Model COM485/8 & COM485/8-CE Product Manual

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FOREWARD

This product manual provides information to install, operate and or program the referenced product(s) manufactured or distributed by Industrial Computer Source. The following pages contain information regarding the warranty and repair policies.

Technical assistance is available at: **1-800-480-0044**.

Manual Errors, Omissions and Bugs: A "Bug Sheet" is included as the last page of this manual. Please use the "Bug Sheet" if you experience any problems with the manual that requires correction.

Guarantee

A thirty day money-back guarantee is provided on all **standard** products sold. **Special order products** are covered by our Limited Warranty, *however they may not be returned for refund or credit. EPROMs, RAM, Flash EPROMs or other forms of solid electronic media are not returnable for credit - but for replacement only. Extended Warranty available. Consult factory.*

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In order to receive refund on a product purchase price, the product must not have been damaged by the customer or by the common carrier chosen by the customer to return the goods, and the product must be returned complete (meaning all manuals, software, cables, etc.) within 30 days of receipt and in as-new and resalable condition. The **Return Procedure** must be followed to assure prompt refund.

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One year limited warranty on all products sold with the exception of the "Performance Series" I/O products, which are warranted to the original purchaser, for as long as they own the product, subject to all other conditions below, including those regarding neglect, misuse and acts of God. Within one year of purchase, Industrial Computer Source will repair or replace, at our option, any defective product. At any time after one year, we will repair or replace, at our option, any defective "Performance Series" I/O product sold. This does not include products damaged in shipment, or damaged through customer neglect or misuse. Industrial Computer Source will service the warranty for all standard catalog products for the first year from the date of shipment. After the first year, for products not manufactured by Industrial Computer Source, the remainder of the manufacturer's warranty, if any, will be serviced by the manufacturer directly.

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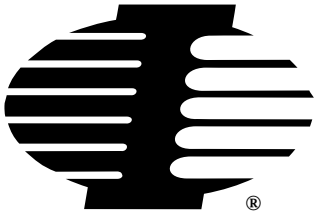
No agent, dealer, distributor, service company, or other party is authorized to change, modify, or extend the terms of this Limited Warranty in any manner whatsoever. Industrial Computer Source reserves the right to make changes or improvements in any product without incurring any obligation to similarly alter products previously purchased.



Shipments not in compliance with this Guarantee and Limited Warranty Return Policy will not be accepted by Industrial Computer Source.

Return Procedure

For any Limited Warranty or Guarantee return, please contact Industrial Computer Source's Customer Service at **1-800-480-0044** and obtain a Return Material Authorization (RMA) Number. All product(s) returned to Industrial Computer Source for service or credit **must** be accompanied by a Return Material Authorization (RMA) Number. Freight on all returned items **must** be prepaid by the customer who is responsible for any loss or damage caused by common carrier in transit. Returns for Warranty **must** include a Failure Report for each unit, by serial number(s), as well as a copy of the original invoice showing date of purchase.

> To reduce risk of damage, returns of product must be in an Industrial Computer Source shipping container. If the original container has been lost or damaged, new shipping containers may be obtained from Industrial Computer Source Customer Service at a nominal cost.

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Some *Sales Items* and *Customized Systems* are **not** subject to the guarantee and limited warranty. However in these instances , any deviations will be disclosed prior to sales and noted in the original invoice. ***Industrial Computer Source reserves the right to refuse returns or credits on software or special order items.***

Advisories

Three types of advisories are used throughout the manual to stress important points or warn of potential hazards to the user or the system. They are the Note, the Caution, and the Warning. Following is an example of each type of advisory:

Note: The note is used to present special instruction, or to provide extra information which may help to simplify the use of the product.

CAUTION!

A Caution is used to alert you to a situation which if ignored may cause injury or damage equipment.

WARNING!

A Warning is used to alert you of a situation which if ignored will cause serious injury.

Cautions and Warnings are accented with triangular symbols. The exclamation symbol is used in all cautions and warnings to help alert you to the important instructions. The lightning flash symbol is used on the left hand side of a caution or a warning if the advisory relates to the presence of voltage which may be of sufficient magnitude to cause electrical shock.

