Canon EOS C700

by Jon Fauer

Canon Cinema EOS C700

This is the camera that many have dreamed Canon would build. They did. Canon presents Cinema EOS C700 at IBC 2016.

It's a Super35 format studio and shoulder-resting "A" camera with internal 4K ProRes and XF-AVC as well as integrated Codex uncompressed RAW recording. There is a choice of two lens mounts, PL or EF mount—and a choice of Global Shutter or Standard CMOS sensor. Pixel size is 6.4 x 6.4 µm. Depending on model and mode, effective image area is 26.2 x 13.8mm (29.6 mm diagonal) when shooting 4K and 28.9 x 15.2 (32.6mm diagonal) in RAW 4.5K.

Brief history

Canon launched the first Cinema EOS C300 on the stage of the Paramount Theater in Hollywood on November 3, 2011—five years ago. That was the "beginning of a new relationship" for Canon in Hollywood. It was their first professional 35mm digital cine camera. In a presentation, Masaya Maeda, Senior Managing Director, drew the outline of a pyramid. Consumer, prosumer and DSLR cameras occupied the base. The C300 was shown in the middle. The top of the pyramid, representing the pinnacle of digital motion picture production, was empty. We asked when the top would be filled. Mr. Maeda said modestly, "We are still learning. We'd like to begin a dialog with the community here in Hollywood to better understand the expectations of the industry and where we should go."

The next five years were a remarkable success story. Cinema EOS cameras appeared on sets and locations worldwide. The look, low-light capabilities, medium-format shape, EF mount, quality and usability was appealing to cinematographers and rental houses.

Five months after the C300 was launched at NAB 2012, Canon introduced the 4K EOS C500. Another five months later, September 2012 at IBC in Amsterdam, Canon showed the EOS C100 camera. Then, in April 2015 at NAB, Canon presented the C300 Mk II with internal 4K recording to CFast 2.0 cards and 15 stops of dynamic range.

More than 40,000 Cinema EOS cameras have been shipped worldwide. EF mounts account for about 90 percent of the C300

market. On the C500, it's a 50/50 split between EF and PL.

Canon is the camera pyramid. The new EOS C700 digital cinema camera introduced at IBC is a rugged and expandable "A" camera system for all segments of the industry. The EOS C700 EF and EOS C700 PL will ship in December at a list price of $35,000. The EOS C700 GS PL will ship in January 2017 with a list price of $38,000.

C700 overview

The C700 is modular. The rugged magnesium body is similar in size to another popular camera and about half the weight (approximately 7.9 lb for the EOS C700 PL and EOS C700 GS PL Main Body). The styling is distinctly Canon. Rounded edges and semi-circular sides behind the lens mount hint at the Canon C300 design legacy. Whereas the C300 has a medium format heritage, the C700 will be equally comfortable handheld, shoulder-resting, on a head, Steadicam, gimbal rig or rigged to a car mount.

There are enough 3/8-16 and 1/4-20 threaded holes on the top and bottom to satisfy the most demanding cheese-plate and accessory obsessed camera crew. The top handle attaches with two screws in a plethora of positions for perfect balance. Focus tape hooks adorn both left and right sides. Clearly, the designers at Canon listened to the requests of camera crews.

The shoulder pad consists of two sections that adjust to fit the width of any camera operator's shoulder. It has industry-standard Hirth tooth rosettes on each side and sockets with 15mm rods in front. The camera comes with a standard rear V-lock battery mount. An Anton Bauer Gold Mount adapter could be used, but may not send battery status information to the camera's EVF.

Standard CMOS sensor and GS Models

C700 comes in three models

- EOS C700 EF — EF mount with standard CMOS sensor
- EOS C700 PL — PL mount with standard CMOS sensor
- EOS C700 PL GS — PL mount with global shutter sensor

If you have your heart set on a C700 EF GS, you might buy a C700 PL GS and ask a Canon service center to swap the mount.

