Broadcast Zoom Lens Lineup

Studio & Field Lenses

ENG/EFP Lenses

Pro-Video & Remote-Controlled Lenses

Broadcast Studio and Field Lenses

P. 14 - 15

4K UHD 2/3"

- UHD-DIGISUPER 122 — 4K Premium UHDxs
- UHD-DIGISUPER 111 — 4K Premium UHDxs
- UHD-DIGISUPER 86 — 4K Premium UHDxs
- UHD-DIGISUPER 90 — 4K UHDxs
- UHD-DIGISUPER 66 — 4K UHDxs
- UHD-DIGISUPER 27 — 4K Premium UHDxs

HD 2/3"

- DIGISUPER 100AF — HDxs Auto Focus
- DIGISUPER 100 — HDxs
- DIGISUPER 95 TELE — HDxs
- DIGISUPER 95 — HDxs
- DIGISUPER 86AF — HDxs Auto Focus
- DIGISUPER 80 — HDxs
- DIGISUPER 76 — HDxs
- DIGISUPER 27AF — HDxs Auto Focus
- DIGISUPER 27 — HDxs
- DIGISUPER 22 xs — HDxs

Broadcast ENG/EFP Lenses

P. 18, 19, 20

4K UHD 2/3"

- CJ45ex13.6B — 4K UHDxs
- CJ45ex9.7B — 4K UHDxs
- CJ25ex7.6B — 4K UHDxs
- CJ20ex7.8B — 4K UHDxs
- CJ15ex4.3B — NEW — 4K UHDxs
- CJ12ex4.3B — 4K UHDxs
- CJ24ex7.5B — 4K UHDGC
- CJ18ex7.6 — 4K UHDGC
- CJ14ex4.3B — 4K UHDGC
- CJ18ex28B — 4K UHDGC
- CJ15ex8.5B — 4K UHDGC

HD 2/3"

- HJ40ex14B — HDxs
- HJ40ex10B — HDxs
- HJ21ex7.5B — HDxs
- HJ17ex6.2B — HDxs
- KJ22ex7.6B — HDGC
- KJ17ex7.7B — HDGC
- KJ10ex4.5B — HDGC

HD 1/3"

- KT17ex4.3B — HDGC

Pro-Video Lenses

P. 20

HD 2/3"

- KJ20x8.2B (IRSD) — HDGC
- KJ20x8.2B (KRSD) — HDGC
- KJ13x6B — HDGC

HD 1/2"

- KH20x6.4 — HDGC

Remote Controlled Lenses

P. 21

HD 2/3"

- KJ22ex7.6B (ITS-ME/RE)
- KJ17ex7.7B (ITS-ME/RE)
- KJ20x8.2B (KTS)

HD 1/2"

- KH20x6.4 (KTS)

CANON **BROADCAST LENSES**

Focal Length Table

Broadcast, Studio and Field Lenses (4K 2/3”, HD 2/3”)

Angle of view horizontal (16:9)	72.9°	66.7°	60.7°	60.1°	58.3°	57.2°	56.1°	54.6°	42.3°	39.1°	3.4°	3.1°	1.02°	0.92°	0.81°	0.80°	0.77°	0.69°	0.68°	0.67°	0.65°	0.59°	0.59°	0.55°	0.47°
Focal Legnth (mm)	6.5	7.3	8.2	8.3	8.6	8.8	9	9.3	12.4	13.5	161	180	540	600	675	690	710	800	810	820	840	925	930	1000	1178
UHD-DIGISUPER 122																									
UHD-DIGISUPER 111																									
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DIGISUPER 80																									
DIGISUPER 76																									
DIGISUPER 27 AF																									
DIGISUPER 27																									
DIGISUPER 22 xs																									

Broadcast ENG/EFP Lenses (4K 2/3”, HD 2/3”)

