IQ TECHNOLOGIES, INC.

SmartCable™

SMART CABLEMAKER™

MODEL SC821PLUS

US PATENT #4631698

User Manual

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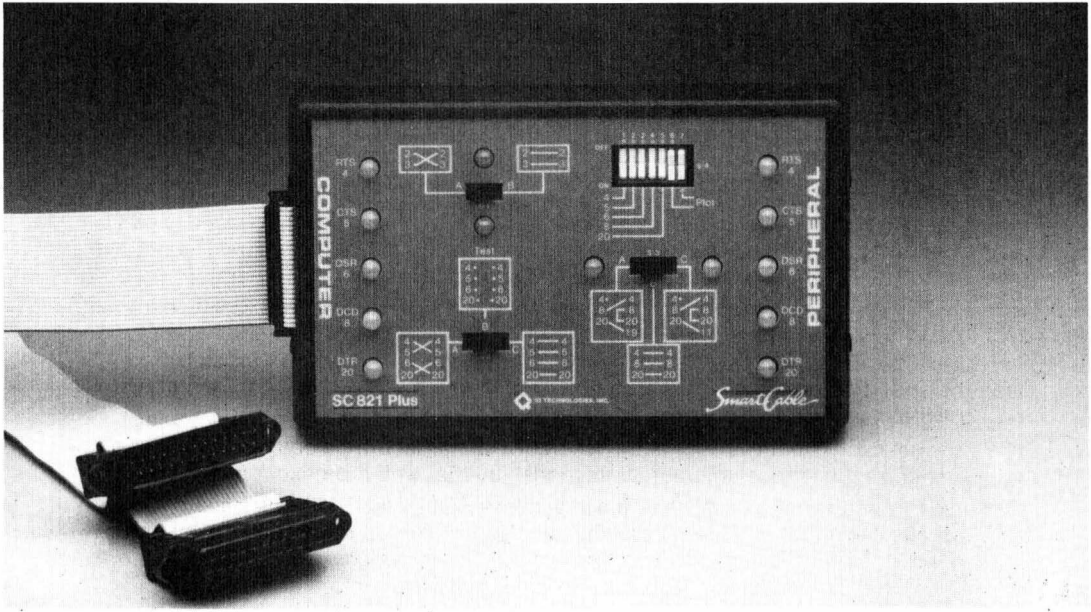

COMPUTER
PERIPHERAL
RTS 4
CTS 5
DSR 6
DCD 8
DTR 20
SC 821 Plus
SmartCable

INTRODUCTION

The RS-232-C interface is a popular means of interconnecting serial peripheral devices to a computer. Recommended Standard Number 232, Revision C, is a rigid standard developed by the Electronics Industy Association in 1968. As originally conceived, the Standard was devised to solve a very specific problem: Modem to terminal interfacing.

Attempting to interface printers to computers using the RS-232-C Standard has presented designers with interfacing situations not covered by the rules set down in the standard. To interface a computer to a printer, modem or plotter through the RS-232-C serial port is more than just connecting a 25-pin cable assembly. Some devices require jumpers, cross-wiring, and different voltage states (high/low) on certain pins.

The SC821PLUS is an intelligent cable that instantly interfaces two RS232 asynchronous serial devices while simultaneously providing a graphic display of the interface configuration. The SC821PLUS works with computers, terminals, printers, modems, bar code readers, digitizers, etc., in fact any device that has an RS232 asynchronous port.

The SC821PLUS takes the guess-work out of custom cabling. Never has interfacing RS232 serial equipment been so easy. Total time to interface 2 pieces of equipment and figure the correct interface is about 30 seconds! Try that with a breakout box!

Interfacing unfamiliar equipment is a cinch with the SC821PLUS. All you have to do is set 3 switches. When the SC821PLUS has your application up and running, you can either leave it in place for as long as you need the connection or you can build a cable for the interface. The SC821PLUS provides all the necessary information.

OPERATING INSTRUCTIONS

NOTE: 1 Before starting, it is important to insure that both the computer and the peripheral being connected are properly configured. Take a moment to go through the RS-232 check list located in Section A of the Troubleshooting Guide and verify that all parameters are correctly set.

NOTE: 2 To reduce the chance of errors it is recommended that application programs (word processors, data bases etc.) not be used when initially establishing communications between the two devices. Step 4 will allow the use of your applications to assure proper handshaking of the interface.

