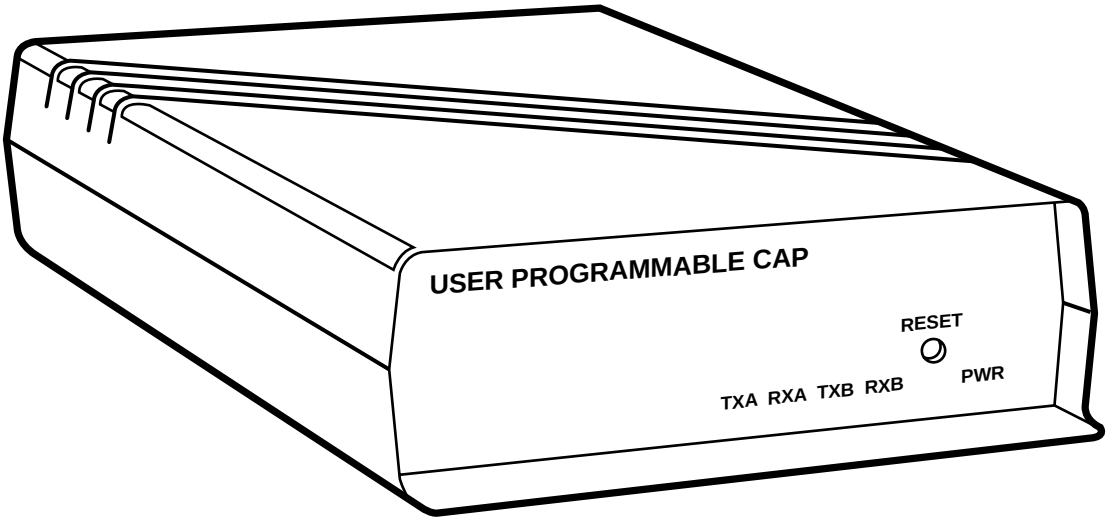
1000 Park Drive • Lawrence, PA 15055-1018 • 724-746-5500 • Fax 724-746-0746

BLACK BOX®
NETWORK SERVICES

APRIL 1992
CMA005A
CMA005C

User Programmable CAP



CUSTOMER SUPPORT INFORMATION

Order **toll-free** in the U.S. 24 hours, 7 A.M. Monday to midnight Friday: **877-877-BBOX**
FREE technical support, 24 hours a day, 7 days a week: Call **724-746-5500** or fax **724-746-0746**
Mail order: **Black Box Corporation**, 1000 Park Drive, Lawrence, PA 15055-1018
Web site: **www.blackbox.com** • E-mail: **info@blackbox.com**

FEDERAL COMMUNICATIONS COMMISSION
RADIO FREQUENCY INTERFERENCE STATEMENT

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 required to correct the interference.

TRADEMARKS

AT® is a registered trademark of International Business Machines Corporation.

Any other trademarks mentioned in this manual are acknowledged to be the property of the trademarks owners.

CONTENTS

1.0 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

Translations — Maximum memory available for translations is 8K. 256 bytes or less for each match string or substitution string. Formula: MEMORY USAGE = TOTAL LENGTH OF ALL MATCH AND SUBSTITUTION STRINGS + 10 BYTES OVERHEAD PER TRANSLATION. EXAMPLE: CONVERT 10 16-CHARACTER STRINGS TO 4-CHARACTER STRINGS 10*16 + 10*4 + 10*10 (OVERHEAD) = 300 BYTES

Controls — Reset

Environment — Operating Temperature: 32° to 113° F (0° to 45° C)
Storage Temperature: -44° to 158° F (-20° to 70° C)
Humidity: 0 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)

Weight — 2 lb. (0.9 kg)

Card Rack Specifications

Size — 5.2"H x 19"W x 9.3"D (13.2 x 48.3 x 23.6 cm)

Weight — 9.5 lb. (4.3 kg), without cards

Rack Power Supply Specs — Primary: 115 VAC/60 Hz model or 230 VAC/50 Hz model
Output: 16 volts center-tap AC, 3.125 amps

Card Capacity — Rack holds up to 12 Cards.

2.0 Introduction

The User Programmable CAP lets two incompatible devices that use RS-232 interfaces communicate with each other. The unit is programmed for your application through internal DIP switches and jumpers. The unit'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 unit into your application. See Appendix A for the pinouts of the listed cables.

- Card Rack
- Power Supply
- Cables:
  CAP-to DTE Cable
  CAP-to-Modem Cable
  CAP to AT® Cable
  Straight 9-Pin Cable
  CAP-to-PC Cable

2.1 Possible Conversions

The User Programmable 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 User Programmable CAP's communication ports can be set individually for your devices' word structure.

