DEL MEDICAL

ATC-725

ATC 725
X-Ray Generator
Installation, Operation & Service Manual

P/N 8000-ATC-725

Revision: D, October 24, 2005

Attention: Consult Accompanying Documents - As Applicable

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GENDEX-DEL IMAGING CORP.

50B NORTH GARY AVENUE

ROSELLE, IL 60172

IMPORTANT - X-RAY PROTECTION

X-ray equipment may cause injury if used improperly. The instructions contained in this manual must be read and followed when operating the ATC-725 High Frequency Generator. GENDEX Corporation's authorized dealers will be glad to assist you in placing the ATC-725 into operation.

The ATC-725 provides a high degree of protection from unnecessary radiation. However, no practical design can provide complete protection nor prevent operators from exposing themselves or others to unnecessary radiation.

Personal radiation monitoring and protective devices are available. You are urged to use them to protect against unnecessary radiation exposure.

It is important that you be fully acquainted with applicable government radiation protection regulations. Many provisions of these regulations are based on recommendations of the National Council on Radiation Protection and Measurements. Recommendations for medical x-ray protection are published in NCRP Report Number 102, and is available from:

NCRP Publications
7910 Woodmont Ave.
Suite 1016
Bethseda, MD 20814

Those responsible for the planning and x-ray and gamma-ray equipment installations must be thoroughly familiar and comply completely with NCRP Number 49, "Structural Shielding Design and Evaluation for Medical Use of X-Rays and Gamma-Rays of Energies up to 10 MEV", as revised or replaced in the future.

The Center For Devices And Radiological Health has discontinued the Radiological Health Bulletin. However, this information can now be found on the internet, through the CDRH home page (http://www.fda.gov/cdrh/cdrhhome.html).

X-RAY EQUIPMENT SAFETY RECOMMENDATIONS

All movable assemblies and parts of this equipment must be operated with reasonable care. The manufacturer's equipment recommendations as outlined in the User and Installation/Maintenance Manuals accompanying the equipment must be observed.

Routine inspection of these assemblies should be performed by qualified service personnel on a semi-annual basis. Only properly trained service personnel should be permitted access to internal assemblies, as live electrical components are present. Be sure line disconnect switches are open or other appropriate safety precautions are followed before service work is performed.

Failure to follow manufacturer's service personnel's recommendations may result in serious injury or loss of life to the operator or those in the immediate area.

ELECTRICAL GROUNDING

This equipment must be grounded to a separate earth ground. No other means is acceptable. Refer to the National Electrical Code for grounding of Radiographic equipment.

X-RAY TUBE

△ CAUTION △

The ATC-725 is shipped with a tube loading programs specifically designed for the individual x-ray tubes. The programs are based on focal spot size and anode heat dissipation of the tube insert that will be used with the generator. Tube inserts of load capacities other than those for which the ATC-725 was configured may be DESTROYED if used with the incorrect tube loading program. Consult GENDEX for additional information.

INTRODUCTION

This manual provides the necessary instructions for proper operation, installation, adjustments and calibration of the GENDEX ATC-725 High Frequency Generator.

It is recommended that all persons operating or servicing this equipment read this manual. A thorough understanding of the ATC-725 and its proper use must be obtained before any radiographic exposures are made.

X-RAYS CAN BE DANGEROUS

The ATC-725 must be serviced by trained personnel who are familiar with the safety precautions that are required.

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CHAPTER I
OPERATOR'S INSTRUCTIONS

INTRODUCTION

The Gendex-Del ATC is a high frequency, microprocessor based, anatomically programmed generator. The unit features a unique menu driven, soft key approach that makes it extremely easy to use.

The ATC comes with a pre-programmed database that can be easily customized to meet your customer's imaging requirements. The database provides a selection of 8 body regions with up to 15 views per region - a total of 120 different examinations. When the technologist chooses an examination, the ATC automatically selects the following parameters: kV, mAs, focal spot, bucky and AEC field. Also, the operator can chose from up to twenty patient thickness selections (by centimeter) for each examination. This effectively makes possible up to 2400 unique anatomical examinations.

Each examination can be manually overridden at any time. The technologist can change the techniques selected for the current procedure only or it can be changed permanently.

The ATC can be operated in one of 4 modes:

1. APR: All imaging parameters are automatically selected.
2. Manual: Allows free selection of techniques.
3. AEC: Allows selection of kV and ion chamber.
4. Tomo: Allows for linear tomography.

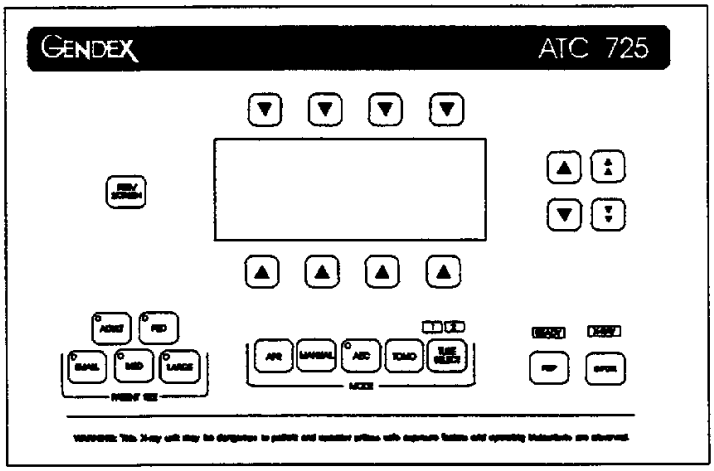


Figure 1-1

TECHNICAL INNOVATIONS

The ATC series has an advanced menu-driven man-machine interface which provides unparalleled ease of use. The ATC displays all information that is of current interest to the operator, while maintaining all other information within the software. This other data can then be easily recalled by the operator if desired.

What makes this all possible is microprocessor control. The 80188 processor is capable of 3 million operations per second and is accompanied by 64K of nonvolatile RAM for APR database storage. Future applications will be able to use up to 1 megabyte of data storage. The design of the control also includes provisions for interfacing with outside devices such as a line printer and personal computer. Connection to an external PC allows uploading and downloading of APR databases and using the features of a PC to more efficiently create/modify APR databases.

Another outstanding technical feature of the GENDEX-DEL ATC is the vacuum fluorescent display (VFD) which serves as the main interface between the control and the user. The display gives unparalleled brightness and readability regardless of room brightness or aspect angle. The VFD has the viewing angle of 140 degrees, more than twice the viewing angle of an LCD. The VFD is a superb interface with the operator, capable of displaying 8 lines of data with 43 characters per line. This is extremely valuable in displaying APR information to the user and aiding in installation and APR database modification routine.

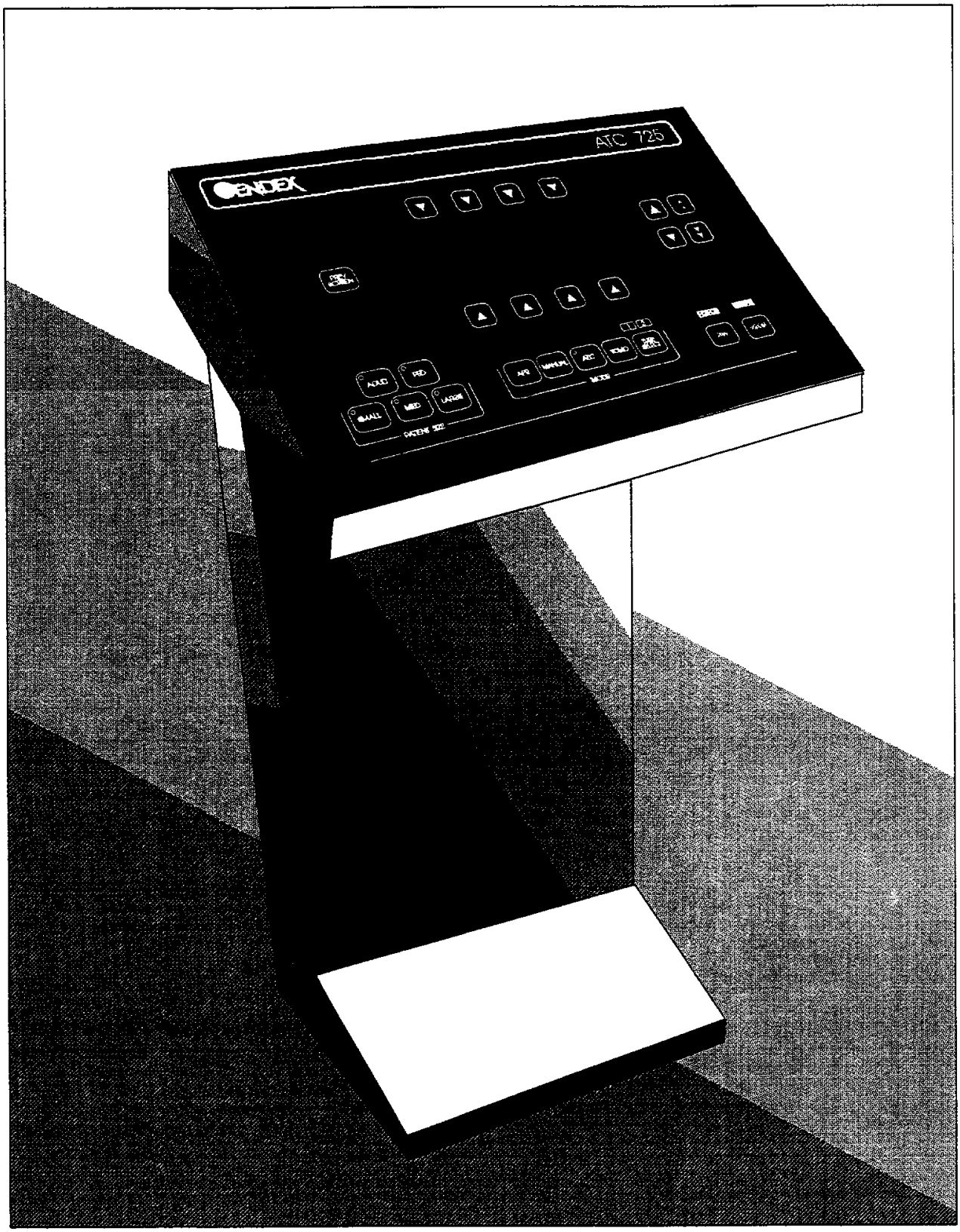


Figure 1-2 Full Pedestal and Front Panel

POWER ON/OFF PROCEDURE

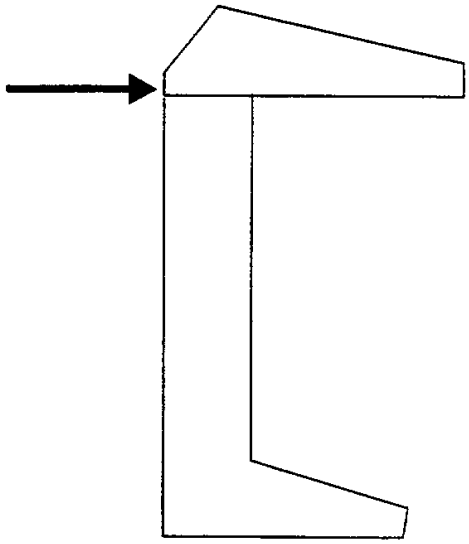


Figure 1-3 Power Switch Location

TO POWER UP THE ATC 725 GENERATOR:

1. If necessary, set the main power disconnect switch to "On".
2. Turn the power switch of the ATC 725 control to "On". This switch is located on the rear of the operator control console.
3. Within a few seconds, all control panel indicators will illuminate, and an audible tone will sound during a "Power-Up" Self Test.

When this Self Test is completed, the display screen will present the preprogrammed anatomical regions. The system is now ready for use.

TO POWER DOWN THE ATC 725 GENERATOR:

1. Turn the power switch on the operator console to "Off".
2. If the generator will not be used for an extended period, set the main power disconnect switch to "Off".

The data base of the ATC Generator is stored in nonvolatile memory and will not be erased when the power is turned "Off".

ATC CONTROL CONSOLE DESCRIPTION

The ATC control panel consists of an eight line, central display and numerous function keys (push buttons). Each of these have dedicated functions with the exception of the eight (multi-function) function keys surrounding the display. These eight keys are used to make selections of the fields shown on the display directly above or below them. The central display and function keys operate in the same manner as a bank automatic teller machine.

The multi-function keys are used either to make a selection from the alternatives listed in the display (e.g. anatomical regions) or to select a technique parameter (e.g. kV, time, mAs) to change.

To make a selection press the key directly above (for the top row of buttons) or below (bottom row) the choice desired. The next menu will appear.

There are two situations to change technique parameters. If it is a numerical parameter with a range of values (e.g.kV, mAs, time), press the key relating to the parameter to be changed. The present value will be highlighted on the screen. This value can be changed by pressing the up or down keys, of which there are two sets, fast change or normal change.

For other parameters (e.g. focal spot, film receptor, AEC fields, density), the multi-function key toggles through the possible values.

There are keys dedicated to a single function. They are: mode selection keys, patient size selection keys, PREP, EXPOSE, PREV SCREEN, increment, decrement, fast increment, and fast decrement.

There are three Mode selection keys. They are APR, MANUAL, and TOMO (if installed). Pressing the APR key will display the Anatomical Programmed Radiology main menu, the MANUAL key will display the manual menu, and the TOMO key will display the TOMO menu. Pressing the AEC key will enable automatic exposure control in either the APR or MANUAL modes. If a two tube system is installed, the TUBE SELECT allows the operator to toggle between the two x-ray tubes.

In the APR mode, one of six Patient Sizes may be selected by pressing either of ADULT or PED and either SMALL, MED, or LARGE, thereby selecting the pre-programmed patient thickness (CM) and the exposure technique for that thickness. Patient Size keys have no effect in MANUAL, TOMO, or when manual AEC is selected.

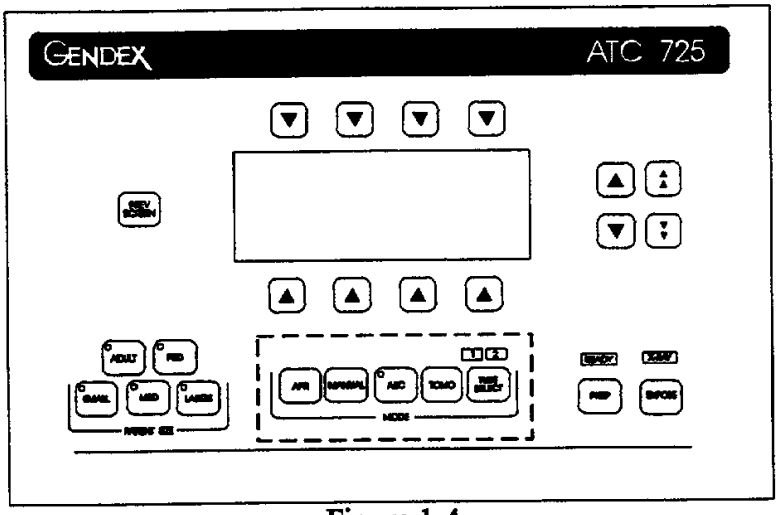


Figure 1-4

MODE SELECTION KEYS

The ATC generator operates in three basic modes: Anatomical Programmed Radiology (APR), Manual, and Tomography. Automatic Exposure Control (AEC) can also be selected in combination with the APR and Manual Modes.

1. -APR- Selecting anatomical region (e.g. SKULL), view (e.g. A/P), and patient size (e.g. ADULT SMALL) recalls the pre-programmed technique settings from the APR database. This ensures consistent radiography without the use of extensive technique charts. The pre-programmed technique factors for kV, mAs, exposure time, focal spot, receptor, and AEC function can be changed by using the keys surrounding the central display.
2. -MANUAL- Permits the individual selection of all technique parameters by using the keys surrounding the central display.
3. -AEC- Selects AEC in either the APR or MANUAL modes. In the APR mode, AEC can be selected either for the current examination or by the pre-programmed APR data base. When AEC is selected, the operator can select among two film/screen combinations, three field(s) of the ion chamber, and five optical density variations and may vary, if desired, the kV and Backup mAs.
4. -TOMO- Permits a TOMO exposure. The control displays the ANGLE of the slice and SWEEP SPEED that have been selected on the tomographic controller. The operator selects on the APR console the kV, mAs, and focal spot for the exposure.
5. -TUBE SELECT - Selects between two x-ray tubes (if this option is installed). Pressing the "TUBE SELECT" key, Tube One or Tube Two and the associated x-ray apparatus will be enabled. The Data Base incorporates Tube protection parameters for each selected tube.

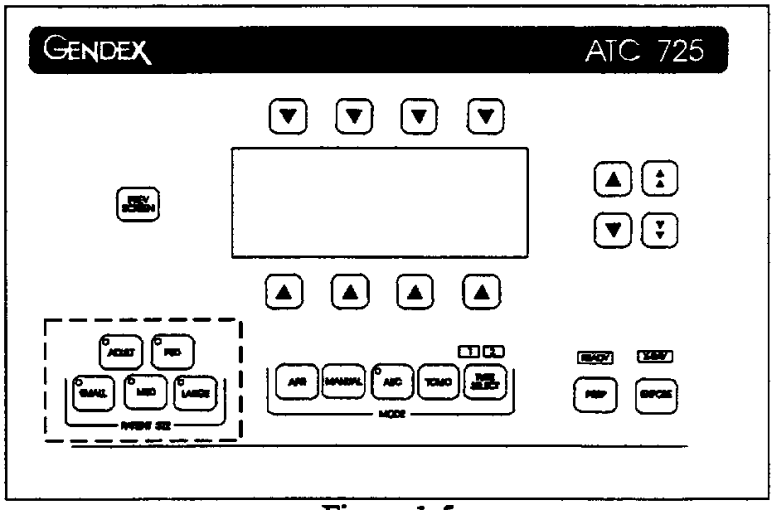


Figure 1-5

Patient Size Selection

The APR technique data base varies the kV and/or the mAs with patient thickness, (CM). Six techniques are pre-programmed by Patient Size and are accessed by choosing ADULT or PED and SMALL, MED, or LARGE.

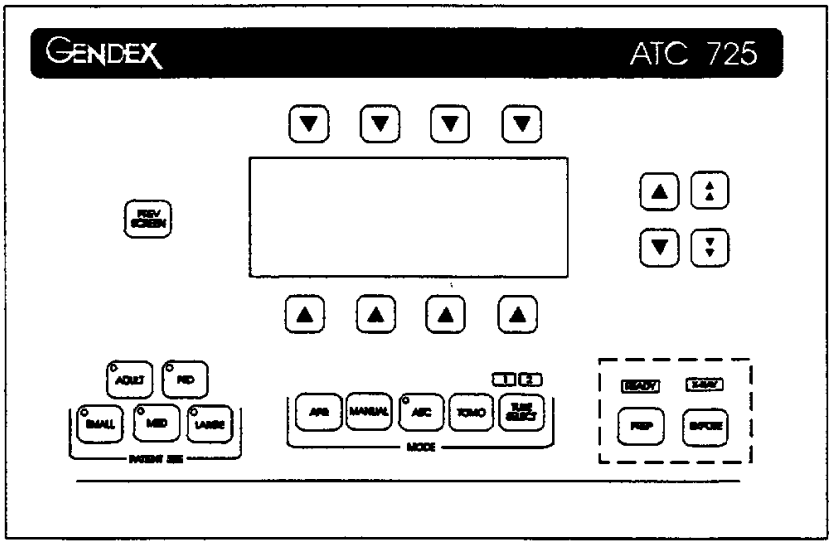


Figure 1-6

Prep and Expose

To make an exposure, PREP must be pressed and held until the READY light appears. Continue to hold PREP, press the EXPOSE key and hold both keys until the x-ray light goes out and audible tone ends.

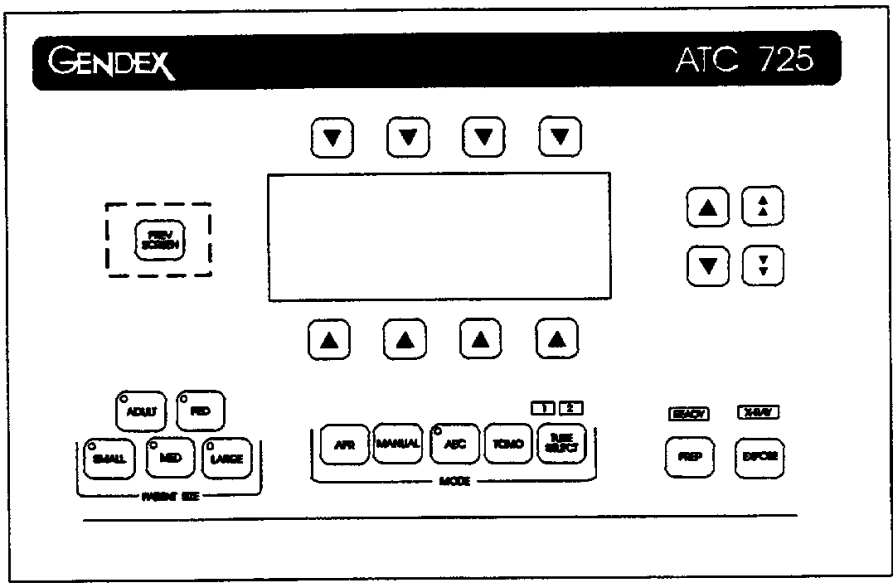


Figure 1-7

Previous Screen

The "PREVIOUS SCREEN" key will return the operator to the screen immediately preceding the one currently displayed.

The "PREVIOUS SCREEN" key is also used to access the daily Tube Warm-up Procedure and a service related menu called "Utilities".

The Tube Warm-up Procedure can be accessed by pressing the "PREVIOUS SCREEN" key when in the first "APR" (Anatomical Region) menu.

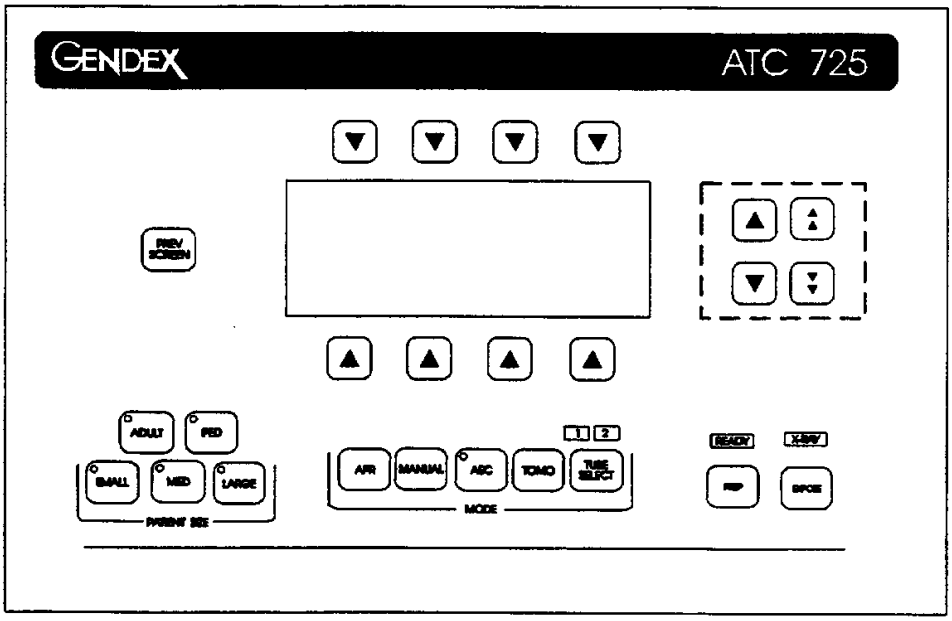


Figure 1-8

Increment and Decrement

The Increment and Decrement keys are used in conjunction with the kV, mAs, CM, or Time keys. When one of these keys is pressed, that parameter is highlighted on the screen in reverse video. The values are changed with the increment or decrement keys.

Kilovoltage and Centimeter values change by one. Changing the centimeter thickness will have an effect on mAs, kV and exposure TIME when in the "APR" mode. The values of mAs will change in 20% intervals and may change the exposure TIME. Exposure TIME changes are in intervals of 25% increments, and are limited by the selected mAs and/or the tube protect program in the data base. Fast increment and fast decrement keys will change values about five times faster.

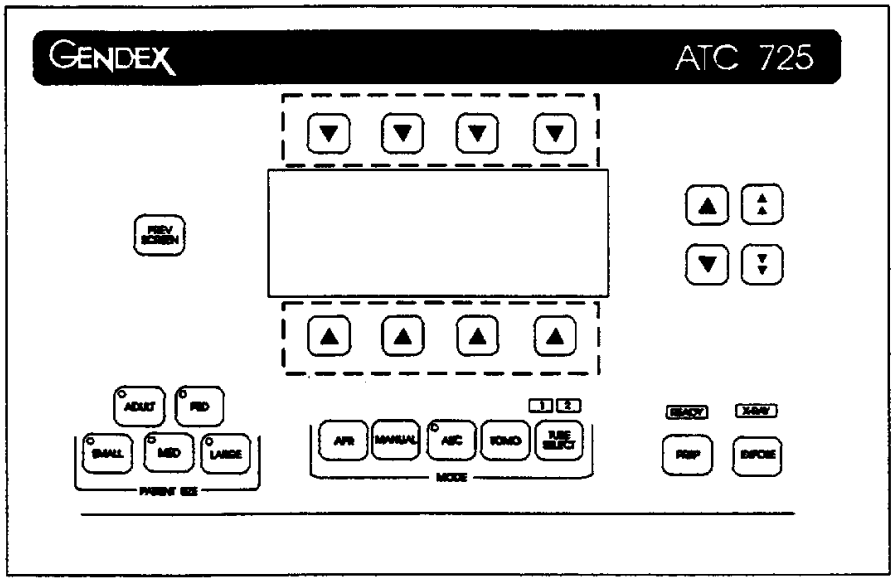


Figure 1-9

Multi-function Keys

Each multi-function key is defined on the central display screen. An undefined key will have no effect when pressed. Pressing a defined key will either toggle through a choice of options or allow a technique factor to be modified by the increment or decrement keys.

Specific details on each menu will be defined in the appropriate sections of this manual.

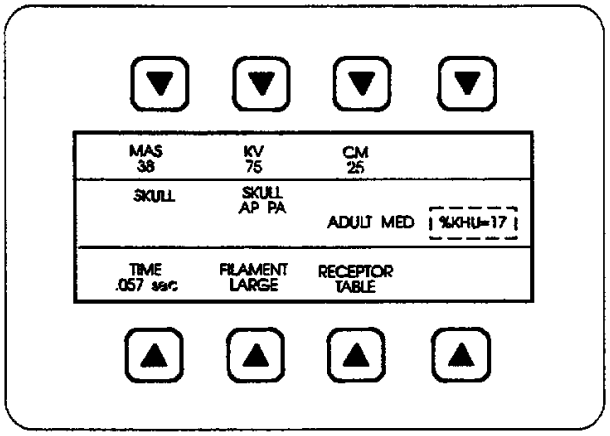


Figure 1-10

X-RAY TUBE ANODE HEAT DISPLAY

The ATC generator automatically calculates x-ray tube anode heat loading and displays this value as a percentage of maximum kilo heat units (KHU) at the far right end of the central display while in the expose menu.

BASIC X-RAY PROCEDURES

△ CAUTION △

THE FOLLOWING PROCEDURES WILL PRODUCE X-RAYS. OPERATING PERSONNEL SHOULD TAKE PRECAUTIONS TO ENSURE THEIR PERSONAL SAFETY AND THE SAFETY OF OTHERS IN CLOSE PROXIMITY. MINIMUM PRECAUTIONS ARE AS FOLLOWS:

a) Wear lead aprons.
b) Personnel remaining in the X-ray room during exposure should be behind a lead shield.
c) Minimize radiation scatter through doorways, walls and floor.

APR MODE

When the power is turned ON, the ANATOMICAL REGION menu appears on the display screen. Pressing the multi-function key closest to the desired REGION will display the VIEW OF REGION menu.

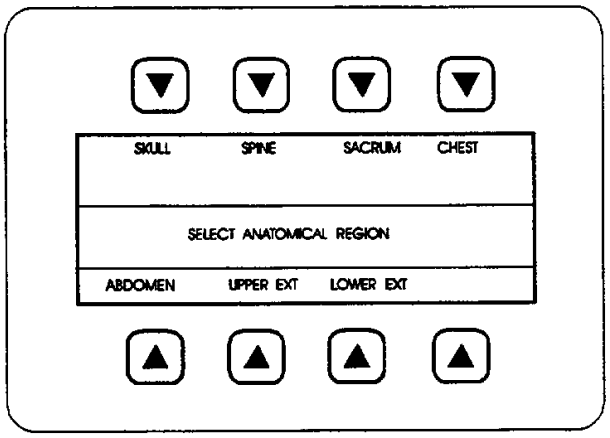


Figure 1-11 APR Mode "Region" Screen

Pressing a multi-function key closest to the desired VIEW will display the pre-programmed technique factors for the exposure. If MORE appears in the lower right window of the display, additional VIEWs may be accessed by pressing the associated multi-function key.

The information on the technique factor display include mAs, kV, selected patient thickness, calculated exposure time, selected focal spot, and the selected image receptor. Patient Size should be entered at this time, either ADULT or PED and either SMALL, MED, or LARGE. The generator is now set to make an exposure.

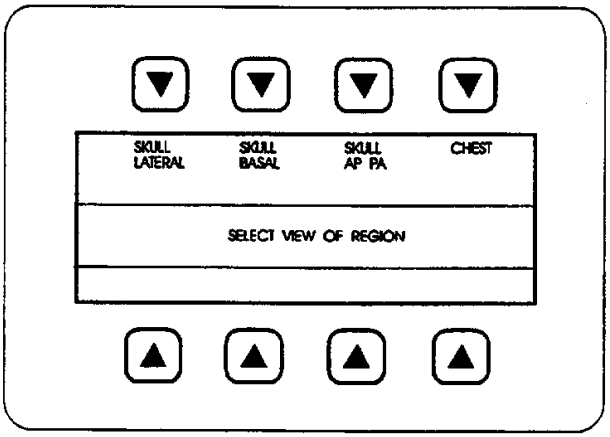


Figure 1-12 APR Mode "View" Screen

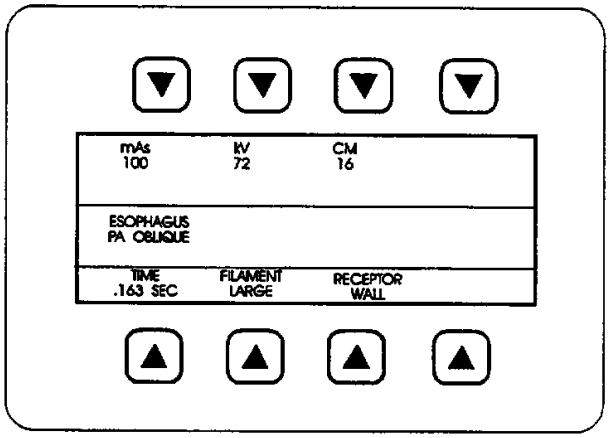


Figure 1-13 Display of Generator Settings

These three selections, "REGION", "VIEW", and "SIZE" are the only ones required to prepare for an APR exposure. To initiate the exposure press the "PREP" key and wait for the illumination of the green "READY" light. To make the exposure press the "EXPOSE" key (while holding down the "PREP" key). The red "X-RAY" light will turn on and an audible tone will be heard. Both the illumination of the red "X-RAY" light and the audible tone will terminate at the end of the exposure.

MANUAL MODE

The manual mode is accessed by pressing the "MANUAL" key. This mode allows the technologist to set up the technique parameters (kV, mAs, focal spot, time and image receptor) individually.

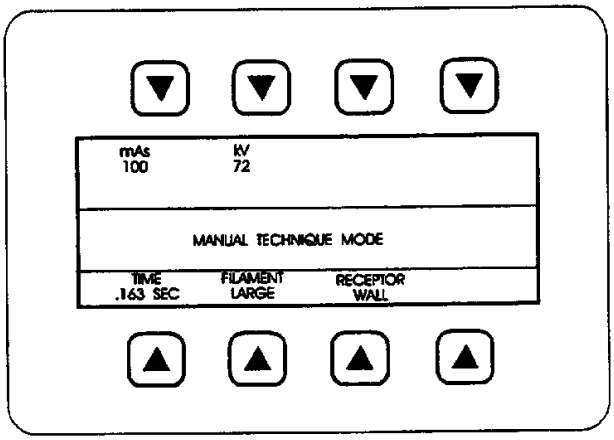


Figure 1-14 Manual Mode Screen

The MANUAL screen displays selected kV, mAs, exposure TIME, image receptor, and focal spot. Any of these factors may be modified by pressing the multi-function key closest to the name of that factor. If that function is kV, mAs, or exposure TIME, the displayed value may be change by using the increment or decrement keys. If that function is FOCAL SPOT or IMAGE RECEPTOR it may be toggled through the available selections by additional pressing of the associated key. When the desired selection is displayed, another factor can be modified by pressing its multi-function key and continuing as above.

When all the parameters are set, press the "PREP" key and wait for the illumination of the green "READY" light. To make the exposure press the "EXPOSE" key (still holding down the "PREP" key). The red "X-RAY" light will turn on and an audible tone will be heard. The illumination of the red "X-RAY" light, green "ready" light, and the audible tone will terminate at the end of the exposure.

APR MODE with AEC

The Gendex-Del Automatic Exposure Control (if installed), can be activated by pressing the "AEC" mode key. When in the "APR" mode, the ion chamber location and field selection are pre-programmed.

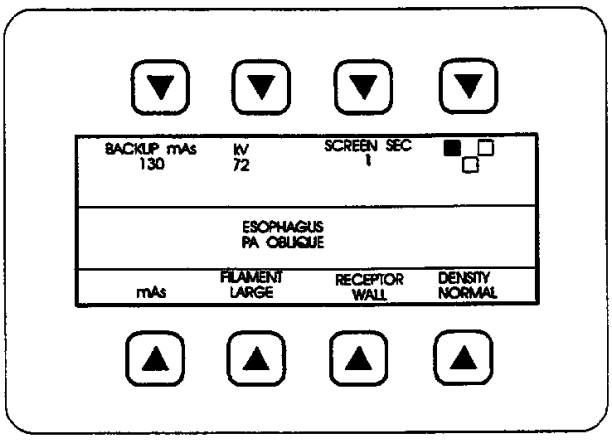


Figure 1-15 APR Mode with AEC

When AEC is selected, Centimeter thickness, pre-read exposure time, and mAs are not displayed. In their place are Screen Select (programmed in AEC unit), Ion Chamber Fields, film Density, Back-up mAs, and kV.

Pre-programmed kV and Back-up mAs will be displayed. This mAs value is about 2 to 3 times the expected mAs for the pre-programmed kV. Any technique parameter may be individually changed in the same manner as described previously.

The various chamber field combinations can be accessed by toggling the multi-function key adjacent to the field display on the screen.

"Screen Select" refers to the choice of two different film-screen combin- ations. The film-screen speeds may vary by site and are calibrated to the technologist's preference during the installation. The other, film-screen is select by pressing the associated multi-function key. "Density" refers to optical density on the finished radiograph. Changes in density, ranging from minus 50% to plus 50% can be selected by pressing the associated multi- function key. Repeated key presses will cycle through the density range.

Exposures are initiated by pressing PREP and EXPOSE as previously described. Once the exposure is complete, the display will indicate the actual mAs of the exposure.

If an AEC exposure terminates improperly, one of two faults will be displayed: BACKUP mAs and GENERATOR.

"AEC Backup mAs Termination" shows the exposure was terminated by the AEC mAs backup circuitry and indicates a possible problem requiring service. No further AEC exposure should be attempted until the problem is corrected. "Generator Termination of AEC" indicates the exposure was terminated by the generator before the AEC terminated the exposure. This indicates either that the mAs selected on the generator control was less than the requirements for the exposure or that the ion chamber is not in the X-ray beam. Should either occur, make the appropriate correction, and press the RESET key to permit another exposure.

MANUAL MODE with AEC

If the ATC X-ray Generator is equipped with a Gendex-Del Automatic Exposure Control, it can be activated by pressing the "AEC" mode key. When AEC is chosen in the manual mode; kV, focal spot and, image receptor must be selected by the technologist as described in the "Basic X-ray Procedures-Manual mode" section of this chapter.

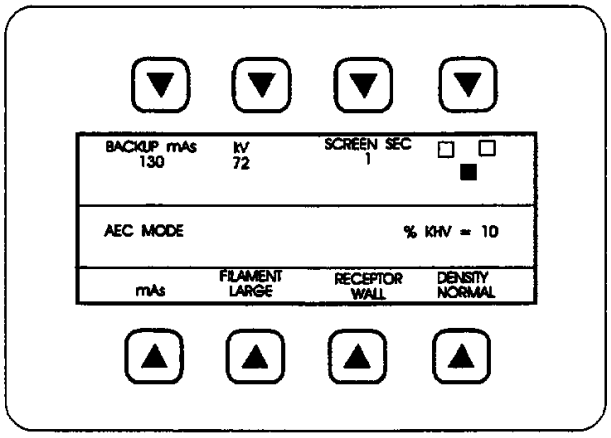


Figure 1-16 Manual Mode with AEC

In addition, a choice of film-screen combination, ion chamber fields, and film density can be set up on the control as discussed in the previous section. The default mAs value is programmed for the selected kV. It may be changed by the technologist, but its value should be 2 to 3 times the expected mAs of the exposure. Exposures are initiated by pressing PREP and EXPOSE as previously described.

Once the exposure is complete, the display will indicate the actual mAs of the exposure. If an AEC exposure terminates improperly, one of two faults will be displayed: BACKUP mAs and GENERATOR.

"AEC Backup mAs Termination" shows the exposure was terminated by the AEC mAs backup circuitry and indicates a possible problem requiring service. No further AEC exposures should be attempted until the problem is corrected.

"Generator Termination of AEC" indicates the exposure was terminated by the generator before the AEC terminated the exposure. This indicates either that the mAs selected on the generator control was less than the requirements for the exposure or that the ion chamber is not in the X-ray beam. Should either occur, make the appropriate correction, and press the RESET key to permit another exposure.

