CML Semiconductor Products
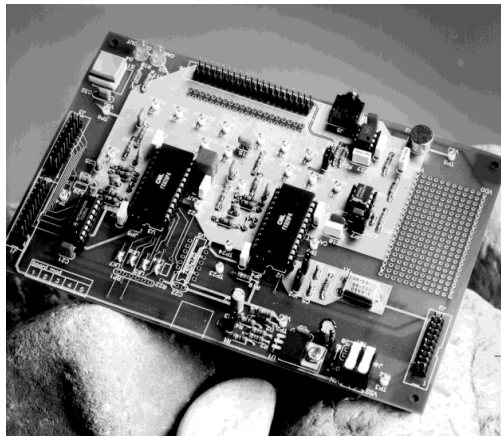
Evaluation Kit User Manual **EV8000**

1.0 Features

- **For FX818, 828, 829 Product Evaluation**

- **UV-Erasable PIC μC Board**

- **On-Board Microphone**

- **On-Board Regulator**

- **Easy Access to Test Points**

- **Socketed Discrete Components around Target Devices**

- **User's Prototyping Area**

- **Loudspeaker Output**

- **Single Power Supply Operation**

- **Windows™ Software Included**

1.1 Brief Description

The EV8000 Evaluation Kit comprises two boards. The signalling processor board contains an FX828 and an FX829. An FX818 is also provided and can be fitted in place of the FX828. The signalling processor board is powered from a single 8 - 35V dc power supply; an on-board regulator sets 3.3V or 5.0V operation. LEDs indicate the status of the FX829 carrier detect output and the FX828 comparator output. Both of these lines are available on the same connectors as the C-BUS. The FX828/818 and FX829 may be driven from a common external clock, or from a common crystal oscillator. The supply current of either target device may be measured by removing the appropriate jumper. A user prototyping area is provided and important signals can be monitored by test points. There is an on-board microphone and a loudspeaker output.

C-BUS signals can be applied at either of two connectors (J1 or J2). The other can be used to add future C-BUS evaluation kits in parallel with the EV8000. A third connector (J3) provides a daisy chained C-BUS to enable a second EV8000 signalling processor board to be controlled from the same PC. The signalling processor board can also be used with a user's own μC board, with appropriate software. Component footprints are provided in case the user requires level shifting between the C-BUS input logic HI and the V_{DD} level of the signalling processor board.

The μC board is fitted with a PIC μC containing the firmware to interface a PC serial port to the signalling processor board C-BUS. The EV8000 is controlled by Windows™ software on the PC.

CONTENTS

Note: As this product is still in development, it is likely that a number of changes and additions will be made to this specification. Items marked TBD or left blank will be included in later issues. Information in this data sheet should not be relied upon for final product design.
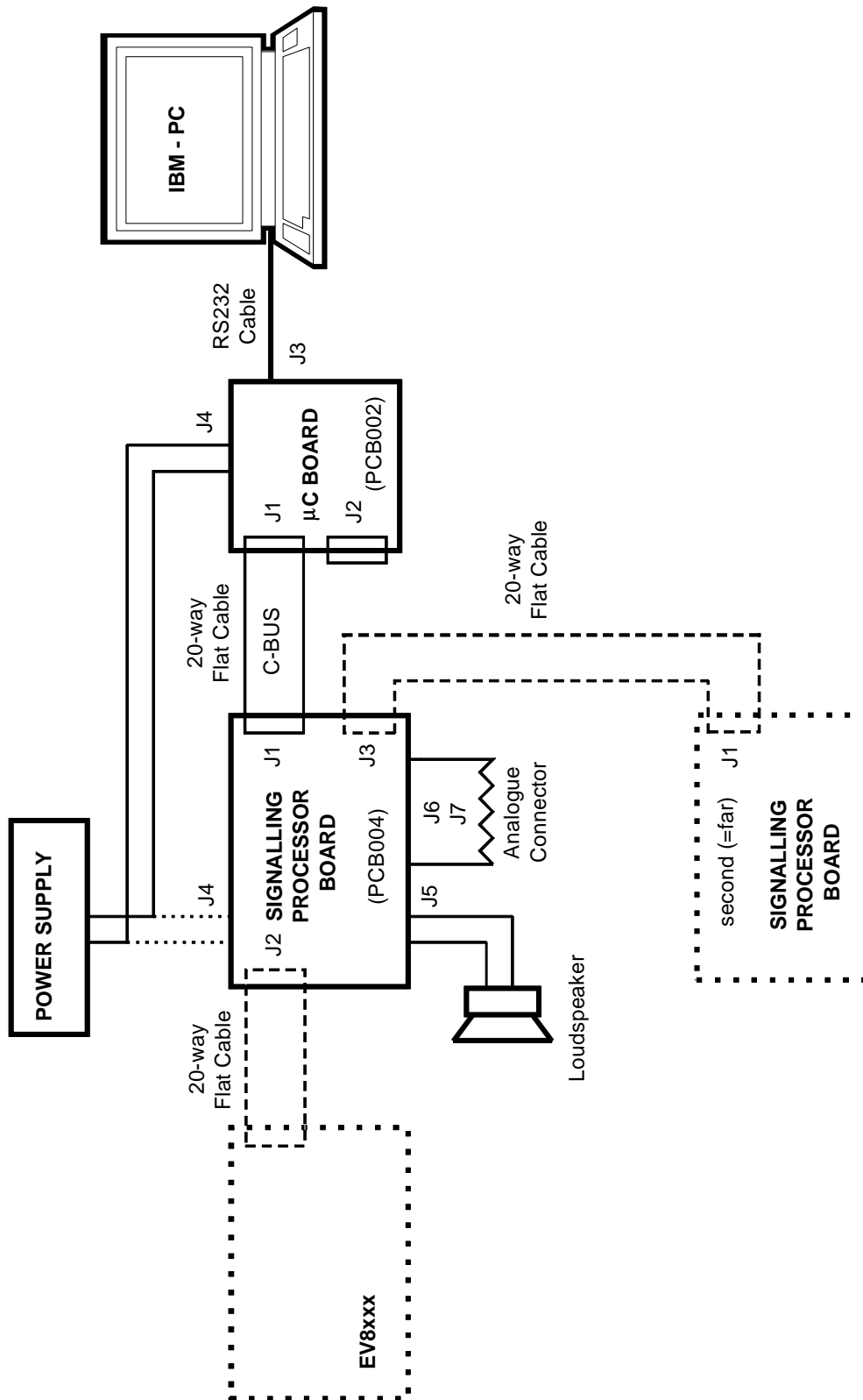
Figure 1 Block Diagram

1.2   Preliminary Information

1.2.1   Laboratory Equipment

The following laboratory equipment is needed to use this evaluation kit:

1.2.1.1 8 - 35V DC Power Supply (which can also be used to supply the PIC programming voltage, if set to 13V).

1.2.1.2 A μC control board, together with appropriate firmware and a user interface. This kit contains a suitable control board, which is fitted with a pre-programmed PIC 16LC74JW (or similar) μC.

1.2.1.3 An 8Ω loudspeaker.

1.2.1.4 An IBM compatible PC; 40MHz '386DX or better with 8MB of RAM, running Microsoft Windows 3.11 / '95 / NT having a serial port configuration of 8 data bits, no parity, 1 stop bit and 19,200 baud with hardware handshake but without CR -> CR/LF conversion.

The following laboratory equipment is needed to re-program the PIC μC in this evaluation kit:

1.2.1.5 If the evaluation kit is to be programmed via the serial port (J3), then a PC running DOS, or a DOS window under Windows 3.11 or '95, will need to be used with the PIC programming software supplied (**PICPROGA.EXE**).

1.2.1.6 As an alternative to on-board programming, a PIC 16-series Development System (available from Arizona Microchip Technology), or a suitable PIC programmer, together with PIC development software, may be preferred.

1.2.1.7 MPASM assembler or MPLAB software is required for re-assembling the source code. These tools are available from Arizona Microchip Technology.

1.2.1.8 A UV-eraser to remove the pre-programmed PIC μC firmware.

1.2.2   Handling Precautions

Like most evaluation kits, this product is designed for use in office and laboratory environments. The following practices will help ensure its proper operation.

1.2.2.1 Static Protection

This product uses low power CMOS circuits which may be damaged by electrostatic discharge. Partially damaged circuits may function erroneously, leading to misleading results. Observe ESD precautions at all times when handling this product.

1.2.2.2 Contents - Unpacking

Please ensure that you have received all of the items listed on the separate information sheet (EK8000) and notify CML within 7 working days if the delivery is incomplete.

1.3   Quick Start

This section provides instructions for users who wish to experiment immediately with the evaluation kit. A fuller description of the kit and its use appears later in this document.

1.3.1   Setting-Up

THE EV8000 COMES PRE-CONFIGURED FOR OPERATION AT 5.0V.

The μC board contains a socket for a 40-pin DIL PIC (or compatible) general-purpose μC, which the user may re-program with his applications software. The μC board comes with a pre-programmed PIC 16C74AJW or equivalent containing communications firmware and application specific demonstration firmware for the EV8000 evaluation kit.

The kit also contains a 9-way D-type RS232 cable (for connection to a PC), as shown in the Block Diagram of Figure 1. No board adjustments are required by the user.

The C-BUS connector on the signalling processor board, J1 or J2, should be linked to connector J1 on the μC board with a 20-way flat cable, as shown in Figure 1, connecting pin 1 to pin 1. Analogue signals can be input or monitored at connector J6.

BEFORE APPLYING POWER, PLEASE CHECK THE FOLLOWING:

ENSURE THE PIC μC IS PLUGGED INTO SOCKET U2 ON THE μC BOARD.

ATTACH THE 9-WAY RS232 CABLE TO CONNECTOR J3 ON THE μC BOARD AND THE SERIAL PORT OF A PC.

ATTACH THE 20-WAY FLAT CABLE TO CONNECTOR J1 ON THE μC BOARD AND CONNECTOR J1 ON THE SIGNALLING PROCESSOR BOARD. PIN 1 MUST CONNECT TO PIN 1.

Connect any other equipment as shown in Figure 1.

Ensure the PC software supplied is set up as detailed in Section 1.6.3.1.

The EV8000 boards each have connections for a single 8 - 35V dc power supply. Only one board (as shown in Figure 1) needs to be connected as power is supplied to the other board over the 20-way flat cable. If the μC board supplied is not used, then power will need to be applied to the signalling processor board instead.   Each board has its own power supply regulator chip, with a jumper to select 3.3V or 5.0V (default) operation.

Ensure that the component value jumpers on each of the EV8000 evaluation boards are correctly set for 3.3V or 5.0V operation. Please refer to Sections 1.6.1.1 and 1.6.2.1 for further details.

MAKE SURE BOTH BOARDS HAVE THIS LINK SET TO THE SAME VOLTAGE. DAMAGE MAY RESULT IF THIS STEP IS NOT OBSERVED. DO NOT OPERATE THE μC BOARD WITH ITS VOLTAGE SELECTION LINK REMOVED. THE μC BOARD AND SIGNALLING PROCESSOR BOARD VOLTAGE SELECTION LINKS HAVE DIFFERENT CONFIGURATIONS.

