

# **Data and Voice Card Operation Manual**

Channel Card for the Series KMX 9000 Multiplexers

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1

## STATUTORY NOTICES



Case Communications Ltd declare that this product conforms with the protection requirements of Council Directive 89/336/EEC on the approximation of the laws of the member states relating to electromagnetic protection.

This equipment has been tested using shielded cables supplied by Case Communications Ltd. These cables, or equivalents, must be used to ensure compliance with this declaration.

All PCB assemblies contain Electrostatic Sensitive Devices (ESDs) which may be permanently damaged if incorrectly handled. This equipment must be handled in accordance with BS5783 code of practice for the handling of electrostatic sensitive devices.

### APPROVALS

The UK approval number for the Data Voice Card (DVC) is NS/1282/2/M/602467

The Data Circuits are approved for indirect connection to Telecommunications Systems under the General Approval number NS/G/1234/J/100003 when operated in the Series KMX 9000 multiplexer chassis. The DVC data circuits do not contain any safety isolation barriers, and any apparatus connected to them must conform with the safety requirements of the General Approval.

The Safety status of the Voice port is TNV.

The Safety status of all other ports is SELV.

The Voice circuit is approved for direct connection in accordance with OTR/001 port types. 2BN (2 wire) and 2CN (4 wire).

### PROTECTION OF THE NETWORK

Data ports (as opposed to the voice ports) on this apparatus are marked: **"SAFETY WARNING. See instructions for use."**

This equipment has no barrier between Attachment (non-network) ports, all non-networking ports may be connected only to SELV circuits as defined in BS7002 (EN60950).

WARNING: Inter-connection directly, or by way of other apparatus, of ports marked:

**"WARNING**

Connect only apparatus complying with BS6301 to this (or these) port(s)"

or

**"WARNING**

Connect only apparatus complying with BS6301 to this (or these) port(s) unless connection is made to a telecommunications network."

or

**"SAFETY WARNING. See instructions for use."**

with ports not so marked may produce hazardous conditions on the telecommunications network. Advice should be obtained from a competent engineer before such a connection is made.

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# Preface

The DVC is a channel interface card for installation in the Series KMX 9000 range of TDM multiplexers. This manual assumes that the user is familiar with the control of the Series KMX 9000 multiplexers and installation procedures for channel cards. This manual applies to cards fitted in Series KMX 9000 multiplexers with TLM/QLM firmware V3.00 or later. Refer to the Series KMX 9000 multiplexer manual X729-300051 for further details.

## STATUTORY NOTICES continued

If the card(s) are not installed in a Case Communications Series KMX 9000 chassis the following conditions must be met to maintain their approval:

- Ensure that the power drawn by the card(s), together with the chassis and any auxiliary equipment drawing power from the chassis, is within the rating of the chassis power supply. (Refer to the Power Consumption Table in the Series KMX 9000 Multiplexer Reference Manual part number X729-300051.)
- Install the card so that, with the exception of the chassis bus connector, clearance and creepage distances shown in the table below are maintained between the module and all other parts of the chassis which use or generate a voltage shown in the table; the creepage distance shown in brackets applies where the local environment within the chassis is subject to conductive pollution or dry non-conductive pollution which could become conductive due to condensation.

Clearance (mm)	Creepage (mm)	Voltage used or generated by host or other cards
2.0	2.4 (3.8)	Up to 50 Vrms or Vdc
2.6	3.0 (4.8)	Up to 125 Vrms or Vdc
4.0	5.0 (8.0)	Up to 250 Vrms or Vdc
4.0	6.4 (10.0)	Up to 300 Vrms or Vdc

- For a chassis using or generating voltages greater than 300 V (rms or dc), you must obtain advice from a competent telecommunications safety engineer before installing the modules.

