

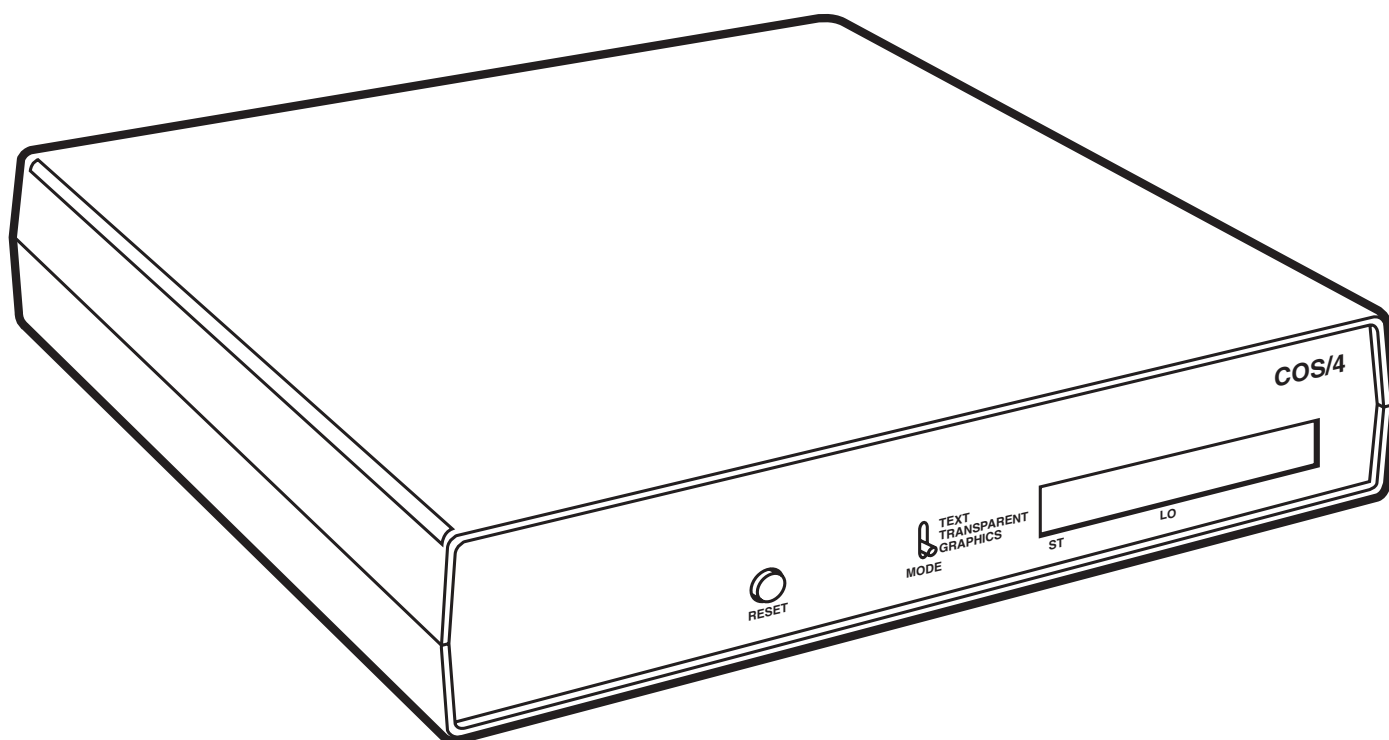


BLACK BOX[®]
NETWORK SERVICES



JUNE 2000
SW421A-R2
SW422A-R2

RS-422 Code-Operated Switches



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1. Specifications

Data Rates — 300, 1200, 2400, 4800, 9600, 19,200, 38,400, 76,800 bps

Interface — RS-422/V.11, full duplex, asynchronous

RS-422 Circuits Supported

<u>Pin #</u>	<u>Description</u>	<u>Pin #</u>	<u>Description</u>
12	Control in low	18	Data in high
13	Control in high	19	Data in low
14	Control out high	24	Data out high
15	Control out low	25	Data out low

Connectors — COS/4: (5) Female DB25 (master port and four subordinate ports); COS/8: (9) Female DB25 (master port and eight subordinate ports); 5 to 8 bit, asynchronous

