NICA X

# NICA X Codec System
# Reference Manual

SONIFEX

**Important Note** :

'Appendix B - Regulatory Statement' must be drawn to the users and installers attention before the use or installation of this product


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# *WARRANTY AND SAFETY INFORMATION*

**Warranty and Liability**

**Important: the purchaser is advised to read this clause**

(a) The Company agrees to repair or (at its discretion) replace Goods which are found to be defective (fair wear and tear excepted) and which are returned to the Company within 12 months of the date of despatch provided that each of the following are satisfied:

(i) notification of any defect is given to the Company immediately upon its becoming apparent to the Purchaser;

(ii) the Goods have only been operated under normal operating conditions and have only been subject to normal use (and in particular the Goods must have been correctly connected and must not have been subject to high voltage or to ionising radiation and must not have been used contrary to the Company's technical recommendations);

(iii) the Goods are returned to the Company's premises at the Purchaser's expense;

(iv) any Goods or parts of Goods replaced shall become the property of the Company;

(v) no work whatsoever (other than normal and proper maintenance) has been carried out to the Goods or any part of the Goods without the Company's prior written consent;

(vi) the defect has not arisen from a design made, furnished or specified by the Purchaser;

(vii) the Goods have been assembled or incorporated into other goods only in accordance with any instructions issued by the Company;

(viii) the defect has not arisen from a design modified by the Purchaser;

(ix) the defect has not arisen from an item manufactured by a person other than the Company. In respect of any item manufactured by a person other than the Company, the Purchaser shall only be entitled to the benefit of any warranty or guarantee provided by such manufacturer to the Company.

(b) In respect of computer software supplied by the Company the Company does not warrant that the use of the software will be uninterrupted or error free.

(c) The Company accepts liability:

(i) for death or personal injury to the extent that it results from the negligence of the Company, its employees (whilst in the course of their employment) or its agents (in the course of the agency);

(ii) for any breach by the Company of any statutory undertaking as to title, quiet possession and freedom from encumbrance.

(d) Subject to conditions (a) and (c) from the time of despatch of the Goods from the Company's premises the Purchaser shall be responsible for any defect in the Goods or loss, damage, nuisance or interference whatsoever consequential economic or otherwise or wastage of material resulting from or caused by or to the Goods. In particular the Company shall not be liable for any loss of profits or other economic losses. The Company accordingly excludes all liability for the same.

(e) At the request and expense of the Purchaser the Company will test the Goods to ascertain performance levels and provide a report of the results of that test. The report will be accurate at the time of the test, to the best of the belief and knowledge of the Company, and the Company accepts no liability in respect of its accuracy beyond that set out in Condition (a).

(f) Subject to Condition (e) no representation, condition, warranty or other term, express or implied (by statute or otherwise) is given by the Company that the Goods are of any particular quality or standard or will enable the Purchaser to attain any particular performance or result, or will be suitable for any particular purpose or use under specific conditions or will provide any particular capacity, notwithstanding that the requirement for such performance, result or capacity or that such particular purpose or conditions may have been known (or ought to have been known) to the Company, its employees or agents.

(g) (i) To the extent that the Company is held legally liable to the Purchaser for any single breach of contract, tort, representation or other act or default, the Company's liability for the same shall not exceed the Price of the Goods.

(ii) The restriction of liability in Condition (g)(i) shall not apply to any liability accepted by the Seller in Condition (c).

(h) Where the Goods are sold under a consumer transaction (as defined by the Consumer Transactions (Restrictions on Statements) Order 1976) the statutory rights of the Purchaser are not affected by these Conditions of Sale.

**Returning the Warranty Card**
In order to register the date of purchase so that we can keep you informed of any design improvements or modifications, it is important to complete the warranty registration document that is enclosed with the product and return it to Sonifex Ltd in the UK.

For your own records you should write down the serial number (which can be found on the rear of the NICA X) and software versions.

| | |
|---|---|
| Serial Number | ……. |

**Unpacking the NICA X**
Each NICA X is shipped in protective packaging and should be inspected for damage before use. Where an item is found to have transit damage, notify your supplier immediately with all the relevant details of the shipment. Packing materials should be kept for inspection and also for if the product needs to be returned.

**Safety of Mains Operated Equipment**
CE This equipment has been designed to meet the safety regulations currently advised in the country of purchase and it conforms to the safety regulations specified by use of the CE Mark.

The power supply is rated to 90 - 250VAC at 47 – 63Hz.

Warning : There are no user serviceably parts inside the machine. If you should ever need to look inside the unit, always disconnect the mains supply before removing the equipment covers.

**Fuse Rating**
The NICA X has an internal fuse for the Live mains input, which is rated at 2.5A.

**Power Cable and Connection**
An IEC power connector is supplied with the NICA X which has a moulded plug attached – this is a legal requirement. If no moulded plug has been supplied with your NICA X, please contact your supplier, because an IEC connector is always supplied from the Sonifex factory.

If for any reason, you need to use the Net-Log with a different power cable, you should use the following wiring guidelines

| Wire Colour | Connection |
|---|---|
| Green, or green and yellow | Earth (E) |
| Blue, or Black | Neutral (N) |
| Brown, or Red | Live (L) |

# CHAPTER 1 INTRODUCTION

### 1.1 - Overview

This Reference Manual is written for the NICA X Codec System manufactured by Sonifex Ltd. The NICA X digital audio codec system is described as a "codec system" for good reason. The NICA X is a highly configurable intelligent codec which can be configured by the user to suit several different modes of operation.

All the modes of operation are available in the standard unit - there are no optional extras apart from a microphone amplifier card and an audio switch card. It is up to the user how much or how little of the functionality of the NICA X is employed.

The principal choices are as follows:

#### 1.1.1 - Coding Standards

The NICA X is a multi-standard codec system which supports G.722, MPEG Layer 2, and apt-X100 coding.

There are two codec card options which may be installed in the NICA X.

1. G.722 and MPEG Layer 2 card
2. apt-X100 card

The 1U versions of the NICA X only accept one card of your choice. The 2U version can accept two cards; the combinations being:

1 x apt-X100 and 1 x MPEG/G.722

or

2 x MPEG/G.722

The apt-X100 card is capable of 7.5kHz mono audio at 64kbit/s and 15kHz mono audio at 128kbit/s.

The NICA X is the only codec, other than APT Ltd.'s own codecs, to employ APT's Inverse Multiplexing Algorithm. This means that the NICA X is unique in being able to communicate over ISDN at 15kHz mono audio bandwidth, with APT Ltd.'s stereo capable codecs, such as the DSM100 and the BCF256.

The 7.5kHz "clear" mode, and the 15kHz "IMUX" mode is auto-detected in the NICA X so there is no need for manual intervention.

When two codec cards are installed in a single NICA X unit, the user can operate the system either as two discreet codecs, or as one codec capable of auto-detecting any incoming mode, for example an auto-detect G.722, MPEG L2, apt-X100 codec.

#### 1.1.2 - Line Interfaces

The NICA X can be operated on X21 and/or ISDN S Bus line interfaces.

On the X21 connection, the NICA X can be connected to a fixed point-to-point digital service, such as kilostream, in order to achieve a high bandwidth stereo audio connection using either MPEG Layer 2 or apt-X100 coding.

The NICA X's maximum data rate over the X21 interface is 256kbit/s.

Over the ISDN S Bus connection, the NICA X provides the following bandwidth:

| | | |
|---|---|---|
| Using G.722 | 64kbit/s | 7.5kHz mono audio bandwidth |
| Using MPEG | 64kbit/s | 8kHz mono audio bandwidth at 48kHz sampling |
| | | 10kHz mono audio bandwidth at 24kHz sampling |
| Using apt-X100 | 64kbit/s | 7.5kHz mono audio bandwidth |
| | 128kbit/s | 15kHz mono audio bandwidth |
| | 128kbit/s | 7.5kHz stereo audio bandwidth |

The NICA X can be used as a dedicated fixed line or ISDN codec. Alternatively, in applications where both types of services are employed - Studio-to-Transmitter Links for example, the NICA X can support both fixed and ISDN lines.

This means the NICA X can be used to provide stereo audio main feed to the transmitter plus an on-line ISDN backup service which automatically switches in if the main line fails. Both fixed service and ISDN service can be connected to the same NICA X, or if redundancy in hardware is required, then the fixed and ISDN services can each be connected to a dedicated NICA X codec with active monitoring taking place between the two codecs.

We hope that these extensive features within the NICA X will help you now, and in the future, to create innovative and cost effective digital audio communication solutions.

**1.2 - Model Numbers And Specifications**

| Model Number | ISDN TA | APTX100 Codec | MPEG/ G722 - 1 Codec | MPEG/ G722 - 2 Codec | 1U or 2U unit | Keypad & LCD |
|---|---|---|---|---|---|---|
| NICA X-1A | NO | YES | NO | NO | 1U | NO |
| NICA X-1M | NO | NO | YES | NO | 1U | NO |
| NICA X-1AT | YES | YES | NO | NO | 1U | NO |
| NICA X-1MT | YES | NO | YES | NO | 1U | NO |
| NICA X-2A | YES | YES | NO | NO | 2U | YES |
| NICA X-2M | YES | NO | YES | NO | 2U | YES |
| NICA X-2AM | YES | YES | YES | NO | 2U | YES |
| NICA X-2MM | YES | NO | YES | YES | 2U | YES |
| NICA X-2AX | NO | YES | NO | NO | 2U | YES |
| NICA X-2MX | NO | NO | YES | NO | 2U | YES |
| NICA X-2AMX | NO | YES | YES | NO | 2U | YES |
| NICA X-2MMX | NO | NO | YES | YES | 2U | YES |

# CHAPTER 2 CONNECTION DETAILS AND INDICATORS

Please refer to Appendix A for detailed pin connection information. You should also read Appendix B, a Regulatory Statement, on the electrical safety of the codec.

### 2.1 - Power

WARNING: This equipment must be earthed.

This unit is mains powered via an IEC filtered inlet for 90 – 250V supply. There is an internal fuse for the Live mains input. An IEC power cable is provided.

The power switch is double poled, switching the Live and Neutral.

The enclosure is earthed via an internal earth stud.

### 2.2 - X.21 Ports

The NICA X has two X.21 ports for connection to an ISDN Terminal Adapter or Leased Line modem etc. The ports are 15 way D-type female connectors.

The NICA X normally derives its clock from the X.21 interface. The X.21 clock can be 56kbit/s to 256kbit/s depending on the Mode of operation (see section 3.1). Also the NICA X can generate its own internal clock for use on X.21 circuits where the clock is not provided (see section 3.1.5 ).

The X.21 ports are leased circuit interfaces restricting their use to clock and data only.

*Note for NICA X-2 only :*

*The NICA X-2 has an X.21 DCE port (Breakout) available for use as Port 2 of the integral Terminal Adapter. This can be used for the connection of an external codec. The port is a 15 way D-type female connector.*

*To use this port the Mode setting of Channel 2 must be set for Breakout use. (see section 3.2). This port can be set to operate at 56kbit/s or 64kbit/s.*

### 2.3 - ISDN S Bus

The ISDN S Bus RJ45 connector should be connected to the ISDN2 termination box using the cable provided.

Note: The ISDN TA is optional in both NICA X-1 and NICA X-2 units

### 2.4 - RS232 Remote Control Port

The RS232 Remote Control Port connector is a 9 way D-type female connector. The supported signals are RXD, TXD, and GND.

There are also optional RS485 connections for connecting multiple NICA X units on a common bus.

### 2.5 - Auxiliary RS232 Data Port

The Auxiliary RS232 data port is a 9 way D-type male connector. Signals supported are RX, TX , RTS and CTS. Two ports are provided on the one connector for units with two codecs fitted.

The auxiliary data port must be enabled at both ends of a link. The baud rate is variable between 1200 and 9600 for APTX100 codecs and fixed at 1200 baud for MPEG codecs. To enable the port and to set the baud rate, see sections 3.1.1.7 and 3.1.2.7. In Debug mode this port provides access to the ISDN TA management port at 9600 baud.

### 2.6 - Audio Inputs And Outputs

There are two analogue audio inputs and two analogue audio outputs which use 3 pin XLR connectors. They are electronically balanced line level inputs with a high impedance input and low impedance output. There is an optional Microphone Input Module allowing CH1 INPUT to take a microphone.

The maximum headroom is 12dBu for APTX100 codecs and 18dBu for MPEG/G722 codecs and it has 0dBu gain through the encode and decode path. The audio bandwidth depends on the coding mode selected - See section 3.1.1.1 and 3.1.2.1 for further information.

**2.7 - External Inputs**

The External Input connector is a 15 way D-Type female connector. There are 8 external optically isolated inputs. They are high sensitivity opto coupled LED's with common anodes and a series 1K5 resistor.

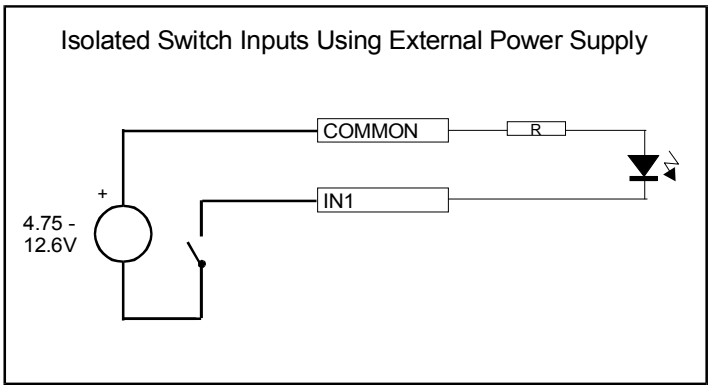
The input can be driven by 5V logic, by switches using an external excitation supply (4.75 - 12.6V) or using the supply voltage (12V nominal) provided on the External Input connector.

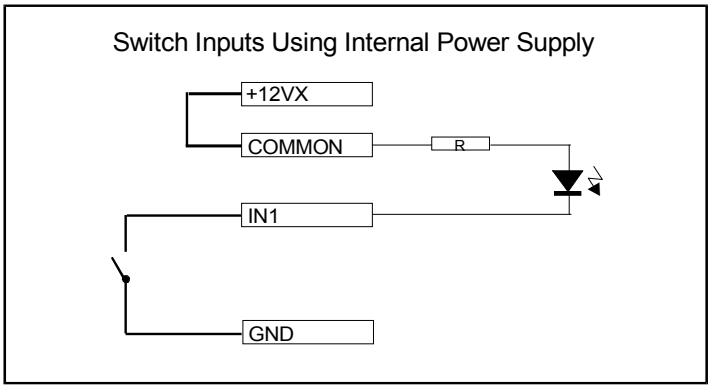
ion = 1.5mA min.
imax = 10mA.

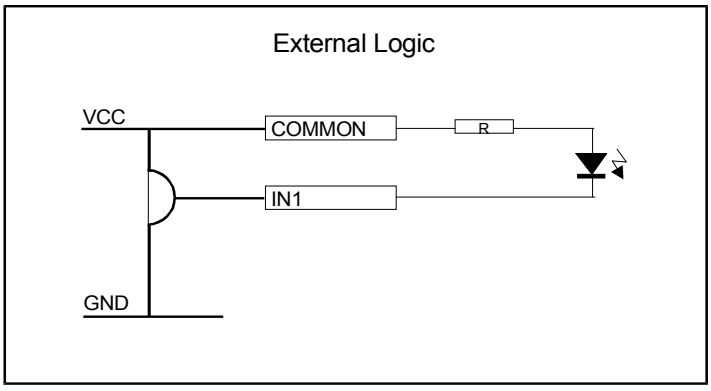
Isolation Voltage = 48V max
Excitation Voltage = 4.75-15V max

The External Inputs can be programmed to perform any command in the system. Some common uses are to :-

Trigger dialling Book entries,
Change Codec Mode,
Trigger Backup functions,



### 2.8 - External Outputs

The External Output connector is a 15 way D-Type female connector. There are 8 external isolated relay outputs which are Normally Open (NO) contacts with one shared common connection. The relay contacts are rated at 1A@24Vdc and 0.5A@120Vac.

The External Relay Outputs can be programmed to switch depending on a number of circumstances for example:-

Framing indication
Backup mode running
ISDN Call Up

### 2.9 - Headphone Monitor And Level Indicators

The headphone monitor connector is a ¼ inch stereo jack socket for A type jack plugs. The level is adjusted using the volume control buttons on the front panel.

The Monitor section also has a level indicator for CH1 and CH2 with a range from -15dBu to +12dBu in 3dB steps The audio monitored can be selected as one of the modes A, B, C or D, by pressing the two volume keys together:-

| Mode | Channel 1 | Channel 2 |
|---|---|---|
| A | Input | Input |
| B | Output | Output |
| C | Input | Output |
| D (only if Mic module fitted) | Microphone Input | Output |

The CH1/CH2 LED's indicate the selection.

### 2.10 - Power Indicator

The power indicator is a green LED which indicates that the internal DC voltage is good.

### 2.11 - Frame Indicators - CH1, CH2

There are green LED decoder framing indicators for channels 1 and 2. These indicate that the DATA channels have synchronised/framed to the incoming clock and data. These will only illuminate if the correct format data is present i.e. the correct type of codec is at the remote end for the mode set at the NICA X.

If in Autodetect Mode, these indicators will flash whilst the unit is hunting for the correct Mode. This only occurs when an ISDN call is active or an X.21 interface is active. See sections 3.1.1.1 and 3.1.2.1 for mode settings.

### 2.12 - Loop Indicator

The loop indicator is a red LED. This indicates that the unit is set to loopback. See section 3.1.3.

### 2.13 - Call Indicators

The Call 1 and Call 2 indicators are red LED's. They indicate that an ISDN call is present on Channel 1 and Channel 2 of the Terminal Adapter respectively. On power up these LED's will flash during the ISDN Terminal Adapter reset.

### 2.14 - IMUX Indicator

The IMUX indicator is a yellow LED. This indicates that the unit is set to an IMUX coding mode. See section 3.1.1.

### 2.15 - Backup Indicator

The BACKUP indicator is a yellow LED with the following functions :
ON - This indicates that the unit is currently in the backup state.
FLASHING - This indicates that the Primary has failed and the unit is running in Reserve or trying to establish Reserve.
See Chapter 6 for more information on the Backup Function.

### 2.16- Level Indicators

The level indicators represent the audio level as presented to the CH1 and CH2 audio outputs. The are purely for indication of audio present and should not be used for calibration of levels.

# CHAPTER 3 OPERATION

There are a number of ways the NICA X may be operated. The table below gives 3 scenarios and the relevant sections in the manual.

| | Manual sections |
|---|---|
| NICA X-2 operated from front panel keypad and LCD display | 5 |
| NICA X-1 configured from front panel dipswitches | 3.3 |
| NICA X-1/2 operated via the remote control port | 8 |

There are a number of applications which the NICA X can be used for. The table below gives 5 scenarios and the relevant sections in the manual

| | Manual sections |
|---|---|
| NICA X-2 Operation on ISDN | 5, 7.1 |
| NICA X-1 Operation on ISDN controlled via remote port | 8, 7.1 |
| Operation on a fixed data link | 7.2 |
| Operation on a fixed data link with ISDN backup | 7.3,6 |
| Operation as a backup Codec to an external service | 7.4,6 |

### 3.1 - Codec Configuration

Before the NICA X can be used the Codec first has to be set to the correct mode. The NICA X can be set into the correct Mode using :-

- DIP Switches on the NICA X-1 - see section 3.3
- Keypad and Display on the NICA X-2 - see section 5
- Remote Control Port on the NICA X-1 and NICA X-2 - see section 8

The sections below give information on the two types of codecs.

#### 3.1.1 - apt-X100 Codec Specifics

The following information is relevant to NICA X units fitted with an apt-X100 codec card.