1.3.2   Operation

This evaluation kit has no inherent functionality without the μC board and appropriate firmware and PC software. The signalling processor board may be used independently of the μC board, if the user wishes to interface to a different type of μC. The user will then have to supply his own software.

The μC board is designed to control the operation of the signalling processor board. The firmware which is pre-programmed into the PIC μC has both communications and application specific functions. These functions are controlled from the PC software (ES8000) which runs in a Windows environment.

Refer to Section 1.6.5 for the known software bugs and Section 1.6.6 for the troubleshooting guide.

The `PICPROGA.EXE` program can be used to re-program the PIC μC firmware, if required.

1.4   Signal Lists

CONNECTOR PINOUT - SIGNALLING PROCESSOR BOARD				
Connector Ref.	Connector Pin No.	Signal Name	Signal Type	Description
J1, J2	1, 2	V_{IN}	Power	+ve power from external power supply.
	3, 4	V_{SS}	Power	0V power from external power supply.
	5	C-BUS-HI	I/P	Logic HI level for level shifting, if fitted.
	6	D/IRQ	O/P	Alternative IRQ for daisy chain connector.
	7	/IRQ	O/P	C-BUS interrupt line.
	8	D/CS	I/P	Alternative CS for daisy chain connector.
	9	/CS	I/P	C-BUS chip select line.
	10	PTT	O/P	PTT switch.
	11	SER-CLK	I/P	C-BUS serial clock.
	12	I/O3		Spare I/O
	13	C-DATA	I/P	C-BUS command data.
	14	I/O1		Spare I/O
	15	R-DATA	O/P	C-BUS reply data.
	16	I/O2		Spare I/O
	17	CARDET	O/P	FX829 carrier detect output.
	18	COMPOUT	O/P	FX828 comparator output.
	19, 20	V_{SS}		
J3	1, 2	V_{IN}	Power	+ve power from external power supply.
	3, 4	V_{SS}	Power	0V power from external power supply.
	5	C-BUS-HI	I/P	Logic HI level for level shifting, if fitted.
	6	V_{SS}		
	7	D/IRQ	O/P	Alternative IRQ for daisy chain connector.
	8	V_{SS}		
	9	D/CS	I/P	Alternative CS for daisy chain connector.
	10	I/O3		Spare I/O
	11	SER-CLK	I/P	C-BUS serial clock.
	12	V_{SS}		
	13	C-DATA	I/P	C-BUS command data.
	14	V_{SS}		
	15	R-DATA	O/P	C-BUS reply data.
	16	V_{SS}		
	17	I/O1		Spare I/O
	18	I/O2		Spare I/O
	19, 20	V_{SS}		

CONNECTOR PINOUT - SIGNALLING PROCESSOR BOARD				
Connector Ref.	Connector Pin No.	Signal Name	Signal Type	Description
J4	1	V_{SS}	Power	0V power from external power supply.
	2	V_{IN}	Power	+ve power from external power supply.
J5	1, 2	SPEAKER	O/P	Output for 8Ω loudspeaker.

CONNECTOR PINOUT - SIGNALLING PROCESSOR BOARD - ANALOGUE INTERFACE				
Connector Ref.	Connector Pin No.	Signal Name	Signal Type	Description
J6, J7	even Nos.	V_{SS}		
	1	MICIN	I/P	FX829 mic input.
	3	829MOD2	O/P	FX829 MOD2 gain control output.
	5	829MOD1	O/P	FX829 MOD1 gain control output.
	7	AUDOUT	O/P	FX829 audio volume control output.
	9	VOLIN	I/P	FX829 audio volume control input.
	11	829MOD1IN	I/P	FX829 MOD1 gain control input.
	13	829SUMOUT	O/P	FX829 audio summing amplifier output.
	15	FFSK/DTMF	O/P	FX829 FFSK modem or DTMF gen output.
	17	FILOUT	O/P	FX829 audio filter/limiter section output.
	19	829EXTSUMIN	I/P	FX829 additional input to summing amp.
	21	DEMODIN	I/P	FX829 Rx input.
	23	COMPIN	I/P	FX828 comparator input.
	25	8x8MOD2	O/P	FX8x8 MOD2 gain control output.
	27	8x8MOD1	O/P	FX8x8 MOD1 gain control output.
	29	TXSUBAUD	O/P	FX8x8 sub audio output.
	31	8x8MOD1IN	I/P	FX8x8 MOD1 gain control input.
	33	8x8SUMOUT	O/P	FX8x8 audio summing amplifier output.
	35	TXAUDOUT	O/P	FX828 selcall tone generator output.
	37	RXAUDOUT	O/P	FX8x8 Rx audio filter section output.
	39	8x8EXTSUMIN	I/P	FX8x8 additional input to summing amp.

TEST POINTS - SIGNALLING PROCESSOR BOARD		
Test Point Ref.	Default Measurement	Description
TP1	8 - 35V	V_{IN} connection.
TP2	5.0V	V_{DD} connection (3.3V or 5.0V)
TP3	0V	V_{SS} connection.
TP4	0V	V_{SS} connection.
TP5	0V	V_{SS} connection.
TP6	0V	V_{SS} connection.
TP7	LO	FX829 carrier detect output.
TP8	-	FX829 mic input.
TP9	$V_{DD}/2$	FX829 DEMODFB pin.
TP10	$V_{DD}/2$	FX8x8 RXAMPOUT pin.
TP11	$V_{DD}/2$	FX829 MOD2 gain control output.
TP12	$V_{DD}/2$	FX829 MOD1 gain control output.
TP13	$V_{DD}/2$	FX829 audio summing amplifier output.
TP14	$V_{DD}/2$	FX829 FFSK modem or DTMF generator output.
TP15	$V_{DD}/2$	FX829 audio filter/limiter section output.
TP16	$V_{DD}/2$	FX8x8 MOD2 gain control output.
TP17	$V_{DD}/2$	FX8x8 MOD1 gain control output.
TP18	$V_{DD}/2$	FX8x8 sub audio output.
TP19	$V_{DD}/2$	FX8x8 audio summing amplifier output.
TP20	$V_{DD}/2$	FX828 selcall tone generator output.
TP21	$V_{DD}/2$	FX8x8 Rx audio filter section output.
TP22	-	FX828 comparator output.
TP23	HI	C-BUS interrupt request line.
TP24	HI	C-BUS chip select line.

JUMPERS - SIGNALLING PROCESSOR BOARD			
Link Ref.	Positions	Default Position	Description
JP1	1-2	o/c	Sets V_{DD} = 3.3V (closed) or V_{DD} = 5.0V (open)
JP2,3	1-2	1-2	Remove to supply an external clock to JP3 pin 2.
JP4	1-2	1-2	Remove to measure I_{DD} of FX829.
JP5	1-2	1-2	Remove to measure I_{DD} of FX8x8.
JP6	1-2 or 2-3	1-2	Select FX829 (default) or FX8x8 to drive loudspeaker.
JP7	1-2	1-2	Connects microphone to FX829 MICIN.

CONNECTOR PINOUT - μC BOARD				
Connector Ref.	**Connector Pin No.**	**Signal Name**	**Signal Type**	**Description**
J1	1, 2	V$_{IN}$	Power	+ve power from external power supply.
	3, 4	V$_{SS}$	Power	0V power from external power supply.
	5	RA0	BI	PIC μC Bidirectional Port, pin 2
	6	RA1	BI	PIC μC Bidirectional Port, pin 3
	7	RA2	BI	PIC μC Bidirectional Port, pin 4
	8	RA3	BI	PIC μC Bidirectional Port, pin 5
	9	RB0	BI	PIC μC Bidirectional Port, pin 33
	10	RB1	BI	PIC μC Bidirectional Port, pin 34
	11	RB2	BI	PIC μC Bidirectional Port, pin 35
	12	RB3	BI	PIC μC Bidirectional Port, pin 36
	13	RB4	BI	PIC μC Bidirectional Port, pin 37
	14	RB5	BI	PIC μC Bidirectional Port, pin 38
	15	RB6	BI	PIC μC Bidirectional Port, pin 39
	16	RB7	BI	PIC μC Bidirectional Port, pin 40
	17	RC0	BI	PIC μC Bidirectional Port, pin 15
	18	RC1	BI	PIC μC Bidirectional Port, pin 16
	19	RC2	BI	PIC μC Bidirectional Port, pin 17
	20	RC3	BI	PIC μC Bidirectional Port, pin 18
J2	1	RA4	BI	PIC μC Bidirectional Port, pin 6
	2	RA5	BI	PIC μC Bidirectional Port, pin 7
	3	RD0	BI	PIC μC Bidirectional Port, pin 19
	4	RD1	BI	PIC μC Bidirectional Port, pin 20
	5	RD2	BI	PIC μC Bidirectional Port, pin 21
	6	RD3	BI	PIC μC Bidirectional Port, pin 22
	7	RD4	BI	PIC μC Bidirectional Port, pin 27
	8	RD5	BI	PIC μC Bidirectional Port, pin 28
	9	RD6	BI	PIC μC Bidirectional Port, pin 29
	10	RD7	BI	PIC μC Bidirectional Port, pin 30
	11	RE0	BI	PIC μC Bidirectional Port, pin 8
	12	RE1	BI	PIC μC Bidirectional Port, pin 9
	13	RE2	BI	PIC μC Bidirectional Port, pin 10
	14 to 18 inc	-	-	Not used. No connection needed.
	19, 20	V$_{SS}$	Power	0V power from external power supply.

CONNECTOR PINOUT - µC BOARD				
Connector Ref.	Connector Pin No.	Signal Name	Signal Type	Description
J3	1	DCD	Output	PC connection (linked to DTR).
	2	RXD	Output	PC connection to screen.
	3	TXD	Input	PC connection to keyboard.
	4	DTR	Input	PC connection.
	5	V_{SS}	Power	0V common connection to PC.
	6	DSR	Output	PC connection (linked to DTR).
	7	RTS	Input	PC 'RTS' connection.
	8	CTS	Output	PC 'CTS' connection.
	9	-	-	Not used. No connection needed.
J4	1	V_{SS}	Power	0V power from external power supply.
	2	V_{IN}	Power	+ve power from external power supply.

TEST POINTS - µC BOARD		
Test Point Ref.	Default Measurement	Description
TP1	8 - 35V	V_{IN} connection.
TP2	3.3V or 5.0V	V_{DD} connection.
TP3	0V	V_{SS} connection.
TP4	0V	V_{SS} connection.
TP5	3.3V or 5.0V	V_{PP} connection (13.0V in programming mode).

JUMPERS - µC BOARD			
Link Ref.	Positions	Default Position	Description
JP1	1-2 or 2-3	2-3	Sets V_{DD} = 3.3V (1-2) or V_{DD} = 5.0V (2-3)
JP2_1,2	1-2	1-2	Disconnect to supply external clock to JP2_1 (1).
JP3	1-2	1-2	Connects TXD to RS232 converter in normal use.
JP4 to JP7	1-2	n/f	Only fitted (and JP3 removed) in Programming Mode.
SW1	-	o/c	Push to reset switch. (Default = o/c = not reset).

