High-Speed BOX Camera for Sports

QDCAM®

Global Shutter
Multi-Camera Synchronizing Exposure System
Multi-Camera High-Speed Video
Synchronizing Playback System
High-Speed Box Camera for Sports QDCAM®

Affordable High-Speed Box Camera

**Features**

**High-speed shooting**
4× speed

With 1920 × 1080 pixel FHD resolution, 4 × speed shooting at 239.8 fps or 200 fps is possible. In combination with a slow-motion server, smooth slow-motion playback can be performed, making high-precision sports analysis possible.

**High-resolution shooting**
4K

At a frame rate of 59.94 fps or 50 fps, 3840 × 2160 pixel UHD resolution shooting is possible. At 24 fps, 4096 × 2160 pixel DCI 4K resolution shooting is possible.

**Optical transmission using a fiber optic camera cable**

You can use optical transmission system using SMPTE standard fiber optic camera cables which are installed in stadiums and other facilities frequently used for sports broadcasting.

**Remote camera operation using a LAN/IP network**

Box cameras for city view, weather view or other purpose, installed in a distance, can be controlled remotely by PC through an IP network.

**Global shutter CMOS image sensor**

QDCAM

Global shutter image sensor provides excellent picture without rolling shutter distortion in a quick moving object. Global shutter sensor is suitable for sports shooting.

**Micro four thirds lens system**

The adoption of micro four thirds allows the use of inexpensive, high-quality lenses. It also allows the use of bright lenses that are effective for high-speed shutter shooting under nighttime game lighting. The iris and focus can also be controlled remotely by electronic control using electrical contacts.

**Multi-camera synchronizing exposure system**

The exposure timing of multiple cameras can be synchronized with high-precision without being affected by differing camera cable lengths. This allows the video from multiple cameras to be frozen simultaneously, preventing any timing deviation when switching to a video from a different angle. This also can improve the calculation accuracy of automatic sports referee systems which use images from multiple cameras. (Japan patent No. 6635635)

**Multi-camera high-speed video synchronizing playback system**

When linked with a QDVS recorder/player, high-speed video from multiple angles can be synchronized for slow-motion playback or frame-by-frame playback, allowing the video to be checked for sports referee calls.
Synchronizing shooting with high-precision improves the calculation accuracy of automatic judgement system.

Affordable high-speed cameras allow variety of slow-motion views.

Video Assistant Referee

Example: Race start and goal scenes

Example: Martial arts game scenes

High-precision synchronous high-speed video shooting and synchronized playback for checking the timing of a wide range of movements.

Sports Broadcasting and Program Production

Affordable cameras are ideal for multi-angle video or free viewpoint video production that requires large number of cameras.

Can also be used for UHD program production.

Automatic Judgement System

Synchronizing shooting with high-precision improves the calculation accuracy of automatic judgement system.

Sports Analysis and Coaching

A wide range of analysis is possible using high-speed shooting synchronized with high-precision.

Delayed display of video with QDVS allows athletes to check their own form.

Team formations and player movements can be analyzed for use in coaching.
Camera Interface

Genlock input
The Tri-level Sync or Black Burst reference synchronization signal is input here.

SDI output
Quad Link SDI is output for 4x speed video and 4K video output. At other times, 4-system output of the same SDI is performed.

Remote communication
A controller or cam-site unit is connected here using a communication cable.

Power input
DC 11.8 to 16.8V

Lens and Camera Communication Control Items

<table>
<thead>
<tr>
<th>Focus</th>
<th>Iris</th>
<th>Zoom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Near ↔ Far</td>
<td>Open ↔ Close</td>
<td>Wide ↔ Tele-photo</td>
</tr>
</tbody>
</table>

Camera control

Video Format
DCI24/DCI23/UHD60/UHD59/UHD50/UHD24/UHD23/FHD240/FHD239/FHD200/FHD60/FHD59/FHD50/FHD24/FHD23/FHD59/FHD60

Step Shutter
1/50, 1/60, 1/100, 1/120, 1/125, 1/200,..., 1/250, 1/400, 1/500, 1/750, 1/1000, 1/2000, 1/5000, 1/4000, 1/6000, 1/8000, 1/12000 sec

