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UART
Windows 95

8250 Serial Interface

This was the first IBM-compatible serial chip, and it allows one byte to be received and sent at a time. It is not recommended to try communications above 19.2Kbps with this chip since it may not process data fast enough to guarantee data delivery. If the computer is fast enough, then it may compensate for the deficiencies in the chip by gathering data as fast as the chip can receive it. However, this chip has fundamental limitations within its read and write cycles that preclude error-free high-speed communication. Some software can compensate for data overrun errors by providing error-checking, but overall performance will suffer.

Many people believe they are using 8250-compatible serial chips when in fact they are not. This is due to misleading utilities which indicate a serial port is an 8250 when in fact it is 16450-compatible. It's a good bet that almost no computers shipping in the last few years have the older 8250-style serial chip.

16450 Serial Interface

This was the second evolution of the IBM-compatible serial chip. It gave a boost to high-speed communications by increasing the speed of read and write cycles, but it still could only send and receive one byte at a time. Almost all computers and serial chips that have shipped in the past few years include 16450-compatible chips. Notable exceptions include IBM's PS/2-style computers which have always shipped with 16550-compatible serial chips.

16550 Serial Interface

This is the third evolution of the IBM-compatible serial chip. It was yet still faster than the 16450, and now allowed multiple bytes of data to be buffered within the chip itself until the software was ready to access the data. With proper programming by the software, this serial chip theoretically allows up to 14 more bytes to be transmitted and received by the serial port. The buffers are commonly called "FIFOs," or first-in-first-out buffers.

The original 16550 had defective FIFO buffers, but it was still faster than the 16450. The original PS/2 machines contained this defective version of the 16550. However, the 16550a and compatibles have fully operational buffers and multiple bytes of data can be received and transmitted. CCLINK can detect serial chips that are 16550a-compatible.

When programming the serial chip, the first bit of the Interrupt Enable Register (IIR) -- port 3FA on COM1 -- is set to enable the FIFOs, while bits 7 and 8 contain the number of bytes to buffer.

Advanced

Accessed by selecting Options|Advanced...

This dialog allows you to access some of CCLINK's most guarded secrets. They are described below:

Check for 16550 FIFO Buffers

Selecting this option tells CCLINK to determine if the port to be monitored or opened is a 16550a-compatible serial port with functional FIFO buffers. There is little reason to deselect this option, unless you suspect CCLINK is screwing up your internal modem (which shouldn't happen, so let me know, OK?) The 16550a FIFO check is very easy, and simply involves putting the UART into FIFO mode and then checking again to ensure FIFO mode is enabled.

Verify COM port on startup

This option is required in Windows for Workgroups environments, and it allows CCLINK to do its snooping magic on those platforms. Deselecting this option is allowed in straight Windows 3.1x environments.

With this option enabled, CCLINK will open the port for the briefest of milliseconds when starting up, and will only do this once for each COM port selected while CCLINK is running. Disable this option if you suspect an internal modem to be hanging or locking up when CCLINK accesses the modem's port or interrupt.

Run Auto-Dial Mode Minimized

Select this option to run CCLINK as a minimized icon when in Auto-Dial mode. If the modem is not dialing for some reason, running CCLINK as a window may help diagnose the problem.

Default window length

Enter a smaller number if you wish CCLINK's window to appear longer, or enter a larger number if you wish the window to appear shorter. Often, I shorten the window to 240 pixels so that I only see the LEDs and not the text on the right.

Default window height

Enter a smaller number if you wish to squeeze CCLINK's window a bit, or enter a large number if you enjoy staring at empty space.

See Number of milliseconds between input buffer reads, Number of milliseconds between COM port checks for information on these little devils.

Dial Prefix for Auto-Dial

Enter the string you wish to prefix your phone number with for Auto-Dial mode. ATDT should be fine, or you can turn off the speaker with ATM0DT,

or whatever. Pulse-dialers should use ATDP.

Defaults

Selecting this button restores all of the Advanced options to their shipping defaults.

LED colors!

