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**FEDERAL COMMUNICATIONS COMMISSION
AND
CANADIAN DEPARTMENT OF COMMUNICATIONS
RADIO FREQUENCY INTERFERENCE STATEMENTS**

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This digital apparatus does not exceed the Class A limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par le ministère des Communications du Canada.

NORMAS OFICIALES MEXICANAS (NOM) ELECTRICAL SAFETY STATEMENT

INSTRUCCIONES DE SEGURIDAD

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.
3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.
4. Todas las instrucciones de operación y uso deben ser seguidas.
5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc..
6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.
7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.
8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.
9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.

10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.
11. El aparato eléctrico deberá ser connectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.
12. Precaución debe ser tomada de tal manera que la tierra fisica y la polarización del equipo no sea eliminada.
13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.
14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.
15. En caso de existir, una antena externa deberá ser localizada lejos de las líneas de energia.
16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.
17. Cuidado debe ser tomado de tal manera que objetos liquidos no sean derramados sobre la cubierta u orificios de ventilación.
18. Servicio por personal calificado deberá ser provisto cuando:
 - A: El cable de poder o el contacto ha sido dañado; u
 - B: Objetos han caído o líquido ha sido derramado dentro del aparato; o
 - C: El aparato ha sido expuesto a la lluvia; o
 - D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o
 - E: El aparato ha sido tirado o su cubierta ha sido dañada.

1. Specifications

Interface —	Channels 1 and 2: RJ-45; Channel 3: DB25 male; Both: V.24/RS-232-C
Configuration —	Channels 1 and 2: DCE; Channel 3: DTE
Transmission —	Asynchronous, full duplex
Baud Rate —	1200, 2400, 4800, 9600, 19,200, or 38,400 bps selectable
Word Size —	7 or 8 data bits
Parity —	Odd, even, mark, space, or none
Stop Bits —	1 or 2
Flow Control —	Hardware (RTS/CTS), software (X-ON/X-OFF)
Buffer Size —	2 KB
Operating Temperature —	32 to 158°F (0 to 70°C)

Max. Altitude**Tolerance —** Up to 15,000 feet (4572 m)**Relative
Humidity****Tolerance —** 5 to 95%, noncondensing**Power —**No AC power or batteries required;
Derives power from the RS-232
interface**Size —**2.1"H x 2.7"W x 7.4"D (5.3 x 6.9 x
18.8 cm)**Weight —**

0.1 lb. (0.05 kg)

2. Introduction

The Clever Code-Operated Switch is a miniature 3-way code-operated switch that allows a connection between one asynchronous RS-232 device and either of two asynchronous RS-232 devices. Typically, the Switch's channel 3 (DB25 male) plugs directly into the RS-232 port of a DCE such as a modem. Channels 1 and 2 (modular RJ-45 jacks) are then connected by modular cable to two DTE devices such as a PC, terminal, or printer. Channel 3 may communicate with either channel 1 or channel 2. Channels 1 and 2 may also communicate with each other.

The Clever Code-Operated Switch has two operating modes: Data Mode and Command Mode. When powered up, the Switch automatically enters Data Mode and allows a normal flow of data between the two default channels. While in Data Mode, the Switch also "listens" for a character string (from any channel) to tell the device to switch channels or to enter Command Mode. While in Command Mode, the Switch will accept AT commands to change speed, data format, and other user-configurable parameters.

3. Installation

Since configuring the Clever Code-Operated Switch is performed through the RS-232 interface, you have to install the unit first before you configure it. This chapter describes the serial-interface connections necessary, as well as power requirements.

3.1 Connecting Channels 1 and 2

The two async DCE interfaces on the Switch have RJ-45 female ports that conform to the EIA/TIA-561 standard (see Figure 3-1, below). These ports may be connected to almost any RS-232 DTE device: PCs, terminals, printers, laptops, Macintosh® computers, plotters, etc.

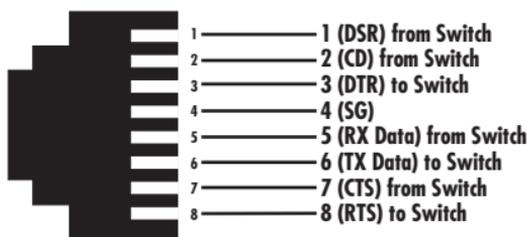


Figure 3-1. EIA/TIA-561 interface pinouts for the Switch's RJ-45 jacks (ports 1 and 2).

