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MODEL ICOM422/485

USER MANUAL

FILE: MICOM422-485.F1

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Chapter 1: Introduction

The ICOM422/485 Serial Interface Card provides multipoint transmission capability for long communication lines in noisy environments using RS422 or RS485 differential line drivers. The data lines are opto-isolated from the computer and from each other to assure communication when large common mode noise is superimposed. Opto-isolators are included on the RTS and CTS control lines as well as the transmit and receive lines. Further, an on-board DC-DC converter supplies isolated power for the line driver, RTS, and CTS circuits.

A crystal oscillator is located on the card. This oscillator permits precise selection of baud rate from 50 to 115,200.

The output transceiver used, the 75176, is capable of driving extremely long communication lines at high baud rates. It can drive up to 60mA on balanced lines and receive inputs as low as 200mV differential signal superimposed on common mode noise of maximum 500 V. In case of communication conflict, the transceivers feature thermal shutdown.

COM Port Compatibility

Type NS16550 UARTs are used as the Asynchronous Communication Element (ACE). These include a 16-byte transmit/receive buffer to protect against lost data in multitasking operating systems, while maintaining 100% compatibility with the original IBM serial port.
However, use of ICOM422/485 card is not restricted to the standard DOS addresses of COM1 through COM4. Continuous address selection is available anywhere within the I/O address range 000 to 3FF hex. The FINDBASE program included with your card will scan your computer for available addresses.

Line Bias and Termination

For increased noise immunity, the communication lines may be loaded at the receiver and biased at the transmitter. RS485 communications requires that one transmitter supply a bias voltage to ensure a known "zero" state when all transmitters are off, and one receiver input be terminated to reduce offset potentials. The ICOM422/485 supports these options by means of jumpers on the card. See Chapter 3, Option Selection for more details. If your card includes the "S03" option, Tranzorbs have been added to protect the ICOM422/485 against large voltage spikes.

RTS and CTS Transceiver Control

RS485 communications require the transmitter driver to be enabled and disabled as needed, allowing all cards to share a communications line. The ICOM422/485 card supports manual control of the request to send (RTS) line. Your software must set the RTS bit to a logic 1 to enable the driver and logic 0 to disable the driver.

The CTS line is normally controlled by software. If you are not controlling CTS under software, CTS must be pulled up to +5VDC for the card to operate. This is easily done one of two ways; (a) by installing a jumper at the terminals labeled CTS on the card or (b) by installing a jumper in the mating connector between pins 5 and 9. When that latter is done, it serves to check for proper installation of the communication cable because the card will not operate unless the cable is installed. To check for proper cable connection, you can read the CTS bit by software.

LED Monitors

Two LED indicators are provided on the ICOM422/485 card. The LED's blink to indicate activity on the transmitting and receiving lines and are useful for problem diagnosis. The blinking is more visible at slower speeds as high speed communication blinks the LED's too fast for the eye to see.

Communication Modes

Model ICOM422/485 supports Simplex, Half-Duplex, and Full-Duplex communications in a variety of 2 and 4-wire cable connections. Simplex is the simplest form of communications with transmissions occurring only in one direction. Half-Duplex allows traffic to travel in both directions, but only one way at a time. In Full-Duplex operation, data travels in both directions at the same time. RS485 communication only supports Half-Duplex because the same pair of signal lines are used for transmitting and receiving.

Specification

Communications Interface

- Serial Ports: One shielded male D 25-pin IBM AT style connector compatible with RS422 and RS485 specifications. Serial communications ACE used is type NS16550. Transceivers used are type 75176.
- Serial Data Rates: 300 to 56K baud. Asynchronous.
- Address: Continuously mappable within 000 to 3FF (hex) range of AT I/O bus addresses.
- Multipoint: Compatible with RS422 and RS485 specifications. Up to 32 drivers and receivers allowed on line.
- Input Isolation: 75 Volts, from computer.
- Transzorbs: Optional protection for data lines against external voltage transients.
- Receiver Input Sensitivity: ±200 mV, differential input.
- Transmitter Output Drive Capability: 60 mA (100 mA short-circuit current capability).
- Auxiliary Power Output: 5 VDC at 20 mA available at connector pin 9. External fuse recommended.

Environmental

- Operating Temperature Range: 0 °C. to +60 °C.
- Storage Temperature Range: -50 °C. to +120 °C.
- Humidity: 5% to 95%, non-condensing.

- Power Required: +5VDC at 400 mA typical, 2 W total power consumption.
- Size: 7" long. (178 mm).