Who said computers can't be fun! Choose one of the four color settings for the LEDs. The Random selection produces new colors every time the LEDs are updated or unhidden. You lucky dogs using 64,000 colors or so will see solid colors, while the rest of us will probably see colors that are randomly thatched. Kind of kooky, eh?

Always On Top

Accessed by selecting Options|Always On Top

This option is selected by default. Selecting it forces CCLINK or CCLINKjr to remain on top of all other windows. This mode is helpful if you wish to monitor another communications software without having to switch back and forth to CCLINK.

AT-Input -- main menu selection

The AT-Input is available from the main menu. Selecting this option gives CCLINK control of the serial port, and allows the user to input "AT" commands to the modem. A small "I" appears on the window to indicate "input" mode. Deselecting this option is also a quick way of hanging up the modem if it is connected, since DTR is lowered. A small "M" appears on the window since CCLINK is now in "monitor" mode.

In Input mode, typing "AT" and hitting the <enter> key should elicit an "OK" or "0" from the modem. If double-letters appear, then the modem is echoing each typed letter that CCLINK displays in the AT window.

To tell CCLINK not to display each letter, deselect Options|Duplex from the menu. To tell the modem not to echo each character, typing ATE0<enter> should do the trick.

If the modem does not respond with 0 or OK when typing AT<enter>, then one of the following may be wrong:

- 1) Serial Port speed too high;
- 2) Wrong port selected;

3) Interrupt incorrect on the modem or is not defined correctly in SYSTEM.INI. Examine the interrupt settings listed under CCLINK's Help|Info menu option. If these port or interrupt settings are incorrect, then the SYSTEM.INI may have to be changed or, more likely, the modem's interrupt must be changed. Try the modem first before mucking with the SYSTEM.INI.

The AT-Input option is only available with CCLINK, not CCLINKjr.

AT-window

This window appears when the you select AT-Input. You can input modem AT-commands at this point, and determine whether or not the modem is responding.

To free up the COM port and turn off the AT-window, deselect AT-Input from the main menu.

The AT-window option is only available with CCLINK, not CCLINKjr.

Auto-Dial

Enabling Auto-Dial tells CCLINK to have the modem automatically a number. This feature is useful if a phone is attached to the back of the modem, which you can then pick up when the modem has finished dialing.

To enable Auto-Dial, select the CCLINK icon on your Windows desktop, and choose to edit CCLINK Properties, which can be done with Alt-Enter when using Program Manager. At the end of the Command Line, type the COM port where your modem is located and, optionally, the phone number you wish the modem to automatically dial. For instance, if the modem is on COM3 then the Command Line would read like the following:

```
C:\CCLINK\CCLINK.EXE com3 1,617-555-2121
```

If you do not include a phone number, then CCLINK will prompt you with a list of phone numbers. Phone numbers added to the list will be saved in the CCLINK.INI file, and they will be displayed when program loads again. You may wish to have multiple CCLINK icons that dial different numbers or some that do not dial at all. See [Setup](#) for instructions on creating icons.

While the modem is dialing, CCLINK will display a message instructing you when to pick up the phone and tell CCLINK to exit. Some modems may require you to wait until the modem has finished dialing before picking up the phone.

Auto-Dial is only available with CCLINK, not CCLINKjr.

CCLINK -- Core Communications and Data Link Diagnostics

CCLINK is a monitoring program that allows users to observe, diagnose, and gather information about their communications and communication platform. Here are some its features:

- 1) CCLINK allows modem configuration and AT-command input.
- 2) CCLINK also allows the user to monitor any port in the computer, including parallel ports.
- 3) CCLINK provides an Auto-Dial utility which allows a user to have the modem automatically dial merely by clicking an icon on their Windows desktop.
- 4) CCLINK has Auto-Send, which automatically configures the modem when dialing.

CCLINKjr provides almost all the features that CCLINK offers, but CCLINKjr does not allow AT-Input or Auto-Dial. However, CCLINKjr is smaller than CCLINK and may be more compatible with some older communication software.

CCLINKjr -- Core Communications and Data Link Diagnostics, junior

CCLINKjr is a monitoring program that allows users to observe, diagnose, and gather information about their communications and communication platform. CCLINKjr also allows the user to monitor any port in the computer, including parallel ports.