CLEVER CODE-OPERATED SWITCH

Any device connected to channels 1 and 2 must have a special interface cable. On one end, this interface cable must have an RJ-45 male plug; on the other end, it must have a connector that fits into your RS-232 serial device. The diagrams below and on the following page show pin connections between the Switch's sub-channels and common RS-232 serial interfaces. You may use these diagrams to construct your own cables, or you may purchase pre-made cables.

PC/XT™ or Serial Printer to Clever Code-Operated Switch Pinouts:

Serial DB25 Pin Number	Clever Code-Operated Switch RJ-45 Pin Number
6 (DSR)	1
8 (CD)	2
20 (DTR)	3
7 (SG)	4
3 (RX Data)	5
2 (TX Data)	6
5 (CTS)	7
4 (RTS)	8

PC/AT® to Clever Code-Operated Switch Pinouts:

Serial DB9 Pin Number	Clever Code-Operated Switch RJ-45 Pin Number
6 (DSR)	1
1 (CD)	2
4 (DTR)	3
5 (SG)	4
2 (RX Data)	5
3 (TX Data)	6
8 (CTS)	7
7 (RTS)	8

3.2 Connecting Channel 3

Channel 3 on the Clever Code-Operated Switch is a DB25 male, and is designed to plug directly into the DB25 female RS-232 port on a modem, multiplexor, CSU/DSU, or other asynchronous serial DCE device. The table on the next page lists the pin connections on the Switch's DCE interface.

CLEVER CODE-OPERATED SWITCH

Pin #	Description	Direction
1	Protective Ground	N/A
2	Transmit Data	From the Switch
3	Receive Data	To the Switch
4	Request to Send	From the Switch
5	Clear to Send	To the Switch
6	Data Set Ready	To the Switch
7	Signal Ground (common return)	N/A
8	Carrier Detect	To the Switch
9	9-to-12-Volt Power (optional)	To the Switch
20	Data Terminal Ready	From the Switch
22	Ring Indicator	To the Switch

If your application requires an RS-232 cable between the Switch and the modem, it must be a straight-through cable (pinned 1-1, 2-2, 3-3, etc.) of the *shortest* possible length.

3.3 Power Requirements

The Switch derives all necessary operating power from the DB25 interface, and requires no AC power or batteries for operation. When the DCE device is turned on, the Switch automatically “powers up.”

4. Configuration

Once the Switch has been physically connected to the RS-232 devices on channels 1, 2, and 3, the unit is ready to configure for operation. Based upon the requirements of your application, you will either be able to operate the unit in its default configuration or you will need to enter configuration commands. This chapter describes the default settings, provides configuration instructions, and gives a detailed list of each AT command used by the Switch.

4.1 Default Settings (Data Mode)

When the Switch is plugged into the DB25 port of a DCE and powered up (by turning on the DCE), the unit automatically enters Data Mode. Data Mode allows data transfer between any two of the Switch's ports, and also allows for the switching of channels (see **Chapter 5** for a more detailed explanation of channel switching).

The Switch's default settings are shown on the next page. These settings allows the Switch to work with most RS-232 equipment. If you need to change any of the settings, refer to **Section 4.2**.

CLEVER CODE-OPERATED SWITCH

Channels 1 and 2 (RJ-45 jacks)

Data Rate	9600 bps
Flow Control	RTS/CTS
Data Length	8 data bits
Parity	No parity
Stop bits	One stop bit

Channel 3 (DB25 male)

Data Rate	9600 bps
Flow Control	RTS/CTS
Data Length	8 data bits
Parity	No parity
Stop bits	One stop bit

Channel Connection

Channel 1 to Channel 3

Channel-Switching Commands

type `~~~asw13` to connect channel 1 to channel 3

type `~~~bsw23` to connect channel 2 to channel 3

type `~~~csw12` to connect channel 1 to channel 2

4.2 Configuration Procedures (Command Mode)

In order to change the configuration settings of the Switch, you will need to switch from Data Mode to Command Mode.

To enter Command Mode...
type `\\` and wait for the “OK” result code.