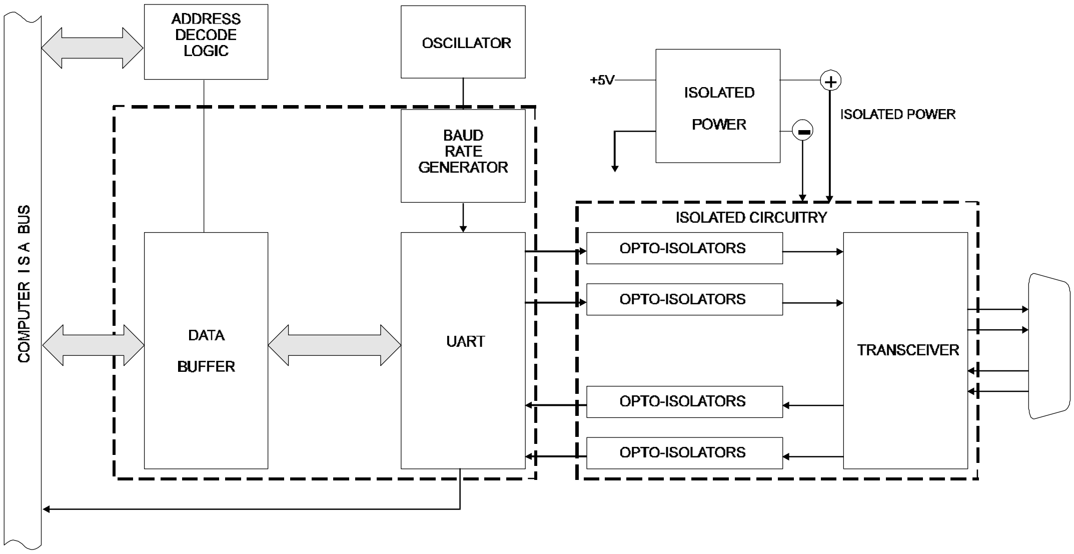

Figure 1-1: ICOM422/485 Block Diagram

Chapter 2: Installation

The software provided with this card is contained on either one CD or multiple diskettes and must be installed onto your hard disk prior to use. To do this, perform the following steps as appropriate for your software format and operating system. Substitute the appropriate drive letter for your CD-ROM or disk drive where you see d: or a: respectively in the examples below.

CD Installation

DOS/WIN3.x

1. Place the CD into your CD-ROM drive.
2. Type D:Enter to change the active drive to the CD-ROM drive.
3. Type INSTALLEnter to run the install program.
4. Follow the on-screen prompts to install the software for this card.

WIN95/98/NT

1. Place the CD into your CD-ROM drive.
2. The CD should automatically run the install program after 30 seconds. If the install program does not run, click START | RUN and type d:install, click OK or press Enter.
3. Follow the on-screen prompts to install the software for this card.

3.5-Inch Diskette Installation

As with any software package, you should make backup copies for everyday use and store your original master diskettes in a safe location. The easiest way to make a backup copy is to use the DOS DISKCOPY utility.

In a single-drive system, the command is:

```
DISKCOPY  A:  A:Enter
```

You will need to swap disks as requested by the system.
In a two-disk system, the command is:

```
DISKCOPY  A:  B:Enter
```

This will copy the contents of the master disk in drive A to the backup disk in drive B.

To copy the files on the master diskette to your hard disk, perform the following steps.

1. Place the master diskette into a floppy drive.
2. Change the active drive to the drive that has the diskette installed. For example, if the diskette is in drive A, type A:Enter.
3. Type INSTALLEnter and follow the on-screen prompts.

Directories Created on the Hard Disk

The installation process will create several directories on your hard disk. If you accept the installation defaults, the following structure will exist.

[CARDNAME]

Root or base directory containing the SETUP.EXE setup program used to help you configure jumpers and calibrate the card.

DOS\PSAMPLES:	A subdirectory of [CARDNAME] that contains Pascal samples.
DOS\CSAMPLES:	A subdirectory of [CARDNAME] that contains "C" samples.
Win32\language:	Subdirectories containing samples for Win95/98 and NT.

WinRisc.exe

A Windows dumb-terminal type communication program designed for RS422/485 operation. Used primarily with Remote Data Acquisition Pods and our RS422/485 serial communication product line. Can be used to say hello to an installed modem.

ACCES32

This directory contains the Windows 95/98/NT driver used to provide access to the hardware registers when writing 32-bit Windows software. Several samples are provided in a variety of languages to demonstrate how to use this driver. The DLL provides four functions (InPortB, OutPortB, InPort, and OutPort) to access the hardware.

This directory also contains the device driver for Windows NT, ACCESNT.SYS. This device driver provides register-level hardware access in Windows NT. Two methods of using the driver are available, through ACCES32.DLL (recommended) and through the DeviceIOControl handles provided by ACCESNT.SYS (slightly faster).

SAMPLES

Samples for using ACCES32.DLL are provided in this directory. Using this DLL not only makes the hardware programming easier (MUCH easier), but also one source file can be used for both Windows 95/98 and WindowsNT. One executable can run under both operating systems and still have full access to the hardware registers. The DLL is used exactly like any other DLL, so it is compatible with any language capable of using 32-bit DLLs. Consult the manuals provided with your language's compiler for information on using DLLs in your specific environment.