Canon Cinema EOS C700

Quick review. Global shutter is electronic, not mechanical, where the image is captured in a single moment by every pixel on the sensor. A standard CMOS captures the image by scanning the scene from top to bottom. Depending on the speed of the scan, a standard sensor (sometimes called rolling shutter) sometimes results in the dreaded "jello" effect where a straight tennis racquet appears curved in mid stroke or a helicopter's rotating blades look rubbery. A standard sensor may also result in "flash band" effect, which is partial exposure of the frame. For example, photographers' strobes at a rock concert may result in half of your frame being black.

Canon C700 standard CMOS models have 15 stops of dynamic range. They provide dual-pixel autofocus capability when autofocus lenses are used. Standard CMOS sensor models have more dynamic range, autofocus and are expected to ship sooner.

Because of the extra processing power that goes into exposing the entire sensor at one time, Global Shutter (GS) models lose a little dynamic range. They have 14 stops of exposure latitude. They are slightly more expensive and will ship a little later. Global shutter models are helpful for sports, fast action, concerts and events where jello and flash band effects are undesirable. Having said that, because the C700's CMOS sensor outputs to three Digic 5 processors, processing speed is extremely fast.

Lens mounts

The Canon Cinema Lock EF mount is the same ruggedized version first seen on the C300 Mk II. Flange focal depth is 44 mm. Inside diameter within the lens cavity is 54 mm. A Mitchell/PL/Panavision style locking ring secures the lens in place when you rotate the tabs clockwise (clock to lock). You do not twist the lens itself as you would on a Canon DSLR. The EF mount has Canon's familiar gold-plated lens data and power pins.

The PL mount has the typical flange depth of 52 mm. The inside diameter is the same as EF: 54 mm. The C700's PL mount is fitted with Cooke /i lens metadata and power pins.

Codex Integrated Recorder

With a Codex CDX-36150 attached, the C700 will record uncompressed 10-bit or 12-bit 4K RAW up to 120 fps and 2K ProRes up to 240 fps. The Codex CDX-36150 is made specifically for the C700 and attaches to the rear of the camera. It is smaller and lighter because it uses the C700's menus and controls.

The battery plate that comes with the camera is removed, revealing a multi-pin connector. The Codex attaches securely there. Codex will offer 2 models of the recorder so users can order with either V-Lock or Anton Bauer Gold Mount.

You use a Codex Capture Drive 2.0 (1 TB or 2 TB capacity), the same familiar media used in Alexa and VariCam35. The CDX-36150 could democratize RAW recording with its affordable price around $6,000 and industry-standard media.

EVF

The C700 has a crisp 1920x1080 OLED Viewfinder (EVF-V70). Although sold separately, it is an essential accessory in the camera package and something no C700 user should be without. The OLED Electronic Viewfinder has an HDR simulated picture with a "stretched" dynamic range for increased shadow detail and highlight retention. This is accomplished without the requisite increase in brightness of true HDR.

Because C700 or C700 PL models have 4622 x 2496 pixels, surround view in the viewfinder can be available. Encroaching microphone booms at the top of frame are easy to see. Masks and framelines are user adjustable. When moving away from the eyepiece, the viewfinder helpfully dims but doesn't turn off. Furthermore, the EVF will not burn out when exposed to direct sun.

