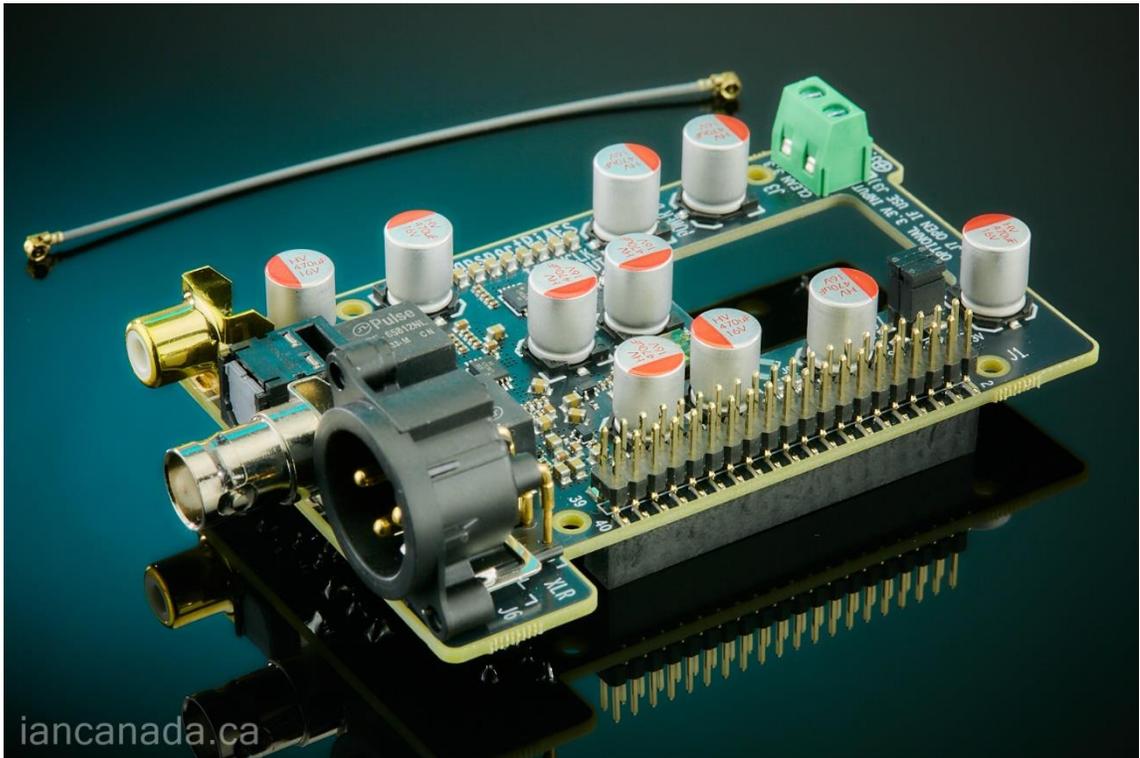# TransportPi AES II

Flagship Ultra-low jitter AES/EBU S/PDIF transport interface

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A. Introduction

TransportPi AES II is a dedicated AES/EBU S/PDIF transport interface board. Compared with all other solutions, it is the first one that uses discrete 50Mbps 1-bit differential driver and dedicated femtosecond clock drivers to achieve the highest signal quality and lowest noise levels for both AES/EBU and S/PDIF outputs. And it also integrates the well-reputed multi-stages 1-bit discrete secondary re-clockers (similar to a ReClockPi) to ensure the best possible low-jitter performance. TransportPi AES II is so far the flagship AES/EBU and S/PDIF transport interface board for audiophiles to improve the sound quality of an external DAC to a highest possible level.

TransportPi AES II works in SYNC clock mode so it will need a FifoPiQ7 or FifoPiMa to operate.

B. Highlighted Features and Specifications

- Flagship AES/EBU S/PDIF transport board with isolated AES/EBU, RCA, Toslink optical outputs and non-isolated BNC output

- Discrete 50Mbps 1-bit differential drive to achieve the best possible AES/EBU signal quality at the lowest noise levels

- Dedicated femtosecond clock drivers for S/PDIF outputs to achieve best possible signal quality and lowest jitter level

- Built-in the well-reputed 1-bit 3 stages discrete secondary re-clockers

- LDO free design to make it directly use the 3.3V ultracapacitor or battery power supply for the best power supply performance

- Could be so far the best AES/EBU and S/PDIF streamer transport interface

- Optimized PCB impedance control for the high speed AES/EBU and S/PDIF signals

- 4 layers PCB design with dedicate shield layers to eliminate EMI noise

- Metal film ultra-low noise resistors to ensure the lowest possible noise level

- Pure sync mode works with FifoPiQ7, FifoPiMa or FifoPiQ3 or other re-clockers.