Use caution when servicing any electrical component. We have tried to identify the areas which may pose a Caution or Warning condition in this manual; however, Industrial Computer Source does not claim to have covered all situations which might require the use of a Caution or Warning.

You must refer to the documentation for any component you install into a computer system to insure proper precautions and procedures are followed.

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Chapter 1: Installation

Backing up the Disk

The software provided with the COM485/8 card is in MS-DOS on diskette. As with any software package, you should make back-up copies for everyday use and place your original master diskette in a safe location.

The easiest way to make a back-up copy is to use the DOS DISKCOPY utility.

In a single-drive system the command is `diskcopy a: a:`

In a two-drive system the command is `diskcopy a: b:`

(This will copy the master disk in drive A to the back-up disk in drive B.)

Hard Disk Installation

The files contained on the master diskette may also be copied onto your hard disk. To do this perform the following:

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

Files contained on the disk are stored in separate directories as follows:

COM485-4:	Root or base directory containing the FINDBASE PROGRAM that will help you to decide what base address to use with the card. Also contains the COM480ST.EXE setup program.
PSAMPLES:	Contains Pascal samples.
CSAMPLES:	Contains “C” samples.
BSAMPLES:	Contains QuickBASIC samples.
VBACCES:	VisualBASIC utility driver that includes PEEK and POKE statements for reading and writing RAM as well as INPORT and OUTPORT for reading and writing I/O. The driver is in the form of a DLL and allows you to access hardware as if the language was designed for it when you use VisualBASIC for Windows 3.x (VB 4.0 support is provided separately.)

Installation the Card

The COM485/8 card can only be installed in a long slot of an IBM PC/XT/AT or compatible computer. Before installing the card carefully read the **OPTION SELECTION** and **ADDRESS SELECTION** sections of this manual and configure the card according to your requirements. You can find an open base address with the FINDBASE program on the diskette provided with the card. Finally, our COM880ST.EXE setup program will lead you through the process of setting the options on the COM485/8. 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 (cards or devices) overlap you will experience unpredictable computer behavior.

To install the card:

1. Turn off the 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 COM480ST.EXE setup software program.
5. Select the base address on the card using either the **Address Selection** section of this manual or the suggestions for COM485/8 in our FINDBASE setup software program.
6. Install the card in an I/O expansion slot.

   Note: If installed in an eight-bit slot, IRQ's 10-15 will be unavailable.
7. Install the I/O cable.
8. Inspect for proper fit of the card and cable and tighten screws.
9. Replace the computer cover.

The COM485/8 provides nine DB9 connectors via a single DB25 connector on the mounting bracket. To ensure that there is minimum susceptibility to EMI and minimum radiation it is important that the card mounting bracket be properly screwed into place and that there be a positive chassis ground. Also, proper EMI cabling techniques (cable connect to chassis ground at the aperture, shielded twisted-pair wiring, etc) be used for the input/output wiring.

Chapter 2: Functional Description

The COM485/8 Serial Interface Card was designed for effective multipoint transmission in the most common protocols. The COM485/8 is 13.38 inches long and may only be installed in long slots of IBM PC/XT/AT or compatible computers. If installed in an eight-bit slot, the high interrupts (IRQ 10-15) will not be available to the COM485/8.

RS-485 Balanced Mode Operation

The COM485/8 supports RS-485 modes which use differential balanced drivers for increased range and noise immunity. RS-485 improves on RS422 with switchable transceivers and the ability to support multiple devices on a single "party line". The RS-485 specification defines a maximum of 32 devices on a single line. The number of devices served on a single line can be expanded by use of "repeaters".

COM485/8 also has the capability to add load resistors to terminate the communications lines. RS-485 communications requires that one transmitter supply a bias voltage to ensure a known "zero" state when all transmitters are off. Also, receiver inputs at each end of the network should be terminated to eliminate "ringing". The COM485/8 supports biasing by default and supports termination by jumpers on the card. If your application requires the transmitter to be un-biased, please cantact the factory.

Comm Port Compatibility

Type NS16550 UART's are used as the Asynchronous Communication Element (ACE) which 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, the COM485/8 card is not restricted to the standard DOS addresses of COM1 - COM4. Continuous address selection is available anywhere within the I/O address range 000 to 3F8 hex and our FINDBASE program will scan I/O Bus memory-mapped addresses in your computer for available addresses that can be used by COM485/8 without conflict with other computer resources..

