INSTRUCTION MANUAL

JOYSTICK

015-0175-00

Tektronix, Inc. P.O. Box 500 Beaverton, Oregon 97005 Phone: 644-0161 Cables: Tektronix

070-1060-00

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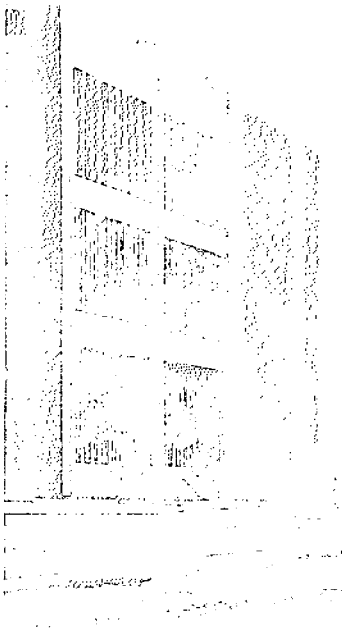
WARRANTY



All Tektronix instruments are warranted against defective materials and workmanship for one year. Tektronix transformers, manufactured in our plant, are warranted for the life of the instrument.

Any questions with respect to the warranty, mentioned above should be taken up with your Tektronix Field Engineer or Representative.

All requests for repairs and replacement parts should be directed to the Tektronix Field Office or representative in your area. This procedure will assure you the fastest possible service. Please include the instrument Type (or Part Number) and Serial or Model Number with all requests for parts or service.

Specifications and price change privileges reserved.

TABLE OF CONTENTS

Abbreviations and symbols used in this manual are based on or taken directly from IEEE Standard 260 "Standard Symbols for Units", MIL-STD-12B and other standards of the electronics industry. Change information, if any, is located at the rear of this manual.

Fig. 1-1. Joystick 015-0175-00.

SECTION 1
SPECIFICATION

Introduction

The Tektronix 015-0175-00 Joystick is an input device intended for use with the Tektronix 4901 Interactive Graphic Unit. The Joystick provides X and Y Axis positioning voltages from high resolution sensing elements using a single control handle. An opening in the enclosing shroud limits travel of the control handle. The Joystick can be calibrated so the perimeter of the opening in the shroud corresponds to the limits of the display area on the T4002 Terminal Display Unit, or some portion of the display area.

TABLE 1-1

ELECTRICAL

Parameter	Performance Limits
Resolution (X and Y)	Within one addressable point of a previously stored point.
CURSOR BRIGHTNESS Voltage Output Range	+6 volts or less, to at least +14 volts.
SEEK Input Voltage Range	+2.4 volts to +5.5 volts.

TABLE 1-2

ENVIRONMENTAL

Parameter	Performance Limits
Temperature	
Operating Range	0°C to +50°C.
Storage Range	−40°C to +65°C.
Altitude	
Operating Range	To 15,000 feet.
Storage Range	To 50,000 feet.
Transportation Test	Not specified. Tested to NTSC procedure 1A with a 24 inch drop.

TABLE 1-3

MECHANICAL

Parameter	Performance Limits
Joystick Excursion	
Side-to-Side	66° within 4°.
Corner-to-Corner	94° within 4°.
Finish	Anodized Aluminum.
Dimensions	
Height	2 pounds, 8 ounces.
Diameter	5.425 inches.

STANDARD ACCESSORIES

1 ea.	Instruction Manual	070-1060-00

SECTION 2
OPERATING INSTRUCTIONS

OPERATING INSTRUCTIONS

General

To effectively use the 015-0175-00 Joystick, the operation and capabilities of the instrument must be known. This section describes the operation of the instrument controls and indicators and gives the adjustment procedure necessary to modify instrument calibration to meet specific needs.

Instrument Controls

CURSOR BRIGHTNESS and IG OFF. This is a dual purpose control that varies the intensity of the crosshair cursor display and, in the switch detent position of the control, disables the Interactive Graphic Unit to which the Joystick is connected.

Control Handle. This single handle located in the square cutout area of the enclosing shroud is mechanically connected to the potentiometers that supply the X and Y Axis positioning voltages. With the Joystick situated so the READY light and CURSOR BRIGHTNESS/IG OFF control face the user, pushing the control handle away will position the crosshair cursor display toward the upper part of the display area. Setting the control handle to the user's left will position the crosshair cursor display to the left part of the display area. The perimeter of the cutout area in the enclosing shroud corresponds to the limits of the display area of the T4002 Graphic Computer Terminal Display Unit.

READY Light. The READY light indicates, when it is lit, that the Interactive Graphic Unit to which the Joystick is connected is ready to accept new X and Y Axis positional information. The READY light can only be lit when the CURSOR BRIGHTNESS/IG OFF control is in some position other than IG OFF.

Connectors

P1000 is a 37-pin connector used to connect the Joystick to the Interactive Graphic Unit being used. Construction of the plug eliminates the possibility of improperly installing it. A locking device on P1000 securely attaches it to the mating connector on the Interactive Graphic Unit, and eliminates accidental disconnection or removal.

