



INSTRUCTION MANUAL

30" OPTICAL COMPARATOR

2600/2800 SERIES
5600/5800 SERIES

Made in U.S.A.

2600 and 5600 SERIES 30" OPTICAL COMPARATOR

INSTRUCTION MANUAL

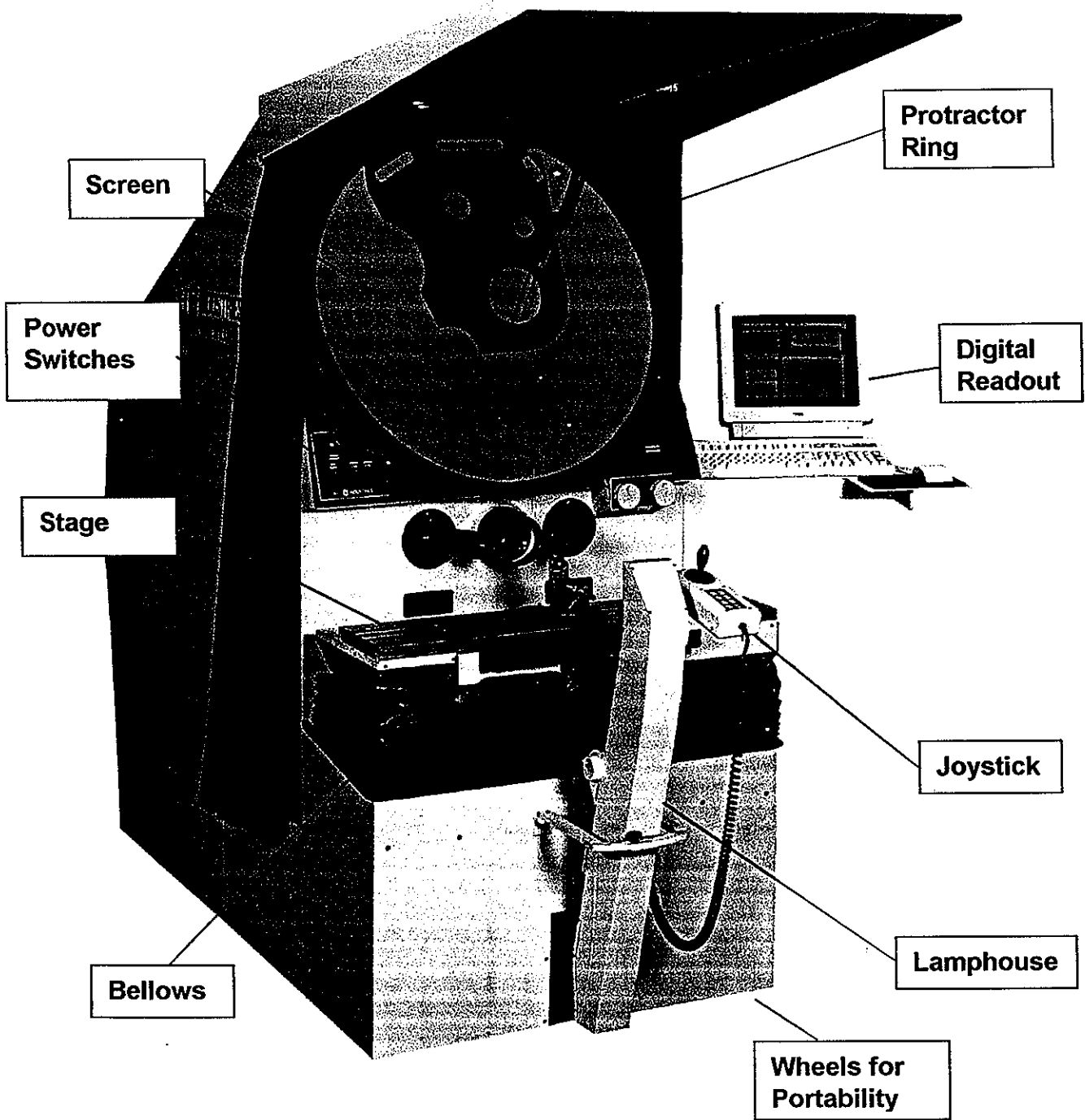
INTRODUCTION

This manual contains the instructions for the installation, operation and maintenance of the SCHERR-TUMICO 2600 and 5600 Series horizontal beam optical comparator. This also applies to the 2800 and 5800 series, which are the CNC controlled configurations.

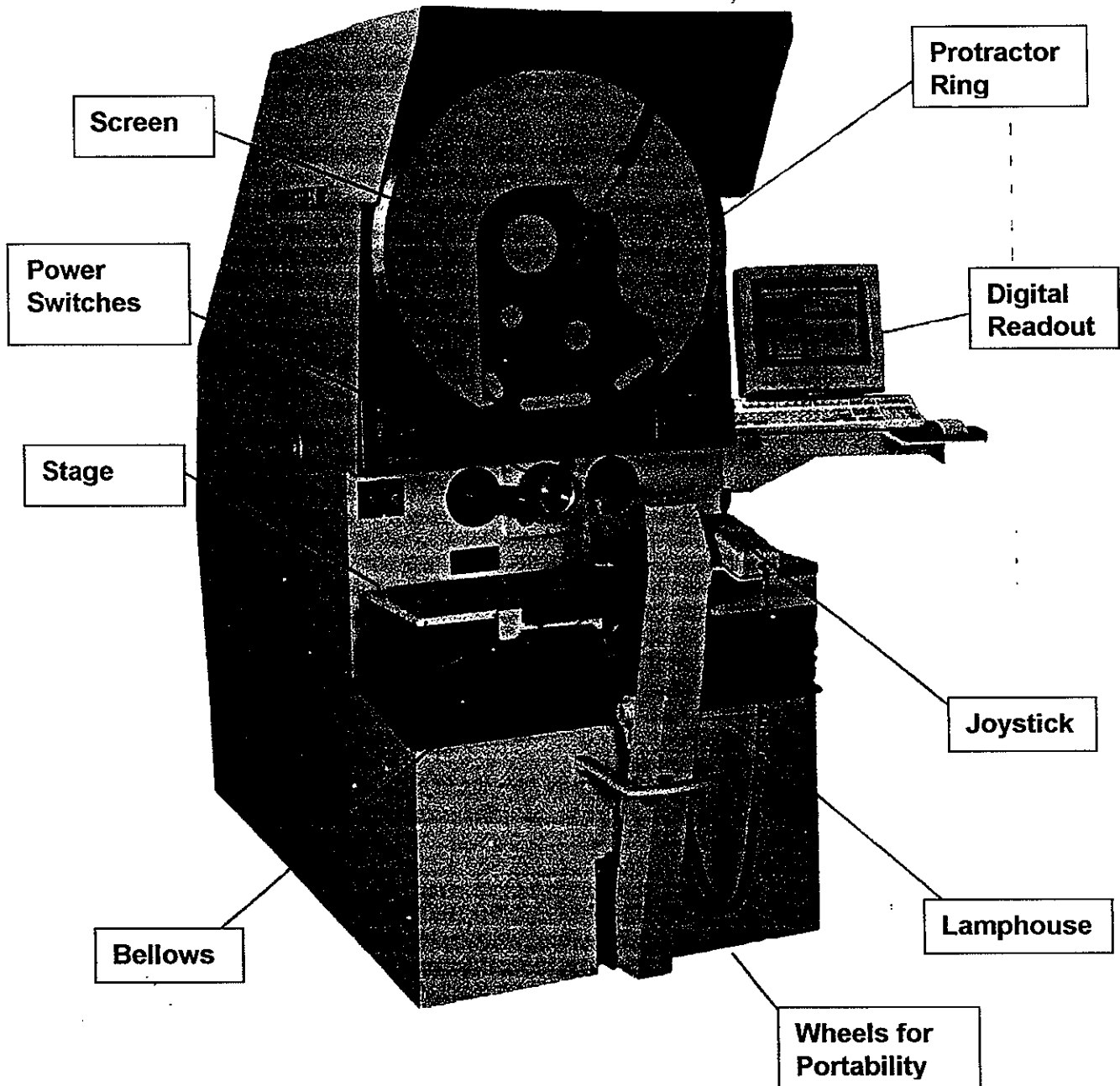
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22-2600 Series Nomenclature



22-5600 Series Nomenclature



SPECIFICATIONS (2600-2800 Series)

Machine Dimensions

Length..... 96" (2440 mm)
 Width..... 35.5" (900 mm)
 Height..... 80" (2030 mm)
 Height to Screen Center.... 59" (1500 mm)

Work Table

Length..... 35" (890 mm)
 Width..... 8" (200 mm)

Clamping Slots..... 3
 Allowable Workload..... 500 lb. (225 Kg)

Measuring Capacity (Standard)

X-axis..... 12" (300 mm)
 Y-axis..... 9" (225 mm)
 Focus..... 3" (75 mm)
 Scale Resolution......00005" (.001mm)
 Optional (20" x 7" - XY travel)

Screen Size..... 30" (760 mm)
 Image..... Inverted

Digital Protractor Resolution..... 1 min.
 .01 deg.

Magnification Lenses

5X, 10X, 20X, 25X, 31 ¼ X, 50X,
 62 ½ X, 100X

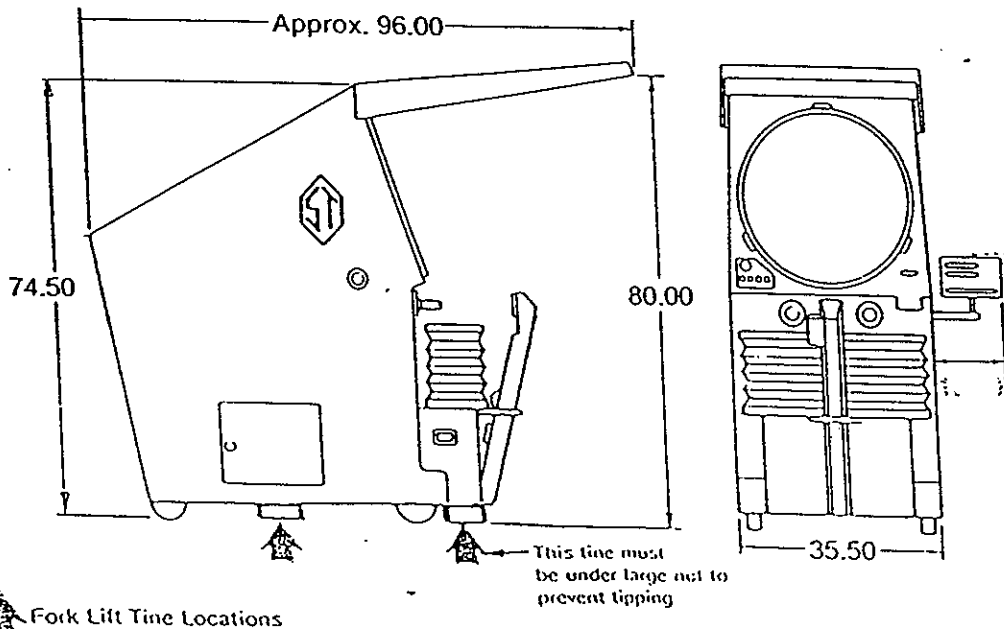
Electrical

Voltage..... 115v, 50 or 60 Hz
 Current..... 8 amps
 Lamps (Tungsten-Halogen)
 Profile Illum..... 200 watt, 24 volt
 Surface Illum..... 150 watt, 21 volt (2)

Weight

Comparator..... 1800lb. (820 Kg)
 Crated Comparator..... 2000 lb. (910 Kg)

SPECIFICATIONS



SPECIFICATIONS (5600-5800 Series)

Machine Dimensions

Length..... 88" (2235 mm)
 Width..... 35.5" (900 mm)
 Height..... 80" (2030 mm)
 Height to Screen Center.... 57" (1450 mm)

Work Table

Length..... 35" (890 mm)
 Width..... 8" (200 mm)

Clamping Slots..... 3
 Allowable Workload..... 500 lb. (225 Kg)

Measuring Capacity (Standard)

X-axis..... 12" (300 mm)
 Y-axis..... 9" (225 mm)
 Focus..... 3" (75 mm)
 Scale Resolution......00005" (.001mm)
 Optional (20" x 7" - XY travel)

Screen Size..... 30" (760 mm)
 Image.....Erect

Digital Protractor Resolution..... 1 min.
 .01 deg.

Magnification Lenses

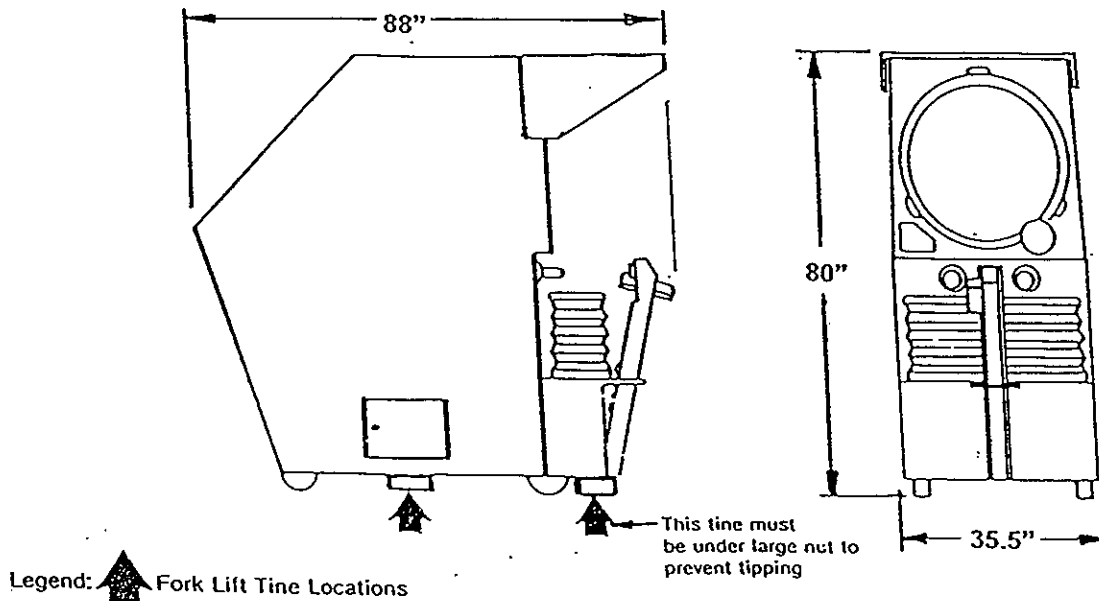
5X, 10X, 20X, 25X, 31 ¼ X, 50X,
 62 ½ X, 100X

Electrical

Voltage.....115v, 50 or 60 Hz
 Current.....8 amps
 Lamps (Tungsten-Halogen)
 Profile Illum.....200 watt, 24 volt
 Surface Illum.....150 watt, 21 volt (2)

Weight

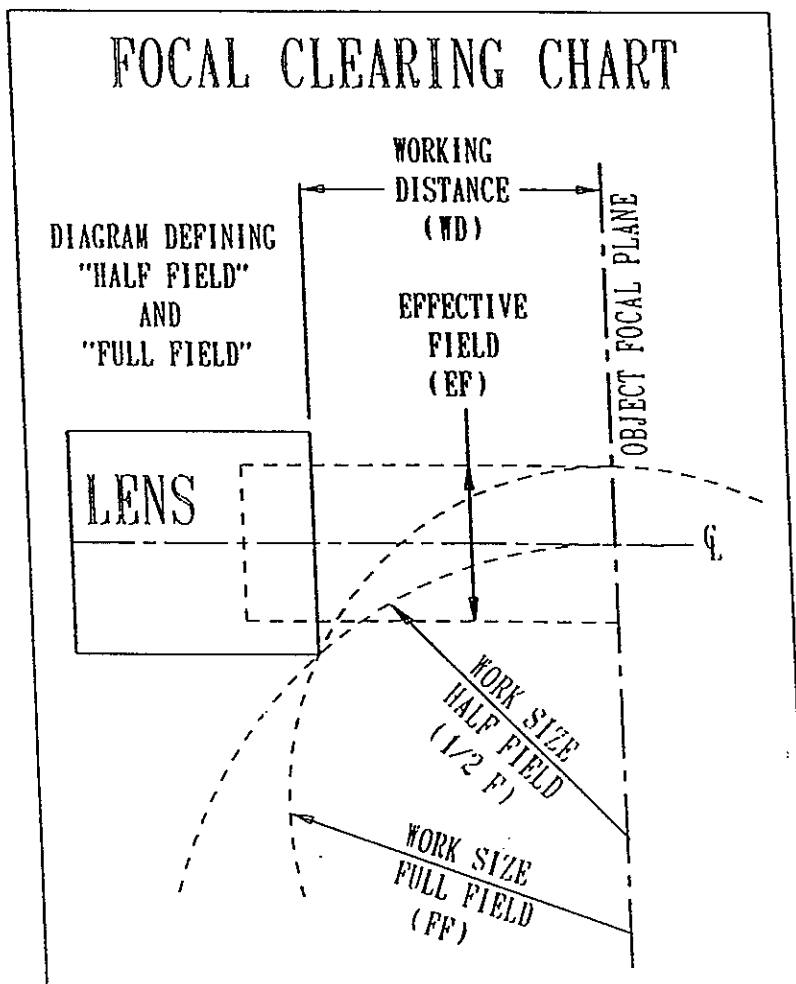
Comparator.....1800lb. (820 Kg)
 Crated Comparator..... 2000 lb. (910 Kg)



Focal Clearing Chart

30" OPTICAL COMPARATORS

MAG.	WD	EF	DIA 1/2F	DIA FF
5X	4.8" (122mm)	6.0" (152mm)	10.1" (256mm)	9.9" (251mm)
10X	6.5" (165mm)	3.0" (76mm)	20.3" (516mm)	15.5" (394mm)
20X	4.4" (112mm)	1.5" (38mm)	15.4" (391mm)	13.5" (343mm)
31.25X	3.2" (81mm)	1.0" (25mm)	10.0" (254mm)	7.9" (201mm)
50X	2.4" (61mm)	0.6" (15mm)	8.0" (203mm)	6.3" (160mm)
62.5X	2.1" (53mm)	0.5" (13mm)	6.4" (163mm)	5.3" (135mm)
100X	1.8" (46mm)	0.3" (8mm)	6.4" (163mm)	5.4" (137mm)



INSTALLATION SITE

The SCHERR-TUMICO 2600 or 5600 is a precision optical instrument and should be installed in a clean, vibration free location. Dust, oil and other contaminants may coat the lenses and mirrors and cause distortion or otherwise reduce image quality. Extremes in temperature may cause excessive expansion or contraction of the comparator and parts to be measured resulting in inaccuracy of part measurement. High humidity may result in condensation and fogging of the mirror, lenses and screen. It is recommended to install the comparator in an air-conditioned room with a lower than normal light level.

INSTALLATION

The SCHERR-TUMICO 2600 or 5600 requires setup by a trained technician upon receipt. Avoid rough handling which could cause misalignment and inaccuracy of measurement.

UNPACKING

IMPORTANT...If you have any questions about unpacking or setup, contact S-T Industries or local S-T distributor.

1. Remove wood sides from pallet. Remove any loose accessories and set aside. Remove plastic bag covering optical comparator. Unbolt brackets holding comparator on pallet.
2. Pick up comparator with a fork lift. **Be sure to lift at marked positions. (See Specification page)** While still being held by the forklift, remove wood beam from under comparator and install leveling feet (4) under base of comparator. Remove bolts from channel bracket. Place comparator on floor and back out forklift. Slide channel bracket out from under comparator. Roll comparator in to position. **Caution:** Do not push or pull comparator using the lamp-house.
3. Adjusting leveling feet until comparator is level and stable. Remove any packaging material from around stage, screen, lamphouse and mirrors.
4. Check for shipping damages. Document shortages and damages and report to S-T Industries including the Model number and Serial number.
5. Wipe down the comparator with clean dust rags. **CAUTION:** Do not use shop air hoses to blow dirt from the comparator. Flying particles can damage mirror surfaces or optics.

If equipped with optional 6-position lens changer, remove shipping straps from turret and plug in turret power cord.

Do not connect power to the comparator until setup is complete

SETUP

DRO

1. Locate arm and tray for digital readout on right side of comparator. Loosen clamps and rotate tray and arm until in desired position to support DRO. Tighten clamps to hold in position. **Do not over tighten.**
2. Locate Digital Readout. Place on tray. Unwrap cords on side of comparator and plug into digital readout. Plug cables marked X axis and Y axis into the X axis and Y axis connectors on the back of the digital readout. Plug the unmarked cable into the 'Q' axis connector on the back of the digital readout. Plug in power cord to DRO. **CAUTION:** If you have the edge detection option, be careful not to overbend small fiberoptic bundles.) Secure cables to arm with wire ties if necessary.

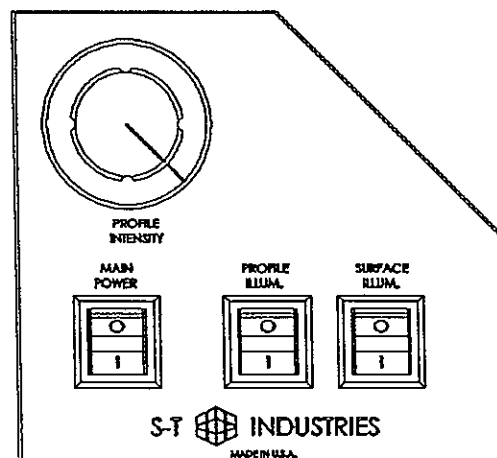
Note: If the comparator is configured with the QC 4215 DRO, there will be a different setup for the DRO tray. See section on CNC option.

STAGE SETUP

1. Remove shipping bracket from stage.
2. Locate joystick and install on joystick mount on lamphouse. Plug in connector to joystick connection in front of stage assembly.

POWER UP

Connect main power cord to power connection at the rear of the comparator and plug into outlet. Turn on main power switch. Check fan and DRO operation. Turn on profile and surface illumination and check operation.



POWER SWITCHES

There are 3 power switches located on the left side of the comparator.

1. The Main Power switch controls all power to the lamps, fans and digital readout.
2. The Profile Illumination switch controls power to the profile lamp.
3. The Surface Illumination switch controls power to the surface illumination lamps.

There is also a potentiometer to control the profile illumination intensity.

Note: The fans will operate when the main power switch is turned on.

PROFILE AND SURFACE ILLUMINATION

Profile and surface illumination each have their own light sources and respective ON-OFF switches.

The profile illuminator projects a light beam past a part on the stage, creating an accurately magnified image of the part profile on the screen when focused. This allows precise measurements of the features of a part either by comparison to a chart or by positional measurement using a digital readout. There are 2 controls on the right side of the lamphouse. One rotates a green filter into the beam of light. This softens the light to reduce eyestrain and also helps to reduce halo effect. The other control is a telecentric stop. This helps to sharpen fuzzy edges.

The surface illuminator projects light through two telescoping tubes onto the front surface of a part. The reflection can be seen on the screen and the image can be measured using the comparison or positional method. To adjust each illumination tube, push or pull the telescoping illumination tubes and swivel right or left to obtain desired illumination.

MAGNIFICATION LENSES

There are several optional lens magnifications available with the ST 2600 or 5600 optical comparator.

22-2508-00	5X Magnification	22-2501-00	10X Magnification
22-2502-00	20X Magnification	22-2505-00	31 ¼ X Magnification
22-2504-00	50X Magnification	22-2505-00	31 ¼ X Magnification
	22-2507-00	100X Magnification	

See the focal clearing chart for specifications on each lens.

LENS INSTALLATION

Each lens has a magnification number engraved on it. A 10X indicates that the screen image will be magnified 10 times larger than actual size, etc.

To mount a lens, loosen the two lens holding clamps on the lens mounting plate and rotate clamps off the lens flange. Insert the new lens so the flange seats completely. Rotate the spring clamps onto the edge of the lens flange and tighten the clamps. For a lens changer, advance the changer until the appropriate lens holder is in position and install lens as described above. Install weights in unused turret positions.

Mounting a 5X lens system requires some additional steps:

1. Special surface illumination tubes are included which accommodate the large lens diameter.
2. Mount the 5X lens as described above.
3. A special condenser lens is included. This condenser lens spreads the light out to fill the large lens opening. The flange of the condenser lens fits into the hole of the existing condenser lens and a bracket hooks over the top of the lamphouse to support the weight. Tighten the thumbscrews on the bracket until the condenser lens is secure and the light beam is centered on the magnification lens.

Note: If this optical comparator is equipped with a lens changer, you can mount the 5X lens in any position. However, do not operate lens changer with the 5X lens installed. Damage will occur to the lens or the lens changer. Remove the lens before advancing the lens changer.

Caution: Care must be taken to avoid running the stage or parts mounted on the stage into the lens. Damage to the lens may occur.

STAGE OPERATION

JOYSTICK CONTROL (Standard configuration)

The X and Y axes are driven by DC motors and controlled with a 2 axis joystick. (See Nomenclature Figure) The joystick is mounted to the right side of the lamphouse. It can be easily removed and handheld if desired. To move the screen image, deflect the joystick in the desired direction. The more the joystick is deflected, the faster the image will move.

There are 2 toggle switches on the end of the joystick base:

1. The left switch changes the speed range. Down is high or full speed range. Up is low or jog speed range. Pressing and holding the top button of the joystick, when the low speed range is selected, will temporarily switch the speed range to high. The speed range will revert

back to low when the button is released. The top button has no effect if the high speed range is selected.

The low speed range is from 0-5% of maximum speed. The high speed range is from 0-50% and then jumps to 100%. High speed range is used for fast movement to an area of interest or when using edge detection. The Low speed range is selected when precise positioning is desired. Use the top button, if necessary, to quickly get close to target position. Then, use low speed range to creep up to target. Release joystick gradually while approaching target. Then, release completely as target is reached.

