TYPE-16H
HITACHI / HIGH SPEED MOTION ANALYSIS CAMERA

Hitachi, Ltd.
Tokyo Japan

EX-E025

World's Highest Camera Speed up to 10,000 P.P.S.

Fastest Acceleration to Desired Frame Rate

With Event-and-Camera Synchronizer Built-in

As it is called "Zeitdehner" or "micrometer for milliseconds", the high speed camera magnifies the time of phenomena too fast for human eye to follow. When motion pictures taken at 10,000 P. P. S. (pictures per second) are projected at the normal speed of 16 frames a second, the time of phenomena is magnified to 625 times on the projection screen for leisurely examination and study.

High-speed photography has been contributing to scrintists and engineers who are studying design and production problems in high-speed movement of mechanical parts, fluids or devices. HITACHI is proud to be able to make HIMAC a most effective and valuable assistant to the researchers.

Applications

High-speed motion picture photography has unlimited applications on studies in the mechanical, electrical, physical, chemical and medical fields.

1. Science and Engineering

Flow of liquids and gases
Wind tunnel phenomena
Formation of bubbles through supersonic waves
Jet flow
Cavitation of ship propellor
Electrical explosion of metallic wire
Combustion of blasting fuse
Explosion of gunpowder
Arc of circuit breaker
Rectifying condition of commutator motor
Research on flame
Electrical discharge in gas
Research on radioactive rays
Movement of shuttle in looms
Surging of valve spring
Printing shears of printing press
Movement of sewing machine
Research on swaging machine
Destruction of high-speed rotating disk
Hot metal flow in casting
Launching of rockets and missiles
Operation of relay
Research on transitions in welding
Meshing of gears
Vibration of turbine blades
Research on agricultural machinery
Movement of typewriter
Explosive effects of bombs

2. Biology and Medicine

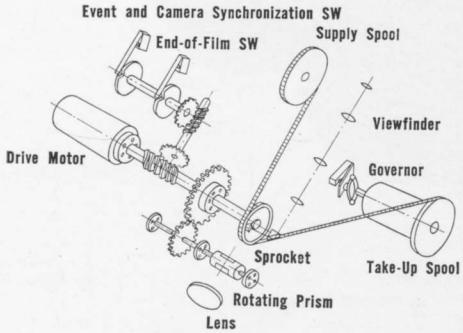
High-speed X-ray photography of internal organs of human being
Movement of vocal chords
Movement of eyelids
Vibration of eardrums
Flying movements of birds and insects
Swimming movememts of fish

