AC34

Single-Channel, Isolated, RS-422/RS-485 Adapter Card for Micro Channel Computers

Form 195.2

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OPTO 22

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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

GENERAL INFORMATION

The AC34 adapter card is a Micro Channel bus compatible, single channel, asynchronous communications card directly compatible with the OPTOMUX family of intelligent controllers.

Summary of Features

- Serial links transient protected
- Multidrop capability
- RS422/RS485 balanced line drivers
- Up to 5000 feet cable length
- Baud rates up to 38.4 k baud
- Full hardware and software compatibility with Micro Channel computers
- One channel of asynchronous communication
- Bi-directional CTS and RTS handshaking lines
- Optical isolated and transformer isolated up to 4000 volts

Electrical Interface

The AC34 adapter card uses RS422/RS485 line drivers to communicate over long distances (5000 feet) at baud rates up to 38.4 k baud. The RS422/RS485 drivers are highly immune to electrical noise. However, the communications cable MUST be twisted pair wires to insure this immunity. Use of straight or bundled wire is NOT recommended and may cause errors in communication due to crosstalk or external noise sources.

A recommended cable is BELDEN #8162 (2 pair) or #8164 (4 pair) Computer Cables for EIA RS422. The four pair cable is useful when using the additional CTS and RTS handshaking lines. These cables have an additional bare wire for connecting to ground. The ground wire should only be connected at one end of the link to avoid ground loop problems.

The AC34 adapter card offers up to 4000 volts of optical isolation in addition to transient suppression. The optical isolation prevents any electrical problems on the serial link from affecting the computer, making the AC34 ideal for industrial use.

JUMPER INSTALLATION

Configuration

Before installing the AC34, configure the board by selecting the appropriate communications jumpers.

Communication Jumpers

Jumpers B2 and B4 connects 220 ohm terminating resistors from + to - on the transmitter (To OPTOMUX) and receiver (From OPTOMUX), respectively. Install both of these jumpers in a normal OPTOMUX network.

Jumpers C2 and C4 connects 220 ohm terminating resistors from + to - on the RTS and CTS lines, respectively. Install both of these jumpers in a normal OPTOMUX network.

Note: If multiple host computers are used, Jumpers B2 and B4 should only be installed on the AC34 channel which are physically at the end of the serial network cables.

Jumper B7 controls the enabling of the RS422/RS485 driver. Removing the jumper will always enable the driver. Installing the jumper will allow the RTS output on the UART to control the driver. The driver is enabled when RTS is active and disabled when RTS is inactive.

If Jumper B7 is installed, then also install Jumpers B1 and B3. These jumpers passively pull the transmit lines (To OPTOMUX) to the inactive state.

If the AC34 is operating with a multidrop OPTOMUX network, then also install Jumpers B5 and B6. These jumpers passively pull the receive lines (From OPTOMUX) to the inactive state. Jumpers C5 and C6 must also be installed to passively pull the CTS line to the inactive state.

Jumper C7 controls the enabling of the RS422/RS485 driver. The driver is under control of the CTS input with the jumper installed. Jumpers B7 and C7 must never be installed at the same time.

The CTS Disable Jumper disables the CTS line on the adapter card. The factory setting is with the jumper installed. Remove the jumper only if CTS is required.

Figure 1 is a schematic of the Group B and C jumpers.

Group B and C Jumpers

The table on the next page describes the functions of the B and C group jumpers. Figure 2 shows the default jumper arrangement for jumper positions B1 through B8 and C1 through C8 on the AC34.

Now plug the AC34 adapter card into any open slot in the IBM PS/2.

