

CML Semiconductor Products

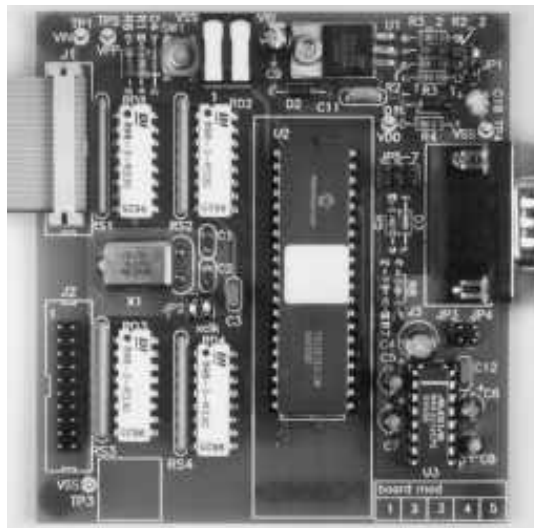
Evaluation Kit User Manual **EV6000**

UM6000/3 November 1996

Advance Information

1.0 Features

- For use with EV6020 and EV6040
- Executes Applications Software for FX602, FX604 and FX614
- Serial (RS232) Interface to a PC
- Socketed PIC 16-Series μ C
- Diagnostic Firmware/Software
- On-Board PIC Programming with Serial Interface and PC Software
- Single Power Supply Operation
- On-Board Supply Regulator



1.1 Brief Description

This board is designed for use with the CML EV6020 and EV6040 Evaluation Kits, which are in turn used for evaluation of the FX602, FX604 and FX614 products. The EV6000 Evaluation Kit comprises one board containing a socket for a UV-erasable PIC μ C which the user may program and control via the RS232 serial interface. With the aid of suitable applications software, the user can demonstrate the use of the FX602, FX604 or FX614 in telecommunications applications. The EV6000 board may be powered from a single 8 - 35V dc power supply; an on-board regulator sets 3.3V or 5.0V operation. The PIC μ C may be driven from an external clock, or from its own crystal oscillator. Test point hooks provide access to programming voltages. Space has been left for the user to ZIF-socket the PIC μ C, if required. Interconnecting cables are provided for an RS232 link to a PC and for 20-way flat cable connections to other CML evaluation kits or other parts of a user's system.

This EV6000 Evaluation Kit is designed to be a general purpose product which may be used to support other CML evaluation kits in the future. Applications software is being regularly updated and users should contact CML for further details.

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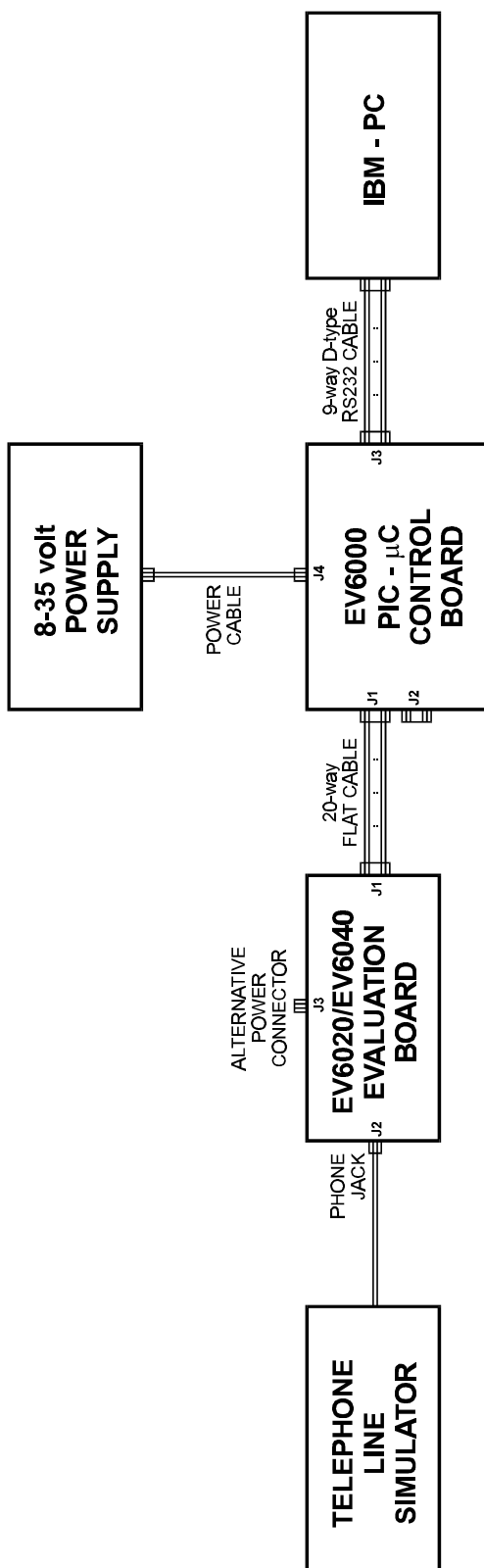