# Contents

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<b>1</b>	<b>Introduction</b>	7
1.1	General Description	7
<b>2</b>	<b>Specifications</b>	8
2.1	Data Channel	8
2.2	ADPCM Voice Channel	9
2.3	General	11
<b>3</b>	<b>Hardware Configuration</b>	11
3.1	Voice Channel Hardware Configuration	11
3.2	LED Status Indicators	15
<b>4</b>	<b>Software Configuration</b>	16
4.1	Data Rate	16
4.2	Remote Channel Address	17
4.3	V24 Control States	17
4.4	Internal/External Channel Clocks	17
4.5	ADPCM Channel Rate	18
4.6	Voice Channel Remote Address	18
<b>5</b>	<b>Channel Interface Connections</b>	18
<b>6</b>	<b>Interface Connecting Cables</b>	19

## **Figures**

3-1	DVC Voice Gain Adjustment	12
3-2	DVC Board Layout	16

## **Tables**

3-1	Settings of SW4 positions 3 and 4	12
3-2	Setting SW4, positions 1, 2	12
3-3	Gain settings by adjustment of SW4 positions 1-4	13

# Data and Voice Card

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## 1. Introduction

### 1.1 General Description

The DVC is a channel interface card for installation in the KMX 9000 series range of TDM multiplexers. This manual assumes that the user is familiar with the control of the Series KMX 9000 multiplexers and installation procedures for channel cards. This manual applies to cards fitted in 9000 series multiplexers with TLM/QLM firmware V 3.00 or later. Refer to the Series KMX 9000 multiplexer manual X729-300051 for further details.

The DVC provides two synchronous data circuits and one ADPCM voice circuit. The electrical interface for the data circuits is V.28. The speed of the data circuits and ADPCM coding rate is user selectable. The maximum speed of any channel is governed by the available aggregate bandwidth. Both data circuits can run at the following speeds:

1200 bps, 2400 bps, 4800 bps, 7200 bps, 9600 bps, 14.4 kbps, 19.2 kbps, 24 kbps, 32 kbps, 48 kbps, 56 kbps and 64 kbps.

ADPCM coding rates are selectable to either 32 kbps, 24 kbps, 19.2 kbps or 16 kbps; at 32 kbps AC15 signalling tones can be carried.

Each data channel supports two end-to-end duplex control signals which are carried in the supervisor channel of the aggregate data stream. These are RTS > DCD and DTR > DSR. Additionally the CTS output reflects the RTS input at the local end. The state of DCD and DSR can be influenced by software control to be either High or Low, as well as following their input status at the other end of the network.

## **2. Specifications**

### **2.1 Data Channel**

#### **Synchronous Channels**

Supports 2 synchronous data channels and one ADPCM voice channel.

#### **Electrical Interface**

Complies with CCITT V.24/V.28.

#### **Data Rate**

All data rates are generated within the aggregate link module (TLM/QLM). Special builds of the TLM/QLM can facilitate different sets of available rates.

Each channel can be selected independently by software control to be one of the rates available on the TLM/QLM up to a maximum of 64kbps.

#### **Receive Clock**

Internal - derived from the aggregate master clock.

External - selected data rate +/- 0.01% (clocks data out of buffer).

#### **Transmit Clock**

Internal - derived from the aggregate master clock.

External - selected data rate +/- 0.01% (clocks data into buffer).

#### **Receive Data Buffer**

An 8 (+/-4) bit data buffer for removing any 'bunching' effect caused by multiplexing and allowing the use of an external receive clock. The buffer is reset to the centre when an underflow/overflow condition occurs.

#### **Transmit Data Buffer**

An 8 (+/-4) bit data buffer for removing the 'bunching' effect caused by multiplexing and allowing the use of an external transmit clock. The buffer is reset to the centre on an underflow/overflow condition or on the positive going edge of the V.24 control signal RTS in half duplex applications.

## **Interface Control Signals**

Two full duplex control signals per channel are transmitted within the TDM Supervisory channel.

## **Loopbacks**

Individual unidirectional channel loopbacks, which loop receive data back to transmit data, can be activated from the front panel. Receive data is also allowed through to the remote end as normal.

## **2.2 ADPCM Voice Channel**

### **Analogue Interface**

Transformer coupled, four wire, with a nominal impedance of 600 ohms, or two wire matched to the impedance reference network as specified in BS6305 figure 5. Transformers conform to BS6301 for safety.

### **Analogue Channel Delay**

Analogue Channel Delay = 6ms, excluding digital bearer channel delay.