- Capable of AES/EBU and S/PDIF up to 192KHz. 384KHz is also possible for qualified receiver

- Supports MCLK frequencies from 5.6448MHz to 98.304MHz

- Supports I2S and DoP format as input

C. TransportPi AES II new features

- Featuring new 7.5 fs ultra-low additive jitter clock drivers for both MCLK and S/PDIF signals. This advanced clocking architecture dramatically reduces phase noise to ensure the highest level of sonic purity

- Higher quality, more durable SPDIF/AES digital transformers

- Enhanced power supply filtering/conditioning networks featuring ultra-low ESR and high bandwidth to achieve lowest possible power supply noise floor

- Precision manufacturing to ensure top level hardware engineering quality

- A slightly larger PCB size with improved silkscreen markings for enhanced legibility

D. Layout

E. Getting start

1. Make sure you FifoPi and rest of the system are configured well and working properly.

2. Install the TransportPi AES II into the GPIO port of the FifoPi. Please use the 13mm standoffs to avoid any possible short circuit between PCBs.

3. Connect the MCLK from FifoPi to the J4 of TransportPi AES II by the 4" supplied U.FL coaxial cable.

4. Connect an AES/EBU differential cable or S/PDIF coaxial cable (RCA or BNC) or a Toslink optical cable from the TransportPi AES II output connector J6, J5, J8 or U6 to the AES/EBU or the S/PDIF input of the external DAC.

5. Turn on the power supply. Make sure POWER LED D1 is light up. Play the music files as normal. Enjoy the music.
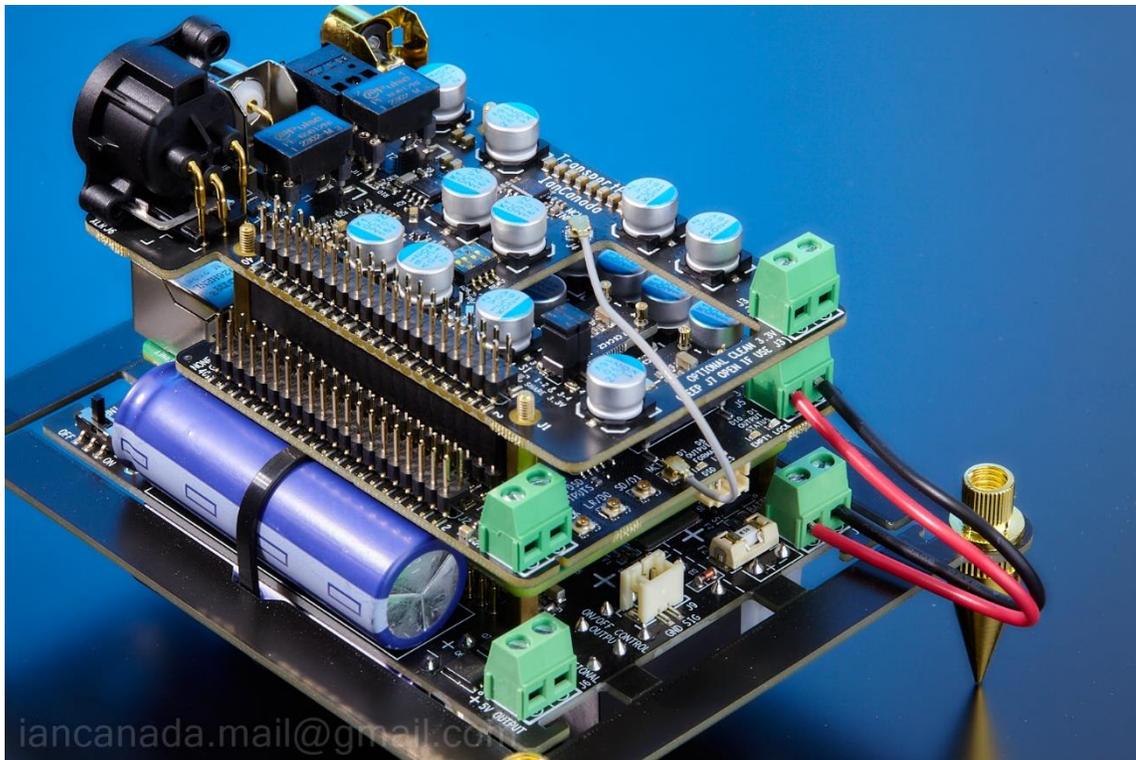
F. Connectors

