



HITACHI 200D Series

220D/240D/260D

analog/hybrid computer specification

Distributed by:

I. HITACHI 220D/240D/ 260D GENERAL SPECIFICATIONS

1. HITACHI MODEL BA-220 FULLY WIRED BASIC ANALOG CONSOLE
- 1.1 Size and Weight
Height 730 mm.
Width 730 mm. *(1030)
Depth 580 mm.
Weight, Approx. 70 kg. *(120)
Remarks: Figure within parenthesis denotes the dimension or weight, as the case may be, of the Basic Console with Oscilloscope Panel.
- 1.2 Computer Power Requirements
Voltage 110/110/120/200/220/240V. AC \pm 10%
Frequency 50/60 Hz \pm 1 Hz
Power consumption Basic Console: 200W, typical
Oscilloscope: 70W, typical
- 1.3 Reference System
Output voltages +10V, -10V Nominal
Output current 0.2A
Balance of two Refs. Adjustable to \pm 0.01%
Noise 2mV_{P-P}, maximum
1mV_{P-P}, typical
Temp. coefficient \pm 0.001%/°C
- 1.4 Operations Modes IC, Operation, Hold, Slave, Pot-set, All
IC, Patch panel, Timer
Control Commands Manual switches, Timers, Output Signals of Digital Logic, and External signals
- 1.5 Function of Control Panel
a) Visual overload indicator

- b) Needle type indicating voltmeter
- c) Null potentiometer and polarity switch
- d) Voltmeter function switch
- e) Voltmeter range switch
- f) Amplifier selector switch
- g) Trunk lines selector switch
- h) Mode control switch
- i) Integrator time scale switch
- j) Time adjuster and scaling switch
- k) Power on-off switch

1.6 Repetitive Operation

Basic: OP time 1 msec to 10 sec, continuous
 IC time Fixed

Relay Mode Control time

differential (Hold mode) . . . 200 μ s, maximum
 50 μ s, typical

Electronic Mode Control

Time differential
 (IC & Operation Mode) . . . 1 μ s, maximum

2. HITACHI MODEL BA-240 FULLY WIRED BASIC ANALOG CONSOLE

2.1 Size and Weight

Height:	730 mm
Width:	1050 mm *(1350)
Depth:	580 mm
Weight, Approx.:	110 kg. *(160)

Remarks: Figures within parenthesis denotes the dimension or weight, as the case may be, of the Basic Console with Modular Logic Control Panel.

2.2 Computer Power Requirements

Voltage	..... 100/110/120/200/220/240 VAC \pm 10%
Frequency	..... 50/60 Hz \pm 1 Hz
Power consumption	..... Basic Console: 300 W, typical Logic Console: 120 W, typical Oscilloscope: 70 W, typical

2.3 Reference System

Same as for Item 1.3

2.4 Operations

Same as for Item 1.4

2.5 Function of Control Panel

Same as for Item 1.5

2.6 Repetitive Operation

Basic: OP time	..... 1 msec. to 10 sec, continuous
IC time	..... Fixed
Option: OP time	..... 1 msec. to 9.9 sec. (using TM-243)
IC time	..... 1 msec. to 9.9 sec. (using TM-243)
Multi Modes	..... IC-OPERATION (using TM-243) OPERATION-HOLD (using TM-243) IC-HOLD (using TM-243)

Relay Mode Control	
time differential	
(Hold Mode)	200 μ s, maximum
	50 μ s, typical
Electronic Mode Control	
time differential	
(IC & Operation Mode)	1 μ s, maximum

3. HITACHI MODEL BA-260 FULLY WIRED BASIC ANALOG CONSOLE

3.1 Size and Weight

Height:	920 mm.
Width:	1180 mm. *(1480)
Depth:	590 mm.
Weight, approx.:	160 kg. *(210)

Remarks: Figures within parenthesis denotes the dimension or weight, as the case may be, of the Basic Console with Modular Logic Control Panel.