### **Voice Distortion**

3.5 qdu @ 32kbps    )  
4.0 qdu @ 24kbps    )  
4.5 qdu @ 19.2kbps ) Estimates; subject to CCITT ratification  
5.0 qdu @ 16kbps    )

### **Signalling Interface**

E & M signalling (type 1) in accordance with SSDC5

### **Signalling Distortion**

Signalling information is transmitted in-band at the voice data rate.  
Distortion +/-1ms.

### **Modulation Technique**

ADPCM (Adaptive Differential Pulse Code Modulation).

## **Voice Data Rate**

16 kbps, 19.2 kbps, 24 kbps and 32 kbps

## **Maximum Expected Input Level**

Switch selectable to be 0, -3, -6 or -9 dBm

## **Output Gain**

Switch selectable between 0, -3, -6 and -9 dB.

## **Overall Channel Gain**

The end to end gain for an individual voice channel is calculated using the following formula:

$$\text{Channel Gain (dB)} = \text{Output gain (expressed in dB)} - \text{Maximum Input level (expressed in dBm)}$$

## **Channel Busy Out**

A voice channel is busied out by automatically asserting the 'M' lead output if:

- power is lost
- or the channel is not configured
- or reliable communications with the remote voice channel cannot be maintained.

## **Loopbacks**

A bi-directional loopback is provided within the DVC voice circuits. Use of voice loopback is not recommended within two wire circuits; feed-back 'howl' is likely to occur.

The loopback provided, being within the analogue portion of the voice circuit, is not compatible with Bit Error Rate Testing (BERT) of the (digital) data path.

## 2.3 General

### Power Consumption

The card uses 6 watts of power. For a further breakdown refer to the chassis loading chart in the Series KMX 9000 Multiplexer Manual.

### MTBF

The MTBF is 32 years calculated to HRD4.

### Environmental

Operating Temperature	+5°C to +40°C
Storage Temperature	-25°C to +55°C
Humidity	5 to 95% non-condensing

## 3. Hardware Configuration

### 3.1 Voice Channel Hardware Configuration

The DVC contains DIP switches and straps for selection of interface types, signalling type and channel gain. See Figure 1-2.

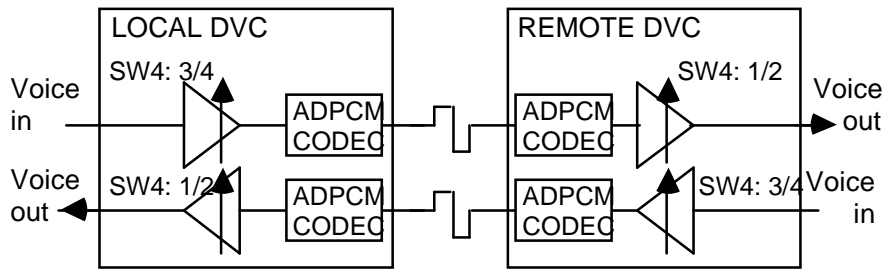
#### E & M Signalling Type Selection

	LK22	LK23
European Standard E (Ground)/M (Ground)	UK	UK
American Standard E (Battery)/M (Ground)	USA	USA

#### Channel Gain Selection

The four way DIP switch, SW4, at the rear of the DVC card facilitates user adjustment of voice channel gain. The chosen switch settings can be directly related to two parameters:

- the maximum signal amplitude expected at the DVC input.
- the signal gain required between the input of the local DVC and the output of the distant voice channel.



**Figure 3-1 DVC Voice Gain Adjustment**

SW4, positions 3 and 4 adjust for expected DVC input levels.

SW4, positions 1 and 2 adjust DVC output gain.