A crystal oscillator is located on the card. This oscillator permits precise selection of baud rate from 50 to 115,200 with the standard crystal oscillator. Other crystals for higher baud rate ability are available upon special order.

The driver/receiver used, the SN75176B, is capable of driving extremely long communication lines at high baud rates. It can drive up to ±60 mA on balanced lines and receive inputs as low as 200 mV differential signal superimposed on common mode noise of +12 V or -7 V. In case of communication conflict, the driver/receivers feature thermal shutdown.

Communication Modes

COM485/8 supports Half-Duplex communications with a 2-wire cable connection. Half-Duplex allows traffic to travel in both directions, but only one way at a time. RS-485 communications commonly use the half-duplex mode since they share only a single pair of wires.

Auto-RTS Transceiver Control

In RS-485 communications, the driver must be enabled and disabled as needed, allowing all cards to share a two wire cable. The COM485/8 card controls the driver automatically. With automatic control, the driver is enabled when data is ready to be transmitted. The driver remains enabled for the transmission time of one character after data transfer is complete and then is disabled. The receiver is also normally disabled during RS-485 transmissions. The COM485/8 automatically adjusts it's timing to the baud rate of the data. (NOTE: Thanks to the automatic control feature, the COM485/8 is ideal for use in WIN95 applications)

Shared IRQ Support

The Model COM485/8 card supports sharing of IRQ resources, and includes an on-board IRQ status register for use with operating systems that support this feature such as Windows NT. This allows the card to use as few as one IRQ line to control all eight ports, greatly simplifying system configuration. Use of this feature is optional, and does not effect performance under DOS or other non-IRQ-sharing operating systems.

How to remain CE Compliant

In order for machines to remain CE compliant, only CE compliant parts may be used. To keep a chassis compliant it must contain only compliant cards, and for cards to remain compliant they must be used in compliant chassis. Any modifications made to the equipment may affect the CE compliance standards and should not be done unless approved in writing by Industrial Computer Source.

The Model COM485/8 is designed to be CE Compliant when used in an CE compliant chassis. Maintaining CE Compliance also requires proper cabling and termination techniques. The user is advised to follow proper cabling techniques from sensor to interface to ensure a complete CE Compliant system. Industrial Computer Source does not offer engineering services for designing cabling or termination systems. Although Industrial Computer Source offers accessory cables and termination panels, it is the user's responsibility to ensure they are installed with proper shielding to maintain CE Compliance.

