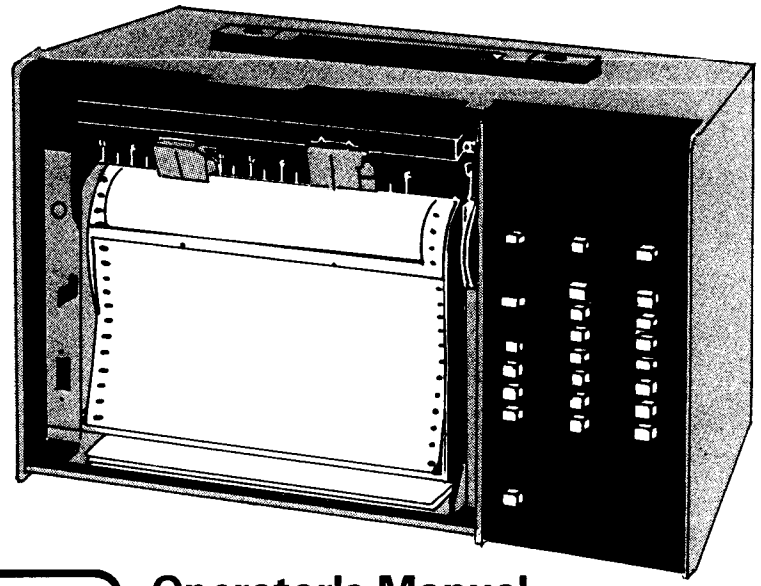
RD3057

Portable Recorder



OMEGA®

An OMEGA Technologies Company

Operator's Manual
M1346/0392

WARRANTY

OMEGA warrants this unit to be free of defects in materials and workmanship and to give satisfactory service for a period of **13 months** from date of purchase. OMEGA Warranty adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that our customers receive maximum coverage on each product. If the unit should malfunction, it must be returned to the factory for evaluation. Our Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective it will be repaired or replaced at no charge. However, this WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear or which are damaged by misuse are not warranted. These include contact points, fuses, and triacs.

We are glad to offer suggestions on the use of our various products. Nevertheless OMEGA only warrants that the parts manufactured by it will be as specified and free of defects.

OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED.

LIMITATION OF LIABILITY: The remedies of buyer set forth herein are exclusive and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

Every precaution for accuracy has been taken in the preparation of this manual, however, OMEGA ENGINEERING, INC. neither assumes responsibility for any omissions or errors that may appear nor assumes liability for any damages that result from the use of the products in accordance with the information contained in the manual.

RETURN REQUESTS / INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA ENGINEERING Customer Service Department. Call toll free in the USA and Canada: 1-800-622-2378, FAX: 203-359-7811; International: 203-359-1660, FAX: 203-359-7807.

BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, YOU MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OUR CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence. Please have the following information available BEFORE contacting OMEGA:

1. P.O. number under which the product was PURCHASED,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems you are having with the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. That way our customers get the latest in technology and engineering.

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CONTENTS

RD3057 means the same thing as Type 3057.
Any numbers after the hyphen indicate options for the recorder.

UNPACKING

Remove the Packing List and verify that all equipment has been received. If there are any questions about the shipment, please call the OMEGA Customer Service Department at 1-800-622-2378 or (203) 359-1660.

Upon receipt of shipment, inspect the container and equipment for any signs of damage. Take particular note of any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

NOTE

The carrier will not honor any claims unless all shipping material is saved for their examination. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

1. GENERAL.

1-1. Description.

The OMEGA RD3057 portable recorder has a DC-servo pen drive and is available in 1- or 2-channel versions.

Its effective recording span is 150mm, and there are 12 measuring ranges from 10mV to 50V full scale.

MODEL NUMBER	DESCRIPTION
RD3057-01	9 red pens, one channel
RD3057-02	9 green pens, two channels
RD3057-11	Portable recorder, 1 pen
RD3057-12	Portable recorder, 1 pen, AC/Ni-Cd/DC
RD3057-13	Portable recorder, 1 pen, AC/Batt/DC
RD3057-21	Portable recorder, 2 pens
RD3057-22	Portable recorder, 2 pens, AC/Ni-Cd/DC
RD3057-23	Portable recorder, 2 pens, AC/Batt/DC
RD3057-RP	Rolls of paper - 10 rolls
RD3057-ZFP	Z-fold paper/10 per pack
CALL SALES	Portable recorder with external chart control

The recorder uses a contactless ultrasonic potentiometer and writes with disposable felt-tip pens.

Three-way power supply operation is possible for outdoor or automobile applications.

1-2. Features.

(1) Free operating position

The recorder can be used in vertical or horizontal operating positions with the roll chart installed.

(2) Contactless ultrasonic pen position transducer

A contactless ultrasonic pen position transducer using a magnetostrictive wire is employed, for reliability and long life.

(3) Z-fold and roll charts can be used

By simply rearranging of the chart compartment you may use either Z-fold or roll chart.

(4) Three-way power supply system

Any of three types of power supply sources – AC voltage, Ni-Cd (or dry) batteries, or +12VDC – can be used for outdoor or automobile operation.

(5) Compact, lightweight.

1-3. Specifications.