Angle of view horizontal (16:9)	96.3°	93.7°	77.3°	75.5°	65.2°	64.6°	63.9°	63.2°	58.9°	52.7°	51.3°	38.9°	37.8°	35.5°	19.6°	12.2°	10.5°	9.1°	7.0°	5.2°	4.3°	4.2°	4.0°	3.5°	3.5°	3.4°	3.3°	3.1°	2.89°	1.4°	1.26°	1.1°	1.0°	0.9°
Focal Legnth (mm)	4.3	4.5	6	6.2	7.5	7.6	7.7	7.8	8.5	9.7	10	13.6	14	15	28	45	52	60	65	78	106	128	131	137	156	158	164	168	180	190	400	437	500	560	612
CJ45ex13.6B																																		
CJ45ex9.7B																																		
CJ25ex7.6B																																		
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KJ22ex7.6B																																		
KJ17ex7.7B																																		
KJ10ex4.5B																																		

Broadcast ENG/EFP Lenses (HD 1/3”)

Angle of view horizontal (16:9)	58.3°	3.8°
Focal Legnth (mm)	4.3	73
KT17ex4.3B		

Focal Length Table

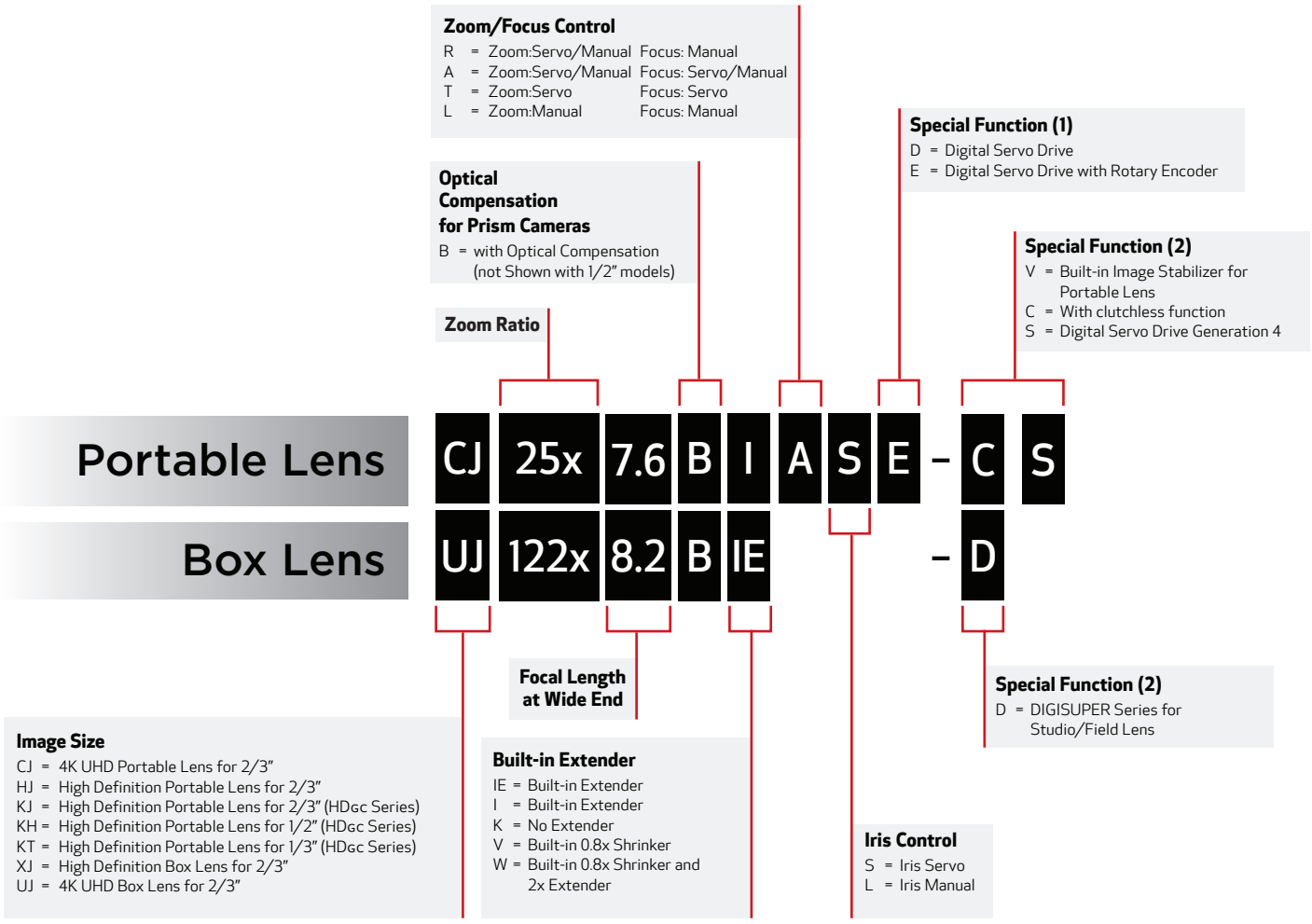
Pro-Video Lenses (HD 2/3")

