutter does not work correctly.	Approx.5.12 ms	Recovers when **DLE ENQ 1** or **DLE ENQ 2** is sent.

Note:
*(*1): Printer cover open error operation can be selected with a memory switch.*

*(*2): When an autocutter error occurs caused by jamming paper, turn the power off and remove the jammed paper. Then turn the power on again.*

The **DLE ENQ1** and **DLE ENQ2** commands are enabled only when a recoverable error (excluding automatically recoverable errors) occurs. In the event of a recoverable error, correct the condition causing the error and transfer the **DLE ENQ1** or **DLE ENQ2** command to recover from the error without having to power down the printer.

Unrecoverable errors

Normal printer operation is no longer possible when an unrecoverable error occur. These errors mean that the printer requires servicing and repair.

Unrecoverable errors

Error name	Type of error	Error LED Flash code Approx.320 ms	Recovery measure
R/W error in memory or gate array	After R/W checking, the printer does not work correctly.	Approx.5120 ms	Impossible to recover.
High voltage error	The power supply voltage is extremely high.		Impossible to recover.
Low voltage error	The power supply voltage is extremely low.		Impossible to recover.
CPU execution error	The CPU executes an incorrect address or the I/F board is not connected.		Impossible to recover.
Internal circuit connection error	Internal circuits are not connected correctly.		Impossible to recover.
UIB error	An abnormall operation occurs in UIB.		Impossible to recover.

Note:
When an unrecoverable error occurs, turn off the power supply immediately. If the power supply function is disabled, hold down the power switch more than 3 seconds to reset the printer.

Sensors

Paper sensors

The printer has two paper sensors.

Paper roll near-end sensor

The near-end sensor is located on the roll paper supply device. It detects the near-end of the roll paper by detecting the paper roll diameter. You can adjust the sensor position. See page 1-7 for details for adjustment.

When it detects a paper near-end, it either stops or continues printing, depending on the **ESC c4** setting. The PAPER OUT LED lights.

When a printing stop is enabled by the **ESC c4**, the sensor detects a paper near-end and the printer automatically goes offline after printing the current line. To restart printing, load new paper and set the printer back online by closing the printer cover. The printer starts initializing and continues printing data stored in the print buffer.

Paper roll end sensor

The paper-end sensor is located in the paper path. It detects the presence of paper from the paper roll in the paper path of the printer mechanism. When there is no paper in the paper path (paper-end status), the PAPER OUT LED indicator lights.

When the sensor detects a paper end, printing stops even if it is in the middle of one transaction; therefore, it is recommended to use the roll paper near end sensor and use the paper end sensor as a supplement.

Printer cover sensor

Paper roll cover open sensor

The cover-open sensor monitors the paper roll cover. When the sensor detects a cover open while printing, the printer stops printing immediately and automatically goes offline, depending on the setting of memory switch 8-8 as follows:

- ❑ OFF (default): Automatically recoverable error. The ERROR LED blinks. When the printer cover is closed, the ERROR LED goes off, and the printer goes online and starts printing at the beginning of the line it was printing when the cover was opened.
- ❑ ON: Recoverable error. The ERROR LED blinks. Even if the cover is closed, the ERROR LED still blinks. You need to transmit the **DLE ENQ** command to recover.

When the printer recovers, it feeds paper to take up the slack, and starts printing from the beginning of the line where an error occurred. In this case, double printing and print position shift may occur. It is recommended to set memory switch 8-8 to ON, clear the buffers by sending **DLE ENQ 2**, and resend the print data. Whether the cover is open or not does not affect the status reported by the paper roll end sensor.

Offline

This printer is not equipped with an online/offline switch. The printer goes offline under the following conditions.

- Between when the power is turned on (including reset using the interface) and when the printer is ready to receive data.
- During the self-test.
- When the paper roll cover is open.
- During paper feeding using the FEED button.
- When the printer stops printing due to a paper-end (in cases when an empty paper supply is detected by either paper roll end detector or the paper roll near-end detector with a printing halt feature set by **ESC c 4**).
- When an error has occurred.
- During macro executing standby status.

BUSY state

Selecting conditions that invoke a BUSY state

The conditions that invoke a BUSY state are selected with memory switch MSW 1-3, as follows.

Printer status		Memory switch MSW 1-3 state	
		ON	OFF
Offline	During the period from when the power is turned on (including resetting using the interface) to when the printer is ready to receive data.	BUSY	BUSY
	During the self-test.	BUSY	BUSY
	When the cover is open.	—	BUSY
	During paper feeding using the paper FEED button.	—	BUSY
	When the printer stops printing due to a paper-end (or when the paper roll is not present).	—	BUSY
	When an error has occurred.	—	BUSY
When the receive buffer becomes full.		BUSY	BUSY

Notes on setting memory switch MSW1-3 to ON

1. The printer mechanism stops but does not become busy when: an error occurs, the cover is open, printing stops due to a paper-end, or paper is fed using the paper FEED button.

2. When setting memory switch 1-3 to ON to enable handshaking with the printer, be sure to check the printer status using the **GS a** command and the ASB function. In this setting, the default value of ***n*** for **GS a** command is 2. The printer automatically transmits the printer status, depending on online/offline changes.

3. When using **DLE EOT** and **DLE ENQ** and **DLE DC4**, be sure that the receive buffer does not become full.

   - When using a host that cannot transmit data when the printer is busy:
     If an error occurs, **DLE EOT**, **DLE ENQ**, and **DLE DC4** cannot be used when the printer is busy due to a receive buffer-full state.

   - When using a host that can transmit data when the printer is busy:
     When the receive buffer becomes full while transmitting bit-image data if **DLE EOT**, **DLE ENQ**, or **DLE DC4** is sent while the bit-image data is processed, the code is also interpreted as bit-image data. Data transmitted when the receive buffer is full may be lost.

     Example: Check the printer status using **GS I** or **GS r** after transmitting each line of data, and use a 4KB receive buffer. Transmit one line of data so that the receive buffer does not become full.

Receive buffer

The capacity of the receive buffer is set using memory switch MSW1-2. A receive buffer full means the receive buffer is in the following condition. The printer ignores the data received when the remaining space in the receive buffer is 0 bytes.

Memory switch MSW1-2	Receive buffer capacity	Buffer full definition
ON	45 bytes	When the remaining space in the receive buffer drops to 16 bytes, the printer status becomes "buffer full" and it remains "buffer full" until the space in the receive buffer increases to 26 bytes.
OFF	4KB	When the remaining space in the receive buffer drops to 128 bytes, the printer status becomes "buffer full" and it remains "buffer full" until the space in the receive buffer increases to 256 bytes.

Operating Mode (Panel Switch Operation)

Self-test Mode

In self-test mode, the following items are checked and printed out:

- Control circuit functions
- Printer mechanisms
- Print quality
- Control software ROM version
- DIP switch settings
- Memory switch settings
- Paper width settings

Use the following procedure to start a self-test.

1. First, open the paper roll cover; then close the paper roll cover while presssing and holding down the FEED button until ERROR LED blinks. The printer prints out the various printer states.
2. When all printer states have been printed, make sure that the following message is printed and the PAPER OUT LED blinks.

   If you want to continue SELF-TEST printing, please press FEED button.

   The printer is now in the self-test wait mode.
3. To start a test print, press the FEED button when the printer is in the self-test wait mode.
4. Make sure that the following message is printed.

***** completed *****

The printer will now be initialized and return to normal operating mode.

Hexadecimal Dump Mode

In hexadecimal dump mode, the data transmitted from the host computer is printed in hexadecimal numbers and in their corresponding characters. Use the following procedure to output a hexadecimal dump.

1. With the paper roll cover open, press and hold down the FEED button while turning on the printer.
2. Close the paper roll cover.

   Data received after this is printed in hexadecimal numbers and their corresponding characters.
3. When printing stops, turn off the power, or press the FEED button three times, or perform a reset.

Memory Switch Setting Mode

The following items are specified in the memory switch setting mode:

- ❑ Autocutter operation
- ❑ Serial communication condition
  - Transmission speed
  - Parity
  - Handshaking
  - Data length
- ❑ Interface setting
  - Select receive buffer capacity
  - Condition for BUSY status
  - Data processing when a reception error occurs
- ❑ Automatic line feed
- ❑ Interface reset signal
  - Pin #6: selection of reset signal
  - Pin #25: selection of reset signal

✎ ***Note:***
All new settings will be lost if the power supply is turned off during the memory switch settings mode. Be sure to follow the proper procedure, and turn the power off at the correct time.

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Starting the memory switch setting mode

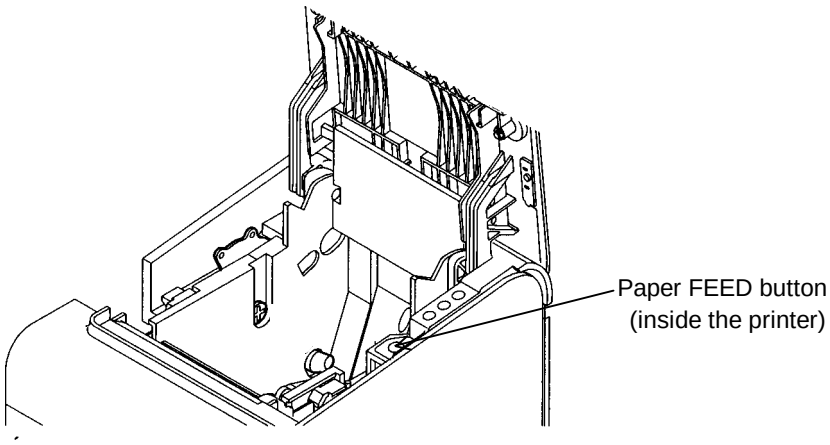
Use the following procedure to start the memory switch setting mode.

1. Open the paper roll cover.
2. Turn the power on while pressing the paper FEED button (located inside the printer).
3. Press the FEED button inside the printer twice while POWER, ERROR, and PAPER OUT LED are lighting.
4. Close the cover.

   The printer is now in the memory switch setting wait mode.
5. Press the FEED button. The printer prints the enabled settings of the memory switches and instructions.
6. Follow the instructions to process the switch settings.

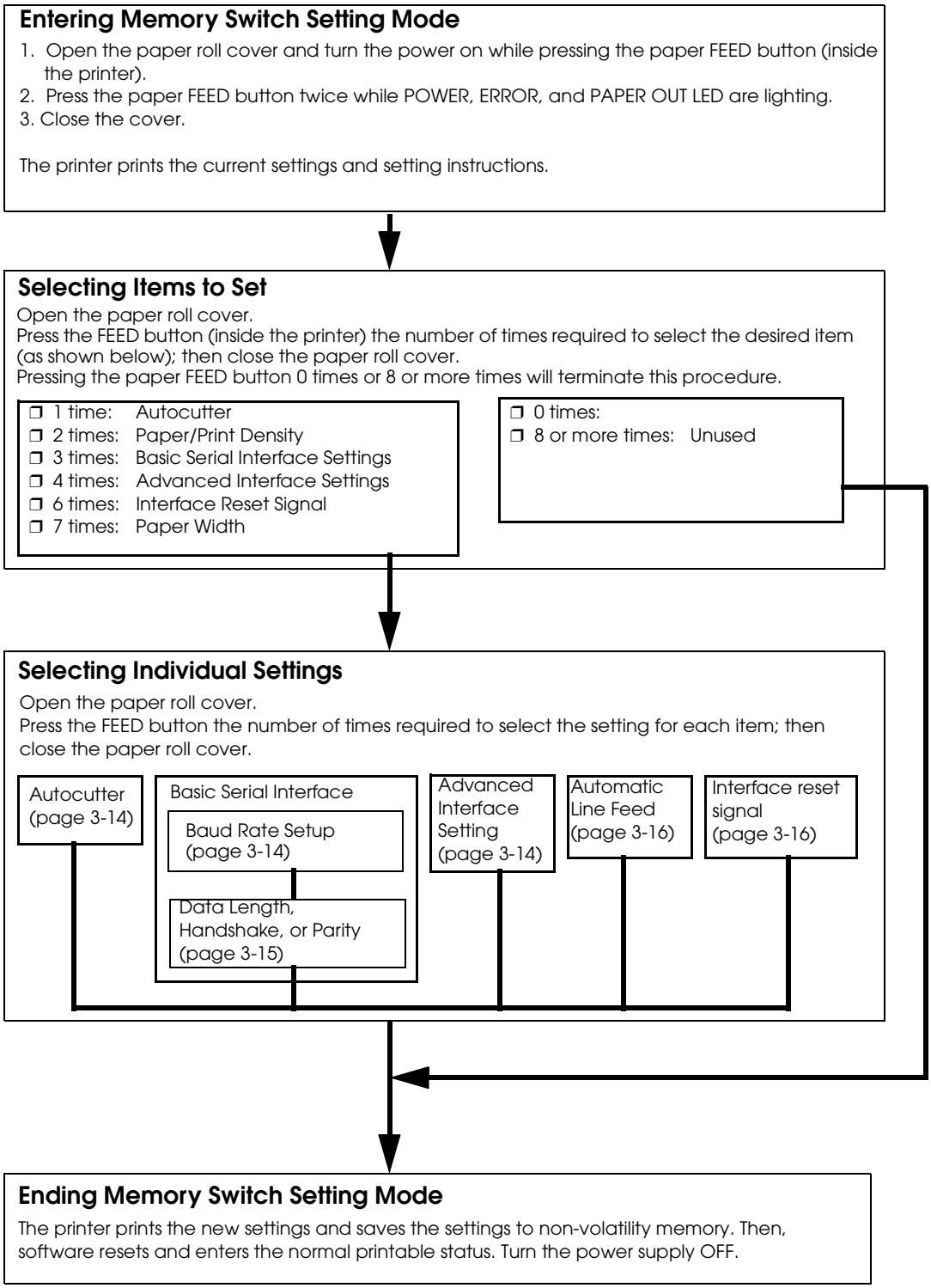
Ending memory switch setting mode

Once the setting is performed, the contents of the setting are stored. Then the printer initializes. When initialization is finished, the printer returns to normal operating mode.



Operating procedure

The procedures used for this process are described below.



Selecting individual settings

❑ Autocutter

Press the FEED button the number of times required to select the desired Autocutter setting.

Press FEED button	Setting to select
0 times:	No change
1 time:	Installed
2 times:	Not Installed
3 or more times:	No change

❑ Basic serial interface setting

To select transmission conditions, first choose "Serial interface settings"; then select "Data length, handshake, or parity."

Press the FEED button the number of times required to select the desired "Serial interface settings" used for transmission conditions.

Press FEED button	Setting selected
0 times:	No change
1 time:	115200 bps
2 times:	57600 bps
3 times:	38400 bps
4 times:	19200 bps
5 times:	9600 bps
6 times:	4800 bps
7 times:	2400 bps
8 or more times:	No change

bps: Indicates the number of transmitted bits per second (bps).

❑ Data length, handshake, or parity

Press the FEED button the number of times required to select the desired "Data length, handshake, or parity" setting used for transmission conditions.

Press FEED button	Setting selected		
	Data Length	**Handshake**	**Parity**
0 times:	No setting is selected		
1 time:	8 bits	DTR/DSR control	No parity
2 times:			Even
3 times:			Odd
4 times:		XON/XOFF control	No parity
5 times:			Even
6 times:			Odd
7 times:	7 bits	DTR/DSR control	No parity
8 times:			Even
9 times:			Odd
10 times:		XON/XOFF control	No parity
11 times:			Even
12 times:			Odd
13 or more times:	Unused		

❑ Transmission-related conditions

Press the FEED button the number of times required to select the desired "Receive buffer size, receive error sequence, or busy condition" setting used for transmission-related conditions.

Press FEED button	Setting selected		
	Receive buffer size	**Receive error sequence**	**BUSY condition**
0 times:	No setting is selected		
1 time:	Large	Change to '?'	Receive buffer full or overrun
2 times:			Receive buffer full
3 times:		Ignore	Receive buffer full or overrun
4 times:			Receive buffer full
5 times:	Small	Change to '?'	Receive buffer full or overrun
6 times:			Receive buffer full
7 times:		Ignore	Receive buffer full or overrun
8 times:			Receive buffer full
9 or more times:	Unused		

❑ Automatic line feed (**CR** command function)

Press the FEED button the number of times required to select the desired auto carriage return setting.

Press FEED button	Setting select ed
0 times:	No change
1 time:	Enabled
2 times:	Disabled
3 or more times:	No change

❑ Interface reset signal

Pins #25 and #6 on the RS-232 I/F circuit board unit (UB-S01/02) are used to input the reset signal. This item is used to "Enable (acknowledge)" or "Disable (not acknowledge)" input of the reset signal from one of these pins. Press the FEED button the number of times required to select the desired interface reset signal setting.

Press FEED button	Setting selected	
	Pin #25	Pin #6
0 times:	No setting is selected	
1 time:	Disable	Disable
2 times:		Enable
3 times:	Enable	Disable
4 times:		Enable
5 times:	Disable	Disable
6 times:		Enable
7 times:	Enable	Disable
8 times:		Enable
9 or more times:	Unused	

Chapter 4

Application Development Information

Development Environment

The following three methods are available for developing applications for a TM printer.