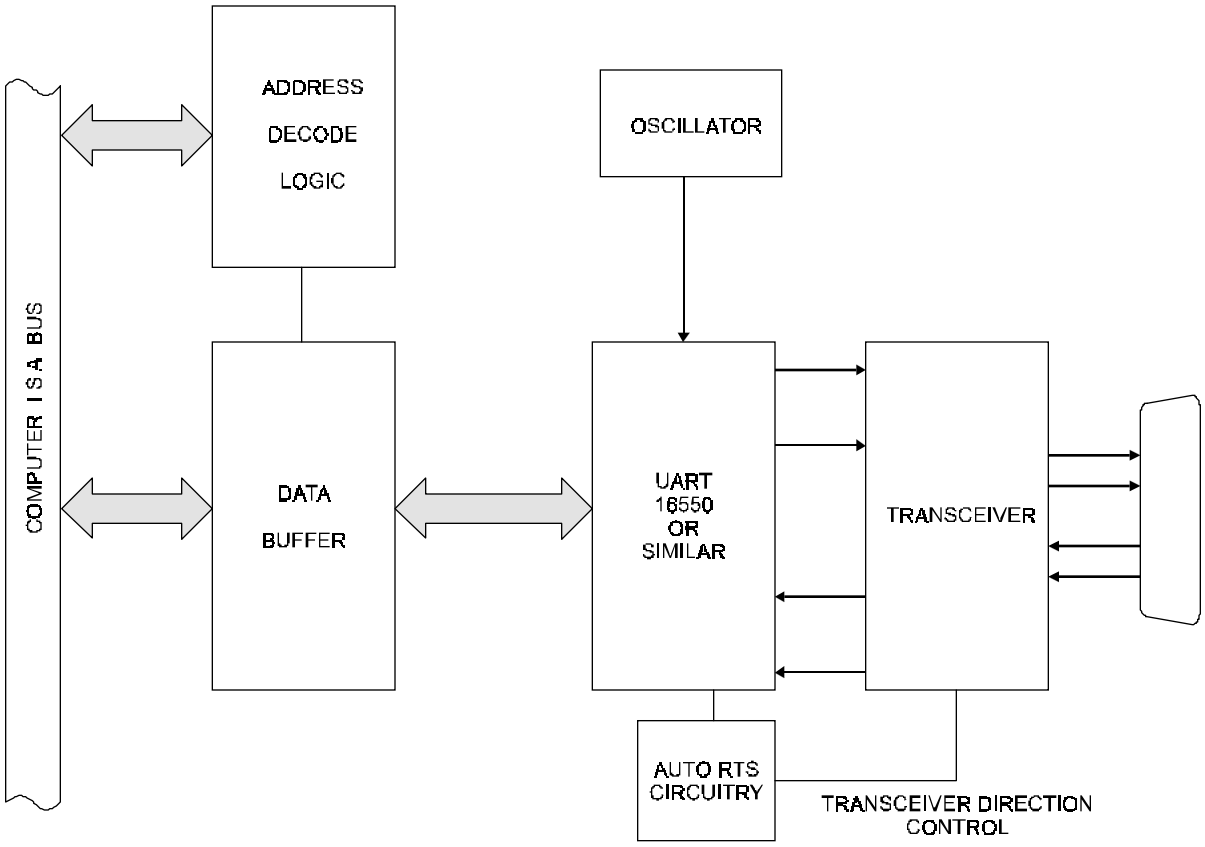

Figure 1-1: COM485/8 Block Diagram
(Only one serial channel shown)

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Chapter 3: COM485/8 Option Selection

To help you locate the jumpers described in this section, 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.

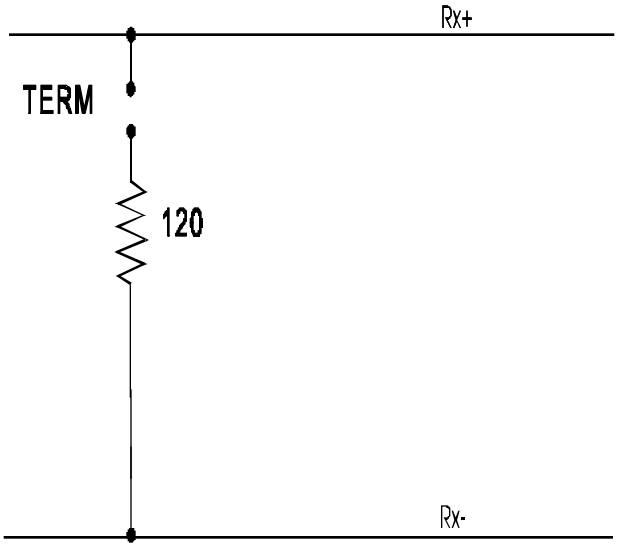

Figure 3-1: Simplified Termination Schematic

Terminations

A transmission line should be terminated at the receiving end in its characteristic impedance. Installing a jumper at the location labeled TERM applies a 120Ω load across the transmit/receive input/output for RS-485 operation.

In RS-485 operations where there are multiple terminals, only the RS-485 ports at each end of the network should have terminating resistors as described above. Also, for RS-485 operation, there must be a bias on the RX+ and RX- lines. *If the COM485/8 card is not to provide that bias, contact the factory technical support.*

Data Cable Wiring

	COM485/8		**RS-485 DEVICE**
All ports:	(TX+) 2	to	(RX+)2
	(TX-) 3	to	(RX-) 3
	(GND) 5	to	(GND) 5 or 7

INTERRUPTS: In addition to standard interrupt levels IRQ2 through IRQ7, the COM485/8 also supports higher interrupts IRQ10 through IRQ15 (Except IRQ13 and others reserved by other installed hardware). Select the desired level by installing a jumper in one of these locations. If the COM485/8 is installed in a short eight-bit slot, the higher interrupts (IRQ10 through IRQ15) will be unavailable to the card.

