



WorldNet Rio Operational Manual

Declaration of Conformance

We the manufacturer

Audio Processing Technology Ltd.
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Declare that the product

WorldNet Rio

is in conformance with the

Radio Equipment & Telecommunications Terminal Equipment (R&TTE) Directive 1999/5/EC.

On behalf of Manufacturer/Importer

Date:

Signature:

Name:

Company Profile

Audio Processing Technology is at the forefront of digital audio data compression technology, supplying that technology in a variety of forms to leading manufacturers of broadcast, professional audio, associated video and telecommunications equipment throughout the world.

The highly acclaimed apt-X™ 4:1 compression algorithm was created at the company's Belfast headquarters where a continuing programme of research and development ensures that future generations of APT products will be equally commercially attractive.

The standard and enhanced versions of the apt-X™ algorithm have been designed to permit wide bandwidth audio, stereo or mono to be carried over low capacity digital telecommunications networks. Alternatively, four times as much audio data can be stored on hard disk, optical and other solid state storage systems.

APT has been acknowledged worldwide as an authority in the field of digital audio data compression. The magnitude of their success can be measured by the hundreds of thousands of apt-X™ based devices in daily use.

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APT Ltd reserves the right to make any changes, without notification, to their products and manual.

Important safety notices

Electrical Supply (UK and Ireland users only)

The connecting wires in the electrical supply comply with the following colour code.

Green & Yellow	Earth
Blue	Neutral
Brown	Live

The green & yellow coloured wire must be connected to the supply plug terminal marked with the letter E or by the  symbol and coloured green or green & yellow.

The blue coloured wire must be connected to the supply plug terminal marked with the letter N or coloured black or blue.

The brown coloured wire must be connected to the supply plug terminal marked with the letter L or coloured red or brown.

SELV Ports

SELV stands for Safe Extra Low Voltages as defined in EN60950. All SELV ports must only be connected to SELV type equipment.

TNV1 Ports

TNV1 stands for Telecommunications Network Voltages type 1. All TNV1 ports must only be connected to TNV1 networks.

Warning

To prevent fire or shock hazard, do not expose this unit to rain or any type of moisture.

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About this manual

The operations manual is intended for installers and operators of the WorldNet Rio digital audio network transmission link. This manual describes the function, installation and use of the unit and provides an overview of the apt-X™ technology.

Unpacking and inspection

After unpacking:

Check the unit for damage during shipping. Immediately report any damage back to the distributor.

Check that the list of contents is complete.

WorldNet Rio Serial Number.....(please complete)

Mains supply connector lead.

Product Overview

The WorldNet Rio is a full duplex multi-channel, multi-algorithm audio codec. It was designed to meet the requirement for a universal codec with the capacity to interface with any of APT's previous products. This is also the first commercial product to incorporate both the standard and enhanced versions of apt-X™ carried on a single Motorola DSP563xx device.

The unit is capable of delivering high quality audio found in inter studio networking, remote/outside broadcasts and STL/TSL applications. It suitable for use in either AM, FM, DAB and other broadcast and professional audio environments. Enhanced apt-X™ offers 16, 20 and 24 bit operation as an extension to the performance of the original 16 bit algorithm. This has advantages for companies involved in audio track mastering applications that require increased bandwidth and dynamic range. The available audio bandwidths, while dependent on the network bit rate and the resolution of the desired audio will range from 3.81kHz to 22.86kHz in stereo mode and 7.62kHz to 24.38kHz when set for mono operation.

When the unit is interfaced with an X21 formatted digital telecom network the input/output data rates required to deliver the above audio bandwidths range from 56kbit/s through to 576kbit/s.

The WorldNet Rio is fully software driven, controlled and monitored through the front panel keyboard and LCD display. A headphone socket mounted on the front panel provides for additional monitoring of the audio input or output. The rear panel audio I/O's can be switched to accept either analogue or digital signals and if required the digital output can be synchronised/locked to an external digital reference signal.

Loaded with the **standard** and **enhanced** versions of the low delay apt-X™ algorithms the WorldNet Rio can be configured for operation in the following PCM formats:

Standard apt-X™ at 16bit PCM.

This ensures that the unit is backwards compatible with existing standard apt-X™ products based on the Lucent DSP16A device.

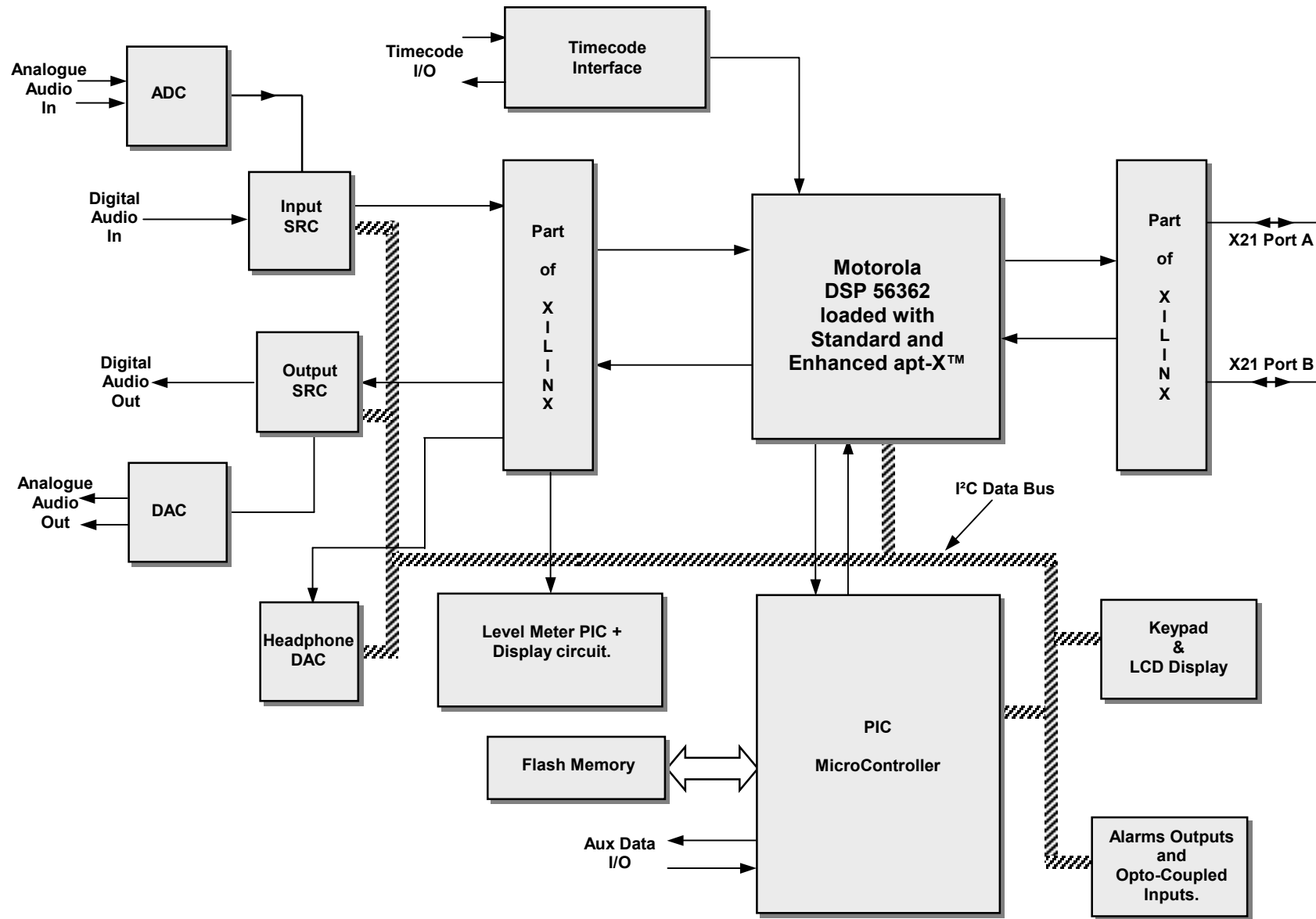
Enhanced apt-X™ at 16bit, 20bit and 24bit PCM.