3.2 Computer Power Requirements

Voltage	100/110/120/200/220/240V.AC $\pm 10\%$
Frequency	50/60 Hz ± 1 Hz
Power consumption	Basic Console: 400 W, typical Logic Control: 120 W, typical Oscilloscope: 70 W, typical

3.3 Reference System

Same as for Item 1.3

3.4 Operations

Same as for Item 1.4

3.5 Function of Control Panel

Same as for Item 1.5

3.6 Repetitive Operation

Same as for Item 2.6

4. MODEL CT-245, SERVO AMPLIFIER FOR BASIC ANALOG COMPUTER

4.1 Functions

- a) Servo-setting potentiometer rotary selector switch
- b) Input selector switch
- c) Servo-set control switch

4.2 Number of selectable

servo potentiometers. 40 ea.

4.3 Install location Manual potentiometer panel

5. MODEL DP-241, DIGITAL-ANALOG CONVERTER FOR BASIC ANALOG COMPUTER

5.1 Function

To generate reference coefficient for potentiometer setting.

5.2 Accuracy $\pm 0.01\%$

5.3 Coefficient 0.0001 to 0.9999

II. ANALOG COMPUTING COMPONENTS SPECIFICATIONS

5.4 Install location: Manual potentiometer panel
5.5 Drift $\pm 1 \text{ mV}/8\text{h}$

6. MODEL TM-243, REPETITIVE OPERATION TIMER

6.1 Number of time periods 2,
(IC-Operation)
(Operation-Hold)
(IC-Hold)

6.2 Range of each period 1 msec. to 9.9 sec. (Operation)
1 msec. to 9.9 sec. (IC)

6.3 Install location Manual potentiometer panel

7. MODEL DA-141, QUAD D.C. AMPLIFIER

Output Voltage $\pm 10\text{V}$, Minimum, at 500 ohms load
Output Current $\pm 20\text{mA}$, Minimum
..... $\pm 25\text{mA}$, Typical
Output Impedance 30 ohms, Typical
Input Impedance 100 kohms, Typical
Frequency Bandwidth (-3dB) 1 MHz, Minimum, with 10k/10k
inverter at 1Vp-p input
..... 300kHz Minimum, with 10k/10k
inverter at 20p-p input
..... 100kHz Minimum, with 100k/100k
inverter at 20Vp-p input
Amplitude Error at 1 kHz input 0.1%, Maximum, with 100k/100k
inverter
Phase Shift at 20Vp-p ,
1 kHz input 0.1° , Maximum (10k/10k)
..... 0.2° , Maximum (100k/100k)
Open Loop DC Gain 2×10^7 , Typical, 1×10^7 , Minimum
Open Loop Gain at 100 Hz 2×10^4 , Typical, 1×10^4 , Minimum
at 1 kHz 2×10^3 , Typical, 1×10^3 , Minimum
Noise (0 to 80 kHz) 1mVp-p , Typical
with 10k/10k Inverter not including
chopper spike, at output
Offset Voltage $\pm 10\mu\text{V}$, Typical, at SJ
..... $\pm 20\mu\text{V}$, Maximum
Offset Temperature Coefficient $\pm 2\mu\text{V}/^\circ\text{C}$, Maximum, referred to
ambient temperature, at SJ
Drift $\pm 10\mu\text{V}/8$ hours, Typical at SJ
Velocity Limit $20\text{V}/\mu\text{s}$, Typical
Number of Resistor Group 2
Number of X 1 Inputs 4/Group (100 kohms)
Number of X 10 Inputs 2/Group (10 kohms)
Overvolt Recovery Time $50\mu\text{s}$, Maximum
Capacitive Load $0.01\mu\text{F}$, Maximum
Resistor Accuracy $\pm 0.05\%$