Notes: I/P = Input   O/P = Output   BI = Bidirectional

Logic HI level   ≈ +V_{DD} Logic LO level ≈ 0V (V_{SS})

1.5   Circuit Schematics and Board Layouts
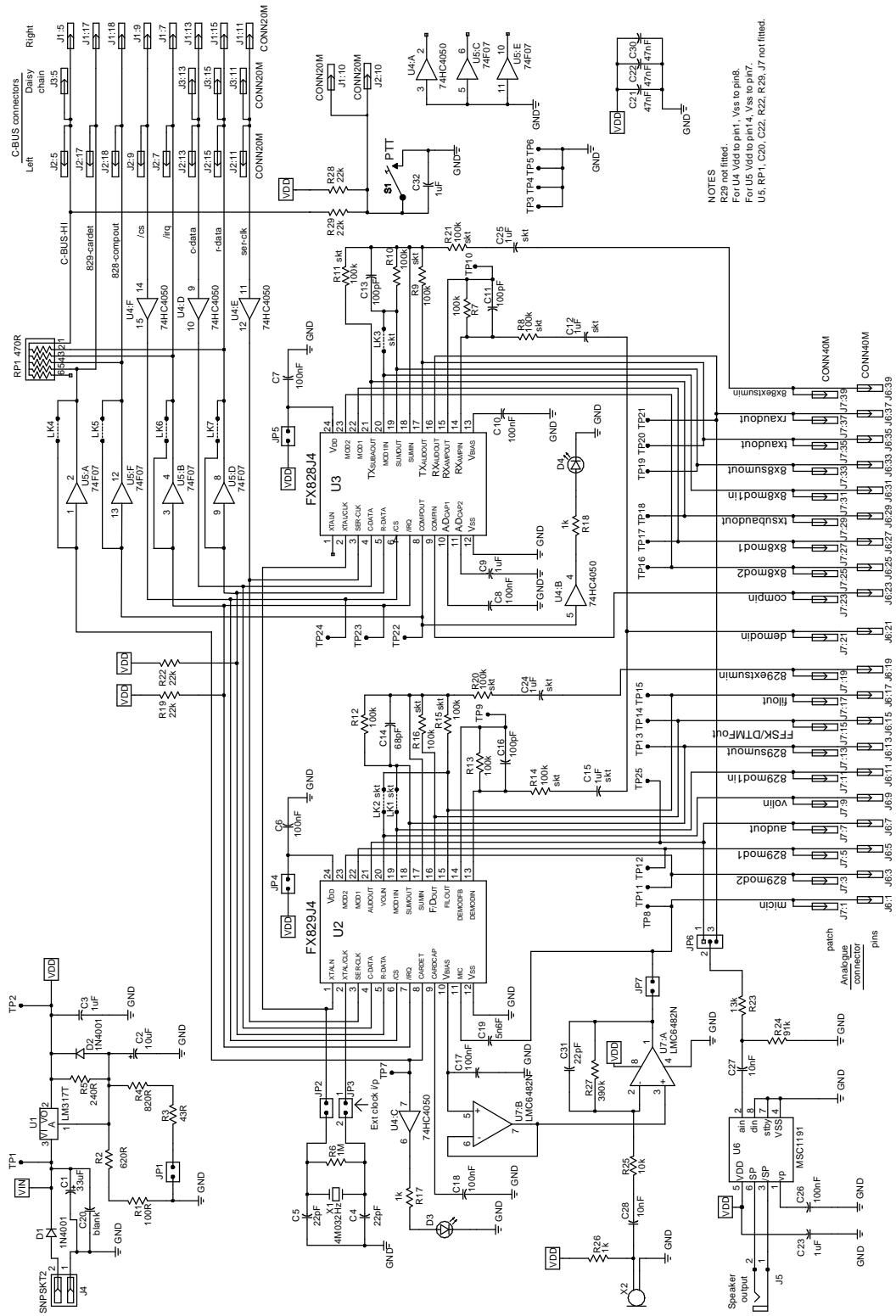
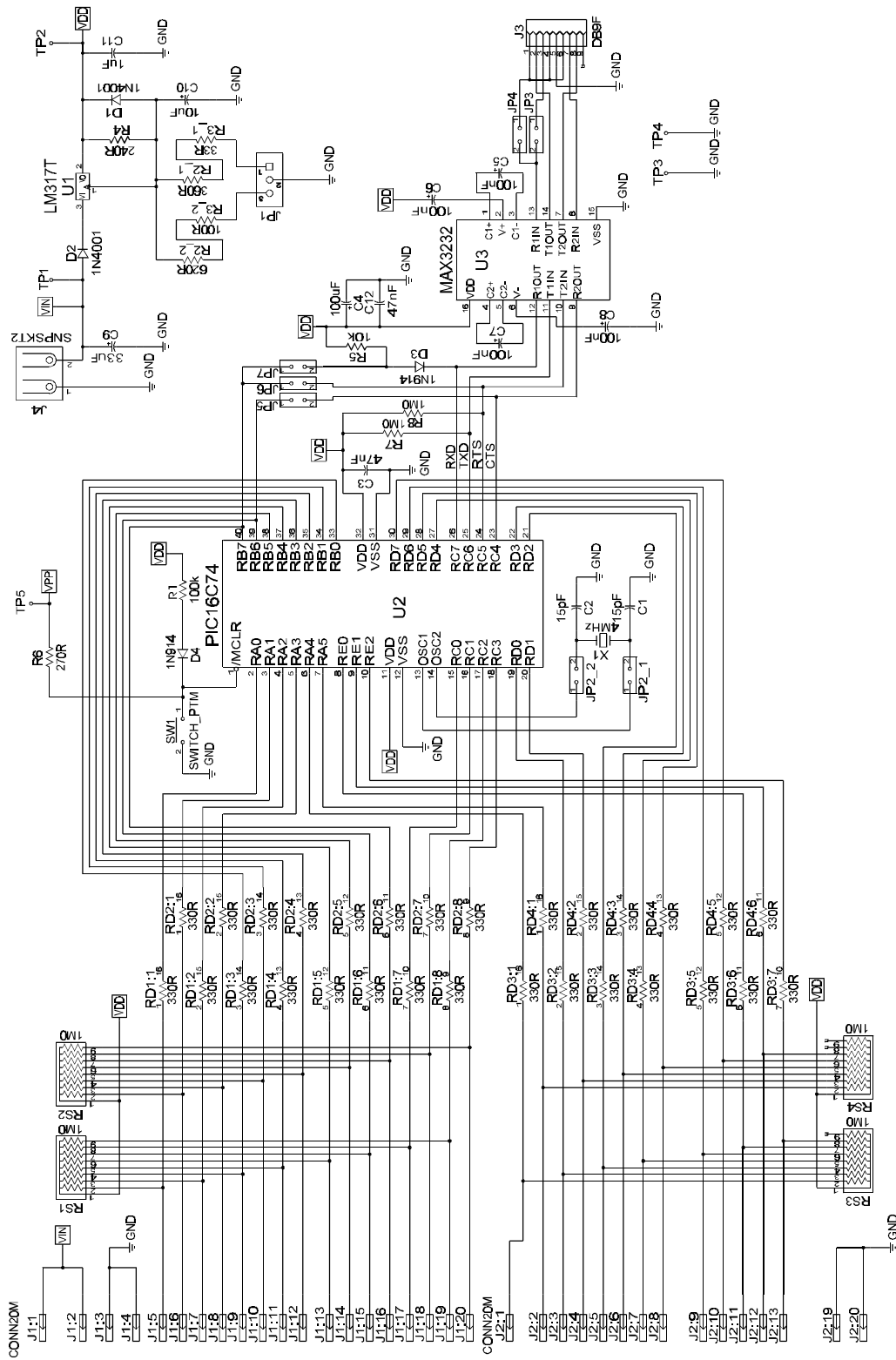**Figure 2 Signalling Processor Board - Circuit Schematic**
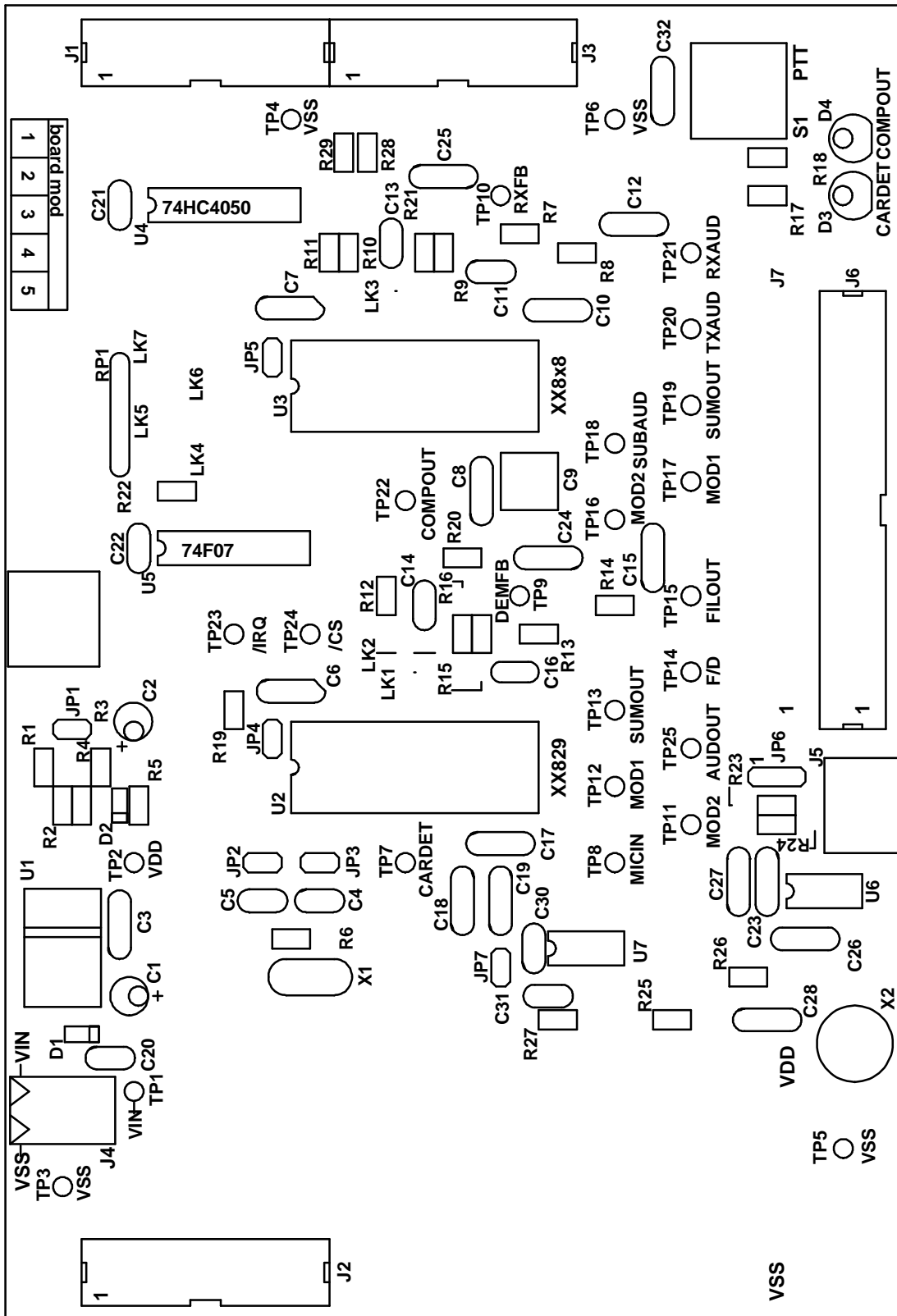
Figure 3 μC Board - Circuit Schematic