Calibration

Adjustments are accessible on the bottom panel of the Joystick to facilitate calibration. The Joystick, as it comes from the factory, is calibrated so the opening in the enclosing shroud corresponds to the limits of the display area of the Terminal Display Unit. However, the instrument can be recalibrated to make the opening in the shroud correspond to some lesser portion of the display area with no detrimental effect on operation. Refer to the following procedure for instrument recalibration.

1. Install the 4901 Interactive Graphic Unit in the Auxiliary Compartment of the T4002 Graphic Computer Terminal and connect the 015-0175-00 Joystick to the 4901.

2. Obtain a crosshair cursor display on the Terminal Display Unit.

3. Set the control handle of the Joystick to position the intersection of the crosshair cursor display to the uppermost part of the display area.

4. ADJUST–Y Gain adjustment R12 to set the intersection of the crosshair cursor display to the vertical position desired.

5. Set the control handle of the Joystick to position the intersection of the crosshair cursor display to the lowest part of the display area.

6. ADJUST–Y Offset adjustment R18 to set the intersection of the crosshair cursor display to the vertical position desired. There will be interaction between step 4 and step 6. Readjust until there is no further interaction.

7. Set the control handle of the Joystick to position the intersection of the crosshair cursor display to the extreme right-hand part of the display area.

8. ADJUST–X Gain adjustment R4 to set the intersection of the crosshair cursor display to the horizontal position desired.

9. Set the control handle of the Joystick to position the intersection of the crosshair cursor display to the extreme left-hand part of the display area.

10. ADJUST–X Offset adjustment R15 to set the intersection of the crosshair cursor display to the horizontal position desired. There will be interaction between step 8 and step 10. Readjust until there is no further interaction.

11. Recheck the Y Axis adjustments.

SECTION 3
CIRCUIT DESCRIPTION

General

This section contains a description of the circuitry used in the 015-0175-00 Joystick. The description begins with a discussion of the general function of the Joystick circuitry, then describes each circuit in detail. Refer to the schematic diagram in the Diagrams section throughout the following circuit description for electrical values and relationships.

CIRCUIT OPERATION

General

The 015-0175-00 Joystick is primarily a source of two precisely variable voltages. These voltages, when used with the Tektronix 4901 Interactive Graphic Unit, provide X and Y Axis positioning. The amplitude and level of these voltages can be adjusted to make the perimeter of the control handle opening correspond to any desired portion of the viewing area of the T4002 Terminal Display Unit. The Joystick also contains a CURSOR BRIGHTNESS control, a graphics disabling switch, and a READY indicator lamp.

READY Indicator

When the READY lamp is on, it indicates that the Interactive Graphic Unit to which the Joystick is connected is ready to accept new X and Y Axis positional information. In this state, a positive level called SEEK is applied to the base of transistor Q2 through R9. This positive level turns on Q2, causing a negative change in the collector circuit. This negative level biases transistor Q5 into saturation and applies five volts to READY indicator lamp DS5.

CURSOR BRIGHTNESS and IG OFF Control

Variable resistor R1 varies the level called CURSOR BRIGHTNESS between +5 volts and +15 volts approximately. In the IG OFF position of the CURSOR BRIGHTNESS control, switch S1 opens and transistor Q2 is biased on. The collector of Q2 steps negative and the level called $\overline{\text{OFF}}$ inhibits the Interactive Graphic Unit.

X and Y Axis Positioning Circuits

R3 and R11 are high resolution, conductive plastic-element potentiometers. Both are mechanically connected to a single control handle and provide X and Y axis positioning voltages to the 4901 Interactive Graphic Unit. R4 and R12 adjust the range of voltages that R3 and R11 can provide. R15 and R18 provide DC offset adjustments for the minus differential inputs to the 4901.

SECTION 4
MAINTENANCE

Information

This section contains information that will aid in keeping the 015-0175-00 Joystick operating at its peak performance. Parts identification and soldering techniques are included where necessary.

Preventive Maintenance

Design of the 015-0175-00 Joystick permits a minimum of preventive maintenance. Occasional cleaning of the instrument may be accomplished using a cloth or dry paint brush to remove loose dirt. Hardened dirt can be removed with a paint brush, cotton-tipped swab or cloth dampened with a water and mild detergent solution. To clean the interior, use low-velocity compressed air to blow off the accumulated dust. High velocity air streams should be avoided to prevent damage to components.

Periodic preventive maintenance checks on the transistors used in the unit are not recommended. The circuits within the unit generally provide the most satisfactory means of checking transistor usability.

Corrective Maintenance

Replacement of some parts in the unit should be done by following a definite procedure. Some procedures, such as soldering and replacing components on the circuit board are outlined in this portion of the manual.

