Raabe.

A/S REGNECENTRALEN
SCANDINAVIAN INFORMATION PROCESSING SYSTEMS

SYSTEM LIBRARY

RCSL NO: 55-D54
AUTHOR : Tom Sandvang
EDITION: Sep. 1969

RC 4000 PERIPHERAL DEVICES

RC 610 LINE PRINTER
REFERENCE MANUAL

ABSTRACT

This report describes the logical structure of the RC 610 line printer when used in connection with the RC 4000 computer.

CONTENTS

INFORMATION DEPARTMENT
DK-2500 VALBY · BJERREGAARDSVEJ 5 · PHONE: (01) 46 08 88 · TELEX: 6464 rcinf dk · CABLES: INFOCENTRALEN

MAIN CHARACTERISTICS

The line printer is connected to the low-speed data channel by means of a buffer register of 24 bits.

The printer is supplied with an internal line buffer which can hold 132 printing positions.

The printer is supplied with one of two standard character sets, both subsets of the ISO 7-bits character set and of the font type OCR-B. They consists of 4 control characters, 1 space and 88 or 59 graphical characters respectively. The only difference between the two character sets is that the larger one includes small letters as well as capital letters whereas the smaller one only includes capital letters. Small letters output on a printer with the limited character set will, however, be printed as capital letters. As an option the printer can be delivered with extra control characters and the possibility for shifting between the standard set of graphics and an alternative set of graphics. These options are described in the appendix to this report.

Print drums with expanded alternative character sets can be delivered.

The maximum printing speed is 1000 lines per minute for the smaller character set and 670 lines per minute for the larger character set. The vertical format is controlled by means of an 8-track format control tape.

The paper feed speed is 15, 25 or 30 milliseconds for 1, 2 or 3 lines respectively; after the third line the paper feed speed is 5 milliseconds per line corresponding to the maximum paper feed speed of 35 inches per second.

The printing density is 10 characters per inch and 6 lines per inch.

The printer is supplied with a local/remote switch which can be set manually. In the remote state the device is program controlled. In the local state the operator may insert or adjust printing forms.

CHARACTER SET

In the internal representation of a character the bits are identified by the bit identifiers b1 through b7, each bit having the binary weight as shown:

bit identifier	b7	b6	b5	b4	b3	b2	b1
weight	64	32	16	8	4	2	1

In the following code table the columns and rows are identified by the decimal equivalent of the following binary numbers:

column:	b7	b6	b5	0	0	0	0
row:	0	0	0	b4	b3	b2	b1

Accordingly, the decimal value of a character is the sum of the column and row numbers. For instance, the character H has the numerical representation 64 + 8 = 72.

Empty positions in the code table specify characters that are not available on the printer.

	0	16	32	48	64	80	96	112
0			SP	0		P		p
1			!	1	A	Q	a	q
2			"	2	B	R	b	r
3				3	C	S	c	s
4				4	D	T	d	t
5			%	5	E	U	e	u
6			&	6	F	V	f	v
7			'	7	G	W	g	w
8			(	8	H	X	h	x
9			)	9	I	Y	i	y
10	NL		*	:	J	Z	j	z
11	VT		+	;	K	Æ	k	æ
12	FF		,	<	L	Ø	l	ø
13	CR		-	=	M	Å	m	å
14			.	>	N		n	
15			/	?	O	_	o	

STANDARD SHIFT IN CODE TABLE

SP **Space, causes the printing position to be increased by one.**

Control characters:

CR Carriage Return:
This character causes the printing of a line followed by a movement of the printing position to the beginning of the same line.

FF Form Feed:
This character causes the printing of a line followed by a movement of the printing position to the beginning of the next form selected by track 0 of the format control tape.

NL New Line:
This character causes the printing of a line followed by a movement of the printing position to the beginning of the next line.

VT Vertical Tabulation:
This character causes the printing of a line followed by a movement of the printing position to the beginning of the next line selected by track 1 of the format control tape.

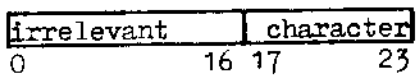
COMMANDS

The line printer accepts write and sense commands. Only the basic command field i.e. bits 22 - 23 in the effective address of the input/output instruction is interpreted. Thus the value of the modifier field i.e. bits 18 - 21 in the effective address is irrelevant.

Read and control commands have no effect at all.

WRITE COMMAND

A write command initiates the output of one character from a working register. The contents of the working register is interpreted as follows:



During the transfer of any one character different from CR, FF, NL, or VT the printer will be busy for approximately 12 microseconds.

The output of an unavailable character has no effect apart from making the printer busy as mentioned above.

After the transfer of one of the control characters CR, FF, NL, or VT the printer is busy during the printing of the line. This will not exceed 100 milliseconds.

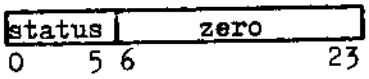
When the printing is either completed successfully or terminated by an error condition the printer delivers an interrupt signal.

If the control character required an upspacing of the paper the paper feed is then activated and during this it is possible to fill the line buffer again.

When the line buffer is full further output of graphical characters will be lost. The first 132 characters of the line are, however, printed when one of the above mentioned control characters is output.

SENSE COMMAND

When the printer is available a status word can be transferred from the buffer register to a working register by means of a sense command. The status word contains the following information:



The status bits have the following meaning:

0 intervention
1 parity
2 timer
3 (not used = 0)
4 (not used = 0)
5 end of paper

Intervention: The intervention status indicates that the operator has interfered with the device by means of the local/remote switch. The status bit is cleared when the next write operation is initiated.

