Covers the World
HITACHI 505 Analog Computer
The HITACHI 505 is produced by HITACHI, LTD.,
the leading manufacturer of Analog Computers in Japan.
Not only recognized as a leader
among Japanese enterprises,
HITACHI also maintains an important
and respected position in international business circles.

The HITACHI 505 is an all-transistorized,
±100V desk top analog computer offering
large machine accuracy and
hybrid computer capabilities.

High reliability and extreme stability — thanks
to its all solid-state design (even choppers!)
— results in easy operation
and a totally maintenance-free concept.
Expandable modular design permits direct expansion
to the maximum limit.

Routine simulations, as well as complex
and difficult computations requiring high speed,
unique function generation capabilities,
and precision can be accurately solved
on the HITACHI 505 by the engineer,
researcher or scientists.

Hybrid Orientation

The HITACHI 505 is a well-designed hybrid oriented computer;
especially, facilities offered by built-in digital logic elements and further
hybrid capability presented by expandability of servo-set computing elements.

Facilities offered by this ANALOG/HYBRID system are:
(1) Sequential computation and control facilities
(2) Track and hold facilities
(3) Multi-mode control facilities
(4) Event-counting and time-counting facilities
(5) Simulation of including logical element

The HITACHI 505 can organize an ANALOG/DIGITAL hybrid system by
combination with a digital computer for general use, presenting a depend-
able service for analysis of complex scientific problems.
Special Features

1. The computer basically consists of solid-state D.C. amplifiers provided with FET chopper circuits in order to boast high reliability and to eliminate mechanical troubles. These amplifiers have a 100 volt 20 ma output with low drift and a high S/N ratio for extreme accuracy.

2. Electronic mode control integrators are adopted; a flexible selection of integrator gains from 1 to 1,000, and the ratio between real time and time in the high-speed repetitive mode of 1 to 0.001, permit easy operator control for computing and readout speed. Moreover, direct control of the integrator from digital logic elements can be performed.

3. The completely shielded, color-coded, detachable patchboard has been designed with the programmer in mind. Most connections may be made with low-capacity bottle plugs. Also, a unique method for temporary labelling of the potentiometers is provided.

4. Readout of solutions is obtained with a 4-digit DVM or a 3-channel Y" oscilloscope. Repeating operations are synchronously performed with sweep time of the oscilloscope, and operation control is achieved through the oscilloscope. Electronically generated scales are displayed on the tube face, providing an accurate reference during readout of solutions. Solutions are also available externally for a X-Y plotter or other monitoring devices.

5. A timer which can be optionally and independently set up as 3-channels realizes time sequence of every possible combination.

6. Another unique operation element of the HITACHI 505 is a new 2-variable function generator. This is especially effective in aircraft industries, automobile and rolling stock industries, and chemical engineering fields. This two-variable function generator, in particular, is a novel silicon transistor device featuring 25 non-interacting fixed breakpoints. A large selection of other function generators is available for special purposes, including: 3 different fixed breakpoint function generators; 1 variable breakpoint function generator; 2 trigonometric function generators; 2 log function generators; and 2 X² function generators.

Configuration Guide

<table>
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<th>Components</th>
<th>Suffix</th>
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<tr>
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<td>Quantity of Units</td>
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<td>Logarithmic Function Generators</td>
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<td>Voltage Comparators</td>
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<td>Service Handle</td>
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<tr>
<td>Cable for Expansion</td>
<td>- - -</td>
<td>1 1 1 1 2</td>
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</table>
Multiplier
No adjustment is required for this stable multiplier. High accuracy is obtained by superimposing a triangular wave.
Static error: ±0.05% typ.
Dynamic error: ±0.2% max.
Frequency response: 10 KC (100 V DC x 100 V p-p)
Operating functions: Multiplication; division; squaring
A high-accuracy multiplier (±0.02% typ.) is also available.

Function Generator
There are many types of function generators available; however, the following properties comprise a representative one:
Variable function generator
Number of polygonal lines: 10
Maximum slope: 5V/V
Frequency response: 20 KC
Input voltage: 0 to +100 V
0 to -100 V
In addition to the above, a trigonometric function generator unit, square function generator unit, logarithmic function generator unit, two-variable function generator unit, and universal variable function generator unit are available.