1. Set the switches on the SC821PLUS as follows:

Switch	Position
S1	B
S2	B
S3	B
S4-1	Off
-2	Off
-3	Off
-4	Off
-5	Off
-6	Off
-7	On

2. Connect the SC821PLUS between the computer and the peripheral to be interfaced. Verify that power is applied to both devices.

SWITCH S-1

If both yellow LED's by switch 1 are illuminated, this switch is in the correct position. If only one yellow LED is illuminated, move switch S1 to position "A". Both yellow LED's should now be illuminated. However, if still only one LED is illuminated, then the peripheral device may be a receive only unit. In this case leave switch S1 in position "A".

NOTE: An equipment problem such as the power off or the cable not installed correctly can cause one LED to light. Check to assure that all power is applied and the cable is properly seated.

SWITCH S-2

NOTE: Ignore both LED's labeled DCD (pin 8) during this step.

Look at the RTS, CTS, DSR, and DTR LED's on both the computer and peripheral side of the SC821PLUS. Disregarding the color of the illuminated LED's, if corresponding LED's are lit on both the computer and peripheral sides of the SC821PLUS, then move switch S2 to position "A". If the illuminated LED's on each side of the SC821PLUS do not correspond then move switch S2 to position "C".

SWITCH S-3

Observe the LED's next to switch S3. If one of them is illuminated then move switch S3 towards the lit LED. If both of them are illuminated or neither one of them are illuminated then leave switch S3 in position "B".

NOTE: The LED's next to switch S3 - A & C display the status of lines 19 & 11 respectively.

SWITCH S-4

If you are connecting to a plotter or to a computer (such as a Kaypro) which requires that the CTS and DSR lines be tied together for proper handshake control then set switch S4 as follows:

S4-6	ON
S4-7	OFF

3. Attempt to transfer data between the two devices. This may be accomplished by filling the computer screen with text (or a disk directory) and pressing the shift and PrtSc deys. Data transfer is indicated by a momentary flickering of one of the yellow LED's by switch S1. If data was not transferred properly, proceed to the Troubleshooting section.

4. Load an application program (your word processor, data base, etc) and recall a lengthy file (3 or more pages). Attempt to transfer the file to the peripheral. Make sure intelligible data transfer occurred over the complete file. This test assures proper handshaking line connections.
5. If data was transferred successfully you can proceed to the section on Constructing a Cable for instructions on building a permanent cable. If the data transfer was unsuccessful, i.e.; breaks or errors occur periodically throughout the data, proceed to the next section, Troubleshooting the Interface.

TROUBLESHOOTING THE INTERFACE

Find the description which most closely defines your problem and go to the referenced section:

Garbage appeared on screen or printer . . . . . Section A
Data was transferred correctly for a brief period and then errors appeared . . . . Section B
Yellow light flickered but nothing appeared on screen or printer . . . . . Section C
Yellow light didn't flicker and nothing appeared on screen or printer . . . . . Section D

A. GARBAGE APPEARED ON SCREEN OR PRINTER.

1. This problem is caused by a mismatch of one or more of the RS-232 communications parameters. Perform the following checklist and verify that both devices are set the same. Make sure you are not running any application software when this error occurs.

RS-232 Checklist

a. Are both devices using the RS232 serial interfaces?

b. Is the baud rate (transmission speed) matched between the two devices?

c. Are both devices using the same form of parity (error checking)? Typical selections are odd, even, none, mark, space.

d. Is the word length (bits per character) matched between the two devices? Normal selections are 7 or 8, although some manufacturers of specialized equipment use 5 or 6.

e. Are the number of stop bits matched between the two devices? Normal options are 1, 1.5, and 2.

f. Are both devices using the same form of flow control? This is the method used by one device to tell the other to stop sending data. Improper setting of this parameter can result in lost or garbled data.

g. Is the BUSY polarity set correctly? Some devices allow selection of busy (usually DTR) polarity. This parameter is important in hardware flow control. If the sending device requires a high (positive) busy signal to enable transmission, the peripheral should be set to generate a high (positive) signal when it is ready to receive data.

h. Are both devices using the same standard for encoding? The vast majority of equipment made today use ASCII code. However, there is still some equipment that use other codes for specific applications. If you are in doubt, consult your equipment user manual or call the manufacturer.

i. Is the transmission mode matched between the two devices? Choices are, simplex, half duplex, and full duplex. A mismatch in transmission mode can result in double characters being displayed or in data being transmitted by a device but not being displayed.

j. Is data being transferred asynchronously or synchronously? The majority of applications today utilize asynchronous data transfer where each character is defined by start and stop bits. The SC821PLUS was designed for asynchronous applications and will work in synchronous environments where clocks are provided on pins 15 and 17.

k. Is the SC821PLUS the only cable between devices? Extension cables or adaptors may not contain the signal lines needed for correct operation.