Use ordinary 60/40 solder and a 35- to 40-watt pencil type soldering iron on the circuit board. The tip of the iron should be clean and properly tinned for best heat transfer to the solder joint. A higher wattage soldering iron may separate the etched wiring from the base material.

The following technique should be used to replace a component on the circuit board. Most components can be replaced without removing the board from the unit.

1. Grip the component lead with long-nosed pliers. Touch the soldering iron to the lead at the solder connection. Do not touch the soldering iron tip directly on the board, as it may damage the board.

2. When the solder begins to melt, pull the lead out gently. This should leave a clean hole in the board. If not, the hole can be cleaned by reheating the solder and placing a sharp object, such as a toothpick or pointed tool, into the hole to clean it out.

3. Bend the leads of the new component to fit the holes in the board. Cut the leads of the new component to the same length as those of the old component. Insert the leads into the board until the component is firmly seated against the board, or as positioned originally. If it does not seat properly, heat the joint, and gently press the component into place.

4. Apply the iron and a small amount of solder to the connection to make a firm solder joint. To protect heat-sensitive components, hold the lead between the component body and the solder joint with a pair of long-nose pliers or other heat sink.

5. Clip the excess lead that protrudes through the board.

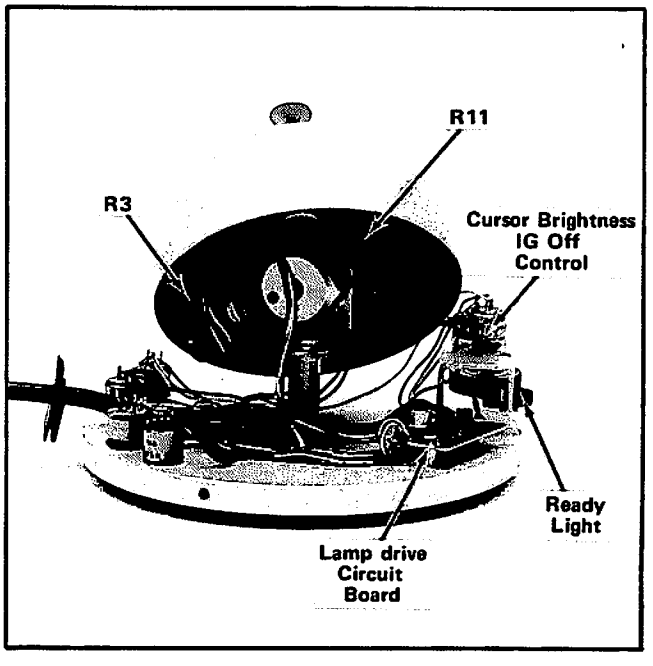


Fig. 4-1. Component location in the Joystick.

6. Clean the area around the soldered connection with flux-remover solvent to maintain good environmental characteristics and appearance. Be careful not to remove information printed on the board.

All electrical and mechanical part replacements can be obtained through your local Tektronix Field Office or representative. However, many of the standard electronic components can be obtained locally in less time than is required to order them from Tektronix, Inc. Before purchasing or ordering replacement parts, check the parts lists for value, tolerance, rating and description.

Some parts are manufactured or selected by Tektronix to satisfy particular requirements, or are manufactured for Tektronix to out specifications. These and most mechanical parts should be ordered through your Tektronix Field Engineer or Field Office.

