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1. INTRODUCTION

To The Time-Sharing Neophyte:

If this is your first attempt at programming, or if you are a programmer accustomed solely to some sort of batch processing operation, welcome to a whole 'nother world -- the world of the BCC 500 Time-Sharing System. This method of computation is known variously and vaguely as "time-sharing, real-time, interactive," etc., because of its ability to process many users' problems "simultaneously" (approximately 500 in the BCC system) and react immediately. It might also be called "personalized" computing. The beginner at the teletypewriter console will find that his terminal exhibits all the recalcitrance of a refractory child, apparently hoping to train him before he trains it (as is the wont of children). Once you, as programmer, do succeed in the latter, however, you will find direct communication with the computer an enjoyable and very practicable substitute for the cold uncertainty surrounding a source deck being swallowed (piecemeal) by a remote card reader.

The purpose of this short guide is to introduce you to the jargon of the trade and to the teletypewriter console itself. The sooner you begin working at your terminal, the better! Hands-on learning is far quicker and better retained than sweating programming rules

from a technical text. We have tried to keep this in mind while designing our programming manuals and hope you will be in easy reach of a teletypewriter as you read them.

2. TELETYPEWRITER CONSOLE CONTROLS

User programs are controlled in two ways -- by system commands applicable to the specific programming language used (e.g., FORBAS commands for FORTRAN and BASIC), and by controls built into the teletypewriter console. This chapter and the next describe the built-in controls. System commands are covered in separate manuals.

Initially the BCC 500 will support Teletype Models 33 and 35. Teletype Model 37 and both IBM 2741 models will be added soon and the table of functions concluding this section will be updated accordingly.

KEYBOARD DESCRIPTIONS

Teletypewriter console controls fall into three areas: the keyboard, optional call control unit buttons, and optional paper tape unit buttons and switches (figure 1). Keyboard formats vary widely (figures 2-5), although all are patterned after the standard typewriter. The arrangement of call control unit buttons is extremely flexible also, and some terminals have none at all. While the table of control functions concluding this chapter incorporates most compatible console capabilities, the limits of your mechanical control of the system are determined in the final analysis by the terminal you use.