Advances in DSP technology have led to this introduction of the enhanced apt-X™ algorithm. A single Motorola DSP563xx device provides increased stereo and mono audio channel capability and simultaneous full duplex operation. There has also been a reduction in signal processing delay, improvements in audio quality and increased dynamic range

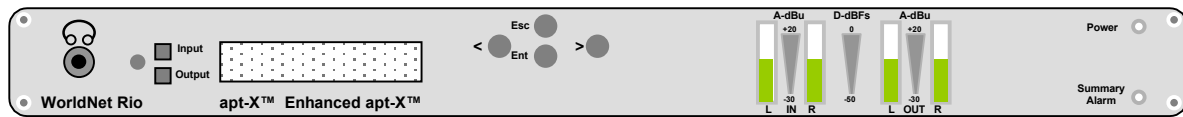
These improvements and extensions in the performance of apt-X™ will guarantee that the algorithm will meet the demands of current and future PCM standards.

Additional interfaces allow for the connection of Auxiliary and Timecode data plus Alarms and Opto-coupled control.

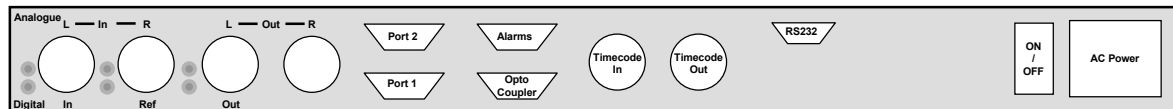
WorldNet Rio Functional Diagram



Front Panel Layout



Rear panel layout



Operational Modes

The WorldNet Rio has three I/O modes of operation:

1. Analogue I/O

The audio clocks and recovered network clocks will be asynchronous to each other. The SRC's will provide the data buffer for the apt-X™ DSP.

2. Digital I/O

With SRC's ON and the audio clocks referenced to either the AES receiver or AES Reference input. The audio clocks and recovered network clocks will be asynchronous to each other and the SRC's will provide the data buffer for the apt-X™ DSP.

3. Analogue I/O in Low Delay Mode

The audio clocks will be derived from the network clock and thus synchronous with the apt-X™ DSP. The SRC's can now be bypassed thus reducing the signal processing delay. The table on page 20 indicates which modes are low delay.

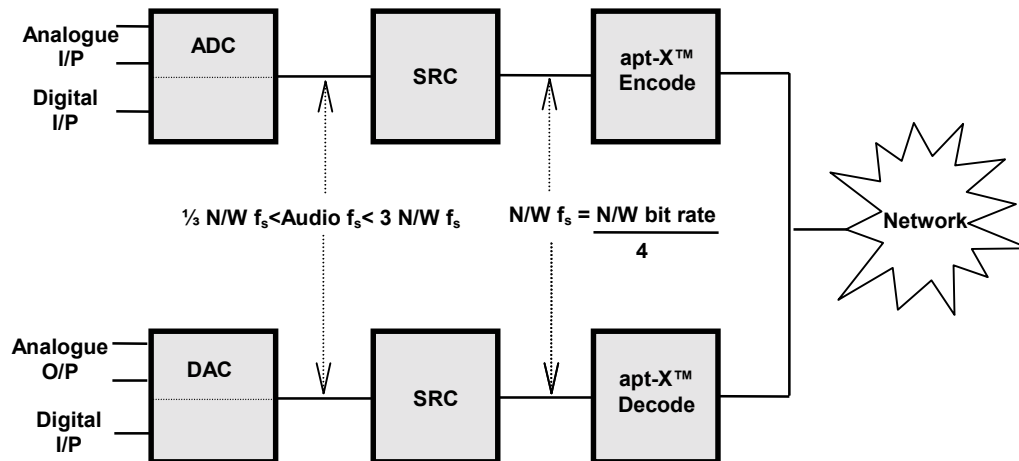
Digital Reference

In the REFERENCE mode the digital audio O/P can be synchronised/locked to one of three external digital reference signals, 32, 44.1 or 48kHz. If the sampling frequency of the audio is different from the reference signal but by a factor of less than 3:1 then the SRC module should function satisfactorily and pass audio to the output. The sampling frequency of the output audio will have been up or down converted to match the frequency of the reference signal.

Sample Rate Converter

When the apt-X™ algorithm is used to reduce the bit rate of a digital audio signal prior to transmission over a digital communications circuit, then the encoder/decoder sampling frequency is one quarter of the data rate of that circuit.

The sample rate converter accepts digital audio at one sample rate and either up or down converts it to match the requirements of the network. For satisfactory operation the sampling frequency of the audio signal must be somewhere in the range, greater than one third, or less than three times the network sampling frequency (see Fig).



Autosync

AutoSync is an integral feature of the WorldNet Rio and is automatically enabled when the unit is operating normally. This is a proprietary automatic synchronisation facility that enables the apt-X™ compressed audio data stream to be decoded without prior knowledge of the compressed word boundaries. This enables the compressed audio data to be handled using only bit timing, no word clock being required. Synchronisation is obtained by periodically inserting a unique 10 bit sync word into the compressed audio data stream. The compressed word boundaries are established when three successive sync words have been identified by the decoder. Synchronism is normally lost only under very adverse channel error conditions (BER of 1:100) at which point the output is muted until synchronisation, through autosync, is very quickly restored.

Rear Panel Connectors

Analogue Input/Outputs

The analogue audio **inputs** and **outputs** consist of balanced Left and Right, line level channels. The audio bandwidth capability ranges from 10Hz to 3.5kHz stereo through to a maximum 22kHz stereo. Audio I/O levels are fixed and will accept and output audio levels up to a full scale range of +18dBu. The input impedance is selectable between 600Ω and 10kΩ and the output impedance is selectable between 600Ω and 50Ω. The I/O's are via two female and two male XLR-3 rear panel mounted connectors with pin connections as shown below.

NB: The Left audio channel I/O connectors can be switched to accept either analogue or digital audio signals. The Right audio channel **input** connector can also be switched to accept a digital reference input signal.

NB: These are SELV (Safe Extra Low Voltage) connections and must only be connected to other SELV ports

Digital Input/Output

These I/O's conform to the AES/EBU standard with impedances of 110Ω and sampling frequencies of 32, 44.1 and 48kHz. Pin connections are as shown.

