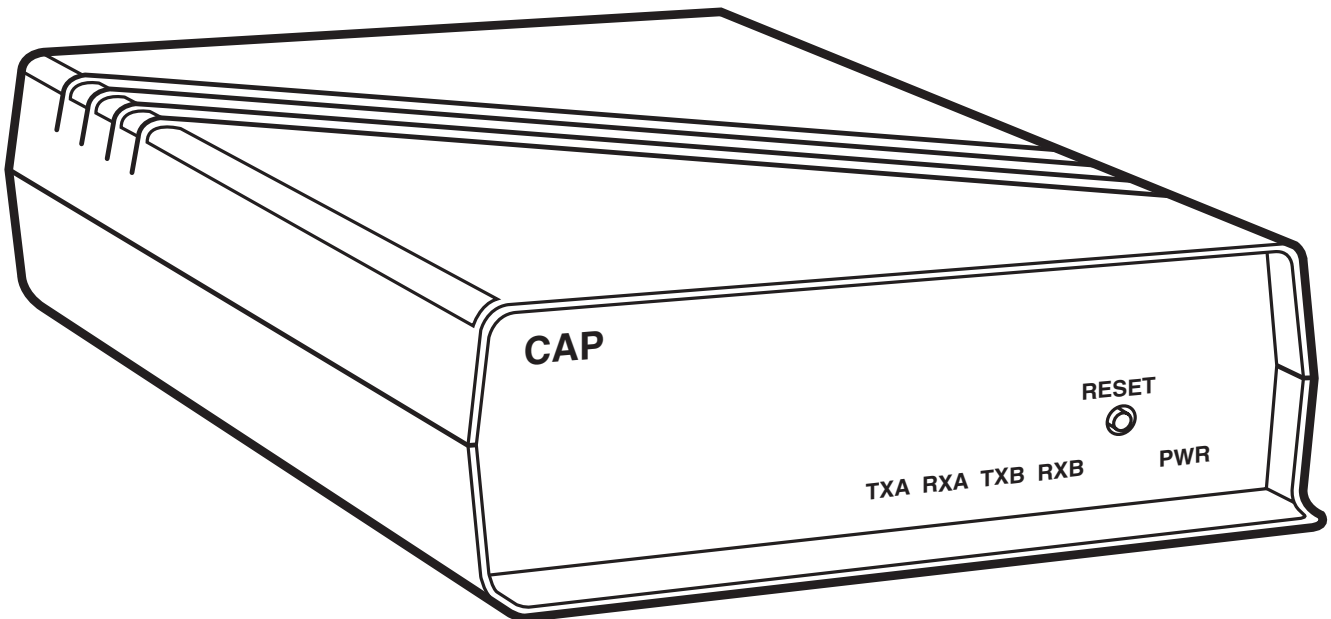




Communications Adapter Plus (CAP)



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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 Industry Canada.

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 Industrie Canada.

INSTRUCCIONES DE SEGURIDAD (Normas Oficiales Mexicanas Electrical Safety Statement)

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 conectado 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 física 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 energía.
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 líquidos 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.

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TRADEMARKS

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1. Specifications

Protocol —	Asynchronous only
Speed —	45.5 bps to 38.4 kbps
Flow Control —	Hardware, X-ON/X-OFF, ENQ/ACK
Indicators —	RXD and TXD for Ports A and B; Power
Interface —	RS-232/CCITT V.24 configured as DTE
Connectors —	(2) DB9 female
Processor —	Z-80 CPU
Memory —	32K RAM
Controls —	Reset
Environment —	Operating Temperature: 32 to 113°F (0 to 45°C) Storage Temperature -44 to +158°F (-20 to +70°C) Humidity: Up to 95% noncondensing
MTBF —	58,000 hours for a ground-benign environment
Enclosure —	High-impact plastic
Power —	115-VAC, 50-60 Hz, 95 mA, 11 watts, or 230-VAC, 50-60 Hz, 48 mA, 11 watts
Size —	1.8"H x 5.5"W x 8.5"D (4.6 x 14.0 x 21.6 cm)
Shipping Weight —	2 lb. (0.9 kg)
Card Rack Specifications	
Rack Size —	5.2"H x 19"W x 9.3"D (13.2 x 48.3 x 23.6 cm)
Card Size —	0.8"H x 4"W x 8.1"D (2 x 10.2 x 20.1 cm)
Weight —	9.5 lb. (4.3 kg), without cards
Rack Power Supply Specs —	Primary: 115-VAC/60 Hz model (230-VAC/50 Hz model, 90 mA); Output: 17 v.ct ~ 750 mA, 12.75 vA; Input connector for 230-VAC version: IEC320; Additional power cord will have to be purchased according to the country of use.

2. Introduction

The Communications Adapter Plus (CAP) lets two incompatible devices that use RS-232 interfaces communicate with each other. The CAP is programmed for your application through internal DIP switches and jumpers. The CAP's 32K of RAM can be allocated in different amounts for each port.

Below is a list of optional equipment you can use to integrate the CAP into your application. See **Appendix A** for the pinouts of the listed cables.

- Card Rack (RM010—CAP)
- Power Supply (PS154)
- Cables:
 - CAP-to DTE Cable (EHN023)
 - CAP-to-Modem Cable (EHN024)
 - CAP-to-AT Cable (EHN025)
 - Straight 9-Pin Cable (ECN12D*)
 - CAP-to-PC Cable (EHN026)

*Specify gender and length.

2.1 Conversions Possible with the CAP

The CAP can convert between two devices for any of the following parameters:

- **Word Structure** — Defines the structure of the asynchronous characters transmitted and received over the RS-232C interface. The CAP's communication ports can be set individually for your devices' word structure.