DAILY X-RAY TUBE SEASONING PROCEDURE

Following the tube warm up procedure will extend the useful life of the x-ray tube. Therefore, it is important to slowly warm the tube target prior to radiographic studies if the unit has been idle for three hours or more.

The ATC generator has a pre-programmed tube warm up procedure. Enter this portion of the program by starting from the APR "Regions" screen and pressing the "PREV SCREEN" key.

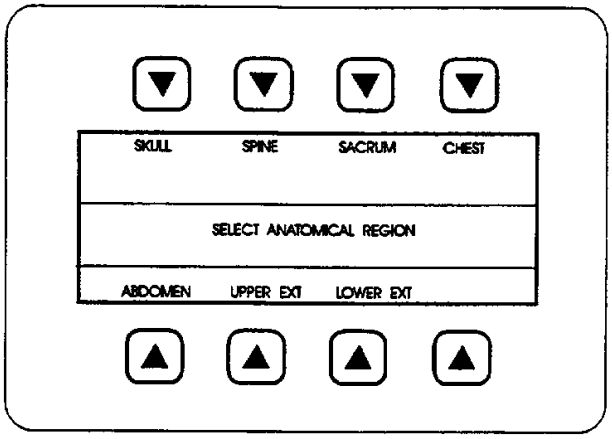


Figure 1-17 APR Mode "Region" Screen

Press tube warm up.

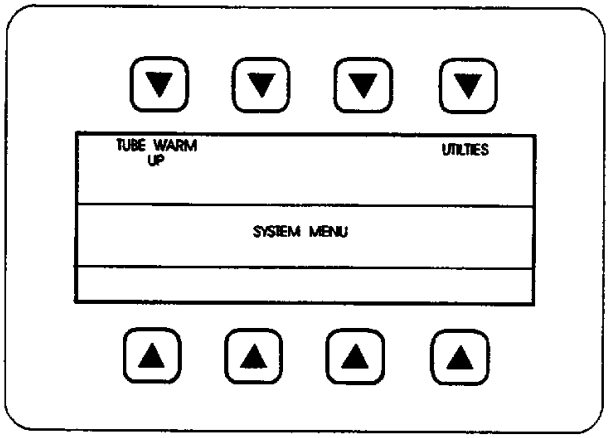


Figure 1-18

Once in this mode, the program will select the first of a series of five exposures. Make the first exposure. A clock will then count 90 seconds. Make the next exposure. The clock will reappear. Repeat until the five exposures have been made. The display will then indicate that the Tube Warm Up is complete.

There are two ways to exit the tube warm up mode. The first method is to press one of the five following keys; the "Prev Screen", "APR", "TOMO", "MANUAL", and "AEC" keys. The second method would be to press the cancel key while in the clock timer mode.

FAULT INDICATIONS

The display can indicate three types of fault conditions: X-ray generator faults, Exposure key faults, and AEC related faults. These fault conditions may be reset by pressing the RESET key appearing in the central display. Some faults require servicing of the equipment

.

Generator faults will be displayed as a mA-FAULT, kV-FAULT, and COMMUNICATION-FAULT. Use of the equipment should be discontinued until the malfunction is corrected by a serviceman.

An Exposure key fault will occur if the operator releases either the PREP or X-RAY keys during x-ray exposure (before the generator terminates the exposure).

When the RESET key is pressed, the generator will cycle through the normal power up sequence. If this fault continues to occur servicing is required.

If an AEC exposure terminates improperly, one of two faults will be displayed: BACKUP mAs and GENERATOR.

"AEC Backup mAs Termination" shows the exposure was terminated by the AEC mAs backup circuitry and indicates a possible problem requiring service. No further AEC exposure should be attempted until the problem is corrected.

"Generator Termination of AEC" indicates the exposure was terminated by the generator before the AEC terminated the exposure. This indicates either that the mAs selected on the generator control was less than the requirements for the exposure or that the ion chamber is not in the X-ray beam. Should either occur, make the appropriate correction, and press the RESET key to permit another exposure.

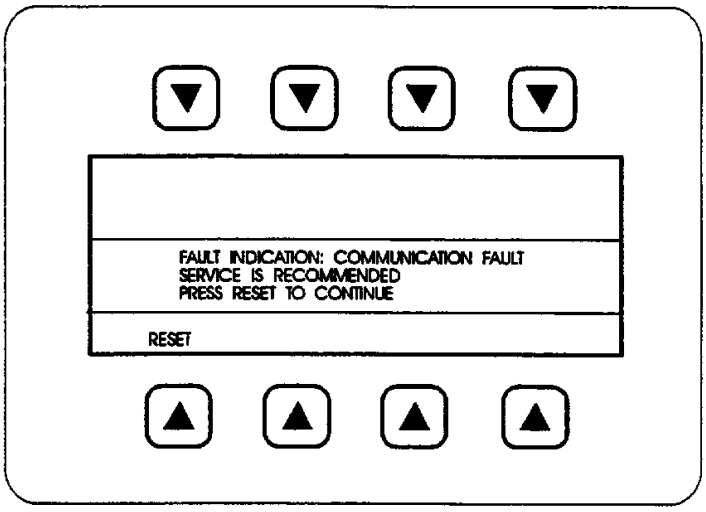


Figure 1-19

CHAPTER 2
TECHNIQUE REPROGRAMMING

INTRODUCTION

The ATC generator comes with a pre-programmed APR Data Base that was developed to serve the widest range of users. Because of requirements which may be unique to a specific installation, provision has been made to permit the changing of that Data Base. This section describes how the Data Base may be reprogrammed.

To enter the reprogramming mode, first press the APR key to display the main APR screen.

Next press the PREV SCREEN key to reach the System Menu. There are three Flow Charts outlining the Data Base change program. They are:

1. The Entry/Region Change Flow Chart
2. The View Change Flow Chart
3. The Technique Factors Change Flow Chart

Since each of these charts refers to software routines on the other charts, they should be examined together.

ENTRY / REGION CHANGES

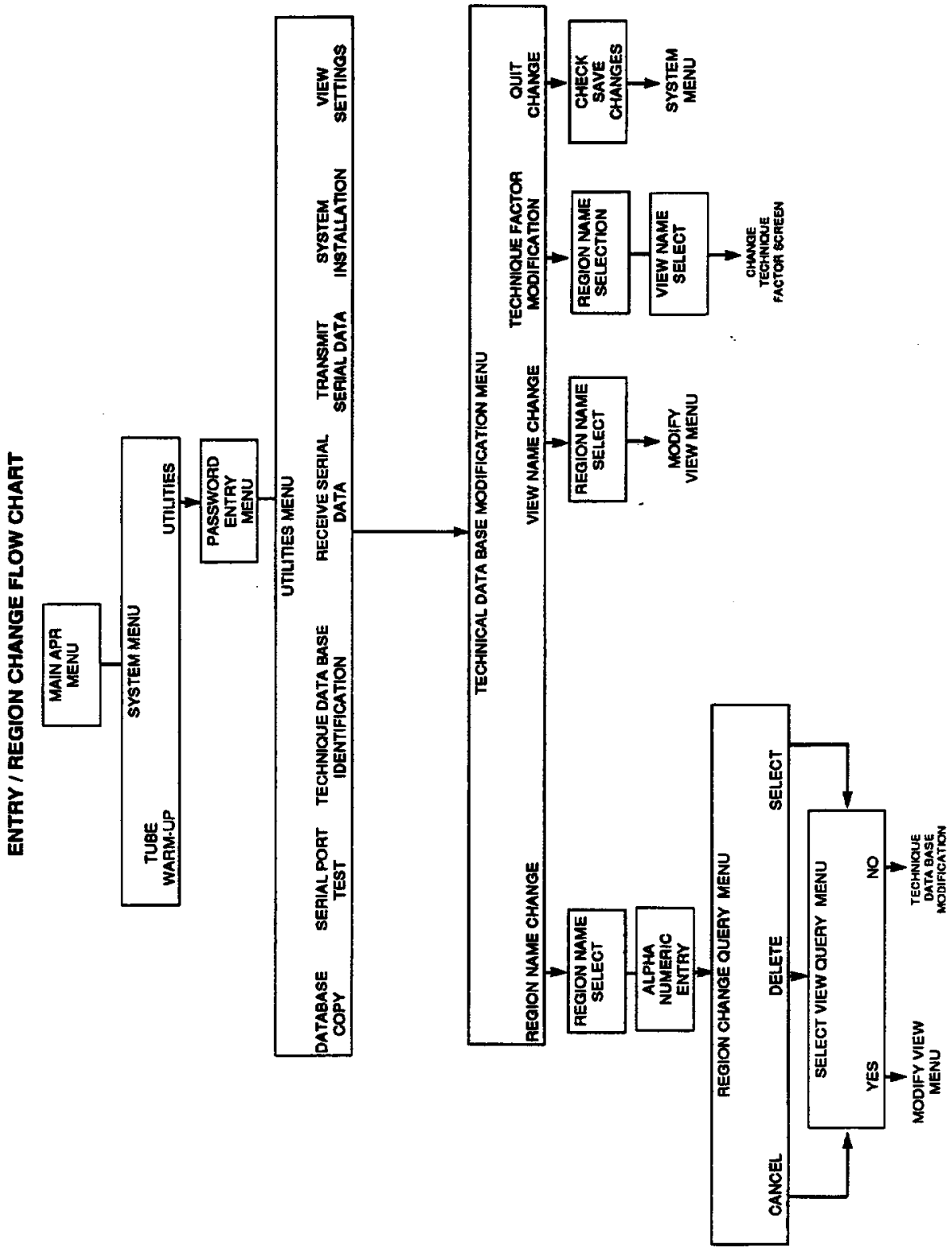


Figure 2-1 The Entry/Region Change Flow Chart

The Entry/Region Change Flow Chart consist of several menus and screens.

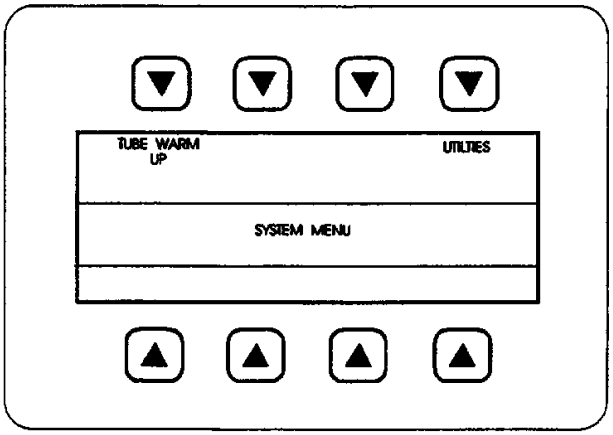


Figure 2-2 System Menu Screen

The System Menu has two options, the TUBE WARM UP procedure (described in Chapter One) and UTILITIES. Press the UTILITIES key to bring up Password Entry.

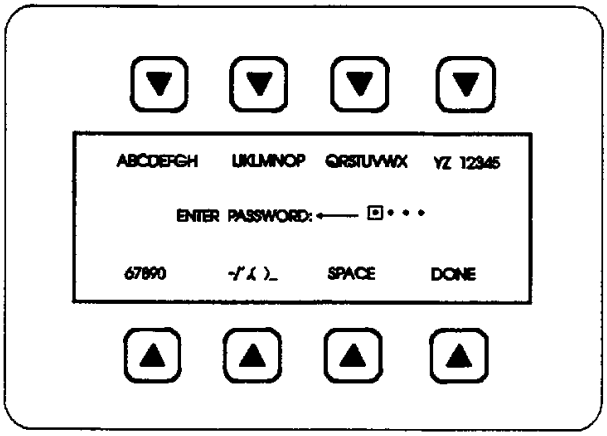


Figure 2-3 Password Entry Menu

The service engineer may program the APR Data Base for any desired password. This password is required to be entered for the next menu. The password is entered as follows:

Enter each letter (number) by first pressing the key associated with the Group in which the letter occurs. The next screen will link the keys to a single letter from the Group. Press the associated key to select the desired letter. The screen will now return to the menu in which the Groups are displayed. Select the next letter of the password in the same manner and continue selecting until the password entry is completed. An incorrect password will bring up the Systems Menu. The correct password will bring up the Utilities Menu.

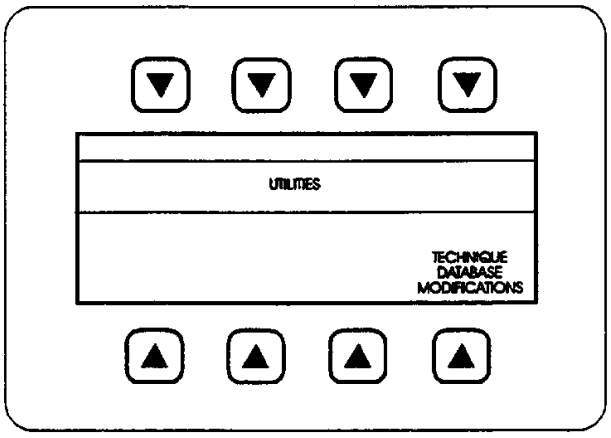


Figure 2-4 Utilities Menu Screen

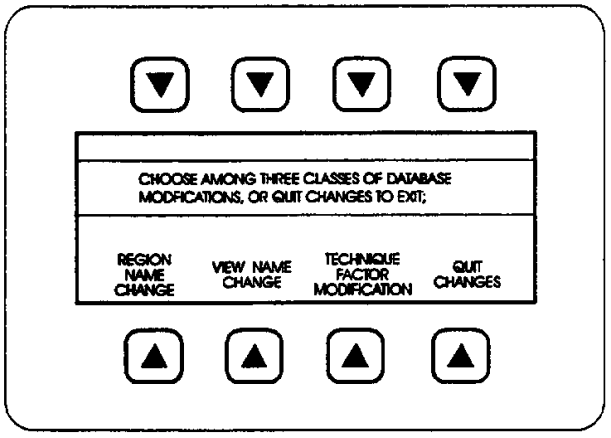


Figure 2-5 Technique Data Base Modification Menu

Press the key associated with TECHNIQUE DATA BASE MODIFICATION to call up the Technique Data Base Modification Menu.

The selections in this menu permit REGION NAME CHANGE, VIEW NAME CHANGE, AND TECHNIQUE FACTOR MODIFICATION (kV, mAs, etc.). Pressing the QUIT CHANGE key exits the menu, checks and saves the data, and then recalls the Systems Menu. Each major window of this menu will be described.

REGION/VIEW NAME CHANGES

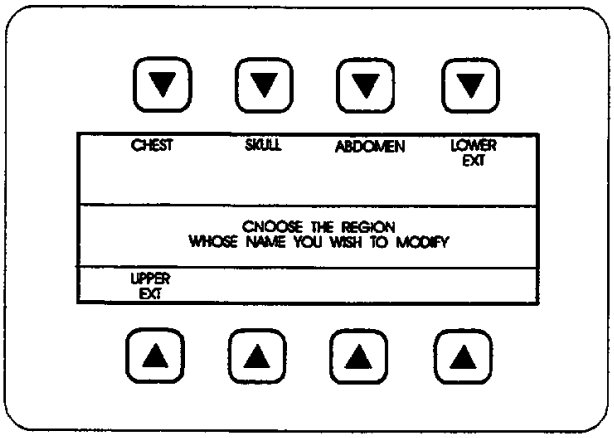


Figure 2-6 Region Name Select Screen

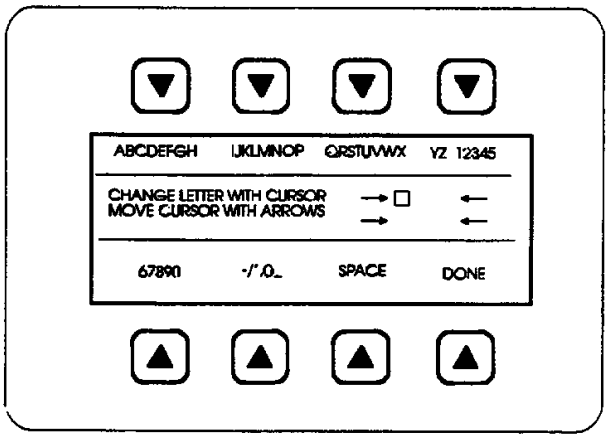


Figure 2-7 Alpha Numeric Entry Menu

These two menus are similar. Each will display the Regions or Views already programmed in the Data Base. The desired Region (or View) to be changed is selected by pressing its associated key.

The Alpha Numeric Entry Menu displays the name of Region (or View if one has been selected) and permits an addition to or a change of that selection. New text can be added in the same manner as is used to enter the password. The cursor may be moved by pressing the INCREMENT or DECREMENT keys. The description may be in either or both of two entry lines. There is a maximum of ten characters for each line. A single line description may be placed in either the upper or lower line (to place it closest to its associated key) and may be centered by the use of the SPACE key. When finished with the description, press the DONE key.

If no name change of the Region (or View) selected is desired, pressing the DONE key will enter the next menu, the Region Change Query Menu.

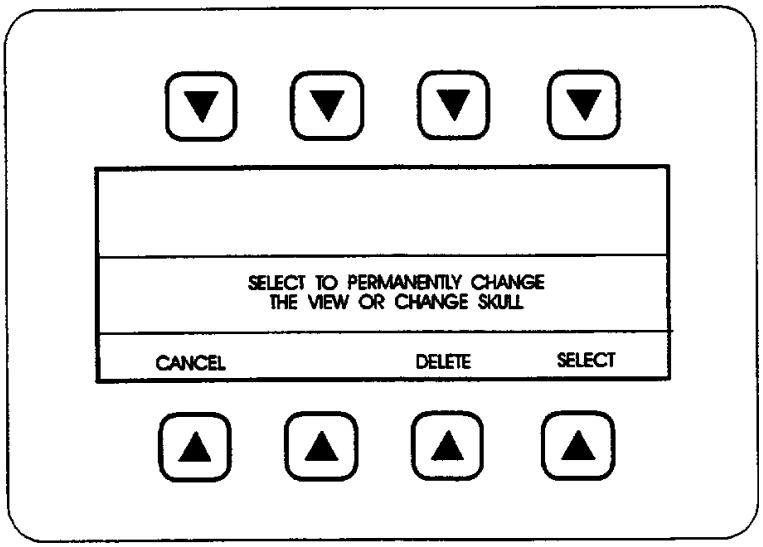


Figure 2-8 Change Query Menu

In this menu the displayed Region name may be CANCEL(led) (no change), DELETED (Region name deleted), or SELECT(ed) (accepted into the Data Base). Making any of these selection will bring up the Select View Query Menu.

VIEW CHANGES

SELECT VIEW MENU

This menu offers two selections, NO, which returns to the Technique Data Base Modification Menu, and YES which permits the further modification of the Data Base associated with this Region, i.e, View and Technique Factors. When YES is selected the Modify View Menu appears (see the View Change Flow Chart).

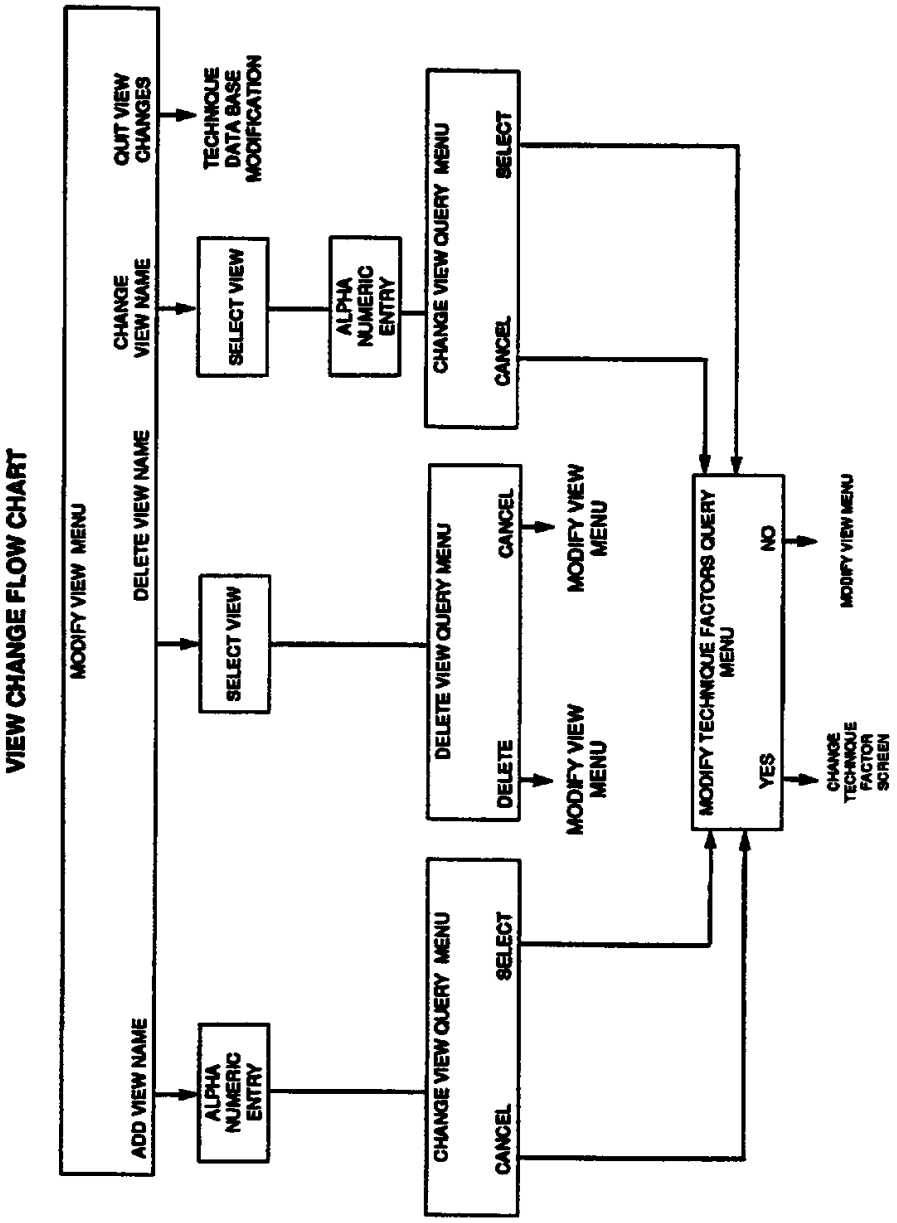


Figure 2-9 View Change Flow Chart

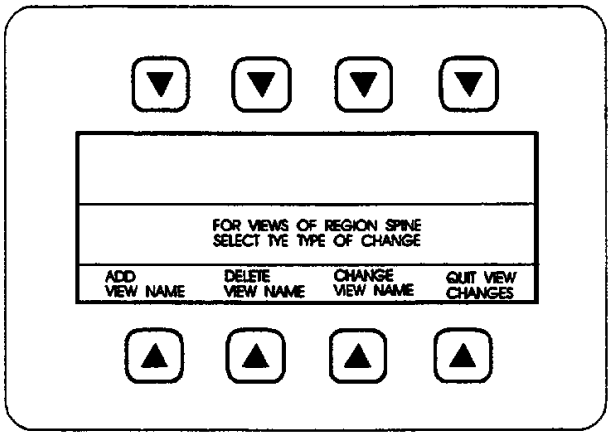


Figure 2-10 Modify View Menu

The Modify View Menu offers four choices, ADD VIEW NAME, DELETE VIEW NAME, CHANGE VIEW NAME, or QUIT VIEW CHANGES (exit to the Technique Data Base Modification Menu). Upon selection of one of the first three options, the next screen(s) to appear require View selection or Alpha Numeric entries as previously described. At the end of these will appear a confirmation screen, the Change/Delete View Query Menus.

DELETE VIEW QUERY MENU

The Delete View Query Menu asks for confirmation of the requested deletion. Pressing DELETE erases the View and pressing CANCEL retains the View. After either selection the Modify View Menu will appear.

CHANGE VIEW QUERY MENU

The Change View Query Menu asks for confirmation of the changes, press SELECT for "yes" and CANCEL for "no". After selection the Modify Technique Factor Query Menu will appear.

MODIFY TECHNIQUE FACTORS

MODIFY TECHNIQUE FACTORS QUERY MENU

This menu offers two selections, NO, which returns to the Modify View Menu, and YES, which permits the modification of the Technique Factors (i.e. kV, mAs) associated with this Region and View. When YES is selected, the Change Technique Factors Screen appears (see the Technique Factor Change Flow Chart).

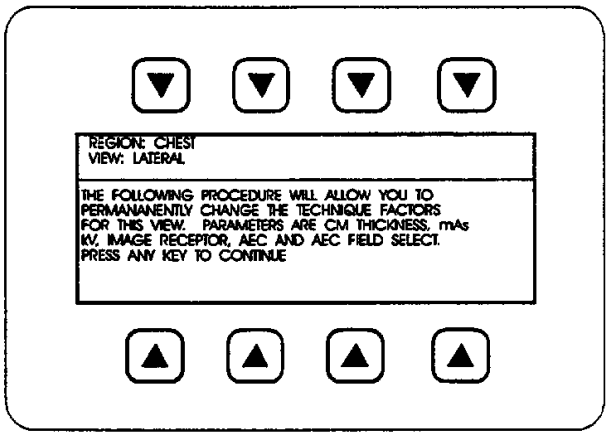


Figure 2-11 Change Technique Factor Screen

This is an information screen. Press any key to get the Technique Factors Entry Menu.

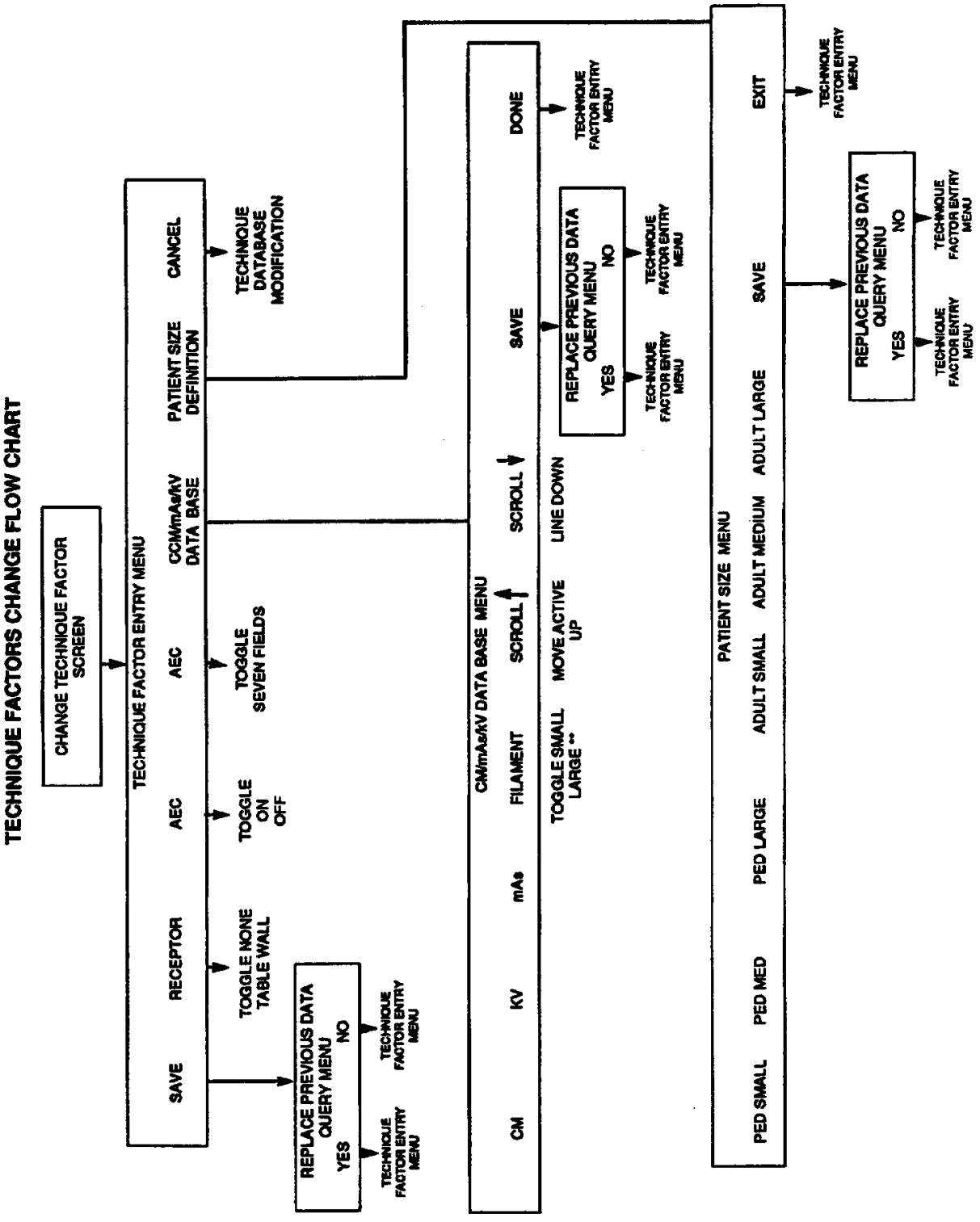


Figure 2-12 Technique Factors Change Flow Chart

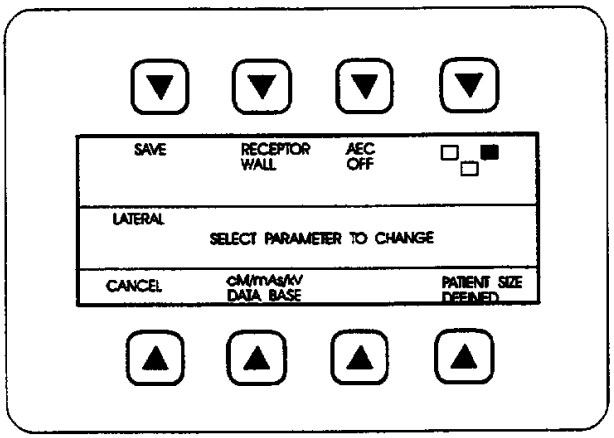


Figure 2-13 Technique Factor Entry Menu

This menu permits the selection of the exposure options for the selected Region and View. Three of the keys when repeatedly pressed, toggle through specific choices:

1. RECEPTOR key - TABLE, WALL, NONE
2. AEC key - ON, OFF There must be AEC installed in the selected receptor.
3. AEC field - All combinations of 1, 2, or 3 fields selected in the receptor ion chamber.

If AEC is OFF, the choice has no meaning.

The other key functions are:

1. CM/kV/mAs DATA BASE key enters the CM/kV/mAs Data Base Menu.
2. PATIENT SIZE DEFINITION key enters the Patient Size Menu.
3. CANCEL key returns to the Technique Data Base Modification Menu.
4. SAVE key display a Replace Previous Data Query Menu.

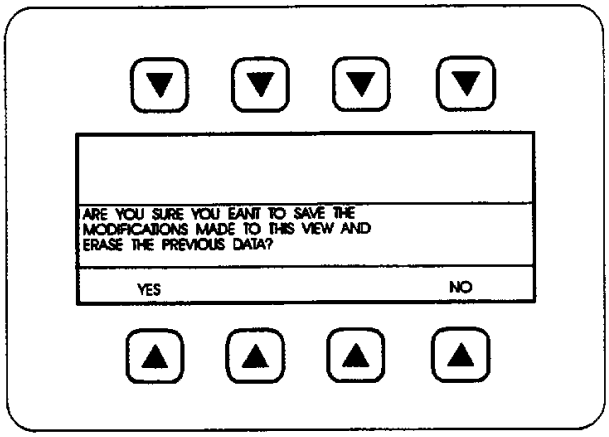


Figure 2-14 Replace Previous Data Query Menu

This menu is a confirmation menu and is used after SAVE entries. YES replaces any previous data with newly entered data and NO retains any previous data. Both YES and NO return to the Technique Factor Entry Menu.

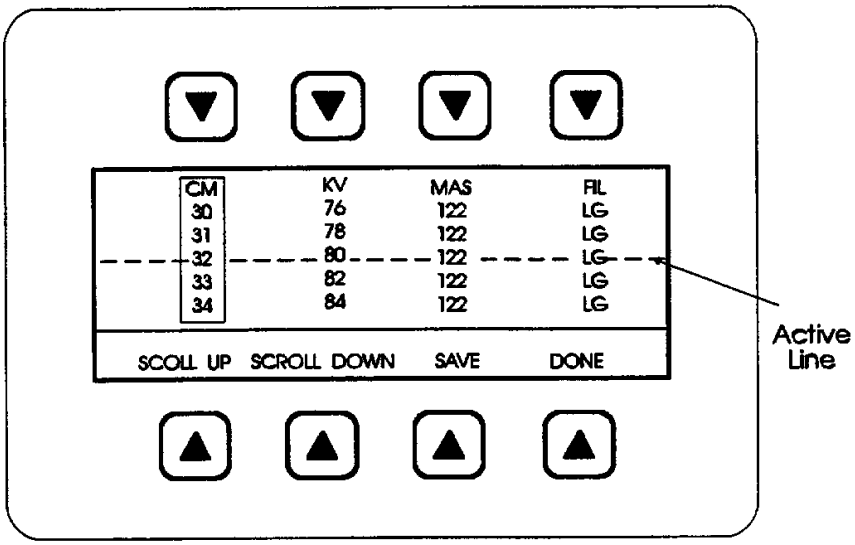


Figure 2-15 CM/Kv/mAs/ Data Base Change Menu

This menu enables the entry of four exposure factors into the Data Base for the selected Region and View. These factors are:

1. Patient thickness - CM (centimeters)
2. Kilovoltage - kV
3. MilliAmpSeconds - mAs
4. Focal Spot - Lg, Sm

The ACTIVE LINE appears in the middle of the display. It is the parameters on this line that may be changed. Pressing the SCROLL UP or SCROLL DOWN keys will cause the display to move across this line.

CM should be programmed first. Move the display (SCROLL UP/DOWN) so that the ACTIVE LINE is across the value to be changed. Press the CM key to highlight the CM value on the active line. Use the INCREMENT OR DECREMENT keys to select the desired value. Scroll to the next line to enter another CM value. Remember that six of the CM values will have Patient Size assigned to them.

In the same way the kV values should be entered next. Then the mAs values are entered. The mAs values are in a preselected table and only those values can be entered.

The FILAMENT will toggle between Large Focus and Small Focus each time the associated key is pressed.

The SAVE key displays the Replace Previous Data Query menu as described above. The DONE key returns Technique Factor Entry Menus <u>without</u> saving the new data.

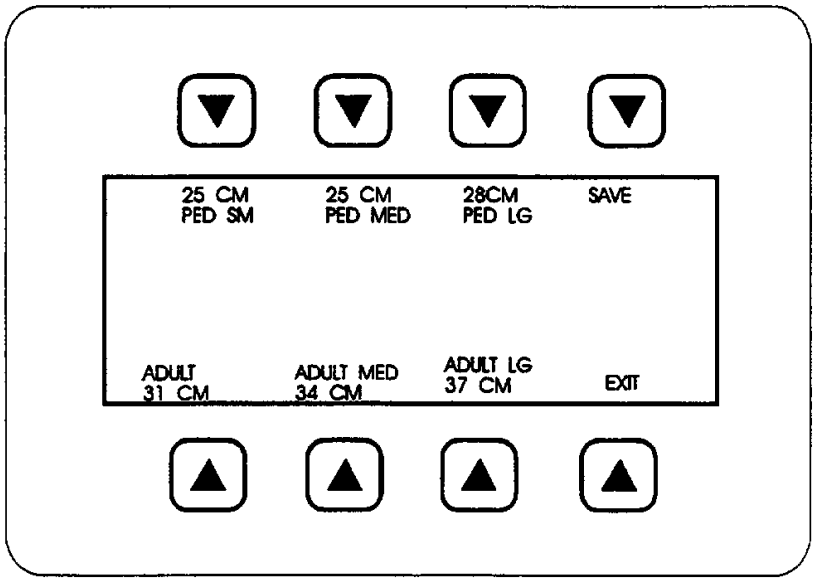


Figure 2-16 Patient Size Menu

The Patient Size Change Menu permits the assignment of the Six Patient Size Keys to specific thickness values. Press the key associated with the Patient Size to be defined. The CM value becomes is highlighted. Use the INCREMENT and DECREMENT to select the desired value and then select the CM associated with the next Patient Size to be entered.

Please Note:

The CM thickness of "Ped Small" should be less than that of "Ped Med", etc.

Press the SAVE key when finished. The Replace Previous Data Query is then displayed. The EXIT key returns to the Technique Factor Entry Menu without saving the new data.

Technique Data Base Worksheet

Planning data base changes will speed the reprogramming process. This worksheet has been provided as a guideline for the data base arrangement.