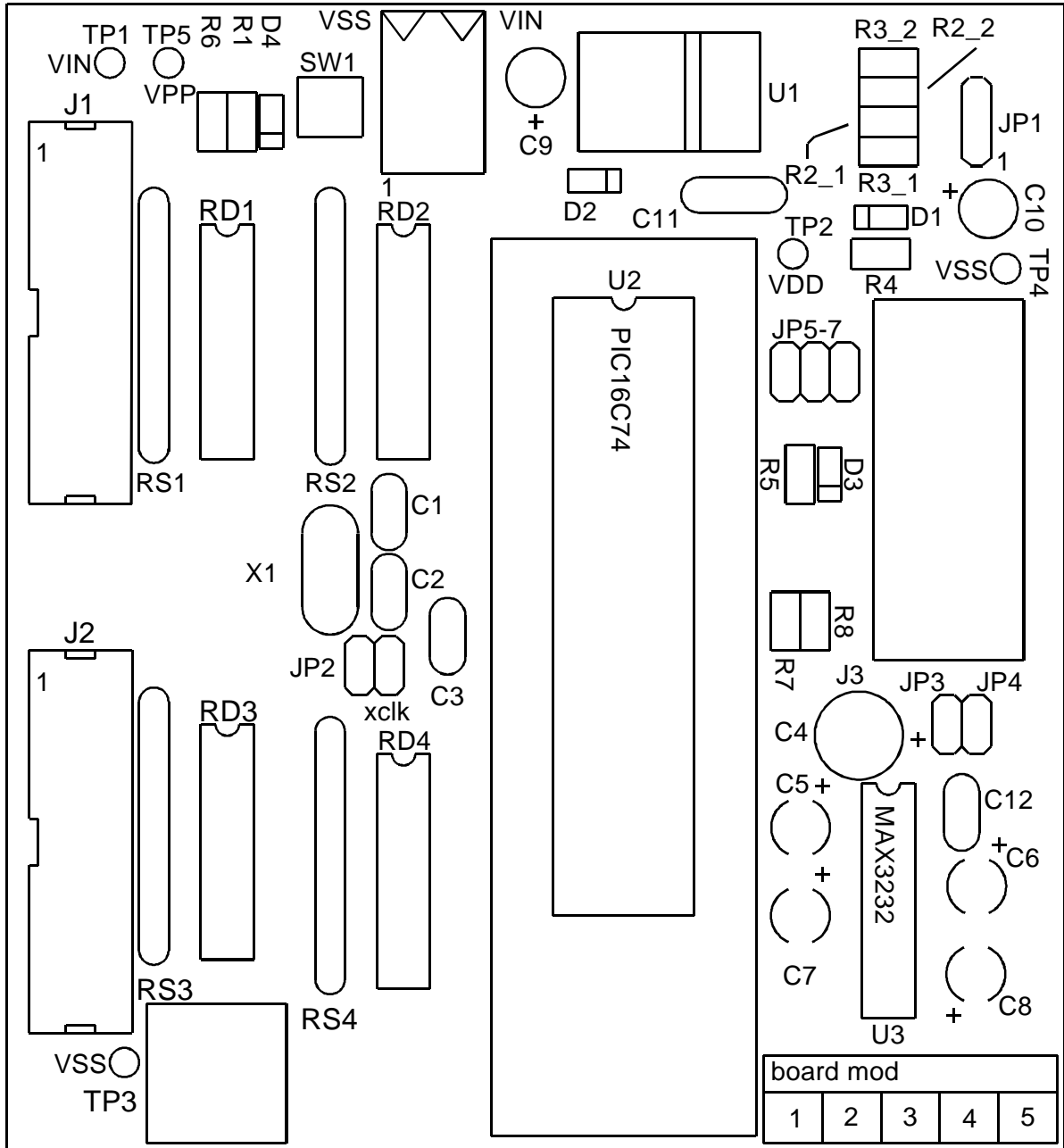**Figure 4 Signalling Processor Board - Layout**

Figure 5 µC Board - Layout

1.6   Detailed Description

1.6.1   Hardware Description - Signalling Processor Board

1.6.1.1 Operating Voltage
Jumper JP1 is used to select the operating voltage. Open circuit selects 5.0V operation (default) and closed circuit (link fitted) selects 3.3V operation.

1.6.1.2 Clock/Oscillator
The evaluation devices may use either an external clock or their own xtal oscillator. A 4.032MHz xtal is provided on-board for the latter method. The links on jumpers JP2 and JP3, which are normally fitted, select the xtal oscillator. An external clock may be supplied to JP3 pin 1 once the links have been removed.

1.6.1.3 Microphone
By fitting a link to jumper JP7, the on-board electret microphone is connected via a buffer amplifier to the MICIN input of the FX829. The signal applied to the FX829 can be monitored at TP8.   A push-to-talk (PTT) switch is also provided.

1.6.1.4 Loudspeaker
An 8Ω loudspeaker output is provided at the 3.5mm mono jack socket J5. The signal source for the loudspeaker can be either the FX829 (default) or the FX8x8, link selectable at jumper JP6.

1.6.1.5 C-BUS and optional level shifting.
There are identical connectors (J1 and J2) either side of the board for C-BUS. This enables the C-BUS source to be connected either side of the signalling processor board and also enables future C-BUS evaluation boards to be connected in parallel. A third connector (J3) allows the daisy chaining of a second signalling processor board with alternative /IRQ and /CS lines. This allows for the emulation of both ends of a radio link, using a single PC.

If it is desired to operate the signalling processor board at V_{DD} = 3.3V with the interface to C-BUS operating at V_{DD} = 5.0V, then level shifting components will need to be added to the signalling processor board. Level shifting can be added to the C-BUS interface by removing solder links LK4 to LK7 and fitting the following components:

> A 74F07 in position U5.
> A pull-up resistor pack in position RP1, suggested value 470Ω.
> A pull-up resistor in position R22, suggested value 22kΩ.
> A de-coupling capacitor for U5 may be fitted in position C22, suggested value 47nF.

1.6.1.6 Analogue re-configuration
Some discrete components and links around the target devices are socketed to allow path gains to be adjusted. Also the analogue connector J6 has a second bare footprint, J7, which, in conjunction with the removable components and links, can be used as a patch board to allow the user to re-arrange signal paths as required.

1.6.1.7 I_{DD} Measurement
The current consumption of the FX829 or the FX8x8 may be measured by removing the link on jumper JP4 or JP5 respectively and replacing it with a multimeter.

1.6.2   Hardware Description - μC Board

1.6.2.1 Operating Voltage
Jumper JP1 is used to select the operating voltage. A link fitted at position 1,2 selects 3.3V operation and at position 2,3 selects 5.0V operation (default). Do not operate this board with the link on jumper JP1 removed.

1.6.2.2 Clock/Oscillator
A 4MHz xtal is the highest frequency xtal that may be used with a PIC16LC74(A)JW at V_{DD} = 3.3V. The PIC 16C74(A)JW has a similar limitation and is fitted for availability reasons. Although rated at 5.0V, it has been found to work successfully at 3.3V. The links on jumpers JP2, which are normally fitted, select an on-board 4MHz xtal. An external 3.58MHz clock, for example, may be supplied to JP2_1 (1) once the links have been removed, taking care to adjust any firmware timing routines accordingly.

1.6.2.3 RS232 Interface
The RS232 interface (connector J3) has its communications protocol determined by the μC firmware. A suggested configuration is 8 data bits, no parity, 1 stop bit and 19,200 baud with hardware handshake but without CR -> CR/LF conversion. The firmware supplied in the PIC μC assumes this configuration.

1.6.2.4 Reset Switch (SW1)
This is provided to reset the PIC μC firmware, should this be required.

1.6.2.5 Programming Mode

TO ENTER PROGRAMMING MODE
(a) Remove power from board
(b) Disconnect the μC board from the signalling processor board
(c) Ensure the link on jumper JP1 is fitted in position 2,3 for V_{DD} = 5.0V
(d) Remove link on jumper JP3
(e) Insert links on jumpers JP4, JP5, JP6 and JP7
(f) Re-apply power to board
(g) Connect the programming voltage (V_{PP} = 12.5V to 13.5V) power supply between test point
        TP5 (+ve) and V_{SS} (-ve)
(h) Ensure the PIC μC programming utility `PICPROGA.EXE` is loaded into the PC under DOS
        and the PC is connected to the μC board
(i) UV-erase the PIC μC first, then download firmware into the PIC μC and verify it

TO LEAVE PROGRAMMING MODE
(a) Remove power from board (including the programming voltage)
(b) Remove links on jumpers JP4, JP5, JP6 and JP7
(c) Insert a link on jumper JP3
(d) Reconnect the link on jumper JP1 to its original position
(e) Reconnect the μC board to the signalling processor board, checking that the voltage
        selection jumpers are correctly set
(f) Ensure the ES8000 software is running on the PC under Windows
(g) Re-apply power to board and run the new μC firmware

1.6.3   Software Description - Signalling Processor Board

1.6.3.1 Installation
The ES8000 Windows Application Software consists of a single executable file named
ES8000xx.EXE, where xx refers to the version number. Copy this from its 3.5" floppy disk to the hard
disk of the user's PC.

Windows NT and '95
For convenient and quick launching of the program create an ES8000 shortcut within the Start
menu or Desktop.

Windows 3.11
For convenient and quick launching of the ES8000 software create a new program group and
ES8000 icon.

1.6.3.2 System Requirements
This program is a 16-bit application, compatible with Windows 3.11, NT and '95 operating
systems. The software has been designed to operate on a 386DX 40MHz or faster with 8MB of
RAM. We recommend that the user has the screen resolution set no lower than 800 x 600, to   allow
maximised device forms to fit within the screen.

Note: **ES8000 Version 1.0** requires the signalling processor board crystal (X1) frequency to be 4.032MHz,
to ensure correct generation of frequency data.

1.6.3.3 Starting the ES8000 Windows Application Software
Windows NT and '95
To execute the program from the Start Menu click on the Start Button, and then point to the
folder that contains the ES8000 Windows Application Software. Click on the program when it has
been located.

If a shortcut has not been created in the Start Menu then execute the program using the Run
command, click on the Start button and then click on Run. Type the path and name of the
program and then click on the OK button. If the program path is unknown click on Browse to look
for the item.

Windows 3.11
To execute the program locate the ES8000 icon from the appropriate program group. Double   click
on the program icon when it has been located.

If a program group and icon has not been created execute the program using the Run command, click
on the File menu then click on Run. Type the path and name of the program and then click   on
the OK button. If the program path is unknown click on Browse to look for the item.