Maximum expected		Recommended [0=off]		Selected input
DVC input level		switch settings: [1=on]		gain
Voltage	Power	SW4, 3	SW4, 4	Gain (dB)
1.1Vpk	0dBm	0	1	0
775mVpk	-3dBm	1	1	+3
548mVpk	-6dBm	0	0	+6
387mVpk	-9dBm	1	0	+9

**Table 3-1 Setting SW4 positions 3 and 4.**

Output Gain	SW4, 1	SW4, 2
0dB	1	0
-3dB	0	0
-6dB	1	1
-9dB	0	1

**Table 3-2 Setting SW4, positions 1, 2.**

**Note:** The output gain can be calculated through the use of the following equation:

$$\text{Output gain [dB]} = \text{Required overall gain [dB]} + \text{Max expected input level [dBm]}$$

The following table presents the various gain settings available by adjustment of DIP switch SW4 positions 1 - 4:

Maximum Expected DVC Input Signal		SW4 positions 1234 0= OFF, 1 = ON			
Voltage	Power	Required Overall DVC Channel Gain			
		+0dB	-3dB	-6dB	-9dB
1.1 V pk	0 dBm	1001	0001	1101	0101
775 mV pk	-3 dBm	0011	1111	0111	(0101)
548 mV pk	-6 dBm	1100	0100	(0111)	(0101)
387 mV pk	-9 dBm	0110	(0100)	(0111)	(0101)

**Table 3-3 Gain settings by adjustment of SW4 positions 1-4.**

**Note 1:** Configurations shown in parentheses will lead to a marginal degradation in channel dynamic range, and should consequently be avoided if possible.

**Note 2:** It is recommended that the selected settings are identical at both ends of the link, and at all stations within larger networked systems, however in some circumstances, non-identical switch settings may be employed to accommodate dissimilar signal amplitudes at each end of the link.

If non-identical settings are required, independent channel gains are configured as follows: switch 3 and 4 are set at the DVC to which voice is input; and switch 1 and 2 are set at the output end of the voice channel.

**Note 3:** 0dBm = 1mW in 600 Ohms.

### Configuration of Voice Interface

The DVC analogue interface can be configured for two wire or four wire operation. and the line termination resistance can be selected for class 'b' return loss, giving compatibility with 600 ohm systems, or for class 'a' return loss, giving compatibility with systems employing the network impedance specified in BS6305 fig.5. Selection of these features is achieved through adjustment of a number of jumper links, as detailed below.

**NOTE:** Do not attempt to adjust these links in a live system. Always disconnect the 15 way connector from the DVC interface and remove power before touching these links.

For 4 wire interfaces, set links 24, 25, and 26 to '4W'.

For 2 wire interfaces, set links 24, 25, and 26 to '2W'.