  Word Structure Options:

  a) 5, 6, 7, or 8 Data Bits
  b) Even, Odd, Mark, Space, or No Parity Bit
  c) 1, 1.5, or 2 Stop Bits

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

  Buffer Flow Control Options:

  1. **Hardware Flow Control —** A pin of the RS-232 interface in 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 User Programmable CAP is asked to stop transmitting when only 256 bytes of unused space remain in the buffer. The unit permits the device to transmit again when only 256 bytes of information remain in the buffer. The unit is DTE; it sources DTR and monitors CTS.

  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 transmits 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 User Programmable 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 the User Programmable 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 Programmable CAP is asked to stop transmitting when only 256 bytes of unused space remains in the buffer. The Programmable CAP permits the device to transmit again when the buffer is emptied to a point where only 256 bytes of information remain.

  4. **No Flow Control —** For those situations in which a device uses no flow control, the Programmable 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 Programmable CAP 's communication port's 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 User Programmable CAP can conform to almost any device's data code.

  User Programmable CAP Data Code Options:

  a) ASCII
  b) EBCDIC
  c) TRANSCODE
  d) BAUDOT
  e) TICKER TAPE
  f) OTHER — The User Programmable 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 User Programmable CAP's Transmission Mode Options are:

  a) **Full-Duplex —** Transmission occurs in both directions simultaneously.

  b) **Half-Duplex —** Transmission occurs in either direction, but not simultaneously.

  c) **Simplex —** Transmission occurs in one direction only.

2.2 User Programmable CAP Features

You can program the User Programmable CAP to convert single or multiple character sequences to other single or multiple character sequences. This unit is an inline buffer box with two modes of operation: programming mode and pass-thru mode.

2.2.1 Programming Mode

In Programming Mode, you can enter and update translation equations and any other parameters used in the translation process. Translation equations consist of two parts, the match string and the substitute string. Each of these strings can be up to 256 characters long. These translation equations are stored in a nonvolatile memory which retains information all the time, even during power loss. Maximum memory available for the translations in 8K. You can enter programming mode either by toggling a DIP switch or by entering a user-defined software string.

2.2.2 Pass-Thru Mode

In Pass-Thru Mode, the unit buffers data received from each port and translates any character sequences as defined in the translation equations. Then it retransmits this data out of the other port, using the configured word structure, baud rate, and flow control of the port. A character sequence is passed through transparently unless it corresponds to a match string in one of the translation equations. If a match occurs, the character sequence is replaced by the substitute string of the corresponding translation equation.

2.2.3 Upload User programmable capability

The User Programmable CAP can upload its internal translation table for storage on a PC. So you can to have a backup of the table if you ever need it.

2.2.4 Download User programmable capability

The User Programmable CAP can be programmed by downloading a translation table from a PC. This is useful if you want to configure more than one unit with the same table, such as in identical installations in multiple locations.

2.2.5 Partial Match Timeout

A Partial Match Timeout can be enabled via a menu option. This lets the unit pass a partially matched string through the unit if the remainder of the string was not received within the time period set by the user.

2.2.6. Control Field in Substitute String

You can program a control field in each substitute string. This lets the unit raise or lower a DTR or RTS control lead. The unit can also enter a program mode when a valid match string is received.

3.0 Installation

Before you install the User Programmable 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 Void)	_____	_____
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

DIP Switch Positions	Device A	Device B
Baud Rate (Use Table 3-5 and choose the rates closest to your devices). The rate should be ± 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

DIP Switch Positions	Device A	Device B
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	_____	_____

DIP Switch Positions	Device A	Device B
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

	Device A	Device B
The CAP accepts receive data only if its receiver is enabled.		
DCD Enables Receiver - when DCD is active (High), the CAP receives data (half-duplex)		
Receiver Always Enabled — The CAP can always receive (full duplex)	_____	_____

Source of TX Enable

The CAP can transmit only when its transmitter is enabled.	_____	_____

CTS enables the transmitter when input is active. Choose if your device asserts DTR with a crossover cable, or asserts CTS when it is powered on and/or it can receive data. You must use this option if you are using hardware flow control.

Transmitter Always Enabled — The CAP can always transmit (software or no flow control).

3.2 Installing the User Programmable CAP

Before the User Programmable 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 User Programmable 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.

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 User Programmable CAP.

Table 3-1. Pins Supported by the User Programmable 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 ballpoint pen. A switch is ON 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 OFF.

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.