Angle of view horizontal (16:9)	96.3°	93.7°	77.3°	75.5°	65.2°	64.6°	63.9°	63.2°	60.7°	58.9°	51.3°	47.1°	37.8°	35.5°	19.6°	12.2°	10.5°	9.1°	7.0°	5.2°	4.3°	4.2°	4.0°	3.5°	3.5°	3.4°	3.3°	3.1°	1.45°	1.4°	1.1°	1.15°	1.0°
Focal Legnth (mm)	4.3	4.5	6	6.2	7.5	7.6	7.7	7.8	8.2	8.5	10	11	14	15	28	45	52	60	78	106	128	131	137	156	158	164	168	180	385	400	500	525	560
KJ20×8.2B																																	
KJ13×6B																																	

Pro-Video Lenses (HD 1/2")

Angle of view horizontal (16:9)	75.7°	57.1°	6.8°	3.1°
Focal Legnth (mm)	4.5	6.4	59	128
KH20×6.4				
KH13×4.5				

Understanding Canon Lens Naming Conventions



Canon Broadcast Lens Technology

Optical Performance

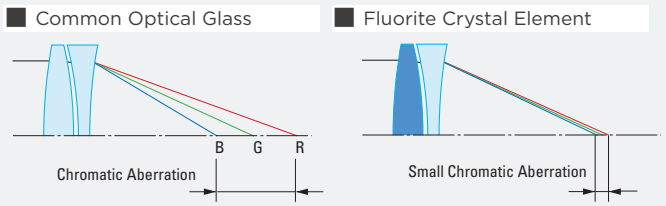
Superb Optical Materials Produce a High-Performance Lens

Fluorite · UD Glass · Hi-UD Glass

Unlike conventional optical glass, Fluorite has remarkably low dispersion properties. Realizing the effectiveness of Fluorite glass, Canon has put it to practical use in many lenses, primarily in the anterior section of zoom lenses to help correct telephoto chromatic aberration. Both UD*1 glass and Hi-UD glass*2 have dispersion properties similar to Fluorite and are effective for correcting chromatic aberration. Due to its high refractive characteristics, Hi-UD glass is especially known for its spherical aberration correction. Used in the anterior and zooming sections of a lens, Hi-UD glass is effective for controlling aberration fluctuation seen when focusing and zooming.

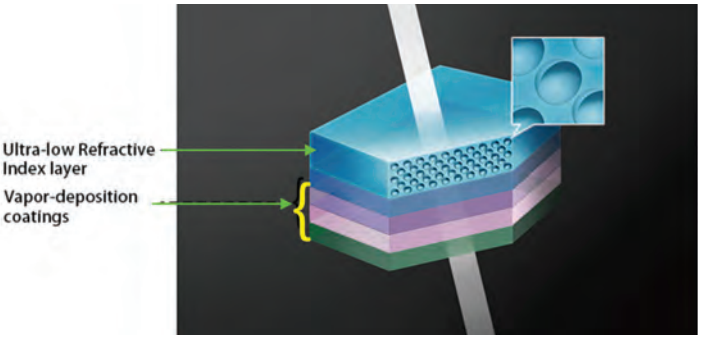
**1 UD-Ultra Low Dispersion.*
**2 Hi-UD High Index Ultra Low Dispersion.*