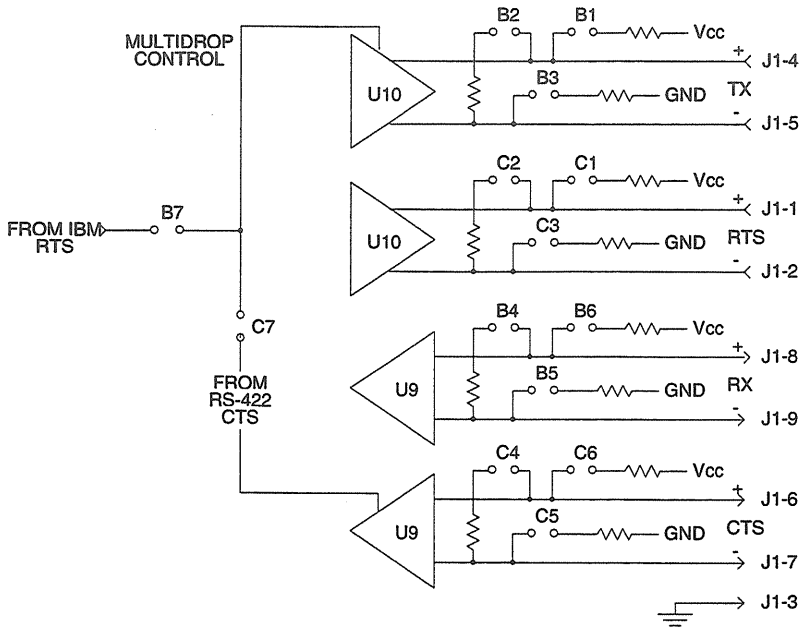

Figure 1 - Group B And C Jumper Schematic

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/RS485 driver from the RTS output on the UART
B8	Not used

Group C Jumper Descriptions

C1	Pull up jumper for the RTS line
C2	Terminate jumper for the RTS line
C3	Pull down jumper for the RTS line
C4	Terminate jumper for the CTS line
C5	Pull down jumper for the CTS line
C6	Pull up jumper for the CTS line
C7	Enables the RS422/RS485 driver from the CTS line
C8	Not used

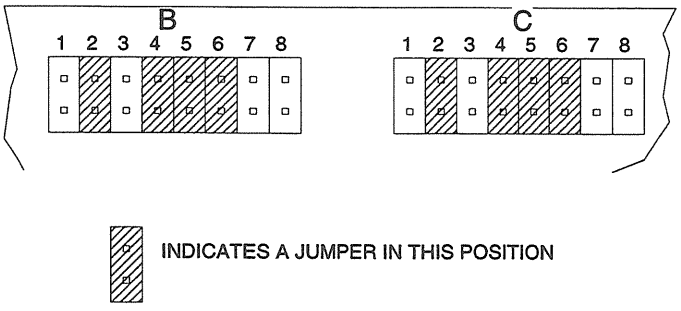

Figure 2 - Default Group B And C Jumper Settings

CONFIGURATION

The AC34 is designed for operation with the IBM PS/2 computers featuring the Micro Channel bus. The AC34 supports the Programmable Option Select (POS) functions associated with the Micro Channel bus. 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 AC34. (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 command.*
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 AC34 adapter card.
4. Turn on the IBM PS/2 with the Backup Diskette inserted in drive A.
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 AC34 will now have Channel A assigned as COM2.**

* 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. Follow the menu of choices which is documented in the IBM manual.

NETWORK CONNECTION

Now with the AC34 adapter card installed in the Micro Channel computer, 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 (24 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.

