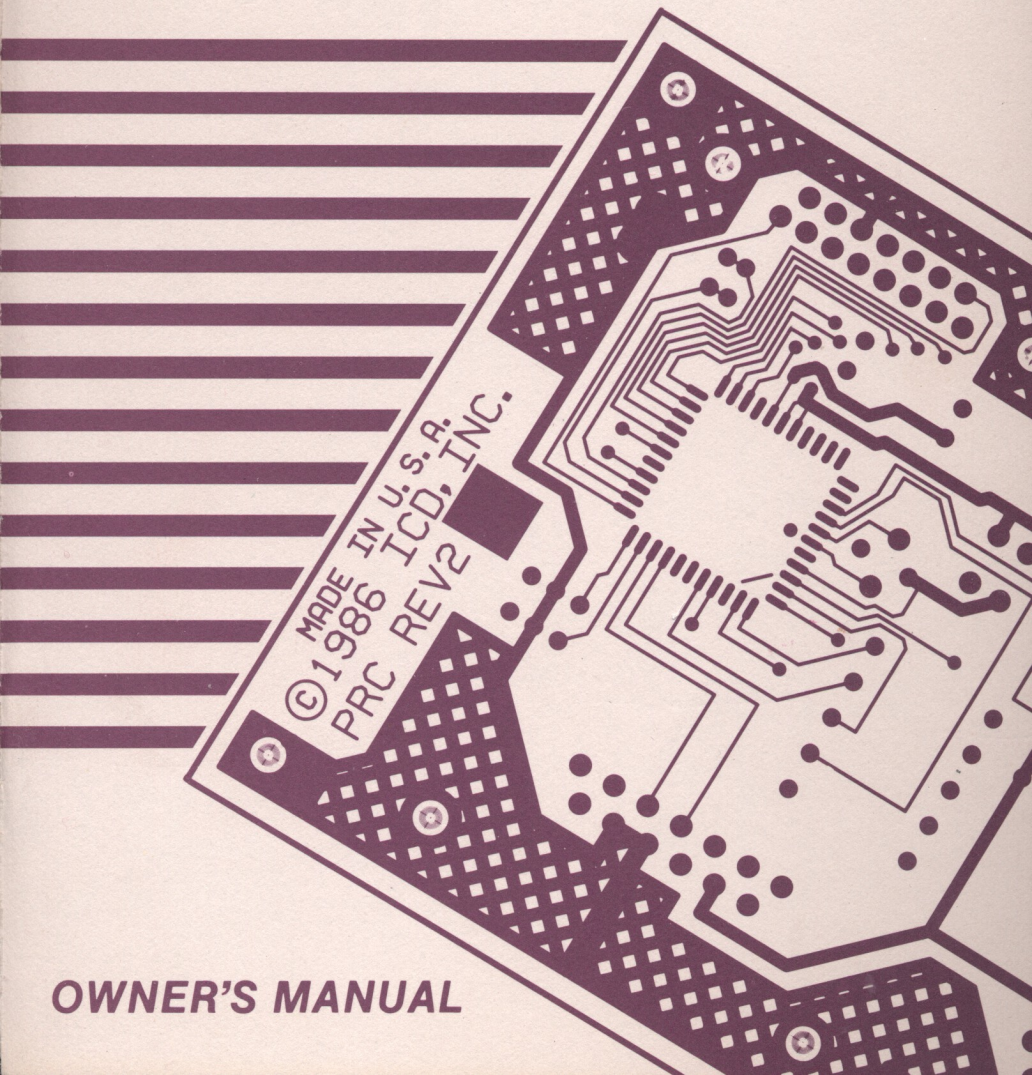
P: R: CONNECTION

The Printer and MODEM Interface for Atari Computers



OWNER'S MANUAL

P:R: Connection

The Printer and
MODEM Interface
for Atari Computers

by ICD

Note—throughout this manual:

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Published by ICD, Inc.
1220 Rock Street
Rockford, IL 61101-1437
U.S.A.

PREFACE

You have just purchased the P:R: Connection, another high quality product from ICD. The P:R: Connection has been designed to add lasting value to your 8-bit Atari Computer by allowing you the choice of hundreds of printers (P: devices) and MODEMs (R: devices). Thousands of dollars and many man hours have been used to develop *the most* economical and flexible high quality interface for your needs. There is no such thing as 100% compatibility (as we tried with the 850) but we have come very close. It is impossible to match code byte for byte without using exactly the same hardware (a feat which was not economically feasible). Instead, we created something much better than the 850 for a lower price (much like Atari did when they created the 800XL to replace the old 800 computer). Virtually all printer software (designed for the 850) will work with the P:R: Connection, and most MODEM software will work without any modification. We have included a translator type file (PRC.SYS) which should work with the few MODEM programs which otherwise will not run. (See Appendix F.) For the latest information on P:R: Connection compatibility call the ICD BBS. It's on-line 24 hours a day at 815/968-2229 running 300/1200/2400 baud.

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WARRANTY

CHAPTER 1—INTRODUCTION TO THE P:R: CONNECTION

Why an interface?

The P:R: Connection is an interface between your 8-bit Atari computer and other RS-232 or 'centronics' parallel devices. These devices may include MODEMs, printers, other computers, or anything which uses either of these two types of ports. There are dedicated MODEMs and printers available just for the Atari which require no interface. These dedicated devices are fine as long as you are satisfied with their operation and never plan on buying another computer. On the other hand, standard serial and parallel devices will work with most other computers including the new Atari ST and the IBM PC.

P: and R: Devices

There have been thousands of programs written for the 8-bit Atari computers many of which use a printer or MODEM ('P:' or 'R:' device). Although some also support other standards, these programs almost always support the Atari 850 interface standard. Before the P:R: Connection, there was no way to accomplish this device standard other than by using an Atari 850. Most of these programs require a 'P:' device for the printer and an 'R:' device for the MODEM. If you do plan on using a serial printer with your Atari, make sure the programs you use will support an 'R:' device for a printer. NOTE: ICD has written a DOS command (SPRINT) which will divert the output and make the 'R:' device look like the 'P:' device to the system. This allows the use of a serial printer (with software requiring a 'P:' device) with any program running under SpartaDOS.

How does it work?

Inside the P:R: Connection is our custom computer chip (PRC9985-6) which contains ROM, RAM, a CPU, and a PIA. This is effectively an entire computer on a single chip. The ROM portion contains the software to make the printer port work like a 'centronics' standard port or 'P:' device. The 'P:' device is virtually identical to the Atari 850 'P:' device.

This ROM also contains the software handler which loads into the Atari computer (when called) and sets up the two serial ports as 'R:' devices ('R1:' and 'R2:'). This 'R:' handler is loaded either with the AUTORUN.SYS (RS232.SYS) which comes with Atari DOS (RS232.COM with SpartaDOS) or else whenever the computer is powered up with the P:R: Connection attached and no disk drives respond. The 'R:' handler is relocatable which means that it loads into the computer at the lowest possible memory location and then protects itself by moving MEMLO up. The P:R: Connection's 'R:' handler is very similar to the Atari 850 'R:' handler at the CIO level. (This means that it uses the same XIO commands as the Atari 850 interface device.) At the SIO level there are several calls different from the 850 which may make a few programs designed for the 850 not function properly. To remedy this, we have included an SIO emulation handler called PRC.SYS. More information on compatibility and the SIO differences can be found in appendices B, C, and F.

Compatibility

The P:R: Connection has been designed as a cost effective replacement for the now obsolete Atari 850 interface. Our hardware design requirements were to make a unit small and compact with clean ergonomic design. This required a molded case with cords only to be attached on two sides. The bulky external power supply also had to be eliminated. All of this was made possible due to the recent development of low power single chip microcomputers. Unfortunately, the 1200XL requires an internal modification to work with the P:R: Connection or any other device which uses the computer for its power. (See appendix E for details.)

The P:R: Connection software design requirements were full compatibility with the 850 protocol. Like the problem Atari had when they designed the 800XL, we found programs written for the 850 which used illegal calls outside the CIO architecture. To provide a link between these programs and the P:R: Connection, we have included a binary file called PRC.SYS which works like a translator. PRC.SYS is fully relocatable and works with any DOS. This should provide full compatibility with programs designed for the 850 which use an 'RBIN' type handler and normally don't load the 850 handler (like Hometerm). If programs are found which don't work properly with the P:R: Connection, we will make every attempt to provide a patch or solution for proper operation. (See appendix F for more information on compatibility.)

Installation and Use

Since the P:R: Connection is powered by the host computer, it should be plugged directly into the 13 pin male socket where the disk drive normally goes. Then plug the next device into the 13 pin socket on the P:R: Connection, the next device into that, and so on. (It will probably work from any of the 13 pin connectors in the daisy chain but since there is a voltage drop in each of these connectors, it is best to plug it directly into the computer.) You will then need a cable to connect between the P:R: Connection ports and the peripheral which you intend to use. These cables may be purchased direct from ICD, from your dealer, or made from the specifications in table 1-1 or 1-2, appendix D, and your peripheral manual. (Cables designed for the Atari 850 will work.) The P:R: Connection ports and their locations are:

R1: This is the 9 pin connector towards the outside. Use this connector as your main RS232 serial port since it supports full handshaking.