Chromatic Aberration Correction Comparison



Air Sphere Coating

In the context of HDR Optical imaging, Air Sphere Coating (ASC) technology is a critically important new innovation in broadcast field lenses. This is a Canon-developed technology that is an additional layer deposited on top of the normal multilayer coatings that are used to minimize numerous internal reflections that conspire to lower light transmission efficiency and to contaminate deep black reproduction. ASC is an ultra-low refractive index silicon dioxide film that includes microscopic air spheres having a sub-nanometer diameter arranged in regular structure. Because these spheres are microscopic when comparing to the wavelength of visible light and as they are in an ordered array, light does not scatter. In combination with the multilayer coatings, ASC achieves far lower reflectance and significantly reduces flare and ghosting.



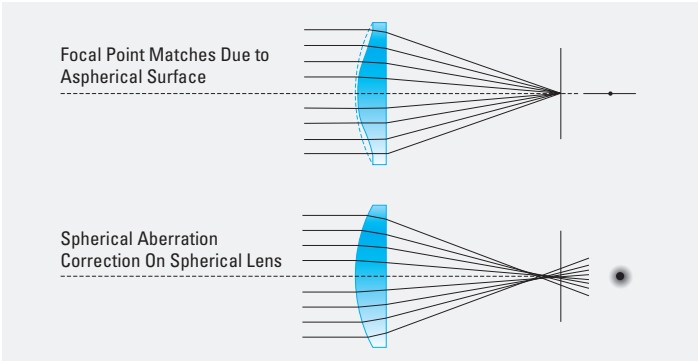
Bokeh Effect

When shooting in macro, the focus position of the lens can be changed as the focal length is adjusted, when using the optional MCJ-S02 Macro Controller, creating a bokeh effect. This built-in feature can be utilized to support special techniques in which the focus position can be shifted within the same shot just by using the Macro Controller, allowing for subtle creative defocus effects. This can help provide a degree of creativity when shooting live events such as a concert.

High Quality, Compact Size and Weight

Large Aperture Aspheric Lens

Spherical aberration will increase as the diameter of a spherical lens increases. However, aspheric lenses form an ideal shape for aberration correction and are the desired lens type for improving optical performance. As they are more compact, aspheric lenses reduce the weight of the entire lens system. Through its optical design and large aperture processing techniques, Canon has developed compact, large aperture, high magnification field zoom aspheric lenses. As a result of this development, all high-magnification field zoom lenses released since 2000 have a constant total lens length regardless of zoom ratio.



Focus Breathing Suppression

Constant Angle Focusing System (CAFS)

CAFS is a technology that suppresses view-angle fluctuation (breathing) while focusing. The Zooming Effect of Focus is the phenomenon where the picture size (angle of view) changes when focusing. Canon's 32-bit CPU calculates and controls the zoom when focusing in order to counteract this phenomenon. As a result of CAFS, the UHD-DIGISUPER and DIGISUPER Series has zero Zooming Effect of Focus.

Advanced Design Technology to Help Minimize Various Aberrations

Image Stabilizer (IS)

Canon launched its first field zoom lens with a shift type anti-vibration mechanism in 2000*. Prior to that, Canon introduced the IS-20B anti-vibration adapter for portable zoom lenses. Those cutting-edge technologies, along with the Vari-angle Prism image stabilizer (VAP-IS) lens, helped to usher in the era of optical image stabilization in broadcasting lenses.

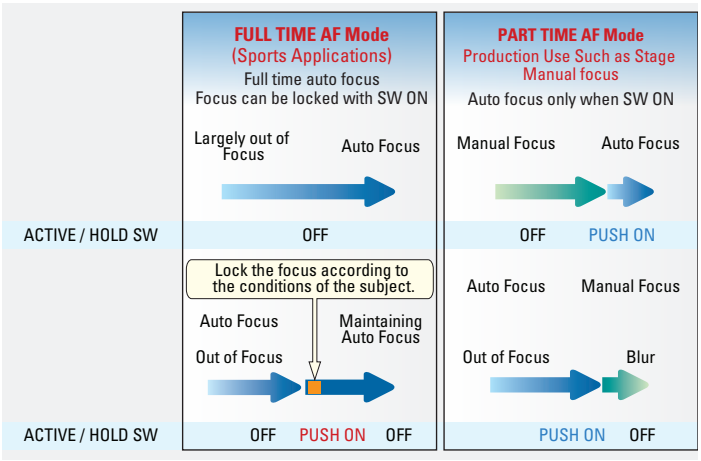
**Adopted for DIGISUPER 86 XS (XJ86 × 9.3 B). The world's first field zoom lens for broadcasting.*