Pen Drive System: Automatic null-balancing DC servo mechanism.
Number of Channels: 1 or 2.
Writing System: Ink writing using disposable felt-tip pen cartridge.
Recorder Ink Colors: Red (1st channel) and green (2nd channel).
Pen Offset between Channels: Approx. 5 mm on the time axis.
Effective Recording Span: 150 mm (100 uniform divisions at 1.5 mm/division). Scale mark 0 (right most) to 10.
Type of Input: Floating (guarded terminal not provided).
Voltage Ranges: 10, 20, 50, 100, 200, 500 mV/F.S. 1, 2, 5, 10, 20, 50 V/F.S. (12 ranges).
Zero Set: Independently adjustable over full effective span for each channel.
Input Impedance: Approx. 1 MΩ constant on all voltage ranges.
Maximum Allowable Source Resistance: 10 kΩ.
Zero Stability: ±(2 μV + 0.02% of effective recording span/°C max.
Warm-up: Approx. 15 minutes.
Maximum Allowable Input Voltage: 50 V DC on 10 mV to 500 mV ranges and 250 V DC on 1 V to 50 V ranges.
Reference Range: 500 mV.
Accuracy: ±0.5% of effective recording span (on reference range) at st'd conditions. Excludes errors due to cahrt paper expansion or shrinkage, and errors due to source resistance.
Span Accuracy between Ranges: Less than 0.5% of pen deflection.
Dead Band: Less than 0.2% of effective recording span.
Maximum Common Mode Voltage: 130 V rms AC, 180 V DC.
Common Mode Rejection Ratio: More than 120 dB at power line frequency or at DC and at standard conditions.
Normal Mode Rejection Ratio: More than 50 dB at power line frequency.
Maximum Pen Speed: Typically 30 cm/sec.
Overshoot: None.
Chart Drive: Pulse motor drive system.
Chart Speeds: 2, 6, 20, 60 cm/mm and cm/hr (8 ranges).
Chart Speed Accuracy: ±0.25% at st'd conditions

excludes errors due to chart paper expansion or shrinkage.

Chart: Z-fold chart (174 mm X Approx. 15 m) (standard) or roll chart (174 mm X Approx. 20 m) (specified).

Pen Lift: The recording pens are respectively lifted and lowered by a operation of PEN LIFT levers on the front.

Operating Position (recording surface): Horizontal, vertical.

Dielectric Strength:

1500 V AC for one minute between power line and case.

1000 V AC for one minute between input terminals and case.

Insulation Resistance: More than 100 MΩ at 500 V DC at standard conditions between power line and case, input terminals and case and between each channel input terminals.

Power Supply: 100, 120, 200, 220 or 240 V AC ±10% (must be specified) for both 50 and 60 Hz (option) Ni-Cd battery, dry batteries, EXT 12 V DC.

Power Consumption:

1 channel

Maximum; Approx. 16 VA.

Pen servo at balance; Approx. 13 VA.

2 channels

Maximum; Approx. 22 VA.

Pen servo at balance; Approx. 16 VA.

Standard Conditions: Temperature 23±2°C humidity 55 ± 10%.

Operating Temperature Range: 0 to 50°C however, 0 to 40°C for dry built-in Ni-Cd or dry batteries.

Operating Humidity Range: 40 to 80% R.H.

Dimensions: Approx. 223 X 332 X 174 mm (8-3/4 X 13-1/8 X 6-7/8").

Weight:

1 channel

5 kg (11 lbs) (only for AC power line).

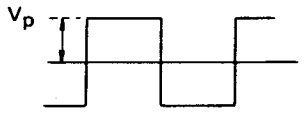
6.5 kg (14.3 lbs) (includes Ni-Cd battery).

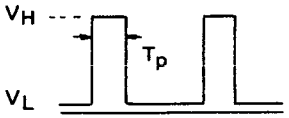
2 channels

6 kg (13.2 lbs) (only for AC power line).

7.5 kg (16.5 lbs) (includes Ni-Cd battery).

1-4. Optional Features. Contact Sales for availability.

<table>
<tr><td>Function</td><td colspan="3">Chart Control /CHC</td></tr>
<tr><td>Description</td><td colspan="3">• Remote chart drive control is possible using external oscillator signal (rectangular waveform and pulse train)
• Remote chart drive start / stop control is possible using external contact, open collector or TTL level signal
L logic level or closed contact . . . . . chart drive start
H logic level or open contact . . . . . chart drive stop</td></tr>
<tr><td rowspan="5">Specifications</td><td>Remote control signal waveforms</td><td>Rectangular waveforms</td><td>Pulse train</td></tr>
<tr><td>Signal level</td><td> 

4V < Vp < 24V</td><td> 

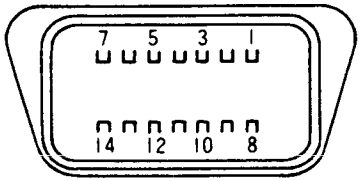
+4V < VH < +24V
−24V < VL < +0.5V
Tp > 1ms</td></tr>
<tr><td>Maximum signal source impedance</td><td>600Ω</td><td>50Ω</td></tr>
<tr><td>Chart speed</td><td colspan="2">0.3 f cm/min (f = frequency)</td></tr>
<tr><td>Maximum frequency</td><td>200Hz</td><td>200pps</td></tr>
<tr><td>Accessory</td><td colspan="3">Connector plug for remote control (A9024KC)</td></tr>
</table>

*TTL. signal level L: 0 to +0.5V M: +2.4 to +5.0V

1-5. Accessories

ITEM	PART NUMBER
Z-fold paper	RD3057-ZFP
Roll paper	RD3057-RP
Disposable felt-tip pen cartridge (felt pen tip and ink cartridge)	
(1st channel (red))	RD3057-01 (9 per pack)
(2nd channel (green))	RD3057-02 (9 per pack)
Fuse	
0.2A (for 100V AC power supply)	A9048KF
0.1A (for 200V AC powr supply)	G9048ZF
2A (for Ni-Cd battery or dry batteries)	A9043KF
Power Cord	A9009WD
Ni-Cd Battery	A9002ED
Connector (for EXT. DC)	A9116KC
Connector (for EXT. chart control)	A9024KC
Instruction Manual	M1346

- Remote



Pin No.		Pin No.	
1	.....	8	COMMON
2	.....	9	COMMON
3	.....	10	COMMON
4	EXT. start	11	COMMON
5	.....	12	COMMON
6	EXT. clock	13	COMMON
7	Clock select	14	CASE

2. NAMES AND FUNCTIONS OF COMPONENTS.

2-1. Front Panel.