- EPSON OPOS ADK
  Uses OCX controls customized for POS application development.
- EPSON Advanced Windows Driver
  Allows printing from applications on the TM-T90, as with other general printers.
- ESC/POS commands
  Let you control the TM printer directly.

Maintenance Counter and Turning the Power Supply Off

This printer has maintenance counter using the ESC/POS command **GS g 0, GS g 2**.

- The values of the maintenance counter are automatically stored in the NV memory every 2 minutes (or 4 minutes maximum) when the printer is operating, except in the power save mode.
- However if the power off is performed by the power switch or controlled by the host, the printer stores the latest values of the maintenance counter and executes the power off control, regardless of the updating interval described above.
- If the printer isn't sending or receiving data for two seconds or isn't operating while the power is turned on, the printer enters the power-saving mode and all of the values of the maintenance counter including the printer operation time stop counting.

When DIP switch 1-1 is set to OFF, turning the power on and off with the front switch is disabled. In this case, an ESC/POS command is used to turn the power off. See page 3-2.

Setting Paper Width

For the TM-T90, 58/60 mm or 80 mm paper width is available. Set the paper width using the customized value, which is set using the ESC/POS command **GS (E** (Function 5).

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Print Density

It is recommended that you set print density for your paper type to ensure adequate print quality and reliability. If the set density exceeds recommendations, it may lead to print head dirt and blank dot printing. Refer to the table below for information about original paper numbers and density levels. Set the print density using the customized value, which is set using the ESC/POS command **GS (E** (Function 5).

Original paper number and density level <ANK/multilingual model>

Original Paper No.	Density Level
P350	× 0.9
P300, P310, KF50	× 0.95
TF50KS-E, PD170R, PD750R, TF60KS-F1	× 1.0
PD160R	× 1.05
AF50KS-E	× 1.1

Original paper number and density level <Japanese model>

Original Paper No.	Density Level
P350	× 0.9
P300, P310, KF50	× 0.95
TF50KS-E, PD750R, TF60KS-F1	× 1.0
PD160R	× 1.05
PD170R	× 1.1

Divided Head Control

If low power supply capacity is used, transmit **GS (E** (Function 5), and specify 2-4 divided head control. This eliminates the power supply for dots and save current consumption. (The default setting is 1 head control division, which supplies power to all dots at a time.) Print speed slows if you increase the number of divisions. By using **GS (K** (Function 97), you can change head control divisions during printing. You can maintain print speed if you use divided head control printing only for printing a logo or for high density printing.

Note:

- *In order to improve 2-color printing quality, 2 divided head control is recommended for two-color printing.*
- *If 4 divided head control on two-color paper is specified, the black-color density may not be changed.*

Note:

Refer to the ESC/POS Application Programming Guide for how to use the command. Be sure to use in combination with Function 1 and 2, for use with each function of ***GS (E****.*

Bar Code Printing

You can print bar codes, using the **GS k** command for any of the following types of bar codes:

UPC-A, UPC-E
JAN 8 (EAN), JAN 13 (EAN)
CODE 39
ITF (Interleaved 2 of 5)
CODABAR
CODE 93
CODE 128

Bar code height is specified by **GS h**, and width is specified by **GS w**. HRI character-related commands are **GS H** for the position, and **GS f** for font selection.

CODE128 Bar Code

In the CODE128 bar code system, it is possible to represent 128 ASCII characters and 2-digit numerals using one bar code character that is defined by combining one of the 103 bar code characters and 3 code sets. Each code set is used for representing the following characters:

- Code set A: ASCII characters 00H to 5FH
- Code set B: ASCII characters 20H to 7FH
- Code set C: 2-digit numeral characters using one character (100 numerals from 00 to 99)

The following special characters are also available in CODE128:

- SHIFT characters
  In code set A, the character just after SHIFT is processed is a character for code set B. In code set B, the character just after SHIFT is processed is a character for code set A. SHIFT characters cannot be used in code set C.
- Code set selection character (CODE A, CODE B, CODE C)
  This character switches the following code set to code set A, B, or C.
- Function character (FNC1, FNC2, FNC3, FNC4)
  The usage of function characters depends on the application software. In code set C, only FNC1 is available.

Printable characters in code set A

Character	Transmitted Data		Character	Transmitted Data		Character	Transmitted Data	
	Hex	Decimal		Hex	Decimal		Hex	Decimal
NUL	00	0	(	28	40	P	50	80
SOH	01	1	)	29	41	Q	51	81
STX	02	2	*	2A	42	R	52	82
ETX	03	3	+	2B	43	S	53	83
EOT	04	4	,	2C	44	T	54	84
ENQ	05	5	-	2D	45	U	55	85
ACK	06	6	.	2E	46	V	56	86
BEL	07	7	/	2F	47	W	57	87
BS	08	8	0	30	48	X	58	88
HT	09	9	1	31	49	Y	59	89
LF	0A	10	2	32	50	Z	5A	90
VT	0B	11	3	33	51	(	5B	91
FF	0C	12	4	34	52	\	5C	92
CR	0D	13	5	35	53	)	5D	93
SO	0E	14	6	36	54	^	5E	94
SI	0F	15	7	37	55	_	5F	95
DLE	10	16	8	38	56	FNC1	7B, 31	123, 49
DC1	11	17	9	39	57	FNC2	7B, 32	123, 50
DC2	12	18	:	3A	58	FNC3	7B, 33	123, 51
DC3	13	19	;	3B	59	FNC4	7B, 34	123, 52
DC4	14	20	<	3C	60	SHIFT	7B, 53	123, 83
NAK	15	21	=	3D	61	CODEB	7B, 42	123, 66
SYN	16	22	>	3E	62	CODEC	7B, 43	123, 67
ETB	17	23	?	3F	63			
CAN	18	24	@	40	64			
EM	19	25	A	41	65			
SUB	1A	26	B	42	66			
ESC	1B	27	C	43	67			
FS	1C	28	D	44	68			
GS	1D	29	E	45	69			
RS	1E	30	F	46	70			
US	1F	31	G	47	71			
SP	20	32	H	48	72			
!	21	33	I	49	73			
"	22	34	J	4A	74			
#	23	35	K	4B	75			
$	24	36	L	4C	76			
%	25	37	M	4D	77			
&	26	38	N	4E	78			
'	27	39	O	4F	79			

Printable characters in code set B

Character	Transmitted Data		Character	Transmitted Data		Character	Transmitted Data	
	Hex	Decimal		Hex	Decimal		Hex	Decimal
SP	20	32	H	48	72	p	70	112
!	21	33	I	49	73	q	71	113
"	22	34	J	4A	74	r	72	114
#	23	35	K	4B	75	s	73	115
$	24	36	L	4C	76	t	74	116
%	25	37	M	4D	77	u	75	117
&	26	38	N	4E	78	v	76	118
'	27	39	O	4F	79	w	77	119
(	28	40	P	50	80	x	78	120
)	29	41	Q	51	81	y	79	121
*	2A	42	R	52	82	z	7A	122
+	2B	43	S	53	83	{	7B,7B	123,123
,	2C	44	T	54	84	|	7C	124
_	2D	45	U	55	85	}	7D	125
.	2E	46	V	56	86	—	7E	126
/	2F	47	W	57	87	DEL	7F	127
0	30	48	X	58	88	FNC1	7B, 31	123, 49
1	31	49	Y	59	89	FNC2	7B, 32	123, 50
2	32	50	Z	5A	90	FNC3	7B, 33	123, 51
3	33	51	(	5B	91	FNC4	7B, 34	123, 52
4	34	52	\	5C	92	SHIFT	7B, 53	123, 83
5	35	53	)	5D	93	CODEA	7B, 41	123, 66
6	36	54	^	5E	94	CODEC	7B, 43	123, 67
7	37	55	_	5F	95			
8	38	56	`	60	96			
9	39	57	a	61	97			
:	3A	58	b	62	98			
;	3B	59	c	63	99			
<	3C	60	d	64	100			
=	3D	61	e	65	101			
>	3E	62	f	66	102			
?	3F	63	g	67	103			
@	40	64	h	68	104			
A	41	65	i	69	105			
B	42	66	j	6A	106			
C	43	67	k	6B	107			
D	44	68	l	6C	108			
E	45	69	m	6D	109			
F	46	70	n	6E	110			
G	47	71	o	6F	111			

Printable characters in code set C

Character	Transmitted Data		Character	Transmitted Data		Character	Transmitted Data	
	Hex	Decimal		Hex	Decimal		Hex	Decimal
00	00	0	40	28	40	80	50	80
01	01	1	41	29	41	81	51	81
02	02	2	42	2A	42	82	52	82
03	03	3	43	2B	43	83	53	83
04	04	4	44	2C	44	84	54	84
05	05	5	45	2D	45	85	55	85
06	06	6	46	2E	46	86	56	86
07	07	7	47	2F	47	87	57	87
08	08	8	48	30	48	88	58	88
09	09	9	49	31	49	89	59	89
10	0A	10	50	32	50	90	5A	90
11	0B	11	51	33	51	91	5B	91
12	0C	12	52	34	52	92	5C	92
13	0D	13	53	35	53	93	5D	93
14	0E	14	54	36	54	94	5E	94
15	0F	15	55	37	55	95	5F	95
16	10	16	56	38	56	96	60	96
17	11	17	57	39	57	97	61	97
18	12	18	58	3A	58	98	62	98
19	13	19	59	3B	59	99	63	99
20	14	20	60	3C	60	FNC1	7B, 31	123, 49
21	15	21	61	3D	61	CODEA	7B, 41	123, 65
22	16	22	62	3E	62	CODEB	7B, 42	123, 66
23	17	23	63	3F	63			
24	18	24	64	40	64			
25	19	25	65	41	65			
26	1A	26	66	42	66			
27	1B	27	67	43	67			
28	1C	28	68	44	68			
29	1D	29	69	45	69			
30	1E	30	70	46	70			
31	1F	31	71	47	71			
32	20	32	72	48	72			
33	21	33	73	49	73			
34	22	34	74	4A	74			
35	23	35	75	4B	75			
36	24	36	76	4C	76			
37	25	37	77	4D	77			
38	26	38	78	4E	78			
39	27	39	79	4F	79			

Notes on Printing 2-Dimensional Codes

The TM-T90 supports 2-dimensional code printing. Be sure to follow the notes below when printing 2-dimensional codes.

- ❑ When printing PDF417 (2-dimensional code), it is recommended to set the height of one module of the symbol to three to five times the width of one module, also making sure that the total height is almost 5 mm {0.2"} or more.
- ❑ The recognition rate of the 2-dimensional code may be affected by such items as different widths of the modules, print density, environmental temperature, type of the thermal paper, and characteristics of the reader. Therefore, the user should check the recognition rate in advance so that the limitations of the reader can be considered.

2-color Printing

Color selection can be made with the commands **GS (L** and **GS (N**. The functions of these commands are as follows:

GS (N
Used with character data. It affects each character. The character color can be specified on a character-by-character basis.

GS (L
Affects the graphics data defined by **GS (L**.

✎ ***Note:***
The second color may fade. Printing using the 1st color is recommended for printing that needs preservation.

- *The 1st color: Black in a two-color thermal paper specification*
- *The 2nd color: Red in a two-color thermal paper specification*

Printer Status

To get the printer status, the following commands are available.

	Printer status
ASB (auto status back)	**GS a**
Real-time status	**DLE EOT**
Status	**GS r**

For reference, differences between those 3 statuses are:

- ASB:
  When processed as a normal command, the printer automatically transmits a status message whenever the status changes. It is always necessary to check the ASB status.
- Real-time status:
  When the printer receives this command, it responds with the specified printer status. Reporting the printer status takes priority over any normal print data. The printer also stores the code string of the command in the receive buffer as a part of bit-image data.

- Status:
  The printer transmits specified printer status in the same way it processes normal print data.

NV Memory

The NV memory of the printer can be roughly divided into 3 parts.

- Firmware program area.
- NV memory area for product information. (The user cannot edit this.)
- NV memory area that user can access.

The following are features of the NV memory that the user can access.

a) Memory switches: using command **GS (E**
(MSW1, MSW2, MSW8, and customized values such as the paper width, serial communication conditions.)

b) User NV memory: using command **GS (C**

c) NV graphics memory: using commands **GS (L, GS 8L**

d) User defined code page (Page 255 (space page)) : using command **GS (E**

e) Area for command default values specified by users: using command **GS (M**

By changing these values, you can customize your printer.

The following table shows the memory combinations that can be specified with NV graphics. If any other combination is specified, the NV graphics memory value is adjusted to the suitable value from the combinations.

User NV memory	NV graphics memory
1 K byte	**less than 384 K bytes**
64 K bytes	**less than 256 K bytes**
128 K bytes	**less than 128 K bytes**
192 K bytes	**0 byte**

Note the following when writing to and erasing NV memory.

❑ The following restrictions apply when performing NV memory operations (including data storage and deletion).

- The paper FEED switch must not be used to feed paper.
- The real-time command must not be executed.
- The ASB status will not be sent, even when the ASB function is set to enabled.

- The printer sometimes enters the Busy state while data is written to NV memory. It is important not to send data from the host computer while the printer is in the Busy state, as it will be incapable of processing any received data.

- Frequent use of the functions for defining data to and deleting data from NV memory can damage the memory. As a rule in using the various commands (functions of the **GS (C**, **GS (E**, **GS (L**, **GS (M**, and the **GS g 0** commands), avoid writing to NV memory more than a 10 times per day.

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Customizing the Printer

You can customize your TM printer by changing the memory switches and the command default values and saving the data into the NV (non-volatile) memory. Refer to the commands **GS (E** and **GS (M** in next section.

Initial printer setup

Initial setup printer can be made using memory switches and DIP switches. The relevant command is **GS (E**. See page 2-10 for details about memory switch definitions.

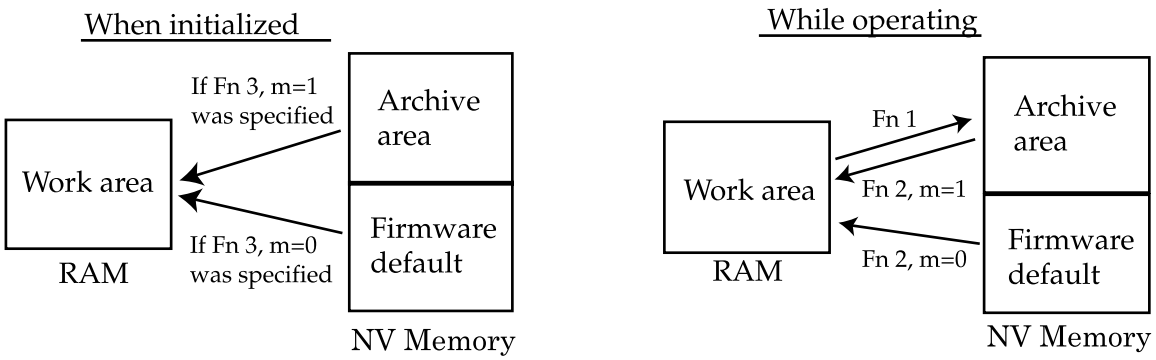
Changing command default values

You can customize your TM by changing the command default values and saving the data into the NV memory. The relevant command is the **GS (M**, and some sub-functions are shown below:

Function 1: Saves the setting values in the work area to the archive area.

Function 2: Loads the values to the work area.
when parameter m = 0: Loads the firmware default values to the work area.
when parameter m = 1: Loads the stored values in the archive area to the work area.

Function 3: Selects or cancels the auto-load process for the values stored in the archive area.
when parameter m = 0: Cancels the auto-load process. The firmware default values are loaded to the work area when the printer is initialized.
when parameter m = 1: Specifies the auto-load process. The values stored in the archive area is loaded to the work area when the printer is initialized.



These functions affect status commands, character-related commands, bar-code related commands, print position-related commands, and so on.

Using the NV Memory

There is free area in the NV memory that the user can use. You can use this free area for notations, to write other character information, or for many other purposes. The data remains after you turn off the power. Use **GS (C** to read and write this data.

Graphics Printing

Graphics printing is supported by the following commands.

- NV graphics command **GS (L** and **GS 8L**.

You can use other commands shown below, which are also available in previous printer models. However, EPSON recommends using **GS (L** and **GS 8L**.

- Download bit image commands **GS *** and **GS /**.
- Raster bit image command **GS v 0**.
- Normal bit image command **ESC ***.

The main characteristics are as follows.

NV graphics **GS (L** and **GS 8L**	EPSON recommends use of these comprehensive commands for NV bit images, downloaded bit images, and other conventional bitmap image functions. For the TM-T90, two-color graphics printing is available. Executing one of these commands deletes the definition data for NV bit images and downloaded bit images.
Download bit images **GS *** and **GS /**	These commands function to read bit image data temporarily from memory and print it. There is size limitation, and data is cleared by reset or power off. However, if you print a bit image many times, its data is downloaded only one time. After that high-speed printing is available. However, only one bit image can be registered.
Raster bit images **GS V 0**	For a normal bit image, this specifies each columnar 8-bit data byte, but a printer using a thermal printing mechanism has poor performance using this command. On the other hand, **GS V 0** specifies data horizontally and enables increased printing speed.
Bit images **ESC ***	Printing method for a normal bit image. There is no size limitation, but the user needs to send data every time. Printers with a thermal printing mechanism have to store each line of data, and this slows printing speed.