R2: This is the nine pin connector in the center. Use this only when you need an extra RS232 port and with softward which supports an 'R2:' device.

P1: 'P1:' is the parallel printer port which is the 15 pin connector located next to 'R2:'.

Using the P:R: Connection with a MODEM

Connect your MODEM cable between serial port 1 (the 9 pin socket on the outside) of the P:R: Connection and your MODEM. For correct operation with a particular program, see your terminal program for details on use with the 850 interface.

TERMINAL PROGRAMS

AMODEM7

Through a special arrangement with Trent Dudley, author of AMODEM7, we have included a full version of his latest terminal program. We feel this is one of the best terminal programs around for Atari computers. AMODEM7 is a BASIC program with machine code speed. It works at 300, 1200, 2400 baud and supports macros for sending pre-typed strings.

850 EXPRESS

Keith Ledbetter, author of 1030 EXPRESS and now 850 EXPRESS has allowed ICD to distribute his latest terminal program with our P:R: Connection and R-Time 8. This is a fantastic terminal program written in ACTION! from OSS. 850 EXPRESS is worth more than most terminal programs you would pay $30 or more for in a store!

AMODEM7 and 850 EXPRESS are distributed on a "freeware" basis which means: Try the program out, if you like it and use it as your main terminal software, send the author payment of whatever you feel it is worth. (Send $5, $10, $20, etc.) You are free to distribute this freeware to your friends as long as you pass on this message and do not remove or modify the author's name, address, copyright notice, etc. from the program.

RSCOPE

Joe Miller originally wrote TSCOPE as a terminal program to work with the Atari 850 and COMPUSERVE's unique file transfer protocol. TSCOPE quickly became the standard terminal program for Atari COMPUSERVE users. Recently COMPUSERVE has added XMODEM protocol which has allowed users a greater choice of software. RSCOPE is a new 'R:' handler version of TSCOPE modified by Joe Miller to work with standard 'R:' handler devices and not just the Atari 850. We would like to thank Joe for his continuing support of the Atari 8-bit community.

PRC.SYS

Some programs (such as the current version of HOMETERM) may require our SIO emulation program called PRC.SYS. If using Atari DOS 2 or 2.5, copy PRC.SYS to a blank disk, rename it to AUTORUN.SYS and APPEND the AUTORUN.SYS from your terminal program to it (see your DOS manual). If using SpartaDOS, just put PRC.SYS in a batch file and run it first, before your terminal program.

ICD BBS (815) 968-2229

This is a good place to test out your new interface or MODEM. We support 300, 1200, 2400 baud communications and are in operation 24 hours a day, 7 days a week. No password is required for UPLOAD, DOWNLOAD or full message base access and there are no charges (other than long distance) to use this board. We do request that you use your real name and location when signing on.

Using the P:R: Connection with a Printer

If using a parallel printer, plug your printer cable from the parallel port (15 pin) of the P:R: Connection into your printer.

If using a serial printer, plug your printer cable from serial port 1 or 2 (9 pin) of the P:R: Connection into your printer. Since the Atari operating system defaults to a parallel printer, you must use a DOS (such as SpartaDOS from ICD) with the capabilities to divert all print output to the serial port or you must use programs which support serial printers.

Options

There are two user selectable hardware options inside the P:R: Connection. These are selected by opening the case and moving the jumper plugs at SW1 and SW2. If you already have a printer which supports the Atari without an interface (usually a direct connect Atari brand printer) you may want to use the P:R: Connection as a serial interface only. SW1 selects printer ON or printer OFF. Leave SW1 at the default of "P-ON" unless your direct connect printer does not function properly with the P:R: Connection installed.

If you test your printer out and it prints one line on top of another without feeding any paper, it needs a line feed for every carriage return. You can fix this by moving SW2 to "LF/CR". The default for SW2 is "CR only" which matches the Atari 850.

CHAPTER 2—THE PARALLEL AND SERIAL INTERFACES

The Parallel Interface

The parallel interface contains all the lines necessary to control standard parallel printers. Most parallel printers will use a 36 pin centronics connector. The signals listed in table 2-1 are supported by the P:R: Connection.

TABLE 2-1 Standard Parallel Printer Signals

Direction	Function	Pin
from P:R:C	Data Strobe	1
to P:R:C	Busy	13
to P:R:C	Fault	12
(none)	Data Pull up	9
(none)	Ground	11
from P:R:C	Data Bit 0	2
from P:R:C	Data Bit 1	3
from P:R:C	Data Bit 2	4
from P:R:C	Data Bit 3	5
from P:R:C	Data Bit 4	6
from P:R:C	Data Bit 5	7
from P:R:C	Data Bit 6	8
from P:R:C	Data Bit 7	15

The Serial Interface

The serial interface is RS-232-C compatible which means that you may connect any RS-232-C device to the P:R: Connection and communicate with it. There are actually two serial ports on the P:R: Connection. Port 1 ('R1:') is a full port which contains all necessary handshaking lines that some MODEMs and other devices require, and port 2 ('R2:') is a stripped port containing only the receive and transmit lines (the DTR and RTS lines are held in the "ready" state if needed). The P:R: Connection **does not** include a current loop port like port 4 of the old Atari 850. We felt that would add unnecessary expense since current loop interfaces are rarely used.

RS-232 Defined

The RS-232-C standard defines about 20 lines, of which, only about 8 are commonly used. Even though a device does not support all signals, it is still considered "RS-232 compatible". The P:R: Connection serial port 1 supports the signals listed in table 2-2. This port 1 matches port 1 on the Atari 850.

The P:R: Connection is considered a data terminal (also DTE or Data Terminal Equipment) whereas a MODEM is a data set (also DCE or Data Computer Equipment). There is no problem in connecting "data terminals" to "data sets", however, when connecting two "data sets" (or "data terminals"), you must take care since the signals are directional (i.e. you must cross XMT to RCV, DTR to CTS, etc.).

TABLE 2-2 The Most Common RS-232 Signals

Direction	Description	Abbreviation	Pin
from P:R:C	Transmitted data	XMT	3
to P:R:C	Received data	RCV	4
from P:R:C	Data terminal ready	DTR	1
to P:R:C	Signal (carrier) detect	CRX	2
to P:R:C	Data set ready	DSR	6
from P:R:C	Request to send	RTS	7
to P:R:C	Clear to send	CTS	8
(none)	Signal ground	GND	5

CHAPTER 3—CONCURRENT I/O VS. BLOCK MODE (RS-232)

Throughout this manual, numerous references are made to "concurrent I/O" and "block mode". These are simply two different methods of implementing the Atari serial bus for the transmission of serial data. **If you are to write programs supporting the P:R: Connection 'R:' Handler, you MUST understand the difference and what limitations each method presents.**

Block Mode. . .What is it?

Block mode is very much like reading or writing disk sectors. The data is saved in a buffer until either 1) the buffer is full, 2) an end-of-line character is placed in the buffer, or 3) the channel is closed. When one of these conditions is met, the entire buffer is transmitted from the computer to the P:R: Connection. This leaves the serial bus free for the computer to communicate to other devices.

There are two very serious limitations of block mode operation. The first being that input from the ports is not possible, thus block mode is output-only. Any input to the RS-232 port is simply ignored since the P:R: Connection does not store any data at its ports.

The second limitation is that data arriving at the RS-232 outputs is not "real-time". When simply sending data to another computer, a printer, or some other non-interactive peripheral, this mode of operation is sufficient. Data at the output will normally appear one line at a time.

Concurrent Mode I/O

While in concurrent mode I/O, the P:R: Connection simply acts as a bit carrier. In essence, it throws a switch connecting a port to the serial bus of the computer. Thus the serial device (POKEY) of the computer acts as a UART (universal asynchronous receiver transmitter).

In this mode, communication is full duplex (bi-directional) and occurs in "real-time". Thus, when in a terminal program, data you type appears at the output as you type it (unless you type faster than the current baud rate, in which case the data you type is buffered). A terminal program simply acts as a switch carrying data you type to the RS-232 handler output and the RS-232 handler input to the screen output handler.

Since the serial port is strictly used to carry port data, the serial bus may not be used for anything else while in concurrent mode. This means that neither printers nor disk drives may be active during concurrent mode. Instead, you must first close the RS-232 port and then perform the necessary disk I/O (or printing). The major drawback is that when the port is closed, any data arriving at the port will be lost—this is a problem with all serial RS-232 and MODEM interfaces for the Atari (this would not be a problem with a properly designed interface connected through the parallel expansion bus using a UART). Note that all Atari terminal programs do use concurrent mode I/O—they could not receive data if they didn't.

CHAPTER 4—RS-232 HANDLER FUNCTIONS AND TABLES

The following is a list of all input/output and XIO calls to the RS-232 ports of the P:R: Connection. Note that IOCB is an input/output channel number that indicates what OPEN device shall receive or provide data. For most XIO calls, you may use any legal IOCB number as long as it is NOT open to any other device. From Atari BASIC, you may use IOCB numbers 1 through 7 (0 is reserved for editor 'E:' I/O).

Note that IOCB #7 is used for the BASIC LPRINT statement and IOCB #6 is used for graphics modes functions from BASIC. Also if using SpartaDOS, IOCB #4 and IOCB #5 are used while doing output and input redirection respectively (via the DOS PRINT command and batch files).