##### 3.1.1.1 - Modes For apt-X100

| Quick Reference Table | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | - CONFIG<br>- MODE | MOD | 9,10,11,12 |

The tables below list the Codec Modes for apt-X100 versions

| | apt-X100 Mode Name | Max. Audio Bandwidth | Audio Mode | Data Rate kbit/s | Data Mode | Data Interface |
|---|---|---|---|---|---|---|
| 0 | None Set | - | - | - | - | - |
| 1 | Auto Detect | - | - | - | - | ISDN/X21 |
| 2 | APT ISDN Clr-M | 7.5KHz | Mono | 64 | Clear | ISDN |
| 3 | APT ISDN IMUX-M | 15KHz | Mono | 2 x 64 * | IMUX | ISDN |
| 4 | APT ISDN IMUX-S | 7.5KHz | Stereo | 2 x 64 * | IMUX | ISDN |
| 5 | APT X21 64k-M | 7.5KHz | Mono | 64 | Clear | X21 |
| 6 | APT X21 128k-M | 15KHz | Mono | 128 | Clear | X21 |
| 7 | APT X21 128k-S | 7.5KHz | Stereo | 128 | Clear | X21 |
| 8 | APT X21 256K-S | 15KHz | Stereo | 256 | Clear | X21 |
| 9 | APT X21 IMUX-M | 15KHz | Mono | 2 x 64 * | IMUX | X21 |
| 10 | APT X21 IMUX-S | 7.5KHz | Stereo | 2 x 64 * | IMUX | X21 |

* These modes will operate on 1x 64k channel as well as 2 x 64k channels

##### 3.1.1.2 - Coding Delays

The coding delay of the apt-X100 algorithm is considerably lower than other coding techniques such as MPEG. The information below gives the delay of an encode/decode path of a NICA X. i.e. the delay between your input audio locally and the output audio remotely. These figures do not take account of the transmission delays of the digital service or ISDN service. However assuming there are no satellite hops involved this should be insignificant.

| Coding Mode | Coding Delay |
|---|---|
| APT 64k mono | ~ 13mS |
| APT 256k stereo | ~ 5mS |
| APT IMUX 2 x 64k mono | ~ 13mS |
| APT 64k mono over ISDN (local call) | ~ 17mS |

#### 3.1.1.3 – Auto Synchronisation

When operating in a CLEAR Date Mode, the NICA X sets the auto synchronisation mode of the apt-X100 chip to automatically synchronise to the incoming data stream. In an IMUX mode the Autosync is not required as the IMUX process itself deals with the synchronisation of the audio data stream.

#### 3.1.1.4 - CLEAR Mode

CLEAR mode will only operate at 64kbit/s on 1 channel of ISDN to give 7.5kHz mono audio. On a fixed data service such as a Kilostream, Satellite link or Microwave link, the NICA X can operate at either 64k, 128k or 256k. The clock can be provided by the network or internally by the NICA X.

The CLEAR mode enables the unit to operate with other products using aptX-100 coding on just 64kbit/s.

#### 3.1.1.5 - IMUX Mode

The IMUX mode employs APT's inverse multiplexing technique known as MUCAS. This links two 64kbit/s channels together, taking into account any delays between the two data stream clocks and any slippage, to give a 128kbit/s data stream which the codec can then utilise.

In IMUX mode the NICA X will operate at 7.5kHz mono over 64kbit/s, 15kHz mono over 2x64kbit/s and 7.5kHz stereo over 2x64kbit/s.

#### 3.1.1.6 - Stereo/Mono Operation

In CLEAR mode the NICA X can operate in mono over 64kbit/s, mono or stereo at 128kbit/s, and stereo only at 256kbit/s.

With IMUX modes the stereo operation is only relevant for 2 x 64kbit/s data channels. To operate in stereo mode in IMUX, only one unit needs to be set to stereo as the other unit will automatically change to stereo.

In IMUX mode the NICA X can operate in mono mode at 7.5kHz audio bandwidth over 64kbit/s and 15kHz audio bandwidth over 2x64kbit/s. In IMUX mode the NICA X can operate in stereo mode at 7.5kHz audio bandwidth over 2x64kbit/s.

If the unit is operating in stereo mode and one 64kbit/s data channel is lost, then the unit will continue to operate at 7.5kHz mono.

The table below summarises the variations.

| Data | 64kbit/s IMUX mode | 2 x 64kbit/s IMUX mode |
|---|---|---|
| Mono mode | 7.5kHz | 15kHz |
| Stereo mode | 7.5kHz Mono | 7.5kHz Stereo |

#### 3.1.1.7 - Auxiliary Data

| Quick Reference Table | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | - SYSTEM-CONFIG<br>- 6.AUXDATA | AUX | 6,7,8 |

If enabled the auxiliary data uses part of the audio data stream. Therefore the audio quality is slightly affected by the reduction in data bits used to represent the audio. The higher the baud rate, the more data is "stolen" from the audio data. The apt-X100 Codec can operate at 1200, 2400, 4800, 9600 baud rate.

The auxiliary data channel within the audio data stream is only active when enabled. It will only operate with another codec which has the auxiliary data enabled. The baud rate between two units is determined by the unit with the highest setting. The auxiliary data can be used in any mode e.g. Mono/Stereo, CLEAR/IMUX

**NOTE:** If a codec has the auxiliary data enabled and connects to a codec with it disabled the audio will be corrupted.

#### 3.1.1.8 - Compatibility

**Clear Mode**

In CLEAR mode the NICA X will operate with the Nicral NICA64, NICA128, KW, SystemBase, and Glensound apt-X100 codecs, APT's DSM100, APT's DTR128 Reporter, Nicral RePORT and RePORT2 (apt-X100 based).

**IMUX Mode**

In IMUX mode the NICA X will operate with the Nicral NICA128, APT's DTR128 Reporter, APT's DSM100 with IMUX card, and APT's BCF256.

### 3.1.2 - MPEGL2/G.722 Codec Specifics

The following information is relevant to NICA X units fitted with an MPEG codec.

#### 3.1.2.1 - Modes For MPEGL2

| Quick Reference Table | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | - CONFIG<br>- MODE | MOD | 9,10,11,12 |

The tables below list the Codec Modes for MPEGL2 versions

| | MPEG/G.722 Mode Name | Max. Audio Bandwidth | Audio Mode | Data Rate kbit/s | Algorithm | Data Interface |
|---|---|---|---|---|---|---|
| 0 | None Set | - | - | - | - | - |
| 1 | Auto Detect | - | - | - | - | ISDN/X21 |
| 15 | G722 ISDN-M | 7.5 kHz | Mono | 64 | G.722 | ISDN |
| 16 | L2 24KS ISDN-M | 10 kHz | Mono | 64 | MPEGL2 | ISDN |
| 17 | L2 48KS ISDN-M | 8.25 kHz | Mono | 64 | MPEGL2 | ISDN |
| 18 | L2 24KS X21-M | 10 kHz | Mono | 64 - 128* | MPEGL2 | X21 |
| 19 | L2 48KS X21-M | 8.25 - 15 kHz | Mono | 64 - 128* | MPEGL2 | X21 |
| 20 | L2 48KS X21-DM | 8.25 - 15 kHz | DM | 64 - 128* | MPEGL2 | X21 |
| 21 | L2 48KS X21-JS | 8.25 - 15 kHz | Stereo | 64 - 128* | MPEGL2 | X21 |

* These modes will operate on one X21 channel at either 64k or 128k

#### 3.1.2.2 – G.722 Coding

This is ITU-T G.722 and uses statistical framing to encode/decode. There is only one mode associated with G.722 which gives 7.5kHz mono audio over 64kbit/s. The sample rate is 16kHz.

Note: It is a feature of statistical framing that a G.722 decoder will not frame to silence. Therefore, audio must be input to the encode end for a decoder to frame. Also G.722 coding does not encode 1kHz tones very well.

#### 3.1.2.3 - MPEGL2 Coding

ISO/MPEG-1 Layer II (ISO/IEC 11172-3)
ISO/MPEG-2 Layer II (ISO/IEC 13818-3)

The MPEGL2 coding modes are detailed in the table above. The MPEGL2 codec does not have any IMUX modes and therefore can operate over 64kbit/s channels for ISDN applications, or up to 128kbit/s for fixed data link applications. At 64kbit/s the MPEGL2 modes can give up to 10kHz audio bandwidth. On a 128kbit/s fixed data link the NICA X can give 15kHz audio bandwidth in mono, stereo or dual mono.

On a fixed data service such as a Kilostream, Satellite link or Microwave link, the NICA X can operate at either 64k or 128k. The clock can be provided by the network or internally by the NICA X at 128k

#### 3.1.2.4 - Coding Delays

The information below gives the delay of an encode/decode path of a NICA X. i.e. the delay between your input audio locally and the output audio remotely. These figures do not take account of the transmission delays of the digital service or ISDN service. However assuming there are no satellite hops involved this should be insignificant.

| Coding Mode | Coding Delay |
|---|---|
| MPEGL2 48khz sample rate mono 64k | ~ 74mS |
| MPEGL2 24kHz sample rate mono 64k | ~ 136mS |

**3.1.2.5 - Stereo/Mono Operation**

The MPEGL2 modes can only give stereo operation over a fixed data link. The Dual Mono mode gives two independent audio channels with 10kHz bandwidth at 128kbit/s. The Joint Stereo mode gives 15kHz stereo audio bandwidth at 128kBit/s.

**3.1.2.6 - Compatibility**

The MPEG codec in the NICA X is compatible with all G.722 (statistical framing) codecs and all MPEG-1 codecs at 48K sample rate and all MPEG-2 codecs at 24K sample rate. These are only relevant for 64kbit/s operation.

**3.1.2.7 - Auxiliary Data**

| **Quick Reference Table** | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | - SYSTEM-CONFIG<br>- 6.AUXDATA | AUX | 6,7,8 |

The auxiliary data uses part of the audio data stream. Therefore the audio quality is slightly affected by the reduction in data bits used to represent the audio. The MPEG Codec operates at only 1200 baud rate.

The auxiliary data channel within the data stream is always available, and is activated when data is sent. Therefore, the data capacity of a link is used for audio data unless auxiliary data is present.

**3.1.3 - Loop Back**

| **Quick Reference Table** | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | - SYSTEM-CONFIG<br>- 4.LOOP | LBK | 5 |

Loopback will encode the input audio and decode it to the output. It will operate in the mode as set, i.e. apt-x100 or MPEGL2. If in an MPEG mode, a clock must be available, i.e. an ISDN call must be active, or an X.21 active or the internal clock enabled.

When in loopback the unit cannot link to a remote codec.

**3.1.4 - CH1 Mic Or Line Input**

| **Quick Reference Table** | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | - SYSTEM-CONFIG<br>- 5.OPTIONS<br>- 1.AUDIO | OPT | 4 |

A microphone can be connected directly to a NICA X by fitting an optional internal module. If the module is not present, the menu will not appear for MIC/LINE selection.

The MIC/LINE setting for audio input CH1 is set to take a Line level or Microphone level input. This can be set from the DIP switches (NICA X-1), front panel keypad (NICA X-2), or from the remote control port.

The Microphone input level can be adjusted at the monitor section. Depress both volume keys together until CH1 is flashing. This indicates the Microphone Input level is displayed on the CH1 level indicator. The Volume keys now can be used to adjust the Gain of the Microphone input.

To exit this mode, simultaneously press the two volume keys again and this will return the CH1 and CH2 LED's to line level indication.

**3.1.5 – Mono Mix Of L & R Audio Inputs**

| **Quick Reference Table** | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | - SYSTEM-CONFIG<br>- 5.OPTIONS<br>- 1.AUDIO | OPT | |

The Mono Sum of L & R input is an optional feature with the Audio Switch Module Issue 2. This module is fitted internally. If the module is not present the menu will not appear for Mono Sum of L & R selection.

If Mono Sum of L & R is set to ON then audio input to both CH1 and CH2 audio input connectors will be summed together, but ONLY if the codec is set so that channel 1 is in a Mono mode. This is very useful when providing mono ISDN backup to a stereo Primary service.

### 3.1.6 - X21 Clock Source

| Quick Reference Table | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | - SYSTEM-CONFIG<br>- 5.OPTIONS<br>- 2.X21 CLOCK | OPT | |

In X21 modes the NICA X can either use an external clock provided on the X21 interface or it can generate its own internal clock. This may be useful on leased digital circuits where a clock is not provided.

### 3.2 - X21 Breakout Port (NICA X-2 only)

| Quick Reference Table | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | - CONFIG<br>- MODE<br>set 24.BREAKOUT | MOD | |

The NICA X-2 has an X21 DCE port for use on port 2 of the internal Terminal Adapter for connection of an external codec. To use this port the CH2 mode must be set to Mode "24.Breakout". (see section 3.1.1.1 and 3.1.2.1). All ISDN calls on channel 2 will now route the data to the X21 breakout port.

When in CH2 mode is set to "Breakout", the NICA X internal codec can only operate on channel 1 of the ISDN.

### 3.3 - Dip Switches – NICA X-1

| Quick Reference Table | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | None | RSW | |

There is a row of 12 DIP switches on the front of the NICA X-1 allowing a number of parameters to be set. A cover plate is provided to cover the DIP switches to avoid tampering.

Note that the mode settings for the codec depend on the type of codec fitted - either APTX100 or MPEG.
The following table details the function of each switch.

**Table 1 – NICA X-1 Dipswitch Functions**

| Switch | Function | Setting (ON = Down, OFF = Up) |
|---|---|---|
| 1 | SWITCH PRIORITY | ON = switches overwrite internal configuration |
| 2 | BACKUP | ON = enable backup mode |
| 3 | INBAND CONTROL | ON = enable inband control |
| 4 | MIC I/P ENABLE | ON = set CH1 input to Microphone levels |
| 5 | LOOPBACK ENABLE | ON = set codec into loopback |
| 6 | AUX PORT ENABLE | ON = enable auxiliary data channel |
| 7 | AUX BAUDRATE - 2 | Index to table 2 below for baud rate settings |
| 8 | AUX BAUDRATE - 1 | Index to table 2 below for baud rate settings |
| 9 | MODE | Index to table 3/4 below for Mode setting |
| 10 | MODE | Index to table 3/4 below for Mode setting |
| 11 | MODE | Index to table 3/4 below for Mode setting |
| 12 | MODE | Index to table 3/4 below for Mode setting |

**Table 2 – Auxiliary Baud Rate Settings**

| SW 7 | SW 8 | Aux Baud Rate |
|---|---|---|
| OFF | OFF | 1200 |
| OFF | ON | 2400 |
| ON | OFF | 4800 |
| ON | ON | 9600 |

**Table 3 – apt-x100 Codec Mode Dipswitch Settings**

| SW9 | SW10 | SW11 | SW12 | Mode |
|---|---|---|---|---|
| OFF | OFF | OFF | OFF | 1 - AUTO DETECT |
| OFF | OFF | OFF | ON | 2 - APT ISDN Clear-Mono |
| OFF | OFF | ON | OFF | 3 - APT ISDN IMUX-Mono |
| OFF | OFF | ON | ON | 4 - APT ISDN IMUX-Stereo |
| OFF | ON | OFF | OFF | 5 - APT X21 64k-Mono |
| OFF | ON | OFF | ON | 6 - APT X21 128k-Mono |
| OFF | ON | ON | OFF | 7 - APT X21 128k-Stereo |
| OFF | ON | ON | ON | 8 - APT X21 256K-Stereo |
| ON | OFF | OFF | OFF | 9 - APT X21 IMUX-Mono |
| ON | OFF | OFF | ON | 10 - APT X21 IMUX-Stereo |

**Table 4 - MPEGL2 Codec Mode Dipswitch Settings**

| SW9 | SW10 | SW11 | SW12 | Mode |
|---|---|---|---|---|
| OFF | OFF | OFF | OFF | 1 - AUTO DETECT |
| OFF | OFF | OFF | ON | 15 - G722 ISDN-M |
| OFF | OFF | ON | OFF | 16 - L2 24KS ISDN-M |
| OFF | OFF | ON | ON | 17 - L2 48KS ISDN-M |
| OFF | ON | OFF | OFF | 18 - L2 24KS X21-M |
| OFF | ON | OFF | ON | 19 - L2 48KS X21-M |
| OFF | ON | ON | OFF | 20 - L2 48KS X21-DM |
| OFF | ON | ON | ON | 21 - L2 48KS X21-JS |

### 3.4 - Audio Inputs And Outputs

The Audio Inputs and Outputs will have different uses depending on the type of NICA X and the current configuration. The table below details :-

| NICA X type mode setting | Audio Input XLR CH1 | Audio Input XLR CH2 | Audio Output XLR CH1 | Audio Output XLR CH2 |
|---|---|---|---|---|
| NICA X-1A/1AT/2A | APT-CH1 * | APT-CH2 | APT-CH1 ** | APT-CH2 ** |
| NICA X-1M/1MT/2M | MPEG-CH1 * | MPEG-CH2 | MPEG-CH1** | MPEG-CH2** |
| NICA X-2AM<br>Ch 1 APT mode<br>Ch 2 no mode/APT mode | APT-CH1 | APT-CH2 | APT-CH1 | APT-CH2 |
| NICA X-2AM<br>Ch 1 MPEG mode<br>Ch 2 APT mode | MPEG-CH1 | APT-CH1 | MPEG-CH1 | APT-CH2 |
| NICA X-2MM<br>Ch 1 MPEG1 mode<br>Ch 2 no mode | MPEG1-CH1 | MPEG1-CH2 | MPEG1-CH1 | MPEG1-CH2 |
| NICA X-2MM<br>Ch 1 MPEG1 mode<br>Ch 2 MPEG2 mode | MPEG1-CH1 | MPEG2-CH1 | MPEG1-CH1 | MPEG2-CH1 |

* mono inputs must be applied to channel 1 audio input XLR
** mono outputs are available on channel 1 and channel 2 audio output XLR

#### 3.4.1 - Audio Option Modules

The NICA X has an internal position for an Audio Option Module. The available options are :-

| Module | Feature | See manual section |
|---|---|---|
| NIX05 Issue 1 | Audio Switcher for Backup operation | 6.3 |
| NIX05 Issue 2 | Audio Switcher for Backup operation with CH1 and CH2 mono sum. | 6.3 and 3.1.5 |
| NIX03 Issue 3 | Microphone Amp | 3.1.4 |

### 3.5 - F1 & F2 Programmable Function Keys

| Quick Reference Table | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | - SYSTEM-CONFIG<br>- 8.I/O<br>- 1.INPUT TYPE<br>& 2.INPUT COMMAND | EXI | |

The two function keys can be programmed to perform any command in the system. Effectively they are programmed with a remote control command. This means they can also perform inband control of the remote codec as well as the local codec. The Function keys will override the DIP Switch settings currently set on a NICA X-1 unit.

The function keys are programmed either from the front panel keypad and display (see section 5) (NICA X-2) or from the remote control port (see section 8). The function keys can be set to perform a latching or momentary type action and can also perform an A and B command relating to the key press.

Here are some examples :-

1. If set to latching action, pressing the key will perform command A and releasing the key will perform command B, e.g. Loopback ON when key depressed, Loopback OFF when key released.
2. If set to momentary action, pressing and releasing will perform command A and pressing and releasing again will perform command B, e.g. pressing the key will toggle between one mode and another mode.
3. If F1 and F2 are set to latching action, with just command A used on both F1 and F2, pressing and releasing F1 could dial a Book entry, and pressing and releasing F2 could clear down all ISDN calls.

**3.6 - External Inputs**

| **Quick Reference Table** | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | - SYSTEM-CONFIG<br>- 8.I/O<br>- 1.INPUT TYPE<br>& 2.INPUT COMMAND | EXI<br>RIP (reads input state) | |

The external inputs are 8 optically isolated inputs (see Appendix A.5 for connection details). The external inputs can be programmed to perform any command in the system. Effectively they are programmed with a remote control command. This means they can also perform inband control of the remote codec as well as the local codec. The external input command will override the DIP Switch settings currently set on a NICA X-1 unit.

The external inputs are programmed either from the front panel keypad and display (see section 5) (NICA X-2) or from the remote control port (see section 8). In a new system they are factory set to perform dial of BOOK entry 101 on input 1 through to dial BOOK entry 108 on input 8. These, of course, can be changed to any command.

The external inputs can be set to perform a latching or momentary type action and can also perform an A and B command relating to the active or inactive state. Here are some examples:-

1. If set to latching action, taking an input high will perform command A and taking it low will perform command B, e.g. Loopback ON when active, Loopback OFF when inactive.
2. If set to momentary action, pulsing an input high to low will perform command A and pulsing again will perform command B, e.g. pulses will toggle between one mode and another mode.

**3.7 - External Outputs**

| **Quick Reference Table** | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | - SYSTEM-CONFIG<br>- 8.I/O<br>- 3.RELAY MODE | EXO, REL, ROP | |

The external outputs are 8 relays with Normally Open contacts with one shared common connection (see Appendix A.4 for connection details). Each external output has a default setting as listed in the table below or it has a USER setting. The USER setting allows the Relay to be switched by a programmed event in the system. For example an opto input on a remote NICA X could be programmed to switch a relay on the local NICA X.

| **External Output** | **Default Function** | **Description** |
|---|---|---|
| 1 | CH1 Frame | ON when CH1 Frames |
| 2 | CH2 Frame | ON when CH2 Frames |
| 3 | CH 1 Call | ON when CH1 has ISDN Call |
| 4 | CH 2 Call | ON when CH2 has ISDN Call |
| 5 | Unit Active | ON when unit alive and running |
| 6 | Backup State | ON when unit is in performing BACKUP |
| 7 | Backup Fail | ON when unit failed to make BACKUP link |
| 8 | Stereo | ON when main running mode is Stereo. |

### 3.8 - Pin Protection

| Quick Reference Table | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | - SYSTEM-CONFIG<br>- 9.PINS<br>- USER/CONFIG/SYSTEM | PST | |

There is a security PIN protection system in the NICA X which can be disabled or enabled. There are four levels of PIN protection : User, Configuration, System Configuration and Remote Control. They all relate to the front panel user interface apart from the Remote Control PIN which is to protect Remote Control of the NICA X. These are all independently set with a 4 digit PIN protection number.