Figure 1 Block Diagram

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 programming voltage, if set to 13V).
- 1.2.1.2 Either an IBM compatible PC; 20MHz '386 or better, running Microsoft Windows 3.11 / '95 / NT with a terminal emulation program, having a 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 μ C in this evaluation kit:

- 1.2.1.3 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**).
- 1.2.1.4 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.
- 1.2.1.5 MPASM assembler or MPLAB software is required for re-assembling the source code. These tools are available from Arizona Microchip Technology.

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 (EK6000) 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

This evaluation kit comprises a single board containing a socket for a 40-pin DIL PIC (or compatible) general-purpose μ C, which the user may re-program with his applications software.

THE EV6000 COMES WITH A PRE-CONFIGURED PIC 16C74AJW OR EQUIVALENT, CONTAINING DIAGNOSTIC FIRMWARE AND APPLICATION SPECIFIC DEMONSTRATION FIRMWARE FOR THE EV6020 AND EV6040 EVALUATION KITS. THE EV6000 IS SET FOR OPERATION AT 5.0V.

The kit also contains two 20-way flat cables (one of which is needed for connection to an EV6020 or EV6040 CML Evaluation Kit) and 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.

BEFORE APPLYING POWER, PLEASE CHECK THE FOLLOWING:

ENSURE THE PIC μ C IS PLUGGED INTO SOCKET U2 ON THE EV6000 BOARD.

CONNECT THE 9-WAY RS232 CABLE BETWEEN SOCKET J3 AND THE SERIAL PORT OF A PC.

FOR USE WITH EV6020 OR EV6040 EVALUATION KITS, CONNECT A 20-WAY FLAT CABLE BETWEEN SOCKETS J1 ON THE EV6000 AND EV6020 OR EV6040 BOARDS.

The EV6000 board has 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 flat cable. Each board has its own power supply regulator chip, with a jumper to select 3.3V or 5.0V (default) operation.

MAKE SURE BOTH BOARDS HAVE THIS JUMPER SET TO THE SAME VOLTAGE. DAMAGE MAY RESULT IF THIS STEP IS NOT OBSERVED. DO NOT OPERATE EITHER BOARD WITH ITS VOLTAGE SELECTION JUMPER REMOVED.

Ensure that the component value jumpers on the EV6020 or EV6040 evaluation board are correctly set for 3.3V or 5.0V operation. Please refer to Section 1.6.1.1 for further details.

Connect any other equipment as shown in Figure 1.

Ensure the PC terminal emulator program is set up as detailed in section 1.2.1.2.

1.3.2 Operation

The EV6000 kit is designed to control the operation of an EV6020 or EV6040 Evaluation Kit. The firmware which is pre-configured into the PIC μ C has both diagnostic and application specific commands. Refer to section 1.6.2.2 for the diagnostics and section 1.6.2.3 for the applications.