2. The right switch enables or disables the stage motion. When the switch is down or in the Off position, the joystick will not cause the stage to move. When the switch is up or in the On position, the stage will operate normally.

This switch is used to prevent accidental movement of the stage.

LIMIT SWITCHES

There are limit switches to prevent over travel on all motorized axes. Plus, there are limit switches to provide protection from damaging the optics in the event of a lens collision. A switch directly behind the top plate will stop the UP travel of the stage if it contacts the lens. Also, there is a switch in the lens mount that will stop the UP travel of the stage if the lens is lifted off the switch. (This switch is not available with the lens changer option.) The lens is held in place with spring clamps that will allow the lens to flex slightly during a collision and trigger the limit switch.

FOCUS

The focus is manually controlled by the focus knob located below and left of the stage. The focus travel is approximately 3 inches (75mm).

HELIX MEASUREMENTS

Helix profile measurements can be made by use of the swinging lamphouse. The helix indicator or protractor is located on the front of the lamphouse.

To use, loosen the protractor clamp screw and rotate the lamphouse until the protractor reads the correct helix angle or until the screen image is sharp.

Telecentric Stop

The telecentric stop lever, located on the right side of the lamphouse, controls the light from the profile lamphouse with an adjustable iris. It is used to improve the sharpness of screen images of parts with thick sections or walls. To use, focus an object with the telecentric stop in the open position. Then, slide the lever towards the closed position until the clarity of the features is acceptable. This works best with lower magnifications due to the loss of light.

Green Filter

The green filter control knob is located on the right side of the profile lamphouse, next to the telecentric stop. It is used to improve the quality of an image profile by reducing the ghost effect seen around some parts. The green filter is employed by rotating the knob, until an even green color is seen on the screen. The green color also is used to soften the image to reduce eyestrain.

OPTIONS

Fiber Optic Edge Detection Option

This option provides a fast, accurate means of measuring by sensing the edge of an image when it passes by a fiber optic probe on the optical comparator screen. In this way, X-Y coordinates can be automatically entered into geometric functions (Points, Circles, Lines, etc.). This is available with the QuadraChek 200 and 4000 series digital readouts. See catalog of price list for ordering information.

This option includes a swing-away arm, which holds the fiber optic sensor on the screen. It can be moved out of the way when not in use.

Swing-Away Lamphouse Option

To accommodate long parts which must be measured straight on rather than along their length, the 2600 or 5600 is available with a swing-away lamphouse option. Loosen the protractor clamp screw and remove it. Swing the lamphouse to the right. Remove the joystick from the lamphouse, if necessary. It will be necessary to clamp the part firmly in a vise, V-block or other suitable fixture and to use surface illumination in order to make accurate measurements. When finished, return the lamphouse to its normal position, and replace the clamp screw.

6-Position Lens Changer Option

An optional 6-position lens changer stores up to 6 magnification lenses on an internal turret. A lens select switch is located on the left side of the comparator below the power switches. Rotate the switch to the desired magnification. The current lens will be pulled inside the comparator. The turret will rotate to the selected lens which will be pushed out and locked into position. The lenses vary in length and need clearance from the stage and fixtures when exiting or entering the work area to protect the optics. For this reason, there is an interlock circuit that requires the stage to be at a safe distance below the lens opening before the lens changer will operate. A light will illuminate next to the lens select knob until the stage is lowered to a safe position. When the safe position is reached, the light will shut off and the lens changer will begin operating.

CNC Control Option (2800 or 5800 Series)

The CNC control option provides automatic measurement by driving the part to be measured to preprogrammed positions and taking points either by fiber optic edge detection or by manually targeting the edge of the part with the crosshair. The CNC control option is available with the QuadraChek 4000 series digital readout. Consult your QuadraChek manual or contact your S-T representative for more information. See catalog of price list for ordering information. If this comparator is configured with the QC4215 PC digital readout (CNC or non-CNC), there will be a large, monitor and keyboard tray, which will be installed on the right side of the comparator. In addition, there is a CPU bay, which will hang on the lower right of the comparator, which will house the CPU section of the computer.

JOYSTICK CONTROL (CNC configuration)

The X and Y axes are driven by DC servo motors and controlled with a 2 axis joystick. The joystick is mounted to the right side of the lamphouse. It can be easily removed and handheld if desired. To move the screen image, deflect the joystick in the desired direction. The more the joystick is deflected, the faster the image will move. There are 3 buttons on the joystick; one on top of the joystick handle and 2 on the base. The top button and the left base button are wired together so only 2 functions can be controlled by these buttons. These buttons are programmable in the QC4000 CNC digital readout, but are typically set as follows: the top button & left button – Done Measurement & front base button – Enter Point.

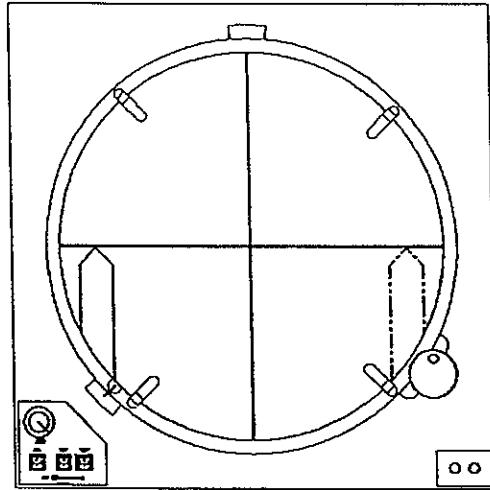
JOG WHEELS (CNC configuration)

In addition to the joystick, there are individual jog wheels for precise control of the X and Y axis. These are located just to the lower right of the screen. By rotating these wheels, the stage can be very accurately positioned. The joystick will override the jog wheels if you attempt to use the jog wheels and the joystick at the same time.

IMPORTANT - The operation of the joystick and jog wheels has been programmed into the QC4000 at the factory. Consult the factory before making any changes.

PROTRACTOR SCREEN OPERATION

The screen is rotated by turning the screen control knob located at the lower right of the screen. The screen can be locked in place using the screen lock located just above the screen control knob. Angle readings are viewed on the digital readout. Consult DRO manual for operation.



Absolute Zero Setting

The following procedure may be necessary if the glass screen is replaced:

1. Rotate the screen so the horizontal line is approximately level.
2. Focus a pointer on the screen with its tip on the left end of the horizontal screen line.
3. Move the stage (X axis only) so the image of the point is on the right end of the screen.
4. Observe the space between the tip of the pointer and the horizontal screen line.
5. Move the stage so the tip moves closer to the line by one half of the observed space.
6. Rotate the screen so the horizontal line is on the tip of the pointer.
7. Move the stage so the image of the point is on the left edge of the screen.
8. Repeat steps 3-7, alternating sides, until the tip remains on the horizontal line.
9. Loosen the reference marker on the lower left of the ring and align with zero reference line on the roller housing cover.

Consult digital readout manual for establishing Zero set point.

ANGULAR MEASUREMENTS (WITH DIGITAL SCREEN PROTRACTOR)

Consult Digital Readout manual for information on Digital Protractor operation

Incremental Method

1. Secure part to stage.
2. Focus image and position as required.
3. Align a screen reference line with an edge or feature, which is a datum. Zero the incremental 'Q' or ANGLE axis display on DRO.
4. Rotate screen reference line to feature to be measured, align by moving stage if necessary and read angle on incremental 'Q' axis display.

Absolute Method

1. Focus image and position as required.
2. Align datum on part with reference line on screen. Secure part to stage.
3. Rotate screen reference line to feature to be measured, align by moving stage if necessary and read angle on absolute 'Q' axis display.

Note: Some digital readouts do not have an incremental reference for the protractor.

MEASURING TECHNIQUES

The optical comparator has 2 basic measuring means. Direct Optical Comparison and Measured Linear Displacement.

If necessary, secure parts to stage top. Do not attempt to get accurate measurements unless parts are stable. S-T Industries offers several standard stage fixtures and builds special fixtures for unusual parts according to customer specifications. Contact S-T Industries sales department for information.

Direct Optical Comparison

Precise measurements can be made by comparing accurately magnified images to scaled drawings or shapes superimposed or overlaid on the image. Irregular contours, angles, radii, tapers, etc., together with high quantity measurements get compared best by use with master charts.

Three ways of chart preparation

1. To-scale part or feature drawings. Hand or CAD produced drawings on Mylar to a scale matching the lens magnification. Be sure lines are thin; .005"-.010" for best comparison accuracy.
2. Hand traced master. Focus a part or feature on the screen at the desired magnification. Use the chart clips or tape to secure a sheet of Mylar or drafting film to the surface of the glass screen. Using a fine point lead pencil, trace the profile. Care must be taken not to rotate the screen or move the part while tracing. Protect pencil lines by spraying a thin coat of a clear fixative.
3. Custom and standard overlay charts. S-T Industries, Inc. can supply precision overlay charts made to order as well as a full line of standard charts.

Charts can be held in place using the chart clips attached to the glass screen.

Measured Linear Displacement

The standard measuring stage allows accurate linear measurements in 2 axis, X and Y. The X axis travel is 12" (300 mm) and the Y axis travel is 9" (225 mm). The stage is equipped with .00005"/.001mm resolution glass scale encoders and one of several available digital readouts.

Procedure

1. Secure the part to the stage and focus area to be measured.
2. Be sure that screen is set at 0° and align first edge to be measured with either the vertical or horizontal screen line.
3. Zero the appropriate axis on the digital readout.
4. Move the stage until the second edge to be measured aligns with the same screen line.
5. Read the linear measurement in the digital readout.

This method can be greatly enhanced with the use of QuadraChek Geometric Digital Readouts.

The X and Y display value or coordinate is used to directly calculate geometric features such as points, lines, circles, distances and angles. Also, fiberoptic edge detection and CNC control add speed, accuracy and reliability to these measurements.

DIGITAL READOUT SYSTEMS

The 2600 or 5600 series 30" optical comparator comes with several optional digital readout systems. The following are typical catalog numbers:

#22-2600-01 30" optical comparator with standard digital readout system. S-T's model 20-7000 DRO features X, Y and angle axis. Also includes INCH/MM, INC/ABS and PRINT features.

#22-2600-02 30" optical comparator with QuadraChek 221 geometric digital readout system. DRO has all standard features plus geometric calculations including point, line, circle, distance, angle and skew and programmability.

#22-2600-03 30" optical comparator with QuadraChek 221E geometric digital readout system. DRO has all features of above system plus fiber optic edge detection.

#22-2600-05 30" optical comparator with QuadraChek 4215 computerized geometric digital readout system. DRO has all features of above system and includes PC computer with latest WINDOWS^R based QC 4215 software. Includes graphic representation of part features, mouse controlled commands, CAD-like graphical user interface and unlimited programmability.

#22-2800-01 CNC 30" optical comparator with QuadraChek 4215 computerized geometric digital readout system. DRO has all features of above system and includes CNC control package for automatic measurement.

CALIBRATION

Protractor

Zeroing Protractor (Set 0°)

1. Rotate the protractor ring until the zero pointer is aligned with the zero reference line.
2. Focus the end of any vertical line on the 74-0500-00 calibration plate or other sharp object at the center of the screen so that the image is just touching the horizontal screen line.
3. Move the image along the X axis line to the edge of the screen. If the image point is not touching the line, rotate the screen until the line touches the point.
4. Move the image along the X axis screen line to the other side of the screen. If the image point is not touching the line, repeat steps 2-4. When the image stays on the line, adjust the zero pointer until it lines up with the reference line. Zero the protractor angle display.

Calibrate Digital Protractor

1. Focus the image of the 74-0500-00 calibration plate crosshair at the center of the screen. Align the horizontal crossline of the screen with the horizontal line of the crosshair image.
2. Rotate the protractor to measure the 90 degree angle formed by the crosshair on the calibration plate.

MAGNIFICATION

The screen magnification can be calibrated by using S-T Industries' 74-0413-00 Master Ball Checker and 74-0330-00 20" magnification scale.

1. Locate appropriate ball for lens to be checked. (Scale is marked with diameters and magnifications)
2. Focus ball in center of screen.
3. Using magnification scale, check size of image left to right and top to bottom. If the image does not split the lines of the magnification scale, use the measuring stage to determine the error.
4. Record the results and move the image to the three o'clock position of the screen. Repeat the check.
5. Move to the remaining three positions of the screen (six, nine and twelve o'clock) and repeat check for all. (The diagonal corners may also be used.)

NOTE: It may be determined that the mirror is correct and that a lens needs adjustment.

For assistance in these procedures, contact S-T Industries, Inc. or your local S-T distributor.

MEASURING STAGE

Linear Accuracy

The measuring stage linear accuracy can be calibrated by using the 74-0500-00 stage calibration plate. Use the highest magnification lens available.

X-Axis

1. With the stage in extreme right or left position, place the calibration plate on the stage so the longer side is parallel with the X axis and the pins are up against the forward edge of the dovetail.
2. Focus on the 6" or 150mm scale.
3. Be sure that the screen is set to 0°.
4. Move the calibration plate until the end mark of the calibration scale is aligned with the vertical screen crosshair. Move the stage back and forth as necessary to finalize the alignment.
5. Zero the X axis display and move to the next increment on the scale (1.0" or 10mm). Record the value and repeat for each increment. In order to calibrate travel beyond 6" (150mm), it will be necessary to reposition the plate. Carefully, slide the calibration plate without moving the stage until the end mark that was at zero is aligned at with the vertical screen line.
6. Continue measuring to end of travel.

Y-Axis

1. For the Y axis, turn the plate on its short edge and use the 6" or 150mm scale. Focus on the desired scale.
2. Be sure that the screen is set to 0°.
3. Move the stage up or down and align the end mark or maximum reachable major increment of the calibration scale with the horizontal screen crosshair.
4. Zero the Y axis display and move to the next increment on the scale (1.0" or 10mm). Record the value and repeat for each increment. Note: The full range of Y axis travel will not be covered because the scale does not start at the edge of the plate.

Stage Squareness

The measuring stage squareness can be calibrated by using 74-0500-00 calibration plate. Use the highest magnification lens available.

1. Place the calibration plate on the stage so the longer side is parallel with the X axis.
2. Focus on the large crosshair in the center of the plate.
3. Be sure that the screen is set to 0°.
4. Move the stage back and forth to see that the horizontal line stays on the crosshair. Adjust the calibration plate if necessary.
5. Move the stage until the end of the vertical line of the crosshair is aligned with the screen crosshair.
6. Zero the X and Y axis displays on the DRO.
7. Move the stage in the Y direction only until you reach the end of the line. If the line has moved away from the crosshair in the X direction, move the stage until it lines up again.
8. The squareness is the deviation of the X axis divided by the length of travel along the Y axis.

MAINTENANCE

Care and cleaning of the Optical System

External Lens Cleaning

Lenses should always be stored when not in use. Dropping or bumping the lens may not crack the glass, but may cause the lens to shift in its mount, resulting in a change of the image size. If a lens is suspected of being out of size, follow the procedure of lens calibration or contact your S-T representative.

1. Remove all dust from external glass surfaces. Use a clean, soft brush (preferably a lens brush sold in camera stores) or clean cotton to avoid scratching. Turn the cotton each stroke to keep wiped dust particles from the lens.
2. With the dust removed use a mild glass cleaner and clean absorbent cotton to clean the lens surface.

CAUTION

Never immerse a lens system in any cleaning solution. Moisten the cotton with the glass cleaner slightly; not soaking wet. Do not disassemble a lens system to adjust or clean internal glass surfaces. Assembly and calibration of these systems requires special alignment equipment and procedures. Notify your S-T representative if you have a lens problem.

Mirror Cleaning

Open right side door to access mirrors. Unhook light shield springs and fold out of the way. Be careful not allow springs to contact mirrors.

Remove dust from mirror with a soft brush or clean cotton, as described previously. If necessary, use a clean cotton cloth and a mild glass cleaner for more thorough cleaning. Wipe gently in straight line motion across the mirror surface, turning the cotton with each pass across the mirror. Due to the delicate nature of the mirror coating, try to keep mirror cleaning to a minimum.

Mirror Adjustment

Do not adjust the bottom mirror unless absolutely necessary. This has been preset at the factory and should not require adjustment.

The adjustment screws for the upper mirror are located on the top rear of the comparator. To adjust the upper mirror, first remove the screw locks that prevent movement of the adjustment

screws during shipment or moving. A large screwdriver is necessary. (Be sure the screwdriver is large enough to fill the slot of the adjustment screw, but not so wide that the internal threads will be damaged.) When looking from the rear of the machine, the adjustment screws form a square corner. The bottom screw will tip the mirror top to bottom; the left screw will tip the mirror side to side. The center screw is only used when the entire mirror must be moved in or out and then it will be used in conjunction with the other two screws.

Projection Screen

Clean the projection screen with glass cleaner or isopropanol. Use a clean, soft cloth. Do not use paper towels as they may contain abrasives. Use a gentle wiping motion. Do not scrub. For very dirty conditions, wet screen several times using a clean cloth each time.

Screen Replacement and Adjustment

If the projection screen needs to be replaced or removed, follow the following procedure:

1. Remove all chart clips from ring.
2. Remove 2 glass clamps and Zero degree pointer from ring.
3. Use 1/16" hex wrench and loosen at least 3 set screws on the edge of the ring to allow glass to become free.
4. Rotate ring so finger hole is at 1 o'clock position. Tip glass out from top and remove.
5. To replace, set bottom edge of glass screen in bottom of ring and gently push top in, removing finger via finger hole. Replace chart clips, glass clamps and Zero degree pointer.
6. Align mounting hole for Zero degree pointer directly across from Zero reference mark on lower left roller housing.
7. Use a square or stage calibration plate to project a sharp straight edge on the screen. Bring the image of the straight edge to the screen crosshair. Using your fingertips, carefully rotate the glass screen in the ring until the line on the screen is parallel with the straight edge.
8. Use 1/16" hex wrench and tighten the set screws on the edge of the ring until the space between the ring and the glass is approximately even and the glass is held firmly. Tighten glass clamps and zero degree pointer.
9. Now, align the screen line and the straight edge exactly. Zero the protractor counter and rotate the ring 180 degrees. If the screen line deviates from the focused edge, move the image 1/2 of the space towards the line. Then, by adjusting the edge set screws, move the screen until the line is exactly on the straight edge.
10. Rotate the screen 90 degrees and repeat step #9.
11. When finished with these adjustments, rotate the ring 360 degrees, stopping every 90 degrees. The crosshair should stay on the straight edge at each position. If not, repeat the above procedure and make very small adjustments.
12. Follow procedure on Absolute zero setting. See section on Protractor Screen Operation.

Fuse Protection

Several fuses and circuit breakers protect all electrical circuits. These protection devices are located in the electrical tray and the motor control board or the servo amplifier power supply. All of the fuses are slow-acting or time-delay type. Turn off the optical comparator and disconnect the power cord before replacing fuses.

The electrical tray, accessed through the left side door of the comparator, contains the main 10 Amp fuse, a 3 Amp lens changer fuse (optional accessory) and a ¼ Amp ring counter fuse. The ¼ Amp fuse has no function on the 2600 or 5600 series optical comparator. (This electrical tray is used on earlier models, which require the fuse). The caps on these fuses will illuminate when the fuse has blown. (Turn off the optical comparator and disconnect the power cord before replacing fuses). Unscrew cap to remove blown fuse. Replace fuse with same fuse type. Replace cap.

The standard motor control (2600 or 5600 series) contains three, 5 Amp fuses for the motor power sections and one, ½ Amp fuse for the computer power supply. These fuses can be accessed in fuse holders located on the circuit board. The motor control circuit board is located directly above the electrical tray inside the left door of the comparator. (Turn off the optical comparator and disconnect the power cord before replacing fuses). Remove screws holding motor control housing in a vertical position and lay the housing down on its front on the electrical tray. Remove the cover (4 screws) to gain access to the motor control board. Change blown fuses with same fuse type. Replace cover and motor control into original position.

The servo amplifier power supply (2800 or 5800 series) contains one, 4 Amp fuse and can be accessed in a fuse holder between the servo amplifier cards and the power supply transformer. The servo amplifier power supply is located inside the right side door on the base of the comparator. (Turn off the optical comparator and disconnect the power cord before replacing fuses). Change blown fuse with same fuse type.

Cooling Fans

Check cooling fans at least monthly to be sure they are operating properly. Clean out any buildup of grease and residue. Lamp life will be decreased significantly if the fans are not operating or operating efficiently. Do not use compressed air to clean the fans because the residue may be blown onto the lamp or optics.

Lamp Replacement

When a lamp fails, wait 5 minutes before replacing to allow fans to cool off lamp area. After this time turn off main power and disconnect main power cord.

Profile Lamp (Part No. 48-8088-00)

1. Remove cover of profile lamphouse.
3. Carefully, lift ejector lever and slide burned lamp from the socket. Be careful, the lamp may still be hot.
4. Install a new lamp into the socket using a clean cloth or gloves to keep from touching the lamp. Push lamp down against ejector lever to seat in the socket.
5. Check cooling fan on front of lamphouse and clean if necessary.
6. Replace power cord and check lamp operation.

Surface Illumination Lamp (Part No. 48-8086-00)

1. To access the lamps, remove left or right illuminator (for lamp to be changed).
2. Carefully, lift ejector lever and slide burned lamp from the socket. Be careful, the lamp may still be hot.
3. Install a new lamp into the socket using a clean cloth or gloves to keep from touching the lamp. Push lamp down against ejector lever to seat in the socket.
4. Check the cooling fan on the side of the comparator; clean if necessary.
5. Replace illuminator.
6. Reconnect power cord and check lamp.

Lubrication

Lubricate V-ways and ball bearings of measuring stage and vertical (Y-axis) ballscrew with light oil occasionally, to prevent corrosion and keep motion smooth. Use a light grease, preferably with Teflon[®], to lubricate horizontal (X-axis) and focus leadscrews. Occasionally, wipe a rust preventative on the top plate to prevent corrosion.

Parts Identification

Compare the part numbers on sub-assembly and part illustrations with their respective parts lists to identify parts.

Parts Ordering

1. Furnish the comparator model and serial number
2. State the part number, description and quantity of each part required.
3. State shipping instructions.