While in Command Mode, you may change the Switch’s configuration settings according to the rules outlined in **Section 4.2.1**. A description of the AT commands you may enter is found in **Section 4.2.2**.

To exit Command Mode and return to Data Mode...
type `AT[O` then press `<CR/ENTER>`.

4.2.1 RULES FOR COMMAND ENTRY

Rule 1: Since the Switch only accepts ASCII characters, all command lines must start with the attention code “AT” followed by “[” (AT[). Before a command or string of commands is executed, the `<ENTER>` or `<CR>` key must be pressed.

Rule 2: You can string commands together in one command line, and separate commands with spaces. However, there can be only 30 characters and spaces after the AT[. If a command line exceeds 30 characters, the Switch aborts execution of the command line and will display an error reply code. This will occur before you press <ENTER/CR>.

Example:

AT[*30-character Switch command* <ENTER/CR>

Rule 3: Each command line must end with an <ENTER/CR>. The Switch will not begin command execution until it receives a carriage-return character.

Rule 4: If you made an error while keying a command, you can edit your entry with the <BACKSPACE> key before you press <ENTER/CR>. (You cannot delete the AT command at the beginning of the line.)

Rule 5: Many commands require a numeric parameter. If you omit this parameter, it will automatically be set at zero.

Rule 6: To store a new configuration in the Switch's non-volatile memory, enter an **AT[W** command.

4.2.2 RESULT CODES

Besides echoing back AT commands, the Switch returns its own result codes after executing a command. The result codes indicate whether or not the execution was satisfactory. You may define result codes as English words (Q0) or numeric digits (Q1), or you may disable them entirely (Q2). The chart in **Section 4.3.2** describes these codes.

<i>Digit Code</i>	<i>Word Code</i>	<i>Meaning of Code</i>
0	OK	Command line executed without errors.
4	ERROR	Error in the command line

NOTE

For screen display purposes, a carriage-return/line-feed character sequence will follow word result codes, while only a carriage-return character will follow numeric result codes.

4.3 Complete “AT” Command Set

The Switch command set has two types of commands: mode setting commands and channel configuration commands. The mode setting commands select operating modes and parameter values for the Switch. The channel configuration commands change the configuration of the channel that you have selected. Both will have an immediate effect when you press the <ENTER/CR> key.

4.3.1 MODE SETTING COMMANDS

The mode setting commands select operating modes and parameter values for the Clever Code-Operated Switch. The letter “n” that follows the command letter represents a numeric value. The text describes valid choices, where (*) is the default selection after a software-reset Z command.

Mode Setting Commands

Command	Function
AT	Command-line prefix. The attention command precedes all other commands listed in this table.
[Directs the Switch to “execute the following commands.”

Mode Setting Commands (continued)

Command	Function
\\	Tells the Switch to leave Data Mode and enter Command Mode so that commands may be entered.
Cn	<p>Selects the channel number for subsequent channel configuration commands. At the start of each command line, selection reverts to 0.</p> <p>n = 0, reserved for future use n = 1, channel 1 n = 2, channel 2 n = 3, channel 3</p>
Jn	Selects X-ON character "n," where "n" is a single ASCII character, either a control character or an upper- or lower-case letter (A through Z, or a through z). NULL, ETX, STX, and carriage-return characters are not allowed.
M1axxxxxx	<p>Defines the channel switching command string that connects <i>channel 1 to channel 3</i>. The "x" portion of the string may be user-defined using 0-7 ASCII characters. All ASCII characters are valid except Backspace, Carriage Return, X-ON/X-OFF characters or tilde (~). Here's an example:</p> <p>programming command string: AT[M1aprinter<cr> (what you will type to switch channels: ~~~aprinter)</p>
M2bxxxxxxx	<p>Defines the channel switching command string that connects <i>channel 2 to channel 3</i>. The "x" portion of the string may be user-defined using 0-7 ASCII characters. All ASCII characters are valid except Backspace, Carriage Return, X-ON/X-OFF characters or tilde (~). Here's an example:</p> <p>programming command string: AT[M2bnetwork<cr> (what you will type to switch channels: ~~~bnetwork)</p>

Mode Setting Commands (continued)