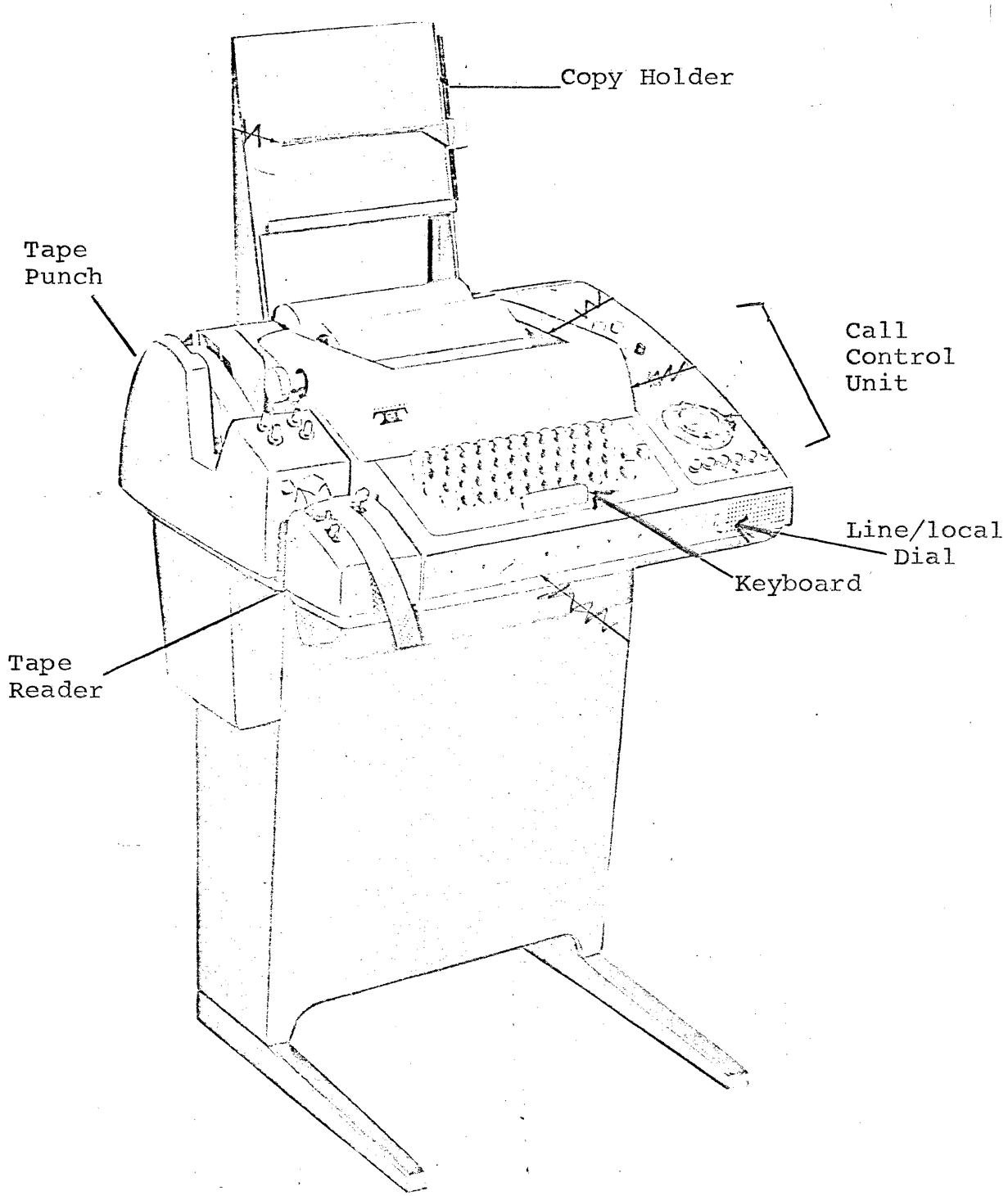

Figure 1. Automatic Send-Receiver (ASR) Teletypewriter Set

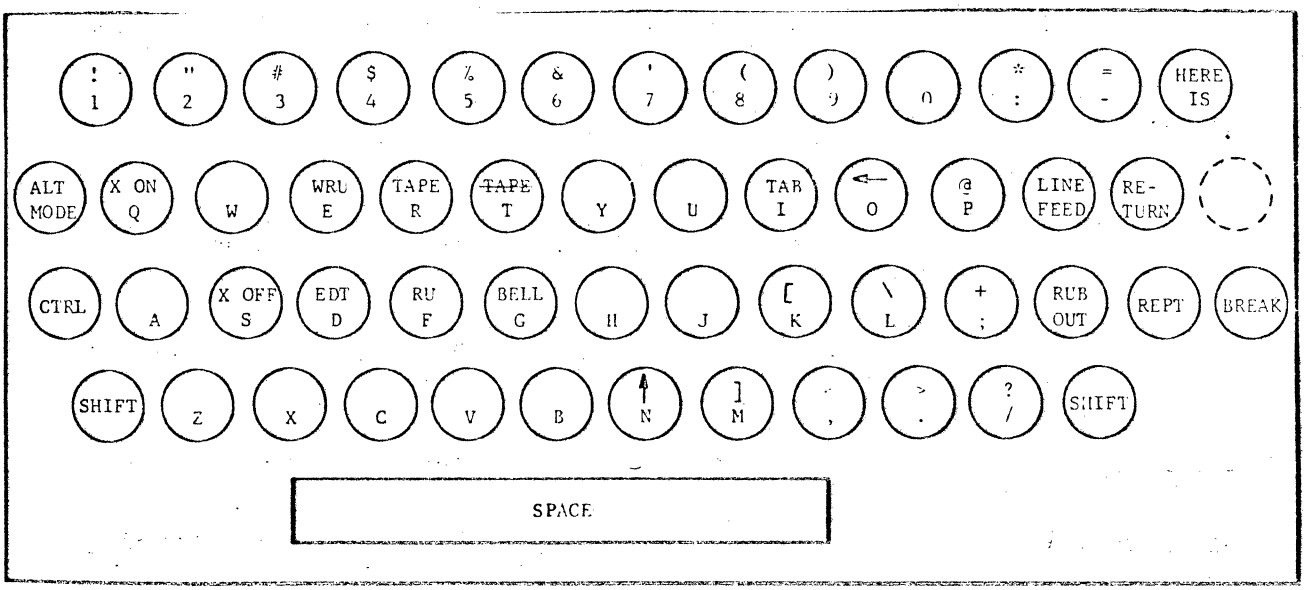

Figure 2: Teletype Model 33 Keyboard

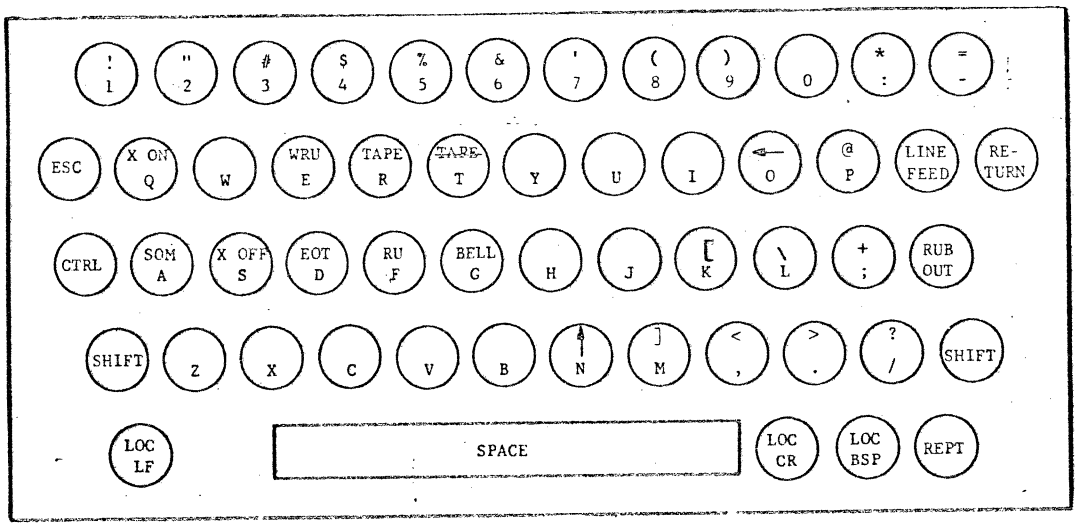

Figure 3: Teletype Model 35 Keyboard

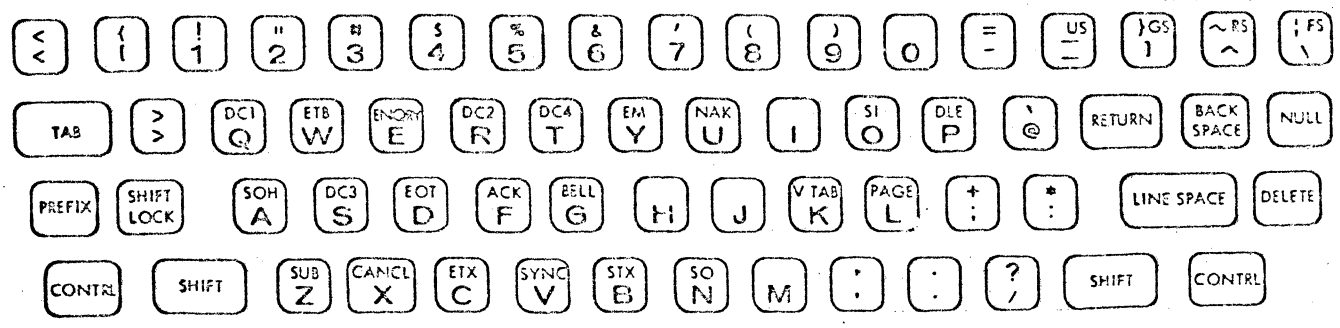

Figure 4: Teletype Model 37 Keyboard

Figure 5: IBM 2741 Keyboard

CONTROL FUNCTIONS TABLE

In the following table the abbreviations (K) and (B) represent (key) and (button). Generally speaking, keys are in the keyboard area of the console, buttons in the call control unit. The LOCAL/LINE dial is located on the front of the Model 33 terminal (figure 1). Keys struck while the SHIFT or CONTROL keys are held down are represented SHIFT/character and CONTROL/character.

CONSOLE CONTROL FUNCTIONS

Function	Teletype 33	Teletype 35	Teletype 37	IBM 2741
End of Input Line - Begin New Line	RETURN (K)	RETURN (K) or LOC CR (B) if local operation	LINE SPACE or NEW LINE	RETURN
Advance Paper One Line - No Return	LINE FEED	LINE FEED		
Return Carriage to Left Margin No Line Advance			RETURN	
Delete Single Character	SHIFT/←(K)	SHIFT/←(K)		BACKSPACE (K)