Indicators — LOCKOUT and SWITCH TIME LED indicators. Segment display for CHANNEL SELECTED

Controls — External: Vertical switch (mode switch), pushbutton reset; Internal: Baud rate (300 to 76,800 bps) and format selectable; DTE/DCE configuration switch for each port (non-functional); Auto Timeout (2.5 min., 5 min, 10 min., or infinite) switch-selectable; Arming selectable, switch-selectable

Addressing — Two-digit code as follows: First digit is switch-selectable, initiates Switch Time—factory setting is EOT (Ctrl D), (Hex 04), (Decimal 4). Second digit assigns channel, Hex 30–37 selects port 0–7. Any channel can switch the channel when the unit is in Switch Time (unless disabled by SW6 positions 1–4). The arming and switching code is stripped by the Code-Operated Switch. The arming character can pass as data in Graphics mode.

Enclosure — High-impact plastic

Operating Temperature — 32 to 122°F (0 to 50°C)

Storage Temperature — -4 to +158°F (-20 to +70°C)

Humidity Tolerance — 15 to 95%, noncondensing

Power — 115/230 VAC (switch-selectable), 60/50 Hz, 11 watts

Size — 12.3" x 11.8" x 2.5" (31.2 x 30 x 6.4 cm)

Weight — 8 lb. (3.6 kg)

2. Introduction

2.1 Description

The Code-Operated Switch 422 (COS) is an asynchronous RS-422 switch. By sending codes to the master port, you can select subordinate ports. The master device (CPU or terminal) selects any of the other ports (printers, modems, or terminals, for example) by transmitting the proper arming and switching codes. The communications link can also be made by any of the subordinate devices by transmitting their own channel address code while the switch is in the Switch Time mode. Once the communications link is established, all other ports are locked out. The ports remain locked out until either the master port or the selected subordinate port sends an arming character. Reception of the arming character causes the COS to break all switched connections (leads 2, TD, and 3, RD, control in and control out—user-selectable) between the master and subordinate port and puts the unit back in Switch Time mode.

Signal ground (pin 7) is tied to chassis ground (pin 1) on each port. All ports have female DB25 connectors. Configuration switches on all ports allow configuration to a DTE or DCE port. The devices also have switches to select the baud rate and word format (parity, character length, and number of stop bits).

Figure 2-1 shows a network involving various peripherals. The computer (or terminal) selects which device it wishes to communicate with by transmitting the proper arming and switching code (0 through 3 for the 4-port model, 0 through 7 for the 8-port model).

NOTE: Models with RS-232 ports are available as part numbers SW853A and SW854A. The COS can also be specially ordered with some RS-422 and some RS-232 ports. These units are configured at the factory at the time the order is placed. When you receive a specially ordered COS, make sure the configuration matches your order.