8. MODEL DA-143, QUAD D.C. AMPLIFIER

Output Voltage	±10V, Minimum, at 400 ohms load
Output Current	±25mA, Minimum ±30mA, Typical
Output Impedance	30 ohms, Typical
Input Impedance	100 kohms, Typical
Frequency Bandwidth (-3dB).....	1MHz, Minimum, with 10k/10k inverter at 1V _{P-P} input 400kHz, Minimum, with 10k/10k inverter at 20V _{P-P} input 100kHz, Minimum, with 100k/100k inverter at 20V _{P-P} input
Amplitude Error at 1kHz Input	0.1%, Maximum, with 100k/100k inverter
Phase Shift at 20V _{P-P} , 1kHz Input	0.1°, Maximum (10k/10k) 0.2°, Maximum (100k/100k)
Open Loop DC Gain	2 × 10 ⁷ , Typical, 1 × 10 ⁷ , Minimum
Open Loop Gain at 100Hz	2 × 10 ⁴ , Typical, 1 × 10 ⁴ , Minimum at 1kHz
Noise (0 to 80 kHz)	2mV _{P-P} , Maximum 1mV _{P-P} , Typical, with 10k/10k inverter not including chopper spike, at output
Offset Voltage	±20µV, Typical, at SJ ±50µV, Maximum
Offset Temperature Coefficient	±2µV/°C, Maximum, referred to ambient temperature, at SJ
Drift	±10 µV/8 hours, Typical at SJ
Velocity Limit	20V/µs, Typical
Number of Resistor Group	2
Number of X 1 Input	4/Group (100 kohms)
Number of X 10 Inputs	2/Group (10 kohms)
Overvolt Recovery Time	50µs, Maximum
Capacitive Load	0.01µF, Maximum
Resistor Accuracy	±0.01%

9. MODEL IN-141, DUAL INTEGRATOR NETWORK

Number of Resistor Group	2 (Committed to Integrator Circuits)
Number of X 10 inputs	2/Group (10 kohms)
Number of X 1 inputs	2/Group (100 kohms)
Number of X 0.1 inputs	2/Group (1 Mohms)
Initial Condition Input	1 (10 kohms)
Resistor Accuracy	±0.05%
Integrating Capacitors	1µF ±0.05%, 0.1µF±0.1% 0.01µF±0.5%, ±0.001µF± 1.0%
Dielectric	Polyethylene (1µF), Polystyrene (0.1, 0.01, 0.001µF)
Integrator Drift	±100µV/sec, Typical (1µF) at Hold Mode ±200µV/sec, Maximum (1µF) at Hold Mode

Bandwidth in IC with 0.001μF	1 MHz, Typical, at 1V _{P-P} Input 50kHz, Minimum at 20V _{P-P} Input
IC Time	100μs, with 0.001μF capacitor
T.I.D.E. in IC with 0.001μF at 1 kHz	±0.75%, Maximum
Switching Time Differential	1μs, Maximum (IC and Operation switch) 200μs, Maximum (Hold Switch)
Logic Control Level	+6V, Logic ONE OV, Logic ZERO.

10. MODEL IN-143, INTEGRATOR NETWORK

Number of Resistor Group	2 (Committed to Integrator Circuits)
Number of X 10 Inputs	2/Group (10 kohms)
Number of X 1 Inputs	2/Group (100 kohms)
Number of X 0.1 Inputs	2/Group (1 Mohms)
Initial Condition Input	1 (10 kohms)
Resistor Accuracy	±0.01%
Integrating Capacitors	1μF±0.01%, 0.1μF±0.1% 0.01μF ±0.1%, 0.001μF±0.5%
Dielectric	Polyethylene (1μF). Polystyrene (0.1, 0.01, 0.001μF)
Integrator Drift	±100μV/sec, Typical (1μF) at Hold Mode ±200μV/sec, Maximum (1μF) at Hold Mode
Bandwidth in IC with 0.001μF	1MHz, Typical, at 1V _{P-P} Input 50 kHz, Minimum, at 20V _{P-P} Input
IC Time	100μs, with 0.001μF Capacitor
T.I.D.E. in IC with 0.001 μF at 1 kHz	±0.75%, Maximum
Switching Time Differential	1μs, Maximum (IC and Operation Switch) 200μs, Maximum (Hold Swtich)
Logic Control Level	+6V, Logic ONE OV, Logic ZERO

11. MODEL EM-141, DUAL MULTIPLIER NETWORK

Input Voltage	-10V to +10V
Output Voltage	-10V to +10V
Static Accuracy	±0.3% of FS, Maximum
Dynamic Accuracy at 1 kHz	±0.5%, Maximum
Phase Shift, Multiplying	
10VDC by 20V at 1 kHz	0.2°, Maximum
Input Resistance	3.3 kohms, approx.
Zero/Zero Error	±0.005% of FS, Typical
Frequency Bandwidth (-3 dB)	
At Full Inputs	100 kHz, Minimum
Output Noise X = Y = 0	5mV _{P-P} , Maximum
Drift	±2mV/°C, Maximum

