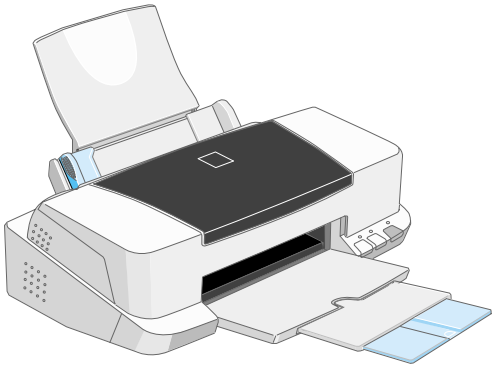
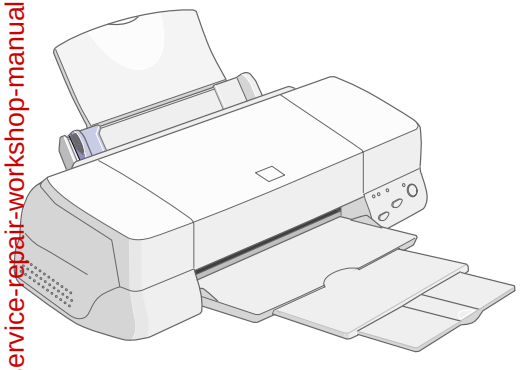
SERVICE MANUAL





Color ink jet printer

Stylus COLOR 860/1160

SEIJ99003

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PRECAUTIONS

Precautionary notations throughout the text are categorized relative to 1)Personal injury and 2) damage to equipment.

DANGER Signals a precaution which, if ignored, could result in serious or fatal personal injury. Great caution should be exercised in performing procedures preceded by DANGER Headings.

WARNING Signals a precaution which, if ignored, could result in damage to equipment.

The precautionary measures itemized below should always be observed when performing repair/maintenance procedures.

DANGER

1. ALWAYS DISCONNECT THE PRODUCT FROM THE POWER SOURCE AND PERIPHERAL DEVICES PERFORMING ANY MAINTENANCE OR REPAIR PROCEDURES.
2. NOWORK SHOULD BE PERFORMED ON THE UNIT BY PERSONS UNFAMILIAR WITH BASIC SAFETY MEASURES AS DICTATED FOR ALL ELECTRONICS TECHNICIANS IN THEIR LINE OF WORK.
3. WHEN PERFORMING TESTING AS DICTATED WITHIN THIS MANUAL, DO NOT CONNECT THE UNIT TO A POWER SOURCE UNTIL INSTRUCTED TO DO SO. WHEN THE POWER SUPPLY CABLE MUST BE CONNECTED, USE EXTREME CAUTION IN WORKING ON POWER SUPPLY AND OTHER ELECTRONIC COMPONENTS.

WARNING

1. REPAIRS ON EPSON PRODUCT SHOULD BE PERFORMED ONLY BY AN EPSON CERTIFIED REPAIR TECHNICIAN.
2. MAKE CERTAIN THAT THE SOURCE VOLTAGES IS THE SAME AS THE RATED VOLTAGE, LISTED ON THE SERIAL NUMBER/RATING PLATE. IF THE EPSON PRODUCT HAS A PRIMARY AC RATING DIFFERENT FROM AVAILABLE POWER SOURCE, DO NOT CONNECT IT TO THE POWER SOURCE.
3. ALWAYS VERIFY THAT THE EPSON PRODUCT HAS BEEN DISCONNECTED FROM THE POWER SOURCE BEFORE REMOVING OR REPLACING PRINTED CIRCUIT BOARDS AND/OR INDIVIDUAL CHIPS.
4. IN ORDER TO PROTECT SENSITIVE MICROPROCESSORS AND CIRCUITRY, USE STATIC DISCHARGE EQUIPMENT, SUCH AS ANTI-STATIC WRIST STRAPS, WHEN ACCESSING INTERNAL COMPONENTS.
5. REPLACE MALFUNCTIONING COMPONENTS ONLY WITH THOSE COMPONENTS BY THE MANUFACTURE; INTRODUCTION OF SECOND-SOURCE ICs OR OTHER NONAPPROVED COMPONENTS MAY DAMAGE THE PRODUCT AND VOID ANY APPLICABLE EPSON WARRANTY.

PREFACE

This manual describes basic functions, theory of electrical and mechanical operations, maintenance and repair procedures of Stylus COLOR 860/1160. The instructions and procedures included herein are intended for the experienced repair technicians, and attention should be given to the precautions on the preceding page. The chapters are organized as follows:

CHAPTER 1. PRODUCT DESCRIPTIONS

Provides a general overview and specifications of the product.

CHAPTER 2. OPERATING PRINCIPLES

Describes the theory of electrical and mechanical operations of the product.

CHAPTER 3. TROUBLESHOOTING

Provides the step-by-step procedures for troubleshooting.

CHAPTER 4. DISASSEMBLY AND ASSEMBLY

Describes the step-by-step procedures for disassembling and assembling the product.

CHAPTER 5. ADJUSTMENTS

Provides Epson-approved methods for adjustment.

CHAPTER 6. MAINTENANCE

Provides preventive maintenance procedures and the lists of Epson-approved lubricants and adhesives required for servicing the product.

APPENDIX

Provides the following additional information for reference:

- ***EEPROM Address Map***
- ***Connector Pin Assignments***
- ***Component Layout***
- ***Parts List and Exploded Diagrams***
- ***C298MAIN Board Circuit Diagram***

Revision Status

Revision	Issued Date	Description
A	August 19, 1999	First Release
B	October 5, 1999	Second release • Correction has been made due to overall review of the manual. • Appendix has additional information.
C	November 25,1999	Third release • Correction has been made due to overall review of the manual. • Some T.B.D have been made clear. • Appendix has additional information. - Fig7-3, 7-4 has been mounted.

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CHAPTER

1

PRODUCT DESCRIPTION

1.1 FEATURES

The major features of EPSON color inkjet printers EPSON Stylus COLOR 860/ 1160 are:

- High Color Print Quality
  - 1440 (H) X 720 (V) dpi printing
  - Four Color Printing (YMCK)
  - Traditional and New Microweave
- Built-in Auto Sheet Feeder
  - Holds 100 cut-sheets (64g/m^2)
  - Holds 10 envelopes
  - Holds 30 transparency films
- Two Built-in Interfaces
  - Bi-directional parallel I/F (IEEE-1284 level 1 device)
  - USB
- Windows/Macintosh exclusive

1.2 SPECIFICATIONS

This section covers specifications of the printers.