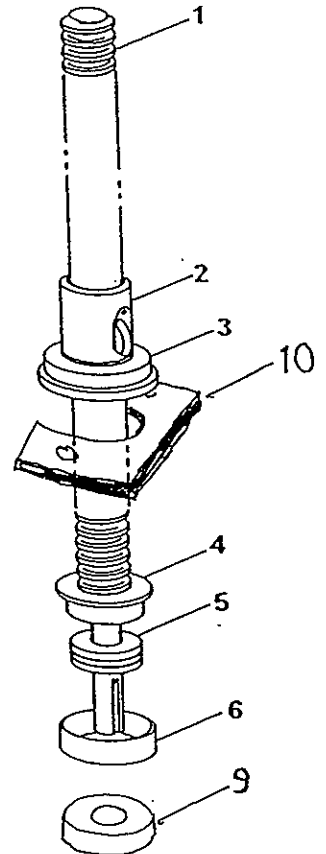
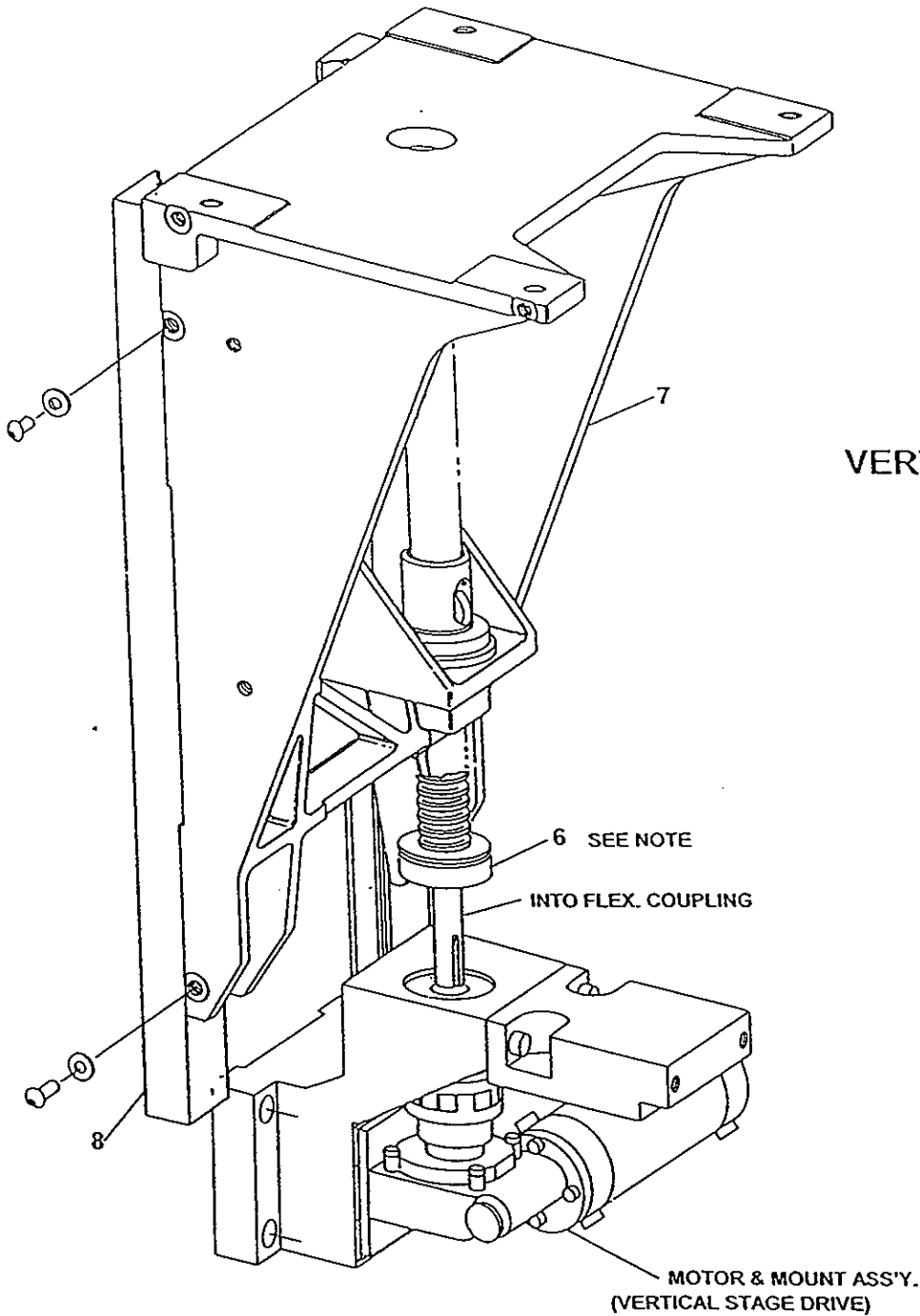
STAGE ASS'Y :

22-0468-00 STANDARD

22-3728-07 CNC

VERTICAL DRIVE SCREW ASS'Y

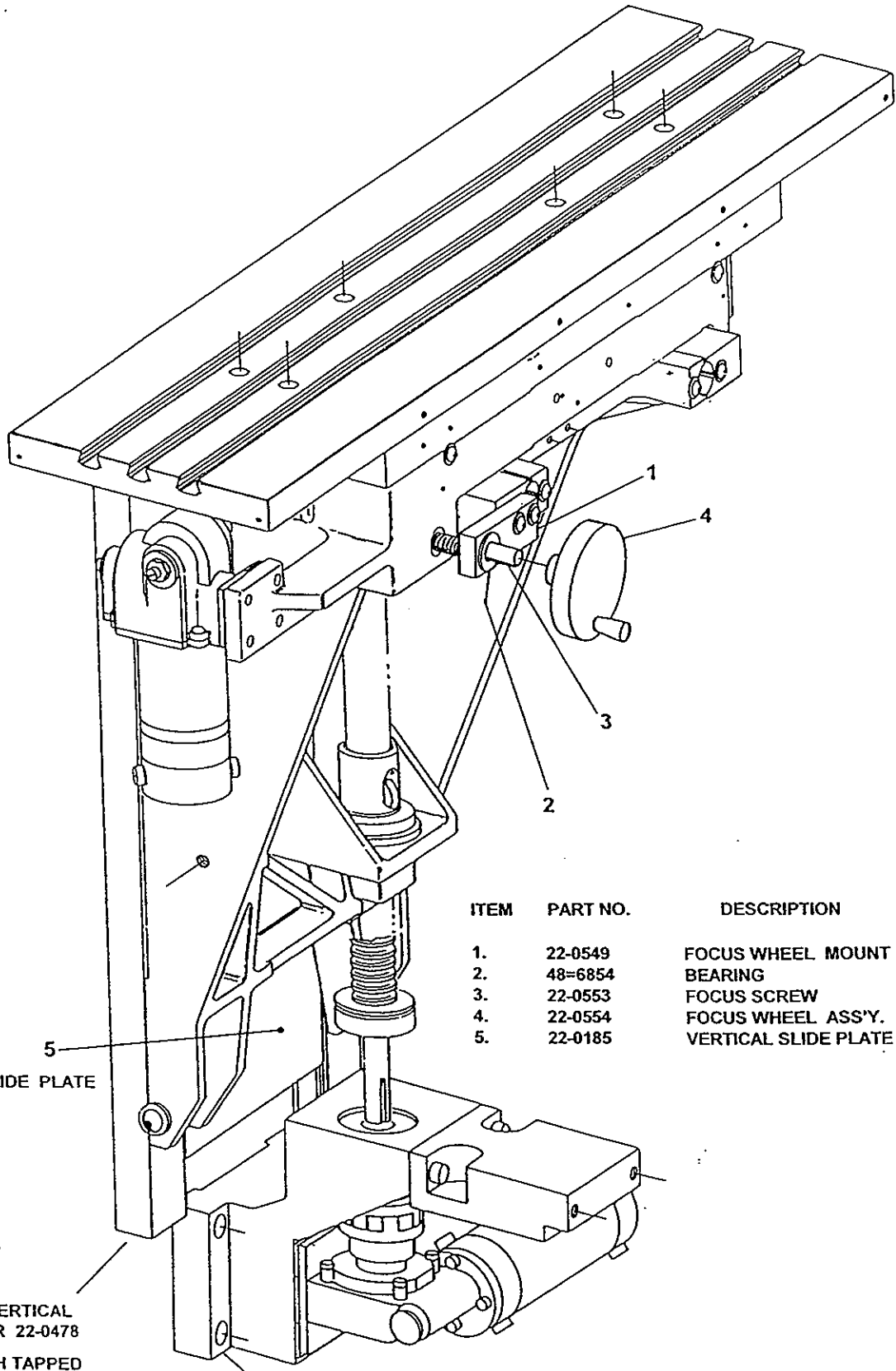
22-3728-07 ITEMS 1 THRU 6



ITEM	PART NO.	DESCRIPTION	QTY.
1.	22 0460 00	Vertical Drive Screw (Std.)	1
1.	22 3728 09	Vertical Drive Screw (CNC)	1
2.	48 6015 00	Ball Nut (Std.)	1
2.	48 7736 00	Ball Nut (CNC)	1
3.	22 0546 00	Collar	1
4.	22 0760 00	Flange Bushing	1
5.	48 6049 00	Thrust Bearing	1
6.	22 0759 00	Bushing	1
7.	22 1880 00	Stage Upright	1
8.	22 0200 00	Vertical Gib (pair)	1
9.	22 3974 00	Spacer	1
10.	22 3973 00	Ball Nut Plate	1

NOTE: KEEP THRUST BEARING LUBRICATED WITH WATER PUMP GREASE.

STAGE ASS'Y. - CNC 30" COMPARATOR



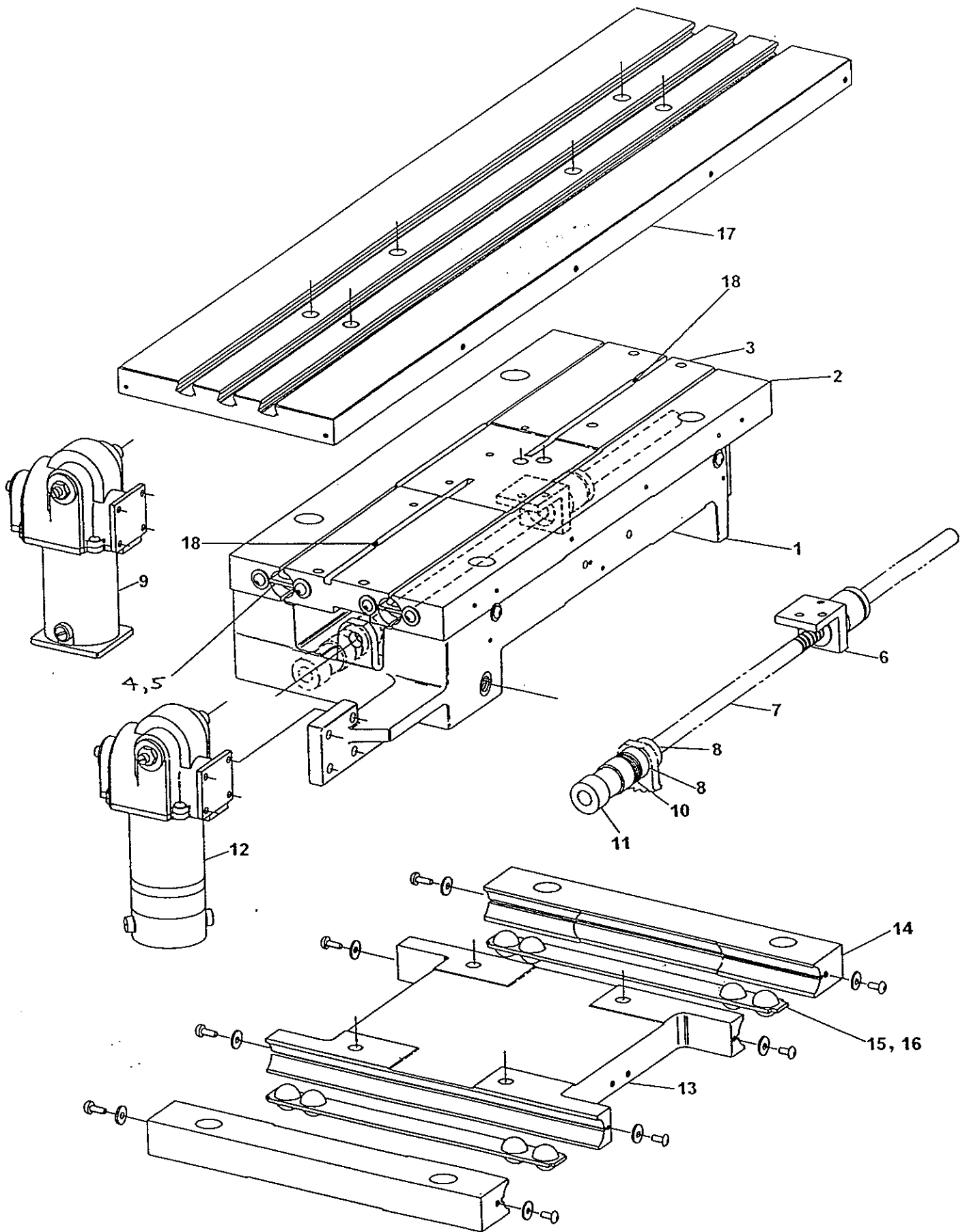
ITEM	PART NO.	DESCRIPTION	QTY.
1.	22-0549	FOCUS WHEEL MOUNT	1
2.	48-6854	BEARING	1
3.	22-0553	FOCUS SCREW	1
4.	22-0554	FOCUS WHEEL ASS'Y.	1
5.	22-0185	VERTICAL SLIDE PLATE	1

5
VERTICAL SLIDE PLATE

NOT SHOWN - VERTICAL
BALL RETAINER 22-0478
ASSEMBLE WITH TAPPED
HOLE AT BOTTOM

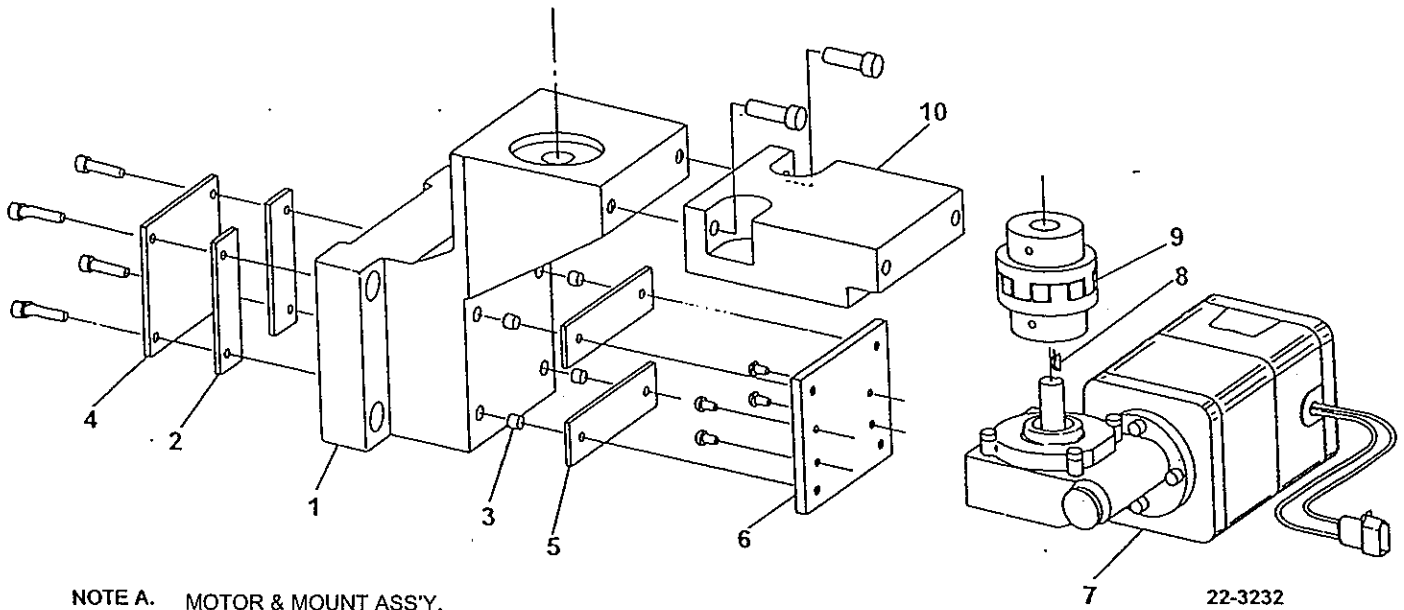
FASTENS TO MAIN FRAME CASTING

X-AXIS AND FOCUS STAGE PARTS



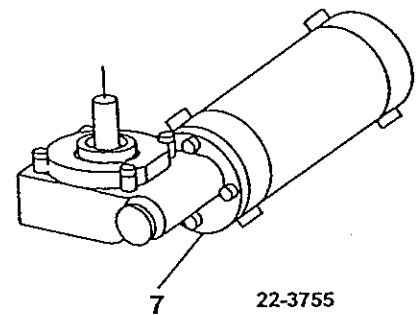
MOTOR AND MOUNT ASS'Y.

(VERTICAL STAGE DRIVE)



NOTE A. MOTOR & MOUNT ASS'Y.
(VERTICAL STAGE DRIVE)
22-3245-00 STD.
22-3728-06 CNC

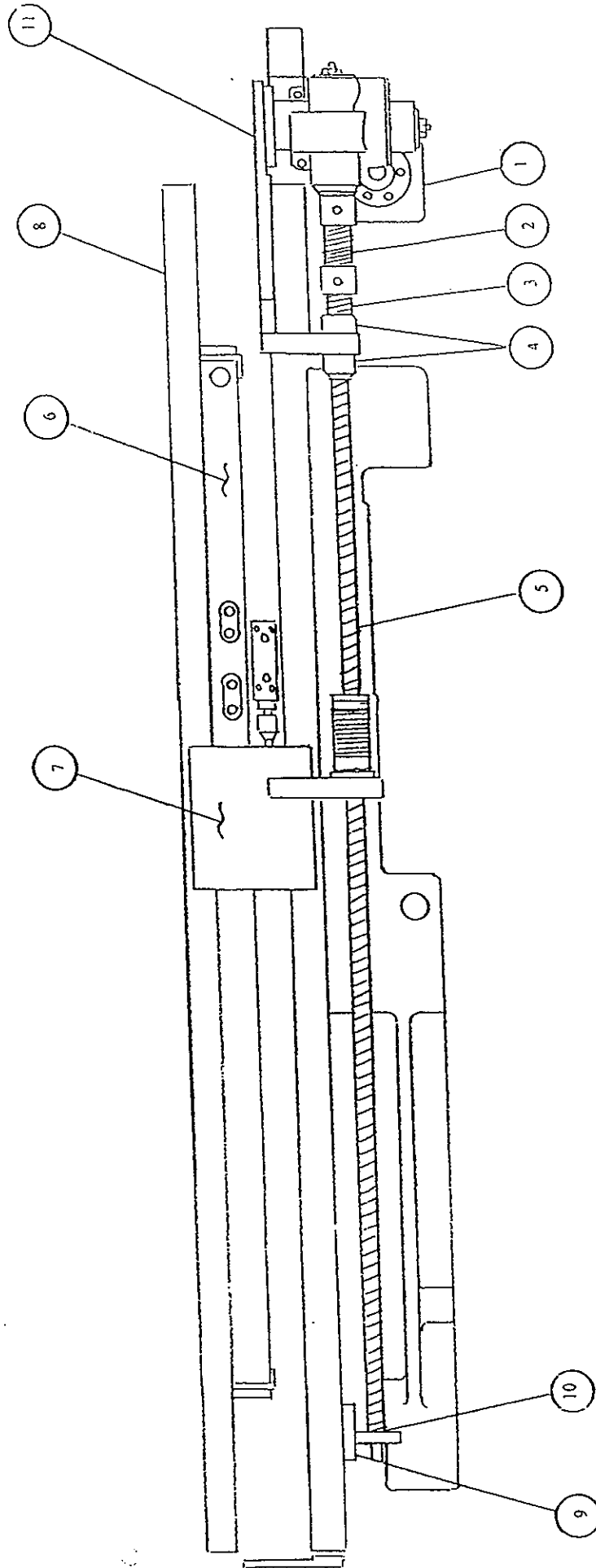
ITEM	PART NO.	DESCRIPTION	QTY.
1.	22-0178-00	MOTOR MOUNT	1
2.	22-1593-00	RUBBER PAD	2
3.	22-1594-00	BUSHING	4
4.	22-1592-00	BACKPLATE	1
5.	22-1591-00	MOTOR PAD	2
6.	22-3244-00	MOTOR PLATE	1
7.	SEE NOTE 'A'		
	22-3232-00	MOTOR (STD.)	1
	48-7358-00	MOTOR BRUSH (STD.)	2
	22-3755-00	MOTOR (CNC)	1
	48-8038-00	MOTOR BRUSH (CNC)	2
8.	22-3285-00	KEY	1
9.	22-3243-00	COUPLING	1
10.	22-1783-00	EXTENSION BLOCK	1
	22-3245-00	MOTOR/MOUNT ASSY. STD.	
	22-3728-06	MOTOR/MOUNT ASSY. CNC	



X-AXIS AND FOCUS STAGE PARTS

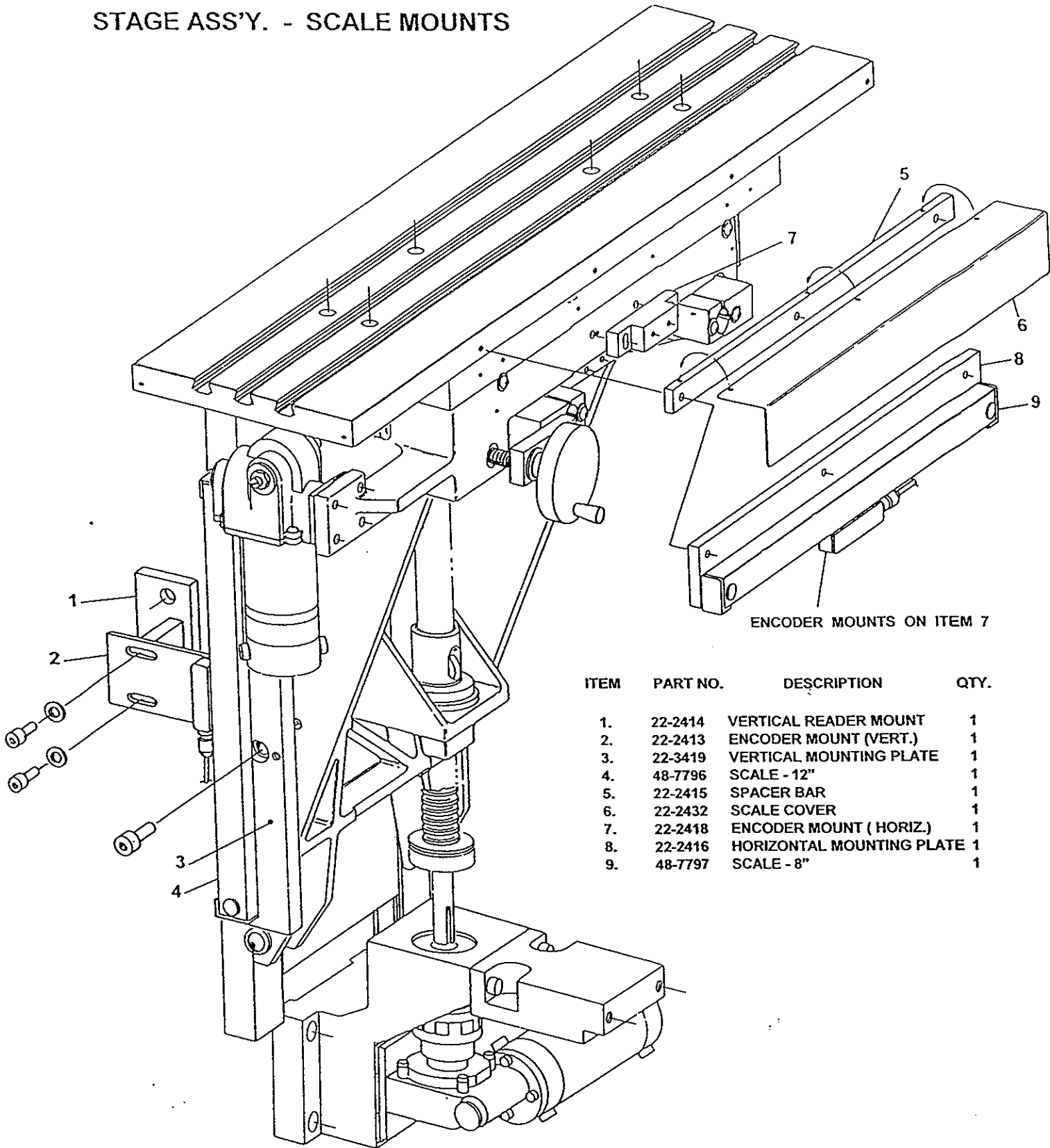
ITEM	PART NO.	DESCRIPTION	QTY.
1.	22-0929-00	FOCUS MOUNT AND BUSHING ASS'Y.	1
2.	22-1749-00	GIB - MATCHED PAIR	1 PR.
3.	22-0201-00	SLIDE PLATE X-AXIS	1
4.	22-0477-00	BALL GUIDE X-AXIS	2
5.	48-5990-00	BALL BEARING	8
6.	22-0476-00	LEAD SCREW MOUNT X-AXIS	1
7.	22-3756-00	X-AXIS DRIVE SCREW ASS'Y.	1
8.	48-5478-00	BEARING	2
9.	22-3556-00	MOTOR ASS'Y (STD.)	1
	48-8112-00	MOTOR BRUSH (STD.)	2
10.	48-6261-00	SPRING	1
11.	48-5987-00	FLEXIBLE COUPLING	1
12.	22-3754-00	MOTOR ASS'Y CNC	1
	48-8038-00	MOTOR BRUSH (CNC)	2
13.	22-0184-00	FOCUS SLIDE PLATE	1
14.	22-0188-00	FOCUS GIB - MATCHED PAIR	1 PR.
15.	22-0479-00	BALL RETAINER	2
16.	48-5990-00	BALL BEARING	8
17.	22-4754-00	TOP PLATE	1
18.	22-0243-88	SPRING	2

20" Extended Travel Option



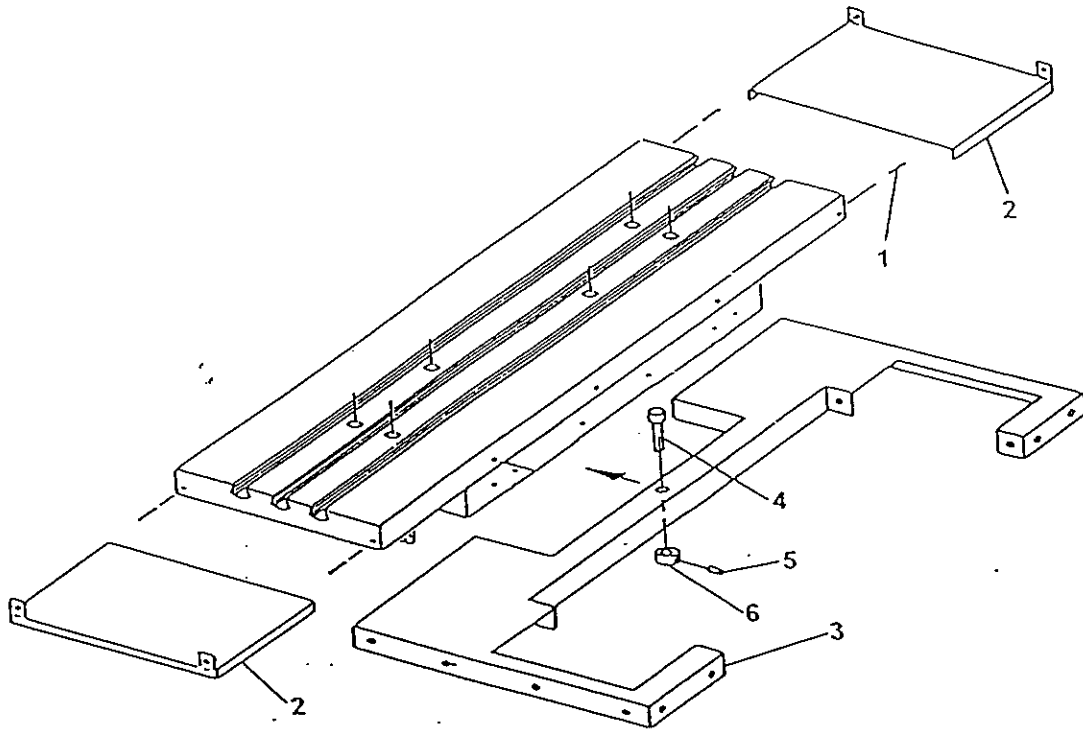
1.	22 0307 00	X-Axis Motor (Standard DC)	1
	22 3754 00	X-Axis Motor (CNC Servo)	1
2.	48 5987 00	Coupling	1
3.	48 6261 00	Spring	1
4.	48 5478 00	Thrust Bearing	1
5.	22 3828 16	X-Axis Drive Screw	1
6.	48 7990 00	X-Axis Encoder (20")	1
7.	22 3828 14	Drive Screw Mount	1
8.	22 3828 06	Top Plate (20" Option)	1
9.	22 3828 12	Drive Screw Guide	1
10.	48 7997 00	Flange Bearing	1
11.	22 3828 17	Motor Mount	1

