

# LIVEWIRE FEATURES IN XDS-PROnS RECEIVERS

This feature guide applies to XDS-PROnS receivers v.4.0.22 and above.

## 1. WHAT IS LIVEWIRE?

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 FEATURES IN PROnS RECEIVERS

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

- Requires a 48 kHz sampling rate
- LAN 3 port of the receivers is used for Livewire and AES67 Multicast output.
- The receiver website can be accessed through LAN 1, LAN 2 or LAN 3 IP Address.
- IGMP v.2/v.3 capabilities for multicast are supported
- PROnS outputs only work as Livewire Sources
- PROnS 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-PROnS 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-PROnS receivers unless otherwise indicated.

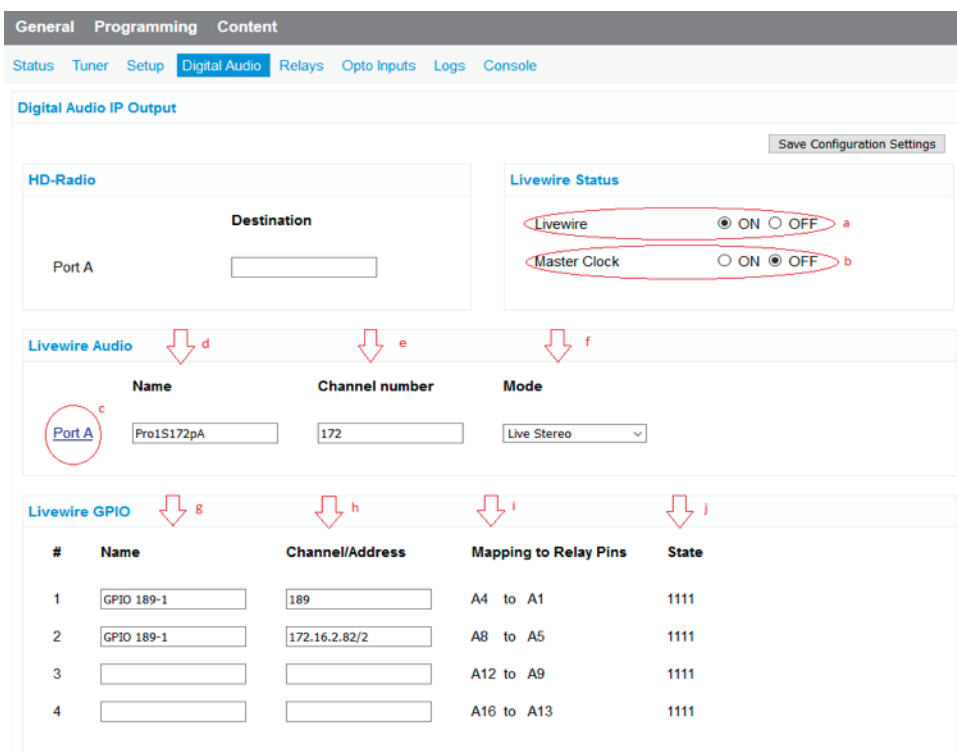
PORT	PROTOCOL	MULTICAST ADDRESS	PURPOSE	DESCRIPTION
<b>93</b>	RUDP / UDP	Unicast	Livewire Routing Protocol	Used to route Audio and GPIO ports
<b>2055</b>	RUDP / UDP	239.192.255.4	GPIO Events	Used to report changes of the GPIO pins
<b>2060</b>	RUDP / UDP	239.192.255.4	GPIO Commands	Used to send commands to GPIO devices
<b>3999</b>	RUDP / UDP	Unicast	Livewire Advertisement and Source Allocation Protocol	Verbose advertisement and source allocation requests
<b>4001</b>	RUDP / UDP	239.192.255.3	Livewire Advertisement and Source Allocation Protocol	Periodic and verbose announcements. Source allocation state announcements and responses.
<b>5004</b>	RTP / UDP	239.192.255.1	Livestream Clock	For clock synchronization (sent every 250us). <b>This is not supported by the XDS-PROnS receivers.</b>
<b>5004</b>	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
<b>7000</b>	RTP / UDP	239.192.255.2	Standard Stream Clock	For clock synchronization (sent every 30 or 40 ms).

## 3. SETTING UP LIVEWIRE+ OUTPUT

### 3.1 WEBSITE USER INTERFACE

The XDS-PROnS 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 3.3
- c) Downloadable SDP file to listen to Livewire+ Audio. Must be done on a host that is in LAN3
- d) Set the Name for the Livewire device
- e) 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
- f) Set Stereo Mode, explained in detail in the section 3.2
- g) GPIO Name, explained in detail in section 3.4
- h) GPIO Channel/Address
- i) GPIO Mapping to Relay Pins
- j) GPIO State
- k) Edit/Save changes at the top right of the page



**Digital Audio IP Output**

Save Configuration Settings

**HD-Radio**

Destination

Port A

**Livewire Status**

Livewire ☒ ON ☐ OFF

Master Clock ☐ ON ☒ OFF

**Livewire Audio**

Name: Port A Channel number: 172 Mode: Live Stereo

**Livewire GPIO**

#	Name	Channel/Address	Mapping to Relay Pins	State
1	GPIO 189-1	189	A4 to A1	1111
2	GPIO 189-1	172.16.2.82/2	A8 to A5	1111
3			A12 to A9	1111
4			A16 to A13	1111

### 3.2 LIVEWIRE STREAMING AUDIO MODES

Livewire+ streaming modes in XDS-PROnS 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

### 3.3 LIVEWIRE CLOCK

Livewire Clock is a UDP output from PROnS 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-PROnS Receiver can also generate this clock when it is in IP only mode. But it is strongly recommended 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-PROnS 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.

### 3.4 LIVEWIRE GPIO SETUP

Livewire GPIOs (General Purpose Input Outputs) are logical pins that can be controlled over UDP using Livewire+ protocols. At the XDS-PROnS 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-PROnS 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.

#### 3.4.1 TRIGGERING LIVEWIRE GPIOs

In order to trigger GPIOs and change the states, the XDS-PROnS 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-PROnS 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-PROnS 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

### 3.4.2 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

## 3.5 LIVEWIRE IGMP ANNOUNCEMENTS

Livewire uses IGMP to join or announce streaming channels over the multicast network. The XDS-PROnS 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.

### 3.5.1 IGMP v.3 PROCEDURE

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

1. A typical multicast network 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

### 3.5.2 IGMP v.2 PROCEDURE

1. A typical multicast network 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

## 3.6 LIVEWIRE COMMAND LINE INTERFACE

Similarly, to AES67 outputs, Livewire outputs can be set on the XDS-PROnS 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*

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