NB: The Left audio channel I/O connectors can be switched to accept either analogue or digital audio signals.

NB: These are SELV (Safe Extra Low Voltage) connections and must only be connected to other SELV ports

XLR-3 MALE		XLR-3 FEMALE	
Pin No.	Function	Pin No.	Function
1	Screen	1	Screen
2	+ve Signal Out	2	+ve Signal In
3	-ve Signal Out	3	-ve Signal In

Reference In

An external digital reference signal can be connected via the Digital Reference In XLR-3 male connector on the rear panel of the unit. When switched to Reference mode the Rio digital audio O/P can be synchronised with this reference signal. The XLR male pin connections are as shown.

NB: The digital reference input connector can also be switched to accept the right audio channel input

X21 DTE/DCE Interfaces

This section transmits compressed data **to** and receives compressed data, clock Indicate and byte signals **from** an externally connected NTU. It also contains the Phase Lock Loop (PLL) function to enable synchronisation with the digital network.

The two 15 way D type female connectors Port 1 CN2-B and Port 2 CN2-A found on the rear panel have the following pin connections:

NB: These are SELV (Safe Extra Low Voltage) connections and must only be connected to other SELV ports.

X21 ports 15 way D type Female			
Pin No		Signal	Description
Port 2	Port 1		
1	16	N/U	
2	17	Tx +	Transmit Data +ve
3	18	Control +	X21 Control +ve
4	19	Rx +	Receive Data +ve
5	20	Indicate +	X21 Indicate +ve
6	21	Clk +	X21 Clock +ve
7	22	Clk +	Byte Clk +
8	23	Common	
9	24	Tx -	Transmit Data -ve
10	25	Control -	X21 Control -ve
11	26	Rx -	Receive Data -ve
12	27	Indicate -	X21 Indicate -ve
13	28	Clk -	X21 Clock -ve
14	29	Clk -	Byte Clk -
15	30	N/U	

Auxiliary Data Interface

The RS232 auxiliary data channel of the WorldNet Rio can offer continuous data transfer rates of 4, 6, 8 and 12kbit/s ie $\frac{1}{4}$ of the selected sampling frequency. With asynchronous characters the data stream is usually non-continuous. To enable the higher baud rates to operate when the 16kHz sampling frequency is selected the WorldNet Rio utilises rate adaption, provided by FIFO's at the receive and transmit ends of the link. This is only valid as long as the average data rate is still less than $\frac{1}{4}$ of the selected sampling frequency. Special care must therefore be taken at baud rates of 4800 and 9600 when the 16kHz sampling frequency is selected.

The RS232 connector is accessed on the rear panel and is connected as follows:

NB: This is a SELV (Safe Extra Low Voltage) connection and must only be connected to another SELV port.

Aux data 9 way D type Female		
Pin No.	Signal	Description
2	T X	Transmit data
3	R X	Receive data
5	GND	Ground
1,4,6,7,8,9	NC	Not Connected

Alarms

Connection to the alarms port is via a 15 way male 'D' type connector CN3-A with pin out details as shown.

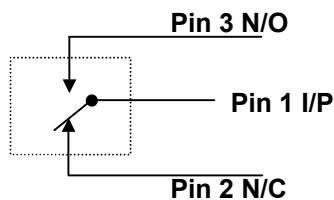
This port provides a means for remotely monitoring the status of the following five operating conditions within the unit.

1. Audio
2. Autosync
3. Network
4. Port2 active
5. Summary alarm, a logical OR of alarms 1-4

Alarm port 15 way 'D' type Female		
CN3-A Pin No	Signal	Function
1	Audio I/P	Audio alarm input
2	Audio N/C	Audio alarm O/P Normally Closed
3	Audio N/O	Audio alarm O/P Normally Open
4	Autosync I/P	Autosync alarm input
5	Autosync N/C	Autosync alarm O/P Normally Closed
6	Autosync N/O	Autosync active O/P Normally Open
7	Network I/P	Network alarm input
8	Network N/C	Network alarm O/P Normally Closed
9	Network N/O	Network alarm O/P Normally Open
10	Port 2 I/P	Port 2 active alarm input
11	Port 2 N/C	Port 2 active alarm O/P Normally Closed
12	Port 2 N/O	Port 2 active alarm O/P Normally Open
13	Summary I/P	Summary alarm input
14	Summary N/C	Summary alarm O/P Normally Closed
15	Summary N/O	Summary alarm O/P Normally Open

ALARM 1

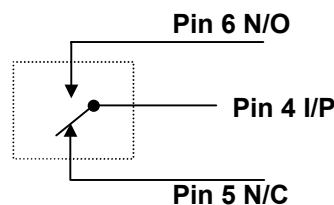
Audio alarm



Indicates a loss of digital reference. (only available when Digital Output is set to REF). This alarm will reset automatically when the digital reference is restored.

ALARM 2

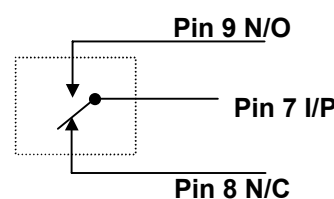
Autosync alarm



Alarm 2 will reset automatically when the autosync data signal is detected.

ALARM 3

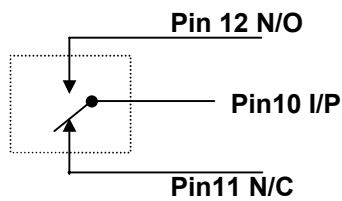
Network alarm



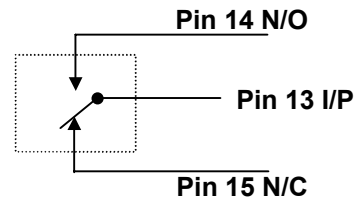
There is a sequence priority for Alarm 3, the highest priority being (a)

- (a) Loss of Port 1 INDICATE signal
- (b) Network bit rate mismatch
- (c) Loss of PLL Lock
- (d) Loss of autosync. (see also Alarm 2)

The alarm will automatically reset when ALL the network conditions are restored.

ALARM 4**Port 2 Active
alarm**

When activated this alarm indicates that the Backup function has been enabled and the data circuit through Port 2 is in use.

ALARM 5**Summary
Alarm**

The summary alarm is activated when the unit is switched ON. It will be de-activated by any of alarms 1-4, or by a loss of power.

Opto-coupler/Isolator

This connector can only be enabled when Enhanced apt-X™ is being used. It is controlled via the menu options:
User Settings/Remote Status and Remote Input.
(See Page 23)

The opto-coupler, a 15 way 'D' type female connector CN3-B will accept a mix of up to a maximum of four **DC** (+5 to -30volts) or Normally closed (**N/C**) or open (**N/O**) contacts. These signals are then converted to data and embedded in the main data stream.

When this feature is enabled then the contacts of alarm relays 1 to 4 on both the local and remote Rio's are disconnected from their normal operation and their circuits are extended to the connector pins as shown in the table. The alarm circuitry can now be used to transport any other user defined control and/or monitoring signals for other peripheral equipment. The Summary alarm is not affected and remains active as before.