'Rn:' is the serial interface port number being opened or used. For the P:R: Connection, 'n' can be either 1 or 2. The first is the full port (with all the handshake lines) of the P:R: Connection. Note that if you use 3 or 4 for 'n', ports 1 or 2 will be accessed rather than receiving an error.

All the function formats are given in their Atari BASIC form. If using assembly language of some other high level language, refer to the language manual for its equivalent form.

Opening an RS-232 Port

Syntax
OPEN #IOCB,Aux1,0,"Rn:"

Remarks
This function opens a channel to an RS-232 port in non-concurrent mode. This means that you may only input data after performing a start concurrent mode function (XIO 40). Note that Aux1 contains the I/O direction bits—4 for input only, 8 for output only, and 12 for both input and output (which is equivalent to 13 of the 850 interface). Many XIO calls do not require that you open an RS-232 channel first, however, it is good practice to open the channel first.

When a channel is opened, the buffer pointers are cleared for only the direction(s) in which the port is being opened. For example, if you are in concurrent mode I/O on port 1 using IOCB #2 and an open for output is performed on port 1 using IOCB #3, the data waiting in the input queue of port 1 is not lost. Multiple OPENs to the RS-232 ports have no effect on concurrent I/O. Thus, in this case, the system remains in concurrent I/O to port 1. In fact, if the second OPEN was for input (or both input and output), this channel would inherit the concurrent I/O characteristic of the first channel.

It is very important to understand the difference between concurrent and block mode for efficient and problem-free programming. Many XIO functions may only be performed during block mode (non-concurrent), however, input may only be performed during concurrent mode I/O. This is due to limitations of the Atari serial port.

Closing an RS-232 Port

Syntax
CLOSE #IOCB

Remarks
This statement will close the IOCB connected to the port in which a prior OPEN statement initiated. If another IOCB is connected to the same port, that connection will remain intact (data input buffers will not be lost). A CLOSE always flushes the data awaiting transmission (in the buffer) to the port indicated by the paired OPEN statement (OPEN prior to the CLOSE on the same IOCB).

Note that the CLOSE will shut down any concurrent I/O even if another IOCB is open to a port. This is usually relevant only when two IOCB's are open to the "Rn:" device. For example, suppose IOCB #1 is open for input on port 1 (in concurrent mode), and IOCB #2 is open for output on port 2. A CLOSE on port 2 will disable the concurrent mode of port 1 thus requiring another XIO 40 to re-enable concurrent I/O. This operation also causes an error since port 2 did not have control over the serial bus. If the CLOSE were performed on port 1, no error would occur, but concurrent mode is still disabled. Thus, the only way to terminate concurrent I/O properly is to CLOSE an IOCB opened to the port currently in concurrent mode. (It is possible to have two IOCB's opened to the same port—concurrent I/O is a property of the connection to the port rather than of the IOCB. An IOCB number simply establishes a reference number (IOCB #) to a port.)

Input Character or Line From RS-232 Port

Syntax
GET #IOCB,varb
INPUT #IOCB,varb$

Remarks
These functions input data from the RS-232 port specified by a preceding open statement. The GET statement inputs the numeric value of one character into a numeric variable. The INPUT statement inputs a string of characters into a string variable. If the input is a numerical ASCII string, you may input into a numeric variable. Input strings are terminated by an end-of-line (EOL) character.

Note that the IOCB must be opened for read or read/write and you must be connected to the port (as indicated by open) in concurrent mode. If you are not in concurrent mode to the correct port, an input attempt will shut down the other port's concurrent I/O. Refer to your BASIC reference manual for more information.

Output Character or Line To RS-232 Port

Syntax
PUT #IOCB,exp
PRINT #IOCB;exp$

Remarks
These functions output data to the RS-232 port specified by a preceding open statement. The PUT statement outputs the numeric value of one character to the port, and the PRINT statement outputs a string of characters to the port. The syntax of the PRINT statement is the same as a normal PRINT statement except that the "#IOCB;" precedes the expression.

Note that the IOCB must be opened for write or read/write but you do not have to be connected to the port (as indicated by open) in concurrent mode. Refer to your BASIC reference manual for more information.

Reading the Port Status

Syntax
```
STATUS #IOCB,DUMMY
FLAGS = PEEK(746) : REM Error bits relating to status history
LINESTAT = PEEK(747) : REM Status of handshake lines
or
STATUS #IOCB,DUMMY
FLAGS = PEEK(746) : REM Error bits relating to status history
INCHARS = PEEK(747) : REM Number of chars in input buffer
OUTCHARS = PEEK(749) : REM Number of chars in output buffer
```

Remarks

These statement sequences are useful for determining many facts about the state of the RS-232 ports. The first syntax is used when in block mode I/O, whereas the second is used in concurrent mode I/O. Notice that the variable DUMMY is simply a CIO status of the success of the STATUS command. If there were an error (DUMMY<>1), then BASIC would halt and give an error message (unless a TRAP was performed prior to the STATUS).

The block mode STATUS (first syntax) returns a status history of the port (in FLAGS) and the state of the control lines (in LINESTAT). The meaning of each bit is given in tables 4-1 and 4-2.

The concurrent mode STATUS (second syntax) returns a status history of the port (in FLAGS) and the number of characters in the input buffer (in INCHARS) and in the output buffer (in OUTCHARS). The meaning of each bit of FLAGS is given in table 4-1.

TABLE 4-1 Meaning of Error Bits From Location 746

Bit Number	Decimal Equiv.	Error Meaning
7	128	Received a data framing error
6	64	Received a data byte overrun error
5	32	Recieved a data parity error
4	16	Received a buffer overflow error (> 255 chars)

TABLE 4-2 Meaning of Status Bits From Location 747

Bit Number*	Decimal Equiv.	Meaning When Bit is Set (1)
7	128	DSR is true (ready)
5	32	CTS is true (ready)
3	8	CRX is true (ready)
0	1	RCV is at MARK (high state)

*Bits 6, 4, and 2 are simply copies of the next highest bit. In the 850 Interface, these bits would indicate a history (i.e. not always ready since last STATUS).

Forcing Early Transmission of Output Blocks

Syntax
XIO 32,#IOCB,0,0,"Rn:"

Remarks
This function causes all the buffered data in the computer to be outputted to the RS-232 port. This works for either block or concurrent mode. Note that if in concurrent mode, bytes are put in a buffer, not to the port directly. The data is then taken out of the buffer and sent to the port when the last byte sent is finished. Thus, you can send data to the CIO (by PRINT, or PUTs) faster than it is transmitted out of the computer.

When an RS-232 port is closed (see CLOSE statement), the data in the buffer is not lost; transmission of the remaining data is forced.

Controlling Outgoing Lines DTR, RTS, and XMT

Syntax
XIO 34,#IOCB,Aux1,0,"Rn:"

Remarks
This function allows you to set the state of the output handshaking lines. This function may not be used while in concurrent mode (see "Setting Concurrent Mode"). Aux1 is coded as indicated by table 4-3.

TABLE 4-3 Control Values Added to Aux1 (XIO 34)

Function	Bit	Decimal Equiv.	Meaning When Bit is SET
DTR	7	128	Set state of DTR (from bit 6)
	6	64	Set DTR Ready (Not ready if bit is CLEAR)
RTS	5	32	Set state of RTS (from bit 4)
	4	16	Set RTS Ready (Not ready if bit is CLEAR)
XMT	1	2	Set state of XMT (from bit 0)
	0	1	Set XMT to MARK (SPACE if bit is CLEAR)

Setting Baud Rate, Stop Bits, and Ready Checking

Syntax
XIO 36,#IOCB,Aux1,Aux2,"Rn:"

Remarks
This function configures the RS-232 port for desired speed and stop bits. It also tells the port which handshake lines to monitor. This function should be used *before* entering concurrent mode (XIO 40), since it may not be used while *in* concurrent mode (see "Setting Concurrent Mode").

Aux1 is the sum of two codes; baud rate and the number of stop bits. The coding is given by Table 4-4. You must add the value representing the desired baud rate to the code (0 or 128) for the desired number of stop bits per word. Note that the word size is always 8 bits plus 1 or 2 stop bits; the P:R: Connection does not support smaller word sizes as did the Atari 850 interface.

Aux2 is coded to be the sum of 3 values (as given by table 4-5). Each value represents a control line to monitor. If the value is 0, then that control line is not monitored. The handshake lines are only checked when you enter into concurrent I/O mode.

TABLE 4-4 Codes to Add to Aux1 (XIO 36)*

Add	Baud Rate	Add	Baud Rate
0	300	8	300
1	45.5	9	600
2	50	10	1200
3	56.875	11	1800
4	75	12	2400
5	110	13	4800
6	134.5	14	9600
7	150	15	19200

*Default is 1 stop bit. Add 128 for 2 stop bits.

TABLE 4-5 DSR CTS CRX Checking Codes for Aux2 (XIO 36)*

Bit	Add	To Check This Line (Before Sending/Receiving Data)
0	1	CRX
1	2	CTS
2	4	DSR

*Default is 0 which indicates no checking of handshake lines.