CCLINKjr provides almost all the features that CCLINK offers, but CCLINKjr does not allow AT-Input or Auto-Dial. CCLINKjr is also smaller than CCLINK.

Carrier Detect

This LED is lit whenever the carrier detect pin is set high on the serial port by the modem. By issuing the AT&C1 command, the modem will raise this signal high when it has established a connection to another modem. AT&C0 keeps the signal high all of the time.

Clear To Send.

This electrical signal on the serial chip is used primarily for hardware flow control. A modem supporting hardware flow control raises this signal on the serial port's UART to indicate that the modem is ready to receive data from the software.

If CCLINK's CTS LED is on, then a modem is probably located on the port being monitored. If DTR, RTS, and CTS are all on, then the port is probably in use by another software application.

Data Terminal Ready

This electrical signal on the serial chip, or UART, is used primarily by software to signal the modem that the serial port is "ready for action." DTR is normally kept "high" or "on" for as long as the software has control of the serial port. Most modems will not answer an incoming call if this signal is not on. By issuing the AT&D2 command, the modem will hang up when DTR is lowered.

Data-Terminal-Ready Toggle

Accessed by selecting Options|DTR Toggle

Selecting and deselecting this option causes the DTR signal to be raised and lowered on the serial port. Lowering DTR signals the modem that no software is controlling the serial port, and the modem will not normally answer incoming calls. Lowering DTR can also cause the modem to hang up if it is currently connected.

This option should only be used for diagnostic purposes since it may interfere with other communication software.

Duplex option

Accessed by selecting Options|Duplex

Selected by default. When duplex is enabled, CCLINK will display every character you type in the AT-window. When disabled, the only characters displayed are those sent by the modem.

Exit option

Accessed by selecting Set|Exit

Selecting this option causes CCLINK or CCLINKjr to terminate. If CCLINK had opened the port, then CCLINK will also close the port.

Hardware Flow Control

Hardware flow control uses two electrical signals to control the flow of data, CTS and RTS. Other forms of hardware flow control may use other signals, but most of the world uses CTS and RTS.

An external modem raises and lowers its CTS signal, which is usually transmitted to the serial port through an RS-232 cable. Most file transfer protocols do not need to worry about hardware flow control, since error-checking within the software will compensate for data loss. However, other applications can be crippled if hardware flow control is not enabled.

The toggling of CTS signals the communication software to either start or stop the flow of data to the modem. Conversely, the communication software that controls the serial port lowers and raises the RTS signal on the serial port to indicate to the modem when it is unsafe and safe to send data without loss of characters.

Help -- main menu selection

Selecting Help from the main menu of CCLINK and CCLINKjr gives three options, About CCLink, Info, and Help .

The CCLINK About dialog box gives version information and incredibly creative icons. If an application has control of the serial port, CCLINK also displays serial port speed, bits per byte, parity, and the number of stop bits for which the port is configured.

The Info dialog box gives incredibly helpful information, like DOS and Windows versions, video capabilities, mouse and CPU information, system resources, and registration information. The Windows Version information does not distinguish between Windows 3.1, 3.11, or Windows for Workgroups. The version 3.95 is displayed for Windows 95. Mouse information is only available if a mouse TSR is loaded in DOS before Windows.

Selecting Help launches this Help file. What a country!

Info -- Help menu selection

Selecting Help|Info from the main menu of CCLINK and CCLINKjr displays the Info dialog.

The Info dialog box gives incredibly helpful information, like DOS and Windows versions, video capabilities, mouse and CPU information, system resources, and registration information. The Windows Version information does not distinguish between Windows 3.1, 3.11, or Windows for Workgroups. However, it does say 3.95 for Windows 95. Mouse information is only available if a mouse TSR is loaded in DOS before Windows.

Hobbit

Man, is that Lord of the Rings a great series or what? My favorite part is the Shire cleansing near the end of Return of the King.

LED -- the "lights" of CCLINK

There are seven LEDs, or Ludicrous Light-Emitting-Diodes, on the CCLINK window when monitoring in serial mode and eight when monitoring in parallel port mode. An LED is lit when that hardware signal is indicated by Windows to be active or high. The LED is cleared when Windows indicates that the hardware signal is inactive or low.