1.2.1 Physical Specification

- Weight: 6.0kg (without ink cartridges) for Stylus Color 860
  8.0kg (without ink cartridges) for Stylus Color 1160
- Dimension:
  [Stylus Color 860]
  Storage: 450 mm (W) x 269 mm (D) x 175 mm (H)
  Printing: 450 mm (W) x 628 mm (D) x 303 mm (H)

  [Stylus Color 1160]
  Printing: 609 mm (W) x 766 mm (D) x 414 mm (H)

1.2.2 Printing Specification

- Print Method
  - On demand ink jet
- Nozzle Configuration
  - Monochrome 144 nozzles (48 x 3 staggered)
  - Color 48 nozzles x 3 (Cyan, Magenta, Yellow)
- Print Direction
  - Bi-direction with logic seeking
- Print Speed & Printable Columns

Table 1-1. Character Mode

Model	Character Pitch	Printable Column	LQ Speed
Stylus Color 860	10 CPI (Pica)	80	238 CPS*
Stylus Color 1160	10 CPI (Pica)	127	238 CPS*

**This value is the speed of normal-dot printing.*

Table 1-2. Raster Graphics Mode

Model	Horizontal Resolution	Printable Area	Available Dot	CR Speed
Stylus Color 860	180 dpi	8.26 inches	1488	23.8/19 IPS
	360 dpi	8.26 inches	2976	23.8/19 IPS
	720 dpi	8.26 inches	5952	19 IPS
Stylus Color 1160	180 dpi	12.716 inches	2289	23.8/19 IPS
	360 dpi	12.716 inches	4578	23.8/19 IPS
	720 dpi	12.716 inches	9156	19 IPS

- Control Code
  - ESC/P Raster command
  - EPSON Remote command
- Character Tables
  - Two international character sets:
    - PC 437 (US, Standard Europe)
    - PC 850 (Multilingual)
- Typeface
  - Bit map LQ font:
    EPSON Courier 10 CPI

1.2.3 Paper Feeding

- Feed Method
  - Friction feed with ASF
- Paper Path
  - Cut-sheet ASF (Top entry, Front out)
- Feed Speed
  - 2.36 inch/sec (Normal, Continuous feed)
  - 4.5 inch/sec (Fast, Continues feed)

1.2.4 Input Data Buffer

- 256KB

1.2.5 Electric Specification

[120V Version]

Rated Voltage:	AC120V
Input Voltage Range:	AC99~132V
Rated Frequency Range:	50~ 60Hz
Input Frequency Range:	49.5~ 60.5Hz
Rated Current:	0.4A (for Stylus Color 860) 0.4A (for Stylus Color 1160)
Power Consumption:	Approx. 18W (ISO10561 Letter Pattern) Approx. 3.5W in standby mode (for Stylus Color 860) Approx. 18W (ISO10561 Letter Pattern) Approx. 3.5W in standby mode (for Stylus Color 1160) Energy Star compliant
Insulation Resistance:	10M ohms min. (between AC line and chassis, DC 500V)
Dielectric Strength:	AC 1000V rms. 1 minutes or AC 1200V rms. 1 second (between AC line and chassis)

[220 ~ 240V Version]

Rated Voltage:	AC220V~240V
Input Voltage Range:	AC198~264V
Rated Frequency Range:	50~60Hz
Input Frequency Range:	49.5~60.5Hz
Rated Current:	0.2 A (for Stylus Color 860) 0.2 A (for Stylus Color 1160)
Power Consumption:	Approx. 18W (ISO10561 Letter Pattern) Approx. 3.5W in standby mode (for Stylus Color 860) Approx. 18W(ISO10561 Letter Pattern) Approx. 3.5W in standby mode (for Stylus Color 1160) Energy Star compliant
Insulation Resistance:	10M ohms min. (between AC line and chassis, DC 500V)
Dielectric Strength:	AC 1500V rms. 1 minute (between AC line and chassis)

1.2.6 Environmental Condition

- Temperature
  - Operating: 10 to 35°C (see the figure below for condition)
  - Non-operating: -20 to 60°C (with shipment container)
    1 month at 40°C and 120 hours at 60°C
- Humidity
  - Operating: 20 to 80% RH
    (without condensation / see the figure below for condition)
  - Non-operating: 5 to 85% RH
    (without condensation / with shipment container)
- Resistance to Shock
  - Operating: 1G, within 1 ms
  - Non-operating: 2G, within 2 ms (with shipment container)
- Resistance to Vibration
  - Operating: 0.15G
  - Non-operating: 0.50G (with shipment container)

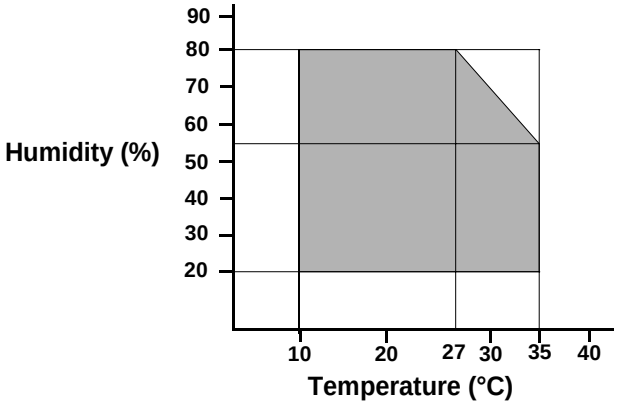

Figure 1-1. Temperature/Humidity Range

1.2.7 Reliability

Total Print Volume: 75,000 pages (A4, Letter)

Print Head Life: 3 billion dots/nozzle

1.2.8 Safety Approvals

[120V Version]

Safety Standards: UL1950
CSA22.2 No.950

EMI: FCC part 15 subpart B Class B
CSA C108.8 Class B

[220~240V Version]

Safety Standards: EN60950 (VDE)

EMI: EN55022 (CISPR Pub.22) Class B
AS/NZS 3548 Class B

1.2.9 Acoustic Noise

Level: Approx. 42dB(A) (According to ISO 7779)
-Used media : Plain Paper
- Print Quality: Fine

1.2.10 CE Marking

[220~240V Version]

Low Voltage Directive 73/23/EEC: EN60950
EMC Directive 89/336/EEC: EN55022 Class B
EN61000-3-2
EN61000-3-3
EN50082-1
IEC801-2
IEC801-3
IEC801-4

1.3 INTERFACE

The EPSON Stylus COLOR 860/1160 provide USB and parallel interface as standard.