Synchro-Shutter
1/60.2 to 1/12066 sec

Gain Adjustment
-6 to +36 dB (1 dB steps)

Color Gain Adjustment
R_GAIN, G_GAIN, B_GAIN

Black Level Adjustment
MASTER PEDESTAL, R_PED, G_PED, B_PED

Automatic Iris
ON/OFF

Automatic Iris Response Speed
0~15

Target Luminance Level Adjustment
-12 to +12 dB (1 dB steps)

Gamma
BT.709 standard gamma * Fine adjustments are possible. BT.2100 hybrid log gamma [HLG]

Knee Mode
MANUAL/AUTO

Knee Point
100%/95%/90%/85%/80%/75%/OFF

Detail Enhancement
0 (OFF) to 7 (High)

Noise Reduction
OFF/ON

Flicker Cancel
50 Hz power lighting / 60 Hz power lighting / OFF

White Balance Mode
AUTO/MANUAL/PRESET

Manual White Balance
MAIN/CH A/CH B/CH C (Take & Load)

Preset White Balance
Color temperature 2600 to 10000K (100K steps)

Color Gamut
BT.709, BT.2020

6-Axis Color Correction
Hue and saturation of each color axis: magenta, red, yellow, green, cyan, and blue

Image Angle Selection for 4x Speed Shooting
CENTER ROI/FULL SCREEN

Scene Memory
Camera setting data can be stored to 3 sets of scene memories and can be loaded from one of scene memories.

Color Bar
ON/OFF

Blemish Compensation
Automatic blemish detection and automatic blemish compensation

ROP (Camera Controller)

Shutter speed display

Scene memory number

B Gain adjustment

R Gain adjustment

Synchro-shutter indicator

Focus ON button

Shutter speed adjustment buttons

Focus/master pedestal dial

Total gain display

White balance display

Menu operation display

Zoom operation buttons

Analog gain indicator LED

Focus on button

Focus/iris button

Automatic iris button

Iris dial

Step Shutter
1/50, 1/60, 1/100, 1/120, 1/125, 1/200,..., 1/250, 1/400, 1/500, 1/750, 1/1000, 1/2000, 1/5000, 1/4000, 1/6000, 1/8000, 1/12000 sec

Gamma
BT.709 standard gamma * Fine adjustments are possible. BT.2100 hybrid log gamma [HLG]

Knee Mode
MANUAL/AUTO

Knee Point
100%/95%/90%/85%/80%/75%/OFF

Detail Enhancement
0 (OFF) to 7 (High)

Noise Reduction
OFF/ON

Flicker Cancel
50 Hz power lighting / 60 Hz power lighting / OFF

White Balance Mode
AUTO/MANUAL/PRESET

Manual White Balance
MAIN/CH A/CH B/CH C (Take & Load)

Preset White Balance
Color temperature 2600 to 10000K (100K steps)

Color Gamut
BT.709, BT.2020

6-Axis Color Correction
Hue and saturation of each color axis: magenta, red, yellow, green, cyan, and blue

Image Angle Selection for 4x Speed Shooting
CENTER ROI/FULL SCREEN

Scene Memory
Camera setting data can be stored to 3 sets of scene memories and can be loaded from one of scene memories.

Color Bar
ON/OFF

Blemish Compensation
Automatic blemish detection and automatic blemish compensation
6-Axis Color Correction

With the QDCAM camera, it is possible to adjust the hue and saturation independently for each of 6 axis colors as shown by the vector scope, specifically red, magenta, blue, cyan, green, and yellow. This 6-axis color correction is useful in cases such as when shooting with cameras from multiple manufacturers, or when color differences cannot be identified when the image is changed by the switcher. In addition, it is possible to change the overall Chroma Level by increasing or decreasing the saturation for all 6 colors without changing the hue.