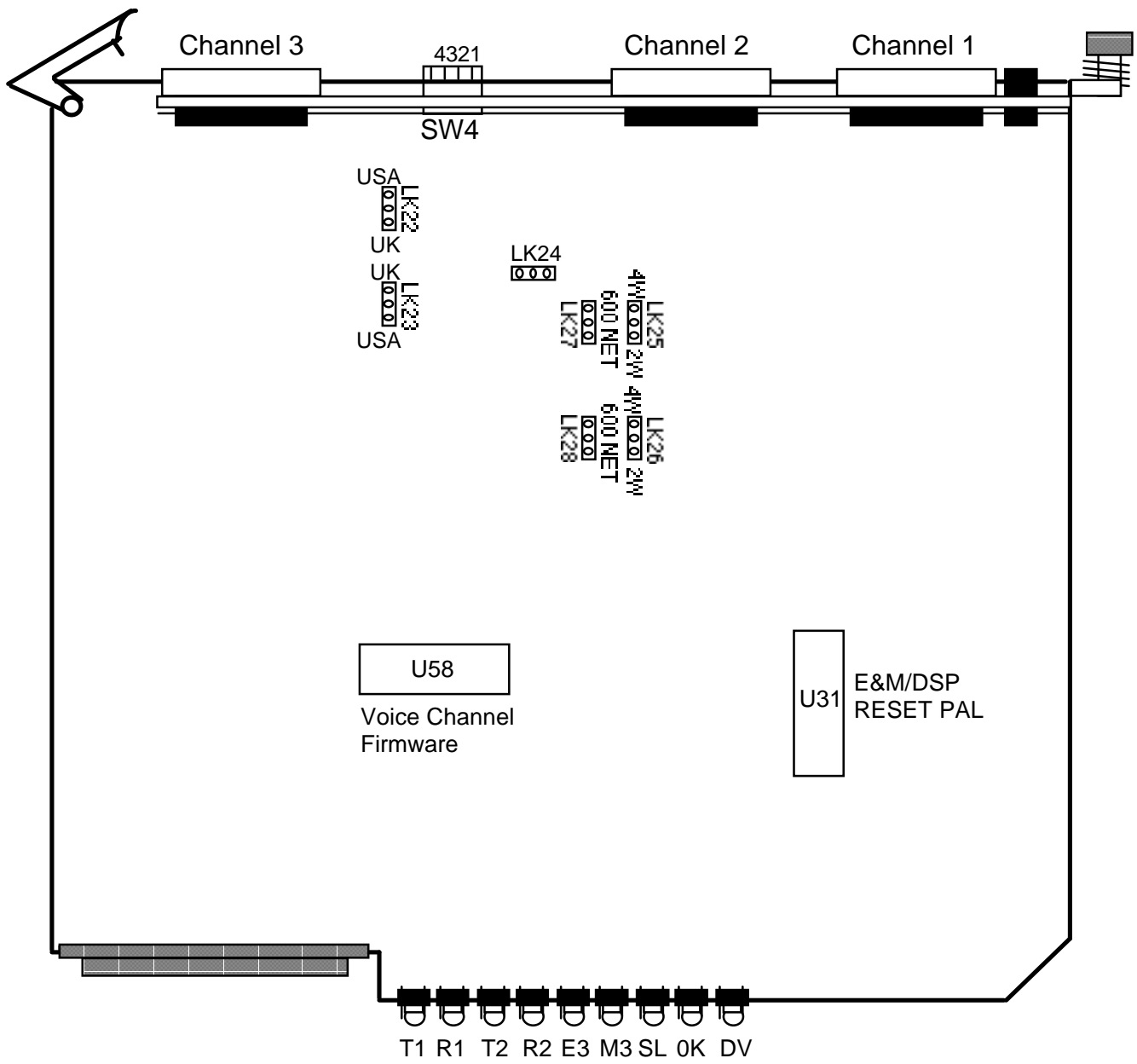
For class 'b' termination, set links 27 and 28 to '600'.

For class 'a' termination, set links 27 and 28 to 'NET'.

Jumper links should be configured to match the analogue equipment (e.g. PABX) connected to the voice channel. For 4-wire operation the 600 ohm termination must be selected. In 2-wire applications the termination impedance should be NET. If in doubt contact the PABX supplier for information. For two wire operation the analogue pair is presented on the analogue input pins of the 15 way interface connector (pins 1 and 2).

### **3.2 LED Status Indicators**

- T1** when illuminated indicates space polarity for transmit data on synchronous data channel 1.
- R1** when illuminated indicates space polarity for receive data on synchronous data channel 1.
- T2** when illuminated indicates space polarity for transmit data on synchronous data channel 2.
- R2** when illuminated indicates space polarity for receive data on synchronous data channel 2.
- E3** when illuminated indicates a busy condition on the 'E' lead input to the voice channel.
- M3** when illuminated indicates a busy condition on the 'M' lead output from the voice channel.
- SL** when illuminated, indicates that the voice channel is not configured or synchronisation failure with the remote end voice channel has occurred. This indicator will be extinguished when good data communications with the remote end voice channel has been established.
- OK** illuminates when the voice channel processor has successfully completed power on diagnostics. This indicator will flash if diagnostics fail.
- DV** indicates the card type-should be permanently illuminated if the card is inserted and the power is on.



**Figure 3-2 DVC Board Layout**

## 4. Software Configuration

### 4.1 Data Rate

After selecting the 'SYNC' data channel to be configured, the data rate can be altered by using the UP and DOWN keys: the entry below the lowest rate or above the highest being DELETE CHANNEL which allows the user to remove the channel from the configuration. If 'DELETE CHANNEL' (0K) is selected by pressing the ENTER key, the parameters for the next channel in the configuration will then be displayed.

## 4.2 Remote Channel Address

Having determined the data rate the next display facilitates selection of the remote channel address:

```
CH nn REMOTE  
ADDRESS mm
```

The current remote channel address is displayed on the second line and the user scrolls through the possible addresses using the UP and DOWN keys to select the required address. The V.24 control and channel clocking attributes for the new channel are transferred to the new channel at the remote multiplexer.