VBACCES

This directory contains sixteen-bit DLL drivers for use with VisualBASIC 3.0 and Windows 3.1 only. These drivers provide four functions, similar to the ACCES32.DLL. However, this DLL is only compatible with 16-bit executables. Migration from 16-bit to 32-bit is simplified because of the similarity between VBACCES and ACCES32.

PCI

This directory contains PCI-bus specific programs and information. If you are not using a PCI card, this directory will not be installed.

SOURCE

A utility program is provided with source code you can use to determine allocated resources at run-time from your own programs in DOS.

PCIFind.exe

A utility for DOS and Windows to determine what base addresses and IRQs are allocated to installed PCI cards. This program runs two versions, depending on the operating system. Windows 95/98/NT displays a GUI interface, and modifies the registry. When run from DOS or Windows3.x, a text interface is used. For information about the format of the registry key, consult the card-specific samples provided with the hardware. In Windows NT, NTioPCI.SYS runs each time the computer is booted, thereby refreshing the registry as PCI hardware is added or removed. In Windows 95/98/NT PCIFind.EXE places itself in the boot-sequence of the OS to refresh the registry on each power-up.

This program also provides some COM configuration when used with PCI COM ports. Specifically, it will configure compatible COM cards for IRQ sharing and multiple port issues.

WIN32IRQ

This directory provides a generic interface for IRQ handling in Windows 95/98/NT. Source code is provided for the driver, greatly simplifying the creation of custom drivers for specific needs. Samples are provided to demonstrate the use of the generic driver. Note that the use of IRQs in near-real-time data acquisition programs requires multi-threaded application programming techniques and must be considered an intermediate to advanced programming topic. Delphi, C++ Builder, and Visual C++ samples are provided.

Findbase.exe

DOS utility to determine an available base address for ISA bus , non-Plug-n-Play cards. Run this program once, before the hardware is installed in the computer, to determine an available address to give the card. Once the address has been determined, run the setup program provided with the hardware to see instructions on setting the address switch and various option selections.

Poly.exe

A generic utility to convert a table of data into an nth order polynomial. Useful for calculating linearization polynomial coefficients for thermocouples and other non-linear sensors.

Risc.bat

A batch file demonstrating the command line parameters of RISCTerm.exe.

RISCTerm.exe

A dumb-terminal type communication program designed for RS422/485 operation. Used primarily with Remote Data Acquisition Pods and our RS422/485 serial communication product line. Can be used to say hello to an installed modem. RISCTerm stands for Really Incredibly Simple Communications TERMinal.

Installing the Card

The ICOM422/485 card can be installed in any long slot of an IBM PC/XT/AT or compatible computer. Before, carefully read the chapters Option Selection and Address Selection of this manual and configure the card according to your requirements. You can find an open base address with the FINDBASE program provided with the card. Finally, our ICOM422/485 setup program will lead you through the process of setting the options on the ICOM422/485. The setup program does not set the options on the card, these must be set by jumpers on the card.

Be especially careful with address selection. If the addresses of two installed functions overlap you will experience unpredictable computer behavior.

To Install the Card

1. Turn off computer power.
2. Remove the computer cover.
3. Remove the blank I/O backplate.
4. Install jumpers for selected options from either the Option Selection section of this manual or the suggestions of our ICOM422/485 setup software program.
5. Select the base address on the card for either the ADDRESS SELECTION section of this manual or the suggestions of our FINDBASE setup software program.
6. Install the card in any I/O expansion slot. Important: Make sure that the card mounting bracket is properly screwed into place and that there is a positive chassis ground.
7. Install the I/O cable.
8. Inspect for proper fit of the card and cable and tighten screws.
9. Turn the computer ON and observe the LED indicators. The LED's will blink when there is any activity on the communication lines.
10. Turn the computer OFF and replace the computer cover.

To ensure that there is minimum susceptibility to EMI and minimum radiation, it is important that there be a positive chassis ground. Also, proper EMI cabling techniques (cable connect to chassis ground at the I/O connector, twisted-pair wiring, and, in extreme cases, ferrite level of EMI protection) must be used. CE-marked versions of ICOM422/485 meet the requirements of EN50081-1:1992 (Emissions), EN50082-1:1992 (Immunity), and EN60950:1992 (Safety).

Chapter 3: Option Selection

For help locating the jumpers described in this section you should refer to the Option Selection Map at the end of this section. Operation of the serial communications section is determined by jumper installation as described in the following paragraphs.

CTS

Serial communications will not operate without this signal. The function of the CTS jumper is to provide the signal when it is not applied externally. If you prefer, you can omit this jumper and install a jumper between CTS and +5VDC on the mating D connector. This jumper in the cabling provides a handy diagnostic tool because the card will not operate unless the cable is properly installed.