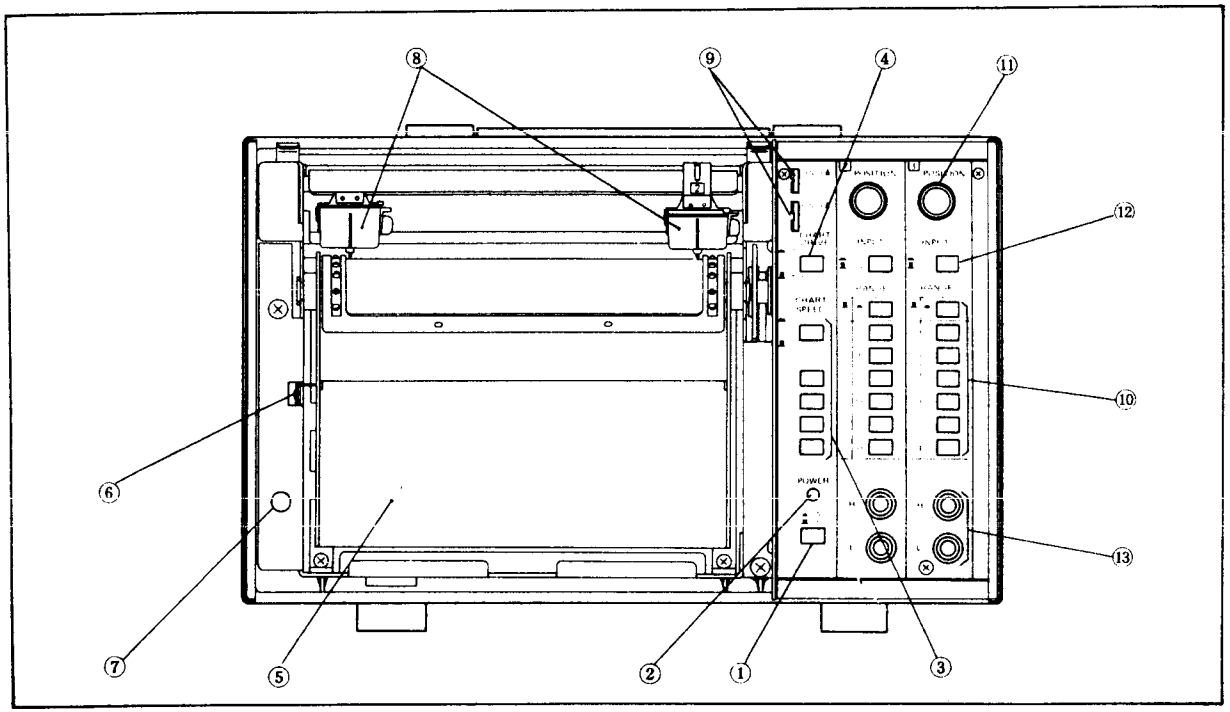


Figure 2-1. Front Panel.

① **POWER Switch:**
Pushbutton switch; Depress to switch ON, depress again to switch OFF.

② **POWER Pilot Lamp:**
Lights when the power pushbutton is set ON.

③ **CHART SPEED Selection Buttons:**
There are four speed buttons and one time-span button. Depressing the desired combination sets the chart speed. (2, 6, 20, 60 cm/h and cm/min). For example, to select a 20 cm/min (1 cm/3s) chart speed, depress the 20 speed button and the cm/min time span button.

④ **CHART DRIVE pushbutton:**
Depressing this button advances the chart at the preselected speed. Depressing the button again halts the chart feed.

⑤ **Chart Compartment:**
Two compartments are provided: one for the unused chart, one for the recorded chart.

⑥ **Chart Compartment Lock Release Lever:**
This lever locks the chart compartment. To install the chart in the chart compartment, press this lever outwards and pull out the chart compartment.

⑦ **Battery Monitor**
When driven by a battery, the battery voltage is monitored.
When the battery voltage drops, the LED lamp goes out. Then, charge it (in case of a Ni-Cd battery) or replace the dry battery.

⑧ **Pens:**
The pen having the shorter pen arm is pen Number 1. The other pen is Number 2.

⑨ **Pen Lift Levers:**
These levers are for lifting and lowering the respective pen.

⑩ **RANGE Selector Pushbuttons:**
10, 20, 50, 100, 200, 500 mV, 1, 2, 5, 10, 20 and 50V ranges may be set in combination with the mV/V selector push button.

⑪ **POSITION Knob:**
This sets the pen position at zero input voltage. The penzero position can be set at any point within the effective recording span.

⑫ **INPUT Switch:**
Turns input signal voltage on and off. At ZERO, servo amplifier inputs are completely disconnected from signal input terminals, and are shorted.

⑬ **Terminals:**
Plus . . . . . H(red)
Minus . . . . L(black)
Connect signal source low impedance terminal to the recorder L terminal.

2-2. Power Supply Panel.