B. DATA WAS TRANSFERRED CORRECTLY THEN ERRORS APPEARED.

1. This problem is normally caused by a discrepancy in handshaking or flow control.
2. Verify that both devices are using the same method of flow control, ie., X-on/X-off, ETX/ACK, DTR.
3. To verify that the correct handshake line is selected by the SC821PLUS, watch the LED's while data is being transferred. When the peripheral's buffer is full, the handshake control line LED (normally DTR or one of the LED's by S3) will change color. At the same time, one or more of the LED's on the computer side should change color correspondingly. Use S3 to select the correct handshake line and transfer data.
4. If there is still a buffer problem after the correct handshake line is selected, set switch S4 as follows and attempt to transfer data:

S4-6 . . . . . ON
S4-7 . . . . . OFF

C. YELLOW LIGHT FLICKERED BUT NOTHING APPEARED ON THE SCREEN OR PRINTER.

NOTE: A flickering yellow light indicates that data is being sent. The most likely problem is in the peripheral not receiving the data, or an incorrect protocol.

1. Verify that power is applied to the peripheral and that it is on line or selected.
2. Perform the RS-232 checklist in Section I.
3. Set switch S4-6 and S4-7 as follows and attempt to transfer data:

S4-6	ON
S4-7	OFF

4. Set switches S4-1 thru S4-5 to the on position and attempt to transfer data. If data is successfully transferred, repeat the OPERATING INSTRUCTIONS beginning with step 4. Then refer to appendix B.

D. YELLOW LIGHT DIDN'T FLICKER AND NOTHING APPEARED ON THE SCREEN OR PRINTER

1. Verify that the correct output port is selected (both hardware interconnect and DOS redirect i.e.; COM1, COM2 etc.) on the computer.
2. Verify that power is applied to the peripheral device and it is on-line or selected.
3. Perform the RS-232 checklist in Section 1.
4. Set switches S4-1 thru S4-5 to the on position and attempt to transfer data. If data is successfully transferred, repeat the OPERATING INSTRUCTIONS beginning with step 4. See appendix B.
5. Look at the peripheral handshake control LED's (DTR and the two LED's by S3). Most computers and modems are set up to recognize a positive signal (space) as a ready indicator and a negative signal (mark) as a busy indicator. If the handshake control LED selected by S3 is red (negative), it will be necessary to change the polarity of the handshake control signal from the peripheral to a positive ready. Instructions for this will be found in the manual for the device.

CONSTRUCTING A CABLE

Once successful communication and handshaking have been established, you may decide to leave the SC821PLUS in place. However, should you decide to construct a custom cable, the following section will provide all the necessary instructions.

NOTE: The following conventions apply to all cables; and should be included in any cable design regardless of any switch position settings.

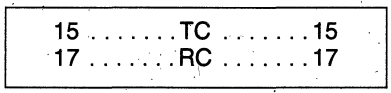
A. All 25 pin interface cables must have Frame ground and Signal ground connected as follows:

1 ..... FG 1	
7 ..... SG 7	

B. If connecting to a modem, the Ring Indicator signal should be connected as follows:

22 ..... RI 22

C. If you are using synchronous equipment, the Transmit clock and Receive clock signals should be connected as follows:



D. All tri-state LED's glow red to indicate NEGATIVE (low) voltage, green to indicate POSITIVE (high) voltage, and white (not lit) to indicate 0 voltage (usually open).

1. When constructing a cable it is important to remember that the signal flow is from switch S2 to S3. Therefore the position of S2 determines which signals are applied to S3. Pin references on the left side of switch S3 refer to pins coming from switch S2, not from the computer connector.
2. To construct a cable from the configuration charts in Appendix A, simply find the chart which corresponds to the settings of S1, S2, S3, S4-6, and S4-7.
3. If a pull-up voltage is applied to a line by Switches S4-1 thru S4-5 a jumper must be installed to one of the lines which illuminate a green LED on the SC821PLUS. Appendix B shows how the pull-ups are connected to various positions of S2 and S3. Jumpers may be installed on either end of the cable if pins are connected through.