TECHNIQUE DATABASE WORKSHEET

(Copy as required)

REGION ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

VIEW ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

(10 LETTERS PER LINE, 10 MORE IF USE TWO LINES)

PATIENT SIZE RANGE : PED SM" ________ CM

PED MD" ________ CM

PED LG" ________ CM

ADULT SM" ________ CM

ADULT MD" ________ CM

ADULT LG" ________ CM

(BUCKY SELECTION:________________ (TABLE, WALL, NONE)

AEC - FIELD SELECT ☐ ☐ ☐

DATA FOR EACH CM THICKNESS

CM	KV	MAS	FOCUS	CM	KV	MAS	FOCUS

CHAPTER 3
SPECIFICATIONS

GENERAL

Input Power: Voltage - 480 VAC -Three Phase - 60 HZ	*Maximum line Current 126 Amps Momentary*
	or
	Voltage - 240 VAC -Three Phase - 60 HZ
	Maximum Line Current 244 Amps Momentary
	Continuous Line Current - .5 AMPS
Line regulation:	*7 percent*
Duty Cycle: 1	*Percent*
kV Selection:	*40 to 125 kV in increments of 1 kV*
kV Accuracy: (Note 1)	*Indicated value +/- (3 kV + 3 Percent of indicated value)*
mAs Selection:	*1 to 600 mAs in increments of 1.2 times previous value*
mAs Accuracy:	*Indicated value +/- (.6 mAs + 5 Percent of indicated value)*
Time Selection: (Note 2)	*Range - 10 Msec to 6.0 Seconds in multiples of 1.25 - Actual values determined by Tube loading characteristics.*
Time Accuracy: (Note 2)	*Indicated Value +/- (5 Msec +8 Percent of indicated value)*
Technique Factor Max Line Current:	*100 kV, Large Spot, 32 mAs, 64 Msec*
Regulatory:	*Meets the requirements of 21 CFR Sub-Chapter J.*

Notes:

1. **On some combinations of kV and mAs there may be a single 2 millisecond kV overshoot of 10 percent.**
2. **At low kVs and mAs (under 5 mAs) the preindicated time may vary from the actual time by 50%. Since the radiation is determined only by the kV and mAs settings, the preindicated time has no effect on the radiation level.**

POWER MODULE

Power Rating:	*50 kilowatts*
Type:	*High Frequency, Microprocessor Controlled*
Kilovolt Range:	*40-125 kV*
Maximum mAs:	*600*
Minimum mAs:	*1.0*
Maximum mA:	*700*
Focal Spot Selection:	*Operator Selectable Independent of Techniques (within Tube Limits)*

OPERATOR CONSOLE

mAs Increments:	*Changes by factor of 1.2 per station*
Time Increments:	*Changes by factor of 1.25 per station*
kV Increments:	*40 to 125 in one kV steps.*
Fault Indicator:	*For kV, mA, communications, operator termination of exposure and AEC.*
Instantaneous Tube Limit:	*Any selectable technique will be within tube limits.*
Anode Heat Calculator:	*Displayed in percentage of tube heat capacity. Updated in six second intervals.*

APR

Available Preprogrammed Technique Locations:	*120*
Programmable Data:	*mAs, kV, patient thickness in centimeters, focal spot, image receptor*

Pre-programmable data with kV, screen selection, ion chamber fields, optional AEC.: focal spot, image receptor

AEC

Post Exposure Indicator:	*Digital Readout of mAs*
Film-Screen Selection:	*Two Different Film-screen combinations*
AEC Density Control:	*5 steps from 50% of original value to 150% of original value.*
Fault Indicator:	*For backup mAs and Generator Termination.*

kV/Density optical tracking

kV range	*Phantom thickness*	*Density +/-*
40-54	*4 inches (10.16 cm)*	*.2*
56-70	*6 inches (15.24 cm)*	*.2*
72-86	*8 inches (20.32 cm)*	*.2*
90-125	*10 inches (25.4 cm)*	*.2*

Default Termination-520mAs

Screen/film speed-factory preset to Screen 1: - 200
Screen 2: - 400

kV Compensation-5 calibration points: - 40, 56,72,90,125 kV

SID range:-36 to 72 inches. (91.44 cm to 182.88 cm)

Ion Chamber/preamplifier:

Ion chamber voltage	*200 Vdc +/-5% internally generated*
Input voltage	*+12 Vdc, -12 Vdc*
Sensitivity	*Film/screen combinations 100-500*
Maximum output	*8.5 Vdc*
Linearity	*+/-5%*

Field sizes:

Center field	*2" x 4.4" (5.08 cm x 11.17 cm)*
Left/Right	*2.2" x 3.6" (5.58 cm x 9.14 cm)*

AEC SPECIFICATIONS (Continued)

Dimensions:

Control/display -Incorporated into generator

Main Chassis -10.4" x 16.75" x 3.06" (incorporated into the rack cabinet)
(26.4 cm x 42.5 cm 7.7 cm)

Regulatory:

Meets the requirements of 21 CFR section 1020.31.

COMPATIBILITY LISTING

The following certified components have been found to be compatible with the ATC-725.

X-ray tube assemblies -

EUREKA

RAD 16	1.0 X 2.0
RAD 21	0.6 X 1.2
RAD 60	0.6 X 1.2
RAD 68	0.6 X 1.2
RAD 74	0.6 X 1.5
RAD 14	0.6 X 1.2
RAD 13	1.0 X 2.0
RAD 8	1.0 X 2.0
RAD 56	0.6 X 1.2
RAD 26	1.0 X 2.0
RAD 68	1.0 X 2.0

EIMAC

A292	0.6 X 1.2
A132	0.6 X 1.2
A119	1.0 X 2.0

DUNDEE

DU303M	1.0 X 2.0
DU304	0.7 X 1.4
PX1436	0.6 X 1.2

TOSHIBA

DR37	0.6 X 1.2
E7239	1.0 X 2.0
E7242	0.6 X 1.5

COMET

DX93H	0.6 X 1.5

PHILLIPS

PG256	0.6 X 1.0

Tubes adapted for High Speed Starter

EUREKA

RAD 60	0.6 X 1.2
RAD 14	0.6 X 1.2
RAD 21	0.6 X 1.2

EIMAC

A292	0.3 X 0.7

Automatic Exposure Control - Gendex-Del Model 110-0085G2

High Speed Starter - HMS Model HS2-MPX-RQ

**Consult Gendex-Del Technical Support for Tube Applications that are not listed

SYSTEM WEIGHTS AND DIMENSIONS

Control Console	30 lbs. (14 kg)
Power Module	104 lbs. (47.3 kg)
High Tension Transformer (Single Tube)	128 lbs. (58 kg)
3 Phase Line Match Transformer	120 lbs. (55 kg)
Rack Cabinet with System Components Installed	600 lbs. (273 kg)

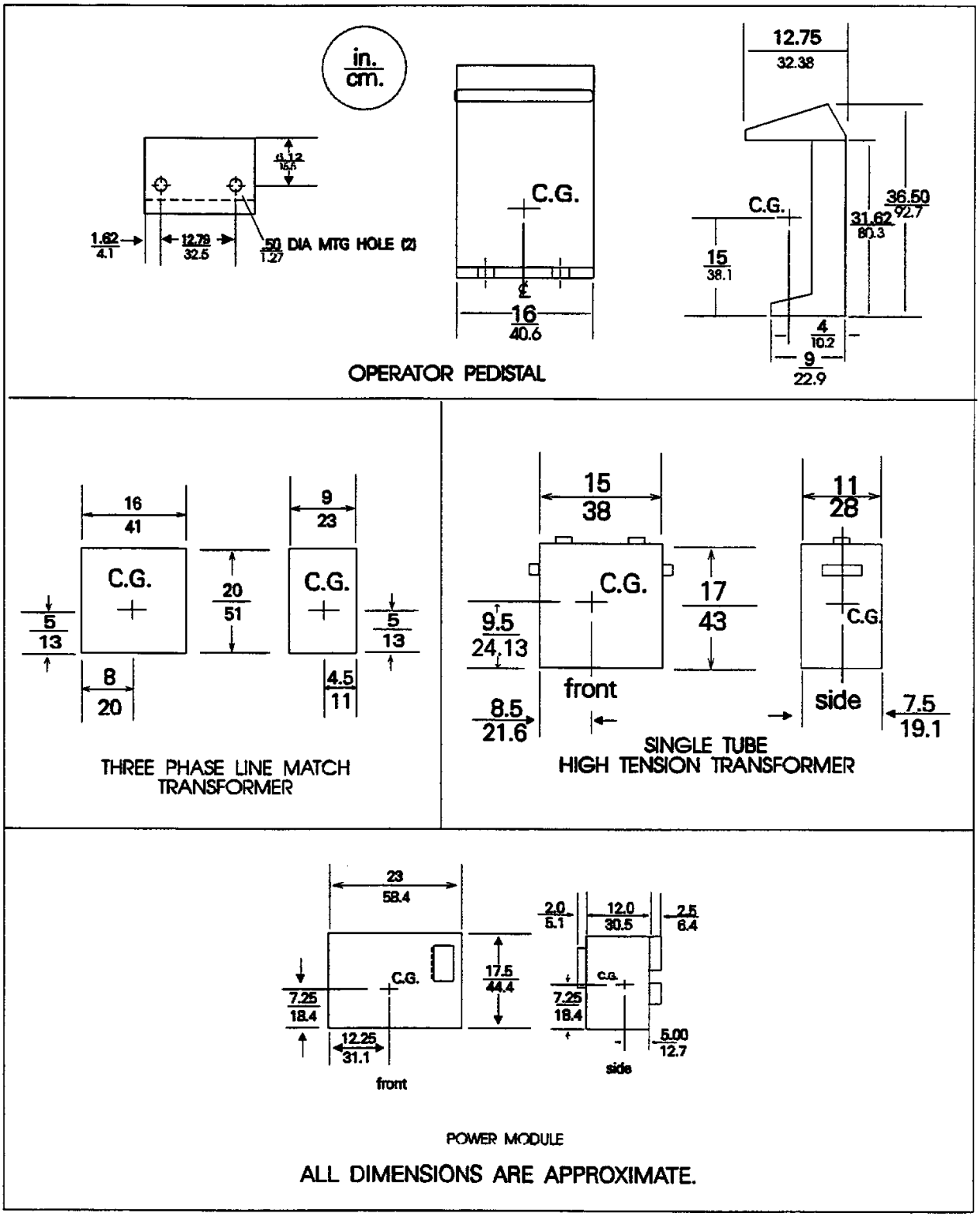


Figure 3-1 Control Panel Dimensions

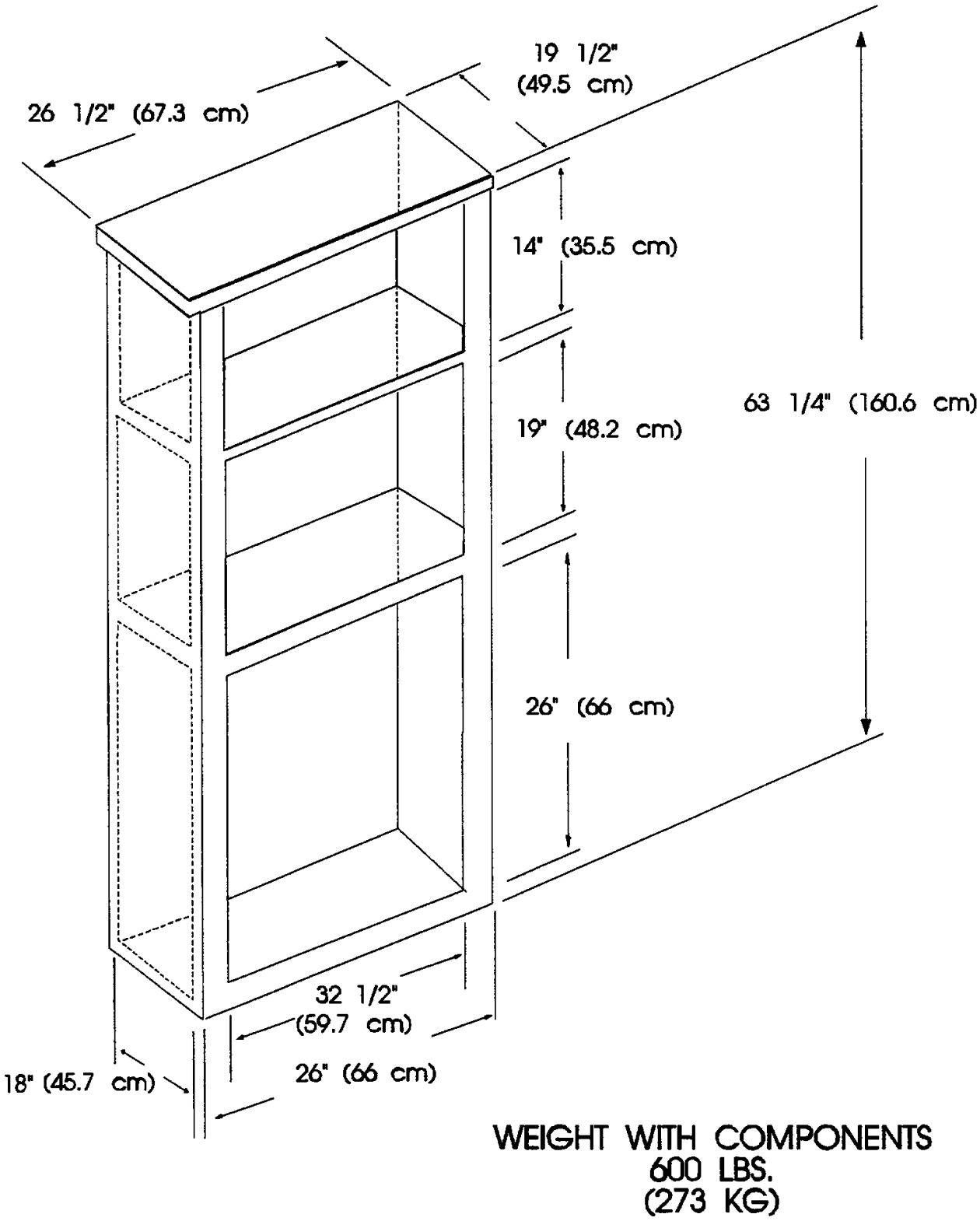
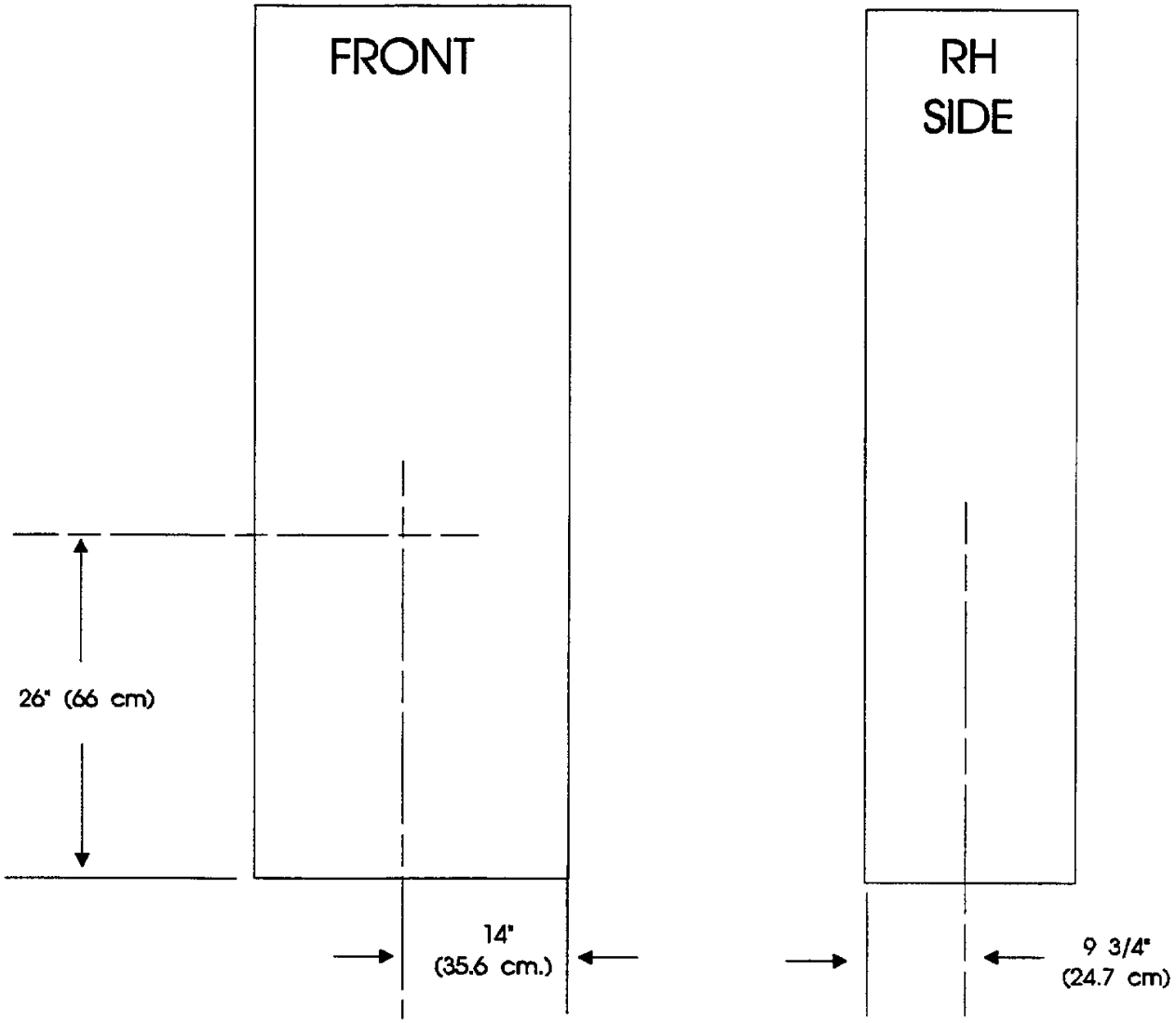


Figure 3-2 Rack Cabinet Dimensions



RACK CABINET
CENTER OF GRAVITY

Figure 3-3

D.H.H.S. Compliance

The Gendex-Del ATC - 725 High Frequency x-ray generator and its associated accessories are certified components conforming to all applicable radiation performance standards as outlined by the Food and Drug Administration, Code of Federal Regulations, Title 21, Subchapter J, at the Time of Manufacture.

CHAPTER 4
PREVENTIVE MAINTENANCE

In order to assure continued safe performance of this X-Ray equipment, a preventive maintenance program MUST be established. It is the owner's responsibility to arrange for this required service.

Maintenance procedures for the ATC 725 X-Ray Generator are required within 30 days after completion of the installation and every 6 months thereafter. Safe equipment performance also requires the use of service personnel who are specifically trained and experienced with medical x-ray apparatus. Applicable preventive maintenance or any repair service should be performed by these skilled individuals.

USER SERVICE AND MAINTENANCE

Cleanliness is a fundamental rule in maintaining equipment. At least once a month, external metallic surfaces should be wiped to remove dust build-up or any other foreign material that may have accumulated. Enameled metal surfaces should be cleaned using a clean cloth slightly moistened in clean water. Do not use cleaners or solvents of any kind as they may dull the finish. Polish with PURE liquid or paste wax. Do not use a wax containing a cleaning substance.

This piece of X-Ray equipment contains operating safeguards to insure maximum safety. Aside from routine maintenance, any abnormal noise, vibration or unusual performance should be investigated by a qualified service engineer. Before requesting service, however, be sure the equipment is being operated in accordance with the foregoing instructions.

SAFETY INFORMATION

If a malfunction is suspected, turn the power off at the main line disconnect and have a qualified service engineer inspect the equipment. Never open a component cover as potentially dangerous voltages are present.

Personnel engaged in maintenance activities should exercise normal caution and care while working with electro-mechanical equipment. Before removing or opening any electrical power panels or covers, verify that the incoming power supply is turned OFF. In the event maintenance procedures require power to be supplied to the unit, extreme care MUST be exercised to insure the safety of service or other personnel in the area. Always verify that the equipment is properly grounded before attempting any electrical operation or adjustment.

⚠ WARNING ⚠

The main SCR capacitor bank (located in the bottom of the Power Module) contains a very high charge when power is applied. This charge is a fatal shock hazard. After power has been disconnected from the system control console, with power off, allow a minimum of five minutes for the capacitor bank to discharge. Check the capacitor bank for zero volts with a DC voltmeter before working on any internal circuitry.

⚠ CAUTION ⚠

CERTAIN TESTS REQUIRE THE PRODUCTION OF X-RAYS. FIELD PERSONNEL SHOULD TAKE PRECAUTIONS TO ENSURE THEIR PERSONAL SAFETY AND THE SAFETY OF OTHERS IN CLOSE PROXIMITY. MINIMUM PRECAUTIONS ARE AS FOLLOWS:

a) Wear lead aprons.

b) Personnel remaining in the X-ray room during exposure should be behind a lead shield.

c) Minimize radiation scatter through doorways, walls and floor.

X-RAY GENERATOR MAINTENANCE

The following list of items must be inspected during each preventive maintenance inspection by qualified service personnel. Should other components become suspect during the inspection, they also should be evaluated as necessary.

1. CALIBRATION

Verify the accuracy of Kilovoltage, Milliamp seconds, and milliamperes. Calibrate as necessary.

2. RELAYS

Inspect electromechanical contactors and relays for pitting, poor contact, loose or missing parts. Replace if necessary.

3. HIGH VOLTAGE TRANSFORMER

a. Check transformer oil level. Proper oil level should be within 1/4" below the bottom side of the cover. To replenish transformer oil, fill with Diala-Ax oil only.

b. Check electrical and mechanical connections of the transformer. Clean and tighten as necessary.

4. HIGH VOLTAGE CABLES

Inspect high voltage cable bushings at the transformer and rotating anode tube for signs of carbonization, tracking and moisture. Replace the vaporproof compound every six months.

5. AUDIBLE & VISUAL EXPOSURE INDICATORS

Confirm that the audible indicator which indicates an X-ray exposure, and the visual indicator, which indicates the production of X-rays, are functioning correctly.

NOTE

- Always observe the tube manufacturer's duty cycle recommendations.

- Avoid unnecessary or excessively long prep periods, as they will shorten tube life. The tube filament and rotor are activated during prep.

CHAPTER 5
PRE-INSTALLATION PLANNING

INPUT POWER REQUIREMENTS

△ CAUTION △

Generator performance will be impaired if additional circuitry is powered by the same incoming line. There are no accessory power provisions within the generator. Attempts to attach accessory items such as wall holders, collimator, tubestands or table power sources to this generator will damage circuitry.

△ CAUTION △

Aluminum wire is unacceptable for use in wiring. All wiring MUST be copper.

WIRING REQUIREMENTS

1. The minimum voltage at the input terminals of the power module during a full load exposure is 235 VAC. Momentary current at this voltage is approximately 244 amps. Continuous current is approximately 0.5 amps.
2. A line matching transformer which permits operation at 240/480 volts, 3 phase, 60 Hz, is included with the ATC 725. This transformer is to be installed between the disconnect switch and the ATC 725 power module. Transformer part number DW636 accommodates 240 Volts and 480 Volts.
3. The ATC-725 requires 2 voltage sources from the same line match transformer: A 280 VAC 3 phase high current source to run the inverter circuit, and a 240 VAC single phase low current source for the logic circuits. These connect to TB1 and TB2 on the back panel of the power module, respectively.
4. GENDEX-DEL provided wiring is sized to optimum gauge and length. Any alterations or substitutions will effect generator performance.

LINE MATCH TRANSFORMER CONNECTIONS

	THREE PHASE LINE MATCH TRANSFORMER				
part number	Tap 1	Tap 2	Tap 3	Tap 4	Tap 5
DW-636	0 Volts	240	260	280	480

SAMPLE CONNECTION FOR THREE PHASE LINE MATCH TRANSFORMER (480 volt line)

1. Attach service disconnect inputs to each individual #5 Tap.
2. Take 3 PHASE outputs from the line match transformer to the power module TB1 from Tap 4.
3. Take single phase, low current outputs for TB2 from Tap #2 of any 2 windings with 16 AWG cable provided.

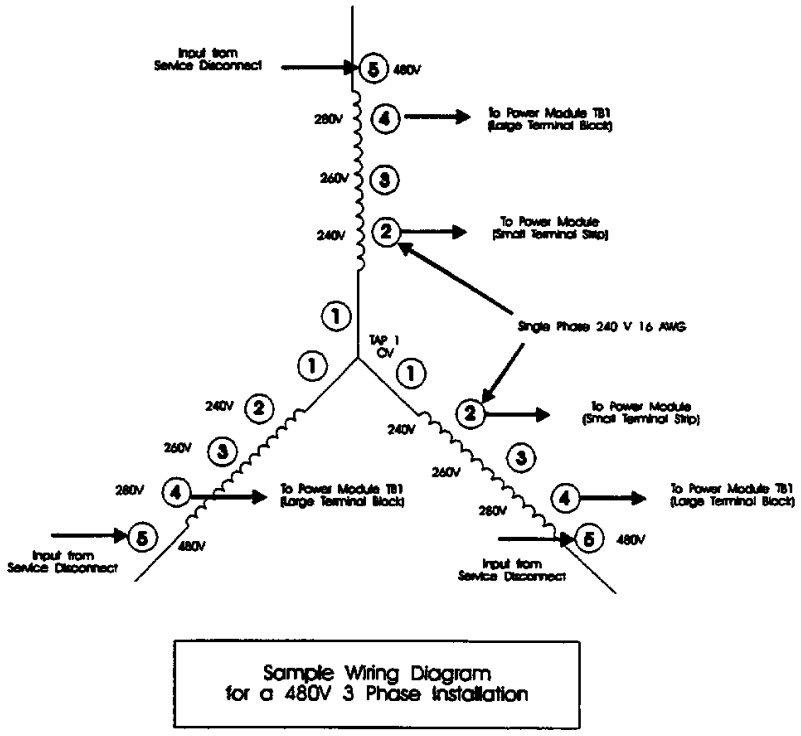


Figure 5-1 Line Match Transformer

NOTE

The input and output taps of the Line Match Transformer will depend upon the disconnect voltage and the type of line match transformer being used. Refer to chart above for tap voltages or call GENDEX-DEL Technical Support for assistance.

Verify all number one taps are tied together.

All units 60 Hertz, WYE Three Phase

Do not exceed 290 VAC into power module (TB1) (Large terminal block)

Do not exceed 250 VAC into power module (TB2) (Small terminal strip)

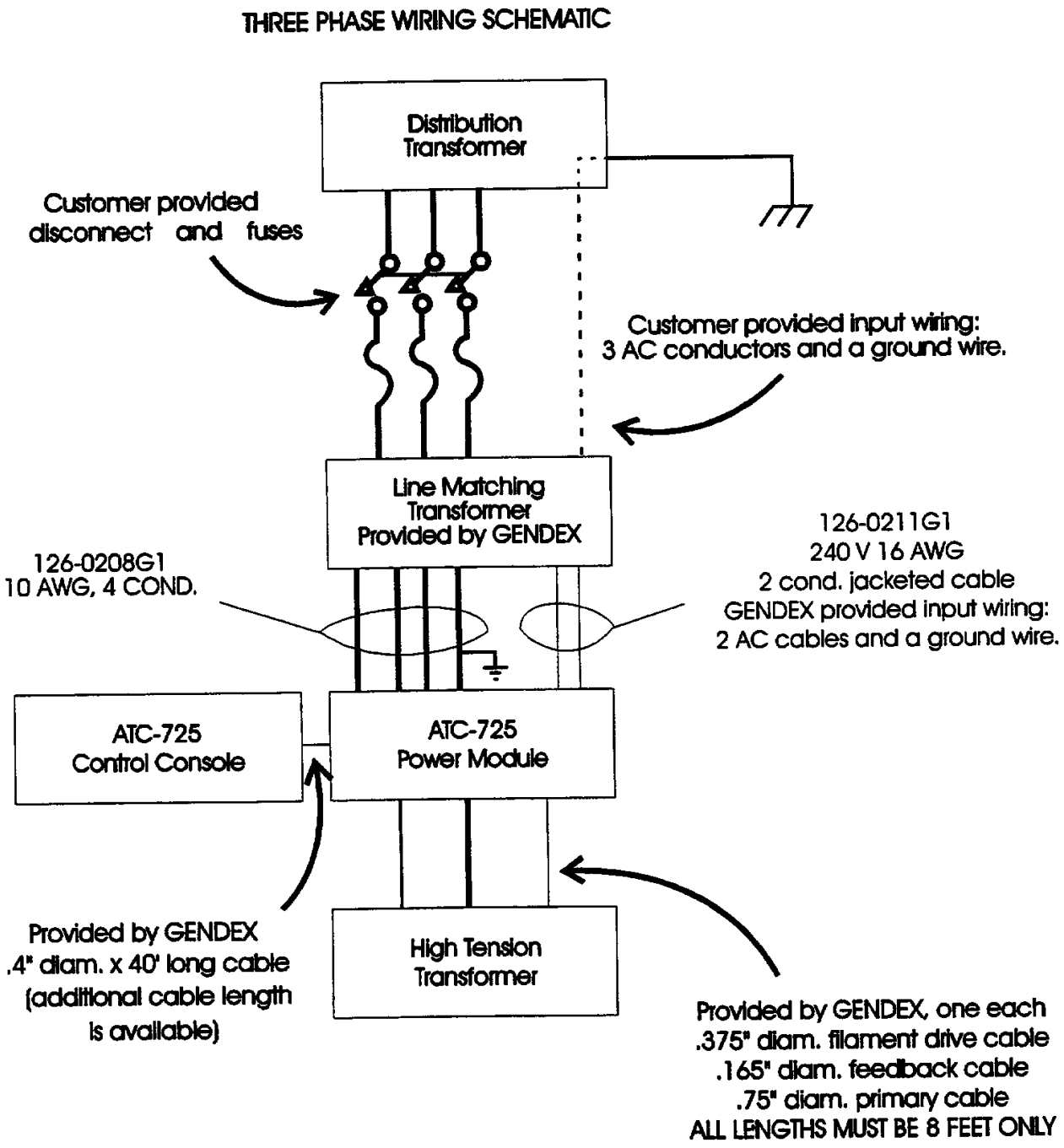

THREE PHASE WIRING SCHEMATIC
Distribution Transformer
Customer provided disconnect and fuses
Customer provided input wiring: 3 AC conductors and a ground wire.
Line Matching Transformer Provided by GENDEX
126-0208G1 10 AWG, 4 COND.
126-0211G1 240 V 16 AWG 2 cond. jacketed cable GENDEX provided input wiring: 2 AC cables and a ground wire.
ATC-725 Control Console
ATC-725 Power Module
Provided by GENDEX .4" diam. x 40' long cable (additional cable length is available)
High Tension Transformer
Provided by GENDEX, one each .375" diam. filament drive cable .165" diam. feedback cable .75" diam. primary cable ALL LENGTHS MUST BE 8 FEET ONLY

Figure 5-2

LINE MATCH TRANSFORMER CONNECTIONS

THREE PHASE LINE MATCH TRANSFORMERS

	Tap #1	Tap #2	Tap#3	Tap#4	Tap#5	Tap#6
DW640	OV	190V	208V	240V	260V	280V
DW670	OV	240V	260V	280V	380V	400V
DW636	OV	240V	260V	280V	480V	N/A

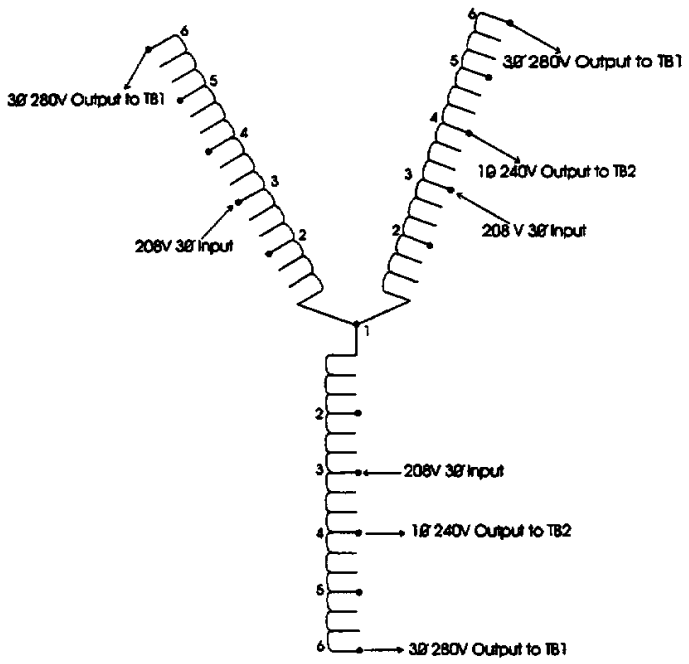
NOTE

The input and output of the Line Match Transformer will depend upon the disconnect voltage and the type of line match transformer being used. Refer to the chart above for tap voltages and diagrams which follow or call Gendex-Del Technical Support for assistance.

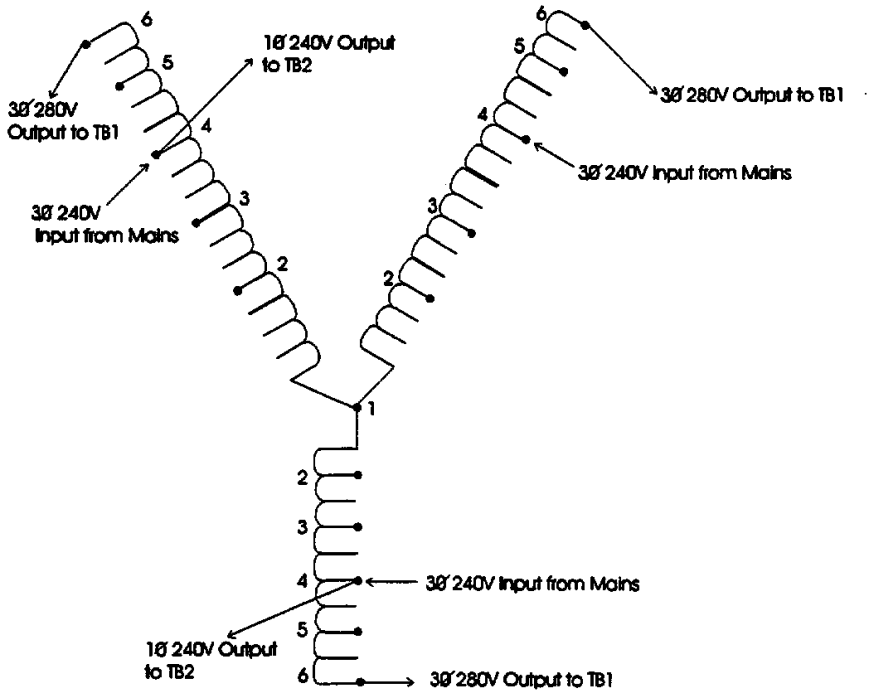
CAUTION

All units 60 Hertz, WYE Three Phase. Do not exceed 290 VAC into power module (TB1) (Large terminal block). Do not exceed 250 VAC into power module (TB2) (Small terminal strip).

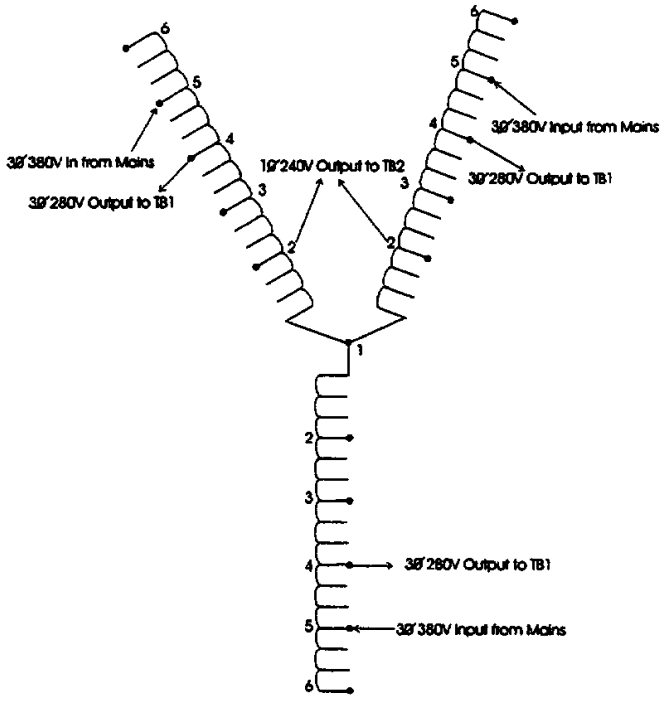
THREE PHASE 208 VOLT
Transformer Type DW640
Gendex-Del #636-0072P1



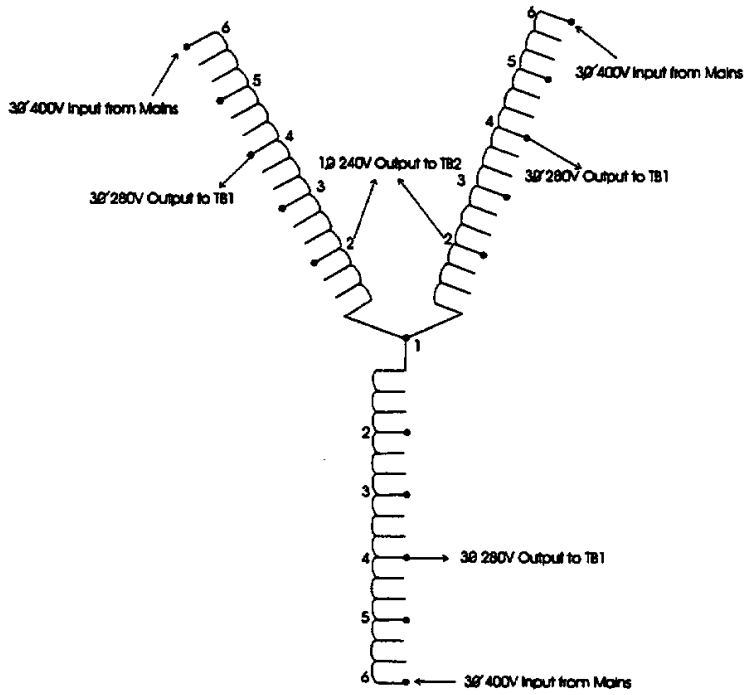
THREE PHASE 240 VOLT
Transformer Type DW-640
Gendex-Del #636-0072P1



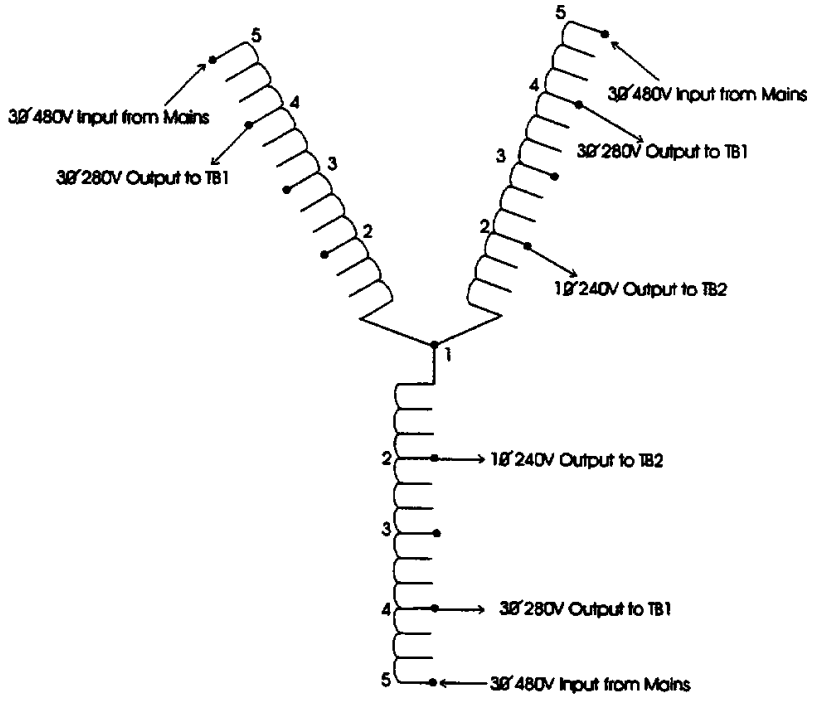
THREE PHASE 380 VOLT
Transformer Type DW-670
Gendex-Del #636-0037P6



THREE PHASE 400 VOLT
Transformer Type DW 670
Gendex-Del #636-0037P6



THREE PHASE 480 VOLT
Transformer Type DW636
Gendex-Del #636-0037P3



THREE PHASE

WIRING REQUIREMENTS

△ CAUTION △

Aluminum wire is unacceptable. All wiring MUST be copper.