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

1.4 Signal Lists

CONNECTOR PINOUT - μ C 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 μ C Bidirectional Port, pin 2	
	6	RA1	BI	PIC μ C Bidirectional Port, pin 3	
	7	RA2	BI	PIC μ C Bidirectional Port, pin 4	
	8	RA3	BI	PIC μ C Bidirectional Port, pin 5	
	9	RB0	BI	PIC μ C Bidirectional Port, pin 33	
	10	RB1	BI	PIC μ C Bidirectional Port, pin 34	
	11	RB2	BI	PIC μ C Bidirectional Port, pin 35	
	12	RB3	BI	PIC μ C Bidirectional Port, pin 36	
	13	RB4	BI	PIC μ C Bidirectional Port, pin 37	
	14	RB5	BI	PIC μ C Bidirectional Port, pin 38	
	15	RB6	BI	PIC μ C Bidirectional Port, pin 39	
	16	RB7	BI	PIC μ C Bidirectional Port, pin 40	
	17	RC0	BI	PIC μ C Bidirectional Port, pin 15	
	18	RC1	BI	PIC μ C Bidirectional Port, pin 16	
	19	RC2	BI	PIC μ C Bidirectional Port, pin 17	
	20	RC3	BI	PIC μ C Bidirectional Port, pin 18	
	J2	1	RA4	BI	PIC μ C Bidirectional Port, pin 6
		2	RA5	BI	PIC μ C Bidirectional Port, pin 7
3		RD0	BI	PIC μ C Bidirectional Port, pin 19	
4		RD1	BI	PIC μ C Bidirectional Port, pin 20	
5		RD2	BI	PIC μ C Bidirectional Port, pin 21	
6		RD3	BI	PIC μ C Bidirectional Port, pin 22	
7		RD4	BI	PIC μ C Bidirectional Port, pin 27	
8		RD5	BI	PIC μ C Bidirectional Port, pin 28	
9		RD6	BI	PIC μ C Bidirectional Port, pin 29	
10		RD7	BI	PIC μ C Bidirectional Port, pin 30	
11		RE0	BI	PIC μ C Bidirectional Port, pin 8	
12		RE1	BI	PIC μ C Bidirectional Port, pin 9	
13		RE2	BI	PIC μ C Bidirectional Port, pin 10	

CONNECTOR PINOUT - μ C BOARD				
Connector Ref.	Connector Pin No.	Signal Name	Signal Type	Description
J3	14 to 18 inc	-	-	Not used. No connection needed.
	19, 20	VSS	Power	0V power from external power supply.
	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	VSS	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.
J4	9	-	-	Not used. No connection needed.
	1	VSS	Power	0V power from external power supply.
	2	VIN	Power	+ve power from external power supply.

TEST POINTS - μ C BOARD		
Test Point Ref.	Default Measurement	Description
TP1	8 - 35V	VIN connection.
TP2	3.3V or 5.0V	VDD connection.
TP3	0V	VSS connection.
TP4	0V	VSS connection.
TP5	3.3V or 5.0V	VPP connection (13.0V in programming mode).

JUMPERS - μ C BOARD			
Link Ref.	Positions	Default Position	Description
JP1	1-2 or 2-3	2-3	Sets VDD = 3.3V (1-2) or VDD = 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