- The User PIN is required to perform a DIAL, or STOP, or BOOK dial function.
- The Configuration PIN is required to perform BOOK edits and Mode changes.
- The System Configuration PIN is required to access the System Configuration menus.

### 3.9 - Remote/Inband Control

| Quick Reference Table | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | - SYSTEM-CONFIG<br>- 7.REMOTE | REM | 3 |

Chapter 8 details the remote control commands available to the user on the RS232 Remote Control Port. Using the auxiliary data channel, the NICA X can also control the remote end NICA X using Inband control. To control the remote NICA X the Inband mode must be enabled as well as the auxiliary data on both units. The remote control command to be sent to the local unit is prefixed with 0 (e.g. 0:STS) and the command to be sent to the remote unit is prefixed with 1 (e.g. 1:STS).

There is also a Debug option in the Remote menu which allows the internal ISDN TA management port to be accessed from the Auxiliary Data RS232 port. This is only used to change factory settings of the ISDN TA.

# CHAPTER 4 ISDN TERMINAL ADAPTER CONFIGURATION

It is important that your Terminal Adapter (TA) is configured correctly for smooth operation. The table below lists the programmable settings.
Note : The Terminal Adapter Control is used to connect the codec section to another codec over ISDN. Normal operation will be at 64kbit/s data rate per port. If dialling internationally remember an extra 0 needs to be added after the international code 00 to ensure digital access.

### 4.1 - Data Rate

| Quick Reference Table | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | - SYSTEM-CONFIG<br>- 1.ISDN TA CONFIG | CTC | |

The Data Rate of the Terminal Adapter Channel 1 and 2 can be set to 64k, 56K and 64kS.

The TA will auto rate adapt between synchronous 56 and 64k incoming calls. However, outgoing calls must be set at the correct data rate as the remote device may not be able to auto rate adapt. The Rate selected is the default Rate for the Codec. Therefore if a call is made manually from the Codec the default Rate will be used. If a call is made from a BOOK entry which changes the Rate of a Codec, the Rate will be set back to the default Rate when the call is cleared (This rule also applies to the Mode of the audio codec). The 64kS (64k stripped) selection makes the ISDN call at 64k but sets the audio codec Mode to 56K. This is sometimes required when dialling to the USA where the international connection is made at 64k but the national connection within the USA is stripped to 56K. The USA switched digital network used to be based on a 56kbit/s service "Switched 56". There are still many active Switched 56 services in the States.

### 4.2 - Multiple Subscriber Numbering - MSN

| Quick Reference Table | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | - SYSTEM-CONFIG<br>- 1.ISDN TA CONFIG | CTC | |

The Multiple Subscriber Number (MSN) can be set for Channel 1 and Channel 2. MSN is used where specific devices on an ISDN line need addressing. This may be the case if two pieces of ISDN equipment are sharing the same ISDN line and need to be independently addressed with separate ISDN numbers. Also some ISDN PABX systems require the channels to be addressed (e.g. The ASCOM Alcatel requires the two channels of each TA to have MSN of 1 and 2 respectively). It is important that the B channel mapping of both channels is set to B1&B2 if you are using MSN on both channels
Note: MSN is an option on ISDN lines and must be enabled for this function to work.

### 4.3 - B Channel Mapping

| Quick Reference Table | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | - SYSTEM-CONFIG<br>- 1.ISDN TA CONFIG | CTC | |

In the UK the BT ISDN network has a history of B channel mapping being a useful way of routing calls to a specific port of a TA when two numbers were assigned to the ISDN line. The channels of each TA can therefore have the B channel defined.
The ISDN Line has two 64k channels B1 and B2. If you have two numbers with your ISDN service these relate to the B1 and B2 channels. The TA will answer calls depending on the B channel mapping. For example if both Channels are set to 'B1 & B2', then either Channel can answer a call on B1 or B2. (Ch 1 always answers a call first. Ch 2 will answer call if Ch 1 is busy). If Ch 1 is mapped to B1 and Ch 2 is mapped to B2 then Ch 1 will only answer a B1 call, and Ch 2 will only answer a B2 call. The B channel Mapping effects both incoming and outgoing calls.

### 4.4 - Sub Addressing

| Quick Reference Table | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | - SYSTEM-CONFIG<br>- 1.ISDN TA CONFIG | CTC | |

The Sub-address is used to filter calls to the correct Channel or terminal equipment on an ISDN line. The remote terminal equipment has to dial the sub-address at the end of the number dialled (e.g. 01672517120#12 ). An incoming call with a sub-address element present will be checked against the sub-address defined. If they match the call will be answered. If they do not match the call will not be answered. If there is no sub-address number set in the TA the call will be accepted even if a sub-address is dialled. If there is a sub-address number set in the TA and no sub-address is dialled then the call will not be answered.

### 4.5 - Call In Permit

| Quick Reference Table | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | - SYSTEM-CONFIG<br>- 1.ISDN TA CONFIG | CTA, CTN | |

This function allows incoming calls to be barred. The ISDN network passes the Calling Party Number (CPN) to the answering device. This is also known as Calling Line Identification (CLI) and must be enabled on your ISDN line. The NICA X can be programmed to not answer calls unless they are from certain numbers.

There are five options for Call Permit - ALL, BOOK, NUMBERS, MANUAL and NONE.

- ALL enables all calls to be Permitted.
- BOOK permits incoming calls to be answered as long as the CPN matches any of the BOOK entries in the NICA X.
- NUMBERS allows 10 numbers to be programmed into the System and the incoming call will only be Permitted if the CPN matches any of the 10 numbers.
- MANUAL allows a remote control command to answer the call.
- NONE prevents incoming calls from being answered.

### 4.6 - Dialling Prefix

| **Quick Reference Table** | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | - SYSTEM-CONFIG<br>- 1.ISDN | CTC | |

This function allows a dialling prefix to be added to all numbers dialled either manually or from a BOOK entry. This helps if moving the unit between locations where a 9 is required for an outside line or if a low cost routing prefix is required.

### 4.7 - Timeout

| **Quick Reference Table** | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | - SYSTEM-CONFIG<br>- 3.TIMEOUT | CCT | |

This menu allows the TIMER to be enabled which will automatically clear down calls after the set time. This may be useful in preventing high ISDN bills when users forget to clear down calls. However, it must be set to the required length to avoid important broadcasts being cut.

The options are 5 mins, 10 mins, 30 mins, 1 hour, 2 hours, 5 hours and OFF.

### 4.8 - Buzzer On Call In/Drop

| **Quick Reference Table** | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | - SYSTEM-CONFIG<br>- 5.OPTIONS<br>- 3.BUZZER | CTC | |

There is a Buzzer in each NICA X unit which can be controlled by a remote control command (BUZ) as well as by the two options Buzzer on Call In and Buzzer on Call Drop.

# CHAPTER 5 FRONT PANEL CONTROL

This section of the manual refers to use of the NICA X-2 only, which has an LCD display.

### 5.1 - User Interface

The user interface consists of a backlit LCD display, four 'soft keys' and a numeric keypad. The functions of the soft keys are defined on the bottom row of the LCD display. (See figure 7.0 on page 37).

### 5.2 - Power Up Top Menu

```
VERSION 2.0
(c) SONIFEX LTD
```

On power up the unit goes through an initialisation process. The Terminal Adapter module is configured during initialisation. The user definable configuration options, as last defined, are also set from non-volatile memory.

Once the initialisation is complete the top menu is displayed.

```
1: Idle
2: Idle
1: M00     2:M00
DIAL      STOP      BOOK      CONF
```

The top two lines of the display shows the state of Channel 1 and Channel 2 as follows:-

| State | Description |
|---|---|
| Idle | Channel Idle or not in use |
| Busy | Channel busy performing a function in between states |
| Out 384050 | ISDN Call is active made outgoing manually to number displayed |
| Out WRFM | ISDN Call is active made outgoing from Book - name displayed |
| In | ISDN Call is active made incoming (no Called Party Number) |
| In 517120 | ISDN Call is active made incoming from number displayed |
| In WRFM | ISDN Call is active made incoming from number matched to BOOK entry |
| ACTIVE | X21 Mode set and X21 active (as shown by X21 Indicate line) |

The third line shows the abbreviated Mode running on Channels 1 and 2.

The fourth line relates to the function of the four soft keys.

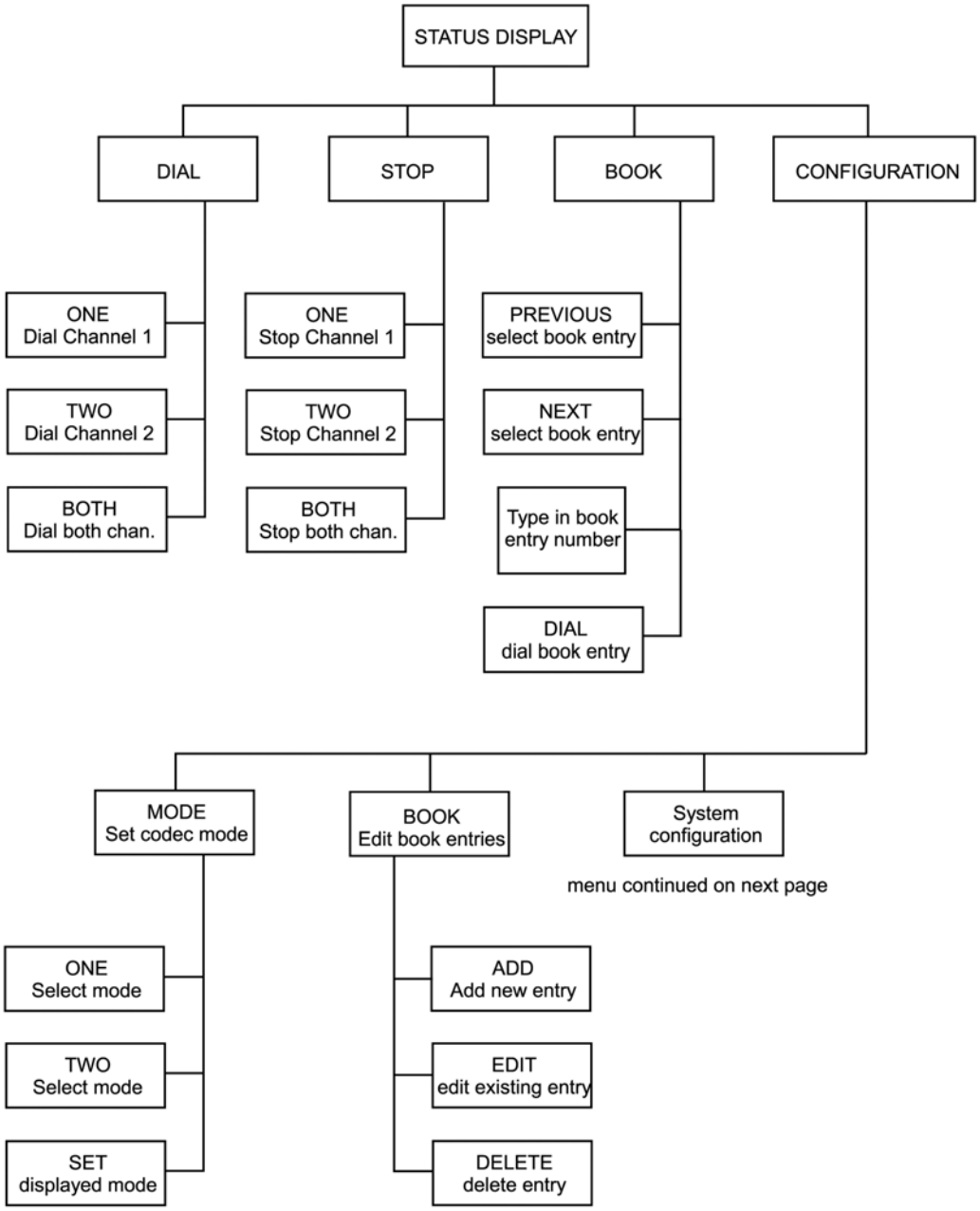
The STATUS key on the keypad will toggle the display between showing the Channel State on the top two lines to showing the Codec running Modes on the top two lines. In each case an abbreviation of the other is shown on the third line.

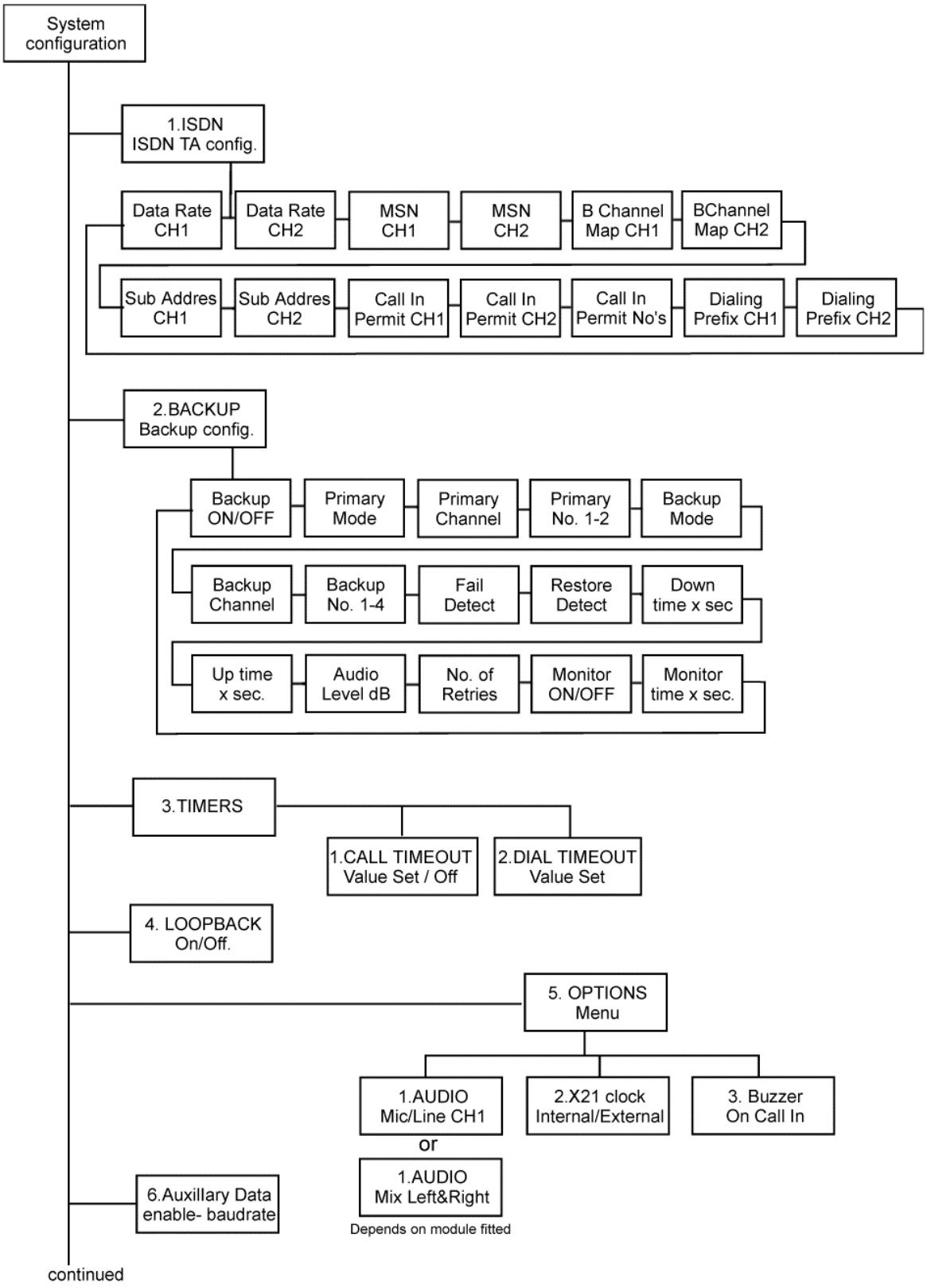
```
1: 2 APT ISDN Clr-M
2:
1: Idle      2:Idle
DIAL      STOP      BOOK      CONF
```

Note: The unit type and software version is available in the Factory menu (SYSTEM-0.FACTORY)

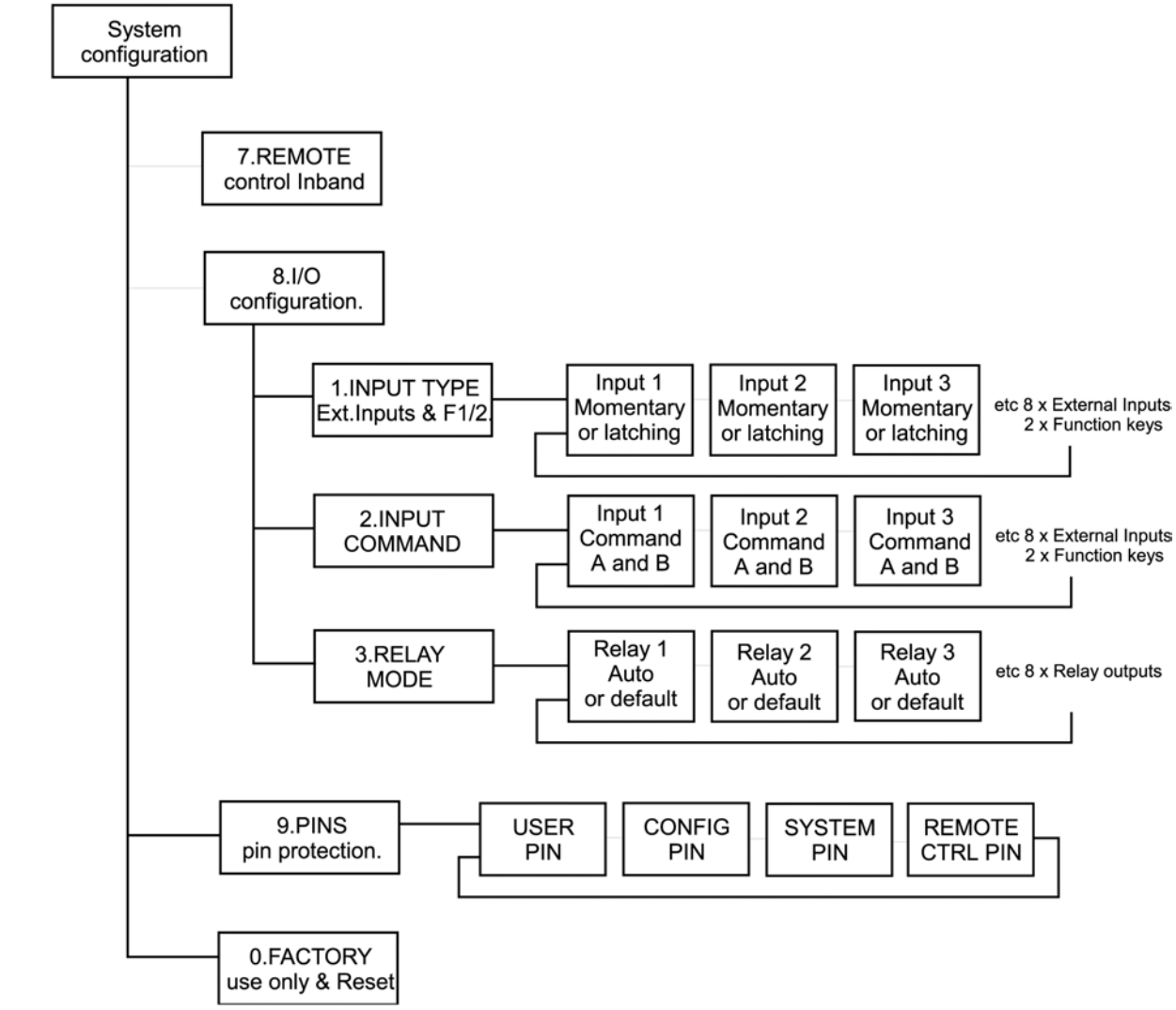
### 5.2 - Menu Tree

The next 3 pages show the menu tree structure :


STATUS DISPLAY
DIAL
STOP
BOOK
CONFIGURATION
ONE
Dial Channel 1
TWO
Dial Channel 2
BOTH
Dial both chan.
ONE
Stop Channel 1
TWO
Stop Channel 2
BOTH
Stop both chan.
PREVIOUS
select book entry
NEXT
select book entry
Type in book
entry number
DIAL
dial book entry
MODE
Set codec mode
BOOK
Edit book entries
System
configuration
menu continued on next page
ONE
Select mode
TWO
Select mode
SET
displayed mode
ADD
Add new entry
EDIT
edit existing entry
DELETE
delete entry


System configuration
1.ISDN ISDN TA config.
Data Rate CH1
Data Rate CH2
MSN CH1
MSN CH2
B Channel Map CH1
BChannel Map CH2
Sub Addres CH1
Sub Addres CH2
Call In Permit CH1
Call In Permit CH2
Call In Permit No's
Dialing Prefix CH1
Dialing Prefix CH2
2.BACKUP Backup config.
Backup ON/OFF
Primary Mode
Primary Channel
Primary No. 1-2
Backup Mode
Backup Channel
Backup No. 1-4
Fail Detect
Restore Detect
Down time x sec
Up time x sec.
Audio Level dB
No. of Retries
Monitor ON/OFF
Monitor time x sec.
3.TIMERS
1.CALL TIMEOUT Value Set / Off
2.DIAL TIMEOUT Value Set
4. LOOPBACK On/Off.
5. OPTIONS Menu
1.AUDIO Mic/Line CH1
or
1.AUDIO Mix Left&Right
Depends on module fitted
2.X21 clock Internal/External
3. Buzzer On Call In
6.Auxillary Data enable- baudrate
continued

CONTINUATION



**5.3 - Setting Modes**

| Quick Reference Table | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | - CONFIG<br>- MODE | MOD | 9,10,11,12 |

It is important that the Codec Mode is set correctly (see section 3.1 "Codec Settings").

