



Live-Link™

mini Remote Camera Interface System

**STUDIO
TECHNOLOGIES
INC.**

Introduction

Live-Link™ Mini is a highly-integrated camera extender system optimized for electronic news gathering (ENG), uplink truck, and specialized broadcast, corporate, and education applications. The system consists of a compact, portable camera end unit and two choices of companion “truck end” units. One truck end unit allows rack mounting while the other version is portable and matches the size of the camera end unit. Whatever combination is selected, all systems provide the resources needed for a range of single-camera live events. Interconnected using just one single-mode optical fiber, the same solid performance will be supplied whether the units are hundreds of feet or miles apart. Other notable features of Live-Link Mini systems can include support for embedded and line-level audio, talent cueing (IFB), party-line (PL) and 4-wire intercom, AC and DC powering, and compatibility with 3G-, HD-, and SD-SDI signals. Those resources, along with its fast, simple setup and “totally pro” performance make the Live-Link Mini a unique product for demanding applications.



Live-Link Mini Camera End Unit Front View

Key Features

- One 3G-/HD-/SD-SDI path in each direction
- Line-level and powered talent cueing (IFB) outputs
- Interconnects using one single-mode fiber
- Excellent audio quality throughout
- Full SMPTE®-standards compatibility
- Integrated 2-channel party-line (PL) intercom support
- 4-wire intercom support (selected truck end units)
- Audio de-embed outputs (selected truck end units)
- Standard optical, video, and audio connectors
- Battery mount on camera end and truck end portable units

Video Transport

Live-Link Mini transports two SDI video signals, one going from the camera end to the truck end and the other from the truck end to the camera end. 3G-, HD-, and SD-SDI signals at a wide range of formats and rates are supported. On the front panel of the camera end unit a BNC connector provides the “return” SDI signal. At the truck end units the SDI signal originating at the camera end is provided as two independent, buffered SDI outputs.

Optical Transport

The camera end unit interconnects with its associated truck end unit using one strand of single-mode optical fiber. Two optical wavelengths, one traveling in each direction, are used for signal transport. All video, audio, and control data is multiplexed (combined) as part of a single industry-standard SDI signal. One ST optical connector is provided on each unit. This connector type was selected because of its low cost and wide acceptance. It's routine to find ST connectors terminated on the “house fiber” that's present in many sports stadiums, education facilities, and convention centers. It's also common for mobile broadcast and field-production applications to utilize ST-terminated tactical-grade TAC-4 or TAC-12 multi-strand fiber assemblies.

Two Truck End Units Available

To meet the needs of specific applications two Live-Link Mini truck end units are available. One version mounts in one space (1U) of a standard 19-inch equipment rack, while the second version is portable and matches the form-factor (style) of the camera end unit.

The rack-mount truck end unit offers flexibility in powering and includes four de-embed audio outputs. A source of 100-240 V, 50/60 Hz can be connected to power the unit. Alternately, a 12 Vdc source can be connected. Some applications may benefit from having analog outputs associated with the audio channels embedded by a connected camera, camcorder, or other video source. This version de-embeds the four channels associated with group 1, converts them to analog, and presents them on four balanced line-level outputs.

The rack-mount truck end version supports both party-line (PL) and 4-wire intercom systems. This allows integration into a large range of professional intercom scenarios. Dual-channel party-line user beltpacks can be directly connected and powered. Alternately, an existing party-line intercom circuit can be directly connected, with the Mini unit just acting as another user device. The single-channel 4-wire intercom interface allows connection to a local or remotely-located matrix intercom system. The portable truck end version has a feature set optimized for field applications where easy setup, fast configuration, small size, and battery operation are important. Identical in size to the camera end unit, a pair of Mini portable units can be easily transported in a small portable case. As with the camera end unit, powering can be provided by an external source of 12 Vdc or a broadcast-style battery. Additional features include two de-embed analog outputs and party-line (PL) intercom support.