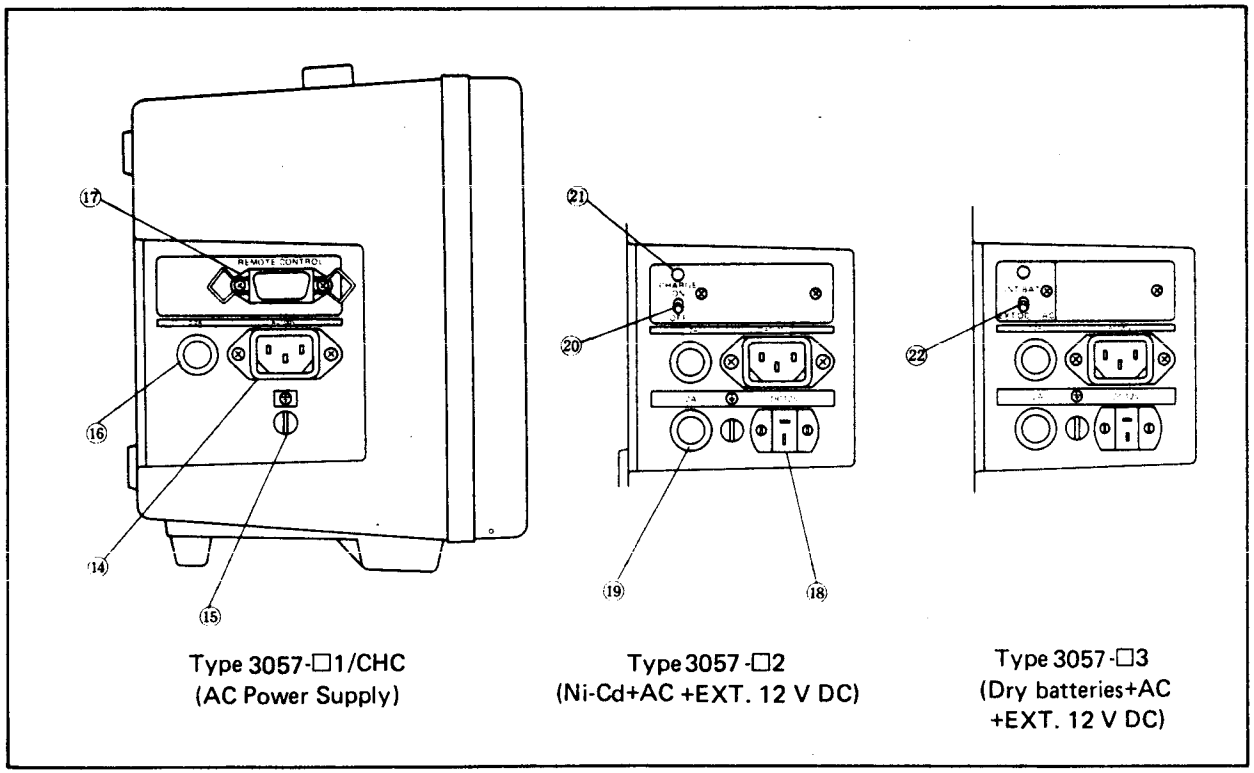


Figure 2-2. Power Supply Panel.

2-2-1. Type 3057-□ 1/CHC (AC power source)

⑭ **AC power supply socket:**
The power cord supplied with the instrument plugs into this socket. This is a three-pronged socket whose center pin is connected to the earth terminal ⑮ .

⑮ **Earth Terminal:**
This terminal should be connected to a protective earth, for safety.

⑯ **AC Power Supply Fuse Holder:**
For 100 or 120VAC power supply rating 0.2A fuse or for 200V, 220V or 240V power supply rating 0.1 A fuse is installed.

⑰ **REMOTE CONTROL (chart control) Connector:**
This connector is supplied with the instrument if the remote chart drive option chart start/stop and external chart speed control using an external clock (oscillator) signal is equipped.

2-2-2. Type 3057-□2 (AC + Ni-Cd + EXT. 12V DC)

⑱ **EXT. DC Power Supply Socket:**
If the instrument is operated with external DC12V supply connector supplied with the instrument into this socket.

⑲ **EXT. DC Power Supply Fuseholder:**
For an external DC 12V source, a 2A rating fuse is installed.

⑳ **CHARGE ON/OFF Switch:**
Supplied with the instrument for Type 3057-□2 (3-way power supply type with Ni-Cd Battery included).
After connecting the AC power supply to the instrument, turn this switch ON to recharge the Ni-Cd battery.
However, after using the recorder, always turn the CHARGE ON/OFF switch OFF.

㉑ **Charging Monitor Lamp:**
Supplied with the Type 3057-□2 (3-way power supply type with Ni-Cd Battery included). Lights while the Ni-Cd battery is being recharged.

2-2-3. Type 3057-□3 (AC + Dry battery + EXT. 12V DC)

㉒ **INT BAT/EXT DC or AC Selector Switch:**
Supplied with the Type 3057-□3 (3-way power supply type with dry batteries). Set this switch to EXT DC or AC, if the instrument is operated with AC power supply or external power source.

3. OPERATION.

3-1. How to Use the Plastic Cable Tie.

Insert the cable tie supplied with the instrument through the hole in the instrument rear panel, and the cable can be fixed as shown in Figure 3.1 to facilitate carrying the instrument.

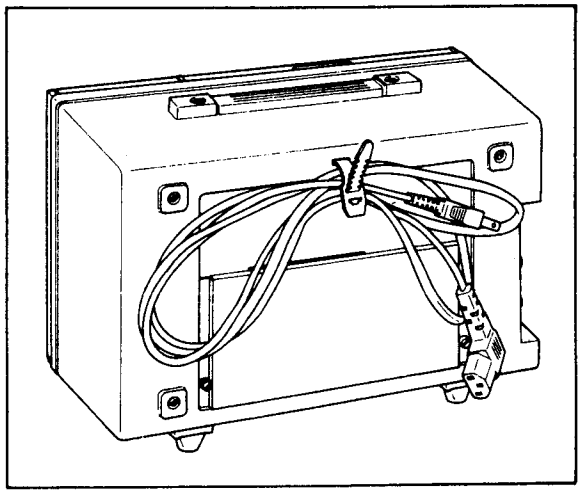


Figure 3-1.

3-2. Preparation.

Make the following initial settings

- POWER ON/OFF Switch . . . . . OFF
- PEN Lift Lever . . . . . UP
- CHART DRIVE switch . . . . . OFF
- INPUT Switch . . . . . ZERO
- POWER Cord . . . . . See below

  if the instrument is operated on an AC power supply; the power cord supplied with the instrument must be used.

  if the instrument is operated on an external DC 12V source; the connector for EXT. DC supplied with the instrument must be used.

3-3. Chart Paper Loading.

3-3-1. Z-fold chart paper

(1) When using Z-fold charts riffle the chart thoroughly from left to right and from top to bottom, as shown in Figure 3-2.

(2) Press the chart compartment lock release lever outward (left) as shown in Figure 3.3. Lift the chart compartment upward, and remove it to the horizontal position as shown in Figure 3-4.

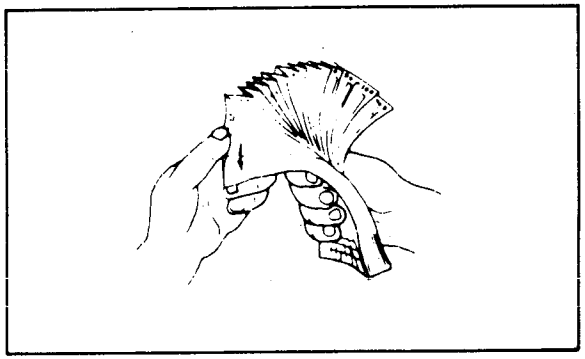


Figure 3-2.