Delete Current Line	ALT MODE (K) or CTRL/X (K)	ESC (K) or CTRL/X (K)	CTRL/X (K)	
Repeat Specified Character	(Char) and REPT (K)	(Char) and REPT (K)		Hold down (Char)
Stop System During Printing	CTRL/SHIFT/@ (K) or S (K)	BREAK (B) followed by BRK - RLS (B)		

3. TAPE PUNCH/READ PROCEDURES

As was mentioned in the last chapter, tape punch/read controls are an optional adjunct of the TTY console. Again, the specific controls used vary with the teletypewriter model used. Some or all of the following controls used in handling paper tape may be present on your particular TTY.

TAPE UNIT CONTROLS

LCL (Local) Dial or Button	Pressed when an off-line operation is performed.
ON/OFF Buttons	Pressed to turn tape punch unit on or off.
REL (Release) Button	Allows blank tape to be pulled manually through the punch unit; releases lock on feed-in gate.
START/STOP/FREE Switches or TD ON/TD OFF Buttons	Used to control the tape reading operation. FREE has the same effect as REL.
B. SP. Button or LOC B. SP. Key	Used to backspace tape during punching.

RETURN and LINE FEED Keys	Pressed to indicate end of input line during punching.
RUBOUT Key	Punches holes in all eight levels of the paper tape.
T (Tape) Button	Pressed to punch tape with no typed copy or to read tape and type a copy simultaneously.
KT (Keyboard-Tape) Button	Pressed to produce a paper tape and typed copy simultaneously or to punch a tape copy and type a page copy while reading the original tape.
TTS (Tape Send) Button	Tape is read without a typed copy.
TTR (Tape Receive) Button	Tape is punched from a remote source without a typed copy.
MOTOR ON Button	Same effect as LCL. Tape is punched off-line without a typed copy.

CTRL and X OFF Keys	Pressing X OFF while holding down the CTRL (Control) key punches a character that stops the tape reader when read.
CTRL and X ON Keys	Pressing X ON while holding down CTRL turns the tape reader on.

PUNCHING PAPER TAPE

The paper tape punch unit produces one-inch, eight-level, fully perforated tape with the eighth level code generated by the keyboard.

When punching a paper tape off-line, set the TTY to local mode (LCL) and press the tape punch unit's ON button. If your specific model permits, select either the T or KT button. Before punching, hit the RUBOUT key several times to clean your tape.