Differences between GS (L and GS 8 L

❏ All commands possess the same functions for "Graphics data processing."

❏ Specifications (conventions) concerning the function code (**fn**) are identical, while only the parameters (**pL**, **pH**, **p1**, **p2**, **p3** and **p4**) used to specify the parameter values from **m** on differ.

Command	Description
GS (L	The parameter value is 2 bytes less than that for **GS 8 L**. Used to fix the parameter value. Used when sending data divided into blocks.
GS 8 L	Possesses a powerful range of expression. Used for batch transfer of large volumes of data.

- Be sure to use **GS 8 L** when the parameter value exceeds 65535 bytes for Functions 67 and 112.

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"GS ("Command Group

For extended use in the future, the **GS (** command group has been constructed so that various parameters can be specified. Here is an explanation of a basic rule for specifying parameters for these commands.

GS (x pL pH(d1 d2 d3...dk)

- The parameter *x* represents a character such as "A," "B," or "C" in the command name.
- ***pL, pH*** specify the number of bytes after ***pH (d1 d2 d3...dk)***.
- The number of bytes can be calculated by ***pL*** + ***pH*** × 256; therefore, up to 65535 bytes can be specified. However, the maximum number of bytes will differ, depending on the command or function specified. Refer to each command description for details.

The following shows how to specify parameters for Function 1 of the **GS (C** command.

GS (C pL pH m a b (c1, c2) (d1...dk) *(Edit User NV Memory)*

Function 1: stores data in NV memory specified by ***GS (C pL pH m a b c1 c2 d1...dk***

- Specified parameters:

  - ***m*** = 0 (fixed)
  - ***a*** = 1 or 49 (either is fixed)
  - ***b*** = 0 (fixed)
  - ***c1*** = 32 to 126
  - ***c2*** = 32 to 126

  c1 and ***c2*** consist of any 2 bytes with ASCII codes from 32 to 126, and they are key codes for data control.

  - ***dk*** = 32 to 254

  Data corresponds to ASCII codes from 32 to 254.

- Example: The key code is "MK" and the data is "EPSON"

GS (C	***10***	***0***	***0***	***1***	***0***	***"MK"***	***"EPSON"***
	pL	***pH***	***m***	***a***	***b***	***c1c2***	***d1 d2 d3 d4 d5***

Note:
pL, pH specify the total number of bytes for the parameters; therefore the total number of bytes is 10 and pL = 10, pH = 0 (10 + 0 × 256 = 10)

Commands List

Refer to the ESC/POS Application Programming Guide for a command reference.

Command	Name
HT	Horizontal tab
LF	Print and line feed
FF	Print data in page mode and change to standard mode
CR	Print and carriage return
CAN	Cancel print data in page mode
DLE EOT	Real-time status transmission
DLE ENQ	Real-time request to printer
DLE DC4	Generate real-time pulse
	Execute power-off sequence
	Clear buffer
ESC FF	Print data in page mode
ESC SP	Set right-side character spacing
ESC !	Select print mode(s)
ESC $	Set absolute print position
ESC %	Select/cancel user-defined character set
ESC &	Define user-defined characters
ESC *	Select bit-image mode
ESC –	Turn underline mode on/off
ESC 2	Select default line spacing
ESC 3	Set line spacing
ESC =	Select peripheral device
ESC ?	Cancel user-defined characters
ESC @	Initialize printer
ESC D	Set horizontal tab positions
ESC E	Turn emphasized mode on/off
ESC G	Turn double-strike mode on/off
ESC J	Print and feed paper
ESC L	Select page mode
ESC M	Select character font
ESC R	Select an international character set
ESC S	Select standard mode
ESC T	Select print direction in page mode
ESC V	Turn 90° clockwise rotation mode on/off
ESC W	Set print area in page mode
ESC \	Set relative print position
ESC a	Select justification
ESC c 3	Select paper sensor(s) to output paper-end signals
ESC c 4	Select paper sensor(s) to stop printing
ESC c 5	Enable/disable panel buttons
ESC d	Print and feed ***n*** lines
ESC p	Generate pulse
ESC t	Select character code table
ESC {	Turn upside-down printing mode on/off
FS p	Prints an NV bit image ***n*** in m mode
FS q	Defines the specified NV bit image

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Command	Name
GS !	Select character size
GS $	Set absolute vertical print position in page mode
GS (A	Execute test print
GS (C	Edit NV user memory
	Function 0: Delete the specified record.
	Function 1: Store data in the specified record.
	Function 2: Send data in the specified record.
	Function 3: Send the number of bytes of memory used.
	Function 4: Send the number of bytes of remaining memory (unused area).
	Function 5: Transmit the key code list identifying the stored data.
	Function 6: Delete all data in the NV user memory.
GS (D	Enable/disable real-time commands
GS (E	User setup commands
	Function 1: Enable user selection mode.
	Function 2: Terminate user selection mode (by software reset).
	Function 3: Select memory switch values.
	Function 4: Send memory switch values.
	Function 5: Enter customized values.
	Function 6: Send customized values.
	Function 7: Copy user-defined page.
	Function 8: Define data to character code pages in work area using column format.
	Function 9: Define data to character code pages in work area using raster format.
	Function 10: Delete the data from character code pages in work area.
	Function 11: Select transmission settings for serial interface.
	Function 12: Send transmission settings for serial interface.
GS (K	Select printing control method
	Function 48: Specify the print control mode.
	Function 49: Specify the print density.
	Function 97: Specify the number of parts for energizing the head.
GS (L	Set graphics data
	Function 48: Transmit the NV graphics memory capacity.
	Function 50: Print the graphics data in the print buffer.
	Function 51: Transmit the remaining capacity of the NV graphics memory.
	Function 64: Transmit the defined NV graphics key code list.
	Function 65: Delete all NV graphics data.
	Function 66: Delete the specified NV graphics data.
	Function 67: Define the raster graphics data in the NV memory.
	Function 69: Print the specified NV graphics data.
	Function 112: Store the raster graphics data in the print buffer memory.
GS (M	Customize printer control value(s)
	Function 1: Copy the settings stored in the active area to the storage area (save settings).
	Function 2: Copy the settings stored in the storage area to the active area (load settings).
	Function 3: Enable or disable automatic loading of the settings upon initialization.
GS (N	Select character style(s)
	Function 48: Select character color.
GS (k	Setup and print symbol
	Function 065: Set the number of columns of the data area for PDF417.
	Function 066: Set the number of rows of data area for PDF417.
	Function 067: Set the module width of one PDF417 symbol to *n* dots.
	Function 068: Set the module height.
	Function 069: Set the error correction level for PDF417 symbols.
	Function 070: Specify or cancel various PDF417 symbol options.
	Function 080: Store symbol data in the PDF417 symbol storage area.
	Function 081: Print the PDF417 symbol data in the symbol storage area.
	Function 082: Transmit the size of the symbol data in the symbol storage area.
GS *	Define downloaded bit image
GS /	Print downloaded bit image
GS :	Start/end macro definition
GS B	Turn white/black reverse printing mode on/off
GS H	Select print position of HRI characters
GS I	Transmit printer ID
GS L	Set left margin

GS P	Set horizontal and vertical motion units
GS T	Set print position to the beginning of the print line
GS V	Select cut mode and cut paper
GS W	Set printing area width
GS \	Set relative vertical print position in page mode
GS ^	Execute macro
GS a	Enable/disable Automatic Status Back (ASB)
GS b	Turn smoothing mode on/off
GS f	Select font for HRI characters
GS g 0	Initialize maintenance counter
GS g 2	Transmit maintenance counter
GS h	Set bar code height
GS k	Print bar code
GS r	Transmit status
GS v 0	Print raster bit image
GS w	Set bar code width

Kanji Command List

These commands are used only for the Japanese, Simplified Chinese, Traditional Chinese, or Korean model.

Command	Name
FS !	Set print model(s) for Kanji characters
FS &	Select Kanji character mode
FS (A	Select Kanji character style(s)
	Function 48: Select the type of the Kanji font.
FS -	Turn underline mode on/off for Kanji characters
FS .	Cancel Kanji character mode
FS 2	Define user-defined Kanji character
FS C	Select Kanji character code system
FS S	Set left- and right-side Kanji character spacing
FS W	Turn quadruple-size mode on/off for Kanji characters

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Command Comparison of TM-T90 and TM-T88II

Comparison of commands

Command	TM-T90 original	TM-T88II compatible mode (MSW 8-7 On)	TM-T88II
DLE EOT	1. Adds the following bits to printer status (when *n* = 1) Bit 5: Not waiting for online recovery/waiting for online recovery. Bit 6: Paper FEED button not being pressed/ paper FEED button being pressed. 2. Adds the following bits to the error code status (when *n* = 3) Bit 2: Mechanical error has not occurred/ has occurred	In TM-T88II-compatible mode, bit 2 is always 0, because a cover open error during printing is an automatically recoverable error.	1. Printer status (when *n* = 1) Bit 5: Undefined. Bit 6: Undefined. 2. Error cause status (when *n* = 3) Bit 2: Undefined
DLE ENQ	*n* = 0: Adds cancellation of waiting for online recovery status.	←	
DLE DC4 (2)	New command	←	—
ESC &	User-defined characters and user-defined bit-images can be defined simultaneously (the size is the same as before). When the command is executed, the definition of a user-defined bit-image is not cleared.	→	User-defined characters and user-defined bit-images cannot be defined simultaneously. When the command is executed, the definition of any user-defined bit-image is cleared.
ESC =	Range: 1 ≤ *n* ≤ 3	→	Range: 0 ≤ *n* ≤ 255
ESC @	Executes reading of the default values customized for the printer.	←	
ESC V	Adds to the range, *n* = 2, 50 (operation is the same as when *n* = 1, 49). Range: 0 ≤ *n* ≤ 2, 48 ≤ *n* ≤ 50	←	Range: 0 ≤ *n* ≤1, 48 ≤ *n* ≤ 49
ESC W	Default vertical length: approx. 117.3 mm {4.62"}. Maximum value for vertical length: approx. 234.5 mm {9.23"}. Vertical length is 117.3 mm {4.62"} when 2-color paper is selected by customized value (*a* = 116) (when paper width is 58 mm {2.28"}). Default horizontal length: approx. 50.8 mm {2"}. (when paper width is 60 mm {2.36"}). Default horizontal length: approx. 54.2 mm {2.13"}.	←	Default vertical length: approx. 117.3 mm {4.62"}. Maximum value for vertical length: approx. 117.3 mm {4.62"} (when paper width is 58 mm {2.28"}). Default horizontal length: approx. 50.8 mm {2"}.
ESC c 0	Ignored (This printer ignores this command and the following parameter.)	→	Disabled (This printer ignores this command, but the printer accepts the following parameter.)
ESC c 1	Ignored (This printer ignores this command and the following parameter.)	→	Disabled (This printer ignores this command, but the printer accepts the following parameter.)
ESC c 3	Default *n* = 0	→	Default *n* = 15

Comparison of commands

ESC c 6	Ignored (This printer ignores this command and the following parameter.)	←	Ignored (This printer ignores this command and the following parameter.)
ESC t	Adds 16 to 18 to available range for "*n*" Range: $0 \le n \le 5$, $16 \le n \le 19$, $n = 255$	←	Range: $0 \le n \le 5$, $n = 19$ (*1), $20 \le n \le 26$ (*2), $n = 255$ (*1) Applies only to ROMs ver. 3.14 or later (*2) Supported only for Thai characters
FS q	Defined range: 0 to 384KB selectable NV bit-image memory is specified by **GS (E** command (default: 384KB) Maximum defined area: 3M bits (384KB)	←	All defined area: 2M bits (256KB) fixed
GS (D	Newly added.	←	
GS (E	Newly added.	←	
GS (K	Newly added.	The default head division number is 2.	
GS (L	Newly added.	←	
GS (M	Newly added. Customizes default values for the printer.	←	Initialization resets the values to their defaults.
GS (N	Newly added.	←	—
GS (k	Newly added.	←	—
GS *	User-defined characters and user-defined bit-images can be defined simultaneously (the size is the same as before).	→	User-defined characters and user-defined bit-images cannot be defined simultaneously. When the command is executed, the definition of any user-defined bit-image is cleared.
GS I	Transmits the printer name and ID. The status of DIP switches transmitted by $n = 112$ or $n = 113$.	Product ID: 32 Version ID: 70	
GS T	Newly added.	←	
GS V	Adds to the range, $n = 0, 48, 65$. This change relates to the printer specification. The function has not been changed. Range: ① $0 \le n \le 5$, $48 \le m \le 49$ ② $65 \le m \le 66$, $0 \le n \le 255$	←	Range: ① $m = 1, 49$ ② $m = 66$, $0 \le n \le 255$
GS W	Default: $nL = 0$, $nH = 2$ When paper width is 60 mm: $nL = 128$, $nH = 1$	←	Default: $nL = 0$, $nH = 2$ When paper width is 58 mm: $nL = 104$, $nH = 1$

Comparison of commands

GS a	Adds panel switch status to the ASB status. ① The following bits are added to the second byte (printer information): Bit 0: Not waiting for online recovery/waiting for online recovery	The ASB for the panel switch status is always disabled (cannot be set). In the TM-T88II-compatible mode, since a cover open error during printing is an automatically recoverable error, the second bit of the second byte is always 0.	②The second byte (printer information) Bit 0: Undefined Bit 1: Undefined. Bit 2: Undefined.
GS g 0	Newly added.	←	
GS g 2	Newly added.	←	
GS v 0	Printable height of an image: 4095 dots (size in the vertical direction) Range: $0 \le vL \le 255$, $0 \le vH \le 15$	←	Printable height of an image: 2303 dots (size in the vertical direction) Range: $0 \le vL \le 255$, $0 \le vH \le 8$
Other	Even if a data string is being transmitted, the transmission will stop when the host outputs a BUSY signal. A cover open error during printing follows the setting of MSW 8-8. (Default: recoverable error).	→ →	Once transmission of a data string has started, the transmission continues even if the host outputs a BUSY. A cover open error during printing is an automatically recoverable error.

FAQ List

The questions shown in the list below begin with "Q" and their replies with "A."

1. Sentences beginning with "Q" provide information relating to a question or problem.
2. The instructions described in the "A" sentence below it answer the question or solve the problem.

Abnormal Print Results

Q: The printer does not print according to the selected program settings.

A: Check the hexadecimal dump to confirm whether data was received properly.

The hexadecimal dump is designed to output received data in its original format. Output the data from the hexadecimal dump and compare it with the sent data.

Confirmation procedure

1. Output the contents of the hexadecimal dump. (Refer to the section below, "Outputting contents of a hexadecimal dump.")
2. Compare that with the sent data.
3. If the data from the hexadecimal dump matches the sent data, proceed to "Corrective procedure" below.

Corrective procedure

Begin by confirming that the correct command procedure was followed.
(Refer to the "ESC/POS Application Programming Guide.")

Outputting contents of a hexadecimal dump

Use the following procedures to view the contents of the hexadecimal dump.

1. With the paper roll cover open, press and hold the FEED button; then press the power switch.
2. Close the paper roll cover.

The received data will now be printed in both hexadecimal and character formats.

3. When printing completes, power off the printer.

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Q: Print data dropout occurs.

A: Check the handshake process.

Data dropout can occur when the handshake between the host computer and the printer is not performed correctly. This can result in errors related to print buffer capacity.

Confirmation procedure

Use the following steps to check the handshake process.

1. Select a comparatively large volume of data for printing and send it to the printer.
2. Disable the online state by opening the printer cover while the printer is printing.
3. Check the data send operation.
   - If data send terminates: Handshake process is normal.
   - If data send continues: Handshake process is abnormal.
4. If you find the handshake process to be abnormal, follow the steps listed in "Corrective procedure" below and re-enter host unit and printer settings so that they match.

Corrective procedure

1. Confirm the serial communication cable.
   Confirm the specification for the cable connection. See "Connection Form and Cables" on page 2-2.
2. Confirm the conditions for serial communication.
   Confirm the serial communication conditions set for the printer and the host.
   serial communication conditions
   - Baud rate
   - Parity
   - Flow control
   - Data length

You can confirm the setting for the printer as follows.

1. Confirm serial communication condition of the printer by running a self-test (see page 3-10).
2. Confirm DIP SW 1-2.
   The printer serial communication conditions can be set using the DIP switches and memory switches. When you power on the printer, it checks DIP SW 1-2 and selects whether to use the DIP switch settings or memory switch settings as the initial communication condition. The selected setting is printed by the self-test.

   DIP SW1-2 OFF: Uses communication conditions set by the memory switches.
   ON: Uses communication condition set by the DIP switches.

3. Set communication conditions
   When DIP SW1-2 is ON
   Follow the procedures for setting the DIP switches (see page 2-9) and set.

