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U N I C O R D E R  
U - 2 2 8 ( 5 0 0 )

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S P E C I F I C A T I O N

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Specifications are subject to change without notice.

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## 1. OUTLINE

PANTOS Model U-228 Desk-top Automatic zero balancing DC-servo Recorder is a device to continuously record waveform corresponding to input signal on chart paper which moves at a constant speed by pens which are automatically balanced by means of servo system; a method known as a self-balancing method or so called zero method.

Based on years of our experience, U-228 recorder was developed giving emphasis on substantial specifications and improved performance and versatility in operation in addition to consideration on style as well as compactness and light weight. As a result, this recorder has many outstanding features, as described in the following.

## 2.

- (1) Power voltage can be easily changed among 5 voltage ranges so that U-228 is applicable to power voltages of every country in the world.
- (2) Use that inclines from a desk-top type on a record horizontal side, and 12° changes the angle into a wall hanging type to which the record side is vertical is possible.  
The limited space can be effectively used.
- (3) In addition of being compact and light weight, it is designed as being easily carried by one hand from one place to other wherever necessary.
- (4) Having an extended writing panel, the state of recording can be easily observed.
- (5) Having no obstacles on the right side of the writing panel, entry of data into the chart paper is easy.
- (6) The pulse motor is adopted for the record paper feed.  
Abundant sending speeds at 23 velocities every 24 steps can be freely selected.  
Driving stop from the outside is also possible. can do the record paper feed proportional to the frequency in the external signal source
- (7) Equipped with a fast forward switch that makes the position correction of the chart paper easy.
- (8) Rewind switch allows the chart paper to be easily retracted to a desired position.
- (9) Because the chart take-up device is designed so as to be optionally built into the recorder without having to externally attaching it, only a minimum space is required for the operation (optional).
- (10) Equipped with a chart paper end alarm, the end of the chart paper is notified by a buzz and a flashing lamp.
- (11) Using cartridge type fiber tip pens, such trouble as sudden "out of ink" cannot happen during the recording.  
The maintenance is easy, too.
- (12) Adoption of 1kHz modulation type servo amplifier and direct current servo method.  
It has an excellent response, the noise characteristic, and the temperature characteristic.
- (13) The polarity of signal input can be changed by a switch.
- (14) Equip a proofreading power supply.  
A check of fullspan voltage accuracy and proofreading can be performed easily.

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- (15) Having a superimposed event marker as a standard feature, entries of marks can be made on any part of the chart. This feature is also helpful in knowing the recorded time lag between the pens.
- (16) Adoption of film potentiometer, and it equips it with the shake slice protection circuit. Reliability has improved further.

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Items	Specifications								
M o d e l	U-228-500								
Number of channels ※1	1 ~ 2								
Measuring system	Automatic Zero Balancing DC - servo								
Writing width	250 mm								
P e n s p e e d ※2	Less than 1 / 3 sec								
Z e r o p o i n t	Right Zero of the chart paper.								
Zero set range	+100% from right zero center.								
Zero point check switch	Provided								
Measuring range	1, 2, 5, 10, 20, 50, 100, 200, 500 mV 1, 2, 5, 10, 20, 50, 100, 200 V (17 ranges)								
Fine adjust for Measuring range ※3 (Range Vernier)	Provided								
Polarity switch	Provided								
Input method	Floating								
Input impedance	1 M Ω (constant)								
Tolerable signal source resistance	Less than 10 k Ω								
A c c u r a c y ※4	± 0.3% (23°C) Temperature Coefficient ± 0.025%/°C MAX.								
Errors between ranges	2 mV ~ 50 mV ranges ± 0.15% (23°C) Temperature Coefficient ± 0.005%/°C MAX. 0.1 V ~ 200 V ranges ± 0.2% (23°C) Temperature Coefficient ± 0.0075%/°C MAX.								
D e a d b a n d	± 0.1%								
L i n e a r i t y	± 0.25%								
Noise rejection ※5	<table border="1"> <tr> <td rowspan="2">CMRR</td> <td>DC</td> <td>Over 160 dB</td> </tr> <tr> <td>AC (50 / 60 Hz)</td> <td>Over 160 dB</td> </tr> <tr> <td>NMRR</td> <td>AC (50 / 60 Hz)</td> <td>Over 64 dB</td> </tr> </table>	CMRR	DC	Over 160 dB	AC (50 / 60 Hz)	Over 160 dB	NMRR	AC (50 / 60 Hz)	Over 64 dB
CMRR	DC		Over 160 dB						
	AC (50 / 60 Hz)	Over 160 dB							
NMRR	AC (50 / 60 Hz)	Over 64 dB							