CAP Word Structure Options:

- a) 5, 6, 7, or 8 Data Bits
- b) Even, Odd, or No Parity Bit (in some cases Mark and Space)
- c) 1, 1.5, or 2 Stop Bits

- **Buffer Flow Control** — The CAP can provide the protocol for stopping and starting data transfer between two devices.

CAP Buffer Flow Control Options:

1. **Hardware Flow Control** — A pin of the RS-232 interface is used for buffer flow control. If the pin being monitored by the sending device is +12 V, the device can transmit data. If the pin is -12 V, the device cannot transmit data. A device attached to the CAP is asked to stop transmitting when only 256 bytes of unused space remain in the buffer. The CAP permits the device to transmit again when 512 bytes of unused space remain in the buffer. It will source DTR (Pin 20) and monitor CTS (Pin 5).
2. **ENQ/ACK Flow Control** — Some devices request permission to transmit a block of asynchronous data by sending an "ENQ" control code (05H). The device can transmit the block only if it receives an "ACK" control code (06H) in response. A block may be anywhere from 1 to 256 bytes. If a larger block size is required, you will have to do custom programming.

NOTE

The CAP will not initiate ENQ for ENQ/ACK protocol; it only responds with ACK to an ENQ. In some applications, custom firmware can be configured to have CAP initiate ENQ.

3. X-ON/X-OFF Flow Control — The sending device is allowed to transmit data until it receives an “X-OFF” control character (13H). After it receives this character, it must wait until it receives an “X-ON” control character (11H) before it can transmit again. The device attached to the CAP is asked to stop transmitting when only 256 bytes of unused space remains in the CAP’s buffer. The CAP permits the device to transmit again when 512 bytes of unused space remain in the CAP’s buffer.

4. No Flow Control — For those situations in which a device uses no flow control, the CAP can be configured to always receive and transmit data without any protocol.

- **Baud Rate** — A unit of signaling speed equal to the number of signal events per second. The CAP’s communication ports’ baud rate must be set to match that of the device attached to that port.

Common rates between 45.5 and 38,400 bps are available. See the baud-rate chart (Table 3-4) for specific rates available. Some other baud rates between 18.75 and 38,400 are available with custom programming.

- **Code Set** — Rules that specify the way sets of characters (also called codes) are represented internally to a computer. The CAP can conform to almost any device’s data code.

CAP Data Code Options:

- ASCII
- EBCDIC
- TRANSCODE
- BAUDOT
- TICKER TAPE
- OTHER** — The CAP can pass data in any code set without conversion if both ports are set up for “OTHER.”

- **Transmission Mode** — This is the protocol defining how information is transmitted over the RS-232C interface.

The CAP’s Transmission Mode Options are:

- Full-Duplex** — Transmission occurs in both directions simultaneously.
- Half-Duplex** — Transmission occurs in either direction, but not simultaneously.
- Simplex** — Transmission occurs in one direction only.

3. Installation

Before you install the CAP, you should plan how to program the unit for your application. The checklist in **Section 3.1** will help you plan your installation. After completing the checklist, go to **Section 3.2**.

3.1 Installation Checklist

NOTE

In the checklist, Device A is the device you will connect to Port A, and Device B is the device you will connect to Port B.

Word Structure and Buffer Flow Control:

DIP-Switch Positions	Device A	Device B
----------------------	----------	----------

Stop Bits (1, 1.5, or 2)	_____	_____
---------------------------------	-------	-------

Parity Type (Odd, Even, Mark,Space or None)	_____	_____
--	-------	-------

Data Bits (5, 6, 7, or 8) The number should be equal to or greater than the number of bits needed to represent your data code: ASCII — 7 or 8 bits EBCDIC — 8 bits TRANSCODE — 6 bits BAUDOT — 5 bits TICKER TAPE — 6 bits	_____	_____
---	-------	-------

Flow Control Type (Hardware, ENQ/ACK, X-ON/X-OFF, None)	_____	_____
--	-------	-------

Baud Rate and Data Code

Baud Rate (Use Table 3-5 and choose the rates closest to your devices). The rate should be $\pm 4\%$ of your device's actual baud rate.

Data Code The selections are: ASCII, EBCDIC, TRANS-CODE, BAUDOT, TICKER TAPE, and OTHER	_____	_____
--	-------	-------

RS-232 Lead Options, Equipment Type, Transmission Mode, Buffer Allocation

Operation of RTS Output Lead: Normal (for half-duplex); Active (for full-duplex)	_____	_____
---	-------	-------

Equipment type of CAP (DCE or DTE must be the opposite of your device.) DCE when using crossover cable, DTE when using straight-pinned cable	_____	_____
---	-------	-------

Transmission Mode (Full duplex, half-duplex, or simplex)	_____	_____
---	-------	-------

Buffer Allocation Port A — 1/2, 3/4, 1/8 Port B — 1/2, 1/4, 7/8	_____	_____
--	-------	-------

If one of your devices will do most, or all of the transmission, you may assign it a larger portion of the CAP buffer. Otherwise, assign half of the buffer to each port.

Source of RX Enable

DIP-Switch Positions

Device A

Device B

The CAP accepts receive data only if its receiver is enabled.

DCD Input Enables Receiver — when DCD is active (High), the CAP receives half-duplex data.

Receiver Always Enabled — The CAP can always receive (full duplex).

Source of TX Enable

The CAP can only transmit when its transmitter is enabled.

CTS enables the transmitter when input is active. You must use this option if you are using hardware flow control.

Transmitter Always Enabled - Choose if not using hardware flow control.

3.2 Installing the CAP

Before the CAP can be installed, you must program it to match your specific application. You must set internal DIP switches and jumpers. This is a very simple procedure if you first fill out the checklist in the previous section. The checklist will help you set the DIP switches and jumpers in a logical order.