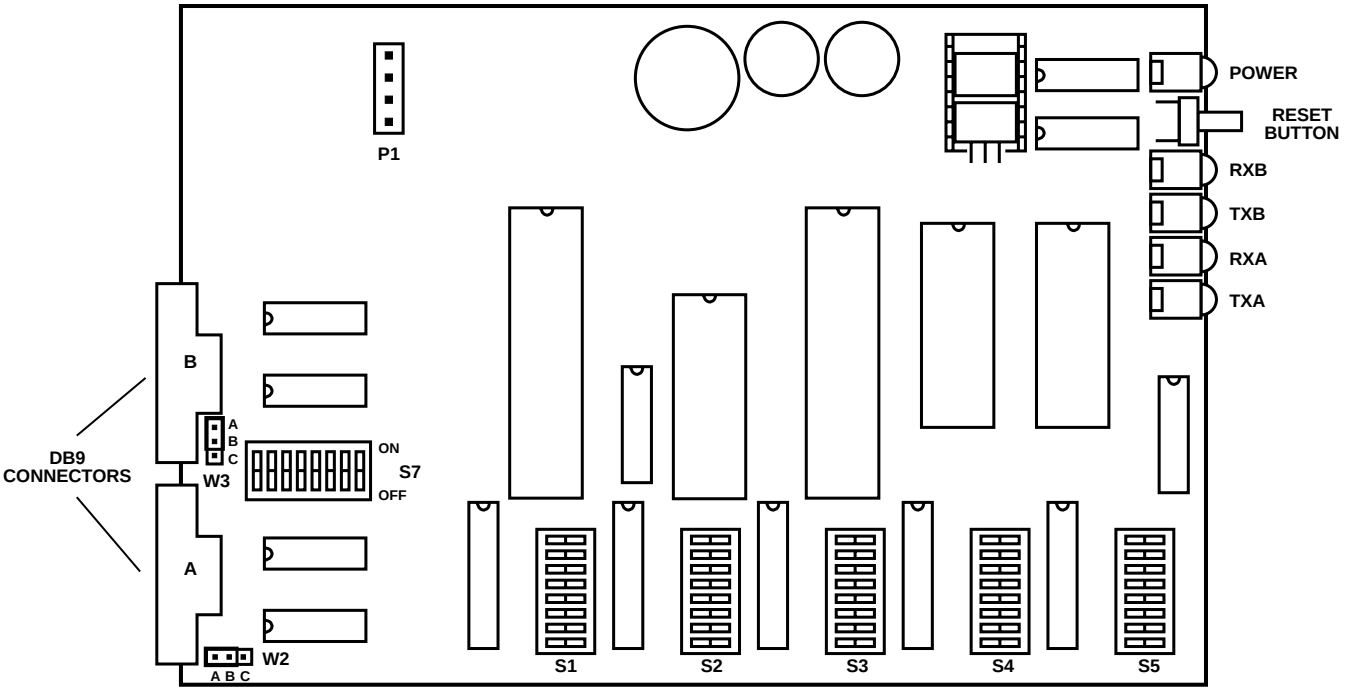


Figure 3-1. Switch Locations on the Circuit Board.

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 Pass-Thru and Program Mode, 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	OFF	OFF						
1.5 Stop Bits	ON	OFF						
1 Stop Bit	OFF	ON						
2 Stop Bits	ON	ON						
Odd Parity			OFF					
Even Parity			ON					
Parity Disable				OFF				
Parity Enable				ON				
8 Data Bits					OFF	OFF		
7 Data Bits					OFF	ON		
6 Data Bits					ON	OFF		
5 Data Bits					ON	ON		
Flow Control								
Hardware							OFF	OFF
ENQ/ACK							ON	OFF
X-ON/X-OFF							OFF	ON
X-ON/X-OFF on Reset							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.

- **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:

ASCII	7
EBCDIC	8
BAUDOT	5
TICKER TAPE	6
TRANSCODE	6

NOTE

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

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								
38400	OFF	OFF	OFF	OFF	OFF			
19200	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			
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

NOTE

If your desired baud rate is within 4% of one listed in Table 3-4, in most cases you should set the unit to the listed rate.

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 User Programmable CAP

OPTION	SWITCH POSITION SETTING							
	1	2	3	4	5	6	7	8
Port A Mode Pass-Thru Mode Program Mode	 OFF ON							
Port B Mode Pass-Thru Mode Program Mode		 OFF ON						
Equipment Type That Port A Should Emulate DCE - Crossover cable DTE - Straight-pinned cable			 OFF ON					
Port A Mode Full Duplex Half Duplex				 OFF ON				
Equipment Type That Port B Should Emulate DCE - Crossover cable DTE - Straight-pinned cable					 OFF ON			
Port B Mode Full Duplex Half Duplex						 OFF ON		
Buffer Allocation **Port A Port B** 1/2 1/2 3.4 1/4 1/8 7/8 RESERVED							 OFF ON OFF ON	 OFF OFF ON ON

Table 3-6. Switch S7 Settings for the User Programmable CAP

OPTION	SWITCH POSITION SETTING							
	1	2	3	4	5	6	7	8
RI Input Port A Forced Inactive (Low) Monitored (Custom programming only)	OFF ON							
DTR Output Port A Forced active (High) Controlled (Hardware flow control)		OFF ON						
DCD Input Port A Forced active (High) Monitored (enables Receive Data)			OFF ON					
CTS Input Port A Forced active (High) Monitored (enables Transmit Data)				OFF ON				
RI Input Port B Forced Inactive (Low) Monitored (custom programming only)					OFF ON			
DTR Output Port B Forced active (High) Controlled (hardware flow control)						OFF ON		
DCD Input Port B Forced active (High) Monitored (enables Receive Data)							OFF ON	
CTS Input Port B Forced active (High) Monitored (enables Transmit Data)								OFF ON

Table 3-7 DSR Jumper Settings for User Programmable CAP

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

3.5 User Programmable 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.

3.6 Rackmount Application

The Cards (CMA005C) are installed into the RM010 Rack, which holds up to 12 Cards. For Rackmount Card Application, the configuration is idential to the CMA005A configuration.