Anamorphic

C700 supports anamorphic format lenses by electronically desqueezing the image in the viewfinder and on connected monitors. You can take advantage of the camera's full 4K resolution by using 1.3x squeeze anamorphic lenses.
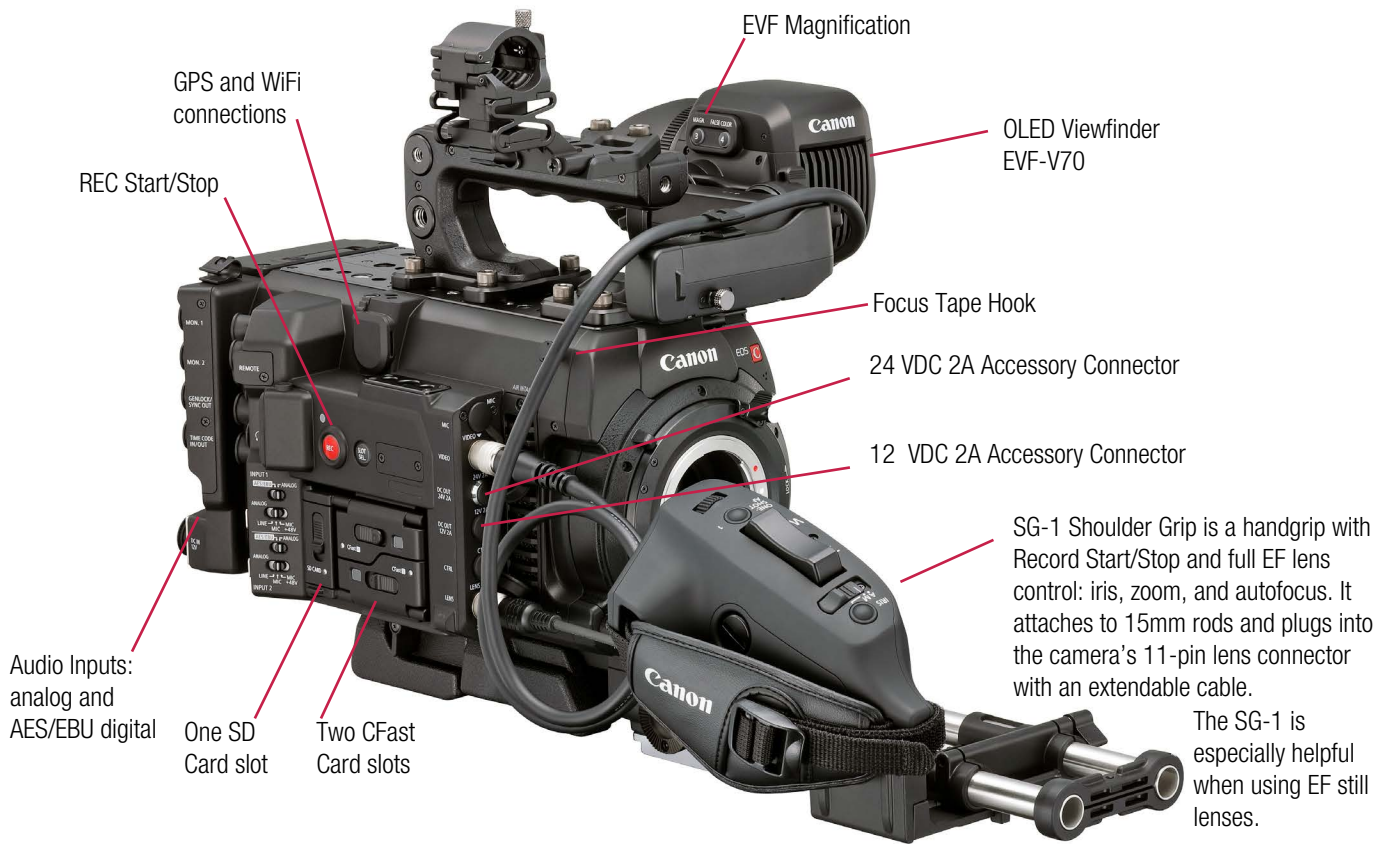
Popular 2x squeeze anamorphic lenses cover a native 1.2:1 aspect ratio on the sensor. That translates to an actual resolution of 2592 x 2160 pixels. This squeezed "window" can be repositioned left or right in post if, for example, you see a previously undetected, errant C-Stand lurking on the right side of frame.

Canon Cinema EOS C700 Modular System

ND FILTER selection controlled by + and - buttons:
Clear, 2, 4, 6, 8, 10 stops (Clear, ND.6, 1.2, 1.8, 2.4, 3.0)

Focus Tape Hook

IRIS dial to set aperture on EF lenses lacking manual ring

POWER On/Off

REC Start/Stop

Shoulder Support Unit SU-15

Eyepiece Diopter

EVF Menu

MENU

Select/Set

Joystick

MAIN DISPLAY with 6 control buttons

SELECT/SET menu dial and button

Codex CDX-36150 Integrated Recorder

Codex Recorder comes in 2 versions: with Gold Mount or V-Mount battery plate for onboard battery to power camera and recorder

Canon Cinema EOS C700 Modular System

EVF Magnification

GPS and WiFi connections

OLED Viewfinder EVF-V70

REC Start/Stop

Focus Tape Hook

24 VDC 2A Accessory Connector

12 VDC 2A Accessory Connector

SG-1 Shoulder Grip is a handgrip with Record Start/Stop and full EF lens control: iris, zoom, and autofocus. It attaches to 15mm rods and plugs into the camera's 11-pin lens connector with an extendable cable.