On-Air Audio Signals

Unlike other systems from the Live-Link family, Mini’s camera end unit does not provide analog microphone- or line-level inputs for supporting on-air audio signals. Instead, Mini relies on an associated camera, camcorder, or other video source to embed on-air audio signals into audio group 1 of the source SDI. This minimizes the camera end unit’s size, reduces cost, and simplifies setup. The embedded audio signals are transported, along with picture data, to the associated Mini truck end unit. The rack-mount truck end unit provides four balanced line-level analog outputs whose source is de-embedded from the four channels associated with embedded audio group 1. These outputs can be important for applications that require analog signals that start as embedded audio on Mini’s camera end SDI input. Of course, these audio channels remain in the SDI signal and are present in the truck end’s SDI outputs. The portable truck end version provides two balanced line-level analog outputs whose sources are de-embedded from channels 1 and 2 of embedded audio group 1. Providing just two channels is a good compromise,

working within the unit’s compact size yet de-embedding the most commonly-utilized channels.

Signal Embedding and Continuous Operation

Live-Link Mini’s line/IFB audio, intercom audio, and control data are transported between camera and truck end units as embedded SDI data. This data is combined with embedded audio data that may be present on a connected SDI input signal. The control data, required for features such as remote enabling of the party-line interface “nulling” function and opposite-end optical status, are embedded as horizontal ancillary (HANC) data. Live-Link Mini-associated audio signals (line/IFB and intercom) are transported in each direction using one group of standard embedded SDI audio data. This allows the two line inputs on the truck end to be sent to the camera end. And the two audio channels associated with the intercom interfaces are sent from the camera end to the truck end and vice-versa.

Mini’s overall audio transport design was carefully implemented so that audio embedded into group 1 by an external device, such as a camera, will always be passed through “end-to-end.” By default Live-Link Mini’s line/IFB audio and intercom audio data is embedded into group 2; any audio data present in groups 1, 3, and 4 is passed through from the SDI input on either end (camera or truck) to the SDI output on the other. For added flexibility, on both of the rack-mount truck end versions a configuration setting allows the group used for embedding to be changed from group 2 to group 3.

Should an external source of SDI not be provided to the SDI input on the camera end or truck end units an internal SDI clock and video signal generator in each unit will automatically become active. This ensures that an SDI signal will always be present and line/IFB audio, intercom audio, and control data transport will be maintained. The default SDI image 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 SDI signal is active. For application flexibility, on both rack-mount truck end versions the internally-generated SDI video signal can be selected from two choices, the alternate setting allowing color bars to be generated.

Talent Cueing (IFB)

For talent cueing and audio return support two line-level audio signals can be transported from the truck end unit to the camera end unit. The line inputs on the truck end units allow connection of a variety of analog line-level audio signals. To support a range of applications, both line-level “dry” and



Live-Link Mini Truck End Unit Front Views



Live-Link Mini Truck End Unit Rack-Mount Version Back View

powered “wet” IFB outputs are provided on the camera end unit. The balanced line-level outputs can be useful when interfacing with wireless IFB systems and battery-powered user belt packs. Listen-only belt packs, such as those from Studio Technologies, can be directly connected to and powered by the camera end unit’s IFB output. In most applications the IFB signals will be used for talent cueing. But the audio quality is such that even transporting on-air signals would be appropriate. As an additional resource, the signal connected to channel 1 of the line input on the truck end units can also be selected to route to intercom channel 1. This useful feature allows intercom users, typically camera operators, to monitor the cue audio signals being sent to on-air talent.

Intercom

A major strength of Live-Link Mini is its integrated 2-channel intercom system. With an extensive list of resources the typical hassles and limitations associated with intercom system implementation are eliminated. A 2-channel party-line (PL) intercom interface is provided on the camera end and all three truck-end versions. Each PL interface can be user configured to operate either stand-alone or in conjunction with an existing party-line circuit. In the stand-alone mode DC power and two channels of audio termination are provided. This allows user belt packs, 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. And for a user to optimize the important party-line audio “null” requires only a press of the auto-null pushbutton switch. Circuitry under processor control will then quickly select the setting required for optimum audio performance.

