

Engineering Note E-523

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Digital Computer Laboratory
Massachusetts Institute of Technology
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SUBJECT: CORE DRIVERS -- MODEL V AND MODEL VI
To: Group 62,63, and Test Equipment Committee
From: Harold W. Boyd
Date: February 10, 1953

Abstract: The Model V and Model VI Core Drivers are standard test units which can deliver rectangular wave current pulses of variable amplitude, rise time, and duration. Model V supplies negative-going pulses, whereas Model VI supplies positive-going pulses, both from a ground level.

1.0 SPECIFICATIONS

Dimensions: 5-1/4 x 5 x 19 inches for rack mounting.

Circuits: Mono-bi-stable multivibrator (5965)
Amplifier (1/2, 5687)
Cathode follower (1/2, 5687)
Current Amplifier (4, 6CD6's)

Input: Standard .1 μ sec pulses, negative, 13-30 volts.

Output: Shape - rectangular
Amplitude - variable from 0 to greater than 1.6 Amps.
Rise Time - less than 0.15 μ sec, and .2 to 1.0 μ sec in
2 overlapping ranges
Duration - 1 - 40 μ sec in two overlapping ranges (mono-
stable).
.6 - 40 μ sec (bi-stable).

Duty Factor: Limited by multivibrator to no more than:
40% in monostable
75% in bistable
Limited by dissipation in output tubes to no more than:
20% at 2.0 amps output
25% at 1.6 amps output

40% at 1.0 amps output
 50% at 0.8 amps output
 75% at 0.53 amps output

Resolution Time: 0.5 μ sec at maximum output amplitude.

(May be complemented in "bistable" from 12.5 KC to 2 Mc by tying J1 and J2 together)

Power Requirements: (approximate during pulse)

	<u>Model V</u>	<u>Model VI</u>
+150		.03 - 2.03 A.
-150	.03 - 2.03 A.	.04 A.
-300	.04 A.	
6.3 V a-c		10.6 A.

2.0 OPERATION

The Core Drivers (schematics C-52170 (Model V) and C-52643 (Model VI)) consist of four stages; these are in turn: a monostable multivibrator, inverter-amplifier, cathode follower, and current amplifier.

The monostable multivibrator is for convenience labeled mono-bi-stable. The name arises from the two options in the use of this stage. The multivibrator favors one side as its conducting side to insure the current amplifier stage of being normally cut-off. In monostable operation the multivibrator is set to its unfavored state by a pulse fed into J1-set and there remains for a duration determined by the time constant of the timing network.* The duration of the multivibrator in the selected state determines the pulse width of the output current squarewave. The pulse width is variable from less than 1 to greater than 40 μ sec in two overlapping regions as selected by the Duration Coarse and Duration Fine controls.

* Timing network -- C-2 or C-3, and R₂ and CR3 in both C-52170 and C-52643.

In bi-stable operation the multivibrator is set to its unfavored state by a pulse fed into J1-set and there remains (up to above 40 μ sec) until cleared by a pulse fed into J2-clear. In this mode of operation, therefore, the multivibrator appears to be bi-stable, and the output pulse width is determined by the time delay between the two input triggers (J1 and J2).

The output gate of the multivibrator stage cuts off the normally conducting inverter-amplifier which follows it. The rate at which the voltage rises at the plate of this tube is determined by the value of capacitance between its plate and ground. This rate in turn determines the rate of rise in the output current pulse. With the Rise Time Coarse set on "short," the rise time is .15 μ sec or less, but is not variable in this position. With the Rise Time Coarse set on "medium" or "long" the rise time can be varied by the Rise Time Fine control from less than .2 μ sec to greater than 1 μ sec in two overlapping ranges.

The upper level of the output voltage of the inverter-amplifier is varied by a diode and potentiometer which afford a variable clamp. The lower level of voltage output is sufficient at all times to insure cut-off of the current amplifiers. The upper level can be varied by the output Amplitude control (variable clamp) from a value sufficient to insure cut-off of, to a value sufficient to produce slightly positive bias on the 6CD6's. Thus, the output amplitude can be varied from 0 to about 2 Amperes. If all 4-- 6CD6's are marginal the maximum current would be about 1.6 Amperes. If all 4 - 6CD6's are average more than 2 Amperes may be obtained.

The current output of the Core Drivers, although variable up to about 2 Amperes, is limited by the screen dissipation of the 6CD6's that comprise the current amplifier stage. A measure of the screen dissipation is afforded by the screen current warning lamp and for safety's sake should not be allowed to glow. When driving cores at 2 Amperes, a duty factor of about 20% can be obtained without excessive screen dissipation. At a duty factor of 50%, driving cores, a maximum of about 0.8 Amperes of output current may be safely obtained.

If it is desired not to use more than 1 Ampere output pulses, two 6CD6's (of the normal complement of 4) may be used to obtain faster rise times. The duty factor, however, should not be allowed to exceed 20% at 1 Ampere -- even though the screen warning lamp will not glow till a 40% duty factor is reached.

The model VI core driver has, in addition to the above controls, a zero current adjustment potentiometer located in the back of the unit. With this control the quiescent (no-trigger) output current can be brought to zero for all or any setting of the output Amplitude control. This is accomplished by adjusting the potential at the 6CD6's cathodes to ground.

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3.0 PRECAUTIONS

To avoid excessive heater-to-cathode voltages on the tubes, the use of either a separate filament supply or an isolation transformer is required for Model V. Since, however, both models V and VI require 10.6 Amperes at 6.3 volts, a separate filament supply is advisable.

It is suggested that whenever the Core Driver is turned on, the output amplitude control be fully counter-clockwise (down) at first. The output can then be brought up to the desired value or to a value limited by the glow of the screen current warning lamp. This is merely to protect the tubes in case the initial combination of duty factor, amplitude setting, and trigger amplitudes, are such that screen dissipation would be excessive.

Drawings:

Model V - C-52170

Model VI - C-52643

Signed

Harold W. Boyd
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Approved

R. L. Best
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Approved

DRB
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Drawings attached:

C-52170

C-52643



