Digital Computer Laboratory
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SUBJECT: PROGRAMMING FOR AND OPERATION OF OSCILLOSCOPE AND CAMERA

To: Scientific and Engineering Computation Group

From: E.S.Kopley

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Abstract: Programming for the oscilloscope is similar to plotting points
in a Cartesian plane with additional restrictions and conventions
peculiar to WWI. The new mode for intensifying a spot on the
oscilloscope and the new camera indexing instruction must be used by
July 1. Many programs are available for oscilloscope post-mortems.
Operators' instructions for optimum use of the oscilloscope and camera
are outlined in great detail.

Introduction

It is hoped that this compilation of oscilloscope and camera information
will be an aid to both programmers and operators. Sections A and B directly
concern programmers and Sections C and D are of greater interest to computer
operators. However, both programmer's and operator's recognition of each others
problems might manifest itself in a more extensive and efficient use of the
oscilloscope and camera.

A. Programming for the Scope

(M-1623-1 pp.17-18 is a reference for the following with the exception that
the words "horizontal" and "vertical" must be interchanged.)

A spot is displayed on the Scope in the following way: *

(1) With the ordinate in the Accumulator the instruction si 600(o) is called
for. This sets the vertical decoder to the position specified by digits 0 through
10 of the AC, where digit zero serves as the sign.

(2) With the abscissa in the Accumulator, the instruction rco is called for.
This sets the horizontal decoder to the position specified by digits 0 through 10
of the AC, and also intensifies the spot on the scope. This spot has as its ordinate
the last ordinate that was set up with an si 600(o). Again digit zero serves as the
sign.

Horizontal Line

Consequently, to get a horizontal line, only one si 600(o) need be programmed
followed by as many rco instructions as the number of spots desired. With reference
to the last statement, actually only one rco need be used if a cycle is set up using
the rco instruction where the number of times one goes through the cycle corresponds
to the number of spots desired on the horizontal line. Before each successive rco
instruction the number in the Accumulator should be greater, by a constant increment,
than the number in the Accumulator immediately preceding the previous rco. To obtain
distinct

* (o) means octal

spots on a horizontal line one must not program the spots more closely together than 2^{-6}.

Intensification Lines

The S&EC Group has restricted itself in the past to intensification line 600(o). However, if a programmer finds a need for using more than one line, he may use 601,602,...,605. If any line other than the 600(o) line is used, the programmer would do well to mention this at the top of his performance request.

Scope Limits

The center of the Scope represents the number pair (0,0). The limits of the Scope correspond to the limits of WWI. Thus the Scope plots numbers between $(-1+2^{-15})$ and $(+1-2^{-15})$ in both the horizontal and vertical directions. This, of course, is not exactly true since the decoders merely consider digits 0-10. Consequently, the true limits are $(-1+2^{-10})$ and $(+1-2^{-10})$.

B. Film Conventions, Output and Post Mortems

Camera Indexing

(M-1623-1 pp. 5-6 CAMERA is a reference for the following with the exception that si 500 must be replaced by si 4.)

All scope programs should begin with an index instruction if pictures of a display are desired. The standard scope subroutines and post-mortems comply with this. The index instruction si 4 closes the shutter, advances the film and opens the shutter (as far as the programmer is concerned). If the programmer uses the scope as a form of output, it is suggested that he index the camera with an si 4 at the end of his display to eliminate the possibility of his losing the data on the last frame in the case where the next programmer has been remiss and has omitted an initial index. The programmer need not concern himself with indexing at any other time during the use of standard scope subroutines since there is automatic indexing whenever a frame is filled.

Handling of Film

Each week-day at 8:00 AM, all frames taken during the previous 24 hour period will be developped by the photo-lab and made available to programmers by 12 noon of that day. Programmers may view their results in the form of negatives with the aid of a Filmsort. They may obtain prints of whatever they request, providing the request is made in the early part of the afternoon, by 5:00 PM of the same day. All programmers film transactions should take place at the counter in the film section of the Tape Room. The film section is located at the end of the counter away from the Reception Room.

Spot Intensification Change

Memorandum M-2126 describes the new method for intensifying a spot on the scope. If a programmer uses the old method and/or his scope subroutines use the old method, it must be so indicated at the top of his performance request. He need merely write "Old Decoders". If he wishes to use the new system he need only write "New Decoders". Until July 1, both systems will be acceptable. However, all new scope programming must use the "new" system and "old" programming should be converted to the "new" system before July 1. If the operator should put the

Decoder switch on the "new" position with "old" programming, or the converse of this, before July 1, very little damage will result since the negatives need only be turned over and rotated 90° for the correct picture. However, a hybrid system would obviously be "fatal" unless the switch were manipulated properly at the propitious moments.

