

Livewire/AES67 features in XDS-PROnR Receivers

This feature guide applies to XDS-PROnR receivers v.3.4.6 and above.

1. WHAT IS LIVEWIRE/AES67?

AES67 is an open standard of Layer 3 protocols designed to allow interoperability between audio-over-IP systems. Livewire is an Audio-over-Ethernet system created by Axia Audio (Telos Alliance). Its purpose is to route and distribute broadcast-quality audio in radio stations. Livewire+ provides routing of audio from 'anywhere-to-anywhere' using multicast sources and destinations of uncompressed PCM audio that is globally visible on a LAN. Livewire+ is an open standard that enables full AES67 interoperability, and it can be seen as a "special case" of AES67 output. It operates in a specific range of multicast addresses and a specific UDP Port (5004 for Audio).

2. LIVEWIRE/AES67 FEATURES IN PROnR RECEIVERS

XDS-PROnR receivers are compatible with the Livewire+ standard. The features include:

- Requires a 48kHz sampling rate
- LAN 2 port of the receivers is used for Livewire and AES67 Multicast output.
- The receiver website can be accessed through LAN 1 or LAN 2 IP Address.
- IGMP v.2/v.3 capabilities for multicast are supported
- PROnR outputs only work as Livewire Sources
- PROnR have as many Livewire/AES67 outputs as ports
- GPIO features for Relay firing
- Livewire Standard Stream Clock can be supplied to the network by the receiver
- XDS-PROnR receiver can only work as a master clock, but it cannot act as a slave. Clocking is provided by XDS headend.
- Livewire routing protocols use the same password as set for the user **ADMIN**

Some of the standard requirements are listed below. All are supported by XDS-PROnR receivers unless otherwise indicated.

PORT	PROTOCOL	MULTICAST ADDRESS	PURPOSE	DESCRIPTION
93	RUDP / UDP	Unicast	Livewire Routing Protocol	Used to route Audio and GPIO ports
2055	RUDP / UDP	239.192.255.4	GPIO Events	Used to report changes of the GPIO pins
2060	RUDP / UDP	239.192.255.4	GPIO Commands	Used to send commands to GPIO devices
3999	RUDP / UDP	Unicast	Livewire Advertisement and Source Allocation Protocol	Verbose advertisement and source allocation requests
4001	RUDP / UDP	239.192.255.3	Livewire Advertisement and Source Allocation Protocol	Periodic and verbose announcements. Source allocation state announcements and responses.
5004	RTP / UDP	239.192.255.1	Livestream Clock	For clock synchronization (sent every 250us). This is not supported by the XDS-PROnR receivers.
5004	RTP / UDP	239.192.0.1 to 239.192.128.254	RTP Livewire Audio	Last two address octets pertain to channel ID, e.g. 9999=239.192.39.15 Default RTP parameters: Audio: L24/48000/Stereo Port: 5004
7000	RTP / UDP	239.192.255.2	Standard Stream Clock	For clock synchronization (sent every 30 or 40 ms).

