

Remote Camera Interface System

Introduction

Live-Link Jr. is a highly-integrated camera extender system optimized for electronic news gathering (ENG), uplink truck, and specialized broadcast applications. The portable camera end unit and rack-mounted truck end unit provide all the resources needed for a single-camera live event. Linked using just two single-mode optical fibers, the same excellent performance will be supplied whether the units are hundreds of feet or miles apart. Notable features of the Live-Link Jr. system include performance flexibility, support for high-quality on-air (program), talent cue (IFB) and intercom audio, and ease of use.



Live-Link Jr. Camera End Unit
(shown with opticalCON DUO connector)

Key Features

- 3G/HD/SD-SDI support
- All audio transported embedded into SDI paths
- Integrated party-line and 4-wire intercom support
- Excellent audio quality throughout
- Full SMPTE®-standards compatibility
- Standard optical, video, and audio connectors
- Hybrid fiber/copper powering of camera end unit
- AC and DC powering of truck end unit

Video Transport

Live-Link Jr. transports one SDI video signal in each direction: camera-end-to-truck-end and truck-end-to-camera-end. 3G-, HD-, and SD-SDI signals are fully supported. A “loop” output is associated with each SDI input. This provides a signal that follows the embedding process within Live-Link Jr. This “post-embedder” signal can be valuable for “confidence” monitoring, transport of signals via coax, or as an aid during testing or troubleshooting. At the truck end the SDI signal originating at the camera end unit is provided as two independent, buffered SDI outputs.

Audio Transport

The camera end unit has two “mic/line” inputs that are compatible with microphone or line-level signals. Related features include adjustable input sensitivity, phantom power, and level metering. Each input stage can be independently set for compatibility with line-level signals (0 dB gain) or mic signals (gain of 15, 30, or 45 dB). The provided phantom power is +48 volt DC to ensure correct operation with professional-grade microphones. Extensive filtering on the mic/line inputs minimizes the chance of audio performance issues occurring due to the presence of radio-frequency signals. Protection against damage due to ESD (“static”) discharge is also incorporated.

Two balanced line-level outputs are provided on the truck end unit’s back panel and are associated with the camera end unit’s mic/line inputs. Two additional balanced line-level outputs are also located on the truck end unit’s back panel. These outputs provide de-embedded analog signals associated with group 1, channels 1 and 2 of the transported SDI. These “convenience” outputs allow audio embedded, for example, by a camera connected to the camera end unit to be accessible without the need for an external de-embedder unit at the truck end. They can be very useful when connected to inputs on an audio mixer, speaker monitor panel, or RF transmission system.

Intercom

A major strength of Live-Link Jr. is its integrated 2-channel intercom system. With its extensive resources and capabilities the typical hassles and limitations associated with intercom system implementation should be a thing of the past. A 2-channel party-line intercom interface is provided on both the camera end and truck end units. This allows user beltpacks, such as the ubiquitous RTS® BP325, to be directly connected and powered. A fully functional camera-end-to-truck-end “comms” system can be up and running in just minutes. The advanced 2-wire-to-4-wire converter circuitry provides simply excellent audio performance. Adjustment of the converter’s “nulling” is user activated by pushbutton switches on both the camera end and truck end units. The pushbuttons allow both the local and alternate-end nulling process to be started.

The Live-Link Jr. truck end also provides a 4-wire interface that is associated with intercom channel 2. An audio input and audio output allows direct interfacing with local and remotely-located matrix intercom systems. In this manner intercom users at the camera end unit, truck end unit, and remote locations can be part of the same intercom circuit.

The party-line interface on the camera end unit provides a power source and the required signal terminations. This allows direct connection of user beltpacks; a typical application could use up to three BP325 units. With its selectable operating mode the truck end party-line interface offers additional resources. Most applications will have the truck end configured for stand-alone operation where power and signal terminations are required. In this mode up to five BP325 beltpacks could be connected. Alternately, the truck end’s power source and signal terminations can be disabled allowing interfacing with an existing party-line intercom system. This will allow the truck end’s party-line interface to become just another “user” on an already installed system.