Setting Translation Modes and Parity

Syntax
XIO 38,#IOCB,Aux1,Aux2,"Rn:"

Remarks
This function configures the input and output parity and the level of ASCII/ATASCII translation. Aux1 is coded to specify all these parameters while Aux2 is the "won't translate" character. This character is only used in the "heavy ATASCII/ASCII translation" mode and is returned (during a GET or INPUT) when the incoming character is not an ASCII character with a value of 32 to 127 ($20 to $7F in HEX). The value of Aux1 is derived from table 4-6.

TABLE 4-6 Control Values Added to Aux1 (XIO 38)

Function	Add	Resulting Function Performed
OUTPUT PARITY	0	Do not change parity bit (default)
	1	Set output parity to odd parity
	2	Set output parity to even parity
	3	Set parity bit to 1
INPUT PARITY	0	Ignore and do not change parity bit (default)
	4	Check for odd parity, clear parity bit
	8	Check for even parity, clear parity bit
	12	Do not check parity, clear parity bit
TRANS-LATION	0	Light ATASCII/ASCII translation (default)
	16	Heavy ATASCII/ASCII translation
	32	No translation
LINE FEEDS	0	Do not append LF after CR (default)
	64	Append LF after CR (translated from EOL)

Setting Concurrent Mode

Syntax
XIO 40,#IOCB,0,0,"Rn:"

Remarks
This function starts concurrent mode I/O with RS-232 port 'n'. A successful OPEN statement must be performed before entering concurrent I/O. Note that you should also perform all other XIO (34, 36, and 38) statements before this statement. You must set concurrent I/O before any attempts to input data through the RS-232 port.

For more information on concurrent mode I/O, refer to Chapter 3 "Concurrent I/O vs. Block Mode".

APPENDIX A – ICD PRODUCT OFFERINGS

P:R:Connection – Now you're no longer limited to 'Atari Only' printers and MODEMS . . . the P:R:Connection is a flexible alternative to the Atari 850 interface. Suddenly hundreds of printers and MODEMS become compatible with your Atari, you can even share the same printer and MODEM with your ST or IBM PC.

The P:R:Connection plugs directly into the serial (disk drive) port of any 8 bit Atari and provides the user with a standard 'centronics' printer port and two RS-232 type serial ports. It also draws its energy from your computer which means one less cord fighting for an outlet while its compact size leaves your work space virtually clutter-free. The P:R:Connection's serial ports resemble those of the 850 interface, possessing the same signals and functions and using a fully compatible built in R: handler. Why not make your connection the right connection . . . with our Connection! **$89.95** 6 ft. Standard MODEM Cables **$14.95** 6 ft. Standard Printer Cables **$14.95**

Printer Connection – It may look just like an ordinary cable . . . but don't let its simplistic styling fool you! This little dynamo's electronics are built right into the cable end and it possesses the power of compatibility . . . *printer* compatibility. (Compatible with all 'centronics' parallel printers.) With the Printer Connection, you're no longer limited to 'Atari Only' printers.

So, for you "adventurous" Atari owners who dare to explore the world of printers . . . this one's for you! **$59.95**

Multi I/O – Five functions in one box give your 130XE or 800XL the leading edge in performance and execution.

1) RAMDISK: Choose from two versions; 256K or 1Meg. Built in software allows the RAM to be partitioned into multiple disks as desired. The Multi I/O has its own AC power supply which allows the RAM to retain its memory when the computer is off.

2) PARALLEL PRINTER INTERFACE: A 'centronics' type parallel interface which uses a standard 850 cable. Accessed as P1: or P2: with or without LF.

3) SERIAL PRINTER/MODEM INTERFACE: This port accepts either a serial printer or RS232 type MODEM. The 850 handler is built in; always there when needed, which means an extra 1800 bytes of free memory! Built in software also allows a serial printer to appear as a parallel printer and provides it with XON/XOFF software handshaking.

4) SPOOLER: Use any amount of RAM as a print spooler. Works with either of the specified printer ports. Built in software features: Pause, Resume, Repeat Copies, Clear and Size.

5) HARD DISK INTERFACE: Supports up to eight SASI and SCSI controllers at the same time to use industry standard 5-1/4" and/or 3-1/2" hard drives. 256K **$199.95** 1Meg **$349.95** 130XE Adapter (adds two cartridge slots) **$19.95**

FLASHBACK! A hard disk and Multi I/O backup program designed to take the 'manual' out of copying and saving files. **$29.95**

US Doubler – Expanding the 1050's strength is what ICD's US Doubler is all about . . . a true performer in the niche of hardware modifications. With the simple addition of this chip set, your Atari is transformed into a powerhouse, radiating with innovative qualities never before possessed in a 1050; like true double density for greater storage and an accelerated I/O rate designed to triple your speed when combined with SpartaDOS.

Furthermore, the US Doubler is fully compatible with existing Atari software and not only supports true double density but, single density and the 130KB 'Dual Density' (1050 Mode) as well. ICD's US Doubler Package comes complete with two plug-in chips and SpartaDOS Construction Set (including two manuals and two program diskettes). **$69.95** US Doubler 1-4 without SpartaDOS Construction Set **$39.95**

SpartaDOS Construction Set – Perfection . . . that's how we describe our DOS and we're sure you'll agree when you put the SpartaDOS Construction Set to work. It supports everything from the 810 disk drive to hard disk drives, RAMDISKS with the RAMBO XL modified 800XL or 1200XL, the 130XE, the modified 320K XE plus the AXLON 128 board for the 800! And there's more . . .

A special menu file allows rapid transfer, erasure and lock or unlock of tagged files, using only the Space Bar, Option, Start, and Select keys. The utility package also features a 32 character keyboard buffer, intelligent switching between disk densities, a binary file game menu, subdirectories, time/date file stamping, and a 175 page manual containing everything you ever wanted to know about SpartaDOS and the US Doubler. **$39.95**

SpartaDOS Tool Kit – This is an incredible collection of new, unreleased utilities written for all SpartaDOS versions. These tools were written by the professional programmers at ICD, unlike some of the 'buggy' public domain utilities available. (A few utilities may not be applicable to the older SpartaDOS versions.) SpartaDOS Tool Kit is a *must* for any serious SpartaDOS user. Some included tools are:
RENDIR.COM – rename subdirectories
VDELETE.COM – verify delete (prompts you to delete a file or not)
WHEREIS.COM – find a file name (full or partial) anywhere on the disk
MIOCFG.COM – save and reload MIO configurations on floppies
SORTDIR.COM – sorts directories many ways . . . fast and safe to use
DISKRX.COM – the SpartaDOS disk editor . . . edit sectors, trace files or sector maps in any density, rebuild directories, etc.
DOSMENU.COM – a SpartaDOS menu for Atari DOS 2 lovers
SpartaDOS Tool Kit requires SpartaDOS and will help you get the most power out of this top performing DOS! **$29.95**

SpartaDOS X – Just what your 8 bit has been waiting for . . . a cartridge based DOS which adds increased power to your computer and includes a surplus of features such as 80 column support, Ultra Speed operation with the US Doubler and the new Atari XF551 drives plus high speed support for standard Indus GT drives. And for you programmers, now the time consuming process of searching and indexing is streamlined due to the built in data base's incredible speed. **$79.95**

R-Time 8 – We've got the *time* if you've got the Atari. In fact, the R-Time 8 will even provide you with continuous and automatic date information as well! Its unique piggyback cartridge sports a clock board and a three to five year battery back up. A top extension port welcomes the use of additional cartridges since this handy device of ours requires no cartridge area memory of its own. What's more, the R-Time 8 works with all DOS types and plugs into any slot on your Atari computer.

Put our SpartaDOS to work with the R-Time 8 and just like magic . . . each file you create or rewrite is now instantly tagged with time and date information. We're sure that the R-Time 8 will add a new and exciting dimension to your Atari, one that you'll rely on *time* after *time!* **$69.95**

RAMBO XL – You'll be saying "thanks for the memory!" after the RAMBO XL transforms your 800XL or 1200XL into a mighty 256K computer and makes it memory compatible with the 130XE. Now your XL can support BASIC XE extended mode or the standard 64K RAMDISK supplied with Atari DOS 2.5. The new RD.COM handler supplied with SpartaDOS Construction Set gives a 192K RAMDISK . . . that's enough memory to duplicate a full double density disk in one pass! Our RAMBO XL package includes a plug-in decoding board and complete installation instructions.