If it is intended to use the IRQ sharing feature of operating systems like Windows NT, place the IRQ jumpers for all ports that will share IRQs on the same IRQ level. As many or as few ports can share IRQs as desired under Windows NT.

Note: In Windows NT, changes must be made to the System Registry to support IRQ sharing. The following is excerpted from "Controlling Multiport Serial I/O Cards" provided by Microsoft in the MSDN library. Document id: mk:@ivt:nt40res/D15/S55FC.HTM, also available in the Windows NT Resource Kit.

The Microsoft serial driver can be used to control many *dumb* multiport serial cards. *Dumb* indicates that the control includes no on-board processor. Each port of a multiport board has a seperate subkey under the Current Control Set\Services\Serial Subkey in the Registry. In each of these subkeys, you must add values for **DosDevices**, **Interrupt**, **Interrupt Status**, **Port Address**, and **PortIndex** because these are not detected by the Hardware Recognizer. (For descriptions and ranges for these values, see Regentry.hlp, the Registry help file on the Windows NT Workstation Resource Kit CD.)

For example, if you have an eight-port COM485/8 board configured to use address 0x100 with an interrupt of 0x5, the values in the Registry are: [assuming every port is configured to use the same IRQ, and the addresses are configured to be consecutive and contiguous]

Serial2 subkey:
PortAddress = REG_DWORD 0x100
Interrupt = REG_DWORD 5
DosDevices = REG_SZ COM3
InteruptStatus = REG_DWORD 0x500
PortIndex = REG_DWORD 1

Serial3 subkey:
PortAddress = REG_DWORD 0x108
Interrupt = REG_DWORD 5
DosDevices = REG_SZ COM4
InteruptStatus = REG_DWORD 0x500
PortIndex = REG_DWORD 2

Serial4 subkey:
PortAddress = REG_DWORD 0x110
Interrupt = REG_DWORD 5
DosDevices = REG_SZ COM5
InteruptStatus = REG_DWORD 0x500
PortIndex = REG_DWORD 3

Serial6 subkey:
PortAddress = REG_DWORD 0x120
Interrupt = REG_DWORD 5
DosDevices = REG_SZ COM7
InterruptStatus = REG_DWORD 0x500
PortIndex = REG_DWORD 5

Serial7 subkey:
PortAddress = REG_DWORD 0x128
Interrupt = REG_DWORD 5
DosDevices = REG_SZ COM8
InterruptStatus = REG_DWORD 0x500
PortIndex = REG_DWORD 6

Serial8 subkey:
PortAddress = REG_DWORD 0x130
Interrupt = REG_DWORD 5
DosDevices = REG_SZ COM9
InteruptStatus = REG_DWORD 0x500
PortIndex = REG_DWORD 7

Serial5 subkey:

PortAddress = REG_DWORD 0x118

Interrupt = REG_DWORD 5

DosDevices = REG_SZ COM6

InteruptStatus = REG_DWORD 0x500

PortIndex = REG_DWORD 4

Serial9 subkey:

