# AC32

# DUAL CHANNEL

# RS422/RS485 ADAPTER CARD

# For Micro Channel

# Computers

Form 184.6

February 1995

**OPTO 22**

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For Technical Assistance call our new 24 hour Hotline: 1-800-HLP-OPTO (1-800-457-6786)
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This technical document describes the features, specifications, and operations of the product.

The information in this manual has been carefully checked and is believed to be accurate; however, no responsibility is assumed for possible inaccuracies or omissions. Specifications are subject to change without notice.

Opto 22 warrants all its products to be free from defects in material or workmanship for 24 months from the manufacturing date code.

This warranty is limited to the original cost of the unit only and does not cover installation labor or any other contingent costs.

# Table of Contents

## WARNING!!!

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

# General Information

The AC32 card is an IBM PS/2 compatible, dual channel, asynchronous communications card directly compatible with the OPTOMUX family of intelligent controllers. The AC32 also provides an additional RS-422/485 serial port for a terminal or another computer.

## Summary of Features

- Serial links transient protected
- Multidrop capability
- RS-422/485 balanced line drivers
- Up to 5,000 feet cable length
- Baud rates from 300 to 38.4 KBd
- Two channels of asynchronous communications

## Electrical Interface

RS-422/485 line drivers are used to give the AC32 asynchronous adapter card the ability to communicate over long distances (5,000 feet) at baud rates up to 38.4k baud. The RS-422/485 drivers are highly immune to electrical noise.

# Jumper Installation

## Configuration

Before installing your AC32, configure your board by selecting the appropriate communications jumpers.

**Note:** Channel B Jumpers have the same functions and are designated with a B (i.e., B1, B2, ...).

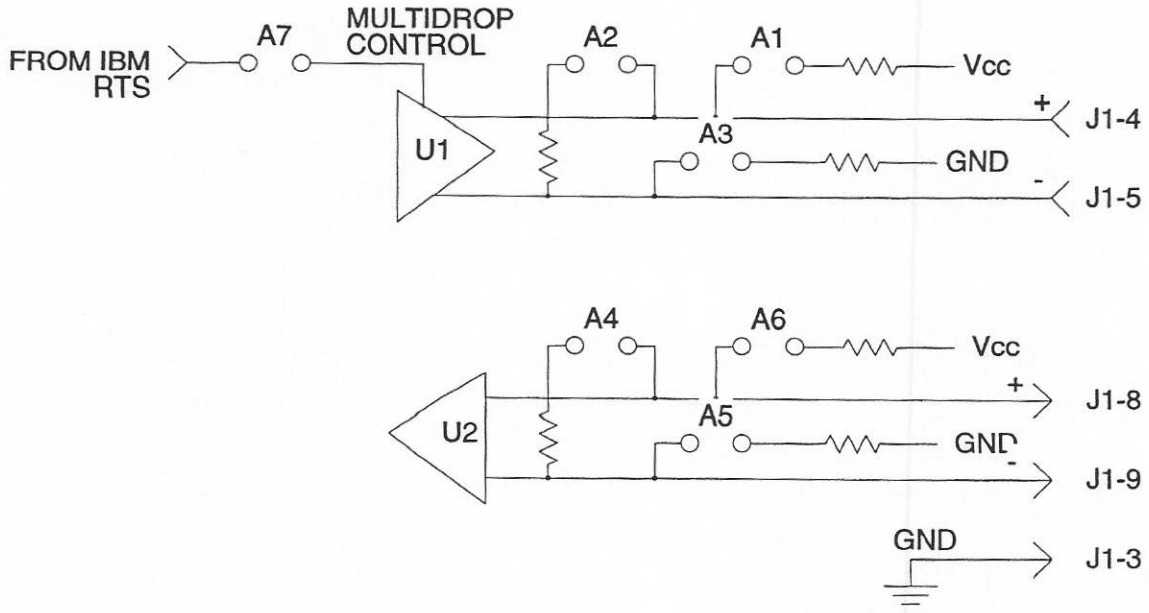


**Figure 1** - Channel A Jumpers

# Communication Jumpers

## Channel A

Installing Jumpers A2 and A4 connects 220 ohm terminating resistors from + to - on the transmitter (to OPTOMUX) and receiver (from OPTOMUX), respectively. In a normal OPTOMUX network, these jumpers should both be installed.