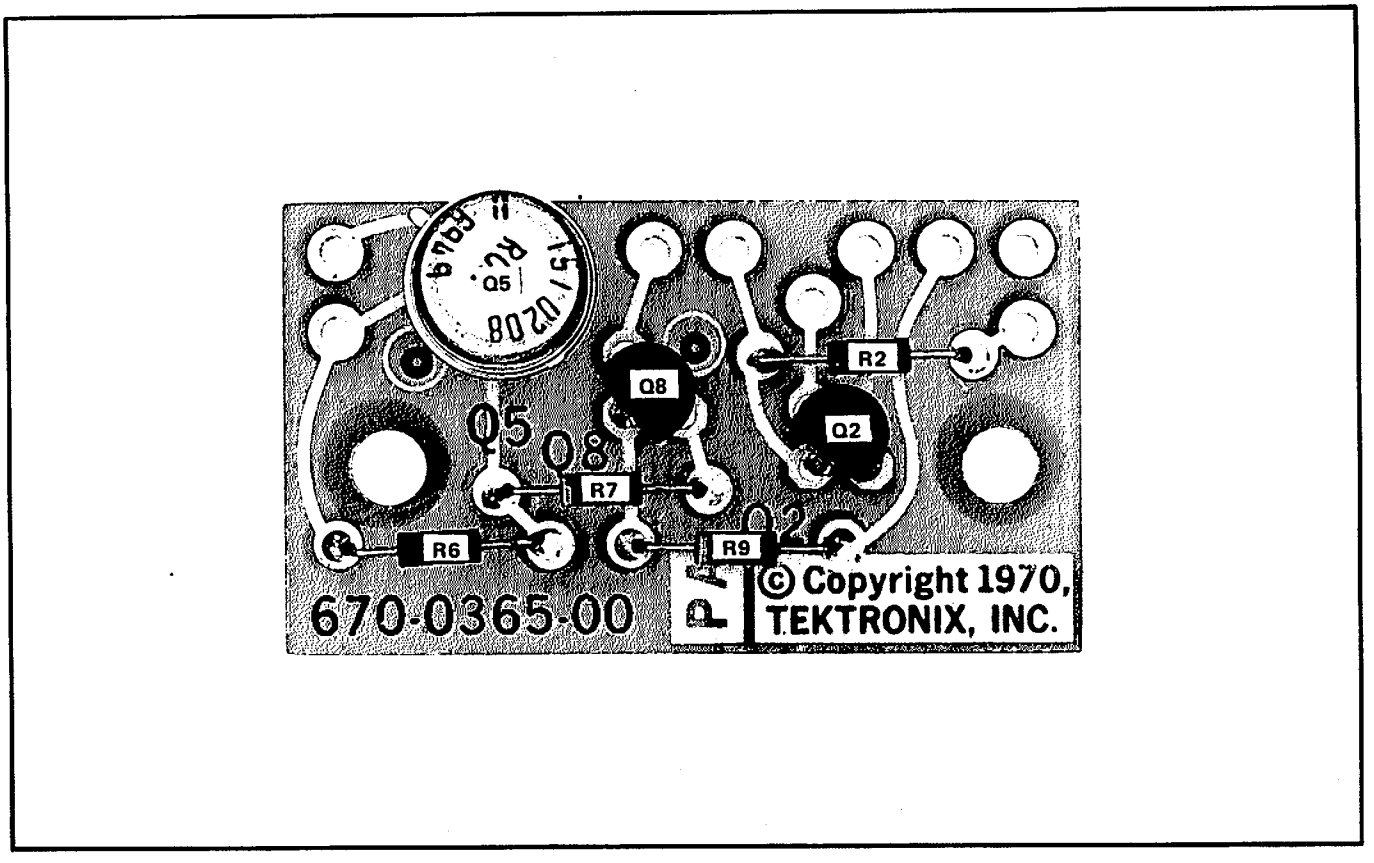


Fig. 4-2. Lampdrive Circuit Board.

NOTES

PARTS LIST ABBREVIATIONS

BHB	binding head brass
BHS	binding head steel
cap.	capacitor
cer	ceramic
comp	composition
conn	connector
CRT	cathode-ray tube
csk	countersunk
DE	double end
dia	diameter
div	division
elect.	electrolytic
EMC	electrolytic, metal cased
EMT	electrolytic, metal tubular
ext	external
F & I	focus and intensity
FHB	flat head brass
FHS	flat head steel
Fil HB	fillister head brass
Fil HS	fillister head steel
h	height or high
hex.	hexagonal
HHB	hex head brass
HHS	hex head steel
HSB	hex socket brass
HSS	hex socket steel
ID	inside diameter
inc	incandescent
int	internal
lg	length or long
met.	metal
mtg hdw	mounting hardware
OD	outside diameter
OHB	oval head brass
OHS	oval head steel
P/O	part of
PHB	pan head brass
PHS	pan head steel
plstc	plastic
PMC	paper, metal cased
poly	polystyrene
prec	precision
PT	paper, tubular
PTM	paper or plastic, tubular, molded
RHB	round head brass
RHS	round head steel
SE	single end
SN or S/N	serial number
S or SW	switch
TC	temperature compensated
THB	truss head brass
thk	thick
THS	truss head steel
tub.	tubular
var	variable
w	wide or width
WW	wire-wound

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial or model number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number
00X	Part removed after this serial number
*000-0000-00	Asterisk preceding Tektronix Part Number indicates manufactured by or for Tektronix, Inc., or reworked or checked components.
Use 000-0000-00	Part number indicated is direct replacement.

SECTION 5
ELECTRICAL PARTS LIST

Values are fixed unless marked Variable.

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description			
				CHASSIS			
				Bulb			
DS5	150-0045-00			Incandescent #685			
				Connector			
P1000	131-0422-00			Receptacle, electrical, 37-pin, male			
				Resistors			
Resistors are fixed, composition, ±10% unless otherwise indicated.							
R1[1]	311-0645-00			50 kΩ, Var			
R3	311-1077-00			1 kΩ, Var			
R4	311-0086-00			2.5 kΩ, Var			
R11	311-1077-00			1 kΩ, Var			
R12	311-0086-00			2.5 kΩ, Var			
R14	321-0258-00			4.75 kΩ	1/8 W	Prec	1%
R15	311-0328-00			1 kΩ, Var			
R17	321-0258-00			4.75 kΩ	1/8 W	Prec	1%
R18	311-0328-00			1 kΩ, Var			
				Switch			
	Wired or Unwired						
S1[2]	311-0645-00						
				LAMPDRIVE Circuit Board Assembly			
	*670-0365-00			Complete Board			
				Transistors			
Q2	*151-0190-02			Silicon	NPN	TO-92	2N3904
Q5	*151-0208-01			Silicon	PNP	TO-5	2N4036
Q8	*151-0190-02			Silicon	NPN	TO-92	2N3904
				Resistors			
Resistors are fixed, composition, ±10% unless otherwise indicated.							
R2	317-0103-00			10 kΩ	1/8 W		5%
R6	317-0103-00			10 kΩ	1/8 W		5%
R7	317-0471-00			470 Ω	1/8 W		5%
R9	317-0472-00			4.7 kΩ	1/8 W		5%