   When DIP SW1-2 is OFF
   Follow the procedures for setting the serial communication conditions using the memory switches (see page 2-10) and set. You can set either by printer panel operation or **GS (E**. Refer to "Operating Mode (Panel Switch Operation)" on page 3-10.

Q . Drawer kick does not operate properly.

A . Drawer specifications differ, depending on the manufacturer and the part number.

Refer to "Drawer kick connector" in Appendix A and confirm connector pin assignments. Make sure that the specifications of the drawer to be used meet the following conditions before connecting it to the drawer kick-out connector. These conditions also apply to any other devices that use the drawer kick-out connector. Any devices that do not satisfy all the following conditions must not be used.

[Conditions]

- A load must be provided between drawer kick-out connector pins 4 and 2 or between pins 4 and 5. (*1)
- When the drawer open/close signal is used, a switch must be provided between drawer kick-out connector pins 3 and 6. (*2)
- The resistance of the load must be 24 W or more, or the input current must be 1 A or less. (*3)
- Be sure to use drawer kick-out connector pin 4 (24 V power output) to drive the device. Never connect any other power supply to the drawer kick-out connector. (*4)

NOTES:

(*1) Operating the printer with incorrectly installed devices voids the warranty.

(*2) Connecting devices other than the drawer open/close switch voids the warranty.

(*3) If a device with a resistance of less than 24 Ω or an input current of over 1 A is used, the resulting overcurrent may damage the device.

(*4) Connecting a power supply other than that specified voids the warranty.

Q. Unable to recover from a recoverable error state even after executing DLE ENQ.

A. When the printer is BUSY state due to recoverable error, you cannot execute command. Check below points.

- ❑ Set MSW1-3 to ON, and the BUSY condition is "When receive buffer is full." (The default setting is OFF, and the BUSY condition is "When offline or receive buffer full.")
  Refer to "Selecting conditions that invoke a BUSY state" in Chapter 3.

- ❑ Even if MSW1-3 is set to ON, under receive buffer full condition, data cannot be received.
  Refer to "Notes on setting memory switch MSW1-3 to ON" in Chapter 3.

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Q. Unable to print a part of Page 0 (for example, ä, ü, ë) in Visual Basic.

A. When programming with Visual Basic, limitations prevent data from 81h through 9Fh and from E0h through FEh from being sent as characters. However, you can use the following procedure to send this data.

```
Dim Send_ data(0) As Byte
Send_data(0) = &h81 '1 byte of sending data
MSComm1.Output = Send_data
```

Appendix A

Interfaces and Connectors

RS-232 Serial Interface

Interface board specifications (RS-232 standard)

Item		Specifications
Data transfer method		Serial
Synchronization		Asynchronous
Handshaking		Select one of the following using DIP switch 3 or the memory switches (control panel operation or command "**GS (E**"). ❏ DTR/DSR ❏ XON/XOFF
Signal level	MARK	–3 V to –15 V logic 1 = On
	SPACE	+3 V to +15 V logic 0 = Off
Bit length		Select one of the following using DIP switch 4 or the memory switches (control panel operation or command "**GS (E**"). ❏ 7 bit ❏ 8 bit
Baud rate		Select one of the following using DIP switches 7/8 or the memory switches (control panel operation or command "**GS (E**"). ❏ 115200 bps ❏ 57600 bps (cannot be set using the DIP switches) ❏ 38400 bps ❏ 19200 bps ❏ 9600 bps ❏ 4800 bps (cannot be set using the DIP switches) ❏ 2400 bps (cannot be set using the DIP switches) (bps: bits per second)
Parity check		Select one of the following using DIP switch 5 or the memory switches (control panel operation or command "**GS (E**"). ❏ None ❏ Yes ❏ No
Parity selection		Select one of the following using DIP switch 6 or the memory switches (control panel operation or command "**GS (E**"). ❏ Even ❏ Odd
Stop bit		1 or more bits However, the stop bit for data transferred from the printer is fixed at 1 bit.
Connector	Printer side	D-sub 25-pin (female) connector

Functions of each connector pin

Pin no.	Signal name	Signal direction	Function
1	FG	—	Frame ground
2	TXD	Output	Transfer data
3	RXD	Input	Reception data
4	RTS	Output	Memory Switch MSW 1-6 OFF:Same as DTR signal (pin 20) Memory Switch MSW 1-6 ON: Logical product of DTR signals for DM-D and TM (if both are SPACE, the printer can receive data (SPACE).)
6	DSR	Input	This signal indicates whether the host computer can receive data. SPACE indicates the host computer can receive data, and MARK indicates the host computer cannot receive data. When DTR/DSR control is selected, the printer transmits data after confirming this signal. When XON/XOFF control is selected, the printer does not check this signal. Changing the setting for memory switch 1-7 enables this signal to be used as a reset signal for the printer. When used as reset signal for printer, the printer is reset when the signal remains MARK for 1 ms or more.
7	SG	—	Signal ground
20	DTR	Output	1) When DTR/DSR control is selected, this signal indicates whether the printer is BUSY. SPACE indicates that the printer is ready to receive data, and MARK indicates that the printer is BUSY. The BUSY condition can be changed by using memory switch 1-3. (Refer to BUSY state on page 3-9.) 2) When XON/XOFF control is selected, this signal indicates whether the printer is correctly connected and is ready to receive data. SPACE indicates that the printer is ready to receive data. The signal is always SPACE, except in the following cases: • During the period from when the power is turned on to when the printer is ready to receive data. • During the self-test
25	INIT	Input	Changing the setting for memory switch 1-8 enables this signal to be used as a reset signal for the printer. When you use this signal as a reset signal for the printer, the printer is reset when the signal remains SPACE for 1 ms or more.

XON/XOFF

When XON/XOFF control is selected, the printer transmits XON or XOFF signals as follows. Transmission timing differs depending on the setting of memory switch 1-3.

	Printer status	Memory Switch 1-3	
		ON	OFF
XON	1) When the printer goes online after turning on the power (or reset using interface)	Transmits	Transmits
	2) When the receive buffer is released from the buffer full state	Transmits	Transmits
	3) When the printer switches from offline to online	—	Transmits
	4) When the printer recovers from an error using the **DLE ENQ 1** or **DLE ENQ 2** commands	—	Transmits
XOFF	5) When the receive buffer becomes full	Transmits	Transmits
	6) When the printer switches from online to offline	—	Transmits

Code

The XON/XOFF codes are shown below.

- XON code: 11H
- XOFF code: 13H

Note:
When the printer goes from offline to online mode and the receive buffer is full, XON is not transferred.

When the printer goes from online to offline mode and the receive buffer is full, XOFF is not transferred.

When memory switch MSW 1-3 is off, XON is not transferred as long as the printer is offline even if a receive buffer full state has been cleared.

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Resetting the printer using the interface

The printer can be reset using interface pins 6 and 25 by changing the DIP switch setting.

Reset switching

Signal Line	Memory Switch	Reset Condition
Pin 6 (DSR)	MSW 1-7: ON	MARK level input
Pin 25 (INIT)	MSW 1-8: ON	SPACE or TTL-HIGH level input

To reset the printer, the following requirements must be satisfied.

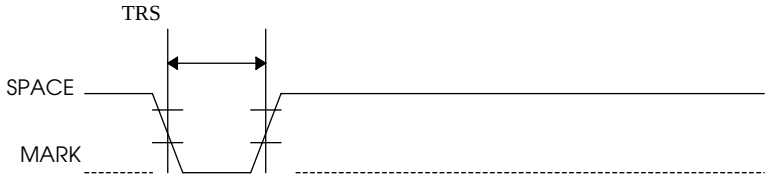
❑ DC characteristics:

Reset DC characteristics

		Pin 6 (DSR)	Pin 25 (INIT)
Input HIGH voltage	VHI	–15 to +3 V	+2 to +15 V
Input LOW voltage	VIL	+3 to +15 V	–15 to + 0.8 V
Input HIGH current	IIH	–5.3 mA (maximum)	1 mA (maximum)
Input LOW current	IIL	–5.0 mA (maximum)	–2 mA (maximum)
Input impedance	RIN	3 kΩ (minimum)	

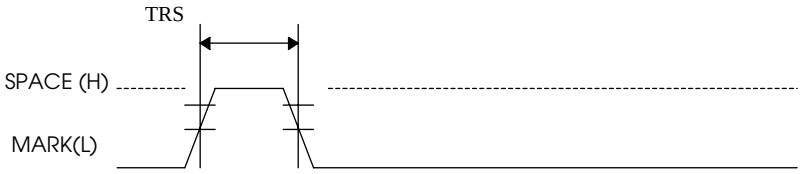
❑ AC characteristics:
Minimum reset pulse width:TRS 1 ms (minimum)

- When using pin 6 (DSR) (MSW 1-7 is ON):



Minimum reset pulse width (pin 6)

- When using pin 25 (INIT) (MSW 1-8 is ON):



Minimum reset pulse width (pin 25)

Note:
When a signal that does not satisfy the requirements above is input, printer operation is not guaranteed. When a signal is input to pin 25 (INIT) at the TTL level, the requirements above also must be satisfied. Although a signal is input to pin 6 (DSR) at the TTL level, according to the DC characteristics described above, the operation is not guaranteed and pin 6 cannot be controlled.

When pin 6 (DSR) and pin 25 (INIT) are open, the printer is operating.

IEEE 1284 Parallel Interface

Modes

The IEEE 1284 parallel interface has the following two modes.

Mode	Communication direction	Other information
Compatibility mode	Host → printer communication	Conforms with the Centronics standard
Reverse mode	Printer → host communication	Assumes a data transfer from an asynchronous printer

❑ Compatibility mode

- Compatibility mode is data transmission from the host to printer only: Centronics compatible.
- Specifications

Data transmission:	8-bit parallel
Synchronization:	Externally supplied $\overline{\text{STROBE}}$ signals
Handshaking:	$\overline{\text{ACK}}$ and BUSY signals
Signal levels:	TTL compatible
Connector:	ADS-B36BLFDR176 (HONDA) or equivalent (IEEE 1284 Type B)
Reverse communication (printer host):	Nibble or Byte mode

❑ Reverse mode

The status data transmission from the printer to the host proceeds in the Nibble or Byte mode.

These modes allow data transmission from the asynchronous printer under the control of the host. Data transmissions in the Nibble mode are made via the existing control lines in units of four bits (Nibble). In the Byte mode, data transmissions proceed by making the eight-bit data lines bidirectional. Both modes fail to proceed concurrently with the compatibility mode, thereby causing half-duplex transmission.

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Interface signals

Connector pin assignments

Pin	Source	Compatibility Mode	Nibble Mode	Byte Mode
1	Host	$\overline{\text{Strobe}}$	HostClk	HostClk
2	Host/Ptr	Data 0 (LSB)	Data 0 (LSB)	Data 0 (LSB)
3	Host/Ptr	Data 1	Data 1	Data 1
4	Host/Ptr	Data 2	Data 2	Data 2
5	Host/Ptr	Data 3	Data 3	Data 3
6	Host/Ptr	Data 4	Data 4	Data 4
7	Host/Ptr	Data 5	Data 5	Data 5
8	Host/Ptr	Data 6	Data 6	Data 6
9	Host/Ptr	Data 7 (MSB)	Data 7 (MSB)	Data 7 (MSB)
10	Printer	$\overline{\text{Ack}}$	PtrClk	PtrClk
11	Printer	Busy	PtrBusy/Data 3, 7	PtrBusy
12	Printer	Perror	AckDataReq/Data 2, 6	AckDataReq
13	Printer	Select	Xflag/Data 1, 5	Xflag
14	Host	$\overline{\text{AutoFd}}$	HostBusy k	HostBusy
15		NC	ND	ND
16		GND	GND	GND
17		FG	FG	FG
18	Printer	Logic-H	Logic-H	Logic-H
19		GND	GND	GND
20		GND	GND	GND
21		GND	GND	GND
22		GND	GND	GND
23		GND	GND	GND
24		GND	GND	GND
25		GND	GND	GND
26		GND	GND	GND
27		GND	GND	GND
28		GND	GND	GND
29		GND	GND	GND
30		GND	GND	GND
31	Host	$\overline{\text{Init}}$	$\overline{\text{Init}}$	$\overline{\text{Init}}$
32	Printer	$\overline{\text{Fault}}$	$\overline{\text{DataAvail}}$/Data 0, 4	$\overline{\text{DataAvail}}$
33		GND	ND	ND
34	Printer	DK_STATUS	ND	ND
35	Printer	+5V	ND	ND
36	Host	$\overline{\text{SelectIn}}$	1284-Active	1284-Active

*NC: Not connected
ND: Not defined

Note:

Bidirectional communications cannot take place unless all signals are connected on both sides (printer and host).

Connect all signal lines using a twisted pair cable. Connect the return side to the signal ground level.

Make sure that the signals satisfy electrical characteristics.

Set the leading edge and trailing edge times to 0.5 ms or less.

Do not ignore $\overline{Ack}$ or BUSY signals during a data transfer. Ignoring such signals may result in data corruption.

Make the interface cables as short as possible.

Electrical characteristics

DC characteristics (excluding logic-H, +5 V signals)

Characteristic item			Symbol	Standard		Condition
				Minimum value	Maximum value	
Output	Voltage	H level	VOH	* 2.4 V	5.5 V	* IOH = 0.32 mA
		L level	VOL	–0.5 V	* 0.4 V	* IOL = –12 mA
	Current	H level	IOH	0.32 mA	—	VOH = 2.4 V
		L level	IOL	–12 mA	—	VOL = 0.4 V
Input	Voltage	H level	VIH	2.0 V	—	
		L level	VIL	—	0.8 V	
	Current	H level	IIH	—	–0.32 mA	VIH = 2.0 V
		L level	IIL	—	12 mA	VIL = 0.8 V

LOGIC-H signal transfer characteristics

Characteristic item			Symbol	Standard		Condition
				Minimum value	Maximum value	
Output	Voltage	H level	VOH	3.0 V	5.5 V	
		L level	VOL	—	2.0 V	During power off

+5 V signal transfer characteristics

Characteristic item			Symbol	Standard		Condition
				Minimum value	Maximum value	
Output	Voltage	H level	VOH	* 2.4 V	5.5 V	* IOH = 0.32 mA
		L level	VOL	—	—**	During power off
	Current	H level	IOH	—	0.32 mA	VOH = 2.4 V
		L level	IOL	—**	—	During power off

* VO and IOL are not guaranteed during a power off condition.

** No guarantee is offered for VOL and IOL while the power is OFF.

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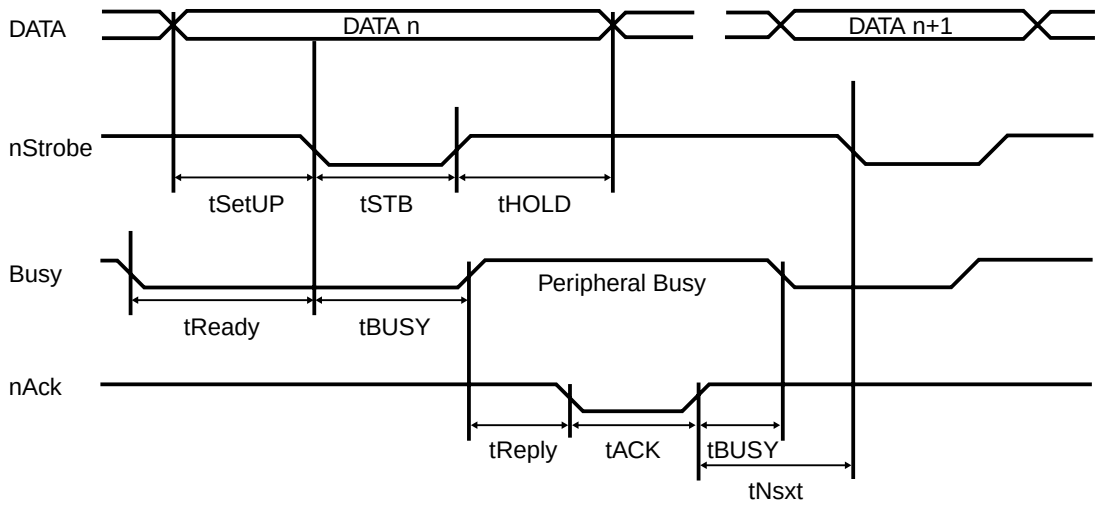
Data reception timing (compatibility mode)



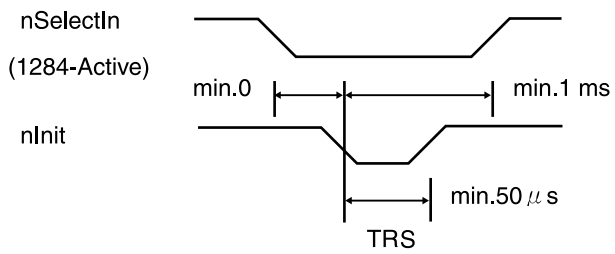
Characteristic item	Symbol	Requirements	
		Minimum (ns)	Maximum (ns)
Data hold time (host)	tHold	750	—
Data setup time	tSetup	750	—
Strobe pulse width	tSTB	750	—
Ready cycle idle time	tReady	0	—
BUSY output delay time	tBUSY	0	500
Data transfer time	tReply	0	•
ACKNLG pulse width	tACK	500	10 ms
BUSY release time	tnBUSY	0	•
ACK cycle idle time	tNext	0	—

The printer latches data at the rising edge of the $\overline{\text{Strobe}}$ signal.