STAGE ASS'Y. - SCALE MOUNTS

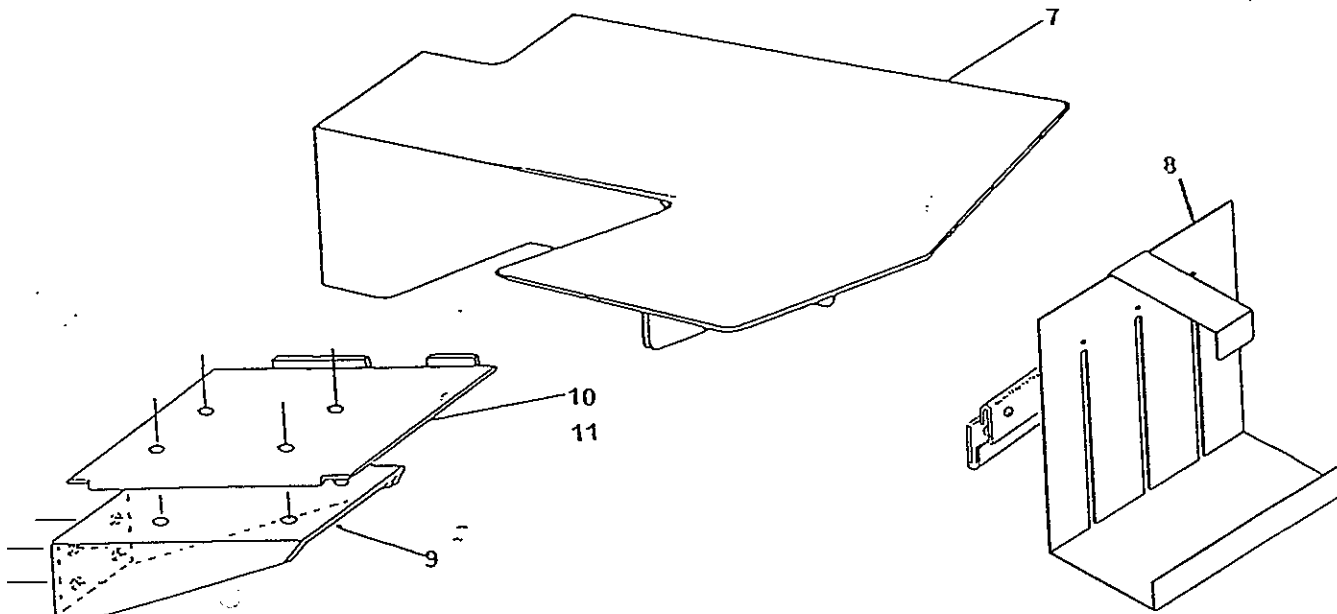


ITEM	PART NO.	DESCRIPTION	QTY.
1.	22-2414	VERTICAL READER MOUNT	1
2.	22-2413	ENCODER MOUNT (VERT.)	1
3.	22-3419	VERTICAL MOUNTING PLATE	1
4.	48-7796	SCALE - 12"	1
5.	22-2415	SPACER BAR	1
6.	22-2432	SCALE COVER	1
7.	22-2418	ENCODER MOUNT (HORIZ.)	1
8.	22-2416	HORIZONTAL MOUNTING PLATE	1
9.	48-7797	SCALE - 8"	1

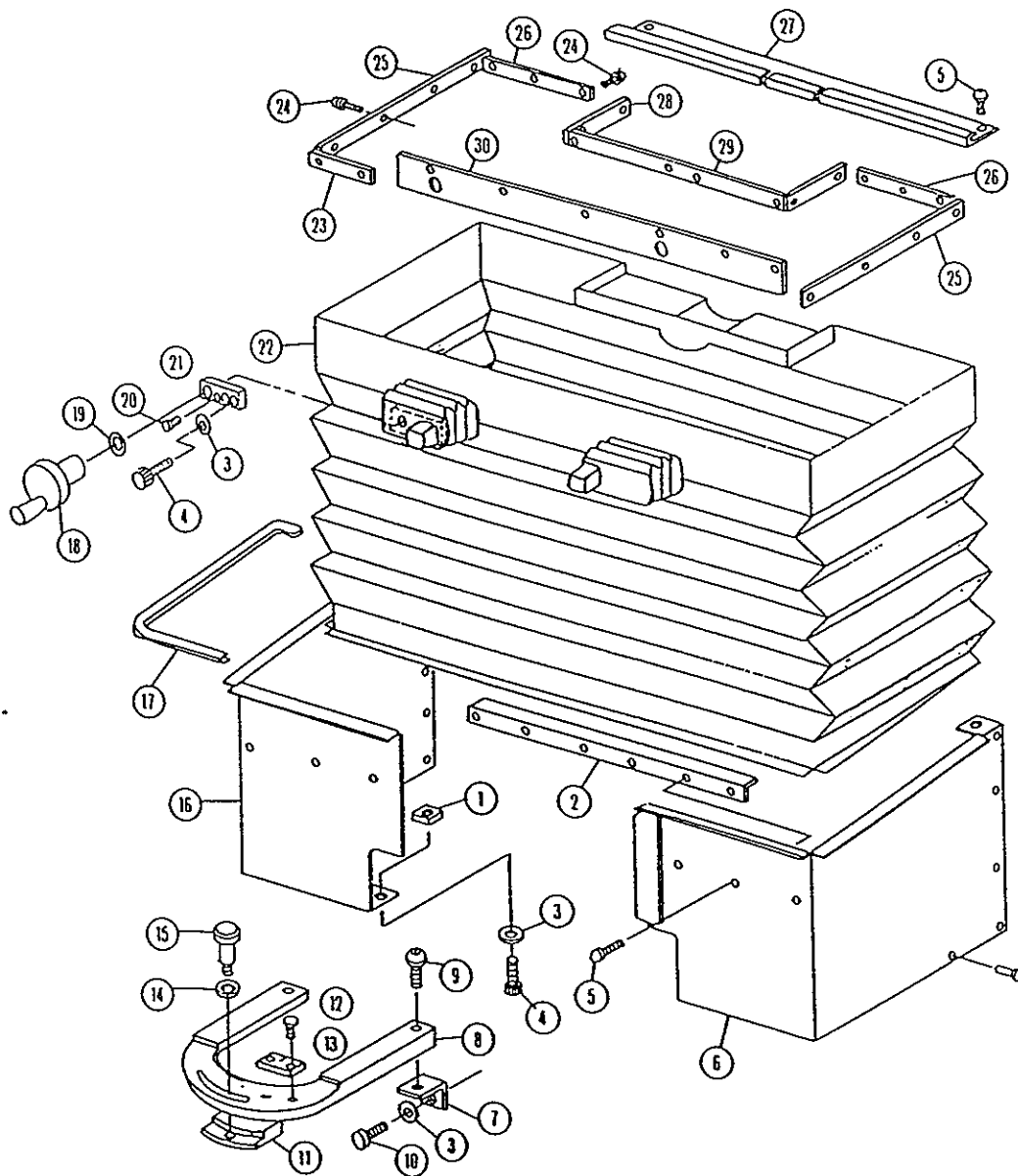
STAGE SLIDE COVERS



ITEM	PART NO.	DESCRIPTION	QTY.
1.	48-5149-00	SPRING PIN	4
2.	22-1902-00	STAGE SLIDE DUST COVER	2
3.	22-0704-00	TOP BAG FRAME ASS'Y	1
4.	22-0765-00	PIN & CAP ASS'Y	1
5.	48-5813-00	SET SCREW	1
6.	22-1280-00	COLLAR	1
7.	22-3749-01	QC 4000 TRAY (OPTIONAL)	1
8.	22-3750-00	COMPUTER BAY (OPTIONAL)	1
9.	22-3509-00	DISPLAY ARM	1
10.	22-3509-06	DRO TRAY (QC2200)	1
11.	22-3509-07	DRO TRAY (QC3200)	1



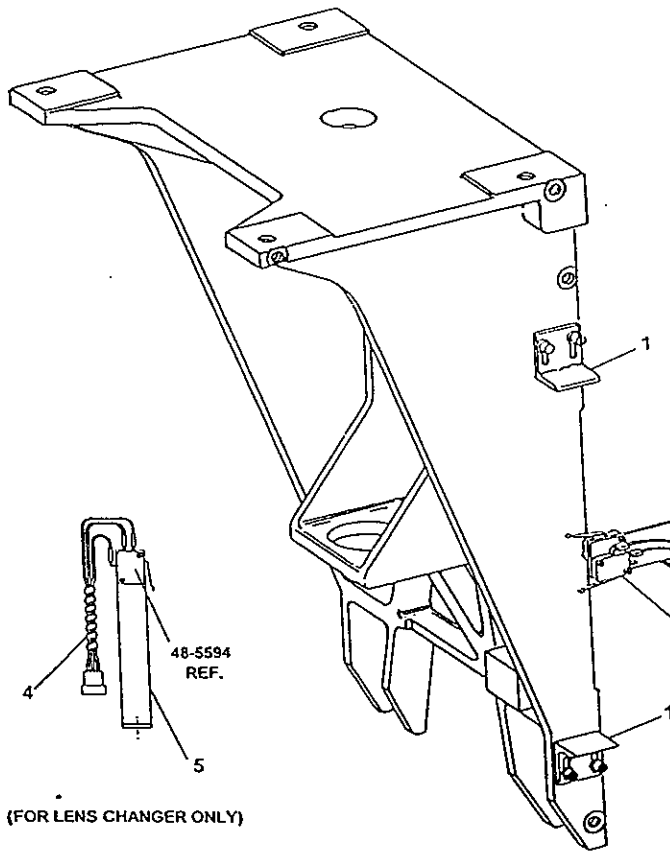
Bag Assembly



Bag Assembly

22 1907 06

1.	48 5036 00	Hex Nut 10-32	2	16.	22 1922 00	Bag Tin (Left Side)	1
2.	22 1909 00	Frame & Vernier Support	1	17.	48 5695 00	Black Edge Trim	10'
3.	48 6083 00	Washer	6	18.	22 0554 00	Focus Wheel Assembly	1
4.	48 6244 00	Socket Cap Screw 10-32 x 1"	4	19.	48 6854 00	Washer	1
5.	48 5358 00	Bu. Hd. Screw 10-32 x 3/8"	18	20.	48 6684 00	Bu. Hd. Screw 10-24 x 3/4"	1
6.	22 1905 00	Bag Tin (Right Side)	1	21.	22 0549 00	Focus Wheel Mount	1
7.	22 1908 00	Bracket, Vernier Mount	2	22.	22 1891 00	Bellows	1
8.	22 1911 00	Vernier Mount	1	23.	22 1912 00	Mounting Strip (Front Left)	1
9.	48 5275 00	Bu. Hd. Screw 10-32 x 3/4"	2	24.	48 5137 00	Bu. Hd. Screw 6-32 x 1/4"	29
10.	48 5016 00	Socket Cap Screw 10-32 x 3/4"	2	25.	22 1913 00	Mounting Strip (Sides)	2
11.	22 0722 00	Grad Degree Mount	1	26.	22 1914 00	Mounting Strip (Back)	2
12.	48 5365 00	Bu. Hd. Screw 2-56 x 3/8"	2	27.	22 1923 00	Back Bag Support	1
13.	22 0723 00	Vernier Plate	1	28.	22 1915 00	Mounting Strip (Back Inside)	1
14.	48 5032 00	Washer	1	29.	22 1916 00	Mounting Strip (Back Center)	1
15.	22 0529 00	Thumb Screw	1	30.	22 0740 00	Front Bag Strip	1



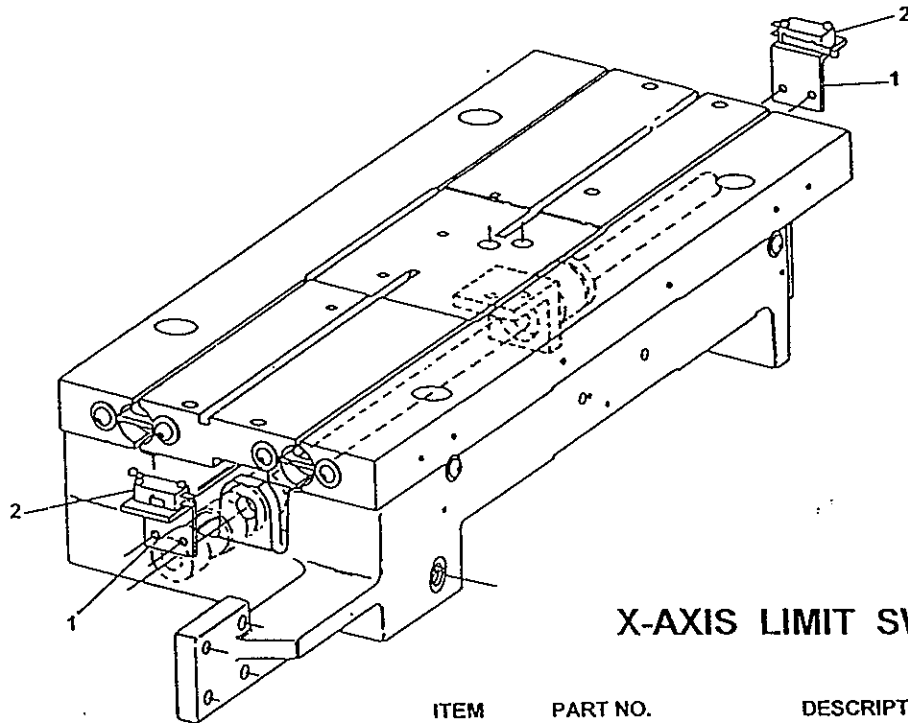
VERTICAL LIMIT STOPS

ITEM	PART NO.	DESCRIPTION	QTY.
1.	22-2232	SWITCH STOP	2
2.	22-2233	STAGE STOP	1
3.	48-5594	MICROSWITCH (SPDT)	2
4.	22-3292	STAGE LIMIT SWITCH WIRE ASS'Y.	1
5.	22-3293	STAGE STOP BRACKET	1

FASTENS TO MAIN FRAME CASTING

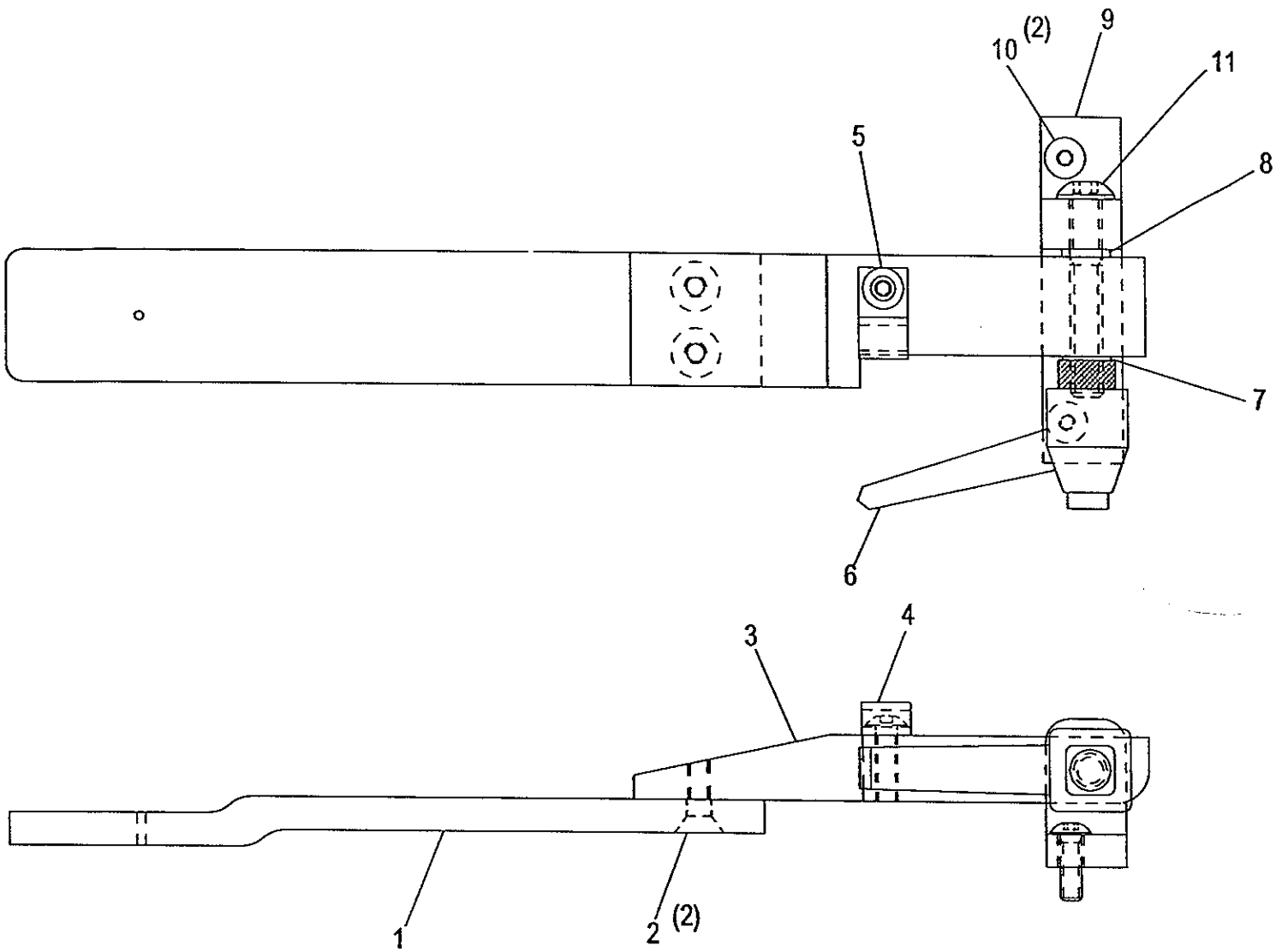
48-5594
REF.

(FOR LENS CHANGER ONLY)



X-AXIS LIMIT SWITCHES

ITEM	PART NO.	DESCRIPTION	QTY.
1.	22-0679	MICROSWITCH MOUNT	2
2.	48-5594	MICROSWITCH	2

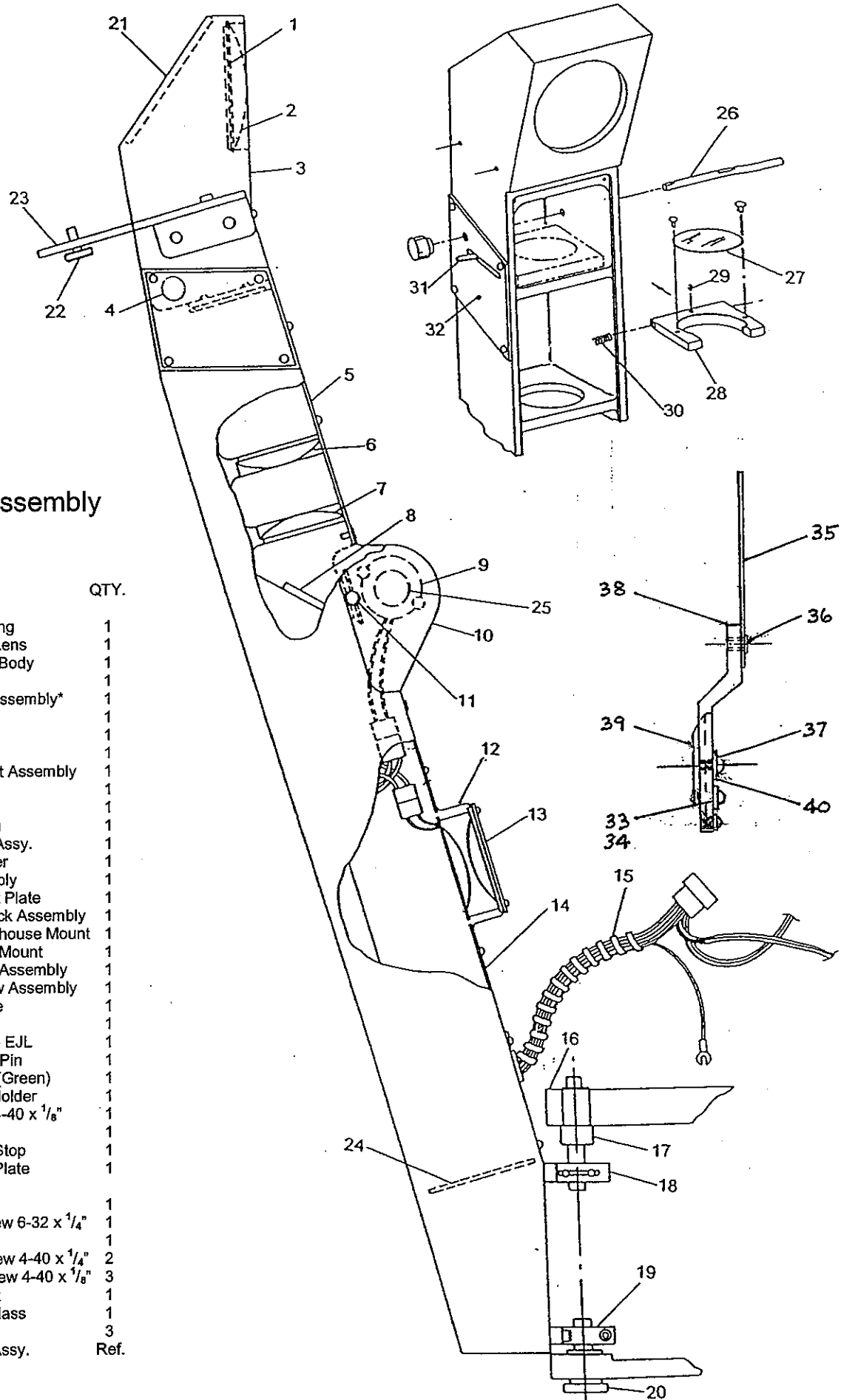


Edge Detection Arm Assembly

ITEM	PART NO.	Description	QTY.
1.	22 3747 05	Optic Mount	1
2.	48 5974 00	Screw, FHCS 8-32 x 1/2"	2
3.	22 3747 02	Swivel Arm	1
4.	48 7352 00	Clamp, Cable	1
5.	48 5438 00	Screw, BHCS 8-32 x 3/16"	1
6.	48 8299 00	Handle, Adjustable	1
7.	48 6630 00	Wave Washer	1
8.	48 6151 00	Washer, Nylon	1
9.	22 3747 11	Edge Sensor Arm Mount	1
10.	48 5126 03	Screw, BHCS 8-32 x 1/2"	1
11.	48 8147 00	Screw, BHCS 1/4-20 x 1/2"	1
12.	48 7785 00	Fiber Optic Cable	Ref
*	22 3747 10	Complete Assembly	1

LAMPHOUSE ASS'Y.

22-3204

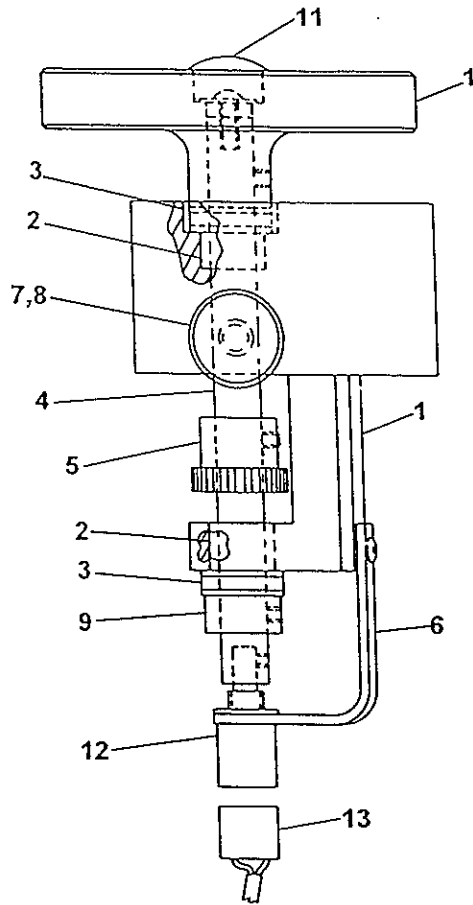


Profile Lamphouse Assembly 22 3204 00

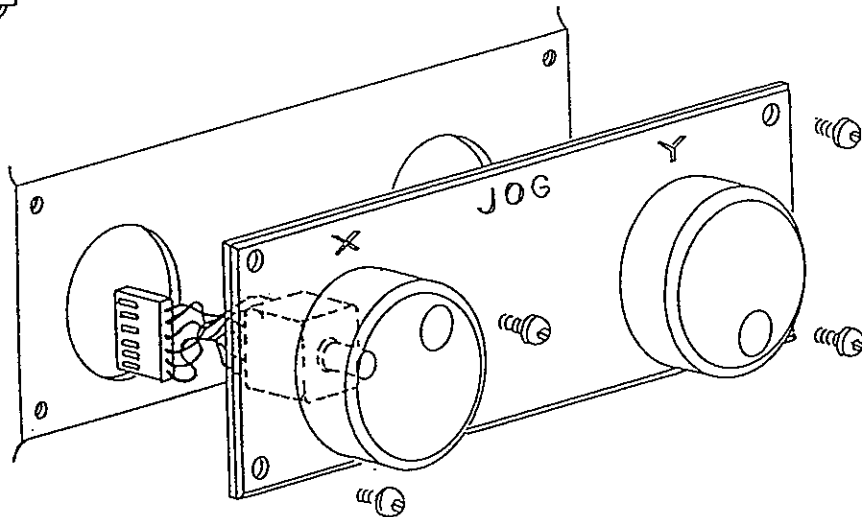
ITEM	PART NO.	Description	QTY.
1.	22 0515 00	Retaining Ring	1
2.	22 1647 00	Condenser Lens	1
3.	22 3236 01	Lamphouse Body	1
4.	48 6017 00	Knob	1
5.	22 0513 00	Top Cover Assembly*	1
6.	48 5772 00	Lens	1
7.	22 1649 00	Lens	1
8.	22 1651 00	Mirror	1
9.	22 3934 02	Lamp Socket Assembly	1
10.	22 3934 03	Lamp Cover	1
11.	22 0087 00	Lock Screw	1
12.	22 3829 00	Fan Housing	1
13.	22 0512 00	Fan & Plug Assy.	1
14.	22 0459 00	Bottom Cover	1
15.	22 3225 00	Wire Assembly	1
16.	22 0517 00	Motor Mount Plate	1
17.	22 0525 00	Pivot Pit Block Assembly	1
18.	22 0526 00	Upper Lamphouse Mount	1
19.	22 0521 00	Lamphouse Mount	1
21.	22 0499 00	Cover Plate Assembly	1
22.	22 3215 00	Cap & Screw Assembly	1
23.	22 3209 00	Control Base	1
24.	22 3829 03	Shroud	1
25.	48 8088 00	Lamp - Type EJL	1
26.	22 0668 00	Filter Mount Pin	1
27.	22 0409 00	Filter Glass (Green)	1
28.	22 0664 00	Filter Lens Holder	1
29.	48 5813 00	Set Screw 4-40 x 1/8"	1
30.	22 0669 00	Spring	1
31.	22 0719 00	Telecentric Stop	1
32.	22 3223 00	Telecentric Plate	1
33.	48 6126 00	Washer	1
34.	48 5137 00	Bu. Hd. Screw 6-32 x 1/4"	1
35.	22 0493 00	Top Cover	1
36.	48 6001 00	FHBHC Screw 4-40 x 1/4"	2
37.	48 6836 00	Pan Hd. Screw 4-40 x 1/8"	3
38.	22 0502 00	Glass Mount	1
39.	22 0398 00	Heat Abs. Glass	1
40.	48-5797-00	Washer	3
	*22 0513 00	Top Cover Assy.	Ref.