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Items	Specifications
Temperature characteristics ※6	Zero drift upon introduction of power      Less than $\pm 0.5\%$ (at constant room temperature)
	Zero drift upon stabilization      Less than $\pm 0.15\% / 10^\circ\text{C}$
Chart speed ※7 ※8	(1) 10, 15, 20, 30, 40, 60, mm/h, cm/h, mm/min, cm/min 24 steps and 23 speeds (10 mm/min and 60 cm/h are overlapping) (2) Chart drive by External signal • Chart speed : 1mm / min at 1Hz, 600Hz MAX. • Input impedance : Over 4.7 k $\Omega$ • External power Voltage : High level ; +2V ~ +20V Low level ; +0.8V ~ -20V (operable at TTL level) Signal waveform : Pulse, sine wave, square wave, triangular wave, etc. (Pulse width ; Over 50 $\mu$ sec)
Chart fast forward switch	Provided
Chart end alarm	Following actions take place when chart paper comes to an end ; • Buzzer is sounded • Lamp is flashed • Chart drive is stopped • Pen is stopped
Chart rewind device	Provided
Record paper feed drum	With Proket (Models : 500)
Chart paper	No 2516P50, 20m long, right zero
Recording pen	Cartridge type fiber tip pen
Ink colors	Channel 1 - red, Channel 2 - green
Pen lift	Individually and manually operated (Distance between pens : 4mm)
Torque reduction circuit ※9	Provided
Event marker	Superimposing Amplitude : +3.5 $\pm$ 1 graduation Time : 0.2 ~ 0.4 sec
Event maker switch ※10	Provided
Calibration voltage	Voltage : +1mV Accuracy $\pm 0.2\%$ (23 $^\circ\text{C}$ )      Temperature coefficient $\pm 0.007\% / ^\circ\text{C}$
Environment	Temperature 0 ~ 45 $^\circ\text{C}$ Humidity 45 ~ 85%

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Items	Specifications		
P o w e r	A C 100, 115, 200, 220, 240V ±10% (5ranges) Common for 50Hz, 60Hz		
Power consumption(TYP.)	Number of channels	When Balanced	Max.
	1	19VA	32VA
	2	21VA	47VA
Insulation resistance	Power - Chassis (GND) : Over 50MΩ (DC500V megger)		
	Input terminal - Chassis (GND) : Over 100MΩ (DC500V megger)		
Dielectric strength	Power - Chassis (GND) : A C 1000V for 1 minute		
	Input terminal - Chassis (GND) : A C 1000V for 1 minute		
External dimensions	430 (W) × 123 (H) × 354 (D) mm (The size of the projecting thing is not included.) Externalview (Drawing Number 225D02-00-0011)		
W e i g h t	Number of Channels	1	2
	Weight	7kg	8kg
A c c e s s o r i e s	Chart paper No. 2516P50 ... 1 Recording pen For channels 1 (Red) NDA-5R ... 1 For channels 2 (Green) NDK-18G ... 1 Drive wire (1.5m) It is the same as that of the number of channels. Pulley positioning rod ... 1 Fuses, 1A and 0.5A 1 each Recording form holder Right and left each one Dust cover ... 1 Power cord Adaptor ... 1 Instruction manual ... 1		

- ※ 1 A short recording pen is for channel 1 and a long recording pen is for channel 2.
- ※ 2 Time required for travelling 99% of input signal.
- ※ 3 Each of the measuring ranges can be expanded up to 2.5 times.
- ※ 4 Accuracy including straight line when polarity switch is set to "+", and it measures it with the highest sensitivity range.
- ※ 5 The value in the measurement with the highest sensitivity range is indicated.
- ※ 6 The value in the measurement with the highest sensitivity range is indicated.  
The energizing time until stabilizing is about 30 minutes.

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- ※ 7 Chart drive may be remotely operated in this case, an external control terminal "CHART DRIVE" is used. (Cautions 1 )  
Moreover, it can operate also by making it a closed circuit with a point of contact, an analog switch, and an open collector transistor.
- ※ 8 An external signal is applied to external control terminal "CHART OSC" upon setting chart speed unit selection switch on the panel to "EXT" position.
- ※ 9 It is a device to protect DC servo motor when voltage exceeding the measuring range is applied frequently or for a long time.
- ※ 10 External control is also possible.  
In such a case, an external control terminal "MARK" is used. (Cautions 1 )  
Moreover, it can operate also by making it a closed circuit with a point of contact, an analog switch, and an open collector transistor.