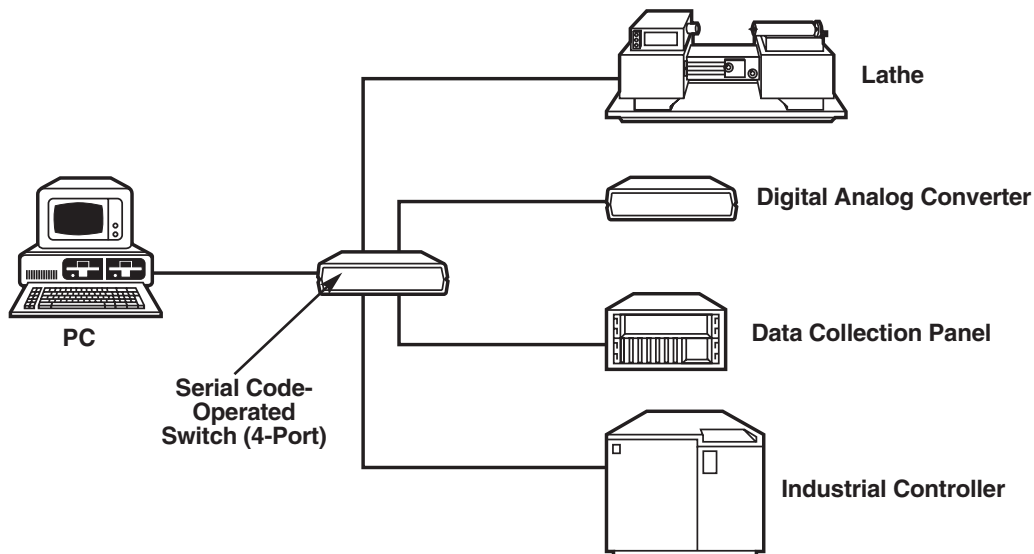
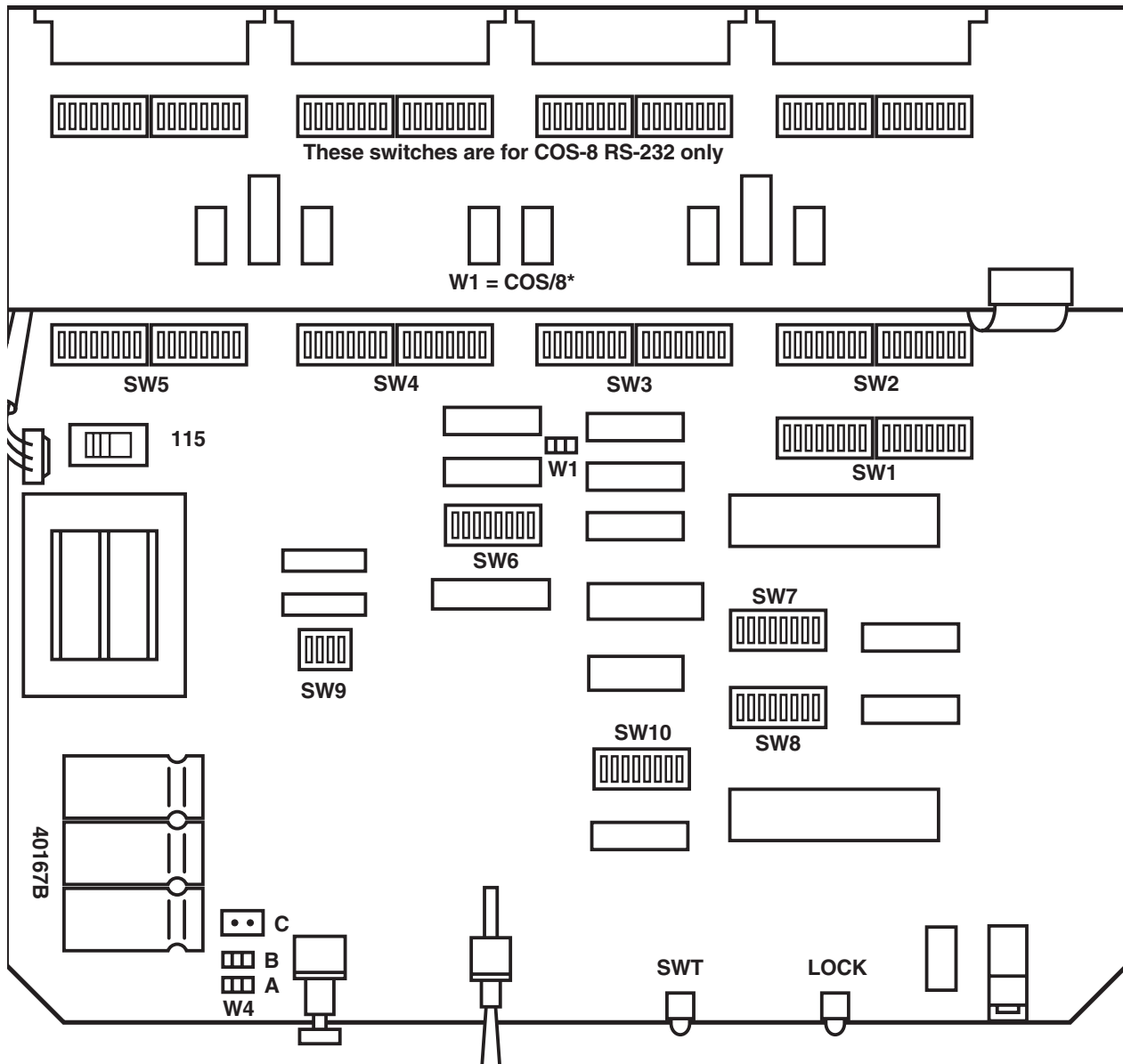


Figure 2-1. Typical Application.