PROTRACTOR RING DRIVE ASS'Y.

22-3704-00

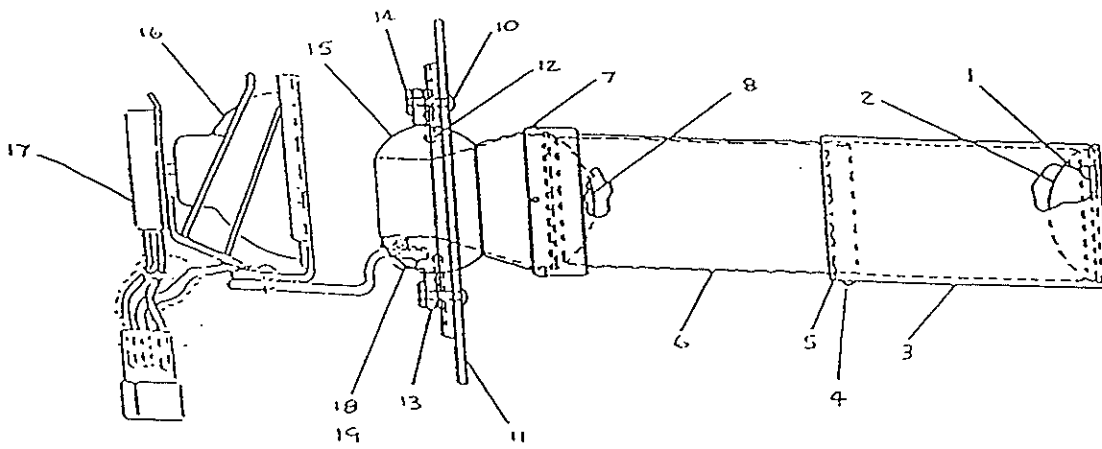


ITEM	PART NO.	DESCRIPTION	QTY.
1.	22-3704-02	MOUNT SUB ASS'Y.	1
2.	48-7710-00	NEEDLE BEARING	2
3.	48-7711-00	THRUST BEARING	2
4.	22-3704-06	SHAFT	1
5.	22-0262-00	GEAR	1
6.	22-3704-03	ENCODER MOUNT	1
7.	22-2107-18	THUMB SCREW	1
8.	22-3704-07	LOCK PIN	1
9.	48-5378-00	SET SCREW COLLAR	1
10.	22-3704-01	HANDWHEEL	1
11.	48-7019-04	HOLE COVER	1
12.	48-7692-00	ENCODER	1
13.	22-3723-03	ENCODER CABLE ASS'Y.	1

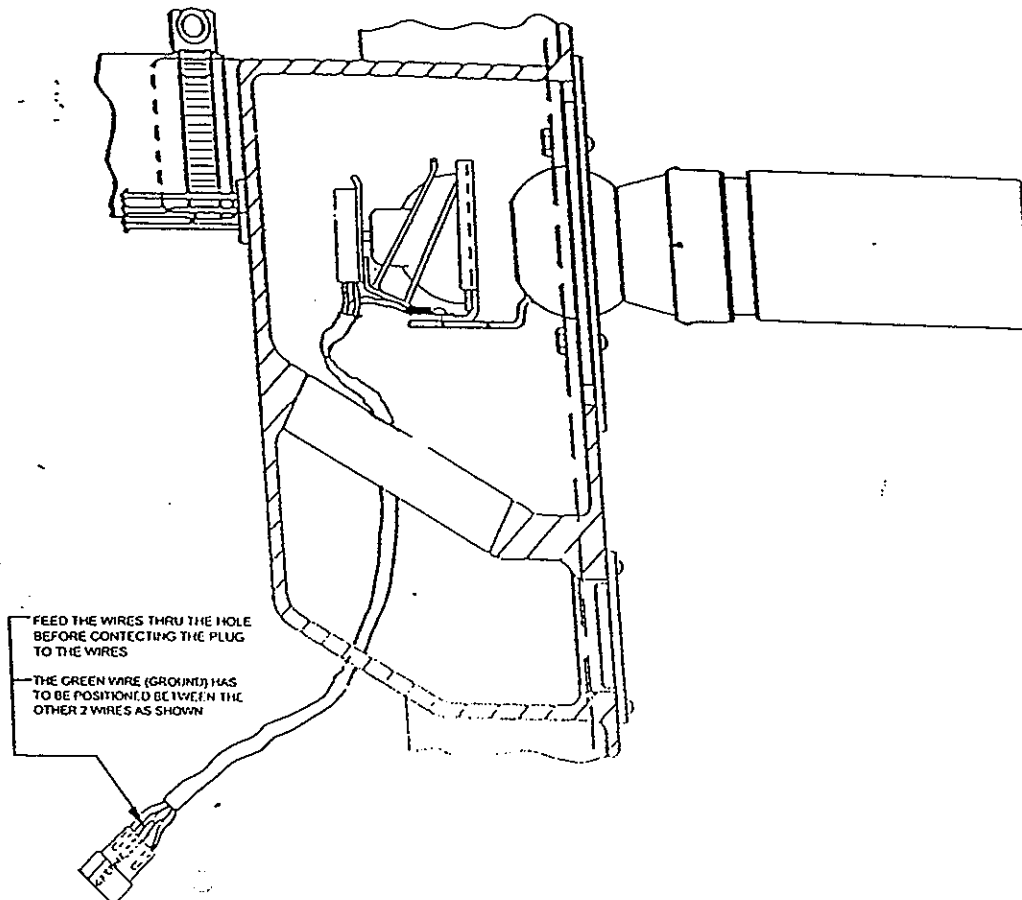


Micropositioning Jog Control (CNC)

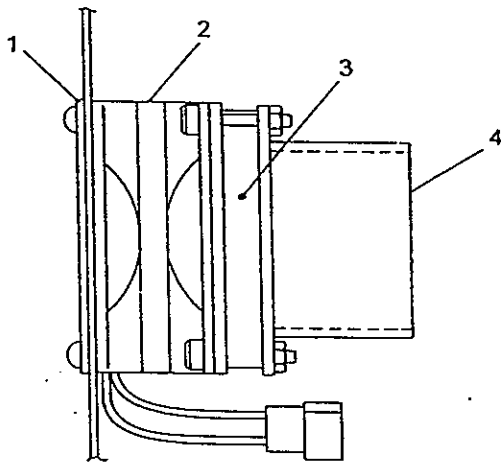
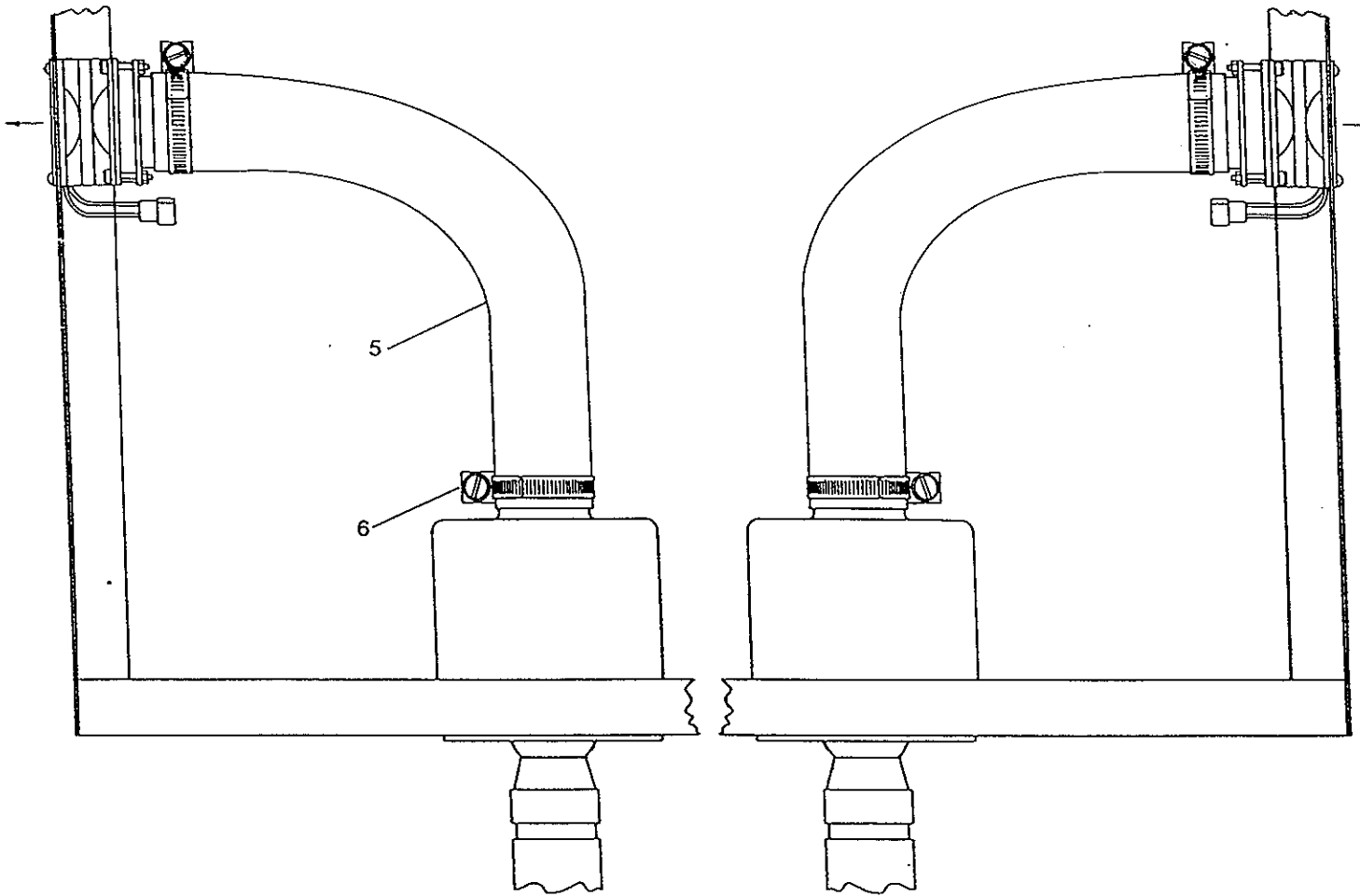
ITEM	PART NO.	DESCRIPTION	QTY.
1.	48-5339-00	BUTTON HEAD SCREW 4-40x.25	4
2.	22-3728-23	COVER PLATE	1
3.	48-7764-00	KNOB	2
4.	22-3863-00	ENCODER ASS'Y	2



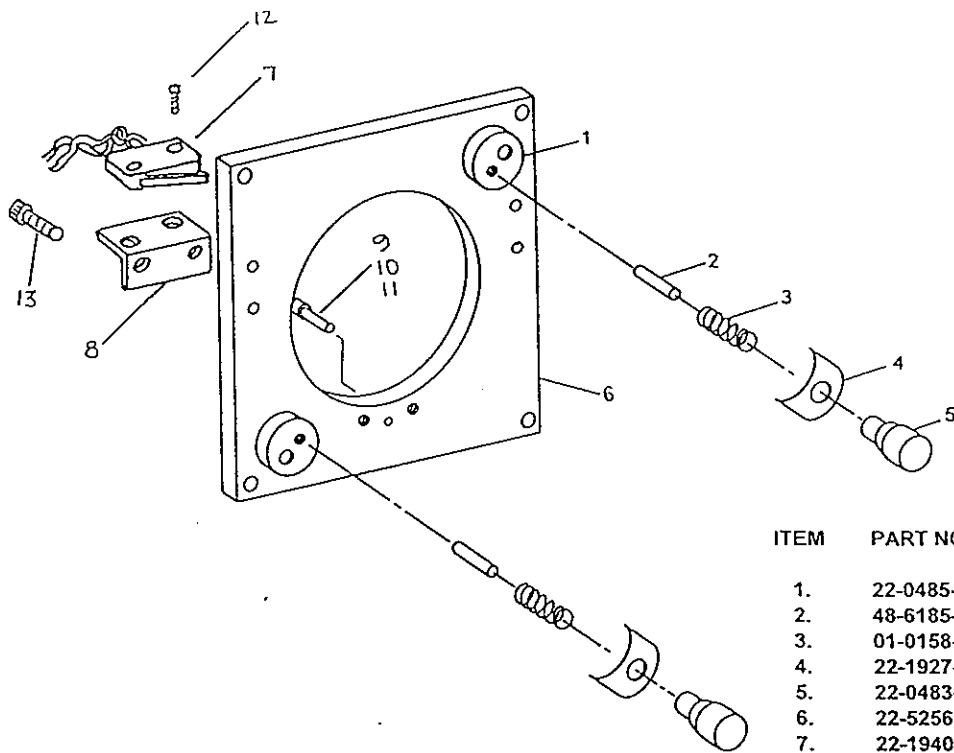
1.	22 0098 00	Retaining Ring	1	12.	48 5499 00	Spring Pin $\frac{1}{8}$ " Dia. x $\frac{3}{4}$ "	2
2.	22 1645 00	Condenser Lens	1	13.	22 0442 00	Adj. Block	2
3.	22 0446 00	Adjustable Lens Tube	1	14.	22 0730 00	Mounting Strap	2
4.	48 5137 00	Bu. Hd. Screw 6-32 x $\frac{1}{2}$ "	1	15.	22 0444 00	Swivel End	1
5.	48 6028 00	'O' Ring	1	16.	48 8086 00	150 Watt Lamp (EKE)	1
6.	22 0447 00	Lens Tube	1	17.	22 3933 06	Lamp Socket Assembly	1
7.	48 5158 00	Round Hd. Screw 2-56 x $\frac{1}{4}$ "	4	18.	48 5438 00	Bu. Hd. Screw 8-32 x $\frac{3}{8}$ "	1
8.	22 1646 00	Heat Abs. Condenser Lens	1	19.	48 6839 00	Washer	1
9.	48 5958 00	Flat Hd. Screw 10-32 x $\frac{5}{16}$ "	3				
10.	48 6038 00	Bu. Hd. Screw 6-32 x $\frac{1}{8}$ "	4				
11.	22 0443 00	Surface Illum. Mount Plate	1				
					22 3933 01	Surface Illuminator Assembly Consists of Above Items in an Assembled Unit	



SURFACE ILLUMINATION
COOLING FAN ASS'Y.



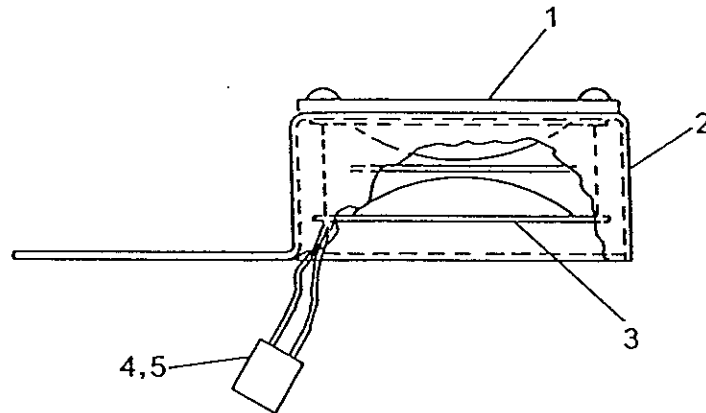
ITEM	PART NO.	DESCRIPTION	QTY.
1.	48-6778	FAN GUARD	1
2.	22-3845-01	FAN ASS'Y.	1
3.	22-3086	FAN SPACER	1
4.	22-3042	SURFACE ILLUMINATOR INTAKE ASS'Y.	1
5.	22-0675	HOSE	2
6.	48-5993	HOSE CLAMP	4



LENS HOLD DOWN ASS'Y.

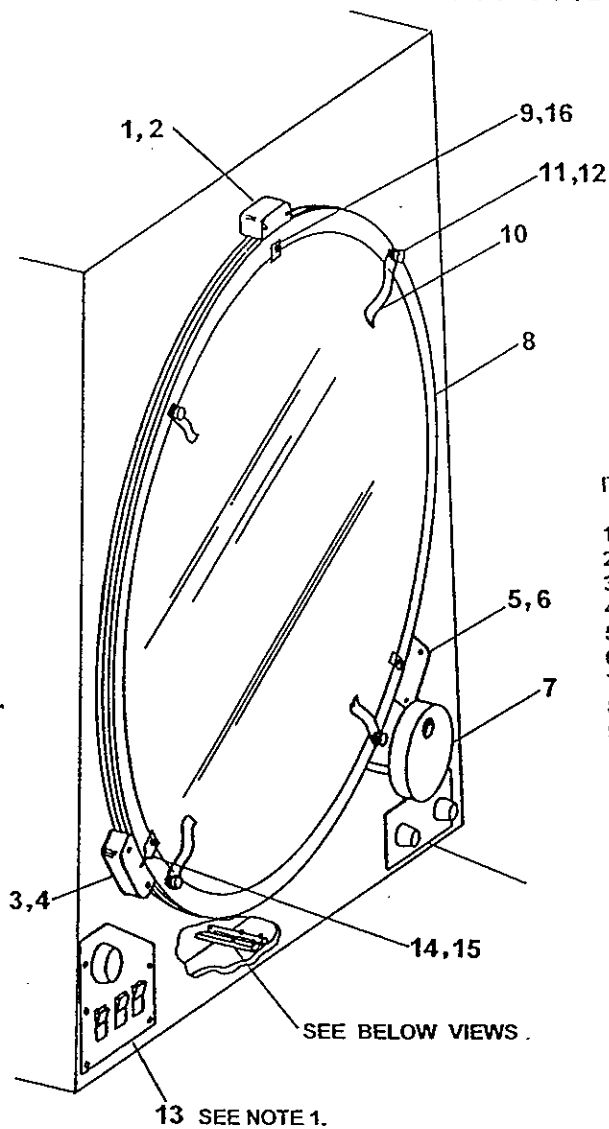
ITEM	PART NO.	DESCRIPTION	QTY.
1.	22-0485-00	SPACER RING	2
2.	48-6185-00	SET SCREW, 10-32x1.25	2
3.	01-0158-88	COMPRESSION SPRING	2
4.	22-1927-00	SPRING CLIP	2
5.	22-0483-00	LOCK NUT	2
6.	22-5256-00	LENS HOLDER PLATE	1
7.	22-1940-00	SWITCH & WIRE ASS'Y	1
8.	22-1926-00	MOUNT	1
9.	48-5813-00	SET SCREW, 4-40x.125	2
10.	22-1280-00	COLLAR	1
11.	22-2798-00	PLUNGER	1
12.	48-5623-00	SCREW, 4-40x.5	2
13.	48-5358-00	SCREW, 10-32x.375	2

FAN & COVER ASS'Y. 22-0512-00



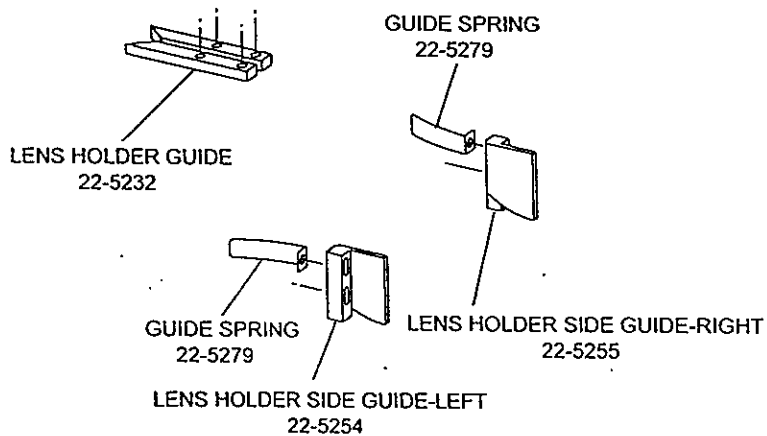
ITEM	PART NO.	DESCRIPTION	QTY.
1.	48-6778	FAN GUARD	1
2.	22-3829	MOTOR COVER	1
3.	48-6289	FAN	1
4.	48-6233	PLUG - 3 CIRCUIT	1
5.	48-6189	PIN	2

TOP FRONT ASS'Y.



ITEM	PART NO.	DESCRIPTION	QTY.
1.	22-0266-00	ROLLER HOUSING ASS'Y.	1
2.	22-0487-00	ROLLER HOUSING COVER	1
3.	22-0265-00	ROLLER HOUSING ASS'Y.	1
4.	22-3729	ROLLER HOUSING COVER	1
5.	22-3704-13	ROLLER HOUSING ASS'Y.	1
6.	22-3704-10	ROLLER HOUSING COVER	1
7.	22-3704-00	PROTRACTOR RING DRIVE ASS'Y.	1
8.	22-2325	PROTRACTOR RING	1
9.	22-0441	GLASS CLIP	2
10.	22-0955	CLIP ASS'Y.	4
11.	22-0952	PIVOT SCREW	4
12.	16-0134	LOCKSCREW	4
13.	22-3226-00	WIRE ASS'Y. - POWER SWITCH	1
14.	22-3743	REF. POINTER	1
15.	48-6988	WASHER	1
16.	48-6106	FELT	2

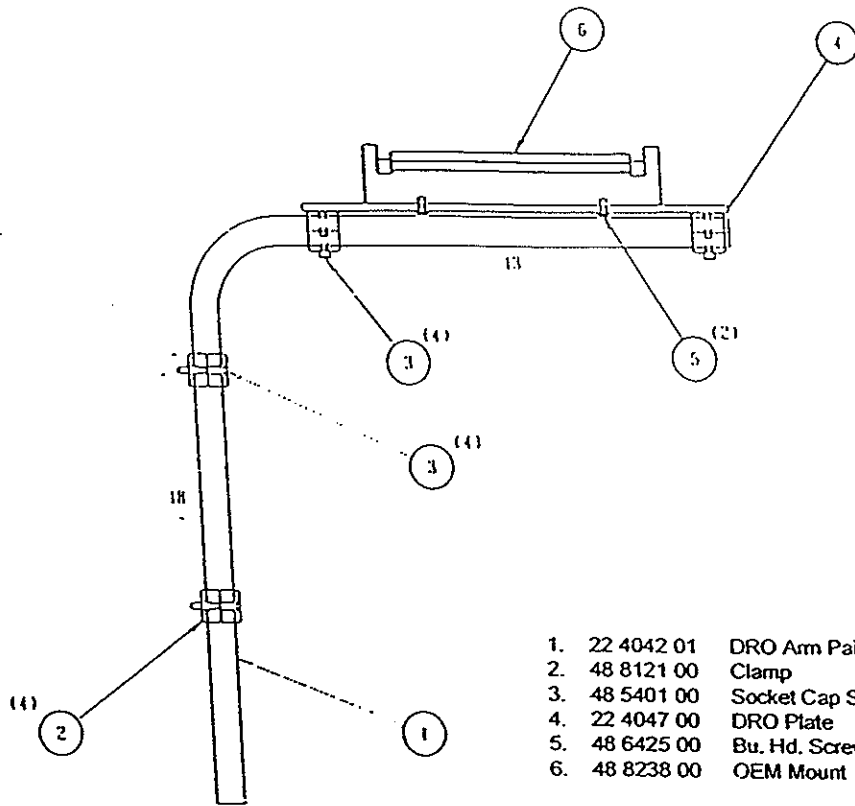
NOTE: 1. STANDARD ASS'Y.
WITH LENS CHANGER



LENS CHANGER GUIDES MOUNT INSIDE
LOWER VIEWING FRAME AND ON EACH
SIDE OF LENS PLATE AREA INSIDE.