NOTE

Remember the neither the CMA005A or CMA005C are supplied with cables. If you need cables, you will have to order them separately.

4.0 Operation

The User Programmable CAP uses the Programming Mode to enter and update translation equations and other parameters used in the translation process.

Programming Mode is menu-driven. You will need a dumb terminal (or similar device) to use the Programming Mode. Cursor positioning is not used. The only control characters used in the menu screens are carriage return and linefeed characters, which terminate every line.

4.1 Entering and Exiting the Programming Mode

You can access the Program Mode through either port. Remove the cover of the unit, and turn on the Program Mode DIP switch for the port. When one port is in Program Mode, the other port is disabled.

To exit the Program Mode, select the X option from the main menu. Remove the unit's cover and turn off the Program Mode DIP switch for the port. Then either press the reset pushbutton, or turn the unit off and on again.

4.2 Programming Menu

When you are in Program Mode, a menu-driven program helps you with adding and editing the translation equations.

This is the Main Menu:

```
PROGRAM MODE MENU

(1) ADD a new translation
(2) DELETE an old translation
(3) LIST & EDIT one translation
(4) INSERT a translation
(5) LIST ALL translation equations
(6) CLEAR ALL translation equations
(7) UPLOAD translation table
(8) DOWNLOAD translation table
(9) Set Partial String Timeout
(A) Set Special Flow Control Mode
(X) EXIT from program mode

Please enter your selection (1-9, A, X):
```

The options are explained below:

- **Add —** This option lets you add one translation equation. The unit can store up to 150 different translation equations. Each translation equation is assigned an equation number, from 001 to 150, when you enter the equation into the unit.
- **Delete —** The unit prompts you for an Equation Number when you select this function. If you don't know the number of the equation you want to delete, select the List All function from the Main Menu, and the screen will show all Equations and their numbers.

NOTE

When an equation is deleted, all of the remaining equation numbers (after the one deleted) are moved up one place. For example, if you delete Equation No. 003, Equation 004 becomes 003, and so on.

- **List and Edit —** The unit prompts you for an Equation Number when you select this function. After you enter the number, the program displays the existing equation and lets you edit it. If you don't know the Equation Number, select the List All function.
- **Insert —** The unit prompts you for an Equation Number when you select this function. The translation entered is inserted before the Equation Number specified. If you don't know the Equation Number, select the List All function.

- **List All —** Here's a sample of what appears on your screen when you select this option:

```
TRANSLATION KEY:          M - Match String
                          S - Substitute String
                          F - Function Code

TRANSLATIONS IN PORT A TO PORT B DIRECTION
(PRESS ANY KEY TO SCROLL, PRESS RETURN TO
RETURN TO MENU)

#: TRANSLATION:

001   M-CATALOG
      S - DIR

002   M - LISTFILE
      S - TYPE
```

- **Clear All —** This option lets you delete all equations from memory. The unit asks you "Do you really want to do this? Y/N." Entering **Y** deletes all equations. Entering **N** or any other key returns you to the Main Menu.
- **Upload Translation Table —** This option causes the unit to upload its internal translation table for storage on a PC.
- **Download Translation Table —** This option lets the User Programmable CAP be programmed by downloading a translation table stored on a PC. It overwrites any existing translation equations currently stored in the unit.
- **Set Partial String Timeout —** This option allows the User Programmable CAP to pass a partially matched string through the unit if the remainder of the string was not received within the time period set by the user. This timeout can be set in the range of 1 second to 5 minutes or disabled.
- **Set Special Flow Control Modes —** This option allows you to set the function of the RTS andDTR control leads on Port A and Port B. There are three optons available for each of the leads: normal operation, always high, and always low.

  DTR Normal Operation — If this option is selected, DTR is on after reset. DTR will remain on unless the User Programmable CAP buffer fills, then DTR will turn off drop until there is more room in the buffer, then it will turn on again.

  DTR Always High — This option turns DTR on after reset and it will remain on unless it is changed by a function code.

  DTR Always Low — This option turns DTR off after reset and it will remian off unless it is changed by a function code.

  RTS Normal Operation — If this option is selected, RTS is off after reset. RTS will remain off until the User Programmable CAP has data to send out a port. At this point, the User Programmable CAP will raise RTS of that port, send the data out, and when it has no more data to send, it will drop RTS.

  RTS Always High — This option turn RTS on after reset and it will remain on unless it is changed by a function code.

  RTS Always Low — This option turns RTS off after reset and it will remain off unless it is changed by a function code.