Terminations and Bias

A transmission line should be terminated at the receiving end in its characteristic impedance. Installing a jumper at the location labeled LD applies a 136Ω load across the input for RS422 mode and across the transmit/receive input/output for RS485 operation. When noise is a potential problem on long lines, the terminating resistor should be divided and its center point grounded to help reduce noise voltage pickup. To accomplish this, also install a jumper at the position marked LD GND for 68-ohm termination resistance on the positive and negative branches of the receiving line.

In RS485 operations, where there are multiple terminals, only the RS485 ports at each end of the network should have terminating resistors as described above. If the card is to have an ungrounded load, do as above except do not install the LDGND jumper. (See Appendix A, Application Considerations.) Also, for RS485 operation, there must be a bias on the RX+ and RX- lines. If the ICOM422/485 card is to provide that bias, install jumpers at the locations labeled +BIAS and -BIAS.

RTS Control

For RS485 operation, installing a jumper at the location labeled RTS allows the state of the RTS line to be controlled by the UART. Removing the jumper causes the RTS signal to be pulled high allowing the port to start a transmission at any time.

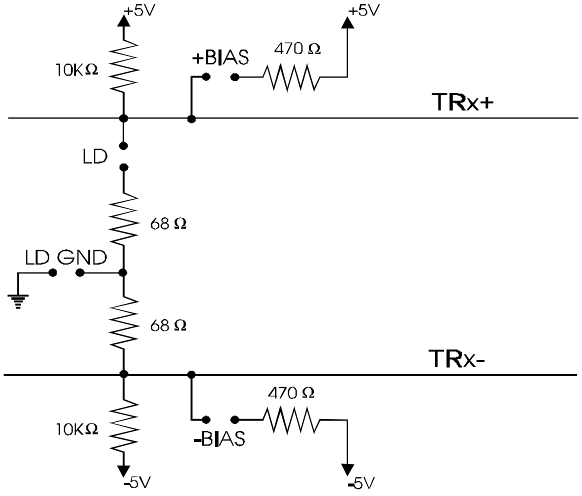

Figure 3-1: Simplified Schematic

Simplex or Duplex

The receiver can be set in either Simplex or Duplex by installing jumpers marked SX or DX. Simplex mode is intended for one-way communication able to transmit or receive. Duplex mode allows transmission or reception either simultaneous or alternatively as defined in the following paragraph.

Full or Half-Duplex

Full-Duplex allows simultaneous bi-directional communications and is selected by installing the FDX jumper. Half-Duplex allows bi-directional transmit and receiver communication but only one at a time, and is required for RS485 communications. Proper selection depends on the wire connections used to connect the two serial ports. Tx is the transmit wires and Rx is the receive wires.

				Cable	
Mode		**Jumpers**		**Card A**	**Card B**
Simplex	2-wire Receive Only	SX-FDX	Rx+	12	24
			Rx-	13	25
Simplex	2-wire Transmit Only	SX-FDX	Tx+	24	12
			Tx-	25	13
Half-Duplex	2-wire with local echo	DX-HDX-RTS	TRx+	12	12
			TRx-	13	13
Half-Duplex	2-wire w/o local echo	SX-HDX-RTS	TRx+	12	12
			TRx-	13	13
Full-Duplex	4-wire w/o local echo	DX-FDX	Tx+	24	12
			Tx-	25	13
			Rx+	12	24
			Rx-	13	25

Also connect ground (Pin 7) when communicating in Simplex or RS422 modes.

Table 3-1: Communication Modes and Cabling Options

Interrupts

The ICOM422/485 supports the standard interrupt levels IRQ2 through IRQ7. Select the desired level by installing a jumper in one of these locations.