2.2 Board Layout



*W5 on the COS/4 is the same as W1 on the COS/8.

Figure 2-2. Component Layout.

3. Installation

3.1 General

Installation of the COS is a matter of connecting the modem and terminal connectors to the proper communications equipment using the interface connectors.

When viewing the COS from the rear, the leftmost connector is the Master connector. The channel connectors are numbered from left to right 0, 1, 2, 3 (4, 5, 6, and 7 also for COS/8).

The COS directs data flow between the master port and whichever subordinate port that has been specified in the command sequence.

Determine if any internal switches must be reconfigured to match your particular application. The unit's internal DIP switches are factory-preset to the following parameters:

Baud Rate:	9600 bps
Word Format:	8 data bits, 1 stop bit, and parity disabled
Auto Timeout:	Disabled
Arming Character:	04 Hex (EOT), CTRL D
All Serial Ports:	DCE with DSR, DTR Control

3.2 Switch Settings

CAUTION

If any internal DIP-switch settings must be changed, be certain that power is disconnected from the unit before changing settings.

Refer to Figure 2-2 for the location of the switches. In the following switch descriptions, closed is abbreviated as C and open is abbreviated as O.

3.2.1 SWITCH SW6

Switch Position

Close only one	{	1	Open	=	Disables the slave's ability to put the unit into switch time.
		2	Open	=	Disables the master's ability to put the unit into switch time.
		3	Open	=	Disables the master's ability to switch from switch time to channel.
		4	Open	=	Disables the slave's ability to switch from switch time to channel.
		5	Closed	=	2.5-minute auto timeout.
		6	Closed	=	5-minute auto timeout.
		7	Closed	=	10-minute auto timeout.
		8	Closed	=	Timeout is infinite.