4.3 Translation Equation Entry

Each translation equation has certain parameters associated with it. To create a translation equation, you must do the following:

- Define the direction of the translation.
- Define a match string.
- Define a substitution string.
- Define an optional function code.

4.3.1 Direction of Translation

The Direction of Translation involves the User Programmable CAP asking you if the translation is in the Port A to Port B direction or in the Port B to Port A direction.

4.3.2 Entering Match and Substitution Strings

The match string and the substitution string can each be up to 255 characters long. To enter a match or substitution string, type 1 to 255 characters and hit Return (or Enter). You can enter control characters by typing a backslash (\) followed by the two hexadecimal digits that represent the desired character. If you want to enter an actual backslash, type two backslashes for each one you need. To enter a carriage return, type **\0D**.

Example 1: Convert Carriage Return to Carriage Return Linefeed.

Match String	\0D
Substitute String	\0D\0A

Example 2: Convert Backspace to Escape "[A"

Match String	\08
Substitute String	\1B[A

4.3.3 Entering Function Codes

The optional function code associated with each translation enables the User Programmable CAP to take additional action when a match string is encountered in the data stream. These actions include raising or lowering RTS, raising or lowering RTS, or enterng program mode. The program mode selection allows the user to define a software string to enter program mode. These options can be used separately or together. For example: when a match string is received, the User Programmable CAP can drop DTR and raise RTS.

5.0 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.

5.1 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. **Receive —** This indicator flashes when the unit receives data. 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 doesn't flash, another problem might be that the unit 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 that you have configured for the CAP to use. Check the baud rate and DCD input DIP switch options.

3. **Transmit —** 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 DIP switch options.

5.2 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.

6.0 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. In the first listing below, for example, a 061H in ASCII is an "a," a 081H in EBCDIC is an "a," a 001H in Transcode in a "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 captial "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 6.2).

6.1 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	003H	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

6.2 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

6.3 Numbers

All numbers can be converted. Therefore, only one number is given 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

6.4 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	-

6.5 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 (BAUDOT 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 SET 1B)
00AH	025H	0FFH	002H	0FFH	LF (BAUDOT LF SET 1F)
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

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

6.6 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 (they do not). 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
03	P R	P	P	"P" with "R" below
08	W I	w	W	"W" with "I" below
1F	R T	r	R	"R" with "T" below
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 4	d	D	"1" with "4" below (1/4 Option 2)
2A	.	z	Z	End Announcement
2B	.	y	Y	Begin Announcement
2F	.	e	E	Special Figure 3
30	1 8	|	-	"1" with "8" below (1/8)
31	7 8	}	-	"7" with "8" below (7/8)
32	S S	t	T	"S" with "S" below
33	1 2	{	-	"1" with "2" below (1/2)
35	3 4	]	-	"3" with "4" below (3/4)
36	S T	s	S	"S" with "T" below
37	1 4	[	-	"1" with "4" below (1/4 Option 1)
3B	B	b	B	Another code for "B"
3D	5 8	~	-	"5" with "8" below (5/8)
3E	3 8	>	-	"3" with "8" below (3/8)
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 setu 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.

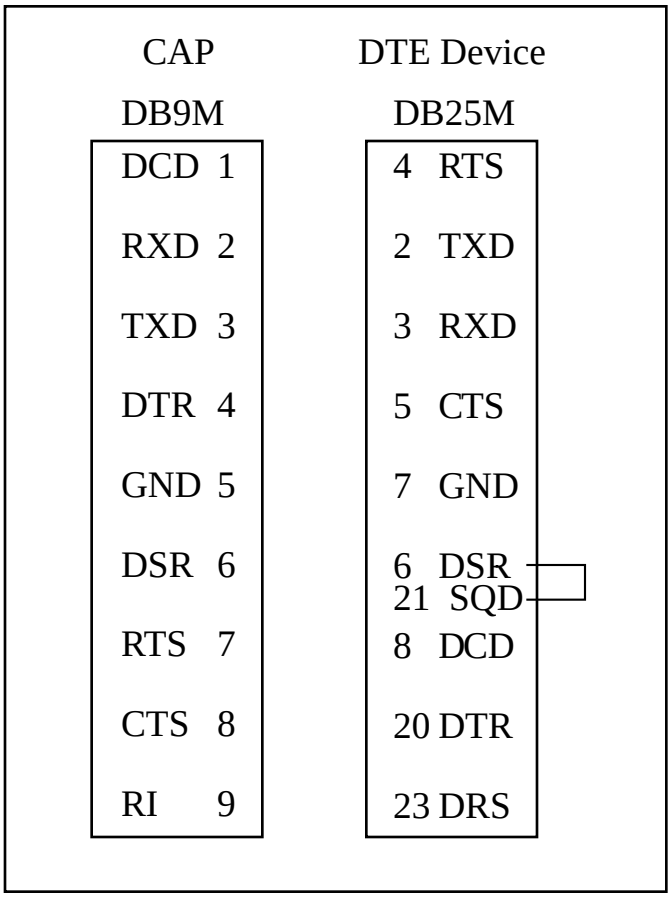


Figure A-1. CAP-to-DTE Cable.