The SG-1 is especially helpful when using EF still lenses.

Audio Inputs: analog and AES/EBU digital

One SD Card slot

Two CFast Card slots

Plate to secure Codex Recorder

Remote Operation Unit OU-700 attaches to the camera right side for redundant menu and Main Display control. It flips up for access to CFast and SD Card slots. The OU-700 detaches for remote control with 75 cm and 1 m cables.

EXT. POWER +10-34 VDC IN (2-pin Fischer)

EXT. POWER +12VDC IN (4-pin XLR)

REC Start/Stop

Canon Cinema EOS C700 Camera Angles

Camera left profile

Camera right profile

Front

Rear
(C700 comes with V-mount
battery plate)

Camera left

Camera right

Camera left rear

Camera right rear

Canon Cinema EOS C700

Users and rental houses asked Canon for an ergonomic 4K Cinema EOS "A" camera as comfortable on the shoulder as it would be in studio mode. They requested integral cheese plates, modular design, and focus tape hooks on both sides.

The Canon EOS C700 has a familiar "front end" lens mount area styled like the popular C300 series. But, whereas the C300/C500/C100 had a medium format camera shape, the C700 takes on a more traditional cinema camera style.

Canon Cinema Lock EF mount

PL Mount

The PL Mount has Cooke /i lens metadata and power pins (in the usual 12 o'clock position). Lens data can be recorded and displayed on monitors, which is helpful for camera assistants to check depth of field and for script supervisors to note focal length, aperture and zoom settings. Note that there are two versions of the C700 PL mount camera: GS (Global Shutter) and Standard CMOS sensor. FFD=52mm. ID=54mm.

B4 Mount Adapter

Canon C700 comes with the choice of two mounts. The Cinema Lock EF is a more rugged mount than the ones found on still cameras. This one has a locking ring and supports bigger, heavier lenses. FFD=44 mm. ID=54 mm.

For users who want to use their 2/3" format lenses, Canon has adapters: Canon B4 to EF adapter (MO-4E) and Canon B4 to PL adapter (MO-4P). Canon's B4 mount adapter blows up the image to resize a 2/3" picture from its original 11 mm image circle (6.6 x 8.8 mm) to a 1" picture with a 15.9 mm image circle (8.8 x 13.2 mm). You lose a little light. As for depth of field and field of view: what you had before is about what you will get after. To power B4 servo lenses with the Canon B4 lens mount adapter, use the C700's 12-pin lens connector.

Presumably, one could also use Super16 lenses on the C700 in crop mode because their image circle is around 14.5 mm. Of course, the B4 adapter would not be used.

Let's build the camera

1. The camera body is approx. 6.6 × 6.1× 12.9 in and weighs 7.6 lb for EOS C700 (7.9 lb for EOS C700 PL and EOS C700 GS PL)

2. Top, built-in cheeseplate of camera. "O frabjous day! Callooh! Callay!" Rental houses, DPs, Operators and ACs will chortle in their joy: There are enough ⅜-16 and ¼-20 threads to mount and balance almost anything.

3. Bottom mounting plate. Lots of ⅜-16 and ¼-20 threads.

4. Top Handle attaches with 2 screws. OLED EVF-V70 comes with an adjustable support and cold shoe mount. (Note: the Anton Bauer Cine 150 battery shown here is V-Mount.)

5. Shoulder Support Unit SU-15 has Hirth tooth rosettes on each side (hurray!) and 15mm rods in front. It has a comfortable shoulder pad that consists of two sections that adjust to fit the width of any Camera Operator's shoulder.