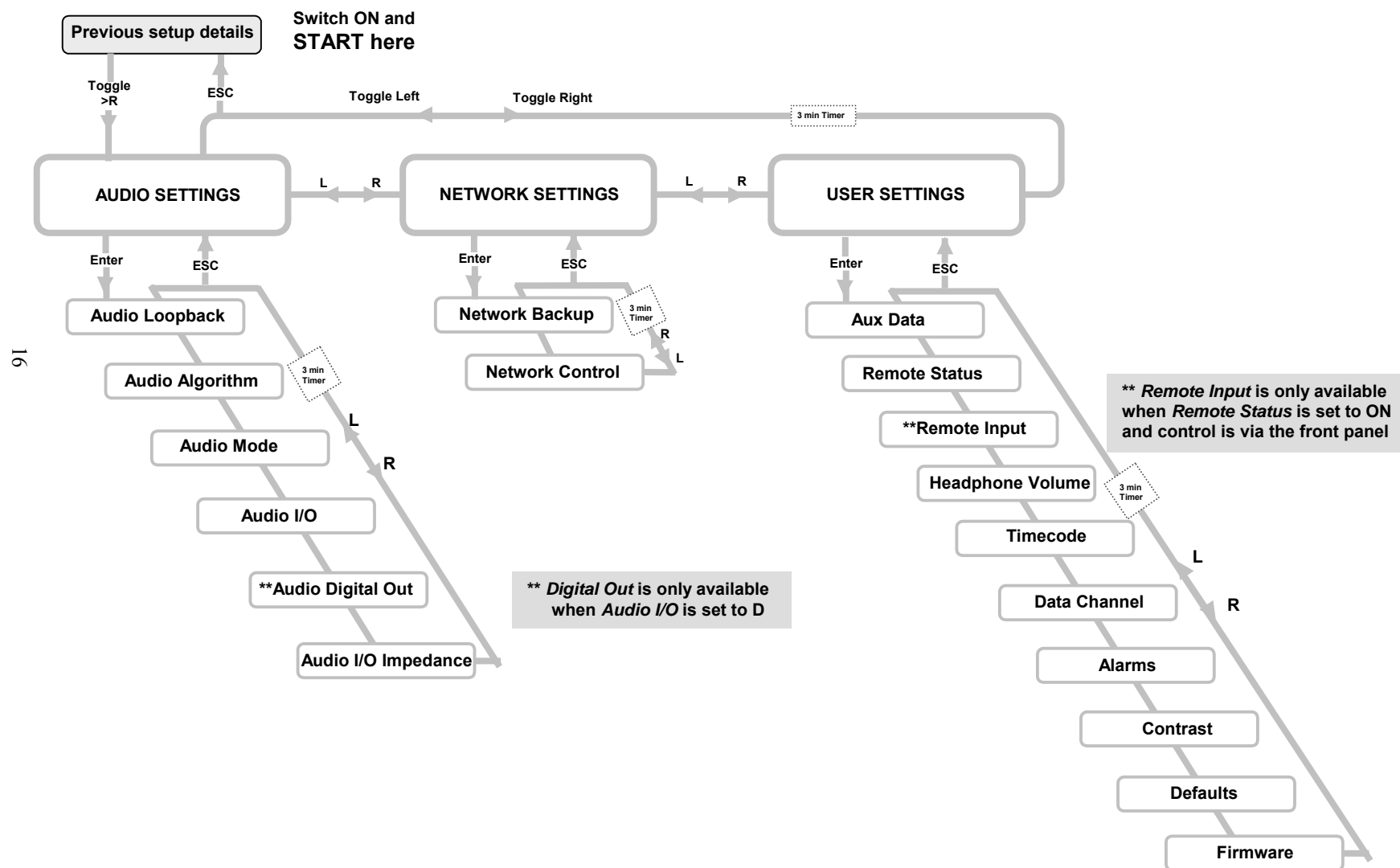
CN3-B Pin No	Signal/Function
16	+ve Alarm 1
17	Clean Alarm 1
18	+ve Alarm 2
19	Clean Alarm 2
20	+ve Alarm 3
21	Clean Alarm 3
22	+ve Alarm 4
23	Clean Alarm 4
24	-ve Alarm 1
25	Gnd
26	-ve Alarm 2
27	Gnd
28	-ve Alarm 3
29	Gnd
30	-ve Alarm 4

Menu Navigation Guide

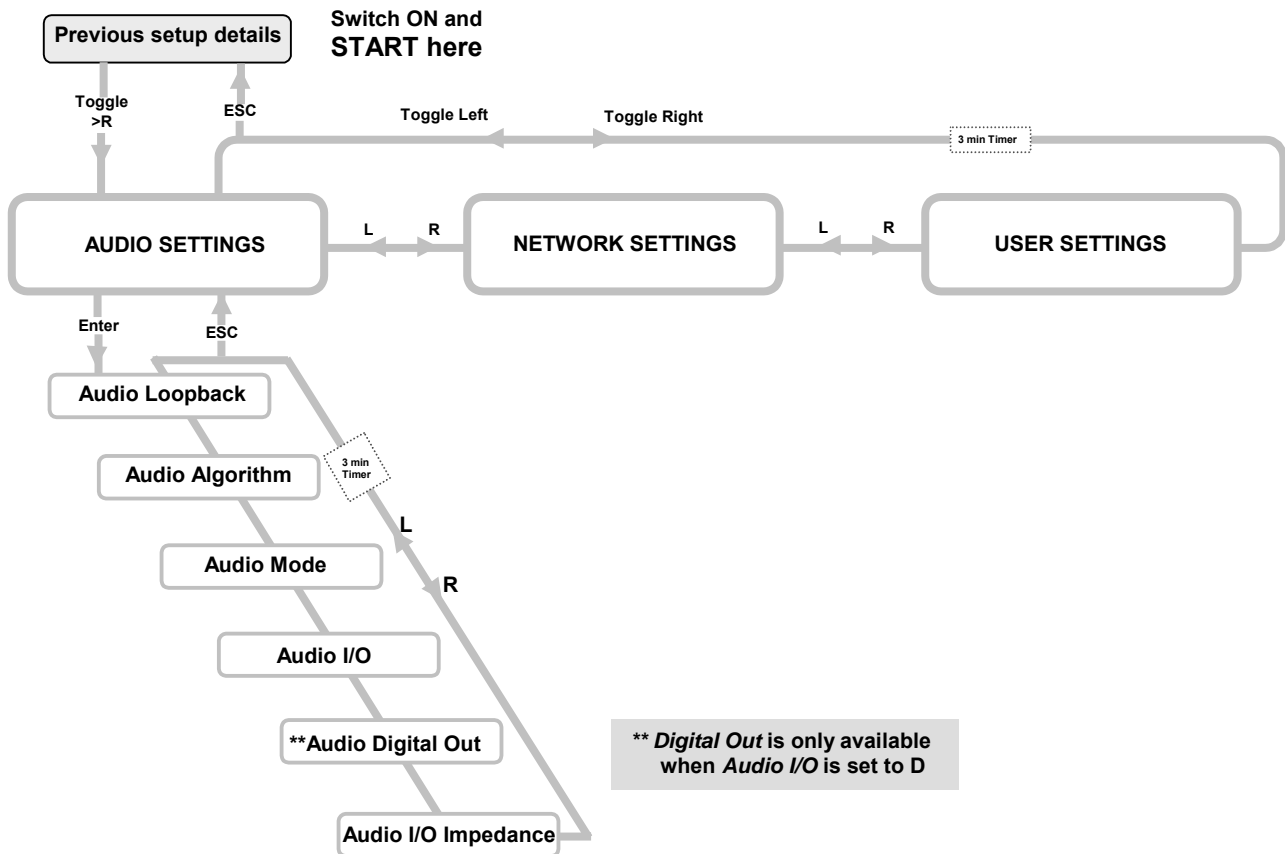
The following main menu and others to follow are designed to assist the operator in moving through the menu settings to access a wide range of options. From the initial display, pressing forward toggle > will access the **AUDIO SETTINGS** options. A combination of the < and > toggle keys and the **ENTER** and **ESC** keys are used to move the display in and out of the menu loops and through the various options. Any option can be changed by moving to it and pressing **ENTER** and then following the specific screen instructions. Pressing **ENTER** will confirm the new option. Pressing **ESC** the required number of times will return to the initial display.