1.6.3.4 Shutting Down the ES8000 Windows Application Software
Windows NT and '95
To quit the ES8000 program click on the close button in the upper-right corner of the main
application window.

Windows 3.11
To quit the ES8000 program click on the upper-left corner pulldown application menu, click on   the
close command.

1.6.3.5 Near and Far ES8000 Definitions
The near EV8000 signalling processor board is connected to the μC board via the J1 connector. Therefore all FX8xx devices located on the near signalling processor board are considered to be near devices and are controlled by near device forms.

The far signalling processor is created by taking a signalling processor board out of a second EV8000 evaluation kit. It should be connected to the near signalling processor board by using another 20-way flat cable between connector J3 on the near board and connector J1 on the far board. Pin 1 on connector J3 should be connected to Pin 1 on connector J1. All FX8xx devices located on the far signalling processor board are considered to be far devices and are controlled by far device forms.

Note: In certain parts of the ES8000 Windows Application Software the variables CBUS and CBUS2 are used. These correspond to the near and far boards respectively.

1.6.3.6 ES8000 and EV8000 Startup Procedure
Ensure all of the hardware is connected correctly. Follow the 'Starting the ES8000 Windows Application Software' instructions described earlier. When the ES8000 Windows Application Software is executed a pop-up window asks the user to switch on the EV8000 kit. Switch on the power supply feeding the signalling processor and μC boards.
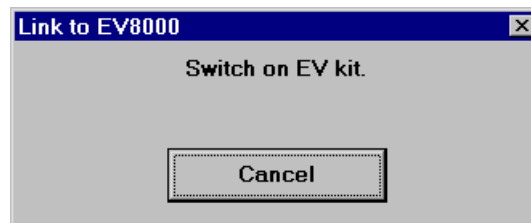
When power has been applied the Add Device pop-up window is opened. If the user is ready to add a device form to the view select the device and click on OK. Click on cancel if you do not require a device form.

Perform a General Reset when the first device form is opened, any further device forms added will not require a General Reset unless they have been opened on the other C-BUS (near or far).

If the ES8000 Windows Application Software is executed with power already applied to the signalling processor and μC boards, simply press the reset switch (SW1) on the μC board. The Add Device window should now open.

If these methods fail, shutdown the ES8000 application and turn off the power supply to the signalling processor and μC boards. Repeat the procedure described above.

1.6.3.7 Toolbar Buttons
An ES8000 toolbar, containing five buttons, has been provided to give quick access to menu commands. The toolbar is optional and can be turned on or off from the View menu. The appearance of the buttons and their command descriptions are as follows:

Button	Command Description
	Initialises the Com link to the µC board
	Notifies the software that the user will be resetting the µC board. It generates a pop-up window, asking the user to push the µC board reset switch. This pop-up disappears when the µC board reset switch (SW1) is pushed.
	Performs a General Reset on the current C-BUS. All EV8000 devices and ES8000 active device forms on this C-BUS will be reset.
	Opens the Add Device pop-up window.
	Opens the About ES8000 pop-up window which displays program information and version number.

1.6.3.8 Viewing the Toolbar and Status Bar
The Toolbar and Status Bar can be removed from or inserted into the main window by clicking on the View menu and then clicking on the required command.

1.6.3.9 Menubars

The main application menubar which resides at the top of the main window contains five pulldown menus. This menubar is available for use until a device form is opened. Whenever a device form is active a form menubar resides at the top of the main window. This form menubar is currently the same for all devices and is similar to the main menubar except for an additional pulldown menu called Local **(disabled in Version 1.0)** and three additional Global pulldown menu commands called General Reset, BER Test and Demo1 **(disabled in Version 1.0)**. The pulldown menus from the form menubar are illustrated below.

Setup Pulldown Menu

This menu allows the user to open the Add Device pop-up window, initialise the RS232 communications link to the μC board and reset the μC board.
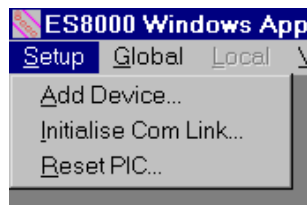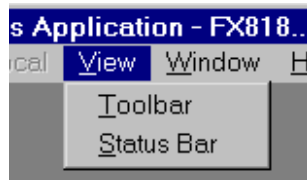
Global Pulldown Menu

This menu allows the user to open the Direct C-BUS Control pop-up window, perform a General Reset and open the BER Test pop-up window.
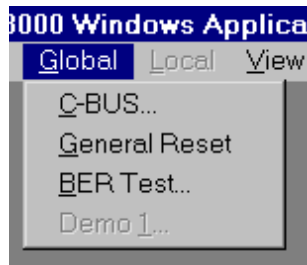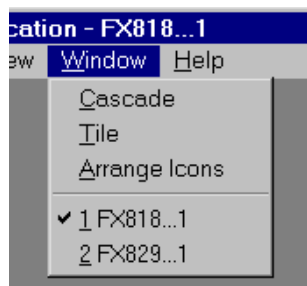
View Pulldown Menu

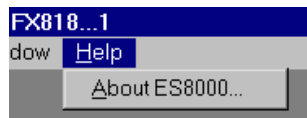This menu allows the user to turn the Toolbar and Statusbar on or off.

Window Pulldown Menu

This menu allows the user to rearrange iconised or opened device forms and to switch between the device forms.

Help Pulldown Menu

This menu allows the user to open the About ES8000 pop-up window which displays program information and version number.

1.6.3.10 Adding a Device Form

There are two ways to add device forms to the view. The quickest method is to click on the Add Device toolbar button which opens the Add Device pop-up window. The second way involves clicking on the Setup menu and then selecting the Add Device command.
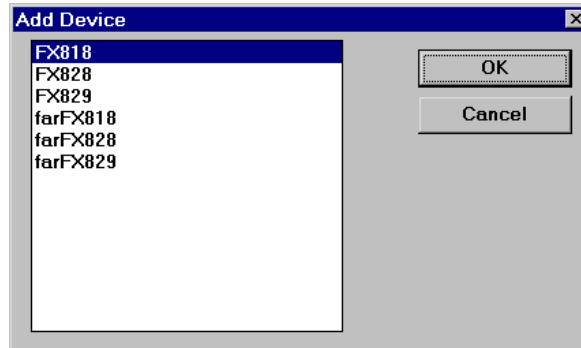
The Add Device window gives the user the choice of near and far devices. The user should select the required device form corresponding to the device located in the near or far signalling processor board. Finally, click on the OK button.

If a device form already exists within the main view, this selection will not be available from the Add Device pop-up window.

The cancel button allows the user to exit the window without selecting a device form.

If the user attempts to open more than four device forms **(Version 1.0 maximum)** during an evaluation session, a pop-up window will notify the user that no more device forms are available.

1.6.3.11 Deleting a Device Form
Windows NT and '95
To close a device form (iconised or open), click on the close button in the upper-right corner of the device form.

Windows 3.11
To close a device form (not iconised), click on the upper-left corner pulldown menu of the device form, and click on the close command.

1.6.3.12 Switching between Opened Device Forms
A device form must have the focus to allow the user to modify the Write registers and view the settings of the read registers.

The device form focus can be switched by simply clicking on the required form. Switching the focus can also be achieved by clicking on the Window pulldown menu, and then click on the required device form.