Auto Focus

TTL Secondary Imaging Phase Difference Detection Method

The Secondary Imaging Phase Difference Detection Method, also used in single lens reflex EOS camera lenses, was adopted for broadcast autofocus systems. As a result of this Method, Canon's Auto Focus System has excellent focusing accuracy within the entire zoom range, along with outstanding focusing speed. Due to high performance servo motors, tracking a moving object at high speed can be possible even from a largely out of focus state.

■ Autofocus Two Types of Operation



AF Mode

Select DIGISUPER lenses provide two autofocus modes. "FULL TIME AF" provides continuous autofocus operation allowing the camera operator to focus on framing the subject. "PART TIME AF" allows for temporary autofocus use with manual focus. The modes can be switched on and off as needed, using the ACTIVE/HOLD switch.

AF In-Focus Display

By using the FDJ - P41 dedicated focus demand, you can change the size (3 options) and position of the AF in - focus frame displayed on the viewfinder*.

** To change the in-focus frame, it is necessary to interlock with the camera.*

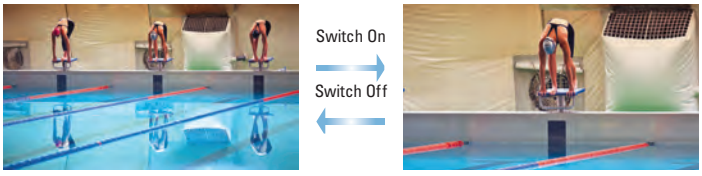
Digital Technology

Digital Servo System/Digital Drive Unit

Since the release of the DIGISUPER 70 in 1995, Canon has been a leader in digital broadcast zoom lens control. Canon's ENG/EFP lenses, having the same digital technology, offer a wealth of features to make shooting more efficient. Canon's digital drive unit is installed in all ENG/EFP and Provideo broadcast lenses.

■ Shuttle Shot

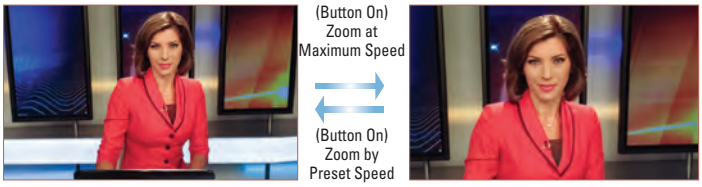
At the touch of a button, this feature allows the operator to zoom back and forth instantly between any two positions at the maximum speed or at any speed memorized in the Speed Presets.



Normal view angle A *Field of view of shuttle memory B*

■ Frame Preset

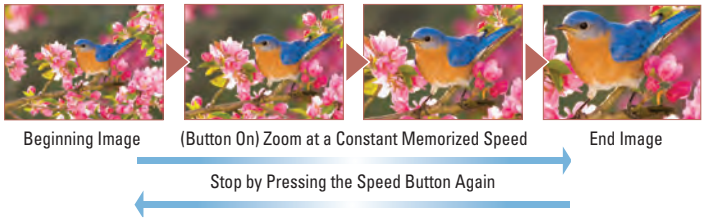
With the Frame Preset feature, a preset frame position can be saved and repeated multiple times.