Line/IFB Signals

Two line-level audio signals can be transported from the truck end to the camera end. The balanced line/IFB inputs are located on the back panel of the truck end and allow connection of a variety of analog audio signals. In most applications the signals will be used for talent cueing. But the audio quality is such that even transporting on-air signals would be appropriate. For flexibility both line-level and “wet” IFB (power and audio) outputs are provided on the camera end unit. Listen-only beltpacks, such as from Studio Technologies, can be directly connected and powered by the camera end unit’s IFB output. For flexibility the signal connected to the line/IFB 1 input on the truck end can also be routed to intercom channel 1. This useful feature allows intercom users, typically camera operators, to monitor the cueing audio signals being sent to the on-air talent.

RS-422 Data

A full-duplex RS-422 asynchronous data path links the truck end unit to the camera end unit. This general-purpose “serial” port can be a valuable resource when used to interface a camera control unit located at the truck end with a camera connected to Live-Link Jr.’s camera end unit. A current-limited source of 5.5 volt DC power is also provided at both the truck end and camera end units. This auxiliary power source is specifically provided should low-cost RS-422-to-RS-232 or RS-422-to-RS-485 converters be required for specific data transport applications.

GPI/GPO

Live-Link Jr. allows one contact closure to be transported in each direction. The GPI (general purpose input) on the truck end unit will correspond with the GPO (general purpose output) contact closure on the camera end unit, and vice versa. This functionality is often useful to support camera tally



Live-Link Jr. Truck End Unit Front Panel



Live-Link Jr. Truck End Unit Back Panel

applications. Using one of the GPI/GPO functions along with the auxiliary 5.5 volt DC power source would allow a complete camera tally indicator to be fully implemented.

Signal Embedding and Continuous Operation

All Live-Link Jr. audio and support signals are transported between units as embedded SDI data. This data is combined with the data already present on the connected SDI input signals. The support signals, such as serial data and GPI/GPO, are embedded as ancillary data. Four Live-Link Jr.-associated audio signals are transported in each direction, each as one group of standard embedded SDI audio data. The two mic/line inputs and two intercom audio channels are sent from the camera end unit to the truck end unit. The two line/IFB inputs and two intercom audio channels are sent from the truck end unit to the camera end unit. By default the Live-Link Jr. audio is embedded on group 2, with any audio on groups 1, 3, and 4 being passed through from the SDI input on either end to the SDI output on the other. A configuration setting allows this group to be changed from 2 to 3. This audio transport design was carefully implemented so that audio embedded by an external device, such as a camera, will be passed through Live-Link Jr. Audio associated with Live-Link Jr. is embedded into the SDI signal along with the externally-embedded audio. The resulting SDI signal can be a valuable resource, for example when connected to the input of a video router.

Should an external source of SDI not be provided to the camera end or truck end units' SDI input, internal SDI clock and video signal generators will become active. This ensures that an SDI signal will always be present, and audio and support signal transport will be maintained. The internally-generated SDI video signal can be selected from among two choices. The default provides a unique solid color that slowly changes over the SDI video data palette. This ensures that connected equipment, and associated users, will be able to recognize that the signal is active. An alternate setting allows color bars to be generated.

Optical Transport

The camera end and truck end units interconnect using two strands of single-mode optical fiber. Only a single optical wavelength per fiber is required since all video, audio, serial data, GPI/GPO, and support signals are transported as part of the SDI data stream. Two ST optical connectors are provided on the back panel of the truck end unit. The camera end unit can be ordered from either of two optical connectors. The standard configuration uses a Neutrik® opticalCON DUO® which provides two fiber and four copper connections. This advanced connector offers a number of advantages for Live-Link Jr. users including fast, reliable mating and un-mating, fiber protection, and the option of providing power to the

camera end unit. The camera end unit can also be ordered with two ST optical connectors. This can prove beneficial for applications that need to utilize an existing inventory of fiber optic cable that is terminated with low-cost, more-generic ST connectors. This typically would be available at facilities such as sports stadiums or convention centers where “house fiber” is offered. It's also common for mobile broadcast and field-production applications to bring tactical-grade TAC-4 or TAC-12 multi-strand fiber assemblies where ST connectors are present.