The Live-Link Mini rack-mount truck end unit also provides a 4-wire interface that is associated with intercom channel 2. An analog audio input and analog audio output allow direct interfacing with local and remotely-located matrix intercom systems. This allows intercom users at the camera end unit, the rack-mount truck end unit, and a remote location to simultaneously be part of the same conversation.

The party-line interfaces on the camera end and truck end units can be user-selected for stand-alone operation, providing industry-standard DC power and two PL audio channels. The camera end unit has sufficient power to support up to three BP325 belt packs. Both versions of the truck end units provide more power, allowing up to five BP325 belt packs to be connected. The party-line intercom interfaces on the camera end and truck



Live-Link Mini Camera End Unit and Truck End Unit Portable Version Back View

end units offer additional flexibility. As previously mentioned, in the stand-alone mode belt packs can be directly supported. But for compatibility with existing party-line intercom circuits each PL interface can be user-selected to disable its power source and terminations. This will allow Mini’s party-line interfaces to perform as “just another” user device on an existing PL system.

Camera End Unit Details

The Live-Link Mini camera end unit is housed in a lightweight aluminum enclosure with an integrated carry handle. Weighing less than 4 pounds (<1.8 kg) it is well suited for portable applications. All input and output signals are interfaced using standard connectors. Status and signal present LEDs are provided for operating and troubleshooting assistance.

Two power sources can be connected to the camera end unit. A 4-pin XLR connector on the front panel allows a 12 Vdc 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 battery mount is compatible with batteries from Anton/Bauer®. Alternately, an optional V-Mount battery mount can be provided.

Rack-Mount Truck End Unit Details

The Live-Link Mini rack-mount truck end unit installs in one space (1U) of a standard 19-inch rack. It’s housed in an aluminum enclosure that weighs less than 4 pounds (less than 1.8 kg), making it perfect for mobile or “fly-pack” applications. LEDs on its front panel provide a complete view of system operation, including an indication of the camera end unit’s optical interconnection status. As with the camera end unit, standard connectors ensure fast installation and rapid, straight-ahead troubleshooting. These include BNC connections for digital video and 3-pin XLRs for audio and intercom. The rack-mount truck end unit allows an AC mains source of 100-240 V, 50/60 Hz to be directly connected. The unit can also be DC

powered using a 12 V source that is connected via a 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 the DC source power the unit. This allows a source of DC, typically a rechargeable battery, to serve in a backup capacity. With this arrangement normal operation can continue even if AC mains power is lost.

Portable Truck End Unit Details

The Live-Link Mini portable truck end unit is housed in a lightweight aluminum enclosure and includes an integrated

carry handle. It weighs less than 4 pounds (<1.8 kg) making it well suited for portable and “throw-down” applications. Input and output signals are interfaced using standard connectors, the possible exception being the two de-embed audio outputs which use a 5-pin XLR. A complement of status and signal present LEDs are provided.

Two DC power sources can be connected. A 4-pin XLR connector on the front panel allows a 12 Vdc power supply to be connected. A battery mount, located on the back of the unit’s cover, is compatible with batteries from Anton/Bauer®. An optional V-Mount battery mount can be provided.

Live-Link Mini 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

Line-Level Audio, Intercom Audio, and Control Data Transport:

SD-SDI: embedded as HANC Ancillary Data per SMPTE ST 272:2004 and ST 291:2011

HD-SDI: embedded as HANC Ancillary Data per SMPTE ST 291:2011 and ST 299:2009

3G-SDI: embedded 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 Interconnect:

Number of Fibers: 1

Fiber Type: single mode

Wavelengths: 1310 ±10 nm, 1550 ±30 nm (DFB lasers)

Launch Power: -5 dBm, nominal

Receive Sensitivity: -18 dBm, nominal at 2.97 Gb/s, pathological

Maximum Input Power: -3 dBm, nominal

Typical Fiber Interconnect Length: 10 km minimum

Line 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

4-Wire Input to Party-Line (PL) 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 (PL) 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