Normal view angle A *The angle of view B*

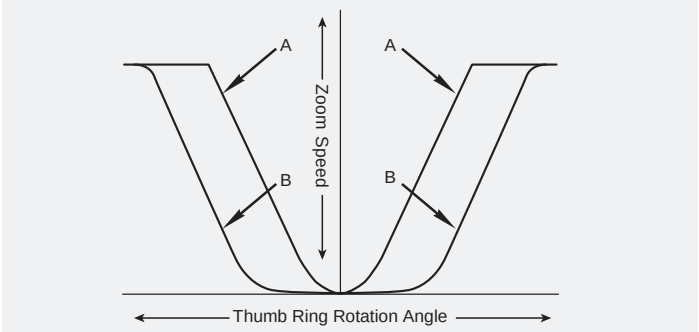
■ Speed Preset

Simply press a button to recall the preset zoom speed.



■ Zoom Servo Characteristics

Zoom Servo characteristics can be selected from two curvature options on the ZDJ-P01 zoom demand.



Zoom Servo Characteristics Example

Virtual Studio System

Canon has a series of HDxs and HDGC (IRSE/IASE version) lenses which are equipped with an enhanced digital drive unit. The digital drive unit's 16-bit encoder makes detection and output of positional information possible at a much higher resolution than an analog position sensor (equivalent to 10 bits). The 16-bit resolution rotary encoder built into the drive unit can be integrated into a virtual studio system. The encoders enable precise control as the zoom servo has a range of 0.5 second quick zooms to over a 5 minute super slow zoom. Repeatabilty in focus and iris control are also precise. Canon's technology has made the encoder device very small, allowing it to be installed in the existing drive unit without adding size or weight.

Further Improving Operational Efficiency

Type S Drive Unit

Canon has improved the operational efficiency of its lenses with the adoption of the Type S Drive Unit *1.

- Matches the aberration correction function on the camera without initialization at power-on
- Reduced power consumption by about 10% *2 when using a battery as compared with previous versions
- Real and virtual images can easily be calibrated with high-precision position detection
- Three 20 PIN connectors allow for simultaneous full servo and virtual system operation
- Easy operation with straightforward menu and display

*1: *Please refer to page 6, Understanding Canon Naming Conventions, Special Functions (2).*

*2: *When zoom, focus & iris in operation.*

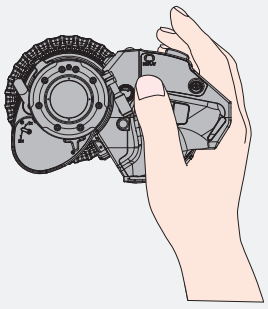
■ Zoom Track

The zoom control range can be set within a more limited range on both the telephoto and wide-angle sides of UHD-DIGISUPER and DIGISUPER Series lenses. With these lenses and the optional ZDJ-P01 zoom demand, the zoom range can be set to virtually any range smaller than the full focal range of the lens. If not used to limit the zoom range, the feature can be used to memorize an additional preset zoom position.

Ergonomic Design

Compact and Lightweight Drive Unit

Canon's HDxs, and HDGC (IRSE/IASE models) Ergonomic Drive Units are tilted at an ideal angle of 12.5 degrees to realize good balance and comfort. An informational display has been added which now allows the user to customize the enhanced digital functions easily, precisely and fully. The enhanced digital functions are easily accessed and set using the Digital Function Selector, an X-Y axis switch located next to the display.



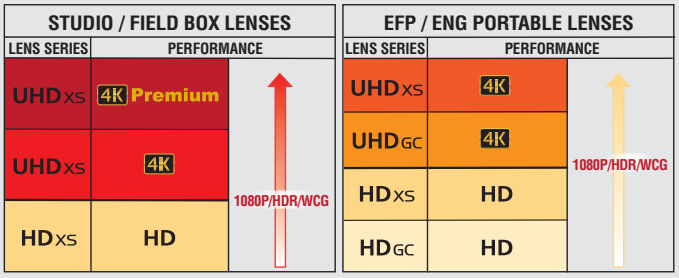
Ergonomic design allows the camera operator's left hand to easily access the focus ring for manual operation.