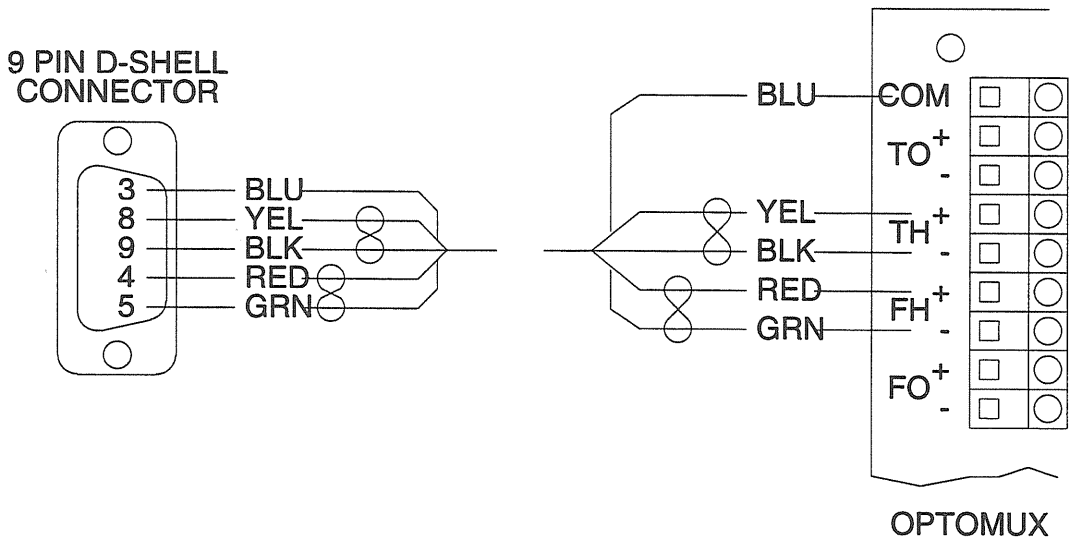

Figure 3 - AC34 to OPTOMUX Connection

COMMUNICATING WITH OPTOMUX

Before applying power to OPTOMUX Brain Board(s), set the baud rate and command protocol on the OPTOMUX Brain Board(s). The baud rate and command protocol are selected by the B group of jumpers on the OPTOMUX Brain Board(s). (Please refer to the OPTOMUX B1 and B2 Digital and Analog Brain Boards Operations Manual, Form 203 for additional information.) For the checkout, remove all of the group B jumpers from one OPTOMUX Brain Board and disconnect all other OPTOMUX Brain Boards on the network. This will select a baud rate of 300, the four-pass protocol, and an OPTOMUX address of 255.

Connect the D shell connector to the AC34 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 in the following program. The underlined part of line ten must be changed to COM1 when using the AC34 card as communications port 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

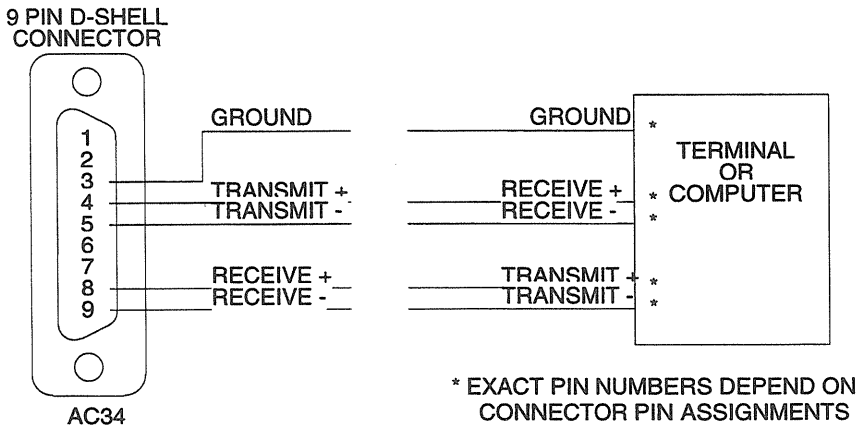

Figure 4 - Adapter Card to Computer Connection

Figure 4 shows the connection between the AC34 and a terminal or computer. Please note that the transmit lines from the AC34 must be connected to the receive lines of the terminal or computer and vice versa.

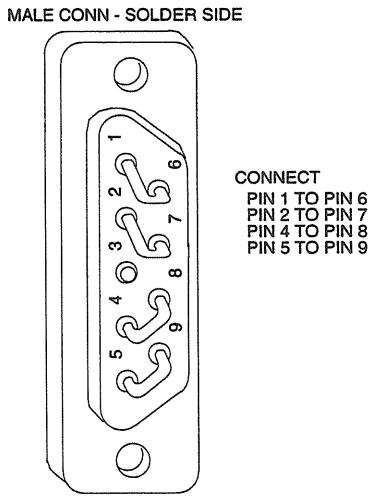

Figure 5 - Pin Connection for Loopback Test

If the connection between the AC34 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 AC34 end can be checked by looping the transmit lines (+ and -) to the receive lines (+ and -), as shown in Figure 5, and run the program example shown on page 6.

