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CE notification

The MIC-3612, developed by ADVANTECH CO., LTD., has passed the CE test for environmental specifications when shielded cables are used for external wiring. We recommend the use of shielded cables. This kind of cable is available from Advantech. Please contact your local supplier for ordering information.

On-line Technical Support

For technical support and service, please visit our support website at:

http://www.advantech.com/support

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Contents

Chapter 1

General Information

1.1 Introduction

The MIC-3612 is a 3U/6U sized 4-port RS-232/422/485 CompactPCI® Comm. Card, serial communication cards which complies with PICMG 2.0 R2.1 CompactPCI specifications. All channels are addressed in a continuous 32 byte I/O block for simplified software access. All channels may also share one PCI interrupt. An interrupt status register is available for determining the interrupt source.

The MIC-3612 comes standard with 16C954 UARTs containing 128 byte FIFOs. These upgraded FIFOs greatly reduce CPU overhead and are an ideal choice for heavy multitasking environments.

1.2 Features

- PCI Specification 2.1x compliant
- Speeds up to 921.6 Kbps
- 16C954 UARTs with 128-byte standard
- Standard Industrial 3U/6U sized CPCI Board size
- I/O address automatically assigned by PCI Plug-and-Play
- OS supported: Windows98, Windows NT, Windows 2000, Windows XP
- Surge protection ($2500V_{DC}$).
- Interrupt status register for increased performance
- Space reserved for termination resistors (for RS-422/485)
- Automatic RS-485 data flow control

1.3 Specifications

- **Bus Interface:** CPCI bus specification 2.1x compliant
- **Bus controller:** PLX9030
- **Communication controller:** 16C954
- **IRQ:** all ports use the same IRQ assigned by PCI Plug-and-Play
- **Data bits:** 5, 6, 7, 8
- **Stop bits:** 1, 1.5, 2
- **Parity:** none, even, odd
- **Surge Protection:** 2500 V_{DC}
- **Speed (bps):** 50 ~ 921.6 K
- **Data signals:**

  TxD, RxD, RTS, CTS, DTR, DSR, DCD, RI, GND (for RS-232)

  TX+, TX-, RX+, RX-, RTS+, RTS-, CTS+, CTS-, GND (for RS-422)

  DATA+, DATA-, GND (for RS-485)
- **Power consumption:**

	Typical	MAX
+5V	220mA	285mA
+3.3V	100mA	200mA
+12v	60mA	80mA

- **Dimensions:** 160 mm x 100 mm
- **Operating temperature:** 0'C ~ 70'C (referring to IEC68-2-1, 2)
- **Operating Humidity:** 5 ~ 95% Relative Humidity,
  non-condensing (referring to IEC 68-2-1, 2)
- **Operating Humidity:** 5 ~ 95% Relative Humidity,
  non-condensing (referring to IEC 68-2-3)
- **Storage Temperature:** -20 ~ 80'C

Chapter 2

Hardware Configuration

This chapter gives users a package item checklist, proper instructions about unpacking and step-by-step procedures for card installation.

2.1 Initial Inspection

In addition to this manual, you should find the following items inside the shipping package of the MIC-3612:

- CPCI communication interface card
- Advantech Automation Software CD-ROM
- CPCI communication card user's manual
- Wiring cable

We have carefully inspected the CPCI communication card series before shipping it. It should be free of marks and scratches and in perfect working order on receipt. As you unpack the CPCI communication card series, check it for signs of shipping damage (damaged box, scratches, dents, etc.). If it is damaged or it fails to meet specifications, notify our service department or your local sales representative immediately. Also notify the carrier. Retain the shipping carton and packing material for inspection by the carrier. After inspection we will make arrangements to repair or replace the unit.
When you handle the CPCI communication card series, remove it from its protective packaging by grasping the rear metal panel. Keep the anti-vibration packaging. Whenever you remove the card from the PC, store it in this package for protection.

Note:

Discharge your body' s static electric charge by touching the back of the grounded chassis of the system unit (metal) before handling the board. You should avoid contact with materials that hold a static charge such as plastic, vinyl and styrofoam. Handle the board only by its edges to avoid static damage to its integrated circuits. Avoid touching the exposed circuit connectors. We also recommend that you use a grounded wrist strap and place the card on a static dissipative mat whenever you work with it.