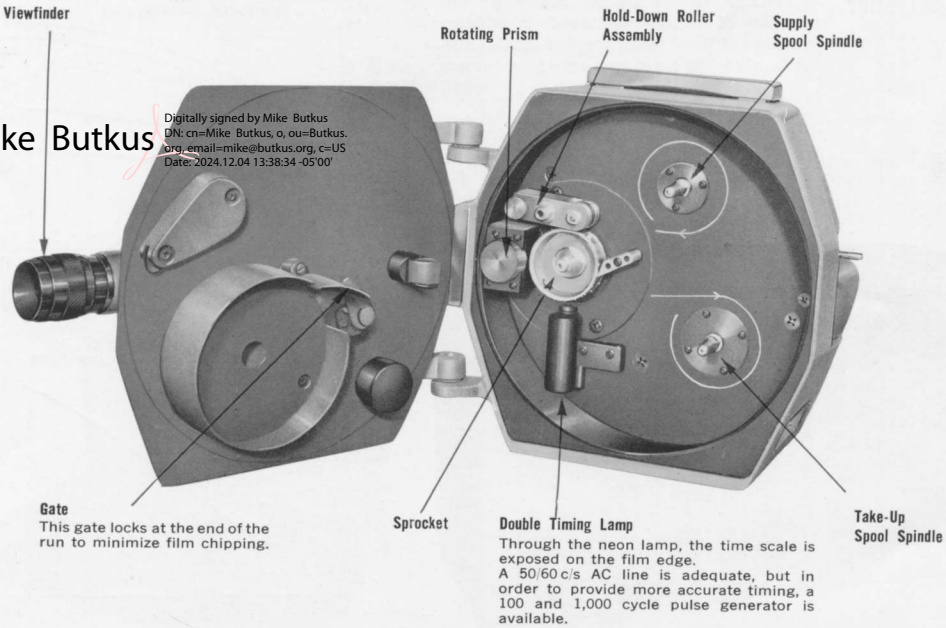
3. Education and Sports

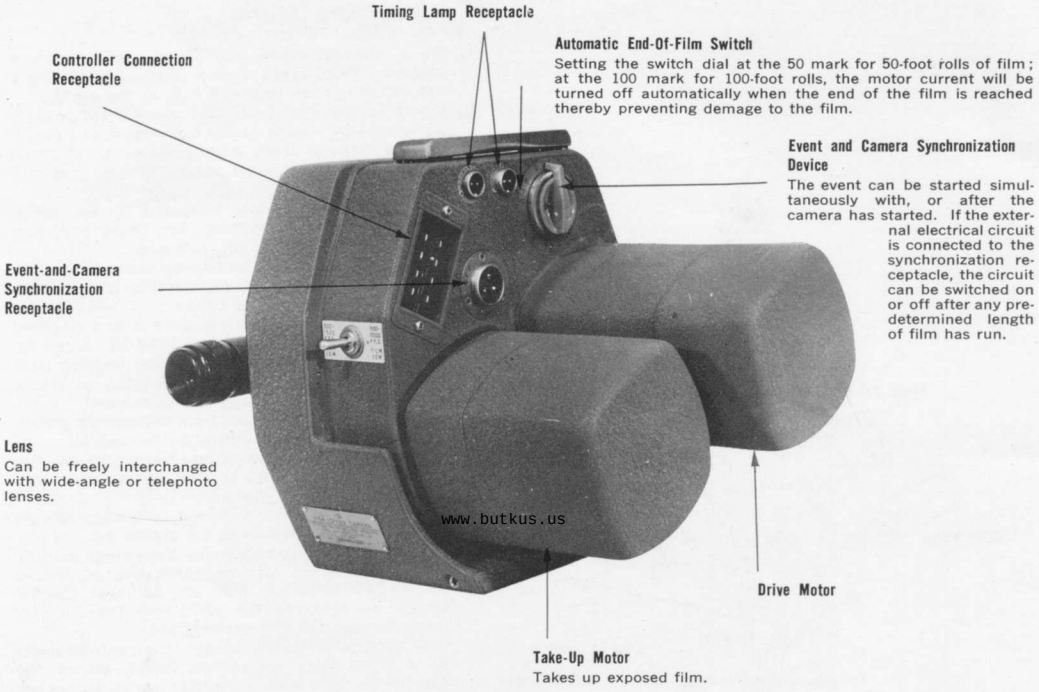
Analysis of hand operations
Research on pitching and throwing motions
Research on hitting the ball in baseball and golf
Movement of musicians' hand

Outstanding Features

1. As a rotating prism high-speed motion picture camera, HIMAC takes motion pictures at the highest frame rate of 10,000 P. P. S. in the world.
2. Synchronization of event and camera is precisely performed by means of the synchronization switch cam to make or break an external electrical circuit after any predetermined length of film has run through the camera.
3. Taked-up film is safely protected by the spcial device "GATE" minimizing film chips and dust resulting from whip of the film end.
4. The drive motor and the take-up one are specially designed for highest speed operation without trouble such as commutator failure.
5. Each camera is supplied complete with a standard focal length lens. A series of NIKKOR lenses for the Nikon Automatic Reflex in focal lengths from 28 mm to 135 mm and extension tubes are available to meet each high-speed requirement.
6. The controller is separated from the camera proper, so that remote-control operation is available.
7. The acceleration to the desired camera speed after starting is very fast, by the aid of ingenious controller and powerful motors.
8. The end-of-film switch provided in camera cuts off its motors automatically at the end of the film run.
9. Camera speed is controlled by the voltage applied. At a higher frame rate on application of voltage above 150 volts AC, however, sprocket starting torque increases to the point that the sprocket tends to tear the film perforations.
   Improving such a performance, the controller acts as a time delay mechanism which allows the camera to start with a resistor series-connected, and some time later releases the voltage to the camera without the resistor.