Truck End Unit Details

The truck end unit mounts in one space (1U) of a standard 19-inch rack. Housed in an aluminum enclosure the unit weighs less than 4 pounds (1.8 kg), making it perfect for mobile or “fly-away” applications. LEDs on the front panel provide a complete view of system operation, including an indication of the camera end unit's optical interconnection status. Standard connectors ensure fast, easy, and low-cost installation as well as rapid, straight-ahead troubleshooting. The connectors include BNCs for digital video, 3-pin XLRs for audio, and a 9-pin D-subminiature for data.

The truck end unit allows an AC mains source of 100-240 volt, 50/60 Hz to be directly connected. The unit can also be DC powered using a 10-18 volt source that is connected via a broadcast-standard 4-pin XLR connector. If both AC and DC power sources are connected the unit will be powered by the AC mains supply. Only if the AC mains source fails will a load be placed on the DC source. This allows a source of DC, typically a battery pack, to serve in a backup capacity. With this arrangement normal operation can continue even if AC mains power is lost.

Camera End Unit Details

The Live-Link Jr. camera end unit is housed in a lightweight aluminum enclosure with an integrated carry handle. Weighing less than 6 pounds (2.8 kg) it is well suited for portable applications. As with the truck end unit, all camera end unit input and output signals are interfaced using standard connectors. A combination of status LEDs and multi-LED audio level meters are provided for operating and troubleshooting assistance.

The camera end unit can be powered from up to three sources. A 4-pin XLR connector on the front panel allows an external 12 volt DC nominal power supply to be connected. A battery mount, located on the back of the unit's cover, allows use of a broadcast-standard rechargeable battery. The standard battery mount is compatible with batteries from Anton/Bauer®. As an option a “V-Mount” battery mount can be provided.

A third input power option is available to Live-Link Jr. camera end units that are ordered with the Neutrik opticalCON

DUO connector. As previously mentioned, this connector supports two fibers along with four metallic conductors. The camera end unit can be powered by a 10-50 volt DC source that enters the unit via the metallic conductors. This method allows the use of hybrid fiber/copper fiber assemblies to both interconnect the SDI signals and provide power to the camera end unit. A variety of fiber/copper cable assemblies can be used. For example, one major vendor offers a tactical-grade cable that has two 16 AWG copper conductors along with two single-mode fibers. Using a readily-available 48 volt DC power source located at the truck end, along with this type of “TAC” cable, an interconnect distance of over 1000 feet (308 meters) is possible. It’s also possible to use SMPTE Hybrid type of fiber/copper cable assemblies to link the truck end unit to the camera end unit. The only caveat would be the need for opticalCON DUO connectors to mate with the camera end unit.

It is important to note that while the Live-Link Jr. camera end unit can be powered by hybrid fiber/copper cable assemblies the unit will not provide a power source for connected cameras or related equipment. The camera end unit is not capable of converting the 10-50 volt DC input into 12 volts DC for use by other equipment.

Hybrid Fiber/Copper Interface Kit

An available Live-Link Jr. option makes it simple to support hybrid fiber/copper cable assemblies. This allows rapid studio or field-deployment of the camera end unit with power provided from the location where the truck end unit is mounted. The kit supplies all the components required for installation in a fixed or mobile application. Included is a Neutrik opticalCON DUO connector with its four electrical contacts and one ground contact pre-wired to an interface cable and associated power entry printed circuit board. This panel-mounted (“bulkhead”) connector is mounted into a designated XLR-standard “D” opening in an I/O or rack panel. Also included in the kit is a universal mains input/48 volt DC, 2.5 A, output power supply. Its DC output cable is directly connected to the power entry circuit board.

The final installation step is to link the two optical ports on the opticalCON DUO connector to the ST connectors located on the back panel of the Live-Link Jr. truck end unit. Two precision LC-to-ST patch cables, 32 feet (10 meters) in length, are provided for this purpose. Using the hybrid fiber/copper interface kit and user-supplied fiber assemblies, the supported interconnect distance will typically be in excess of 1000 feet (308 meters).

Live-Link Jr. General Specifications

SDI Compatibility, Supported Resolutions, and Rates:

SD-SDI per SMPTE® ST 259:2008:

525i: 59.94

625i: 50

HD-SDI per SMPTE ST 292:2011:

720p: 50, 59.94, 60

1080i: 50, 59.94, 60

1080p: 23.98, 24, 25, 29.97, 30

1080psf: 23.98, 24

3G-SDI Level A per SMPTE ST 424:2006 and ST 425:2011:

1080p: 50, 59.94, 60

Audio, Data, GPI/GPO, and Control Data Transport:

Embedded into SD-SDI as HANC

Ancillary Data per SMPTE ST 272:2004 and ST 291:2011.