Index Change

si 500(o) must be changed to si 4 by July 1. However, either instruction will index the camera until July 1.

Scope Output

The scope MRA output routine in current use is a (24,6) routine, tape # 2285 m2.

Post Mortems

Scope Post Mortems: (Not all those listed below are yet available. Consult Tape Room Bulletin Board for availability.)

Bank B (1 bank)

Form	Displays Beginning of Storage	Displays End of Storage	No. of Frames	Time
Octal Fractions	Tape # 2370	Tape # 2439	3	46 sec.
WWI Decimal Instructions	2608	2645	3	44
WWI Octal Instructions	2609	2646	3	43
* Interpreted Dec. Instructions	2614	2647	4	45

Banks A & B (2 banks)

Form	Displays Beginning of Storage	Displays End of Storage	No. of Frames	Time
Octal Fractions	2648	2660	6	102
WWI Decimal Instructions	2649	2661	6	98
WWI Octal Instructions	2650	2662	6	96
* Interpreted Dec. Instructions	2651	2663	9	100

* "new" Decoders and si 4. (All unstarred programs "old" decoders and si 500(o).)

C. Operator Procedure

(1) Pick up magazine A or B in the tape room if the magazine on the camera is to be replaced. The magazine should be replaced by the operator at 8:00 AM each day and the replaced one should be taken to the photo-lab for development. If the photo-lab is closed, leave the magazine on the desk of the Technician in charge of the distribution of film. This desk is situated in the Film Section of the Tape Room, next to the Filmsort. After replacing the magazine, index the camera 3 times. (See Diagram 1)

(2) Put the Scope Power and Beam switches on 10 minutes before the computer period begins to allow for an ample "warming-up" period. (See Diagram 1)

(3) Attach the camera to the scope, preferably before the computer period starts, if the Fairchild Camera is not already attached. Place camera switch in "on" position. This switch is located on side panel near the Camera Index button. (See Diagram 2)

(4) Load the magazine onto the Camera being careful that it is flush with the camera to be sure of correct contact between Index arm and cam. The magazine securing pins hold the magazine in place. (See Diagram 3)

(5) Be sure the Power Cable is connected. (Otherwise the Index Instruction will be ignored.) (See Diagram 3)

(6) Be sure the leftmost switch of the 16 intensification line switches at the top of the scope panel is in "up" position. This is the si 600(o) line. If other lines are being used, their respective switches must be in the "up" position. (See Diagram 3)

(7) Read in the Scope-Calibration program 2551m2.

    (a) Use the settings most recently made available to the operators by the staff member responsible for the scope settings as the initial settings. It is likely that a pencil mark on the dials will conform to the newest settings. (See Diagram 1)

    (b) Make a fine adjustment in your "vertical and horizontal position" settings so as to center your geometric pattern (square). This adjustment is extremely sensitive so that much care must be exercised to turn the dials **very gradually**. (See Diagram 1)

    (c) Make a fine adjustment in the vertical and horizontal gain so as to utilize the maximum area on the scope without losing the corners of any display. This control is not nearly as sensitive as the position dials. Repeat b and/or c until optimum settings are attained. (See Diagram 1)

    (d) Use the aperture, focus and intensity settings given. (See Diagram 3)

    (e) If the resulting settings have strayed considerably from the recommended settings, the new settings should be recorded in the log and this information should be submitted to the staff member responsible for the use of the scope-camera.

    (f) Do not bother with the Grid lights and Panel lights dials. (See Diagram 1)

    (g) Be sure that the opening for viewing the scope through the rubber eyepiece is closed. (See 9 below)

    (h) **Index the camera once before** using it by pressing the index button unless **the magazine** has just been replaced in which case this may be dispensed with since the camera has already been indexed 3 times. (See Diagram 2)

    (i) Adjust the 5-inch scope on the front panel so that it might be viewed by programmers and/or operators. This scope should have the same display as the 16-inch scope attached to the camera.

    (j) Inspect voltage indicator on right side of panel below camera. If indicator does not point exactly to 12 Kilovolts, use the knob to set it to 12. (See Diagram 4)

    (k) Stop Scope Calibration Program.

(8)   (a) If programmer is using the pre-July 1 mode for intensifying a spot on the scope, then the console switch "Reverse Decoders" must be in the "on" (or "old" position). This position will also flash a light on the front panel titled "Reverse Decoder".