1. GENDEX-DEL requires that service disconnect to the generator is fused at 75 amps for 480 volts and 125 for 240 volts. GENDEX-DEL requires a dedicated input line. Different voltages will require different current ratings.
2. A distribution transformer of 80 kVa, three phase is recommended.
3. The minimum voltage at the input terminals of the power module during any exposure of must not fall below 235 VAC. Momentary current is approximately 126 amps at 480 volts and 244 amps at 240 volts. Continuous current is approximately 0.5 amps.
4. A line matching transformer which permits conversion of disconnect voltage 480 VAC to 240 VAC for generator use is part of the three phase ATC-725 system. The transformer is to be installed in an accessible location between service disconnect and the ATC-725 power module. When the rack cabinet is not used the line match transformer is not to be installed under the radiographic table.

THREE PHASE

INPUT POWER REQUIREMENTS (WIRE SIZES)

Distribution Transformer Output	Distribution Transformer to Line Match Transformer in Rack Cabinet		
	50 ft	100 ft	200 ft
Nominal 208 Minimum VL = 203 280 amps momentary	# 00	250 MCM	XXX
Nominal 240 Minimum VL=235 VAC 244 amps momentary	# 0 AWG	#0000 AWG	#400 MCM
Nominal 480 Minimum 465 126 amps momentary	#4 AWG	#2 AWG	# 0 AWG

NOTE

The minimum wire sizes listed above has been selected for the maximum wire resistance allowed at maximum momentary full load current. To meet National Electric Code Specifications, you must select a wire type having an insulation rating of at least 50% of maximum momentary current. The 50% rating also applies to the selection of fuses or circuit breakers.

5. Any combination of no load voltages, wire sizes and wire lengths, between the distribution transformer and the ATC-725 power module, that will produce a voltage drop (at full load) no greater than those suggested, will provide rated output of the ATC-725.
6. A separate #6 AWG wire to earth ground must be provided.
7. All wiring up to the ATC-725 line match transformer input terminals is to be furnished by the customer. Gendex-Del provides the cables between the line match transformer and the power module.
8. All electrical wiring must conform to state and /or local electrical codes. Aluminum wire is unacceptable for use in wiring.

GROUNDING

A separate #6 AWG wire to earth ground must be provided. Follow guidelines established by the National Electrical Code.

CABLE INDEX

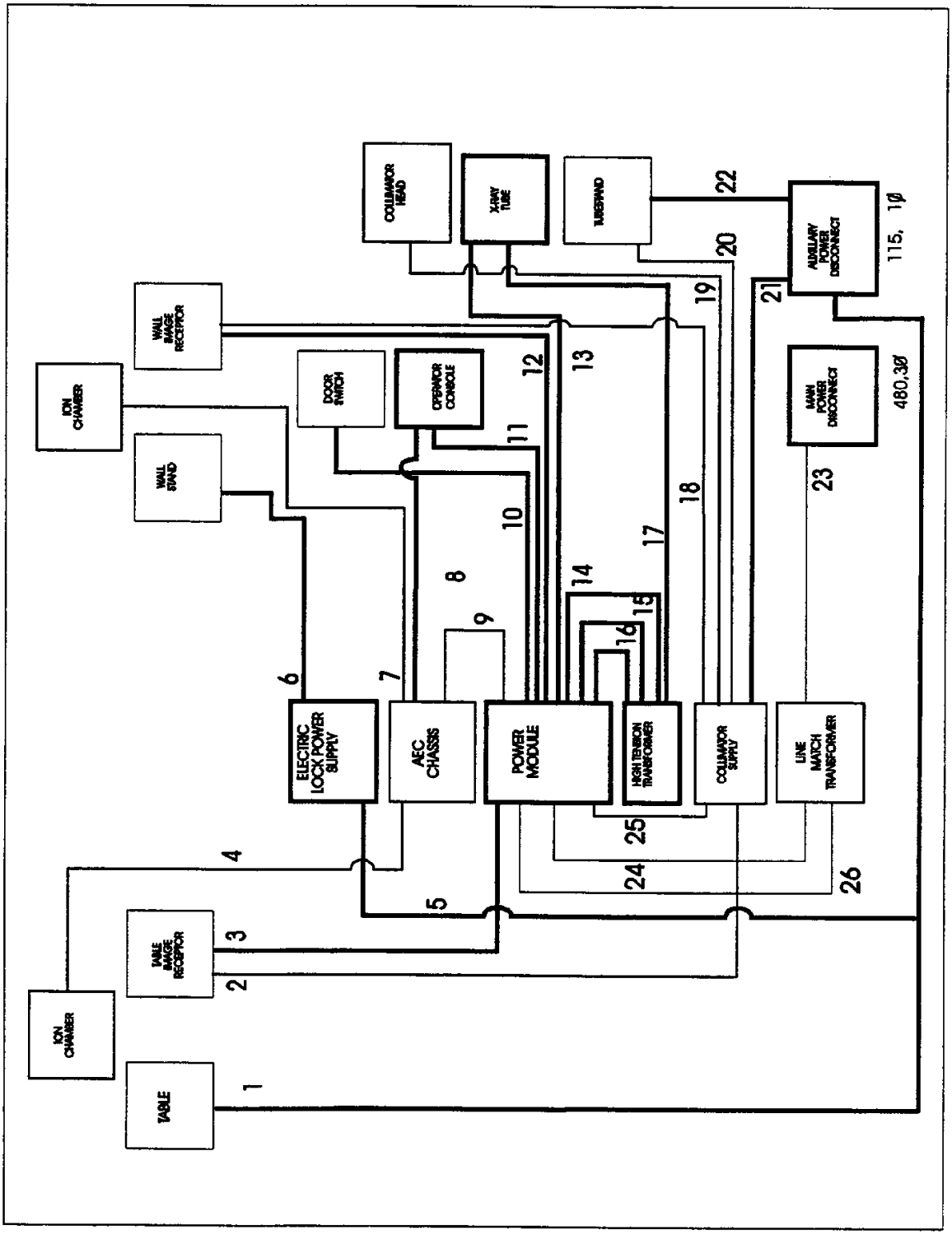


Figure 5-3

CABLE INDEX (Continued)

1. Table power - (Not supplied)
2. Table cassette size sensing cable - 40 feet
3. Table bucky interface cable - 20 feet
4. Table ion chamber cable - 45 feet
5. Electric lock power supply - (Not supplied)
6. Wall stand power - 40 feet
7. Wall ion chamber cable - 45 feet
8. AEC control cable - 10 feet #126-0205G1
9. AEC interface cable - 10 feet #126-0204G2
10. Door switch cable - 45 feet #126-0206G1
11. Control cable - 45 feet
12. Wall bucky interface cable - 20 feet
13. X-ray tube stator cord - 40 feet
14. Primary cable - 8 feet #126-0179G1
15. Filament cable - 8 feet #126-0178G1
16. kV and mA Feedback cable - 8 feet #126-0177G1
17. High tension cables (two)
18. Wall cassette size sensing cable - 40 feet
19. Collimator control cable - 40 feet
20. Vertical S.I.D. cable for tubestand - 40 feet
21. Collimator Power (Not supplied)
22. Tubestand power (Not supplied)
23. Main Power (Not supplied)
24. Line match to power module cable - 4 feet (10 AWG, 4 Cond.)
25. Exposure interlock cable - 40 feet
26. Line match to power module cable - 4 feet (16 AWG, 2 Cond.)
27. Control AEC to AEC Chassis #126-0205G1 (45 feet)

Cable Index Notes:

1. AEC devices are optional .
2. Items 15,16 and 17 must remain 8 feet.
3. Observe local codes with respect to wire size and grounding requirements.
4. The generator requires a dedicated power line.
5. Use copper wire only, aluminum wire is unacceptable.

RACK CABINET

RACK CABINET INTERCONNECT CABLE PATHS

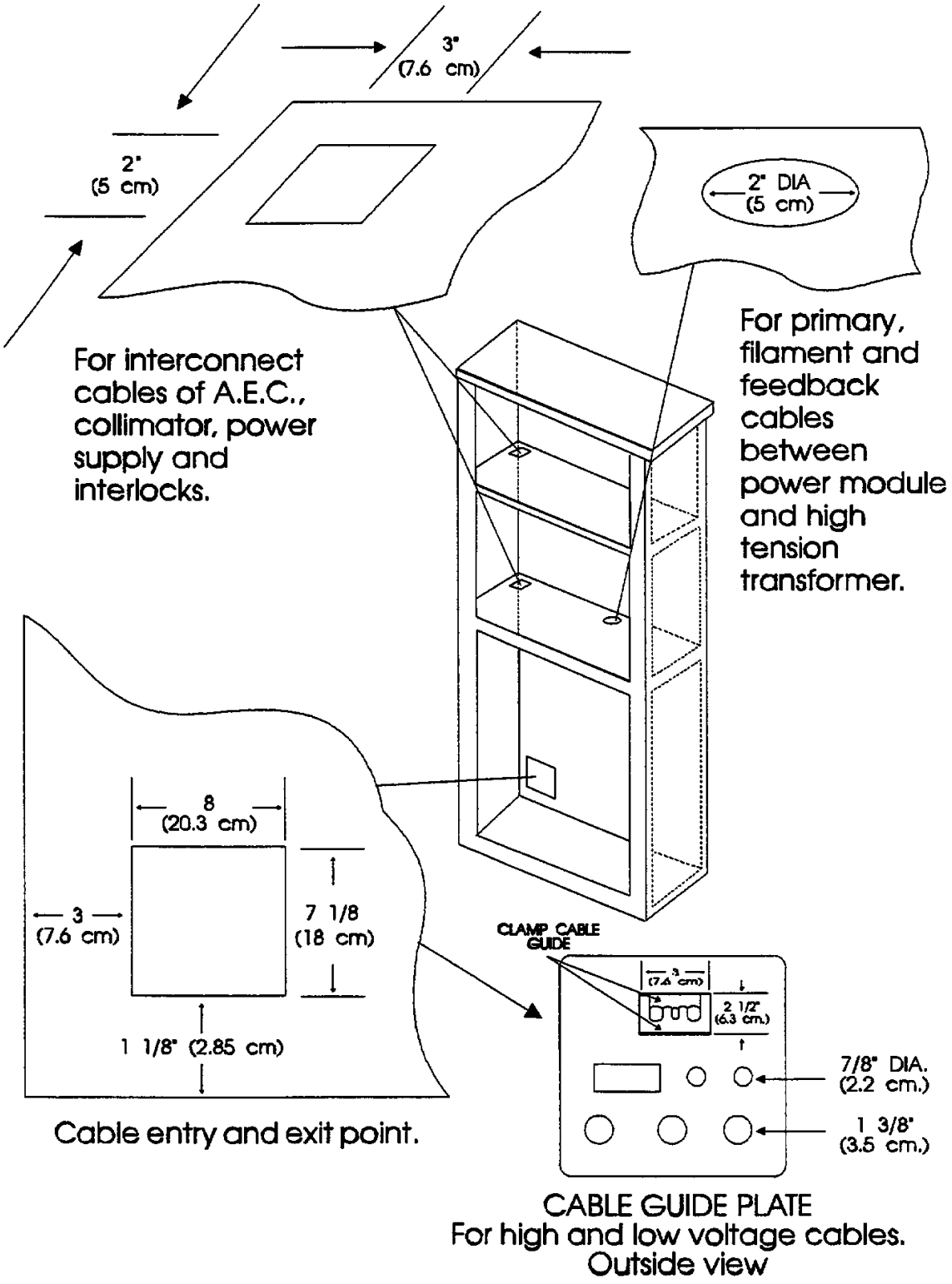
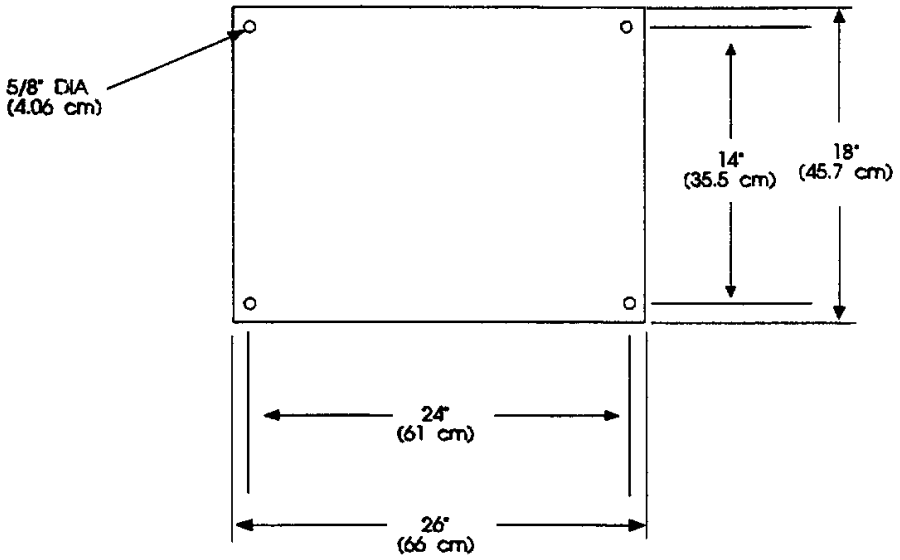


Figure 5-4 Cable Access Holes

FLOOR ATTACHMENT, HOLE PATTERN



NOTE:
Locate and drill floor attachment holes before fastening the high tension transformer in place.

Figure 5-5 Floor Attachment Pattern

MODIFICATIONS

AEC CHASSIS MODIFICATIONS

Once mounted in the rack cabinet, the rear mounting panel and the front box cover of the AEC device will not be needed. The AEC control box assembly will mount directly to the rear of the cabinet wall.

A circuit board retainer assembly will be added to fasten the kV Compensation Adjust and the Gain Adjust boards in place. Assemble the retainer as shown in the figure below. All necessary parts are included with the rack cabinet hardware.

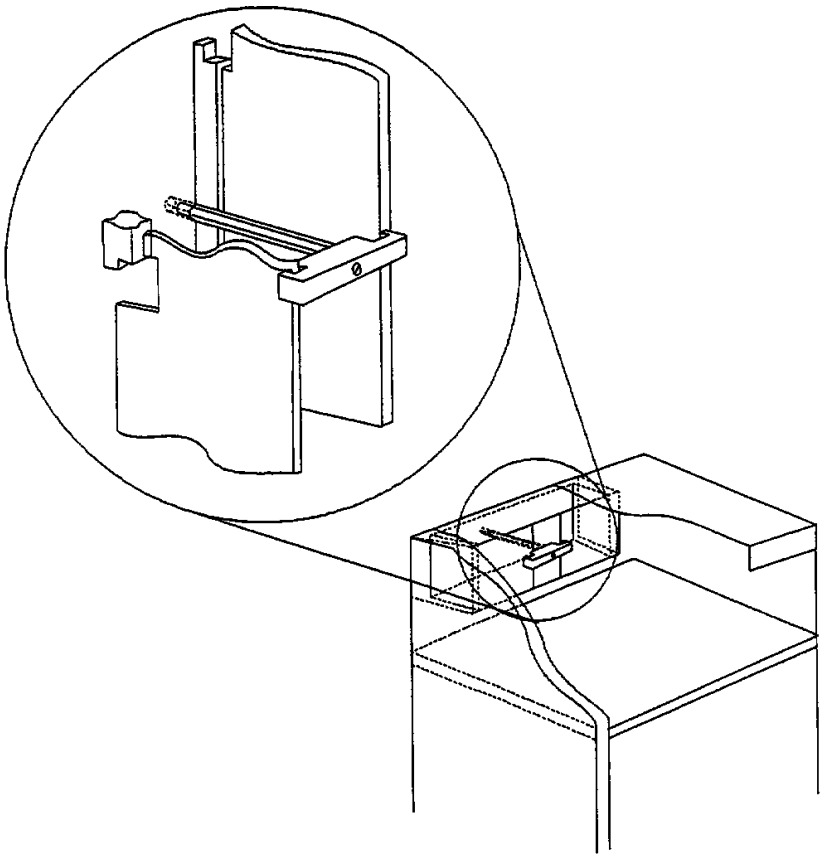


Figure 5-6

LINE MATCH TRANSFORMER

The line match transformer will be attached directly into the cabinet base. See the "Equipment Placement" section of this manual.

RECORD OF SERIAL NUMBERS, DATE OF MANUFACTURE, AND MODEL NUMBERS

Once the generator and collimator components are assembled into the rack cabinet, the equipment identification cables may be difficult to read. Record the identification numbers below.

Power Module:
Serial Number_____
Date of Mfg. _____
Model Number _____

High Voltage:
Transformer
Serial Number _____
Date of Mfg. _____
Model Number _____

AEC Chassis:
Serial Number _____
Date of Mfg. _____
Model Number _____

Collimator:
Serial Number _____
Date of Mfg. _____
Model Number _____

Power Supply:
Serial Number_____
Date of Mfg._____
Model Number_____

CHAPTER 6
INSTALLATION PROCEDURE

RACK MOUNTED ATC 725 X-RAY GENERATOR

△ WARNING △

The main SCR capacitor bank (bottom of power module) contains a very high charge when power is applied. This charge is a fatal shock hazard. After power has been disconnected from the system, either by line disconnect or control console power off, allow a minimum of five minutes for capacitor bank bleed down. CHECK CAPACITOR BANK FOR ZERO VOLTS WITH A DC VOLTMETER BEFORE WORKING ON ANY INTERNAL CIRCUITRY.

△ CAUTION △

Generator performance will be impaired if additional circuitry is powered by the same incoming line. There are no accessory power provisions within the generator. Attempts to attach accessory items such as collimator or table power sources to this generator will damage circuitry.

NOTE

GENDEX-DEL requires a dedicated input line.

RACK CABINET ASSEMBLY PROCEDURE

ASSEMBLY

Attach angle and pin bracket to cabinet base using the 10-32 x 3/8 screws provided. Observe hole orientation.

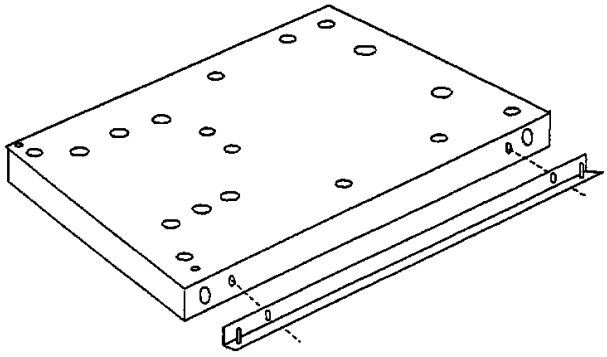


Figure 6-1 Angle and Pin Bracket Assembly

Attach the rear transformer hold down bracket to the cabinet base using the 10-32 x 3/8 screws provided.

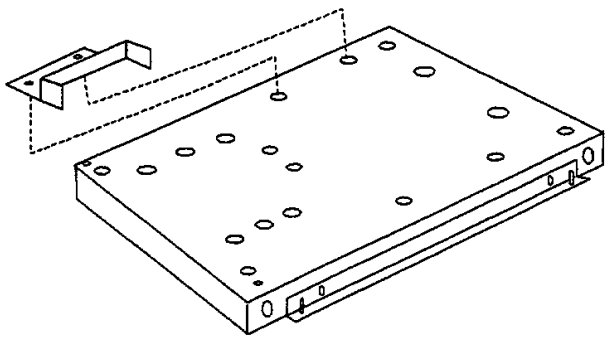


Figure 6-2 Rear Transformer Bracket

Spin the four leveling feet into the cabinet base.

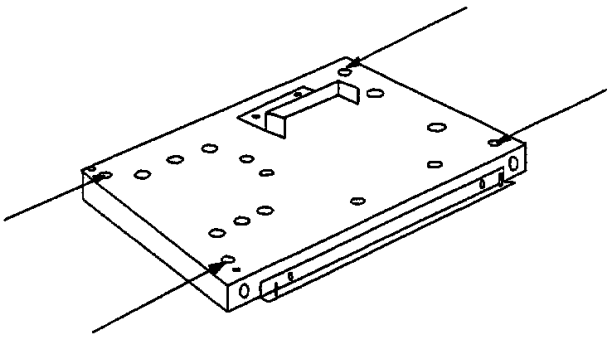


Figure 6-3 Leveling Feet Attachment

Attach the rear power module mounting bracket to the power module support shelf. Use the 10-32 x 3/8 screws provided. (See the figure to the right.)

The GX-30 and MP-300 power modules will use the mounting bracket with eight holes. The ATC-725, ATC-525 and the AP-300 power modules use the mounting bracket with five holes.

NOTE

The power module shelf is 1/8" (0.32 cm) thick and has a 2" (508 cm) diameter hole at the rear.

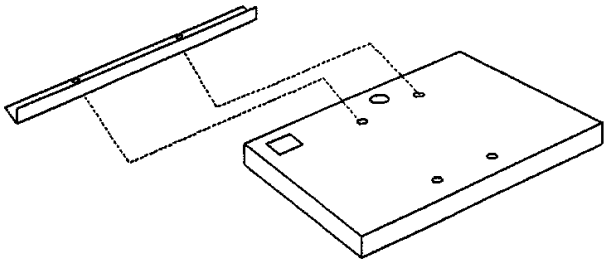


Figure 6-4 Rear Power Module Bracket Attachment

Identify the left hand side panel. It has a mounting bracket welded at its top front. (See figure below.)

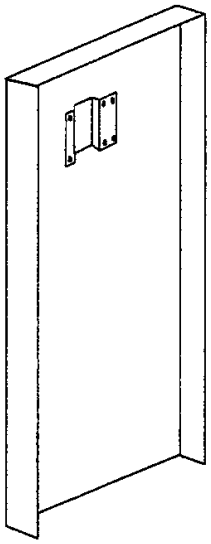


Figure 6-5 Left Panel

Stand the left side on its back. Place the right hand side panel on its back. The top of the right hand side can be identified by its flange.

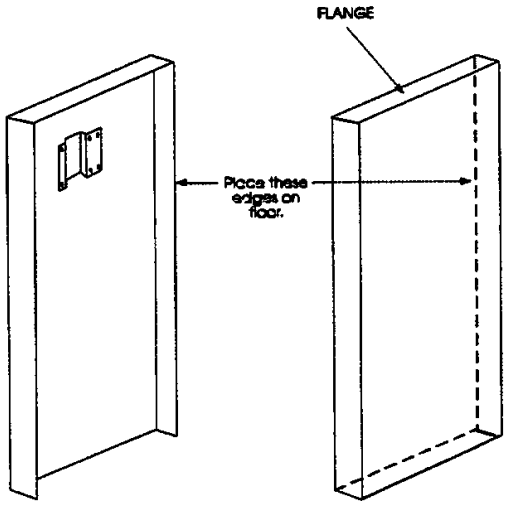


Figure 6-6 Left and Right Panel

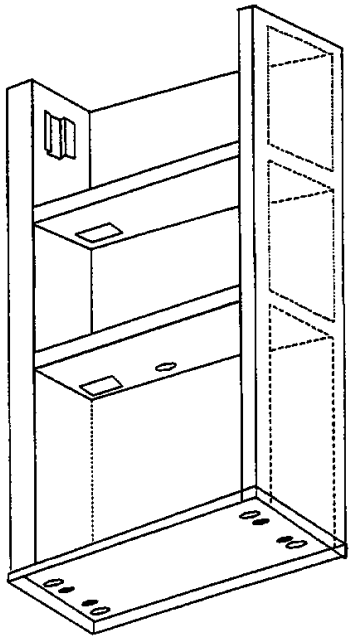


Figure 6-7 Shelf Assembly

Starting from the cabinet base, attach each shelf on the front side only, using the 1/4 -20 screws provided. Do not add the rear shelf screws at this time. Each shelf is unique--pay careful attention to the diagram below. Do not fully tighten the screws at this time.

Turn the cabinet assembly over on its face. Attach the upper rear and lower rear enclosure panels with the 1/4 -20 inch screws provided. Observe both panels for orientation as represented in figure (6-8). The cabinet base and shelves should be fastened in place with the rear enclosure screws. Do not fully tighten the screws at this time.

Turn the cabinet assembly over on its face. Attach the upper rear and lower rear enclosure panels with the 1-4 -20 inch screws provided. Observe both panels for orientation as represented in figure 6-8. The cabinet base and shelves should be fastened in place with the rear enclosure screws. Do not fully tighten the screws at this time.

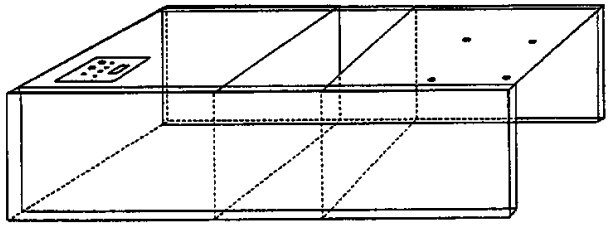


Figure 6-8 Back Panel Assembly

Add the cabinet top cover. Fasten in place with the 10-32 x 1/2 inch screws provided.

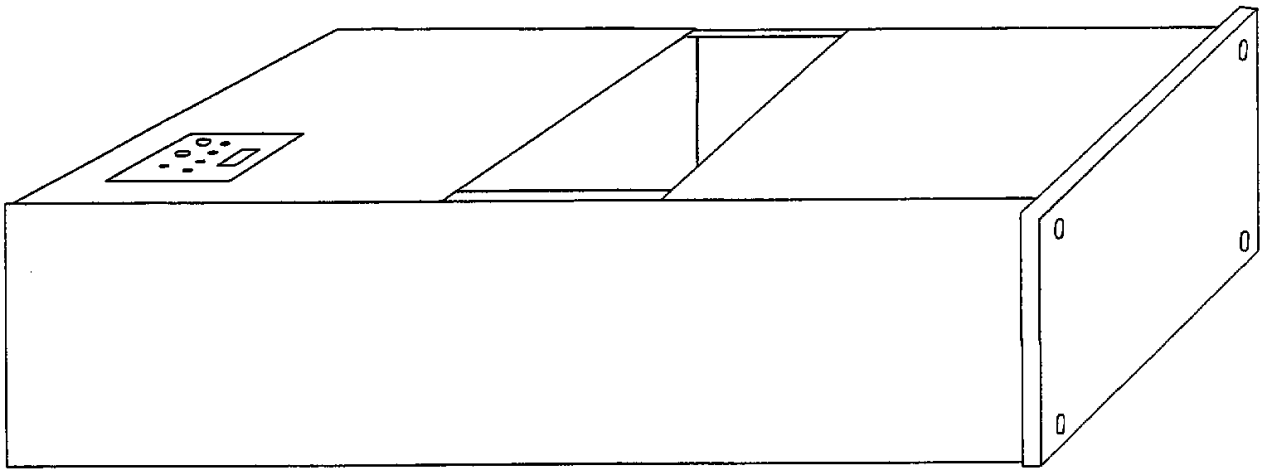
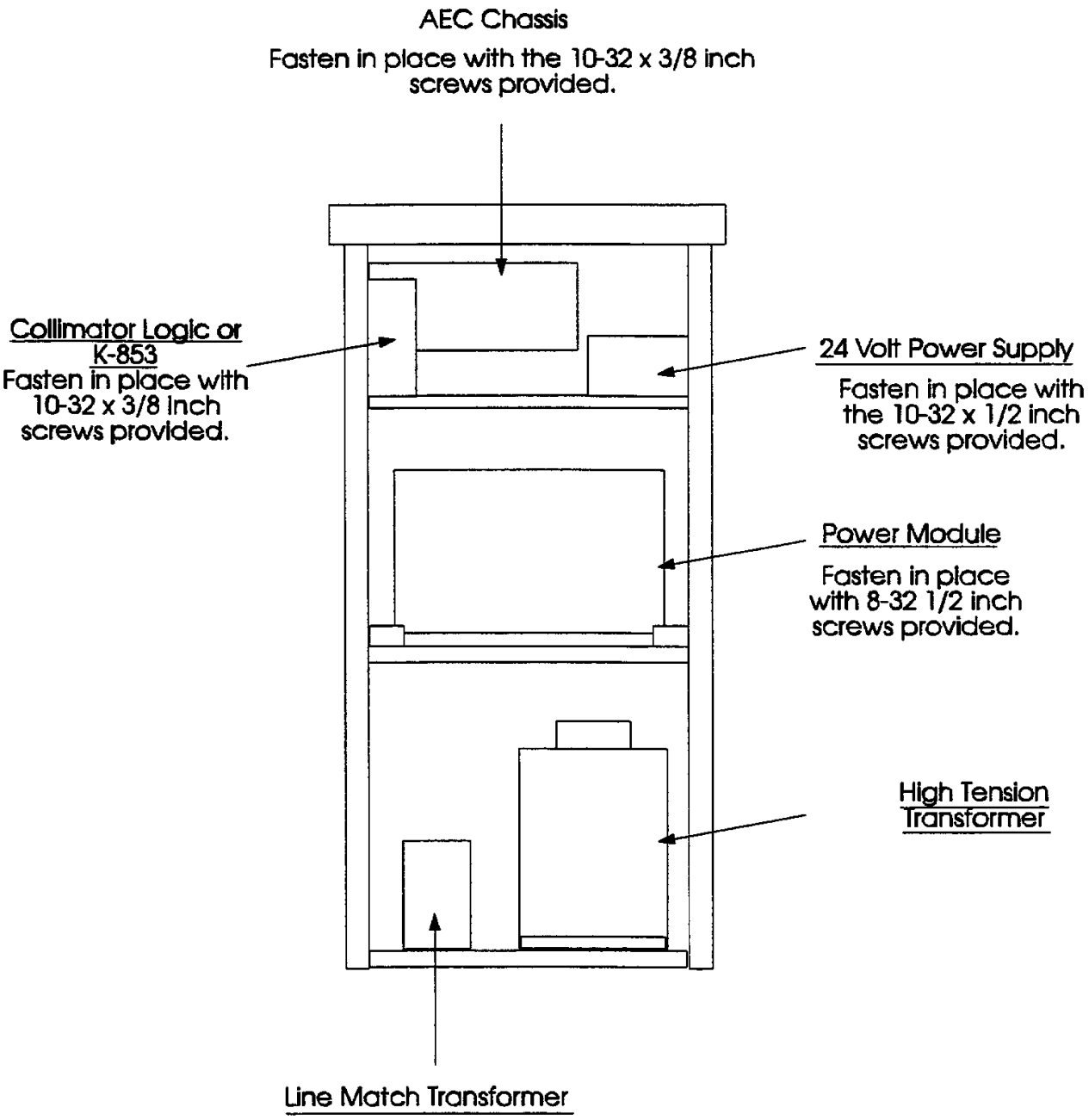


Figure 6-9 Top Panel Assembly

After assuring the cabinet is square, fully tighten all cabinet fasteners.

EQUIPMENT PLACEMENT



Use the appropriate holes for mounting the three phase line match transformer. Fasten in place with the 5/16-18 bolts and nuts provided.

Figure 6-10 Equipment Placement

FINAL ASSEMBLY AND LEVELING

Attach the front power module mounting bracket using the 10-32 x 1/2 inch screws provided. Secure the power module to both the front and the rear power module mounting brackets using the 10-32 x 3/8 inch screws provided. Attach the two door plate supports at the right and left of the power module mounting bracket using the 10-32 x 1/4 inch screws provided.

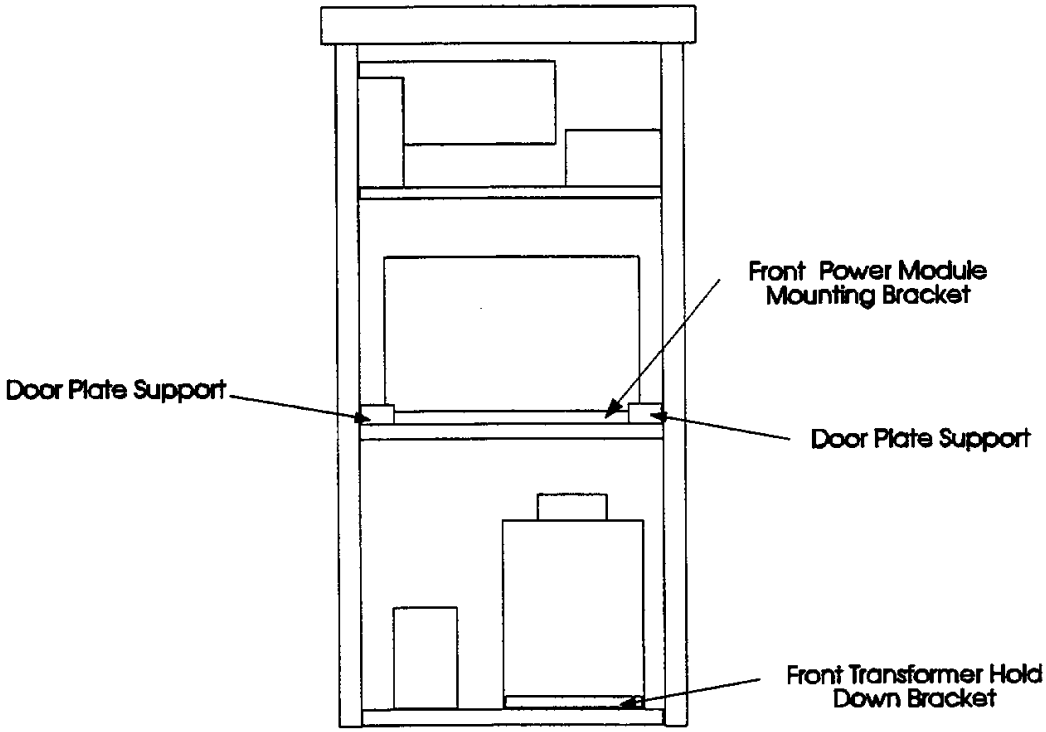


Figure 6-11 Final Bracket Attachment

Perform interconnect wiring of power module, power supply, collimator and AEC chassis as directed by the appropriate manuals. Drape high voltage cables through the rack cabinet access hole. Do not make electrical connections to the high voltage transformer at this time.

Move the fully weighted cabinet into position over the floor attachment holes. Level the unit using the adjustable feet in the base.

Draw the high tension transformer out of the cabinet. Fasten the rack cabinet to the floor in place.

With the high voltage transformer in close proximity to the cabinet, connect the high and low voltage cables as directed in the generator manual.

GENERATOR INTERCONNECTIONS

Power Module
Exposure Interlocks

Each interlock switch must be an isolated set of contacts which closes in the exposure “Go” condition.

TB1 - 1 to Door Interlock

TB1 - 2 to Collimator Interlock

TB1 - 3 to Common

If no door or collimator interlocks are present, wire jumpers must be added to TB1 to allow an exposure.

Plug Connections to Power Module

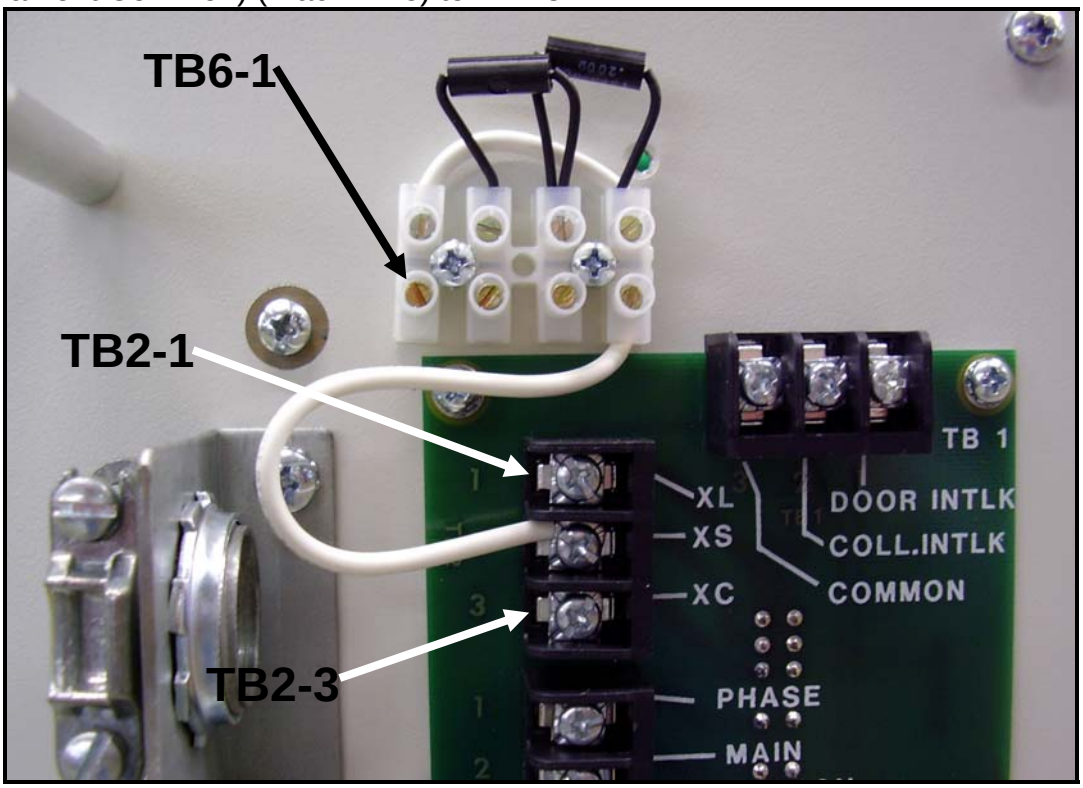
J13-Connects to operator console CPU at J7

Filament Connections to High Tension Transformer (Cable #126-0178G1)

(Large Filament) (Green Wire) to TB2-1

(Small Filament) (White Wire) to TB6-1

(Filament Common) (Black Wire) to TB2-3



Filament Connections

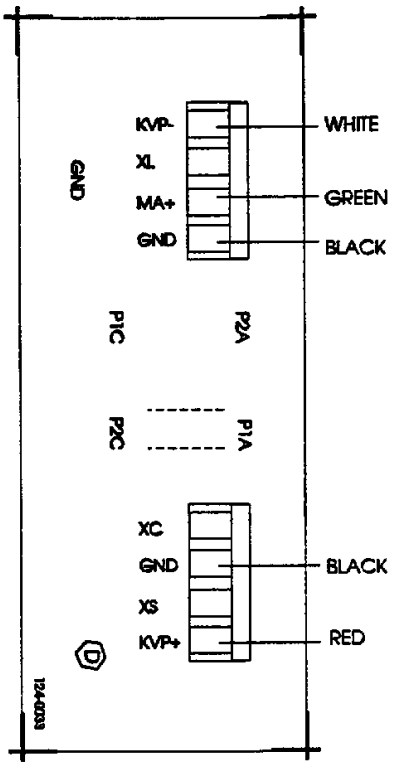


Figure 6-13

J14 - For mA and kV feedback:
Connects to high tension transformer as follows:

White to kV - (Cathode)
Green to mA +
Black to Ground
Red to kV +(Anode)
Black to ground

NOTE

Generator will not turn on without this cable attached.