Resetting the printer through the interface

When the printer is reset through the interface $\overline{\text{Init}}$ signal (pin #31) in compatibility mode, the signal must satisfy the following characteristics. However, note that the reset signal is ignored in reverse mode (pin #36 $\overline{\text{SelectIn}}$ (1284-Active: "H").

- DC characteristics TTL level
- AC characteristics Minimum reset pulse width TR: 50 µs (minimum)



Status transfer from the printer

In the bidirectional parallel interface, status signals can be transferred from the printer using the bidirectional function of the IEEE 1284 Nibble/Byte modes.

Note:
In this case, as opposed to the RS-232 serial interface, real-time interruptions from the printer to the host are disabled, and thus precautions must be taken for the following:

- *The allowable capacity of the printer's internal buffer is 99 bytes (except for ASB status). The status signals exceeding this capacity will be discarded. To prevent the possible loss of status, the host should be ready to accept data (Reverse Mode).*
- *When ASB is used, the host is preferably in the wait state for accepting data (Reverse Idle Mode). When this state is not available, the host should enter the Reverse Mode to constantly monitor the presence of data.*
- *When ASB is used in the Reverse Mode, preference is given to the ASB status for transmission over the other status signals. Any accumulated ASB status signals left for transmission from the last to the newest ASB status transmission are transmitted together at one time as one ASB status, showing the presence of change, followed by the latest ASB status.*

❑ Example:

Normal ASB status (standby) are shown below.

Status 1	Status 2	Status 3	Status 4
0001 0000	0000 0000	0110 0000	0000 1111

The following data is accumulated when near-end detection, R cover opened, and R cover closed occur in the stated order.

	Status 1	Status 2	Status 3	Status 4	
①	0001 0000	0000 0000	0110 0011	0000 1111	Near-end detection
②	0011 1000	0000 0000	0110 0011	0000 1111	Cover open
③	0001 0000	0000 0000	0110 0011	0000 1111	Cover closed

If an ASB status is received after this, the combined ASBs (①+②+③) and the latest ASB (③), a total of 8 bytes, is transferred.

Status 1	Status 2	Status 3	Status 4	
0011 1000	0000 0000	0110 0011	0000 1111	ASB (①+②+③)
0001 0000	0000 0000	0110 0011	0000 1111	Latest ASB

Connectors Specifications

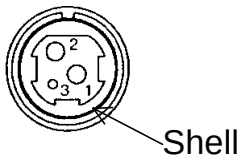
Power Supply Connector

This connector is used to connect the printer to an external power source.

Pin assignments

Power supply connector pin assignments

Pin number	Signal name
1	+24 VDC
2	GND
3	NC
Shell	Frame GND



Power supply connector

Note:
Make sure to ground the frame GND with the screw hole for the frame GND on the metal plate of the interface connector.

Connector model

- Printer side: Hosiden TCS7960-532010 or equivalent
- User side: Hosiden TCP8927-631100 or equivalent
  Hosiden TCP8927-531100 or equivalent

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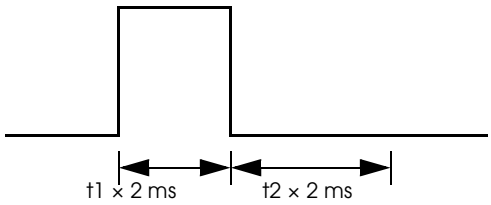
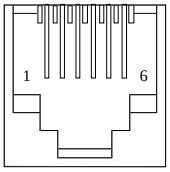
Drawer kick connector

Pulses specified using the **ESC p** or **DLE DC4** command are output to this connector. The host computer uses **DLE EOT**, **GS a** (ASB), or **GS r** commands to detect the status of the input signal.

Specifications

Drawer kick connector specifications

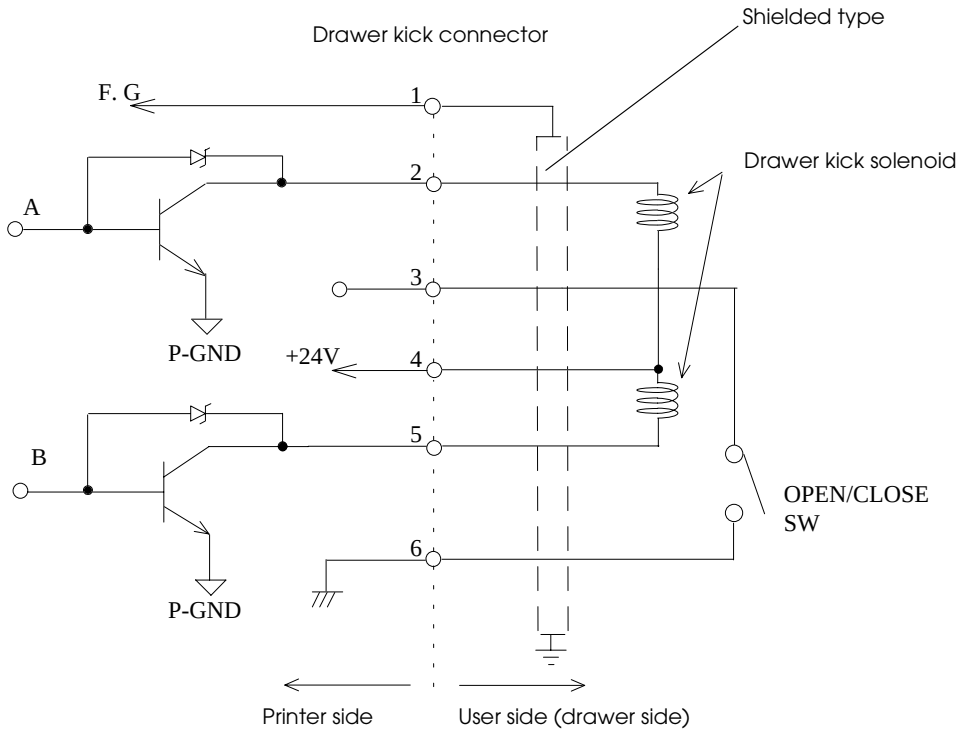
Item		Specifications
Pin arrangement		See the "Drawer kick connector pin assignments" table.
Model number	Printer side	DDK 285D-7660J-100 (or equivalent product)
	User side	6-pole, 6-pin (RJ-12 telephone connector)
Drawer kick drive signal	Output voltage	Approx. 24 V
	Output current	1 A or less
	Output waveform	 This waveform is output to points A and B in the connector circuit diagram. (On time t1 and off time t2 are selected using **ESC p**.)
Drawer open/close signal	Input signal level (connector pin 3)	"L" = 0 — 0.8 V "H" = 2 — 5 V
Connector configuration	External view	

Drawer kick connector pin assignments

Pin #	Signal name	Direction
1	Frame ground	—
2	Drawer kick drive signal 1	Output
3	Drawer kick open/close signal	Input
4	+24V	—
5	Drawer kick drive signal 2	Output
6	Signal ground	—

Note:
Pin 4 outputs +24 V when the power is on. Do not use this for purposes other than operating the drawer.

Connector circuit



Note:

The following restrictions apply to the drawer kick connector.

- *Be sure to use a resistance of 24 Ω or greater for the drawer solenoid. If resistance is less than 24 Ω, overcurrent can develop that will burn out the solenoid.*
- *Use a shielded cable for the drawer connector cable.*
- *Two drives cannot be operated at the same time.*
- *Do not operate the drawer on a continuous basis.*
- *Be sure to use the printer power supply (4-pin connector) as the drawer power supply.*
- *Do not connect a standard telephone line to the drawer kick connector.*

Appendix B
Options and Consumable Products

Roll Paper

Paper specifications are shown below.

Paper specifications

Paper type	Specified thermal paper
Form	Roll
Paper width	Select from the following options. ❒ 79.5 mm ± 0.5 mm {3.13 ± 0.02"} ❒ 59.5 mm ± 0.5 mm {2.34 ± 0.02"} ❒ 57.5 mm ± 0.5 mm {2.26 ± 0.02"}
Core	Inside: 12 mm {0.47"} Outside: 18 mm {0.71"}
External size	Roll diameter: Maximum 102 mm {4.02"} Take-up paper roll width: 80, 60, 58, +0.5/-1.0 mm {3.15, 2.36, 2.28, +0.02/–0.04"}

Note:
Standards for roll cores vary. Therefore, the paper roll near-end detector cannot detect the remaining amount of roll paper precisely.

Specified roll paper type no.

Receipt	Paper width			Original paper
	80 mm {3.15"}	60 mm {2.36"}	58 mm {2.28"}	
Single-color thermal roll paper	ENTPA080-100	ENTPA060-100	ENTPA058-100	TF50KS-E
Two-color thermal roll paper	ENTPB080-100	ENTPB060-100	ENTPB058-100	PD750R

In Japan: Nakagawa Manufacturing Co., Ltd.
In U.S.A.: Nakagawa Mfg. (USA), Inc.
In Europe: Nakagawa Mfg. (Europe) GmbH
In Southeast Asia: N.A.K. Mfg. (Malaysia) SDN BHD

Confidential

Specified original paper type no.

The following original paper can be used for receipts:
(Paper marked with * is the specified roll paper.)

❑ Monochrome thermal roll paper:

* TF50KS-E (paper thickness: 65 µm)	NIPPON Paper Industries Co., Ltd.
TF60KS-F1 (paper thickness: 75 µm)	NIPPON Paper Industries Co., Ltd.
PD160R (paper thickness: 75 µm)	Oji Paper Mfg. Co., Ltd.
PD170R (paper thickness: 75 µm)	Oji Paper Mfg.Co., Ltd.
P350 (paper thickness: 62 µm)	Kanzaki Specialty Papers (U.S.A.)
P310 (paper thickness: 58 µm)	Kanzaki Specialty Papers (U.S.A.)
P300 (paper thickness: 56 µm)	Kanzaki Specialty Papers (U.S.A.)
KF50 (paper thickness: 62 µm)	Kanzaki Spezialpapiere GmbH (Germany)

❑ Two-color thermal roll paper:

* PD750R (paper thickness: 75 µm)	Oji Paper Mfg. Co., Ltd.

Note:
If paper other than the specified paper is used, the print head may be damaged or the print quality may be poor. Therefore, it is recommended to use the specified paper or its equivalent.

The following paper also can be used only for ANK or multilingual models:
Original paper: AF50KS-E (paper thickness: 65 µm) (Jujo Thermal Oy (Finland))

Notes on using thermal paper

Chemicals and oil on thermal paper may cause discoloration and faded printing. Therefore, pay attention to the following:

- ❑ Use water paste, starch paste, polyvinyl paste, or CMC paste when gluing thermal paper.
- ❑ Volatile organic solvents, such as alcohol, ester, and ketone, can cause discoloration.
- ❑ Some adhesive tapes may cause discoloration or faded printing.
- ❑ If thermal paper touches anything that includes phthalic acid ester plasticizer for a long time, it can reduce the image-formation ability of the paper and can cause the printed image to fade. Therefore, when storing thermal paper in a card case or sample notebook, be sure to use only products made from polyethylene, polypropylene, or polyester.
- ❑ If thermal paper touches diazo copy paper immediately after copying, the printed surface may be discolored.
- ❑ Thermal paper must not be stored with the printed surfaces against each other because the printing may be transferred between the surfaces.
- ❑ If the surface of thermal paper is scratched with a hard metal object, such as a nail, the paper may become discolored.

Notes on thermal paper storage

Since color development begins at 70°C {158°F}, thermal paper should be protected from high temperatures, humidity, and light, both before and after printing.

- ❑ Store paper away from high temperatures and humidity. Do not store thermal paper near a heater or in enclosed places exposed to direct sunlight.
- ❑ Avoid direct light. Extended exposure to direct light may cause discoloration or faded printing.
- ❑ When the printer is not used for one week or more, it is recommended not to leave the thermal paper between the platen and the print head.

Notes on using two-color thermal paper

- ❑ If two-color printing is selected by the customized value setting with Function 5 of the **GS (E** command, two-color printing is performed using a two-color thermal paper.
- ❑ There may be some cases where the print color may not be clear, depending on the print pattern.
- ❑ The reliability when two-color thermal paper is used differs from the reliability when single-color thermal paper is used. Refer to "Reliability" on page 1-17 for details.

Roll paper spool diameter

- ❑ Inside: 25.4 mm {1.00"}
- ❑ Outside: 31.4 mm {1.24"}

Note:
Paper must not be pasted to the roll paper spool.

Print density adjustment

For the best print quality and reliability, select the proper print density for the paper type used. See the table below. If the density levels shown in the table are exceeded, "Reliability" on page 1-17 cannot be guaranteed. Print density can be set with a software command transmitted from the host computer.

Original paper number and density level <ANK/multilingual model>

Original Paper No.	Density Level
P350	× 0.9
P300, P310, KF50	× 0.95
TF50KS-E, PD170R, PD750R, TF60KS-F1	× 1.0
PD160R	× 1.05
AF50KS-E	× 1.1

Original paper number and density level <Japanese model>

Original Paper No.	Density Level
P350	× 0.9
P300, P310, KF50	× 0.95
TF50KS-E, PD750R, TF60KS-F1	× 1.0
PD160R	× 1.05
PD170R	× 1.1

Power supply

- ❑ PS-170, PS-180

PS-170

Electrical characteristics

- ❑ Input conditions

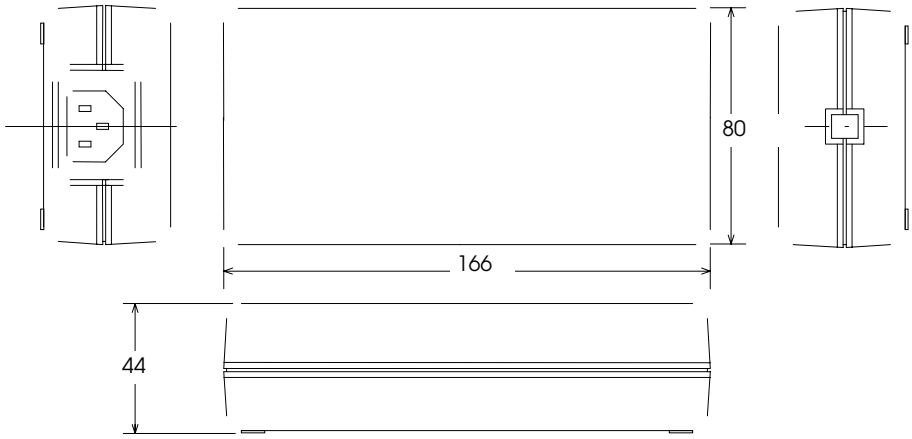
Input voltage (rating)	90 to 264 VAC (100 VAC -10 % to 230 VAC +15 %)
Frequency (rating)	50 to 60 Hz ± 3 Hz
Input current (rating)	100 VA
AC switch	None
Energizing LED	None

- ❑ Output conditions

Output voltage (rating)	24 VDC ± 5%
Output voltage (rating)	2.0 A
Output electric power (rating)	48 W
Output peak current	4.5 A (within 300 msec)

Case specifications

❑ Size:	80 mm (D) × 166 mm (L) × 44 mm (H) {3.15 (D) × 6.54 (L) × 1.73" (H)} (excluding projections). Refer to the figure below.
❑ Weight:	Approx. 0.52 kg (excluding the AC cable)
❑ Material:	Flame-resistance grade: V0
❑ Color:	Black (matte)



Case specifications

Material

No specific brominated flame retardants, such as PBBE and PBB, are used in this product.

AC cable selection

- ❑ Select an AC cable that satisfies the following conditions.
  - Product safety standard
  - Plug with PE terminal
- ❑ The AC cable is not included in the package.