[1]Furnished as a unit with S1.
[2]Furnished as a unit with R1.

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations which appear either on the back of the diagrams or on pullout pages immediately following the diagrams of the instruction manual.

INDENTATION SYSTEM

This mechanical parts list is indented to indicated item relationships. Following is an example of the indentation system used in the Description column.

Assembly and/or Component
Detail Part of Assembly and/or Component
mounting hardware for Detail Part
Parts of Detail Part
mounting hardware for Parts of Detail Part
mounting hardware for Assembly and/or Component

Mounting hardware always appears in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation.

Mounting hardware must be purchased separately, unless otherwise specified.

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial or model number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

ABBREVIATIONS AND SYMBOLS

For an explanation of the abbreviations and symbols used in this section, please refer to the page immediately preceding the Electrical Parts List in this instruction manual.

SECTION 6
MECHANICAL PARTS LIST

FIGURE 1 EXPLODED

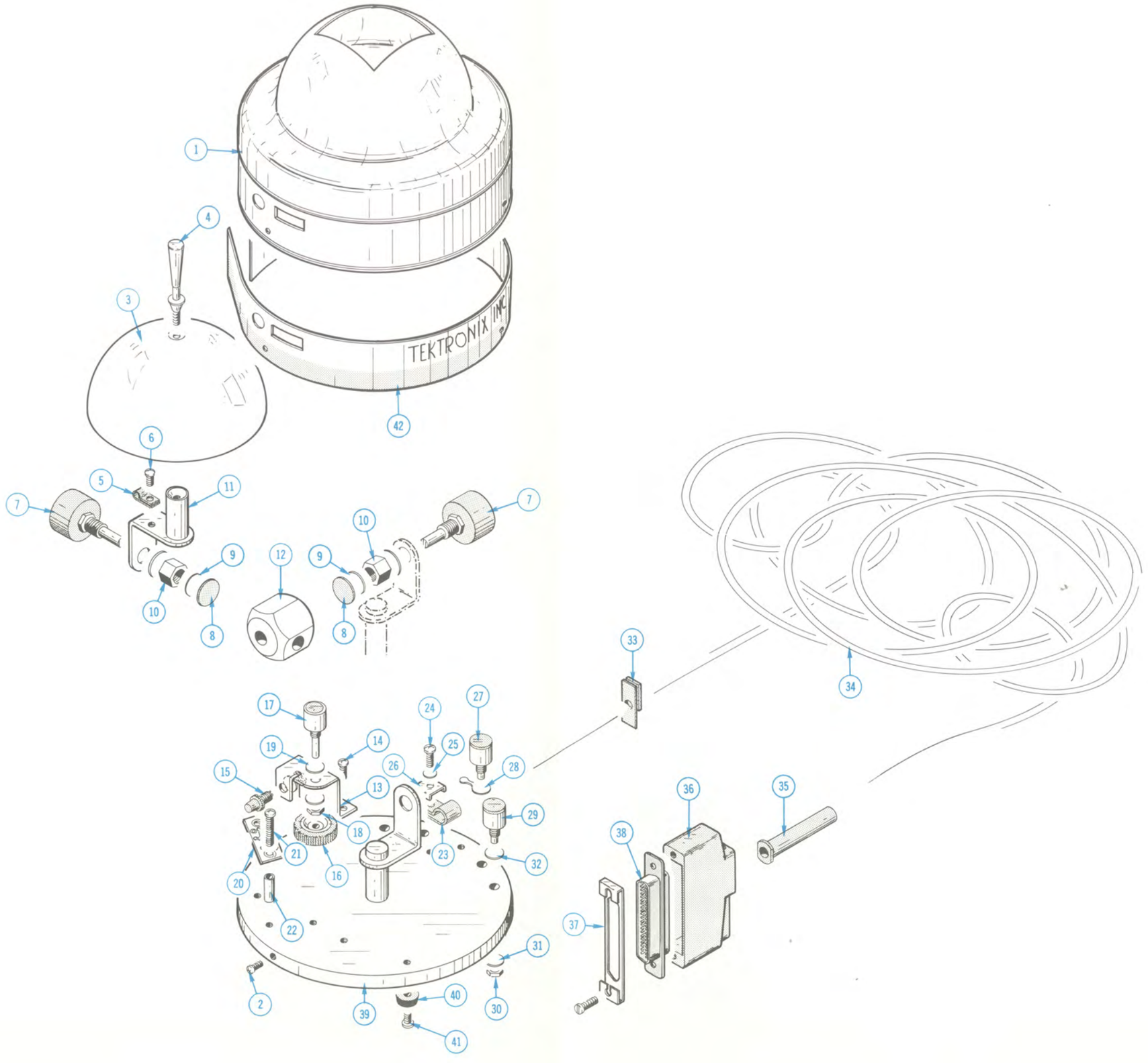
Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5	Description
1-1	380-0213-01			1		HOUSING, controller, outer
	- - - - - -			-		mounting hardware: *(not included w/housing)*
-2	211-0584-00			3		SCREW, 6-32 x 0.25 inch, CHS
-3	380-0214-01			1		HOUSING, controller, inner
	- - - - - -			-		mounting hardware: *(not included w/housing)*
-4	214-1422-00			1		LEVER, controller
-5	343-0144-00			1		CLAMP, cable, 0.125 inch diameter
	- - - - - -			-		mounting hardware: *(not included w/clamp)*
-6	213-0034-00			1		SCREW, thread forming, #2 x 0.312 inch, PHS
-7	- - - - - -			2		RESISTOR, variable, *w/hardware*
	- - - - - -			-		mounting hardware for each: *(not included w/resistor)*
-8	210-1118-00			1		WASHER, plastic, 0.253 ID x 0.625 inch OD
-9	210-1015-00			1		WASHER, spring tension, 0.254 ID x 0.50 inch OD
-10	210-0600-00			1		NUT, hex., 0.375-32 x 0.562 inch
-11	407-0813-01			1		BRACKET, w/post
-12	376-0108-00			1		COUPLING, variable resistor
	- - - - - -			-		coupling includes:
	213-0126-00			2		SETSCREW, 6-32 x 0.25 inch, HSS
-13	407-0812-00			1		BRACKET, component mounting
	- - - - - -			-		mounting hardware: *(not included w/bracket)*
-14	211-0097-00			2		SCREW, 4-40 x 0.312 inch, PHS
-15	136-0279-00			1		LIGHT, indicator, *w/hardware*
-16	366-0341-00			1		KNOB, charcoal—CURSOR BRIGHTNESS
	- - - - - -			-		knob includes:
	213-0140-00			2		SETSCREW, 2-56 x 0.094 inch, HSS
-17	- - - - - -			1		RESISTOR, variable
	- - - - - -			-		mounting hardware: *(not included w/resistor)*
-18	210-0583-00			1		NUT, hex., 0.25-32 x 0.312 inch
	210-0940-00			1		WASHER, flat, 0.25 ID x 0.375 inch OD
-19	210-0046-00			1		WASHER, lock, internal, 0.261 ID x 0.40 inch OD