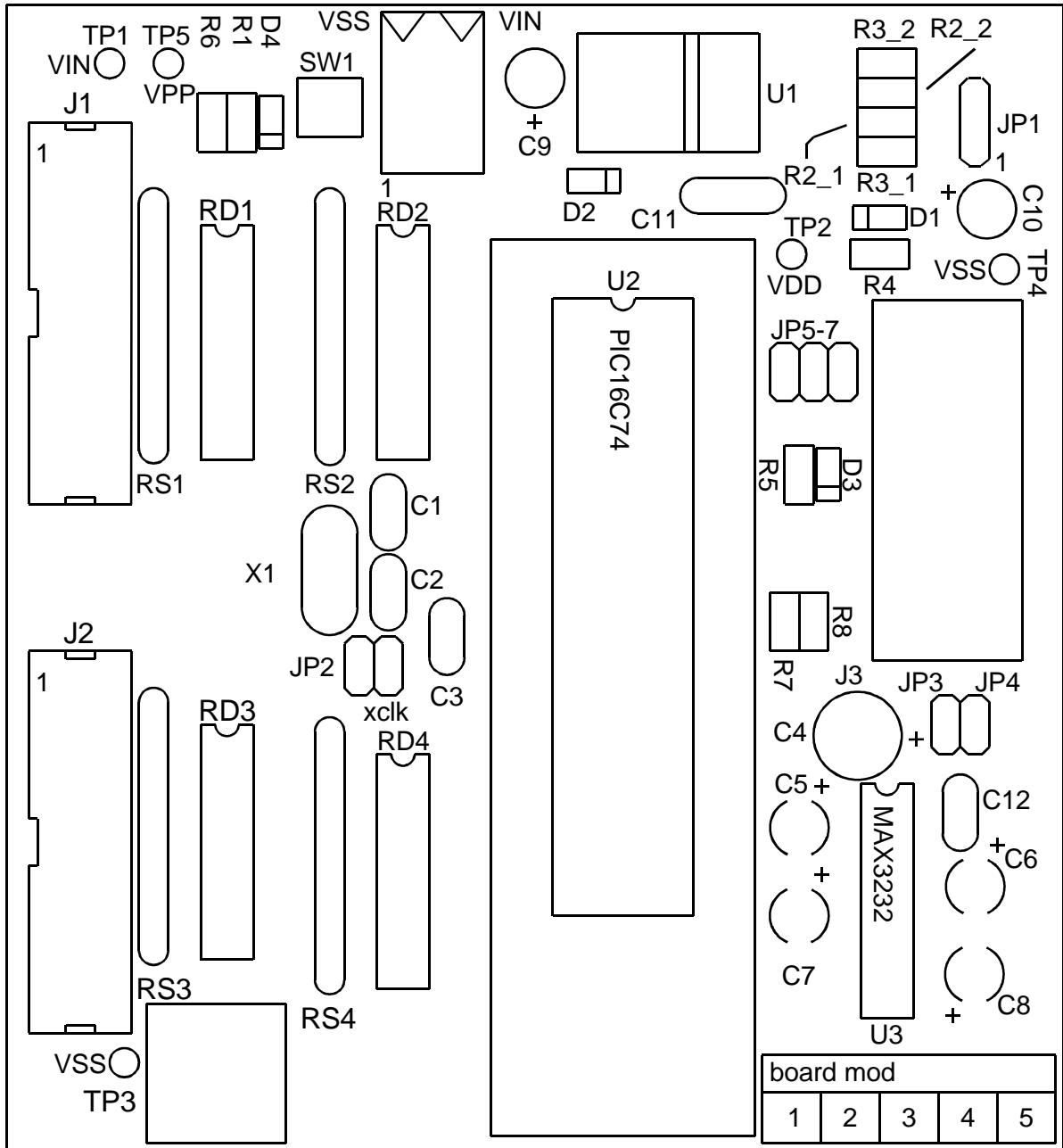


Figure 3 μ C Board - Layout

1.6 Detailed Description

1.6.1 Hardware Description

1.6.1.1 Operating Voltage

The selection of operating voltage ($V_{DD} = 3.3V$ or $5.0V$) by jumper JP1 affects the choice of component values around the evaluation device on the EV6020 or EV6040 Evaluation Kit. Care should be taken to ensure that JP1 is set the same way as jumpers JP1, JP3, JP4, JP5, JP6 and JP7 on the EV6020 or EV6040 Evaluation Kit.

1.6.1.2 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. Two 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 jumpers have been removed, taking care to adjust any firmware timing routines accordingly.

1.6.1.3 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. Linefeeds are provided by the EV6000 firmware. The firmware supplied in the PIC μC assumes this configuration.