PortAddress = REG_DWORD 0x138

Interrupt = REG_DWORD 5

DosDevices = REG_SZ COM10

InteruptStatus = REG_DWORD 0x500

PortIndex = REG_DWORD 8

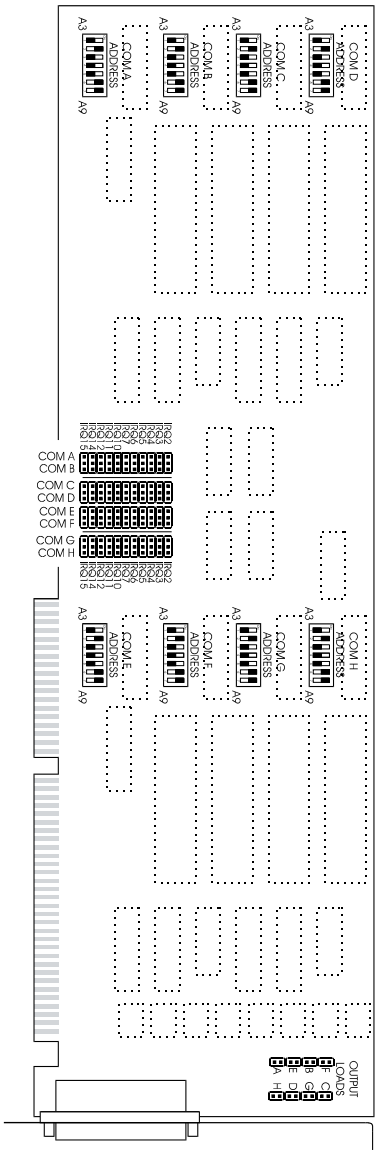

Figure 3-2: COM485/8 Option Selection Map

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Chapter 4: Address Selection

The COM485/8 base address can be selected anywhere within an I/O address range 100-3F8 hex, 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 FINDBASE base address locator program provided on diskette with your card will assist you to select a base address that will avoid this conflict.

Hex Range	Usage
000-0FF	Internal System - Not Usable
1F0-1FF	AT Hard Disk
200-207	Game Control
278-27F	Parallel Port (LPT2)
238-23B	Bus Mouse
2E8-2EF	Asynchronous Communications (COM4)
2F8-2FF	Asynchronous Communications (COM2)
300-31F	Prototype Card
320-32F	XT Hard Disk
378-37F	Parallel Port (LPT1)
380-38F	SDLC Communications
3A0-3AF	SDLC Communications
3B0-3BB	MDA
3BC-3BF	Alt. Parrallel Port
3C0-3CF	EGA
3DO-3DF	CGA
3E8-3EF	Asynchronous Communications (COM3)
3F0-3F7	Floppy Disk
3F8-3FF	Asynchronous Communications (COM1)

Table 4-1: Standard Address Assignments for PC and PC/XT Computers

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: COM485/8 Address Switches

In order to read the address switch setup, assign a binary "1" to switches that are turned OFF and a binary "0" to switches in the ON position. For example, as illustrated in the following table, switch selection corresponds to binary 10 1101 1xxx (hex 2D8). The "xxx" represents address lines A2, A1, and A0 used on the card to select individual registers. See **PROGRAMMING** section of this manual.

Switch Label	A9	A8	A7	A6	A5	A4	A3
Setup	OFF	ON	OFF	OFF	ON	OFF	OFF
Binary Represent'n	1	0	1	1	0	1	1
Conversion Factors	2	1	8	4	2	1	8
HEX Represent'n	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.

The following table lists standard DOS Com Port addresses.

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.

IRQ Status Registers

The Model COM485/8 uses the industry standard 16550 UART, so we won't deal with those registers. However, the COM485/8 also includes the ability to share up to eight interrupts on one IRQ line, and this requires the addition of one status register. This register is located at COMA base address & 0x400. So if COMA is set to 0x350, this status register is located at 0x750.

Chapter 5: Programming

Sample Programs

There are two sample programs installed with the diskette with the COM485/8 card. These are:

Sample 1: This program is provided in C, Pascal, and QuickBASIC. It performs a test of the loopback feature of the UART. It requires no external hardware and no interrupts.

Sample 2: This program is provided in C only and demonstrates interrupt-driven RS-485 half-duplex operation. The program requires at least two computers with one card in each and a two-wire cable interconnecting them. That cable must connect the Tx pins from card 1 to the Rx pins respectively of card 2 and the Tx pins from card 2 to the Rx pins at card 1.

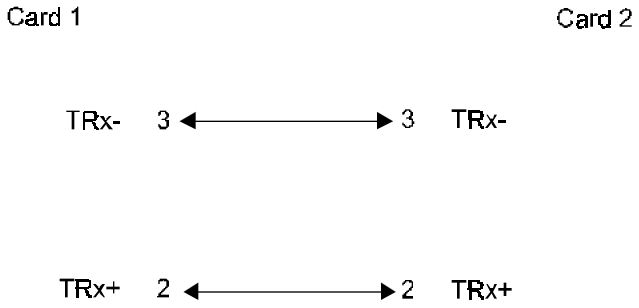

Figure 5-1: Two-Wire Cable Demonstration

RS-485 Programming

Programming the UART for RS-485 communication can be divided into three distinct sections: initialization, reception, and transmission. Initialization deals with option setup on the chip including baud rate selection. Reception deals with incoming-character processing which can be done using either polling or interrupts. Transmission deals with the process of sending the data out.