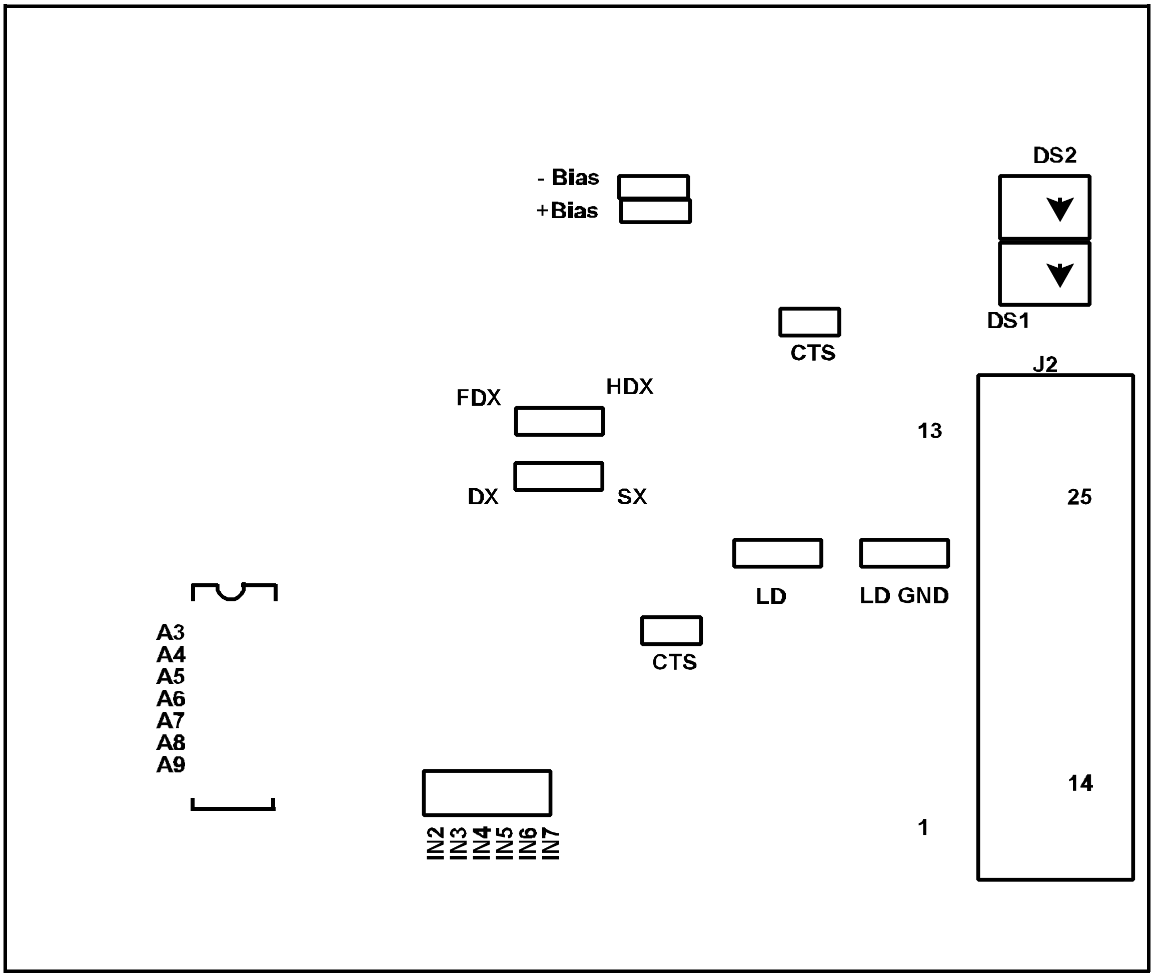

Figure 3-2: ICOM422/485 Option Selection Map

Chapter 4: Address Selection

The ICOM422/485 base address can be selected anywhere within an I/O address range 100-3FF hex (except 1F0 through 1F8) for AT's and 200 through 3FF for XT's, providing that the address does not overlap with other functions. If in doubt, refer to the table below for a list of standard address assignments. (The primary and secondary binary synchronous communication ports are supported by the Operating System.) The base address locator program FINDBASE provided on CD will assist you to select a base address that will avoid this conflict.

Hex Range	Usage
000-01F	DMA Controller 1
020-03F	INT Controller 1, Master
040-05F	Timer
060-06F	8042 (Keyboard)
070-07F	Real Time Clock, NMI Mask
080-09F	DMA Page Register
0A0-0BF	INT Controller 2
0C0-0DF	DMA Controller 2
0F0	Clear Math Coprocessor Busy
0F1	Reset Coprocessor
0F8-0FF	Arithmetic Processor
1F0-1F8	IDE Fixed Disk
200-207	Game I/O
278-27F	Parallel Printer Port 2
2F8-2FF	Asynchronous Comm’n (Secondary)
300-31F	Prototype Card
360-36F	Reserved
378-37F	Parallel Printer Port 1
380-38F	SDLC or Binary Synchronous Comm’n 2
3A0-3AF	Binary Synchronous Comm’n 1
3B0-3BF	Monochrome Display/Printer
3C0-3CE	Local Area Network
3D0-3DF	Color/Graphic Monitor
3F0-3F7	Floppy Diskette Controller
3F8-3FF	Asynchronous Comm’n (Primary)

Table 4-1: Standard Address Assignments for 286/386/486 Computers

Address Setup switches are marked A3-A9. In order to configure the desired address, assign "1" to all Address Setup switches turned OFF and assign "0" to all Address Setup switches turned ON. These 1's and 0's are a binary representation of the base address. This binary number is then converted to a hexadecimal number.

Address Switch Settings	1st Digit		2nd Digit				3rd Digit
Switch Label	7	6	5	4	3	2	1
Address Line Controlled	A9	A8	A7	A6	A5	A4	A3
Decimal Weight	512	256	128	64	32	16	8
Hexadecimal Weight	200	100	80	40	20	10	8

Table 4-2: ICOM422/485 Address Switch Setup

For example, as illustrated in the following table, switch selection corresponds to hex 2D8 (binary 10 1101 1xxx). The "xxx" represents address lines A2, A1, and A0 used on the card to select individual registers. See the Programming chapter of this manual.