PS-180

Electrical characteristics

- ❑ Input conditions

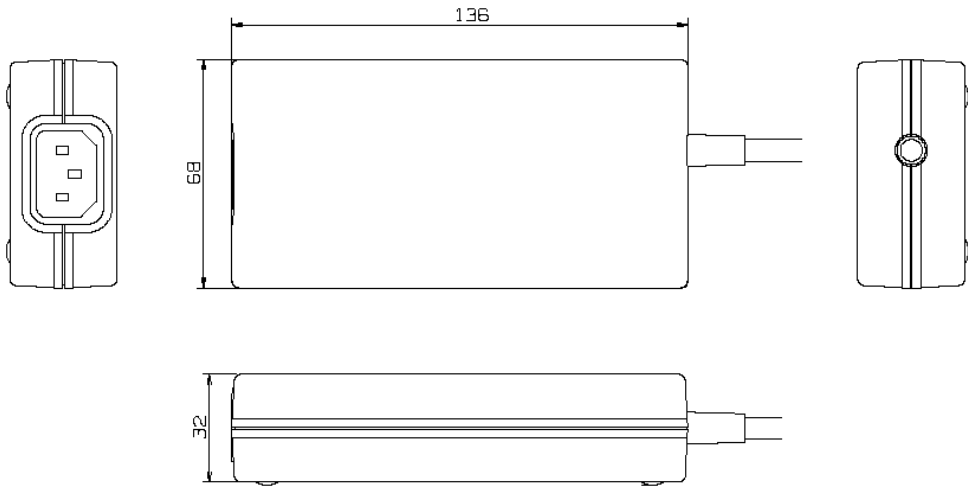
Input voltage (rating)	90 to 264 VAC (100 VAC -10% to 230 VAC +15%)
Frequency (rating)	47 Hz to 63 Hz
Input current (rating)	100VA
AC switch	None
Energizing LED	None

- ❑ Output conditions

Output voltage (rating)	24 VDC ± 5%
Output current (rating)	2.0 A
Output electric power (rating)	48 W
Output peak current	4.5 A (within 300 ms at 6/1 duty)

Case specifications

- ❑ Size: 68 mm(D) × 136 mm(L) × 32 mm(H)
  {2.68 (D) × 5.35 (L) × 1.26" (H)}
  (excluding projections) Refer to the figure below.
- ❑ Mass: Approx. 0.4kg (excluding the AC cable)
- ❑ Material: Flame-resistance grade: V0
- ❑ Color: Black (matte)



Case specifications

Material

No specific brominated flame retardants, such as PBBE and PBB, are used in this product.

DC cable

- ❑ Connector TCP8927-63-1110(HOSHIDEN) equivalent product
- ❑ Cable 2-wire shielded (AWG 18)
- ❑ Length Approx. 1500 mm {4.9'} +100/-0 mm{+3.9"/-0"}
- ❑ Pin assignments No. 1 = +24V
  No. 2 = GND
  No. 3 = NC
  SHELL = shielded (FG)

Usage cautions

- ❑ AC cable Select an AC cable that satisfies the following conditions
  - Product safety standards
  - Plug with PE terminal
- ❑ Ground connection Certainly ground for safety

Appendix C

Character Code Tables

Page 0 (PC437: USA, Standard Europe)
(International character set: when U.S. is selected.)

HEX	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
BIN	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0 0000	NUL 00	DLE 16	SP 32	0 48	@ 64	P 80	` 96	p 112	Ç 128	É 144	á 160	░ 176	└ 192	╨ 208	α 224	≡ 240
1 0001	01	XON 17	! 33	1 49	A 65	Q 81	a 97	q 113	ü 129	æ 145	í 161	▒ 177	┴ 193	╤ 209	ß 225	± 241
2 0010	02	18	" 34	2 50	B 66	R 82	b 98	r 114	é 130	Æ 146	ó 162	▓ 178	┬ 194	╥ 210	Γ 226	≥ 242
3 0011	03	XOFF 19	# 35	3 51	C 67	S 83	c 99	s 115	â 131	ô 147	ú 163	│ 179	├ 195	╙ 211	π 227	≤ 243
4 0100	EOT 04	20	$ 36	4 52	D 68	T 84	d 100	t 116	ä 132	ö 148	ñ 164	┤ 180	─ 196	╘ 212	Σ 228	⌠ 244
5 0101	ENQ 05	21	% 37	5 53	E 69	U 85	e 101	u 117	à 133	ò 149	Ñ 165	╡ 181	┼ 197	╒ 213	σ 229	⌡ 245
6 0110	06	22	& 38	6 54	F 70	V 86	f 102	v 118	å 134	û 150	ª 166	╢ 182	╞ 198	╓ 214	µ 230	÷ 246
7 0111	07	23	' 39	7 55	G 71	W 87	g 103	w 119	ç 135	ù 151	º 167	╖ 183	╟ 199	╫ 215	τ 231	≈ 247
8 1000	BS 08	24	(40	8 56	H 72	X 88	h 104	x 120	ê 136	ÿ 152	¿ 168	╕ 184	╚ 200	╪ 216	Φ 232	° 248
9 1001	09	25	) 41	9 57	I 73	Y 89	i 105	y 121	ë 137	Ö 153	⌐ 169	╣ 185	╔ 201	┘ 217	Θ 233	∙ 249
A 1010	LF 10	26	* 42	: 58	J 74	Z 90	j 106	z 122	è 138	Ü 154	¬ 170	║ 186	╩ 202	┌ 218	Ω 234	· 250
B 1011	ESC 11	27	+ 43	; 59	K 75	[91	k 107	{ 123	ï 139	¢ 155	½ 171	╗ 187	╦ 203	█ 219	δ 235	√ 251
C 1100	FF 12	FS 28	, 44	< 60	L 76	\ 92	l 108	| 124	î 140	£ 156	¼ 172	╝ 188	╠ 204	▄ 220	∞ 236	n 252
D 1101	CR 13	GS 29	- 45	= 61	M 77	] 93	m 109	} 125	ì 141	¥ 157	¡ 173	╜ 189	═ 205	▌ 221	φ 237	2 253
E 1110	14	30	. 46	> 62	N 78	^ 94	n 110	~ 126	Ä 142	₧ 158	« 174	╛ 190	╬ 206	▐ 222	ε 238	■ 254
F 1111	15	31	/ 47	? 63	O 79	_ 95	o 111	SP 127	Å 143	ƒ 159	» 175	┐ 191	╧ 207	▀ 223	∩ 239	SP 255

Confidential

Page 1 (Katakana)

	HEX	8	9	A	B	C	D	E	F
HEX	BIN	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	━ 128	┴ 144	SP 160	ー 176	タ 192	ミ 208	╤ 224	× 240
1	0001	━ 129	┬ 145	。 161	ア 177	チ 193	ム 209	╥ 225	円 241
2	0010	━ 130	┤ 146	「 162	イ 178	ツ 194	メ 210	╪ 226	年 242
3	0011	━ 131	├ 147	」 163	ウ 179	テ 195	モ 211	╡ 227	月 243
4	0100	━ 132	─ 148	、 164	エ 180	ト 196	ヤ 212	◢ 228	日 244
5	0101	━ 133	─ 149	・ 165	オ 181	ナ 197	ユ 213	◣ 229	時 245
6	0110	━ 134	│ 150	ヲ 166	カ 182	ニ 198	ヨ 214	◥ 230	分 246
7	0111	━ 135	│ 151	ァ 167	キ 183	ヌ 199	ラ 215	◤ 231	秒 247
8	1000	┃ 136	┌ 152	ィ 168	ク 184	ネ 200	リ 216	♠ 232	〒 248
9	1001	┃ 137	┐ 153	ゥ 169	ケ 185	ノ 201	ル 217	♥ 233	市 248
A	1010	┃ 138	└ 154	ェ 170	コ 186	ハ 202	レ 218	✦ 234	区 250
B	1011	┃ 139	┘ 155	ォ 171	サ 187	ヒ 203	ロ 219	♣ 235	町 251
C	1100	┃ 140	┌ 156	ャ 172	シ 188	フ 204	ワ 220	● 236	村 252
D	1101	┃ 141	┐ 157	ュ 173	ス 189	ヘ 205	ン 221	○ 237	人 253
E	1110	┃ 142	└ 158	ョ 174	セ 190	ホ 206	゛ 222	／ 238	▒ 254
F	1111	┼ 143	┘ 159	ッ 175	ソ 191	マ 207	゜ 223	＼ 239	SP 255

Page 2 (PC850: Multilingual)

	HEX	8	9	A	B	C	D	E	F
HEX	BIN	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	Ç 128	É 144	á 160	░ 176	└ 192	ð 208	Ó 224	— 240
1	0001	ü 129	æ 145	í 161	▒ 177	┴ 193	Ð 209	ß 225	± 241
2	0010	é 130	Æ 146	ó 162	▓ 178	┬ 194	Ê 210	Ô 226	‗ 242
3	0011	â 131	ô 147	ú 163	│ 179	├ 195	Ë 211	Ò 227	¾ 243
4	0100	ä 132	ö 148	ñ 164	┤ 180	─ 196	È 212	õ 228	¶ 244
5	0101	à 133	ò 149	Ñ 165	Á 181	┼ 197	ı 213	Õ 229	§ 245
6	0110	å 134	û 150	ª 166	Â 182	ã 198	Í 214	µ 230	÷ 246
7	0111	ç 135	ù 151	º 167	À 183	Ã 199	Î 215	þ 231	¸ 247
8	0100	ê 136	ÿ 152	¿ 168	© 184	╚ 200	Ï 216	Þ 232	° 248
9	1001	ë 137	Ö 153	® 169	╣ 185	╔ 201	┘ 217	Ú 233	¨ 249
A	1010	è 138	Ü 154	¬ 170	║ 186	╩ 202	┌ 218	Û 234	· 250
B	1011	ï 139	ø 155	½ 171	╗ 187	╦ 203	█ 219	Ù 235	¹ 251
C	1100	î 140	£ 156	¼ 172	╝ 188	╠ 204	▄ 220	ý 236	³ 252
D	1101	ì 141	Ø 157	¡ 173	¢ 189	═ 205	¦ 221	Ý 237	² 253
E	1110	Ä 142	× 158	« 174	¥ 190	╬ 206	Ì 222	¯ 238	■ 254
F	1111	Å 143	ƒ 159	» 175	┐ 191	¤ 207	▀ 223	´ 239	SP 255

Confidential

Page 3 (PC860: Portuguese)

	HEX	8	9	A	B	C	D	E	F
HEX	BIN	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	Ç 128	É 144	á 160	░ 176	└ 192	╨ 208	α 224	≡ 240
1	0001	ü 129	À 145	í 161	▒ 177	┴ 193	╤ 209	ß 225	± 241
2	0010	é 130	È 146	ó 162	▓ 178	┬ 194	╥ 210	Γ 226	≥ 242
3	0011	â 131	ô 147	ú 163	│ 179	├ 195	╙ 211	π 227	≤ 243
4	0100	ã 132	õ 148	ñ 164	┤ 180	─ 196	╘ 212	Σ 228	⌠ 244
5	0101	à 133	ò 149	Ñ 165	╡ 181	┼ 197	╒ 213	σ 229	⌡ 245
6	0110	Á 134	Ú 150	ª 166	╢ 182	╞ 198	╓ 214	µ 230	÷ 246
7	0111	ç 135	ù 151	º 167	╖ 183	╟ 199	╫ 215	τ 231	≈ 247
8	1000	ê 136	Ì 152	¿ 168	╕ 184	╚ 200	╪ 216	Φ 232	° 248
9	1001	Ê 137	Õ 153	Ò 169	╣ 185	╔ 201	┘ 217	θ 233	• 249
A	1010	è 138	Ü 154	¬ 170	║ 186	╩ 202	┌ 218	Ω 234	· 250
B	1011	Í 139	¢ 155	½ 171	╗ 187	╦ 203	█ 219	δ 235	√ 251
C	1100	Ô 140	£ 156	¼ 172	╝ 188	╠ 204	▄ 220	∞ 236	ⁿ 252
D	1101	ì 141	Ù 157	¡ 173	╜ 189	═ 205	▌ 221	ø 237	² 253
E	1110	Ã 142	₧ 158	« 174	╛ 190	╬ 206	▐ 222	∈ 238	■ 254
F	1111	Â 143	Ó 159	» 175	┐ 191	╧ 207	▀ 223	∩ 239	SP 255

Page 4 (PC863: Canadian-French)

	HEX	8	9	A	B	C	D	E	F
HEX	BIN	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	Ç 128	É 144	¦ 160	░ 176	└ 192	╨ 208	α 224	≡ 240
1	0001	ü 129	È 145	´ 161	▒ 177	┴ 193	╤ 209	ß 225	± 241
2	0010	é 130	Ê 146	ó 162	▓ 178	┬ 194	╥ 210	Γ 226	≥ 242
3	0011	â 131	ô 147	ú 163	│ 179	├ 195	╙ 211	π 227	≤ 243
4	0100	Â 132	Ë 148	¨ 164	┤ 180	─ 196	╘ 212	Σ 228	⌠ 244
5	0101	à 133	Ï 149	¸ 165	╡ 181	┼ 197	╒ 213	σ 229	⌡ 245
6	0110	¶ 134	û 150	³ 166	╢ 182	╞ 198	╓ 214	µ 230	÷ 246
7	0111	ç 135	ù 151	¯ 167	╖ 183	╟ 199	╫ 215	τ 231	≈ 247
8	1000	ê 136	¤ 152	Î 168	╕ 184	╚ 200	╪ 216	Φ 232	° 248
9	1001	ë 137	Ô 153	⌐ 169	╣ 185	╔ 201	┘ 217	θ 233	• 249
A	1010	è 138	Ü 154	¬ 170	║ 186	╩ 202	┌ 218	Ω 234	· 250
B	1011	ï 139	¢ 155	½ 171	╗ 187	╦ 203	█ 219	δ 235	√ 251
C	1100	î 140	£ 156	¼ 172	╝ 188	╠ 204	▄ 220	∞ 236	ⁿ 252
D	1101	‗ 141	Ù 157	¾ 173	╜ 189	═ 205	▌ 221	ø 237	² 253
E	1110	À 142	Û 158	« 174	╛ 190	╬ 206	▐ 222	∈ 238	■ 254
F	1111	§ 143	ƒ 159	» 175	┐ 191	╧ 207	▀ 223	∩ 239	SP 255

Confidential

Page 5 (PC865: Nordic)

	HEX	8	9	A	B	C	D	E	F
HEX	BIN	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	Ç 128	É 144	á 160	░ 176	└ 192	╨ 208	α 224	≡ 240
1	0001	ü 129	æ 145	í 161	▒ 177	┴ 193	╤ 209	ß 225	± 241
2	0010	é 130	Æ 146	ó 162	▓ 178	┬ 194	╥ 210	Γ 226	≥ 242
3	0011	â 131	ô 147	ú 163	│ 179	├ 195	╙ 211	π 227	≤ 243
4	0100	ä 132	ö 148	ñ 164	┤ 180	─ 196	╘ 212	Σ 228	⌠ 244
5	0101	à 133	ò 149	Ñ 165	╡ 181	┼ 197	╒ 213	σ 229	⌡ 245
6	0110	å 134	û 150	ª 166	╢ 182	╞ 198	╓ 214	µ 230	÷ 246
7	0111	ç 135	ù 151	º 167	╖ 183	╟ 199	╫ 215	τ 231	≈ 247
8	1000	ê 136	ÿ 152	¿ 168	╕ 184	╚ 200	╪ 216	Φ 232	° 248
9	1001	ë 137	Ö 153	⌐ 169	╣ 185	╔ 201	┘ 217	θ 233	• 249
A	1010	è 138	Ü 154	¬ 170	║ 186	╩ 202	┌ 218	Ω 234	· 250
B	1011	ï 139	ø 155	½ 171	╗ 187	╦ 203	█ 219	δ 235	√ 251
C	1100	î 140	£ 156	¼ 172	╝ 188	╠ 204	▄ 220	∞ 236	ⁿ 252
D	1101	ì 141	Ø 157	¡ 173	╜ 189	═ 205	▌ 221	ø 237	² 253
E	1110	Ä 142	₧ 158	« 174	╛ 190	╬ 206	▐ 222	∈ 238	■ 254
F	1111	Å 143	ƒ 159	¤ 175	┐ 191	╧ 207	▀ 223	∩ 239	SP 255

Page 16 (WPC1252)

	HEX	8	9	A	B	C	D	E	F
HEX	BIN	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	€ 128	SP 144	SP 160	° 176	À 192	Đ 208	à 224	ð 240
1	0001	SP 129	‘ 145	¡ 161	± 177	Á 193	Ñ 209	á 225	ñ 241
2	0010	‚ 130	’ 146	¢ 162	² 178	Â 194	Ò 210	â 226	ò 242
3	0011	ƒ 131	“ 147	£ 163	³ 179	Ã 195	Ó 211	ã 227	ó 243
4	0100	„ 132	” 148	¤ 164	´ 180	Ä 196	Ô 212	ä 228	ô 244
5	0101	… 133	• 149	¥ 165	µ 181	Å 197	Õ 213	å 229	õ 245
6	0110	† 134	– 150	¦ 166	¶ 182	Æ 198	Ö 214	æ 230	ö 246
7	0111	‡ 135	— 151	§ 167	· 183	Ç 199	× 215	ç 231	÷ 247
8	1000	ˆ 136	˜ 152	¨ 168	¸ 184	È 200	Ø 216	è 232	ø 248
9	1001	‰ 137	™ 153	© 169	¹ 185	É 201	Ù 217	é 233	ù 249
A	1010	Š 138	š 154	ª 170	º 186	Ê 202	Ú 218	ê 234	ú 250
B	1011	‹ 139	› 155	« 171	» 187	Ë 203	Û 219	ë 235	û 251
C	1100	Œ 140	œ 156	¬ 172	¼ 188	Ì 204	Ü 220	ì 236	ü 252
D	1101	SP 141	SP 157	173	½ 189	Í 205	Ý 221	í 237	ý 253
E	1110	Ž 142	ž 158	® 174	¾ 190	Î 206	Þ 222	î 238	þ 254
F	1111	SP 143	Ÿ 159	¯ 175	¿ 191	Ï 207	ß 223	ï 239	ÿ 255

Confidential

Page 17 (PC866: Cyrillic #2)