1.3.1 Parallel Interface (Forward Channel)

Transmission Mode:	8 bit parallel, IEEE-1284 compatibility mode
Synchronization:	By STROBE pulse
Handshaking:	BY BUSY and ACKNLG signal
Signal Level:	TTL compatible level
Adaptable Connector:	57-30360 (amphenol) or equivalent

BUSY signal is set high before setting either -ERROR low or PE high, and held high until all these signals return to their inactive state.

BUSY signal is at high level in the following cases:

- During data entry (see data transmission timing).
- When input data buffer is full.
- During -INIT signal is at low level or during hardware initialization.
- During printer error (see -ERROR signal).
- When the parallel interface is not selected.

ERROR signal is at low level when the printer is in one of the following states:

- Printer hardware error (fatal error)
- Paper-out error
- Paper-jam error
- Ink-out error

PE signal is at high level during paper-out error.

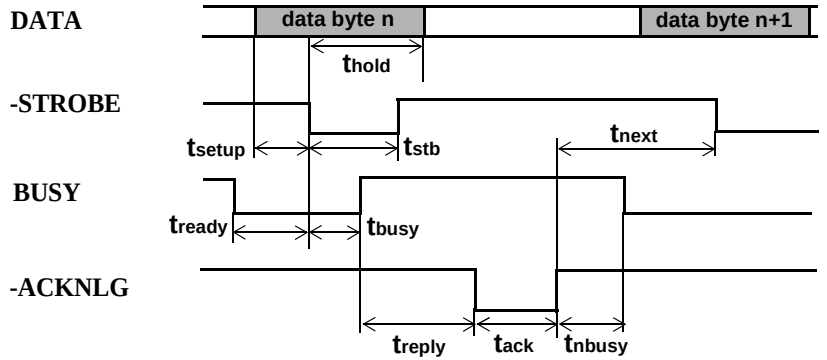

Figure 1-2. Data Transmission Timing

Table 1-3.

Parameter	Minimum	Maximum
tsetup	500ns	-
thold	500ns	-
tstb	500ns	-
tready	0	-
tbusy	-	500ns
tt-out*	-	120ns
tt-in**	-	200ns
treply	0	-
tack	500ns	10us
tnbusy	0	-
tnext	0	-

* *Rise and fall time of every output signal.*
** *Rise and fall time of every input signal.*
*** *Typical timing for tack is shown on the following page.*

Table 1-4. Typical Time of tack

Parallel I/F Mode	Typical Time of tack
High Speed	1us
Normal Speed	3us

Table 1-5. Signal Level: TTL Compatible (IEEE-1284 level 1 device)

Parameter	Minimum	Maximum	Condition
VOH*	-	5.5V	
VOL*	-0.5V	-	
IOH*	-	0.32mA	VOH = 2.4V
IOL*	-	12mA	VOL = 0.4V
CO	-	50pF	
VIH	-	2.0V	
VIL	0.8V	-	
IIH	-	0.32mA	VIH = 2.0V
IIL	-	12mA	VIL = 0.8V
CI	-	50pF	

* *A low logic level on the Logic H signal is 2.0V or less when the printer is powered off, and this signal is equal to or exceeding 3.0V when the printer is powered on. The receiver shall provide an impedance equivalent to 7.5K ohm to ground.*

Table 1-6. Connector Pin Assignment and Signals

Pin No.	Signal Name	Return GND Pin	In/Out	Functional Description
1	-STROBE	19	In	The strobe pulse. Read-in of data is performed at the falling edge of this pulse.
2	DATA0	20	In	The DATA0 through DATA7 signals represent data bits 0 to 7, respectively. Each signal is at high level when data is logical 1 and low level when data is logical 0.
3	DATA1	21	In	
4	DATA2	22	In	
5	DATA3	23	In	
6	DATA4	24	In	
7	DATA5	25	In	
8	DATA6	26	In	
9	DATA7	27	In	
10	-ACKNLG	28	Out	This signal is a negative pulse indicating that the printer can accept data again.
11	BUSY	29	Out	A high signal indicates that the printer cannot receive data.
12	PE	28	Out	A high signal indicates paper-out error.
13	SLCT	28	Out	Always at high level when the printer is powered on.
14	-AFXT	30	In	Not used.
31	-INIT	30	In	The falling edge of a negative pulse or a low signal on this line causes the printer to initialize. Minimum 50us pulse is necessary.
32	-ERROR	29	Out	A low signal indicates printer error condition.
36	-SLIN	30	In	Not used.

Table 1-6. Connector Pin Assignment and Signals (continued)

Pin No.	Signal Name	Return GND Pin	In/Out	Functional Description
18	Logic H	-	Out	Pulled up to +5V via 3.9 K ohm resistor.
35	+5V	-	Out	Pulled up to +5V via 3.3K ohm resistor.
17	Chassis GND	-	-	Chassis GND
16,33, 19-30	GND	-	-	Signal GND
15,34	NC	-	-	Not connected

NOTE: *In/Out refers to the direction of signal flow seen from the printer side.*

1.3.2 Parallel Interface (Reserve Channel)

Transmission Mode: IEEE-1284 nibble mode
Adaptable Connector: See forward channel.
Synchronization: Refer to the IEEE-1284 specification
Handshaking: Refer to the IEEE-1284 specification
Data Trans. Timing: Refer to the IEEE-1284 specification
Signal Level: IEEE-1284 level 1 device
See forward channel.

Table 1-7. Connector Pin Assignment and Signals

Pin No.	Signal Name	Return GND Pin	In/Out	Functional Description
1	HostClk	19	In	Host clock signal.
2	DATA0	20	In	The DATA0 through DATA7 signals represent data bits 0 to 7, respectively. Each signal is at high level when data is logical 1 and low level when data is logical 0. These signals are used to transfer the 1284 extensibility request values to the printer.
3	DATA1	21	In	
4	DATA2	22	In	
5	DATA3	23	In	
6	DATA4	24	In	
7	DATA5	25	In	
8	DATA6	26	In	
9	DATA7	27	In	
10	PtrClk	28	Out	Printer clock signal.
11	PtrBusy / DataBit-3,7	29	Out	Printer busy signal and reverse channel transfer data bit 3 or 7.
12	AckDataReq / DataBit-2,6	28	Out	Acknowledge data request signal and reverse channel transfer data bit 2 or 6.
13	Xflag / DataBit-1,5	28	Out	X-flag signal and reverse channel transfer data bit 1 or 5.
14	HostBusy	30	In	Host busy signal.
31	-INIT	30	In	Not used.