J6: AES/EBU XLR balanced output connector
Impendence: 110 ohms
Output level: 3V p-p (terminated), 6V p-p (unterminated)
Transformer isolated

J6: RCA S/PDIF coaxial cable output connector
Impendence: 75 ohms
Output level: 0.8V p-p (terminated)

Transformer isolated

J8: BNC S/PDIF coaxial cable output connector

Impendence: 75 ohms

Output level: 0.8V p-p (terminated)

Direct drive non-isolated (for lower jitter)

J6: Toslink S/PDIF opticial output connector

Optical isolated

J4: External MCLK input (u.fl coaxial cable socket)

Must connect an external MCLK signal from a FifoPi, FifoPiMa or other re-clocker using a u.fl coaxial cable.

J1, J2: 40 pin GPIO connectors

pin number	J2 40 PIN GPIO connector to board below (Raspberry Pi, IsolatorPi I/II, FiFoPi, or similar)	J1 Optional 40 PIN GPIO connector to HAT on top
1,17	3.3V from preceding board	3.3V from preceding board
2,4	5V or 3.3V from preceding board	5V or 3.3V from preceding board
6,9,14,20, 25,30,34, 39	GND	GND
12	SCK input	SCK from preceding board
35	LRCK/DL input	LRCK/DL PIN from preceding board
40	DATA/DR input	DATA/DR PIN from preceding board
All other pins	same pin from preceding board	same pin from preceding board

40 pin GPIO connector note: All input/output signals are LVTTL (3.3V) logic level except power and ground.

J3: Optional 3.3V DC power supply input

By default, TransportPi AES II takes 3.3V power supply from FifoPi clean side through GPIO. If you want an independent power supply for TransportPi AES II, you can connect a 3.3V (100mA or higher) power supply to the 2-pin 5.0mm terminal J3. MAINTAINING CORRECT POLARITY!!! J7 jumpers must keep open in this case. Low noise linear 3.3V power supply will be good for TransportPi AES II. 3.3V ultracapacitor or LifePO4 battery power supplies are great and highly recommended.

J7: Power supply jumpers

Jumpers	Short (default)	Open

1-2	Takes 3.3V power supply	Takes 3.3V power supply from J3
3-4	from FifoPi through GPIO	

G. Jumper switch S2 for MCLK frequency settings

Switch pins	Settings	MCLK frequencies to use
1	1 ON, all others OFF	MCLK: 22.5792/24.5760 MHz
2	2 ON, all others OFF (default)	MCLK: 45.1584/49.1520 MHz
3	3 ON, all others OFF	MCLK: 90.3168/98.3040 MHz
4	N/A	N/A