You must supply the eight 256K DRAMS (available from ICD for $32.00) and the DOS of your choice. The RAMBO XL provides a low cost answer to high performance memory enhancement. **$39.95**

ACTION! – A programming language so fast and exciting we had to call it ACTION! When you want to write something with a short development time but with the execution speed of machine language, turn to ACTION! Blending the elements of PASCAL and C, ACTION! is easier to work with on 8-Bit Atari computers. See for yourself why ACTION! is the most popular alternative to BASIC in the 8-bit Atari world! **$79.95**

ACTION! Tool Kit – A collection of useful routines to make ACTION! work for you immediately. **$29.95**

MAC/65 – This is the macro assembler and editor for programmers who are serious about assembly language. If you are going to spend time with low level code, why not use the best? MAC/65's speed and power runs circles around the competition. Includes the powerful DDT . . . a screen-oriented debugging program. MAC/65 and DDT are without equal on any 8-bit computer system! **$79.95**

MAC/65 Tool Kit – This tool kit will show you the way to use MAC/65 quickly and effectively from the start! **$29.95**

BASIC XL – BASIC XL is a must for anyone with the desire to use or learning Atari BASIC. The superb manual includes an indepth tutorial on using BASIC XL with your Atari 8-bit computer. BASIC XL is fully compatible with Atari BASIC and adds over 45 new commands. BASIC XL supports all 8-bit Atari computers. **$59.95**

BASIC XL Tool Kit – This tool kit gives you more of a good thing with many examples and usable subroutines. **$29.95**

BASIC XE – A programming language designed especially for the 130XE with all the commands and full compatibility with standard Atari BASIC. BASIC XE allows much faster program execution with new floating point routines and the FAST command. Atari BASIC programs will now run 2 to 6 times faster! Larger BASIC programs are now possible with quick access to the extra 64K in a 130XE or 800XL/ 1200XL modified with RAMBO XL. BASIC XE gives you over 60,000 more bytes for your programs . . . use all the memory you paid for.

Our greatly improved editor allows upper or lower case letters, prompted line numbering, and renumbering upon request. Other features include: Advanced string handling, Built-in Player Missile Graphics . . . nine new P/M commands make them easy to control and manageable, Easier Joystick and Paddle Control, Verbal Error Messages instead of just numbers, New statements like PROCEDURE, IF . . . ELSE, and WHILE . . . ENDWHILE. BASIC XE gives you over 50 extra commands at no additional charge! An XL/XE computer is required to use BASIC XE. **$79.95**

The Writer's Tool – The most 'natural' and complete word processor available for Atari 8-bit computers. You'll be amazed at how easy it is to use The Writer's Tool, to produce professional-looking documents with very little effort. The Writer's Tool comes complete with an integrated spelling checker, step-by-step tutorial, printer drivers for most popular printers, and a custom driver for those not-so-common printers. **$69.95**

Personal PASCAL version 2 for the Atari ST – Personal PASCAL is a structured, compiled language. Conforms to the ISO standards with many added features. Personal PASCAL includes: a powerful editor, compiler, linker and extensive, and well documented libraries. Easy access to most GEM functions. Save, compile, and link with the press of one key! Personal PASCAL is the single most popular language program for the Atari ST. **$99.95**

BBS Express! ST – The advanced host communication system that lets your ST do all the talking. Imagine a bulletin board system equipped with features like full descriptions on download and upload files, 32 'IMS' trackable surveys, remote order entry, online sysop maintenance, 40/80 column support, color/monochrome operation and much, much more. Take that leading edge in online performance with our BBS Express! ST . . . the only board worth talking about. **$79.95**

ST Host Adapter – Say goodbye to pre-packaged hard drive systems, the ST Host Adapter is here! It's the only essential element you need to build an ST hard drive system using your choice of standard components. Just connect an SCSI controller to industry standard drives or connect SCSI imbedded drives directly to the ST Host Adapter. It's that easy! And, a battery backed-up time/date clock is built right in for up-to-the-minute information with every file. **$135.95**

Call or write for more information on our ICD Hard Drive Kits. We can supply any or all of the pieces to build your own custom hard drive setup.

FAST Hard Drive System – If memory is what you want, memory is just what you'll get with every FAST Hard Drive System. With storage capacities ranging from 20 megabytes up to 224 megabytes and dual drive systems as well. Get all the memory you need with the only ST hard drive that fits perfectly under your monitor. Each system welcomes up to six SCSI devices and daisy-chaining from Atari's DMA port. Comes with an internal clock and built-in quiet fan. For further information and pricing, please call or write ICD.

APPENDIX B—P:R: CONNECTION SIO COMMANDS

For the sake of compatibility and interests of all who use the P:R: Connection, as much technical information is included in this manual as possible. In this appendix, all SIO commands available to the P:R: Connection are given. We encourage you to use this information to make the P:R: Connection a mainstay in the Atari market.

SIO Commands for the Serial Interface (for R: Handlers)

On all SIO commands, the RS-232 port number is encoded into the device ID; a $50 port is 1, and $51 is port 2 (this is calculated by SIO as DEVIC + DUNIT-1). The device commands (DCOMND) are listed below followed by their function. Note that AUX1 and AUX2 are copies of memory locations $30A and $30B respectively (normally the sector number). The data direction is determined by DSTAT (location $303) where $80 indicates output (from computer) and $40 indicates input (to computer).

A($41) = Set state of DTR/RTS/XMT lines
No data frame
AUX1 = Coded data as follows
Bit[0] : New state of XMT (0 = SPACE)
Bit[1] : 1 if to set new state of XMT, 0 if no change
Bit[4] : New state of RTS (0 = OFF)
Bit[5] : 1 if to set new state of RTS, 0 if no change
Bit[6] : New state of DTR (0 = OFF)
Bit[7] : 1 if to set new state of DTR, 0 if no change

S($53) = Get state of CTS/CRX/DSR lines
Data frame returned (4 bytes):
+1 = Returned status coded as follows:
Bit[0] : Current state of RCV, 1 = MARK, 0 = SPACE
Bit[1] : (same as B0)
Bit[2] : (same as B3)—no history given
Bit[3] : Current state of CRX, 1 = ready (on line)
Bit[4] : (same as B5)—no history given
Bit[5] : Current state of CTS, 1 = ready
Bit[6] : (same as B7)—no history given
Bit[7] : Current state of DSR, 1 = ready

X ($58) = Enter concurrent mode
No data frame
AUX 2 = Index of lines to monitor coded as follows:
Bit[0] : 1 = Check CRX line ready—NAK returned if not ready
Bit[1] : 1 = Check CTS line ready—NAK returned if not ready
Bit[2] : 1 = Check DSR line ready—NAK returned if not ready
To exit concurrent mode, pulse COMMAND low for at least 100uS. The P:R: Connection is fast enough to react to the command (if any) that caused the COMMAND to be pulsed, however, the standard P:R: Connection handler simply pulses COMMAND low with no command frame being sent.

? ($3F) = Get parameters of boot segment
Data frame returned (12 bytes)
+0 = 12 bytes of data to put in DCB for next SIO call

! ($21) = Get boot code segment from P:R: Connection
Data frame returned (#bytes determined by '?' command)
+6 = Run address to finish RS-232 handler load process

% ($25) = Main handler transmission command
Data frame returned (#bytes as used in boot code)
+0 = start of RS-232 handler code

Note that there is no write command. To output data in block mode, you must first enter concurrent I/O and then send the data as per concurrent mode. When transmission is finished (last character emptied from buffer), you should wait a few jiffies and then shut down concurrent I/O.

APPENDIX C—R: HANDLER SOURCE CODE

This appendix contains the source code of the 'R:' handler of the P:R: Connection. Lately, it has become a trend to include a 'R:' handler that supports several devices (e.g. an RBIN handler has been around for some time that supports the 850 interface, 1030 MODEM, 830 MODEM, and the XM301 MODEM). The P:R: Connection is similar to the 850 interface on the SIO level, however, a few key SIO calls are lacking; they are 'B', for set baud rate, and 'W', for write block. These are not needed by the P:R: Connection since it emulates block mode by 1) entering concurrent mode, 2) sending the data, and 3) exiting concurrent mode. But, as a result of the missing SIO commands, the RBIN handler is not compatible with the P:R: Connection.

Generally, the authors of terminal programs and BBS's (bulletin board systems) allow an 'R:' handler to be loaded before the program loads. Thus, most of these programs will work with the P:R: Connection. The one most notable exception is HOMEPACK (version 1). This program has special XIO calls which emulate the suspend and resume functions of the Atari MODEMs (which use a T handler). Therefore, a special 'R:' handler called PRC.SYS is supplied on our distribution diskette.