1.6.1.4 Programming Mode

TO ENTER PROGRAMMING MODE

- (a) Remove power from board
- (b) Disconnect the EV6000 from other Evaluation Kits
- (c) Ensure 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 evaluation kit
- (i) 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 jumper JP1 in its original position
- (e) Reconnect the EV6000 to the other Evaluation Kits, checking that the voltage selection jumpers are correctly set
- (f) Ensure the terminal emulator program is running on the PC
- (g) Re-apply power to board and run μC firmware via the PC terminal emulator

1.6.2 Software Description

1.6.2.1 PIC μ C 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 μ C. When the top window first appears the user will be prompted to enter the number of the serial communications port to which the EV6000 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 μ C 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 μ C, by pressing the RESET switch (SW1) on the EV6000 Evaluation 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.

1.6.2.2 EV6020/EV6040 Diagnostic Firmware

This is supplied both as a collection of assembler source routines on disk and pre-programmed into the PIC μ C, where it is identified as EF6000. The diagnostic and applications firmware supplied may be replaced or supplemented by the user's own applications firmware. The PIC μ C firmware is controlled by a terminal emulator program, from a PC with Windows 3.11, '95 or NT.

Text commands are entered by the user into the terminal emulator. Characters are not case sensitive. There is a global limit of 6 characters on any user input string. Whenever the **>ok** prompt is displayed a new command may be entered and should be terminated by pressing the **<Return>** key. Whenever a command has been entered, the **>** prompt is returned if data entry is required. To use a function, the appropriate set-up commands must be entered before-hand. For example, to use the EV6040 to transmit external data to the line, the following should be entered:

```
>ok
6040<Return>           ; sets EV6000 for use with the EV6040
>ok
tx<Return>             ; sets the FX604 into Tx mode
>ok
txext<Return>         ; select desired function
>
```

The diagnostic commands are shown below.

(a) Set-up commands:

```
6020  Set board for connection to and control of EV6020.
6040  Set board for connection to and control of EV6040.
dbit  Set FSK data format to 7 or 8 data bits. The user is prompted for the number of data
bits.
zp    Set FX602/FX604 into zero power mode.
zpirq Set FX602 into zero power mode, generating a pulse at the IRQN pin if ringing or a
line reversal is detected.
alert Set FX602 into tone alert detect mode.
rx&tx Set FX604 into Rx mode with back channel enabled.
tx    Set FX604 into Tx mode without data retiming.
rx    Set FX602/FX604 into Rx mode without data retiming.
```

(b) Utilities: (Press **<Esc>** to exit these functions)

```
f!    Enter a mode where a 5 character string will write hex data to any register. PIC  $\mu$ C
ports are mapped as registers. Use the format aa dd<Return> where
aa is the register address in hex and dd is the data.
f@    Enter a mode where a 2 character string containing a register address in hex will
return the contents of that register.
echo  Enter a test mode where any text string entered by the user will be returned to the
terminal emulator by the EV6000.
dtmf  Enter a mode where any DTMF digit entered by the user will be transmitted by the
EV6020/6040.
```

txalt Enter a test mode where a continuous "10101010" pattern will be transmitted at 1200 baud by the FX604. Press **<Esc>** to terminate this pattern.

(c) Functions: (Press **<Esc>** to exit these functions)

rxfsk Enter a mode where FSK data received by the FX602/FX604 is interpreted as ASCII characters and displayed within the terminal emulator window. If the FX604 Tx back channel is enabled, then entering a 1 or 0 will change the state of the transmit data output. The FX602/FX604 is operated with data retiming selected.

txtxt Enter a mode where text entered by the user or downloaded as a text transfer is transmitted by the FX604. The FX604 is operated with data retiming selected.

txext Enter a mode where raw data can be applied by the user to connector J2 pin 2 on the EV6000 board for transmission at 1200 baud by an FX604 on the attached EV6020/EV6040 board. A clock output is provided on J2 pin 1 of the EV6000 board, the positive-going edge of which may be used to latch data on to J2 pin 2.

rxext Enter a mode where raw data which has been received by an FX602 or FX604 at 1200 baud on the attached EV6020/EV6040 board can be read by the user on connector J2 pin 2 of the EV6000 board. A clock output is provided on J2 pin 1 of the EV6000 board, the positive-going edge of which may be used to latch data from J2 pin 2.