	HEX	8	9	A	B	C	D	E	F
HEX	BIN	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	А 128	Р 144	а 160	176	192	208	р 224	Ё 240
1	0001	Б 129	С 145	б 161	177	193	209	с 225	ё 241
2	0010	В 130	Т 146	в 162	178	194	210	т 226	Є 242
3	0011	Г 131	У 147	г 163	179	195	211	у 227	є 243
4	0100	Д 132	Ф 148	д 164	180	196	212	ф 228	Ї 244
5	0101	Е 133	Х 149	е 165	181	197	213	х 229	ї 245
6	0110	Ж 134	Ц 150	ж 166	182	198	214	ц 230	Ў 246
7	0111	З 135	Ч 151	з 167	183	199	215	ч 231	ў 247
8	1000	И 136	Ш 152	и 168	184	200	216	ш 232	° 248
9	1001	Й 137	Щ 153	й 169	185	201	217	щ 233	• 249
A	1010	К 138	Ъ 154	к 170	186	202	218	ъ 234	· 250
B	1011	Л 139	Ы 155	л 171	187	203	219	ы 235	√ 251
C	1100	М 140	Ь 156	м 172	188	204	220	ь 236	№ 252
D	1101	Н 141	Э 157	н 173	189	205	221	э 237	¤ 253
E	1110	О 142	Ю 158	о 174	190	206	222	ю 238	■ 254
F	1111	П 143	Я 159	п 175	191	207	223	я 239	SP 255

Page 18 (PC852: Latin2)

	HEX	8	9	A	B	C	D	E	F
HEX	BIN	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	Ç 128	É 144	á 160	176	192	đ 208	Ó 224	ˉ 240
1	0001	ü 129	Ĺ 145	í 161	177	193	Đ 209	ß 225	˝ 241
2	0010	é 130	ĺ 146	ó 162	178	194	Ď 210	Ô 226	˛ 242
3	0011	â 131	ô 147	ú 163	179	195	Ë 211	Ń 227	ˇ 243
4	0100	ä 132	ö 148	Ą 164	180	196	ď 212	ń 228	˘ 244
5	0101	ů 133	Ľ 149	ą 165	Á 181	197	Ň 213	ň 229	§ 245
6	0110	ć 134	ľ 150	Ž 166	Â 182	Ă 198	Í 214	Š 230	÷ 246
7	0111	ç 135	Ś 151	ž 167	Ě 183	ă 199	Î 215	š 231	¸ 247
8	1000	ì 136	ś 152	Ę 168	Ş 184	200	ě 216	Ŕ 232	° 248
9	1001	ë 137	Ö 153	ę 169	185	201	217	Ú 233	¨ 249
A	1010	Ö 138	Ü 154	170	186	202	218	ŕ 234	· 250
B	1011	ö 139	Ť 155	ź 171	187	203	219	Ũ 235	ũ 251
C	1100	î 140	ť 156	Č 172	188	204	220	ý 236	Ř 252
D	1101	Ź 141	Ł 157	ş 173	Ż 189	205	Ţ 221	Ý 237	ř 253
E	1110	Ä 142	× 158	« 174	ż 190	206	Ů 222	ţ 238	■ 254
F	1111	Ć 143	č 159	» 175	191	¤ 207	223	´ 239	SP 255

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Page 19 (PC858: Euro)

	HEX	8	9	A	B	C	D	E	F
HEX	BIN	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	Ç 128	É 144	á 160	░ 176	└ 192	ð 208	Ó 224	— 240
1	0001	ü 129	æ 145	í 161	▒ 177	┴ 193	Ð 209	ß 225	± 241
2	0010	é 130	Æ 146	ó 162	▓ 178	┬ 194	Ê 210	Ô 226	‗ 242
3	0011	â 131	ô 147	ú 163	│ 179	├ 195	Ë 211	Ò 227	¾ 243
4	0100	ä 132	ö 148	ñ 164	┤ 180	─ 196	È 212	õ 228	¶ 244
5	0101	à 133	ò 149	Ñ 165	Á 181	┼ 197	€ 213	Õ 229	§ 245
6	0110	å 134	û 150	ª 166	Â 182	ã 198	Í 214	µ 230	÷ 246
7	0111	ç 135	ù 151	º 167	À 183	Ã 199	Î 215	þ 231	¸ 247
8	1000	ê 136	ÿ 152	¿ 168	© 184	╚ 200	Ï 216	Þ 232	° 248
9	1001	ë 137	Ö 153	® 169	╣ 185	╔ 201	┘ 217	Ú 233	¨ 249
A	1010	è 138	Ü 154	¬ 170	║ 186	╩ 202	┌ 218	Û 234	· 250
B	1011	ï 139	ø 155	½ 171	╗ 187	╦ 203	█ 219	Ù 235	¹ 251
C	1100	î 140	£ 156	¼ 172	╝ 188	╠ 204	▄ 220	ý 236	³ 252
D	1101	ì 141	Ø 157	¡ 173	¢ 189	═ 205	¦ 221	Ý 237	² 253
E	1110	Ä 142	× 158	« 174	¥ 190	╬ 206	Ì 222	¯ 238	▮ 254
F	1111	Å 143	ƒ 159	» 175	┐ 191	¤ 207	▀ 223	´ 239	SP 255

Page 20 (Thai character code 42)

	8	9	A	B	C	D	E	F
0	ร	๐		ฝ	ย	เ	ๅ	๒๓
1	า	๑	ก	ฟ	ร	แ	ๆ	๒+
2	ำ	๒	ข	ค	ฤ	โ	๓	๒๘
3	ิ	๓	ค	ต	ล	ใ	+	๒-
4	ี	๔	ฆ	ถ	ว	ไ	๔	๒๙
5	ึ	๕	ง	ท	ศ	ๆ	๕	๒๓
6	ื	๖	จ	ธ	ษ	ฯ	๐-	๒+
7	ุ	๗	ฉ	น	ส	๑	๐๙	๒-
8	ู	๘	ช	บ	ห	๒	๐๓	๒๙
9	ฺ	๙	ซ	ป	ฬ	๓	๐+	๒๓
A	ฺ	ข	ฌ	ผ	อ	๔	๙-	๒+
B	ฺ	ค	ญ	ฝ	ฮ	๕	๙๙	๒-
C	←	๑	ฎ	พ	๙๙	๖	๙๓	๒๙
D	↑	๑	ฏ	ฟ	ฯ	๙	๙+	๒๓
E	→	๑	ฐ	ภ	า	๐	๒-	๒+
F	↓	เ	ฑ	ม	ำ	๘	๒๙	

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Page 21 (Thai character code 11)

	8	9	A	B	C	D	E	F
0	๋	๊	เ	ฐ	ภ	ะ	เ	๐
1	๋	๊	ก	ฑ	ม	ั	แ	๑
2	๋	๊	ข	ฒ	ย	า	โ	๒
3	๋	๊	ข	ณ	ร	ำ	ใ	๓
4	๋	๊	ค	ด	ฤ	ิ	ไ	๔
5	๋	๊	ค	ต	ล	ี	า	๕
6	๋	๊	ฆ	ถ	ฦ	ึ	ๆ	๖
7	๋	๊	ง	ท	ว	ื	๘	๗
8	๋	๊	จ	ธ	ศ	ุ	็	๘
9	๋	๊	ฉ	น	ษ	ู	่	๙
A	๋	๊	ช	บ	ส	ฺ	้	๚
B	๋	๊	ซ	ป	ห	฿	๊	๛
C	๋	๊	ฌ	ผ	ฬ	เ	๋	๜
D	๋	๊	ญ	ฝ	อ	แ	์	๑
E	๋	๊	ฎ	พ	ฮ	โ	ํ	๒
F	๋	๊	ฏ	ฟ	ฯ	ใ	๊	

Page 22 (Thai character code 13)

	8	9	A	B	C	D	E	F
0		◌ั		สฺ	ภ	ะ	เ	๐
1	◌็	◌ัะ	ก	ฑ	ม	◌ั	แ	๑
2	◌ะ	◌ัะ	ข	ฒ	ย	า	โ	๒
3	◌ะ	◌ิ	ข	ณ	ร	ำ	ใ	๓
4	◌ิ		ค	ด	ฤ	◌ิ	ไ	๔
5		◌ี	ค	ต	ล	◌ี	า	๕
6	◌ี	◌ัะ	ฆ	ถ	ฦ	◌ี	ๆ	๖
7	◌ะ	◌ัะ	ง	ท	ว	◌ี	๘	๗
8	◌ะ	◌ิ	จ	ธ	ศ	◌ุ	ๆ	๘
9	◌ิ		ฉ	น	ษ	◌ู	◌ู	๙
A		◌ี	ช	บ	ส	◌ู	ๆ	ฯ
B	◌ี	◌ัะ	ช	ป	ห	◌ู	+	๚
C	◌ัะ	◌ะ	ฌ	ผ	ฬ	๑	◌ู	←
D	◌ะ	◌ิ	ญ	ฝ	อ	๒	๐	↑
E	◌ิ		ฎ	พ	ฮ	เ	◌ู	→
F	◌ี		ฏ	ฟ	ฯ	฿	๐	↓

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Page 23 (Thai character code 14)

	8	9	A	B	C	D	E	F
0	ร	ๆ		สฺ	ภ	ะ	เ	๐
1	ร	๑	ก	ฑ	ม	ั	แ	๑
2	ร	๒	ข	ฒ	ย	า	โ	๒
3	ร	๓	ข	ณ	ร	ำ	ใ	๓
4	ร	๔	ค	ด	ฤ	ิ	ไ	๔
5	ร	๕	ค	ต	ล	ี	า	๕
6	ร	๖	ฆ	ถ	ฦ	ึ	า	๖
7	ร	๗	ง	ท	ว	ื	ๆ	๗
8	ร	๘	จ	ธ	ศ	ุ	ฯ	๘
9	ร	๙	ฉ	น	ษ	ู	ๆ	๙
A	ร	๐	ช	บ	ส	ฺ	ๆ	๐
B	ร	๑	ซ	ป	ห	ฺ	ๆ	๑
C	ร	๒	ฌ	ผ	ฬ	๒	ๆ	๒
D	ร	๓	ญ	ฝ	อ	๓	ๆ	๓
E	ร	๔	ฎ	พ	ฮ	๔	ๆ	๔
F	ร	๑	ฏ	ฟ	ฯ	฿	๑	๑

Page 24 (Thai character code 16)

	8	9	A	B	C	D	E	F
0	┌	โ		สฐ	ภ	ะ	เ	๐
1	┐	ใ	ก	ฑ	ม	ั	แ	๑
2	└	่	ข	ฒ	ย	า	็	๒
3	┘	้	ฃ	ณ	ร	ำ	๊	๓
4	│	๊	ค	ด	ฤ	ิ	๋	๔
5	─	๋	ฅ	ต	ล	ี	์	๕
6	├	์	ฆ	ถ	ฦ	ึ	ๆ	๖
7	┤	ํ	ง	ท	ว	ื	๎	๗
8	┴	๎	จ	ธ	ศ	ุ	๏	๘
9	┬	๏	ฉ	น	ษ	ู	ๆ	๙
A	┼	ๆ	ช	บ	ส	ฺ	๗	๚
B	▌	็	ซ	ป	ห	ฺ	๘	๛
C	←	ั	ฌ	ผ	ฬ	ั	๙	๜
D	↑	ี	ญ	ฝ	อ	ี	๚	๝
E	→	ื	ฎ	พ	ฮ	ื	ๆ	๞
F	↓	ุ	ฏ	ฟ	ฯ	฿	๐	

Page 25 (Thai character code 17)

	8	9	A	B	C	D	E	F
0	่	้		ฐ	ภ	ะ	เ	๐
1	ะ	ะ	ก	ฑ	ม	ั	แ	๑
2	ะ	ะ	ข	ฒ	ย	า	โ	๒
3	ะ	ะ	ฃ	ณ	ร	ำ	ใ	๓
4	ะ	ะ	ค	ด	ฤ	ิ	ไ	๔
5	ะ	|	ฅ	ต	ล	ี	า	๕
6	ะ	—	ฆ	ถ	ฦ	ึ	ๆ	๖
7	ะ	┼	ง	ท	ว	ื	๘	๗
8	ะ	┌	จ	ธ	ศ	ุ	ๆ	๘
9	ะ	┐	ฉ	น	ษ	ู	ๆ	๙
A	ะ	└	ช	บ	ส	ฺ	ๆ	ฯ
B	ะ	┘	ซ	ป	ห	ฺ	+	๚
C	ะ	├	ฌ	ผ	ฬ	ๅ	ๆ	←
D	ะ	┬	ญ	ฝ	อ	ๆ	ๆ	↑
E	ะ	┤	ฎ	พ	ฮ	เ	ๆ	→
F	ะ	┴	ฏ	ฟ	ฯ	฿	ๆ	↓

Page 26 (Thai character code 18)

	8	9	A	B	C	D	E	F
0	⌐	ๆ		ฐ	ภ	ะ	เ	๐
1	¬	๑	ก	ฑ	ม	ั	แ	๑
2	└	๒	ข	ฒ	ย	า	โ	๒
3	┘	๓	ฃ	ณ	ร	ำ	ใ	๓
4	│	๔	ค	ด	ฤ	ิ	ไ	๔
5	─	๕	ฅ	ต	ล	ี	ๅ	๕
6	├	๖	ฆ	ถ	ฦ	ึ	ๆ	๖
7	┤	๗	ง	ท	ว	ื	๗	๗
8	┴	๘	จ	ธ	ศ	ุ	็	๘
9	┬	๙	ฉ	น	ษ	ู	่	๙
A	┼	๚	ช	บ	ส	ฺ	้	๚
B	▌	๛	ซ	ป	ห	ฺ	๊	๛
C	←	๐	ฌ	ผ	ฬ	ฺ	๋	๐
D	↑	๑	ญ	ฝ	อ	ฺ	์	๑
E	→	๒	ฎ	พ	ฮ	ฺ	ํ	๒
F	↓	๓	ฏ	ฟ	ฯ	฿	๎	

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Page 255 (Blank page)

	HEX	8	9	A	B	C	D	E	F
HEX	BIN	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	SP 128	SP 144	SP 160	SP 176	SP 192	SP 208	SP 224	SP 240
1	0001	SP 129	SP 145	SP 161	SP 177	SP 193	SP 209	SP 225	SP 241
2	0010	SP 130	SP 146	SP 162	SP 178	SP 194	SP 210	SP 226	SP 242
3	0011	SP 131	SP 147	SP 163	SP 179	SP 195	SP 211	SP 227	SP 243
4	0100	SP 132	SP 148	SP 164	SP 180	SP 196	SP 212	SP 228	SP 244
5	0101	SP 133	SP 149	SP 165	SP 181	SP 197	SP 213	SP 229	SP 245
6	0110	SP 134	SP 150	SP 166	SP 182	SP 198	SP 214	SP 230	SP 246
7	0111	SP 135	SP 151	SP 167	SP 183	SP 199	SP 215	SP 231	SP 247
8	1000	SP 136	SP 152	SP 168	SP 184	SP 200	SP 216	SP 232	SP 248
9	1001	SP 137	SP 153	SP 169	SP 185	SP 201	SP 217	SP 233	SP 249
A	1010	SP 138	SP 154	SP 170	SP 186	SP 202	SP 218	SP 234	SP 250
B	1011	SP 139	SP 155	SP 171	SP 187	SP 203	SP 219	SP 235	SP 251
C	1100	SP 140	SP 156	SP 172	SP 188	SP 204	SP 220	SP 236	SP 252
D	1101	SP 141	SP 157	SP 173	SP 189	SP 205	SP 221	SP 237	SP 253
E	1110	SP 142	SP 158	SP 174	SP 190	SP 206	SP 222	SP 238	SP 254
F	1111	SP 143	SP 159	SP 175	SP 191	SP 207	SP 223	SP 239	SP 255

UD:undefined

International Character Sets

Country	ASCII code (hexadecimal number)											
	23	24	40	5B	5C	5D	5E	60	7B	7C	7D	7E
U.S.	#	$	@	[	\	]	^	`	{	|	}	~
France	#	$	à	°	ç	§	^	`	é	ù	è	¨
Germany	#	$	§	Ä	Ö	Ü	^	`	ä	ö	ü	ß
UK	£	$	@	[	\	]	^	`	{	|	}	~
Denmark I	#	$	@	Æ	Ø	Å	^	`	æ	ø	å	~
Sweden	#	$	É	Ä	Ö	Å	Ü	é	ä	ö	å	ü
Italy	#	$	@	°	\	é	^	ù	à	ò	è	ì
Spain I	Pt	$	@	¡	Ñ	¿	^	`	¨	ñ	}	~
Japan	#	$	@	[	¥	]	^	`	{	|	}	~
Norway	#	¤	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
Denmark II	#	$	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
Spain II	#	$	á	¡	Ñ	¿	é	`	í	ñ	ó	ú
Latin America	#	$	á	¡	Ñ	¿	é	ü	í	ñ	ó	ú
Korea	#	$	@	[	₩	]	^	`	{	|	}	~

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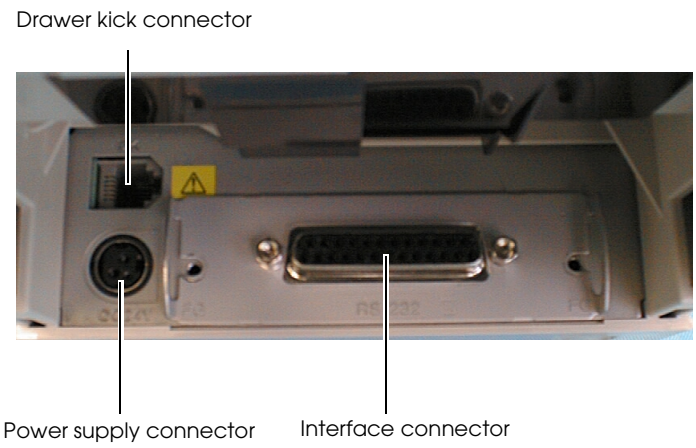
Appendix D

Connection of Cables and Options

Connecting Cables

All cables are connected to the connector panel located on the lower rear side of the printer.