H. Digital Transformer sockets

T1: Digital transformer for the AES/EBU output

T2: Digital transformer for the RCA output

The default transformers are PE65652. For the possible upgrade to the sound quality, they can be replaced with the higher-grade transformers by just plugging into the sockets.
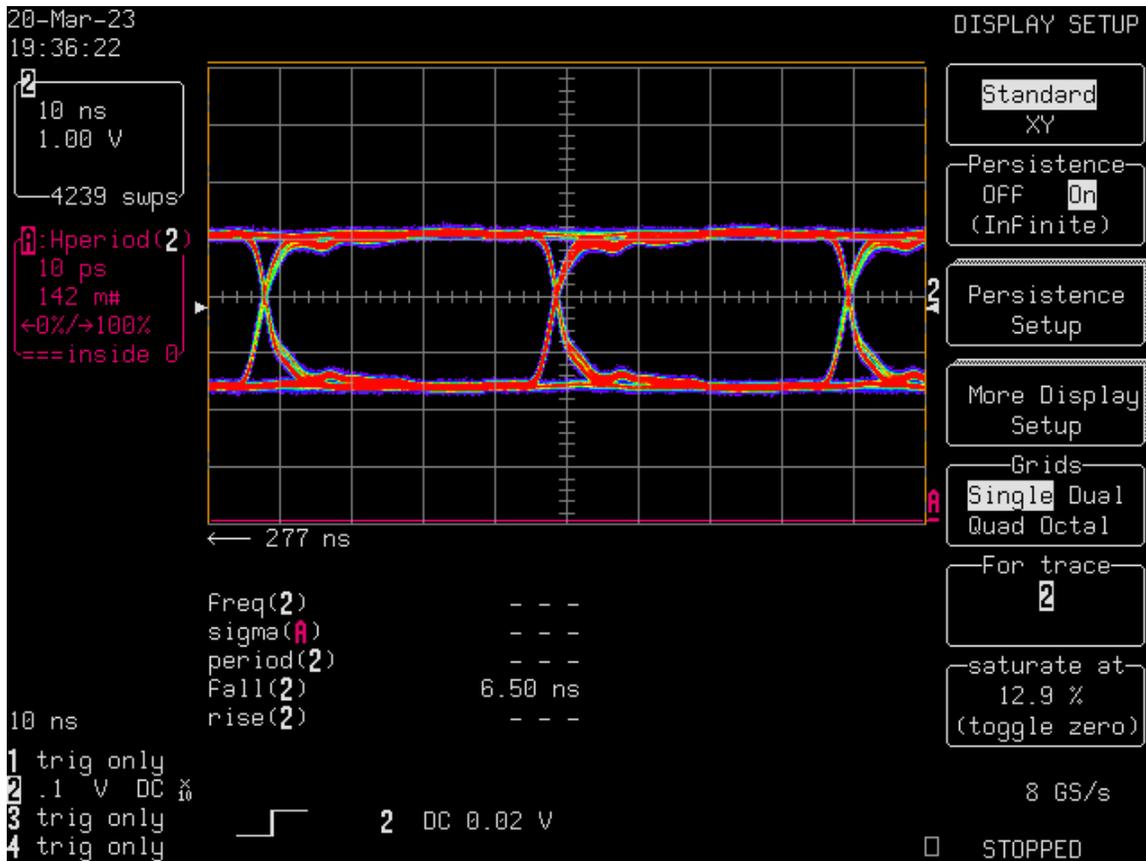
I. LED indicator

D1: Power indicator, Light up to indicate that the 3.3V power supply is applied.

J. AES/EBU signal quality

The eye pattern measurement of the TransportPi AES II's AES/EBU 192 KHz digital output signal after 6 feet XLR balanced cable.

110 ohms terminated, Bandwidth: 1GHz, Sampling rate: 8GS/s

```
20-Mar-23                                    DISPLAY SETUP
19:36:22
2                                          ┌─────────────┐
  10 ns                                    │ Standard    │
  1.00 V                                   │     XY      │
                                           └─────────────┘
    4239 swps                              ┌─Persistence─┐
                                           │ OFF    On   │
 A:Hperiod(2)                              │ (Infinite)  │
  10 ps                                    └─────────────┘
  142 m#                                   ┌─────────────┐
 ←0%/→100%                                 │ Persistence │
  ===inside 0                              │   Setup     │
                                           └─────────────┘
                                           ┌─────────────┐
                                           │ More Display│
                                           │   Setup     │
                                           └─────────────┘
                                           ┌───Grids─────┐
                                           │ Single Dual │
     ←  277 ns                             │ Quad Octal  │
                                           └─────────────┘
                                           ┌─For trace───┐
          Freq(2)           - - -          │     2       │
          sigma(A)          - - -          └─────────────┘
          period(2)         - - -          ┌─saturate at─┐
          Fall(2)          6.50 ns         │   12.9 %    │
 10 ns    rise(2)           - - -          │(toggle zero)│
                                           └─────────────┘
 1 trig only
 2 .1  V  DC ×10
 3 trig only       ___┌─      2  DC 0.02 V          8 GS/s
 4 trig only          ─┘                    □   STOPPED
```

K. Application examples

1. Compact size Ultra-low jitter Raspberry Pi AES/EBU AND S/PDIF transport

Components
(1). TransportPi AES II
(2). FifiPi Q7 (or FifoPi Q3, or FifoPi Ma)
(3). MonitorPi (optional)
(4). Raspberry Pi

Power supply
PurePi

Connections
(1). Connect the MCLK from FifoPi to J4 of TransportPi AES II
(2). Connect the 3.3V pure battery output from J2 of PurePi to 3.3V clean side DC input of FifoPi