2.2 Hardware Installation

Note

Make sure you have installed the driver first before installing the card (Please refer to the software installation in ***Chapter 3 Driver Setup & Installation***).

When you install the MIC-3612 Card, be sure the DLL driver of the MIC-3612 installation is complete, you can now go on to install the MIC-3612 card in your CPCI computer. But it is suggested that you should refer to the computer user manual or related documentation if you have any doubt. Please follow the steps below to install the card on your system.

To install a card:

Step 1: Remove one cover on the unused slot of your CPCI computer slot.

Step 2: Hold the Card Vertically. Be sure that the card is pointing in the correct direction. The components of the card should be pointing to the right-hand side and the black handle of the card should be pointing to lower edge of the chassis.

Step 3: Holding the lower handle, pull the handle down to unlock it.

Step 4: Insert the MIC-3612 card into the CPCI chassis carefully by sliding the lower edges of the card into the card guides.

Step 5: Please push the card into slot gently by sliding the card along the card guide until J1 meets the long needle on the backplane.

Note

If your card is correctly positioned and has been slid all the way into the chassis, the handle should match the rectangular holes. If not, remove the card from the card guide and repeat step 3 again. Do not try to install a card by forcing it into the chassis.

Step 6: Push the card into the right place; secure the card by pushing the handle on to lock it into place.

Note

The **Blue LED** on the front panel details the installation status of the card while the system is on.

In **step 5,** when J1 meets the long needle on the backplane, **Blue LED** will light; after **step 6**, the system can configure the card automatically, and the **Blue LED** is turned off when the system finished the device configuration.

If the system power is off, you can install the card step by step without attending **Blue LED's** state.

To remove a card:

Step 1: Push the handle down to unlock the card, then the CPCI system will automatically uninstall the card configuration.

Step 2: Once the system finished the device configuration, the **Blue LED** on the front panel will turn on. Now you can slide the card out.

Note 1

Advantech MIC-3612's "Hot-Swap" function complies with CPCI Hot Swap Specification PICMG 2.1 R2.0.

Note 2

Because of the "Hot-Swap", the above steps detail the card removal process while the system is on.

If the system power is off, please follow **step1** and **step2** and disregard the status of the **Blue LED**.

2.3 I/O Address and Interrupt Setup

In this section, you will learn to set an I/O base address for the MIC-3612.

Base address setting

When the MIC-3612 is installed in the system or if the machine is first turned on, the configuration software must scan the various buses in the system. If the software locates the MIC-3612, the system will configure the device based on the parameters of the PCI device configuration registers, including the I/O base address, I/O range, memory base address, memory range, and so forth. The I/O base address is the base address on the four ports of the MIC-3612 card. The four ports address and interrupt register setting are as shown:

Base Address Setting	
CH 1	Base Add. + 00H
CH 2	Base Add. + 08H
CH 3	Base Add. + 10H
CH 4	Base Add. + 18H
Interrupt Register	Base Add. + 62H

Interrupt Register

The four-port interrupt belongs to the share interrupt mode. Read the register to achieve current interrupt status of all 4 channels. Active high indicates that interrupt is dependent on which channel.

Interrupt Register (Base Add. + 62H)	
Bit	**Function**
0	CH 1
1	CH 2
2	CH 3
3	CH 4
4	Not Used
5	Not Used
6	Not Used
7	Not Used