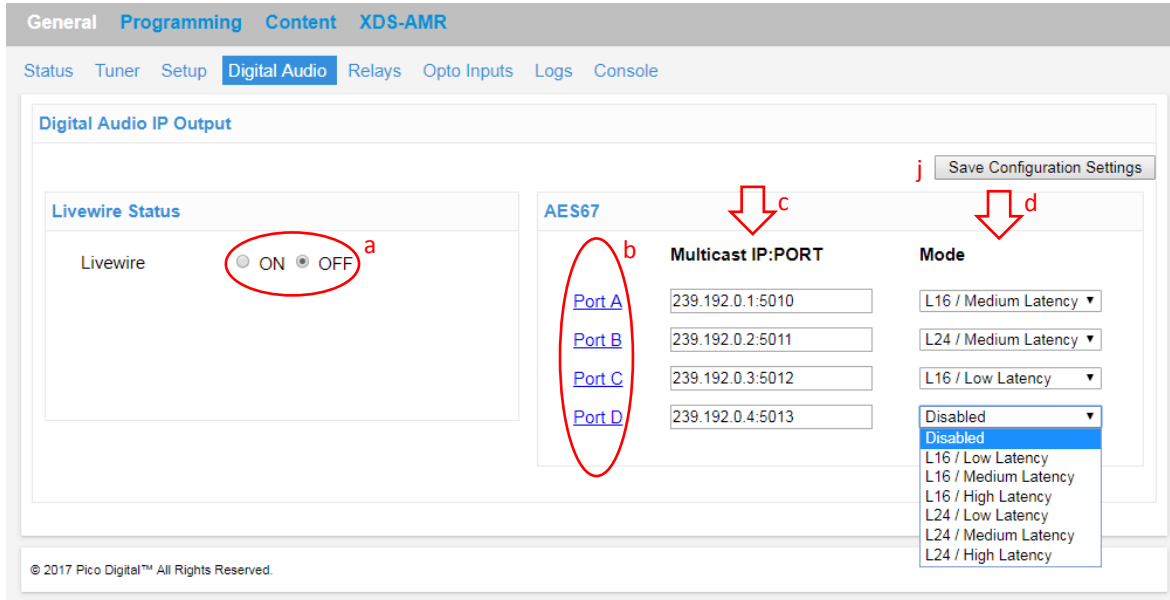
3. SETTING UP AES67 OUTPUT

3.1 WEBSITE USER INTERFACE

The XDS-PROnR website has an interface to set the AES67 streams per port. This webpage is found under General > Digital Audio > Digital Audio IP Output:

- Toggle Livewire Off for AES67
- Downloadable SDP file to listen to AES67 Audio. Must be done on a host that is in LAN2

- c) Set Port outputs:
 - Multicast IP
 - UDP Port
 - Streaming Audio Mode
- d) Set Format and Latency mode, explained in detail in the section 3.2
- e) Edit/Save changes at the top right of the page



3.2 AES67 STREAMING AUDIO MODES

AES67 modes in XDS-PROnR receivers are defined by a combination of encoding formats and network latency. The following AES67 streaming modes are supported:

- a) Disabled
- b) Format L16 – 16-bit linear payload format
 - a. Lower Latency, packet size: 102 bytes (with payload)
 - b. Medium Latency, packet size: 246 bytes (with payload)
 - c. Higher Latency: packet size: 1014 bytes (with payload)
- c) Format L24 – 24 bit linear payload format
 - a. Lower Latency, packet size: 126 bytes (with payload)
 - b. Medium Latency, packet size: 342 bytes (with payload)
 - c. Higher Latency: packet size: 1494 bytes (with payload)

3.3 AES67 COMMAND LINE INTERFACE

All AES67 can be set on the XDS-PROnR receivers through the command line interface over Telnet or Serial connections. Use the command **RTP** on the Hudson> prompt to access the RTP stream menu.

Example:

```
Hudson> rtp
RTP SHOW
RTP port,IP,ip:port      port=A-D, multicast destination ip:port
RTP port,SPP,[n]        port=A-D, samples per packet (12, 48 or 240)
RTP port,FMT,16/24      port=A-D, 16/24
RTP port,DISABLE/ENABLE port=A-D, disable/enable RTP for this port
```

Example of an AES67 setup:

```
Hudson> rtp show
Port:                A
Host:                240.198.0.189:5010
Samples per packet: 12
```

Format: L24
Status: Enabled

Port: B
Host: 240.198.0.190:5011
Samples per packet: 48
Format: L24
Status: Enabled

Port: C
Host: 240.198.0.191:5012
Samples per packet: 240
Format: L16
Status: Enabled