Power Connections For High Tension Transformer To Rear Of Power Module

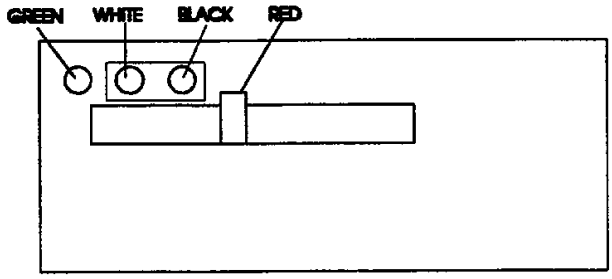


Figure 6-14 (Rear of Power Module)

RED	to	P1A
BLACK	to	P2A
WHITE	to	P1C
GREEN	to	GROUND

NOTE

Cabling should be attached as shown in figure 6-14. Not to rear of commutation capacitors.

Stator Connections

TB3 - 1 Phase (08)
- 2 Main (07)
- 3 Common (09)
- 4 Thermal Switch *
- 5 Thermal Switch Common *

* An isolated, normally closed set of contacts, mounted on the tube housing, which opens if the housing is beyond normal operating temperatures.

If no housing thermal switch is present, a jumper must be placed across TB3-4 and TB3-5 in order to allow an exposure.

Wall Image Receptor Connections

TB4 - 1 Wall Select
- 2 Wall Feedback
- 3 117 VAC
- 4 CKT Common
- 5 117 VAC Common

Liebel - Flarshiem series 8000 Buckys, Marked with B1, B2, etc, Connect as follows:

B1	-TB4	-4
B2	-TB4	-2
B3	-TB4	-1
B4	-TB4	-5
B8	-TB4	-3

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

Liebel - Flarshiem series 8000 Buckys, Marked with 1, 2, 3, etc, Connect as follows:

1	-TB4	-4
2	-TB4	-2
3	-TB4	-1
N	-TB4	-5
L	-TB4	-3

Liebel - Flarshiem series 9000 Buckys, Connect as follows:

L	-TB4	-3
N	-TB4	-5
3	-TB4	-1
2	-TB4	-2
1	-TB4	-4

If a grid cabinet, wall cassette holder or no wall image receptor will be employed, place a jumper between TB4-4 and TB4-2 in order to allow an exposure.

Table Image Receptor Connections

TB5 - 1 Table Select
- 2 Table Feedback
- 3 117 VAC
- 4 CKT Common
- 5 117 VAC Common

Liebel-Flarshiem Series 8000 Buckys, Marked with B1, B2, etc, connect as follows;

B1	-TB5	-4
B2	-TB5	-2
B3	-TB5	-1
B4	-TB5	-5
B8	-TB5	-3

Liebel - Flarshiem series 8000 Buckys, Marked with 1, 2, 3, etc, Connect as follows:

1	-TB5	-4
2	-TB5	-2
3	-TB5	-1
N	-TB5	-5
L	-TB5	-3

Liebel - Flarshiem series 9000 Buckys, Connect as follows:

L	-TB5	-3
N	-TB5	-5
3	-TB5	-1
2	-TB5	-2
1	-TB5	-4

If a grid cabinet or no image receptor will be employed, place a jumper between TB5-4 and TB5-2 in order to allow an exposure.

Connections From Line Match Transformer To Power Module

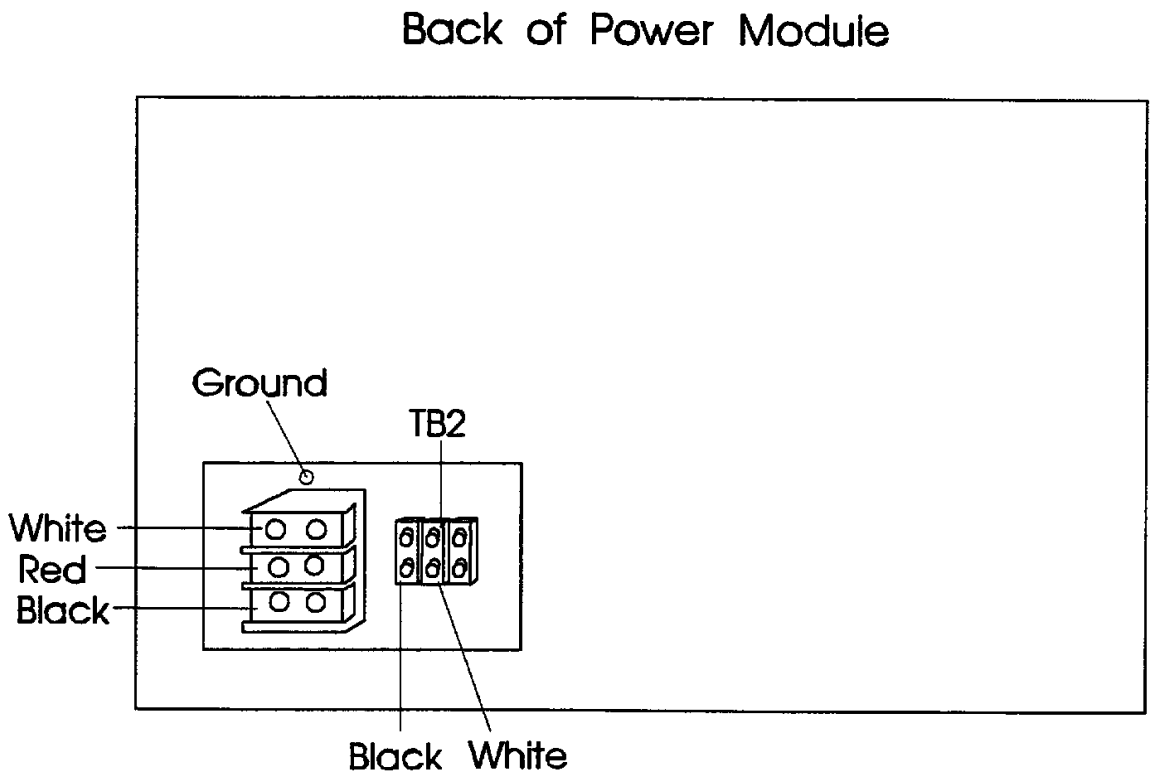


Figure 6-15

The wires shown in Figure 6-15 are from the line match transformer. See figure 5-2 in the preinstallation planning section of this manual.

CHAPTER 7
START UP, OPERATIONAL CHECK AND CALIBRATION PROCEDURE

GENERAL NOTES

This procedure is to be followed...

1. After initial installation of the ATC-725
2. Before beginning calibration of the ATC-725
3. During maintenance inspections.

With it we can verify proper supply voltage, filament drive and control console operation.

△ CAUTION △

Generator performance may be impaired if additional circuity is powered by the same incoming line. There are no accessory power provisions within the generator attempts to attach accessory items such as a collimator or table power sources to this generator will damage circuitry.

△ WARNING △

The main SCR capacitor bank (bottom of power module) contains a very high charge when power is applied. The charge is a fatal shock hazard. After power has been disconnected from the system, either by line disconnect or control console over off, allow a minimum of five minutes for the capacitor bank to discharge. Check the capacitor bank for zero volts with a DC voltmeter before working on any internal circuitry.

△ CAUTION △

THE FOLLOWING PROCEDURES WILL PRODUCE X-RAYS. OPERATING PERSONNEL SHOULD TAKE PRECAUTIONS TO ENSURE THEIR PERSONAL SAFETY AND THE SAFETY OF OTHERS IN CLOSE PROXIMITY. MINIMUM PRECAUTIONS ARE AS FOLLOWS:

a) Wear lead aprons.
b) Personnel remaining in the X-ray room during exposure should be behind a lead shield.
c) Minimize radiation scatter through doorways, walls and floor.

COMPONENT IDENTIFICATION

PICTORIAL DIAGRAMS

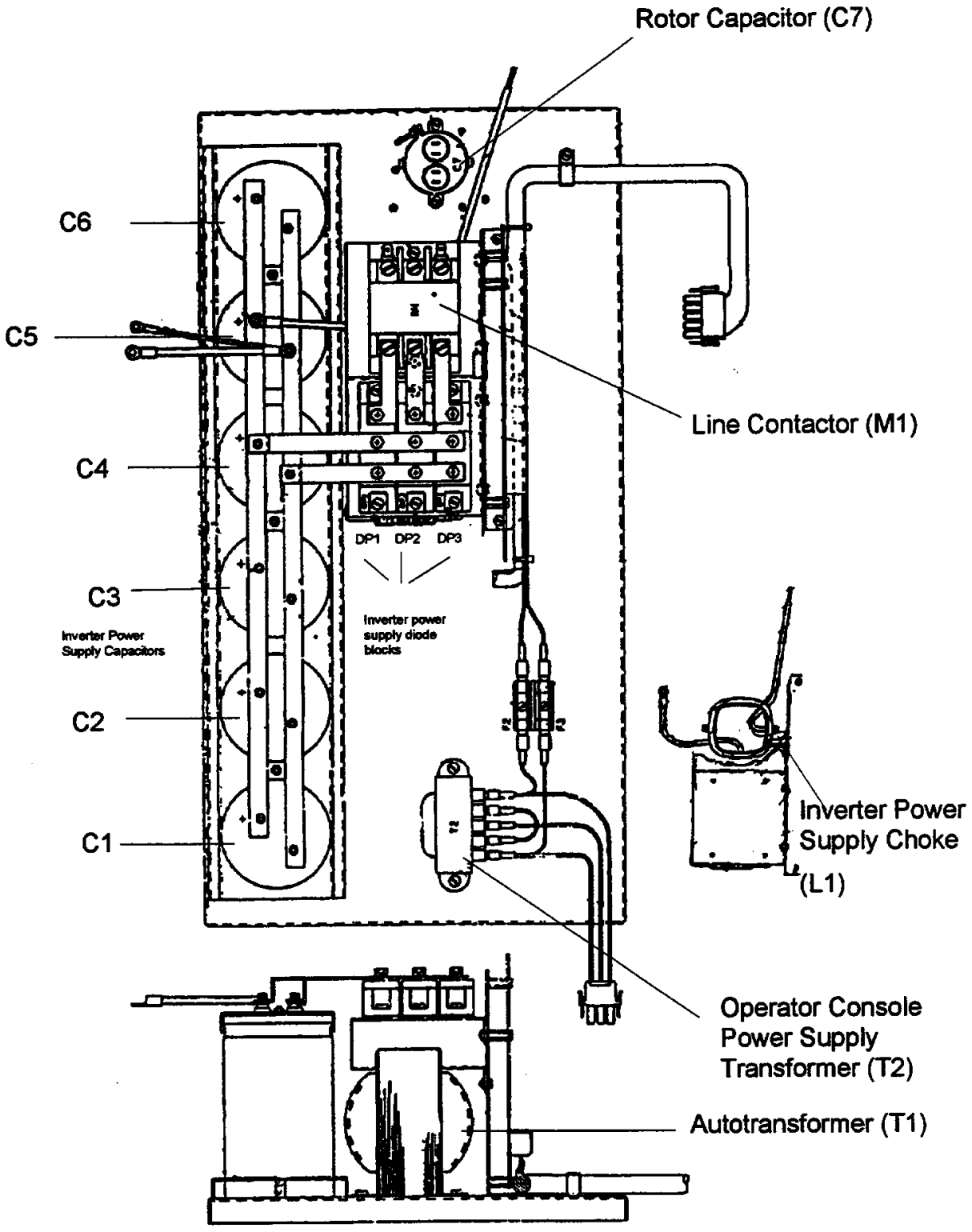


Figure 7-1 Bottom Chassis Assembly

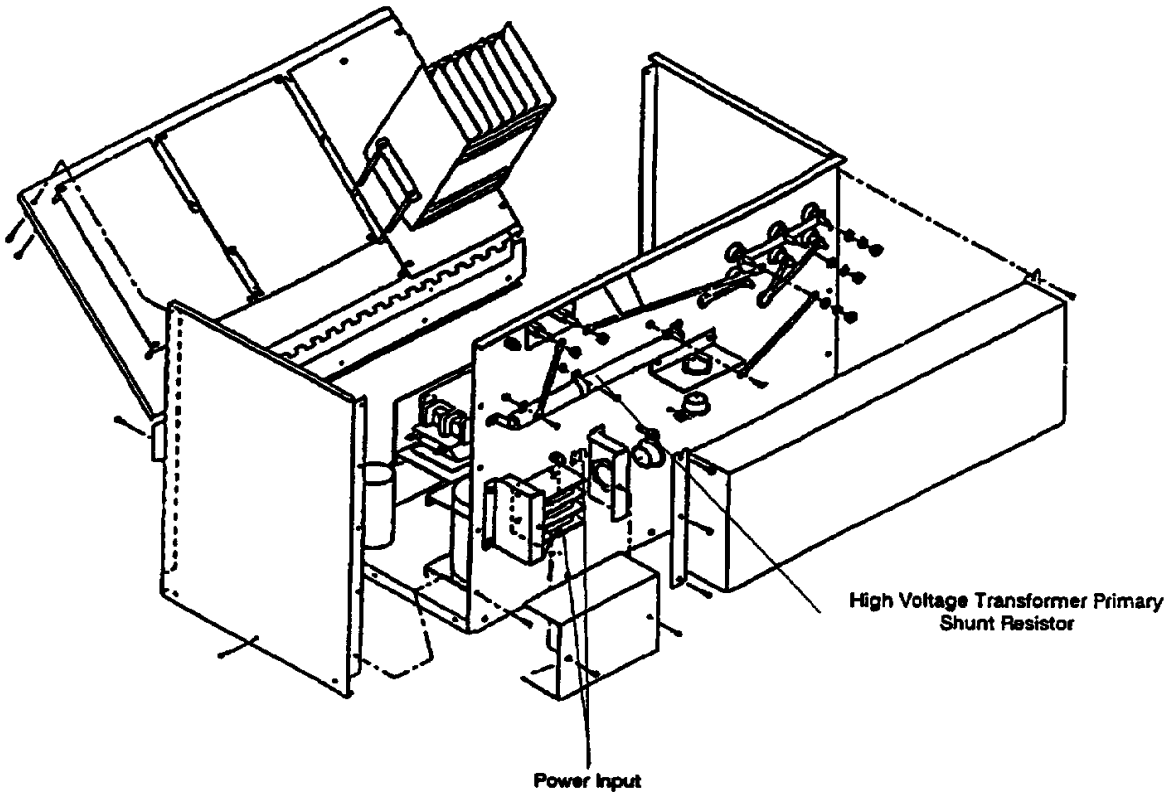


Figure 7-2 Power Module

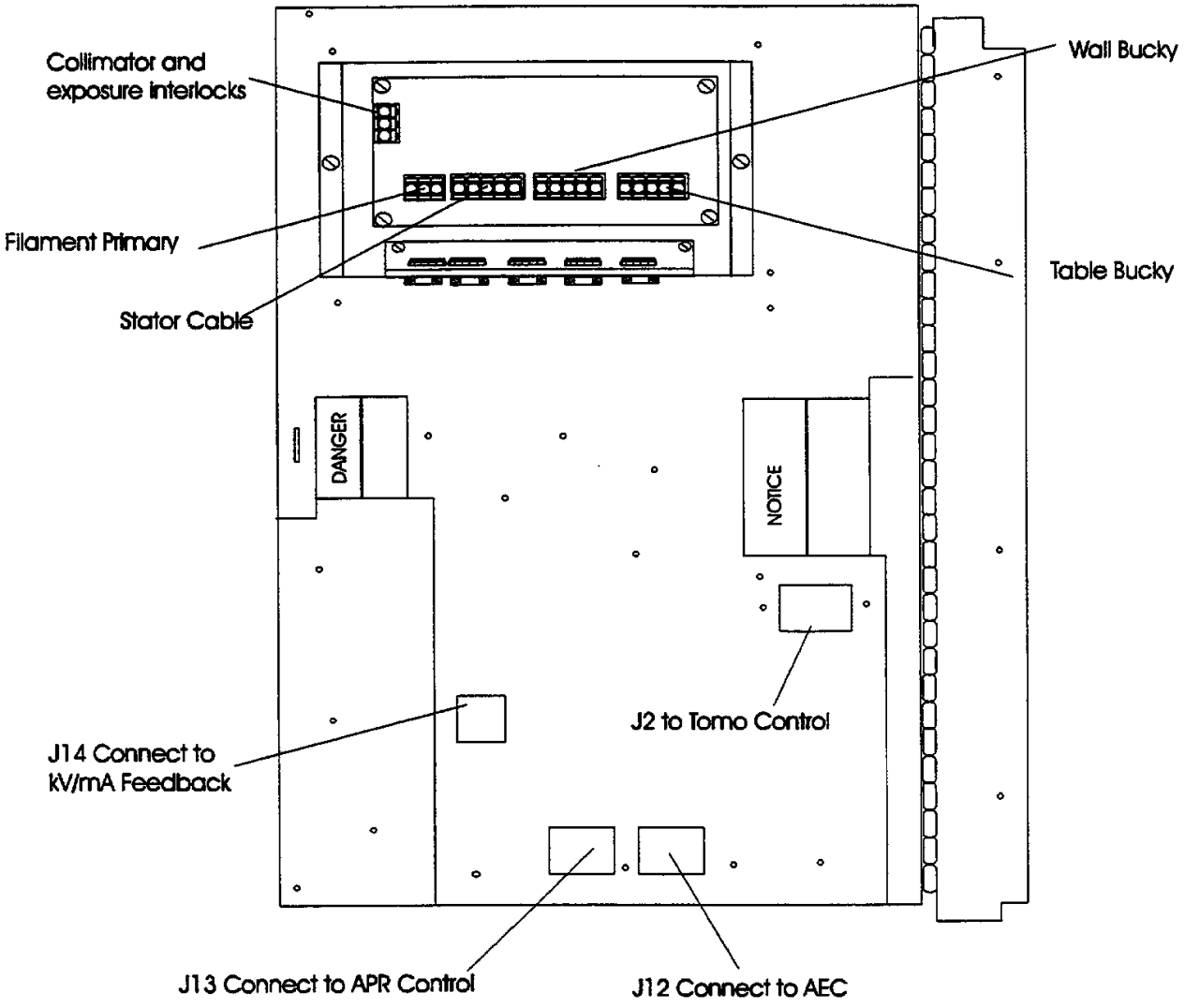
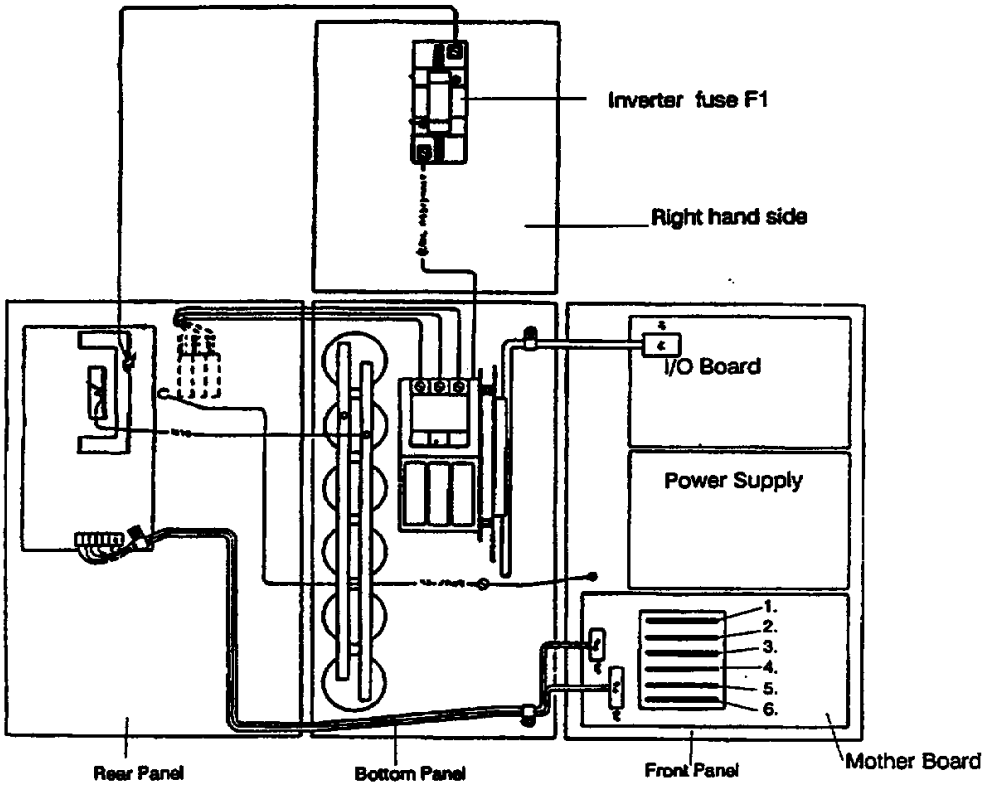


Figure 7-3 Power Module Front Panel



1. - Auxilliary
2. - mA/ Rotor
3. - mAs Regulator
4. - Data
5. - kV Regulator
6. - Logic