From the Top Menu select the CONFigure menu, then select MODE

```
1=  2 APT ISDN Clr-M
2=  0     ⩛       ⩛
Mode configuration
ONE        TWO        SET        EXIT
```

The top line shows the mode set for channel 1. If a mode is set that can use both channels and channel 2 has not been set to a different mode, then this is shown by the down arrows.

If channel 2 has been set to an independent mode, then that is shown on line 2.

Use the ONE and TWO keys to select the available modes, or type in the mode number after selecting ONE or TWO. While the displayed mode is different from the actual mode set, the '=' is replaced by a ':'.

When the required mode(s) is displayed, press 'SET'.

**APTX Modes**

If the channel 2 mode has not been set differently, when channel 1 is set to an APTX mode it automatically applies to channel 2 as well, displayed as "2= 0 ⩛ ⩛ ". In this state, the NICA X will frame to an APTX signal on either channel, or both channels for an IMUX mode.

If channel 1 and channel 2 have been independently set to APTX modes, the APTX codec will be used by the first channel to connect, and two channel modes will not work.

**MPEG Modes**

All MPEG or G.722 modes take up a single channel. In a single MPEG unit, or a dual APTX/MPEG unit, the MPEG and G.722 modes are only available for channel 1. In a dual MPEG unit, they are available independently for the two channels.

NOTE: The Mode Configuration sets the required Mode. The Mode actually running is displayed in the Top Menu.

**Single APTX Version**

With the NICA X-1A or NICA X-2A (APTX version) the CH1 mode only needs to be set to the correct APT mode.

APT Modes which are set on CH1 will automatically set CH2 to the same Mode. This allows either ISDN/X21 channel to be used for that Mode. The APT Modes which use IMUX need both ISDN/X21 channels.

**Single MPEG Version**

With the NICA X-1M or NICA X-2M (MPEG version) the CH1 mode only needs to be set to the correct MPEG/G.722 mode.

**Dual APTX and MPEG Version**

With this version NICA X it is possible to use the unit in two different styles of Operation.

The two codec cards installed can act as two independent codecs. With the NICA X-2AM (MPEG and APT version) it is possible to set the Channel 1 Mode to an MPEG/G.722 mode and set the Channel 2 to an APT Mode. For example:

```
1= 11 G722 ISDN-M
2=  2 APT ISDN Clr-M
Mode configuration
ONE        TWO        SET        EXIT
```

In this case the CH1 audio input and output are for the G.722 Mode and the CH2 audio input and output are for the APT Mode. Similarly the ISDN calls for the G.722 Mode must be made/received on CH1 and the ISDN calls for the APT Mode must be made/received on CH2.
The second style of operation is where the unit appears as one codec capable of all coding Modes APT, G.722, and

MPEG. In this case the Channel 1 mode is just used with Channel 2 mode always set to "0 - NONE SET". The audio will appear on CH1 input and output (or CH2 as well if a stereo mode is used).

APT Modes which are set on CH1 will automatically set CH2 to the same Mode. This allows either ISDN/X21 channel to be used for that Mode. The APT Modes which use IMUX need both ISDN /X21 channels.

**Dual MPEG Version**

With the NICA X-2MM (2 x MPEG version) it is possible to set the Channel 1 Mode to an MPEG/G.722 Mode and set the Channel 2 Mode to another MPEG/G.722 Mode. The unit then operates as two independent 64k only codecs. For example

```
1= 11 G722 ISDN-M
2= 13 L2 48KS ISDN-M
Mode configuration
ONE        TWO        SET        EXIT
```

In this case the CH1 audio input and output are for the first MPEG codec and the CH2 audio input and output are for the second MPEG codec. Similarly the ISDN calls for the G.722 Mode must be made/received on CH1 and the ISDN calls for the MPEGL2 Mode must be made/received on CH2.

### 5.3.1 - Auto Detect

If the Mode is set to "1 AUTO DETECT" the NICA X will auto detect to the incoming data stream and select the correct coding Mode. This will be displayed as the running Mode in the Top Menu.

The Auto Detect feature allows two NICA X units to be in Auto Detect Mode and connected together over ISDN. The units will frame to the "best" coding Mode, where the "best" is defined as :

- 2 channel 15kHz mono audio for apt-X100
- 1 channel 24kHz sampling 10kHz mono audio for G.722/MPEGL2

## 5.4 - Making An ISDN Call

| **Quick Reference Table** | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | - DIAL | DIL | |

The ISDN calls which are active are indicated by the Red LED's "CALL 1" and "CALL 2".
From the Top Menu :

```
1: Idle
2: Idle
1: M02     2:M00
DIAL       STOP       BOOK       CONF
```

Select DIAL :

```
1: Idle
2: Idle
Chan to Dial ?
ONE        TWO        BOTH       CONF
```

Select the Channel you wish to use and enter the required number. If BOTH is selected it will allow the same number to be dialled on both channels.

The display will show you the status of the call. If the Call fails the 'ISDN failure cause' will be displayed (see section 5.7).

### 5.4.1 - Making A Call From The Book

| **Quick Reference Table** | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | - DIAL - BOOK or<br>- BOOK | DBK | |

The important step of making a call from the BOOK is the programming of the BOOK entry in the first place. The BOOK entry holds the name and ISDN numbers of the destination, and can also store the Codec Mode settings.

To make a call from the BOOK select BOOK from the Top Menu and then select the required BOOK entry by either using the PREVious and NEXT keys or by simply typing in the number.

```
1: Idle
2: Idle
3>WRFM
PREV      NEXT      DIAL      CONF
```

Once the required entry is displayed press the DIAL key and the codec Mode will be set (if programmed) and the ISDN numbers will be dialled. Once connected, the name of the Book entry will then be displayed.

When a BOOK entry is cleared, the codec Mode is set back to the default Mode.

The BOOK menu can also be accessed from DIAL-ONE-BOOK or DIAL-TWO-BOOK and then only the chosen channel will be dialled.

### 5.4.2 - Making A Call With A Sub-Address

| **Quick Reference Table** | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | - DIAL | DIL | |

To make a call with a sub-address extension simply enter # and up to a three digit sub-address after the number e.g. 09713889044#344 dials with a sub-address 344.
The equipment with sub-address 344 connected to 09713889044 will answer the call.

The Sub-address is used to filter calls to the correct port or terminal equipment on an ISDN line. The remote terminal equipment must have a sub-address defined. An incoming call with a sub-address element present will be checked against the sub-address defined. If they match, the call will be answered. If they do not match, the call will not be answered. If the remote equipment does not have a sub-address set, or if the sub-address element is not presented by the ISDN network, the call will be accepted.

### 5.5 - Clearing A Call – Stop

| **Quick Reference Table** | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | - STOP | STP | |

To clear a single call select STOP and then either channel ONE, TWO or BOTH. The display will show ' Call clearing', the call will be cleared down and the Call LED will turn off.

By selecting STOP and BOTH, both channel one and two will be cleared one after the other.

### 5.6 - Answering A Call

The unit will always auto answer a call if a channel is free as long as the Call Permit configuration condition is met (see section 4.5). When a call is answered and connected, the relevant Call LED will be illuminated and the display will show 'IN' and the Calling Party Number (CPN), if provided. If the CPN matches a number stored in a BOOK entry then the name of the book entry will be displayed.

### 5.7 - Call Termination Causes

If a call is not successful, the reason for the call failure will be displayed followed by a number in brackets. This number is the Call Termination Cause as presented by the ISDN network. The text is a simple interpretation of the termination cause. However the following list provides some of the more common termination causes

| Number | Cause | NICA X description |
|---|---|---|
| 1 | unallocated/unassigned number | Unallocated Number |
| 2 | no route to specified transit network | Call failed |
| 3 | no route to destination | No ISDN route |
| 4 | channel unacceptable | Call failed |
| 6 | channel unacceptable | Call failed |
| 7 | call awarded and being del. in est. ch. | Call failed |
| 16 | normal call clearing | Call Cleared |
| 17 | user busy | Engaged |
| 18 | no user responding | No User Responding |
| 19 | no answer from user | No Answer |
| 21 | call rejected | Call Rejected |
| 22 | number changed | Number Changed |
| 26 | Non-selected user clearing | Call failed |
| 27 | destination out of order | Dest. Out of Order |
| 28 | invalid number format | Invalid Num. Format |
| 29 | facility rejected | Facility Rejected |
| 30 | response to status enquiry | Call failed |
| 31 | normal, unspecified | Call failed |
| 34 | no circuit / channel available | No Channel Available |
| 38 | network out of order | Network Out of Order |
| 41 | temporary failure | Try Again |
| 42 | switching equipment congestion | Switch Congestion |
| 43 | access information discarded | Call failed |
| 44 | requested channel not available | Call failed |
| 47 | resources unavailable | Resources Not Avail. |
| 49 | quality of service unavailable | Quality Not Avail. |
| 50 | requested facility not subscribed | Not Subscribed |
| 57 | bearer capability not authorised | Capability Not Auth. |
| 58 | bearer capability not available | Capability Not Avail. |
| 63 | service or option not available | Service Not Avail. |
| 65 | bearer capability not implemented | Capability Not Imp. |
| 66 | channel type not implemented | Chan. Type Not Imp. |
| 69 | requested facility not implemented | Facility Not Imp. |
| 70 | only restricted dig. info. bearer available | Call failed |
| 79 | service or option not implemented | Service Not Imp. |
| 81 | invalid call reference value | Call failed |
| 82 | identified channel does not exist | Call failed |
| 83 | a suspend call exits, identity does not | Call failed |
| 84 | call identity in use | Call failed |
| 85 | no call suspended | Call failed |
| 86 | call having req. call identity, "cleared" | Call failed |
| 88 | incompatible destination | Incompatible Dest. |
| 95 | invalid message, unspecified | Call failed |
| 96 | mandatory info element is missing | Call failed |
| 97 | message type not implemented | Call failed |
| 98 | message not compatible with call state | Call failed |
| 99 | information element non-existent | Call failed |
| 100 | invalid information element contents | Call failed |
| 101 | message not compatible | Call failed |
| 102 | recovery on timer expire | Call failed |
| 111 | protocol error, unspecified | Call failed |
| 128 | Network Not Responding | Network Not Resp. |

**5.8 - Book Entries**

| Quick Reference Table | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | - CONF<br>- BOOK<br>- ADD/EDIT/DEL | BKE | |

To Add a new BOOK entry, or to Edit or Delete an existing entry, select BOOK from the configuration menu.

```
1: Idle
2: Idle
Edit book
 ADD        EDIT        DEL        EXIT
```

Select ADD to add a new entry or EDIT or DELETE.

**Book Entry Structure**

Each entry has an ID number, a name (12 characters), a number for Channel 1, and a number for Channel 2 (each 24 digits). The optional settings in the BOOK entry are the codec Mode to be used, the Data Rate of the ISDN, and the Auxiliary Data setting.

If the Mode of the codec is set in a book entry, when the book entry is used the Mode may be changed from the current default Mode. Therefore, when the BOOK entry is then cleared down, the Mode will be set back to the default.

If the NICA X is used as two independent codecs, for example an MPEG/G.722 codec on channel 1 and an APTX codec on channel two, it is important when the book entries are programmed that the ISDN number is programmed into the correct channel, i.e. channel 1 for MPEG/G.722 book entries and channel 2 for APT book entries.

# CHAPTER 6 BACKUP OPERATION

| Quick Reference Table | | | |
|---|---|---|---|
| MEANS OF CONTROL | MENU | REMOTE CONTROL | DIP SWITCHES |
| ACTION | - SYSTEM-CONFIG<br>- 2. BACKUP | CBG, CBM, CBP,<br>CBR, CBE, CBI, CBS | 2 |

The NICA X has a separate mode of operation for performing the backup for a primary service.
There are two scenarios :-

1. Operation as a Primary and Reserve service on one codec.
2. Operation as a Reserve service to an external Primary service on a different codec.

When running in Backup mode there is a main programme loop as follows :-

A. Primary Service
to
B. Primary Service Fail
to
C. Reserve Service
to
D. Primary Service Restored or Reserve Service Failed/Stopped
to
A. Primary Service

### 6.1 – Custom Applications

As well as the Backup Operation the NICA X software version 2.10 onwards also has an additional operating mode called "SM2". This "State Machine 2" is a special mode of operation developed for a specific application now available in the NICA X.
The Operation of SM2 is detailed in section 6.6 State Machine 2

### 6.2 - Backup Configuration

The unit has to be programmed correctly to operate in the required scenario. There are a number of variables in the programming to allow users to fine tune their operation. The table below gives an overview of this.

| Parameter | Options |
|---|---|
| Backup Enable | NORMAL/BACKUP/SM2 |
| Primary Mode | Any codec mode or none set (none set indicates primary service is external) |
| Primary Channel | 0, 1, 2, 1or2, 1&2 |
| Primary No.s | ch1, ch2 ISDN numbers (If primary Mode is on ISDN) |
| Reserve Mode | Any codec mode |
| Reserve Channel | 0, 1, 2, 1or2, 1&2 |
| Reserve No.s | ch1, ch2 ISDN numbers A and B (B are alternative backup numbers) |
| Fail Detect | external/frame/audio1/audio1or2/audio1&2/ind1/ind2/ind1or2/ind1&2 |
| Restore Detect | external/frame/audio1/audio1or2/audio1&2/ind1/ind2/ind1or2/ind1&2 |
| Down Time | 0 - 255 seconds |
| Up Time | 0 - 255 seconds |
| Silence Level | -24dB/-12dB/-6dB/0dB |
| Number of Retries | 0 - 6 |
| Monitor Function | ON/OFF |
| Monitor Time | 0 - 5 minutes |

**Backup Enable**

If set to BACKUP this sets the NICA X into Backup operation mode. Set this to BACKUP once all your other settings are correct. A Remote Control Command CBE can also be used to change this setting (this could be programmed into an Opto Input or a Function Key). The SM2 setting is a custom state machine as described in section 6.6

**Primary Mode**

If the NICA X is providing the Primary and Reserve service then the Primary Codec Mode is set here. It could be any valid mode from the codec mode list.
If the NICA X is providing a Reserve service to an external Primary service then the mode must be set to " NONE SET".

**Primary Channel**

If the NICA X is providing the Primary and Reserve service then the Primary Channel is set here. This must be set by the user taking into account the primary codec Mode set. It could be set to channel 1, 2, channel 1 or 2 (where the data service may be on 1 or 2) or channel 1 and 2 (where it uses two channels in an IMUX mode). The channels could be ISDN or X21 ports depending on the primary codec Mode set.

**Primary No.s**

If the NICA X is providing the Primary and Reserve service and the Primary service is over ISDN then the number(s) to dial are entered here for channels 1 and 2.

**Reserve Mode**

The Reserve Codec Mode is set here. It could be any valid mode from the codec mode list.

**Reserve Channel**

The Reserve Channel is defined here. This must be set by the user taking into account the Reserve Codec Mode which has been set. It could be set to channel 1, 2, channel 1 or 2 (where the data service may be on 1 or 2) or channel 1 and 2 (where it uses two channels in an IMUX mode). The channels could be ISDN or X21 ports depending on the codec Mode set.

**Reserve No.s**

If the Reserve Codec Mode is an ISDN Mode then the ISDN numbers for channel 1 and 2 are saved here. There are two sets of numbers, A and B. If the codec Mode only requires one channel then only one number is entered by the user in each set. The A number(s) are tried first. If the NICA X fails to connect with these number(s) after the set number of retries, it will then use the B number(s)

**Fail Detect**

The Backup operation is continually checking to see if it must activate the Reserve service depending on the state of the option selected here. The options and their activation criteria are listed below. The Fail detect must be active for the 'Drop Time' setting before the Reserve service is activated.

| Fail Detect Method | Description |
|---|---|
| EXTERNAL | An External Opto Input, programmed with remote control command CBI, defines the state of the external Primary service e.g. Active=good, Inactive=fail (This should also be the selection if you wish to use only manual intervention via the front panel or CBS command) |
| FRAME | The frame status is "Off" for the Primary Channel of the NICA X |
| AUDIO 1 | Audio level dropped below the threshold for channel 1 |
| AUDIO 1 or 2 | Audio level dropped below the threshold for either channel 1 or channel 2 |
| AUDIO 1 and 2 | Audio level dropped below the threshold for both channel 1 and channel 2 |
| INDICATE 1 | Depending on the Primary Mode either the X21 Indicate line or TA DCD for channel 1 is inactive |
| INDICATE 2 | Depending on the Primary Mode either the X21 Indicate line or TA DCD for channel 2 is inactive |
| INDICATE 1 or 2 | Depending on the Primary Mode either the X21 Indicate line or TA DCD for channel 1 or channel 2 is inactive |
| INDICATE 1 & 2 | Depending on the Primary Mode either the X21 Indicate line or TA DCD for channel 1 and channel 2 are inactive |

**Restore Detect**
If the Reserve service is active then the Restore Detect selection is continually checked to see if the NICA X must switch back to the Primary service. The options and their criteria are listed below. The Restore Detect must be active for the 'Up Time' setting before the Reserve service is de-activated.

| Restore Detect Method | Description |
|---|---|
| EXTERNAL | An External Opto Input programmed with remote control command CBI defines the state of the external Primary service e.g.Active=good Inactive=fail (This should also be the selection if you wish to use only manual intervention via the front panel or CBS command) |
| FRAME | The frame status is on for the Primary Channel of the NICA X. |
| AUDIO 1 | Audio level above the threshold for channel 1 |
| AUDIO 1 or 2 | Audio level above the threshold for either channel 1 or channel 2 |
| AUDIO 1 and 2 | Audio level above the threshold for both channel 1 and channel 2 |
| INDICATE 1 | Depending on the Primary Mode either the X21 Indicate line or TA DCD for channel 1 is active |
| INDICATE 2 | Depending on the Primary Mode either the X21 Indicate line or TA DCD for channel 2 is active |
| INDICATE 1 or 2 | Depending on the Primary Mode either the X21 Indicate line or TA DCD for channel 1 or channel 2 is active |
| INDICATE 1 & 2 | Depending on the Primary Mode either the X21 Indicate line or TA DCD for channel 1 and channel 2 are active |

**Down Time**

When the Primary service is operating this is the value reloaded into the countdown timer while Fail Detect is false. While the Fail Detect is true the system timer will count down. If the timer expires then the Reserve service will be activated. If the Reserve service is activated but fails to connect or frame the system reverts to trying the Primary service.

**Up Time**

When the Reserve service is operating this is the value reloaded into the countdown timer while Restore Detect is false. While the Restore Detect is true the timer will count down. If the timer expires then the Primary service will be activated.

**Silence Level**

The silence detector level is programmable at -24dBu, -18dBu, -12dBu or -6dBu (±1.5dBu). When the audio input into the detector drops to this level then silence is said to be detected.

**Number of Retries**

This is the number of retries the NICA X performs when dialling the Backup ISDN numbers before switching back to standby or Primary service.

**Monitor Enable**

When the unit goes into Reserve service it will route its output audio into the codec section audio input if the monitor is enabled. This means the remote codec involved in the backup can monitor the actual audio output of the NICA X. (This feature requires the audio switch module).

**Monitor Time**

This is the length of time the audio is switched for monitoring as above.

**Front Panel Control & Remote Command Control**

The Front Panel keys PRIMary and REServe (for NICA X-2) and the Remote Control Command CBS (which could be programmed into a Function key or Opto Input) are manual ways of switching between the Primary and Reserve service. This is sometimes the only way to switch back to Primary if the NICA X is providing the Primary and Reserve service.

### 6.3 - Backup Display - NICA X-2 only

When the NICA X is set to BACKUP ENABLE - ON the display of the NICA X-2 shows the Backup Status Menu. The two keys Primary and Reserve allow the state of the system to be changed between Primary and Reserve Operation. This is protected by the Config PIN entry.

### 6.4 – Operational Examples

The following give examples of how to configure the NICA X for different scenarios.