(b)   If programmer is using the post-July 1 mode for intensifying a spot on the scope, then the console switch "Reverse Decoders" must be in the "off" (or "new" position).

(9)   When viewing Camera-scope through rubber eyepiece opening, viewer must be careful that head is pressed firmly enough against the rubber eyepiece to preclude the possibility of over-exposure of the film.   When not viewing scope through eyepiece be sure that the opening is closed by checking to see that the words "open to view scope" are in clear view.   Another check is to look at the arrow on the knob which controls the opening to the viewer.   This knob is situated at the left of the rubber piece. In order to turn this knob, pull it out slightly and turn while it is in the out position When the arrow points to the closed position, then the opening is closed and pictures may be taken.   When arrow is in open position, scope may be viewed but pictures must not be taken unless viewer has head pressed against eyepiece.

(10)   After CS-Conversion, index the Camera once.

(11)   Record the frame numbers for each program both in the camera log on the Fairchild Camera shelf and on the Performance Request forms.

(12)   Date, programmer's name and tape number should be placed on the name plate of the frames of each programmer.

(13)   Be sure to wind the clock whose face is displayed on each frame and set it to the correct time.

(14)   Index the camera 12 times before removing the magazine.

(15)   When the computer period is over, put the camera switch on the "off" position and press the "close shutter" button. (See Diagram 2)

D.   Plans For The Immediate Future

It is planned that within the next few weeks a 3-way switch will be installed that will permit the following:

(1)   Position 1 will maintain a status quo as far as the present scope calibration system is concerned.   In other words, with the switch in this position one can do his own calibration.

(2)   Position 2 will have the optimum calibration settings for the type of displays programmed by the S&EC Group.   These settings will be kept optimum by a systematic engineering check.

(3)   Position 3 will be used by Group 61.

E.   Hopes For The Future

It is hoped that:

(1)   Hair-lines will be placed on the Fairchild camera face as an aid in calibrating the scope.

(2) Fine adjustment knobs will be connected to the horizontal and vertical position controls to compensate for their extreme sensitivity.

(3) A longer delay will be engineered into the horizontal and vertical decoders in order to eliminate the distortion induced by a long horizontal and/or vertical sweep.

Signed: *Edwin S. Kopley*
Edwin S. Kopley
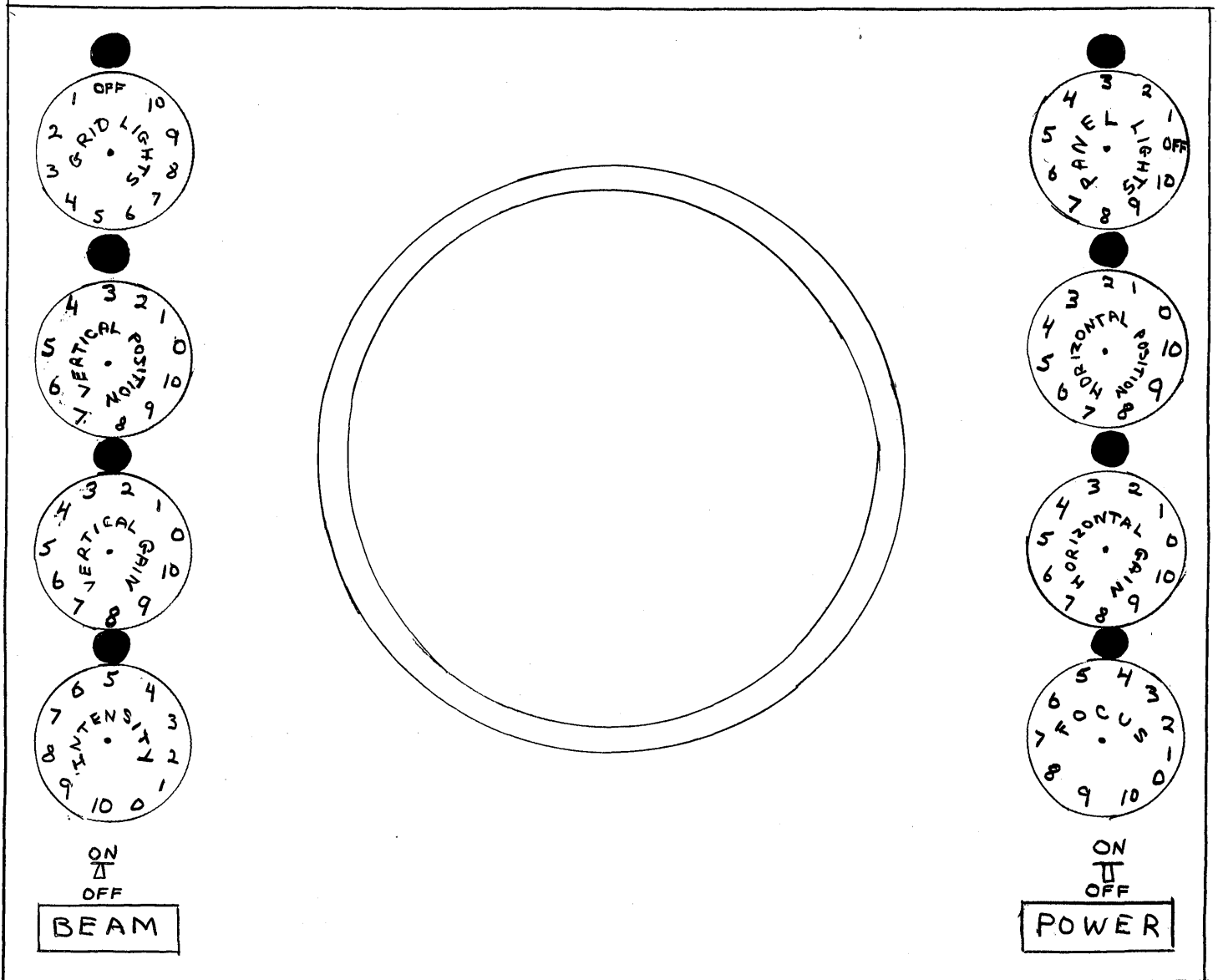
Approved: *J. D. Porter*
Jack D. Porter