Figure 7-4 Power Module Top View

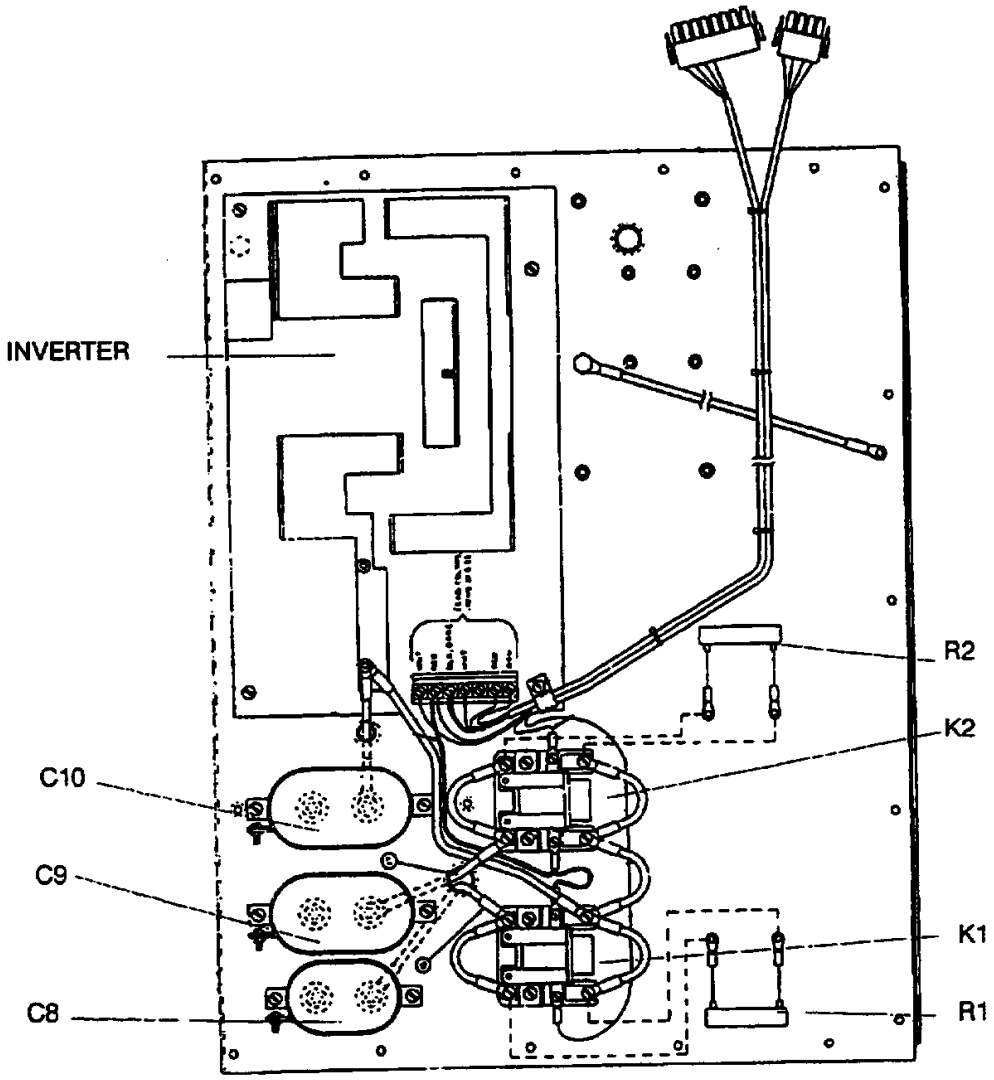


Figure 7-5 Power Module Inner Rear Panel

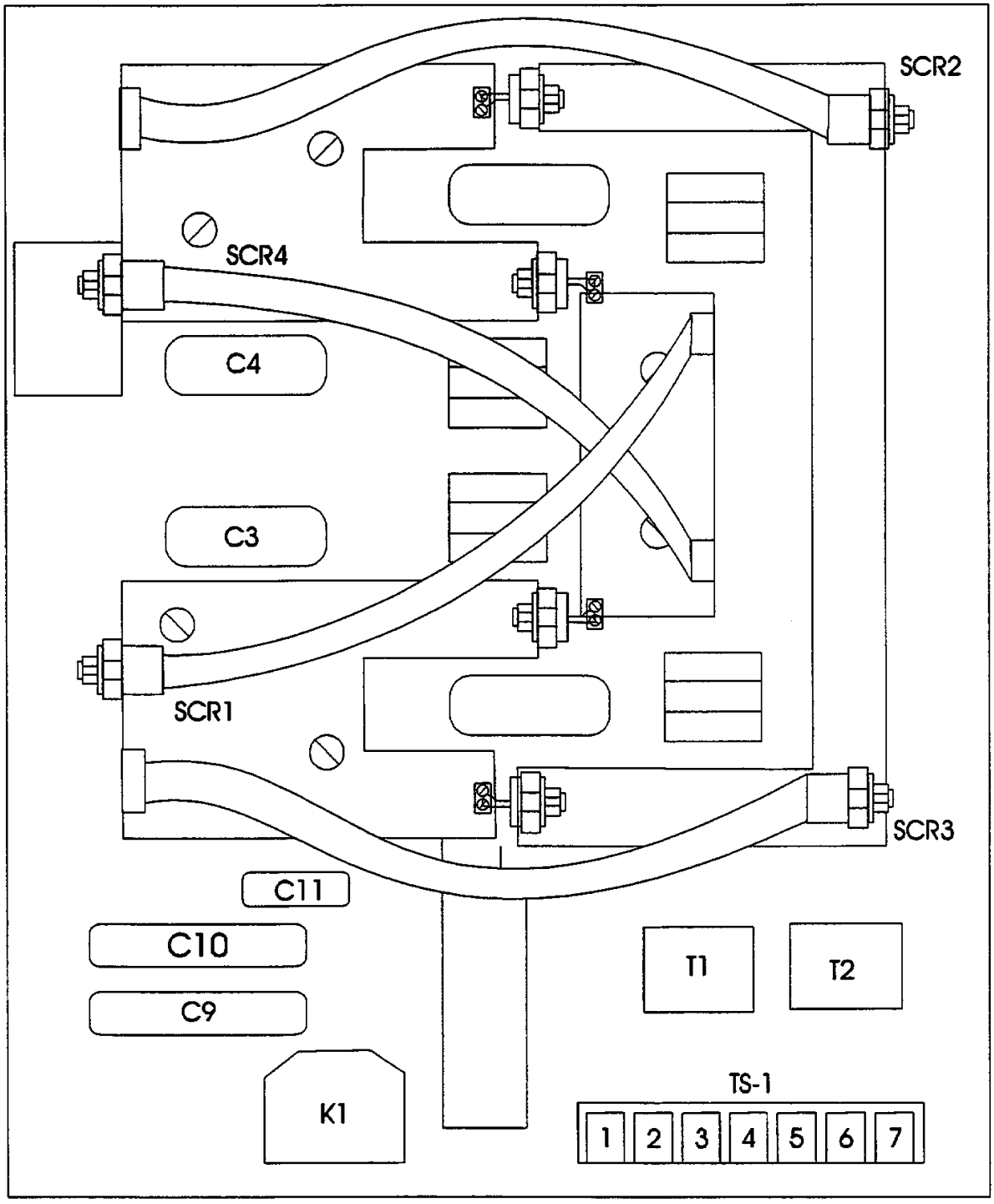


Figure 7-6 Inverter

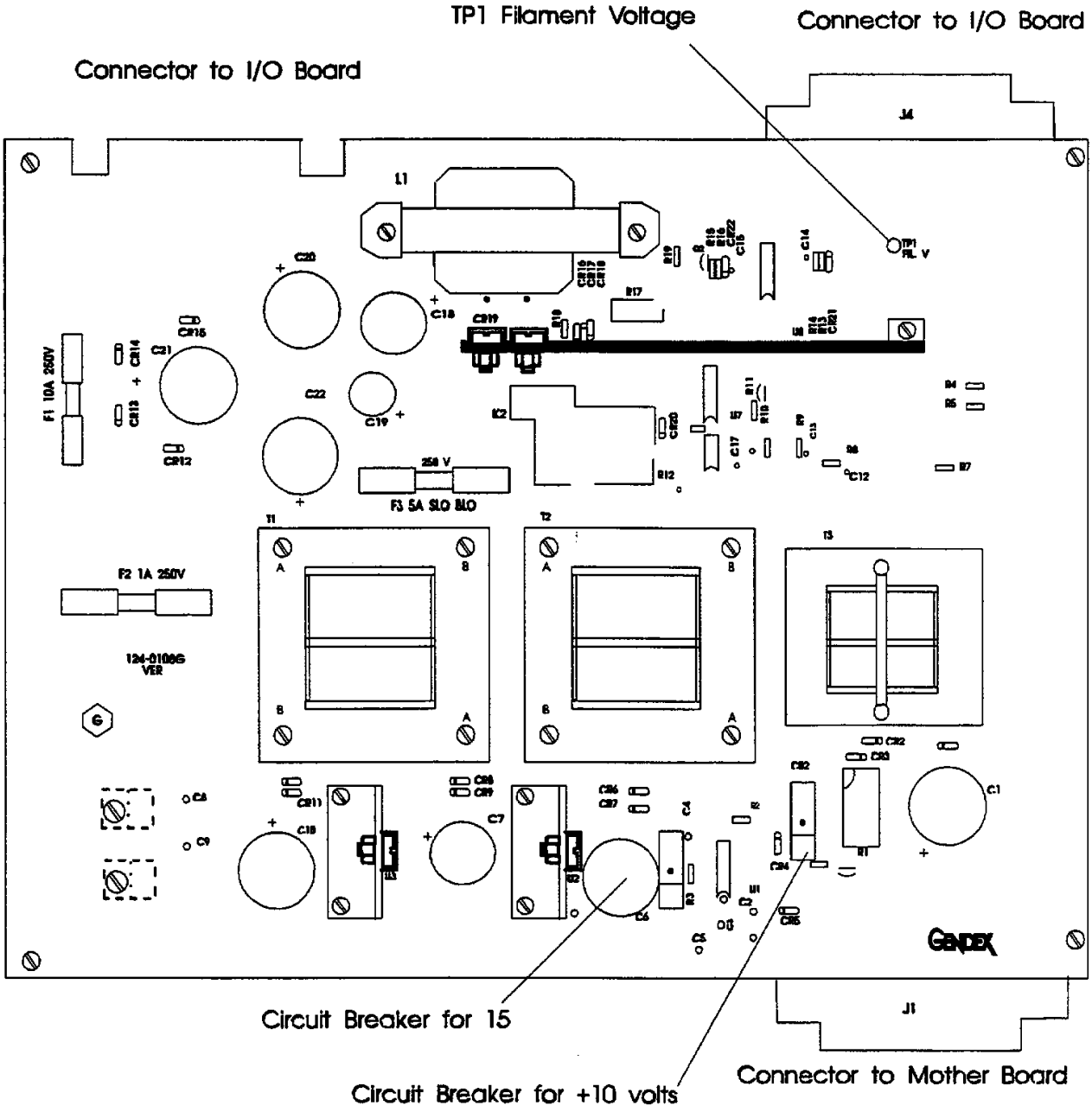


Figure 7-7 Power Supply Board

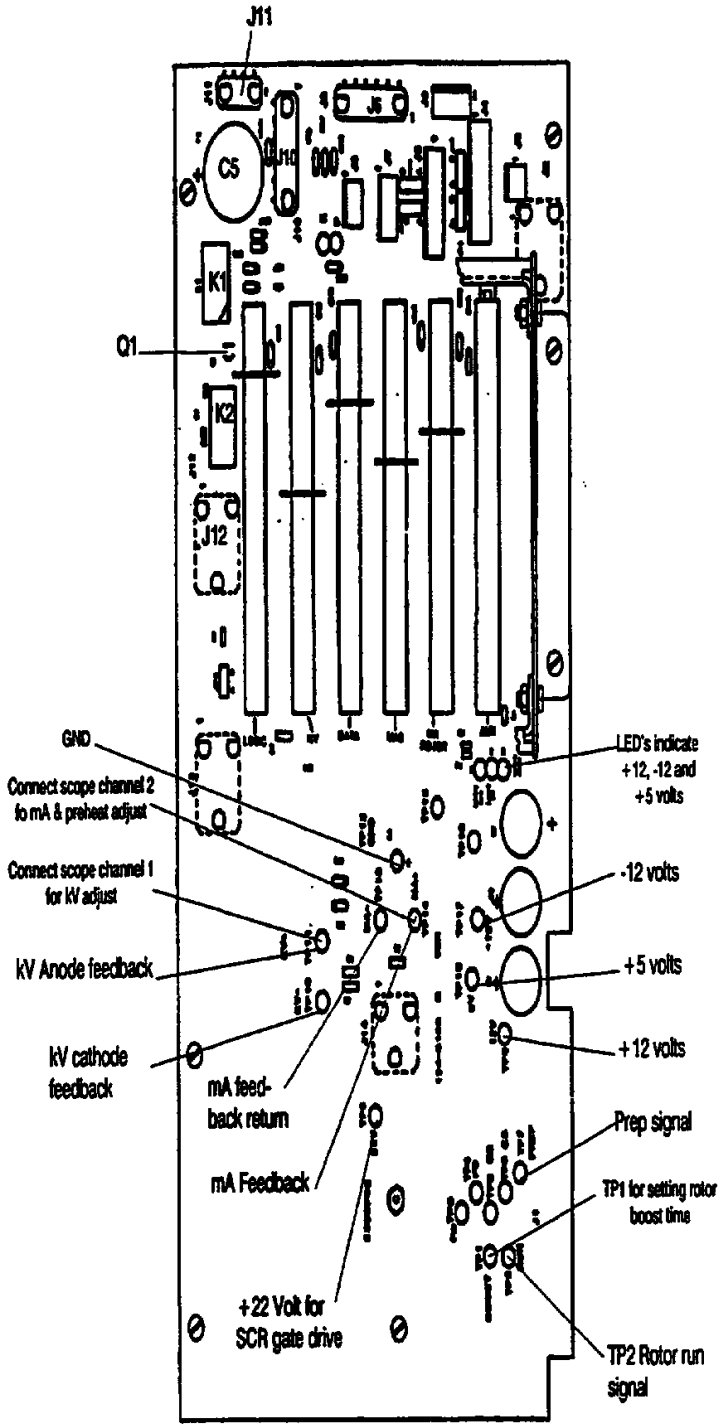


Figure 7-8 I/O Board

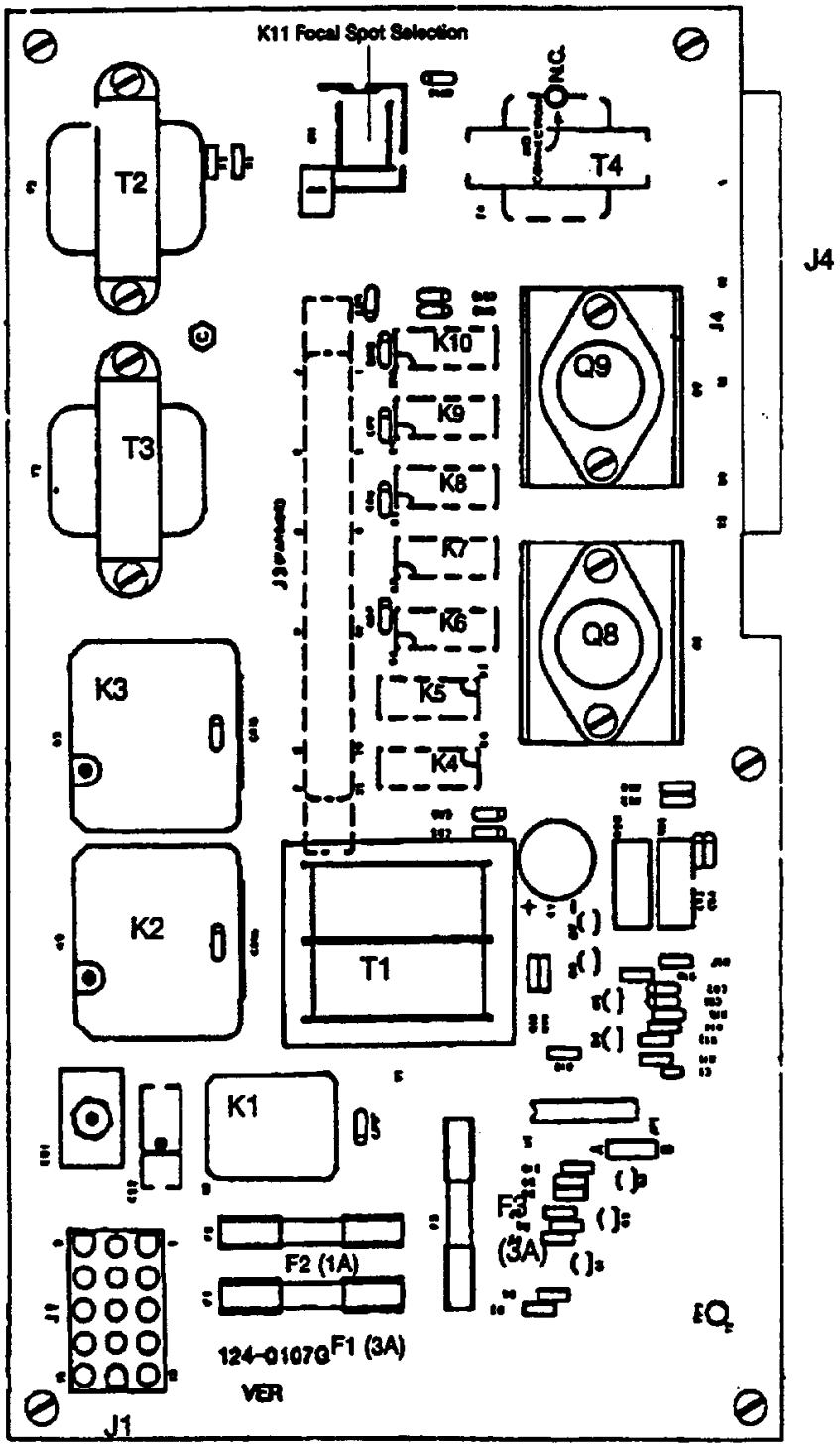


Figure 7-9 I/O Board

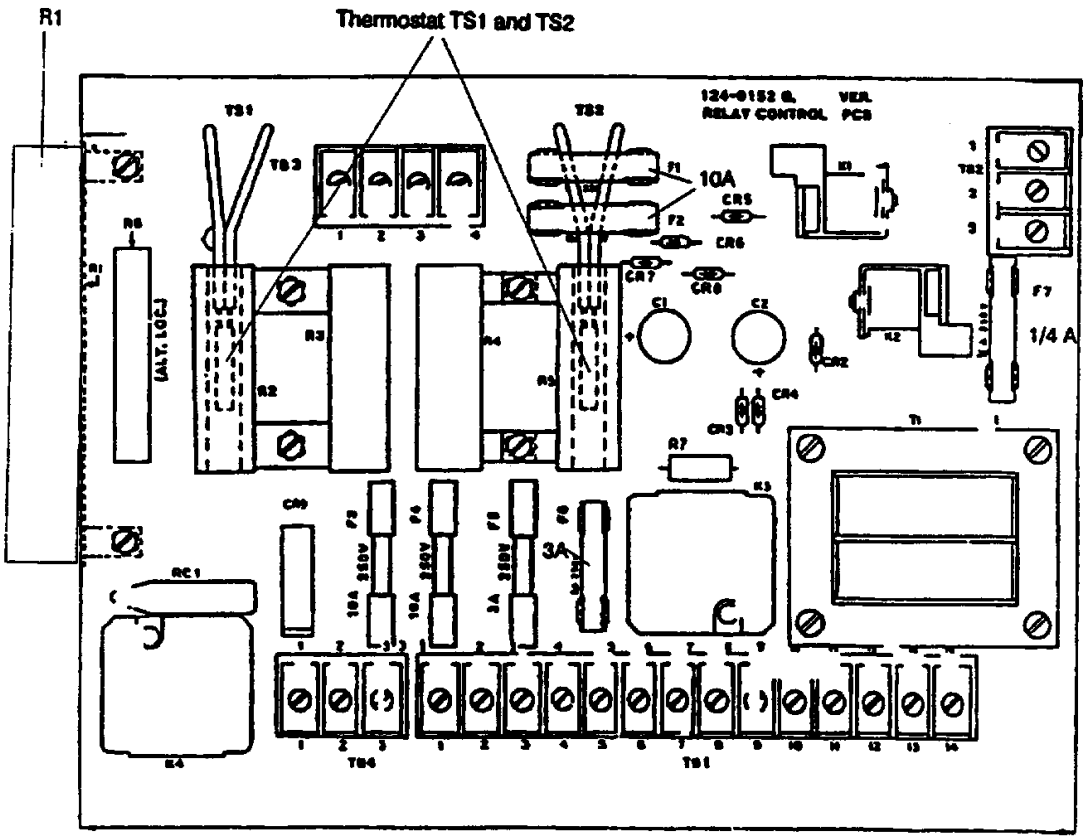


Figure 7-10 Relay Control Board

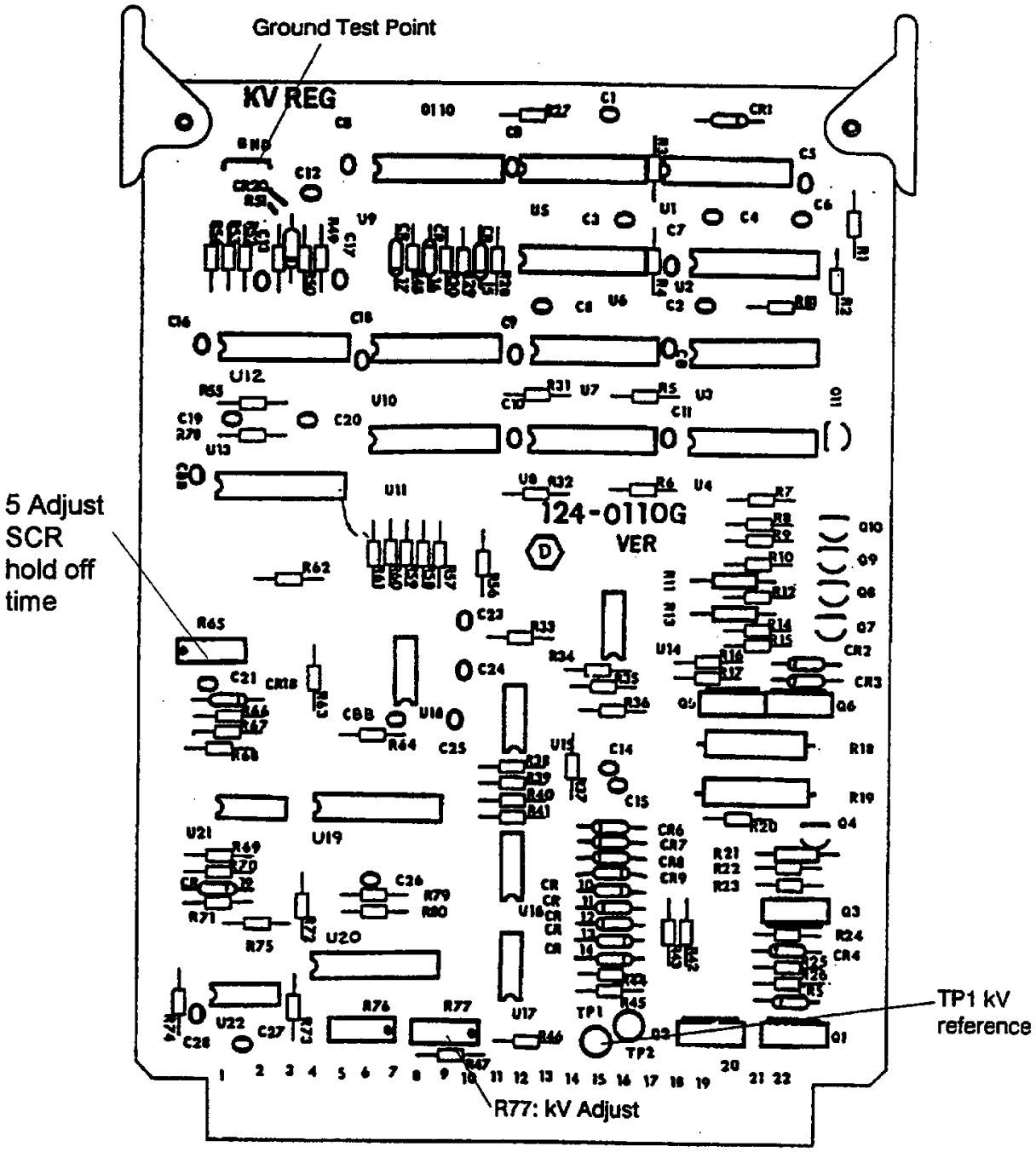


Figure 7-11 kV Regulator

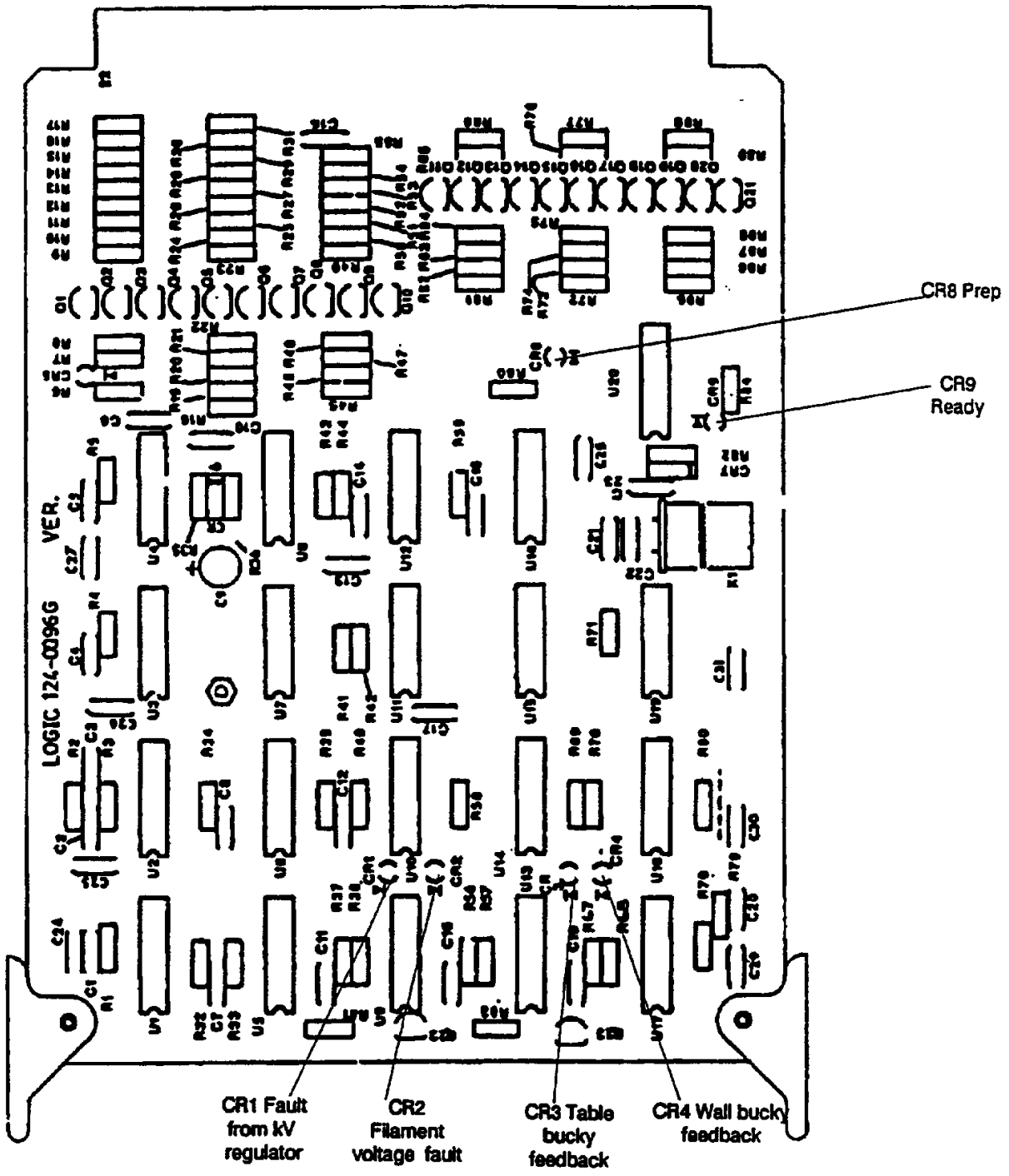


Figure 7-12 Logic Board

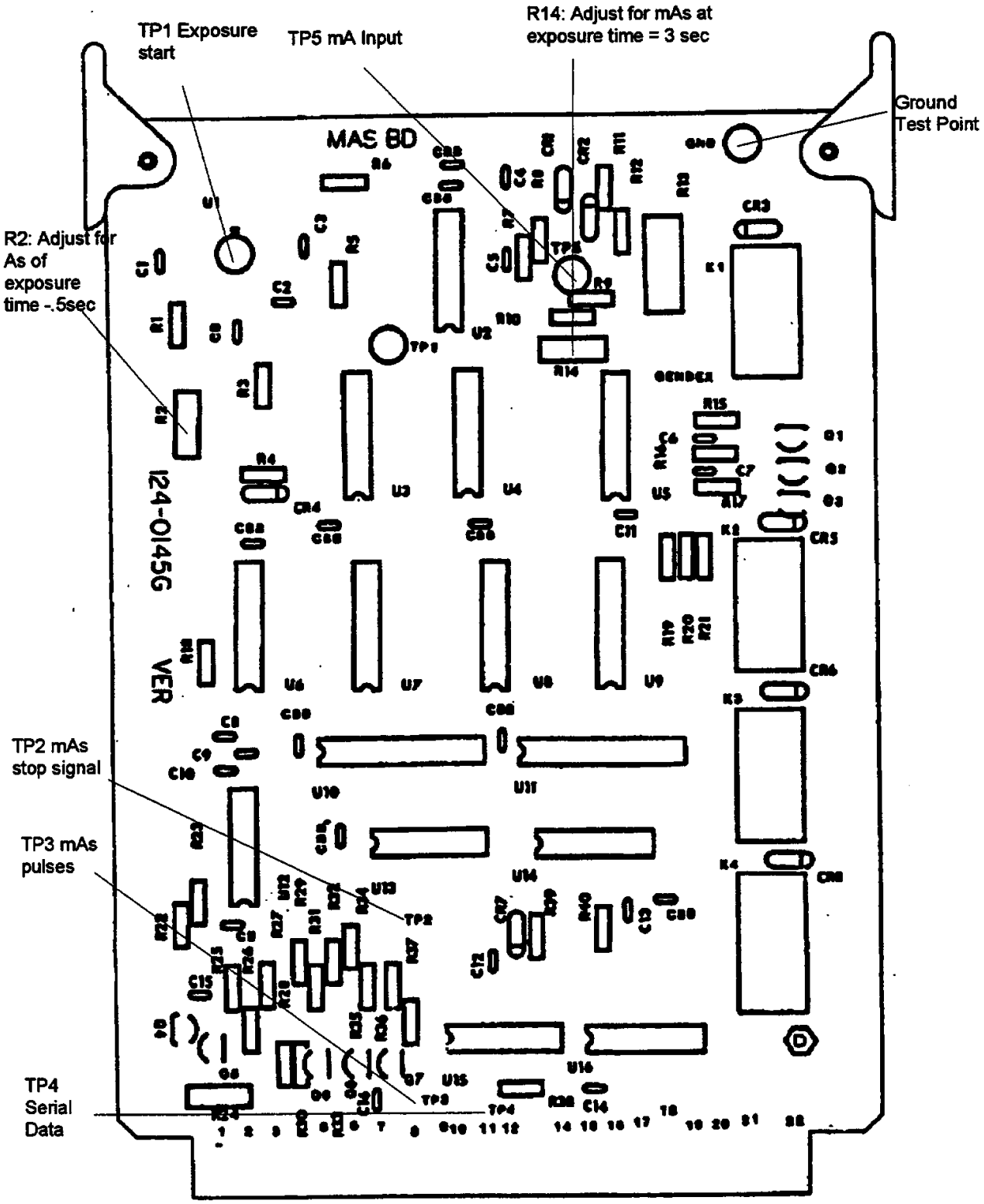


Figure 7-13 mAs Regulator

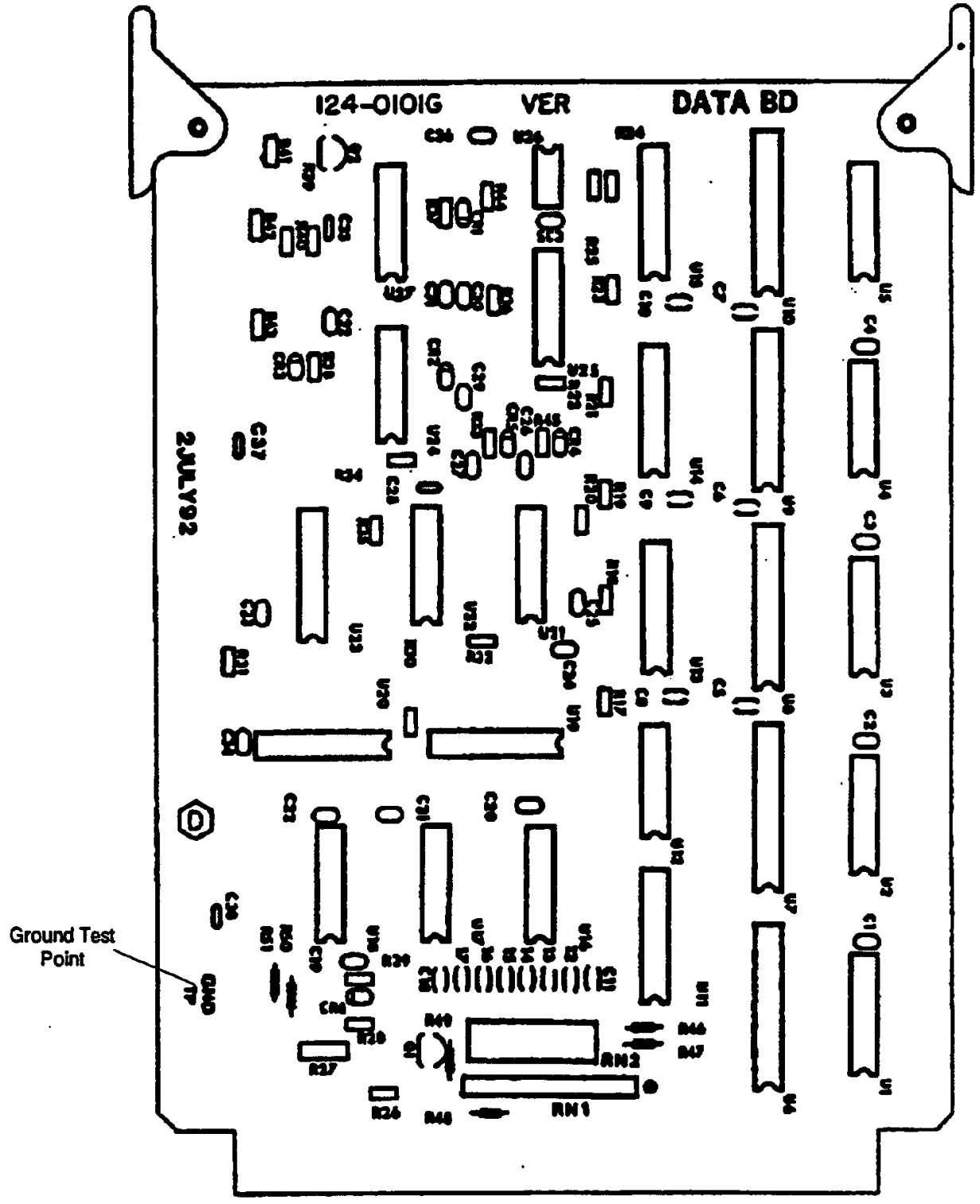


Figure 7-14 Data Board

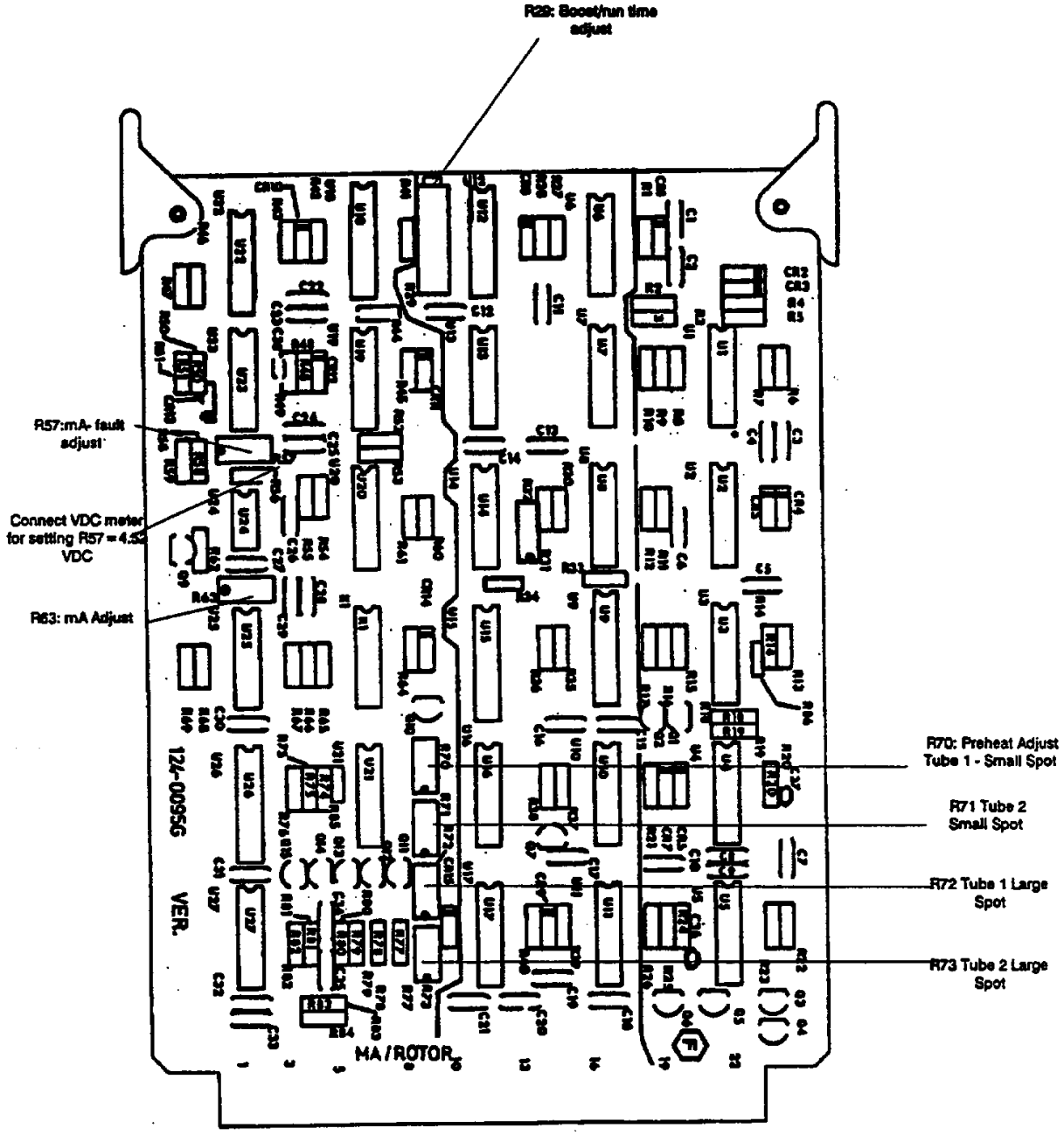


Figure 7-15 mA Rotor Board

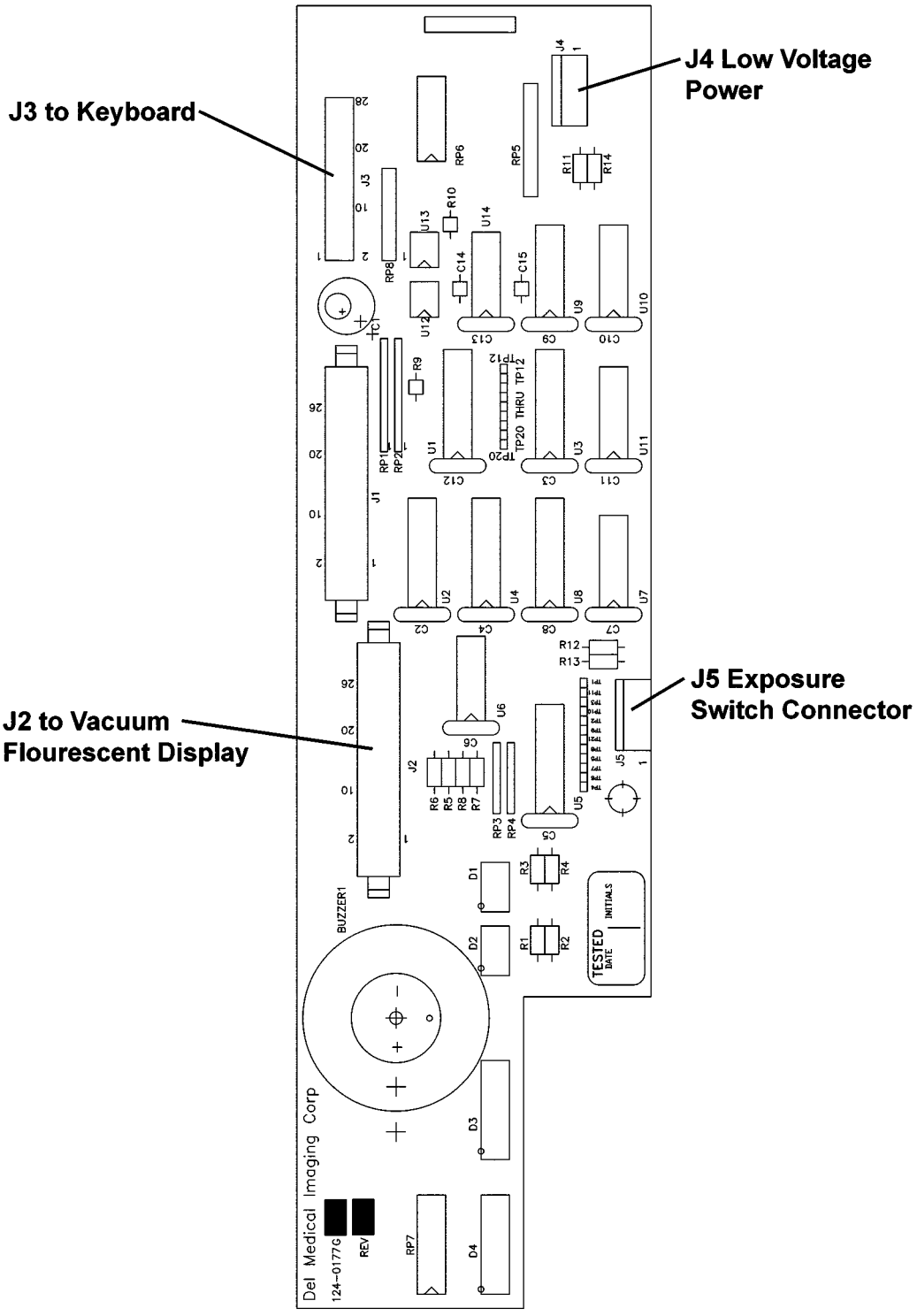


Figure 7-16 Control Interface Board

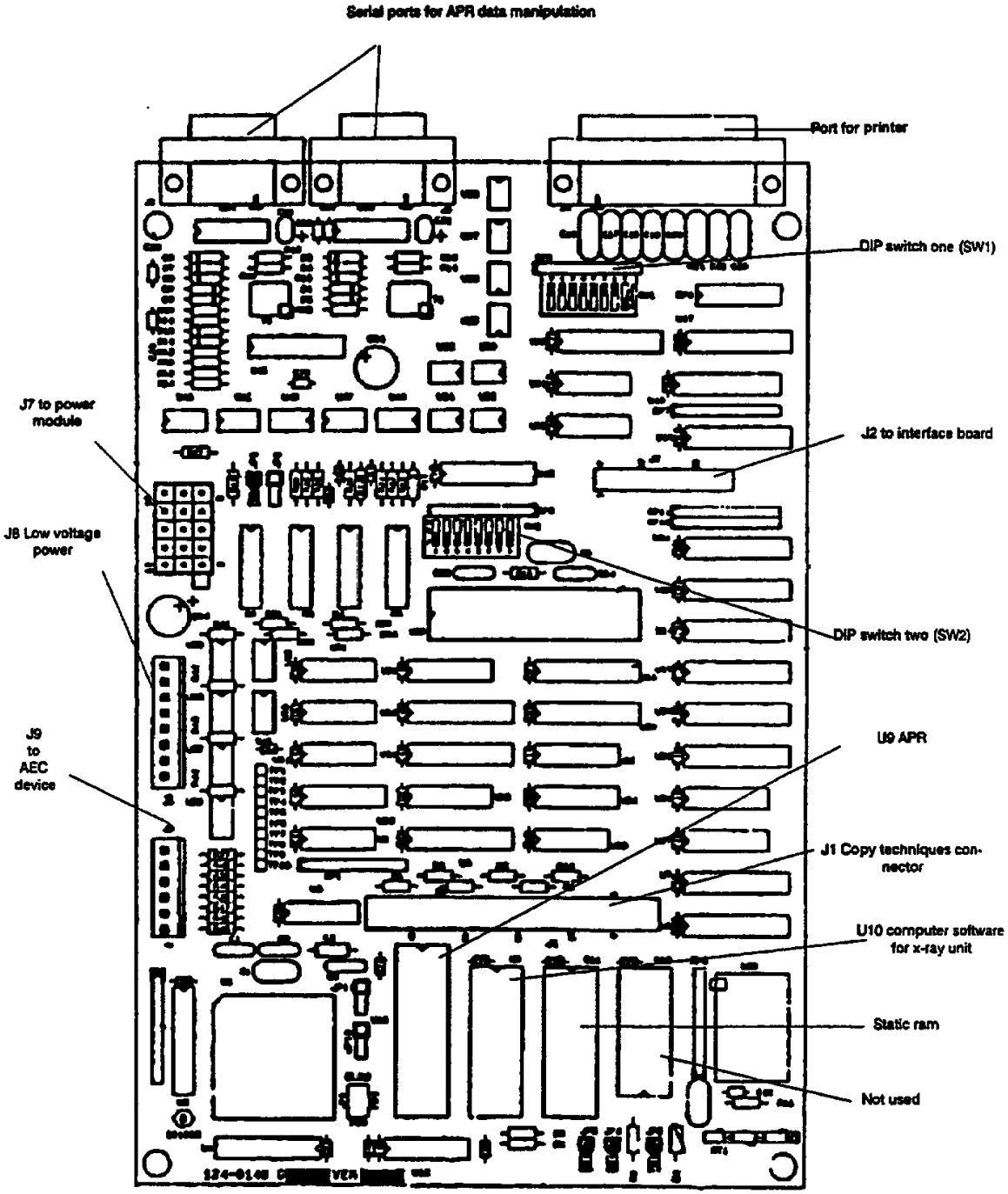


Figure 7-17 CPU Board

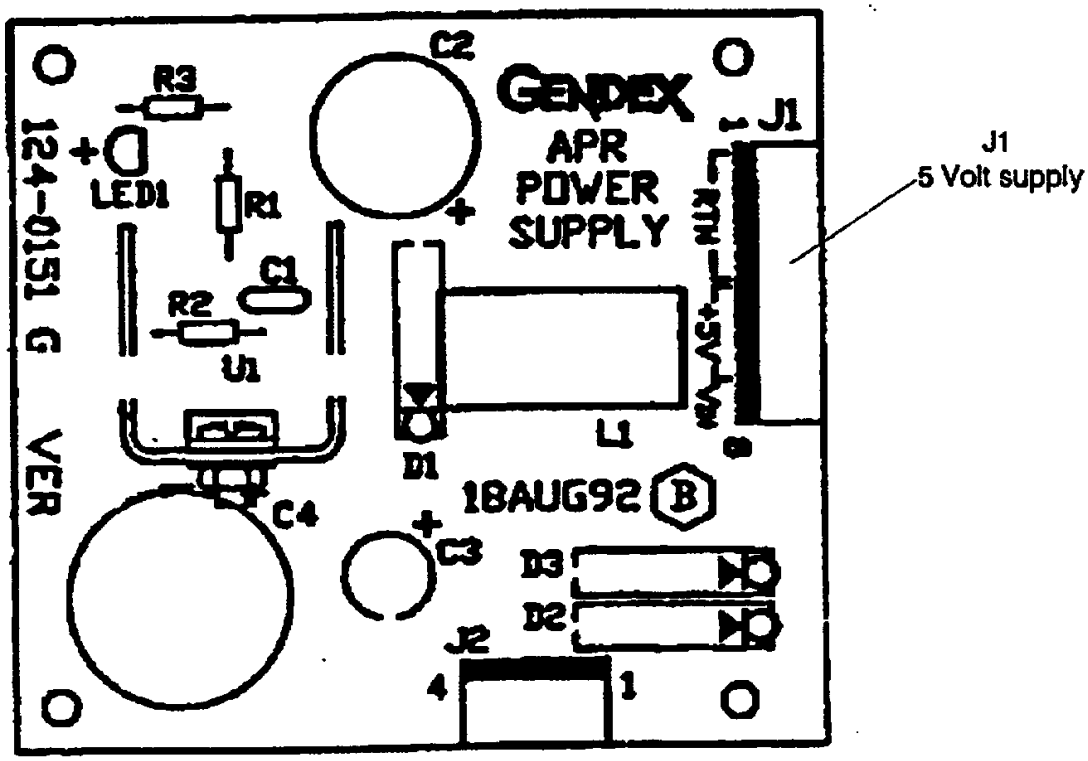


Figure 7-18 Control Power Supply

ADJUSTMENT POT IDENTIFICATIONS

KV REG 124-0110G

Pot	Function	Monitoring Point	Value
R77	KV Adjust	KV display on the dynalyzer	To match with KV setting on the APR control
R85	SCR hold off time	Connect scope at U3-10 on this PCB.	Make exposure and adjust R86 so that the negative pulse is 140 usec

MAS BD. 124-0145G

Pot	Function	Monitoring Point	Value
R2	mAs adjust	mAs display on the dynalyzer	To match with mAs setting on the APR control.
R14	mAs voltage to frequency converter	mAs display on the dynalyzer	mAs at the minimum time is equal with the mAs at the maximum time.

mA/Rotor 124-0095G

Pot	Function	Monitoring Point	Value
R63	mA adjust	mA display on the dynalyzer	To match with the mA setting on the APR control in the diagnosis mode.
R57	mA fault adjust	Connect DCVM to U23, pin 10 on this PCB & GND (TP12) on 124-0106G	DCVM = 0.8 VDC
R29	Preheat /rotor boost time adjust	Connect scope to TP1 (boost) & TP12 (GND) on 124-0106G	Set boost time to 1.5 sec.
R70	Tube 1 - small spot preheat adjust	Connect scope to TP14 (mA+) & TP12 (GND on 124-0106G	Adjust for the flat mA waveform
R71	Tube 2 - small spot preheat adjust	Connect scope to TP14 (mA+) & TP12 (GND) on 124-0106G	Adjust for the flat mA waveform
R72	Tube 1 - large spot preheat adjust	Connect scope to TP14 (mA+) & TP12 (GND) on 124-0106G	Adjust for the flat mA waveform
R73	Tube 2 - large spot preheat adjust	Connect scope to TP14 (mA+) & TP12 (GND) on 124-0106G	Adjust for the flat mA waveform

GENERATOR START UP OPERATIONAL TESTS AND INSTALLATION SET-UP

This procedure will verify correct electrical operation and lead the service engineer through the generator calibration. This procedure is not intended to limit the service engineer's final assembly inspections. At the discretion of the engineer, additional testing may be of value. Instructions, along with test criteria can be obtained by contacting our technical support group. This procedure assures that mechanical and electrical assembly of the generator has been completed. Further, this procedure requires that the "system installation" software of the controller has been programmed.

△ WARNING △

△ CAUTION △

Failure to correctly program the "system installation" file may damage components in the high voltage circuit and x-ray tube.

△ CAUTION △

Lethal voltages are present on the large filter capacitors in this unit. Exercise extreme caution when working near the long copper bus bars attached to the six large capacitors in the base of the power module. Always verify with a DC voltmeter that the capacitors are discharged before attempting any service in this area.

△ WARNING △

The three large commutating capacitors mounted to the left on the rear panel of the power module will remain charged even when the power to the unit is turned off.

TEST EQUIPMENT REQUIRED

kV meter

digital multimeter

storage oscilloscope

Dynalyzer

INSPECTION OF HIGH TENSION TRANSFORMER

1. Visually inspect transformer for signs of oil leaks or dents which would decrease internal component spacing.
2. Check the oil level in the transformer and insure that it is to the top of the circuit board but not above the board.
3. Check that the metal strap is in place between P1 A and P2 C and that the nuts are tightened.
4. Check for loose connections at the transformer terminals.
5. Check tightness of high voltage cable locking rings.

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Inspection Of Power Module

1. Check the hinged front panel for absence of interconnect cable interference.
2. Check that circuit boards are securely fastened in place and that board connectors are properly aligned.
3. Check that all electrical components are mounted securely.
4. Inspect electrical connections for signs of looseness or oxidation. Pay careful attention to power and commutating capacitors as well as incoming power supply connections.
5. Connect one lead of an ohmmeter to chassis ground. Check for an open circuit condition at the following points.