View Angle Mode for 4X Speed Shooting

When shooting at 4X speed such as 240fps, 239.8fps and 200fps frame rate, 2.1million pixel signals out of a total 8.8million pixels are read out. Normally, 2.1million pixel signals in the center of the image sensor are read out to provide high-quality, high-speed video without jaggy. (Center ROI mode)

However, you can also use Full Screen mode, which reads out 2.1million pixel signals by thinning out evenly from the full screen, to take a wider image.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Vertical view angle</th>
<th>Field of view height</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Distance to subject</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7m / 20ft</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15m / 49ft</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30m / 98ft</td>
</tr>
<tr>
<td>Center ROI</td>
<td>4.66°</td>
<td>0.57m / 1.9ft</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.22m / 4.0ft</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.44m / 8.0ft</td>
</tr>
<tr>
<td>Full screen</td>
<td>9.30°</td>
<td>1.14m / 3.7ft</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.44m / 8.0ft</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.88m / 16ft</td>
</tr>
</tbody>
</table>

Example of field of view height when using a micro four thirds lens with focal length f=42.5 mm
Example of System Configuration

Basic System

A simple system can be used as long as it is within the range that can be connected using a 3G-SDI coaxial cable with the maximum allowable length.

Fiber Optic Camera Cable Transmission System

When operating in a stadium for sports broadcasting, or in cases where transmission over a large distance is required such as when using an OB van, optical transmission system can be used.

When supplying power to the camera via the optical camera cable, the maximum camera cable length is 500 m. When power is supplied directly to the cam-site unit, the maximum length can be extended to 2,000 m.
Multi-Camera Central Control System

Remote control via an IP network is possible by performing LAN conversion of the RS-422 communication line used for camera and lens control. A QDCAM control app for Windows PCs is available, and up to 99 cameras and lenses can be controlled from a single Windows PC. The QDCAM control app allows independent control of each camera, as well as central control of a specified camera group. Cameras can also be identified by IP address, and controlled using the QDCAM controller (ROP).

Examples of use
- Multi-view video
- Free viewpoint video
- Sports Judgement
- Sports Broadcasting ...etc.

IP Network Remote Control System

An information camera, such as weather view camera, city view camera or traffic camera, which is installed in a distance from operation center, can be controlled via an IP network. In the same way as the multi-camera central control system, the QDCAM control app is used. When a video encoder is used, the video can also be transmitted using the same network.

Examples of use
- Information camera system ...etc.
Slow-Motion Video Production

Connecting to a Video Production Server

By connecting to a video production server or similar device, it is possible to perform slow-motion playback of live sports and to edit the highlights.

Connecting to the Slow-Motion Recorder/Player QDVS

Loop recording is performed using the QDVS-1000 internal memory, and when a scene which you want to play again occurs, you can switch to playback mode and perform slow-motion playback, frame-by-frame playback, and freeze-frame display.

Recording to a Portable Recorder and Offline Conversion

FHD/240p high-speed video can be recorded as UHD/60p 4K video, and the video file can be converted on a PC to 4X duration FHD/60p slow-motion video.

Video is recorded at the sports site, and the recording media is brought back to the office for analysis or uploading to SNSs.

* A free conversion app is available.
The QDVS-1000 slow-motion server (recording/playback switching type) captures uncompressed QDCAM 240 fps high-speed video and records it by loop-recording in internal memory. When recording is stopped, it can perform FHD 60 fps slow-motion playback, frame-by-frame playback, and freeze-frame display. The playback speed and frame-by-frame playback can be operated as needed by keyboard operations or by using the optional jog controller or T-Bar.

Simultaneous recording is supported. It is possible to use multiple sets of QDCAM and QDVS to synchronize recording and playback. Even with frame-by-frame playback of multi-angle high-speed video, multiple images can be displayed with precision synchronized timing.

While recording, both live display and delayed display are possible. A wide range of display settings are available that support all of the following: recording time, operation when recording is stopped while recording with delayed display, file transfer destination after encoding, still image settings, settings for divided memory use, and live display, as well as overlay display of a still image, drawn lines, or other image during slow-motion playback.

A preset time of recorded video, or the time between the IN and OUT points, can be encoded in H.264-MP4 or MOV format and transferred to NAS or cloud storage. In addition to slow-motion playback, files can also be created for editing and analysis purposes.

Simultaneous recording is supported. It is possible to use multiple sets of QDCAM and QDVS to synchronize recording and playback. Even with frame-by-frame playback of multi-angle high-speed video, multiple images can be displayed with precision synchronized timing.

The magnification function can be used during playback for a zoomed-in display centered on the desired location.