## Channel B

Installing Jumpers B2 and B4 connects 220 ohm terminating resistors from + to - on the transmitter (to OPTOMUX) and receiver (from OPTOMUX), respectively. In a normal OPTOMUX network, these jumpers should both be installed.

**Note:** If multiple host computers are used, Jumpers A2 and A4 or B2 and B4 should only be installed on the AC32 channels, which are physically at the end of the serial network cables.

## Channel A

Jumper A7 controls the enabling of the Channel A RS-422/485 driver. With the jumper removed, the driver is always enabled. With the jumper installed, the enabling is under the control of the RTS output on the UART. When RTS is active, the driver is enabled. When it is inactive, the driver is disabled.

If Jumper A7 is installed, Jumpers A1 and A3 must be installed. These jumpers passively pull the transmit lines (to OPTOMUX) to the inactive state.

## Channel B

Jumper B7 controls the enabling of the Channel B RS-422/485 driver. With the jumper removed, the driver is always enabled. With the jumper installed, the enabling is under the control of the RTS output on the UART. When RTS is active, the driver is enabled. When it is inactive, the driver is disabled.

Jumper B7 is installed, Jumpers B1 and B3 must be installed. These jumpers passively pull the transmit lines (to OPTOMUX) to the inactive state.

## Channel A

If the AC32 Channel A is operating with a multidrop OPTOMUX network, Jumpers A5 and A6 must be installed. These jumpers passively pull the receive lines (from OPTOMUX) to the inactive state.

## Channel B

If the AC32 Channel B is operating with a multidrop OPTOMUX network, Jumpers B5 and B6 must be installed. These jumpers passively pull the receive lines (from OPTOMUX) to the inactive state.

# Group A and B Jumpers

Figure 2 shows the normal jumper arrangement for jumper positions A1 through A7 and B1 through B7. This arrangement is suitable if the AC32 is being used to communicate with two OPTOMUX networks.

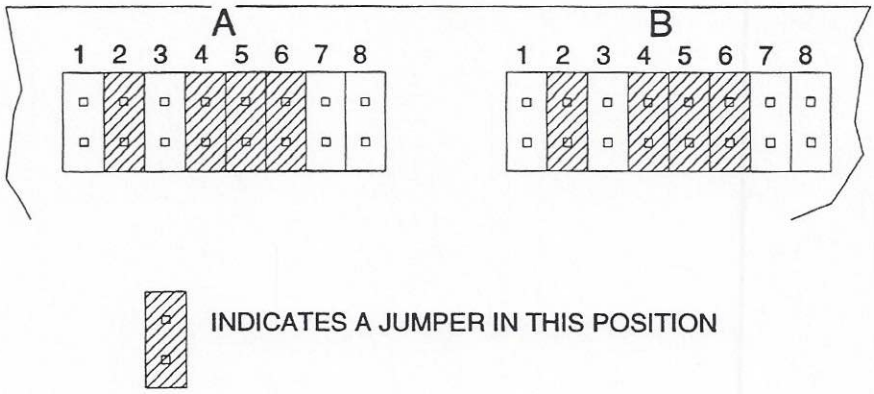


**Figure 2** - Default Group A and B Jumper Settings

Your AC32 card is now ready to be plugged into any open slot in your IBM PS/2.

**Group A Jumper Descriptions**

| | |
|---|---|
| A1 | Pull up jumper for the transmit line |
| A2 | Terminate jumper for the transmit line |
| A3 | Pull down jumper for the transmit line |
| A4 | Terminate jumper for the receive line |
| A5 | Pull down jumper for the receive line |
| A6 | Pull up jumper for the receive line |
| A7 | Enables the RS422/485 driver from the RTS output on the UART |
| A8 | Not used |

**Group B Jumper Descriptions**

| | |
|---|---|
| B1 | Pull up jumper for the transmit line |
| B2 | Terminate jumper for the transmit line |
| B3 | Pull down jumper for the transmit line |
| B4 | Terminate jumper for the receive line |
| B5 | Pull down jumper for the receive line |
| B6 | Pull up jumper for the receive line |
| B7 | Enables the RS422/485 driver from the RTS output on the UART |
| B8 | Not used |