We are making every effort to insure that the P:R: Connection will remain compatible with all communications software. If you should find problems and/or incompatibilities with the P:R: Connection, please don't hesitate to call the ICD BBS and leave your comments or questions. Thanks to everyone for making our product a success.

```
        title   'R: Handler for P:R: Connection -- Appearence after Installing'
                '©1986 ICD, Inc.'

;       Atari SIO interface
;       -------------------
ddevic  equ     $300            ; device ID
dunit   equ     $301            ; device unit number
dcomnd  equ     $302            ; SIO command
dstat   equ     $303            ; SIO status
dbuflo  equ     $304            ; data buffer low
dbufhi  equ     $305            ; data buffer high
dtimo   equ     $306            ; device timeout value
dbytlo  equ     $308            ; number of bytes low
dbythi  equ     $309            ; number of bytes high
daux1   equ     $30A            ; auxilary 1
daux2   equ     $30B            ; auxilary 2
sio     equ     $E459           ; SIO

intvec  equ     $20A            ; SIO interrupt vectors (3)
imirqv  equ     $216            ; Immediate IRQ vector


;       Atari CIO interface
;       -------------------
icdnoz  equ     $21             ; zp device number
iccomz  equ     $22             ; zp command
icax1z  equ     $2A             ; zp aux1 (direction/XIO info)
icax2z  equ     $2B             ; zp aux2 (XIO info)
hatab   equ     $31A            ; handler table

tchar   equ     $43             ; these locations also used by DOS
portn   equ     $44
iocb    equ     $45


;       CIO errors for R: handler
;       -------------------------
ilcom   equ     $84             ; illegal command
noper   equ     $85             ; not open
enack   equ     $8B             ; NACK
porop   equ     $96             ; Port open
inconc  equ     $99             ; in concurrent mode


;       Atari system hardware registers
;       -------------------------------
pokmsk  equ     $10             ; IRQ enable shadow
irqen   equ     $D20E           ; IRQ enable register
irqst   equ     $D20E           ; IRQ status
brkflg  equ     $11             ; break flag
skctl   equ     $D20F           ; Pokey I/O control
audctl  equ     $D208           ; Audio channel pairing register
skstat  equ     $D20F           ; Pokey I/O status
skres   equ     $D20A           ; Pokey reset
serinr  equ     $D20D           ; serial input
seroutr equ     $D20D           ; serial output
pbctl   equ     $D303           ; Port B control (command line)
audf1   equ     $D200           ; audio freq 1-4/control 1-4
audc1   equ     $D201
audf2   equ     $D202
audc2   equ     $D203
```

```
audf3   equ     $D204
audc3   equ     $D205
audf4   equ     $D206
audc4   equ     $D207

dosvec  equ     $0A
inivec  equ     $0C
jiffy   equ     $14             ; jiffy LOW counter
memlo   equ     $2E7            ; Low memory ptr
stloc   equ     $2EA
bptr    equ     $43
ssflag  equ     $2FF


        sbttl   'Initialization and SIO routines'
        page

;       Initialize after reset
;       ----------------------

initz   bit     xwarm           ; if warm, then initz rest
        bmi     resi
xinit    jsr    $ffff           ; do not perform DOS INI on first initz
                                ;  of RS-232 handler... this is because if
                                ;  this is AUTORUN.SYS, it is loaded by DOS INI
                                ;  code... can't go recurse
                                ; NOTE: The $FFFF is replace by the contents of
                                ;  DOSINI by some initz code... DOSINI then pts
                                ;  to INITZ... ex:
                                ;       lda dosini
                                ;       sta xinit+1
                                ;        lda dosini+1
                                ;        sta xinit+2
                                ;       lda #low initz
                                ;       sta dosini
                                ;        lda #high initz
                                ;        sta dosini+1
                                ;       jmp (dosini)
resi    ldy     #0
        sty     xwarm           ; from now on, always initz DOS
        lda     #low cend       ; set memlo to END of handler
        sta     memlo
         lda    #high cend
         sta    memlo+1

cha     lda     hatab,y
        beq     gotnp           ; jump if entry is free
         cmp    #'R'
         beq    docls           ; jump if already present
          iny
          iny
          iny
         bne    cha             ; check next entry.. assume that
                                ;  there is a free entry
gotnp   lda     #'R'            ; create new 'R' entry in table
        sta     hatab,y
         lda    #low rhand
         sta    hatab+1,y
          lda   #high rhand
          sta   hatab+2,y

docls   lda     #$80
```

```
        ldy     #10
wx7     sta     conflg-1,y      ; clear CONFLG,INP,INEND
         dey                    ;  OUP,OUEND,NOCHARS
         bne     wx7
         iny                    ; set Y to 1.
        rts

hiad    db      (obuf)/256
        db      (obuf+256)/256  ; table of high addresses of OBUF


;       Set concurrent mode for interface
;       ---------------------------------

set.con sta     dcomnd
         ldy    #0
         sty    dstat
         iny
        iny
        sty     dtimo
        jmp     sio


        sbttl   'Handler vectors and command entry points'
        page

;       RS232 device handler
;       --------------------

rhand   dw      ropen-1         ; OPEN
        dw      rclose-1        ; CLOSE
        dw      rget-1          ; GET BYTE
        dw      rput-1          ; PUT BYTE
        dw      rstatus-1       ; STATUS
        dw      rspec-1         ; XIO

rvecs   dw      sirdy           ; Serial input ready interrupt
        dw      sordy           ; Serial output ready interrupt
        dw      socmp           ; Serial output complete


;       save unit number in table
;       -------------------------
; in:
;       X       = iocb number ($00, $10,...)
; out:
;       X       = iocb index (0,1,...)
;       Y       = port number (0 or 1)

                                ; Entry for getting unit number
                                ;  with use for put and get
getun   txa                     ; get unit number
        lsr     a
        lsr     a
        lsr     a
        lsr     a
        tax
        lda     unit,X          ; get unit number
         bcc    setun           ; go put in correct places (jump always)

retri   txa                     ; get iocb index
        lsr     a
```

```
        lsr     a
        lsr     a
        lsr     a
        tax
        ldy     icdnoz          ; get unit number from iocb
        dey
        tya
        and     #1
setun   stx     iocb
        sta     dunit           ; set unit number for SIO
        sta     unit,x          ; save in unit table
        sta     portn           ;  set port number
        tay
         lda    #$51
         sta    ddevic
        rts


;       Command entry points
;       ********************

;       OPEN COMMAND
;       ------------

ropen   jsr     retri           ; save unit in IOCB table
        lda     icaxlz          ; save direction bits
        sta     iodir,x
        ldx     #0
        stx     errflg          ; clear error flag
                                ; reset input/output ptrs
        lsr     a               ;  depending if read/write
        lsr     a
        lsr     a
        bcc     cwrt
         sty    inp
         sty    inend
cwrt    lsr     a
        bcc     oprt
;        ldy    portn           ; note that initz values of ptr doesn't matter
;        lda    #0              ; Y is portn from retri...
         sta    oup,y
         sta    ouend,y
oprt    ldy     #1
retx    rts                     ; return good status


;       CLOSE COMMAND
;       -------------

rclose  jsr     getun           ; get unit number etc.

;       Flush output buffer (alias RCLOSE)
;       ----------------------------------
; notes:
;       If in concurrent mode (on ICDNOZ) then just wait till all is
;       transmitted.  If not in concurrent, start concurrent and flush
;       buffer.  If in concurrent on the other channel, then abort with
;       an error (and take it out of concurrent).

flush   jsr     modck           ;place in concurrent mode
         bmi    retx            ;  exit if error (simple rts)
        jsr     enaoi           ;enable output IRQ
```

```
flus2   lda     brkflg
        beq     rstp
         ldy    portn           ; get port number to flush...
         lda    nochars,y
         beq    flus2

        lda     jiffy
        adc     #20
wtjif   cmp     jiffy           ; wait 20 jiffies (this should probably be
        bne     wtjif           ;  less... should be 1/30 sec+)

        ldy     #1              ; successful operation
         db $2C
rstp    ldy     #$80            ; break error.
;       jmp     restor          ; fall through to restor


;       Restore after concurrent mode
;       -----------------------------
; notes:
;       This must not affect the Y register.

restor  bit     conflg          ; only restore if not
        bmi     xrest           ;  already in concurrent mode

        sei
        lda     #$34            ; set command line low..
        sta     pbctl

        lda     pokmsk
        and     #$C7            ; disable input and output interrupts...
        sta     pokmsk          ;  Prev. only disabled input -- may have
        sta     irqen           ;  been cause for crashes when break pressed...

        ldx     #6-1            ; restore Pokey IRQ vectors
rslp1   lda     tpok,x
        sta     intvec,x
         dex
         bpl    rslp1

        ldx     #8-1
        lda     #0
lpla    sta     audf1,x         ; turn all sound off
         dex
         bpl    lpla

        lda     #$80
        sta     conflg          ; not in concurrent mode

        lda     #$3C
        sta     pbctl           ; COMMAND line HIGH
        CLI
xrest   rts


;       Enable output IRQ
;       -----------------
; notes:
;       It is ok to do this if no chars in buffer. The interrupt will
;       simply detect an empty buffer and disable the output IRQ.

enaoi   lda     #8              ; set 2 or 1 stop bits
```

```
        bit     baudr
        bmi     sesb
         lda    #$18
sesb    ora     pokmsk
        sta     pokmsk
        sta     irqen
        rts


;       Status command
;       --------------

rstatus jsr     retri           ; get unit number etc.
        bit     conflg          ; in block mode.. get ctr lines
         bpl    incomo          ;   jump if in concurrent mode

        ldy     #8-1            ; set up DCB
lp3     lda     sttab,y         ; setup DCB for status comnd
        sta     dcomnd,y
         dey
         bpl    lp3
        jsr     sio             ; do serial I/O
        bpl     seer            ; finish setting up error flags
         bmi    retlb           ;  (same as return) return if error

incomo  sec
        lda     inend
        sbc     inp
        sta     stloc+1
         sec
;       ldy     portn           ; Y is portn from retri
         lda    ouend,y
         sbc    oup,y
         sta    stloc+3

seer    lda     errflg          ; get error flags
        sta     stloc
         ldy    #0
         sty    stloc+2
         sty    errflg          ; reset error flags
         beq    great           ; return good status


;       Special XIO command
;       -------------------

rspec   jsr     retri           ; get unit from iocb
        lda     iccomz          ; get command
        cmp     #40             ; check if to set concurrent mode
        bne     compa


;       Set concurrent I/O
;       ------------------
; notes:
;       If alreay in concurrent mode, an error will occur and concurrent
;       mode will be disabled.

        lda     conflg          ; make sure not alreay in
        bpl     incmod          ;  take it out of conc mode if error
         jsr    modck           ; make sure in concurrent
retlb    clc
```

```
          bcc     return          ; exit with given status...

                          ; ------------------------------------
compa     cmp     #32             ; force write of short block
          bne     compb


;         Force write of short block
;         --------------------------
; notes:
;         This simply does a flush on the channel provided. The same
;         errors that occur on flush can occur here. If in concurrent mode,
;         an error should occur.

          lda     conflg          ; check if in concurrent
          bpl     incmod          ; jump if already in concurrent mode.
           jsr    flush           ; do flush without setup
           db $2C                 ; skip the good status return
great     ldy     #1              ; return with good status
return    ldx     iocb            ; get device ID
          lda     iodir,x         ; restore IO direction
          sta     icax1z
          rts

incmod    jsr     restor          ; take out of conc mode
          ldy     #inconc         ; illegal op while in conc mode
          bne     return          ; return with error

                          ;------------------------------------
compb     cmp     #34             ; check if to set control lines
          bne     compc


;         Set control lines (XIO 34)
;         --------------------------

          bit     conflg          ; jump if in block mode
          bmi     inblk

           lda    icax1z          ; get mode
           and    #3              ; XMT setting
           lsr    a               ; BIT[0]=0 if no change
           beq    great           ; exit with good status if no change
            lda   #$73            ; get break/no break
            bcs   setb
             ora  #$80
setb         sta  skctl           ; set break/no break
grtj2     clc
          bcc     great

inblk     lda     icax1z
          sta     daux1           ; set aux 1 byte
          lda     #'A'