THE NEW ERA OF

NEW BCTV LENSES DESIGNED TO SUPPORT THE TRANSITION TO 4K UHD CONTENT CREATION

HDTV is now firmly established worldwide and HD production is expected to continue for many years to come. Ultra HDTV – generally referred to as UHD – has more recently emerged as the next generation of enhanced television service. In 2015 the International Telecommunications union published their ITU-R BT.2020 standard "Parameter Values for UHDTV Systems for Production and international Program Exchange" – that included both 4K UHD and 8K UHD production formats. This standard includes a Wide Color Gamut (WCG). In 2016 they published the ITU-R BT.2100 standard "Image Parameter Vales for High Dynamic Range Television for use in Production and International Program Exchange". This standard specifically applies the High Dynamic Range (HDR) to the HD, 4K UHD, and 8K UHD production formats (all exclusively progressive scan). In September 2017 the industry body – Ultra HD Forum – published their updated Guidelines on technologies and practices that support a commercially deployable Ultra HD real-time linear service with live and pre-recorded content in 2016, which is termed a "UHD Phase A" service. They include 4K UHD and 1080P HD (that includes both HDR and WCG).

These standards and guidelines have spurred increasing attention to the adoption of 4K UHD origination of sports, concerts, and major events. The anticipated protracted coexistence of HDTV and UHDTV has spawned a new generation of 2/3-inch multi format broadcast camera systems – from most of the major international camera manufacturers – that can selectively originate HD or UHD. To support this new era of mixed HD / UHD origination Canon has invested heavily into the development of an array of 2/3-inch 4K UHD broadcast lenses that encompass long zoom field lenses, a studio lens, and a broadening family of portable lenses.



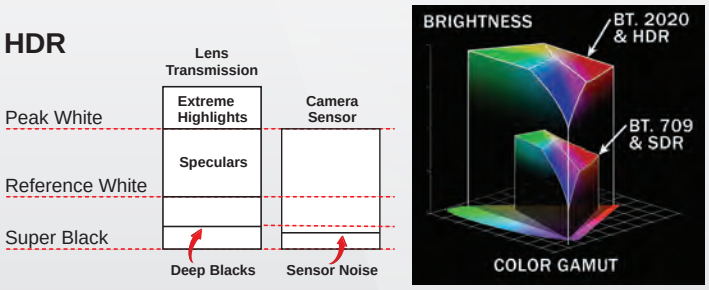
Simplistic mapping of the performance levels within the separate categories of box lenses and portable lenses.

IMPLICATIONS OF HDR AND WCG

Delivering the requisite high image sharpness required for 4K UHD – while simultaneously lowering traditional optical aberrations (that can be more exposed by the high resolution image sensors) – called for multiple innovations in lens design and manufacturing. Lateral chromatic aberration causes color misregistration on high contrast edges within the imagery – especially toward picture extremities. Longitudinal chromatic aberration causes color fringing on any speculars with this imagery. HDR and WCG further enhance the visibility of these

ENHANCED HDTV AND UHDTV

aberrations – because of the elevation in the color volume of the camera video – placing a greater onus on suppressing them to where they become subjectively invisible.

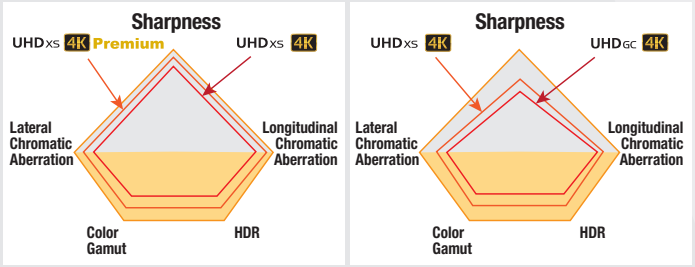


To support HDR the lens must accurately reproduce scene speculars and minimize optical artifacts stimulated by strong scene highlights.

UHD LENS PERFORMANCE HIERARCHY

In the case of the large box field and studio lenses and the portable EFP/ENG lenses Canon has created two performance levels in each. A special priority is assigned to elevating image sharpness (the essence of 4K UHD). An attendant high priority underlies design strategies that aggressively curtail the visibility of the two chromatic aberrations. Higher luminance levels and allied greater color volume associated with HDR / WCG combine to elevate the visibility of even small levels of these chromatic aberrations.