Table 1-7. Connector Pin Assignment and Signals (continued)

Pin No.	Signal Name	Return GND Pin	In/Out	Functional Description
32	-DataAvail / DataBit-0,4	29	Out	Data available signal and reverse channel transfer data bit 0 or 4.
36	1284-Active	30	In	1284 active signal.
18	Logic-H	-	Out	Pulled up to +5V via 3.9K ohm resistor.
35	+5V	-	Out	Pulled up to +5V via 3.3K ohm resistor.
17	Chassis GND	-	-	Chassis GND
16,33, 19-30	GND	-	-	Signal GND
15,34	NC	-	-	Not connected

Note) In/Out refers to the direction of signal flow from the printer's point of view.

Extensibility Request:

The printer responds affirmatively when the extensibility request values are 00H or 04H, which means,

00H: Request Nibble Mode Reverse Channel Transfer.
04H: Request Device ID;
Return Data Using Nibble Mode Rev Channel Transfer.

Device ID:

The printer sends the following device ID string when requested.

When IEEE1284.4 is enabled,
[00H] [5AH] (for Stylus Color 860)
[00H] [5CH] (for Stylus Color 1160)
MFG: EPSON;
CMD: ESCPL2, BDC, D4;
MDL: Stylus[SP]COLOR[SP]860/1160;
CLS: PRINTER;
DES: EPSON[SP]Stylus[SP]COLOR[SP]860/1160;

When IEEE1284.4 is disabled,
[00H] [57H] (for Stylus Color 860)
[00H] [59H] (for Stylus Color 1160)
MFG: EPSON;
CMD: ESCPL2, BDC;
MDL: Stylus[SP]COLOR[SP]860/1160;
CLS: PRINTER;
DES: EPSON[SP]Stylus[SP]COLOR[SP]860/1160;

NOTE 1:*[00H] denotes a hexadecimal value of zero.*

NOTE 2:*MDL value depends on the EEPROM setting.*

NOTE 3:*CMD value depends on the IEEE1284.4 setting.*

1.3.3 USB Interface

Standard:	Based on: "Universal Serial Bus Specifications Rev. 1.0" "Universal Serial Bus Device Class Definition for Printing Devices Version 1.0"
Bit Rate:	12Mbps (Full Speed Device)
Data Encoding:	NRZI
Adaptable Connector:	USB Series B
Recommended Cable Length:	2 meters

Table 1-8. Connector Pin Assignment and Signals

Pin No.	Signal Name	I/O	Function Description
1	VCC	-	Cable power. Max. power consumption is 2mA.
2	-Data	Bi-D	Data
3	+Data	Bi-D	Data, pull up to +3.3 V via 1.5K ohm resistor.
4	Ground	-	Cable ground

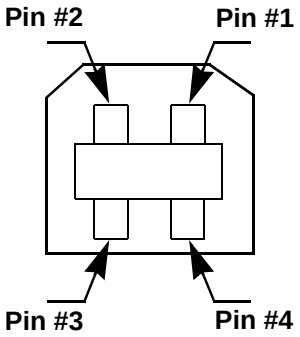

Figure 1-3. USB Pin Assignment

1.3.4 Prevention of Data Transfer Time-out

Generally, hosts abandon data transfer to peripherals when the peripheral is in the busy state for dozens of seconds continuously. To prevent this kind of time-out, the printer receives data very slowly, several bytes per minute, even if the printer is in the busy state. The slowdown starts when the remaining input buffer becomes several hundreds of bytes, and the printer finally gets into the busy state continuously when the input buffer is full.
USB and IEEE1284.4 on the parallel interface do not require such function.

1.3.5 Interface Selection

The printer has two built-in interfaces: the USB and parallel interface.
These interfaces are selected automatically.

- Automatic Selection
  In this automatic interface selection mode, the printer is initialized to the idle state while scanning which interface receives data when it is powered on. Then the interface which received data first is selected. When the host stops data transfer and the printer is in the stand-by state for seconds, the printer is returned to the idle state. As long as the host sends data or the printer interface is in the busy state, the selected interface is let as it is.
- Interface State and Interface Selection
  When the parallel interface is not selected, the interface gets into the busy state. When the printer is initialized or returned to the idle state, the parallel interface gets into the ready state. Note that the interrupt signal such as the -INIT signal on the parallel interface is not effective while that interface is not selected.

1.3.6 IEEE1284.4 Protocol

The packet protocol described by IEEE1284.4 standard allows a device to carry on multiple exchanges or conversations which contain data and/or control information with another device at the same time across a single point-to-point link. The protocol is not, however, a device control language. It does provide basic transport-level flow control and multiplexing services. The multiplexed logical channels are independent of each other and blocking of one has no effect on the others. The protocol operates over IEEE1284.

- Automatic Selection
  An initial state is compatible interface and starts IEEE1284.4 communication when magic strings (1284.4 synchronous commands) are received.
- On
  An initial state is IEEE1284.4 communication and data that received it by the time it is able to take synchronization by magic string (1284.4 synchronous commands) is discarded.
- Off
  An initial state is compatible interface and never starts IEEE1284.4 communication even if magic strings (1284.4 synchronous commands) are received.

1.4 OPERATOR CONTROLS

1.4.1 Operating Switch

Operating switch is located on the control panel.

1.4.2 Control Panel

1.4.2.1 Switches

There are two non-lock type push switches, one lock-type push switch, and four LED lights.

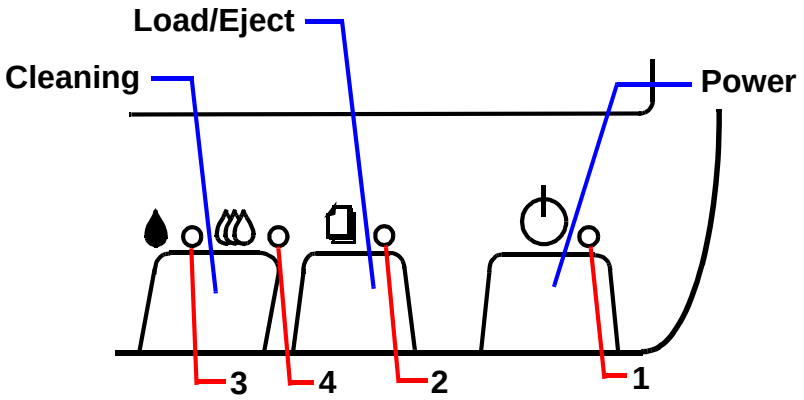

Figure 1-4. Control Panel

1.4.2.2 Indicators

(1) Power
Lights when the operating switch is “ON” and AC power is supplied.

(2) Paper Out
Lights during the paper-out condition, and blinks during the paper-jam condition.