NOTE: It is important to remember that the pull-up designations on S4 (except "8") flow through S2 before reaching the computer side of the cable.

4. If switch S4-6 is on, a jumper should be installed on the *computer* side of the cable between pin 5 and pin 6 or pin 4 and pin 20 depending upon the position of switch S2.

SWITCH S2

position "A"	position "C"
CTS 5 ┐ DSR 6 ┘ jumper	RTS 4 ┐ DTR 20 ┘ jumper

5. If switch S4-7 is OFF, then pin 4 on the *peripheral* connector must not be connected to anything, i.e; open.

THEORY OF OPERATION

1. The SC821PLUS is comprised of three multi-pole switches (S1, S2, S3), a seven position dip switch (S4) and 14 tri-state LEDs mounted in a 3.6 x 5.75 inch plastic enclosure. Two 25 conductor ribbon cables with male and female 25 pin d-sub connectors are provided for interconnecting the various devices. The SC821PLUS derives its power from the drivers of the devices it is connected to and consequently requires no external or internal power supply such as a battery or converter.

2. The interface signals controlled by the SC821PLUS are as follows:

DESCRIPTION	MNEMONIC	PIN
Transmit Data	(TXD)	2
Receive Data	(RXD)	3
Request to Send	(RTS)	4
Clear to Send	(CTS)	5
Data Set Ready	(DSR)	6
Data Carrier Detect	(DCD)	8
Secondary Request to Send	(SRTS)	11
Secondary Request to Send	(SRTS)	19
Data Terminal Ready	(DTR)	20
The following signals are passed straight through by the SC821PLUS:		
Frame Ground	(FG)	1
Signal Ground	(SG)	7
Transmit Clock	(TC)	15
Receive Clock	(RC)	17
Ring Indicator	(RI)	22

3. Switch S1 is a two position switch which controls the connection of TXD and RXD between connector P1 (computer side) and connector P2 (peripheral side). In position "A" it functions as a crossover or null modem connection. In position "B" it functions as a straight through or modem connection. Two yellow LED's, driven by a negative signal on the TXD line provide a visual indication of proper connection.
4. Switch S2 is a three position switch which controls the connection of the RTS, CTS, DSR and DTR signals between P1 and P2. In position "A" it functions as a crossover or null modem connection. In position "C" it functions as a straight-through or modem connection. Position "B" is a test position which provides no connection of the RTS, CTS, DSR and DTR signals between P1 and P2. This allows the user to determine what state the control signals from each device are in. Visual indication of the status on each of these signals is provided by eight tri-state LED's, four on the computer side and four on the peripheral side.
5. Switch S3 is a three position switch which controls the connection of the RTS, DCD, DTR and SRTS signals for special handshaking configurations. Position "A" connects DCD from P1 to RTS from P2, DTR or DSR from P1 to SRTS (pin 19) from P2, and DCD from P2 to DTR from P2. Position "B" passes DCD straight through from P1 to P2 with RTS and DTR going to S-2. Position "C" is the same as position "A" with the exception of the selection of SRTS (pin 11) instead of SRTS (pin 19). Visual indication of the status of the SRTS signals is provided by two tri-state LED's. The left LED displays pin 19 status, while the right LED displays pin 11 status.

NOTE: It is important to understand that the signal flow is from P1 to S2 to S3 to P2. Therefore, the position of S2 determines which signals are input to S3.

6. S4 is a seven position dip switch. Switches S4-1 through S4-5 respectively control the application of a current limited (3 ma max) positive voltage to the RTS, CTS, DSR, DCD and DTR lines on P1 through S2.
7. S4-6 jumpers CTS to DSR (switch S2 in 'A' position) or RTS to DTR (switch S2 in 'C' position). S4-7 isolates RTS on P2. Connecting peripherals such as the Hewlett Packard 74XX Series plotters or the Kaypro Series Computers may require the use of these switches.

