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4-Port X.21 Sprint 2 With Single ADPCM Option.
MXU9010-A1
4-Port V.35 Sprint 2 With Single ADPCM Option.
MXU9014-A1
4-Port V.24 Sprint 2 With Single ADPCM Option.
MXU9012-A1

4-Port X.21 Sprint 2 With Single ADPCM Option.
MXU9010-A1
4-Port V.35 Sprint 2 With Single ADPCM Option.
MXU9014-A1
4-Port V.24 Sprint 2 With Single ADPCM Option.
MXU9012-A1

4-Port X.21 Sprint 2 With Single ADPCM Option.
MXF9505-V11 (France Only)
4-Port V.35 Sprint 2 With Single ADPCM Option.
MXF9505-V35 (France Only)

4-Port X.21 Sprint 2 With Single ADPCM Option.
MXF9505-V11 (France Only)
4-Port V.35 Sprint 2 With Single ADPCM Option.
MXF9505-V35 (France Only)

8-Port X.21 Sprint 2 With Single ADPCM Option.
MXU9011-A1
8-Port V.35 Sprint 2 With Single ADPCM Option.
MXU9015-A1
8-Port V.24 Sprint 2 With Single ADPCM Option.
MXU9013-A1

8-Port X.21 Sprint 2 With Single ADPCM Option.
MXU9011-A1
8-Port V.35 Sprint 2 With Single ADPCM Option.
MXU9015-A1
8-Port V.24 Sprint 2 With Single ADPCM Option.
MXU9013-A1

ADPCM Voice Compression Options for Sprint 2 TDM

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SPRINT 2

**ADPCM VOICE Option
User Manual Supplement**

WARNING

**BEFORE INSTALLATION, PLEASE
REFER TO SAFETY INSTRUCTIONS IN
APPENDIX A**



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Introduction

This User Manual Supplement describes Installation, Operation and Use of the Sprint2 ADPCM Option card, and must be read in conjunction with the Sprint2 Multiplexer User manual.

The Sprint2 ADPCM voice option allows the Sprint2 multiplexer to transmit voice traffic on the same composite link as data. It compresses voice signals using the ADPCM (Adaptive Differential Pulse Code Modulation) algorithm allowing many voice channels to be carried through the digital data network. The card hosts either 1 or 2 voice channels.

Typical use of the ADPCM voice channels is to interconnect two or more PABX systems. If ADPCM is used over a 64K digital circuit up to 2 tie lines may be replaced using a single multiplexer.

A number of hardware configurations are achievable including Tie-Line replacement, PABX Extension, Extension Piggy-Back or a simple Hot-line. Some of these are illustrated later in this section.

Installation details for the ADPCM VOICE module are covered in Installation section commencing on page 14.



Functional Overview

The Sprint2 ADPCM voice option provides excellent quality, low bandwidth voice transmission, over a digital data link, using the ADPCM (Adaptive Differential Pulse Code Modulation) algorithm. It compresses voice signal data to between 32Kbps and 8K bps depending on required voice quality, de-compressing and re-constituting the analogue signal at the remote site.

The option is designed to interconnect PABXs using the inter-PABX signalling protocols DC5 (also known as E&M) and AC15.

The compression bit-rate and other voice parameters are selected using the same configuration methods used for the SPRINT2 MULTIPLEXER.

Mechanical Construction

The ADPCM voice module is built onto a single printed circuit board assembly, which must be installed in the option slot of the Sprint2 MULTIPLEXER . One or Two voice channels are fitted on each option card. The following diagram shows the layout of the voice card:

ADPCM MODULE PCB Layout



Voice Channel Signalling

The ADPCM module supports pulse (E&M/DC5) dialling between telephone or PABX systems. It will also carry tone (Basic AC15 and DTMF) signalling, providing that the bandwidth allocated to the channel is sufficient. This is discussed further in the Voice Signalling Configuration section.

AC15 signalling uses a tone of 2280 Hertz, pulsed at the same rate as DC5 (or E&M) that is 10pps. AC15 is often preferred, since many PABXs incorporate AC15 signalling as standard and no cost is incurred purchasing signalling convertors. Providing that sufficient bandwidth



is allocated, the ADPCM card option supports basic AC15 signalling without the need for such converters.

Voice Tie Line

The diagram below illustrates a voice Tie-Line connection. Extension telephones may direct dial extensions at the remote location, and call out or receive calls from the PSTN connected to the remote location.

Telephone Extensions

The voice card may be used to extend an **extension** line to a remote site as shown in the following diagram. This allows the remote telephone to behave as if it is directly connected to the PABX. Note that this may not be suitable for extending Key-System extensions, as there is no standard for Key-System extension interfaces.