(3) Ink Out (Black)
Lights during no black ink condition, and blinks during the black ink low condition.

(4) Ink Out (Color)
Lights during no color ink condition, and blinks during the color ink low condition.

1.4.3 Panel Functions

Table 1-9. Panel Functions

Switch	Function
Load / Eject (Push for less than 2 sec.*)	• Loads or ejects a paper. • When the carriage is on the ink cartridge replacement position, return the carriage to the capping position.
Load / Eject (Push for 2 sec.*)	• Starts the ink cartridge replacement sequence.** • Moves the carriage to the cartridge replacement position.
Cleaning (Push for 2 sec.*)	• Starts cleaning of the printhead. • In the condition of “Ink Low”, “Ink Out”, or “No Ink Cartridge”, starts the ink cartridge replacement sequence.**
Cleaning (Push for less than 2 sec.*)	• When the carriage is on the ink cartridge replacement position, return the carriage to the capping position.

** It is described in the user’s manual that three seconds are required.*

***This function is not available in printing status.*

Table 1-10. Panel Function with Power On

Switch	Pressing with Power On Function
Load / Eject	• 1) Starts status printing. *1
Cleaning	• Changes code pages / Select IEEE1284.4 mode for parallel I/F. *2
Load/Eject + Cleaning	• Enters the special settings mode. (Factory use only). *3

**1: One of the following actions is carried out according to the content of 1BH of EEPROM.*

Content of 1BH of EEPROM, [bit7] [bit6]	Action
00	Print firmware version, ink counter, selected code page and nozzle check pattern.
11	
01	Start hex-dump printing.
10	Start self test printing.

**2: Not described in the user’s manual.*

**3: See the table below.*

Table 1-11. Special Setting Mode

Switch	Function
Load / Eject	• Initialize EEPROM and reset timer IC.
Cleaning (Push for 10 seconds)	• Reset the ink overflow counter in EEPROM.

1.4.4 Printer Condition and Panel Status

Table 1-12. Printer Condition and LED Status

Printer Status	Indicators				Priority
	Power	Ink Out (Black)	Ink Out (Color)	Paper Out	
Power On Condition	On	-	-	-	9
Ink Sequence	Blink	-	-	-	6
Ink Cartridge Replacement Mode	Blink	-	-	-	5
Data Processing	Blink	-	-	-	8
Paper Out	-	-	-	On	4
Paper Jam Condition	-	Off	Off	Blink	3
No Ink Cartridge / Ink End (Black)	-	On	-	-	7
Ink Level Low (Black)	-	Blink	-	-	7
No Ink Cartridge or Ink End (Color)	-	-	On	-	7
Ink Level Low (Color)	-	-	Blink	-	7
Enter EEPROM and Timer IC Reset	-	ON (for 1 second only)			-
Maintenance Request	Blink	Blink	Blink	Blink	2
Fatal Error	Blink	On	On	Blink	1

1.4.5 Printer Initialization

There are three kinds of initialization methods, and the following explains each initialization.

1. Power-on Initialization
   This printer is initialized when turning the printer power on, or printer recognized the cold-reset command (remote RS command).

   When printer is initialized, the following actions are performed:
   (a) Initializes printer mechanism.
   (b) Clears input data buffer.
   (c) Clears print buffer.
   (d) Sets default values.

2. Operator Initialization
   This printer is initialized when turning the printer power on again within 10 seconds from last power off, or printer recognized the -INIT signal (negative pulse) of parallel interface.

   When printer is initialized, the following actions are performed:
   (a) Cap the printer head.
   (b) Eject a paper.
   (c) Clears input data buffer.
   (d) Clears print buffer.
   (e) Sets default values.

3. Software Initialization
   The ESC@ command also initialize the printer.

   When printer is initialized, the following actions are performed:
   (a) Clears print buffer.
   (b) Sets default values.

1.4.6 Errors

- **Ink Out**
  When the printer runs out most of the ink of any color, it indicates ink-low and keeps printing. When the printer runs out the whole ink of any color, it stops printing and indicates ink-out error. User is then requested to install a new ink-cartridge in this state. An ink-cartridge that has been taken out once should never be used again. Re-installation of the cartridge not filled fully upsets the ink level detection and may eventually cause a serious problem in the print head.
- **Paper Out**
  When the printer fails to load a sheet, it goes into a paper out error.
- **Paper Jam**
  When the printer fails to eject a sheet, it goes into a paper jam error.
- **No Ink-Cartridge**
  When the printer detects that ink-cartridge comes off, it goes into this error mode.
- **Maintenance Request**
  When the total amount of ink wasted through cleanings and flushing reaches to the limit, printer indicates this error and stops. In such a case, the absorber in the printer enclosure needs to be replaced with new one by service personnel.
- **Fatal Errors**
  Carriage control error or CG access error.

1.5 PAPER

1.5.1 Paper Handling

Do not perform reverse feed more than 9.5mm (0.38”).

1.5.2 Paper Specification

1.5.2.1 Cut Sheet

[Size]

For Stylus Color 860/1160:

A4:	Width 210mm (8.3”) x Length 297mm (11.7”)
Letter:	Width 216mm (8.5”) x Length 279mm (11.0”)
B5:	Width 182mm (7.2”) x Length 257mm (10.1”)
Legal:	Width 216mm (8.5”) x Length 356mm (14.0”)
Statement:	Width 139.7mm (5.5”) x Length 215.9mm (8.5”)
Executive:	Width 184.2mm (7.25”) x Length 266.7mm (10.5”)
Photo Paper:	Width 101.6mm (4”) x Length 152.4mm (6”)

For Stylus Color 1160 only:

A3:	Width 297mm (11.7”) x Length 420mm (16.5”)
A3+:	Width 329mm (13.0”) x Length 483mm (19.0”)

[Thickness]

0.08mm (0.003”) - 0.11mm (0.004”)

[Weight]

64g/m^2 (17lb.) - 90g/m^2 (24lb.)

[Quality]

Exclusive paper, Bond paper, PPC

1.5.2.2 Transparency, Glossy Paper

[Size]

For Stylus Color 860/1160:

A4:	Width 210mm (8.3”) x Length 297mm (11.7”)
Letter:	Width 216mm (8.5”) x Length 279mm (11.0”)

For Stylus Color 1160 only:

A3+:	Width 329mm x Length 483mm (Glossy Paper)

[Thickness]

0.075mm (0.003”) - 0.085mm (0.0033”)

**Transparency printing is available only at normal temperature.*

1.5.2.3 Envelope

[Size]

No.10:	Width 241mm (9 1/2”) x Length 104.8mm (4 1/8”)
DL:	Width 220mm (8.7”) x Length 110mm (4.3”)
C6:	Width 162mm (6.4”) x Length 114mm (4.5”)

[Thickness]

0.16mm (0.006”) - 0.52mm (0.02”)

[Weight]

45g/m^2 (12lb.) - 75g/m^2 (20lb.)