2.4 Board Layout: Dimensions

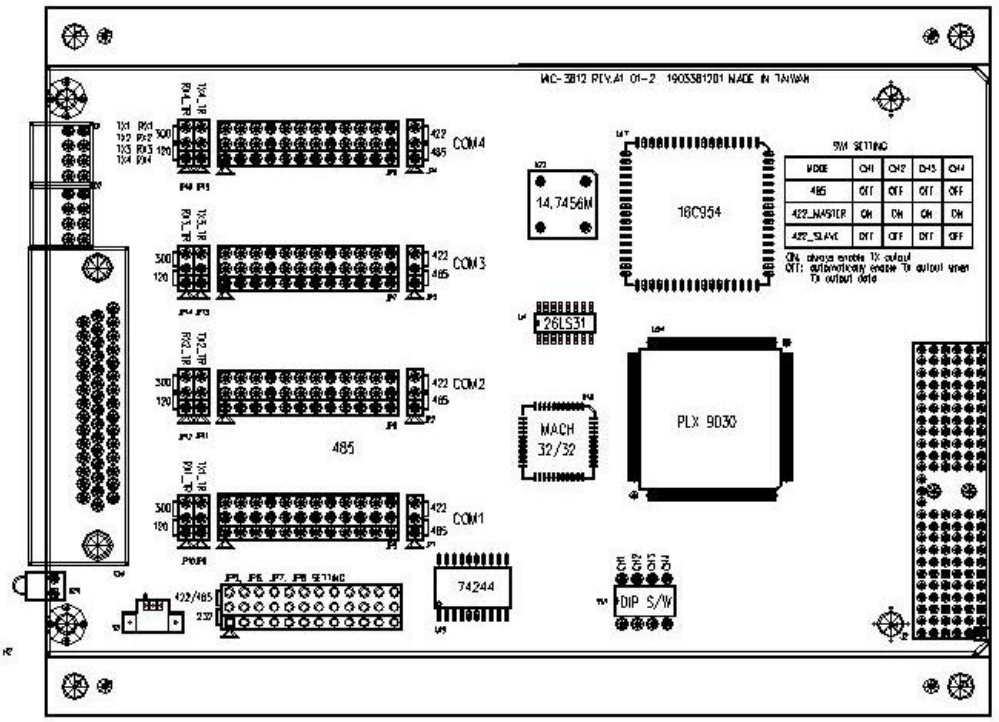


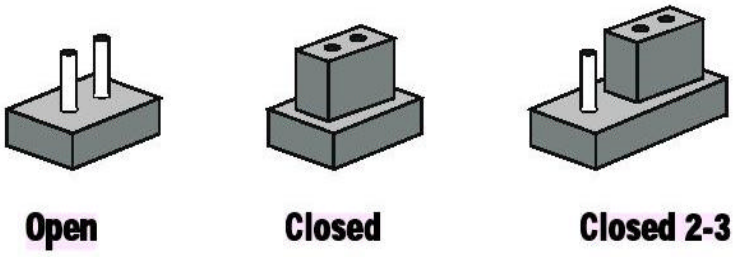
Figure 2-1: MIC-3612 board layout: Dimensions

2.5 Jumper Setting

This section provides the card default configuration and the options for setting each jumper.

How to set jumpers

You configure your card to match the needs of your application by setting the jumpers. A jumper is the simplest kind of electric switch. It consists of two metal pins and a small metal clip (often protected by a plastic cover) that slides over the pins to connect them. To "close" a jumper you connect the pins with the clip. To "open" a jumper you remove the clip. Sometimes a jumper will have three pins, labeled 1, 2 and 3. In this case you would connect either pins 1 and 2 or 2 and 3. You may find a pair of needle-nose pliers for setting the jumpers. If you have any doubts about the best hardware configuration for your application, contact your local distributor or sales representative before you make any changes.



Jumper setting example

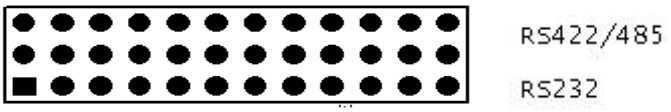
Default Settings

The board is shipped with default settings (all ports are set to RS-485 mode with 3000 terminator resistors). If you need to change these settings, however, see the following sections. Otherwise, you can simply install the card.

For MIC-3612, each port can support three operation modes, RS-232, RS-485 and RS-422.

- **RS-232 mode**

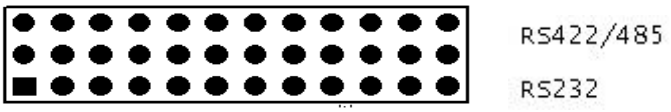
  For RS-232 operation mode, set the jumper group U1 (U2,U8,U9) for Port 1 (2,3,4) to the RS-232 available position.



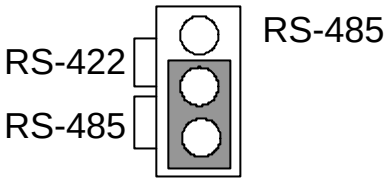
- **RS-485 mode**

  For RS-485 operation mode, users will have to use the following list to set the jumpers.