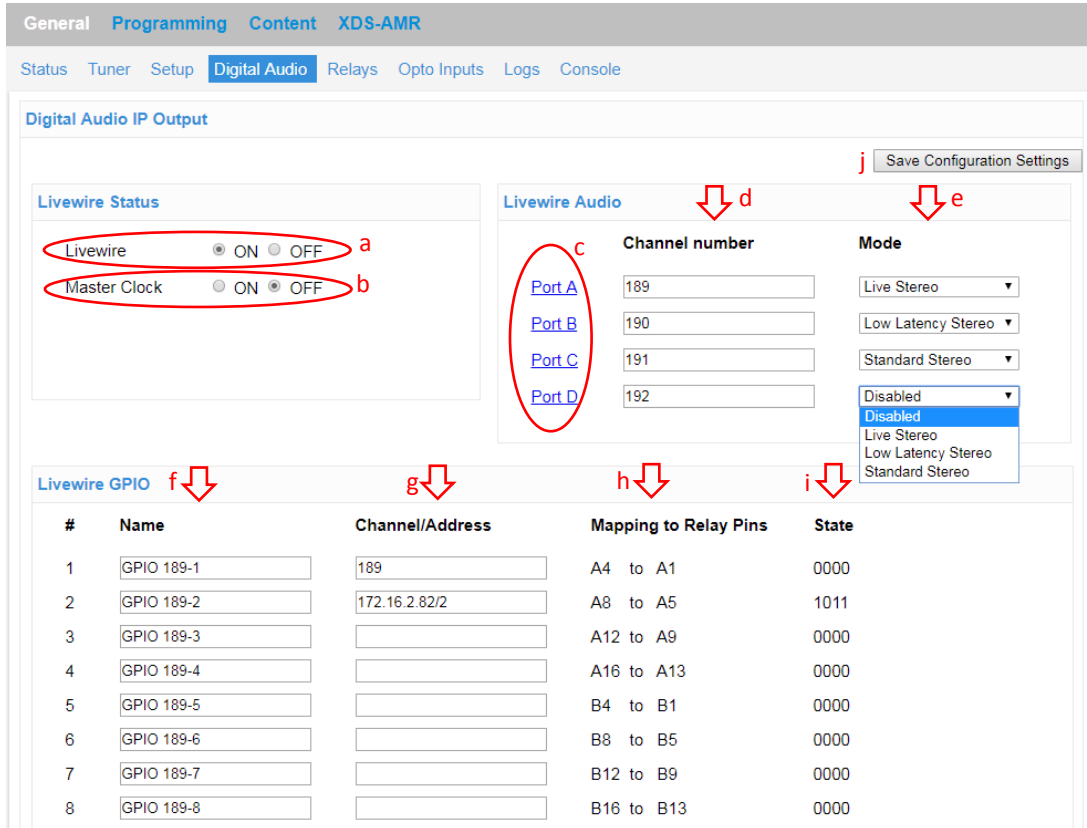
Port: D
Host: 240.198.0.192:5013
Samples per packet: 240
Format: L16
Status: Disabled

4. SETTING UP LIVEWIRE+ OUTPUT

4.1 WEBSITE USER INTERFACE

The XDS-PROnR website has an interface to set the Livewire+ streams per port. This webpage is found under General > Digital Audio > Digital Audio IP Output:

- a) Toggle Livewire On for Livewire Audio
- b) Toggle Livewire Clock On or Off, explained in detail in section 4.3
- c) Downloadable SDP file to listen to Livewire+ Audio. Must be done on a host that is in LAN2
- d) Set Port outputs:
 - Channel Number: Channel will match the last octet in the streaming address in 239.192.0.x range for Livewire.
 - UDP Port: Livewire+ UDP port is 5004, therefore it is not configurable.
 - Streaming Audio Mode
- e) Set Stereo Mode, explained in detail in the section 4.2
- f) GPIO Name, explained in detail in section 4.4
- g) GPIO Channel/Address
- h) GPIO Mapping to Relay Pins
- i) GPIO State
- j) Edit/Save changes at the top right of the page