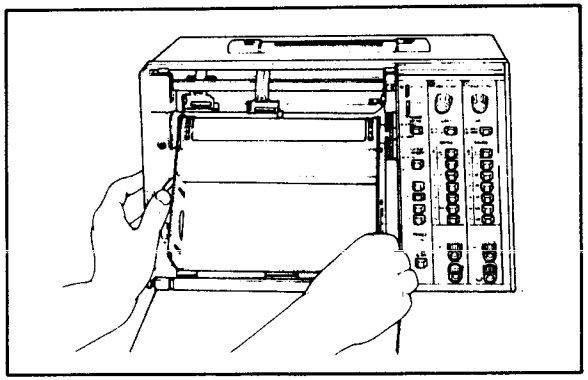


Figure 3-3.

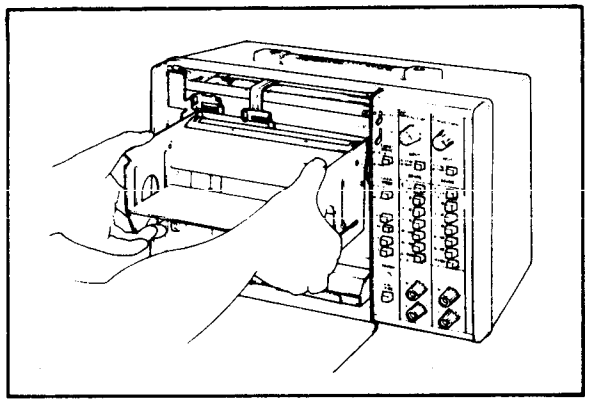


Figure 3-4.

(3) Lay the cardboard supplied with the chart in the chart compartment.
(4) Load the Z-fold chart into the chart compartment as shown in Figure 3-5. Thread the chart under the chart guide roller shaft. Chart drive holes are round at the right and elliptical at the left. Make these drive holes with the sprockets.
(5) Reinstall the chart compartment into the recorder frame. Turn the chart compartment down ward to its original position while pressing the chart compartment lock release lever outward (left).

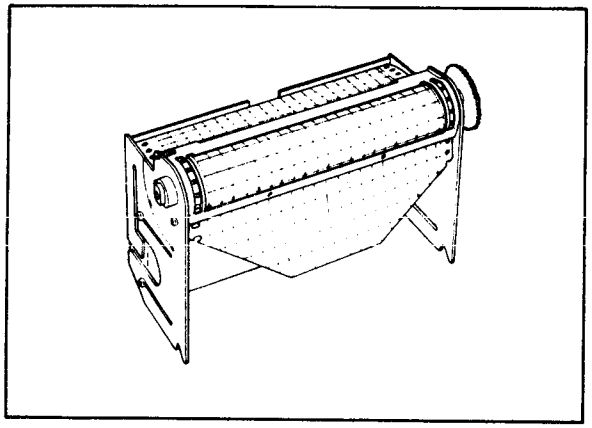


Figure 3-5.

(6) Confirm that the chart can be fed normally by turning the rightmost gear manually. Advance the chart downward until two or three folds of the chart drop into the chart compartment, then shut the cover to keep out dust.

3-3-2. Roll-chart paper

(1) Remove the chart compartment according to the par. 3.3.1 (2) procedure.
(2) Loosen the fixing screw as shown in Figure 3.6, then push the box so that the fixing screw touches the long hole front end perfectly.

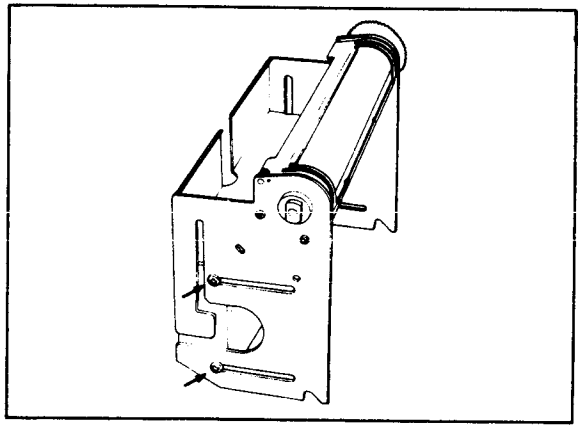


Figure 3-6.

Reattach the screw as shown in Figure 3-7.

(3) Insert the roll chart cardboard roller into the instrument as shown in Figure 3-8 with the round drive hole of the chart paper set at the right side.

(4) Pull out the end of the chart and thread chart under the chartguide roller shaft, engage sprockets and holes.

(5) Reinstall the chart compartment in the original position in the recorder frame.

(6) Confirm that the chart can be fed normally by turning the rightmost gear manually.

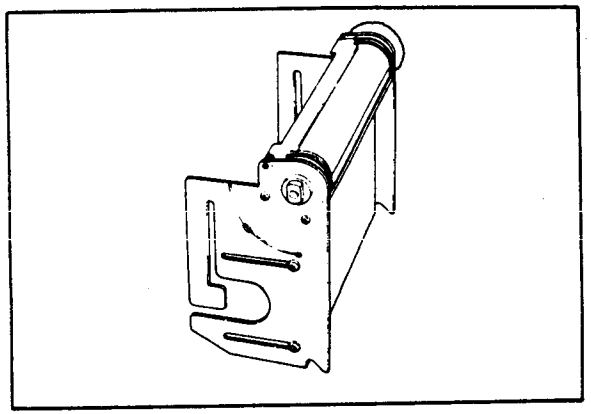


Figure 3-7.

(7) As shown in Figure 3-9, the chart compartment can be fixed on the slant to write data on the recording chart.

(8) Pull the end of the chart out of the lower slit as shown in Figure 3-10, shut the dustproof cover, then the instrument can be used horizontally.

NOTE

Chart paper generally expands or shrinks according to the humidity. Store chart paper in a cool dry place until its use.