NB: If left in any of the menu loops the system will revert to the **START** position after 3 mins.

Main Menu



Audio Settings Menu



Audio Settings

The Audio Settings Menu enables access to control six options as shown on the menu chart.

Loopback

There are two test options available on the Rio unit, **Local Loop** and **Remote Loop** and both are effective in either the analogue or digital operational mode.

Local Loopback

(a) with no network connected

In a test situation this feature will check:

the local Rio unit **only** at maximum bandwidth stereo.

(b) with X21 network connected

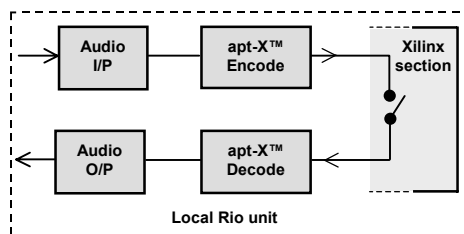
the local Rio at maximum bandwidth stereo

plus

the network and the remote Rio at the maximum audio bandwidth as defined by the network bit rate (eg 15kHz stereo for 256kbit/s).

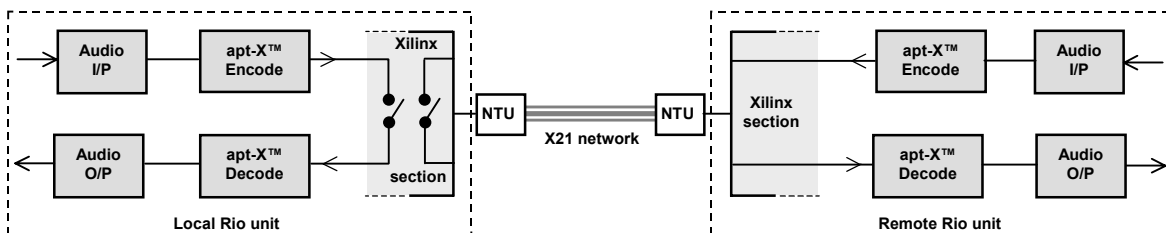
(a) Local Rio unit only

With no network connected a circuit loopback is placed within the line section of the Xilinx module. A stereo audio input will then be coded at the maximum bandwidth stereo available, as defined by the algorithm selected. The encoded signal is then looped back to the decode process and the audio outputs.



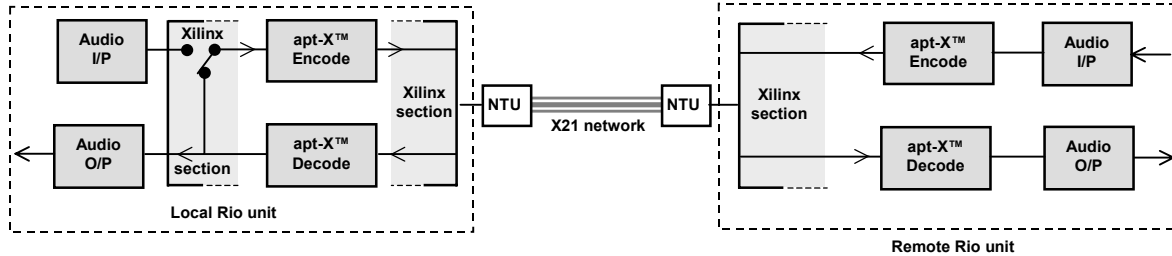
(b) Local and remote Rio units connected to the X21 network.

With a network connected and contact established between two Rio units, as well as the test loop being placed as for (a), then, additionally the local Rio Xilinx controller will also provide a loop back to the remote Rio. If the remote Rio is set up for normal operation with audio signals applied then this loopback will provide a test of the network terminating units at both ends of the link, the X21 network and the encode and decode processes of the remote Rio. The local Rio will again be tested at the maximum stereo bandwidth available. However, the audio bandwidth of the test as monitored at the remote Rio will be determined by the X21 network bit rate and the algorithm selected.



Remote Loopback

With contact established between two Rio units and the local Rio set in Remote Loop mode a section of the Xilinx will provide a loop back to the remote Rio. With the remote Rio set for normal operation with audio signals applied then this loop will provide a test of the network terminating units at both ends of the link, the X21 network and the encode and decode processes of **both** Rio units. During this test the audio input to the local Rio will be disconnected however, the audio signal from the remote Rio can still be monitored at the output of the local unit. The audio bandwidth of the test monitored at the remote Rio will be determined by the X21 network bit rate and the algorithm selected.



Algorithm

The unit is programmed with the software for 16bit standard and enhanced apt-X and 20 and 24 bit enhanced apt-X algorithms. This feature enables the selection of any of these four algorithms.

Mode

The mode of operation is dependent on the apt-X™ algorithm selected.

Having firstly selected the desired algorithm the Rio can then be configured to operate in any of the mono or stereo modes and related network bit rates as shown in the table.

Network Bit Rate (kbit/s)	Mode	Standard apt-X™	Enhanced apt-X™		
		16bit	16bit	20bit	24bit
		Audio Bandwidth (kHz)			
56	Stereo	3.5	3.5		
64	Stereo	3.5 [§]	3.5 [§]		
56	Mono	7	7		
64	Mono	7 [§]	7 [§]		
112	Stereo	7	7		
128	Stereo	7 [§]	7 [§]		
112	Mono	15	15		
128	Mono	15 [§]	15 [§]		
168	Stereo	12	12		
192	Stereo	12 [§]	12 [§]		
168	Mono	20	20	15	15
192	Mono	20 [§]	20 [§]	15	15 [§]
224	Stereo	15	15		
256	Stereo	15 [§]	15 [§]		
224	Mono			20	
256	Mono			20	
280	Stereo			15	
320	Stereo			15 [§]	
224	Mono				20
256	Mono				20
336	Stereo	20	20		15
384	Stereo	20 [§]	20 [§]		15 [§]
448	Stereo			20	
504	Stereo				20
512	Stereo			20	
576	Stereo				20 [§]

Input/Output

The unit has both analogue and digital audio I/O interfaces. This feature enables the user to select either operational mode. The XLR-3 connectors for LEFT analogue audio I/P and LEFT analogue audio O/P are also used for digital audio I/P and O/P respectively. These have to be set to the desired mode via the front panel controls. An LED located beside each connector displays the current mode.