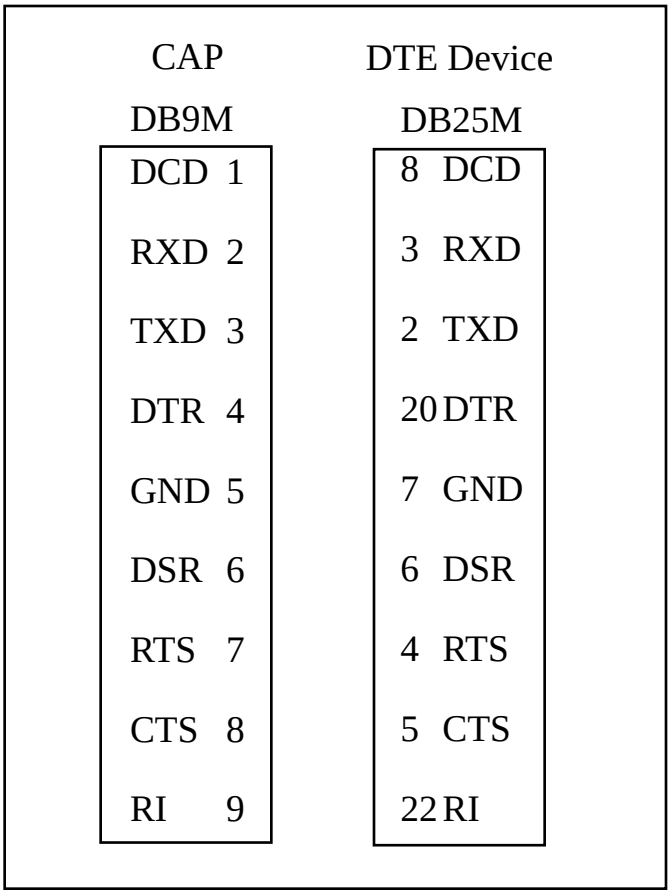


Figure A-2. CAP-to-Modem Cable.

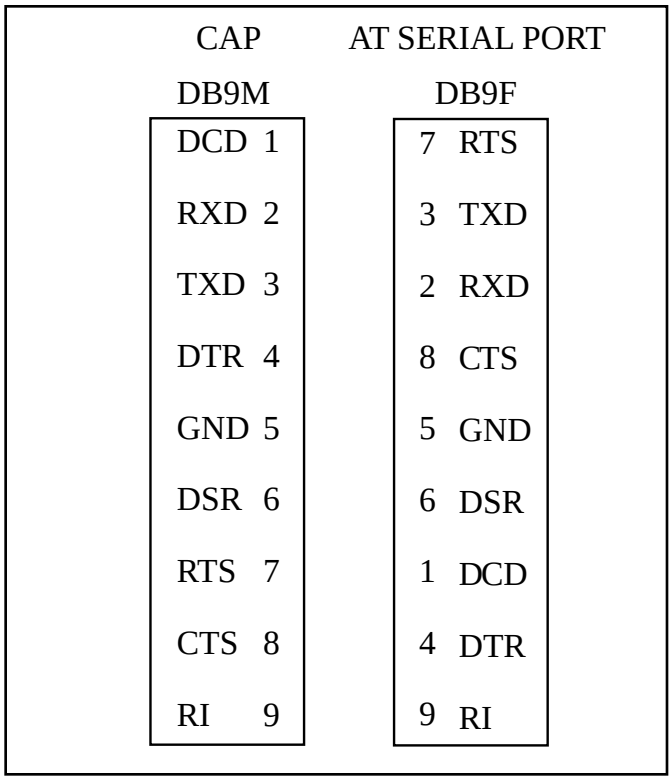


Figure A-3. CAP-to-AT Cable.

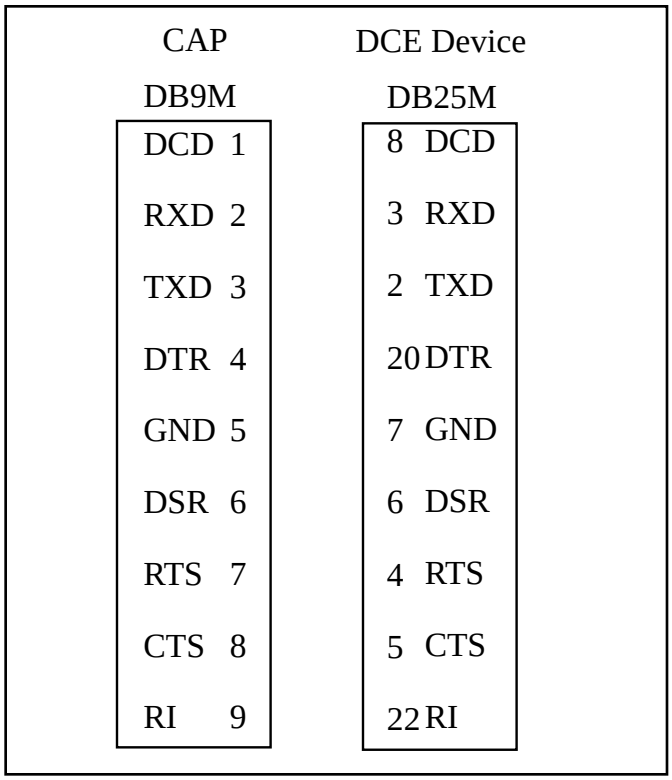


Figure A-4. CAP-to-DCE Cable.