12. MODEL EM-143, HIGH ACCURACY MULTIPLIER NETWORK

Input Voltage	-10V to +10V
Output Voltage	-10V to +10V

Static Accuracy	$\pm 0.05\%$ of FS, Maximum
Dynamic Accuracy at 1kHz	$\pm 0.2\%$, Maximum
Phase Shift at 1kHz	0.2°, Maximum
Input Resistance	2.5 kohms, approx.
Zero/Zero Error	$\pm 0.005\%$ of FS, Typical
Frequency Bandwidth (-3dB)	
at Full Inputs	100kHz, Minimum
Output Noise X = Y = 0	5mV _{P-P} , Maximum
Drift	2mV/°C, Maximum

13. MODEL PT-142, TEN (10) CARBONFILM POTENTIOMETERS WITH FUNCTION SWITCH

13.1 Potentiometer

Type	Carbonfilm, multturn.
Resistance	5 kohm
Independent linearity	not specified
Resolution	not specified
Protection	non-linear lamp
Dial	none

13.2 Function Switch

Type	Double pole, double throw.
Contact rating	125VAC, 3A.

14. MODEL PT-143, TEN (10) WIREWOUND POTENTIOMETERS WITH FUNCTION SWITCH

14.1 Potentiometer

Type	Wirewound, 10 turns
Resistance	5kohm
Independent linearity	$\pm 0.02\%$
Resolution	0.02%
Protection	non-linear lamp
Dial	compatible to Fairchild Model DFA (without lock)

14.2 Function Switch

Type	Double pole, double throw
Contact rating	125VAC, 3A

15. MODEL SP-141, FIVE (5) SERVO POTENTIOMETERS

Type	Wire wound, 10 turns, individually geared with motor.
Resistance	5 kohm
Resolution	0.02%
Setting accuracy	$\pm 0.05\%$ of F.S.
Setting time	1 sec, typical

16. MODEL FG-141, FOUR (4) FUNCTION GENERATOR TERMINATORS

Function	To be used as terminal on patch panel of Function Generator. One (1) FG-141 covers up to four (4) DFG (diode function generator) cards.
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17. MODELS FG-041A, FG-041B, DUAL FIXED BREAKPOINT VARIABLE SLOPE DIODE FUNCTION GENERATOR CARDS

Input Voltage

Minus-input Generator	0 to -10V	FG-041B
Plus-input Generator	0 to +10V	FG-041A
Output Voltage	-10V to +10V	
Parallax Range	$\pm 10V$	
Segments	10/channel, slavable	
Maximum Slope	± 2.5	
Output Noise	50mV _{P-P} , Maximum at unity slope	
Frequency Bandwidth (-3dB).....	20kHz at unity slope with 20V _{P-P} input	
Phase Shift at 100Hz	0.2°, Maximum at unity slope	
Input Resistance	1kohm, approx.	
Setting Accuracy	$\pm 0.2\%$ of FS, Maximum at unity slope	

18. MODEL FG-042, FIXED BREAKPOINT VARIABLE SLOPE DIODE FUNCTION GENERATOR CARD

Input Voltage	-10V to +10V
Output Voltage	-10V to +10V
Segments	10/channel
Maximum Slope	± 2.5
Parallax Range	$\pm 10V$
Noise	50mV _{P-P} , Maximum at unity slope
Frequency Bandwidth (-3dB).....	20kHz at unity slope
Phase Shift at 100Hz	0.2°, Maximum at unity slope
Input Resistance	1 kohm, approx.
Setting Accuracy	$\pm 0.2\%$ of FS, Maximum at unity slope

19. MODEL FG-047, VARIABLE BREAKPOINT, VARIABLE SLOPE DIODE FUNCTION GENERATOR CARD

Input Voltage	-10V to +10V
Output Voltage	+10V to +10V
Segments	10
Maximum Slope	Practically infinite (>100)
Parallax Range	$\pm 10V$
Frequency Bandwidth (-3dB).....	20kHz, Minimum at unity slope
Phase Shift at 100 Hz	0.2°, Maximum at unity slope
Input Resistance	50 kohms, approx.
Setting Accuracy	$\pm 0.5\%$ of FS, Maximum at unity slope
Noise	50mV _{P-P} at unity slope