# Configuration

The AC32 is designed for operation with the IBM PS/2 computers featuring the Micro Channel bus. The AC32 supports the Programmable Option Select (POS) functions associated with the Micro Channel. The POS is designed to eliminate the jumpers normally used to select card address and interrupt lines. You will need the Opto 22 diskette, part number 8860, to do the following procedure which is required for the initial installation of the AC32. (If you do not have the diskette, you may download the installation files from the Opto 22 BBS. See the Appendices for more information.)

1. Make a Backup copy of IBM supplied Reference Diskette (Version 1.01 or later), using the DOS DISKCOPY commands.*
2. Copy all the files on the OPTO 22 supplied diskette to the new Backup Diskette.
3. Turn off the IBM PS/2 and install the AC32 adapter card.
4. Turn on the IBM PS/2 and insert Backup Diskette.
5. During boot up, the IBM PS/2 will beep twice and automatically load the configuration program.
6. Follow the instructions as displayed and select AUTOMATIC CONFIGURATION.
7. When configuration is complete, remove the Backup Diskette and press ENTER.
8. The IBM PS/2 will reboot and beep once to signal a good configuration.
9. The AC32 will now have Channel A assigned as COM2 and Channel B assigned as COM3.**

* Please refer to the DOS manual for information on copying diskettes.

** To change these assignments, use the IBM supplied Reference Diskette and DO NOT select AUTOMATIC CONFIGURATION. You will then be presented with a menu of choices which is documented in the IBM manual.

# Network Connection

Now that you have installed the AC32 card in the IBM PS/2, wire the connector that comes with the card.

## Required Equipment

- soldering iron
- solder
- wire stripper
- cable with two twisted pairs plus at least one additional conductor OR a variety of color-coded wires (22 gauge minimum) for data link

## Connecting Wire

Figure 3 shows the wiring between the D-shell connector and the first OPTOMUX on the link. Please note that the pin numbers are labeled on the connector.

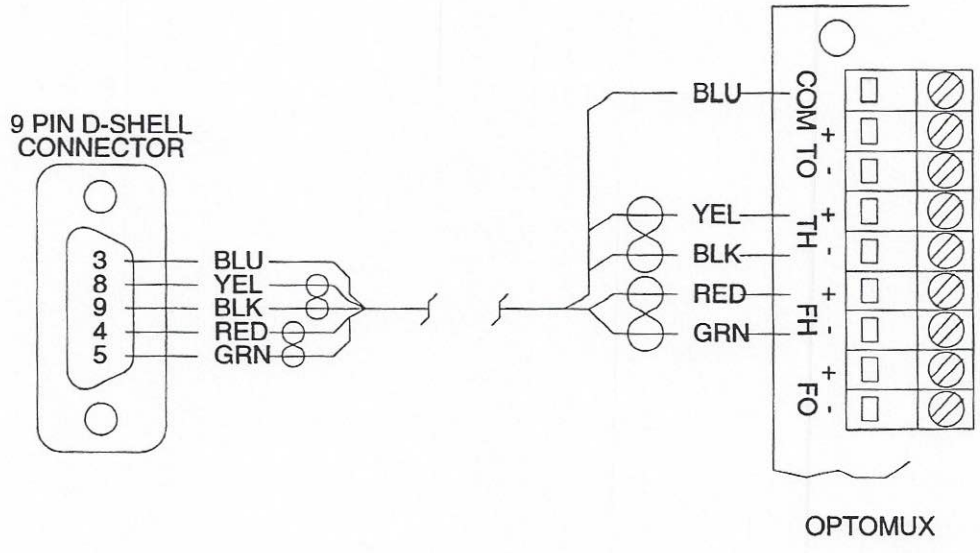


Figure 3 - Adapter Card to OPTOMUX Connection

# Communicating With OPTOMUX

Before applying power to OPTOMUX, set the baud rate and command protocol on the OPTOMUX. The baud rate and command protocol are selected by the B group of jumpers on the OPTOMUX. For the checkout, remove all of the B group jumpers from the OPTOMUX. This will select a baud rate of 300, the 4-pass protocol, and an OPTOMUX address of 255.