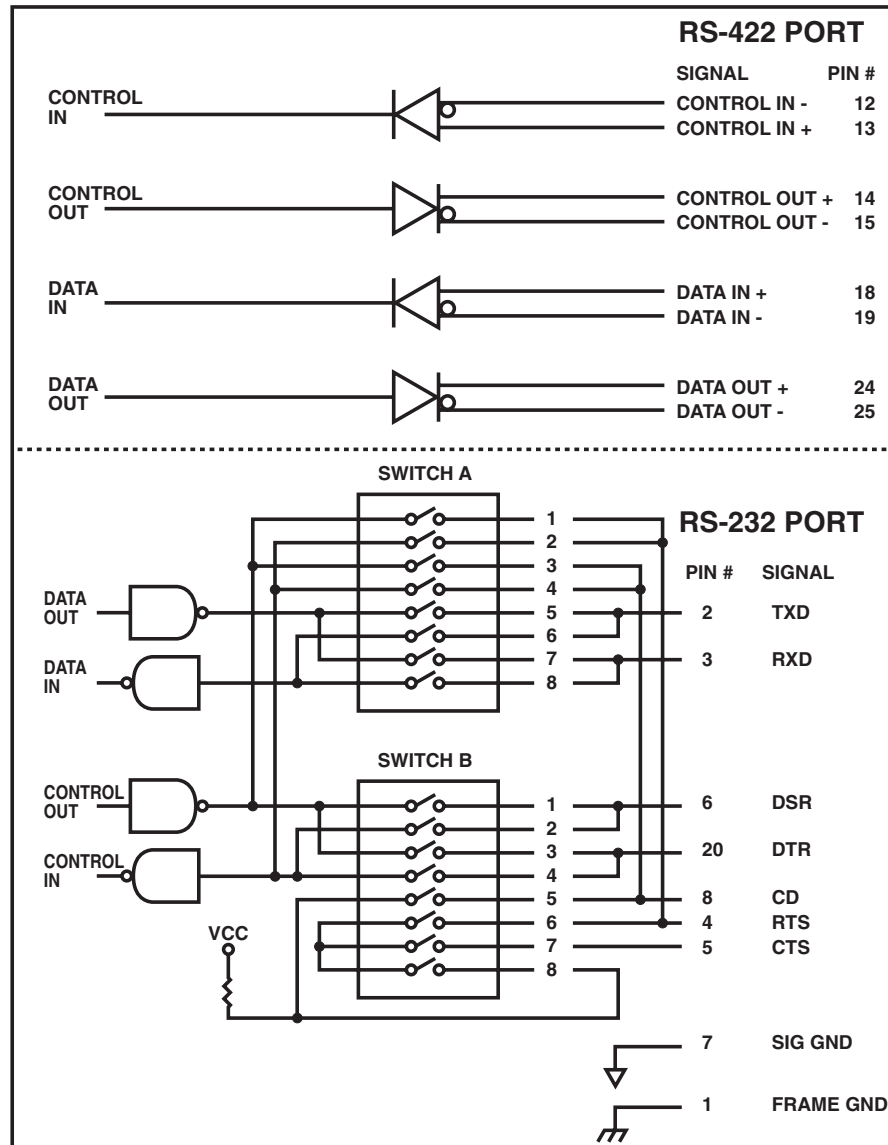


Figure 3-1. Port Configuration Switches.

Typical Switch Configuration for DCE

Switch A Close 6 and 7
Switch B Close 1 and 4

Typical Switch Configuration for DTE

Switch A Close 5 and 8
Switch B Close 2 and 3

Note that positions 6, 7, and 8 on Switch B may be selected to assert RTS or CTS high or to tie RTS directly to CTS.

Switch 5 may be used to assert CD high.

RS-422 operates independently of port switch settings.

DTE is used if connecting to a terminal.

DCE is used if connecting to a modem.

RS-422 CODE-OPERATED SWITCHES

3.2.2 SWITCH SW7

Switch Position

1	Open	= Even Parity
1	Closed	= Odd Parity

Position 2	Position 3	Word Length
Closed	Closed	5 bits
Open	Closed	6 bits
Closed	Open	7 bits
Open	Open	8 bits

4	Open	= 2 stop bits
4	Closed	= 1 stop bit
5	Open	= Parity Disable
5	Closed	= Parity Enable
6	Always Open	

7	See graphics mode description, Section 4.6.3.	
8	See graphics mode description, Section 4.6.3.	

3.2.3 SWITCH SW8 ARMING CODE SETTINGS

EOT is the factory-default arming character.

ASCII codes 1 through 6 are the port address codes.

C = Closed (Off)

O = Open (On)

Arming Characters				Arming Character Switch Positions							
ASCII	CTRL	Hex	Decimal	LSB							MSB
				1	2	3	4	5	6	7	8
NUL	@	00	0	C	C	C	C	C	C	C	C
SOH	A	01	1	O	C	C	C	C	C	C	C
STX	B	02	2	C	O	C	C	C	C	C	C
ETX	C	03	3	O	O	C	C	C	C	C	C
EOT	D	04	4	C	C	O	C	C	C	C	C
ENQ	E	05	5	O	C	O	C	C	C	C	C
ACK	F	06	6	C	O	O	C	C	C	C	C
BEL	G	07	7	O	O	O	C	C	C	C	C
BS	H	08	8	C	C	C	O	C	C	C	C
HT	I	09	9	O	C	C	O	C	C	C	C
LF	J	0A	10	C	O	C	O	C	C	C	C
VT	K	0B	11	O	O	C	O	C	C	C	C
FF	L	0C	12	C	C	O	O	C	C	C	C
CR	M	0D	13	O	C	O	O	C	C	C	C
SO	N	0E	14	C	O	O	O	C	C	C	C
SI	O	0F	15	O	O	O	O	C	C	C	C