[Quality]

Bond paper, Plain paper, Air mail

Note1: Envelope printing is available only at normal temperature.
Note 2: Keep the longer side of the envelope horizontally at setting.

1.5.2.4 Index Card

[Size]

A6 Index Card:	Width 105mm (4.1”) x Length 148mm (5.8”)
A5 Index Card:	Width 148mm (5.8”) x Length 210mm (8.3”)
5 x 8” Index Card:	Width 127mm (5.0” x Length 203mm (8.0”)
10 x 8” Index Card:	Width 127mm (5.0”) x Length 203mm (8.0”)

[Thickness]

Less than 0.23mm (0.0091”)

1.5.3 Printing Area

1.5.3.1 Cut Sheet

See the figure below and tables on the right for printable areas for Raster Graphics mode and Character mode.

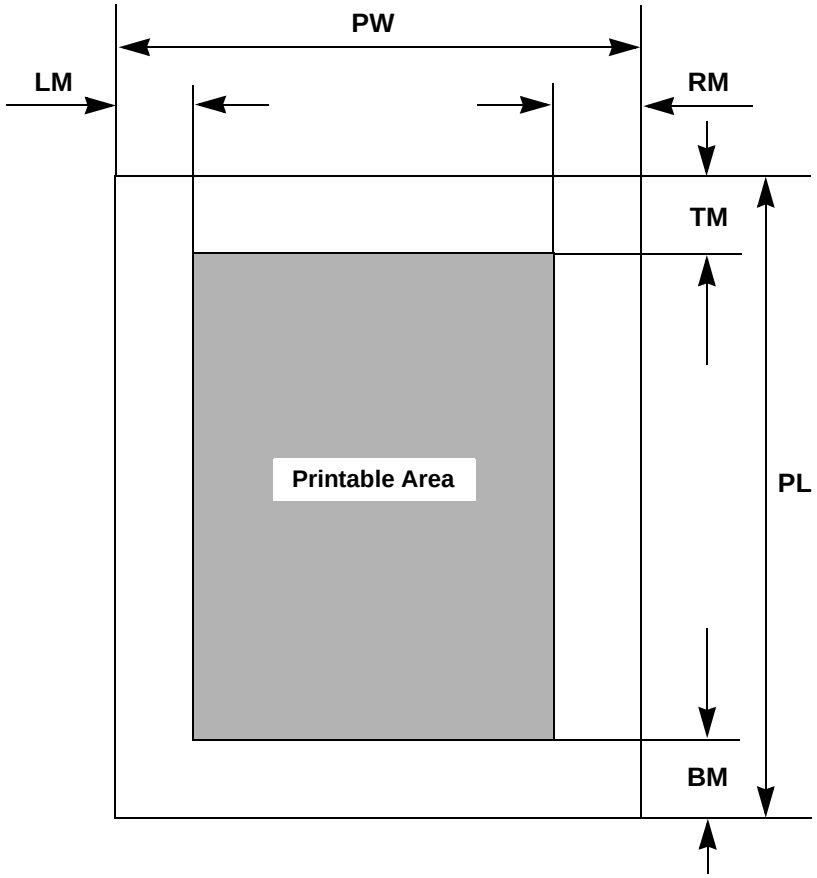

Figure 1-5. Printable Area for Cut Sheet

Table 1-13. Character Mode

Paper Size	Left Margin (min.)	Right Margin (min.)	Top Margin (min.)	Bottom Margin (min.)
A3 (*1)	3mm (0.12”)	3mm (0.12”)	3mm (0.12”)	14mm (0.54”) /3mm (0.12”) (*2)
A4	3mm (0.12”)	3mm (0.12”)	3mm (0.12”)	14mm (0.54”) /3mm (0.12”) (*2)
Letter	3mm (0.12”)	9mm (0.35”)	3mm (0.12”)	14 mm (0.54”) / 3mm (0.12”) (*2)
B5	3mm (0.12”)	3 m (0.12”)	3mm (0.12”)	14 mm (0.54”) / 3mm (0.12”) (*2)
Legal	3mm (0.12”)	9mm (0.35”)	3mm (0.12”)	14 mm (0.54”) / 3mm (0.12”) (*2)
Statement	3mm (0.12”)	3mm (0.12”)	3mm (0.12”)	14 mm (0.54”) / 3mm (0.12”) (*2)
Executive	3mm (0.12”)	3mm (0.12”)	3mm (0.12”)	14 mm (0.54”) / 3mm (0.12”) (*2)

Table 1-14. Raster Graphics Mode

Paper Size	Left Margin (min.)	Right Margin (min.)	Top Margin (min.)	Bottom Margin (min.)
A3*	3 mm (0.12”)	3 mm (0.12”)	3 mm (0.12”)	14 mm (0.54”) / 3mm (0.12”) **
A3+*	3 mm (0.12”)	3 mm (0.12”)	3 mm (0.12”)	14 mm (0.54”) / 3mm (0.12”) **
A4	3 mm (0.12”)	3 mm (0.12”)	3 mm (0.12”)	14 mm (0.54”) / 3mm (0.12”) **
Letter	3 mm (0.12”)	3 mm (0.12”)	3 mm (0.12”)	14 mm (0.54”) / 3mm (0.12”) **
B5	3 mm (0.12”)	3 mm (0.12”)	3 mm (0.12”)	14 mm (0.54”) / 3mm (0.12”) **
Legal	3 mm (0.12”)	3 mm (0.12”)	3 mm (0.12”)	14 mm (0.54”) / 3mm (0.12”) **
Statement	3 mm (0.12”)	3 mm (0.12”)	3 mm (0.12”)	14 mm (0.54”) / 3mm (0.12”) **
Exclusive	3 mm (0.12”)	3 mm (0.12”)	3 mm (0.12”)	14 mm (0.54”) / 3mm (0.12”) **

* *For Stylus Color 1160 only.*

** *Bottom margin can be reduced to 3mm when paper dimension is defined by using command, otherwise it is not reduced (14mm). As for an area between 3mm and 14mm margin, printing quality may decline.*