Digital Output

This feature is only available when the Audio I/O has been set for digital.

The digital audio output can be set to be any of three sampling frequencies 32kHz, 44.1kHz or 48kHz.

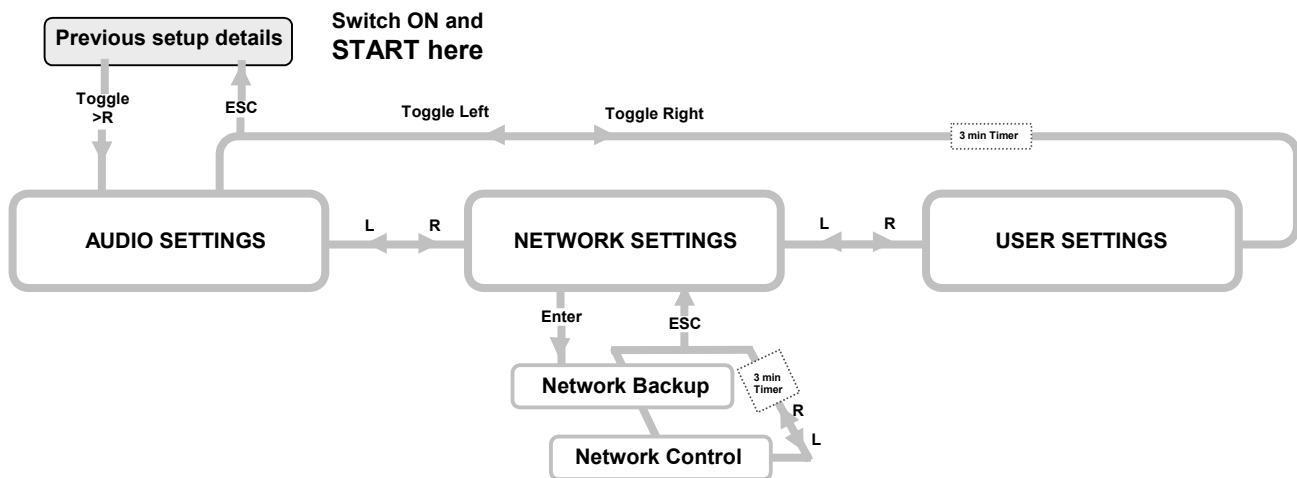
Additionally, when REF is selected the output can be locked or synchronised to an external reference clock signal (ie Studio Reference). The frequency of the reference signal will be displayed.

Input/Output Impedances

This option provides a choice of 600Ω/600Ω or 10kΩ/50Ω for the input and output impedances.

[§] Low delay modes when Analogue interface selected.

Network Settings Menu



Network Settings

The Network Settings Menu enables access to control two options as shown on the menu chart.

Backup

When this function is enabled the Rio can offer a backup function for any critical programming continuity or service requirement. The menu enables access to two backup options, either to a similar Rio unit or APT's NXL product.

The Rio has two X21 data ports Port 1 and Port 2. When connected to a similar X21 network Port 2 can be enabled to automatically backup Port 1 in the presence of any of the following error or fault conditions.

- Port 1 loss of INDICATE signal.
- Loss of Autosync.
- Mismatch of Network and Rio bit rates.
- Loss of PLL lock.

Before the Rio switches to Backup the bottom line of the LCD will describe the fault condition and the summary alarm LED will illuminate.

Rio

When Backup is being supported by another Rio then one unit must be set as MASTER and the other as SLAVE. While in Backup mode the Master unit will continually send a test signal to Port 1. If the Slave unit receives this signal it will reply and both units will, within 3 secs, return to exchanging programme data on the Port 1 main circuit and Port 2 will return to standby mode.

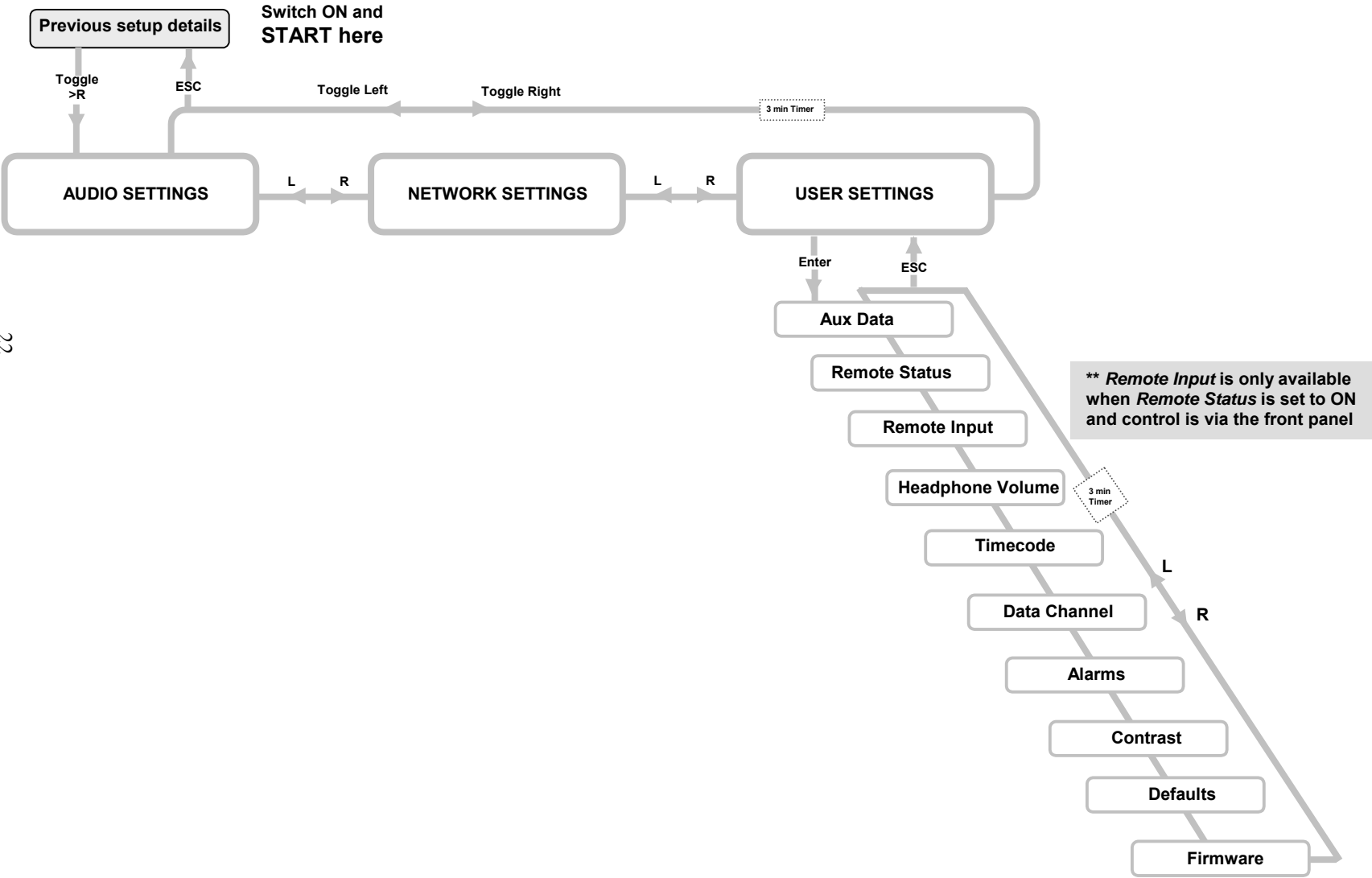
NXL

When Backup is being supported by an NXL unit the Master/Slave option is NOT available otherwise the setup is the same as described for Rio to Rio. While in the Backup mode both units will continue to monitor the conditions on Port 1. When the main circuit is restored and the Port 1 Indicate signal is detected by both units then they will switch back to exchanging data on Port 1 and returning Port 2 to standby mode.