## 4.3 V24 Control States

The transmit V.24 control states may be set as follows:

```
CHnn TX CONTROLS  
C1P C2L
```

C1 controls DTR and C2 controls RTS.

The second line gives the state of each of the V.24 controls (P = pass, H = force high, L = force low). The user can alter each state in turn starting with C1 by pressing the ENTER key and then using the UP and DOWN keys to change the state, the current control state being denoted by a '?' to the right of it. Repeated selection of the ENTER key will leave the states as they were.

**NOTE:** The receive V.24 states are configured by accessing the channel at the remote end of the connection. When adding a new channel the V.24 attributes and clocking parameters for the remote multiplexer are set to the default conditions, i.e. both clocks internal and both V.24 controls forced high.

## 4.4 Internal/External Channel Clocks

The following display is presented:

```
CH nn CLOCKS  
TX INT RX INT
```

The UP and DOWN keys are used to select the appropriate configuration as displayed on the second line:

TX EXT RX INT  
 or TX EXT RX EXT

Pressing ENTER will confirm the selection.

#### 4.5 ADPCM Channel Rate

After selecting the voice channel (ANLG) the data rate may be selected using the UP and DOWN keys to be either 0 K, 32 kbps, 24 kbps, 19.2 kbps or 16 kbps. If 0 K is selected, the channel will be deleted from the configuration.

#### 4.6 Voice Channel Remote Address

The address of a compatible channel, DVC ANLG or MDPT must be selected using the UP and DOWN keys.

CH nn REMOTE  
 ADDRESS mm

## 5. Channel Interface Connections

### Synchronous Channel I/O Connections

25-way D-type socket. Configured for ITU-T V.24/V.28 DCE

Pin No.	Signal Name	Direction
1	Protective ground	-
2	Transmit data	To Mux
3	Receive data	From Mux
4	Request to send (control 1 in)	To Mux
5	Clear to send (follows RTS input)	From Mux
6	Data set ready (control 2 in)	From Mux
7	Common return	-
8	Carrier detect (control 1 out)	From Mux
9	+ 12V	From Mux
10	- 12V	From Mux
15	Transmit clock	From Mux
17	Receive clock	From Mux
20	Data terminal ready (control 2 out)	To Mux
24	Ext Transmit clock	To Mux

## Voice Channel Interface Connections

15-way D-type plug

<b>Pin No.</b>	<b>Signal Name</b>	<b>Direction</b>
1	4 wire TX input/2 wire TX/RX	To Mux
2	4 wire TX input/2 wire TX/RX	To Mux
4	E lead (input)	To Mux
5	Signalling reference	-
7	4 wire RX (output)	From Mux
8	4 wire RX (output)	From Mux
15	M lead (output)	From Mux

## 6. Interface Connecting Cables

The following Interface cable assemblies are available from your supplier:

Code 1525	Cable assembly D25P-D25P. V.24 to V.24 (DCE) modem. Clocks supplied to/from modem.
Code 1530	Interface converter/cable D25P-D15P. V.24 to V.11 (DCE). Clock supplied by DCE.
Code 1531	Cable assembly D25P-D25S. V.24 to V.24 (DTE). Clock supplied to DTE.
Code 1532	Interface converter/cable D25P-D15S. V.24 to V.11 (DTE). Clock supplied to DTE.
Code 1538	Interface converter/cable D25P-D37P. V.24 to V.36 (DCE). Clock supplied by DCE.
Code 1539	Interface converter/cable D25P-D37S. V.24 to V.36 (DTE). Clock supplied to DTE.

- Code 1542**                      **Cable assembly D15S to Flying Leads.**  
**For connection of the Voice Channel to a Krone**  
**block.**  
**Standard length is 5 metres.**
- Code 1546-001**                **Cable assembly D15S to D15S**  
**15 way ribbon cable, pin to pin, to connect the voice**  
**channel to the QSU (Quad Subscriber Unit)**  
**Standard length is 1 metre.**