Switch Label	A9	A8	A7	A6	A5	A4	A3
Setup	OFF	ON	OFF	OFF	ON	OFF	OFF
Binary Representation	1	0	1	1	0	1	1
Conversion Factors	2	1	8	4	2	1	8
HEX Representation	2		D				8

Table 4-3: Example Address Setup

Review the Address Selection Table carefully before selecting the card address. If the addresses of two installed functions overlap you will experience unpredictable computer behavior.

Serial COM Port	**IRQ**	**Base Hex Address**	**Address Switch Settings**						
			A9	**A8**	**A7**	**A6**	**A5**	**A4**	**A3**
COM1	IRQ 4	3F8	1	1	1	1	1	1	1
COM2	IRQ 3	2F8	1	0	1	1	1	1	1
COM3	IRQ 4	3E8	1	1	1	1	1	0	1
COM4	IRQ 3	2E8	1	0	1	1	1	0	1

Table 4-4: Standard DOS COM Port Addresses

Notice that only two interrupts are assigned to four serial ports. "Sharing" interrupts is not a good idea if both ports are used at the same time.

Chapter 5: Programming

Sample Programs

There are sample programs provided with the ICOM422/485 card in C, Pascal, QuickBASIC, and several Windows languages. DOS samples are located in the DOS directory and Windows samples are located in the WIN32 directory.

Windows Programming

The ICOM422/485 card installs into Windows as COM ports. Thus the Windows standard API functions can be used. In particular:

- CreateFile() and CloseHandle() for opening and closing a port.
- SetupComm(), SetCommTimeouts(), GetCommState(), and SetCommState() to set and change a port's settings.
- ReadFile() and WriteFile() for accessing a port.

See the documentation for your chosen language for details.

Under DOS, the process is very different. The remainder of this chapter describes DOS programming.

Initialization

Initializing the chip requires knowledge of the UART's register set. The first step is to set the baud rate divisor. You do this by first setting the DLAB (Divisor Latch Access Bit) high. This bit is Bit 7 at Base Address +3. In C code, the call would be:

```
outportb(BASEADDR +3,0x80);
```

You then load the divisor into Base Address+0 (low byte) and Base Address+1 (high byte). The following equation defines the relationship between baud rate and divisor:
desired baud rate = (crystal frequency) / (16 * divisor)

On the ICOM422/485 card, the crystal frequency is 1.8432 MHz. Below is a table for the popular divisor frequencies:

Baud Rate	**Divisor**	**Notes**	**Approx Max Cable length ***
115200	1		375 feet
57600	2		660 ft
38400	3		920 ft
28800	4		1160 ft
19200	6		1620 ft
14400	8		2050 ft
9600	12	Most common industrial speed	4000 ft
4800	24		4000 ft
2400	48		4000 ft
1200	96		4000 ft

*These are theoretical maximums based on typical conditions and good quality cables.

Table 5-1: Baud Rate Divisors

In C, the code to set the chip to 9600 baud is:

```
outportb(BASEADDR, 0x0C);
outportb(BASEADDR +1,0);
```

The second initializing step is to set the Line Control Register at Base Address +3. This register defines word length, stop bits, parity, and the DLAB.

Bits 0 and 1 control word length and allow word lengths from 5 to 8 bits. Bit settings are extracted by subtracting 5 from the desired word length.

Bit 2 determines the number of stop bits. There can be either one or two stop bits. If Bit 2 is set to 0, there will be one stop bit. If Bit 2 is set to 1, there will be two stop bits.

Bits 3 through 6 control parity and break enable. They are not commonly used for communications and should be set to zeroes.

Bit 7 is the DLAB discussed earlier. It must be set to zero after the divisor is loaded or else there will be no communications.

The C command to set the UART for an 8-bit word, no parity, and one stop bit is:

```
outportb(BASEADDR +3, 0x03)
```

The third step of the initialization sequence is to set the Modem Control Register at Base Address +4. This register controls functions on some cards. Bit 1 is the Request to Send (RTS) control bit. This bit should be left low until transmission time. Bits 2 and 3 are user-designated outputs. Bit 2 may be ignored on this card. Bit 3 is used to enable interrupts and should be set high if an interrupt-driven receiver is to be used.

The final initialization step is to flush the receiver buffers. You do this with two reads from the receiver buffer at Base Address +0. When done, the UART is ready to use.