          jsr     set.con         ; go set state of ports
           clc
           bcc    return          ; return with status from SIO


                          ; ------------------------------------
compc     cmp     #36             ; check if to set baud rate...
          bne     compd
```

```
;       Set baud rate (XIO 36)
;       ----------------------
; notes:
;       This operation is always legal. It can change baud rate right
;       in the middle of concurrent I/O if it wants.

        lda     icaxlz          ; get baud rate/word size/stop bits
        sta     baudr,y
         lda    icax2z          ; get CTS flag
         and    #7
setct    sta    ctsflg,y
        clc
        bcc     grtj2           ; return with good status

                        ; ---------------------------------
compd   cmp     #38             ; check if to set translation mode
        bne     undef


;       Set translation (XIO 38)
;       ------------------------
; notes:
;       This operation is also always legal. Translation mode may be changed
;       right in the middle of concurrent mode if desired.

rtrans  lda     icaxlz          ; get translation mode
        sta     tramod,y
         lda    icax2z          ; get won't translate charac
         sta    trachr,y
        clc
        bcc     grtj2

                        ; ---------------------------------
undef   ldy     #ilcom          ; illegal command error
        rts


;       Place handler into concurrent mode if not already
;       -------------------------------------------------
; notes:
;       This routine first checks to see if it is in concurrent mode,
;       if so, then it makes sure the right port is opened. If not, it
;       will place itself into concurrent mode. Errors are a SIO type
;       error if P:R: is not on, or a already concurrent type of error.

modck   lda     conflg          ; check if concurrent mode
        bmi     ctok            ; go make sure its the same

        cmp     portn           ; make sure same as device ID
        bne     incmod
         ldy    #1              ; return with good status...
reterl   rts

                                ; Set concurrent mode (unconditionally)
                                ; -------------------------------------
ctok    ldy     portn
        lda     ctsflg,y
        sta     daux2           ; controls must be ready for X command
        lda     #'X'
ctok2   jsr     set.con
         bmi    reterl          ;  jump if an error occurs...
```

```
        ldy     portn           ;  get port number (0 or 1)
        sty     conflg          ; now in concurrent mode
        lda     baudr,y         ; get baud rate
        and     #$0F            ; strip other bits..
        tay
         lda    bauth,y         ; get baud rate HIGH
         sta    audf2
         sta    audf4
        lda     baut1,y         ; get baud rate LOW
        sta     audf1
        sta     audf3

        lda     #$A0            ; set no sound..
        sta     audc1
        sta     audc2
        sta     audc3
        sta     audc4

        SEI                     ; disable IRQ while setting up
        lda     #$73            ; set SKCTL..
        sta     skctl
         lda    #$78
         sta    audctl          ; set channel pairing

        ldy     #6-1            ; get new IRQ vectors..
seir2   lda     intvec,y        ; Save old vectors
        sta     tpok,y
         lda    rvecs,y
         sta    intvec,y
          dey
          bpl   seir2

        lda     #$20            ; enable input interrupt...
        ora     pokmsk          ; set pokey mask bits
        sta     pokmsk
        sta     irqen
         CLI                    ; enable interrupts..
         ldy    #1
         rts


;       Put byte
;       --------

rput    sta     tchar           ; save character
        jsr     getun           ; get unit number from table

        lda     tramod,y        ; Get translation mode
        and     #$30
        tay
         cmp    #$20            ; jump if no translation
         bcs    cpari

        lda     tchar           ; check if EOL
        cmp     #$9B
        bne     ckpar
         lda    #13             ; if EOL send CR/LF
         jsr    sench           ;  send char to buffer
         tya
          bmi   expu
```

```
        ldx     portn
        lda     tramod,x        ; check if to append LF
         asl    a
         bpl    expug           ; exit with good status
          lda   #10             ; send LF
          bne   sench

ckpar   and     #$7F            ; check if valid character
        dey
        bmi     sench
         cmp    #' '            ; heavy translation
         bcc    expug
         cmp    #$7D
         bcc    sench           ; jump if valid character
expug   ldy     #1
expu    rts

sench   sta     tchar           ; save character
cpari   ldx     portn
cpar    lda     tramod,x        ; do parity build
        and     #3
        beq     sencm
        asl     tchar
         cmp    #3
         beq    setpl           ; set high parity
        lsr     a
        lda     tchar
pupa    bcc     shlpp
         eor    #$80            ; (odd parity)
shlpp   asl     a
        bne     pupa
setpl   ror     tchar           ; set parity bit

sencm   ;ldx    portn           ;get device number... (already loaded)
        lda     hiad,x          ; set address of buffer
        sta     wx49+2          ; stuff it...
        ldy     ouend,x         ; get ptr to end of output
        iny
        tya

wpu     jsr     brkck           ; (exits concurrent if brk)
         bmi    exbrk           ;  exit if break...
        cmp     oup,x
        beq     wpu             ; wait for room (only happens if CONC mode)

        tay
        lda     tchar
        pha
wx49    sta     obuf,y          ; put character in buffer
        tya
        sta     ouend,x         ; save end ptr
         lda    #0
         sta    nochars,x       ; signal some chars in buffer
        pla

        bit     conflg          ; if not in conc mode
        bpl     isin            ;  then check if to flush buffer...

        cmp     #13             ; if CR then flush it...
        beq     fluit
         iny                    ; now check if buffer is full
```

```
          tya
          cmp     oup,x           ; check if this filled it
          bne     ret5            ; not full, so return with good status
fluit      jmp    flush           ; flush buffer...

isin      jsr     enaoi           ; enable output irq if chars
ret5      ldy     #1              ;  and return with good status
exbrk     rts


;         Get character
;         -------------

rget      jsr     getun           ; get unit number from table
          cpy     conflg          ; make sure in concurrent mode
          bne     ret8            ; jump if error...

cbk       jsr     brkck           ; check if break
           bmi    ret8            ;  jump if break error
           ldx    inp             ;  check if character in buffer
           cpx    inend
           beq    cbk             ; jump if none

          lda     ibuf,x
          inx
          stx     inp             ; get char and bump ptr
          sta     tchar           ; save character

          lda     tramod,y        ; check parity
          and     #$0C
          beq     ctra            ; jump if no parity check..
           cmp    #$0C
           beq    clpar           ; clear parity
          and     #4
          eor     tchar           ; force into even/ODD parity
ckpl      bcc     noe
           eor    #$80
noe       asl     a
          bne     ckpl
           bcc    clpar

          lda     #$20            ; set parity error
          ora     errflg
          sta     errflg

clpar     asl     tchar
          lsr     tchar           ; clear parity

ctra      lda     tramod,y        ; get translation mode
          and     #$30
          tax
          lda     tchar
          cpx     #$20
          bcs     notr            ; jump if no translation
           and    #$7F
           cmp    #13             ; CR
           bne    nocr
            lda   #$9B
nocr      dex
          bmi     notr            ; exit if not heavy

          cmp     #' '            ; heavy translation
```

```
        bcc     gdef
        cmp     #$70
        bcc     notr
gdef    lda     trachr,y        ; translation character
notr    ldy     #1
        rts

ret8    jmp     restor          ; take it out of concurrent


        sbttl   'Interrupt handlers'
        page

;       Check break flag.. if break then abort
;       --------------------------------------

brkck   bit     brkflg          ; check break flag
        bmi     reno
        jsr     restor          ; restore from concurrent
        ldy     #$80            ; reset break flag...
        sty     brkflg          ; S=1 if error (Y=error msg)
        rts
reno    bit     restor          ; force S flag to 0
        rts


;       serial output ready/complete IRQ
;       --------------------------------

sordy
socmp   CLD                     ; make sure decimal flag is cleared
        tya
        pha                     ; save Y register (but not A)
        txa
        pha

        ldy     conflg          ; get correct buffer...
        lda     hiad,y          ; get high address of buffer
        sta     WX79+2          ; save it in routine...
        lda     oup,y           ; see if is a character to send
        cmp     ouend,y
        bne     seou            ; jump if so.. send character

        lda     pokmsk          ; clear interrupt flag
        and     #$E7
        sta     pokmsk
        sta     irqen
        lda     #-1
        sta     nochars,y       ; no characters in buffer
        bne     noinr           ; jump (always)

seou    tax
        inx                     ; get character..
wx79    lda     obuf,x
        sta     seroutr
        txa
        sta     oup,y

wtod    lda     #$08            ; make sure an Output Done interrupt
        and     irqst           ;  will not occur.  (apparently OD can
        beq     wtod            ;  happen even after SEROUT is loaded)
```

```
noinr   pla
        tax

reti    pla                     ; return from interrupt
        tay
        pla
        rti


;       Serial input ready IRQ
;       ----------------------

sirdy   CLD                     ; make sure not in deciaml mode
        tya
        pha

        lda     serinr          ; get character
        ldy     inend           ; get input buffer ptr
        sta     ibuf,y

         lda    skstat          ; get status
         sta    skres           ;  ..reset status
          eor   #-1
          and   #$C0            ; get overrun/frame error bits
          ora   errflg          ; save flags

        iny
        cpy     inp             ; check if hit end..
        sty     inend
        bne     exin            ;  jump if no overrun..
         iny                    ; bump current position
         sty    inp
         ora    #$10            ; set overrun flag
exin    sta     errflg
        clc
        bcc     reti            ; return from interrupt


        sbttl   'Tables and system variables'
        page


;       Table for DCB on status command
;       -------------------------------

sttab   db      'S',$40
        dw      stloc,4,4

;       Baud rate tables
;       ----------------

bautl   db      $A0,$CD,$E3,$6F,$95,$C0,$F6,$47
        db      $A0,$CC,$E3,$EA,$6E,$B3,$56,$28
bauth   db      $0B,$4C,$45,$3D,$2E,$1F,$19,$17
        db      $0B,$05,$02,$01,$01,$00,$00,$00


xwarm   db      -1              ; first time through, no dosini is done

tramod  db      $00,$00         ; translation mode:
                                ;   B6 - 1 if append LF after CR (out)
                                ;   B5 - 1 if no translation
```

```
                                ;    B4- 1 if heavy, 0 if light
                                ;  B[3,2] - 00 ignore parity (input)
                                ;            01 check odd/ clear
                                ;            10 check even/ clear
                                ;            11 no check/ clear
                                ;  B[1,0] - 00 no change (output)
                                ;            01 set odd parity
                                ;            10 set even parity
                                ;            11 set parity bit to 1
baudr   db      $00,$00         ; Baud rate:
                                ;  B[3-0] - baud rate (index into table)
                                ;  B[5-4] - 00 = 8 bits
                                ;           01 = 7 bits
                                ;           10 = 6 bits
                                ;           11 = 5 bits
                                ;  B[7] - 1 if 2 stop bits (else 1 stop)
ctsflg  db      $00,$00         ; indicates which must be true for conc mode
                                ;  B[0] - 1 if CRX monitor
                                ;  B[1] - 1 if CTS monitor
                                ;  B[2] - 1 if DSR monitor
trachr  db      $00,$00         ; Translation character: char to return
                                ;  if in heavy translation..
ecode                           ; address of end of handler code

                        ; THE FOLLOWING MUST STAY IN ORDER...
                        ; (and after TRACHR)!!!
conflg  ds      1               ; Concurrent mode flag.. (<0 if not in conc)
inp     ds      1               ; input ptr
inend   ds      1               ; input end ptr
oup     ds      2               ; output ptr
ouend   ds      2               ; output end ptr
nochars ds      2               ; no chars in out buffer flag

iodir   ds      8               ; icaxlz bytes (saved from open)
unit    ds      8               ; icdnoz bytes (saved from open/xio/status)
tpok    ds      6               ; holds serial I/O irq vectors
errflg  ds      1               ; error flag

obuf    ds      256             ; output buffer..
        ds      256             ; 2nd output buffer
ibuf    ds      256             ; input buffer..
cend                    ; End of handler.. (new memlo)

        end
```