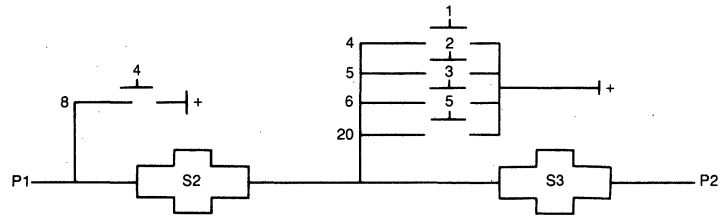
PULL-UPS / SWITCH S4

Switch S4-1 through 5 provide the ability to guarantee a known logic state to pins 4, 5, 6, 8 and 20. This is known as "PULLING UP" or providing a constant positive voltage to these pins to enable communications.

Initially, switches S4-1 through 5 should be set OFF. Attempt to establish communications between the two devices using S1, S2, and S3. If the peripheral fails to respond to the computer, S4-1 through 5 should be used to isolate which logic control pins require a pull-up voltage.

STEP	ACTION
1	Make note of any green LED.
2	Toggle S4-1 through 5 ON. This applies a pull-up voltage to pins 4, 5, 6, and 20 leaving switch S2, and pin 8 on the computer side.
3	Attempt to transfer data.
4	Turn off one switch at a time while attempting to transfer data
5	Make note of any switch, when turned off that inhibits data transfer. In some cases, more than one switch may inhibit data flow.

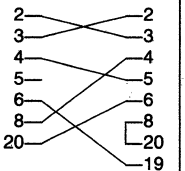
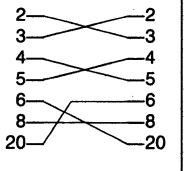
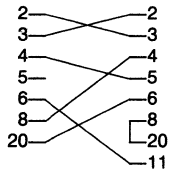
SWITCH S4-1...5



Using the chart provided in Appendix B, locate the diagram corresponding to the final position of S2, S3 and S4. This illustrates the pin or pins requiring pull-up jumpers when building a custom cable.

Since the cable you're building will not contain batteries or an external power source, it is necessary to locate and tap a positive voltage to connect the pull-up jumpers. Positive voltages are available on any pin that causes a LED on pin 4, 5, 6, 8 or 20 to glow green when switch S4-1 through S4-5 is OFF

SWITCH S4-6 OFF
SWITCH S4-7 ON

S1 S2 S3	S1 S2 S3	S1 S2 S3
A A A	A A B	A A C
		
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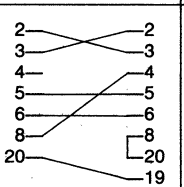	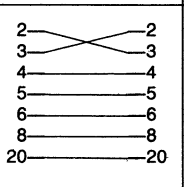	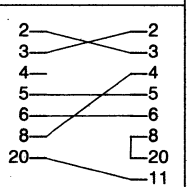
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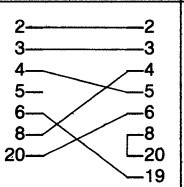
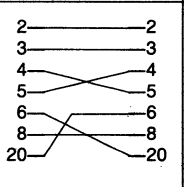
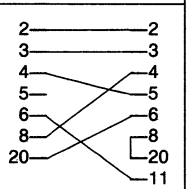
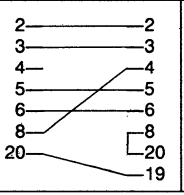
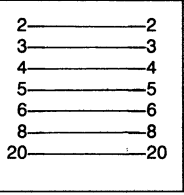
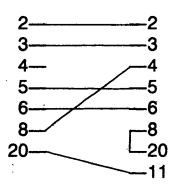
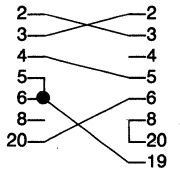
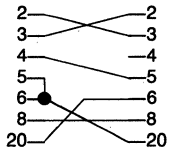
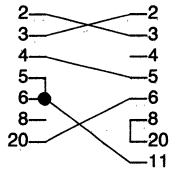
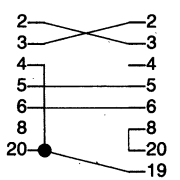
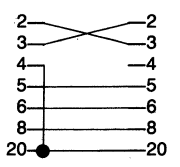
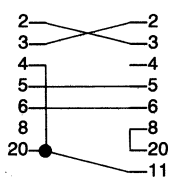
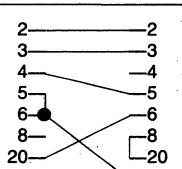
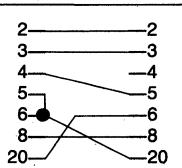
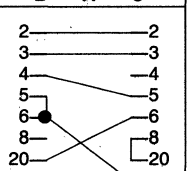
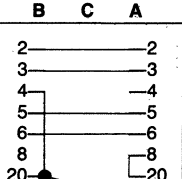
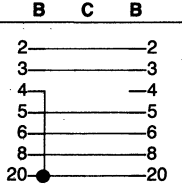
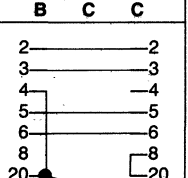
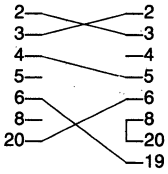
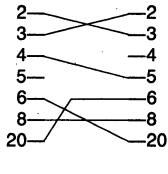
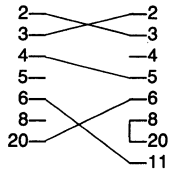
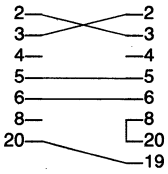
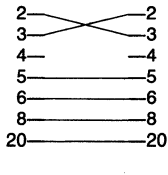
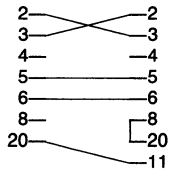
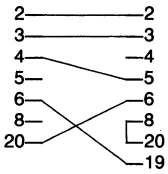
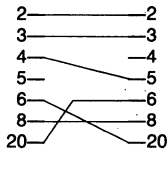
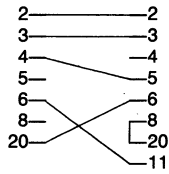
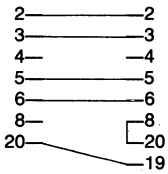
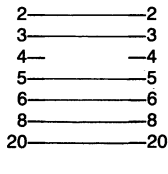
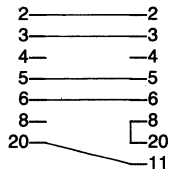
		
