



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±10%
Frequency	50/60 Hz ± 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 ±0.01%
Noise	2mVp-p, maximum 1mVp-p, typical
Temp. coefficient	±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
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- 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 \pm 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

**II. ANALOG
COMPUTING
COMPONENTS
SPECIFICATIONS**

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

5.4 Install location: Manual potentiometer panel

5.5 Drift ± 1 mV/8h

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 ± 10 V, Minimum, at 500 ohms load

Output Current ± 20 mA, Minimum
 ± 25 mA, Typical

Output Impedance 30 ohms, Typical

Input Impedance 100 kohms, Typical

Frequency Bandwidth (-3dB) 1 MHz, Minimum, with 10k/10k
inverter at 1V_{p-p} input
300kHz Minimum, with 10k/10k
inverter at 20V_{p-p} input
100kHz Minimum, with 100k/100k
inverter at 20V_{p-p} input

Amplitude Error at 1 kHz input 0.1%, Maximum, with 100k/100k
inverter

Phase Shift at 20V_{p-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) 1mV_{p-p}, Typical
with 10k/10k Inverter not including
chopper spike, at output

Offset Voltage ± 10 μ V, Typical, at SJ
 ± 20 μ V, Maximum

Offset Temperature Coefficient ± 2 μ V/°C, Maximum, referred to
ambient temperature, at SJ

Drift ± 10 μ V/8 hours, Typical at SJ

Velocity Limit 20V/ μ 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 μ s, Maximum

Capacitive Load 0.01 μ F, Maximum

Resistor Accuracy ± 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 x 10 ⁷ , Typical, 1 x 10 ⁷ , Minimum
Open Loop Gain at 100Hz	2 x 10 ⁴ , Typical, 1 x 10 ⁴ , Minimum
at 1kHz	2 x 10 ³ , Typical, 1 x 10 ³ , Minimum
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 ambi- ent 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 0.001 μ F	1 MHz, Typical, at 1V _{P-P} Input 50kHz, Minimum at 20V _{P-P} Input
IC Time	100 μ s, with 0.001 μ F capacitor
T.I.D.E. in IC with 0.001 μ F at 1 kHz . .	$\pm 0.75\%$, Maximum
Switching Time Differential	1 μ s, Maximum (IC and Operation switch) 200 μ s, 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	$\pm 0.01\%$
Integrating Capacitors	1 μ F $\pm 0.01\%$, 0.1 μ F $\pm 0.1\%$ 0.01 μ F $\pm 0.1\%$, 0.001 μ F $\pm 0.5\%$
Dielectric	Polyethylene (1 μ F). Polystyrene (0.1, 0.01, 0.001 μ F)
Integrator Drift	$\pm 100\mu$ V/sec, Typical (1 μ F) at Hold Mode $\pm 200\mu$ V/sec, Maximum (1 μ F) at Hold Mode
Bandwidth in IC with 0.001 μ F	1MHz, Typical, at 1V _{P-P} Input 50 kHz, Minimum, at 20V _{P-P} Input
IC Time	100 μ s, with 0.001 μ F Capacitor
T.I.D.E. in IC with 0.001 μ F at 1 kHz . .	$\pm 0.75\%$, Maximum
Switching Time Differential	1 μ s, Maximum (IC and Operation Switch) 200 μ s, 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	$\pm 0.3\%$ of FS, Maximum
Dynamic Accuracy at 1 kHz	$\pm 0.5\%$, Maximum
Phase Shift, Multiplying	
10VDC by 20V at 1 kHz	0.2 $^\circ$, Maximum
Input Resistance	3.3 kohms, approx.
Zero/Zero Error	$\pm 0.005\%$ of FS, Typical
Frequency Bandwidth (-3 dB)	
At Full Inputs	100 kHz, Minimum
Output Noise X = Y = 0	5mV _{P-P} , Maximum
Drift	$\pm 2\text{mV}/^\circ\text{C}$, Maximum

12. MODEL EM-143, HIGH ACCURACY MULTIPLIER NETWORK

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

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

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 resist-
ance 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

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 $\pm 3\%$ 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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