1.6.3.13 Device Forms
The evaluation software has been designed so that each device has a corresponding device form. The device forms have been created based on the device data sheets to allow the user to easily and quickly set up a device in the required operating mode. Additional FFSK sections are included on the FX829 device form, as it was considered important to have these features available. Future releases of the ES8000 software will include device demonstration windows. The device forms for the FX818, FX828 and FX829 are illustrated on the following pages.
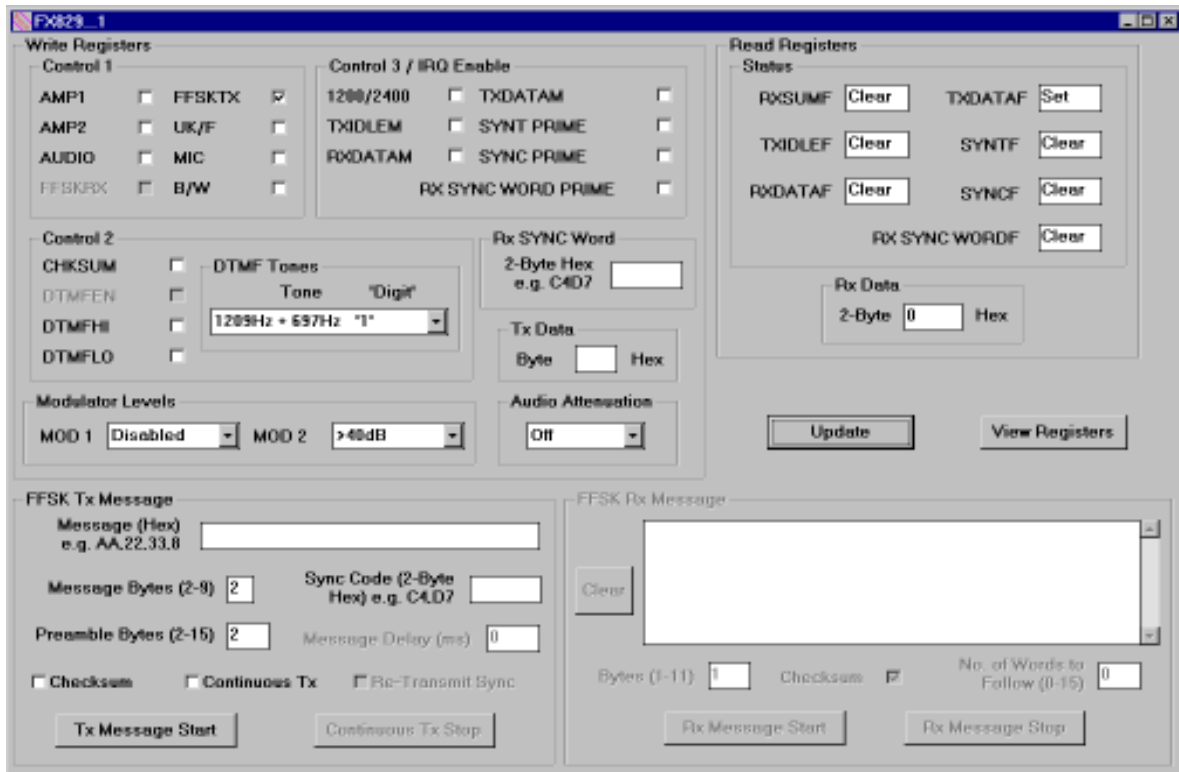
FX818
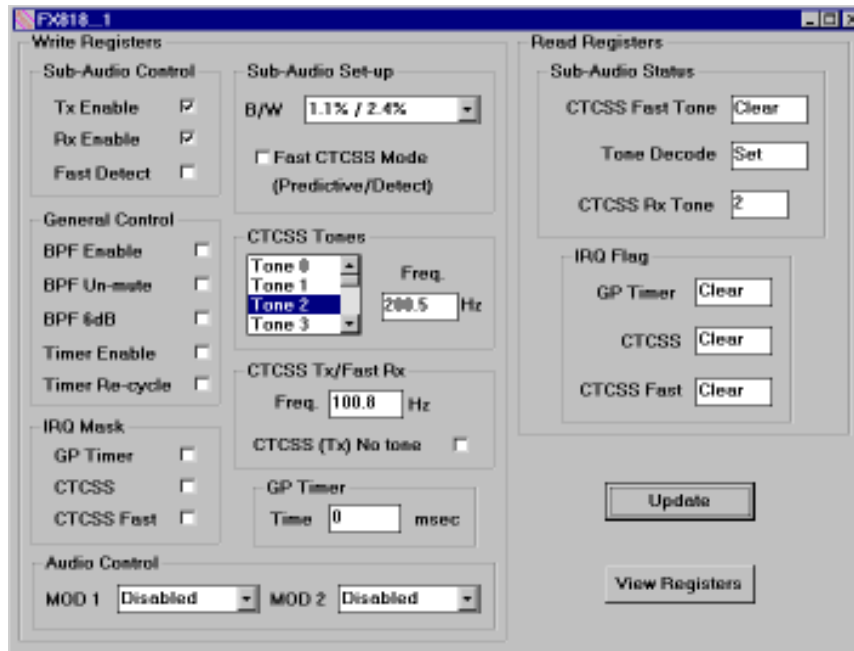
FX828
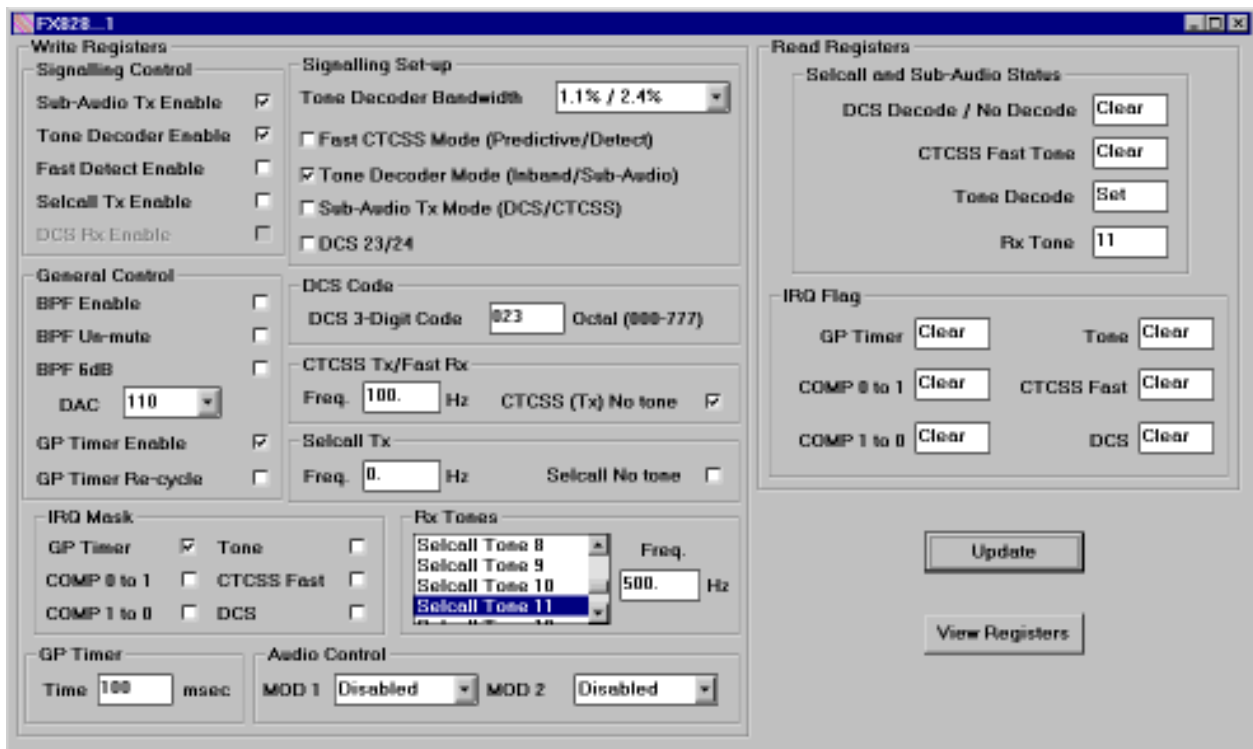
Note: The GP Timer edit box displays the number to be programmed into the GP Timer Register.
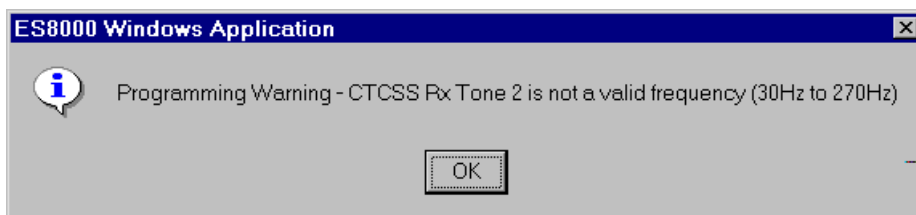
FX829

For certain user input values, device programming data will not be generated and the write register concerned will not be updated. When this situation occurs a stop error message pop-up window will be opened to notify the user. The user should then re-enter a new value before clicking on the Update button.
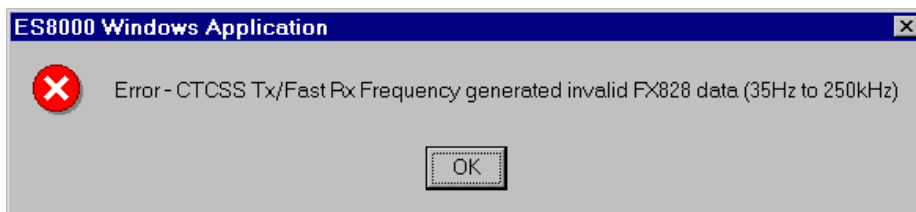
Other (incorrect) user input values may be entered, causing the application to open an information pop-up window. This window notifies the user that the device write register was programmed, but with invalid data.

Note: The ES8000 Windows Application Software can be used to evaluate FX8x8 and FX829 devices
outside their specified characteristics. Therefore, minimum and maximum device form input values
used within the application are based on the validity of the equations used to generate the
programming data and register size constraints,
ie. An 8-bit register allows an integer input of 0-255.

1.6.3.14 Writing and Reading the FX8x8 and FX829 device registers
When the write register of a device form has been set up, the settings can be loaded into the
appropriate device by clicking on the Update button. This will also acquire the settings of the read
registers. The read register settings will then be displayed on the device form view. To minimise data
exchange between the PC and EV8000, only modified write register settings are passed to the μC.

1.6.3.15 Write Register Input Controls
The device forms have been created to allow the user to quickly and easily set-up the device write
registers.

Checkboxes are used for the majority of write register input controls. Each checkbox usually
corresponds to a data bit in a write register. The write register bit is set to '1' when the checkbox is
checked and set to '0' when unchecked. The toggling between checked and unchecked is achieved
by clicking on the checkbox area.

Due to variations in the Windows libraries, the checkbox display on a Windows 3.11 operating system
will have a different appearance to that on Windows NT and '95. The differences in display on the
various Windows platforms are as follows:

Windows NT and '95
The checkbox will have a 3D appearance with a ▯ (tick) indicating the checkbox is checked (Bit set to
'1'). The inside of the checkbox is a different colour to the form foreground colour. Note: if a checkbox
is ever disabled by the software, the inside of the checkbox will be greyed together with the checkbox
description text. Once disabled the user cannot change the state of the checkbox.

Windows 3.11
The checkbox will have a 2D appearance with a ▯ (cross) indicating the checkbox is checked (Bit set
to '1'). The inside of the checkbox is the same colour as the form foreground colour. Note: if a
checkbox is ever disabled by the software, the inside of the checkbox remains the same colour but the
checkbox description text will be greyed. Once disabled, the user cannot change the state of the
checkbox.

To enter frequencies, integer values and codes, edit boxes are provided. The user should click on an
edit box and enter the required value. If the input value is outside the evaluation limits or the format of
data is invalid, an error or warning pop-up window message will be encountered when the Update
button is clicked.

To select from a list of settings, dropdown lists (combo boxes) and vertically scrolled multiline edit
boxes are provided.
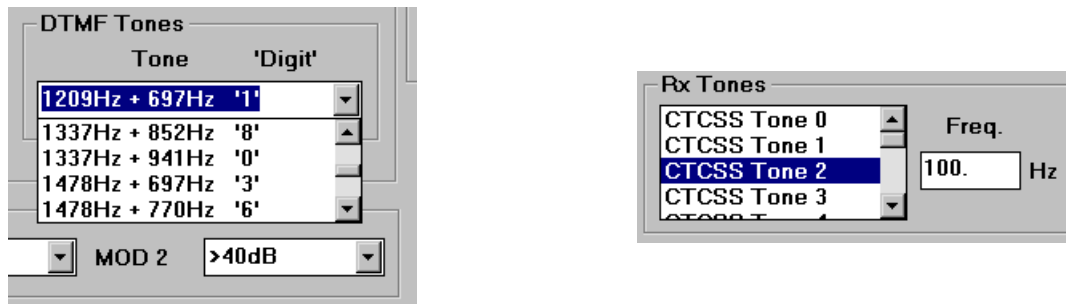
The user should click on the drop button located to the right of the combo box. When the combo box opens up, the vertical scroll bar should be used to move up and down through the list of options. When the required option is found, the user should click on it. Likewise, for the multiline edit boxes, the list of options can be viewed and selected by using the vertical scroll bar followed by clicking on the option.

1.6.3.16 Read Register Output Display

The read register output display section located on the right of the device forms consists of read-only single line edit boxes. These boxes display the read register settings after an update or View Register has taken place. The edit boxes corresponding to bit settings will display either the 'clear' or 'set' text corresponding to a '0' or '1' respectively.

1.6.3.17 FX8x8 Rx Tones

The FX8x8 device forms are very similar for the entry of Rx tones. However, the multiline edit box list created for the FX828 will display CTCSS and Selcall tones, depending on the state of the Tone Decoder Mode bit in the Signalling Set-up write register. For the FX828, both sets of tones are stored in memory but only one set is sent to the EV8000 Evaluation Kit, depending on the Tone Decode mode setting.

Assigning frequencies to an Rx tone is achieved by clicking on the required tone number and then entering the frequency in the single line edit box on the right. No enter key or delimiter is required at the end of the frequency setting. When the tone number is selected the focus automatically switches to the frequency edit box ready for frequency entry.

1.6.3.18 Viewing the FX8x8 and FX829 device registers

The current device form write register settings and the actual device read register settings can be viewed by clicking on the View Registers button. The pop-up window which follows, lists the register addresses and data.