This section explains how to set the units for your application. **Sections 3.2.1** and **3.2.2** provide some preliminary information to help you with the installation.

NOTE

Prior to installation, review the specifications of all the devices in your system to ensure compatibility with the CAP.

3.2.1 AC POWER

AC Power is supplied to the unit by a 115-VAC wallmounted power supply. A 220-VAC power supply is also available.

NOTE

Do not power on the unit until all switch and jumper selections are complete.

3.2.2 CABLE REQUIREMENTS

Both ports of the unit are configured as DTE. A special crossover cable is necessary to make one port DCE. If you require both ports to be configured as DCE, you will need two crossover cables (see **Appendix A**).

The EIA RS-232 cable that connects to either of the unit's two ports must be terminated with a male DB9 connector. Table 3-1 shows all the pins on the RS-232 interface which are supported by the CAP.

COMMUNICATIONS ADAPTER PLUS (CAP)

Table 3-1. Pins Supported by the CAP

PIN	NAME	DESCRIPTION	SOURCE
1	DCD	Data Carrier Detect	DCE
2	RD	Receive Data	DCE
3	TD	Transmit Data	DTE
4	DTR	Data Terminal Ready	DTE
5	SG	Signal Ground	DTE and DCE
6	DSR	Data Set Ready	DCE
7	RTS	Request to Send	DTE
8	CTS	Clear to Send	DCE
9	RI	Ring Indicator	DCE

3.3 DIP-Switch Settings

Positions 1-8 of each DIP switch can be turned ON or OFF with a small-tipped instrument such as a ball-point pen. A switch is OFF when it is pushed in the direction of the arrow marked on the switch. If it is pushed in the direction opposite the arrow, it is ON.

If any switch positions are changed with the unit turned off, the unit is automatically set to those options when it is turned on. If the switches are changed with the unit turned on, you must press the Reset button to configure the unit with the new settings. Figure 3-1 shows the location of the DIP switches.

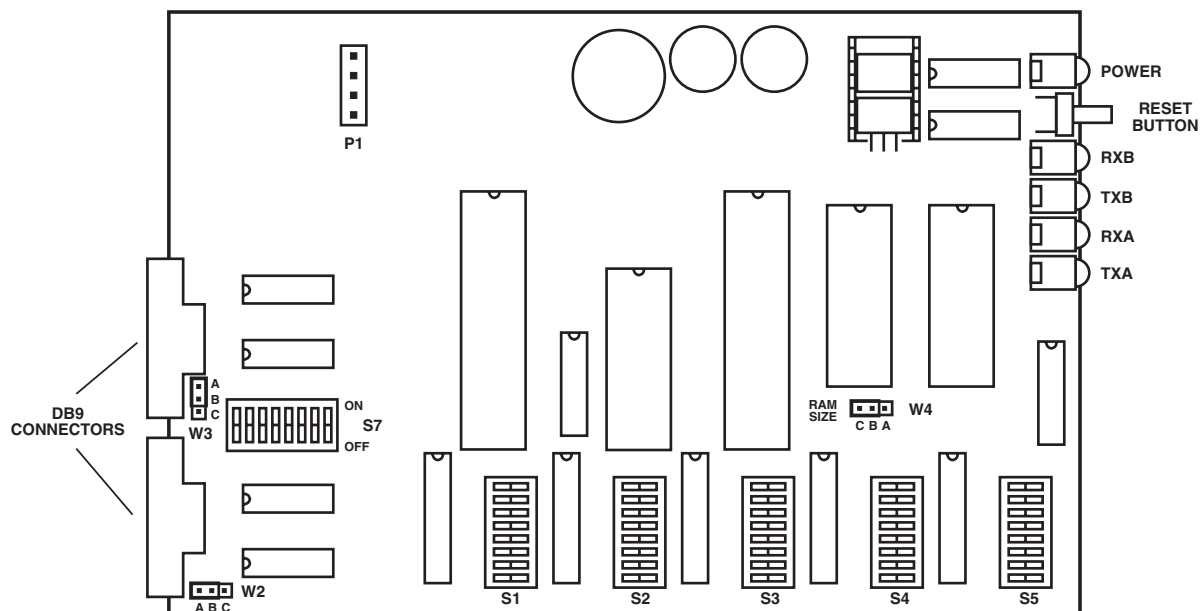


Figure 3-1. Switch Locations on the Circuit Board.

Table 3-2 defines the function of each of the unit's switches. Tables 3-3 through 3-8 give switch settings for particular applications.

Table 3-2. Switch Functions

SWITCH	FUNCTION
S1	Port A word structure and buffer flow control
S2	Port B word structure and buffer flow control
S3	Port A baud rate and data code set
S4	Port B baud rate and data code set
S5	Ports A and B RS-232 lead options, equipment type, transmission mode, and buffer allocation
S6	Reset Pushbutton
S7	RS-232 Interface Options

Table 3-3 shows settings for word structure and buffer flow control.

Table 3-3. Switches S1 (Port A) and S2 (Port B)

OPTION	SWITCH-POSITION SETTING							
	1	2	3	4	5	6	7	8
Word Structure 1 Stop Bit 1.5 Stop Bits 1 Stop Bit 2 Stop Bits	OFF ON OFF ON	OFF OFF ON ON						
Odd Parity Even Parity			OFF ON					
Parity Disable Parity Enable				OFF ON				
8 Data Bits 7 Data Bits 6 Data Bits 5 Data Bits Flow Control Hardware ENQ/ACK X-ON/X-OFF X-ON/X-OFF (X-ON on Reset)					OFF OFF ON ON	OFF ON OFF ON		OFF OFF ON ON

NOTE

For all hardware flow control, CTS and DTR Switch 7 options must NOT be in the forced active position.