6. SU-15 Shoulder Support attaches to camera base with 4 ¼-20 screws

8. Remote Operation Unit OU-700 Display

7. SG-1 (Shoulder Grip) is a handgrip with full EF lens control: iris, zoom, and autofocus. It attaches to 15mm rods and plugs into the camera's 11-pin lens connector with an extendable cable.

OU-700 flips up

9. OU-700 Remote Operation Unit attaches to the camera right side and mimics all the functions of the built-in Main Display. It conveniently flips up for access to the CFast and SD card slots.

Codex CDX-36150 Recorder on Canon EOS C700

1. To attach the Codex CDX-36150, first remove the battery plate at the rear of the C700.

2. A multi-pin connector is revealed. The Codex Recorder connects here. CDX-36150 records 4K RAW uncompressed up to 120 fps.

3. The rear of the Codex recorder has a battery plate to which an onboard Gold Mount Anton Bauer or V-Mount battery can attach (2 models).

External power 12 VDC can be supplied via the 4-pin XLR connector on the camera.

External power (10-32 VDC) can also be supplied via the 2-pin Fischer connector on the Codex.

Codex CDX-36150 camera left side

Rear Gold Mount battery plate

Multi-pin connector

Codex CDX-36150 camera right side

Codex Capture Drive 2.0 (in 1 TB or 2 TB capacity) is the same familiar media used in Alexa and VariCam35.

10-32 VDC external power in 2-pin Fischer connector

Canon EOS C700 Connections

Front

Mic IN
Video OUT = EVF
24V DC 2A 3-pin OUT
12V DC 2A 2-pin OUT
Remote Control Connector
12-pin Lens Connector

Rear

Monitor OUT × 2
Genlock/Sync
V-Mount
Timecode IN/OUT
HDMI OUT
12V DC IN 4-pin XLR

3G-SDI OUT × 4
Remote B (RS-422)
Remote A
Ethernet
Headphone OUT
Audio IN XLR x 2 includes AES/EBU
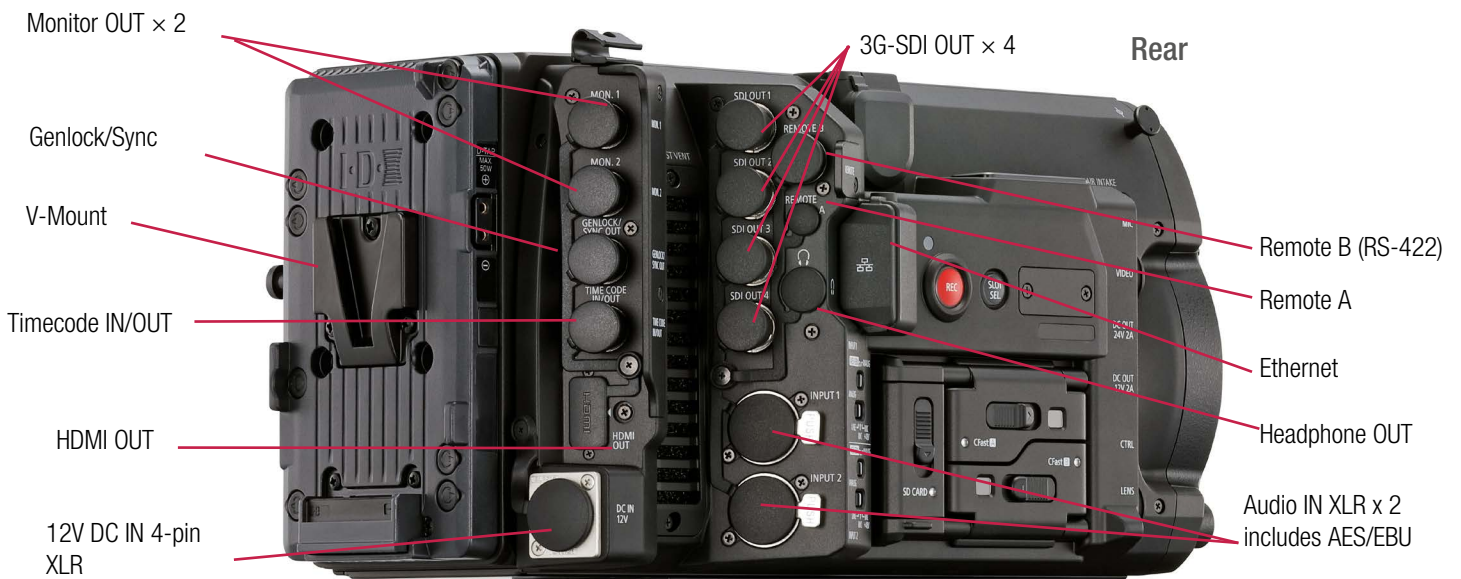
Formats, Media, Resolutions, Bit Depth and Frame Rates