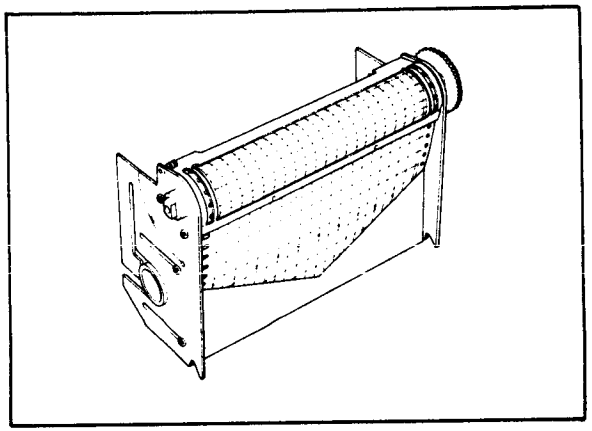


Figure 3-8.

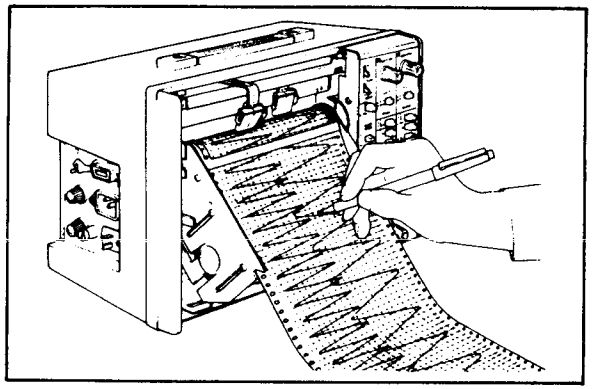


Figure 3-9.

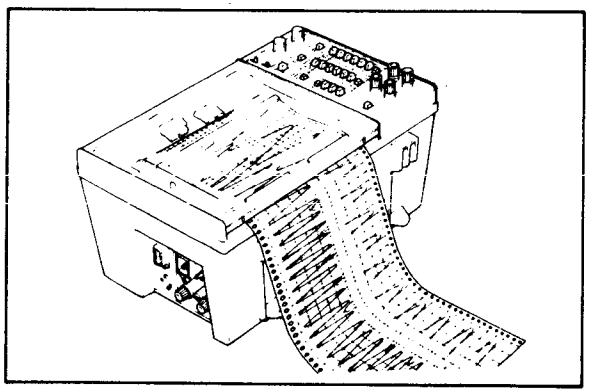


Figure 3-10

3-4. Pen Replacement.

The Type 3057 uses easy-to-replace disposable felt pen cartridges that eliminate messy ink handling.

1. The felt-tip pen cartridges are made of plastic, and marked with the ink color on the front and top as shown in Figure 3-11.

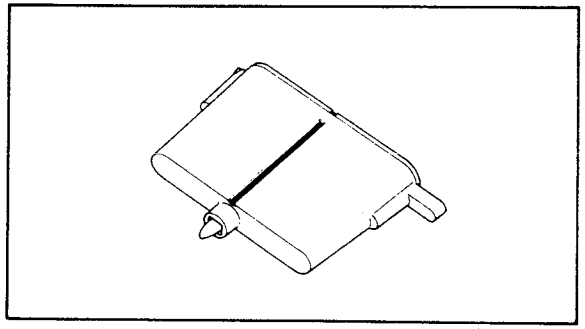


Figure 3-11.

2. Install each pen cartridge with the colored line forward (See Figure 3-12).
   Install as follows: insert the left side of the cartridge into the clip, then press the right edge of the cartridge into the clip.

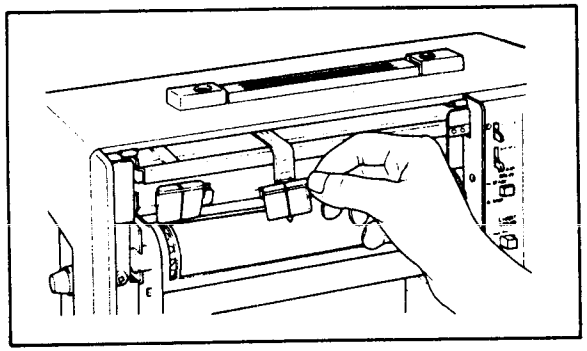


Figure 3-12.

3. Remove the pen cartridge from the pen holder, in the reverse order: press the right edge of the cartridge toward you to pop it out of the clip (See Figure 3-13).

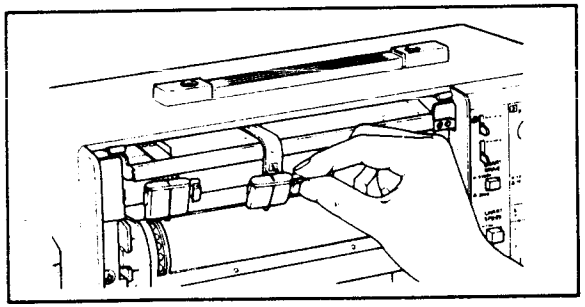


Figure 3-13.

4. When the felt pen cartridges are to be used, remove the pen caps from the pens and be care not to lose them.
5. When the instrument is not to be used for more than an hour, replace the pen caps to prevent ink dryout.

CAUTION

- As the pen-tip is made of felt, do not crush it by applying strong pressure.
- When felt pen is new, sometimes ink does not flow from pen-tip. In this case rub pen tip lightly against paper.

3-5. Dry Battery Installation.

For Type 3057-□3, remove the fixing screw on the rear panel, and install ten dry batteries supplied with the instrument into the instrument main frame.

When installing, according to the label indication on the battery compartment, install them so that the label is at the left of the batteries.

Set the INT BAT/EXT DC or AC selector switch to INT BAT. Normally, a set of alkaline dry batteries will last about twelve hours for the two pen recorder.

3-6. External DC Power Supply (Type 3057-□2, -□3).

To operate the recorder with the external DC power supply, prepare stable 12V DC power supply (voltage 10 to 15V and current 1A).

Solder the lead wires to the EXT DC connector supplied with the recorder, before connecting the external DC power supply.

3-7. Measurement and Recording.

1. Depress the POWER pushbutton to set it ON. The power pilot lamp will light up.
2. With the input switches at zero, adjust the POSITION knob on each channel to zero the pens.
3. Set the voltage sensitivity with the Range Selector knob in accordance with the input voltage. Take care when the input voltage may be high. The maximum allowable input voltages are 250V DC for 1 to 5V ranges and 50V DC for 10 to 500mV ranges.
4. Set the chart feed speed with the CHART SPEED push buttons press the CHART DRIVE 'START' pushbutton to drive the chart at the preselected speed.
5. Set the PEN lift levers to DOWN to begin recording with all pens.