Embedded into HD-SDI as HANC

Ancillary Data per SMPTE ST 291:2011 and ST 299:2009.

Embedded into 3G-SDI as HANC

Ancillary Data per SMPTE ST 291:2011, ST 299:2009, and ST 425:2011.

SDI Inputs and Outputs:

Type: unbalanced

Impedance: 75 ohms

Level: 800 mV p-p, nominal

Optical Outputs:

Compliance: SMPTE ST 297:2006 (as applicable)

Fiber Type: single mode

Wavelength: 1310 ±20 nm (FP laser)

Launch Power: -3 dBm, nominal

Typical Fiber Interconnect Length: 10 km minimum

Optical Inputs:

Compliance: SMPTE ST 297:2006 (as applicable)

Fiber Type: single mode

Wavelengths Supported: 1250 to 1650 nm

Receive Sensitivity: -17 dBm, nominal @ 2.97 Gb/s

Maximum Input Power: -3 dBm, nominal

Audio, Mic/Line Input to Mic/Line

Output:

Frequency Response: +0/-0.35 dB, 20 Hz to 20 kHz

Distortion (THD+N): 0.003%, measured at 1 kHz

Dynamic Range: 109 dB

Audio, Line/IFB Input to Line Output:

Frequency Response: ±1 dB, 20 Hz to 20 kHz

Distortion (THD+N): 0.01%, measured at 1 kHz

Dynamic Range: 101 dB

Audio, 4-Wire Input to Party-Line Intercom Pin 3:

Frequency Response: ±1.25 dB, 100 Hz to 10 kHz (band limited for optimal performance)

Distortion (THD+N): 0.02%, measured at 1 kHz

Dynamic Range: 99 dB

Party-Line Hybrids:

Topology: 3-section analog circuitry compensates for resistive, inductive, and capacitive 2-wire party-line loads

Nulling Method: automatic upon user initiation, processor implements digital control of analog circuitry; settings stored in non-volatile memory

Nulling Line Impedance Range: 120 to 240 ohms

Trans-Hybrid Loss: >45 dB, typical at 1 kHz

Data Transport:

Compatibility: full duplex RS-422 asynchronous (serial)

Rate: auto-sensing, 115.2 kb/s, maximum

GPI/GPO Transport:

GPI Input: +3.3 Vdc logic, activates on closure to system common

GPO Output: normally open, isolated, solid-state relay contact, 60 Vdc maximum, 400 mA maximum

Auxiliary Power Source: 5.5 Vdc, 40 mA maximum

Live-Link Jr. Truck End Unit Specifications

Line/IFB and 4-Wire Intercom Inputs:

Type: analog, electronically balanced, capacitor-coupled, 20 k ohms

Nominal Level: +4 dBu

Maximum Level: +24 dBu

De-Embed, Mic/Line, and 4-Wire Intercom Outputs:

Type: analog, electronically balanced, capacitor-coupled, intended to drive balanced loads of 2 k ohms or greater
Source Impedance: 200 ohms

Nominal Level: +4 dBu

Maximum Level: +24 dBu into 10 k ohms

Party-Line Intercom Interface:

Type: 2-channel party-line, unbalanced (common on pin 1, DC modulated with channel 1 audio on pin 2, channel 2 audio on pin 3)

Compatibility: dual-channel intercom system such as from RTS®

Nominal Audio Level: -10 dBu

Maximum Audio Output Level:

Pin 2: +9 dBu

Pin 3: +10 dBu

Output Voltage (Pin 2 to Pin 1): 29 Vdc, selectable on/off

Output Current (Pin 2 to Pin 1): 300 mA maximum; requires ≥10 mA current draw for detection of connected device

Impedance (Pin 2 to Pin 1; Pin 3 to Pin 1), Local Party-Line Power Enabled: 200 ohms

Impedance (Pin 2 to Pin 1; Pin 3 to Pin 1), Local Party-Line Power Disabled: >10 k ohms