For no flow control and normal software flow controls (such as X-ON/X-OFF and ENQ/ACK), the CTS and DTR Switch 7 options should be in the forced active position. See Tables 4-7 and 4-8 for Switch 7 Option settings.

3.4 Setting the Mark and Space Parity

In some cases, it is possible to use mark and space parity. A mark parity bit represents a binary 1. A space parity bit represents a binary 0.

To use either mark or space parity, Position 4 must be OFF (to disable even or odd parity) and the following conditions must be met.

Table 3-4. Switch S3 (Port A) and S4 (Port B) Settings for Baud Rate and Data Code Set

OPTION	SWITCH-POSITION SETTING							
	1	2	3	4	5	6	7	8
Baud Rate								
38,400	OFF	OFF	OFF	OFF	OFF			
19,200	ON	OFF	OFF	OFF	OFF			
9600	OFF	ON	OFF	OFF	OFF			
4800	ON	ON	OFF	OFF	OFF			
4800	OFF	OFF	ON	OFF	OFF			
2400	ON	OFF	ON	OFF	OFF			
2400	OFF	ON	ON	OFF	OFF			
1828.72	ON	ON	ON	OFF	OFF			
1371.54	OFF	OFF	OFF	ON	OFF			
1200	ON	OFF	OFF	ON	OFF			
1037.92	OFF	ON	OFF	ON	OFF			
600	ON	ON	OFF	ON	OFF			
300	OFF	OFF	ON	ON	OFF			
200	ON	OFF	ON	ON	OFF			

- **For Mark Parity** — Mark parity can be used only if your device is using a word structure containing one stop bit. Set Positions 1 and 2 ON (2 stop bits). The first stop bit appears as a mark parity bit.

- **For Space Parity** — Set the data bit switches for one more data bit than the data code set requires. For example, if your device is using the 7-bit ASCII code set, set Positions 5 and 6 for 8-bit data (7 + 1 = 8). The extra data bit appears as the space parity bit. The data bits required to represent a character in each code set are as follows:

ASCII7 EBCDIC8 BAUDOT5
 TICKER TAPE6 TRANSCODE6

NOTE

Space parity cannot be used for 8-bit EBCDIC data because the CAP cannot be configured for 9 data bits.

Table 3-4 (continued). Switch S3 (Port A) and S4 (Port B) Settings for Baud Rate and Data Code Set

OPTION	SWITCH-POSITION SETTING							
	1	2	3	4	5	6	7	8
Baud Rate								
164.82	OFF	ON	ON	ON	OFF			
150	ON	ON	ON	ON	OFF			
1371.54	OFF	OFF	OFF	OFF	ON			
1200	ON	OFF	OFF	OFF	ON			
1037.92	OFF	ON	OFF	OFF	ON			
600	ON	ON	OFF	OFF	ON			
300	OFF	OFF	ON	OFF	ON			
200	ON	OFF	ON	OFF	ON			
164.82	OFF	ON	ON	OFF	ON			
150	ON	ON	ON	OFF	ON			
134.28	OFF	OFF	OFF	ON	ON			
110.35	ON	OFF	OFF	ON	ON			
100	OFF	ON	OFF	ON	ON			
74.42	ON	ON	OFF	ON	ON			
67.14	OFF	OFF	ON	ON	ON			
55.82	ON	OFF	ON	ON	ON			
50	OFF	ON	ON	ON	ON			
45.5	ON	ON	ON	ON	ON			
Data Code Set								
ASCII						OFF	OFF	OFF
EBCDIC						ON	OFF	OFF
TRANSCODE						OFF	ON	OFF
BAUDOT						ON	ON	OFF
TICKER TAPE						OFF	OFF	ON
ASCII						ON	OFF	ON
ASCII						OFF	ON	ON
OTHER (Use only if both devices have the same code set)						ON	ON	ON

NOTE

The selected baud rate can be within 4% of your desired rate and still allow error-free communication.

NOTE

Make sure Switches S1 and S2 are set for the correct number of data bits for the particular Data Code set chosen (Table 3-3 and the code set list in Section 3.4).

Table 3-5. Switch S5 Settings for the CAP

OPTION	SWITCH-POSITION SETTING																											
	1	2	3	4	5	6	7	8																				
RS-232 Lead Options for Port A Normal - RTS output rises when the Port has data to transmit. Used for half-duplex operation. Active - RTS outputs are always active.	OFF ON																											
RS-232 Lead Options for Port B Normal - RTS output rises when the Port has data to transmit. Used for half-duplex operation. Active - RTS outputs are always active.		OFF ON																										
Equipment Type that Port A Should Emulate DCE — crossover cable DTE — straight-pinned cable			OFF ON																									
Transmission mode for Port A Full duplex Half-duplex				OFF ON																								
Equipment Type that Port B Should Emulate DCE — crossover cable DTE — straight-pinned cable					OFF ON																							
Transmission Mode for Port B Full duplex Half-duplex						OFF ON																						
Buffer Allocation <table border="0"> <tr> <td>Port A</td> <td>Port B</td> <td></td> <td></td> </tr> <tr> <td>1/2</td> <td>1/2</td> <td></td> <td></td> </tr> <tr> <td>3/4</td> <td>1/4</td> <td>OFF</td> <td>OFF</td> </tr> <tr> <td>1/8</td> <td>7/8</td> <td>ON</td> <td>ON</td> </tr> <tr> <td>RESERVED</td> <td></td> <td>OFF</td> <td>ON</td> </tr> </table>	Port A	Port B			1/2	1/2			3/4	1/4	OFF	OFF	1/8	7/8	ON	ON	RESERVED		OFF	ON							OFF ON OFF ON	OFF OFF ON ON
Port A	Port B																											
1/2	1/2																											
3/4	1/4	OFF	OFF																									
1/8	7/8	ON	ON																									
RESERVED		OFF	ON																									