Reception

Reception can be handled in two ways: polling and interrupt-driven. When polling, reception is accomplished by constantly reading the Line Status Register at Base Address +5. Bit 0 of this register is set high whenever data are ready to be read from the chip. Polling is not effective at high data rates above because the program cannot do anything else when it is polling or data could be missed. The following code fragment implements a polling loop and uses a value of 13, (ASCII carriage return) as an end-of-transmission marker:

```
do
{
while (!(inportb(BASEADDR +5) & 1)); /*Wait until data ready*/
  data[i++]= inportb(BASEADDR);
}
  while (data[i]!=13);  /*Reads the line until null character rec'd*/
```

Interrupt-driven communications should be used whenever possible and is required for high data rates. Writing an interrupt-driven receiver is not much more complex than writing a polled receiver but care should be taken when installing or removing your interrupt handler to avoid writing the wrong interrupt, disabling the wrong interrupt, or turning interrupts off for too long a period. The handler would first read the Interrupt Identification Register at Base Address +2. If the interrupt is for Received Data Available, the handler then reads the data. If no interrupt is pending, control exits the routine. A sample handler, written in C, is as follows:

```
 do
{
   readback = inportb(BASEADDR +2);
   if (readback & 4)         /*Readback will be set to 4 if data are available*/
   data[i++]=inportb(BASEADDR);
}
   while(readback!=1);
   outportb(0x20,0x20);          /*Write EOI to 8259 Interrupt Controller*/
   return;
```

Transmission

RS485 transmission is simple to implement. First the RTS line should be set high by writing a 1 to Bit 1 of the Modem Control Register at Base Address +4. The RTS line is used to toggle the transceiver from receive mode to transmit mode and vice versa. It is not carried out on the line in RS485 and not used for handshaking. Similarly, the CTS line is not used in RS485 and should always be enabled by installing a jumper as described earlier.

After the above is done, the card is ready to send data. To transmit a string of data, the transmitter must first check Bit 5 of the Line Status Register at Base Address +5. That bit is the transmitter-holding-register-empty flag. If it is high, the transmitter has sent the data. The process of checking the bit until it goes high followed by a write is repeated until no data remains. After all data has been transmitted, the RTS bit should be reset by writing a 0 to Bit 1 of the Modem Control Register.

The following C code fragment demonstrates this process:

```
outportb(BASEADDR +4, inportb(BASEADDR +4)|0x02) ;
  /*Set RTS bit without altering states of other bits*/
while(data[i]); /*While there is data to send*/
{ /*Wait until transmitter is empty*/
  while(!(inportb(BASEADDR +5)&0x20))  /*Wait until transmitter is empty*/
  outportb(BASEADDR,data[i]);
  data++;
}
outportb(BASEADDR +4, inportb(BASEADDR +4)&0xFD);
/*Reset RTS bit without altering states of other bits*/
```

Chapter 6: Connector Pin Assignments

The popular 25-pin D subminiature connector is used for interfacing to communication lines. The connector is equipped with 4-40 threaded standoffs (female screw lock) to provide strain relief. The mating connector is AMP type 747304-2 or equivalent.

Pin No.	Assignment
1	
2	
3	
4	Request to Send (RTS)
5	Clear to Send (CTS)
6	
7	Signal Ground (GND)
8	
9	+5V Supply (20mA)
10	
11	
12	Receive Line + (RX+)
13	Receive Line - (RX-)
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	Transmit Line + (TX+)
25	Transmit Line - (TX-)

Table 6-1: Connector Pin Assignments

Note

For Simplex, Half-Duplex, and Full-Duplex operation, see the Option Selection section of this manual for pin connection information.

Appendix A: Application Considerations

Introduction

Working with RS422 and RS485 devices is not much different from working with standard RS232 serial devices and these two standards overcome deficiencies in the RS232 standard. First, the cable length between two RS232 devices must be short; less than 50 feet at 9600 baud. Second, many RS232 errors are the result of noise induced on the cables. The RS422 standard permits cable lengths up to 5000 feet and, because it operates in the differential mode, it is more immune to induced noise.

Connections between two RS422 devices (with CTS ignored) should be as follows:

Device #1		**Device #2**	
Signal	ICOM422/485 25 pin	Signal	ICOM422/485 25 pin
Gnd	7	Gnd	7
TX^+	24	RX^+	12
TX^-	25	RX^-	13
RX^+	12	TX^+	24
RX^-	13	TX^-	25

Table A-1: Connections Between Two RS422 Devices

A third deficiency of RS232 is that more than two devices cannot share the same cable. This is also true for RS422 but RS485 offers all the benefits of RS422 plus allows up to 32 devices to share the same twisted pairs. An exception to the foregoing is that multiple RS422 devices can share a single cable if only one will talk and the others will all receive.

Balanced Differential Signals

The reason that RS422 and RS485 devices can drive longer lines with more noise immunity than RS232 devices is that a balanced differential drive method is used. In a balanced differential system, the voltage produced by the driver appears across a pair of wires. A balanced line driver will produce a differential voltage from ±2 to ±6 volts across its output terminals. A balanced line driver can also have an input "enable" signal that connects the driver to its output terminals. If the "enable" signal is OFF, the driver is disconnected from the transmission line. This disconnected or disabled condition is usually referred to as the "tristate" condition and represents a high impedance. RS485 drivers must have this control capability. RS422 drivers may have this control but it is not always required.