Connectors for Electrical Signals:

SDI: BNC, 3G-SDI optimized, gold plating on center pin, per IEC 61169-8 Annex A

Line/IFB and 4-Wire Intercom Inputs: 3-pin female XLR

De-Embed, Mic/Line, Party-Line

Intercom, and 4-Wire Intercom Outputs: 3-pin male XLR

Data, GPI/GPO, and Auxiliary DC: 9-pin female D-subminiature (DE-9F)

DC Input: 4-pin male XLR

AC Mains Input: 3-blade, IEC 320 C14-compatible (mates with C13)

Optical Connectors: two ST (UPC polish)

Power Inputs:

AC Mains: 100 to 240 V, 50/60 Hz, 24 W maximum

DC: 10 to 18 V, 2.0 A maximum

Dimensions (Overall):

19.00 inches wide (48.3 cm)

1.72 inches high (4.4 cm)

8.7 inches deep (22.1 cm)

Mounting: one space (1U) in a standard 19-inch rack

Weight: 3.9 pounds (1.8 kg)

Live-Link Jr. Camera End Unit Specifications

Mic/Line Inputs:

Input Sensitivity: selectable for line level (unity gain), 15, 30 or 45 dB gain

Maximum Input Level: +24 dBu

Type: electronically balanced

Impedance: approximately 3 k ohms

CMRR: 61 dB at 60 Hz

Phantom Power: 48 Vdc, meets IEC 61938 P48 standard

Line Outputs:

Type: analog, electronically balanced, capacitor-coupled, intended to drive balanced loads of 2 k ohms or greater
Source Impedance: 200 ohms

Nominal Level: +4 dBu

Maximum Level: +24 dBu into 10 k ohms

IFB Output:

Type: 2-channel unbalanced (common on pin 1, DC modulated with channel 1 audio on pin 2, channel 2 audio on pin 3)

Nominal Audio Level: -10 dBu

Maximum Audio Output Level:

Pin 2: +9 dBu

Pin 3: +10 dBu

DC Output Voltage (Pin 2 to Pin 1): 28 V

DC Output Current (Pin 2 to Pin 1): 120 mA maximum

Impedance (Pin 2 to Pin 1; Pin 3 to Pin 1): 200 ohms

Party-Line Intercom Interface:

Type: 2-channel party-line, unbalanced (common on pin 1, DC modulated with channel 1 audio on pin 2, channel 2 audio on pin 3)

Compatibility: dual-channel intercom system such as from RTS®

Nominal Audio Level: -10 dBu

Maximum Audio Output Level:

Pin 2: +9 dBu

Pin 3: +10 dBu

Output Voltage (Pin 2 to Pin 1): 28 Vdc

Output Current (Pin 2 to Pin 1): 180 mA maximum; requires ≥10 mA current draw for detection of connected device

Impedance (Pin 2 to Pin 1; Pin 3 to Pin 1): 200 ohms

Connectors for Electrical Signals:

SDI: BNC, 3G-SDI optimized, gold plating on center pin, per IEC 61169-8 Annex A

Mic/Line Inputs: 3-pin female XLR

Line, IFB, and Party-Line Intercom Outputs: 3-pin male XLR

Data, GPI/GPO, and Auxiliary DC: 9-pin female D-subminiature (DE-9F)

DC Input: 4-pin male XLR

Optical Connector(s): Neutrik® optical-CON DUO® or two ST (UPC polish), factory installed, selectable at time of order

Battery Mounting: Anton/Bauer® QRC-Gold®, standard; IDX® P-V2 V-Mount, optional

Power Inputs:

DC (4-Pin XLR) and Battery Mount: 10 to 18 Vdc, 1.9 A maximum at 12 V; 2.1 A at 10 V

Copper/Optical Hybrid via opticalCON DUO: 10-50 Vdc, 0.54 A maximum with 48 V source and 500 feet (154 meters) of two 16 gauge copper conductors, maximum length TBD

Dimensions (Overall):

6.5 inches wide (16.5 cm)

5.7 inches high (14.5 cm)

10.4 inches deep (26.4 cm)

Weight: 5.5 pounds (2.5 kg)

Specifications subject to change without notice.

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