A) TB1 and TB2 line terminal contacts

B) Inverter fuse

C) Both Sides of capacitors

D) Heat sinks on inverter

E) SCR gate leads

Inspection Of Controller

1. Verify all sections of switches SW1 and SW2 of the CPU board are off for SW1-1, 2, 8 set "ON"..
2. Check the hinged panel for absence of interconnect cable interference.
3. Check that all electrical components are mounted securely.
4. Inspect electrical connections for signs of looseness or oxidation.

OPERATIONAL TESTING

1. Remove fuse F3 from the power supply board.
2. Remove inverter fuse F1 from the inverter.
3. Disconnect the stator, filament and high tension primary cables from the power module at this time.
4. Turn on the main power disconnect switch. Do not turn the control on at this time.
5. Use a DVM to measure approximately 280 volts at the input terminals of the line contactor.
6. Measure 240 volts at TB2-2 and TB2-3 on the relay control board.

NOTE

Steps five and six verify basic input voltage levels to the power module.

7. Press the "ON" switch on the rear of the controller. Observe the following actions:

A) The line contactor will energize after an approximate 7 second delay.

B) The control panel will run through a short self test, then illuminate with the " APR Regions" screen.

C) The +5 volt, +12 volt, and -12 volt led's will light on the power module mother board.

8. Connect the negative lead of a D.V.M. to the ground test point on the mother board. Check for the following voltages on the mother board;
   A) TP9 = +12 vdc +/- 5%
   B) TP12 = +5 vdc +/ - 5%
   C) TP13 = -12 vdc +/ - 5%
9. On the Power supply board observe the voltage at the F3 fuse clip nearest C19 with respect to the mother board ground. This value should be +40 vdc plus/minus 5%.
10. Turn the control "off".

NOTE

Steps seven, eight and nine verify low voltage power supplies.

11. Confirm the voltage of the capacitor bank falls to a safe level before proceeding.

WARNING

The inverter capacitor bank will hold a charge after the unit is turned off. A discharge circuit is employed to deplete this charge. However, always confirm with a DC voltmeter that the capacitors are discharged.

12. Return fuse "F3" to its place on the power supply board.

Do not return the inverter fuse to its place at this time.

13. Turn the controller "ON".
14. Press the "expose" switch only. Observe the K1 relay on the mother board energize. Release the "expose" switch.
15. Set the generator as follows:
   A) Mode - Manual
   B) kV- 70kV
   C) mAs- 15 mAs
   D) Focal spot- Large focus
16. Set the control to change "time". There are three commutating relays, two on the rear panel and K1 on the inverter. Notice the state of these relays in accordance with the table below as "time"is increased. This test is to confirm electrical function, not necessarily to verify the following chart exactly.

Time	Left Panel Relay	Right Panel Relay	K1
.022	Closed	Closed	Closed
.034	Open	Closed	Closed
.043	Open	Closed	Open
.054	Closed	Open	Open
.068	Open	Open	Closed
.085	Open	Open	Open

17. Select small focus, verify that K11 on the I/O board is energized.
18. Select large focus, verify that K11 on the I/O board is de-energized.
19. Turn power "OFF".

NOTE

Steps fourteen, fifteen, sixteen, seventeen, and eighteen confirm various relay operations.

20. Reconnect stator cable.
21. Reconnect filament cable.
22. Reconnect high voltage primary cable.
23. After assuring no voltage is present on the capacitor bank, replace the inverter fuse F1.

PROGRAMMING THE INSTALLATION MENU

It will be necessary to configure portions of the ATC operational software. During the installation process, we will identify to the computer, tube types, accessories, power levels, etc. The following procedure is needed to access the "Instruction Menu".

1. Turn the unit on. The generator will activate in the "APR Region Screen". Press the "Prev Screen" key.

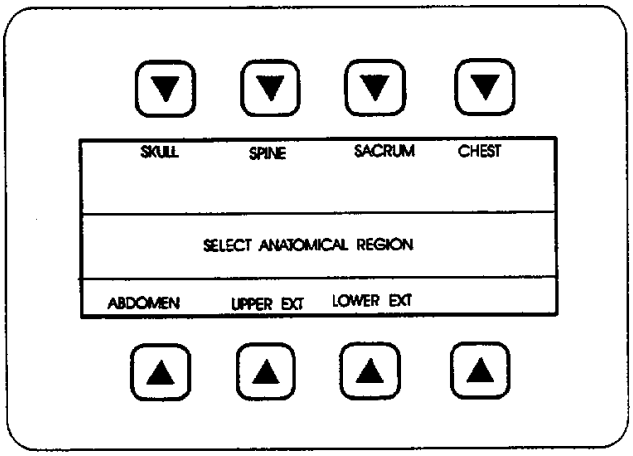

Figure 7-19 APR Mode "Region" Screen

2. This action brings the program to the system menu. Press the key above "Utilities"

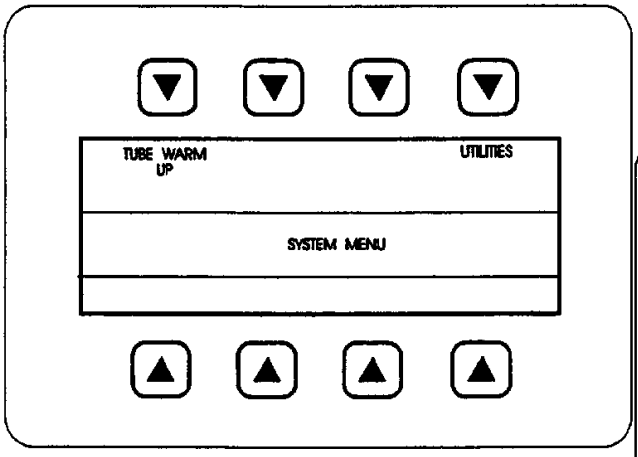

Figure 7-20 System Menu Screen

3. As a safety precaution, GENDEX-DEL has placed a password interlock before allowing access to the utilities file menu. Enter the password.

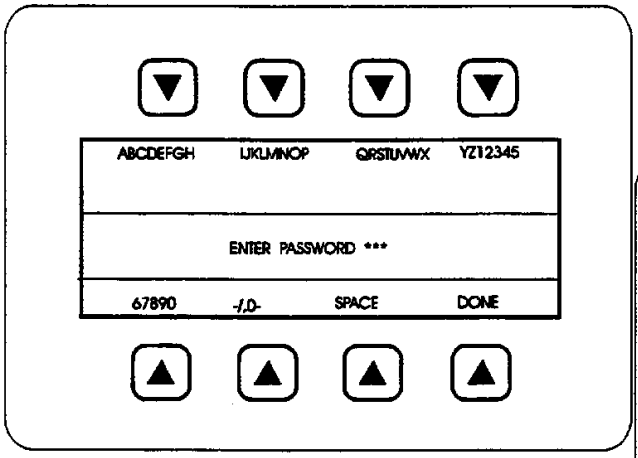

Figure 7-21 Password Screen

4. Once the password has been accepted, access is granted to the utilities menu. In order to proceed with installation programming, press the key below "System Installation".

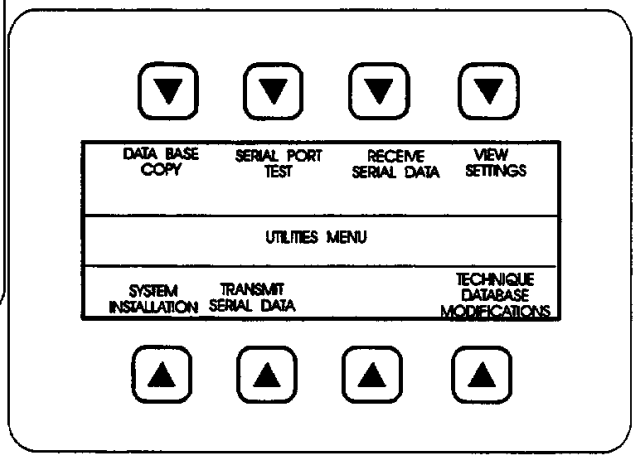

Figure 7-22 Utilities Menu Screen

When the "Installation Menu" is presented on the display screen programming is done as follows:

1. Select tube one from the existing list of tubes. "Next Tube" represents the allowable x-ray tubes. "Select" will input the tube displayed on the screen to memory.

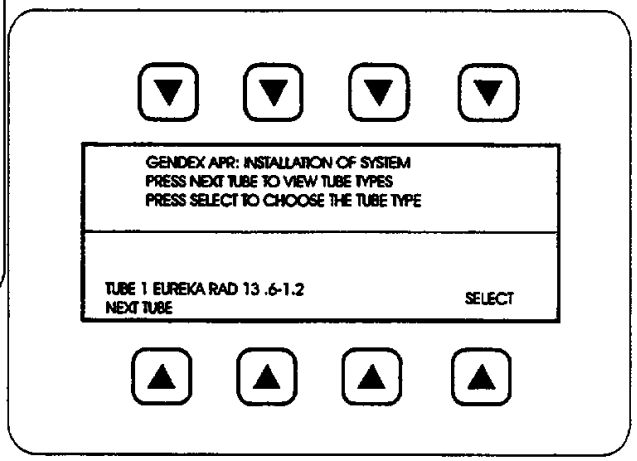

Figure 7-23 Installation Menu Step 1

If the ATC- 725 Generator is to be installed as a two tube system, select tube two by choosing from the list. If the ATC Generator is a single tube installation, input "NONE" into the tube two file location.

2. The next selection screen will be used to program the use of table or wall buckys, or grid cabinets. Press the key above Wall Bucky, Table Bucky and grid cabinet to activate operation for image receptors.

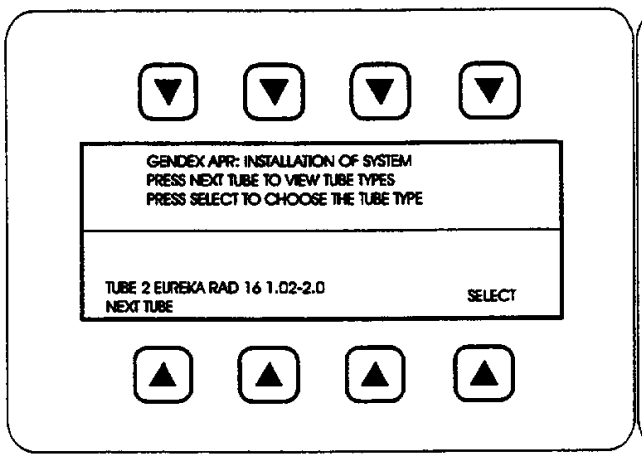

Figure 7-24 Installation Menu Step 2

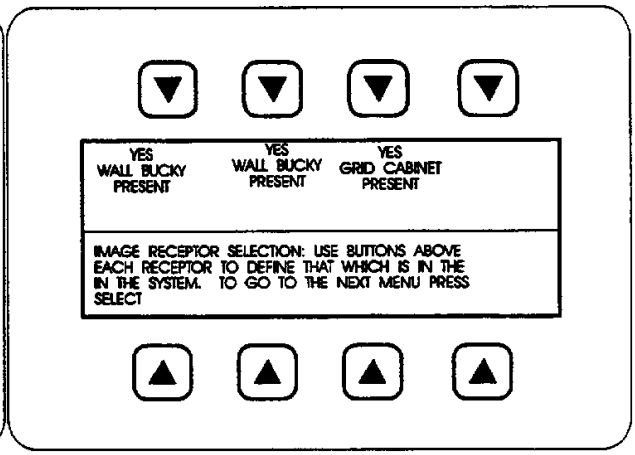

Figure 7-25 Installation Menu Step 3

NOTE

1. **If the x-ray tube to be installed with the ATC-725 Generator is not on the tube list, contact GENDEX-DEL Technical support for assistance**

"Grid Cabinet" must be selected "Yes" if a wall and Table Bucky both are not on the system.

Press the key below "select" to input the data

3. The next step is to have a default selection for the image receptor in the manual mode of operation. Choose from table, wall, or grid cabinet.

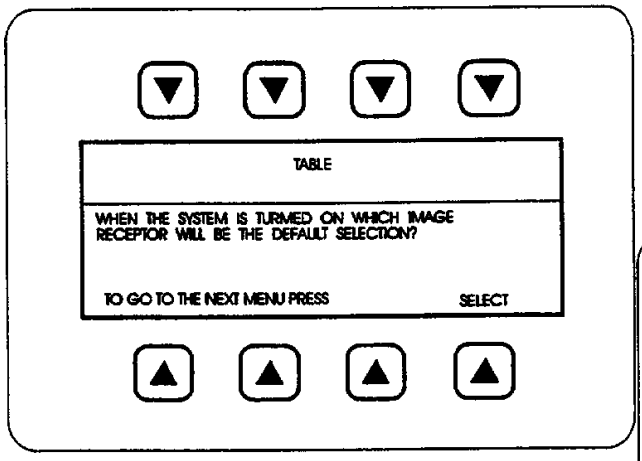

Figure 7-26 Installation Menu Step 4

Press the key below "Select" to input the selection.

4. The next step is to input film/screen speed for non-AEC exposures. Choose from the available film/ screen combinations.

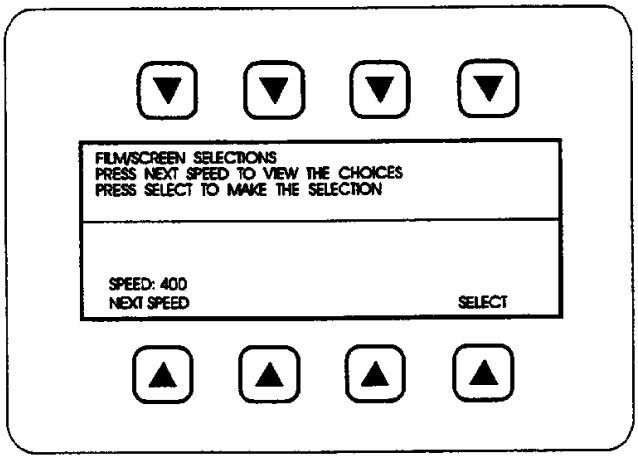

Figure 7-27 Installation Menu Step 5

Press the key below "Select" to input the data.

5. The next step is to input the presence or absence of automatic exposure control. Make the selection, then press the key below "Select" to input the data.

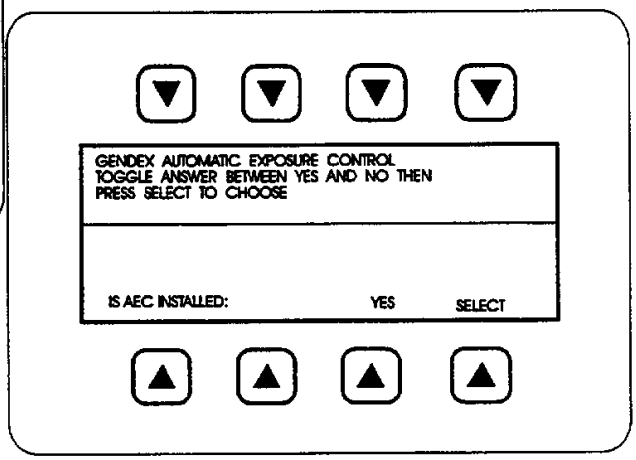

Figure 7-28 Installation Menu Step 6

6. Inputting the presence of A.E.C. will make it necessary to identify which image receptors have ion chambers.

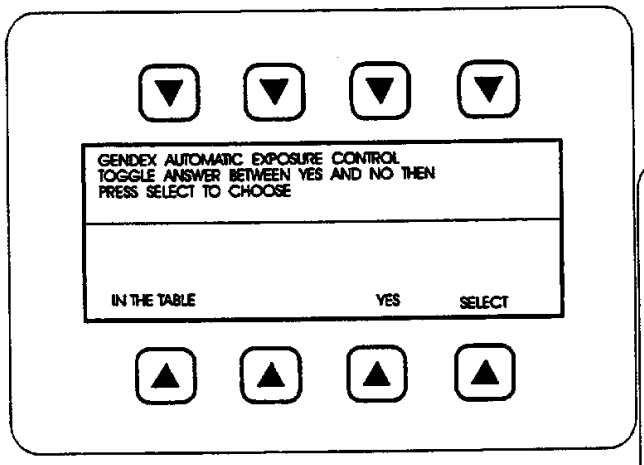

Figure 7-29 Installation Menu Step 7

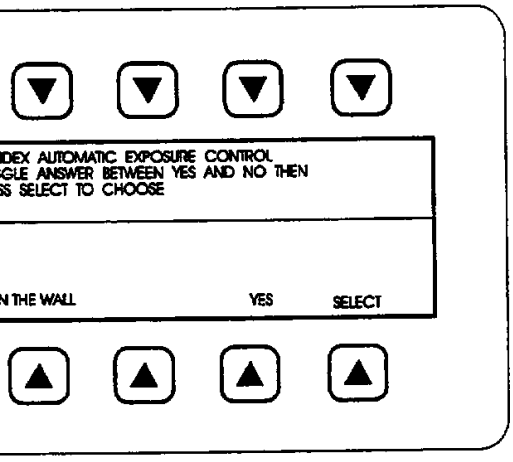

Figure 7-30 Installation Menu Step 8

Make the appropriate selection, then press the key below "Select".

7. During the next step, the installer must decide if the ATC-725 Generator will operate at full rated output. The ATC-725 generator is designed to always operate at its full rated output. However, if the unit is installed on a less than ideal power line, it will be necessary to derate the output power.

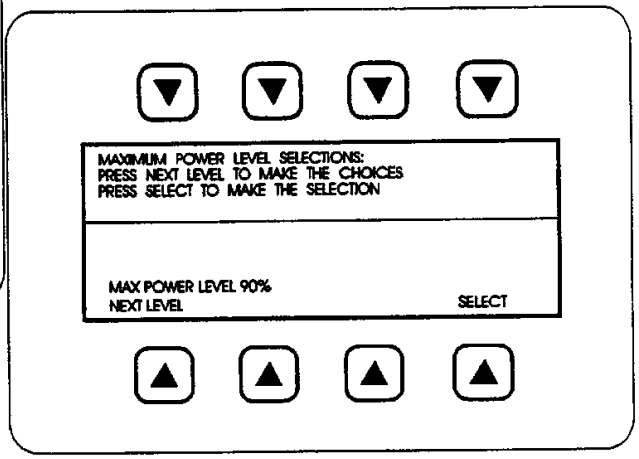

Figure 7-31 Installation Menu Step 9

Derating the generator will reduce the mA output during exposure. The effect will be longer exposure times. kV will not be effected. Once a satisfactory power line is connected to the generator, the programmed power level can be increased accordingly.

To change the operating power level press the key below "Power Level". Press the key below "Select" to input the data.

8. When entering the manual mode of operation, the ATC-725 Generator will begin with default selections for mAs, kVp and focal spot. Program these selections by pressing the key above mAs, kVp, or Filament. Technique factors can be changed by using the increment or decrement keys, filament will be changed simply by pressing the key above "Filament".

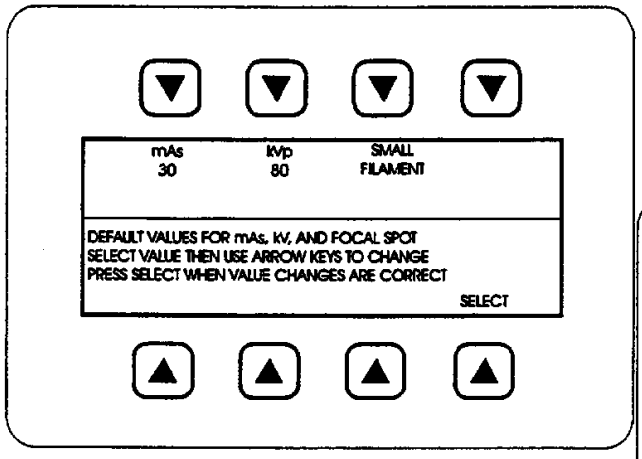

Figure 7-32 Installation Menu Step 10

A default for which image receptor was programmed in Step 3 of this procedure.

9. Last in the Instruction Menu Program is to assign a password for the administrator of the department. Programming a password for the administrator will allow that person to permanently change the technique database. This password will not allow access to the "Installation Menu", "Database Copy" routine, or the "View Settings" list.

To enter or modify an Administrator Password, press the key below "Yes".

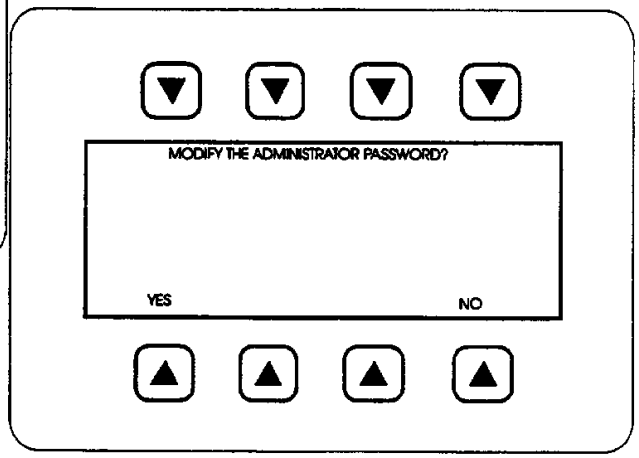

Figure 7-33 Installation Menu Step 11

At this point the installer will be presented with the password screen. First, choose a bundle of characters which contain the intended letter or number. Press the key adjacent to the bundle. This action will separate the characters for individual selection.

Choose the appropriate character by pressing the key adjacent to that point.

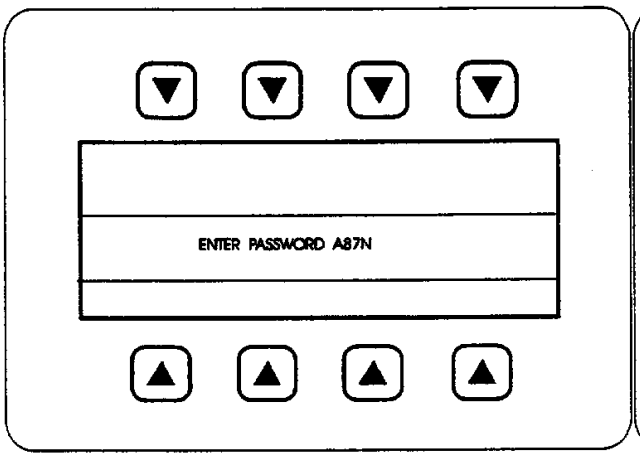

Figure 7-34 Step 12 Administrator Password Change

Continue this process until four symbols have been entered. Lastly, press the key below "Done".

At this point all parameters for the installation menu have been programmed. The choices have been received in memory. The data can be altered as necessary by repeating this procedure. To review all selections without the capability to make modifications, access the "View Settings" menu on the utility screen.

VIEW SETTINGS

The purpose of this file is to look up the operating parameters and list of accessories programmed into the installation menu. No changes can be made in this file. To step through the file, press the key below "More". All changes must be done in the "System Installation" file.

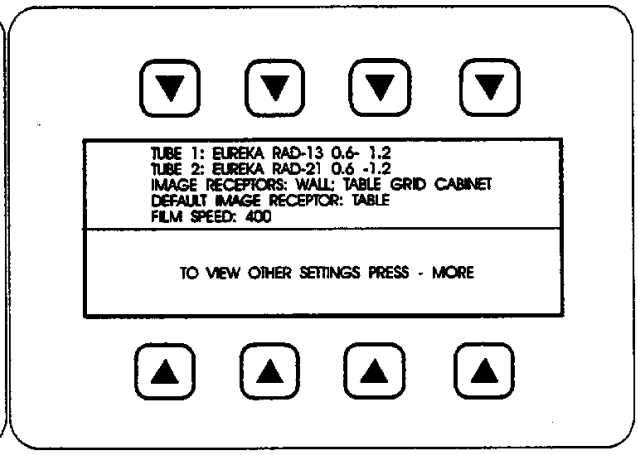

Figure 7-35 View Settings - Screen 1

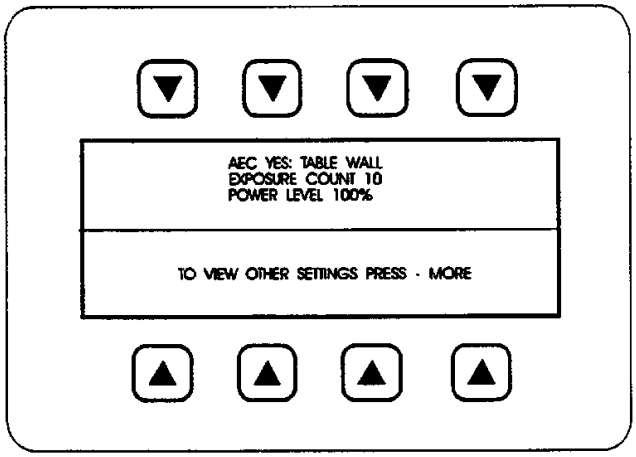

Figure 7-36 View Settings - Screen 2

GENDEX-DEL APR X-RAY CALIBRATION PROCEDURE

This procedure is to be followed upon initial installation of the ATC-725.

△ WARNING △

The main SCR capacitor bank (bottom of power module) contains a very high charge even after power is turned off. The charge is a fatal shock hazard. After power has been disconnected from the system, either by turning the line disconnect or the control console switch off, allow a minimum of five minutes for capacitor bank to discharge. Check the voltage across the capacitor bank for zero volts with a DC voltmeter before working inside the power module.

△ CAUTION △

Generator performance may be impaired if additional circuitry is powered by the same incoming line. There are no accessory power provisions within the generator. Attaching accessory items such as the collimator or table to this generator may damage circuitry and will void the warranty.

TEST EQUIPMENT REQUIRED:

- DUAL TRACE STORAGE OSCILLO-SCOPE
- DIGITAL MULTIMETER
- DYNALYZER

△ CAUTION △

THE FOLLOWING PROCEDURES WILL PRODUCE X-RAYS. OPERATING PERSONNEL SHOULD TAKE PRECAUTIONS TO ENSURE THEIR PERSONAL SAFETY AND THE SAFETY OF OTHERS IN CLOSE PROXIMITY. MINIMUM PRECAUTIONS ARE AS FOLLOWS:

a) Wear lead aprons.

b) Personnel remaining in the X-ray room during exposure should be behind a lead shield.

c) Minimize radiation scatter through doorways, walls and floor.

INITIAL TEST EXPOSURE

△ CAUTION △

Lethal voltages are present on the large filter capacitors in this unit. Exercise extreme caution when working near the long copper bus bars attached to the six large capacitors in the base of the power module. Always verify with a DC voltmeter that the capacitors are discharged before even attempting any service in this area.

The three large commutating capacitors mounted to the left on the rear panel of the power module will remain charged when the power to the unit is turned off.

1. Set SW1-2, 8 on the control CPU (0148) PWB to "ON", set all other sections to "OFF" (SW1-1 OFF to display mA).
2. Turn the Main Power Disconnect Switch "ON".
3. Turn the generator "ON". Select Manual Mode. Six values will be displayed in the upper right corner of the control display. The value for "mA" is in the upper right, the value for "Preheat mA" is to the left of the "mA" and the value for "kV" is to the left of the "Preheat mA". The three numbers under these are the HEX values of the inputs into the respective D/A converters.
4. Set the generator as follows:

kV	60 kV
mAs	15 mAs
Focal Spot	Large
mA	200 mA approx.

"mA" is visible in the upper left corner of the display. Change "TIME" to achieve an "mA" of about 200 mA.

5. Make an exposure to verify the functionality of the generator.

CALIBRATE mA

1. With power off, place the mA/Rotor Board on the extender card.
2. Turn power on. Set generator as follows:

kV	84 kV
mAs	32 mAs
Focal Spot	Large
mA	300 mA

3. Make exposures and adjust R63 on the mA rotor (0095) pwb for a Dynalyzer "mA" reading of the same value (+/- 3 mA) as indicated for "mA" (upper right) on the control screen.
4. Turn the X-ray generator "OFF".
5. Set SW1-1 back to on.

INITIAL SETTING OF PREHEAT POTS

1. Connect Channel 1 of the scope to "A + C" on the Dynalyzer using the BNC connections.
2. Connect Channel 2 of the scope to "mA" on the Dynalyzer using the BNC connections. Do not connect scope probe ground lead.
3. Set scope as follows:

   Vertical defl. —— 2 V/div

   Horiz. Sweep —— 5 msec/div

   Mode ———— chop

   Trigger ———— Channel 1

4. Turn the generator "ON".
5. Set the generator as follows:
   Tube 1
   Focal Spot Large
   kV 80 kV
   mAs 15 mAs
   Time greater than 50 msec
6. Make exposure and adjust R72 on mA rotor (0095) PWB for a flat waveform.
7. Set the generator as follows:
   Tube 1
   Focal Spot Small
   kV 80 kV
   mAs 15 mAs
   Time greater than 50 msec
8. Make exposure and adjust R70 on mA Rotor (0095) PWB for a flat waveform.
9. Turn the generator "OFF".
10. Remove the mA rotor (0095) PWB from the card extender and insert it back into card cage.

CALIBRATE mAs

1. Place the mAs (0145) PWB on the card extender.
2. Turn the generator "ON".
3. Set the generator as follows:
   Focal Spot Large
   kV 84 kV
   mAs 114 mAs
   Time 381 msec. (approx.)
4. Make exposures and adjust R2 on the mAs (0145) PWB for a reading of 114 mAs (± 1 mAs) on the Dynalyzer.
5. Adjust mAs voltage to frequency converter
6. Set the generator as follows:
   Focal Spot Large
   kV 84 kV
   mAs 114 mAs
   Time .241 Sec. (Approx.)
7. Make an exposure and record the mAs indicated by the Dynalyzer.
8. Increase time (same mAs setting) to 2.5 sec. (Approx.) and repeat exposure. Adjust R14 on the mAs PWB (0145) so that the indicated mAs on the Dynalyzer is the same recorded mAs (± 1 mAs). (Ccw increases mAs.)
9. Turn the generator "OFF".
10. Remove the mAs (0145) PWB from the card extender and insert it back into the card cage.

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CALIBRATE PREHEAT

1. With power off, place the mA rotor (0095) PWB on the card extender.
2. Turn the generator "ON".
3. Set the generator as follows:
   Tube 1
   Focal Spot Large
   kV 80 kV
   mAs 15 mAs
   Time Greater than (61 msec)
4. Make exposure and adjust R72 on mA Rotor (0095) PWB for a flat waveform.
5. Set the generator as follows:
   Tube 1
   Focal Spot small
   kV 80 kV
   mAs 15 mAs
   Time Greater than 50 msec
6. Make exposure and adjust R70 on mA Rotor (0095) PWB for a flat waveform.
7. Turn the generator "OFF".
8. Remove the mA Rotor (0095) PWB from the card extender and insert it back into the card cage.

CALIBRATE kV

1. With power off, place the kV (0110) PWB on the card extender.
2. Turn the generator "ON".
3. Set the generator as follows:
   Tube 1
   Focal Spot Large
   kV 84 kV
   mAs 15 mAs
   Time greater than 50 ms (61 msec)
4. Make exposure and adjust R77 on kV (0110) PWB for 84 kV (±1 kV) on the Dynalyzer.
5. Turn power off, remove the kV regulator from the extender card.

CALIBRATION VERIFICATION

1. Connect Channel 1 of the scope to "A + C" on the Dynalyzer using BNC connections.
2. Connect Channel 2 of the scope to "mA" on the Dynalyzer using BNC connections.
3. Set scope as follows:
   Vertical defl. —— 2 V/div
   Horiz. Sweep —— 10 msec/div
   Mode ———— chop
   Trigger ———— Channel 1
4. Turn the generator "ON".
5. Set the generator as follows:
   Tube 1
   Focal Spot Large
   kV 84 kV
   mAs 114 mAs
   Time .381 msec.
6. Make exposure and verify for proper waveforms.
7. Set the generator as follows:
   Tube 1
   Focal Spot small
   kV 84 kV
   mAs 114 mAs
   Time 561 Sec. (approx.)
8. Make exposure and verify for proper waveforms.
9. Turn the generator "OFF".

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ALTERNATE CALIBRATION PROCEDURE

GENDEX-DEL recommends using an EIMAC as the method of calibrating the ATC-725 x-ray generator. Calibrations done with a dynalyzer will bring the generator to within the published specifications. Calibrations done with other forms of test equipment may not bring the generator to within published specifications.

The following alternate calibration procedure can be used if no dynalyzer is immediately available in order to prove electrical functionality of the machine.

Incorrectly connected mAs meters or mAs meters with hidden defects may cause damage to the x-ray tube filaments.

mA CALIBRATION

1. With power off, attach the scope probe to TP14(mA+) on the mother board.
2. Attach the scope ground clip TP12 (-mA) on the mother board.
3. Set the scope for a time base of 10 msec per division, a vertical deflection of 1 or 2 volts per division.
4. Place the mA/Rotor board on the extender card.
5. Set SW1-1 of the control CPU board to the "OFF" position.
6. Turn the controller "ON".
7. Set the generator to "manual" mode, tube one, select 60 kV approximately 10 mAs, large focus, and an exposure time at least 60 msec.

⚠ CAUTION ⚠

Observe proper radiation protection procedures, the following steps will allow x-ray emission.

8. Select manual mode. Observe the number which will appear in the upper right hand corner of the display screen. This number will represent the selected mA for the exposure.
9. Use the information in Table One in order to predict the amplitude of mA waveform.

NOTE

Exposure time can be adjusted in order to allow the predicted mA to match up with the chart.

TABLE ONE

Predicated mA	mA amplitude (equivalent voltage across TP14, mA + and TP13, mA-)
50	1.0 Volts
75	1.5
100	2.0
125	2.5
150	3.0
175	3.5
200	4.0
225	4.5
250	5.0
275	5.5
300	6.0
325	6.5
350	7.0
375	7.5
400	8.0
425	8.5
450	9.0
475	9.5
500	10.0
525	10.5
550	11.0
575	11.5
600	12.0
625	12.5
650	13.0
675	13.5
700	14.0

10. Record the predicted mA _____, and the voltage specified in table one for that mA,_____ volts.
11. Make an exposure and observe the mA waveform. The average mA amplitude should be equal to the values in step 10. If not adjust R633 (Average mA Adjustment of the mA/Rotor Board to arrive at this time.
12. Make an exposure and observe the waveform. Adjust, if necessary, R72 (Large Focus Preheat) of the mA/Rotor Board for a flat waveform.
13. Switch the generator to small focus. Reset time for at least 60 msec.
14. Make an exposure and observe the waveform. Adjust, if necessary, R70 (Small Focus Preheat) of the mA. Rotor for a flat waveform.

After adjusting for a flat waveform at this technique, the mA amplitude of the small focus should be less than or equal to the amplitude of the large focus. Higher small focus amplitudes will indicate a problem in the filament drive circuitry. Contact our technical support group for assistance.

15. Once these adjustments have been done, it may be necessary to do some minor fine tuning. Make exposures at the following power levels, referring back to the predicted mA and Table One. Verify the predicted mA and mA amplitudes which occur during the exposures are correct. Adjust R63 (which controls average mA for both small and large focus), R72 (which controls large focus preheat), and R70 (which controls small focus preheat) as necessary, in order to obtain flat waveforms of the correct amplitude.

Shot one - 84 kV, Large Focus, 26 mAs

Shot two - 110 kV, Large Focus, 26 mAs

Shot three - 84 kV, Small Focus, 26 mAs

Shot four - 110 kV, Small Focus, 26 mAs

16. Turn power off.
17. Return the mA/Rotor Board to the card cage. Return SW1-1 to "ON" position.

kV CALIBRATION

1. With power off, place the kV regulator board on the extender card.
2. Insert a kV meter into the high voltage circuit or place a kV meter into the x-ray field.
3. Turn the controller "On".
4. Set the generator at manual mode, tube one, large focus, 84 kV, 15 mAs.
5. Make an exposure, observe the kV value. Adjust (if necessary) R77 on the kV regulator board for the selected kilovoltage plus/minus 1 kV.
6. Turn the controller "Off".
7. Disconnect test equipment from x-ray generator.

mAs Adjustment

mAs has been preadjusted and verified at the factory. However, it may become necessary to test or adjust mAs in the field. Gendex-Del recommends using an Eimac dynalyzer (or equivalent) for this measurement.

Set dynalyzer and then set up the dynalyzer as follows:

kVp Display	A+C
mA + mAs display	mAs
Fil Amps, Line	Line
Trigger Source	kVp
kV Display	3.3 msec
Window Delay	Off
Procedure	Normal
Trigger Mode	Percent
Trigger Level	75%
Printer	OFF

△ CAUTION △

Incorrectly connected mAs meters may cause damage the x-ray tube filament.

mAs Asjustment Is As Follows:

1. With the generator "Off", place the mAs regulator board on the extender card.
2. Insert the dynalyzer (or equivalent) into the high tension circuit.
3. Turn the generator "On".
4. Set the generator to manual mode, tube one, large focal spot, 84 kV, approximately 100 mAs and an exposure time of approximately 0.5 seconds (appox.).
5. Make exposure and adjust R2 on the mAs regulator board for a reading of plus/minus 1 mAs on the Dynalyzer.
6. Increase exposure time to approximately 2.6 seconds.
7. Make exposures and adjust R14 on the mAs regulator board for a reading of plus/minus 1 mAs on the dynalyzer.
8. Turn the generator "off".
9. Remove the dynalyzer from the circuit.
10. Remove the mAs regulator from the extender card. Return the board to the card rack.

ADDITIONAL OPTIONAL INSPECTIONS

THE FOLLOWING FOUR CALIBRATIONS ARE NOT NORMALLY REQUIRED. INFORMATION IS INCLUDED IN CASE THEY MUST BE DONE.

CALIBRATE HIGH TENSION TRANSFORMER BALANCE

1. Connect Channel 2 of the scope to the Dynalyzer "C" BNC jack and connect Channel 1 of the scope to the Dynalyzer "A" BNC jack.
2. During the following adjustment observe the anode and cathode waveforms to verify that the Dynalyzer is not reading spikes.
3. Make an exposure and move the center tap of the power resistor on the back of the power module until the Dynalyzer reading of Anode kV is the same as the reading of Cathode kV.