20. MODEL FG-143A, DUAL SINE-COSINE, DGF, (IN COMBINATION WITH DA-143)

Input Voltage	-10V to +10V (-180° to +180°)
Output Voltagw	-10V to +10V
Operable Functions	$\text{Sin} \frac{\pi}{2}X$, $\text{Cos} \frac{\pi}{2}X$, $\text{Sin} \pi X$, $\text{Cos} \pi X$
Static Accuracy at $\frac{\pi}{2}$ Range	$\pm 0.5\%$ of FS, Typical $\pm 1\%$ of FS, Maximum
Frequency Bandwidth (-3dB) at $\frac{\pi}{2}$ Range	100kHz, Minimum

Phase Shift at 1kHz 0.3°, Maximum
Drift at $\frac{\pi}{2}$ Range 10mV/8 hours Max. at same temperature

21. MODEL FG-144A, QUAD SQUARE 'X', DFG, (IN COMBINATION WITH DA-143)

Input Voltage 0 to +10V or 0 to -10V
Segments 10/channel
Static Accuracy ±0.1% of FS, Typical
±0.2% of FS, Maximum
Frequency Bandwidth (-3dB) 100kHz
Phase Shift at 1kHz 0.3° (10V_{P-P} Input), Typical

22. MODEL FG-145A, QUAD LOG'X', DFG (IN COMBINATION WITH DA-143)

Input Voltage -0.1V to -10V, or 0.1V to 10V
Output Voltage 0 to 10V or 0 to -10V
Segments 6/channel
Static Accuracy ±0.5% of FS, Maximum
at $1V < |Input| \leq 10V$
Frequency Bandwidth (-3dB) 10kHz (10VDC + 1V_{P-P} Input)
Phase Shift at 1kHz 0.3°, Typical

23. MODEL FD-141, FREE RESISTORS & DIODES

Silicon Diode 10 ea.
Resistor 100KΩ 0.1%
10 ea.

24. MODEL ZO-141, FREE RESISTORS & CAPACITORS

Capacitor	1.0μF	±0.1%	2 ea.
	0.1μF	±0.5%	2 ea.
	0.01μF	±0.5%	2 ea.
	0.001μF	±1.0%	2 ea.
Resistor	1MΩ	±0.1%	8 ea.
	10kΩ	±0.1%	4 ea.

25. MODEL ZO-142, FREE RESISTORS & CAPACITORS

Capacitor	10μF	1%	8 ea
Resistor	1MΩ	±0.1%	8 ea.
	10kΩ	±0.1%	4 ea.

26. MODEL TD-141, TIME DELAY UNIT

Input Voltage -10V to +10V
Output Voltage -10V to +10V
Delay Time (A) 10 to 0.1 sec (0.1 sec/steps)
(B) 1 to 0.01 sec (0.01 sec/step)
(C) 0.1 to 0.001 sec (0.001 sec/step)
(D) 0.01 to 0.0001 sec
(0.0001 sec/steps)
Accuracy ±2% at (A) (B)
±10% at (C)
Amplitude error ±0.2% at D.C. all range

27. MODEL TR-141, FORTY (40) TRUNKS

External Trunk Line 40 trunks
(20 addressable trunks)

28. MODEL CP-142, QUAD COMPARATORS WITH AMPLIFIERS AND QUAD ELECTRONIC SWITCHES

Quad Comparators with Amplifiers

Input resistors 2 ea. 10 kohm $\pm 0.01\%$
Sensitivity ± 5 mV maximum with
hysteresis characteristics

Response at output voltage 1 μ sec, maximum

Quad Electronic Switches

Analog Input Resistance 100 kohms $\pm 0.05\%$ including resistance of electronic switch
Equivalent Off Impedance 1,000 Mohms, Minimum, at 10V
Propagation Time 1 μ sec. Maximum
Offset Current 10^{-9} A, Maximum
Control Input Resistance 10 kohms, approx.
Analog Input Voltage -10V to +10V
Control Voltage +6V (ON) and 0V (OFF), approx.
Threshold Level +3V, approx.

29. MODEL AS-141, QUAD ELECTRONIC SWITCHES

Analog Input Resistance 100 kohm $\pm 0.05\%$ including resistance of electronic switch
Equivalent Off Impedance 1,000 Mohms, Minimum, at 10V
Propagation Time 1 μ s, Maximum
Offset Current 10^{-9} A, Maximum
Control Input Resistance 10 kohms, approx.
Analog Input Voltage -10V to +10V
Control Voltage +6V (ON) and 0V (OFF), approx.
Threshold Level +3V, approx.