Cautions 1 External operation terminal signal (Operation with TTL level signal is possible.)

High level (+2 ~ +20V)

..... Chart paper sending (Remote control)→ Stop, Event marker → OFF

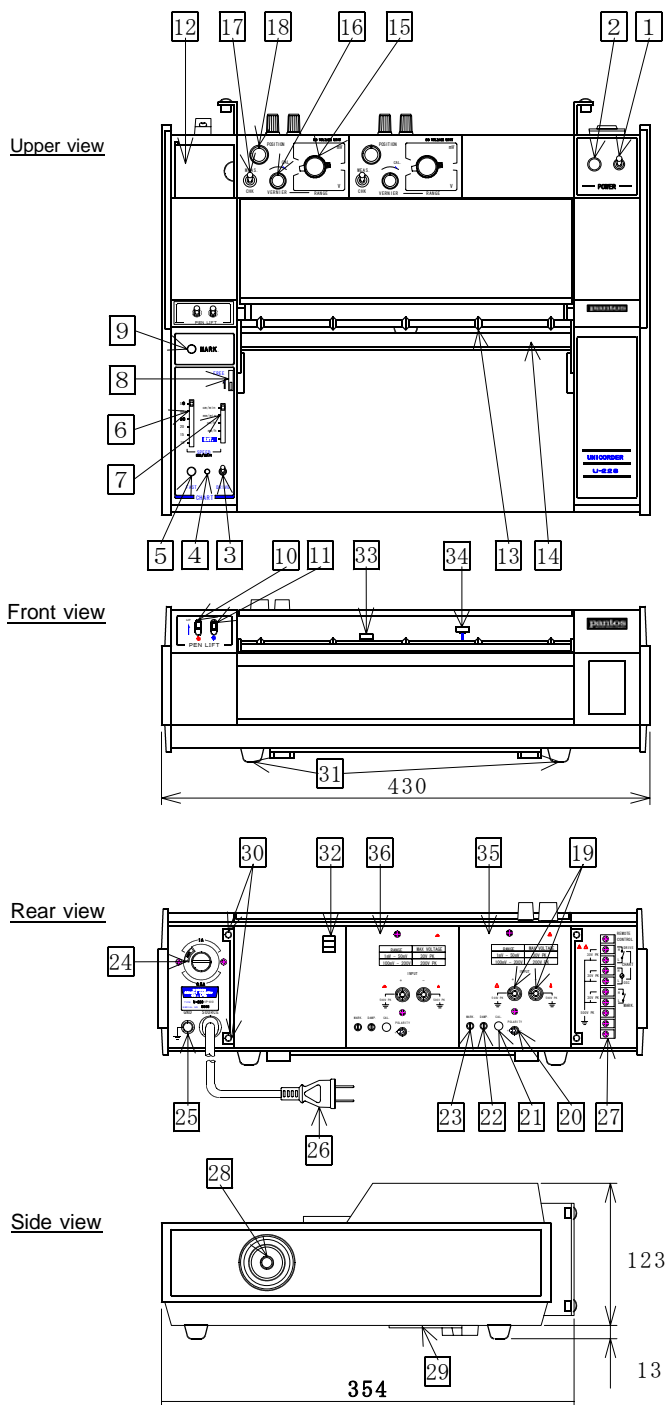
Low level (+0.8 ~ -20V)

..... Chart paper sending (Remote control)→ Drive, Event marker → ON

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No.	Name
1	Power supply switch
2	Power supply pilot lamp
3	Chart paper sending switch
4	Chart paper sending pilot lamp
5	Chart paper fast forward switch
6	Chart paper speed change switch
7	Chart paper speed unit change switch
8	Chart paper free knob
9	Event marker switch
10	Channel 1 Pen lift knob
11	Channel 2 Pen lift knob
12	Pen box
13	Chart paper control roller
14	Chart paper cutter
15	Measurement range change switch
16	Measurement range fine-tuning machine
17	Zero point check switch
18	Zero point adjustment machine
19	Input terminal
20	Polar change switch
21	Full span voltage calibrator
22	Braking adjustment machine
23	Marker amplitude adjustment machine
24	The power supply voltage change with a fuse
25	Grand terminal
26	Power supply plug
27	External operation terminal
28	Chart rewind knob
29	Inclination leg
30	Power supply code holder
31	Rubber leg
32	Code clamper
33	Channel 1 Record pen
34	Channel 2 Record pen
35	Channel 1 Amplifier unit
36	Channel 2 Amplifier unit

★ In an one channel type case, the amplifier unit, the record pen, and pen lift knob by the side of a channel 2 are excluded.

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