Connect the D-shell connector to the AC32 card and turn on the power to the IBM PS/2 and the OPTOMUX. To test the link, enter the IBM BASIC interpreter and type the following program into the IBM PS/2. The underlined part of line ten will have to be changed to COM1 when using the AC32 card as communications port number one.

```
10    OPEN "COM2:300,N,8,1,RS,CS,CD,DS" AS #1
20    PRINT #1,">FFACD"
30    INPUT #1,B$
40    PRINT B$
```

When running the program, both the receive and transmit LED's on the OPTOMUX will flash. The IBM PS/2 will display the AFFACD on the screen. If nothing is displayed, verify that all the wiring has been done correctly.

## Communicating with Terminals or Other Computers

Figure 4 shows the connection between the AC32 and a terminal or computer. Please note that the transmit lines from the AC32 must be connected to the receive lines of the terminal or computer and vice versa.

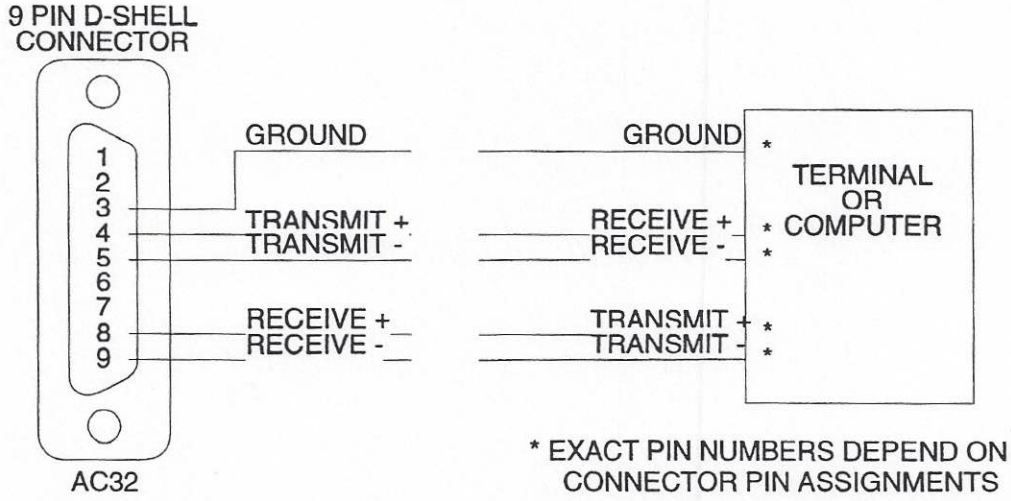


Figure 4 - Adapter Card to Computer Connection

If the connection between the AC32 and the computer or terminal has been made as shown and there is a problem with communication, check the communication port setup at both ends for corresponding baud rate, word length, parity, protocol, etc.

If there is still a problem, the AC32 end can be checked by looping the transmit lines (+ and -) to the receive lines (+ and -), as shown in Figure 5, and operating the program example shown on page 7.

MALE CONN - SOLDER SIDE

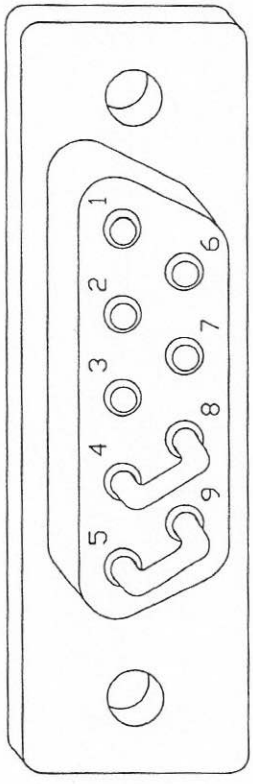


Figure 5 - Connection Between AC32 and Pin Assignment

# Appendix

## Configuring The IBM PS/2 Serial Port

The IBM PS/2 uses a 16550 UART device for serial communications. The DOS operating system and many of the programming languages use calls to the BIOS to configure the serial port. However, the BIOS will only accept baud rates of 19,200 or less. This is generally because reliable communications cannot be maintained by the inefficient BIOS routines for transmitting and receiving characters.