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) / (32 * divisor)
```

On the COM485/8 card, the crystal frequency is 3.6864 MHz. Below is a table for the popular divisor frequencies:

Baud Rate	Divisor	Notes:	Max Diff. Cable Length *
115200	1		375 feet
57600	2		660 ft
38400	3		920 ft
28800	4		1165 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

Table 5-1: Baud Rate Divisor Values

* Recommended maximum distances for differentially driven data cables (RS422 or RS-485) are for typical conditions. RS-232 communication lines have a maximum length of 50 feet, regardless of speed.

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 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. A simple polling loop must continuously check this bit and read in data as it becomes available. 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:

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

Transmission

RS-485 transmission is simple to implement. The AUTO feature of the COM485/8 card automatically enables the transmitter when data are ready to send so no software enabling is required.

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.

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

Chapter 6: Connector Pin Assignments

The popular 9-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. Connector pin assignments are as follows:

Pin Connections

RS-485 Functions			
Pin 1	-		
Pin 2	-	Tx^+	Transmit Data
Pin 3	-	Rx^+	Receive Data
Pin 4	-		
Pin 5	-	GND	Ground
Pin 6	-		
Pin 7	-		
Pin 8	-		
Pin 9	-		

Note: If connections are to be a Model COM485/8-CE, the CE-certifiable cabling and breakout methodology (cable shields connected to ground at the mounting bracket, shielded twisted-pair wiring, etc.) must be used. The cable offered by Industrial Computer Source is not a CE approved cable.

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Chapter 7: Specifications

Communications Interface

I/O Connection:	9-pin male D-sub connectors
Serial Ports:	Nine shielded male D-sub 9-pin IBM AT style connectors compatible with RS-485 specifications.
Character length:	5, 6, 7, or 8 bits.
Parity:	Even, odd or none.
Stop Interval:	1, 1.5, or 2 bits.
Serial Data Rates:	50 to 115,200 (Faster or custom rates available), Asynchronous, Type 16550 buffered UART.
Address:	Continuously mappable within 000 to 3FF (hex) range of AT I/O bus addresses.

RS-485 Differential Communication Mode

Multipoint:	Compatible with RS-485 specifications. Up to 32 drivers and receivers allowed on line. Serial communications ACE used is type NS16550. Driver/Receivers used are type SN75176EP.
Receiver Input Sensitivity:	±200 mV, differential input.
Common Mode Rejection:	+12V to -7V
Transmitter Output Drive Capability:	60 mA, with thermal shutdown.

Environmental

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

Power Required:	+5VDC at 125 mA typical, -12VDC at 5 mA typical, +12VDC at 5 mA typical, 750 mW total power consumption.
Size:	13.375" long by 3 7/8" If the card is installed in an 8-bit XT-style slot, the card will work but higher order IRQ's 10-15 will be unavailable.)

Appendix A: Application Considerations

Introduction