To allow the user to view all of the FX8x8 CTCSS/Selcall tones, dropdown edit boxes are included in the FX8x8 View Registers' windows.
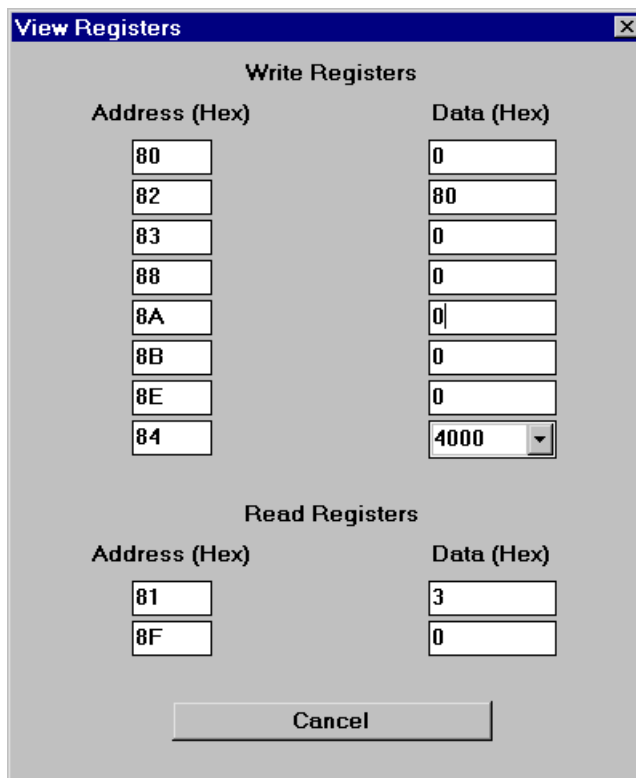
1.6.3.19 Automatic Disabling of Input Controls

This software feature shows the user which areas of the device form require user input and also prevents the user selecting incorrect modes of operation.

An input control disabled by the software will be greyed on the display and will not respond to the user clicking on it. When the software establishes that the user has modified an input control, thus eliminating any possible conflicts, the disabled input control will be re-enabled, ready for user selection.

An example of the conflicting modes of operation is when the FX828 Sub-Audio Transmitter is enabled. The FX828 data sheet states that the DCS decoder and the Sub-Audio (CTCSS or DCS) transmitter should not be enabled at the same time. Therefore the DCS Rx checkbox will be automatically disabled by the software to prevent user selection.

Note: Windows 3.11 users may find the display text associated with edit boxes to be invisible whilst the input control is disabled.

1.6.3.20 Direct C-BUS Control

Individual device registers can be written to and read using this pop-up window. The window is activated by clicking on the Global Menu and then clicking on the C-BUS command.

To perform a write to a device register the user should enter the register address and data in hex and then click on the Write button. Likewise, to read a device register the user should enter the register address and then click on the relevant read button, depending on the number of bytes to be read.
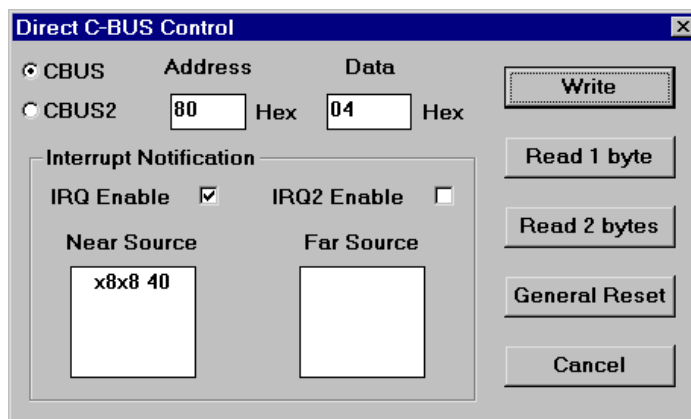
The user can read or write to either near or far C-BUS by clicking on the respective C-BUS radio buttons (CBUS or CBUS2).

The General Reset button within this window will allow the user to reset devices controlled by the selected C-BUS. The General Reset button within the Direct C-BUS Control window will not reset device form displays and variables.

This window contains an interrupt notification section. This section comprises of two checkboxes to select either near or far C-BUS interrupts and two corresponding multiline read-only edit boxes to display the source of the interrupts.

When the user enables one of these interrupt notification checkboxes, the PC will then be notified of any interrupts from the (near and/or far) signalling processor boards. IRQ corresponds to the near devices and IRQ2 to the far devices. The interrupt source string displayed shows the device (either x829 or x818) and IRQ Flag or Status setting (Hex).

Warning: **Application warnings or even fatal errors may be encountered if the Direct C-BUS Control window is used to view interrupt notifications that are occurring less than every 10ms. Whilst viewing continuous interrupt notifications the user should disable the Windows Screen Saver and not attempt any window resizing, etc.**

The Cancel button is used to exit this pop-up panel.

Note: The Direct C-BUS Control window does not modify any of the device form displays or variables. Therefore, after using the Direct C-BUS Control, certain device form display settings should be ignored until a General Reset is performed or the form write registers are modified.

1.6.3.21 FFSK Messaging
Unlike the FX8x8 device forms the FX829 device forms can be set up to receive and transmit data without clicking on the Update button. This feature is only applicable to FFSK Messaging.

Due to the speed constraints of Windows and the serial communication link, the FFSK messaging routines controlling the FX829 are performed by the PIC µC.

Note: The EF8000 firmware does not allow the user to operate both the near and far signalling processor boards in the same FFSK messaging mode (Tx or Rx).

1.6.3.22 FFSK Rx Message

Select FFSKRX and AMP1 by clicking on their respective checkboxes in the Control 1 write register and enable the required synchronisation bit in the Control 3 / IRQ Enable write register. If RX SYNC WORD PRIME is selected, enter a 2-byte RX SYNC word in hex, before clicking on the Update button. If required, other control bits can be set before the Update button is clicked i.e. baud rate, etc.

The user can now setup the FFSK Rx Message section of the device form. Start by entering the number of data bytes in a single message, click on the Rx Bytes edit box and enter an integer number(1-11).

```
┌─ FFSK Rx Message ──────────────────────────────────────┐
│        ┌────────────────────────────────────────────┐▲ │
│        │ SYNT,D(01,32,03,42,05,BB),C(B3,61,TRUE)    │  │
│        │ SYNC,D(AA,99,43,05)                        │  │
│        │ WORD,D(05,78,92,CA,DF,22,45,72),C(57,FA,TRUE)│ │
│ Clear  │ SYNC,D(03,67,23,45,91,EE),C(3C,05,TRUE)    │  │
│        │   + D(03,67,23,45,91,EE),C(3C,05,TRUE)     │  │
│        │   + D(03,67,23,45,91,EE),C(3C,05,TRUE)     │▼ │
│        └────────────────────────────────────────────┘  │
│                                    No. of Words to      │
│   Bytes (1-11) [6]   Checksum  ☑   Follow (0-15)  [2]   │
│                                                         │
│      [  Rx Message Start  ]      [  Rx Message Stop  ]  │
└─────────────────────────────────────────────────────────┘
```

If a FFSK Rx checksum is required based on the number of bytes expected, the Rx checksum should be set by checking this checkbox. The FFSK Rx message setup can be stored in memory at any stage by clicking on the Update button. To transfer the data to the μC board and thus start receiving FFSK messages the user should click on the Rx Message Start button. The FFSK message received will be displayed in the read-only, multiline, vertically scrolled edit box. This edit box will clear automatically when a maximum number of lines is reached (500) . However a clear button is provided to allow the user to clear the edit box at any stage.

Up to 15 following words can be received by the FFSK Rx Message section, by clicking on the appropriate edit box and entering the required number. A following word comprises of message data bytes and checksum (if transmitted) immediately following the previous message without further synchronisation.

Whilst receiving FFSK messages the FFSK Rx Message Start button is disabled until the FFSK Rx Stop button is clicked by the user.

Rx message display format with Rx checksum:

Message Synchronisation Codeword, D(message data bytes), C(2-byte checksum, validity)
i.e. SYNC, D(AA,11,33), C(85,2A, TRUE)

Rx message display format without Rx checksum:

Message Synchronisation Codeword, D(message data bytes)
i.e. WORD, D(AA,11,33)

The Rx Message Synchronisation Codeword will be either SYNT, SYNC or WORD.

Note: The FX829 device form cannot receive continuous FFSK messages when the inter-message delay is <100ms.

> **Warning:** **Prolonged window resizing or similar background activities may cause application warnings or even fatal errors whilst receiving continuous FFSK messages with small inter-message delays.**

1.6.3.23 FFSK Tx Message

Select FFSKTX, TXIDLEM and TXDATAM by clicking on their respective checkboxes and then click on the Update button. If required, other control bits can be set before Update button is clicked i.e. baud rate etc.

The user should then enter the number of data bytes to be transmitted in a single message using the Tx message bytes edit box (2-9). The number of preamble bytes should be entered into the preamble bytes edit box (2-15). The user has the option of adding a 2-byte checksum to the message. This can be achieved by checking the Tx Checksum checkbox.

The FFSK Tx message form setup can be stored in memory at any stage by clicking on the Update button. To transfer the data to the µC board and therefore transmit the FFSK message, the user should click on the Tx Message Start button.

A checkbox is provided to allow the user to continuously transmit the same FFSK message. When this checkbox has been checked the user has the option of re-transmitting the 2-byte synchronisation code. When the Re-Transmit Sync checkbox is checked an inter-message delay can be specified. The minimum message delay is 100ms, although a value of 0 can be entered to indicate that no delay is required.

In continuous Tx mode the transmission can be stopped by clicking on the Continuous Tx Stop button. To indicate that a continuous FFSK transmission is in progress the Tx Message Start button is disabled until the Continuous Tx Stop button is clicked by the user. Likewise when the Continuous Tx checkbox is unchecked the Re-Transmit Sync checkbox and Message Delay edit box are disabled.

Note: The timer used for the inter-message delay has been implemented in the Windows software. Therefore, the delay may vary depending on PC performance and other background tasks running. Whilst operating in continuous FFSK Tx mode with an inter-message delay, it is recommended that the user disables the Windows Screen Saver and does not attempt any window resizing, etc.

In continuous FFSK transmit mode with an inter-message delay specified, the delay entered by the user is the time difference between the end of a message and the start of the next message.

1.6.3.24 FX829 Bit Error Rate Testing

To allow the user to perform FX829 Bit Error Rate Testing (BERT) the EF8000 firmware contains a BERT routine, configured by the ES8000 Windows Application software. This facility requires two EV8000 signalling processor boards (near and far) and user input to both near and far FX829 device forms before BERT can commence.