Table 3-6. Switch S7 Settings for the CAP

OPTION	SWITCH-POSITION SETTING							
	1	2	3	4	5	6	7	8
RI Input Port A RS-232 RI Connected (custom programming only) Forced Inactive (High)	ON OFF							
DTR Output Port A Controlled by software (hardware flow control) Forced always active (High)		ON OFF						
DCD Input Port A RS-232 DCD Connected input enables Receive Data (Half-duplex) Forced internally active (Receive always enabled)			ON OFF					
CTS Input Port A RS-232 CTS Connected input enables Transmit Data (either hardware, or both hardware and software flow control) Forced internally active (Receive always enabled)				ON OFF				
RI Input Port B RS-232 RI Connected (custom programming only) Forced active (High)					ON OFF			
DTR Output Port B Controlled by software (hardware flow control) Forced active (High)						ON OFF		
DCD Input Port B RS-232 DCD Connected input enables Receive Data (Half-duplex) Forced internally active (Receive always enabled)							ON OFF	
CTS Input Port B RS-232 CTS Connected input enables Transmit Data) Forced internally active (Receive always enabled)								ON OFF

Table 3-7. DSR Jumper Settings for CAP

FUNCTION	JUMPER POSITION
DSR Jumper for Port A — No Connection DSR Jumper for Port A — DSR Output Always Active	W2 — AB W2 — BC
DSR Jumper for Port B — No Connection DSR Jumper for Port B — DSR Output Always Active	W3 — AB W3 — BC

3.5 CAP to Device Connection

After the unit is programmed for your application, you can physically install it.

Connect the unit to the two incompatible devices with RS-232 cables. Make sure the port configured for Device A is connected to Device A, and the port configured for Device B is connected to Device B. Apply AC Power.

Your unit is ready for operation.

4. Troubleshooting

If you have difficulty with your application, the problem may be in either the unit's configuration or the cabling between the devices. This chapter advises you how to quickly find and correct the problem.

4.1 Diagnostic LEDs

Five diagnostic LEDs are mounted on the front of the unit. One LED is for POWER. Two LEDs are for Port A, and two are for Port B. The two LEDs for each port are Receive Data and Transmit Data. If the unit does not appear to be communicating with your devices, the following checklist may be useful.

1. **Power** — The Power LED should be on when the unit is plugged into a wall outlet. The unit will not operate without power.
2. **RXA and RXB** — These indicators flash when the unit receives data to its A or B port. The unit cannot pass information between two devices unless it receives data to transmit. Never assume your equipment is transmitting data to the unit. Monitor this LED to verify that the unit is actually receiving data. If this LED does not flash when your device is transmitting to the unit, check the following:
 - a) Verify whether your device is DTE or DCE.
 - b) Check that the crossover cable pinning is correct.

If the LED flashes, another problem might be that the CAP is ignoring the data your device is sending. This happens if the CAP's receiver is not enabled, or if the data doesn't have the same baud rate/word structure that you have configured for the CAP to use. Check the baud rate/word structure and the DCD input DIP switch options.

3. **TXA and TXB** — If the CAP receives data when its receive enable is active, it puts the data in its internal buffer. Then the CAP attempts to transmit the data out the other port. However, the CAP cannot transmit if it is flow-controlled OFF. If the transmit LED does not light, check the flow control and the CTS input DIP switch options.

4.2 Cables and Configuration

If the LEDs for both ports are working properly, but the two devices are not communicating with each other, check the following:

1. Check for a good connection between Pins 2, 3, and 7 of the cables that attach your equipment to the CAP. These are the pins for TXD, RXD, and Signal Ground.
2. Recheck all DIP switches and jumper positions for both ports to verify that the CAP is configured to match both devices it is connecting. For example, if Port A is configured to use one stop bit and your device is expecting two, it may not receive the data correctly.

5. Code Set Conversion Tables

This section contains tables that give the hexadecimal number (followed by “H”) for a character in the ASCII, EBCDIC, Transcode, Baudot, and Ticker Tape codes. The column labeled “Character or Control” gives the character that the hexadecimal number represents.

The characters are in the same order as the codes. Looking at the first listing in **Section 6.1**, for example, a 061H in ASCII is an “a,” a 081H in EBCDIC is an “a,” a 001H in Transcode is an “A,” a 003H in Baudot is an “A,” and a 020H in Ticker Tape is a special ticker-tape conversion character called a special figure five (SF5). A lower-case “a” in ASCII (061H) would be converted to a capital “A” in Baudot (03H), because Baudot does not support lower-case letters. An upper-case “A” in Baudot would be converted to an upper-case “A” in ASCII (see **Section 5.2**).

5.1 Lower-Case Letters

Only ASCII and EBCDIC support lower-case letters. All lower-case letters are converted to upper-case letters in the other codes, with the exception of some ticker-tape codes.