FIGURE 1 EXPLODED (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5	Description
1-20	670-0365-00			1		CIRCUIT BOARD ASSEMBLY—LAMPDRIVE
	- - - - - -			-		circuit board assembly includes:
	388-1705-00			1		CIRCUIT BOARD
	- - - - - -			-		mounting hardware: *(not included w/circuit board assembly)*
-21	211-0014-00			2		SCREW, 4-40 x 0.50 inch, PHS
-22	166-0025-00			2		TUBE, spacer, 0.25 inch long
-23	343-0003-00			1		CLAMP, cable, plastic, 0.25 inch diameter
	- - - - - -			-		mounting hardware: *(not included w/clamp)*
-24	212-0023-00			1		SCREW, 8-32 x 0.375 inch, PHS
-25	210-0008-00			1		WASHER, lock, internal, #8
-26	210-0863-00			1		WASHER, D shape, 0.191 ID x 0.515 inch
-27	- - - - - -			1		RESISTOR, variable
	- - - - - -			-		mounting hardware: *(not included w/resistor)*
	210-0583-00			1		NUT, hex., 0.25-32 x 0.312 inch
	210-0940-00			1		WASHER, flat, 0.25 ID x 0.375 inch OD
-28	210-0223-00			1		LUG, solder, 0.25 ID x 0.437 inch OD, SE
-29	- - - - - -			3		RESISTOR, variable
	- - - - - -			-		mounting hardware for each: *(not included w/resistor)*
-30	210-0583-00			1		NUT, hex., 0.25-32 x 0.312 inch
-31	210-0940-00			1		WASHER, flat, 0.25 ID x 0.375 inch OD
-32	210-0046-00			1		WASHER, lock, internal, 0.261 ID x 0.40 inch OD
-33	348-0261-00			1		GROMMET, plastic
-34	175-1157-01			ft		CABLE, special purpose, electrical, 6.50 feet
-35	200-0779-01			1		CABLE NIPPLE, 1.93 inches long
-36	200-0660-00			1		COVER, connector, *w/hardware*
-37	131-0975-00			1		LOCK, sliding, connector, *w/hardware*
-38	131-0422-00			1		CONNECTOR, receptacle, 37 pin
-39	432-0070-01			1		BASE, controller, w/variable resistor bracket
-40	348-0037-00			4		FOOT, rubber, 0.188 inch h, 0.50 inch diameter
	- - - - - -			-		mounting hardware for each: *(not included w/foot)*
-41	211-0097-00			1		SCREW, 4-40 x 0.312 inch, PHS
-42	334-1584-00			1		LABEL, identification