**Example 1**

The Primary service is provided by the NICA X using an X21 line and the Reserve service is using ISDN IMUX on 2 channels (see figure section 7.3 backup diagram). In this case both units must be a NICA X. We shall call the two units Studio Site Unit and Transmitter Site Unit. (These are example names as the units may not actually be at these locations as they could be between two Radio Station sites for example). The Transmitter Site will dial the ISDN calls when switching to Reserve.

The units are programmed as follows :

| Parameter | Transmitter Site Unit | Studio Site Unit |
|---|---|---|
| Backup Enable | BACKUP | BACKUP |
| Primary Mode | 8. APT X21 256K-S | 8. APT X21 256K-S |
| Primary Channel | 1 | 1 |
| Primary No.s | none | none |
| Reserve Mode | 3.APT ISDN IMUX-M | 3.APT ISDN IMUX-M |
| Reserve Channel | 1&2 | 1&2 |
| Reserve No.s | 1>01933651819,<br>2>01933651819 | 1><br>2> |
| Fail Detect | Frame | Frame |
| Restore Detect | External | External |
| Down Time | 10 seconds | 10 seconds |
| Up time | 10 seconds | 10 seconds |
| Silence Level | n/a | n/a |
| Number of retries | 2 | 0 |
| Monitor function | OFF | OFF |
| Monitor Time | n/a | n/a |

Setup Commands Using the Remote Control Port :

| Transmitter Unit | Studio Unit |
|---|---|
| 0:CBP8,1<br>0:CBR3,4<br>0:CBN3,01933651819<br>0:CBN4,01933651819<br>0:CBG1,0,10,10,0,2<br>0:CBM0,0<br>0:CBE1 | 0:CBP8,1<br>0:CBR3,4<br>0:CBN3,<br>0:CBN4,<br>0:CBG1,0,10,10,0,2<br>0:CBM0,0<br>0:CBE1 |

The following description is of the Transmitter Site Unit. The Studio Site Unit would be very much the same but without making the ISDN calls.

```
Primary: On -ACTIVE   ■
Reserve: Off
P: M08    R: M03
PRIM        RES              CONF
```

The unit is running on the Primary service and the Primary service is active.

```
Primary: On -FAIL     ■
Reserve: Off -
P: M08    R: M03
PRIM        RES              CONF
```

The failure detector detects that Frame is lost

```
Primary: Off-FAIL
Reserve: On-BUSY      ■
P: M08    R: M03
PRIM        RES              CONF
```

After the set 'Down Time' the NICA X automatically dials the Reserve Numbers.

```
Primary: Off-
Reserve: On-ACTIVE  ■
P: M08    R: M03
PRIM        RES              CONF
```

The unit is running on the Reserve service and the Reserve service is active.

```
Primary: Off-
Reserve: On - ACTIVE ■
P: M08    R: M03
PRIM        RES              CONF
```

The restore detector detects that External input has occurred. (or if manually forced by front panel keys or remote control command).

```
Primary: On - ACTIVE  ■
Reserve: Off -
P: M08    R: M03
PRIM        RES              CONF
```

After the set 'Up Time' the NICA X automatically switches to the Primary service and clears the calls associated with the Reserve service.

**Example 2**

The Primary service is provided by the NICA X on X21 port 1 and the Reserve service is on X21 port 2. The unit is programmed as follows.

The remote units for Primary and Reserve do not have to be NICA X units, or the same unit, as long as they are set to compatible coding Modes. If separate units were used for Primary and Reserve they would not have to be in Backup Mode. If the same NICA X unit was used remotely to provide Primary and Reserve then it would have to be in Backup Mode with the same settings as below.

| **Parameter** | **Setting** |
|---|---|
| Backup Enable | BACKUP |
| Primary Mode | 8. APT X21 256K-S |
| Primary Channel | 1 |
| Primary No.s | n/a |
| Reserve Mode | 8. APT X21 256K-S |
| Reserve Channel | 2 |
| Reserve No.s | n/a |
| Fail Detect | Indicate 1 |
| Restore Detect | Indicate 1 |
| Down Time | 10 seconds |
| Up time | 10 seconds |
| Silence Level | n/a |
| Number of Retries | n/a |
| Monitor Function | OFF |
| Monitor Time | n/a |

Setup Commands Using the Remote Control Port :
0:CBP8,1
0:CBR8,2
0:CBG5,5,10,10,0,0
0:CBM0,0
0:CBE1

```
Primary: On -ACTIVE  ■
Reserve: Off
P: M08    R: M08
PRIM        RES              CONF
```

The unit is running on the Primary service and the Primary service is active.

```
Primary: On -FAIL    ■
Reserve: Off -
P: M08    R: M08
PRIM        RES              CONF
```

The failure detector detects that Indicate 1 has failed

```
Primary: Off-FAIL
Reserve: On -ACTIVE ■
P: M08    R: M08
PRIM        RES              CONF
```

After the set 'Down Time' the NICA X automatically switches to the Reserve service.

```
Primary: Off-
Reserve: On -ACTIVE ■
P: M08    R: M08
PRIM        RES              CONF
```

The unit is running on the Reserve service and the Reserve service is active.

```
Primary: Off-
Reserve: On -ACTIVE ■
P: M08    R: M08
PRIM        RES              CONF
```

The restore detector detects that Indicate 1 has restored.

```
Primary: On -ACTIVE   ■
Reserve: Off -
P: M08    R: M08
PRIM        RES              CONF
```

After the set 'Up Time' the NICA X automatically switches back to the Primary service.

**Example 3**

The Primary service is provided by an external system and the Reserve service is provided by the NICA X using ISDN IMUX on 2 channels (see figure section 7.4 backup diagram). In this example the Audio Switch Module (option) is fitted.

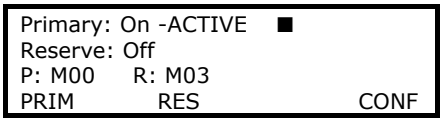
The Audio Programme feed from the primary external service is input into the CH1 and CH2 input connectors of the NICA X and the Audio Switch Module loops this through to the output connectors of the NICA X. The Relays on the audio switch module rest in this routing position so if the NICA X fails the programme feed is still routed as required.

The remote unit to provide the other end of the Reserve does not have to be a NICA X unit as long as it is set to a compatible coding Mode. If a NICA X is used, it must not be set in Backup Mode, but just in the compatible coding Mode.

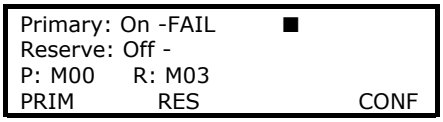
The NICA X is programmed as follows :

| Parameter | Setting |
|---|---|
| Backup Enable | BACKUP |
| Primary Mode | 0.NONE SET |
| Primary Channel | n/a |
| Primary No.s | n/a |
| Reserve Mode | 3.APT ISDN IMUX-M |
| Reserve Channel | 1&2 |
| Reserve No.s | 1>01933651819, 2>01933651819 |
| Fail Detect | AUDIO1&2 |
| Restore Detect | AUDIO1&2 |
| Down Time | 10 seconds |
| Up time | 10 seconds |
| Silence Level | -24dBu |
| Number of Retries | 2 |
| Monitor Function | OFF |
| Monitor Time | n/a |

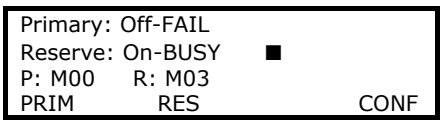
Setup Commands Using the Remote Control Port
0:CBP0,0
0:CBR3,4
0:CBN3,01933651819
0:CBN4,01933651819
0:CBG4,4,10,10,3,2
0:CBM0,0
0:CBE1




The unit is monitoring the Primary service and the Primary service is active.



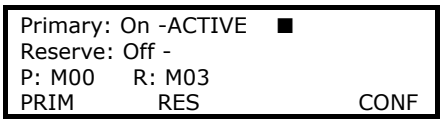

The failure detector detects that Audio has failed on channels 1 and 2.




After the set 'Down Time' the NICA X automatically dials the Reserve Numbers.


The unit is running on the Reserve service and the Reserve service is active.


The restore detector detects that Audio has been restored on channels 1 and 2.




After the set 'Up Time' the NICA X automatically switches to monitoring the Primary service and clears the calls associated with the Reserve service.

### 6.5 - Audio Switch Module (Optional)

The Audio Switch Module is an optional module fitted internally and is required for operational scenarios that use audio testing for the fail and restore detectors. It is capable of performing a number of audio switching functions

The Input Audio Connector can be Routed to the Output Audio Connector for Backup options where the Primary Service is external and the Reserve Service is provided by the NICA X Codec (see figure section 7.4 backup diagram).

The Output Audio Connector can be routed internally to the Silence detector (without this module only the Input Audio Connector can be routed to the Silence Detector.

The Monitor Function used in Reserve service operation allows the Audio Input Connector to be Routed to the Audio Output Connector but also the Audio Output Connector to be routed to the audio input of the codec to send to the remote reserve codec.

Issue 2 Audio Switch Modules have the facility to sum the Left and Right audio input. When the main mode is set to Mono (i.e. Main mode Mono and no secondary mode or breakout). This is useful when using the Backup mode when the Primary service is stereo with a mono backup service.

### 6.6 – State Machine 2

The SM2 (State Machine 2) mode of BACKUP is a custom mode of operation developed for a specific application. It is designed to operate with a Local and Remote NICA X model 2MM to give two independent G722 audio channels from the Remote unit to the Local Unit. The return audio path is not used. The two audio channels are described as Channel 1 and Channel 2

**General Definitions :**

Channel 1 controlled by Local end unit opto input 1 (External Input connector)
Channel 2 controlled by Local end unit opto input 2 (External Input connector)

Channel 1 Remote Relay contact at Remote end unit Relay 3 (External Input connector)
Channel 2 Remote Relay contact at Remote end unit Relay 4 (External Input connector)

Channel 1 Alarm relay contact at Local end unit Relay 6 (External Output connector)
Channel 2 Alarm relay contact at Local end unit Relay 7 (External Output connector)

("On" = Current flowing through opto isolator / relay contact closed);

**Operation Under Control Scenario :**

Channel 1 "on"

Dial up Remote unit and Operate Remote relay for Channel 1 (Relay3);

Channel 2 "on"

Dial up Remote unit and Operate Remote relay for Channel 2 (Relay4);;

Channel 1 "off"

Turn off Remote unit Channel 1 relay (Relay3), wait approximately 10 seconds before disconnection. If channel 1 is turned back "on" within the 10 seconds leave connected and reset the timer;

Channel 2 "off"

Turn off Remote unit Channel 2 relay (Relay4), wait approximately 10 seconds before disconnection. If channel 1 is turned back "on" within the 10 seconds leave connected and reset the timer;

**Operation Under Fault or Error Conditions :**
No redial attempts.
Call Drop Out:
Close Local unit alarm relay contact, do not automatically redial. Alarm relay to be open circuit when Channel control is "off";

At remote end unit if no connection or after a call drop out etc. turn "off" Remote end Relays for Channel 1 and 2.

#### 6.6.1 - Operating States

In this operating mode, each channel has its own controlling state machine. The major states are :

RESET
When the TA and codec modules come out of reset go to OFFLINE.
OFFLINE
On entry, if the channel has a connection it is disconnected.
On entry, set the Remote relay state =0.
When the external I/P =1 go to DIALLING.
DIALLING
On entry, any existing calls are disconnected and the Primary ISDN number is dialled.
When framed, go to ONLINE.
When failure to connect reported, go to ALARM.
ONLINE
On entry, set the Remote relay state =1.
When the external I/P =0 go to WAIT.
When the connection is broken go to ALARM.
WAIT
On entry, a 10s timer is started.
On entry, set the Remote relay state =0.
When the external I/P =1 return to ONLINE.
When the timer elapses, go to OFFLINE.
ALARM
On entry, close the channel's alarm relay contact.
When either channel is in this state, the "Backup" LED flashes.
The Alarm relays are fixed in software as Relay 6 for channel 1, Relay 7 for channel 2.
When the external I/P =0 open the relay contact and go to OFFLINE.

### 6.6.2 – User Interface

When the NICA X is in SM2 mode, the top-level display is as below.

```
1: Idle
2:Out 01933651819
1: OFF      2: ONLINE
                          CONF
```

The first two lines show the connection state of the two channels, the same as in the Normal mode.
The next line shows control state for each channel, as described above.
The only soft key available is CONF, taking the user to the configuration displays.

### 6.6.3 – Configuration

(A script to be sent to the remote control port of the NICA X is provided below which will set the units to the required settings).

**Local Unit Configuration**

The Mode of Channel1 and Channel2 should be set to 16. L2 24KS ISDN-M.

To give the External Opto Inputs control over their respective channels:

| **External Opto Inputs** | | |
|---|---|---|
| **Parameter** | **Value** | **Type** |
| Opto 1A | 0:CBI1,1 | Latching |
| Opto 1B | 0:CBI0,1 | Latching |
| Opto 2A | 0:CBI1,2 | Latching |
| Opto 2B | 0:CBI0,2 | Latching |

The F1 and F2 buttons could be programmed in the same way to give front panel control.
To configure the mode of operation :

| **Backup Parameter Settings** | |
|---|---|
| **Parameter** | **Value** |
| Backup Mode | SM2 (i.e. 2) |
| Primary Mode | n/a |
| Primary Channel | n/a |
| Primary No.s | valid ISDN number |
| | valid ISDN number |
| Reserve Mode | n/a |
| Reserve Channel | n/a |
| Reserve No.s * | empty |
| | empty |
| Fail Detect * | EXTERNAL |
| Restore Detect * | EXTERNAL |
| Down Time | 10 s |
| Up Time * | 0 |
| Silence Level | n/a |
| Number of Retries * | 0 |
| Monitor Function * | OFF |
| Monitor Time * | n/a |

Settings for the parameters marked "*" may or may not affect operation, and operation can only be guaranteed with them set as shown.

**Remote Unit Configuration**

The Mode of Channel1 and Channel2 should be set to 15. G722 ISDN-M.

To give the codecs' signal bits control over their respective relays:

| **External I/P Bits** | | |
|---|---|---|
| **Parameter** | **Value** | **Type** |
| Signal 1A | 0:REL3,1 | Latching |
| Signal 1B | 0:REL3,0 | Latching |
| Signal 2A | 0:REL4,1 | Latching |
| Signal 2B | 0:REL4,0 | Latching |

Configuration Scripts (Sent to a unit in factory defaults) :

| **Local Unit** | **Remote Unit** |
|---|---|
| 0:EXI0,"0:CBI1,1",1 | 0:EXI20,"0:REL3,1",1 |
| 0:EXI1,"0:CBI0,1",1 | 0:EXI21,"0:REL3,0",1 |
| 0:EXI2,"0:CBI1,2",1 | 0:EXI22,"0:REL4,1",1 |
| 0:EXI3,"0:CBI0,2",1 | 0:EXI23,"0:REL4,0",1 |
| 0:MOD16,16 | 0:MOD15,15 |
| 0:CBG0,0,10,0,0,0 | |
| 0:CBM0,0 | |
| 0:CBN1,384000 | |
| 0:CBN2,384010 | |
| 0:CBE2 | |

# CHAPTER 7 APPLICATION DIAGRAMS

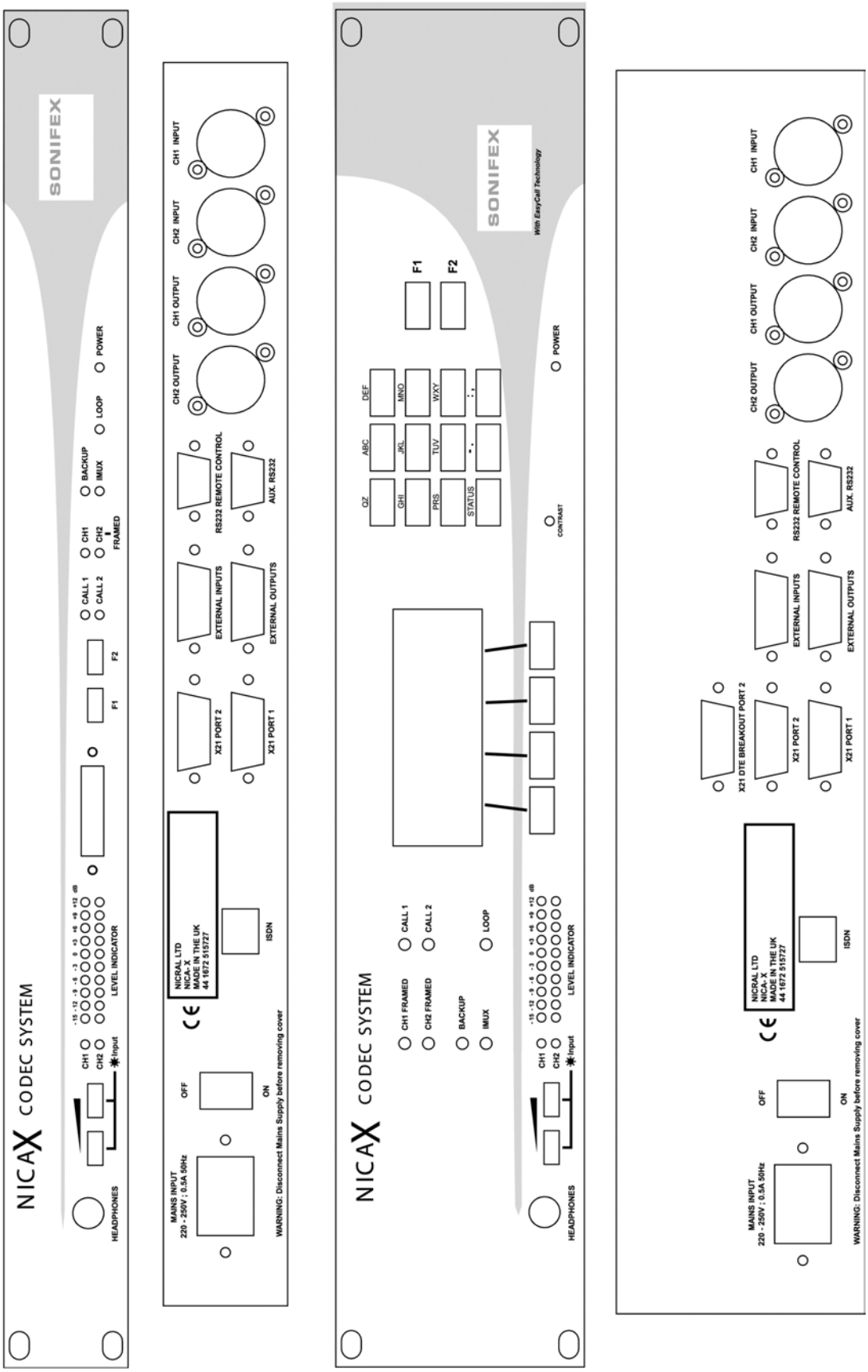
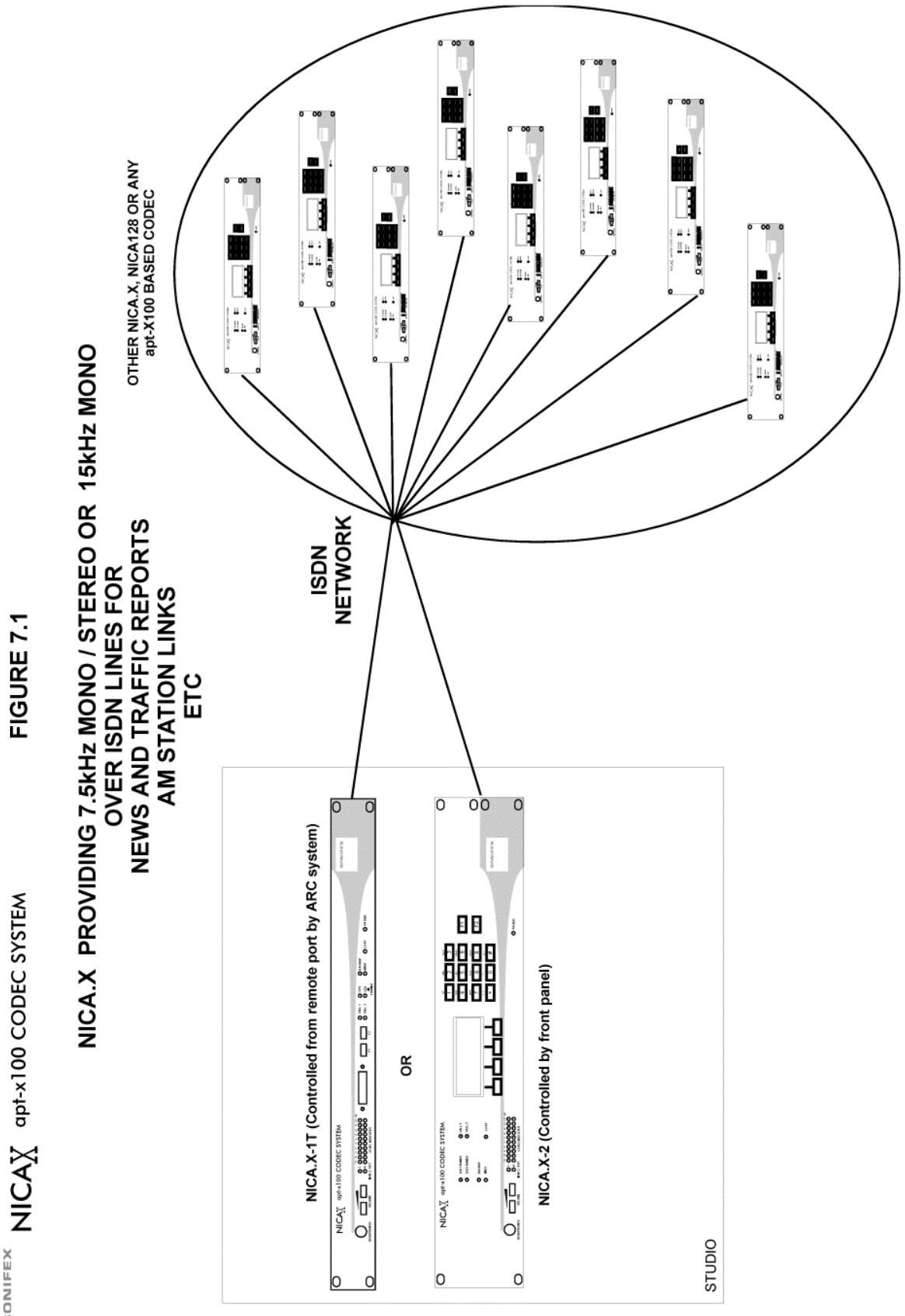
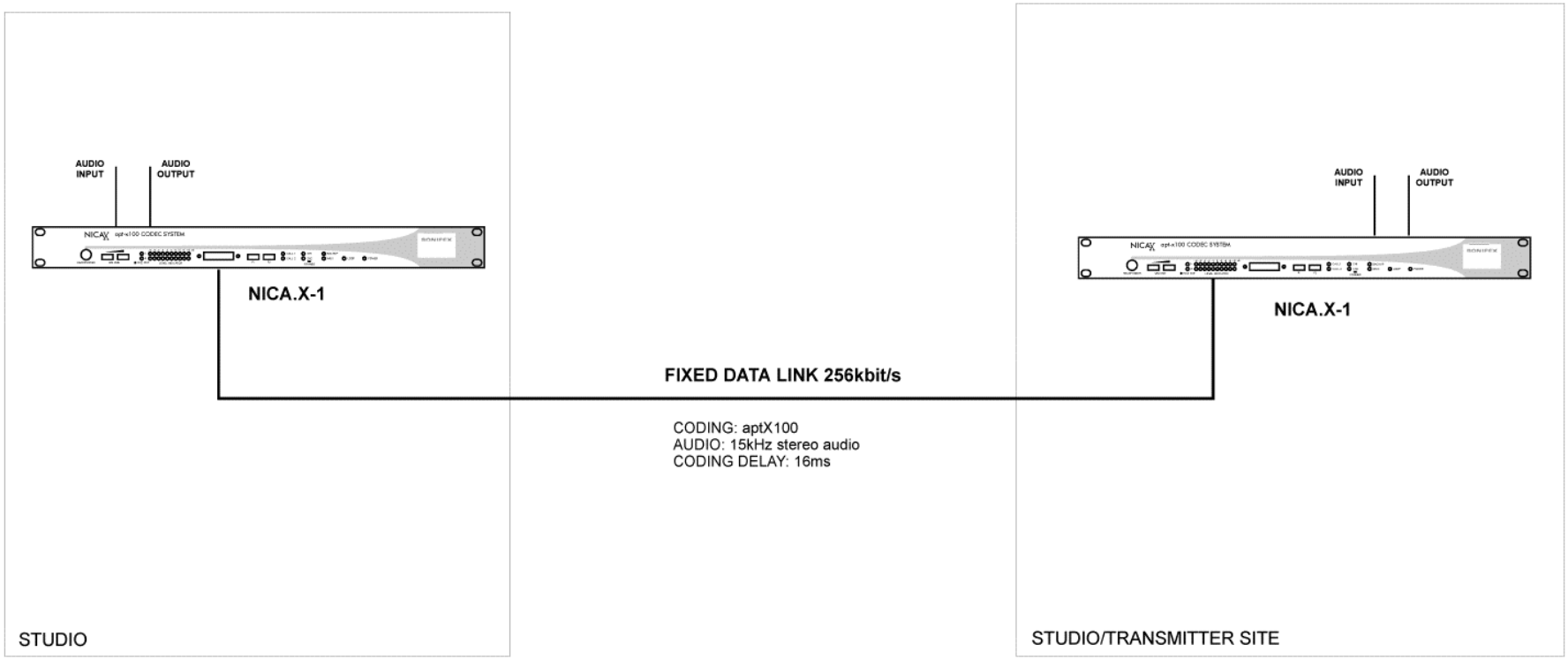