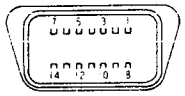
CAUTION

- If high frequency (higher than 1 kHz) voltages or pulse voltages are applied between the recorder earth terminal and the measuring L terminal, pen fluctuation may occur.
  In this case, eliminate the high frequency voltages with a filter, or use recorder with the earth terminal and L terminal shorted.
- The recorder does not have a guard terminal, so always connect the low-impedance side of the signal source to the L terminal.
- Before recording, turn the right most gear (chart manual, advance roller) backwards to minimize the backlash, otherwise there is a time delay before the chart starts moving in low chart speed mode.

3-8. Remote Chart Control (Type 3057-□□/CHC).

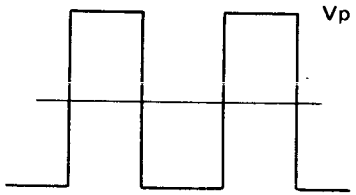
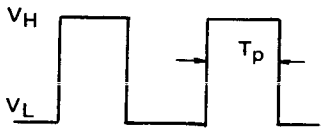
Control Signal Name	Signal States		Control Action	Effects of Pushbutton Settings and Other Control Signals
	Contact	TTL or Open-collector		
EXTERNAL START	Closed	Low	Chart runs forward	This signal is enabled by stop button, and over-ridden by START button
	Open	High	Chart Stops *1	
CLOCK SELECT	Closed	Low	Selects EXTERNAL CLOCK	None
	Open H	High	Selects INTERNAL CLOCK	
EXTERNAL CLOCK	Not applicable *2		Determines forward chart speed when CLOCK SELECT is in closed/ low state	Affected by CLOCK SELECT signal only

Notes: *1. If STOP button depressed. *2. Refer to specifications in Section 1-2.



Pin 4: External Start
Pin 6: External Clock
Pin 7: Clock Select
Pins 8 through 13: Signal Common

Two functions ① remote control of chart drives (START/STOP by external contact, open collector or TTL-level signal) and ② chart drive forward speed control by means of external clock (oscillator) signal, are possible.

Waveforms	Rectangular waveforms	Pulse train
Signal level	 4V<Vp<24V	 +4V < V_H < +24V −24V < V_L < +0.5V Tp > 1ms
Maximum Signal Source Impedance	600Ω	50Ω
Chart Speed	0.3 fcm/min (f=frequency Hz)	
Maximum Frequency	200Hz	200 pps
Pin Connection	Between pins No.6 and 13	

3-8-1. Chart Drive Start/stop Control

Chart drive start/stop control is possible by means of control signal at remote control connector pin 4 only when the CHART DRIVE STOP pushbutton is in STOP state.

3-8-2. Clock Select

Chart drive forward speed control by means of external clock oscillator is possible with pins No.7 and 13 shorted or with TTL signal (same as open collector) L level. (see 3-8-3.)

Otherwise (e.g. when nothing is connected to pins 7 and 13) chart is fed by built-in quartz oscillator.

3-8-3. External Clock

To drive chart by means of external clock oscillator:

Connect the external oscillator to pins No.6 and No.13 (COM) and connect closed (contact) or Low level (TTL or open collector signals) between pins No.7 and 13.

4. MAINTENANCE.

4-1. Storage.

Do not store the instrument where it will be exposed to:

- Direct sunlight or high temperatures.
- High humidity
- Dust, dirt, salty or corrosive gases.
- Vibration
- Strong magnetic fields or electrical noise. (especially when using UHF (e.g. 550 MHz) transceivers, use them more than one meter away from the recorder.

4-2. Pen Care.

- Always replace the pen caps after use to prevent gradual ink dryout.
- Pen cartridges may be stored for approximately up to one year maximum under ideal conditions.

4-3. Recharging and Replacement of Ni-Cd Battery for Type 3057-□2.

A rechargeable Ni-Cd battery installed in the 3057-□2 instrument, and the instrument can be operated continuously for about 7 hours of the Ni-Cd battery is first fully charged. Recharge the Ni-Cd battery when the battery monitor indicates battery voltage drop.

Check that the power switch on the front panel is turned off, and plug the power cord into its socket on the left side panel of the instrument. Plug the power cord into an AC line of appropriate voltage, and turn the CHARGE ON/OFF Switch ON, and the battery in the instrument will be automatically recharged.

The battery will be fully charged in about 15 hours, but take care not to overcharge it.

If after full recharging the battery runs down very quickly or does not function, the battery is faulty and must be replaced according to the procedure below:

(1) Remove the rear panel as shown in Figure 4-1.

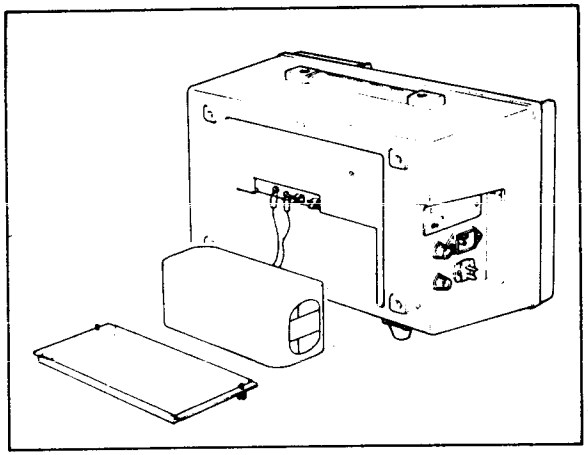


Figure 4-1.

(2) Remove the two screws holding the battery, and remove the battery.

(3) Connect the new battery (+) lead wire (red) to the (+) terminal.

(4) Remove the insulating tube covering the (−) lead wire (blue) end, and screw the (−) lead wire to the (−) terminal.
Be careful not to short the battery (+) and (−) terminals.