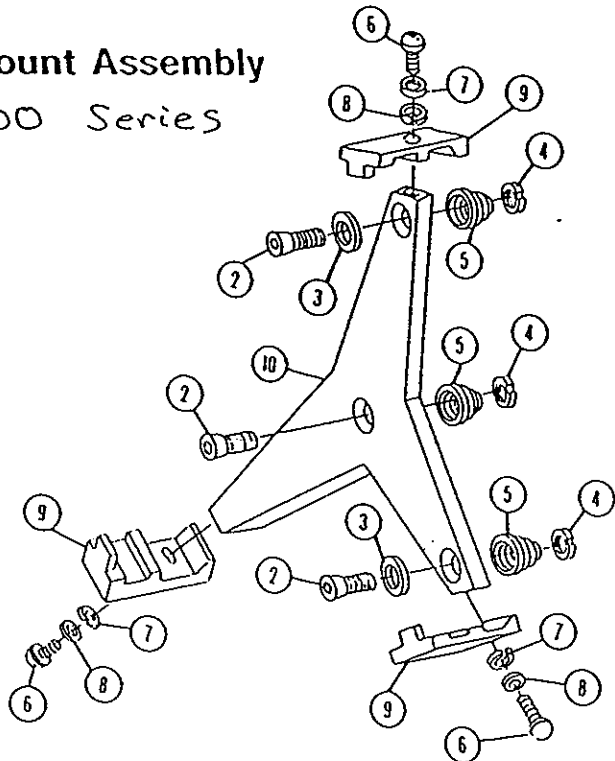
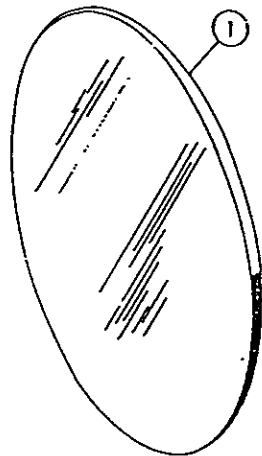
(FINAL LENS GUIDES)

READOUT ARM ASSY.



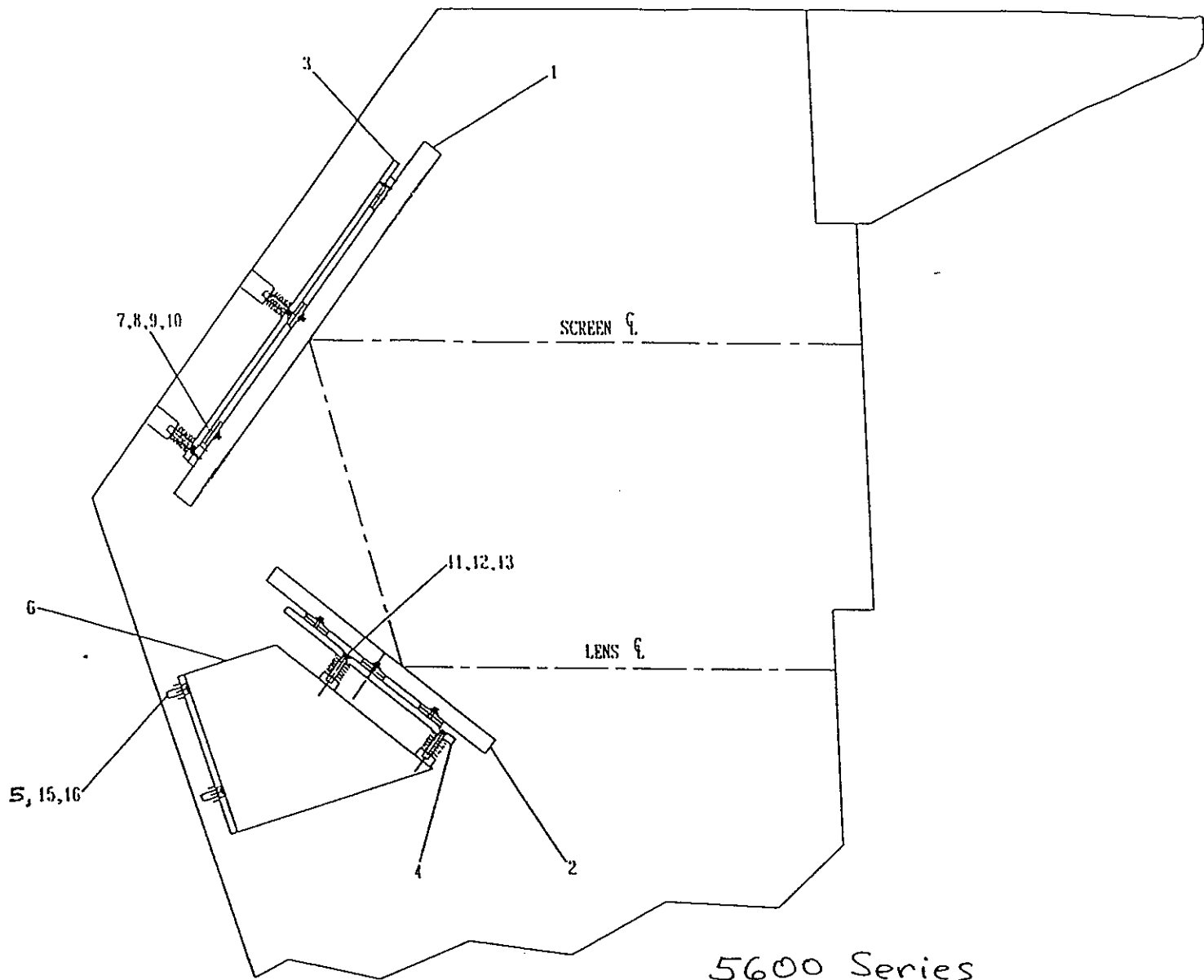
1.	22 4042 01	DRO Arm Painted	1
2.	48 8121 00	Clamp	4
3.	48 5401 00	Socket Cap Screw 1/4-20 x 1 1/2"	8
4.	22 4047 00	DRO Plate	1
5.	48 6425 00	Bu. Hd. Screw 1/4-20 x 1/2"	2
6.	48 8238 00	OEM Mount	1

Mirror Mount Assembly 2600 Series



1.	22 0470	Mirror	1	6.	48 6150	Soc Cap Screw 1/8-18 x 1 1/4" LG	3
2.	22 0471	Spherical Radius Screw	3	7.	48 5718	Flat Washer	3
3.	22 0473	Spherical Washer	2	8.	48 6206	Lock Washer	3
4.	22 0472	Lock Screw	3	9.	22 377Z	Mirror Clamp Block	3
5.	22 0474	Compression Spring	3	10.	22 0180	Mirror Mount	1

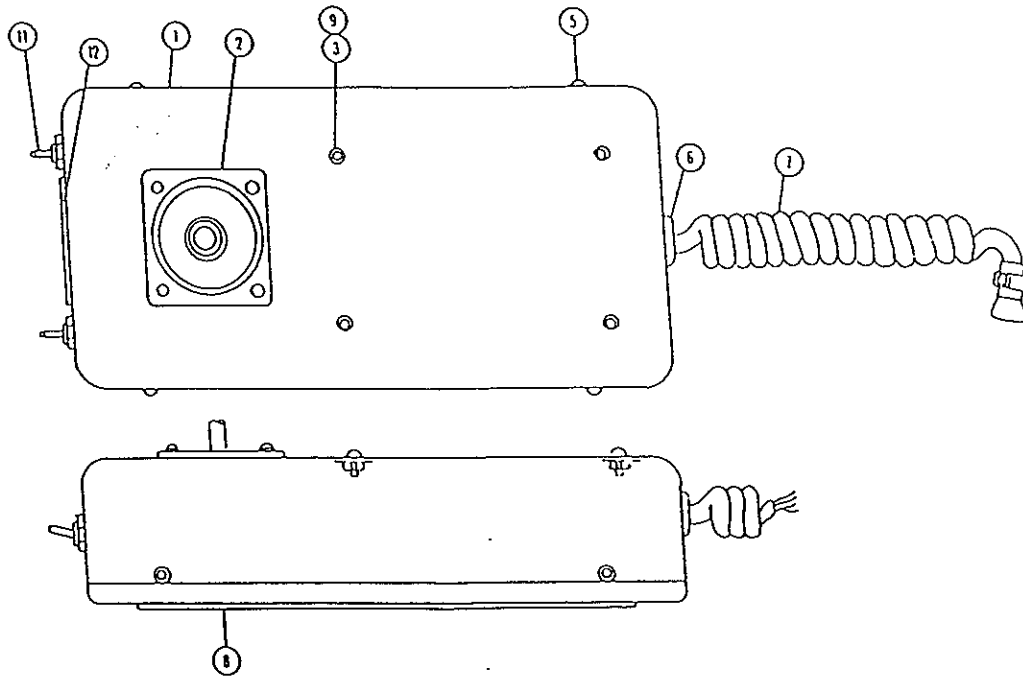
22 0475 Mirror Mount Assembly



5600 Series
Mirror Assembly

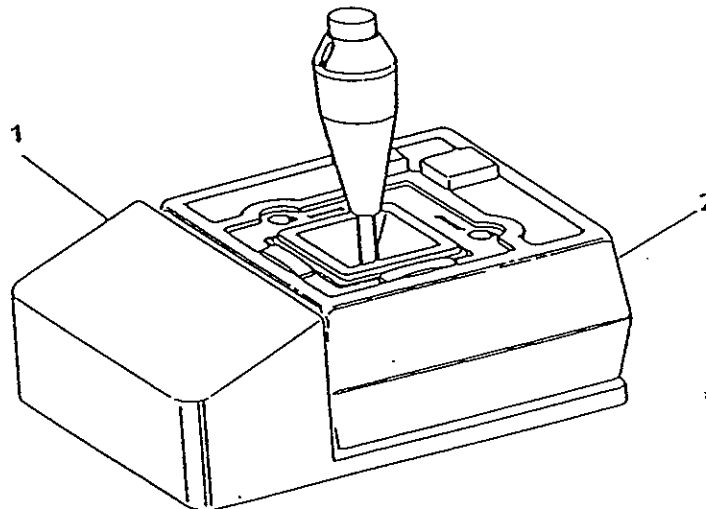
1.	22 3774 69	Top Mirror & Plate Assy	1
2.	22 3774 72	Bottom Mirror & Plate Assy	1
3.	22 3774 66	Top Mirror Plate	1
4.	22 4102 00	Bottom Mirror Plate	1
5.	48 5035 00	Hex Nut	3
6.	22 3774 12	Bottom Mirror Mount	1
7.	48 5057 00	Butt. Hd. Screw 1/4-20 x 3/4"	6
8.	48 6033 00	Washer	6
9.	48 6077 00	Lock Washer	6
10.	22 0472 00	Lock Screw	3
11.	22 0471 00	Screw, spherical	6
12.	22 0474 00	Spring, compression	6
13.	22 0473 00	Washer, spherical	4
14.	48 5262 00	Screw, 1/4-20 x 1 1/4"	3
15.	48 5956 00	Screw, 1/2-20 x 1 1/4"	3
16.	48 5955 00	Washer	3

Joystick Assembly



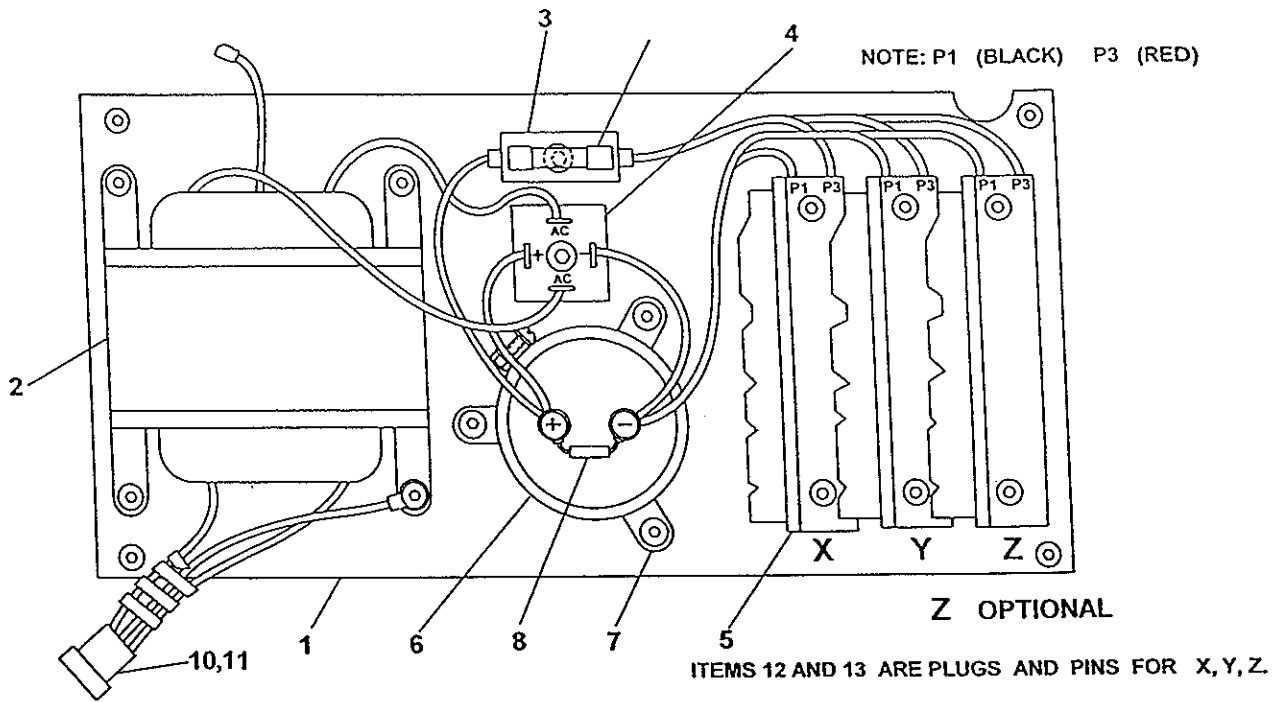
1.	22 3217 00	Base & Cover Assembly	1	8.	22 3219 00	Rubber Pad	2
2.	22 3207 00	Joystick & Wiring Assembly	1	9.	48 5624 00	Nut, Hex 4-40	4
3.	48 6184 00	Bu. Hd. Screw 4-40 x 3/8"	4	11.	22 3248 00	Toggle Switch Assembly	1
5.	48 5339 00	Bu. Hd. Screw 4-40 x 1/4"	5		48 7623 00	Toggle switch (Reference)	
6.	48 6101 00	Grommet	1	12.	48 7303 00	Toggle Switch Plate	1
7.	22 3208 00	Coiled Cord Assembly	1				
					22 3205 00	Joystick Assembly	

CNC JOYSTICK ASS'Y. 22-3823-00



ITEM	PART NUMBER	DESCRIPTION	QTY.
1.	22-3827-00	JOYSTICK BASE & REST ASS'Y.	1
2.	48-7763	JOYSTICK	1

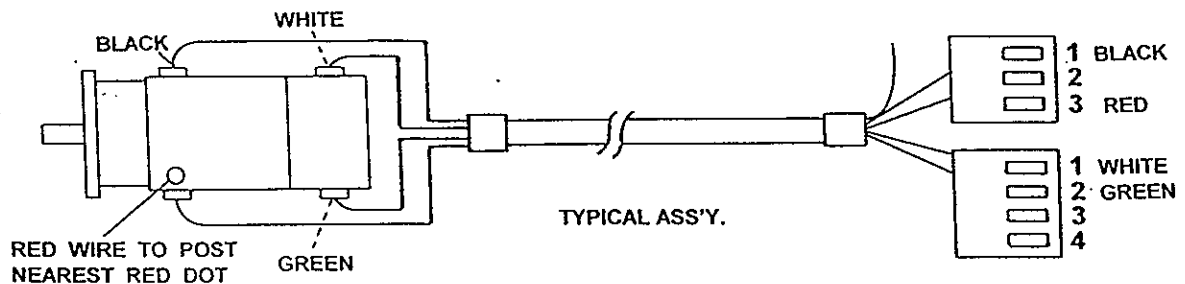
AMPLIFIER AND TRANSFORMER ASS'Y. 22-3724-07



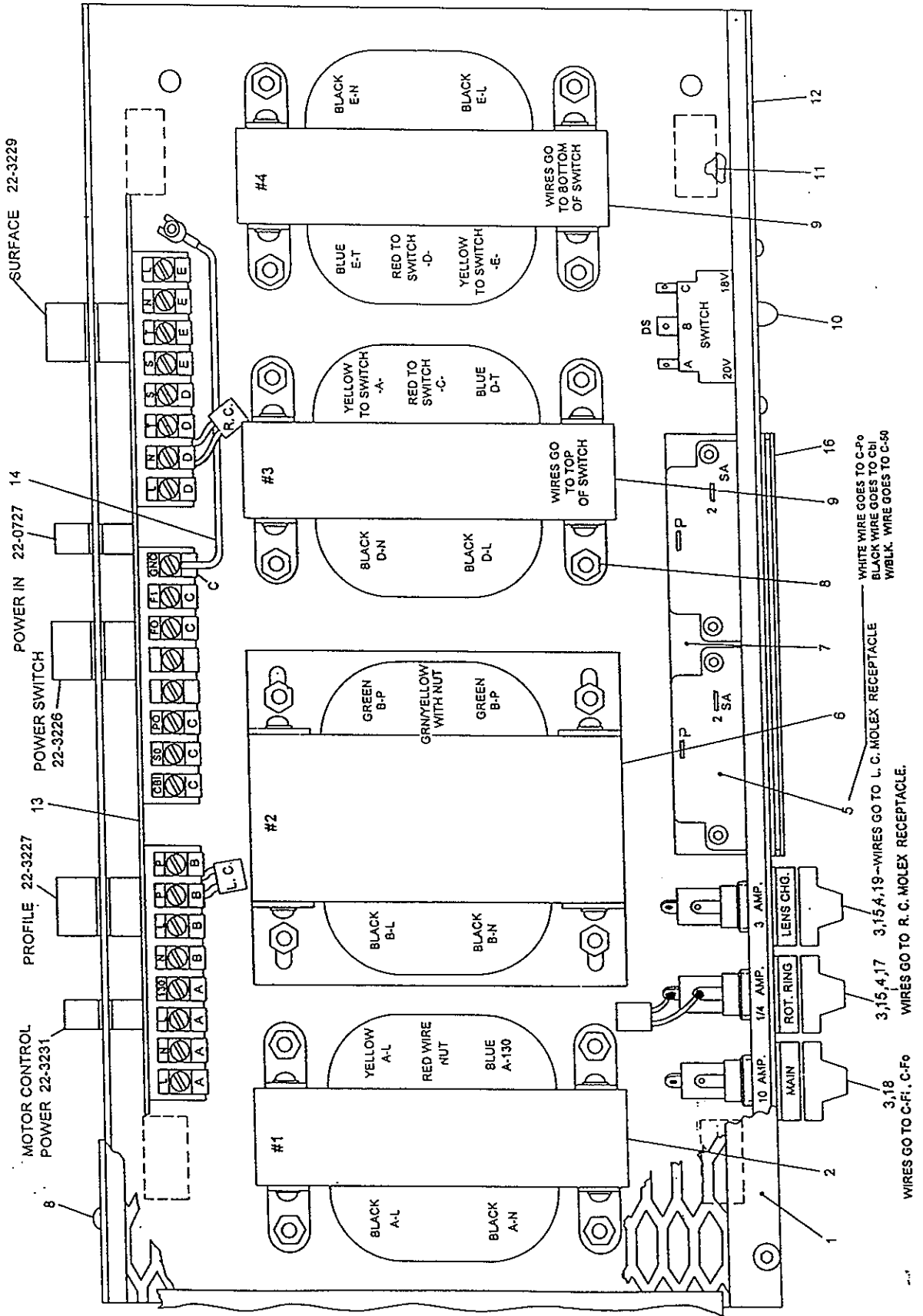
ITEM	PART NO.	DESCRIPTION	QTY.
1.	22-3724-29	AMPLIFIER BASE	1
2.	48-7799	TRANSFORMER	1
3.	48-7843	FUSE POST HOLDER	1
4.	48-7802	BRIDGE RECTIFIER	1
5.	22-3724-67	TUNED AMPLIFIER	2
6.	48-7800	CAPACITOR	1
7.	48-7801	CAPACITOR BASE MOUNT	1
8.	48-7803	RESISTOR	1
9.	48-7842	FUSE	1
10.	48-6189	MALE CONNECTOR PIN	3
11.	48-6233	3 PIN CONNECTOR HOUSING	1
12.	48-7839	1.5 AMP. HOUSING	3
13.	48-7841	1.5 AMP. PIN	6

CABLE ASS'Y. Y-AXIS MOTOR 22-3728-38

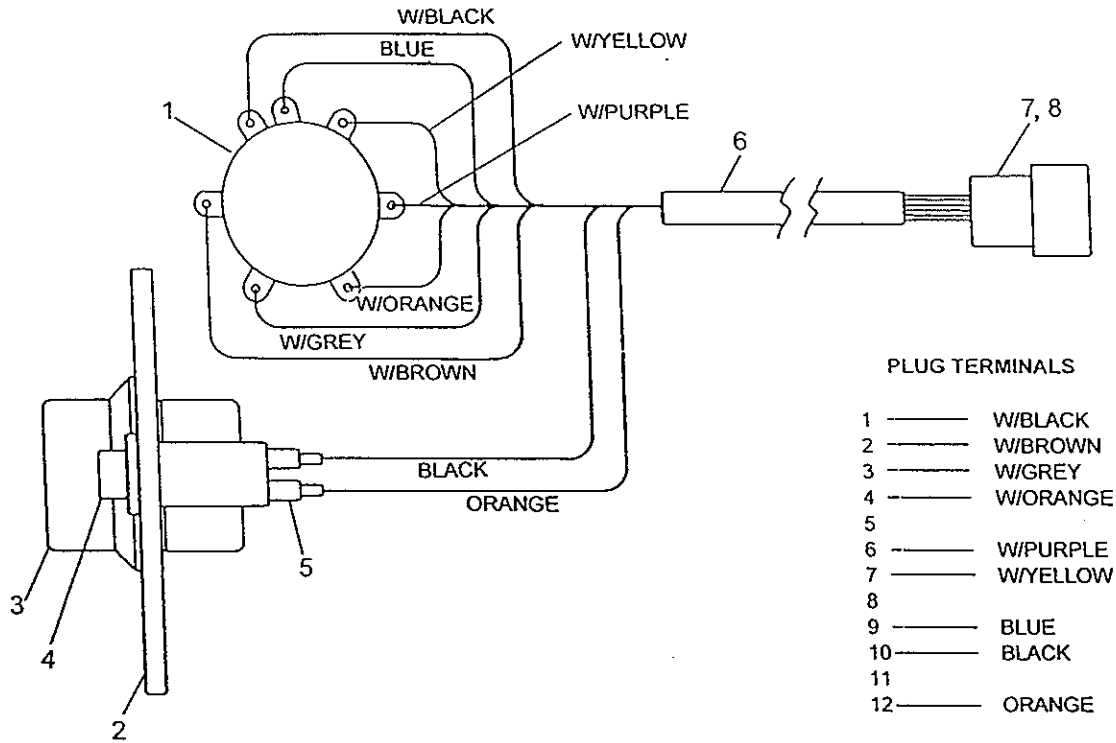
CABLE ASS'Y. X-AXIS MOTOR 22-3728-39



PARTS BREAKDOWN ON PAGE 29

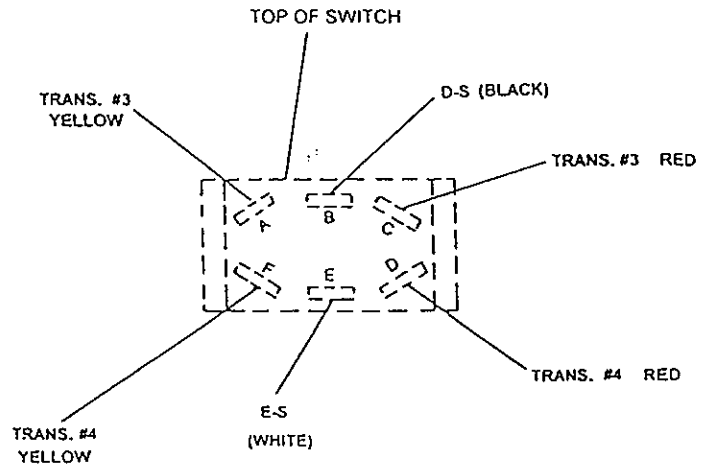


LENS SELECTOR SWITCH ASS'Y. 22-3291



ITEM	PART NO.	DESCRIPTION	QTY.
1	48-6766	SWITCH	1
2	22-3284	LENS CHANGE PLATE	1
3	48-5446	KNOB	1
4	48-7308	RED INDICATOR LIGHT	1
5	48-5812	TERMINAL	2
6	48-6202	SPIRAL WRAP	4"
7	22-2668-02	12 CIRCUIT PLUG	1
8	48-6184	MALE PIN TYPE TERMINAL	2