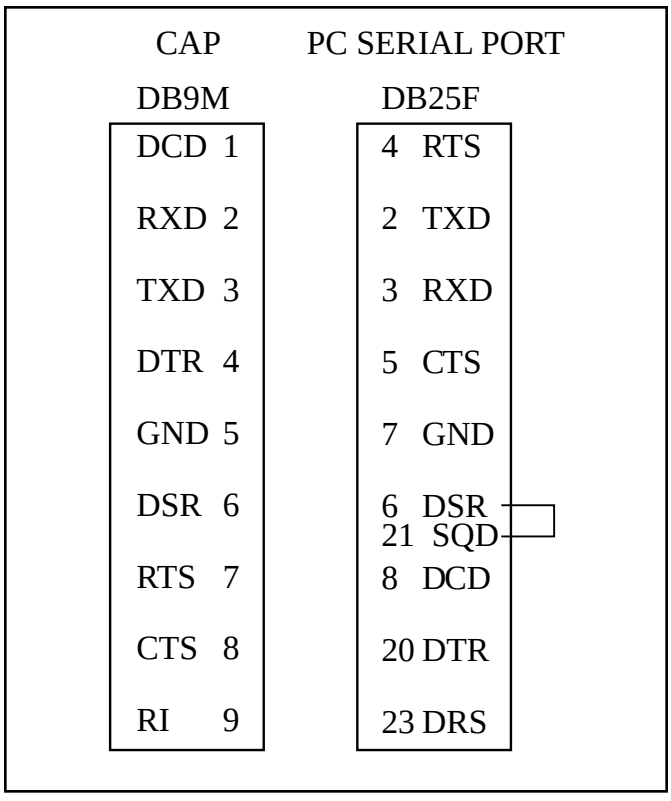


Figure A-5. CAP-to-PC Cable.

Switches S1 (Port A) and S2 (Port B)

POSITION	1	2	WORD STRUCTURE
	OFF	OFF	1 stop bit
	ON	OFF	1 1/2 stop bits
	OFF	ON	1 stop bit
	ON	ON	2 stop bit
POSITION	3		
	OFF		Odd parity (See Section 3.4 for Mark and Space Parity)
	ON		Even parity
POSITION	4		
	OFF		Parity disable (voids Position 3)
	ON		Parity enable
POSITION	5	6	
	OFF	OFF	8 data bits
	OFF	ON	7 data bits
	ON	OFF	6 data bits
	ON	ON	5 data bits
POSITION	7	8	BUFFER FLOW CONTROL
	OFF	OFF	Hardware flow control using CTS/DTR, or no flow control
	ON	OFF	ENQ/ACK buffer flow control
	OFF	ON	X-ON/X-OFF buffer flow control
	ON	ON	X-ON/X-OFF buffer flow control

(CAP transmits an XON code out the port on Reset, as, after a power failure.)

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 (X-ON/X-OFF and ENQ/ACK) the CTS and DTR Switch 7 options should be in the "forced active" position.