STANDARD ACCESSORIES

	070-1060-00			1		MANUAL, instruction *(not shown)*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CARTON ASSEMBLY
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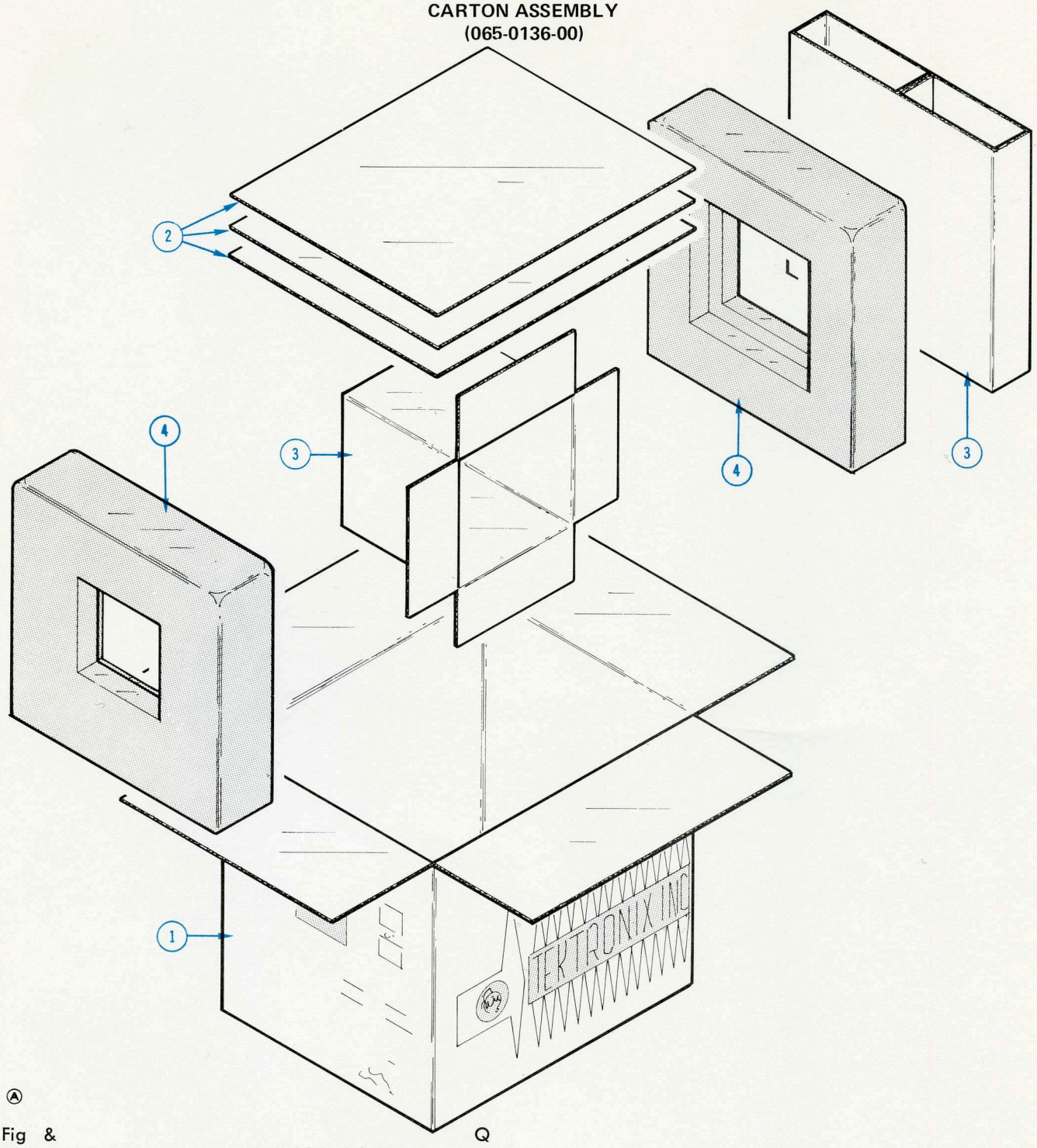

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Fig & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5	Description
2-	065-0136-00			1		CARTON ASSEMBLY for 015-0175-00 carton assembly includes:
1	004-0639-00			1		CARTON
-2	004-0539-00			1		PAD SET 3 piece
-3	004-1078-00			1		PAD SET 2 piece
-4	004-0211-00			2		END CAP plastic