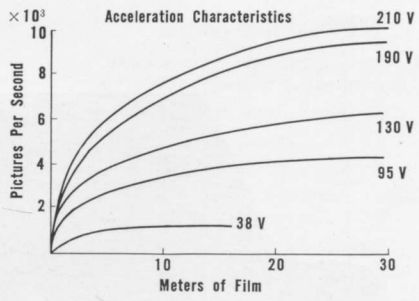


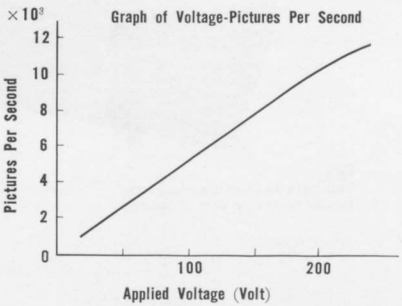




Controller

Permits remote-control operation, and regulation of the camera speed. In addition, an electrical timer make possible synchronization to allow the event to prestart the camera.

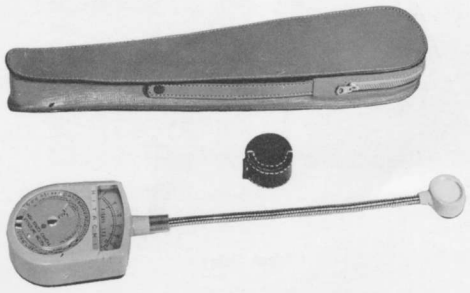




Specifications

Dimensions		300×300×250 mm
Weight		14.5 kg
Performance	Speed Range	500～10,000 P.P.S.
	Film Used	16 mm×30.5 m reel (100 ft) both sides perforated. Kodak Tri X for high speed cameras or high sensitivity color film Sakura SSS, Fuji SSS,
Power Supply		AC 110/115 V, 50/60 c/s when 500～7,000 P.P.S. AC 200/230 V, 50/60 c/s when 500～10,000 P.P.S. Maximum current—over 30 amperes
Optical System	Lens	Standard lens: 50 mm, f 2.0 Auto-Nikkor
	Finder	Magnification ×9.5, visibility adjustment possible
	Rotating Prism	Square prism using high refraction index, low dispersion optical glass
Controller	Dimensions	210×300×430 mm
	Weight	25 kg
	Performance	1. Remote-control operation 2. Regulation of the camera speed 3. Cutting off the camera automatically at the end of the film run. 4. By means of the electrical timer built into the unit, the camera can be started after the event has started.
Connecting Cords		Power supply-control 5 m Controller-camera 5 m Remote control cord 5 m Timing lamp cord 5 m
Standard Accessories		Lens case (1), Camera Carring case (1), Tools for assembly (1 set), Lubricant Atomizer (1), Blower (1), Brush (1), Neon lamp (6), Synchronization cam (10), Accessory bag (1), Dark bag (1), Silicon cloth (1), Film Strip for focusing (6), Lubricating oil (50 cc), Instruction book (1), Camera speed characteristic chart (1), 100′ film-spool for daylight loading (3), 100′ film-spool can (3)
Special Accessories	Exposure Meter for High Speed Camera	Measuring range: 0～3,000,000 lux
	Extension Tube Kit	Nikon, E-Ring
	Interchangeable Lenses	28 mm f 3.5 Auto-Nikkor 35 mm f 2.8 Auto-Nikkor 105 mm f 2.5 Auto-Nikkor 135 mm f 3.5 Auto-Nikkor
	Lens Hood	For 28 mm f 3.5 Auto-Nikkor For 35 mm f 2.8 Auto-Nikkor For 50 mm f 2.0 Auto-Nikkor For 105 mm, 135 mm Auto-Nikkor
	Filters	Yellow, Orange, Red, Green, UV and Polarizing filter
	Tripod	Mitchell type with head case and tripod bag, standard and baby
	Lighting Equipment	1,000 W reflector lamp (spot light) Clamp for lamp
	Timing Light Pulse Generator	100 c/s Pulse width: 200 μS 1,000 c/s Pulse width: 80 μS When 1,000 c/s is used, measuring is made convenient by making each 10th pulse 200 μS

Lens Kit



Exposure Meter for High Speed Camera

On-line camera manual library

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Timing-Light Pulse Generator

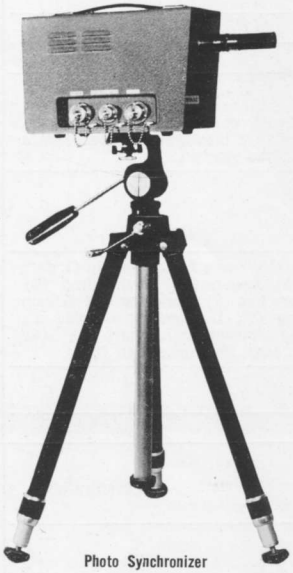
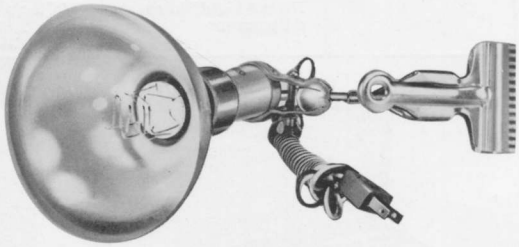