FIGURE 7.0


SONIFEX
NICA X apt-x100 CODEC SYSTEM
FIGURE 7.1
NICA.X PROVIDING 7.5kHz MONO / STEREO OR 15kHz MONO
OVER ISDN LINES FOR
NEWS AND TRAFFIC REPORTS
AM STATION LINKS
ETC
ISDN
NETWORK
OTHER NICA.X, NICA128 OR ANY
apt-X100 BASED CODEC
NICA.X-1T (Controlled from remote port by ARC system)
OR
NICA.X-2 (Controlled by front panel)
STUDIO

## FIGURE 7.2

# NICA.X-1 PROVIDING 15kHz STEREO AUDIO FOR USE ON STL (STUDIO TO TRANSMITTER LINKS) STS (STUDIO TO STUDIO LINKS)



## FIGURE 7.3

## NICA.X-1 PROVIDING UP TO 15kHz STEREO AUDIO FOR USE ON STL (STUDIO TO TRANSMITTER LINKS) STS (STUDIO TO STUDIO LINKS) WITH ISDN BACKUP PROVIDING 7.5kHz OR 15kHz MONO AUDIO

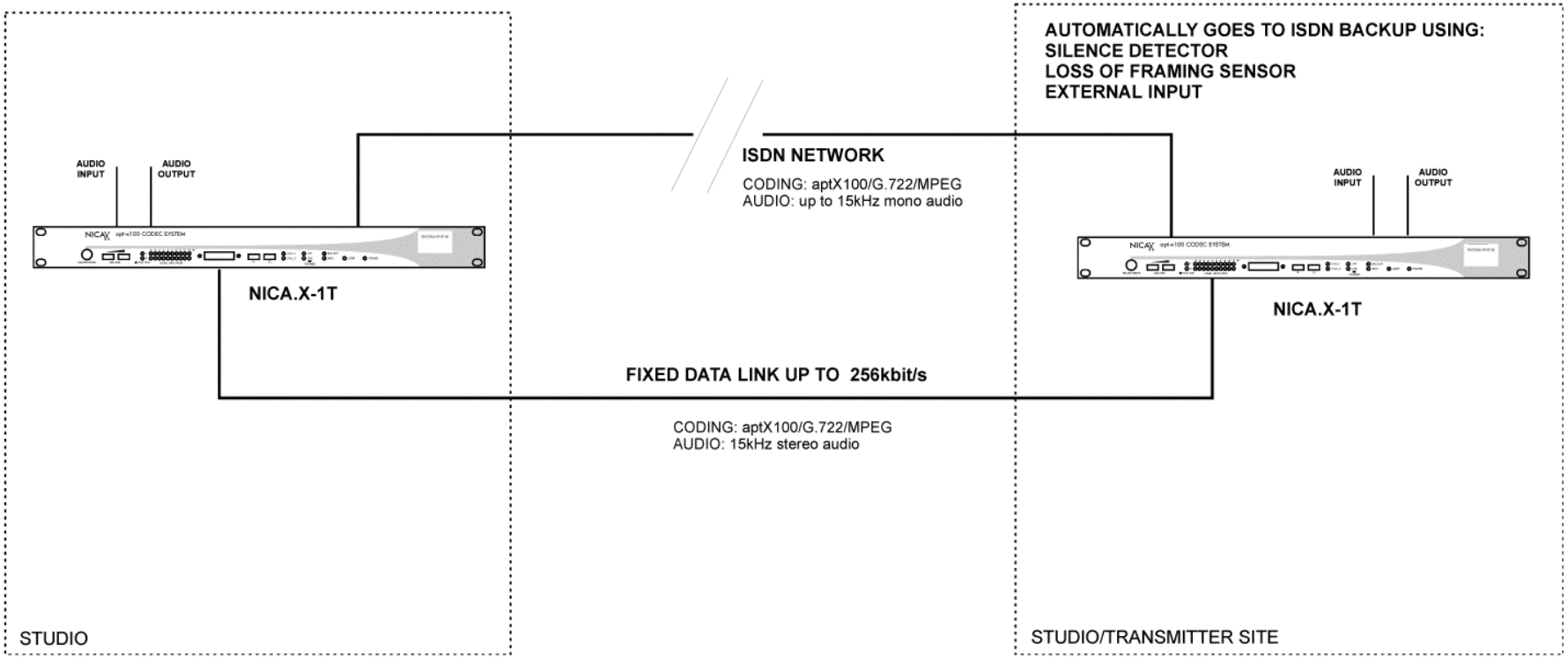
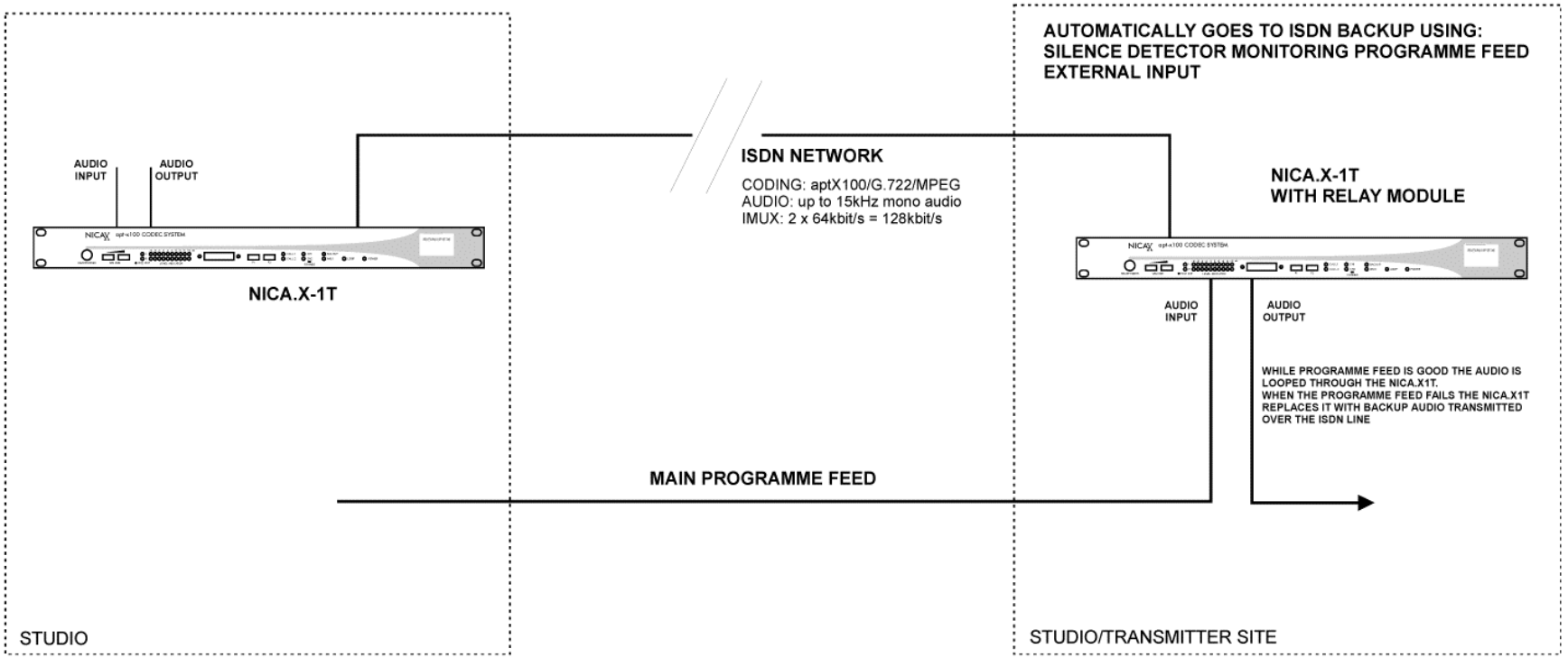


FIGURE 7.4

## NICA.X-1 PROVIDING ISDN BACKUP OF 7.5kHz OR 15kHz MONO AUDIO FOR MAIN PROGRAMME FEED



# CHAPTER 8 REMOTE CONTROL PROTOCOL

### 8.1 - Revision

This chapter is Revision 3 of the remote control specification.

### 8.2 - Introduction

The remote control port provides full control of the NICA X. All operations available from the front panel are available through this port with the exception of Factory Level commands.

For brevity, the remote control device has been referred to throughout this document as a "PC", but obviously this is all just as relevant for any computer system using RS232 communications.

If the NICA X unit is linked to a NICA X unit at the far end then it is possible to control the functions of the far end unit through the inband data channel if this feature has been enabled.

### 8.3 - Protocol

The character format is fixed at 9600 baud, no parity, 8 data bits and 1 stop bit.

All messages to the NICA X consist of up to 84 characters followed by either a CR, or by ETX BCC, where BCC is the exclusive OR sum of all characters in the message and 0xff.

The NICA X always answers within 7 seconds and never transmits except in answer to a received message. The end style sent by the NICA X matches that received; if no valid end was detected, no answer is sent.

The PC must not start sending another message until the last character of the previous response has been fully received, or 7 seconds have elapsed since the last message was sent and no reply was received.

All commands consist of the following :

Unit ID - 0 for local unit, 1 for far end unit.

':'

Command mnemonic- three character upper case alpha numeric, from the list below.

Parameter list- the number of parameters and their meaning are command dependent. Parameters are separated by a comma. Empty parameters can be signalled by the lack of data between commas, or empty parameters at the end of a parameter list can be omitted if the command allows. Any non-printing character other than CR or ETX is just stripped as white space, but must not appear within a parameter. Name parameters, e.g. book names, must be enclosed within quote marks and can contain spaces as valid characters.

Responses consist of the following :

A decimal response code.
If required, a comma followed by a returned result list with parameters separated by commas.

**8.4 - Command List**

**Activate Relay (REL)**
**DESCRIPTION:** Activate a given relay output.
**SYNTAX:** <unit id>:REL <relay no>,<en>
**RESPONSE:** <respcode>,<relay number>,<en>
**PARAMETERS:**
<relay no> = a valid relay number ( 1 to 8 ).
<en> = 0 - turn relay off, 1 - turn relay on.
**EXAMPLE:**
*(PC)* 0:REL1,1↵
*(NX)* 00↵

**Answer Call (ANS)**
**DESCRIPTION:** Answer a call for the specified channel.
**SYNTAX:** <unit id>:ANS <channel>
**RESPONSE:** <respcode ( =0 )>
**PARAMETERS:**
<unit id> = 0 - local unit, 1- far end unit.
<channel> = The channel number ( 1 or 2 ).
**EXAMPLE:**
*(PC)* 0:ANS2↵
*(NX)* 00↵
i.e. The NICA X accepts the command.

**Book Dial (DBK)**
**DESCRIPTION:** Dial a book entry.
**SYNTAX:** <unit id>:DBK <book id>,<channel>
**RESPONSE:** <respcode ( =0 )>
**PARAMETERS:**
<book id> = ID number for selected book entry.
<channel> = One of: 0-both, 1-chan1, 2-chan2. The channel to use if only want to dial half of book.
**EXAMPLE:**
*(PC)* 0:DBK24↵
*(NX)* 00↵
i.e. Dial book entry number 24, the NICA X accepts the command.

**Configure Backup - Enable Backup (CBE)**
**DESCRIPTION:** Select the backup mode of operation.
**SYNTAX:** <unit id>:CBE <enable>
**RESPONSE:** <respcode>,<enable>
**PARAMETERS:**
<enable> = 0 = disable backup operation, 1 = enable backup operation, 2 = enable special SM2 operation.
**EXAMPLE:**
*(PC)* 0:CBE1↵
*(NX)* 00↵
i.e. Set the unit into backup mode; the NICA X accepts the command and reports back the current settings.

**Configure Backup - External Input (CBI)**
**DESCRIPTION:** Indicate the state for the external detector
**SYNTAX:** <unit id>:CBI <state>, <chno>
**RESPONSE:** <respcode>,<state>
**PARAMETERS:**
<state> = 1 - the external input indicator is active, 0 - the external input indicator is inactive.
<chno> = optional parameter, specifying the channel number (1 or 2) for operating modes where the channels are independent (only SM2 at the moment). If omitted, defaults to 1.
**EXAMPLE:**
*(PC)* 0:CBI1↵
*(NX)* 00↵
i.e. Set the external input indicator to active; the NICA X accepts the command.

**Configure Backup - General Settings (CBG)**
**DESCRIPTION:** Configure the general settings for the backup mode of operation.
**SYNTAX:** <unit id>:CBG <f.detect>,<r.detect>,<dtime>,<utime>,<silence>,<retry>
**RESPONSE:** <respcode>,<enable>,<f.detect>,<r.detect>,<dtime>,<utime>,<silence>,<retry>
**PARAMETERS:**
<f.detect> = fail detect reason loss of one of :-
0:External
1: Frame.
2: Audio on channel 1.
3: Audio on channel 1 or 2.

4: Audio on channels 1and 2
5: Indicate on channel 1.
6: Indicate on channel 2.
7: Indicate on channel 1 or 2.
8: Indicate on channel 1 and 2.
<r.detect> = restore detect reason restore of one of :-
0:External
1: Frame.
2: Audio on channel 1.
3: Audio on channel 1 or 2.
4: Audio on channels 1and 2
5: Indicate on channel 1.
6: Indicate on channel 2.
7: Indicate on channel 1 or 2.
8: Indicate on channel 1 and 2.
<d.time> = time for fail detect to be true before switching to backup ( 1 - 99 seconds ).
<u.time> = time for restore detect to be true before switching to primary ( 1 - 99 seconds ).
<silence> = silence detector level one of
0: -6db
1: -12db
2: -18db
3: -24db
<retry> = number of retries for dialing ( 0 to 5 ).
**EXAMPLE:**
*(PC)* 0:CBG5,0,10,10,0,2↵
*(NX)* 00,5,0,10,10,0,2↵
i.e. Set the fail detect as Indicate on channel 1, restore detect as external, down time of 10 seconds, up time of 10 seconds, silence level of 0dB and number of retries to 2; the NICA X accepts the command and reports back the current settings.

**Configure Backup - ISDN numbers (CBN)**
**DESCRIPTION:** Configure the ISDN numbers for the backup mode of operation.
**SYNTAX:** <unit id>:CBN <id num>,<ISDN number>
**RESPONSE:** <respcode>,<id num>,<ISDN number>
**PARAMETERS:**
<id num> = ISDN id number one of :-
1 - Primary mode channel 1 number.
2 - Primary mode channel 2 number.
3 - Reserve mode channel 1 number ( pair A )
4 - Reserve mode channel 2 number ( pair A )
5 - Reserve mode channel 1 number ( pair B )
6 - Reserve mode channel 2 number ( pair B )
<isdn number> = ISDN calling line identification number, up to 24 digits.
**EXAMPLE:**
*(PC)* 0:CBN3, 01933651819↵
*(NX)* 00,3, 01933651819↵
i.e. Set the Reserve mode channel 1 A number to 01672517120; the NICA X accepts the command and reports back the current settings.

**Configure Backup - Monitor Settings (CBM)**
**DESCRIPTION:** Configure the monitor mode settings for the backup mode of operation.
**SYNTAX:** <unit id>:CBM <enable>,<m.time>
**RESPONSE:** <respcode>,<enable>,<m.time>
**PARAMETERS:**
<enable> = 0 - monitor off, 1 - monitor on.
<m.time> = time that monitor remains active once enabled ( 1 to 5 minutes ).
**EXAMPLE:**
*(PC)* 0:CBM1,1↵
*(NX)* 00,1,1↵
i.e. Set the monitor mode on with a time of 1 minute; the NICA X accepts the command and reports back the current settings.

**Configure Backup - Primary Settings (CBP)**
**DESCRIPTION:** Configure the primary settings for the backup mode of operation.
**SYNTAX:** <unit id>:CBP <mode>,<port>
**RESPONSE:** <respcode>,<mode>,<port>
**PARAMETERS:**
<mode> = a valid mode number ( 1 to max modes ) or 0 indicating external Primary Unit.
<port> = 0 - none set, 1 - port 1, 2 - port 2, 3 - port 1 or 2, 4 - port 1 & 2 .
**EXAMPLE:**
*(PC)* 0:CBP8,1↵
*(NX)* 00,08,1↵

i.e. Set the Primary mode to 8 using port 1; the NICA X accepts the command and reports back the current setting.