Notes:

Some terminal emulators have been found not to support full hardware flow control when transferring text files. This could result in data loss when using the **txtxt** command. If this problem is experienced, users should try using a lower data rate or a different terminal emulator.

The PIC I/O line (J2 pin 1) which is used for the **rxext** and **txext** commands is an open-collector output with only a weak, 1M Ω , pull-up resistor fitted to the EV6000 board.

When using either of the **f!** or **f@** utilities, the register address equates to the following I/O ports:

05	PORT A
06	PORT B
07	PORT C
08	PORT D
09	PORT E

The individual lines of each port equate to EV6020 (and EV6040) connections as follows:

_dtmf	PORT A	bit 0	
_acload	PORT A	bit 1	
_wp	PORT A	bit 2	
_txline	PORT A	bit 3	
_d3	PORT B	bit 0	
_d2	PORT B	bit 1	
_d1	PORT B	bit 2	
_d0	PORT B	bit 3	
_zp	PORT B	bit 4	(_m0 for EV6040)
_mode	PORT B	bit 5	(_m1 for EV6040)
_irqn	PORT B	bit 6	
_det	PORT B	bit 7	
_clk	PORT C	bit 0	

_rxd	PORT C	bit 1	
_lvcp	PORT C	bit 2	(_txd for EV6040)
_muten	PORT C	bit 3	(_rxeq for EV6040)

If the user wished to manually enable the near end speech path (from TP18 to the line), the following commands would be entered:

```
>ok
f!<Return>
>05 08<Return>           ; sets HI port A bit 3, energising relay 1
>07 08<Return>           ; sets HI port C bit 3, enables speech input (TP18)
><Esc>
>ok
```

1.6.2.3 Applications Software

(a) Application/Demonstration Commands (Press <Esc> to exit these functions)

cas Follows the CAS detection part of the CIDCW algorithm detailed in the FX602 data sheet. Near end speech is input between TP18 and V_{SS} (TP1 or TP2). If the detect output is set for a time longer than T1, the near end speech path (TP18 to the line) is muted. If the detect output then remains set (making a total detect time longer than T3 but less than 65ms) then, after a quiet period of 50ms, the DTMF digit "D" acknowledgement tone is transmitted down the line.

Once this sequence has been completed, or aborted for not meeting a timing requirement, the near end speech path is un-muted and the FX602 returned to tone alert mode.

On the EV6020 board, the line termination resistor R20 ($\approx 600\Omega$) should be fitted. Note that this software does not present an off hook dc load to the line.

casd Operates as above, but two decimal counters are run. The first counts the number of times the near end speech is muted and the second counts the number of times the DTMF acknowledgement is sent. The results are displayed and updated in the form:

```
M=00000000 ,A=00000000 .>
```

where **M** represents mutes of the near end speech path and **A** represents acknowledgement tones sent.

On the EV6020 board, the line termination resistor R20 ($\approx 600\Omega$) should be fitted. Note that this software does not present an off hook dc load to the line.

cast This enables the user to adjust the CAS detection algorithm timings T1 and T3. The user is prompted as follows:

```
T1=3A98>
```

Type <Return> for no change, or enter the new setting (in μ s) in hex.

e.g. For T1 = 10ms = 10,000 μ s = 2710hex, type 2710<Return>

The user is then prompted to alter T3 in the same way. The default settings are T1 = 15ms = 3A98hex and T3 = 25ms = 61A8hex.

cidcw This demonstration covers both the BT and Bellcore off-hook caller ID services. The CAS detection algorithm runs as detailed for **cas** but once the DTMF acknowledgement is sent the FX602 is set to receive mode and the FSK data is displayed in the form of these examples:

```
>80,02,01376-513833.01,03101415.11,01,.00,
  1, 2, 3,          2, 3,          2, 3,  4.
```

where 1 is the Message type word
 2 is the Parameter type word
 3 is the Parameter characters or data
 4 is the Result of the checksum

or in the following form:

```
>80,A parameter.00,
  1, 2,          3.
```

where 1 is the Message type word
 2 is the Message characters or data
 3 is the Result of the checksum

On the EV6020 board, the line termination resistor R20 ($\approx 600\Omega$) should be fitted. Note that this software does not present an off hook dc load to the line.

clip This demonstration covers the BT on-hook service initiated by a line reversal. On the EV6020 board, JP1 should be in position 2-3 for detection of a line reversal. The idle condition is with the FX602 in zero power mode and with IRQN enabled. When a line reversal is detected the FX602 is set to tone alert mode. Once the alert tone is detected the FX602 is set to receive FSK data, which is displayed in the same way as for **cidcw**.