  1. Jumper group U1 (U2,U8,U9) for Port 1 (2,3,4) to the RS-422/485.



2. Jumper JP1 (JP2,JP3,JP4) for Port 1(2,3,4) to the RS-485.



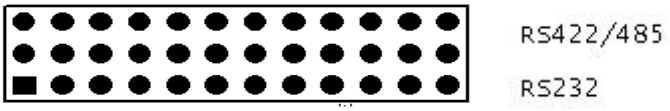
3. DIP switch S1 have to switch to "AUTO" for RS-485 mode

	CH1	CH2	CH3	CH4
ON	ON	ON	ON	ON
OFF	AUTO	AUTO	AUTO	AUTO

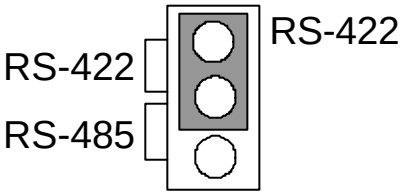
- **RS-422 Master mode**

For RS-422 Master mode, the RS-422 Tx signal will always be enabled. For this mode, users will have to use the following list to set the jumpers.

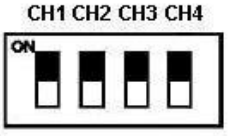
1. Jumper group U1 (U2,U8,U9) for Port 1 (2,3,4) to the RS-422/485.



2. Jumper JP1(JP2,JP3,JP4) for Port 1(2,3,4) to the RS-422.



3. For RS-422 Master mode, DIP switch S1 will have to be "ON"

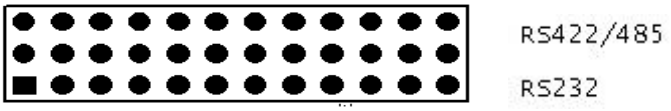


	CH1	CH2	CH3	CH4
ON	ON	ON	ON	ON
OFF	AUTO	AUTO	AUTO	AUTO

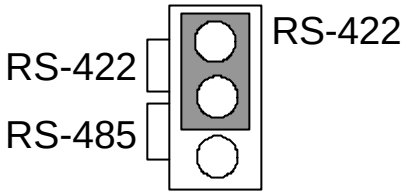
- **RS-422 Slave mode**

  For RS-422 Slave mode, the RS-422 Tx signal will be auto-enabled to send the data. To set this mode, users will have to use the following list to set the jumpers.

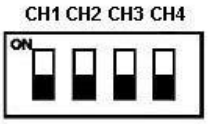
1. Jumper group U1 (U2,U8,U9) for Port 1 (2,3,4) to the RS-422/485.



2. Jumper JP1(JP2,JP3,JP4) for Port 1(2,3,4) to the RS-422.



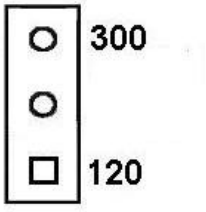
3. For RS-422 Slave mode, DIP switch S1 will have to be switched to "AUTO"



	CH1	CH2	CH3	CH4
ON	ON	ON	ON	ON
OFF	AUTO	AUTO	AUTO	AUTO

Terminator resistor setup (JP4~JP12)

In the RS485/422 mode, you can install terminator resistors to match line impedance. For each signal line Tx (Data), Rx will have to be a separate resistor 120Ω or 300Ω. For more details about jumper locations please refer to Figure 2-1.



Chapter 3

Pin Assignment & Wiring

3.1 Pin assignments

The following diagrams show the pin assignments for the MIC-3612 DB44P connector.

RS-232 Mode

The MIC-3612 has 4 RS-232 ports. The following lists the pin assignments of the DB44 connector on the bracket. You may fabricate the cable for DB44 to 4 x DB9 with these output pin.

Pin No.	Signal	Pin No.	Signal	Pin No.	Signal
1	TX0	17	DTR0	3	RTS0
2	RX0	18	DSR0	16	CTS0
31	DCD0	32	RI0	33	GND
5	TX1	21	DTR1	7	RTS1
6	RX1	22	DSR1	20	CTS1
35	DCD1	36	RI1	37	GND
9	TX2	25	DTR2	11	RTS2
10	RX2	26	DSR2	24	CTS2
39	DCD2	40	RI2	41	GND
13	TX3	29	DTR3	15	RTS3
14	RX3	30	DSR3	28	CTS3
42	DCD3	43	RI3	44	GND

Table 3-1: MIC-3612 DB44 Connector Pin Assignment for RS-232 Mode

The Table 3-2 is the description of DB9P male connector.