Command	Function
M3cxxxxxxx	<p>Defines the channel-switching command string that connects <i>channel 1</i> to <i>channel 2</i>. The “x” portion of the string may be user-defined using 0-7 ASCII characters. All ASCII characters are valid except Backspace, Carriage Return, X-ON/X-OFF characters or tilde (~). Here’s an example:</p> <p>programming command string: AT[M3cprtⁿwk<cr> (what you will type to switch channels: ~~~cprtⁿwk)</p>
Nn	<p>Selects X-OFF character “n,” where “n” is a single ASCII character, either a control character or an upper- or lower-case letter (A through Z, or a through z). NULL, ETX, STX, and carriage-return characters are not allowed.</p>
O	<p>Return to Data Mode.</p>
T	<p>Causes a software reset with all Switch modes and channel configurations set to <i>factory-default</i> values. The Switch will then enter Data Mode. (Note: You must wait approximately 5 seconds after receiving the “OK” response before passing data.)</p>
Un	<p>Causes the Switch to reset to default connection path as defined by the command AT[An upon detection of loss of CD on the composite port.</p> <p>“n” can be 0, 1, 2, or 3.</p> <p>n = 0, DISable reset to default connection path, at the composite channel, regardless of the status of CD</p> <p>n = 1, ENable reset to default connection path if loss of CD for 60 msec</p> <p>*n = 2, ENable reset to default connection path if loss of CD for 300 msec</p> <p>n = 3, ENable reset to default connection path if loss of CD for 1 sec</p>

Mode Setting Commands (continued)

Command	Function
Vn	View channel configuration or mode configuration. n = 0, view the configuration of channel 3 n = 1, view the configuration of channel 1 n = 2, view the configuration of channel 2 n = 3, view the configuration of channel 3 n = 4, view the channel switching command string and the active connection path
W	Stores configuration into non-volatile memory
Z	Causes a software reset with all Switch modes and channel configurations set to <i>previously stored</i> values. The Switch will then enter Data Mode. (Note: the user must wait approximately 5 seconds after receiving the "OK" response before passing data.)

4.3.2 CHANNEL CONFIGURATION COMMANDS

The following commands change the configuration of the channel that you select with the Cn command. The Cn command must be in the command line before a channel configuration command, or the Switch rejects the configuration command. The letter "n" that follows the command letter represents a numeric value. The text describes the valid choices, where the choice marked with an asterisk (*) is the default selection after a software reset T or Z command.

CLEVER CODE-OPERATED SWITCH

Channel Configuration Commands

Command	Function
An	Selects the active communication path that will be established when the Switch is powered up, or when the AT[O] command is issued, and the unit enters Data Mode. n = 0, Reserved for future use n = 1, connect channel 1 to channel 3 n = 2, connect channel 2 to channel 3 *n = 3, connect channel 1 to channel 2
Bn	Selects baud rate for the selected channel. n = 0-3, Reserved for future use n = 4, 1200 bps n = 5, 2400 bps n = 6, 4800 bps *n = 7, 9600 bps n = 8, 19,200 bps n = 9, 38,400 bps
En	Determines whether the local Switch echoes the data received in the command mode back to its channel. (Note: Each channel can have its own echo option.) *n = 1, echo on n = 0, echo off
Fn	Determines the method of flow control between a selected Clever Code-Operated Switch channel and the device connected to that channel. n = 0, none *n = 1, RTS/CTS n = 2, X-ON/X-OFF

Channel Configuration Commands

Command	Function
Gn	Allows the user to select the behavior of Carrier Detect on channels 1 and 2. *n = 0, CD always ON n = 1, CD of channels 1 and 2 follows CD of channel 3
Ln	Selects data length for the channel. *n = 1, 8-bit data n = 0, 7-bit data
Pn	Selects parity for the channel. *n = 0, no parity n = 1, odd parity n = 2, even parity n = 3, mark n = 4, space
Qn	Determines format of result codes sent to each channel. (Note: Each channel can have its own result code format.) *n = 0, word codes n = 2, result codes not sent n = 1, digit codes
Sn	Selects the number of stop bits for the channel. *n = 1, 1 stop bit n = 0, 2 stop bits

5. Operation

Once the Clever Code-Operated Switch is connected and configured properly, it is ready to operate. This chapter describes the Switch's LEDs, Data Mode, switching channels, switching to Command Mode, and flow control.