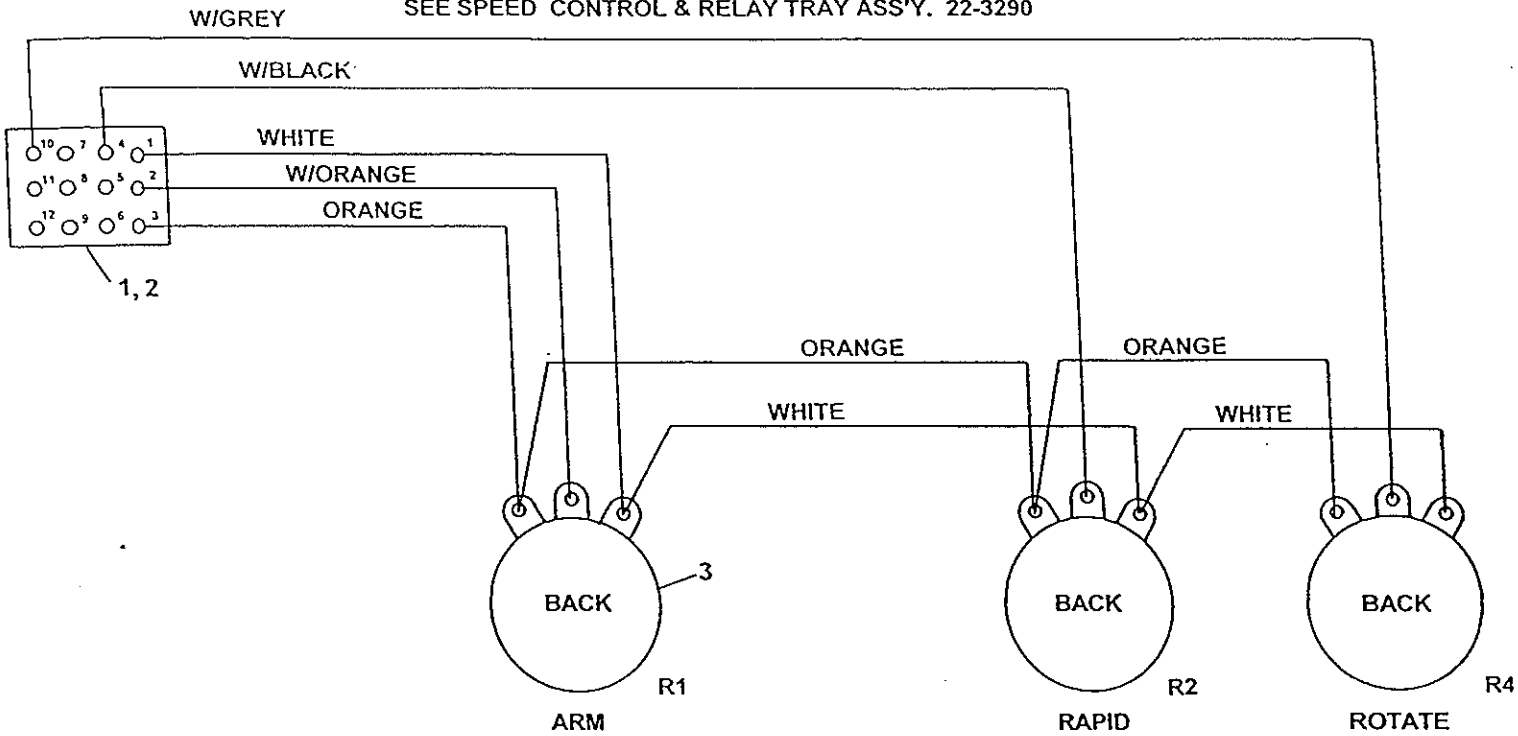
ITEM	PART NO.	DESCRIPTION	QTY.
1.	22-3264	PROTECTIVE COVER ASS'Y.	1
2.	22-3288-02	TRANSFORMER ASS'Y.-M. C.	1
3.	22-3280-04	FUSE POST ASS'Y.	3
4.	48-6189	MALE PIN	4
5.	22-3280-06	CIRCUIT BREAKER WIRE ASS'Y.	1
6.	22-3280-01	PROFILE TRANSFORMER ASS'Y.	1
7.	22-3270	CIRCUIT BREAKER MOUNT	1
8.	48-6045	ELASTIC NUT #6-32	20
9.	22-3280-03	TRANSFORMER ASS'Y.	2
10.	22-3280-05	SWITCH WIRE ASS'Y.	1
11.	22-3278	RUBBER PAD	8
12.	22-3263	30" TRAY WLDT.	1
13.	22-3235	C. B. ASS'Y. POWER SUPPLY	1
14.	22-3280-07	GROUND WIRE ASS'Y.	1
15.	48-6706	PLUG	2
16.	22-3242	TRAY REST	1
17.	48-7302	FUSE 1/4 AMP.	1
18.	48-5832	FUSE 10 AMP.	1
19.	48-5885	FUSE 3 AMP.	1
20.			



SPEED POT. WIRE ASS'Y. 22-3295

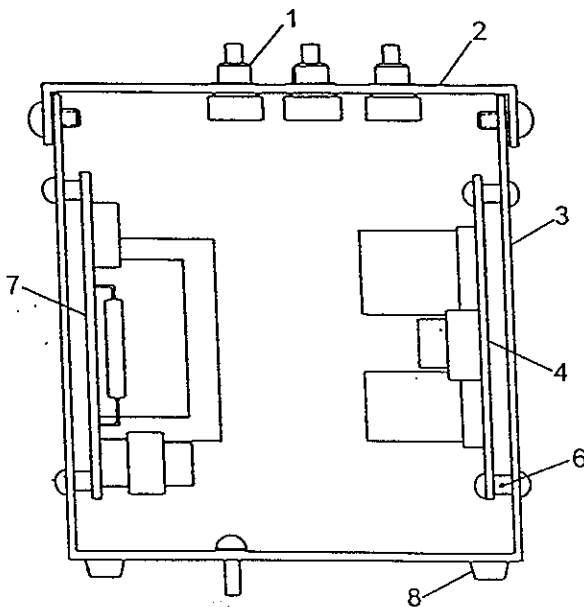
48-6202 SPIRAL WRAP NOT SHOWN.

SEE SPEED CONTROL & RELAY TRAY ASS'Y. 22-3290



ITEM	PART NO.	DESCRIPTION	QTY.
1.	22-2668-05	PLUG, 12 CIRCUIT BLACK	1
2.	48-6189	TERMINAL	5
3.	48-6475	POTENTIOMETER	3

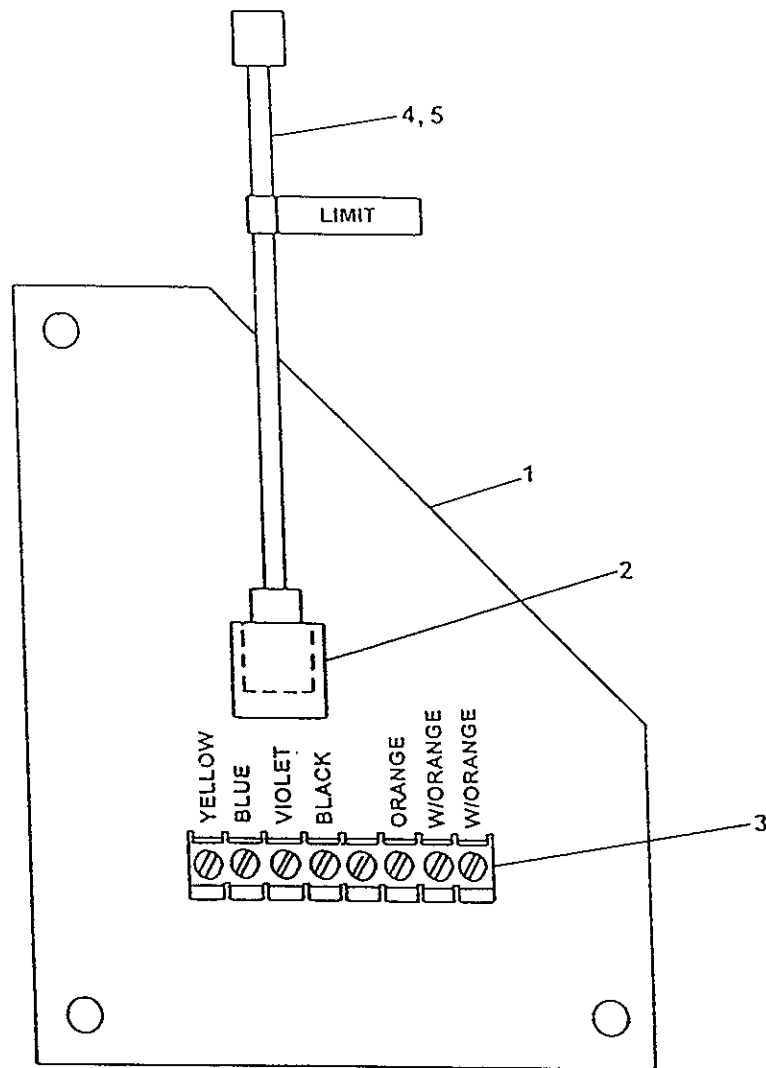
SPEED CONTROL AND RELAY TRAY ASS'Y. 22-3290



ITEM	PART NO.	DESCRIPTION	QTY.
1.	22-3295	SPEED POT. WIRE ASS'Y.	1
2.	22-3297-01	COVER	1
3.	22-3296-01	TRAY	1
4.	22-3286	RELAY CIRCUIT BOARD	1
5.	22-3298	INTERNAL WIRING ASS'Y.	1
6.	48-6457	STAND OFF	4
7.	22-1889	CIRCUIT BOARD	1
8.	22-3278	RUBBER FOOT PAD	8

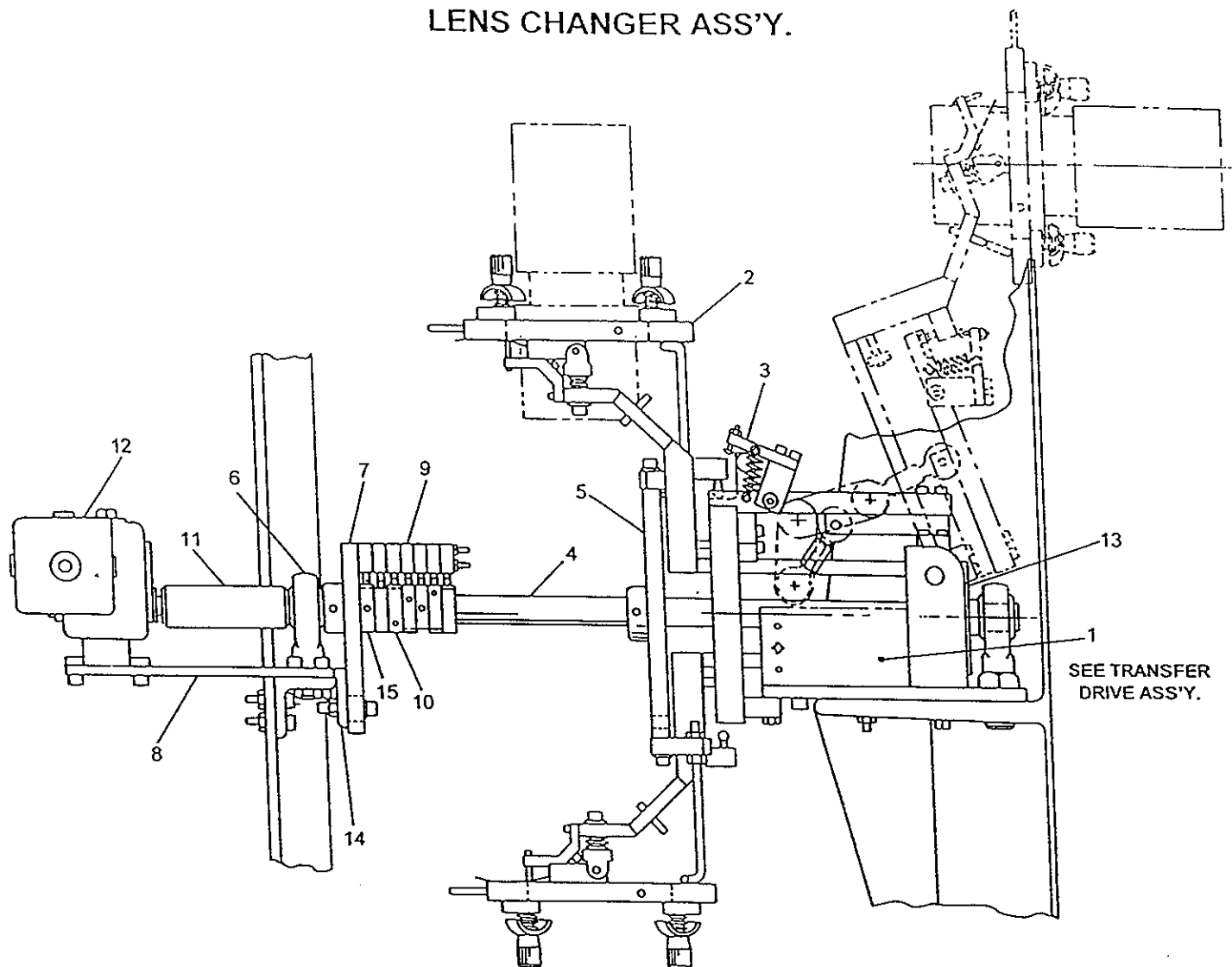
ITEM 5. INTERNAL WIRING ASS'Y. NOT SHOWN

LIMIT SWITCH CIRCUIT BOARD



ITEM	PART NO.	DESCRIPTION	QTY.
1.	22-3261	LIMIT SWITCH CIRCUIT BOARD	1
2.	48-7624	MODULAR CONNECTOR	REF.
3.	48-7622	TERMINAL BLOCK	REF.
4.	48-7625	MODULAR CABLE	1
5.	22-3728-45	CABLE ASS'Y. - CNC LIMIT SWITCH	1

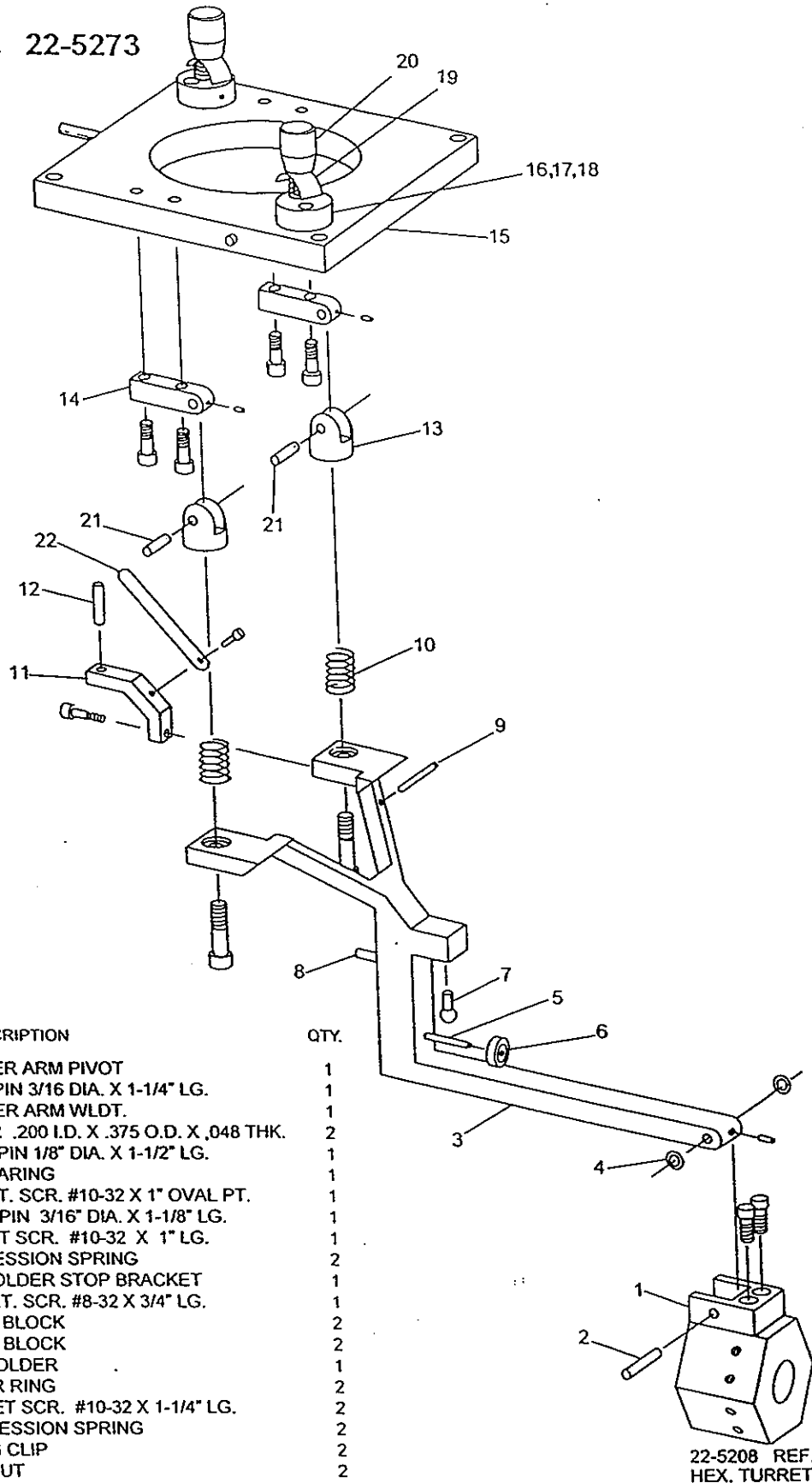
LENS CHANGER ASS'Y.



ITEM	PART NO.	DESCRIPTION	QTY.
1.	22-5288	BASE PLATE	1
2.	22-5263	TRANSFER ARM ASS'Y.	6
3.	22-5285	PICKUP ARM ASS'Y.	1
4.	22-5240	INDEXING SHAFT	1
5.		LENS HOLDER STOP ASS'Y.	1
6.	48-6747	ROD END BEARING	1
7.	22-5220	INDEXING SWITCH MTG. PLATE	1
8.	22-5236	INDEXING MOTOR MOUNT	1
9.	22-5273	INDEX SWITCH WIRING ASS'Y.	1
10.	22-5241	ROTATIONAL CAM	6
11.	22-2742	RIGID COUPLING	1
12.	22-5281	MOTOR & PLUG ASS'Y.	1
13.	22-5208	HEX. TURRET	1
14.	22-5237	LIMIT SWITCH MTG. ANGLE	1
15.	22-5242	INDEXING COLLAR	1

TRANSFER ARM ASS'Y. 22-5273

(SINGLE STATION)

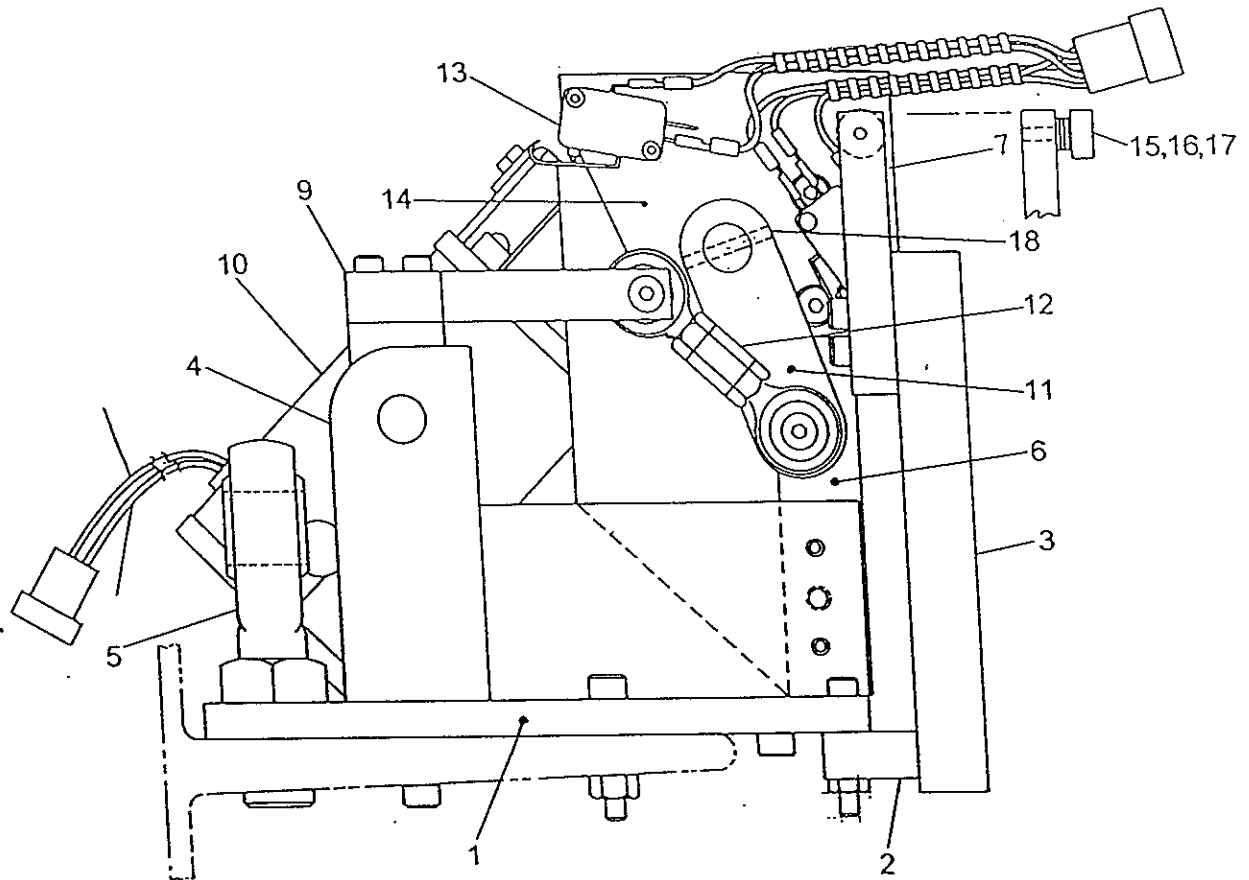


ITEM	PART NO..	DESCRIPTION	QTY.
1	22-5206	TRANSFER ARM PIVOT	1
2	48-6753	DOWEL PIN 3/16 DIA. X 1-1/4" LG.	1
3	22-5244	TRANSFER ARM WLDT.	1
4	48-6488	WASHER .200 I.D. X .375 O.D. X .048 THK.	2
5	48-5067	SPRING PIN 1/8" DIA. X 1-1/2" LG.	1
6	48-5183	BALL BEARING	1
7	48-7284	SOC. SET. SCR. #10-32 X 1" OVAL PT.	1
8	48-5121	SPRING PIN 3/16" DIA. X 1-1/8" LG.	1
9	48-5072	SOC. SET SCR. #10-32 X 1" LG.	1
10	48-6749	COMPRESSION SPRING	2
11	22-5251	LENS HOLDER STOP BRACKET	1
12	48-6752	SOC. SET. SCR. #8-32 X 3/4" LG.	1
13	22-5252	SPRING BLOCK	2
14	22-5253	SWIVEL BLOCK	2
15	22-5256	LENS HOLDER	1
16	22-0485	SPACER RING	2
17	48-6185	SOC. SET SCR. #10-32 X 1-1/4" LG.	2
18	01-0158-88	COMPRESSION SPRING	2
19	22-1927	SPRING CLIP	2
20	22-0483	LOCK NUT	2
21	48-5040	DOWEL PIN 3/16" DIA. X 3/4" LG.	2
22	22-5264	LENS HOLDER PUSHER SPRING	1

NOTE: ITEM 3

22-5244-01 TRANSFER ARM WLDT.
 (5X LENS ARM)

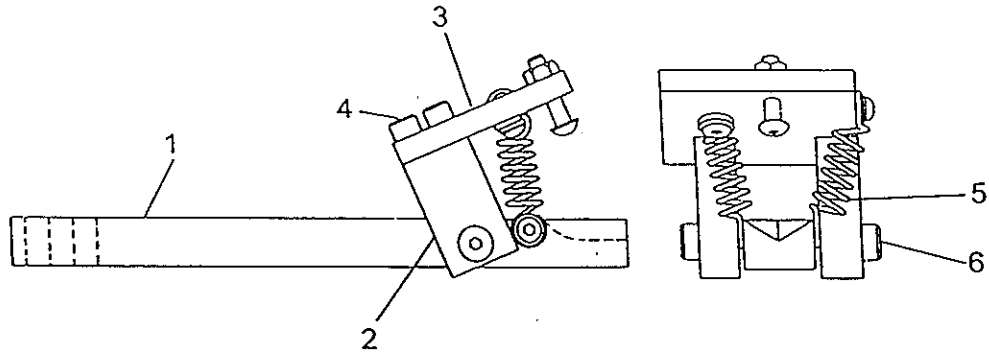
TRANSFER DRIVE ASS'Y.