*** *Refer to 1.5.2 Paper Specification for PW (paper width) and PL (paper length).*

1.5.3.2 Envelopes

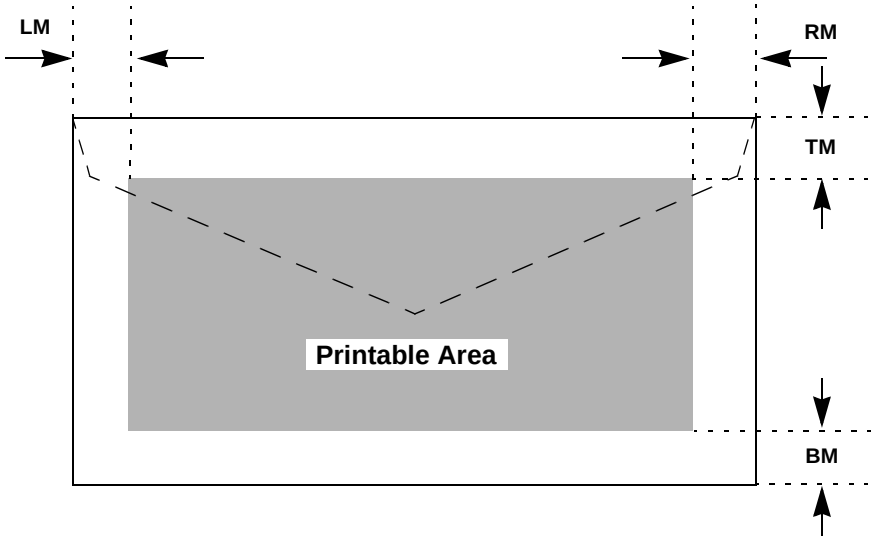

Figure 1-6. Printable Area for Envelopes

Table 1-15. Envelope Margin

Size	Left Margin (min.)	Right Margin (min.)	Top Margin (min.)	Bottom Margin (min.)
#10	3 mm (0.12”)	28 mm (1.10”)	3 mm (0.12”)	14 mm (0.55”)
DL	3 mm (0.12”)	7 mm (0.28”)	3 mm (0.12”)	14 mm (0.55”)
C6	3 mm (0.12”)	3 mm (0.12”)	3 mm (0.12”)	14 mm (0.55”)

1.6 INK CARTRIDGE

1.6.1 Black Ink Cartridge

Type:	Exclusive Cartridge
Color:	Black
Print Capacity:	900 pages/A4 (ISO/IEC 10561 Letter Pattern at 360 dpi)
Ink Life:	2 years from date of production
Storage Temperature:	
Storage:	-20 °C to 40 °C (within a month at 40 °C)
Packing:	-30 °C to 40 °C (within a month at 40 °C)
Transit:	-30 °C to 60 °C (within 120 hours at 60 °C and within a month at 40 °C)
Dimension:	27.8 mm (W) x 52.7 mm (D) x 38.5 mm (H)

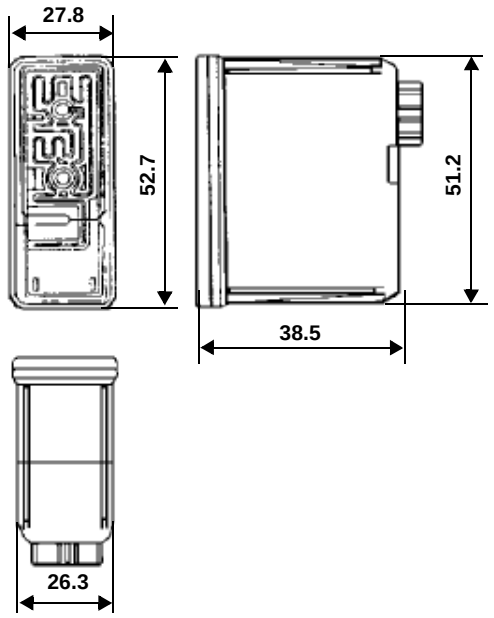

Figure 1-7. Black Ink Cartridge

1.6.2 Color Ink Cartridge

Type:	Exclusive Cartridge
Color:	Magenta, Cyan, Yellow
Print Capacity:	300 pages / A4 (360 dpi, 5% duty each color)
Ink Life:	2 years from date of production
Storage Temperature:	
Storage:	-20 °C to 40 °C (within a month at 40 °C)
Packing:	-30 °C to 40 °C (within a month at 40 °C)
Transit:	-30 °C to 60 °C (within 120 hours at 60 °C and within a month at 40 °C)
Dimension:	42.9 mm (W) x 52.7 mm (D) x 38.5 mm (H)

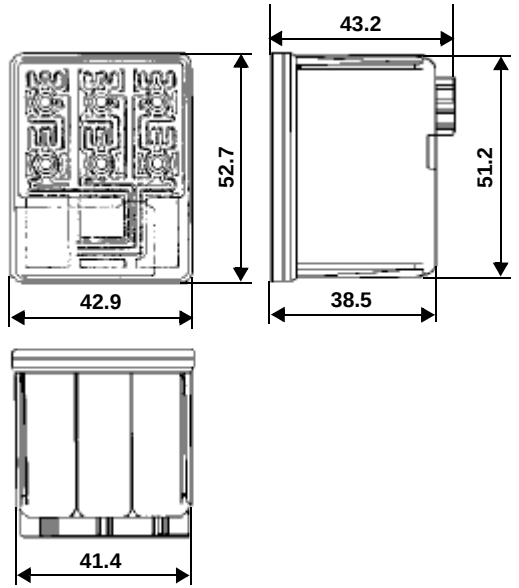

Figure 1-8. Color Ink Cartridge

Note 1: Ink cartridge can not be refilled. The ink cartridge is prepared only for article of consumption.
Note 2: Do not use the ink cartridge which contains life-expired ink.
Note 3: Ink will be frozen under -4 °C environment; however, it will be usable after being left at room temperature for more than three hours.

CHAPTER

2

OPERATING PRINCIPLES

2.1 Overview

This section describes the operating principles of the printer mechanism and electrical circuit boards. The EPSON Stylus COLOR 860/1160 has the following boards:

- ☐ Main board: C298MAIN Board (Stylus COLOR 860/1160)
- ☐ Power supply board: C298PSB/PSE Board (Stylus COLOR 860/1160)
- ☐ Panel board: C298PNL Board (Stylus COLOR 860)
  C304PNL Board (Stylus COLOR 1160)

2.1.1 Printer Mechanism

Unlike other EPSON ink jet printers, the Stylus COLOR 860/1160 uses DC motor for power source. Use of the DC motor enable the printer to lower noise during printing to a great extent. Table 2-1 shows the various motor types used in the printer and their applications.