2. **Full function Ultra-low jitter Raspberry Pi AES/EBU, S/PDIF I2S/DSD over HDMI transport**
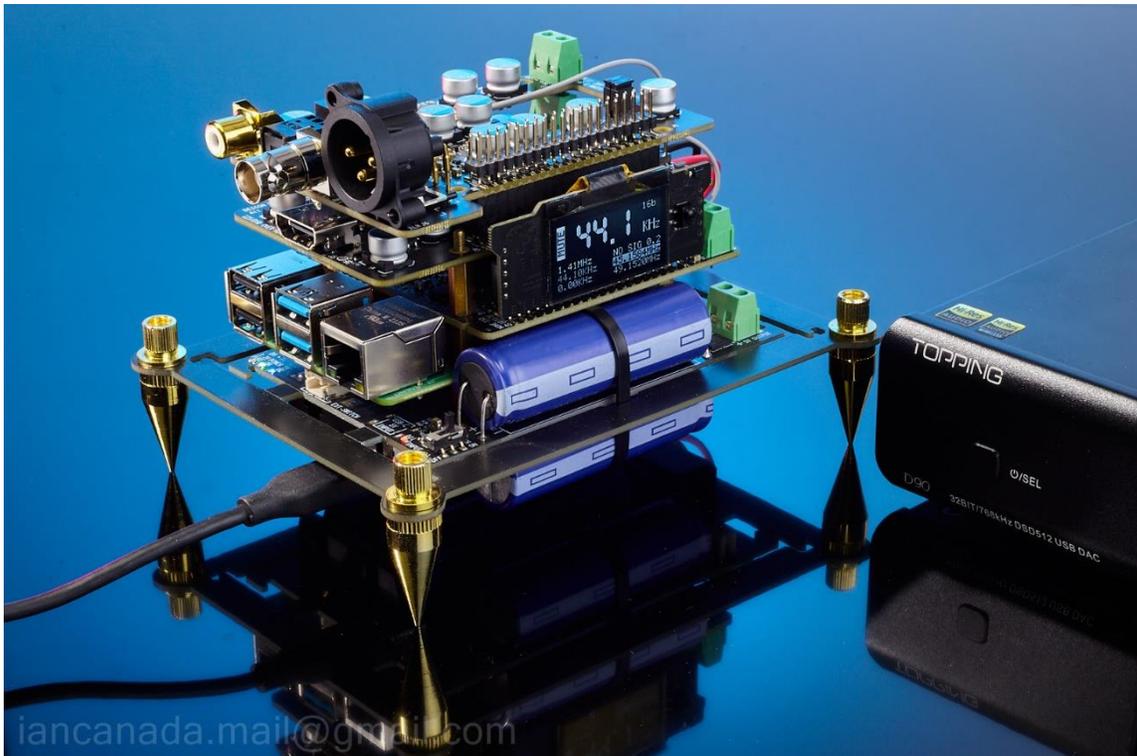
   Components
   (1). TransportPi AES II
   (2). HdmiPi Pro
   (3). FifiPi Q7 (or FifoPi Q3, or FifoPi Ma)
   (4). MonitorPi (optional)
   (5). Raspberry Pi

   Power supply
   PurePi

   Connections
   (1). Connect the MCLK from FifoPi to J4 of TransportPi AES II
   (2). Connect another the MCLK from FifoPi to J4 of HdmiPi Pro
   (3). Connect the 3.3V pure battery output from J2 of PurePi to 3.3V clean side DC input of FifoPi

3. Flagship AES/EBU, S/PDIF and I2S/DSD over HDMI transport

Components
(1). TransportPi AES II
(2). HdmiPi Pro (optional)
(3). FifiPi Q7 or FifoPi Q3
(4). StationPi Pro
(5). GEN4-ULCD-24PT Touch screen
(6). Raspberry Pi
(7). Amanero Combo384 or compatible size USB streamer (optional).

Power supply
(1). LinearPi 5V + UcConditioner 5V
(2). LifePO4 Mini + UcConditioner 3.3V
(3). Hammond 1182N6 transformer

Connections
(1). Connect the MCLK from FifoPi to J4 of TransportPi AES II
(3). Connect another MCLK from FifoPi to J4 of the HdmiPi Pro (optional)

(4). Connect the 3.3V output from UcConditioner 3.3V to 3.3V clean side DC input of FifoPi

(5). Connect the 5V output from UcConditioner 5V to the 5V input of StationPi pro.

(6). Keep both jumpers at J9 on StationPi Pro short to share 5V with FifoPi Pi side

(7). Connect the control cable from FifoPi to StationPi Pro

4. Flagship Raspbarry Pi CM5 AES/EBU, S/PDIF transport

Components
(1). TransportPi AES II

(2). FifiPi Q7 III or other FifoPi versions

(3). MonitorPi Pro with GPIO extension KIT

(4). Raspberry Pi CM5

(5). StationPi CM5

Power supply
StationPi CM5's Conditioning 5V + ultra-low Linear 3.3V