Livewire Status

Livewire ON OFF **a**

Master Clock ON OFF **b**

Livewire Audio

Channel number Mode

Port A 189 Live Stereo **d** **e**

Port B 190 Low Latency Stereo

Port C 191 Standard Stereo

Port D 192 Disabled

Livewire GPIO

#	Name	Channel/Address	Mapping to Relay Pins	State
1	GPIO 189-1	189	A4 to A1	0000
2	GPIO 189-2	172.16.2.82/2	A8 to A5	1011
3	GPIO 189-3		A12 to A9	0000
4	GPIO 189-4		A16 to A13	0000
5	GPIO 189-5		B4 to B1	0000
6	GPIO 189-6		B8 to B5	0000
7	GPIO 189-7		B12 to B9	0000
8	GPIO 189-8		B16 to B13	0000

4.2 LIVEWIRE STREAMING AUDIO MODES

Livewire+ streaming modes in XDS-PROnR receivers are defined by a combination of packet size and its network latency impact. The following Livewire+ streaming modes are supported:

- a) Disabled
- b) Format Live Stereo, packet size 126 (with payload), network traffic: packets sent out with highest frequency
- c) Format Low Latency Stereo, packet size 342 (with payload), network traffic: packets sent out with low frequency
- d) Format Standard Stereo, packet size 1494 (with payload), network traffic: packets sent out with lowest frequency

4.3 LIVEWIRE CLOCK

Livewire Clock is a UDP output from PROnR based on PCR, which is generated to provide clocking and synchronization to a Livewire network. Livewire units set as Slave will scan the network for a Master clock to synchronize IP audio streams. The XDS-PROnR Receiver can also generate this clock when it is in IP only mode. But it is strongly recommend not to have hybrid settings (SAT and IP mixed setups in network), as this will lead to audio drops due to bad synchronization. The XDS-PROnR clock is available only to the maximum Master priority which is 7. Frequency is 30 or 40 ms. As it is a Livewire Clock class C (Standard Stream Clock), it uses the Multicast IP 239.192.255.2, UDP Port 7000.

4.4 LIVEWIRE GPIO SETUP

Livewire GPIOs (General Purpose Input Outputs) are logical pins that can be controlled over UDP using Livewire+ protocols. At the XDS-PROnR receivers, these GPIOs are tied to the relay pins in groups of 4. Axia units typically are tied to 5 pins, and in this case, the 5th pin of the receiver will be considered always closed. In total, the XDS-PROnR receivers have up to 8 Livewire GPIOs. Inputs and outputs are internally connected in hardware making them bidirectional. On the website, the order of the GPIO pins are as follows: 1 | A4 | A3 | A2 | A1 since GPIO Pin 5 is disconnected (1) GPIO current states can be read on the website and CLI. The value for a disconnected pin is 1, and for a connected pin is 0.

4.4.1 TRIGGERING LIVEWIRE GPIOs

In order to trigger GPIOs and change the states, the XDS-PROnR receiver uses two methods defined in the Livewire standard:

- a) Port Routing: This is used to map a GPIO port to another through the destination unit’s address and GPIO pin number. Note that this assignation can also be made to control XDS-PROnR ports from another Livewire unit.
- b) Channel Assignment: When setting a GPIO to a channel, the receiver will listen to triggered events over the channel to change the GPIO state accordingly. Note that events are triggered only when there is a change (switching on or off a relay). As XDS-PROnR GPIOs are bidirectional, if a state changes due to relay firing and the relay is mapped to a GPIO with a channel assignment, the receiver will send out a UDP notification.