30. MODEL RL-141, QUAD RELAY

Relay Double pole, double throw
Operable signal Logic signal or equivalent
Speed 10 msec, maximum

31. MODEL RL-142, QUAD RELAY & TRIPLE LIMITER

Relay Double pole, double throw
Operable signal Logic signal or equivalent
Speed 10 msec, maximum
Limiter to be used in conjunction with a 100 kohm/100 kohm amplifier
Number of limiters 3 limiters
Maximum limit ± 10 V
Minimum limit ± 1 V
Slope after limit 5mV/V

32. MODEL BL-240, BASIC LOGIC, MODULAR CONSOLE

32.1 General Specification

Logic Level 0 and +6V, Nominal
Fan Out 6 minimum

**III. DIGITAL LOGIC
COMPONENTS
SPECIFICATIONS**

Circuit	.....	All solid state
Control Modes	.....	CLEAR, RUN, STOP and STEP
Clock	.....	10 μ s, 100 μ s, 1ms, 10ms, 100ms
Clock accuracy	.....	$\pm 0.01\%$

32.2	Function	
	Switches	Comparators 8
		Flip-flops 10
		Manual switches 2
	Indicators	Logic gates 16
		Flip-flops 10
		Counters 40
		Comparators 8
		Manual switches 2
	Decade switches	..... 4
	System Control Switch (P.B.)	
	(Clear, Run, Stop, Step)	..... 1

33. MODEL LG-141, EIGHT (8) LOGIC GATES

Function	.....	AND gates with Inverter
Modes	.....	AND, NAND
Outputs	.....	True and Complement

34. MODEL FF-141, FIVE (5) FLIP-FLOPS

Central Control	.....	Clear
States	.....	Set and Reset

35. MODEL CU-141, TWO (2) SINGLE DECADE COUNTERS

Single Decade Counters		
Control Inputs	.....	RUN CLEAR
Control Outputs	.....	Decimal 0 to 9 outputs, Carry-out and N-out
State Indication	.....	By Terminated indicators

36. MODEL CU-142, TWO (2) SINGLE DECADE COUNTERS

Single Decade Counter		
Control Inputs	.....	RUN, CLEAR
Control Outputs	.....	Decimal 0 to 9 Carry-out and N-out
State Indication	.....	By Terminated indicators

37. MODEL PP-242, PATCH PANEL FOR MODEL BA-220 BASIC ANALOG COMPUTER

Color coded	
Non shielded	
800 patching holes	

38. MODEL PP-244, PATCH PANEL FOR MODEL BA-240 BASIC ANALOG COMPUTER

Color coded	
Non shielded	
1440 patching holes	

IV. ACCESSORY & DISPLAY DEVICES

39. MODEL PP-246, PATCH PANEL FOR MODEL BA-260 BASIC ANALOG COMPUTER

Color coded
Non shielded
2160 patching holes

40. MODEL PK-240, PATCH CORD KIT

Kit consists of followig:

20 each,	Patch cord,	PC-015 (10 cm)
40 each,	Patch cord,	PC-025 (20 cm)
20 each,	Patch cord,	PC-045 (40 cm)
10 each,	Patch cord,	PC-065 (60 cm)
10 each,	Patch cord,	PC-085 (80 cm)
30 each,	Bottle plug	BP-025 (2 pins)
20 each,	Bottle plug,	BP-245 (4 pins)
10 each,	Connecting Jacks	

41. MODEL MU-041, MAINTENANCE UNIT

Maintenance unit for maintenance of modules

42. MODEL OS-242A, OSCILLOSCOPE UNIT, WITHOUT CABINET, FOR INSTALLATION IN BASIC LOGIC MODULAR CONSOLE

Indicator Unit	9 Inches Square Cathode-Ray Tube
Inputs	Four Vertical, One Horizontal
	Inputs, Trigger input and Blanking input
Full scale Range	2, 1, 0.5, 0.2
Time Range	10ms, 20ms, 50ms, 100ms, 200ms, 500ms, 1s, 2s, per Full Scale
Reading Accuracy	±3% of Full Scale
Scale	Electronic Scale Illumination by 11 x 11 grid lines
Adjustments	Intensity, Scale Intensity, Scanning Frequency, Positions, Trigger

-Complete-



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