Arming Characters				Arming Character Switch Positions							
ASCII	CTRL	Hex	Decimal	LSB 1	2	3	4	5	6	7	MSB 8
DLE	P	10	16	C	C	C	C	O	C	C	C
DC1	Q	11	17	O	C	C	C	O	C	C	C
DC2	R	12	18	C	O	C	C	O	C	C	C
DC3	S	13	19	O	O	C	C	O	C	C	C
DC4	T	14	20	C	C	O	C	O	C	C	C
NAK	U	15	21	O	C	O	C	O	C	C	C
SYN	V	16	22	C	O	O	C	O	C	C	C
ETB	W	17	23	O	O	O	C	O	C	C	C
CAN	X	18	24	C	C	C	O	O	C	C	C
EM	Y	19	25	O	C	C	O	O	C	C	C
SUB	Z	1A	26	C	O	C	O	O	C	C	C
ESC	[	1B	27	O	O	C	O	O	C	C	C
FS	\	1C	28	C	C	O	O	O	C	C	C
GS	]	1D	29	O	C	O	O	O	C	C	C
RS	^	1E	30	C	O	O	O	O	C	C	C
US	—	1F	31	O	O	O	O	O	C	C	C
SPACE		20	32	C	C	C	C	C	O	C	C
!		21	33	O	C	C	C	C	O	C	C
"		22	34	C	O	C	C	C	O	C	C
#		23	35	O	O	C	C	C	O	C	C
\$		24	36	C	C	O	C	C	O	C	C
%		25	37	O	C	O	C	C	O	C	C
&		26	38	C	O	O	C	C	O	C	C
'		27	39	O	O	O	C	C	O	C	C
(		28	40	C	C	C	O	C	O	C	C
)		29	41	O	C	C	O	C	O	C	C
.		2A	42	C	O	C	O	C	O	C	C
+		2B	43	O	O	C	O	C	O	C	C
,		2C	44	C	C	O	O	C	O	C	C
-		2D	45	O	C	O	O	C	O	C	C
.		2E	46	C	O	O	O	C	O	C	C
/		2F	47	O	O	O	O	C	O	C	C
0		30	48	C	C	C	C	O	O	C	C
1		31	49	O	C	C	C	O	O	C	C
2		32	50	C	O	C	C	O	O	C	C
3		33	51	O	O	C	C	O	O	C	C
4		34	52	C	C	O	C	O	O	C	C
5		35	53	O	C	O	C	O	O	C	C
6		36	54	C	O	O	C	O	O	C	C
7		37	55	O	O	O	C	O	O	C	C
8		38	56	C	C	C	O	O	O	C	C
9		39	57	O	C	C	O	O	O	C	C
:		3A	58	C	O	C	O	O	O	C	C
;		3B	59	O	O	C	O	O	O	C	C

RS-422 CODE-OPERATED SWITCHES

Arming Characters				Arming Character Switch Positions							
ASCII	CTRL	Hex	Decimal	LSB 1	2	3	4	5	6	7	MSB 8
<		3C	60	C	C	O	O	O	O	C	C
=		3D	61	O	C	O	O	O	O	C	C
>		3E	62	C	O	O	O	O	O	C	C
?		3F	63	O	O	O	O	O	O	C	C
@		40	64	C	C	C	C	C	C	O	C
A		41	65	O	C	C	C	C	C	O	C
B		42	66	C	O	C	C	C	C	O	C
C		43	67	O	O	C	C	C	C	O	C
D		44	68	C	C	O	C	C	C	O	C
E		45	69	O	C	O	C	C	C	O	C
F		46	70	C	O	O	C	C	C	O	C
G		47	71	O	O	O	C	C	C	O	C
H		48	72	C	C	C	O	C	C	O	C
I		49	73	O	C	C	O	C	C	O	C
J		4A	74	C	O	C	O	C	C	O	C
K		4B	75	O	O	C	O	C	C	O	C
L		4C	76	C	C	O	O	C	C	O	C
M		4D	77	O	C	O	O	C	C	O	C
N		4E	78	C	O	O	O	C	C	O	C
O		4F	79	O	O	O	O	C	C	O	C
P		50	80	C	C	C	C	O	C	O	C
Q		51	81	O	C	C	C	O	C	O	C
R		52	82	C	O	C	C	O	C	O	C
S		53	83	O	O	C	C	O	C	O	C
T		54	84	C	C	O	C	O	C	O	C
U		55	85	O	C	O	C	O	C	O	C
V		56	86	C	O	O	C	O	C	O	C
W		57	87	O	O	O	C	O	C	O	C
X		58	88	C	C	C	O	O	C	O	C
Y		59	89	O	C	C	O	O	C	O	C
Z		5A	90	C	O	C	O	O	C	O	C
[		5B	91	O	O	C	O	O	C	O	C
		5C	92	C	C	O	O	O	C	O	C
]		5D	93	O	C	O	O	O	C	O	C
		5E	94	C	O	O	O	O	C	O	C
..		5F	95	O	O	O	O	O	C	O	C
-		60	96	C	C	C	C	C	O	O	C
a		61	97	O	C	C	C	C	O	O	C
b		62	98	C	O	C	C	C	O	O	C
c		63	99	O	O	C	C	C	O	O	C
d		64	100	C	C	O	C	C	O	O	C
e		65	101	O	C	O	C	C	O	O	C
f		66	102	C	O	O	C	C	O	O	C
g		67	103	O	O	O	C	C	O	O	C