Table 2-1. Motor Types and Corresponding Applications

Motor Name	Type	Application / Feature
CR Motor	DC with brush	Used to drive the carriage making little noise. A a linear scale is used to monitor the motor's operating condition.
PF Motor	DC with brush	• Drives paper feeding rollers used to send paper at specified speeds and load/eject paper. • CR lock lever operation • To monitor paper feeding pitch, a loop scale is attached beside the high-precision gear.
Pump/ASF	4-Phase 48-pole stepping motor	Like the Stylus COLOR 800 and Stylus Pro 5000, this motor manages pump drive and paper loading from ASF. Since this is a stepping motor, it has no scales or photo sensors that are used to monitor the motor's operating condition.

The basic structure of the printer mechanism is mostly common to the Stylus COLOR 400/600/440/640/740, except that the Stylus COLOR 860/1160 uses a Pump/ASF motor. With this motor equipped, the paper loading mechanism and the pumping mechanisms are independently driven, which allows the printer to offer higher throughput as a result.

Figure 2-1 shows the printer mechanism block diagram for the Stylus COLOR 860/1160.

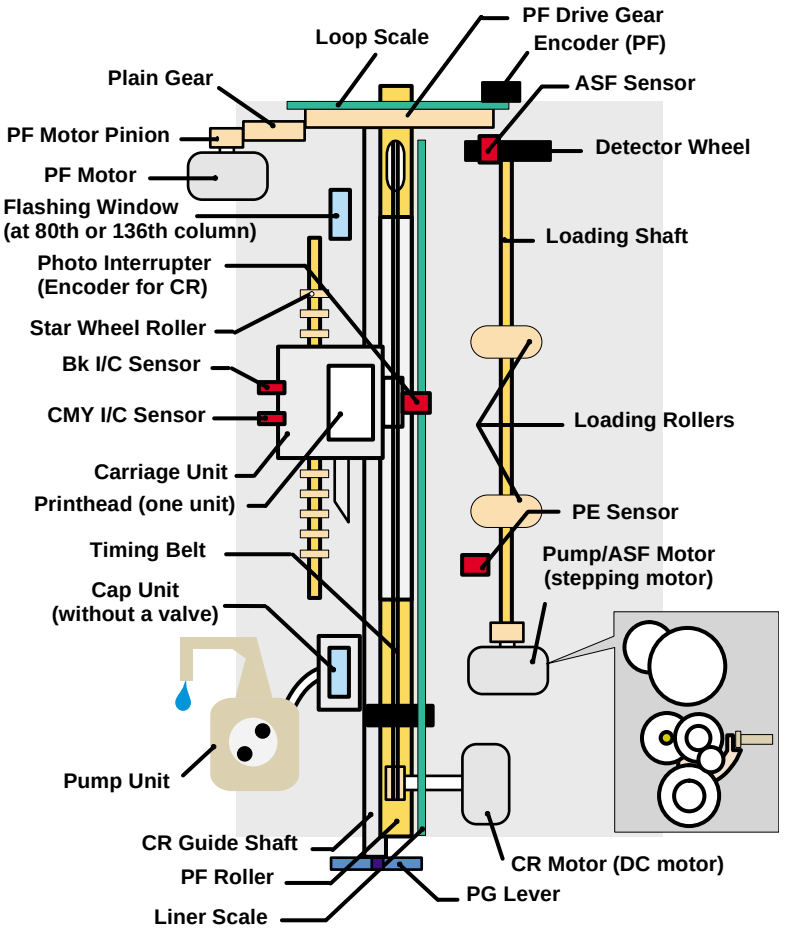

Figure 2-1. Printer Mechanism Block Diagram

2.1.1.1 Printing Mechanism

The basic operating principles of the printhead, which plays a major role in printing, are the same as previous models; ones that use a on-demand type U-CHIP head method. (Refer to Figure1-1.)
Also, unlike the Stylus Color IIs, 820 and 200, the Stylus COLOR 860/1160 is not an automatic correction type. So, in order to correct dispersion of multi layer piezo electric element that drives each nozzle, you are required to input a VH value written on the top surface of the printhead by using an exclusive program when you replace the printhead, control board, or printer mechanism. (Note there are no resistor arrays to determine the VH voltage on the main control board.) Following explains printhead.

- PZT
  PZT is an abbreviation of Piezo Electric Element. Print signals from the Main board are sent through the driver board on the printhead unit to the PZT. Then, the PZT pushes the top cavity which has ink stored to discharge the ink from each nozzle on the nozzle plate.
- Cavity Set
  The ink absorbed from the ink cartridge goes through the filter and then is stored temporarily in this tank called “cavity” until PZT is driven.
- Nozzle Plate
  The board with nozzle holes on the printhead surface is called Nozzle Plate.
- Filter
  When the ink cartridge is installed, if any dirt or dust around the cartridge needle is absorbed into the head, there is a great possibility of causing nozzle clog and disturbance of ink flow, and finally causing alignment failure and dot missing. To prevent this problem, a filter is set below the cartridge needle, where ink is filtered.

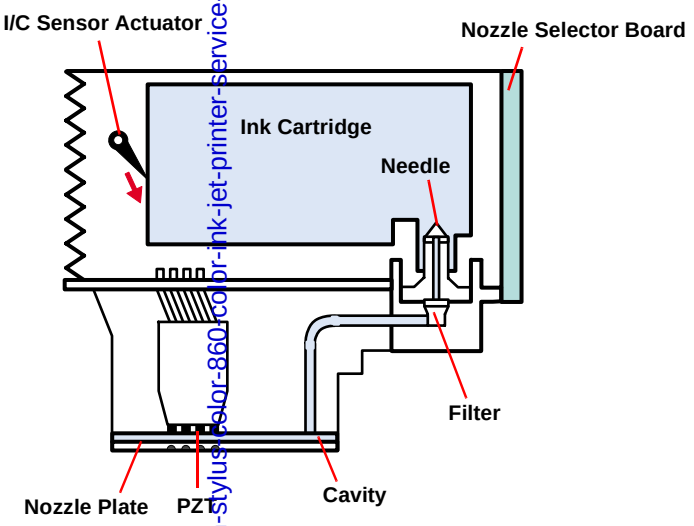

Figure 2-2. Printing Mechanism

Product: 1999 EPSON Stylus Color 860 Color Ink Jet Printer Service Repair Workshop Manual
Full Download: https://www.arepairmanual.com/downloads/1999-epson-stylus-color-860-color-ink-jet-printer-service-repair-workshop-manual/
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