Photo Synchronizer

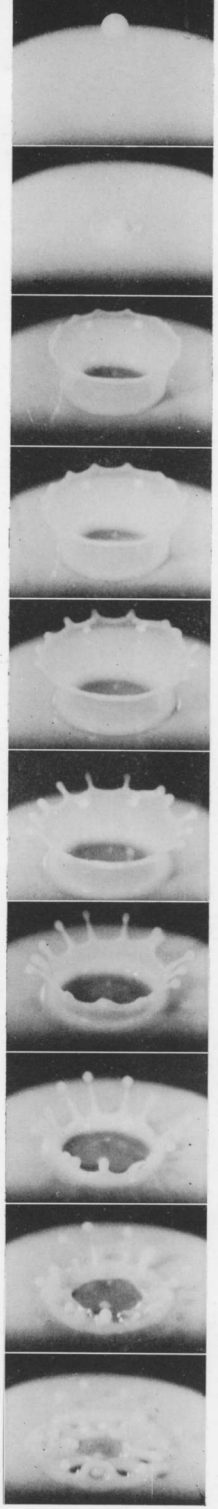
Tripod (Standard)

Tripod (Baby)

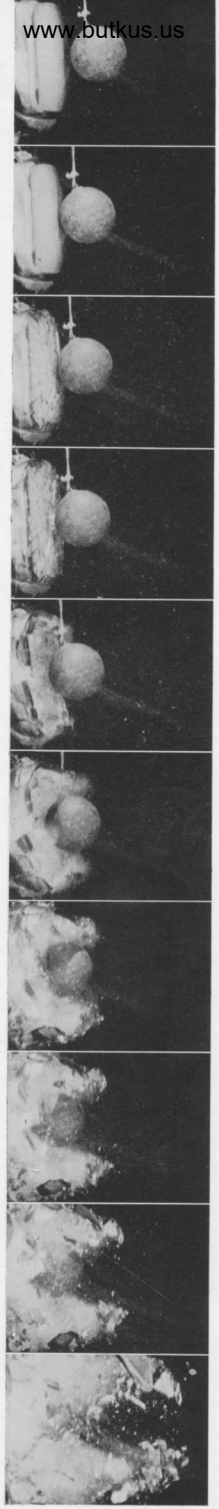


Reflector Lamp and Grip

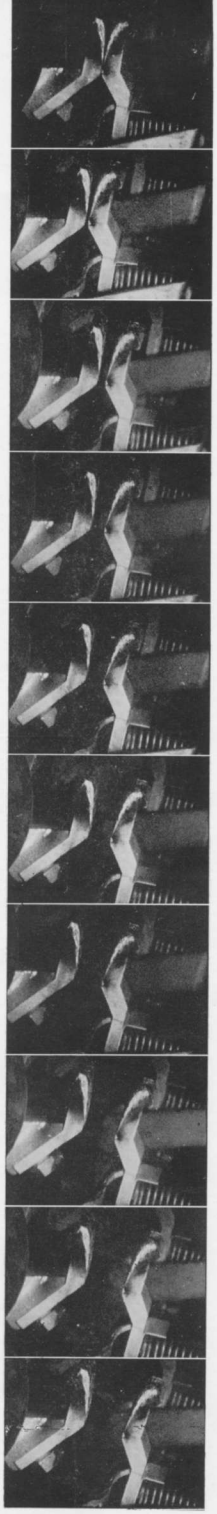
Camera Stand



(1) Crown Taken in Picture at 7,000 P.P.S.
A beautiful image of crown formed by a drop of milk just dropped into a plate full of milk. Photographed at the interval of 40 frames.



(2) Shattering of Cathode Ray Tube at 3,000 P.P.S.
Photographed at the interval of 10 frames.



(3) Here, Circuit Breaker, Capacity 7,000 kVA has been Photographed at 5,500 P.P.S. in operation.
Photographed at the interval of 10 frames.

Some Examples of Hitachi High Speed Camera Photography

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