Signal	Name	Pin#	Mode
GND	Ground	5	
TX	Transmit Data	3	Output
DTR	Data Terminal Ready	4	Output
RTS	Request To Send	7	Output
RX	Receive Data	2	Input
DSR	Data Set Ready	6	Input
CTS	Clear To Send	8	Input
DCD	Data Carrier Detect	1	Input
RI	Ring Indicator	9	Input

Table 3-2: RS232 Mode DB9 Male Connector Description

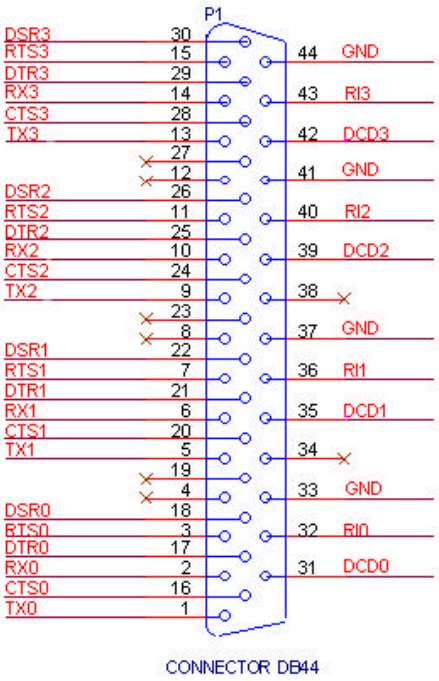


Figure 3-1: MIC-3612 DB44 Connector RS-232 Mode

RS-485 Mode

The MIC-3612 has 4 RS-485 ports. The following lists the pin assignments for the DB44 connectors on the bracket. You may copy the octopus cable for DB44 to 4 x DB9 with these output pin.

Pin No.	Signal	Pin No.	Signal	Pin No.	Signal
2	DATA0+	31	DATA0-	33	GND
6	DATA1+	35	DATA1-	37	GND
10	DATA2+	39	DATA2-	41	GND
14	DATA3+	42	DATA3-	44	GND

Table 3-3: MIC-3612 DB44 Connector Pin Assignment for RS-485 Mode

The Table 3-2 is the description of DB9P male connector.

Signal	Name	Pin#
GND	Ground	5
DATA-	Transmit Data	1
DATA+	Data Terminal Ready	2

Table 3-4:RS-485 Mode DB9P Male Connector Description

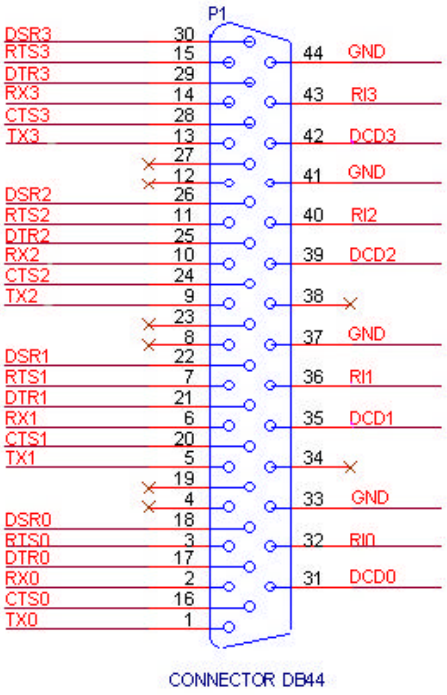


Figure 3-1: MIC-3612 DB44 Connector RS-232 Mode

RS-422

MIC-3612 has 4 RS-422 ports. The following lists the pin assignments of the DB44 connector on the bracket. You may fabricate octopus cable for DB44 to 4 x DB9 with these output pin.