5.1 LEDs

The Switch has one LED, which is located between the two modular jacks on the rear of the unit. This LED glows when the unit is powered up and in Data Mode (a normal flow of data exists between two selected channels). When the Switch is in Command Mode, the LED does not glow.

5.2 Normal Operation (Data Mode)

When the Switch is plugged into the DB25 port of a DCE and powered up (by turning on the DCE), the unit automatically enters Data Mode. Data Mode allows data transfer between any two of the Switch's channels, and also allows for the switching of channels.

Data transfer in Data Mode will occur according to the factory-default parameters stored into the unit (see **Section 4.1**), unless those settings have been changed in Command Mode (see **Sections 4.2** and **4.3**).

NOTE

You may use the **Vn** command to view the configuration of each channel.

5.3 Switching Channels

The Switch allows two methods of channel switching: from Data Mode and from Command Mode. Using one of these two methods, you can change channels at any point in the operation of the Switch.

5.3.1 SWITCHING CHANNELS FROM DATA MODE

While in Data Mode the Switch monitors each channel for a command string that will tell the unit to switch channels. There are three default command strings, one for each possible channel-to-channel connection. You also have the option of creating your own custom command strings to fit your unique application. There are three default command strings (listed below) factory-programmed into the Switch.

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~~~**asw13** connects channel 1 to channel 3

~~~**bsw23** connects channel 2 to channel 3

~~~**csw12** connects channel 1 to channel 2

To switch channels while in Data Mode, enter any of the three character strings shown above. Keep in mind these guidelines:

1. You may enter one of the strings from any channel, even a channel that is not “connected” (for example, you may enter a command string from channel 3 while channels 1 and 2 are connected).
2. You may embed the command string in the midst of a longer character stream. The new channel connection will take effect immediately after the last character of the command string.

### *User-Defined Channel-Switching Command Strings*

The Switch allows you to customize each of the three channel-switching command strings. The first *four* characters (~~~ and a, b, or c) must remain intact. You can alter the “x” portion of the character string. The

potential command strings are shown below:

~~~**axxxxxxx** connects channel 1 to channel 3

~~~**bxxxxxxx** connects channel 2 to channel 3

~~~**cxxxxxxx** connects channel 1 to channel 2

5.3.2 SWITCHING CHANNELS FROM COMMAND MODE

There are three command strings that can be entered from Command Mode to change the communication path that will be active when the Switch enters Data Mode. They are listed below:

AT[A1 connects channel 1 to channel 3

AT[A2 connects channel 2 to channel 3

AT[A3 connects channel 1 to channel 2

After typing one of the above command strings, key **AT[O** then press <CR/ENTER> to return to Data Mode.

5.4 Switching to Command Mode

To switch from Data Mode to Command Mode:

key `\` and wait for the “OK” result code.

While in Command Mode you may change the Switch’s configuration settings according to the rules outlined in **Section 4.2.1** (also listed below). A description of the AT commands you may enter is found in **Section 4.2.2**.

To exit Command Mode and return to Data Mode...
key `AT[O` then press `<CR/ENTER>`

5.5 Talking to Your Modem

You may issue commands to your modem while the Switch is in Data Mode. In order to issue commands that the modem can recognize, the modem must be in its Command Mode.

NOTE

The Command Mode sequence on most Hayes® type modems is `+++`. After you receive an OK response, you may issue commands to your modem as defined in the modem’s user guide.

Appendix: Cables

Modular channel cables (for channels 1 and 2) are not supplied with the Clever Code-Operated Switch. You may construct your own cables using the pinout diagrams in **Section 3.1**, or you may purchase the pre-made adapter cable listed below.

EL08MS-14 RJ-45 (8-Wire) Modular Cable, 14-ft.
(4.3-m), straight-pinned

Also available are Modular Adapter Kits. To connect the Switch to two RS-232 serial devices, use one of the adapters listed below and an RJ-45 Modular Cable.

Modular Adapter Kits

DB25 Male ↔ RJ-45 Female, 8-WireFA025

DB25 Female ↔ RJ-45 Female, 8-WireFA027

DB9 Male ↔ RJ-45 Female, 8-WireFA066

DB9 Female ↔ RJ-45 Female, 8-WireFA065