**Configure Backup - Reserve Settings (CBR)**
**DESCRIPTION:** Configure the reserve settings for the backup mode of operation.
**SYNTAX:** <unit id>:CBB <mode>,<port>
**RESPONSE:** <respcode>,<mode>,<port>
**PARAMETERS:**
<mode> = a valid mode number ( 1 to max modes ).
<port> = 0 - none set, 1 - port 1, 2 - port 2, 3 - port 1 or 2, 4 - port 1 & 2 .
**EXAMPLE:**
*(PC)* 0:CBR3,4↵
*(NX)* 00,03,4↵
i.e. Set the Reserve mode to 3 using ports 1 and 2; the NICA X accepts the command and reports back the current settings.

**Configure Backup - Switch Backup (CBS)**
**DESCRIPTION:** Switch the backup mode of operation
**SYNTAX:** <unit id>:CBS <state>
**RESPONSE:** <respcode>,<state>
**PARAMETERS:**
<state> = 1 - Primary service, 0 - Reserve service.
**EXAMPLE:**
*(PC)* 0:CBS1↵
*(NX)* 00↵
i.e. Set the unit to switch to the Primary service; the NICA X accepts the command.

**Configure Call Timeout Setting (CCT)**
**DESCRIPTION:** Configure the call timeout setting.
**SYNTAX:** <unit id>:CCT <timer>,<dial time>
**RESPONSE:** <respcode>,<timer>,<dial time>
**PARAMETERS:**
<timer> = one of:
0: disable call timer.
1 .. 7: set call timer to one of the times shown below.

| <timer> value | time set |
|---|---|
| 1 | 5 minutes |
| 2 | 10 minutes |
| 3 | 30 minutes |
| 4 | 1 hour |
| 5 | 2 hours |
| 6 | 5 hours |

<dial time> = time allowed for TA to establish an ISDN call ( 1 - 99 seconds )
**EXAMPLE:**
*(PC)* 0:CCT4,20↵
*(NX)* 00,4,20↵
i.e. Set the unit to timeout after 1 hour, and allow 20 seconds for call out; the NICA X accepts the command and reports back the setting.

**Configure System PINS (PST)**
**DESCRIPTION:** Configure the security pins used by the system.
**SYNTAX:** <unit id>:PST <user en>,<user pin>,<config en>,<config pin>,<system en>,<system pin>, <remote en>,<remote pin>
**RESPONSE:** <respcode>,
**PARAMETERS:**
<user en> = 0 - disable, 1 - enable
<user pin> = 4 digit pin number
<config en> = 0 - disable, 1 - enable
<config pin> = 4 digit pin number
<system en> = 0 - disable, 1 - enable
<system pin> = 4 digit pin number
<remote en> = 0 - disable, 1 - enable
<remote pin> = 4 digit pin number
**EXAMPLE:**
*(PC)* 0:PST 1,1111,0,2,1,3333,0,4444↵
*(NX)* 00,1,1111,0,2222,1,3333,0,4444↵

**Configure TA - Answer Option (CTA)**
**DESCRIPTION:** Configure the TA answer options.
**SYNTAX:** <unit id>:CTA <channel>,<answer mode>
**RESPONSE:** <respcode>,<answer mode>
**PARAMETERS:**
**<**channel> = TA channel : 1 or 2
<answer mode> = one of : 0 - none, 1 - all, 2 - book match, 3 - number match, 4 - manual.
**EXAMPLE:**
*(PC)* 0:CTA1,2↵
*(NX)* 00,1,2↵
i.e. Set the TA to only answer calls whose CLI matches a book entry ISDN number; the NICA X accepts the command.

**Configure TA - Call Permit Numbers (CTN)**
**1DESCRIPTION:** Configure the numbers used for TA call permitting by numbers.
**SYNTAX:** <unit id>:CTN <number id>, <isdn number>
**RESPONSE:** <respcode>, <number id>, <isdn number>
**PARAMETERS:**
<number id> = Call permit number id.
<isdn number> = ISDN calling line identification number, up to 24 digits.
**EXAMPLE:**
*(PC)* 0:CTN2, 01933651819↵
*(NX)* 00,2, 01933651819↵
i.e. Set the second call permit number to 01933651819; the NICA X accepts the command and reports back the current setting.

**Configure TA - Channel Settings (CTC)**
**DESCRIPTION:** Configure the channel specific settings for the TA module.
**SYNTAX:** <unit id>:CTC <channel>,<rate>,<msn>,<bmap>,<sub>,<buzz call in>
**RESPONSE:** <respcode>, <channel>,<rate>,<msn>,<bmap>,<sub>,<buzz call in>
**PARAMETERS:**
<channel> = TA channel : 1 or 2.
<rate> = 0 – NOT SET, 1 - 56k, 2 – 64k, 3 – 64kS
<msn> = ISDN multiple subscriber number, up to 24 digits.
<bmap> = 0 - B1+2, 1 - B1, 2 - B2.
<sub> = ISDN sub address, up to 6 digits.
<buzz call in> = 0 - disable buzz, 1 - enable buzz.
**EXAMPLE:**
*(PC)* 0:CTC1,0,,1,123,1↵
*(NX)* 00,1,0,,1,123,1↵
i.e. Set channel 1 of the TA to have : 64k data rate, no msn, using B1, with a sub address of 123 and buzz on calls in; the NICA X accepts the command and reports back the current settings.

**Edit Book Entry (BKE)**
**DESCRIPTION:** Edit the settings for a specified book entry.
**SYNTAX:** <unit id>:BKE <book>,<name>,<number1>,<number2>,<main mode>,<secondary mode>,<rate>,<aux1>,<aux2>
**RESPONSE:** <respcode>, <book >,<name>,<number1>,<number2>,<main mode>,<secondary mode>,<rate>,<aux1>,<aux2>
**PARAMETERS:**
<book > = NICA X book number ( 1 to max books ).
<name> = string up to 12 characters long representing the name of the book entry.
<number 1> = ISDN destination number, up to 24 digits.
<number 2> = ISDN destination number, up to 24 digits.
<main mode> = a valid codec mode number ( 1 to max modes ).
<secondary mode> = a valid codec mode number ( 1 to max modes ).
<rate> = 0 - none set, 1 - 56k, 2 - 64k, 3 - 64ks.
<aux1> = 0 - auxiliary data off, 1 - 1200, 2 - 2400, 3 -4800, 4 - 9600, ? - none set.
<aux2> = 0 - auxiliary data off, 1 - 1200, 2 - 2400, 3 -4800, 4 - 9600, ? - none set.
**EXAMPLE:**
*(PC)* 0:BKE7,"SONIFEX",01933651819,01933651819,13,0,0,0,0↵
*(NX)* 00,7,"SONIFEX",01933651819,01933651819,13,00,0,0,0↵
i.e. Set book entry 7 with name "SONIFEX", ISDN number 1 - 01933651819, ISDN number 2 - 01933651819, main mode 13, no secondary mode, data rate 64k, auxiliary data off; the NICA X accepts the command and reports back the current settings.

**Enable/Disable LoopBack (LBK)**
**DESCRIPTION:** Configure the loopback mode of operation.
**SYNTAX:** <unit id>:LBK <loopback>
**RESPONSE:** <respcode>,<loopback>
**PARAMETERS:**

<loopback> = 0 - off, 1 - on.
**EXAMPLE:**
*(PC)* 0:LBK 1↵
*(NX)* 00,1↵
i.e. Set system loopback on; the NICA X accepts the command.

**Enable/Disable System Options (OPT)**
**DESCRIPTION:** Configure the settings for system options.
**SYNTAX:** <unit id>:OPT <audio>, <x21clk>, <monomix>
**RESPONSE:** <respcode>,<audio>,<x21clk>,<monomix>
**PARAMETERS:**
<audio> = 0 - microphone, 1 - line.
<x21clk> = 0 - internal clock, 1 - external clock.
<monomix> = 0 - left channel for mono, 1 - left and right sum for mono
**EXAMPLE:**
*(PC)* 0:OPT↵
*(NX)* 00,0,1,1↵
i.e The NICA X accepts the command and reports back the current settings.

**Incoming Calling Line Identification (CLI)**
**DESCRIPTION:** Return the CLI for the specified channel.
**SYNTAX:** <unit id>:CLI <channel>
**RESPONSE:** <respcode ( =0 )>,<isdn number>
**PARAMETERS:**
<unit id> = 0 - local unit, 1- far end unit.
<channel> = The channel number ( 1 or 2 ).
<isdn number> = ISDN destination number, up to 24 digits.
**EXAMPLE:**
*(PC)* 0:CLI2↵
*(NX)* 00,01672517120↵
i.e. Request the CLI of channel 2; the NICA X accepts the command and reports back the CLI.

**Information (INF)**
**DESCRIPTION:** Request the product name, revision number and serial number for the system
**SYNTAX:** <unit id>:INF
**RESPONSE:** <respcode ( =0 )>, <product name>
**PARAMETERS:**
<product name> = the name of the product and revision number of the software.
**EXAMPLE:**
*(PC)* 0:INF↵
*(NX)* 00,NICA X 1.2↵
i.e. Request product information; the NICA X accepts the command and reports back the product information.

**Interface Revision (IFR)**
**DESCRIPTION:** The interface revision of the NICA X remote control protocol for this version.
**SYNTAX:** <unit id>:IFR <revision>
**RESPONSE:** <respcode ( =0 )>,<interface revision>,<revision>
**PARAMETERS:**
<unit id> = 0 - local unit, 1- far end unit.
<revision> = The revision of the protocol that the controlling software knows about.
<interface revision> = The interface revision of the NICA X remote control protocol for this version.
**EXAMPLE:**
*(PC)* 0:IFR1↵
*(NX)* 00,2,1↵
i.e.Set the revision level at 1; the NICA X accepts the command and reports back that the settings.

**Manual Dial (DIL)**
**DESCRIPTION:** Manual dial the given ISDN number on the selected TA channel.
**SYNTAX:** <unit id>:DIL <channel>, <isdn number>
**RESPONSE:** <respcode ( =0 )>
**PARAMETERS:**
<channel> = TA channel number ( 1 or 2 ).
<isdn number> = ISDN destination number, up to 24 digits.
**EXAMPLE:**
*(PC)* 0:DIL1, 01933651819↵
*(NX)* 00↵
i.e dial ISDN number 01933651819 on channel 1; the NICA X accepts the command.

**NICA X Status (STS)**
**DESCRIPTION:** Return the call and framing state of the codec.
**SYNTAX:** <unit id>:STS
**RESPONSE:** <respcode ( =0 )>,<mode1>,<mode 2>,<chan1>,<chan2>,<frame1>,<frame2>
**PARAMETERS:**
<mode1> = main running mode
<mode2> = secondary running mode
<chan1> = state of channel 1
<chan2> = state of channel 2
0 - idle
2 - busy
3 - call out
4 - call in
6 - reset
7 - channel ringing
<frame1> = framing state of channel 1
<frame2> = framing state of channel 2
0 - not framed
1 - framed
**EXAMPLE:**
*(PC)* 0:STS↵
*(NX)* 00,03,00,3,0,1,0↵
i.e. Request the current status of the codec; the NICA X accepts the command and reports back that main mode is 3, secondary mode is 0, channel 1 call out, channel 2 is idle, channel 1 is framed, channel 2 is not framed.

**Null Command (NUL)**
**DESCRIPTION:** Sample command to show parameter options.
**SYNTAX:** <unit id>:NUL <parameter1>, <parameter2>,<parameter3>
**RESPONSE:** <respcode ( =0 )>,<parameter1>,<parameter2>,<parameter3>
**PARAMETERS:**
<unit id> = 0 - local unit, 1- far end unit.
<parameter1> = first parameter; if there is a fault with this value then the response code will be 01.
<parameter2> = second parameter; if there is a fault with this value then the response code will be 02.
<parameter3> = third parameter; if there is a fault with this value then the response code will be 03.
**EXAMPLE:**
*(PC)* 0:NUL1,,3↵
*(NX)* 00,1,2,3↵
i.e. The command is presented with parameter 2 missing; the NICA X accepts the command and returns the values of all the parameters.
*(PC)* :NUL1,6,3↵
*(NX)* 02↵
i.e. The command is presented with parameter 2 incorrect; the NICA X rejects the command.

**Present Pin (PIN)**
**DESCRIPTION:** Used to raise security level to enable remote control of NICA X.
**SYNTAX:** <unit id>:PIN <pin no.>
**RESPONSE:** <respcode ( =0 )>
**PARAMETERS:**
<pin no.> = four digit PIN number set for the system.
The PIN presented stays valid until the "pc disconnected" timer drops out.
**EXAMPLE:**
*(PC)* 0:PIN5152↵
*(NX)* 02↵
i.e. present REMOTE PIN of 5152; NICA X rejects PIN

**Programme Optical Input Commands (EXI)**
**DESCRIPTION:** Configure the remote control commands actioned by the optical inputs or function keys.
**SYNTAX:** <unit id>:EXI <opto input>,"<command>",<latch>
**RESPONSE:** <respcode>,<opto input>,<command>,<latch>
**PARAMETERS:**
<opto input> = one of :-
0,1 : optical input 1 ( A,B ).
2,3 : optical input 2 ( A,B ).
4,5 : optical input 3 ( A,B ).
6,7 : optical input 4 ( A,B ).
8,9 : optical input 5 ( A,B ).
10,11 : optical input 6 ( A,B ).
12,13 : optical input 7 ( A,B ).
14,15 : optical input 8 ( A,B ).
16,17: Function key 1 ( A,B ).
18,19: Function key 2 ( A,B ).
20,21: Codec in-band Signal 1 ( A,B ).

22,23: Codec in-band Signal 2 ( A,B ).
<command> = a string representing a valid remote control command enclosed in quotes.
<latch> = 0 - momentary, 1 - latching.
**EXAMPLE:**
*(PC)* 0:EXI 5,"0:LBK1",0↵
*(NX)* 00,5,0:LBK1,0↵

**Read Inputs (RIP)**
**DESCRIPTION:** Read the current state of the NICA X external inputs (opto-couplers, F switches and in-band signals).
**SYNTAX:** <unit id>:RIP
**RESPONSE:** <respcode>,<opto string>,<aux string>
**PARAMETERS:**
<opto string> - an eight-digit binary number representing the eight opto inputs: 0 - off, 1 - on.
<aux string> - an eight-digit binary number representing other inputs, defined as follows:
Bit 0: F1 key pressed.
Bit 1: F2 key pressed.
Bit 2: Signal1 (in-band signal for channel 1- MPEG modes only. See SPU)
Bit 3: Signal2 (in-band signal for channel 2- MPEG modes only. See SPU)
Most significant four digits: for future use (always return 0 at the moment).
**EXAMPLE:**
*(PC)* 0:RIP↵
*(NX)* 00,01001101,00000000↵

**Read Relay Outputs (ROP)**
**DESCRIPTION:** Read the current state of the NICA X relay states.
**SYNTAX:** <unit id>:ROP
**RESPONSE:** <respcode>,<relay>,<system>,<user>
**PARAMETERS:**
<relay> - a string of 8 characters ( 0 or 1 ) representing the state of the actual relays.
<system> - a string of 8 characters ( 0 or 1 ) representing the factory default states for relay use.
<auto> - a string of 8 characters ( 0 or 1 ) representing the programmed states for relay use.
where 0 - inactive, 1 - active
**EXAMPLE:**
*(PC)* 0:ROP↵
*(NX)* 00,11110000,11111111,00000000↵

**Read Silence Detector (RTH)**
**DESCRIPTION:** Read the current state of the NICA X silence detector.
**SYNTAX:** <unit id>:RTH
**RESPONSE:** <respcode>,<detect>
**PARAMETERS:**
<detect> - 0 - no silence, 1 - left silent, 2 - right silent, 3 - left and right silent.
*(PC)* 0:RTH↵
*(NX)* 00,1↵

**Read System Switches (RSW)**
**DESCRIPTION:** Read the NICA X dip switch settings.
**SYNTAX:** <unit id>:RSW
**RESPONSE:** <respcode>,<switch string>
**PARAMETERS:**
<switch string> - a string of 12 characters ( 0 or 1 ) : 0 - off, 1 - on ( 12,11,....,3,2,1 ).
**EXAMPLE:**
*(PC)* 0:RSW↵
*(NX)* 00,001101100001↵

**Reject Call (REJ)**
**DESCRIPTION:** Reject a call for the specified channel.
**SYNTAX:** <unit id>:REJ <channel>
**RESPONSE:** <respcode ( =0 )>
**PARAMETERS:**
<unit id> = 0 - local unit, 1- far end unit.
<channel> = The channel number ( 1 or 2 ).
**EXAMPLE:**
*(PC)* 0:REJ2↵
*(NX)* 00↵
i.e. The NICA X accepts the command.

**Select Relay Output Actions (EXO)**
**DESCRIPTION:** Configure the actions that will activate the relay outputs.
**SYNTAX:** <unit id>:EXO <relay no>,<user>
**RESPONSE:** <respcode>,<relay number>,<user>
**PARAMETERS:**
<relay no> = a valid relay number ( 1 to 8 ).
<user> = 0 - relay under command control, 1 - default action for this relay.
**EXAMPLE:**
*(PC)* 0:EXO1,1↵
*(NX)* 00,1,1↵

**Select Remote Control Inband Enable (REM)**
**DESCRIPTION:** Enable inband channel for remote control commands.
**SYNTAX:** <unit id>:REM <enable>
**RESPONSE:** <respcode>
**PARAMETERS:**
<enable> = 0 - disabled, 1 - enabled , 2 - debug (connects aux to ISDN TA management port)
**EXAMPLE:**
*(PC)* 0:REM 1↵
*(NX)* 00↵

**Set Auxiliary Data Rate (AUX)**
**DESCRIPTION:** Configure the auxiliary channels data rate.
**SYNTAX:** <unit id>:AUX <data rate 1>,<data rate 2
**RESPONSE:** <respcode>,<data rate 1>,<data rate 2>
**PARAMETERS**:
<data rate 1> = one of :-
<data rate 2> = one of :-
0: off
4: 9600baud
3: 4800baud
2: 2400baud
1: 1200baud
**EXAMPLE:**
*(PC)* 0:AUX↵
*(NX)* 00,4,1↵

**Set Codec Mode (MOD)**
**DESCRIPTION:** Set the codec's mode of operation.
**SYNTAX:** <unit id>:MOD <main mode>, <secondary mode>
**RESPONSE:** <respcode>, <main mode>, <secondary mode>
**PARAMETERS:**
<main mode> = a valid mode number.
<secondary mode> = a valid mode number.
**EXAMPLE:**
*(PC)* 0:MOD0,15↵
*(NX)* 02↵
i.e. Set the secondary codec mode to mode 15; the NICA X rejects the command due to an error with parameter 2.

**Signal Private User (SPU)**
**DESCRIPTION:** MPEG modes have a "Private User" bit available for application dependent in-band signalling. This command can set or clear this bit. If the far end is another NICA X, the received bit can be read by a RIP command, or the unit can be programmed to execute a stored command on a change. This command is always accepted, even while the codec is not connected in an MPEG mode. Whenever it is connected in an MPEG mode, the last stored value is transmitted.
**SYNTAX:** <unit id>:SPU <chno>, <on>
**RESPONSE:** <respcode>
**PARAMETERS:**
<chno> - The channel number, 1 or 2.
<on> - Value to set the Private User bit, 0 or 1.
**EXAMPLE:**
*(PC)* 0:SPU2,1↵
*(NX)* 00↵

**Sound System Buzzer (BUZ)**
**DESCRIPTION:** Sound the internal buzzer.
**SYNTAX:** <unit id>:BUZ<on time>,<off time>,<count>
**RESPONSE:** <respcode>
**PARAMETERS:**
<on time> - time to sound buzzer in 1/4 seconds
<off time> - time to remain silent before repeat.
<count> - number of times to repeat the buzz.

**EXAMPLE:**
*(PC)* 0:BUZ1,1,2↵
*(NX)* 00↵

**Stop Call (STP)**
**DESCRIPTION:** Stop calls on one or both channels of the TA.
**SYNTAX:** <unit id>:STP <channel no.>
**RESPONSE:** <respcode ( =0 )>
**PARAMETERS:**
<channel no.> = channel number of call to stop -: 0 ( both), 1 or 2.
**EXAMPLE:**
*(PC)* 0:STP0↵
*(NX)* 00↵
i.e. Stop calls on both channels of the TA; the NICA X accepts the command.