The OPTOWARE driver accesses the 16550 UART directly for transferring characters, therefore allowing higher baud rates to be used. Since the OPTOWARE driver does not do any initialization for the baud rate, the 16550 UART must be initialized prior to calling the driver.

## The 16550 UART Registers

The 16550 UART device contains several registers which specify which baud rate and type of protocol to use. The program listings which follow this section use variables for the values to be written to the registers. These variables can be set to values which would provide the desired baud rate and protocol. The following tables specify the range of values that can be used.

| PORT | BASE Variable | Interrupt |
|---|---|---|
| COM1 | 3F8 Hex | (IRQ4) |
| COM2 | 2F8 Hex | (IRQ3) |
| COM3 | 3220 Hex | * |
| COM4 | 3228 Hex | * |
| COM5 | 4220 Hex | * |
| COM6 | 4228 Hex | * |
| COM7 | 5220 Hex | * |
| COM8 | 5228 Hex | * |

| BAUD RATE | DLH | DLL Variables |
|---|---|---|
| 38400 | 00 | 03 |
| 19200 | 00 | 06 |
| 9600 | 00 | 0C Hex |
| 4800 | 00 | 18 Hex |
| 2400 | 00 | 30 Hex |
| 1200 | 00 | 60 Hex |
| 300 | 01 | 80 Hex |

## PROTOCOL

| Data | Parity | Stop | DLAB Variable |
|---|---|---|---|
| 8 | NONE | 1 | 03 |
| 8 | EVEN | 1 | 1B Hex |
| 8 | ODD | 1 | 0B Hex |
| 8 | NONE | 2 | 07 |
| 8 | EVEN | 2 | 1F Hex |
| 8 | ODD | 2 | 0F Hex |
| 7 | NONE | 1 | 02 |
| 7 | EVEN | 1 | 1A Hex |
| 7 | ODD | 1 | 0A Hex |
| 7 | NONE | 2 | 06 Hex |
| 7 | EVEN | 2 | 1E Hex |
| 7 | ODD | 2 | 0E Hex |

To set the baud rate on the 16550, a value of 80 Hex must first be written to the register at location BASE + 3. The DLL value can then be written to the register at location BASE, and the DLH value can be written to the register at location BASE + 1. Once these values have been written, the DLAB value can be written to the register at location BASE + 3. Finally, a value of 2 is written to the register at location BASE + 4.

For more detailed information on the registers of the 16550 UART, please refer to the IBM PS/2 Technical Reference Manual #68X2260.

### List of Files, Opto 22 Diskette, p/n 8860

@6c67.adf
@6c68.adf
@6c69.adf
lctrm137.exe
os131.exe
readme.exe
read.me

### Opto 22 BBS and Technical Support Hotline

BBS: (909)695-1367

Technical Support: 1-800-835-6786
(909)695-3080

# Program Examples

## Turbo PASCAL Example

```
Procedure SetPort;
const
        BASE = $3F8;                    {COM1 Address}
        DLL = 6;                        {19.2k baud}
        DLH = 0;
        DLAB = 3;                       {8 data, no parity, 1 stop bit}

begin
        Port [BASE + 3] := $80;         {Write parameters to registers}
        Port [BASE] := DLL;
        Port [BASE + 1] := DLH;
        Port [BASE + 3] := DLAB;
        Port [BASE + 4] := 2;
end;
```

## BASIC Example

```
BASE% = &H3F8                   'Base address of COM1
DLL% = 6                        '19.2k baud
DLH% = 0
DLAB% = 3                       '8 data, no parity, 1 stop for OPTOMUX
OUT BASE% +3,&H80               'Sets up control register of 16550
OUT BASE%,DLL%                  'Write parameters out to registers
OUT BASE% + 1,DLH%
OUT BASE% + 3,DLAB%
OUT BASE% + 4,2                 'Sets RTS to always be low
```