Switch S7 Settings

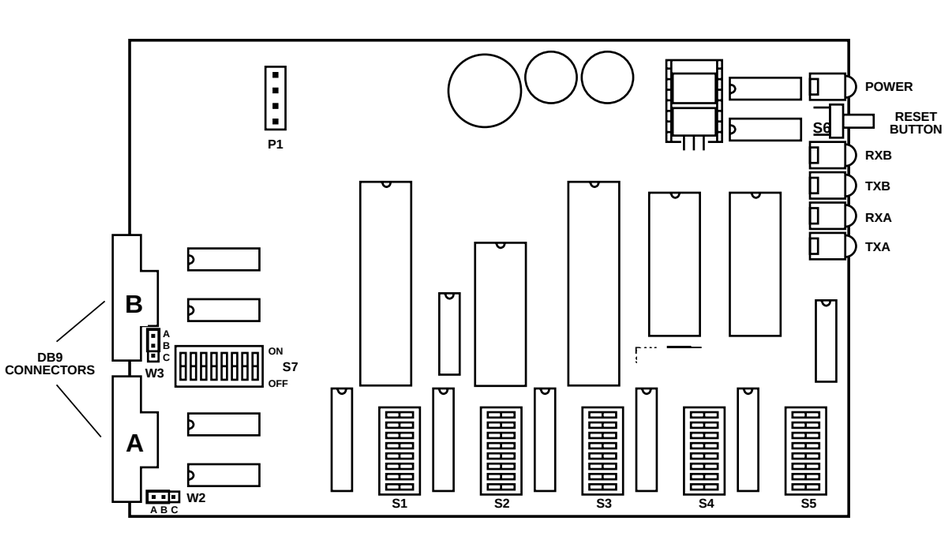
POSITION	1	RI Input Port A
	ON	RS-232 RI connected (custom programming only)
	OFF	Forced inactive (Low)
POSITION	2	DTR Output Port A
	ON	Controlled by software (hardware flow control)
	OFF	Forced always active (High)
POSITION	3	DCD Input Port A
	ON	RS-232 DCD Connected (enables Receive data)
	OFF	Forced active (High)
POSITION	4	CTS Input Port A
	ON	RS-232 CTS connected (enables Transmit data)
	OFF	Forced active (High)
POSITION	5	RI Input Port B
	ON	RS-232 RI connected (custom programming only)
	OFF	Forced inactive (Low)
POSITION	6	DTR Output Port B
	ON	Controlled by software (hardware flow control)
	OFF	Forced active (High)
POSITION	7	DCD input Port B
	ON	RS-232 DCD connected (enables Receive data)
	OFF	Forced active (High)
POSITION	8	CTS Input Port B
	ON	RS-232 CTS connected (enables Transmit data)
	OFF	Forced active (High)

S3 and S4 Switch Settings for Baud Rate and Data Code Set

POSITION 1	2	3	4	Baud Rate With Position 5 OFF	Baud Rate With Position 5 ON	6	7	8	DATA CODE SET
OFF	OFF	OFF	OFF	38,400	1,371.54	OFF	OFF	OFF	ASCII
ON	OFF	OFF	OFF	19,200	1,200	ON	OFF	OFF	EBCDIC
OFF	ON	OFF	OFF	9,600	1,037.92	OFF	ON	OFF	TRANSCODE
ON	ON	OFF	OFF	4,800	600	ON	ON	OFF	BAUDOT
OFF	OFF	ON	OFF	4,800	300	OFF	OFF	ON	TICKER TAPE
ON	OFF	ON	OFF	2,400	200	ON	OFF	ON	ASCII
OFF	ON	ON	OFF	2,400	164.82	OFF	ON	ON	ASCII
ON	ON	ON	OFF	1,828.72	150	ON	ON	ON	OTHER may be chosen only if both devices use the same code set.
OFF	OFF	OFF	ON	1,371.54	134.28				
ON	OFF	OFF	ON	1,200	110.35				
OFF	ON	OFF	ON	1,037.92	100				
ON	ON	OFF	ON	600	74.42				
OFF	OFF	ON	ON	300	67.14				
ON	OFF	ON	ON	200	55.82				
OFF	ON	ON	ON	164.82	50				
ON	ON	ON	ON	150	45.5				

NOTE: If your desired baud rate is within ±4% of one listed above, in most cases you should set the CAP to the listed rate.

Make certain Switches S1 and S2 are set for the correct number of data bits for the particular Data Code Set chosen (see Table 4-3 and the code set list in Section 4.4).



User Programmable CAP Circuit Board

The User Programmable CAP Quick-Setup Sheet

Switch S5 Settings

Mode options, equipment type, transmission mode, and buffer allocation

POSITION	1		Mode options for PORT A	
	OFF		Pass-Thru Mode	
	ON		Program Mode	
POSITION	2		Mode options for PORT B	
	OFF		Pass-Thru Mode	
	ON		Program Mode	
POSITION	3		Equipment type CAP should emulate (Port A)	
	OFF*		DCE - When using crossover cable	
	ON		DTE - When using straight-pinned cable	
POSITION	4		Transmission mode for PORT A	
	OFF		Full duplex/Simplex	
	ON		Half-duplex (hardware flow control configuration must be used with half duplex.)	
POSITION	5		Equipment type CAP should emulate (Port B)	
	OFF*		DCE - When using crossover cable	
	ON		DTE - When using straight-pinned cable	
POSITION	6		Transmission mode for PORT B	
	OFF		Full duplex/Simplex	
	ON		Half-duplex	
POSITION	7	8	Buffer allocation**	
			Port A	Port B
	OFF	OFF	1/2	1/2
	ON	OFF	3/4	1/4
	OFF	ON	1/8	7/8
	ON	ON	RESERVED	

*A CAP crossover cable must be attached to the CAP for it to emulate DCE in addition to selecting the DIP switch option to emulate DCE. See the Appendix for more on cable pinning.

* *Buffer allocation is for data being received by that port, (input data).

DSR Jumper Settings

W2	DSR Jumper for Port A	
	A-B	No connection
	B-C	DSR always active
W3	DSR Jumper for Port B	
	A-B	No connection
	B-C	DSR always active