APPENDIX D—STANDARD PRINTER & MODEM CABLES

The following is the standard connection specification used by ICD for our standard printer and MODEM cables. These should work for the most common printers and MODEMs or they may need to be modified according to the special needs of your particular installation.

Printer Cable Connections

36 pin centronics (male)	DB15P
1	1 - Data Strobe
2	2 - D0
3	3 - D1
4	4 - D2
5	5 - D3
6	6 - D4
7	7 - D5
8	8 - D6
16	11 - Gnd
32	12 - Fault
11	13 - Busy
9	15 - D7
Frame - to the shield wire	No connection to shield

MODEM Cable Connections

DB25P	DB9P
20	1 - DTR
8	2 - CRX
2	3 - XMT
3	4 - RCV
7	5 - GND
6	6 - DSR
4	7 - RTS
5	8 - CTS
Frame - to the shield wire	No connection to shield

APPENDIX E—1200XL MODIFICATIONS

WARNING: The following instructions should help anyone competent with soldering equipment to modify the 1200XL to work with the P:R: Connection and other computer powered peripherals. This modification is not intended for the complete novice.

Turn your computer on its back. **Remove the six phillips head screws which hold the case together** and place them in your parts dish. Turn the computer right side up and lift the top cover up and towards the front. Look inside and find the two ribbon cables which connect the keyboard and console LEDs to the main computer board. Carefully unplug these cables noting the correct polarity of their connectors. **Remove the keyboard assembly and set it aside for now.**

Remove the six phillips head screws holding the computer board in the bottom case. One of these screws is in the upper left hand corner near the on/off switch. Another is in the upper right corner and goes through the heat sink. The remaining four screws are across the front and about four inches apart. (Three of these also hold down the metal shield.)

Remove the computer board assembly from the case. Lift the front of the computer board and the cartridge/joystick/switch assembly up and pull the computer board out and towards you until all the rear connectors are free. Remove this assembly, separate the plastic piece from the PCB and set it aside.

Remove the metal shields and set them aside. There should be several "push" rivets. Remove these then separate and remove the metal covers. NOTE: Some metal covers may be held together with bent metal tabs or screws.

Replace resistor R63 with a jumper wire. 1200XL is the only 8-bit Atari computer with a current limit resistor (R63). This prevents 1200XL owners from using any peripherals (including the XM301 MODEM and P:R: Connection) which draw power from the computer. R63 is located at the top of the PCB near the center. It is just to the right of transistor Q3. Remove this resistor and replace it with a jumper wire. (Any piece of 24-30 gauge wire will do.)

Reassemble and test.
Now you can use devices which draw power from your 1200XL!

APPENDIX F – COMPATIBILITY

The P:R: Connection internal software has been modified to provide even more compatibility than before! In most cases, no other software is required. The exceptions to the rule are:

1) The second serial port (R2:) is not supported with the internal handler. If you plan on using R2:, you will need to load the PRC.SYS external handler first, before your MODEM program.

2) If your MODEM 'crashes' with the P:R: Connection installed (the MODEM begins to send or receive continuously on its own) try to load the PRC.REL file first, before your MODEM program. If that does not solve the problem, reboot and try the PRC.SYS file. (Do *not* use these two files together.)

In both cases you may load the PRC.SYS or PRC.REL files in the following manner. If using SpartaDOS 2.3 or higher, you can include the file as the first filename in your communications batch file. Be sure to include the full name of the file. An optional method for SpartaDOS or most other DOS's is to append your MODEM program onto the end of the PRC.SYS or PRC.REL files.

Every effort has been made to make the P:R: Connection the best 8-bit interface available! If you have any questions or problems, call our tech support department at 815-968-2228 8 A.M.-5 P.M. CST or use your MODEM and call our 24 hour support BBS at 815-968-2229.

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Write to:

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Rockford, IL 61101-1437
Attn: Service Dept

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(Please print)

Name_____

Address_____

City_____ State_____

Country_____ ZIP_____

Phone ( ) _____ Item Purchased_____
(Area Code)

Date of Purchase_____ Serial Number_____

Where Purchased_____

What other products would you like to see us develop?_____

_____

_____

_____

Does your local Atari dealer carry our product line? ☐ Yes ☐ No

Your Atari dealer's name, address_____

_____

_____

_____

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ICD, Inc.
1220 Rock Street, Suite 310
Rockford, Illinois 61101-1437

Possible Errors Using the P:R: Connection

CODE #	ERROR CODE MEANING
128($80)	Break Key Was Pressed
129($81)	IOCB Already Open
130($82)	Nonexistent Device
131($83)	Open for Write Only
132($84)	Invalid XIO Call Made
133($85)	IOCB Not Open (from CIO)
135($87)	Open for Read Only
138($8A)	Device Timeout
139($8B)	NAK - Input Handshake Lines Not Ready
153($99)	Already in Concurrent Mode

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