The Send (SD) and Receive (RD) LEDs function through the Windows programming interface only. As a result, if Windows communications are being redirected -- by a parallel port redirector, for example -- then only the SD and RD LEDs may be operational. The other LEDs rely on Windows to report the true state of the COM port hardware.

When CCLINK is in Parallel mode, each LED represents a bit on the selected port. For instance, if you are monitoring port 3BC, then the eight LEDs represent the eight bits of that port address, where LED 1 is least significant and LED 8 is most significant.

The frequency with which CCLINK updates the LEDs can be controlled by setting the Advanced parameter "Number of milliseconds between COM port checks." The default value is 55 milliseconds, which is about 18 times a second. Higher values will update the LEDs more slowly and possibly less accurately, but CCLINK may be possibly less intrusive. 110 milliseconds is a nice setting if you're not too concerned with getting EVERY hardware signal from the COM port.

Lit\Lighted

These words are interchangeable, according to Webster's, so don't give me any "usage" grief. For example, "The LED is lit" is the same as "the LED is lighted." So there.

Load .INI File

Accessed by selecting Options|Load .INI File...

Selecting this option allows you to observe the CCLINK.INI file, which is where all of CCLINK's and CCLINKjr's settings are saved.

It is not recommended you edit this file. If it does become corrupted, you should rename it to a backup name, and allow CCLINK or CCLINKjr to create it the next time it loads. If you do edit CCLINK.INI, it is very important that it be saved in a plain text format, like that used by DOS Edit and Windows Notepad.

Modem Stuff option

Accessed by selecting Set|Modem Stuff...

This dialog allows you to configure the following modem-related parameters:

Send First String Only

Send Second String Only

Send Both Command Strings

Choosing one of these options determines which strings are sent by the Set main menu command Send AT Commands and by the Auto-Send feature described below. Each AT command string sent is followed by a one-second delay to give the modem enough time to respond.

Auto-Send AT Commands on Port Open

Selecting the Auto-Send option tells CCLINK to send the desired AT command strings input under "Type in Modem AT Commands" upon every port open. For example, every time CCLINK opens the COM port with the AT-Input command or Auto-Dial function, the AT commands are sent as selected by the "Send String" command chosen above. Each AT command string is followed by a carriage-return.

This command is useful if the modem needs special configuration information before dialing. Another use is to configure the modem not to answer (ATS0=0), and then have CCLINK monitor a phone plugged into the modem for incoming calls. Well, I use it for that, believe it or not! (My phone ringer is too loud and so I...oh never mind.)

Type in Modem AT Commands

The sending of each of these AT command strings can be controlled with the "Send Strings" radio-buttons described above. These AT command strings are sent by the Set command "Send AT Commands" and by the Auto-Send function. Any valid modem command is acceptable, including dial strings, like ATDT1,234-56-789, or whatever.

No Title

Accessed by selecting Options|No Title

By selecting Options|No Title, CCLINK's title caption will disappear. By single-clicking on CCLINK, the caption bar will reappear. To save the No Title option, you can use Windows Task Manager by typing Control-Escape, selecting CCLINK, and then selecting End Task. Also, if you exit Windows with CCLINK running, all current settings will be saved.

I've had some real hassles with getting different resolutions to work. I tries some Viper cards and Stealth, but I think there may still be some odd behavior if your font size is way different than what I tested. A symptom of CCLINK not handling the resolutions correctly is text under the LEDs being chopped.

If CCLINK does not appear on the screen correctly, select from the Options menu Advanced and choose Defaults. Then close and reload CCLINK. If this still doesn't handle the problem, try renaming the CCLINK.INI file. If the darned software still doesn't look right, send me e-mail detailing the problem and your video confoguration, and I'll see what I can do. Note the video configuration under Help|Info.

Number of Milliseconds Between COM Port Checks

Accessed by selecting Options|Advanced...

By selecting Options|Advanced , this option appears in the CCLINK Advanced Parameters dialog box. The number determines how often CCLINK will check for changes in the state of the port's hardware signals and events. The default is for CCLINK to check the COM port every 55 milliseconds, or about 18 times a second. Increase the number if the LEDs flash too quickly.