APPENDIX

Configuring the IBM PS/2 Serial Port

The IBM PS/2 uses an 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 16550 UART registers, 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

Program Examples

Turbo Pascal Example

```
Procedure SetPort;
const
        BASE = $3F8;                    {COM1 Address}
        DLL = 6;                        {19.2 k 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                '19.2 k baud
DLH% = 0
DLAB% = 3               '8 data, no parity, 1 stop for OPTOMUX
OUT BASE% +3,&H80       'Sets up control register of 8250
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            /* 38.4 k 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            /* 38.4 k 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);
        }
```

Opto 22 BBS and Technical Support Hotline

BBS: (909)695-1367

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

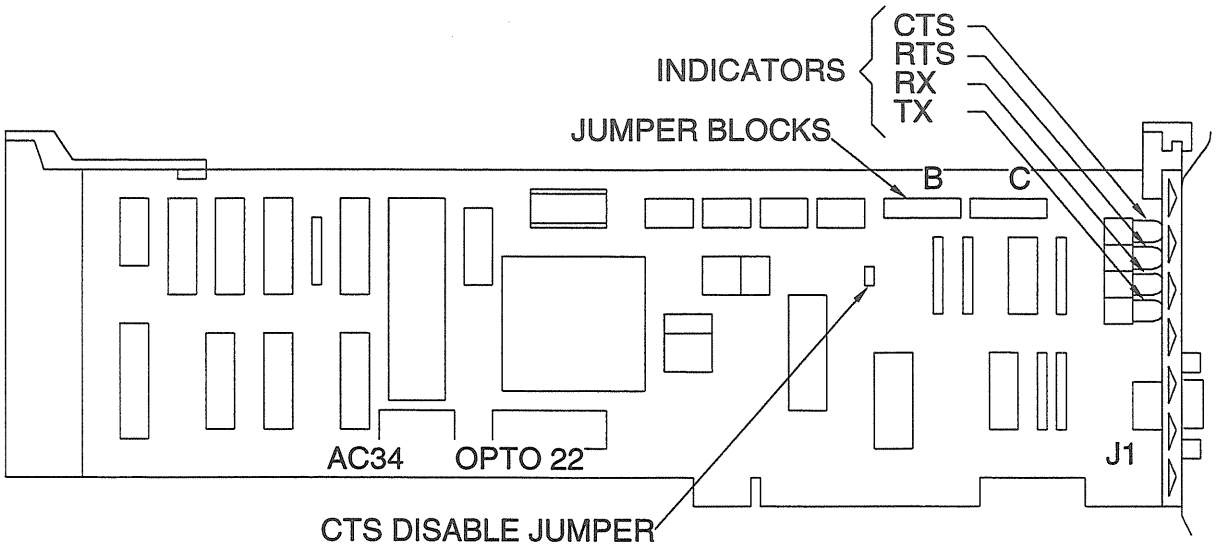

Figure 5 - AC34 Adapter Card Layout

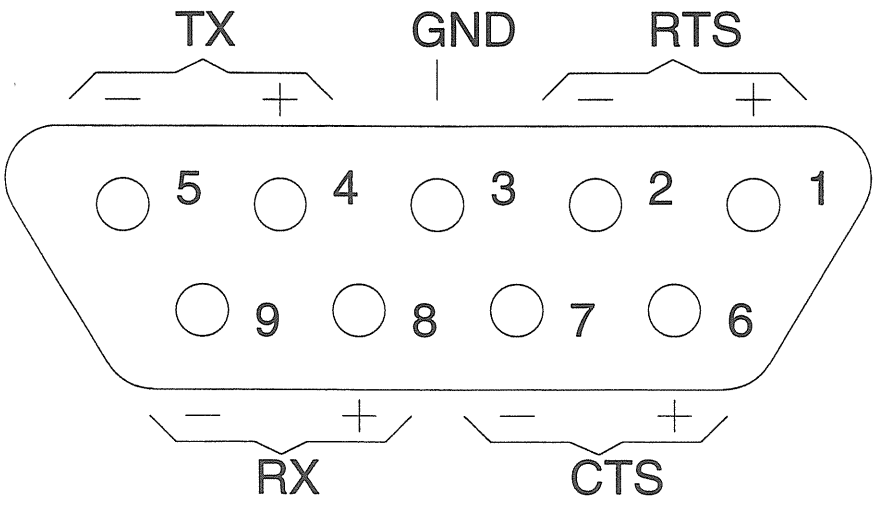

Figure 6 - 9-Pin D Shell Connector

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