Hardware Setup
This function enables connection to a BER Testers as follows:

µC Board J2 Pin 1 to Tester Tx Data O/P
µC Board J2 Pin 2 to Tester Tx Clock I/P
µC Board J2 Pin 3 to Tester Rx Data I/P
µC Board J2 Pin 4 to Tester Rx Clock I/P

The Tester must be able to operate from an external clock. The timings of the clocks provided from the µC board are as follows:
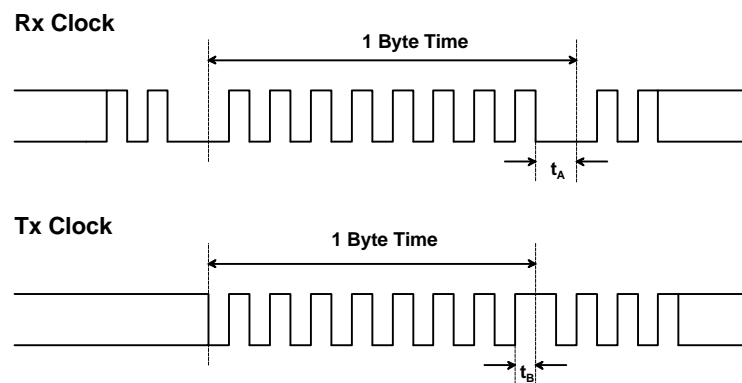
Times t_A and t_B vary as the clocks are adjusted to fit the exact byte periods of the target devices.

Data is assumed to be clocked in and out of the Tester on the rising edge of either Rx or Tx clock.

The FX829 FFSK data from the transmitting signalling processor board can be directly fed from FFSK/DTMF Out (J6 Pin 15) into noise summing circuitry, or via one of the FX829 modulator paths. The output of the noise summing stage should be connected into DEMODIN (J6 Pin 21) of the receiving signalling processor board.

Application Software Setup
After executing the ES8000 Windows Application software the user should open the near and far FX829 device forms. Select FFSKTX, TXIDLEM and TXDATAM on the device form used to control the transmit end. Other write register bits may need to be enabled if the user is not transmitting directly from FFSK/DTMF Out (J6 Pin 15). On the device form used to control the receive end, select FFSKRX, AMP1 and one of the required synchronisation primes.

When the near and far FX829 device forms have been configured select the BER Test command from the Global pulldown menu. The BER Test pop-up window will now appear with a read-only edit box providing status information on the BER Test.

BER Test

BERT Status

Running

| Start | Stop | Cancel |

Two control buttons allow the user to start and stop the function which in turn generate either 'running' or 'idle' status messages.

The Tester should be started before the user clicks on the Start button to ensure bit synchronisation is achieved.

Error messages will be reported in the status edit box if the user has incorrectly configured the FX829 device forms.

Note: Other device functions should not be performed whilst the BERT facility is operational.

1.6.4   Software Description - µC Board

1.6.4.1 PIC µC Programming Software
This is supplied on disk as a self-documented executable file **PICPROGA.EXE** for a PC running DOS (either directly or as a DOS window in Windows 3.11 or '95). It is not recommended for use on Windows NT systems. Please note that this programming software does not meet the Arizona Microchip Technology verification requirements for a "production quality" programmer. Also, it does not support the programming of ID locations and there is no checksum facility.

The user interface consists of two windows. The top window contains the operating instructions and the bottom window shows the command line and data communications with the PIC µC. When the top window first appears the user will be prompted to enter the number of the serial communications port to which the µC board is connected. Once the user has entered this number, the following commands are displayed:

```
press F   to load file.

press C   to enter Configuration Word.  Currently - xxxx

press B   to check target device is blank.

press P   to program target device.

press V   to verify target device.

press R   to read target device.

press A   to view contents of program data array.

press Esc to return to DOS.
```

A new function from the above table can be selected whenever the **>ok** prompt appears in the bottom window.

Notes:

a) Assembler output files must be in the Intel hex format **`(.HEX)`** in order to be usable by this programming software.

b) The PIC μC supplied has a Configuration Word which is preset to **`3FB9H`** if it is a PIC 16C74JW or 16LC74JW, or to **`3FB1H`** if it is a PIC 16C74AJW or 16LC74AJW. In each case, this selects the crystal oscillator, disables the watch dog timer, enables the power up timer and disables code protection. The programming software currently defaults to **`3FB1H.`** Consult Arizona Microchip Technology for more information on the Configuration Word.

c) The "blank check" command **`(B)`** only looks at the first location. A programmed device will always have data in this location as it is the program start address.

d) For each of the commands **`B,P,R`** and **`V`** the user will be prompted to manually reset the target μC, by pressing the reset switch (SW1) on the μC board. This is because PIC programming always starts from location **`0000`** and the program counter can only be incremented.

e) Pressing **`A`** will display the program data in the bottom window, formatted in pages of 48 consecutive locations. Use the **`<PageUp>`** and **`<PageDown>`** keys to scroll through the data. Pressing **`<Esc>`** will return the user to the **`>ok`** prompt.

1.6.4.2 EF8000 Firmware
The PIC μC is supplied pre-programmed with EF8000 firmware, which is used to convert the RS232 serial interface into a C-BUS interface. It also executes some of the higher data rate commands and collects high speed interrupts for pre-processing, before passing these back to the PC. Its operation is transparent and it is controlled by the ES8000 Windows Application Software.

1.6.5   Known Bugs in the ES8000 (Version 1.0) Software

The warnings highlighted in Sections 1.6.3.20 and 1.6.3.22 should be followed to prevent any Windows application failures.

1.6.6   Troubleshooting Guide for the ES8000 (Version 1.0) Software

Question: When I switch the focus to another device form I lose some or all of the previous form setup.

Answer: The majority of device form settings are only stored when the form's Update button is clicked.

Question: I keep receiving numerous pop-up window error messages during my evaluation session, causing the application to do strange things ?

Answer: Perform a General Reset on the near and/or far C-BUS. If this does not solve the problem, shutdown the ES8000 and turn off the power supply feeding the signalling processor and μC boards. Now follow the 'ES8000 and EV8000 Startup Procedure' instructions described earlier.

Question: After operating in several different modes the device form(s) locked up or showed abnormal behaviour ?

Answer: Perform a General Reset on the near and/or far C-BUS. If this does not solve the problem, shutdown the ES8000 and turn off the power supply feeding the signalling processor and μC boards. Now follow the 'ES8000 and EV8000 Startup Procedure' instructions described earlier.

Question: Can the FX829 device form receive continuous FFSK messages ?

Answer: Continuous FFSK messages should only be received when the inter-message delay is $\geq$ 100ms.

Question: At Startup I get an 'Incompatible Software/Firmware versions!' error message ?

Answer: Shutdown the ES8000 and turn off the power supply feeding the signalling processor and μC boards. Now follow the 'ES8000 and EV8000 Startup Procedure' instructions described earlier. If this does not solve the problem check that you are using the correct ES8000 and EF8000 versions. Information on software version numbers, together with the latest software and documentation, can be found by visiting the CML web site.

Question: The FFSK messaging on the FX829 device form is functioning incorrectly ?

Answer: Perform a General Reset on the near and/or far C-BUS and press the reset switch (SW1) on the μC board. If this does not solve the problem follow the 'ES8000 and EV8000 Startup Procedure' instructions described earlier.

Question: When I try to read or write to the μC board I get a 'Cannot Write Port' error message.

Answer: This may occur due to an unconnected serial cable or EV8000 PSU problem. The ES8000 Windows Application Software will not function correctly after a 'Cannot Write Port' error message has occurred. Shutdown the ES8000 and turn off the power supply feeding the signalling processor and μC boards. Now follow the 'ES8000 and EV8000 Startup Procedure' instructions described earlier.

1.7   Performance Specification

1.7.1   Electrical Performance

Absolute Maximum Ratings
Exceeding these maximum ratings can result in damage to the Evaluation Kit.

	Min.	Max.	Units
Supply (V_{IN} - V_{SS})	-0.3	40.0	V
Supply (V_{DD} - V_{SS})	-0.3	7.0	V
Voltage on any connector pin to V_{SS}, except J3 on µC board	-0.3	V_{DD} + 0.3	V
Current into or out of V_{IN} and V_{SS} pins	0	+1.5	A
Current into or out of any other connector pin	-20	+20	mA
Storage Temperature	-10	+70	°C
Operating Temperature	+10	+35	°C

Operating Limits
Correct operation of the Evaluation Kit outside these limits is not implied.

	Min.	Max.	Units
Supply (V_{IN} - V_{SS})	8.0	35.0	V
Supply (V_{DD} - V_{SS})	3.0	5.5	V
Operating Temperature	+10	+35	°C
External Clock Frequency (signalling processor board)	4.0315968	4.0324032	MHz
External Clock Frequency (µC board, V_{DD} = 5.0V)	0.1	20.0	MHz
External Clock Frequency (µC board, V_{DD} = 3.3V)	0.1	4.0	MHz

Operating Characteristics

For the following conditions unless otherwise specified:
Evaluation Devices Xtal Frequency = 4.032MHz, µC Xtal Frequency = 4.0MHz,
V_{DD} = 3.3V or 5.0V, Tamb = +25°C.

	Notes	Min.	Typ.	Max.	Units
DC Parameters					
$I_{DD \, (total)}$	1	-	100.0	-	mA
AC Parameters					
OSC1 Input to PIC µC					
'High' pulse width	2	50.0	-	-	ns
'Low' pulse width	2	50.0	-	-	ns
Xtal/Clock Input to Evaluation Device					
'High' pulse width	2	40.0	-	-	ns
'Low' pulse width	2	40.0	-	-	ns
"C-BUS" Interface					
Input logic "1" level	3	80%	-	-	V_{DD}
Input logic "0" level	3	-	-	20%	V_{DD}
Input leakage current (Vin = 0 to V_{DD})	3	-5.0	-	+5.0	µA
Input capacitance	3	-	10.0	-	pF
Output logic "1" level (I_{OH} = 120µA)	4	90%	-	-	V_{DD}
Output logic "0" level (I_{OL} = 360µA)	4	-	-	10%	V_{DD}
External Loudspeaker Output					
Load Impedance		8.0	-	-	Ω

Notes: 1.   Not including any current drawn from the board connector pins by external circuitry.
2.   Timing for an external input to the XTAL/CLOCK pin.
3.   When µC pin is configured as an input.
4.   When µC pin is configured as an output.

Operating Characteristics - Timing Diagrams

For FX818/FX828/FX829 timing information and operating characteristics, refer to CML Data Sheets.

For µC timing information and operating characteristics, see manufacturer's literature (Arizona Microchip Technology).

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CML Microcircuits

COMMUNICATION SEMICONDUCTORS

CML Product Data

In the process of creating a more global image, the three standard product semiconductor companies of CML Microsystems Plc *(Consumer Microcircuits Limited (UK), MX-COM, Inc (USA) and CML Microcircuits (Singapore) Pte Ltd)* have undergone name changes and, whilst maintaining their separate new names *(CML Microcircuits (UK) Ltd, CML Microcircuits (USA) Inc and CML Microcircuits (Singapore) Pte Ltd)*, now operate under the single title **CML Microcircuits**.

These companies are all 100% owned operating companies of the CML Microsystems Plc Group and these changes are purely changes of name and do not change any underlying legal entities and hence will have no effect on any agreements or contacts currently in force.

CML Microcircuits Product Prefix Codes

Until the latter part of 1996, the differentiator between products manufactured and sold from MXCOM, Inc. and Consumer Microcircuits Limited were denoted by the prefixes MX and FX respectively. These products use the same silicon etc. and today still carry the same prefixes. In the latter part of 1996, both companies adopted the common prefix: CMX.

This notification is relevant product information to which it is attached.

Company contact information is as below:

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