At the end of each input line press the RETURN and LINE FEED keys. You may also wish to hit RUBOUT for quick identification of lines. If you make a mistake, backspace the tape over as many characters as you wish to delete and hit RUBOUT for each character.

When you're finished, press the punch unit's OFF key.

READING PAPER TAPE

When reading paper tape, be sure the tape surface is facing upward (small tape feed holes to the left).

If applicable, press TD ON and set the tape read unit to either T, KT, or TTS mode.

Type the command TAPE and set the tape read switch to START.

The tape read stops automatically when the last character (or CTRL/X OFF) is read. Reading can be halted at any time by hitting the read unit's STOP switch. When finished, press TD OFF and type the command KEY to reset the computer to normal (keyboard input) mode.

4. BCC COMPUTING TERMINOLOGY

Access Time	The time required for the computer to move data to or from a storage device.
Acronym	A word formed from the first letter or letters of the words in a name, phrase, etc. (e.g., COBOL for COmmon Business Oriented Language).
Address	A number used to locate a specific word in the memory of a computer.
Alphanumerics	Alphabetic or numeric characters, usually combined.
Argument	The variable operand or modifier of a program command.
BASIC	A simplified interactive algebraic language developed at Dartmouth College. An extended version is available in the BCC system. Beginner's All-purpose Symbolic Instruction Code.
Buffer	An internal temporary storage area where data is accumulated during input and output operations. It serves to compensate for the difference in speed at which two communicating components perform operations.
Catalog	A listing of user file names with pointers to the location of each file in the user's storage area.

Central Processors	The BCC main-site computers that perform the computational operations requested by the user at his terminal. Referred to as CPU (for Central Processing Unit).
Character Set	A character set usually consists of the letters A to Z, the digits Ø to 9, and selected punctuation marks and mathematical symbols. See Chapter Five for details of the BCC character set.
Compiler	A routine that translates a user's source language statements into object code understandable to the computer. (See Object Program.)
Console	The panel or cabinet containing key, button, switch, or dial controls for communicating with the computer. (See Teletypewriter.)
Constant	Information whose value or meaning is fixed. (See Variable.)
Debugging	Detection and removal of mistakes in a program.
Default	An assumed value in the absence of a specific indication of what the value should be. Usually applied to variables in a command argument.
Disk	A circular metal plate, coated with a ferrous oxide material, that provides a recording surface. Information is recorded onto concentric rings

called tracks, each of which has an address. Reading and writing are done by one or more read/write heads mounted on movable or fixed arms. Fixed-head disks are equivalent to drums in their operation.

Drum	A coated metal cylinder upon whose surface information can be recorded in the form of magnetized spots placed in areas formed by a uniform division of the surface into rows and columns. Reading and writing are performed by a set of read/write heads past which the drum rotates at a constant speed.
Error Message	A message generated by a program to provide information about an error or a program malfunction.
Execution	The interpretation of a machine instruction and performance of the indicated operation(s) on the specified data.
File	A named collection of related information (e.g., program instructions or input data). May be temporary or permanent (saved).
File Password	A code added to a file name by its user to prevent unauthorized access to his file.
FORBAS Control Language	The BCC software system that handles input/output, editing, and similar functions for FORTRAN and BASIC programs.

Format	1. Any specification for arranging elements. 2. A FORTRAN statement specifying the arrangement of characters, fields, lines, punctuation, etc. to input/output a desired presentation of data.
FORTRAN	A language whose statements closely resemble the algebraic notation used to solve scientific and engineering problems. FORmula TRANslator.
Hardware	The magnetic, mechanical, electrical, and electronic devices or components of a computer. (See Software.)
Initialize	To set various counters, switches, and addresses to zero or other starting values at prescribed points in a computer routine.
Input	Information transferred from an external medium into the internal storage of the computer.
Installation Library	A collection of special purpose programs and subroutines accessible to all users of the BCC system, but maintained by BCC systems programmers. Users may also establish their own libraries.
Line Number	Each program statement must be preceded by a line number. These numbers may contain up to six digits.
Listing	A printed reproduction of program information arranged in sequential order.