Voice Piggy Back

A piggy back arrangement using telephone extensions and trunk lines may be arranged as shown below. This gives less flexibility than the Tie-Line approach, as direct extension dialling is not possible in the extension-to-trunk direction.

Use & Configuration

The voice channel options can be modified using the simple terminal configuration process, described in the next section, similar to that for the Sprint2 MULTIPLEXER.

Voice Channel Configuration

This section only describes configuration of the Sprint2 ADPCM voice option card. Configuration of the MULTIPLEXER TDM channels is described in the Configuration section of the Sprint2 MULTIPLEXER manual.

If you are not familiar with general configuration of the SPRINT2 MULTIPLEXER, please refer to the **Use & Configuration** section of the SPRINT2 MULTIPLEXER user manual before reading the following sections or attempting to configure the ADPCM VOICE option card.

ADPCM Setup Display

The ADPCM VOICE configuration display shown below is reached by selecting the correct terminal type from the list displayed after plugging the terminal into the supervisor port.

SPRINT2 TIME DIVISION MULTIPLEXER									Vx.xx	
Mode	:	RUN								
Data Monitor	:	RXD								
Link Clock	:	AUTO 64000								
X.21 Carrier	:	PRESENT								
Residual	:	+4800								
Option Cards	:	DUAL VOICE								
Configure	:	>ACCEPT								
Display Page	:	LOCAL								
COPY CHANNEL	:	1	2	3	4	5	6	7	8	VOX1+2
RATE	:	4800	4800	9600	9600	0	0	0	0	14400
TYPE	:	SYNC	SYNC	SYNC	SYNC					2-BIT
RX CLOCK	:	INT	INT	INT	INT					4W
TX CLOCK	:	INT	INT	INT	INT					0dB OP
BITS/CHAR	:									0dB IP
PARITY	:									4W
RTS/CTS DELAY	:	0ms	0ms	0ms	0ms					0dB OP
SIGNALS	:	BOTH+	BOTH+	BOTH+	BOTH+					0dB IP
CHANNEL MODE	:	RUN	RUN	RUN	RUN					

Use cursor keys to select parameter, SPACE/- to toggle

Voice Channel Parameters

Parameters for the voice channels are accessed by locating the cursor alongside the entry for a particular channel.

To view the valid choices for the parameter, press the **spacebar**, + or - keys.

The choices by parameter are :

PARAMETER	CHOICES	NOTES
Channel	VOX1, VOX1+2, V-LOOP	Voice config selected
Rate	0 8000 to 16000, 400bps steps 16000 to 32000, 400bps steps	<u>Voice channel bit rate:</u> Channel OFF With 2 bit sampling selected With 4 bit sampling selected
Wire	2 or 4	Analogue interface for voice connection
O/P Gain	+6dB, +3dB, 0dB, -3dB, -6dB, -9dB, -12dB, -15dB	Receive gain setting for voice circuit
I/P Gain	+6dB, +3dB, 0dB, -3dB, -6dB, -9dB, -12dB, -15dB	Transmit gain setting for voice circuit
Sampling	2 bit or 4 bit	2 bit sample, 8K to 16K 4 bit sample, 16K to 32K

The LOCAL and REMOTE setup pages are accessed as usual to configure either location.

Channels may be copied in the same way as TDM channels.

Voice Quality / Bandwidth

The sampling rate used for each voice channel is totally at the discretion of the user, depending on the voice **quality** required.

The highest quality achievable is at 32000bps, 4 bit sampling. With this selection, voice quality is extremely good, near Toll Quality.

At 16000bps 2 bit sampling, quality is again very good, the most obvious difference being slightly increased background noise.

In each of the above cases, the bandwidth available to speech **and signalling** is 3.4Khz. Bandwidth falls off linearly with bit rate, towards a minimum of 1.7Khz at either 16000bps 4-bit, or 8000bps 2-bit sampling.

This **must** be born in mind if AC15 signalling, MODEM Tones, of FAX tones are to be suitably preserved. The following table shows bandwidth calculated at various bit rates:

ADPCM BANDWIDTH		
4 bit (bps)	2 bit (bps)	Bandwidth (KHz)
32000	16000	3400
31000	15500	3294
30000	15000	3188
29000	14500	3081
28000	14000	2975
27000	13500	2869
26000	13000	2763
25000	12500	2656
24000	12000	2550
23000	11500	2444
22000	11000	2338
<u>21000</u>	<u>10500</u>	2231
<u>20000</u>	<u>10000</u>	2125
<u>19000</u>	<u>9500</u>	2019
<u>18000</u>	<u>9000</u>	1913
<u>17000</u>	<u>8500</u>	1806
<u>16000</u>	<u>8000</u>	1700

Note: Avoid bandwidths **shaded** if AC15 signalling is to be used. FAX transmission behaves similarly. It has been shown to work successfully even below 12000bps 2-bit, but it is advisable to allow as much bandwidth as possible to ensure reliable transmission, as external influences such as the kind of FAX machine, PABX, and Network losses also affect transmission quality significantly.