ESK:jdp:mm

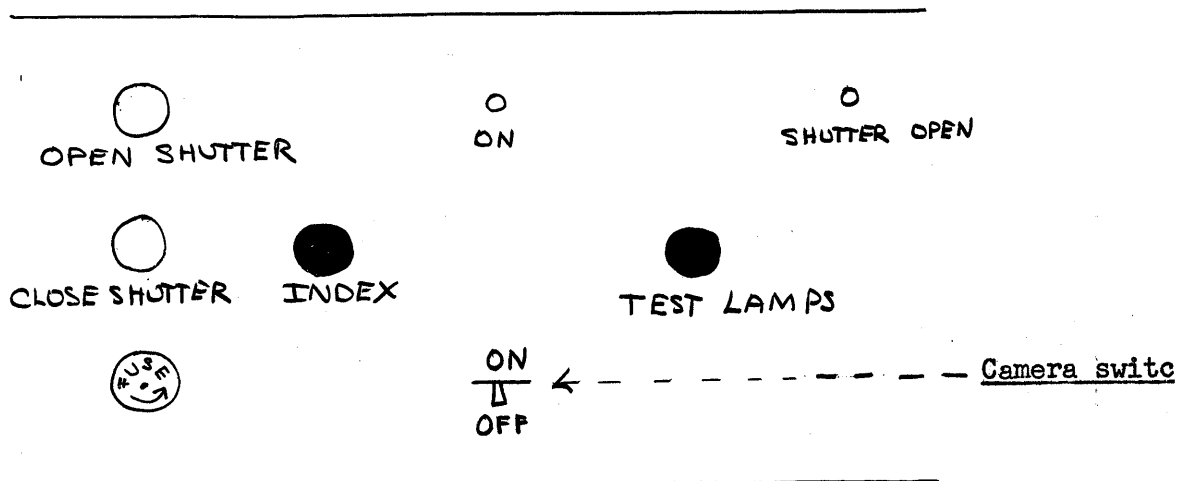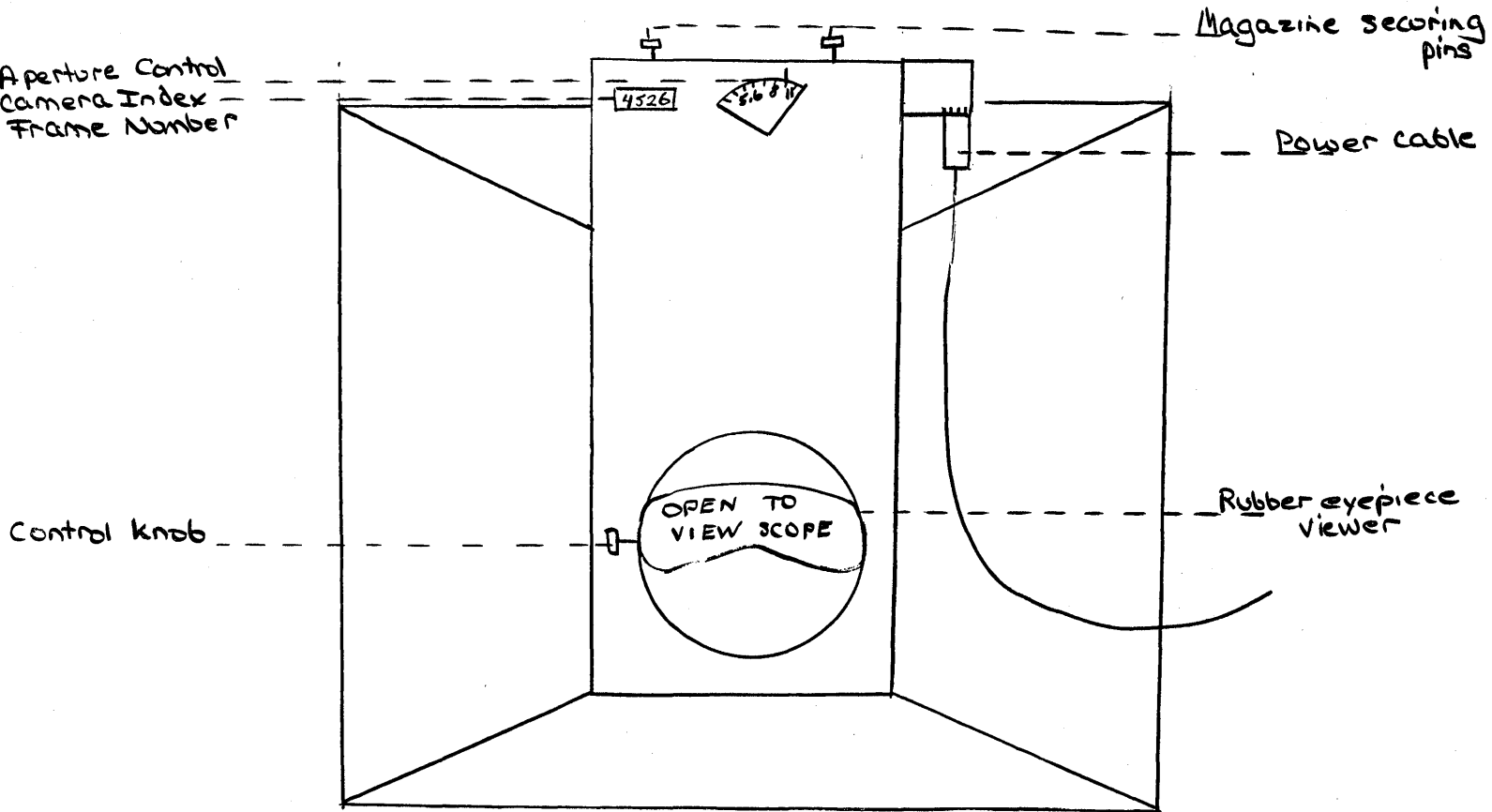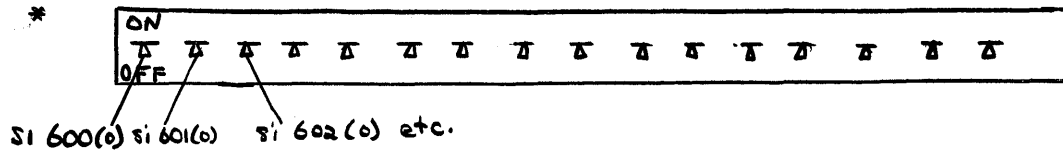Diagram 1   Face of 16"-Scope used with Fairchild Camera
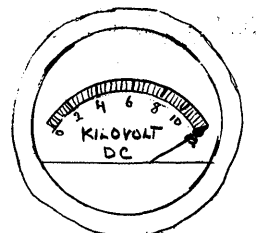

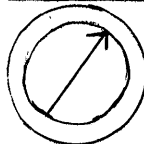Diagram 2   Camera Controls

View of Camera-on-Scope

*

ON

OFF

Si 600(o) si 601(o)   si 602(o) etc.

Magazine securing pins

Aperture Control
Camera Index
Frame Number

4326

Power cable

Control knob

OPEN TO
VIEW SCOPE

Rubber eyepiece
viewer

* Top row of switches controls both the scope attached to the camera and the one above it.

Diagram 4

KILOVOLT
DC

INCREASES OUTPUT

POWER ON

FUSE