Connector panel

Note:
The figure above shows the connector panel for the RS-232/RS-485 interface model printer. The shape of the interface connector varies according to the type of interface used.

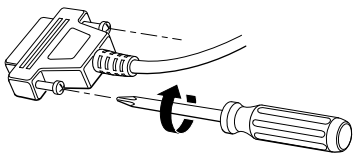
Be sure to turn off the power supply for both the printer and the host computer unit before connecting the various cables.

Connecting the Host Computer

RS-232/RS-485 Interface Models

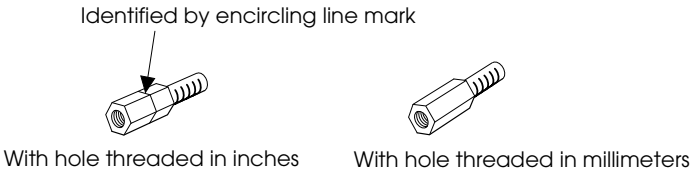
1. Press the connector on the end of the interface cable firmly into the interface connector on the connector panel.

2. When using connectors equipped with screws, use the screws to tighten the connectors firmly in place.



Tightening screws

Note:
The printer comes with hexagon lock bolts with bolt-head threads designed to inch specifications. Users with interface cables that use metric thread screws can replace the inch thread lock bolts with the metric thread lock bolts that come with the printer using a hexagonal (5 mm) screwdriver.



Hexagon bolts threaded in inches and millimeters

3. For interface cables equipped with a ground line, attach the ground line to the screw hole marked "FG" on the printer.

4. Connect the other end of the interface cable to the host computer.

IEEE Interface Models

1. Press the connector on the end of the interface cable firmly into the interface connector on the connector panel.

2. Press down the clips on either side of the connector to lock it in place.

3. For interface cables equipped with a ground line, attach the ground line to the screw hole marked "FG" on the printer.

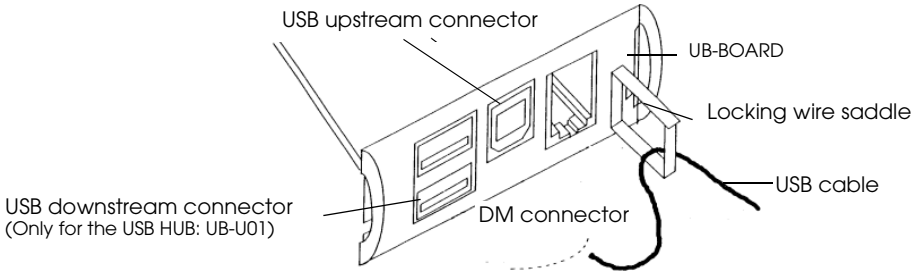
4. Connect the other end of the interface cable to the host computer.

USB Interface Models

1. Attach the locking wire saddle at the location shown in the figure below.

2. Hook the USB cable through the locking wire saddle, as shown in the figure below.

Note:
Hooking the USB cable through the locking wire saddle, as shown in the figure below, will prevent the cable from coming unplugged.



Attaching locking wire saddle

3. Connect the USB cable from the host computer to the USB upstream connector.

4. For models that have the UB-U01 installed, a maximum of two USB devices can be connected to the USB downstream connector.

   Note:
   The UB-U01 serves as a bus power-supply hub. Therefore, it is important to note that bus power supply hubs (including the UB-U01) and bus power supply functions with power dissipation of 100 mA or more cannot be connected directly to the printer. (A UB-U02 can be directly connected to a UB-U01 hub.)

5. Install the UB-U01/02 device driver on the host computer.

   Note:
   For information on how to obtain the required device drivers and their installation procedures, contact the nearest EPSON service center.

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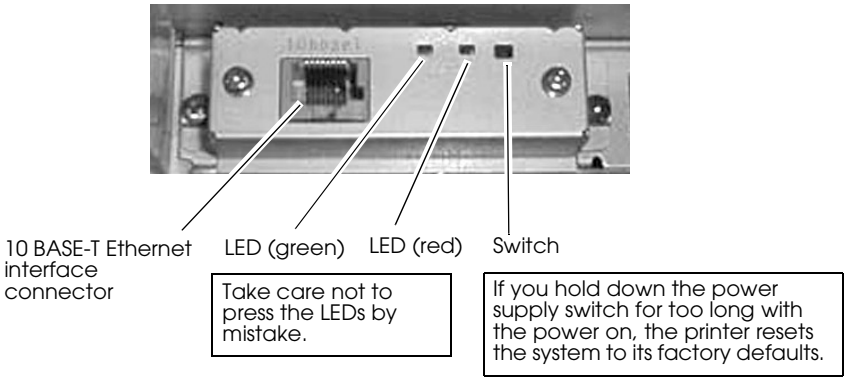
Ethernet Interface Models

Names of parts

The names of the various parts of the Ethernet interface are shown below.



Name of parts

Connecting interface cables

⚠ *CAUTION:*

Connecting devices directly to LAN cables that are installed outdoors will expose them to damage from power surges caused by lightning and other inductive sources. It is best to make sure that devices without proper surge protection are cushioned by being connected through devices that do have surge protection. Otherwise, it is better not to connect them to outdoor lines.

1. Confirm that the power supplies for both the printer and the host computer have been turned off.

2. Connect the 10 Base-T cable to the 10 Base-T Ethernet connector by pressing firmly until the connectors click.

CAUTION:

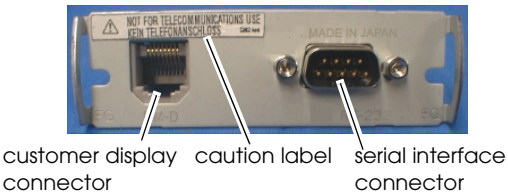
Never attempt to connect the customer display cable, drawer kick out cable, or the standard telephone line cable to the 10 Base-T Ethernet connector.

Note:
Refer to "UB-E01 Developer's Guide" for various setting methods of Ethernet interface.

UB-S09

Part names

The following view shows the part names of the UB-S09.

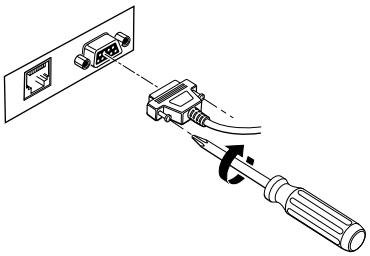


Connecting the cables

Before connecting any of the cables, make sure that both the printer and the host computer are turned off.

1. Plug the cable connector securely into the UB-S09's interface connector.

2. Tighten the screws on both sides of the connector.



Note:
If your interface connector has a grounding wire, attach it to the printer using either of the screws that fasten the UB-S09 to the printer.

3. Attach the other end of the cable to the host computer.

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Connecting the display module cable

1. Make sure both the printer and the host computer are turned off.

2. Disconnect the power supply from the printer.

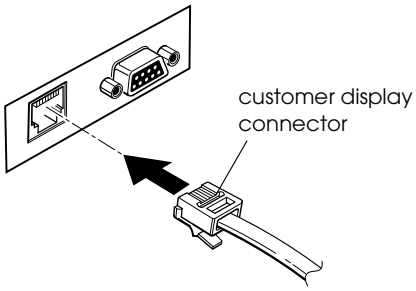
⚠ CAUTION:

You must disconnect the power supply because electrical current is flowing in some parts of the printer circuit even when the power switch is turned off; otherwise, you may damage the UB-S09 and the printer.

3. Plug the cable connector (provided with the direct connection display module) securely into the UB-S09's display module connector until it clicks.

⚠ CAUTION:

Do not connect this connector to an ordinary telephone line.



Note:
Never connect customer display connectors to both the UB-S09 and the TM printer at the same time.

4. Connect the power supply to the printer.

Connecting a Drawer

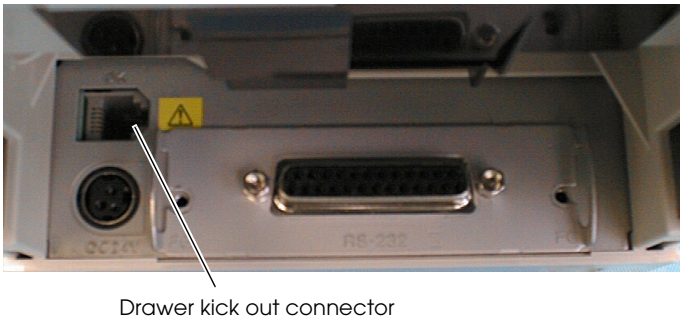
⚠ CAUTION:

Be sure to connect a drawer that meets printer specifications. Connecting a drawer of the wrong specifications may result in damage to both the drawer and the printer.

Never connect the telephone line to the drawer kick out connector (labeled "DK"). Doing so may result in damage to both the telephone line and the printer.

Never connect the drawer cable to the customer display connector (labeled "DM-D"). Doing so may result in damage to both the drawer cable and the printer.

1. Connect the drawer cable to the drawer kick out connector (labeled "DK") on the connector panel.



Connecting drawer

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Connecting the Power Supply Unit (PS-170, PS-180)

Be sure to use the EPSON PS-170, PS-180, or an equivalent product as the power supply unit.

⚠ WARNING:

Always use the EPSON PS-170, PS-180, or an equivalent product as the power supply unit. Using a nonstandard power supply can result in shock and even fire.

Should a fault ever occur in the EPSON PS-170, PS-180, or equivalent product, immediately turn off the power to the printer and remove the power supply cable from the wall socket.

⚠ CAUTION:

Be sure to remove the power supply cable from the wall socket whenever connecting or disconnecting the power supply unit to the printer. Failure to do so may result in damage to the power supply unit or the printer.

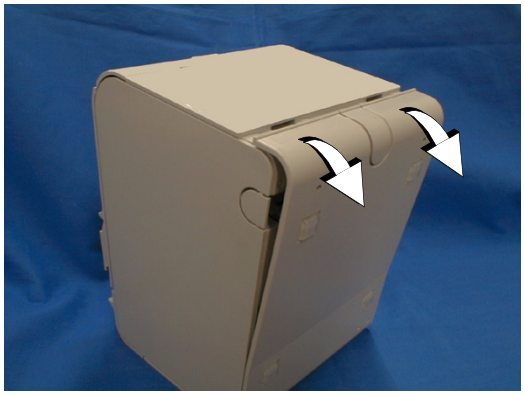
Be sure to confirm that the wall socket power supply satisfies the rated voltage requirements of the power supply unit. Never insert the power supply cable plug into a socket that does not meet the rated voltage requirements of the power supply unit. Doing so may result in damage to both the power supply unit and the printer.

1. Confirm that the printer's power supply is turned off and the power supply unit's power cable has been removed from the wall socket.

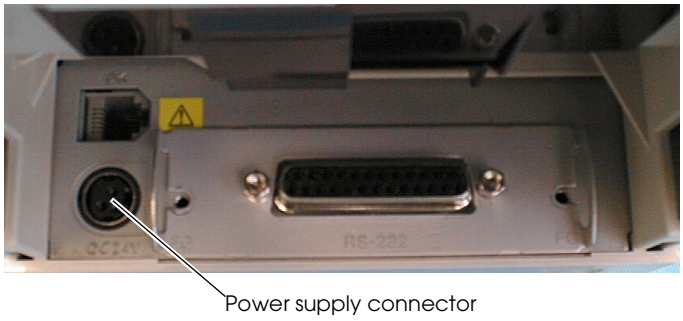
2. Check the specifications label on the power supply unit to confirm that the wall socket power supply meets the rated voltage requirements.

3. To place cables, first break off by hand any of the three portions indicated by circles in the illustration (the other portion is on the right). Then put the cables through the holes and replace the bottom of the cover.

4. Remove the bottom of the cover as shown in the illustration below.



5. Install the connector of the power supply cable onto the power supply connector (labeled DC24V).



Power supply connector

Note:
When removing the DC cable connector from the EPSON PS-170 or PS-180, first confirm that the power supply cable has been disconnected from the power supply unit; then grasp the arrow marked section of the connector and pull straight out.

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Notes on Power Supply Unit and Voltage

- ❑ Connect the external power supply to the power supply connector of the printer. Then plug in the external power supply and turn it on if necessary. Be sure not to connect the external power supply with the wrong polarity. If it is connected incorrectly, the internal circuit fuse of the printer may be blown or the external power supply may be damaged.

- ❑ The power supply voltage is within the range of 24 V ± 7%. If the power supply voltage drops to a value outside the range above during printing, the printer stops printing and waits until the voltage returns to normal and then automatically begins printing again. Therefore, printing speed may slow, the print pitch may not be correct, and some dots in some characters may not be printed.

- ❑ Both high- and low-voltage errors are shown in "Unrecoverable errors" on page 3-6. The blinking patterns are shown in the table.

- ❑ When either a high- or low-voltage error occurs, turn off the power as soon as possible.

Appendix E
Glossary of Terms

2-dimensional codes	A symbology system that conforms to the ANSI standards, such as PDF417, from Symbol Technologies. 2-dimensional codes are used in shipping and receiving, in the automotive industry, and for military applications.
ANK	Alphanumeric. Characters in this set are single-byte, as opposed to Kanji and other character types, which are double-byte.
ASB	Auto status back: a feature that allows the printer to send status information back to the host computer automatically.
bidirectional	Two-way communication between the host and printer, which allows the printer to return status information to the host. The IEEE 1284 standard for the parallel interface has the capacity for bidirectional communication. (See IEEE 1284.)
bitmap	A graphic or a character comprised of individual pixels or dots. Bitmaps are somewhat limited in the degree to which they can be enlarged without distortion. Bitmaps are raster graphics. (See vector.)
buffer, receive	A memory area in the printer that holds incoming data from the host computer and processes it in the order received. Besides the receive buffer, the TM-T90 has a graphics buffer, a user-defined buffer, and a macro buffer.
cpl	Characters per line.
Ethernet	An interface type for a local area network that is available for the TM-T90 printer.
full cut	The TM-T90 autocutter can be set to "full cut," where the printed receipt is completely separated from the roll. See "partial cut."
hex dump	A test mode in which the printer prints hexadecimal numbers representing printable characters and non-printing control codes.
IEEE 1284	The standard used for the TM-T90 parallel interface. This type of interface allows both bidirectional communications and unidirectional ("compatibility mode") communications.
lps	Lines per second.
maintenance counter	The TM-T90 maintenance counters provide information that can be retrieved remotely.

memory switches	A portion of NV memory devoted to storing printer settings. Some of these settings can replace DIP switch functions.
NV	Non-volatile, flash memory. The data stored in this type of memory is not lost when the power is turned off. The TM-T90's NV memory is used to store graphics, primarily bitmap logos. (See bitmap.)
page mode	In this mode, the printer collects data and formatting commands in its buffer until printing is specified with the **ESC FF** or **FF** command. This mode gives the printer more flexibility in formatting, so that it can print character and bar code data, or other graphics data, on the same line.
paper roll spacer	A part attached to the printer to enable printing on 58 mm or 60 mm rolls.
partial cut (perforation cut)	Most EPSON printer autocutters leave one point (small segment) of the receipt uncut. This is called "partial cut." The TM-T90 autocutter can be set to "full cut," where the printed receipt is completely separated from the roll.
printable area	The maximum printable area.
raster graphics	A graphic or a character comprised of individual pixels or dots. Raster graphics are somewhat limited in the degree to which they can be enlarged without distortion. Bitmaps are raster graphics. (See vector.)
RS-232C	The standard serial interface available.
RS-485	A serial interface type available as a dealer option.
single-color	Printing using a thermal paper that is only able to produce black and white printouts.
standard mode	In this mode, the printers print data in the print buffer by executing print commands (such as **LF**, **CR**, and **ESC J**) or when the buffer is full.
two-color	Printing using the appropriate thermal paper to support the TM-T90's capacity to produce two colors and commands to call out the color for characters and graphics in the printouts.
USB	Universal Serial Bus. A serial interface that allows the addition of peripheral devices on a single bus.
VAR	Value added reseller.
vector	A graphic or character created with mathematical algorithms, or curves. It can be scaled larger or smaller without changing its appearance. (See bitmap.)

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