ASCII	EBCDIC	Transcode	Baudot	Ticker Tape	Character or Control				
061H	081H	001H	003H	020H	a	a	A	A	SF5
062H	082H	002H	019H	03BH	b	b	B	B	2ND B
063H	083H	003H	00EH	022H	c	c	C	C	c
064H	084H	004H	009H	027H	d	d	D	D	SF4
065H	085H	005H	001H	02FH	e	e	E	E	SF3
066H	086H	006H	01DH	00DH	f	f	F	F	F
067H	087H	007H	01AH	01AH	g	g	G	G	G
068H	088H	008H	024H	025H	h	h	H	H	S
069H	089H	009H	006H	006H	i	i	I	I	I
06AH	091H	011H	00BH	00BH	j	j	J	J	J
06BH	092H	012H	00FH	00FH	k	k	K	K	K
06CH	093H	013H	022H	012H	l	l	L	L	L
06DH	094H	014H	02CH	01CH	m	m	M	M	M
06EH	095H	015H	00CH	00CH	n	n	N	N	N
06FH	096H	016H	018H	018H	o	o	O	O	O
070H	097H	017H	016H	004H	p	p	P	P	PR
071H	098H	018H	017H	017H	q	q	Q	Q	Q
072H	099H	019H	00AH	01FH	r	r	R	R	RT
073H	0A2H	022H	005H	036H	s	s	S	S	ST
074H	0A3H	023H	010H	032H	t	t	T	T	SS
075H	0A4H	024H	007H	007H	u	u	U	U	U
076H	0A5H	025H	01EH	01EH	v	v	V	V	V
077H	0A6H	026H	013H	008H	w	w	W	W	WI
078H	0A7H	027H	01DH	01DH	x	x	X	X	X
079H	0A8H	028H	015H	02BH	y	y	Y	Y	BEG ANN
07AH	0A9H	029H	011H	02AH	z	z	Z	Z	END ANN

5.2 Upper-Case Letters

All upper-case letters can be converted, so only one letter is given in the “Character or Control” column.

ASCII	EBCDIC	Transcode	Baudot	Ticker Tape	Character or Control
041H	0C1H	001H	003H	003H	A
042H	0C2H	002H	019H	019H	B
043H	0C3H	003H	00EH	00EH	C
044H	0C4H	004H	009H	009H	D
045H	0C5H	005H	001H	001H	E
046H	0C6H	006H	00DH	00DH	F
047H	0C7H	007H	01AH	01AH	G
048H	0C8H	008H	014H	014H	H
049H	0C9H	009H	006H	006H	I
04AH	0D1H	011H	00BH	00BH	J
04BH	0D2H	012H	00FH	00FH	K
04CH	0D3H	013H	012H	012H	L
04DH	0D4H	014H	01CH	01CH	M
04EH	0D5H	015H	00CH	00CH	N
04FH	0D6H	016H	018H	018H	O
050H	0D7H	017H	016H	016H	P
051H	0D8H	018H	017H	017H	Q
052H	0D9H	019H	00AH	00AH	R
053H	0E2H	022H	005H	005H	S
054H	0E3H	023H	010H	010H	T
055H	0E4H	024H	007H	007H	U
056H	0E5H	025H	01EH	01EH	V
057H	0E6H	026H	013H	013H	W
058H	0E7H	027H	01DH	01DH	X
059H	0E8H	028H	015H	015H	Y
05AH	0E9H	029H	011H	011H	Z

5.3 Numbers

All numbers can be converted. Therefore, only one number is given in the “Character or Control” column.

ASCII	EBCDIC	Transcode	Baudot	Ticker Tape	Character or Control
030H	0F0H	030H	016H	028H	0
031H	0F1H	031H	017H	023H	1
032H	0F2H	032H	013H	039H	2
033H	0F3H	033H	001H	02EH	3
034H	0F4H	034H	00AH	029H	4
035H	0F5H	035H	010H	021H	5
036H	0F6H	036H	015H	02DH	6
037H	0F7H	037H	007H	03AH	7
038H	0F8H	038H	006H	034H	8
039H	0F9H	039H	018H	026H	9

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5.4 Special Printable Characters

Any special printable character that cannot be converted is changed to another character that is a valid member for that code set. The common character dash (-) is used, except for ticker-tape code that can't be converted.

ASCII	EBCDIC	Transcode	Baudot	Ticker Tape	Character or Control
020H	040H	01AH	004H	02CH	SP (BAUDOT SP, SET 1B)
021H	05AH	020H	003H	038H	! ! - - -
022H	07FH	020H	011H	038H	" " - " -
023H	07BH	03BH	014H	038H	# # # # -
024H	05BH	01BH	00DH	03CH	\$
025H	06CH	02CH	003H	038H	% % % - -
026H	050H	010H	01AH	01BH	&
027H	07DH	020H	005H	038H	' ' - ' -
028H	04DH	020H	00FH	038	((- (-
029H	05DH	020H	012H	038H)) -) -
02AH	05CH	01CH	003H	038H	* * * - -
02BH	04EH	020H	009H	038H	+ + - + -
02CH	06BH	02BH	00CH	038H	' ' ' ' -
02EH	04BH	00BH	01CH	024H FIGURE DOT
02FH	061H	021H	01DH	002H	/ / / / LETTER DOT
03AH	07AH	020H	00EH	038H	: : - : -
03BH	05EH	020H	01EH	038H	; ; - ; -
03CH	04CH	00CH	003H	038H	< < < - .-
03DH	07EH	020H	003H	038H	= = - - -
03EH	06EH	020H	003H	03EH	> > - - 3/8
03FH	06FH	020H	019H	038H	? ? - ? -
040H	07CH	03CH	003H	038H	@ @ @ - -
05BH	0ADH	020H	003H	037H	[[- - 1/4
05CH	0E0H	020H	003H	038H	\ \ - - -
05DH	0BDH	020H	003H	035H]] - - 3/4
05EH	060H	020H	003H	038H	^ ---
05FH	06DH	020H	003H	038H	_ _ - - -
060H	079H	020H	00CH	038H	' ' - ' -
07BH	0C0H	020H	003H	033H	{ { - - 1/2
07CH	06AH	020H	003H	030H	- - 1/8
07DH	0D0H	020H	003H	031H	} } - - 7/8
07EH	0A1H	020H	003H	03DH	~ ~ - - 5/8
02DH	060H	020H	003H	038H	-

5.5 Control Codes

Any control code that cannot be converted is discarded and shown as an OFFH.