Working with RS-485 devices is not much different from working with standard RS-232 serial devices and this standard overcomes deficiencies in the RS-232 standard. First, the cable length between two RS-232 devices must be short; less than 50 feet. Second, many RS-232 errors are the result of noise induced on the cables. The RS-485 standard permits cable lengths up to 4000 feet and, because it operates in differential mode, it is more immune to induced noise.

Connections between two RS-485 devices (with CTS ignored) should be as follows:

Device #1			**Device #2**		
Signal	COM485/8 9 pin	25 pin	Signal	COM485/8 9 pin	25 pin
Gnd	5	7	Gnd	5	7
TX+	2	7	RX+	9	12
RX+	3	7	TX+	1	13

A third deficiency of RS-232 is that more than two devices cannot share the same cable. This is also true for RS422 *but RS-485 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 always receive.

Balanced Differential Signals

The reason that RS422 and RS-485 devices can drive longer lines with more noise immunity than RS-232 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. RS-485 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. The maximum operating voltage range is from +6V to -6V allowing 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.

RS-422 Specification Summary

Parameter	Conditions	Min.	Max.
Driver Output Voltage (unloaded)		4V	6V
		-4V	-6V
Driver Output Voltage (loaded)	TERM	2V	
	jumpers in	-2V	
Driver Output Resistance			50W
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			4KW

To prevent signal reflections in the cable and to improve noise rejection in both the RS422 and RS-485 mode, the receiver end of the cable should be terminated with a resistance equal to the characteristic impedance of the cable. (The exception is when 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 COM485/8 card. Termination resistors for the RX^+ and RX^- lines are provided on the card and are placed in the circuit when you install the TERM jumpers. Moreover, installing the BIAS jumpers properly biases these lines. (See the **Option Selection** section of this manual.)

RS-485 Data Transmission

The RS-485 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.

RS-485 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.

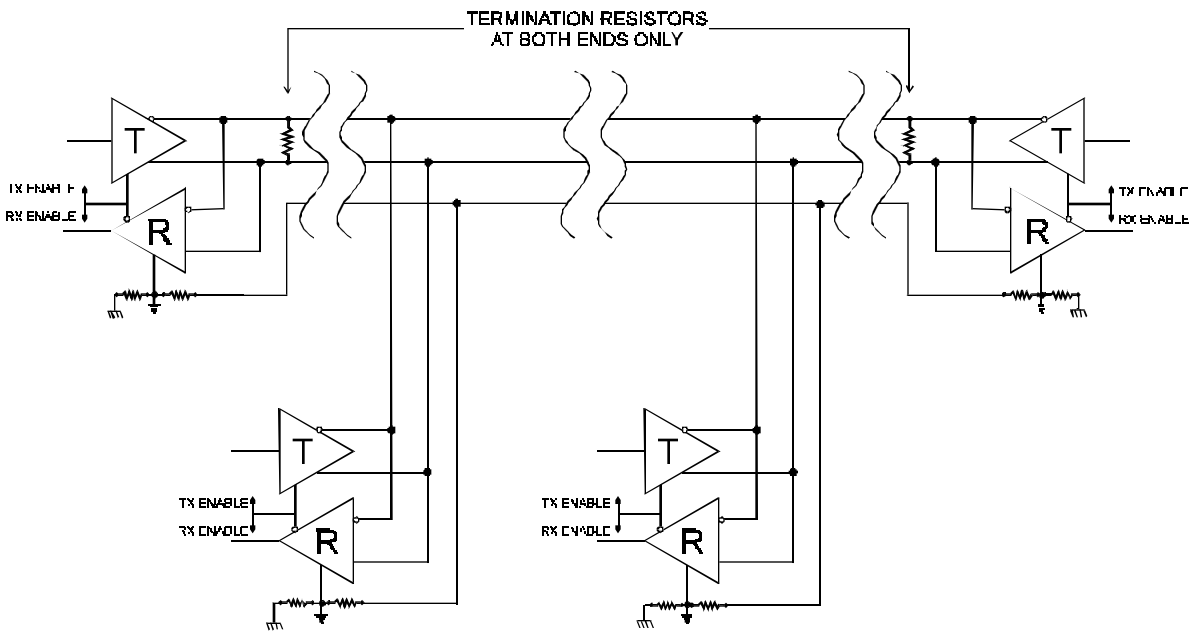

Figure A-1: Typical RS-485 Two-Wire Multidrop Network

RS-485 Four Wire Multidrop Network

An RS-485 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.

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COM485/8-CE

Conformity is accomplished by meeting the requirements of the following European harmonized standards:

EN 50081-1:1992 Emissions, Generic Requirements.

-EN 55022 Measurement of radio interference characteristics of information technology equipment.

EN 50082-1:1992 Immunity, Generic Requirements.

-IEC 801-3:1984 Immunity for radiated electromagnetic fields.
-IEC 801-4:1988 Immunity for AC and I/O lines, fast transient common mode.
-IEC 65A/77B Immunity for AC lines, transients, common, and differential mode.

EN 60950:1992 Safety of Information Technology Equipment.

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April 22, 1997
San Diego, CA

Mr. Steven R. Peltier
President & Chief Executive Officer

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