## Turbo C Example

```
#include <stdio.h>
#include <dos.h>

#define BASE 0x2F8              /* COM2 address */
#define DLL 0x03                /* 38.4k baud */
#define DLH 0x00
#define DLAB 0x03               /* 8 data, no parity, 1 stop */

void setport( )
{
        outportb (BASE + 3,0x80);
        outportb (BASE,DLL);
        outportb (BASE + 1,DLH);
        outportb (BASE + 3,DLAB);
        outportb (BASE +4,2);
}
```

## Microsoft C Example

```
#include <stdio.h>
#include <conio.h>

#define BASE 0x2F8              /* COM2 address */
#define DLL 0x03                /* 38.4k baud */
#define DLH 0x00
#define DLAB 0x03               /* 8 data, no parity, 1 stop */

setport( )
{
        outp (BASE +3,0x80);
        outp (BASE,DLL);
        outp (BASE + 1,DLH);
        outp (BASE + 3,DLAB);
        outp (BASE + 4,2);
}
```

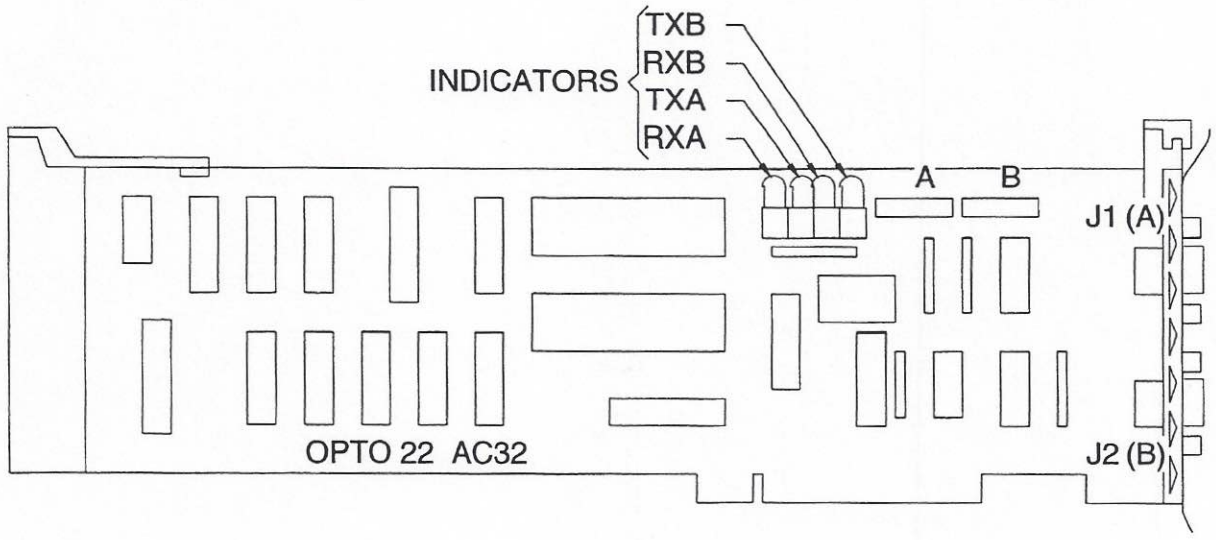


Figure 6 - AC32 Adapter Card Layout

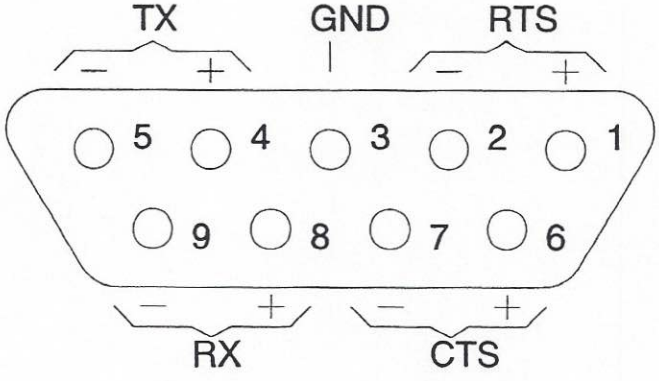


Figure 7 - 9 Pin D-Shell Connector

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