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AUTHOR : Tom Sandvang

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RC 4000 PERIPHERAL DEVICES

RC 4191 PLOTTER CONTROLLER

REFERENCE MANUAL

ABSTRACT

This report describes the logical structure of the RC 4191 plotter controller when used in connection with the RC 4000 computer.

CONTENTS

Main characteristics.....page 1

Character set.....page 2

Step characters.....page 2

Commands.....page 3

Write command.....page 3

Sense command.....page 4

Local/remote switch.....page 5



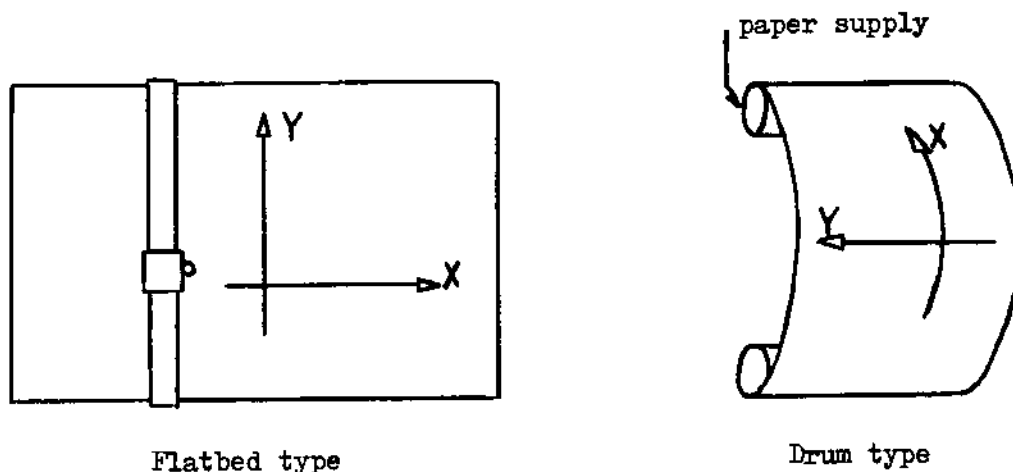
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MAIN CHARACTERISTICS

The plotter controller is connected to the low-speed data channel and contains a buffer register of 7 bits.

Incremental digital plotters of the Calcomp Series 500 and 600 type can be connected to the plotter controller. These plotters can be divided into two main types, the drum type and the flatbed type. The drawing paper for the drum type is supplied from a roll of paper whereas the flatbed type draws on a sheet of paper.

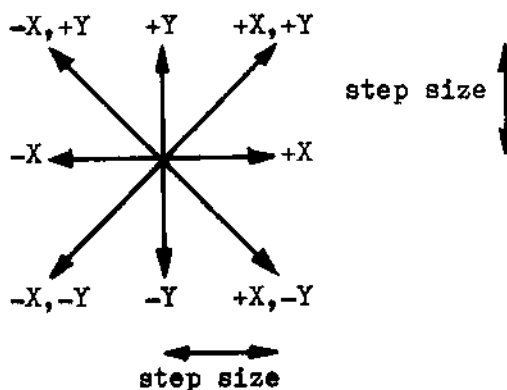
Both types of plotters operate in a normal X-Y coordinate system. The directions of the axes relative to the plotting paper is shown below:



Flatbed type

Drum type

Both the drum type and the flatbed type is incremental plotters operating in the eight vector mode, that is, the pen is able to perform steps in the eight directions:



The size of the step and the speed can vary for the different types, but 0.1 mm and 300 steps/second are typical values.

The plotter is supplied with sensors to detect if the pen is moving outside the plotting paper. Plotters of the flatbed type have sensors for both the X and the Y directions whereas plotters of the drum type only have sensors for the Y directions.

The plotter 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 the plotting paper or the pen.

CHARACTER SET

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

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

The characters are interpreted according to the value of b7:

- b7 = 1 step character
- b7 = 0 control character (used in the control of other plotter types but ignored by the RC 4191 controller)

Step character:

The plotter pen may be moved along the three mutually perpendicular axes denoted X, Y and Z relative to the plotting paper. On each axis the pen can move in both directions as follows:

- + X: move pen one step in positive direction of X-axis
- X: move pen one step in negative direction of X-axis
- + Y: move pen one step in positive direction of Y-axis
- Y: move pen one step in negative direction of Y-axis
- + Z: raise pen from paper
- Z: lower pen onto paper

The bits b6 through b1 of the step character specify any of the 64 combinations of the above possibilities. A bit value of one denotes a move in the combination of directions as follows:

b7	b6	b5	b4	b3	b2	b1
1	+Z	-Z	+X	-X	+Y	-Y

If movements in both directions along the same axis is specified, no movement along this axis is performed.

If movements along both the X, Y and Z axis are specified, the XY-movement is first executed and then the Z-movement.

COMMANDS

The plotter 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 commands and control commands are accepted but have no effect at all.

WRITE COMMAND

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

irrelevant	character
0	16 17 23

After initiation of the output the plotter is busy until the operation is completed successfully or terminated by an error condition. The plotter delivers an interrupt signal when it becomes available.

SENSE COMMAND

When the plotter is available a status word can be transferred to a working register by means of a sense command.

The rightmost 7 bits of the status word contains the last character received in the buffer register, whereas the leftmost 6 bits are status bits:

status	zero	character
0 5 6	16 17	23

The status bits have the following meaning:

- 0 intervention
- 1 (not used = 0)
- 2 (not used = 0)
- 3 (not used = 0)
- 4 (not used = 0)
- 5 pen outside paper

Intervention: The intervention status indicates that the operator has interfered with the device by means of the local/remote switch.

Pen outside paper: The pen-outside-paper status indicates that the pen was outside the plotting area on the paper in the Y direction for the drum type plotters or in either the X or the Y direction for the flatbed plotters.

Subsequent write operations specifying further steps outside the paper are accepted but the output is suppressed and the operations are terminated normally by an interrupt. The pen-outside-paper status remains set.

The pen-outside-paper status is cleared by a write operation but only if the pen again comes inside the plotting area on the paper; this can be obtained as a result either of the write operation itself or of an operator intervention in the local state.

LOCAL/REMOTE SWITCH

In the remote state the plotter is program controlled. In the local state the operator may insert or adjust the plotting paper or activate the operator controls in order to position, raise or lower the pen. Activation of these operator controls in the remote state has no effect.

If the operator switches to local control during execution of a write command the transition to the local state is delayed until the command has been completed.

If a write command is initiated in the local state the plotter accepts the command and becomes busy. The actual operation, however, is delayed until the operator switches to remote control.

When the plotter becomes local the intervention status bit is set. It can only be cleared by a write command.