Network Control

With both the Network Control and Backup functions enabled the Control pin on the Port 2 connector becomes active. Port 2 is now ready to support Port 1 in the event of any network failure.

User Settings Menu



User Settings

The User Settings Menu enables access to control ten options as shown on the menu chart.

Auxiliary Data

This option enables the user to switch the auxiliary data function ON or OFF. If ON, then one of four baud rate settings, 1200, 2400, 4800 or 9600 baud can be selected. The auxiliary data I/O interface is an RS232 formatted 9 way 'D' type female connector.

Remote Status

This option is only available with enhanced apt-X™. It allows the circuitry of alarm relays 1-4 to be disconnected from their normal function. These relays can then be used to convey any suitable, user defined external control and/or monitoring signals between two Rio's. If required, this feature can be configured to operate in both directions, simultaneously.

With Remote Status set to ON, in both Rio's, then the Alarm circuits 1 to 4 become disconnected and only the Summary alarm is left activated. The status of these four circuits can now be controlled from either the:

1. **Front**---locally by the buttons on the front panel.
or
2. **Rear**---remotely by an external device(s) routed via the rear panel opto-coupler connector

The opto-coupler 'D' type connector will accept a mix of up to a maximum of four **DC** (+5 to -30volts) or **Clean** signals. These signals are then converted to data and embedded in the main data stream.

NB: An X21 network failure causes the Remote Status alarm settings to default to the initial start-up condition. These will reset to the defined state when the network is restored.

At the receive end this data is decoded and will control the status of the four original alarm, board mounted relays. The various contacts of these relays are now available, as before on the Alarms connector on the rear panel and can be extended to either control or monitor other peripheral equipment.

Remote Input

This option is only available when the Remote Status is set to ON and control routed to the front panel buttons. Using these buttons the user can set the conditions of each of the four alarm relay circuits to be either High or Low. This information is then processed as described above in Remote Status.

Headphone Volume

The volume of the headphone output can be adjusted through xx selectable levels.

Timecode*

This facility will accommodate EBU timecode operating at 25 frames per second.
(Not available with software version R1.2)

Data Channel

In stereo mode Timecode and Auxiliary data can be interchanged between the Left and Right audio channels.

In mono mode, and using the standard apt-X™ algorithm then either Timecode or Auxiliary data (but not both) is placed in the Left audio channel.

In mono mode and using the enhanced apt-X™ algorithm then Auxiliary data is placed in the left audio channel and Timecode is compressed and placed within the capacity of the control data.

Alarms

Each of the five alarm contact conditions can be tested at the rear panel connector.

* The Timecode feature is a build option that requires RAM chips to be populated on the main PCB. Contact APT for further information if this option is required.

Contrast

The contrast of the LCD display information can be adjusted to the desired level.

Defaults

This option allows the user to restore all factory default settings for the operational parameters of the Rio.

Firmware

The LCD will display the current version of the onboard control software for DSP, Xilinx and PIC and resident in Flash memory. The software can be updated in the field using a serial cable and a terminal emulation program such as HyperTerminal or Procomm Plus.

To download software updates then follow this procedure:

If using **HyperTerminal** emulation software then set up a connection as follows:

Direct to COM 1 or 2.
19200 Baud
8 Data bits
No Parity,
1 Stop Bit
Flow Control OFF.

Connect a serial cable between the serial port on the PC and the AUX DATA connector on the rear panel of the RIO.

NB: Please remember that the serial cable must have the (twisted) pin connections as shown in the table.

PC Connector		Rio Connector
Pin 2		Pin 3
Pin 3		Pin 2
Pin 5		Pin 5

Use either scroll button on the front panel until **USER SETTINGS** is displayed and select **ENT**.

Use either scroll button until **USER.FIRMWARE** is displayed and select **ENT**.

When **REPROGRAM FLASH** is displayed use either scroll button to highlight **YES** and then select **ENT**.

The RIO LCD display will show a series of messages and finally display **START CODE UPLOAD**.

Now go to PC and under the **TRANSFER MENU** select **SEND TEXT FILE**,
Select the hex file as supplied and select **OPEN**.

The code will now start loading into the RIO and will be echoed back to the PC.

The loading process will take approximately 6 to 7 minutes to complete.

When completed the text message **UPLOAD COMPLETE PRESS ENTER** will be displayed.

Select **ENT**

The unit will now reset and re-start with the new updated code.

The unit will still retain the previous configuration unless this is deleted using the **DEFAULTS** option in the **USER SETTINGS** menu.

Technology Review

Enhanced apt-X™ is a development based on the standard 16 bit apt-X™ 4:1 data compression algorithm. On a new platform provided by the Motorola 563xx DSP chip an additional two levels of operation at 20 and 24 bit resolution are now available. This flexibility of operation has also been designed to permit full backwards compatibility with existing 16 bit standard apt-X™ based audio systems and to meet the current and future demands of 20 and 24bit PCM architectures.

The 563xx chip is a very low power CMOS device capable of operation at 100 million instructions per second (MIPS). The implementation of both standard and enhanced apt-X™-algorithms on this platform enables it to deliver four discrete audio channels with bandwidths up to 24kHz at 48kHz sampling frequency and network data rates up to 576kbit/s.

In **SIMPLEX** mode these can be configured as:-

- Four discrete mono encode or decode channels
or
- Two stereo encode or two stereo decode pairs
or

in full **DUPLEX** mode as:-

- Two encode channels plus two decode channels

Enabling any two channels to be configured with differing bit resolutions from the remaining two channels further increases flexibility of operation.