ASCII	EBCDIC	Transcode	Baudot	Ticker Tape	Character or Control
006H	02EH	0FFH	0FFH	0FFH	ACK
007H	02FH	00DH	00BH	0FFH	BEL
008H	016H	0FFH	0FFH	0FFH	BS
0FFH	024H	0FFH	0FFH	0FFH	BYP
018H	018H	0FFH	0FFH	0FFH	CAN
0FFH	01AH	0FFH	0FFH	0FFH	CC
00DH	00DH	0FFH	008H	0FFH	CR
011H	011H	0FFH	0FFH	0FFH	DC1
012H	012H	0FFH	0FFH	0FFH	DC2
013H	013H	0FFH	0FFH	0FFH	DC3
014H	03CH	0FFH	0FFH	0FFH	DC4
07FH	007H	03FH	0FFH	03FH	DEL & Rubout in Ticker Tape
010H	010H	01FH	0FFH	0FFH	DLE
0FFH	020H	0FFH	0FFH	0FFH	DS
019H	019H	03EH	0FFH	0FFH	EM
005H	02DH	02DH	0FFH	0FFH	ENQ
0FFH	026H	0FFH	0FFH	0FFH	EQB
004H	037H	01EH	0FFH	0FFH	EOT
01BH	027H	02AH	0FFH	0FFH	ESC
017H	026H	00FH	0FFH	0FFH	ETB
003H	003H	02EH	0FFH	0FFH	ETX
00CH	00CH	0FFH	0FFH	0FFH	FF
01CH	022H	0FFH	0FFH	0FFH	FS
01DH	0FFH	0FFH	0FFH	0FFH	GS
009H	005H	02FH	0FFH	0FFH	HT
0FFH	01CH	0FFH	0FFH	0FFH	IFS
0FFH	01DH	0FFH	0FFH	0FFH	IGS
0FFH	017H	0FFH	0FFH	0FFH	IL
0FFH	01EH	0FFH	0FFH	0FFH	IRS
0FFH	01FH	0FFH	0FFH	0FFH	IUS
0FFH	006H	0FFH	0FFH	0FFH	LC
00AH	025H	0FFH	002H	0FFH	LF (BAUDOT LF BOTH SETS)
015H	03DH	03DH	0FFH	0FFH	NAK
0FFH	015H	0FFH	0FFH	0FFH	NL
000H	000H	0FFH	000H	000H	NUL & SPARE IN TICKER TAPE

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ASCII	EBCDIC	Transcode	Baudot	Ticker Tape	Character or Control
0FFH	004H	0FFH	0FFH	0FFH	PF
0FFH	034H	0FFH	0FFH	0FFH	PN
0FFH	027H	0FFH	0FFH	0FFH	PRE
0FFH	014H	0FFH	0FFH	0FFH	RES
0FFH	009H	0FFH	0FFH	0FFH	RLF
01EH	035H	0FFH	0FFH	0FFH	RS
00FH	00FH	0FFH	0FFH	0FFH	SI
0FFH	02AH	0FFH	0FFH	0FFH	SM
0FFH	00AH	0FFH	0FFH	0FFH	SMM
00EH	00EH	0FFH	0FFH	0FFH	SO
001H	001H	000H	0FFH	0FFH	SOH
0FFH	021H	0FFH	0FFH	0FFH	SOS
002H	002H	00AH	0FFH	0FFH	STX
01AH	03FH	00EH	0FFH	0FFH	SUB
016H	032H	03AH	0FFH	0FFH	SYN
0FFH	036H	0FFH	0FFH	0FFH	UC
01FH	0FFH	01DH	0FFH	0FFH	US
00BH	00BH	0FFH	0FFH	0FFH	VT

5.6 Ticker Tape

The special codes in Ticker Tape (shown on the next page) cannot be converted to any of the other code sets. These codes are changed to other printable codes that Ticker Tape does not support. This allows the user to interpret Ticker Tape data by checking for these codes.

ASCII and EBCDIC are the only code sets in which all of the changed codes are valid. Transcode and Baudot do not have many codes that Ticker Tape does not support. To interpret the special Ticker Tape codes available, the Baudot and Transcode code sets would need more of these available codes. For example, if a Ticker Tape “WI” is sent to a Transcode device, it is interpreted as a “W.” If a Transcode device sends a “W” to a Ticker Tape device it is interpreted as a “W,” not as a “WI.”

HEX	Ticker Tape	Changed Char ASCII EBCDIC	Baudot Transcode	Description
00		NUL	*	Spare code
02	.	/	/	Letters dot
04	P	P	P	“P” with “R” below
	R			
08	W	w	W	“W” with “I” below
	I			
1F	R	r	R	“R” with “T” below
	T			
20	.	a	A	Special Figure 5
22	c	c	C	Lower Case “C”
24	.	.	.	Figures Dot
25	s	s	S	Lower Case “s”
27	1	d	D	“1” with “4” below (1/4 Option 2)
	4			
2A	.	z	Z	End Announcement
2B	.	y	Y	Begin Announcement
2F	.	e	E	Special Figure 3
30	1		-	“1” with “8” below (1/8)
	8			
31	7	}	-	“7” with “8” below (7/8)
	8			
32	S	t	T	“S” with “S” below
	S			
33	1	{	-	“1” with “2” below (1/2)
	2			
35	3]	-	“3” with “4” below (3/4)
	4			
36	S	s	S	“S” with “T” below
	T			
37	1	[-	“1” with “4” below (1/4 Option 1)
	4			
3B	B	b	B	Another code for “B”
3D	5	~	-	“5” with “8” below (5/8)
	8			
3E	3	>	-	“3” with “8” below (3/8)
	8			
3F	.	DEL	**	Rubout