B C A	B C B	B C C
		

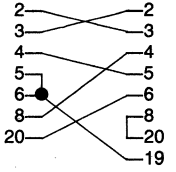
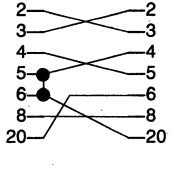
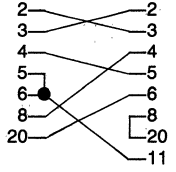
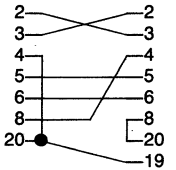
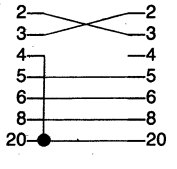
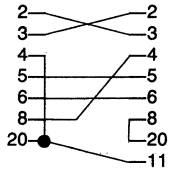
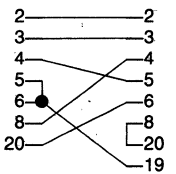
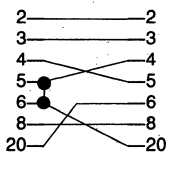
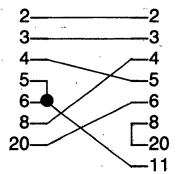
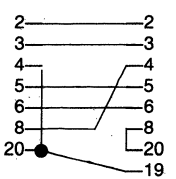
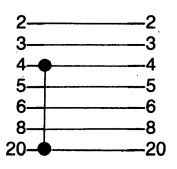
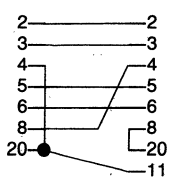
SWITCH S4-6 ON
SWITCH S4-7 OFF

S1 S2 S3	S1 S2 S3	S1 S2 S3
A A A	A A B	A A C
		
A C A	A C B	A C C
		
B A A	B A B	B A C
		
B C A	B C B	B C C
		

SWITCH S4-6 OFF
SWITCH S4-7 OFF

S1 S2 S3	S1 S2 S3	S1 S2 S3
A A A	A A B	A A C
		
A C A	A C B	A C C
		
B A A	B A B	B A C
		
B C A	B C B	B C C
		

SWITCH S4-6 ON
SWITCH S4-7 ON

S1 S2 S3	S1 S2 S3	S1 S2 S3
A A A	A A B	A A C
		
A C A	A C B	A C C
		
B A A	B A B	B A C
		
B C A	B C B	B C C
		

SWITCH S4-1 THRU S4-5
APPLICATION OF PULL-UP VOLTAGES
VERSUS POSITIONS OF S2 & S3

S2	S3	S2	S3	S2	S3
A	A	A	B	A	C
S4-2: 4 — 5		S4-2: 4 — 5		S4-2: 4 — 5	
S4-1: 5		S4-1: 5 — 4		S4-1: 5	
6 — 19		S4-5: 6 — 20		6 — 11	
S4-4: 8 — 4		S4-4: 8 — 8		S4-4: 8 — 4	
S4-3: 20 — 6		S4-3: 20 — 6		S4-3: 20 — 6	
S4-5: 8, 20				S4-5: 8, 20	