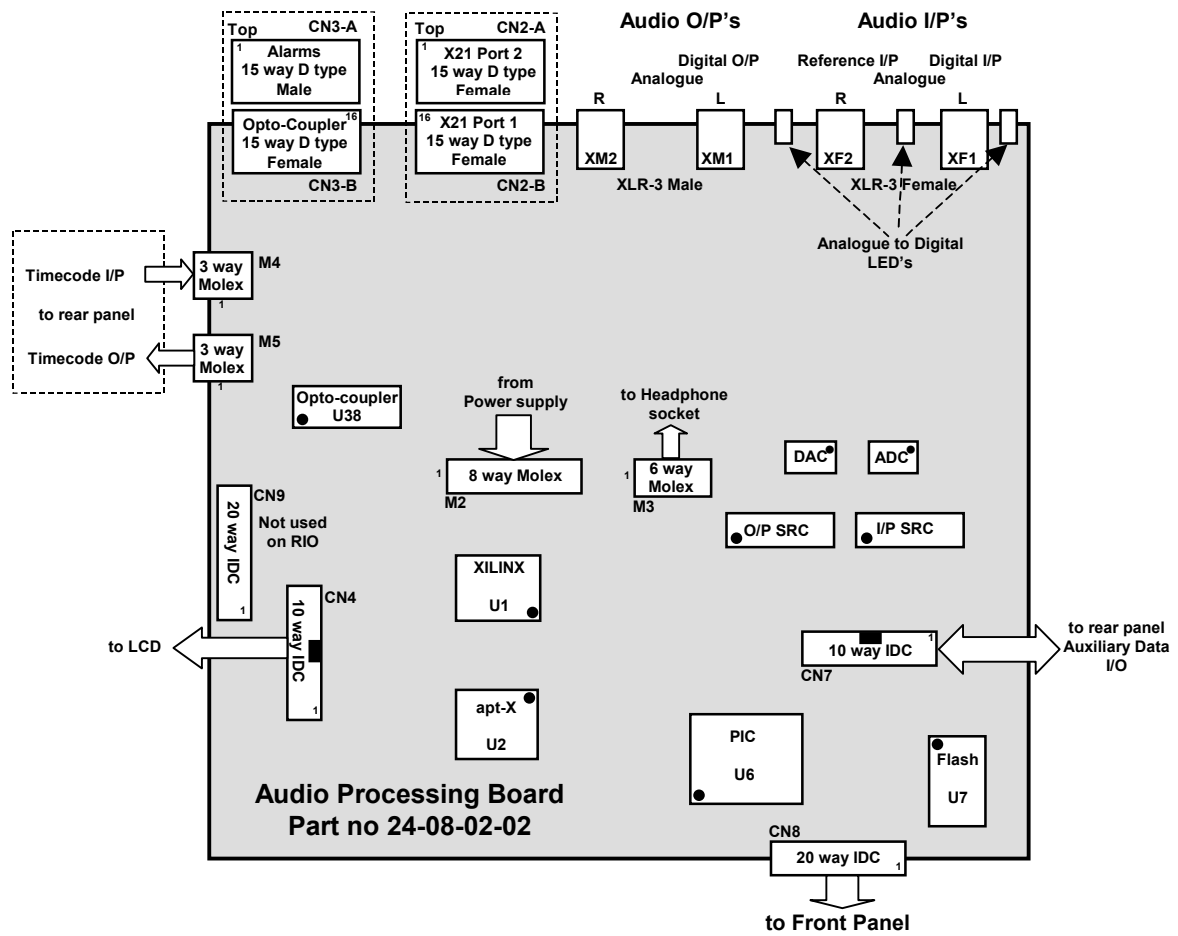
Modifications of the various coefficients within the apt-X™ algorithm itself has led to typical improvements in performance from the original 16 bit technical specification. Operating with 20 and 24 bit resolution the dynamic range capability has been increased by approximately 20 – 25dB respectively and the total harmonic distortion (THD) separation has been improved from a nominal –68 to –74dB and –80dB for 20 bit and 24 bit operation respectively.

The signal processing delay introduced by a complete encode/decode cycle has also been slightly improved to around 2.3msec at 48kHz sampling frequency.

The benefits thus accruing from utilisation of the enhanced apt-X™ algorithm are:-

- Increased stereo and mono audio channel capability.
- Simultaneous full duplex operation with a single device.
- Bit compatibility with current 16, 20 and future 24 bit AES/EBU architecture.
- Asymmetrical bit resolution operation.
- Backwards compatibility with existing 16 bit apt-X™ systems.
- Low complexity implementation and integration on a single DSP device.

Synchronisation of the audio data between encoder and decoder is achieved by autosync. This is a proprietary facility which enables the standard and enhanced apt-X™ compressed data streams to be synchronously decoded without prior knowledge of the compressed word boundaries. As with the auxiliary data facility no data overheads and no audio bandwidth penalties are incurred through the use of the autosync facility.



Technical Specification:

Size	1U × 19" rack mount, 45mm(H) × 480mm(W) × 255mm(D)
Weight	2.25kg
Power supply	100 - 250 VAC, 50 - 60Hz
Power Consumption	>15 watts

Interfaces

Ports 1 and 2	X27 physical level: Female X21 15 way 'D' type (SELV see Note 1)		
Analogue Audio	Input:	Balanced Impedance	XLR-3 (SELV see Note 1) 10kΩ/600Ω
	Output:	Balanced Impedance	XLR-3 (SELV see Note 1) <50Ω/600Ω
Digital Audio	Input	AES/EBU Balanced Impedance	XLR-3 (SELV see Note 1) 110Ω
	Output	AES/EBU Balanced Impedance	XLR-3 (SELV see Note 1) 110Ω
Digital Reference	Input	XLR-3 (SELV see Note 1)	
Timecode	Input	XLR-3 (SELV see Note 1)	
	Output	XLR-3 (SELV see Note 1)	
I/P Opto-coupler	Female 15 way 'D' type		
Auxiliary data	RS232: Female 9 way 'D' type (SELV see Note 1)		
O/P Alarms	Male 15 way 'D' type		

Audio

Analogue Audio Sampling Frequencies (F_s) : 8kHz to 48kHz

Digital Audio Sampling Frequencies (F_s) : 32kHz, 44.1kHz, 48kHz

Sample Rate Converter 3:1 (with bypass mode available)

Audio Bandwidths:
10Hz--3.81kHz to 22.86kHz Stereo
10Hz--7.62kHz to 24.38kHz Mono

Compression

Compression algorithms: 16-bit Standard apt-X™ ADPCM
16, 20 and 24-bit Enhanced apt-X™ ADPCM
Compression Ratio 4:1 Fixed

Coding Delay:

Standard apt-X™	15.25ms @ 8kHz
	2.5ms @ 48kHz
Enhanced apt-X™	12ms @8kHz
	2ms @48kHz

Network Data Rates	56 to 576kbit/s
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Miscellaneous

Dynamic Range	>85dB @ 16bit
	>105dB@ 20bit
	>110dB @24bit
Total harmonic distortion (THD)	>75dB
Phase Response	Linear: DC to $F_s / 2$
Pass Band Ripple	< -0.2dB
Environment	0°C to 50°C, 95% Humidity

Note 1: The ports and connectors marked SELV are Safe Extra Low Voltages and must only be connected to other SELV type equipment.

Service & Customer Support:

If attempts to solve any problem are unsuccessful call APT Customer Support Services.

Europe & Rest of The World	Phone	+44-28 9037 1110
	Fax	+44-28 9037 1137
	E-mail	customersupportuk@aptx.com
North America	Phone	+1-323-463 2963
	Fax	+1-323-463 8878
	E-mail	customersupportusa@aptx.com

Please have the following information ready:

WorldNet Rio serial number (found on rear panel) Ser No.....

Purchase date for equipment.

Distributor Name

Fault conditions details.

Configuration of the WorldNet Rio system.

Contact Addresses

Should you require any assistance please do not hesitate to contact one of the following:

HEADQUARTERS

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Northern Ireland

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