The following screenshot shows how a GPIO mapped to a channel (GPIO 1) and a GPIO mapped to a port (GPIO 2) can be set on the receiver:

Livewire GPIO				
#	Name	Channel/Address	Mapping to Relay Pins	State
1	GPIO 189-1	189	A4 to A1	0000
2	GPIO 189-2	172.16.2.82/2	A8 to A5	1011
3	GPIO 189-3		A12 to A9	0000
4	GPIO 189-4		A16 to A13	0000
5	GPIO 189-5		B4 to B1	0000
6	GPIO 189-6		B8 to B5	0000
7	GPIO 189-7		B12 to B9	0000
8	GPIO 189-8		B16 to B13	0000

4.4.2 GPIO EVENTS

Channel Assignments send GPIO notifications every time there is a change to a Pin, and a channel has been assigned. If a Channel is cleared, the Pins will not reset and the previous state will be preserved.

GPIO Events Multicast are sent to 239.192.255.4 over UDP Source Port: 2060 and UDP Destination Port: 2055

As defined in the Livewire+ standard, triggered events are always sent twice. Keeping in mind that the receiver GPIOs are bidirectional, the following behavior will be seen in a typical relay pulse change:

- 2 events sent -> Relay Closures are usually pulses, and would contain a switch on and off
- 2x events sent -> Input and output tied together at receiver
- 2x events sent -> Livewire protocol requires 2 notifications per change

4.5 LIVEWIRE IGMP ANNOUNCEMENTS

Livewire uses IGMP to join or announce streaming channels over the multicast network. The XDS-PROnR receivers are capable of using IGMP v.3 and v.2 to listen to Livewire traffic in the LAN. Announcements will be made for Livewire channels and master clock.

4.5.1 IGMP v.3 PROCEDURE

The following describes the typical procedure for IGMP querying in a multicast network:

1. A typical multicast switch capable of doing IGMP v.3 queries will send requests to 224.0.0.1.
2. Listeners request to 224.0.0.22 to join groups (source request)
3. Multicast Switch will process queries and forward multicast traffic for each group to the requesting port

4.5.2 IGMP v.2 PROCEDURE

1. A typical multicast switch capable of doing IGMP v.2 queries will send requests to 224.0.0.1
2. Listeners request directly to multicast source to join groups (source request)
3. Multicast Switch will process queries and forward multicast traffic for each group to the requesting port

4.6 LIVEWIRE COMMAND LINE INTERFACE

Similarly to AES67 outputs, Livewire outputs can be set on the XDS-PROnR receivers through the command line interface over Telnet or Serial connections. Use the command **RTP** on the Hudson> prompt to access the RTP stream menu.

Example:

```
Hudson> rtp
RTP SHOW
RTP port,IP,ip:port      port=A-D, multicast destination ip:port
RTP port,SPP,[n]        port=A-D, samples per packet (12, 48 or 240)
RTP port,FMT,16/24      port=A-D, 16/24
RTP port,DISABLE/ENABLE port=A-D, disable/enable RTP for this port
```

Example of a Livewire setup:

```
Hudson> rtp show
Port:      A
Host:      239.192.0.1:5004
Samples per packet: 12
Format:    L24
Status:    Enabled

Port:      B
Host:      239.192.0.2:5004
Samples per packet: 48
Format:    L24
Status:    Enabled

Port:      C
Host:      239.192.0.3:5004
Samples per packet: 240
Format:    L24
Status:    Enabled

Port:      D
Host:      239.192.0.4:5004
Samples per packet: 240
Format:    L24
Status:    Disabled
```

Use the command **LW** at the Hudson> prompt to display the options to set Livewire GPIOs and Clocking

```
Hudson> lw
LW SHOW
LW gpio,NAME,[name]  gpio=1-4
LW gpio,CH,[channel] gpio=1-4
LW ON/OFF            enable/disable Livewire
LW CLK ON/OFF       enable/disable Livewire Master Clock
```

```
Hudson> lw show
GPIO 1
Name:      GPIO 189-1
Channel:   189
State:     0000

GPIO 2
Name:      GPIO 189-2
Channel:   172.16.2.82/2
State:     1011

GPIO 3
Name:      GPIO 189-3
Channel:
State:     0000

...

Livewire:  Enabled
Master Clock: Disabled
```