**System Reset (RES)**
**DESCRIPTION:** After a short delay reboot the NICA X.
**SYNTAX:** <unit id>:RES
**RESPONSE:** <respcode>
**PARAMETERS:**
**EXAMPLE:**
*(PC)* 0:RES↵
*(NX)* 00↵

### 8.5 - Response Codes

Response Codes are as follows:

| Code | Description |
|---|---|
| 00 | OK |
| 01 ... 10 | Parameter ( 1 ... 10 ) error |
| 21 | Invalid Command |
| 22 | Rejected |
| 23 | Security Level |
| 24 | Invalid Pin |
| 25 | Unknown Destination |
| 26 | No Answer |
| 27 | No Far End |

# APPENDIX A CONNECTION DETAILS

### A.1 X21 Ports

All cables must be under 3 metres in length. All cables terminated in D-type connectors must use screen cable with screened connector hoods. The screen should be connected to the D shells. The X21 port connectors on the rear of the units are 15 way D-type female connectors. A connection is normally made pin to pin.

| Pin | Signal | Type at Nica X | Description |
|---|---|---|---|
| 1 | - | - | Not connected |
| 2 | TA | Output | Transmit A |
| 3 | CA | Output | Control A |
| 4 | RA | Input | Receive A |
| 5 | IA | Input | Indicate A |
| 6 | SA | Input | Bit Timing A |
| 7 | - | - | Not Connected |
| 8 | GND | - | Ground |
| 9 | TB | Output | Transmit B |
| 10 | CB | Output | Control B |
| 11 | RB | Input | Receive B |
| 12 | IB | Input | Indicate B |
| 13 | SB | Input | Bit Timing B |
| 14 | - | - | Not Connected |
| 15 | - | - | Not Connected |

### A.2 Auxiliary RS232 Data Port

All Cables must be under 3 metres in length. All cables terminated in D-type connectors must use screen cable with screened connector hoods. The screen should be connected to the D shells. The auxiliary RS232 data port on the rear of the unit is a 9 way D-type male connector. The minimum connections required are RX, TX and GND. This provides access for two auxiliary ports.

| Pin | Signal | Type | Description | Example PC Connection |
|---|---|---|---|---|
| 1 | AUX2 TXD | Input | Transmit Data | |
| 2 | AUX1 RXD | Output | Receive Data | 2 |
| 3 | AUX1 TXD | Input | Transmit Data | 3 |
| 4 | - | - | - | |
| 5 | SG | - | Signal Ground | 5 |
| 6 | AUX2 RXD | Output | Receive Data | |
| 7 | APT CTS | Output | Clear to Send | |
| 8 | APT RTS | Input | Request to Send | |
| 9 | - | - | - | |

The APT CTS and APT RTS line are for use with the APT codec version only.

In a Dual Codec system the AUX1 is for the CH1 Codec Mode and AUX2 is for the CH2 codec Mode.

### A.3 Remote Control Port

All cables must be under 3 metres in length. All cables terminated in D-type connectors must use screen cable with screened connector hoods. The screen should be connected to the D shells. The Remote Control Port has an RS232 and RS485 interface. It is a 9 way D-type female connector. The minimum connections required are RX, TX and GND.

| Pin | Signal | Type | Description | Example PC Connection |
|---|---|---|---|---|
| 1 | | - | - | |
| 2 | RS232 RXD | Output | Receive Data | 2 |
| 3 | RS232 TXD | Input | Transmit Data | 3 |
| 4 | RS485 A | I/O | Data Bus A | |
| 5 | SG | - | Signal Ground | 5 |
| 6 | - | - | | |
| 7 | RS485 PT | | +ve terminator | |
| 8 | RS485 B | I/O | Data Bus B | |
| 9 | RS485 NT | | - ve terminator | |

### A.4 External Outputs

All cables must be under 3 metres in length. All cables terminated in D-type connectors must use screen cable with screened connector hoods. The screen should be connected to the D shells. The Relay Output connector is a 15 Way D-type female connector. These outputs are programmable.

| Pin | Relay Output |
|---|---|
| 1 | +12V * |
| 2 | +12V * |
| 3 | Rly NO 2 |
| 4 | Rly NO 4 |
| 5 | Rly NO 6 |
| 6 | Rly NO 8 |
| 7 | COMMON |
| 8 | GND |
| 9 | +12V * |
| 10 | Rly NO 1 |
| 11 | Rly NO 3 |
| 12 | Rly NO 5 |
| 13 | Rly NO 7 |
| 14 | COMMON |
| 15 | GND |

* Thermal Fuse protection internally at 1A

### A.5 External Inputs

All cables must be under 3 metres in length. All cables terminated in D-type connectors must use screen cable with screened connector hoods. The screen should be connected to the D shells. The Opto Input connector is a 15 Way D-type female connector. These inputs are programmable.

| Pin | Opto Input |
|---|---|
| 1 | +12V * |
| 2 | COMMON |
| 3 | Opto IN 2 |
| 4 | Opto IN 4 |
| 5 | Opto IN 6 |
| 6 | Opto IN 8 |
| 7 | GND |
| 8 | GND |
| 9 | +12V * |
| 10 | Opto IN 1 |
| 11 | Opto IN 3 |
| 12 | Opto IN 5 |
| 13 | Opto IN 7 |
| 14 | GND |
| 15 | GND |

* Thermal Fuse protection internally at 1A

### A.6 Audio

All cables must be under 3 metres in length. All cables terminated in XLR connectors must use screen cable with screened connector shells. The screen should be connected to the XLR shell.

#### Audio Input

The audio input connector is a 3 pin XLR female.

| Pin | Signal |
|---|---|
| 1 | GND |
| 2 | + Input |
| 3 | - Input |

#### Audio Output

The audio output connector is a 3 pin XLR male.

| Pin | Signal |
|---|---|
| 1 | GND |
| 2 | + Output |
| 3 | - Output |

# APPENDIX B REGULATORY STATEMENT

**B.1 - CE Marking**

The CE marking on this product denotes conformity to the European Directive 89/336/EC relating to Electromagnetic Compatibility and European Directive relating to The Low Voltage Directive.

**B.2 - EMC Testing**

Emissions Testing To EN55103-1
Immunity Testing To EN55103-2

Below are notes which must be taken into account when using the NICA X. The NICA X product has been fully tested to the EMC standards as above in all Environments E1, E2, E3, E4, E5 at a NAMAS accredited test house.

| Environment | Description |
|---|---|
| E1 | Residential |
| E2 | Commercial and light industrial (for example theatres) |
| E3 | Urban Outdoors |
| E4 | controlled EMC environment (for example purpose built broadcasting and recording studios), and the rural outdoors |
| E5 | Heavy industrial and environments close to broadcast transmitters |

For use in Environment E5 all cables connected to the unit must be below 1 metre in length.

**B.3 - Electrostatic Discharge**

For E5 the unit is tested to 8KV. This was shown to cause momentary loss of codec framing resulting in momentary loss of audio, however the unit recovers normally. At 4KV tests there were no effects. (E1,E2,E3,E4)

RF Common Mode Immunity Induced on AC Mains cable.

For E5 only it is recommended that the AC mains be supplied through an RF Common Mode Filter.

**B.4 - Radiated Immunity**

For E5 only Radiated Immunity test levels showed that there could be an increase in the THD&N figures of the audio at 10V/metre radiated field on the enclosure.

**B.5 - Radiated Emissions**

For all environments Radiated Emissions tests have shown that Ferrite clamps must be placed on cables connected to the unit. These ferrite clamps are provided with the unit and must be fitted on any cable connected to the unit. The Large ones must be fitted to X21 cables, while the small ones must be fitted to audio cables. The ISDN cable will be supplied with an integral ferrite which must be used.

**B.6 - TA Module**

This product uses an internal Teltrend Midas plus module

**B.7 - Safety & Approval Notice**

The MIDAS PLUS module is approved "Host Independent" for connection to ISDN Basic rate Public telecommunication network interfaces compatible with CCITT 1.420. The approval number issued by the British Approvals Board for Telecommunications is AA605042.

It is designed to operate with a low voltage +5V d.c. ±5% (100mA) supply taken from the host power bus. Care must be taken to ensure that the host is capable of supplying sufficient power for the module and all other auxiliary apparatus drawing power from the host before you install the MIDAS PLUS module.

The interfaces with the host use Safe Extra Low voltages (SELV) only. SELV is a voltage that does not exceed 42.4V peak a.c. or 60V d.c. You are advised to ensure that this module is installed only in host equipment which has a similar SELV interface.

In order to maintain the independent approval of the MIDAS PLUS module, it must be installed such that with the exception of the host bus connector, a clearance distance of 4.00mm and a creepage distance of 5.0 (8.0) mm is maintained between the Midas plus module and all other parts of the host, including any expansion cards, which use or generate a voltage less than 250V (rms or dc); the creepage distance shown in brackets applies where the local environment within the host is subject to conductive pollution or dry non conductive pollution which could become conductive due to condensation. If in doubt, please consult a qualified engineer before installation.

# APPENDIX C THE APT-X100 AUDIO DATA COMPRESSION SYSTEM

### C.1 - Introduction

Linear PCM coding of audio has now become virtually synonymous with ultimate sonic quality. Certainly, it has raised both professional and public expectations of the performance of audible media. For most of its applications 16 bit linear PCM produces fine results, but to take advantage of it in many situations is not without its problems.

In most of these, the overriding limiting factor is the enormous amount of bandwidth it occupies, with the general result that it is too costly or complex to be practically implemented. For example, using a linear 16 bit PCM system sampling at 32kHz, the basic binary bit rate will be 512kbit/s per channel.

The bandwidth problem of PCM is particularly acute in transmission environments, where the transmission costs are proportional to the channel capacity. As a result, a number of alternative music coding schemes have been developed which require significantly lower operating bandwidth for these circuits. Such schemes, employing near instantaneous or delta modulation techniques, operate at bit rates of around 256-400kbit/s per channel, and include error protection overheads. However, for many potential low capacity digital audio applications, for example ISDN, these levels of compression are still inadequate.

The excessive data rates of these existing music compression schemes have been due primarily to their adherence to relatively simple digital companding techniques. These systems exploit little of the natural redundancies associated with the sound signals of interest, unlike their speech coding counterparts. The situation has remained, partly because of the higher sampling overheads involved, and until recently, the absence of high speed Digital Signal Processing (DSP) hardware.

Sub-band ADPCM can be described as a "medium-complexity" scheme which appears particularly suited to high quality audio coding and which does exploit the considerable natural redundancies of audio. A high coding efficiency is ensured in this system as it not only incorporates the benefits of digital companding, but also takes advantage of time and spectral redundancies by using linear prediction and sub-band coding.

This Chapter presents the concepts involved in sub-band ADPCM, explaining the nature of the signal redundancies which are exploited to provide a transparent 16 to 4 bit compression.

### C.2 - Linear PCM Digital Audio Coding

The process by which audio is sampled and coded with a binary bit stream has the advantage of producing an accurately repeatable quality. Noise and speed variations introduced by storage and transmission media can be eliminated, as can multiple generation degradation, and performance criteria such as frequency response and distortion can be better controlled and therefore virtually guaranteed. However, the problems created by the very much higher frequencies required to code audio digitally, coupled with the necessity to maintain the original integrity of the code throughout any processing, inhibit and complicate its use in many applications.

The bit rate of PCM digital audio is defined by the sample frequency and the word length. The analogue signal must be sampled at least twice per cycle in order to code the highest frequencies accurately. In practice it is also necessary to filter the high frequencies to avoid anti-aliasing distortion. By coding in this way an analogue waveform is systematically dissected into many component parts, each one of which is accurately labelled so that it can be exactly reconstructed again, regardless of whether or not the components are audible to the human ear. In many cases it will always be desirable to do this, however there are a great many instances where it is a considerable extravagance if not a positive disadvantage.

### C.3 - Characteristics Of Audio

An audio signal can be defined as an analogue waveform containing frequency components to which the human ear responds. To be considered musical the signal must also be pleasing, and this is a factor on which some very low bit rate coding schemes base greater emphasis than others, but all rely on it to some extent.

The characteristics of the response of the human ear are fundamental to the elimination of coding redundant data. Loud sounds mask quiet sounds of similar frequency, for example, and sensitivity is biased to low frequency sounds. Musical notes are made up of fundamental frequencies and a series of harmonics and, because of the tendency of the ear to lower frequencies, there are few signals that are considered musical with a fundamental frequency above about 4kHz. In fact music and audio signals in general exhibit a diversity of redundant characteristics of which very low bit rate coders are designed to take advantage.

The foremost requirement of hi-fi music coding is the maintenance of a high coding transparency. This implies that the quality, bandwidth and distortion/noise levels of both original and coded music should not be subjectively different. In theory a process relying on the inherent redundancy in music to maintain signal quality might not prove satisfactory for non-redundant signals. Fortunately, most signals of this class already incorporate specific perceptual redundancies to compensate for this (e.g. noisy signals which will invariably mask coding error). This is also true for transient signals, which are exceptionally tolerant because of, amongst other things, temporal masking (the response of the ear to short, sharp rises in level).

### C.4 - ADPCM Audio Coding

Adaptive Differential Pulse Code Modulation is a combination of two extreme quantising techniques: Linear PCM, described above, and Adaptive Differential coding. Differential coding reduces the bit rate of PCM by coding the difference in level between audio samples, as opposed to the absolute level of each sample. Adaptive differential coding adapts the step size represented by each quantising interval depending on the nature of the audio signal. In this way rapid changes in level caused by high frequencies or transients can be accommodated, permitting an overall reduction in bit rate.

### C.5 - Sub-Band Coding

Split band techniques, such as sub-band coding, are used primarily to exploit spectral redundancies within the audio spectrum. The mechanism of sub-band coding is to split the signal into a number of independent bands and to vary the accuracy of the QUANTISATION in each band according to the input signal energy. The effect of this process is to allow the critical regions of the audio spectrum to be coded more accurately permitting greater quantising energy to be concentrated on the high sensitivity, low frequencies. Or, perhaps more importantly, less valuable resources need be expended on coding the areas of the audio spectrum to which the ear is more tolerant. It also has the added advantage that the high energy regions are coded more accurately than PCM, giving a lower coding noise floor. This improvement is commonly referred to as the sub-band gain.

Increasing the number of sub-bands improves the coder's ability to resolve the finer components of the signal spectrum, raising the overall sub-band gain. However, complexity, inter-band leakage, sub-band delay and an adequate energy classification procedure tend to offset the SNR advantage which may accompany an increasing number of bands.

An important subjective by-product of sub-band coding is the reduction in the perceived noise modulation over PCM. Since the audio signal is split into several frequency bands prior to quantisation, modulated quantisation noise, developed at each quantiser, is constrained to that band and cannot interfere with signals in any other band. As a result, noise masking by the modulating spectral component is much more effective due to the reduced noise bandwidth.

The *apt-X100* system divides the audio spectrum into four sub-bands. The quantising levels in each band are then adapted to the relative accuracy required to maximise perceived quality according to the spectral response of the ear. The system automatically adjusts the band edges to changes in sample rates. It is important to note that the bottom band always covers the most critical area of the spectrum for any hi-fi music application, so that the musical fundamental frequencies are coded as accurately as possible.

Low bit rate Sub-band ADPCM coding alone, as so far described, cannot be relied upon to produce audible transparency under all conditions. The real key to the superb performance of the *apt-X100* system lies in two further uniquely implemented techniques.

### C.6 - Backward Adaptive Quantisation

As explained earlier, adaption of the quantising step size according to the energy of the input signal enables the use of lower bit rates. Controlling the adaption by analysis of previous samples makes it possible for the decoder to operate without being sent any gain information. This is achieved by comparing the accuracy of the current sample with the previous one and applying correction in the form of an adaption multiplier from identical look-up tables in the encoder and decoder.

This process provides a near optimal range match over a wide dynamic range, and is particularly effective for adaptive quantisers with large numbers of levels.

Adaptive quantisation also maintains a constant signal to noise ratio throughout the entire dynamic range, unlike linear PCM where the noise floor level is constant by nature. This exploits the masking properties of the human auditory system.

### C.7 - Linear Prediction

Audio signals of high spectral purity, such as tones, have a tendency to produce more audible noise modulation than wide band signals, which have a greater masking effect. This can be controlled by the application of linear prediction prior to quantisation. Once again this involves analysing a small piece of history in order to attenuate predictable signals.

The efficiency of this process actually rises dramatically with an increase in the signal periodicity or spectral purity. The combination of linear prediction and sub-band coding thus avoids the need to resolve the spectrum in order to preferentially code the resonant components. By keeping within four sub-bands, the stationary characteristics of the sub-band signals are such that backward adaptive prediction has been found to provide an almost optimal performance. This is particularly true for sinusoidal type signals whose predictability is largely unaffected by sub-band decimation. However, it is also proven that substantial prediction gains exist for the vast majority of music sounds, and the validity of linear prediction for speech coding has been well documented.

The overall effect of linear prediction, therefore, is to attenuate predictable signals, of which the most subjectively

critical are highly resonant spectra. There is a potential drawback in the presence of noise-like signals as, under such conditions, the prediction process is incapable of providing any coding gain. Fortunately, the significance of this effect is eclipsed by the inherent noise masking which accompanies these signals.

### C.8 - *apt-X100* Sub-Band ADPCM

Sub-band ADPCM has been shown to be a very efficient solution to the problem of high quality audio compression. The diversity of redundancy removal processes involved not only reduce its sensitivity to uncharacteristic signals, but collectively take advantage of the best properties of each. This means that non-musical or discordant sounds are treated as any other signal and will be faithfully reproduced.

The code is structured as a series of 16 bit words. The scheme has been referred to as 4 bit digital audio. More accurately it is 4 bits per sample, as one code word is generated for every four 16 bit linear PCM words input. This scheme uses a 4 band QMF (Quadrature Mirror Filter) tree structure where each band incorporates a backward adaptive quantiser and predictive block.

By allowing all parameter adaptations within the encoder and encoder blocks to follow in a backward mode, no specific side information is transmitted between them. The effect of this is to improve the immunity of the system to transmission errors and to reduce the coding delay across the encoder-decoder process.

### C.9 - Inherent Properties

*REAL-TIME OPERATION.* The processing power of today's high speed digital signal processing technology has made it possible to code and decode audio in real-time.

*LOW, CONSTANT CODING DELAY.* By operating in the time domain to analyse the audio signal, the amount of backward information required to optimise the predictors is relatively small, giving the advantage of a minimal coding delay. The calculations are made accurately over a fixed 122 samples, making the total constant codex delay 3.8mS at a sample rate of 32kHz - the time it takes audio to travel approximately 1.25 metres, or a little over 4 feet. The effects of this delay are inaudible for live off-air foldback and compensation is unnecessary for synchronisation with picture.

*AUTOMATIC RESOLUTION TO ANY SAMPLE FREQUENCY UP TO 50KHZ.* Sub-band coding is able to be resolved to any input sample frequency. In fact, the upper band limit is caused by the speed of the processing technology used. This means that *apt -X100* can be implemented without modification into systems needing the wide bandwidth performance of 48kHz sampling, or to squeeze high quality speech into 64kbit/s using a 16kHz sample rate.

*HIGH IMMUNITY TO BIT ERRORS.* Linear PCM, by its nature, is a very fragile medium. As each word of information is describing an analogue level, any corruption of the data can have disastrous results, causing a rapid breakdown in the sonic performance. The effects of errors range from nasty spiky clicks to white noise at full modulation. The information contained in the *apt-X100* code describe a temporal analysis of the waveform and therefore the effects of corrupting the data are far less severe, making the process several orders of magnitude more robust. So resistant, in fact, that it has so far not been deemed necessary to provide any form of error protection under normal operating conditions.

# APPENDIX D SPECIFICATIONS

| Specification | Description |
|---|---|
| Maximum Input/Output Level | 12dBu APTX /18dBu MPEG |
| Input Impedance | <10kOhms |
| Output Impedance | >60 Ohms |
| Inputs and Outputs | Balanced |
| Headphone Monitor , Level Indicator | Input / output - selectable |
| Silence Detector | Variable - Input |
| Mic Input | Optional - 60dBu level |
| Frequency Response | 20Hz - 15kHz depending on coding mode |
| Coding Standard | apt-X100, MPEG L2, G.722 |
| Inverse Multiplexing Standard | apt MUCAS 2 x 64kBit/s |
| Sample rate | 16,24,32,48KHz |
| Bit Error Immunity | $1 \times 10^{-4}$ |
| Auxiliary Data | RS232 1200 - 9600 baud |
| Logic Inputs | 8 Opto Inputs |
| Logic Outputs | 8 Relay outputs |
| Alarm Output | Uses Relay Outputs |
| Backup Switchover | Loss of Framing |
| | Silence Detector |
| | Logic Input |
| Backup Logic | User Selectable |
| Audio Routing | Relay Option Board |
| ISDN TA Module | International Compatibility |
| Digital Interface | 2 x X.21 DTE |
| Size NICA X-1 | 1U 19" 300mm deep |
| Size NICA X-2 | 2U 19" 300mm deep |
| Power | 90 - 250V ac/dc |
| EMC Approval | EN 55103-1 |
| | EN55103-2 |
| LVD | EN 60950 |

23/8/00 Page 82 Relay output changed to Opto Input in table heading
13/2/01 Added in State Machine 2 operation