Picture data can be overlaid to display sponsor logo, coaching assist lines, etc.
Multi-Camera Synchronizing Exposure System

Consider a live sports broadcast system which transmits signals for multiple cameras using camera cables such as that shown below. With ordinary genlock synchronization, control is performed to align the video signal phases at the time of output from the base unit which is connected to the switcher. As a result, the exposure timing of each camera will be deviated due to the different camera cable lengths. For example, when a signal is transmitted 1,000 m using a fiber-optic cable, a delay of approximately 5 μs occurs. As a result, the video signal becomes deviated by 5 μs due to the different camera cable length, or else the synchronization control signal becomes deviated. This produces deviation of 5 μs or more in the camera exposure timing.

However with QDCAM, the transmission delay time is measured when the base unit power is turned ON and when a camera cable is connected. After a dozen or so seconds for processing, the timing of synchronization control signal transmission will be advanced based on the measured delay time. This ensures that the synchronization signal phase is identical on the camera side, and enables fully synchronized exposure timing. (patent pending)

This technology prevents deviation in timing when freezing the frame and when switching to another angle with multi-angle video. It also improves the calculation accuracy of systems which automatically make referee calls based on video images from multiple cameras.

Multi-Camera High-Speed Video Synchronizing Playback System

Linking a QDCAM camera and QDVS-1000 recorder/player allows synchronized slow-motion playback and frame-by-frame playback of high-speed video from multiple cameras. Because the camera exposure timing is fully synchronized, the timing matches even during frame-by-frame playback from multiple angles. As a result, it is possible to monitor for false starts in speed events, and check video for combat sports and other events.

With the QDVS-1000, encoding is performed with matching start frames, and the video files can be sent to external storage media or a PC for use in video editing and analysis.

In the system shown in the figure below, 4 cameras are shooting 1080/240p video. Synchronized shooting is possible at each camera using the reference synchronization signal (REF), and a common trigger signal is supplied. When each camera receives the trigger signal, it outputs high-speed video with a trigger pattern and supplies it to a QDVS-1000. When each QDVS-1000 detects the trigger pattern, it begins slow-motion playback from the specified time (specified number of frames) earlier based on the trigger pattern time position. Because one slow-motion controller can perform slow-motion playback, frame-by-frame playback, and freeze-frame of 4 QDVS-1000, it is possible to check video with matching time positions (frame numbers) in frame-by-frame or freeze-frame playback even in video which combines the images from 4 cameras.
Products and Accessories

**QDCAM Camera**
- Box camera
  - Model: ME-BXC-CM100
  - * Lens and AC adapter are sold separately.

**QDCAM Controller**
- ROP (operation panel)
  - Model: ME-BXC-RC100
  - * With 5 m communication cable and connector

**QDCAM Transmission System**
- Cam-site unit
  - Model: ME-BXC-CU100
  - * With 3 m communication cable / Optical camera cable is sold separately and includes installation bands. Can also be used as an ordinary 12G-SDI video transmission system.

**Communication Cables**
- 3m
  - Model: ME-BXC-CC3M
- 5m
  - Model: ME-BXC-CC5M
- 10m
  - Model: ME-BXC-CC10M
- 30m
  - Model: ME-BXC-CC30M
- 50m
  - Model: ME-BXC-CC50M

**RS-422/LAN Converter Connection Cable**
- Camera connection cable
  - Model: ME-BXC-SCA
- ROP connection cable
  - Model: ME-BXC-SCB
  - * For connecting a MOXA NPort5130

**Capture Card Supporting Quad 3G-SDI**
- PC video capture card
  - Model: MS-SC710N1-12GSDI-QC
  - * Includes Windows drivers.

**Musashi Controller Connection Kit**
- USB-RS422 converter & cable
  - Model: ME-QDVS-OP422

**Peripheral Devices**

**Jog Shuttle/Slow-Motion Controller**
- Contour Design ShuttleExpress IM/SX Shuttle

**T-Bar Slow-Motion Controller**
- MUSASHI MDC-70T
- MUSASHI MDC-22

**Monitor with Recording Functions**
- SHOGUN 7
  - High-brightness 7-inch
- SUMO 19
  - High-brightness 19-inch
- SHOGUN STUDIO 2
  - Rack-mounting support
  - Simultaneous recording of 2 monitors is possible.