Arming Characters				Arming Character Switch Positions							
ASCII	CTRL	Hex	Decimal	LSB 1	2	3	4	5	6	7	MSB 8
h		68	104	C	C	C	O	C	O	O	C
i		69	105	O	C	C	O	C	O	O	C
j		6A	106	C	O	C	O	C	O	O	C
k		6B	107	O	O	C	O	C	O	O	C
l		6C	108	C	C	O	O	C	O	O	C
m		6D	109	O	C	O	O	C	O	O	C
n		6E	110	C	O	O	O	C	O	O	C
o		6F	111	O	O	O	O	C	O	O	C
p		70	112	C	C	C	C	O	O	O	C
q		71	113	O	C	C	C	O	O	O	C
r		72	114	C	O	C	C	O	O	O	C
s		73	115	O	O	C	C	O	O	O	C
t		74	116	C	C	O	C	O	O	O	C
u		75	117	O	C	O	C	O	O	O	C
v		76	118	C	O	O	C	O	O	O	C
w		77	119	O	O	O	C	O	O	O	C
x		78	120	C	C	C	O	O	O	O	C
y		79	121	O	C	C	O	O	O	O	C
z		7A	122	C	O	C	O	O	O	O	C
—		7B	123	O	O	C	O	O	O	O	C
		7C	124	C	C	O	O	O	O	O	C
		7D	125	O	C	O	O	O	O	O	C
		7E	126	C	O	O	O	O	O	O	C
DEL		7F	127	O	O	O	O	O	O	O	C

3.2.4 SWITCH SW9

See the graphics mode description (**Section 4.6.3**) for additional information.

NOTE

Close only one position at a time.

Position Closed

- 1 = 5-word gap in transmission
- 2 = 25-word gap in transmission
- 3 = 50-word gap in transmission
- 4 = 100-word gap in transmission

RS-422 CODE-OPERATED SWITCHES

3.2.5 BAUD RATE SWITCH SW10

The baud rate is set by closing the switch position for the rate desired.

NOTE

Close only one position at a time.

<u>Position Closed</u>	<u>Baud Rate (bps)</u>
1	300
2	1200
3	2400
4	4800
5	9600
6	19,200
7	38,400
8	76,800

3.3 Straps W1 Through W4, W7

Strap W1, if removed, will disable the COS from passing breaks.

Strap W2 and W3 should always be off.

Strap 4 selects either a power on reset to switch time mode (Strap On) or to port 0 (Strap Off).

When W4 straps A and B are in and strap C is out, switch time mode is selected. This is the factory-default setting.

When W4 straps A and B are out and strap C is in, port 0 is selected.

Strap W7 selects whether the RS-422 Code Operated Switch (COS) will go into switch time or not, when carrier detect is lost on the master port. This will disconnect any port the RS-422 COS may be on if the session is terminated for any reason. The jumper setting for W7 is as follows:

- W7-a strapped: RS-422 COS will NOT go into switch time when Carrier Detect is dropped on the master port.
- W7-b strapped: RS-422 COS WILL go into switch time when Carrier Detect is dropped on the master port. (This is the factory-default setting.)

4. Operation

4.1 Arming Character

When the COS receives the arming character in the data stream, it will enter an armed state called “switch time.” When the COS is in this armed state, the ST LED on the front panel will be lit. You choose the arming character with DIP-switch setting SW8 (see **Section 3.2.3**).

4.2 Channel-Select Character

The channel-select character can only be recognized as such by its position in the data stream. The channel-select character is the first character received after the arming character.