Pin No.	Signal	Pin No.	Signal	Pin No.	Signal
2	TX0+	3	RTS0+	33	GND
31	TX0-	18	RTS0-		
1	RX0+	16	CTS0+		
17	RX0-	32	CTS0-		
6	TX1+	7	RTS1+	37	GND
35	TX1-	22	RTS1-		
5	RX1+	20	CTS1+		
21	RX1-	36	CTS1-		
10	TX2+	11	RTS2+	41	GND
39	TX2-	26	RTS2-		
9	RX2+	24	CTS2+		
25	RX2-	40	CTS2-		
14	TX3+	15	RTS3+	44	GND
42	TX3-	30	RTS3-		
13	RX3+	28	CTS3+		
29	RX3-	43	CTS3-		

Table 3-5: MIC-3612 DB44 Connector Pin Assignment for RS-422 Mode

The Table 3-6 is the description of DB9P male connector.

Signal	Name	Pin#
GND	Ground	5
TX+	Transmit Data+	2
TX-	Transmit Data-	1
RX+	Receive Data+	3
RX-	Receive Data-	4
RTS+	Request To Send+	7
RTS-	Request To Send-	6
CTS+	Clear To Send+	8
CTS-	Clear To Send-	9

Table 3-6:RS-422 Mode DB9 Male Connector Description

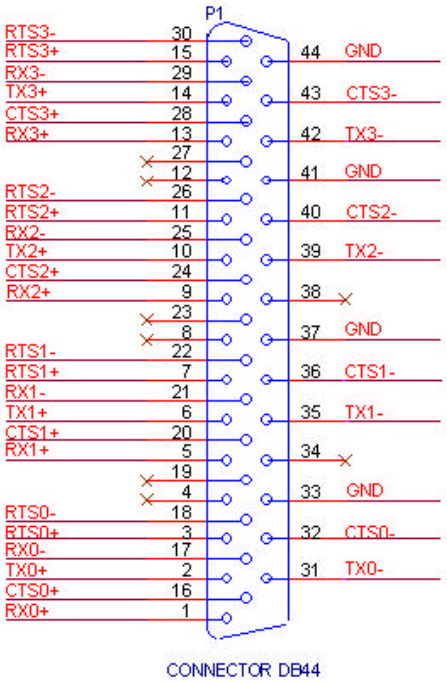


Figure 3-3: MIC-3612 DB44 Connector RS-422 Mode

Chapter 4

Register Structure

4.1 Register Structure

This chapter gives short descriptions of each of the module's registers. For more information please refer to the data book for the OX16C954 UART chip.
All registers are one byte. Bit 0 is the least significant bit, and bit 7 is the most significant bit. The address of each register is specified as an offset from the port base address (BASE).

DLAB is the "Divisor Latch Access Bit, bit 7 of BASE+3.
BASE+0 Receiver buffer register when DLAB=0 and the operation is a read.
BASE+0 Transmitter holding register when DLAB=0 and the operation is a write.
BASE+0 Divisor latch bits 0 - 7 when DLAB=1.
BASE+1 Divisor latch bits 8 - 15 when DLAB=1

The two bytes BASE+0 and BASE+1 together form a 16-bit number, the divisor, which determines the baud rate together with the values of TCR and CPR and Bit7 of MCR(Modem Control Register) (refer to 16C954 datasheet). The formula to set BaudRate as follows:

$$BaudRate = \frac{InputClock}{SC * Divisor * prescaler}$$

In formula, ***SC*** is sample clock value defined by TCR, when TCR=0x00, ***SC*** =16.
Prescaler is defined by MCR[7] and CPR.
Prescaler = 1 when MCR[7] = ‘ 0’;
Prescaler = M+(N / 8), when MCR[7] =‘1’,
where: M = CPR[7:3] (Integer part – 1 to 31)
N = CPR[2:0] (Fractional part – 0.000 to 0.875)

While Bit7 of MCR is Logic”1”, TCR=0x00 and CPR=0x40, set the divisor as follows:

Baudrate	Divisor	Baudrate	Divisor
50	2304	3600	32
75	1536	4800	24
150	768	7200	16
300	384	9600	12
600	192	19200	6
1200	96	38400	3
1800	64	57600	2
2400	48	115200	1

Table 4-1

Else, while Bit7 of MCR is Logic"0", TCR=0x00, set the divisor as follows:

Baudrate	Divisor
230400	4
307200	3
460800	2
921600	1

Table 4-2

BASE+1 Interrupt Enable Register (IER) when DLAB=0

Bit0 Enables received-data-available interrupt

Bit1 Enables transmitter-holding-register-empty interrupt

Bit2 Enables receiver-line-status interrupt

Bit3 Enables modem-status interrupt

Register Mode	650/950 Mode	550/750 Mode
Bit4	Sleep mode	
Bit5	Special Char detect	Alternate sleep mode
Bit6	CTS Interrupt mask	Unused
Bit7	RTS Interrupt Mask	

Table 4-3

BASE+2 (read) Interrupt status register (ISR)

Register	ISR
Bit0	Interrupt pending
Bit1	Interrupt priority (All modes)
Bit2	
Bit3	
Bit4	Interrupt priority (Enhanced mode)
Bit5	
Bit6	FIFOs enabled
Bit7	

Table 4-4

Level	Interrupt source	ISR[5:0] *see note 3*
-	No interrupt pending [1]	000001
1	Receiver status error **or** Address-bit detected in 9-bit mode	000110
2a	Receiver data available	000100
2b	Receiver time-out	001100
3	Transmitter THR empty	000010
4	Modem status change	000000
5 [2]	In-band flow control XOFF **or** Special character (XOFF2) **or** Special character 1, 2, 3 or 4 **or** bit 9 set in 9-bit mode	010000
6 [2]	CTS or RTS change of state	100000

Table 4-5: Interrupt Status Identification Codes

Note

1. ISR[0] indicates whether any interrupts are pending.
2. Interrupts of priority levels 5 and 6 cannot occur unless the UART is in Enhanced mode.
3. ISR[5] is only used in 650 & 950 modes. In 750 mode, it is ' 0' when FIFO size is 16 and ' 1' when FIFO size is 128. In all other modes it is permanently set to 0

BASE+2 (write) FIFO Control Register (FCR)

Bit0 Enables transmit and receive FIFO

Bit1 Clears contents of receive FIFO

Bit2 Clears contents of transmit FIFO

Bits6-7 Sets trigger level for receiver FIFO interrupt.

Bit 7	Bit 6	FIFO Trigger Level
0	0	16
0	1	32
1	0	112
1	1	120

Table 4-6

BASE+3 Line Control Register (LCR)

Bit 0 Word length select bit 0

Bit 1 Word length select bit 1

Bit 2 Number of stop bits

Bit 3 Parity enable

Bit 4 odd/even parity select

Bit 5 Force parity

Bit 6 Tx break

Bit 7 Divisor Latch Access Bit (DLAB)

Bit 1	Bit 0	Word Length(bits)
0	0	5
0	1	6
1	0	7
1	1	8

Table 4-7

BASE+4 Modem Control Register (MCR)

Bit 0 DTR

Bit 1 RTS

Bit 3 Interrupt enable by software

Bit 7 Baud prescale select

BASE+5 Line Status Register (LSR)

Bit 0 Receiver data ready

Bit 1 Overrun error

Bit 2 Parity error

Bit 3 Framing error

Bit 4 Breaks interrupt

Bit 5 Transmitter holding register empty

Bit 6 Transmitter shift register empty

Bit 7 At least one parity error, framing error or break indication on FIFO

BASE+6 Modem Status Register (MSR)

Bit 0 Delta CTS

Bit 1 Delta DSR

Bit 2 Trailing edge ring indicator

Bit 3 Delta received line signal detect

Bit 4 CTS

Bit 5 DSR

Bit 6 RI

Bit 7 DCD

BASE+7 Temporary data register and indexed control

Register offset value bits

Register to select auto 485 mode

Each UART in OX16c954 has one ACR register (Additional control register), **Bits [4:3]** in which it is used to set auto 485 mode with hardware circuit of MIC-3612. The ACR register is one register located at offset 0x00 of the 16c954's Indexed Control Register. Set "11" to **Bits[4:3]** of this register to select auto 485 mode and "00" to select compatible with 16C450, 16C550,16C650 and 16C750. For more information on configuring the ACR, please refer to the data sheet of OX16C954 UART chip.

Interrupt Vector Register

MIC-3612 has an interrupt vector register. It is outside logic circuit from UARTs and the address of register is **BASE+62H.** Read the register to achieve current interrupt status of all 8 channels. Active high, to indicate that interrupt is pending in which channel.