A balanced differential line receiver senses the voltage state of the transmission line across the two signal input lines. If the differential input voltage is greater than +200 mV, the receiver will provide a specific logic state on its output. If the differential voltage input is less than -200 mV, the receiver will provide the opposite logic state on its output. A maximum operating voltage range is from +6V to -6V allows for voltage attenuation that can occur on long transmission cables.

A maximum common mode voltage rating of ±7V provides good noise immunity from voltages induced on the twisted pair lines. The signal ground line connection is necessary in order to keep the common mode voltage within that range. The circuit may operate without the ground connection but may not be reliable.

Parameter	Conditions	Min.	Max.
Driver Output Voltage (unloaded)		4V	6V
		-4V	-6V
Driver Output Voltage (loaded)	LD and LDGND	2V	
	jumpers in	-2V	
Driver Output Resistance			50Ω
Driver Output Short-Circuit Current			±150 mA
Driver Output Rise Time			10% unit interval
Receiver Sensitivity			±200 mV
Receiver Common Mode Voltage Range			±7V
Receiver Input Resistance			4KΩ

Table A-2: RS422 Specification Summary

To prevent signal reflections in the cable and to improve noise rejection in both the RS422 and RS485 mode, the receiver end of the cable should be terminated with a resistance equal to the characteristic impedance of the cable. (An exception to this is the case where the line is driven by an RS422 driver that is never "tristated" or disconnected from the line. In this case, the driver provides a low internal impedance that terminates the line at that end.)

Note

You do not have to add a terminator resistor to your cables when you use the ICOM422/485 card. Termination resistors for the RX+ and RX- lines are provided on the card and are placed in the circuit when you install the LD and LDGND jumpers. Moreover, installing the +BIAS and -BIAS jumpers properly biases these lines. (See the Option Selection section of this manual.)

RS485 Data Transmission

The RS485 Standard allows a balanced transmission line to be shared in a party-line mode. As many as 32 driver/receiver pairs can share a two-wire party line network. Many characteristics of the drivers and receivers are the same as in the RS422 Standard. One difference is that the common mode voltage limit is extended and is +12V to -7V. Since any driver can be disconnected (or tristated) from the line, it must withstand this common mode voltage range while in the tristate condition.

RS485 Two-Wire Multidrop Network

The following illustration shows a typical multidrop or party line network. Note that the transmission line is terminated on both ends of the line but not at drop points in the middle of the line.

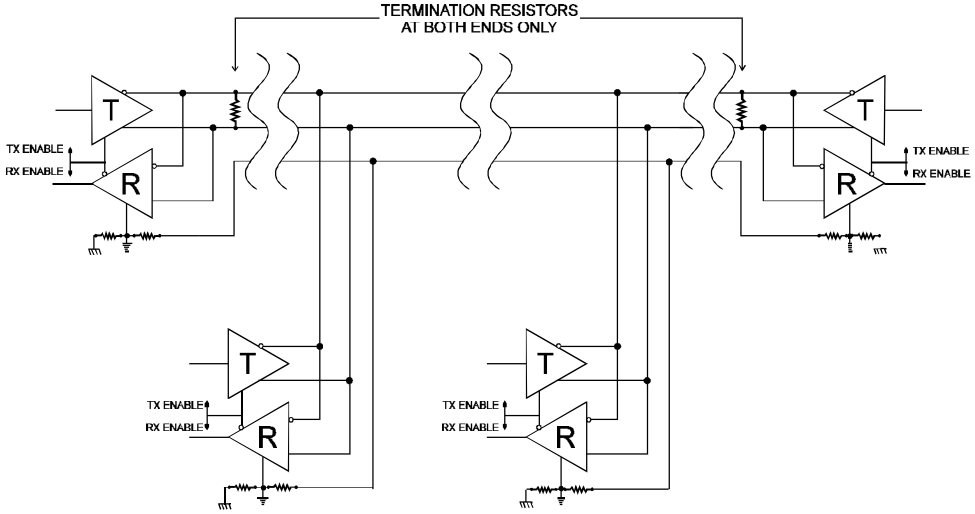

Figure A-1: Typical RS485 Two-Wire Multidrop Network

RS485 Four-Wire Multidrop Network

An RS485 network can also be connected in a four-wire mode. In a four-wire network it's necessary that one node be a master node and all others be slaves. The network is connected so that the master communicates to all slaves and all slaves communicate only with the master. This has advantages in equipment that uses mixed protocol communications. Since the slave nodes never listen to another slave's response to the master, a slave node cannot reply incorrectly.

Customer Comments

If you experience any problems with this manual or just want to give us some feedback, please email us at: ***manuals@accesioproducts.com.***. Please detail any errors you find and include your mailing address so that we can send you any manual updates.

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