On the EV6020 board, relay 2 is energised for 15ms during the silent period between the alert tone and the FSK data. A resistor can be fitted in the R26 position to provide a current wetting pulse. Relay 3 is energised during the FSK receive period. Components can be fitted in positions R30, R36 and C10 to provide an ac termination to the line.

cid This demonstration covers the Bellcore on-hook service associated with ringing. On the EV6020 board, JP1 should be in position 1-2 for detection of ringing. The idle condition is with the FX602 in zero power mode and with IRQN enabled. A detect pulse of duration $< 500\text{ms}$ is assumed to be a line reversal and is ignored. When a burst of ringing current is detected the FX602 is set to receive FSK data, which is displayed in the same way as for **cidcw**.

On the EV6020 board, relay 3 is energised during the FSK receive period. Components can be fitted in positions R30, R36 and C10 to provide an ac termination to the line.

ntt This demonstration covers the NTT on-hook service associated with ringing. On the EV6020 board, JP1 should be in position 1-2 for detection of ringing. The idle condition is with the FX602 in zero power mode and with IRQN enabled. A detect pulse of duration $< 500\text{ms}$ is assumed to be a line reversal and is ignored. When a burst of ringing current is detected the FX602 is set to receive FSK data, which is displayed in the form of the following example:

>20,01,07,20,02,40,02,01376-13833.11,01,20,02,xx,xx,
1, 2, 3, 1, 4, 5, 6, 7, 6, 7, 1, 4, 8.

where 1 is the DLE character
2 is the SOH character
3 is the Header character
4 is the STX character
5 is the Service type word
6 is the Parameter type word
7 is the Parameter characters or data
8 is the 16 bit checksum

On the EV6020 board, relay 3 is energised during the FSK receive period.
Components can be fitted in positions R30, R36 and C10 to provide an ac termination
to the line.

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 connector J3	-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.

	Notes	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 ($V_{DD} = 5.0V$)		0.1	20.0	MHz
External Clock Frequency ($V_{DD} = 3.3V$)		0.1	4.0	MHz

Operating Characteristics

For the following conditions unless otherwise specified:

μC Xtal Frequency = 4.0MHz, $V_{DD} = 3.3V$ or 5.0V, $T_{amb} = +25^{\circ}C$.

	Notes	Min.	Typ.	Max.	Units
DC Parameters					
I_{DD}	1	-	-	20	mA
AC Parameters					
OSC1 Input to PIC μC					
'High' pulse width	2	50	-	-	ns
'Low' pulse width	2	50	-	-	ns
μC Interface (Connector J1)					
Input logic "1" level	3	80%	-	-	V_{DD}
Input logic "0" level	3	-	-	20%	V_{DD}
Input leakage current ($V_{in} = 0$ to V_{DD})	3	-5.0	-	+5.0	μA
Input capacitance	3	-	10	-	pF
Output logic "1" level ($I_{OH} = 120\mu A$)	4	90%	-	-	V_{DD}
Output logic "0" level ($I_{OL} = 360\mu A$)	4	-	-	10%	V_{DD}

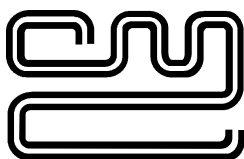
- Notes:**
1. Not including any current drawn from the board connector pins by external circuitry.
 2. Timing for an external input to the OSC1 pin.
 3. When μC pin is configured as an input.
 4. When μC pin is configured as an output.

Operating Characteristics - Timing Diagrams

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

For FX602/FX604/FX614 timing information and operating characteristics, refer to CML Data Sheets.

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