The least-significant four bits of the channel-select character contains the binary number of the subordinate port that is being selected (ASCII 0–7; CTRL @, A, B, C, D, E, F, G, etc.)

4.3 Auto Timeout

If auto timeout is selected, the COS will timeout after an idle time of either 2.5, 5, or 10 minutes (switch-selectable by SW6) and return to ST mode. Data in either direction will continually reset the timer.

4.4 Reset Button

The reset button will force the unit into switch-time mode or to port 0 depending on the setting of strap W4.

NOTE

If auto timeout is selected, the unit will revert to switch time after the appropriate timeout.

4.5 Lockout

“LO” (located on the front panel) will light when the unit is placed in lockout. When the COS is in lockout, the subordinate ports cannot access the master port. The master port can place the unit in lockout and take it out of lockout. The COS can be put into lockout during the switch-time mode by sending an ASCII character 38 or higher from the master port. To get out of lockout, send the arming character.

NOTE

When coming out of lockout, both the LO and ST LEDs will be lit until a port is selected.

4.6 Modes of Operation

The COS can operate in one of three modes. The front-panel toggle switch labeled “MODE” is used to select Text, Transparent, or Graphics modes.

4.6.1 TEXT MODE (UP SWITCH POSITION)

In this mode, the COS will enter switch time whenever it receives an arming character. It will select the subordinate channel that is specified by the channel-select character. The remaining text will pass through the unit until another arming character is encountered. The arming character and the channel-select character will not pass through the unit in this mode. Care must be taken to choose an arming character that will never appear as part of the text.

4.6.2 TRANSPARENT MODE (MIDDLE SWITCH POSITION)

In this mode of operation, all data, including the arming character, will pass through the unit to and from the master port and the subordinate port that was selected before entering this mode. This mode totally disables code control, and all characters printable and non-printable are passed.

4.6.3 GRAPHICS MODE (DOWN SWITCH POSITION)

The third mode is called graphics mode because it is capable of passing graphics data while still maintaining code control. In this mode, an arming character will only be recognized as an arming character if it is preceded by a pause in data transmission of a minimum length of time.

This required pause length can be user-selected (by SW9, positions 1 through 4—see **Section 3.2.4**). Any arming character not preceded by this pause will be passed as data.

This pause is measured in one of three ways as follows:

1. From the time the last character was sent from the master port to the subordinate port (SW7 Position 7 is Closed, and SW7 Position 8 Open).
2. From the time the last character was sent from the subordinate port to the master port (SW7 Position 7 is Open, and SW7 Position 8 is Closed).
3. From the time the last character was sent in either direction (SW7 Position 7 is Closed, and SW7 Position 8 is Closed).

4.7 Troubleshooting

If the COS appears to switch on its own, it is receiving an arming character in the data. Try disabling the port which is not being used for switching (SW6 Positions 1 through 4) or try running graphics mode.

If occasional bit loss occurs, try running two stop bits on the computer equipment (with the COS unit set to receive one stop bit).

If data does not pass and the COS will not switch, check the cables and the SWA and SWB switches.

4.8 Basic Test Program for the COS

```

10 REM*****CODE-OPERATED SWITCH TEST*****
20 OPEN "COM1:9600,N,8,1,CS,DS"AS1      :REM**SET UP COM 1 PC PORT**
30 P=48                                :REM**SET PORT # TO 1 (DECIMAL 48)**
40 PRINT #1,CHR$(4);                   :REM**SEND ARMING CHAR**
50 PRINT #1,CHR$(P);                   :REM**SEND PORT # OUT COM 1**
60 T=P-48                              :REM**CONVERT DEC. TO ACTUAL PORT #**
70 PRINT #1,"THIS IS A TEST OF PORT#"T :REM**SENDS MESSAGE OUT COM 1**
80 FOR I=1 TO 250                      :REM**DELAY**
90 NEXT I                             :REM**LOOP**
100 P=P+1                             :REM**INCREMENT PORT #**
110 IF P=52 THEN GOTO 30 ELSE GOTO 40  :REM**LOOP BACK FOR NEXT PORT*

```

NOTE

REM statements are optional. Semicolons are required at the end of lines 40 and 50 to inhibit CR.

Connect the PC to the master port and run this program using either Basica or GW-Basic®.