Parity: The parity status indicates the erroneous processing of one or more characters in the printer for instance detected as parity errors in the converter or the line buffer or as hammer failure. The status bit is cleared when the next write operation is initiated.

Timer: The timer status indicates the termination of a printing operation that lasts longer than approximately 10 seconds or the detection of a mechanical fault in the printer such as a wrong speed of the printing drum.

One cause for the delay of a printing operation may be that a track without holes on the format control tape has been selected.

The timer status is considered an indication of a serious hardware malfunction and can therefore only be cleared by means of the MASTER CLEAR button which is located inside the printer, only to be operated by technicians.

End of paper: The end-of-paper status indicates that the drum gate is open or that the printer does not sense any paper because the end of the paper is reached or the paper is torn.

If the absence of paper is detected during printing, the line in progress will be completed, but if attemts to print further lines is made before the end-of-paper situation is corrected the printer will accept and execute the commands as normal but without activating the hammers.

The paper sensors are located 5 - 10 centimeters below the printing hammers.

The end-of-paper status is cleared when the paper situation is corrected and the drum gate is closed.

OPERATOR BUTTONS

In order to use the line printer in connection with the RC 4000 computer it must be in the on-line mode as selected by the on-line/off-line switch which is located on the maintenance panel, only to be operated by technicians.

The operator can then use two push-buttons: The local/remote button and the local start/stop button.

The buttons form/line and testprint/paper feed are locked into form-mode and paper-feed-mode respectively.

LOCAL/REMOTE BUTTON: In the remote state the line printer is program controlled. In the local state the operator may insert or adjust the printing forms and operate the local start/stop button.

If the operator switches to local control during a printing operation, the transition to the local state is delayed until the operation has been completed.

In the local state the printer accepts write commands and transfers the character to the line buffer until a control character which demands a printing operation is received. The printer will then become busy, but the actual operation is, however, delayed until the operator switches to remote control.

When the printer becomes local the intervention status bit is set. It remains set until the next write operation is initiated.

When the operator switches to remote control the transition to the remote state will take place immediately.

Two lamps in the local/remote button indicates whether the printer is in the local or remote state.

LOCAL START/STOP BUTTON: When the button is activated in the local state, an operation is executed controlled by the form/line and the testprint/paper feed buttons, but since these buttons are locked

into the form-mode and paper-feed-mode respectively the operation will be an upspacing of the paper to the beginning of the next form as defined by track 0 of the format control tape.

Activation of the local start/stop button in the remote state has no effect.

APPENDIX

This appendix describes the optional control characters and the standard alternative character set.

OPTIONAL CONTROL CHARACTERS

The standard set of control characters can be expanded with the five following control characters: HT, SO, SI, CAN and ESC, the values of which are given in the following code table. These extra control characters belong to each other so it is impossible only to get a subset of them.

The characters are defined as follows:

HT Horizontal Tabulation:
This character causes a movement of the printing position to the next printing position which is divisible with 16. The printing positions are numbered 0 through 131.

SO Shift Out:
This character causes the printer to interpret the character codes that follows and which have the values 32 through 126 as an alternative set of graphics given by the following code table. The character codes 0 through 31 and 127, however, retain their standard interpretation.

SI Shift In:
This character causes the printer to interpret the character codes that follows according to the previous shown standard shift in code table.

CAN Cancel:
This character causes the line buffer to be cleared, a return of the printing position to the beginning of the line and a shift to the standard shift in code table as described under Shift In.

ESC Escape:

This character is used to expand the control character set when used in one of the two sequences:

ESC n NL

ESC n VT

n must be a character with the value 48 through 63 in either the Shift In or the Shift Out code table. The ESC sequences have the following meaning:

ESC n NL
causes the printing of a line followed by a paper feed of n lines and a movement of the printing position to the beginning of that line. n is interpreted modulo 16 so

$0 \leq$ no of lines ≤ 15

Note that ESC 0 NL is equivalent to CR.

ESC n VT
causes the printing of one line followed by a movement of the printing position to the beginning of the next line selected by track no. n of the format control tape. n is interpreted modulo 8 so

$0 \leq$ track no ≤ 7

Note that ESC 0 VT is equivalent to FF.

Any other sequence than the above mentioned causes the ESC character to be ignored and the following two characters to be interpreted as normal characters.

STANDARD SHIFT OUT CHARACTER SET

After having received the character Shift Out the printer will interpret the character codes with the values 32 through 126 to be an alternative set of graphical characters. The following table shows the standard Shift Out character set together with the optional control characters; other optional graphical characters may be assigned to the character values 64 through 126 if an expanded printing drum is delivered.

	0	16	32	48	64	80	96	112
0			SP	0				
1			Ä	1				
2			Ö	2				
3			Ü	3				
4				4				
5			□	5				
6				6				
7			Æ	7				
8		CAN	Ø	8				
9	HT		Å	9				
10	NL		ä					
11	VT	ESC	ö					
12	FF		ü					
13	CR		æ					
14	SO		ø					
15	SI		å					

STANDARD SHIFT OUT CODE TABLE

Printers with the limited character set will not contains the small letters ä, ö, ü, æ, ø and å, but if these characters are output to the printer, the corresponding capital letters will be printed.

When the printer is started, it is initially in the Shift In mode.

NATIONAL LETTERS

The printer can be delivered with either a danish, german or a swedish alphabet. In the standard shift in code table the rows 11, 12 and 13 of column 80 and 112 may thus prior to the installation be assigned as follows:

	danish		german		swedish	
row 11:	Æ	æ	Ä	ä	Ä	ä
row 12:	Ø	ø	Ö	ö	Ö	ö
row 13:	Å	å	Ü	ü	Å	å

All the national characters are available in the standard shift out character set in column 32.