Installation

The multiplexer must be disconnected from the power supply and all peripheral connections before opening.

Voice Module Installation

With power turned **OFF**, the screws on the left and right of the multiplexer are removed. The blanking panel should be removed before the voice card is inserted. This is achieved by removing **three screws** (shown) on the back panel. These screws are used to retain the option card once fitted. Power must be connected to the option module (by its cable) from the power socket on the motherboard. Once this has been done, only the BUS ribbon cable needs to be fitted.

Voice Loop Testing

On a Dual ADPCM board, the voice channels may be looped to each other for test purposes. This allows local PABX connection tests to be performed at a single site location.

Channels **1 and 2** may be looped to each other - speech at the telephone attached to Channel 1 will be heard at the earpiece of the telephone at Channel 2 and vice versa.

This is achieved by setting the voice channel to **V-LOOP** mode.

Note: When doing voice LOOP tests, there **MUST** be a clock source. This may either come from the digital network or the unit may be set to INTERNAL CLOCK (See user manual).



Voice Interface Cabling & Connections

Suitable connection may be arranged using a Krone™ wallboxes type 251 or similar. The private voice equipment is connected to the Krone strips in the wallbox using a Krone IDC tool.

Each **pair** of voice channels is wired using two RJ45 cables to a 237A type Krone connection block as follows:

RJ45 pin	Krone pair Ch1/Ch2 Ch3/Ch4 Ch5/Ch6 etc	Colour	Name	Type
4	1a / 6a	Blue	RXa/TXa	O/P when 4 wire I/O when 2 wire
5	1b / 6b	White/Blue	RXb/TXb	O/P when 4 wire I/O when 2 wire
3	2a / 7a	White/Green	TXa	I/P 4 wire only
6	2b / 7b	Green	TXb	I/P 4 wire only
7	3a / 8a	White/Brown	E	O/P, Closing Contact to ground
8	3b / 8b	Brown	E Lead Reference	Signal ground for UK link positions
2	4a / 9a	Orange	M	I/P, loop to ground
1	4b / 9b	White/Orange	M Lead Reference	Internal -12V bias, Do not connect

Where the following types apply: O/P = Output **from** multiplexer
I/P = Input **to** multiplexer
I/O = Both input and output

Connection may be made directly to the RJ45 connector where the connection is to Private PABX equipment.

It is an approval requirement that the **RJ45 connector tabs must be clipped short** to prevent user access.

The above cables may be ordered separately where required from Black Box.

Voice Impedance Matching

The port impedances are standard for both 2 wire and 4 wire interfaces as follows:

The private system's impedance must be correctly matched to the above to achieve optimal echo cancellation.

Voice Signalling

Configuration

The voice channels are configured for BT standard keying (E&M) and AC15 unless specified by the customer. Please contact Black Box if you require an alternative configuration.

If DC5 (E&M) signalling will not function, the most common cause is that there is no GROUND RETURN connection between the Multiplexer and the PABX system. At least one of these SIGNAL GROUND connections must be made to the PABX ground for each voice card used.

The DC5 (E&M) and SIGNAL GROUND connections are not required for AC15 signalling.

AC15 signalling requires sufficient bandwidth to allow the 2280Hz signalling tones to be passed without degradation. This should be considered with reference to the table in the Voice Quality / Bandwidth section.

Appendix 00000000A - Warnings0

WARNING: THIS EQUIPMENT MUST BE EARTHED

This equipment relies on the EARTH connection to ensure safe operation such that the user and TELECOM Network are adequately protected. It must not under any circumstances be operated without an earth connection, which could nullify its approval for connection to a network.

WARNING: INSTALLATION OF EQUIPMENT

Installation of this equipment must only be performed by suitably trained service personnel.

WARNING: CONNECTION OF OTHER EQUIPMENT

This equipment allows connection only of suitably approved equipment to its ports, the safety status of which are defined below:

TNV Ports:

- i) **Voice 1**
- ii) **Voice 2**

The above named ports are classified as TNV (Telecom Network Voltage) in accordance with Clause 4.2 of EN41003, and **must only** be connected to equipment which similarly complies with the TNV safety classification.