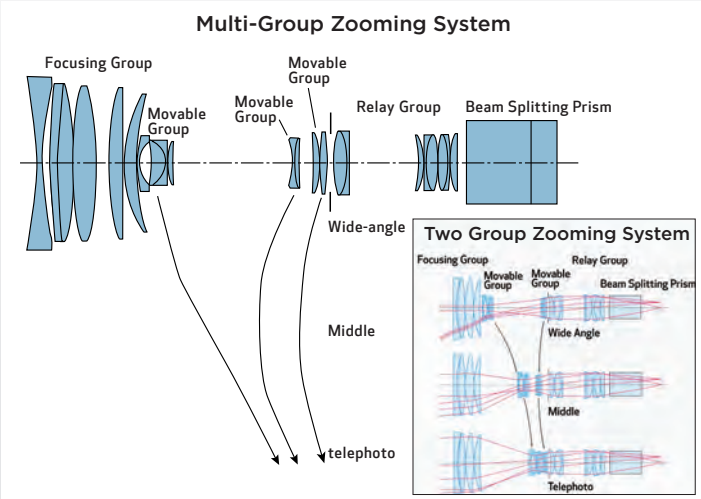
In the case of the Box lenses advanced design strategies allied with advanced optical glass materials are mobilized to maintain high image sharpness across the image plane, over the total focal ranges, and over a wide range of object distances. The 4K PREMIUM box lenses take these strategies to a particularly high level to further tighten those optical performance specifications.



In the case of the portable lenses, similar priorities apply. The UHDxs manifests higher sharpness and lower chromatic aberrations when compared to the UHDgc – although on a different scale to the box lenses.

MULTI-GROUP ZOOMING SYSTEM

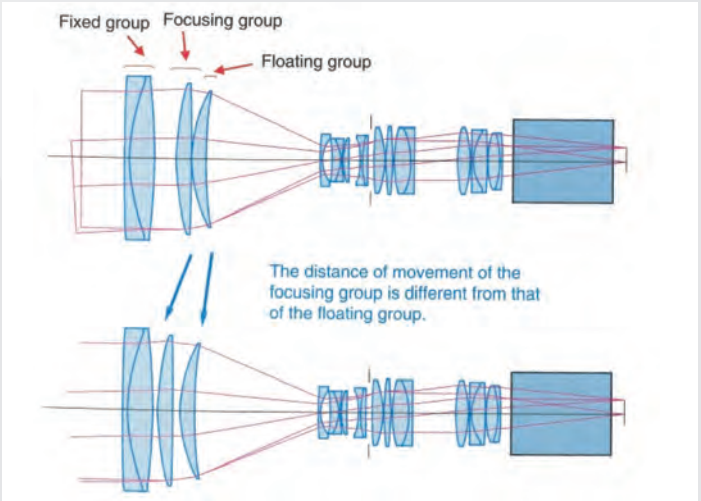
In seeking longer focal ranges for the box field and studio lenses and some of the longer focal length portable lenses, challenges in achieving the requisite zooming speeds while also achieving UHD performance were escalated. This called for a radical new design approach to the zooming optical subsystems. The central goals were to achieve greater control over multiple lens aberrations to help ensure full 4K performance while at the same time expediting an increase in the speed of the zooming action (when the digital drive unit is set to maximum zoom speed).



The traditional two group zooming system (right picture) is being replaced with a three group zooming system (left picture). Three movable groups move differentially with respect to each other over the zoom range. Design optimization consisted in balancing the weight of the three individual groups with their stroke distance during zooming action.

FLOATING FOCUSING SYSTEM

The focus optical subsystem entails high responsibility for numerous optical performance parameters and operational considerations. The lens maximum relative aperture is largely determined by the diameter of this lens input optical grouping. In addition, focus breathing (undesirable alteration to the field angle as the focus control is actuated) characteristics and aberration behavior are associated with this optical subsystem. Overall lens size and weight are heavily proportional to decisions made in the overall design of this system. Central to the design is curtailing the size and weight of the moving lens system. To help ensure UHD optical performance focus fluctuations must be suppressed – and this was accomplished by using two separate moving groups.



New innovations in a floating focus group support 4K UHD performance while curtailing size and weight