Time Delay
This is an electronic transfer delay element based upon padé second order approximation; a fourth order transfer delay circuit can be easily constructed according to required programming.
Delay error: ±2% max. (Range A & B)
Amplitude error: 0.5% max.
Delay range:
0.1 to 10 sec.: A
0.01 to 1 sec.: B
0.001 to 0.1 sec.: C
0.0001 to 0.01 sec.: D

Free Diodes
These are diodes for producing nonlinear characteristics such as saturation, dead-zone, hysteresis, and so forth.
Number of diodes: 10
Number of resistors: 10
Resistance value: 1MΩ ±0.1%

Voltage Comparator
This unit, used for voltage comparison, has a built-in amplifier with very small drift and excellent sensitivity.
Number of input: 2 inputs per channel
Sensitivity: 50mV min.
Response time of relay: 5ms max. or 500μs max.
Output: DPDT transfer relay output and voltage output (response time 10μS)
Furthermore, this comparator imparts hysteresis characteristics to the input of amplifier, in order to eliminate the influence of the input noise.

Automatic Operator
Major parts of circuits for solving boundary value problems and for plotted adjustment in parameters are integrated to simplify operations.

Note
The following components are available as options.
Quad Amplifier
Dual EMC Integrator
High Accuracy Multiplier
Trigonometric Function Generator
Universal Variable Function Generators
2-Variable Function Generators
Square Function Generator
Logarithmic Function Generator
High Speed Voltage Comparator
Analog Switch
Timer
Logic Operator Board
Hybrid Structure
Servo-set Potentiometer
Servo-set Function Generator etc.
Oscilloscope
Potentiometer Indication Plate
Accessory Box
Digital Logic Element
Various logic elements are provided on this unit; used in performing automatic operation and logic circuit simulation by programming on a pre-patch panel.
Supplied elements and quantities are as follows:
- Ring counter unit: 1
- Mode matrix unit: 1
- Flip-flop unit: 2
- Logic gate unit: 2
- Trunk unit: 1
- Counter unit: 2
- Pre-patch panel: 1

Timer
This timer is used for iterative computations and repeating operations. By using three independent timers, wide applications become possible. Main specifications are as follows:
- The timer circuits are silicon semiconductors, providing maximum reliability.
- Four steps of the scale 0.1S, 1S, 100mS, 10mS, can be selected on the panel.
- The timers can be controlled either manually or automatically.
- Mode control for the integrator can be operated by the timer output. A simple 5-step timer for repeating operations is available.

Logic Control Panel
This panel performs various controls of the digital logic element and indications of operation conditions; included are ring counter and flip-flop indications, and manual control.

Control Panel
This panel has the following functions:
- Mode Control
- Voltmeter
  - To improve readout accuracy, this large, square voltmeter is provided with a reflector mirror.
  - Range: 300V, 100V, 30V, 10V, 1V, 0.1V
- Reference Potentiometer
  - Linearity: ±0.1%
  - Resolution: 0.01%
  - Resistance Value: 10KΩ
- Power Control
  - ON-OFF control of HITACHI 505 power source
  - Integrator Capacitor Selection
  - Trunks
**Output Selector**

On this panel the output of the computing elements are selected and called by push buttons. It incorporates the following properties:
- Outputs of maximum 62 DC amplifier and comparators are manually selected by push buttons.
- Standard voltages of positive 100 volts and negative 100 volts are also readout manually by push button selection.
- External signals can be selected.
- Two function switches are provided on the panel, their terminals connected to the function switch panel for manually switching over for optional signal and for ON-OFF operation.

**Overload Indicator**

This unit indicates overload of the DC amplifiers during computing and reveals unbalance conditions during a balance check by neon lamps, simultaneously generating audible signals.
Two function switches are provided on the panel.

**Potentiometer Set Buttons**

Address selection of the potentiometer is performed by these push buttons. The selected potentiometer is accurately indicated by neon lamp.

**Potentiometer**

This is a potentiometer with a protective device. It is easy to set up by using an address push button and a digital dial.
- Number of potentiometers: 18/panel
- Resistance: 30 KΩ
- Resolution: 0.01%
- Selection indication: Neon lamp

**Potentiometer Indication Plate**

Symbols in the equation corresponding to the constant set by the potentiometer or operator's notes are written on this plate, held in place by magnetic attraction.
Writing is done by pencil; erasing is easily accomplished for inscribing new symbols.

<table>
<thead>
<tr>
<th>Size</th>
<th>Analog Console</th>
<th>Control Console</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>350 lbs.</td>
<td>180 lbs.</td>
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<tr>
<td>Power Requirements</td>
<td>Voltage</td>
<td>115 V AC</td>
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<tr>
<td></td>
<td>Frequency</td>
<td>50 or 60 c/s</td>
</tr>
<tr>
<td></td>
<td>Power</td>
<td>500 VA</td>
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</table>
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