* The file conversion software can be downloaded from the MEDIAEDGE website.
Main Product Specifications

**Box camera (ME-BXC-CM100)**

- **Image Pickup Device**: 1/1.1” 8.8 megapixel CMOS imaging element with global shutter
- **Imaging Method**: Single image sensor with Bayer color configuration
- **Lens Mount**: Micro four thirds system
- **Output Video Format**:
  - 4096 × 2160/24p, 23.98p (Quad 1.5G-SDI)
  - 3840 × 2160/60p, 59.94p, 50p (Quad 3G-SDI)
  - 3840 × 2160/24p, 23.98p (Quad 1.5G-SDI)
  - 1920 × 1080/240p, 239.8p, 200p (Quad 3G-SDI)
  - 1920 × 1080/60p, 59.94p, 50p  (3G-SDI)
  - 1920 × 1080/24p, 23.98p (1.5G-SDI)
  - 1920 × 1080/59.94i, 50i (1.5G-SDI)
- **Genlock Reference**: Tri-level Sync or Black Burst
- **Communication Interface**: RS-422 (using communication cable)
- **Gain Setting**: -6 dB to +36 dB
- **Shutter Speed Setting**: Shutter OFF to 1/12000 sec
- **Gamma Setting**: BT.709 gamma / BT.2100 HLG
- **Color Gamut Setting**: BT.709 / BT.2020
- **White Balance**: Manual / Auto / Preset (2800K to 10000K)
- **Flicker Cancel**: OFF / 50Hz / 60Hz
- **Operating Temperature**: -5 to 45°C (23 to 113˚F)
- **Operating Humidity**: 30 to 90% RH (Must be no condensation.)
- **Weight**: 690g (1.52 lb)
- **Dimensions**: 75 (W) x 127 (D) x 75 (H) mm (excluding protrusions)
- **Power Voltage**: DC 13.8V (DC 11.8 to 16.8V)
- **Power Consumption**: 10W (excluding power supply to lens and controller)

**Camera Controller (ME-BXC-RC100)**

- **Communication Interface**: RS-422 (using 10-pin communication cable)
- **Operating Temperature**: 0 to 40°C (32 to 104°F)
- **Operating Humidity**: 20 to 90% RH (Must be no condensation.)
- **Weight**: 850 g (1.87 lb)
- **Dimensions**: 92 (W) x 226 (D) x 36 (H) mm (excluding protrusions)
- **Power Voltage**: DC 13.8V (DC 11.8 to 16.8V) * Power is supplied through the communication cable.
- **Power Consumption**: 1W
- **Accessories**: 5 m communication cable, cable connector, mounting bracket

**Transmission System Cam-Site Unit (ME-BXC-CU100)**

- **Compatible Camera Cable**: SMPTE 311 camera cable with SMPTE 304 connectors
- **Cable Length**: Max. 500 m (when power is supplied to the camera through the camera cable)
- **Max. 2000 m (when local power supply is used for the camera unit)
- **Operating Temperature**: -5 to 45°C (23 to 113°F)
- **Operating Humidity**: 30 to 90% RH (Must be no condensation.)
- **Weight**: 1.26 kg (2.78 lb)
- **Dimensions**: 150 (W) x 150 (D) x 60 (H) mm (excluding protrusions)
- **Power Voltage**: DC 13.8V (DC 12 to 17V when local power supply is used)
- **Power Consumption**: 14W (not including camera power supply)

**Transmission System Base Unit (ME-BXC-BU100)**

- **Compatible Camera Cable**: SMPTE 311 camera cable with SMPTE 304 connectors
- **Cable Length**: Max. 500 m (when power is supplied to the camera through the camera cable)
- **Max. 2000 m (when local power supply is used for the camera unit)
- **Operating Temperature**: 0 to 40°C (32 to 104°F)
- **Operating Humidity**: 30 to 90% RH (Must be no condensation.)
- **Weight**: 1.60 kg (3.53 lb)
- **Dimensions**: 200 (W) x 200 (D) x 42 (H) mm (excluding protrusions)
- **Power Voltage**: DC 13.8V (DC 12 to 17V when local power supply is used)
- **Power Consumption**: Max. 60W (including power supply to cam-site unit and cable loss)

*Specifications may be changed without notice.*