COMPARATOR FRONT

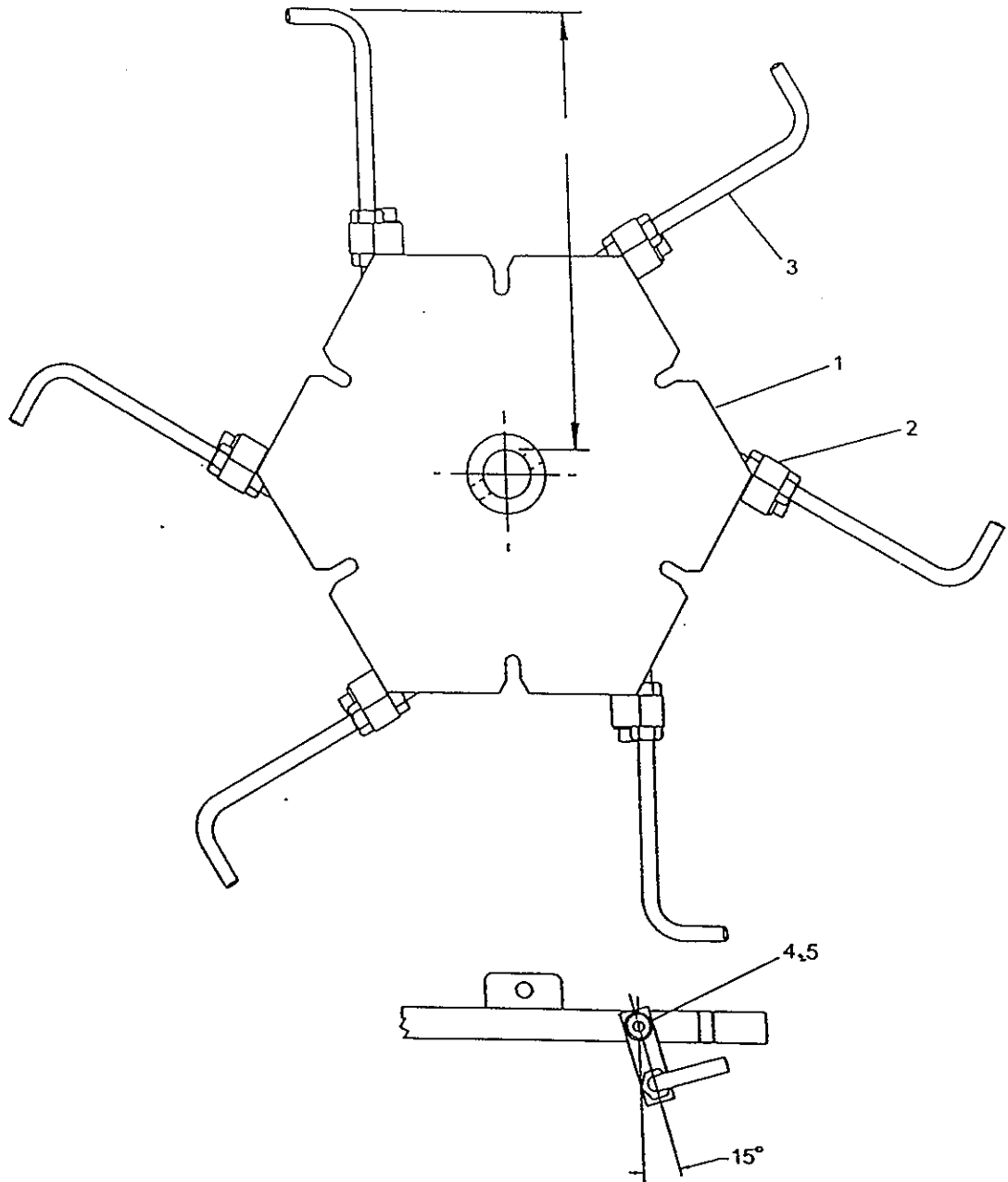
ITEM	PART NO.	DESCRIPTION	QTY.
1	22-5210	BASE PLATE	1
2	22-5223	HOLDING RING MT.	1
3	22-5222	TRANSFER ARM HOLDING RING	1
4	22-5214	LIFT LEVER	1
5	48-6747	ROD END BEARING	1
6	22-5205	TRANSFER ARM MOTOR MT.	1
7	22-5235	PICKUP ARM REST	1
8	22-5213	MOTOR MT. SPACER PLATE	1
9	22-5296	CENTER LIFT LEVER	1
10	22-5281	MOTOR & PLUG ASS'Y.	1
11	22-5212	MOTOR ARM	1
12	22-5228	LIFT ARM DRIVE LINKAGE	1
13	22-5258	TRANSFER MOTOR ARM	1
		LIMIT SWITCH WIRING	1
		MICROSWITCH 48-5594 REF.	1
14	22-5204	TRANSFER MOTOR LIMIT SWITCH PLATE	1
15	48-5124	SPRING PIN	1
16	48-6736	WASHER	3
17	48-5183	ROLLER BEARING	1
18	48-6751	SPRING PIN	1

PICKUP ARM ASS'Y. 22-5285

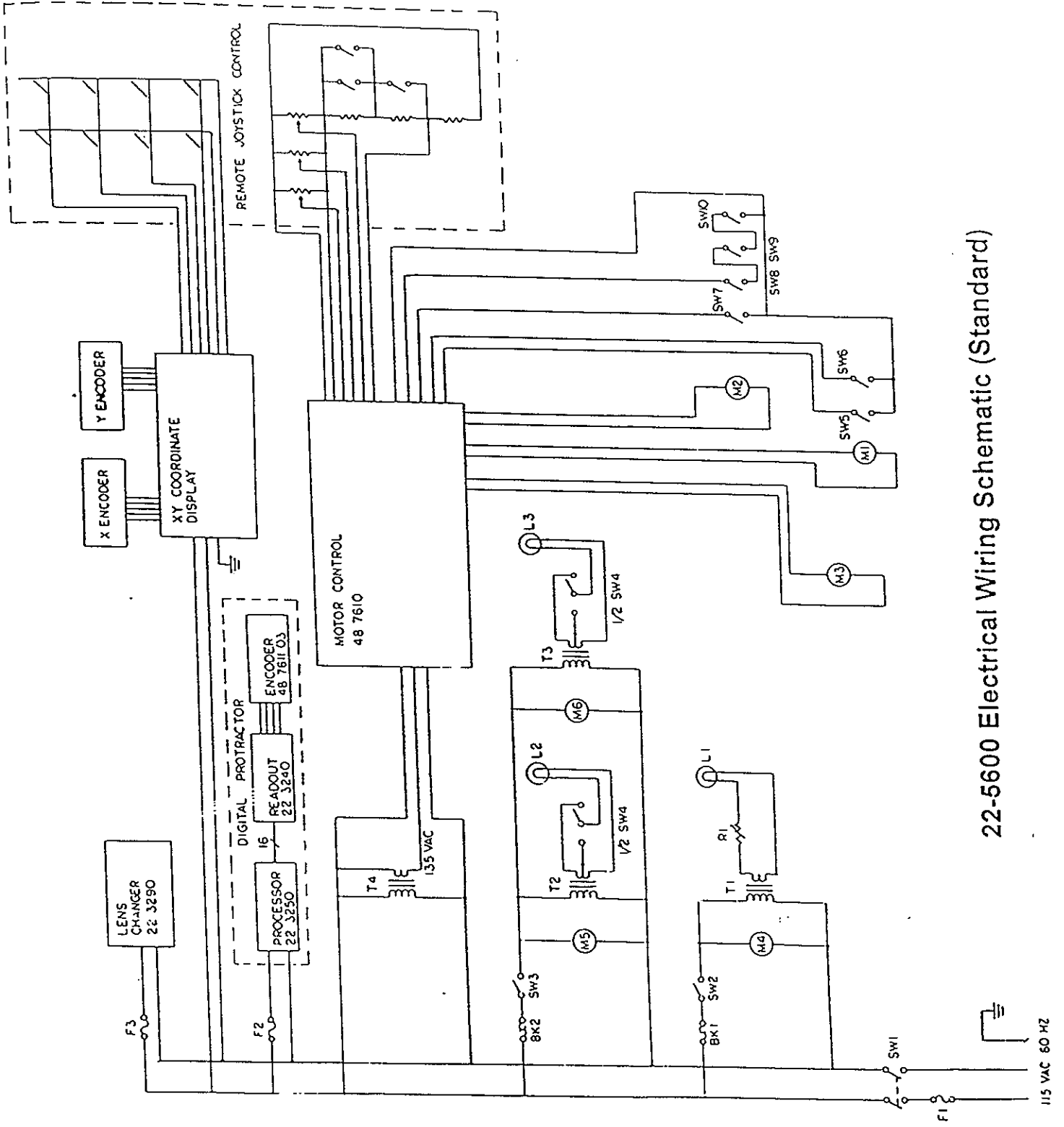


ITEM	PART NO.	DESCRIPTION	QTY.
1.	22-5224	UPPER LIFT LEVER	1
2.	22-5217	LOWER TRANSFER ARM LOCK	2
3.	22-5219	UPPER TRANSFER ARM LOCK	1
4.	48-6754	SOC. CAPSCR. #10-24 X 5/8"	4
5.	48-6748	EXTENSION SPRING	2
6.	48-6131	SHLDR. SCR. 1/4" DIA. X 1/2" LG.	2

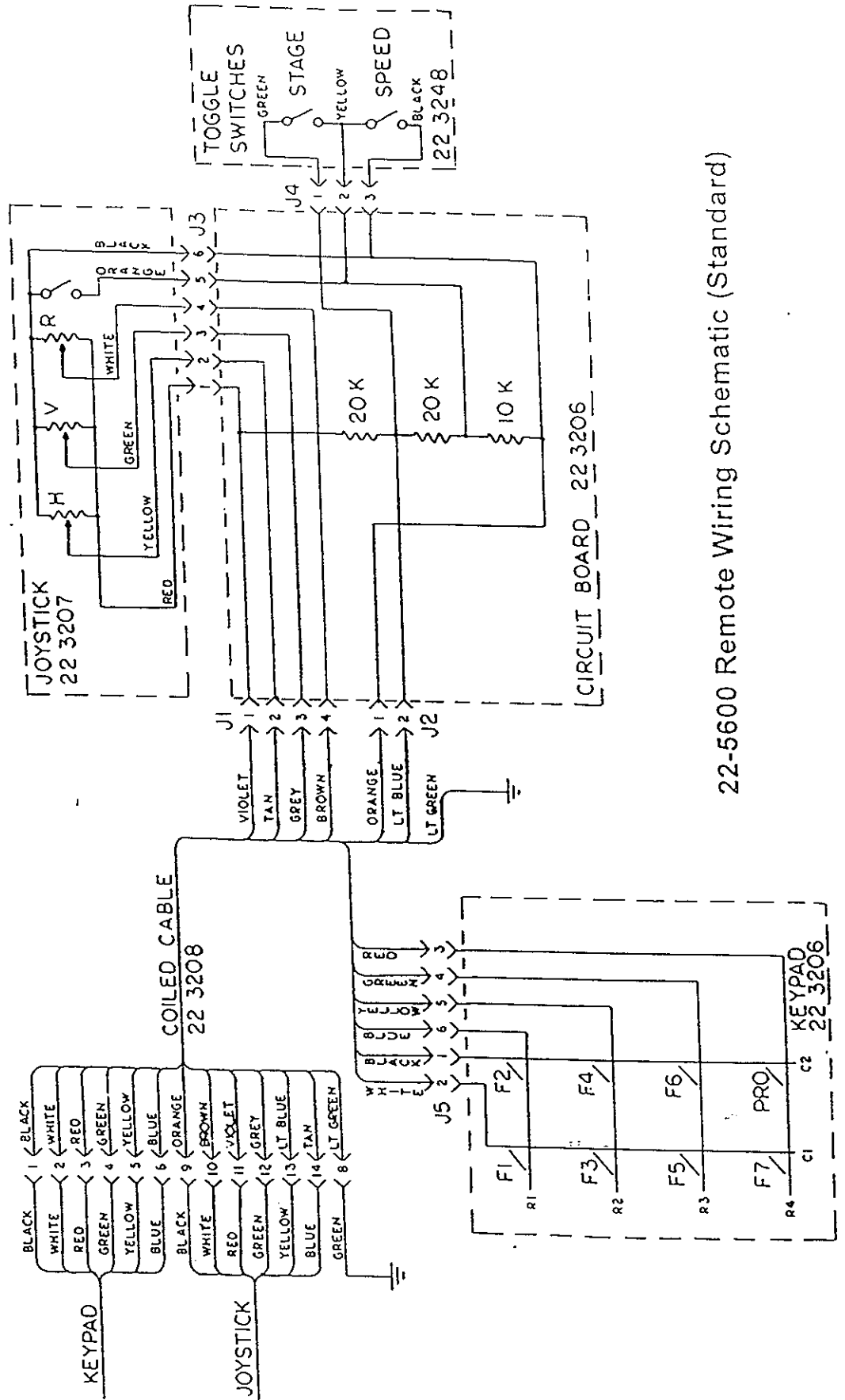
LENS HOLDER STOP ASS'Y.



ITEM	PART NO..	DESCRIPTION	QTY.
1.	22-5239	LENS HOLDER STOP WLDT.	1
2.	22-5231	LENS HOLDER STOP BLOCK	6
3.	22-5211	LENS HOLDER SUPPORT	6
4.	48-6077	LOCKWASHER 1/4" I.D.	6
5.	48-5051	SOC. HD CAPSCR. 1/4 - 20 X 1" LG.	6

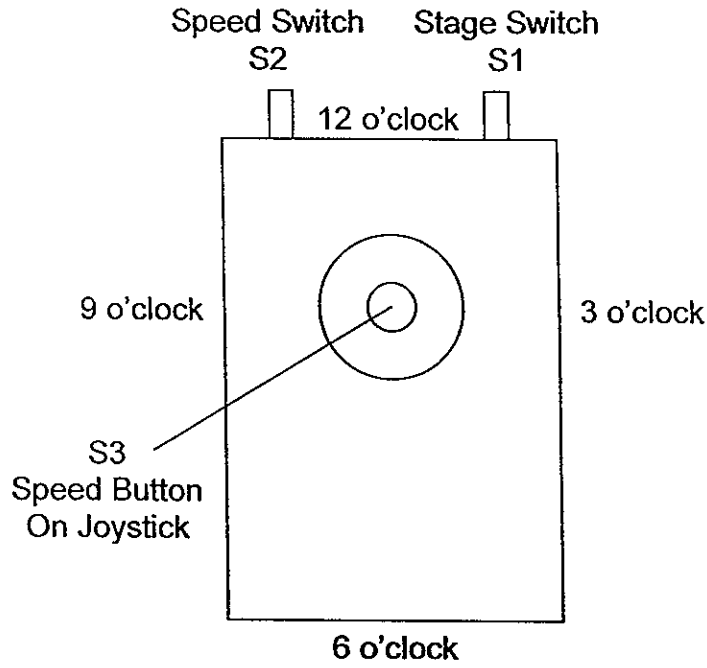


22-5600 Electrical Wiring Schematic (Standard)



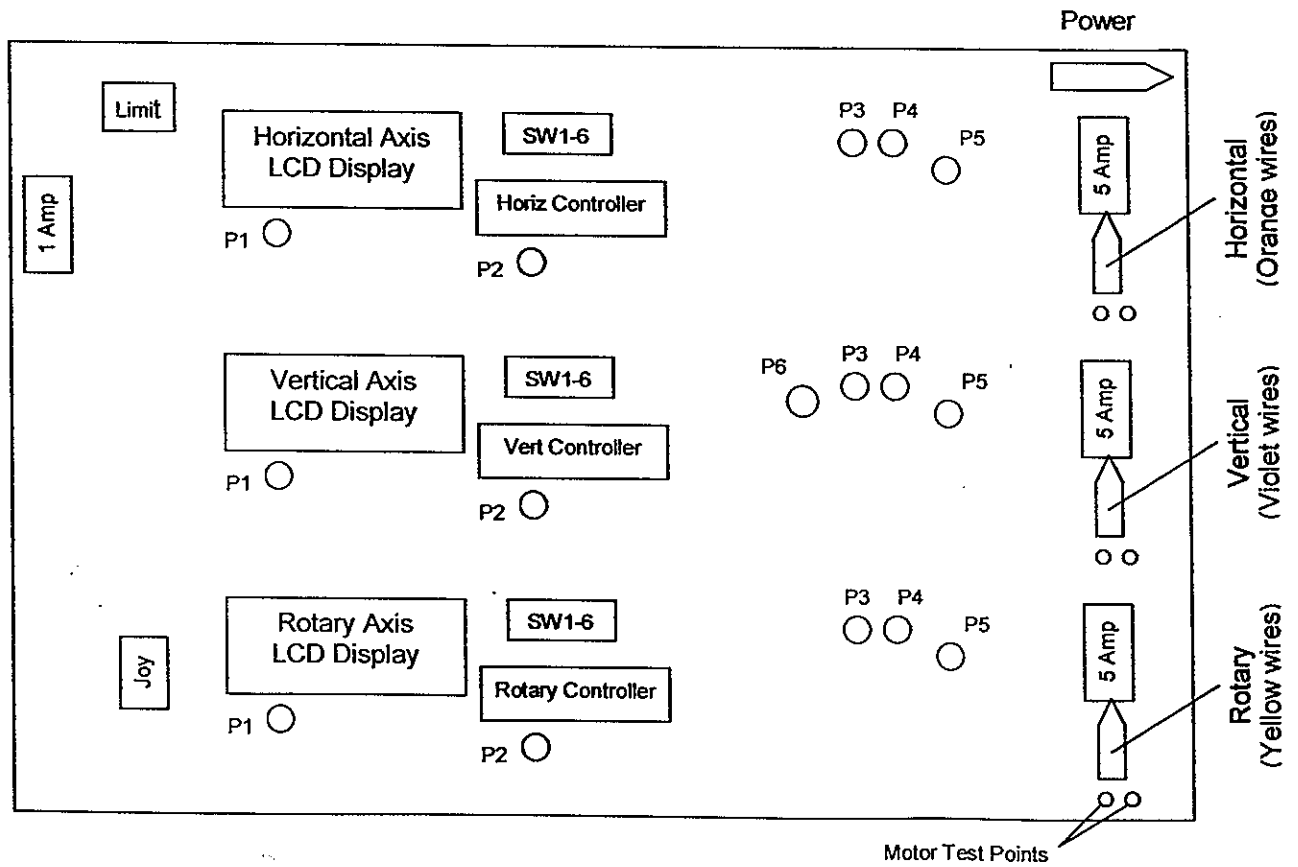
22-5600 Remote Wiring Schematic (Standard)

Joystick control layout



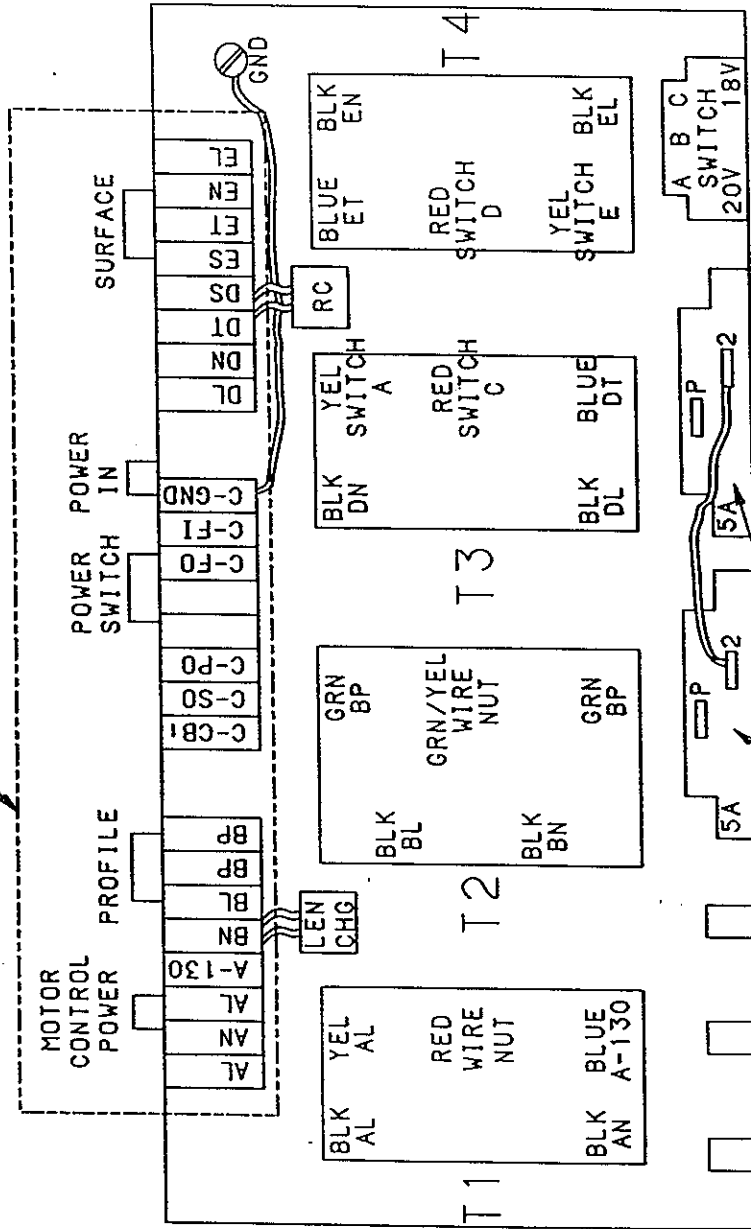
48 7610 00

Motor control board component layout



Electrical Tray Assembly 22-3280

POWER SUPPLY CIRCUIT BOARD ASSY



FRONT VIEW OF SWITCH

WHITE WIRE TO C-PO
BLACK WIRE TO C-CB1
W/BLACK WIRE TO C-SO

MAIN ROTARY LENS RING CHG.

LEN CHG.

WIRE TO LENS CHG. RECEPTACLE

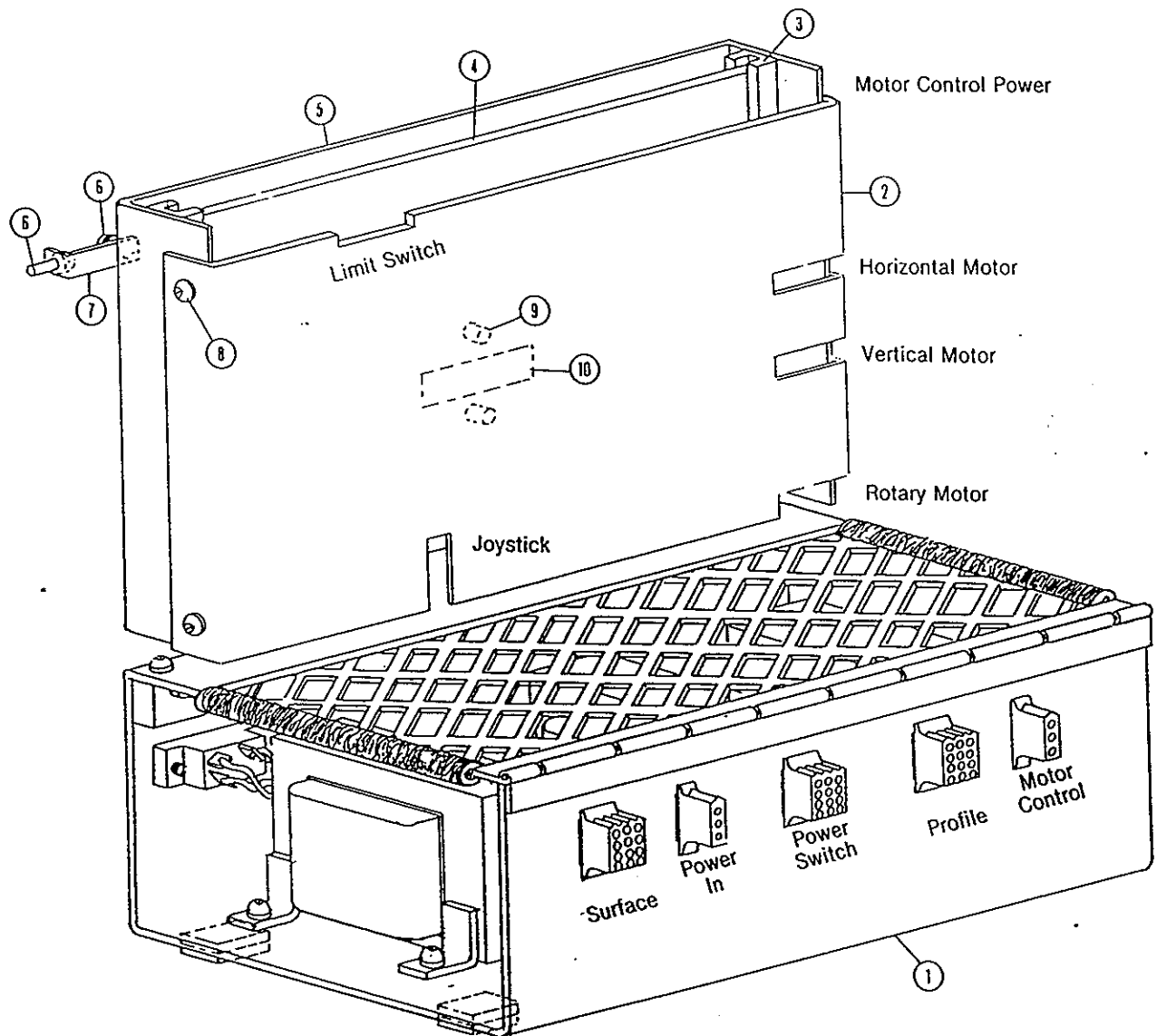
WIRE TO R.C. RECEPTACLE

WIRE TO C-FI & C-FO

TERMINAL B - BLACK WIRE TO DS
TERMINAL E - WHITE WIRE TO ES

- Transformer 1 (1) 22-3280-0200
- Transformer 2 (1) 22-3280-0100
- Transformer 3 (1) 22-3280-0300
- Transformer 4 (1) 22-3280-0300
- Fuse Post (3) 22-3280-0400
- Circuit Breaker Assy. (1) 22-3280-0500
- Switch (1) 22-3280-0500
- 10 Amp Fuse (1) 48-5832-0000
- 1/4 Amp Fuse (1) 48-7302-0000
- 3 Amp Fuse (1) 48-5885-0000
- Power Supply C.B. (1) 22-3235-0000

Electrical Tray & Motor Control Assembly



1.	22 3280 00	Electrical Tray Assembly	1	7.	22 3279 00	Motor Control Mount	2
2.	22 3281 02	Motor Control Cover	1	8.	48 5106 00	Screw, Bu. Hd. 10-32 x 1/4"	2
3.	48 7300 00	Card Mounting Guide	3	9.	48 7400 00	Stand Off	2
4.	48 7610 00	Motor Control Board	1	10.	48 7293 00	Safety Label	1
5.	22 3281 01	Motor Control Housing	1				
6.	48 5111 00	Screw, Bu. Hd. 8-32 x 1/4"	4				
				22 3281 00	Motor Control Board Assembly. Consists of Above Items 2, 3, 4, 5, 8, 9 & 10 in an Assembled Unit.		

ST  INDUSTRIES, INC.

301 Armstrong Boulevard North, St. James, Minnesota 56081-0517
Phone (507) 375-3211 Fax 507-375-4503

40-0422-0000