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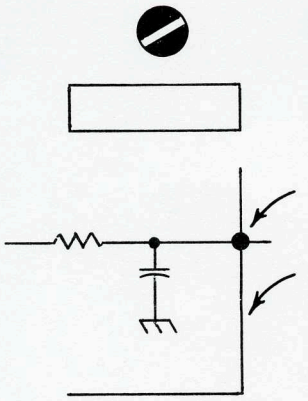
SECTION 7
DIAGRAM

The following special symbols are used on the diagrams:

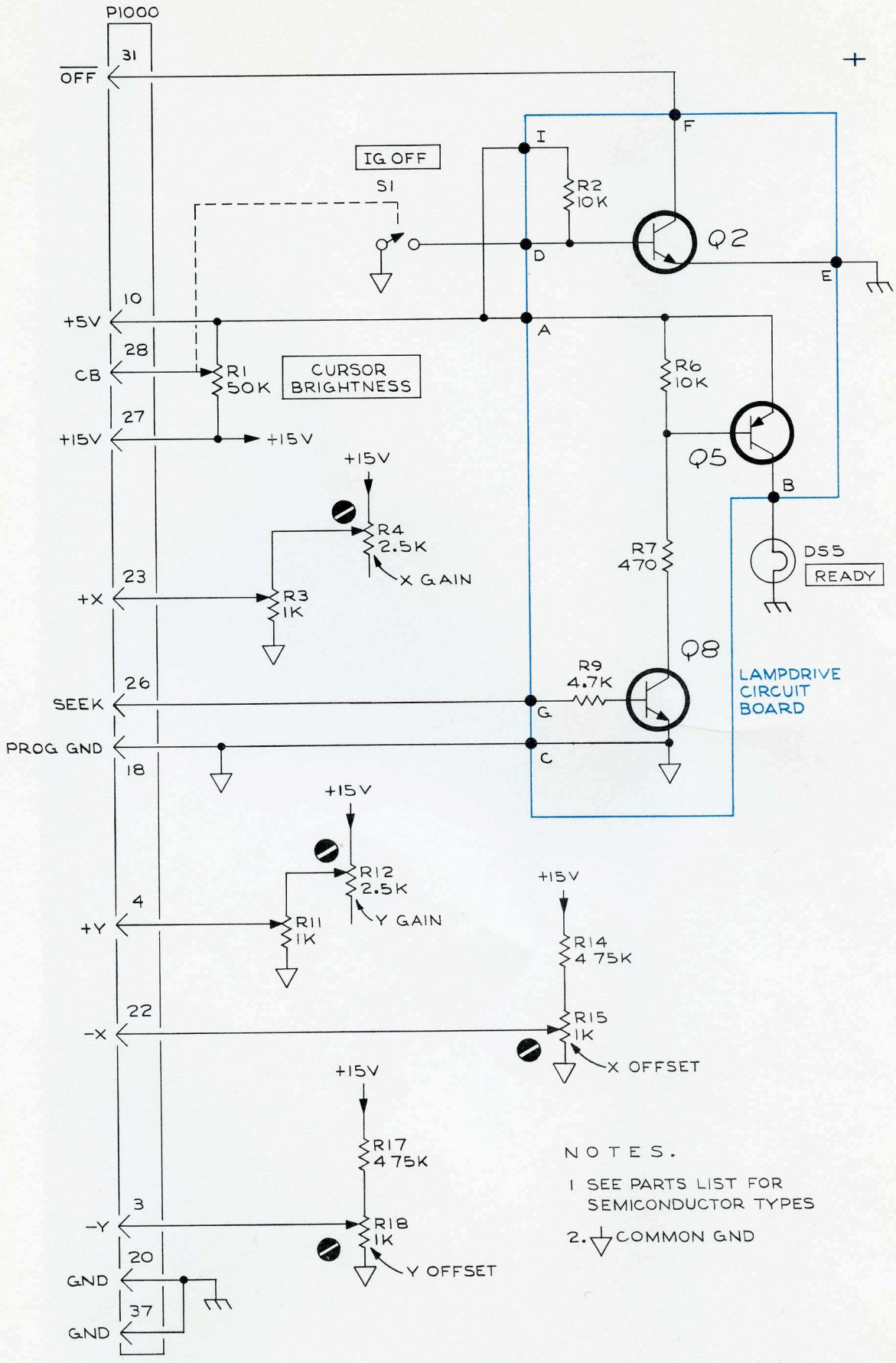


Screwdriver adjustment

Front or rear-panel control or connector

Connection soldered to circuit board

Blue-line encloses components located on circuit board



NOTES.

1 SEE PARTS LIST FOR SEMICONDUCTOR TYPES

2. ⏚ COMMON GND

015-0175-00 Ⓐ JOYSTCK