Number of Milliseconds Between Input Buffer Reads

Accessed by selecting Options|Advanced...

By selecting Options|Advanced , this option appears in the CCLINK Advanced Parameters dialog box. The number determines how often CCLINK will check for incoming data from the serial port. The default is for CCLINK to check the COM port every 55 milliseconds, or about 9 times a second. Increase the number if the AT-window appears to flash too much or if some data is not appearing in the window.

Options -- main menu selection

Selecting this option gives a choice of Parallel, Always On Top, Advanced, and Load .INI File for both CCLINK and CCLINKjr. CCLINK has three additional options, DTR Toggle, RTS Toggle, and Duplex.

Parallel option

Accessed by selecting Options|Parallel

Selecting this option puts CCLINK into parallel port monitoring mode, as shown by the "PPM" symbols on the CCLINK window. Choosing Set|Port Stuff will now show a list of common parallel ports and their respective sister ports. Choose the port you wish to monitor. The LEDs shown by CCLINK at this point are the 8 bits on the port being monitored.

One thing that's neat to do is to put CCLINK into Parallel mode, and have it monitor your mouse port by typing in the port address under Set|Port Stuff's Parallel Other option. It's pretty cool to see all of the lights flickering on and off, especially if you choose Random LEDs from Options|Advanced!

Port Stuff option

Accessed by selecting Set|Port Stuff...

Selecting this option allows you to configure CCLINK's monitoring mode. The following options allow you to configure the port and/or indicate which one to monitor.

Set Serial Port Speed

When CCLINK opens the port, it will open the port at the speed selected with this option. CCLINK opens the port at the speed selected and displays the AT-window when you select AT-Input. The port is also opened for CCLINK's use during Auto-Dial mode.

Since the original Windows COMM driver did not allow the port to be initialized at 115,200 bps, CCLINK programs the COM port UART directly only when 115,200 is selected. A future release of CCLINK will check to see if other COMM drivers are installed, and then it will go through the "more friendly" Windows programming interface to program the port.

Choose COM port

This option selects a COM port for CCLINK to monitor. CCLINK will monitor this port in the background while other applications are accessing the COM port. If you choose AT-Input, then CCLINK will gain control of the port, but only if no other application has current control of it.

When CCLINK opens a COM port, it raises both DTR and RTS signals high, lowers these signals to tell the modem to drop any current connections, and then raises these signals a final time to indicate to the modem that a software package has control of the serial port.

Monitor

Setting the Monitor option "On" tells CCLINK to begin monitoring. Turning this option "Off" effectively disables CCLINK. CCLINK is automatically turned off when it is configured to open a port that does not exist or the port is currently controlled by another device, like a mouse or other piece of software. CCLINK will, of course, can still monitor the port, but selecting AT-Input will fail.

Parallel button

Selecting the Parallel button opens the other port-monitoring dialog. This dialog is the default for Port Stuff if Options|Parallel has been selected. The Parallel dialog box lists the nine major parallel ports available for monitoring. An edit box called Other is also available if you wish to monitor a specific port, like COM1's Modem Control Register (3FC) or COM4's Line Status Register (2ED), or even the mouse port.

Since Windows is reporting these hardware values to CCLINK, the LED "bits" indicated as high may or may not be correct. Use this Parallel option more as a guide than as absolute truth about the current state of

the selected port. When CCLINK incorporates a Windows virtual driver, then maybe the true values will always be displayed.

Receive Data

This LED is raised high when a byte has been received by the serial port. This LED may not be lit as frequently if Windows is very busy, but it should give you a reasonably good indication of incoming data.

Ring Indicator

This LED is raised high by the modem if it detects an incoming call. Some modems do not support this pin, and so they may not indicate a RING even though an incoming call is, uh, incoming. Some internal or PCMICA modems toggle this pin so quickly that CCLINK may not be able to display it. Reduce the Number of milliseconds between COM port checks if you suspect this to be a problem.