Line Impedance Range for Optimal Nulling: 120 to 240 ohms

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

Live-Link Mini Camera End Unit Specifications

Line Outputs:

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

Nominal Audio Level: +4 dBu

Maximum Audio Level: +24 dBu into 10 k ohms

Source Impedance: 200 ohms

Powered 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)

Output Power (Pin 2 to Pin 1): 28 Vdc, 130 mA maximum

Nominal Audio Level: -10 dBu

Maximum Audio Level: +9 dBu

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

Party-Line (PL) 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 systems such as from RTS®

Output Power (Pin 2 to Pin 1): 28 Vdc, 200 mA maximum (requires 10 mA current draw for detection of connected device); selectable on/off

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

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

Nominal Audio Level: -10 dBu

Maximum Audio Level: +9 dBu

Connectors:

Optical: ST (UPC polish)

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

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

DC Input: 4-pin male XLR

Power Inputs:

DC and Battery Mount: 10 to 18 Vdc, 1.7 A maximum at 12 V; 1.9 A at 10 V

Battery Mounting: Anton/Bauer® QRC-Gold® standard; V-Mount optional

Dimensions (Overall):

6.5 inches wide (16.5 cm)

4.9 inches high (12.5 cm)

9.5 inches deep (24.1 cm)

Weight: 3.6 pounds (1.6 kg)

Order Code:

Camera End Unit – Portable: LLM-CA-105

Live-Link Mini Truck End Rack-Mount Unit Specifications**Line and 4-Wire Intercom Inputs:**

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

Nominal Level: +4 dBu

Maximum Level: +24 dBu

4-Wire Intercom Output:

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

De-Embed 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

Frequency Response: ± 0.1 dB, 10 Hz to 22 kHz

Distortion (THD+N): 0.0025%, at +4 dBu out, 1 kHz

Dynamic Range: 117 dB

Party-Line (PL) 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 systems such as from RTS®

Output Power (Pin 2 to Pin 1): 28 Vdc, 300 mA maximum (requires 10 mA current draw for detection of connected device); selectable on/off

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

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

Nominal Audio Level: -10 dBu

Maximum Audio Level: +9 dBu

Connectors:

Optical: ST (UPC polish)

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

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

Party-Line Intercom and 4-Wire Intercom: 3-pin male XLR

De-Embed Outputs: 3-pin male XLR

DC Input: 4-pin male XLR

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

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):

19.0 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)

Order Code:

Truck End Unit – Rack-Mount Version: LLM-TE-107

Live-Link Mini Truck End Portable Unit Specifications**Party-Line (PL) 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 systems such as from RTS®

Output Power (Pin 2 to Pin 1): 28 Vdc, 300 mA maximum (requires 10 mA current draw for detection of connected device); selectable on/off

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

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

Nominal Audio Level: -10 dBu

Maximum Audio Level: +9 dBu

Line Inputs:

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

Nominal Level: +4 dBu

Maximum Level: +24 dBu

De-Embed 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

Frequency Response: ± 0.1 dB, 10 Hz to 22 kHz

Distortion (THD+N): 0.0025%, at +4 dBu out, 1 kHz

Dynamic Range: 117 dB

Connectors:

Optical: ST (UPC polish)

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

Line Inputs: 3-pin female XLR

Party-Line Intercom: 3-pin male XLR

De-Embed Outputs: 5-pin male XLR

DC Input: 4-pin male XLR

Power Inputs:

DC and Battery Mount: 10 to 18 Vdc, 1.7 A maximum at 12 V; 1.9
A at 10 V

Battery Mounting: Anton/Bauer® QRC-Gold® standard;
V-Mount optional

Dimensions (Overall):

6.5 inches wide (16.5 cm)

4.9 inches high (12.5 cm)

9.5 inches deep (24.1 cm)

Weight: 3.6 pounds (1.6 kg)

Order Code:

Truck End Unit – Portable Version: LLM-TE-109

Specifications subject to change without notice.

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