CAUTION

- If the POWER switch on the front panel is set ON, the battery cannot be recharged even, with the CHARGE ON/OFF switch set ON.
- Overcharging (charging for more than 15 hours) may seriously reduce the service life of the battery, so be careful to avoid overcharging. If the Nickel-Cadmium battery is continuously recharged for more than one week, gas and electrolyte may begin to leak from the battery case.
- **Be sure to charge the battery fully before using the instrument for the first time.**
- **If the instrument has been left idle for a long period (more than two months), the capacity of the Nickel-Cadmium battery may be temporarily impaired. Before using instrument again, recharge the battery for approximately one hour, then use battery power for an hour. Repeating this charging/discharging procedure two or three times will fully "reactivate" the battery.**

WARNING

- Nickel-Cadmium batteries may explode if subjected to high temperatures. Never dispose of a worn-out battery in a fire.

Specifications of Nickel-Cadmium Battery

Part No.:	A9002ED
Voltage (nominal):	12 V DC
Charge:	5 hour rate 3500 mAH
	Maximum charging current 350 mA
	Charging interval 15 hours
	Maximum charging voltage 15 V
Dimensions:	Approx. 66 x 166 x 68mm(2-5/8 x 6-1/2 x 2-5/8")
Weight:	Approx. 1.4 kg (3.1lbs)

4-4. Dry Batteries for Type 3057-□3.

10 dry batteries are installed in Type 3057-□3. If the battery monitor indicates that the battery voltage has dropped, remove the recorder rear panel as shown in Figure 4-2 and replace all of the batteries, observing the polarity marks indicated on the compartment.

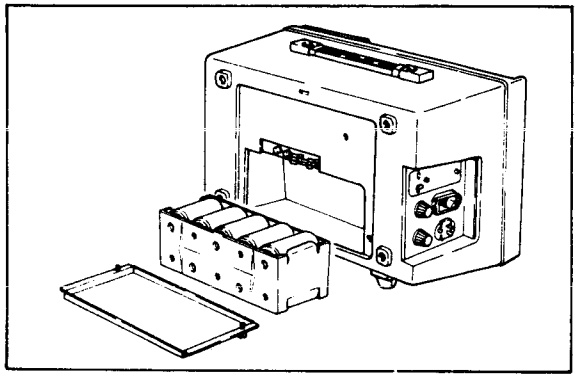


Figure 4-2.

4-5. Calibration.

Chart paper expands and contracts as ambient humidity varies. When extremely accurate measurements are required, compensate for this by calibrating.

4-6. Chart Replacement.

Red 40cm RENEW CHART and 20cm RENEW CHART indications appear on the chart at 40 centimeters and 20 centimeters before the end of the paper. The chart paper should be replaced only by new OMEGA chart paper or roll paper.

RD3057-RP Rolls of paper
RD3057-ZFP Z-fold paper

4-7. Shipping and Transportation

Before shipping or transporting the recorder long distances, remove the pen cartridges, and pack them in a separate box. If possible, the instrument should be packed the same as it was packed when originally delivered.

4-8. Chart Removal

If the recorder is to be unused for a long period, remove the chart paper from the instrument, otherwise the paper may distort and not fold properly after recording.

APPENDIX. PEN CARTRIDGE RECORDING TIME

The pen cartridge will record approximately 600 m of chart paper.

If the pen cartridge is to be used for along period --- especially, for unmanned operation at night --- refer to the table below to calculate the approximate pen life from the chart speed.

Appendix 1. Pen Cartridge Recording Time Table.

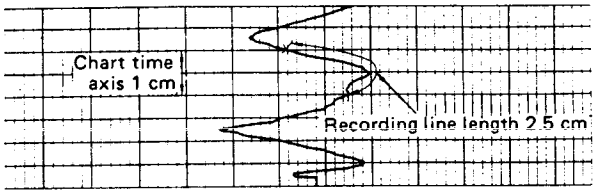
(hour) (mm)
Unit – HH : MM

Avge. length of recorded curve (trace) per cm of chart	Chart Speed cm/min 2	cm/min 6	cm/min 20	cm/min 60	cm/h 2	cm/h 6	cm/h 20	cm/h 60
1	500:00	166:40	50:00	16:40	–	–	3000	1000
2.5	200:00	66:40	20:00	6:40	–	4000	1200	400
5	100:00	33:20	10:00	3:20	–	2000	600	200
7.5	66:40	22:13	6:40	2:13	4000	1333	400	
10	50:00	16:40	5:00	1:40	3000	1000	300	100
25	20:00	6:40	2:00	0:40	1200	400	120	40
50	10:00	3:20	1:00	0:20	600	200	60	20
70	6:40	2:13	0:40	0:13	400	133:20	40	13:20
100	5:00	1:40	0:30	0:10	300:00	100	30	10
250	2:00	0:40	0:12	–	120:00	40	12	4
500	1:00	0:20	–	–	60:00	20	6	2
750	0:40	0:13	–	–	40:00	13:20	4	1:20
1000	0:30	0:10	–		30:00	10	3	1
2500	0:12	–	–		12:00	4	1:12	0:24

(When reference recording length is 600 m.)

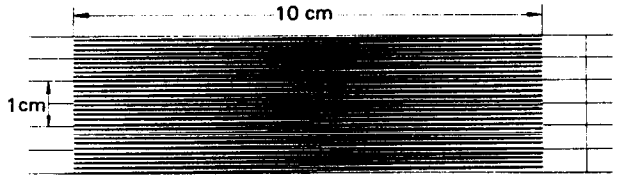
Utilization

Example 1.



Make a sample recording such as shown in the figure above, and calculate or estimate the average length of the recorded curve (trace) per cm of chart. In the example above, the recorded line length is approximately 2.5 cm, so if the recorder chart speed is 20 cm/min, the cartridge recording time is approximately 20 hours.

Example 2.



In this example above, the length of the recorded curve (trace) per cm of chart is 10 cm x 20 = 200 cm. Data for 200 cm is not listed in the table, so must be calculated from the data for 100 cm.

If the recorder chart speed is 6 cm/h, the cartridge recording time is 100 hours (data for 100 cm from the chart) $\times \frac{100\text{ cm}}{200\text{ cm}}$ (= 50 hours).