Request To Send

This electrical signal on the serial chip is used primarily by software to signal the modem that the computer's serial port is ready to receive data. In effect, the software has "approved" the modem's standing request to send data. RTS may be lowered by the software if the software is too busy performing other tasks (e.g. writing to disk) and cannot currently receive data properly. A modem that supports hardware flow control will stop sending data until RTS is raised high again by the software.

Request-To-Send Toggle

Accessed by selecting Options|RTS Toggle

Selecting and deselecting this option causes the RTS RTS signal to be raised and lowered on the serial port. If the modem is configured for hardware flow control, lowering RTS should tell the modem to stop sending data to the port.

This option should only be used for diagnostic purposes since it may interfere with other communication software.

Save Settings

Accessed by selecting Set|Save Settings

Selecting this option tells CCLINK or CCLINKjr to save all changes to the CCLINK.INI file when it exits. Nothing is written to the .INI file until CCLINK or CCLINKjr exits.

Send Data

This LED is raised high when a byte has been transmitted by the serial port. This LED may not be lit as frequently if Windows is very busy, but it should give you a reasonably good indication of outgoing data.

Send AT Commands

Accessed by selecting Set|Send At Commands

Selecting this option tells CCLINK to send the AT commands previously defined under the main menu's Set|Modem Stuff option. This option will not configure the modem if AT-Input has not been selected.

Serial Port

Technically, the serial port is one of the thousands of possible ports through which a computer can receive and send data. Most serial ports are introduced to the outside world through 9- and 25-pin connections. With the correct cable, serial ports can connect to printers, modems, mainframes, and even other computers. Internal modems possess their own serial ports, or UARTs, which interface directly to the computer's main data and address bus by plugging into computer slots.

Types of serial ports include older 8250-compatible chips, the ubiquitous 16450-compatible chips, and 16550 "buffered" serial chips. Each progression in serial chips electrically improved on the previous chip to either provide faster reading or writing of data. The 16550a chip includes buffering capability to combat possible data-loss at high serial port speeds.

Set -- main menu selection

Selecting this option gives a choice of Port Stuff, Save Settings, and Exit for CCLINK and CCLINKjr. CCLINK has two additional options, Modem Stuff and Send AT Commands.

Setting up CCLINK and CCLINKjr

It's easy! Setup involves just making an icon for CCLINK.EXE and CCLINKjr.EXE on your Windows desktop.

For instance, to install CCLINK into the "Accessories" group of Program Manager, do the following:

- 1) Select the "Accessories" group, select File|New|Program Item. Then choose OK.
- 2) Choose "Browse" and select CCLINK.EXE from wherever you have stored that file.
- 3) Select OK and you're done!

If you would like to enable Auto-Dial, enter the COM port and, optionally, the phone number at the end of the Command Line property. See Auto-Dial for more details.

Shiva NetModem compatibility

The only LEDs that light when using the Shiva NetModem is the RD, or Receive Data LED. I may add a pure Windows API mode to CCLINK, which should allow almost full compatibility with the Shiva, but I want to do some more testing first. I have noticed some character loss when CCLINK tries to dial out through the Shiva. In general, however, CCLINK and CCLINKjr should operate fine with the Shiva.

Speed Detect -- Monitoring Serial Port speed

The Speed Detect feature now allows CCLINK to display the speed of the serial port when any other application is using the port. When the serial port is not in use, CCLINK erases the speed display. Loading Help|About will also show the speed, bits per byte, parity, and stop bits for which the current application has configured the serial port. Speeds greater than 57,600 bps may not be displayed correctly, but please let me know of any errors in speed detection.

Universal Asynchronous Receiver and Transmitter.

The UART drives all serial communications in IBM-compatible machines. In conjunction with line drivers and receivers, this chip controls all aspects of serial communications. The UART is actually the serial port itself, and it can be programmed by software to do just about any type of serial I/O. Most UARTs are "really" USARTs ("Synchronous/Asynchronous"), but it sounds better to say "yoo-art" than "yoo-sart," I guess.

Windows 95

Like, it just worked when I ran CCLINK and CCLINKjr on the final beta. Compatibility test passed!

But, seriously, if anyone finds any problems, just drop me a line. Thanks!