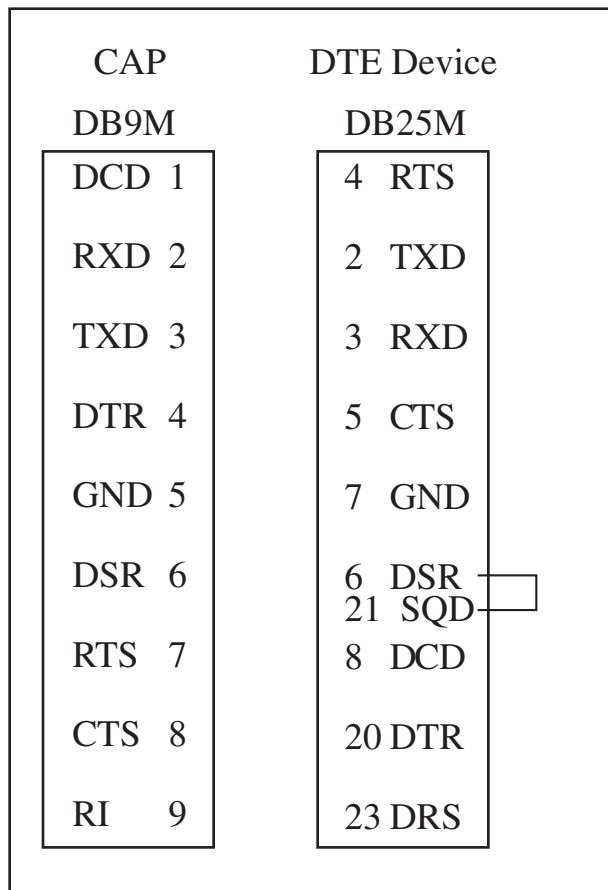
*No conversion

**Del in Transcode, no conversion in Baudot

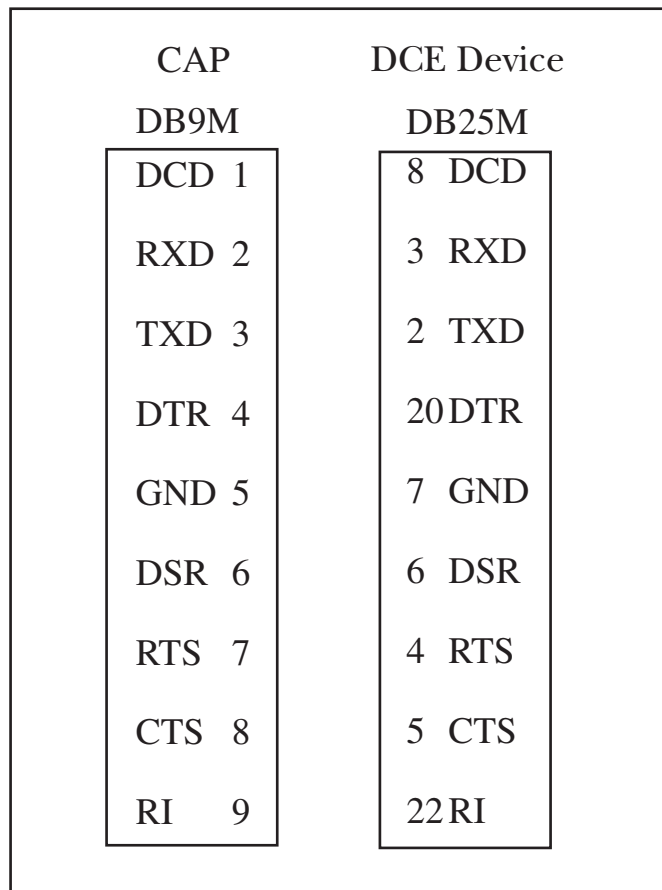
Appendix: Optional Cables

This appendix shows the special pinning required for the CAP to operate in particular applications. If your application matches the caption of one of the pinning diagrams below, make sure the cable you are using matches the pinning shown.

The diagrams are set up so that the left side of the illustration shows pinning on one end of the cable, while the right side shows pinning on the other side. Pins that are directly across from each other are directly connected.



**Figure A-1. CAP-to-DTE Cable
(DB9 to DB25 Male Cable).
(EHN023)**



**Figure A-2. CAP-to-Modem Cable
(DB9 to DB25 Male Cable).
(EHN024)**

CAP DB9M	AT SERIAL PORT DB9F
DCD 1	7 RTS
RXD 2	3 TXD
TXD 3	2 RXD
DTR 4	8 CTS
GND 5	5 GND
DSR 6	6 DSR
RTS 7	1 DCD
CTS 8	4 DTR
RI 9	9 RI

**Figure A-3. CAP-to-AT Cable
(DB9 to DB9 Cable for AT).
(EHN025)**

CAP DB9M	DCE Device DB9*
DCD 1	1 DCD
RXD 2	2 RXD
TXD 3	3 TXD
DTR 4	4 DTR
GND 5	5 GND
DSR 6	6 DSR
RTS 7	7 RTS
CTS 8	8 CTS
RI 9	9 RI

*Must specify gender type when ordering.

**Figure A-4. CAP-to-DCE Cable
(DB9 to DB9 Cable).
(ECN12D)**

CAP DB9M	PC SERIAL PORT DB25F
DCD 1	4 RTS
RXD 2	2 TXD
TXD 3	3 RXD
DTR 4	5 CTS
GND 5	7 GND
DSR 6	6 DSR
RTS 7	21 SQD
CTS 8	8 DCD
RI 9	20 DTR
	23 DRS

Figure A-5. CAP-to-PC Cable(DB9 to DB25 Female Cable).(EHN026)

CAP DB9 female		
Signal	Pin	Direction
DCD	1	Input
RXD	2	Input
TXD	3	Output
DTR	4	Output
GND	5	
DSR	6	Output or N/A
RTS	7	Output
CTS	8	Input
RI	9	Input

Figure A-6. RS-232 Port(s) Pinouts and Signal Flow for Both CAP Ports.



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