S2	S3	S2	S3	S2	S3
C	A	C	B	C	C
S4-1: 4		S4-1: 4 — 4		S4-1: 4	
S4-2: 5 — 5		S4-2: 5 — 5		S4-2: 5 — 5	
S4-3: 6 — 6		S4-3: 6 — 6		S4-3: 6 — 6	
S4-4: 8 — 4		S4-4: 8 — 8		S4-4: 8 — 4	
20 — 19		S4-5: 20 — 20		20 — 11	
S4-5: 8, 20				S4-5: 8, 20	

MANUAL ADDENDUM
SC821PLUS USING DB9 CONNECTOR

When using a DB9 9-pin connector cable with the SC821PLUS the table shown below must be used to "translate" the pin numbers to the correct DB9 configuration. This table is used in conjunction with the SC821PLUS manual wiring tables. Since the DB9 connector is plugged into the AT or AT compatible computer, the connector pin allocations on the left side of the SC821PLUS manual cable diagram are the ones to be translated via this table.

DB9 PINS	DB25 PINS		NAME
2	3		RD
3	2		TD
7	4		RTS
8	5		CTS
6	6		DSR
1	8		CD
4	20		DTR
9	22	*	RI
5	7	*	GND

* Pins 22 and 7 do not show up on the SC821PLUS diagrams but must be connected to the appropriate DB9 connector pins as shown.

WARRANTY

A. **Extension and Scope of Warranty.** IQ Technologies, Inc. ("we") warrants to the original retail consumer purchasers of the SC821PLUS ("you") that each such product will be free from defects in materials and workmanship for a period of 1 year from the date of its purchase. This warranty does not apply to defects due, directly or indirectly, to misuse, abuse, negligence, accident, repairs or alterations outside our facilities, or to lack of maintenance.

B. **Limitations.** WE LIMIT ALL IMPLIED WARRANTIES INCLUDING WITHOUT LIMITATION THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS TO ONE YEAR FROM THE DATE OUR PRODUCT WAS PURCHASED AT RETAIL. WE SHALL IN NO EVENT BE LIABLE FOR DEATH, INJURIES TO PERSONS OR PROPERTY OR FOR INCIDENTAL, CONTINGENT, SPECIAL OR CONSEQUENTIAL DAMAGES ARISING FROM USE OF THE SC821PLUS.

C. **Your Duties.** Within 30 days of your purchase of your SC821PLUS, you must complete and mail to us at 22032 23rd Drive SE, Bothell, WA 98021-9901, attention Customer Service Department (our factory address), the Warranty Card attached to this warranty and which accompanied the product at the time of purchase. If the card was missing when you received the product, you must obtain the card from us within the same time period. YOUR FAILURE TO SO COMPLETE AND MAIL THE CARD WILL VOID THE EXTRA LEGAL PORTION OF THIS WARRANTY. You must give us written

notice at our factory address of any defects before the expiration of the one year period, and, upon our request, make the defective product available to us, at your expense, at the address we designate.

D. **Our Responsibilities.** If you have filed your Warranty Card within the 30-day period, and if you have notified us of the defect prior to the expiration of the warranty period, we will advise you of the location at which the product must be available to us. If our inspection uncovers a defect, we will either repair or replace the product, at our election, or we may refund the purchase price if we cannot readily and quickly provide you with a replacement. We will return the repaired product or replacement at our expense, but if it is determined that there is no defect or that the defect resulted from causes not within the scope of our warranty, then you must bear the cost of repairing or replacing the product. We will inform you of the estimated charge and, at your option, you may either authorize repairs or request return of the unrepaired unit.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

TECHNICAL ASSISTANCE

Technical assistance is available by calling IQ Technologies, Inc. at (206) 483-3555.

IQ Technologies, Inc.
22032 23rd Drive SE
Bothell, WA 98021-9901
206-483-3555
FAX: 206-485-8949