Format	Recorder / Media	Resolution	Data spec	Bit depth	Max. Frame Rate	Available / Update
ProRes	CFast	4K / QFHD	ProRes 422 HQ	10 bit	30 fps	Available
		2K / FHD	ProRes 422 HQ	10 bit	60 fps	Available
			ProRes 4444	12 bit	60 fps	Available
		Crop 2K / FHD	ProRes 422	10 bit	180 fps	Available
	Codex recorder CDX-36150	4K / QFHD	ProRes 422 HQ	10 bit	60 fps	March Firmware Update
		2K / FHD	ProRes 422 HQ	10 bit	120 fps	March Firmware Update
			ProRes 4444 XQ	12 bit	60 fps	March Firmware Update
			ProRes 4444	12 bit	60 fps	March Firmware Update
		Crop 2K / FHD	ProRes 422 HQ	10 bit	240 fps	March Firmware Update
RAW	Codex recorder CDX-36150	4512 x 2376	RAW 1.89:1	—	100 fps	March Firmware Update
		4.2K (GS)	RAW	—	100 fps	March Firmware Update
		4K	RAW	—	120 fps	Available
		4512 x 1920 - Widescreen	RAW 2.39:1 spherical	—	120 fps	March Firmware Update
		Crop 2K	RAW	—	240 fps	March Firmware Update
	Ext. RAW Recorder	4K	RAW	—	60 fps	Available
XF-AVC	CFast	4K / QFHD	YCC422 Intra	10 bit	60 fps	Available
		2K / FHD	YCC422 Intra	10 bit	120 fps	Available
			YCC422 LongGOP	10 bit	60 fps	Available (S&F Not supported)
			RGB444 Intra	12 bit	60 fps	Available
				10 bit	60 fps	Available
		Crop 2K / FHD	YCC422 Intra	10 bit	240 fps	Available
		FHD Interlace	YCC422 LongGOP	10 bit	60i / 50i	Available (S&F Not supported)
		Crop FHD Interlace	YCC422 LongGOP	10 bit	60i / 50i	Available (S&F Not supported)
XF-AVC (Proxy)	SD Card	2K / FHD	YCC420 LongGOP	8 bit	60 fps	Available (S&F Not supported)

Formats, Resolutions and Frame Rates shown at time of release and with future Firmware Update estimate around March 2017.