Logging On/Off	The procedures for linking a teletypewriter to the computer and unlinking from the computer when finished.
Loop	A sequence of instructions that is repeated until a terminal condition is reached.
Memory	The internal hardware area used to store information needed by the central processor. Also referred to as "central memory" and "core".
Microsecond	One millionth of a second.
Millisecond	One thousandth of a second.
Mnemonic	A technique to assist human memory. A mnemonic name resembles the original name (e.g. MON for Monitor or ACC for accumulator).
Multi-programming	The interleaved or apparently simultaneous execution of two or more programs by a single computer.
Nanosecond	One billionth of a second.
Object Program	A sequence of instructions, directly comprehensible to the computer, to perform a given set of arithmetic and logic operations. Also referred to as object language, machine language, or object code.
Octal Numbering System	The number system of base eight used internally in the BCC computing system.

$$177_8 = (1 \times 8^2) + (7 \times 8^1) + (7 \times 8^0)$$
$$= (64) + (56) + (7)$$
$$= 127_{10}$$

Output — Information transferred from the internal storage of a computer to any one of several external media (e.g. paper, cards, magnetic tape, drum or disk storage).

Privilege Codes — Codes saved with a user's file that allow others to read, alter, or execute his file.

Software — Various internal routines facilitating the programmer's efficient use of the computer hardware (e.g. compilers, math routines, utilities).

Source Program — The program statements prepared by the user and later translated into machine language by a compiler. This occurs when the RUN command is given.

Statement — A single program step consisting of a command and its arguments.

Syntax — The rules for constructing program statements, file names, passwords, etc.

Teletypewriter — The point in the communication network where data is entered or typed out. Variously referred to as the terminal, console keyboard, TTY, or by the trade name Teletype.

User Number	Account identification characters assigned to customers.
User Password	A code assigned to a customer to prevent unauthorized use of his account.
Utility Program	An independent program used to assist data processing operation. Performs functions such as clearing storage, printing out storage contents, etc.
Variable	A quantity that can assume any of a given set of values. (See Constant.)

5. BCC CHARACTER SET

The following chart is intended primarily as a reference to be used with other BCC documentation. It represents the entire BCC character set with related octal codes, allowing you to answer easily such questions as the collating sequence and printability of various characters.

PEACE

MODEL #1 CHARACTER SET

	0	1	2	3	4	5	6	7	10	11	12	13	14	15	16	17	
0	∅	:	"	#	$	%	&	'	(	)	*	+	,	-	.	/	STANDARD GRAPHIC
20	Ø	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?	
40	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	
60	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	↑	←	
100	_	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	
120	p	q	r	s	t	u	v	w	x	y	z	{	|	}			
140	± *	∅ *	° *														NON-STANDARD GRAPHIC
160																	
200																	NON-STANDARD MULTIPLE BLANKS
220																	
240																	
260																	
300	NUL	QIT	ESC	BEL	RRS	BRS	FF	NL	LF	HLF	HLR	BS					STANDARD FUNCTION
320																	
340	IL * &@	BY * &A	EOB * &B	&C	EOT * &D	&E	&F	&G		HT &I		&K		CR	&N	&O	NON-STANDARD FUNCTION
360	&P	&Q	PN * &R	RS * &S	PF * &T	&U	&V	&W	&X	&Y	&Z	&[	& \	&]	&↑	&←	

* tentative

BEL: bell
BRS: black ribbon shift
BS : backspace
BY : bypass
CR : carriage return
EOB: end of block
EOT: end of transmission
ESC: escape
FF : form feed (page eject)
HLF: half line feed
HLR: half line reverse feed
HT : horizontal tab
IL : idle
LF : line feed
NL : new line
NUL: null character
PF : punch off
PN : punch on
QIT: quit
RRS: read ribbon shift
RS : record separator
& : control character