Canon Cinema EOS C700 Specs

3 Models	EOS C700 / EOS C700 PL / EOS C700 GS PL
Sensor	CMOS sensor approximately Super 35mm format with 6.4 x 6.4 micron photosites
Total pixels EOS C700/C700 PL	Approx. 11.54 megapixels (4622 x 2496)
Total pixels C700 GS PL	Approx. 10.92 megapixels (4374 x 2496)
Effective Image area	EOS C700/C700 PL: 28.9 x 15.2 mm (32.6mm diagonal) in RAW (Capture Drive) mode EOS C700 GS PL: 27.3 x 15.2 mm (31.3mm diagonal) in RAW (Capture Drive) mode All models: 26.2 x 13.8 mm (29.6 mm diagonal) in 4096x2160 or 2048x1080 resolution
Effective pixels EOS C700/C700 PL	Approx. 8.85 megapixels (4096 x 2160) in 4K / 10.72 megapixels (4512 x 2376) in RAW (Capture Drive) mode
Effective pixels EOS C700 GS PL	Approx. 8.85 megapixels (4096 x 2160) in 4K / 10.15 megapixels (4272 x 2376) in RAW (Capture Drive) mode
Lens mounts	EF (cinema lock type), PL
ISO	160 - 25,600 (and 100 - 102,400 with expanded sensitivity)
Size	Approx. 6.6 × 6.1× 12.9 in (167 × 154 × 327 mm)
Weight	Approx 7.6 lb (3.4 kg)
Internal ND filter	Clear, 2, 4, 6, 8 10 stops with motorized selector
Viewfinder	OLED Electronic View Finder EVF-V70, sold separately
Menu display	3.0-inch (7.66cm on the diagonal) color liquid crystal, approx 1.036 million dots.
Recording media	CFast cards (2 slots) for XF-AVC and ProRes SD card for XF-AVC proxies and JPEG photos Codex Capture Drive 2.0 for RAW
Video formats	XF-AVC/ MPEG-4 AVC/H.264 ProRes Apple ProRes Codec RAW uncompressed
Audio recording	Linear PCM (24 bit- 48kHz) 4-channel
XF-AVC onto internal CFast Cards	XF-AVC 4096x2160 / 3840x2160 422 10-bit to 60 fps XF-AVC 2048x1080 / 1920x1080 422 10-bit to 120 fps XF-AVC 2048x1080 / 1920x1080 444 10-bit and 12-bit to 60 fps
ProRes onto internal CFast Cards	ProRes 422 HQ 4096x2160 / 3840x2160 10-bit to 30 fps ProRes 422 HQ 2048x1080 / 1920x1080 10-bit to 60 fps ProRes 4444 2048x1080 / 1920x1080 12-bit to 60 fps
RAW and ProRes onto Codex Capture Drive with Codex Integrated Recorder (CDX-36150)	4K RAW 4096x2160 12-bit to 120 fps 4.5K RAW 4512x2376 12-bit to 100 fps ProRes 422 HQ 4096x2160 / 3840x2160 10-bit to 60 fps ProRes 422 and ProRes 422 HQ 2048x1080 / 1920x1080 10-bit to 240 fps ProRes 444 and ProRes 4444 XQ 2048x1080 / 1920x1080 12-bit to 60 fps
Gamma modes	Canon Log 3 / Canon Log 2 / Canon Log / Wide DR / etc
Color space	Cinema Gamut / BT.2020 / DCI-P3 / BT.709
LUTs	BT.709 / BT.2020 / DCI / ACESproxy / HDR-ST2084 / and others
Slow & Fast Recording	Slow motion up to 240 fps
White Balance	AWB, 2,000K-15,000K, -20CC to +20CC, Daylight, Tungsten, Presets A and B
Time Code	Drop frame in n the 59.94 Hz mode, non-drop frame, rec run, free run, regen
Rear Connectors—Input	Timecode In/Out, Genlock/SYNC OUT, REMOTE (A/B), MIC, 2x XLR Audio
Rear Connectors—Output	2x MON, 4x SDI-OUT, HDMI OUT, headphones, Genlock/SYNC OUT, TIME CODE input/output, VIDEO
DC Power In	12V DC XLR 4-pin on camera body / 24V DC (10-34V) via Fisher 2-pin on Codex CDX-36150 Recorder
Accessory Power	DC 24V 2A DC 12V 2A D-Tap Connector
Accessories	OLED Electronic View Finder EVF-V70, Remote Operation Unit OU-700, Shoulder Support Unit SU-15, Shoulder Style Grip Unit SG-1, Remote Operation Unit Cable UC-V75, Remote Operation Unit Cable UC-V1000, B4 mount adapter MO-4E / MO-4P Remote Controller RC-V100, Wireless Transmitter WFT-E6, GPS Receiver GP-E1, Unit Cable UN-5/UN-10, Codex CDX-36150 (Codex Recorder for Canon C700), Codex Capture Drive 2.0 Media

These are not final specifications and are subject to change