CALIBRATION OF SCR HOLD OFF TIME

1. Connect Channel 1 of the scope to Pin 10 of u3 on the kV PWB.
2. Set scope as follows:
   Channel ---------- 1
   Vertical defl. ------ 5 V/div
   Horiz. Sweep ---- 100 usec/div
   Mode ------------ single sweep
   Trigger ---------- Channel 1
3. Place the kV regulator board on the extender card.
4. Set the generator as follows:
   Tube 1
   Focal Spot Large
   kV 80 kV
   mAs 32 mAs
   Time Greater than 50 ms
5. Make exposure and adjust R65 on kV (0110) PWB so that the negative pulse width is 140 usec.
6. Turn the generator "OFF".
7. Remove the kV (0110) PWB from the card extender and insert it back into the card cage.

mA Fault Calibration

Filament over-voltage limit circuit. This circuit will watch the voltage applied to the filament transformer and ultimately, the x-ray tube filament. Its purpose will be to turn off the filament supply due to component failure or misadjustment. Before attempting this adjustment, observe the relay K2 of the power supply board. This relay will be energized during normal operation. If the relay de-energizes even with very low generator power settings, this may indicate component failure. If the relay remains energized with low power settings, but trips at high power settings, this may indicate an adjustment is necessary.

Should adjustment be necessary, the procedure is as follows;

1. Place the mA/rotor board on the extender card.
2. Connect the negative lead of a DVM to the mother board ground point.
3. Connect this positive lead of the DVM to U23, pin 10 on the mA/ rotor board.
4. Turn the generator "On".
5. Set the generator to manual mode, tube one, large focus, 70 kV, 11 mAs, minimum time.
6. Press and hold "Prep" while adjusting R57 of the "mA/Rotor" board for 0.8 VDC. If mA faults occur, turn pot CW to reduce value. Then press reset to continue.
7. Turn the generator "Off". Return the mA/Rotor board to the card cage.

Boost Time Adjustment

1. Place the mA/Rotor board on the extended card.
2. Attach scope probe to TP1 on the mother board, ground clip to ground test point on mother board.
3. Set scope time base for .5 seconds per division. Vertical deflection for 2 volts per division.
4. Turn controller on.
5. Press "PREP".Observe boost time. Adjust (if necessary) R29 of the mA/rotor board to provide 1.5 seconds of rotor boost.
6. Turn controller "OFF".

AEC INSPECTION AND CALIBRATION

APR-AEC will be powered up by +12, -12 from APR module

AEC Cable Interconnections

There are three (four with two ion chambers) cable connections.

1. Generator Power Module to AEC Main chassis (power and signals).
2. Generator Control to AEC Main chassis (signals). The standard length is 45 feet.
3. and 4. Ion chamber to AEC main chassis. The standard length is 40 feet.

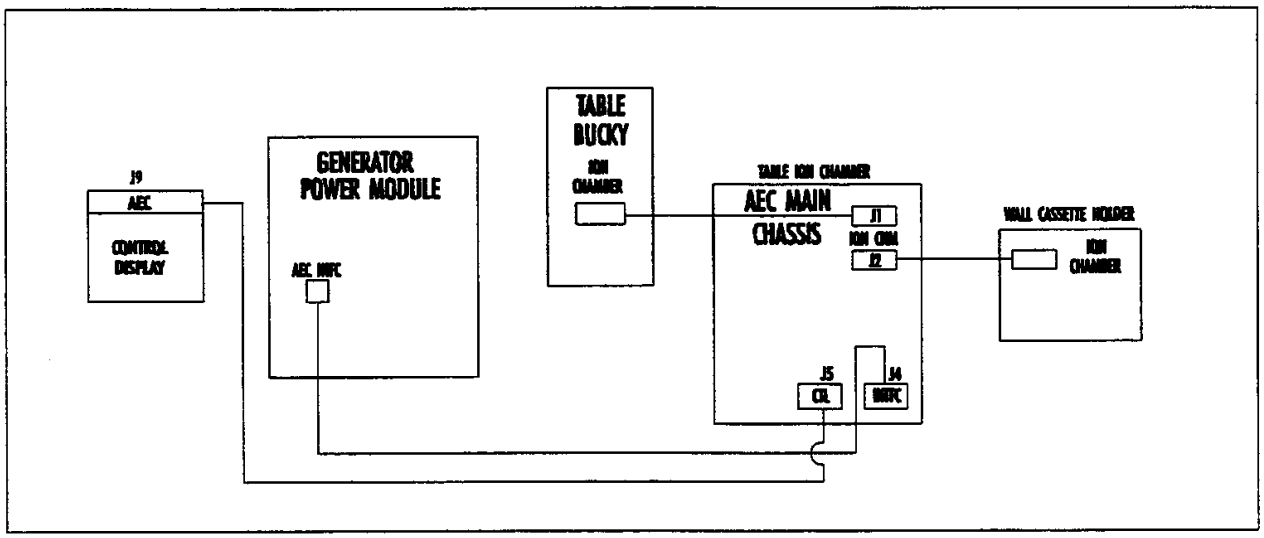

Figure 7-37 Cable Interconnections

Connections for Ion Chambers on Main AEC Board.

J1- TABLE

J2 - WALL

Test Points

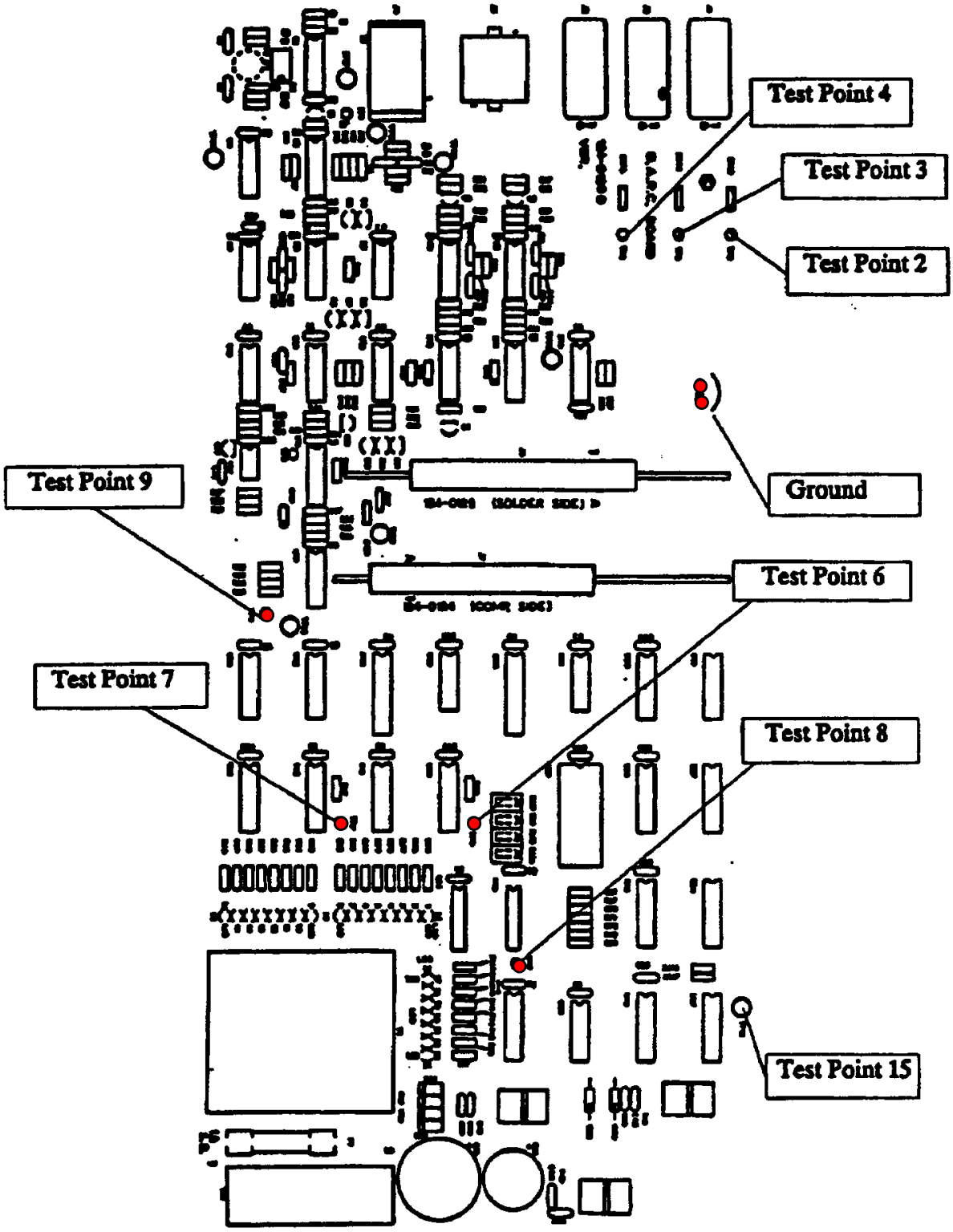

Figure 7-38

AEC Communication Link Checkout

This test will verify the correct selection of modes of operation, fields, densities, and desired kilovoltage between the controller and the AEC device.

1. With the power "Off" place a jumper on the AEC device "Main AEC Board" between the ground lead and TP6.
2. Turn the generator "On", select AEC operation.
3. Move through the selections on the chart to the right, verify that the proper LED's illuminate.

Control Selection	Led on Main AEC Board
Left field	2
Center field	3
Left and Center fields	2 & 3
Right and Center fields	2 & 4
All fields	2, 3 & 4
Left and Right	Fields 2 & 4
Right	Field 4
Screen One	LED 5 on
Screen Two	LED 5 off
Density Normal	6
Density -25%	7 & 8
Density -50	7
Density +25%	6 & 8
Density +50%	6 & 7

4. Turn the generator "Off", remove the jumper.
5. Place a jumper on the AEC device "Main AEC Board" between TP8 and the ground lead.
6. Turn the generator "On", select manual mode, Lagre Spot, 32 mAs.
7. Move through the selections on the chart below, verify the proper LED's illuminate.

	kV LED						
SELECTED	17	18	19	20	21	22	23
40-41	ON	ON	ON	-	-	-	-
42-43	ON	ON	ON	-	-	-	ON
44-45	ON	ON	ON	-	-	ON	-
46-47	ON	ON	ON	-	-	ON	ON
48-49	ON	ON	ON	-	ON	-	-
50	ON	ON	ON	-	ON	-	ON
51-53	ON	ON	ON	-	ON	ON	-
54-55	ON	ON	ON	-	ON	ON	ON
56	ON	ON	-	ON	-	-	-
57-58	ON	ON	-	ON	-	-	ON
59-61	ON	ON	-	ON	-	ON	-
62-63	ON	ON	-	ON	-	ON	ON
64-65	ON	ON	-	ON	ON	-	-
66	ON	ON	-	ON	ON	-	ON
67-69	ON	ON	-	ON	ON	ON	-
70-71	ON	ON	-	ON	ON	ON	ON
72-74	ON	-	ON	ON	-	-	-
75	ON	-	ON	ON	-	-	ON
76	ON	-	ON	ON	-	ON	-
77-79	ON	-	ON	ON	-	ON	ON
80-81	ON	-	ON	ON	ON	-	-
82-83	ON	-	ON	ON	ON	-	ON
84-85	ON	-	ON	ON	ON	ON	-
86-88	ON	-	ON	ON	ON	ON	ON
89-94	-	ON	ON	ON	-	-	-
95-100	-	ON	ON	ON	-	-	ON
101-105	-	ON	ON	ON	-	ON	-
106-108	-	ON	ON	ON	-	ON	ON
109-114	-	ON	ON	ON	ON	-	-
115-120	-	ON	ON	ON	ON	-	ON
121-125	-	ON	ON	ON	ON	ON	-

8. Turn the generator off.
9. Remove the jumper between TP8 and ground.

AEC Device Field Calibration Procedure

The purpose of the field calibration procedure is to match the response of the AEC with the particular film/screen and film processing system in use where the equipment is installed. No ion chamber alone can match the response of all the various combinations. The AEC circuitry provides the means to compensate for the nonlinear kV response of the commonly used film screen combinations. Two different response curves, Screen 1 and Screen 2, may be calibrated into the AEC by this procedure.

Normally a system will have two 3 field detectors, Wall and Table, which are automatically selected at the Generator when the appropriate image receptor is selected. Each input has balancing offset adjustments and gain controls.

The 3 field ion chamber has several adjustments, namely drift for each field, field balancing and preamplifier gain. These are factory adjustments. Please call the manufacturer if you feel an adjustment might be necessary.

Required Equipment:

Calibrated High Frequency Generator

Installed Automatic Exposure Control Option

Densitometer capable of measuring optical film densities from .5 to 2.5 +/- .05.

X-Ray film processor

Film and cassettes

Phantom - 10 pieces of 1" x 8" x 8" (2.54 cm x 20.32 cm x 20.32 cm) pieces acrylic

OR

Flat bottom (no reinforcing bumps) plastic bucket to hold 12 30.5 cm inches of water.

Voltmeter

Small screwdriver

Calibrated oscilloscope - DC to 1 MHz response - storage scope desirable.

△ CAUTION △

CERTAIN TESTS REQUIRE THE PRODUCTION OF X-RAYS. FIELD PERSONNEL SHOULD TAKE PRECAUTIONS TO ENSURE THEIR PERSONAL SAFETY AND THE SAFETY OF OTHERS IN CLOSE PROXIMITY. MINIMUM PRECAUTIONS ARE AS FOLLOWS:

a) Wear lead aprons.
b) Personnel remaining in the X-ray room during exposure should be behind a lead shield.
c) Minimize radiation scatter through doorways, walls and floor.

Calibration Procedure

1. Set up x-ray system in the manner in which normal examinations will occur.
2. Make sure film is loaded in the cassette. Six inches of phantom should be placed in the field, with the collimated x-ray field confined within the area of the phantom.
3. Set the generator to the following technique:
   - Large focal spot
   - Appropriate tube
   - Table or wall image receptor
   - AEC "ON"
4. The AEC is precalibrated at the factory to match typical film/screen combinations of both 200 speed (Screen 1) and 400 speed (Screen 2). The settings are based upon a 40 SID and an 8:1, 103 line grid. This calibration procedure fine tunes the AEC to the individual installation parameters. The following procedure would be similar for other speed systems.

Preliminary Gain Adjustments

FOR THE TABLE IMAGE RECEPTOR

1. Disconnect table ion chamber cable from main AEC board.
2. Place a jumper from TP2 and TP15 (both on Main AEC Board.)
3. Connect voltmeter to TP11 (on Gain Adjust Board) and Ground (of the Main AEC Board).
4. Adjust R107 for 1.5 VDC.
5. Remove the jumper and voltmeter. Reconnect ion chamber cable.

FOR THE WALL IMAGE RECEPTOR

1. Disconnect the wall ion chamber cable from the main AEC Board.
2. Place a jumper from TP3 to TP15 (both on the main AEC Board).
3. Connect a voltmeter to TP10 (on the Gain Adjust Board) and ground.
4. Adjust R113 for 1.5 VDC.
5. Remove the jumper and voltmeter. Reconnect the wall ion chamber cable.

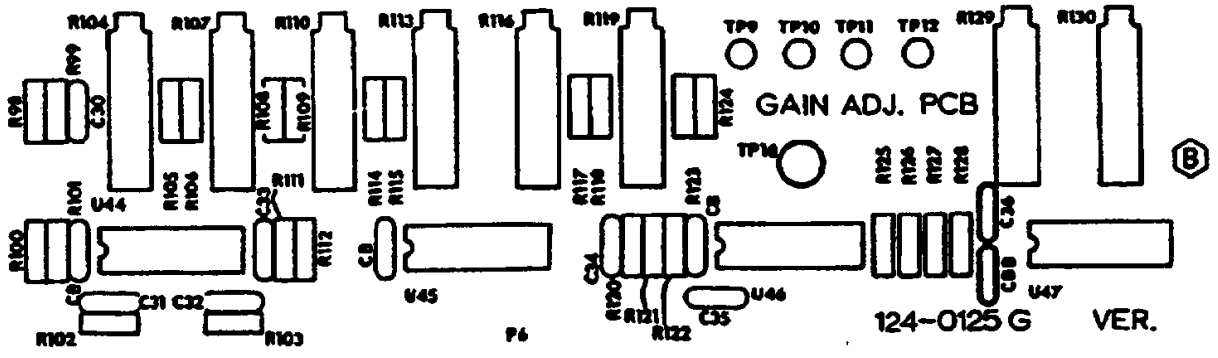

Figure 7-40

kV Compensation Adjustments

1. Verify the initial settings of the reference voltage. Connect the DC voltmeter between TP9 and GND of the Main AEC Board. Select 72 kV "N" density. The voltage should be 3.0 Volts when either Screen 1 or Screen 2 is selected. This voltage may be adjusted using R137 for Screen 1 and R138 for Screen 2 (kV Compensation PWB 124-0124).
2. Be sure an image receptor is selected, the screen selection you wish to calibrate is selected, and density selection is N (normal).
3. If the Automatic Exposure Control is to be used with only one film/screen system, both Screen 1 and Screen 2 should be calibrated at the same time to this single speed system, using the same phantom thicknesses, generator settings, and pots as listed in paragraph 10. To match the calibration of Screen 2 to that of Screen 1, it is necessary only to match elapsed mAs during the exposure. No film is required but an empty cassette must be used. For example, film is used to adjust R130, Screen 1 so that density at 72 kV is 1.2. Then an empty cassette is used and R129 is adjusted so that the mAs of exposure at 72 kV with Screen 2 selected, is the same as the mAs recorded for the calibrated Screen 1. This mAs matching is then repeated in turn as the other kV stations are calibrated.
4. Set the Generator to 72 kV and 50 mAs. Insert 6 (15.24 cm) inches of water (or plastic) in the field and collimate to within the water. Insert film/cassette into the Cassette tray, select proper screen (step 2), make an exposure. It is important to record the elapsed mAs of this exposure. Develop the film and measure the density at the center of the film. If the density is 1.2 +/- .05 go to step 10.

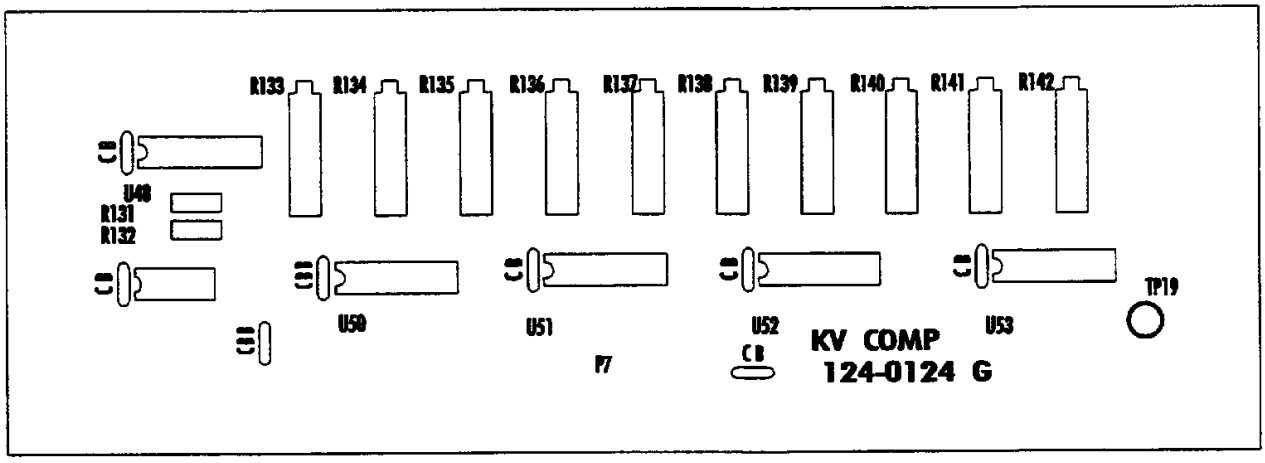

Figure 7-41 kV Compensation Circuit Board

5. When the measured density is not 1.2 (+/- .05), divide 1.2 by the density measured on the film and multiply the quotient by the mAs of that exposure. This number is the first approximation of the required exposure mAs for 72 kV to obtain a density of 1.2 . Record this time.

Sample calculation

kV setting - 72

$\frac{1.2}{1.63} \times 30 = 22$ mAs

Exposure mAs - 30

6. Locate R130 (R129 if calibrating screen 2) on the Gain Adjust PWB (124-0125). Using the same film cassette without film, take an exposure.

7. Compare the mAs of the current exposure (30 in the sample above) with the mAs calculated (22 in the sample above) to obtain a 1.20 density. If the current exposure mAs is smaller, turn the pot counter-clockwise. Take exposures until the mAs of that current exposure as indicated on the generator control is close to the calculated mAs. IF R130 OR R129 CANNOT BE SET LOW ENOUGH THE GAIN SETTING OF THE PREAMPLIFIER OF THE ION CHAMBER IS SET TOO HIGH. CONSULT THE MANUFACTURER FOR CHAMBER GAIN ADJUST INFORMATION.

8. Take another film and measure the density. If the measured density is not 1.2 +/- .05 return to step 4 and repeat steps 4 through 8.

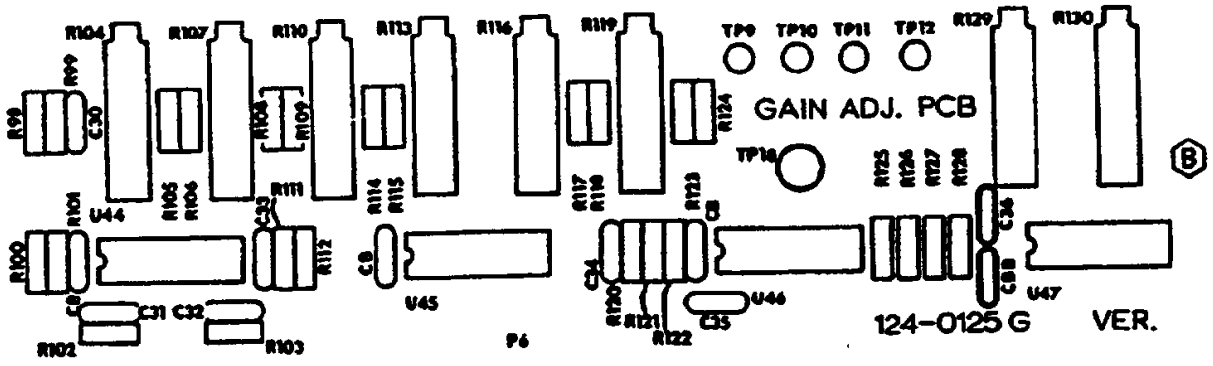

Figure 7-42 Gain Adjustment Circuit Board

9. The master screen gain for Screen 1 (R130) has now been calibrated. It must not be changed for the remainder of the calibration procedure.
10. Repeat steps 4 through 8 for 40, 56, 90, and 125 kV. For each kV, use the settings listed below. Be aware that pots for individual kV gain work opposite than the pot described in step 7. If the current mAs is larger, turn the pot counter-clockwise to decrease.

	kV	Generator mAs	Inches of Water (Plastic)	Pot to Adjust
Screen 1-200 speed system	40	100	1 (2.54 cm)	R133
	56	70	4 (10.16 cm)	R135
	90	70	8 (20.32 cm)	R139
	125	70	10 (25.4 cm)	R141
Screen 2-400 speed system	40	70	1 (2.54 cm)	R134
	56	70	5 (12.7 cm)	R136
	90	70	9 (22.86 cm)	R140
	125	70	10 (25.4 cm)	R142

Screen 2 (400 speed) is calibrated in a similar manner using the appropriate controls and pots for screen 2. Start with Step 1.

SECONDARY GAIN ADJUSTMENT

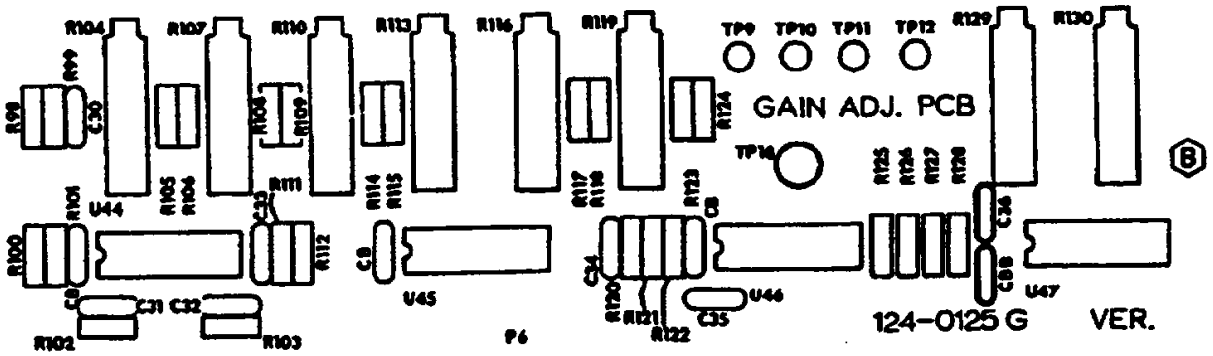

Figure 7-42 Gain Adjustment Circuit Board

1. Select the table image receptor, 72 kV, 50 mAs. Insert 6 (15.24 cm) inches of water (or plastic) into the field and collimator to within the attenuation material. Insert an empty cassette in the bucky tray. Set S.I.D. to 40 inches (1 meter). Make an exposure. Record the mAs_____.
2. Select the wall image receptor and recreate the above conditions. Make an exposure. Record the mAs_____. If the mAs matches the mAs recorded in step 1, this portion of the calibration is complete. Proceed to step 4. If the mAs does not match, continue on to step 3.
3. If the mAs is different, adjust R113 (on the Gain Adjust Board) until the mAs in step 1 is achieved.
4. If an auxiliary ion chamber is present in the system, repeat steps 1 through 3 as required, this time adjusting R119 (on the Gain Adjust Board) to match the mAs recorded in step 1.
5. Verify the AEC performance by using film and radiographic phantom.

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BACK-UP TIMER TEST

1. Verify the setting of the AEC mAs backup timer as follows:
   A. Connect Dynalyzer to Generator.
   B. Set Generator.
      40 kV
      250 mAs
      Large Spot
      Disconnect Ion chamber
   C. Place a jumper on the main AEC Board from test point 7 to ground. This will allow a view of the circuit's activity.
   D. Make exposures and adjust R4 until the following LED pattern is seen.

LED	9	10	11	12
	OFF	OFF	ON	ON
LED	13	14	15	16
	ON	ON	OFF	OFF

2. Set Generator to:
   40 kV,
   600 mAs,
   Large Spot
3. Disconnect Ion chamber.
4. Place a jumper on the main AEC board from test point 7 to ground.
5. Make an exposure and verify that:
   A. Only LED 9 lights
   B. The exposure is terminated.
   C. The Dynalyzer records a mAs of 520 +/-mAs. Adjust R4 (CW to increase if necessary.
6. Reconnect ion chamber.
7. Remove jumper.
8. Remove test equipment.

OTHER FIELD SETTINGS AND ADJUSTMENTS:

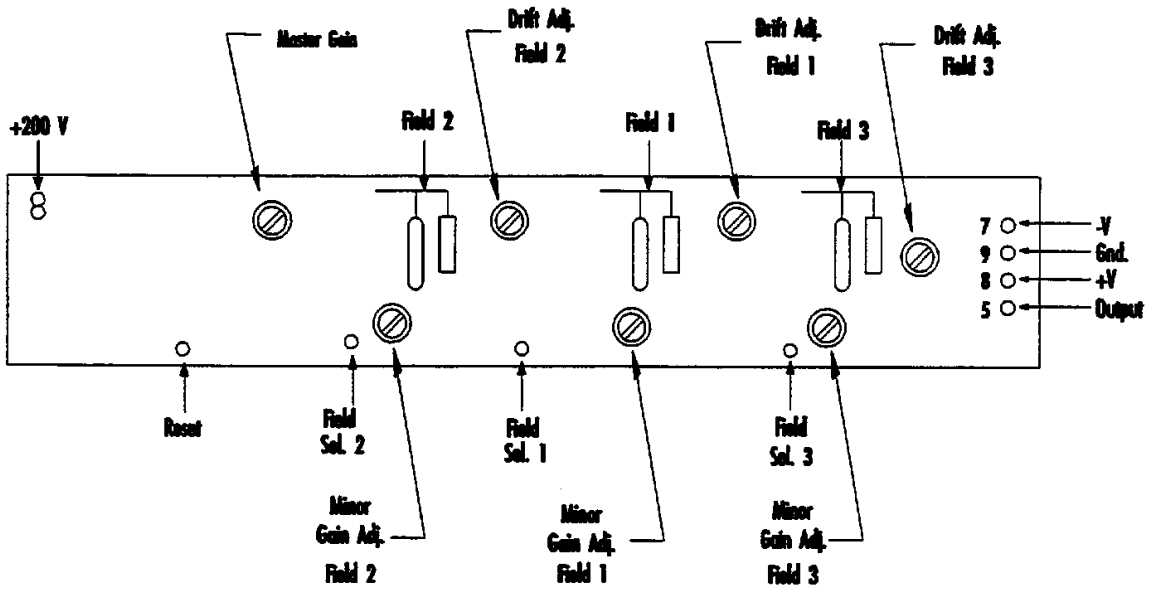
A. Placing a jumper between Test Point 8 and Ground will allow a view of kV selection circuitry.
B. Placing a jumper between Test Point 6 and Ground will allow a view of input selections as follows:
   D1 - Unit in reset
   D2 - Field 3 selected
   D3 - Field 2 selected
   D4 - Field 1 selected
   D5 - Screen 1 or 2
   D6, 7, 8 - Density selections.

For any other adjustments consult the factory.

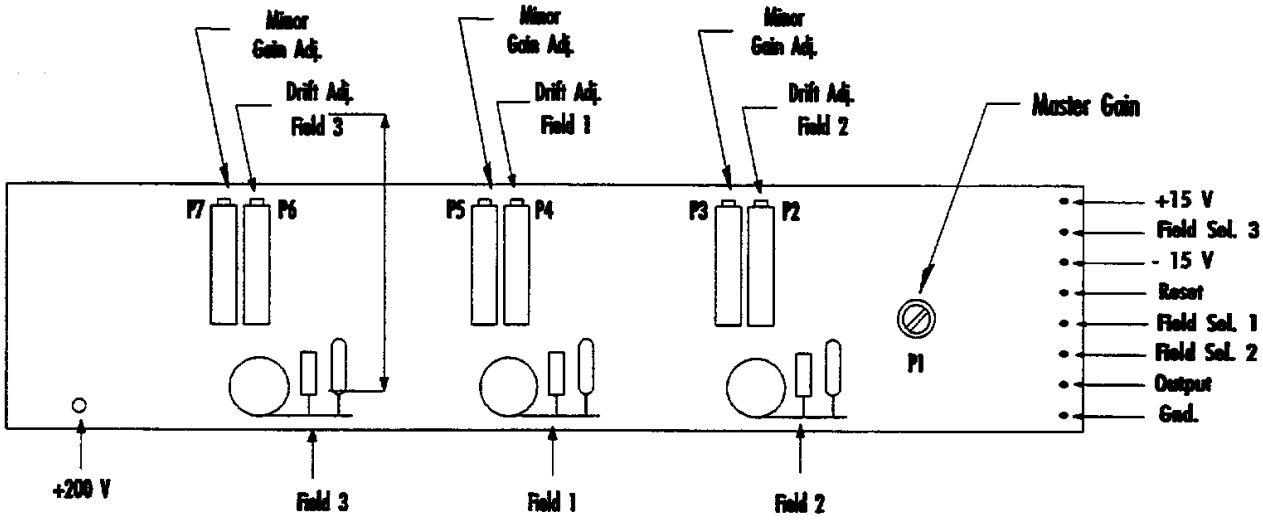
MAINTENANCE

The calibration of the AEC must be checked every 6 months when the generator is checked.

Preamplifier Adjustment



PREAMPLIFIER BOARD 60917 (for ICX 159, etc.)



PREAMPLIFIER BOARD 60667 (for ICX 153, etc.)

Figure 7-45

Part Indentification

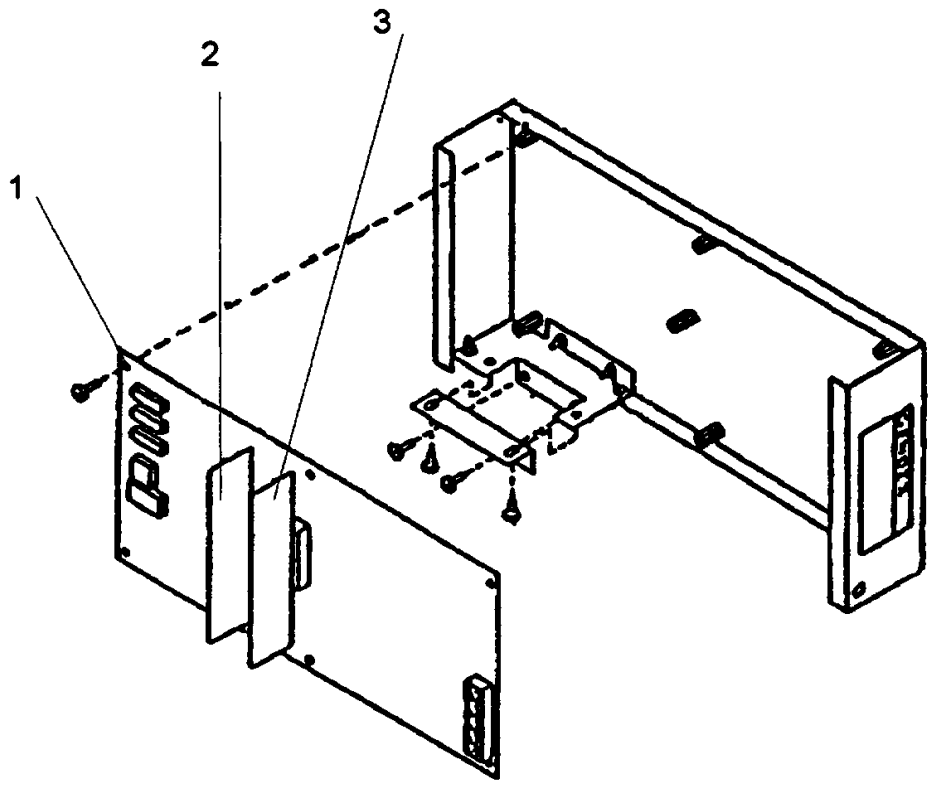
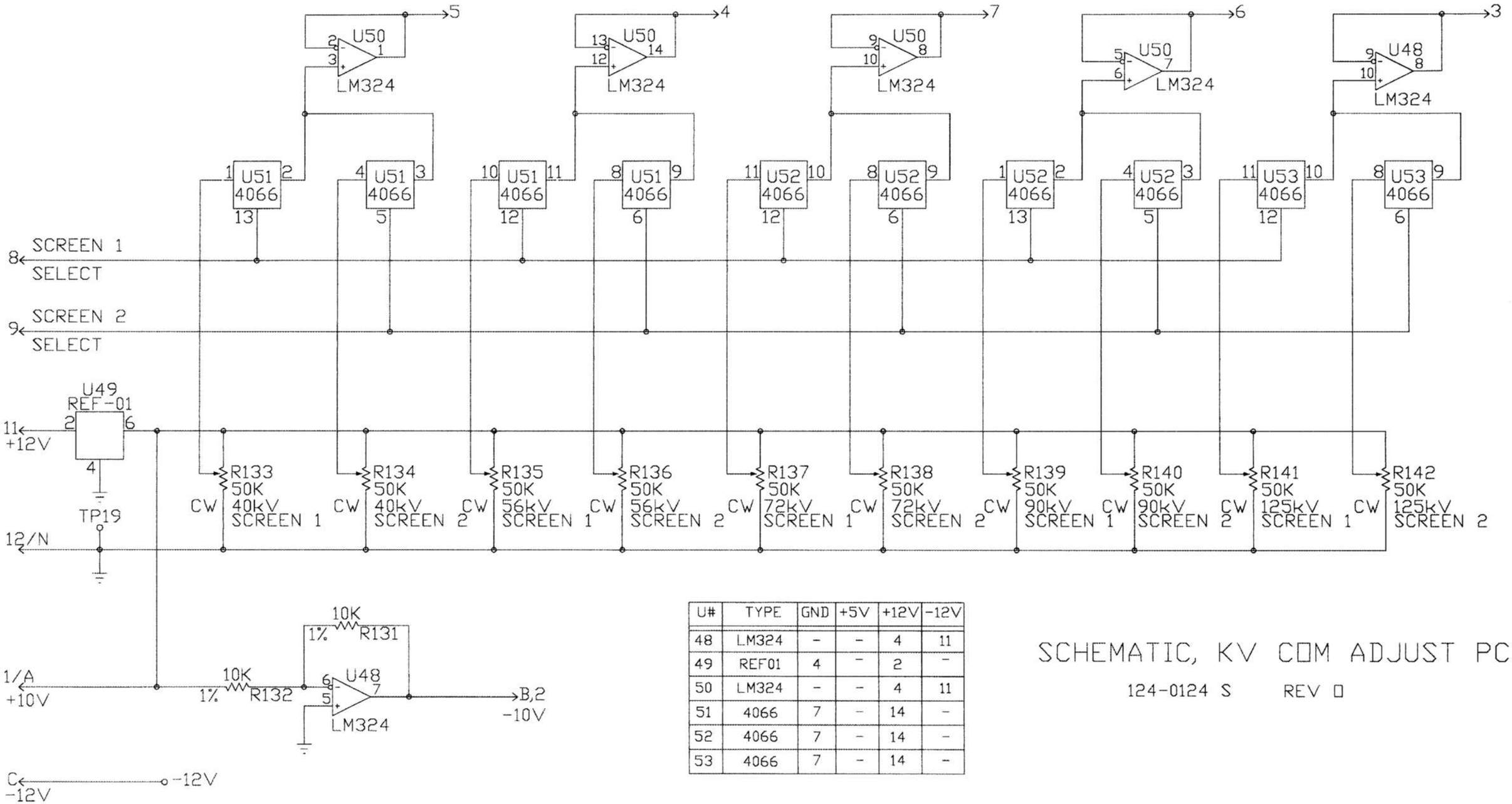


Figure 7-46

1. Main AEC Board
2. Gain Adjustment Board
3. kV Compensation Board

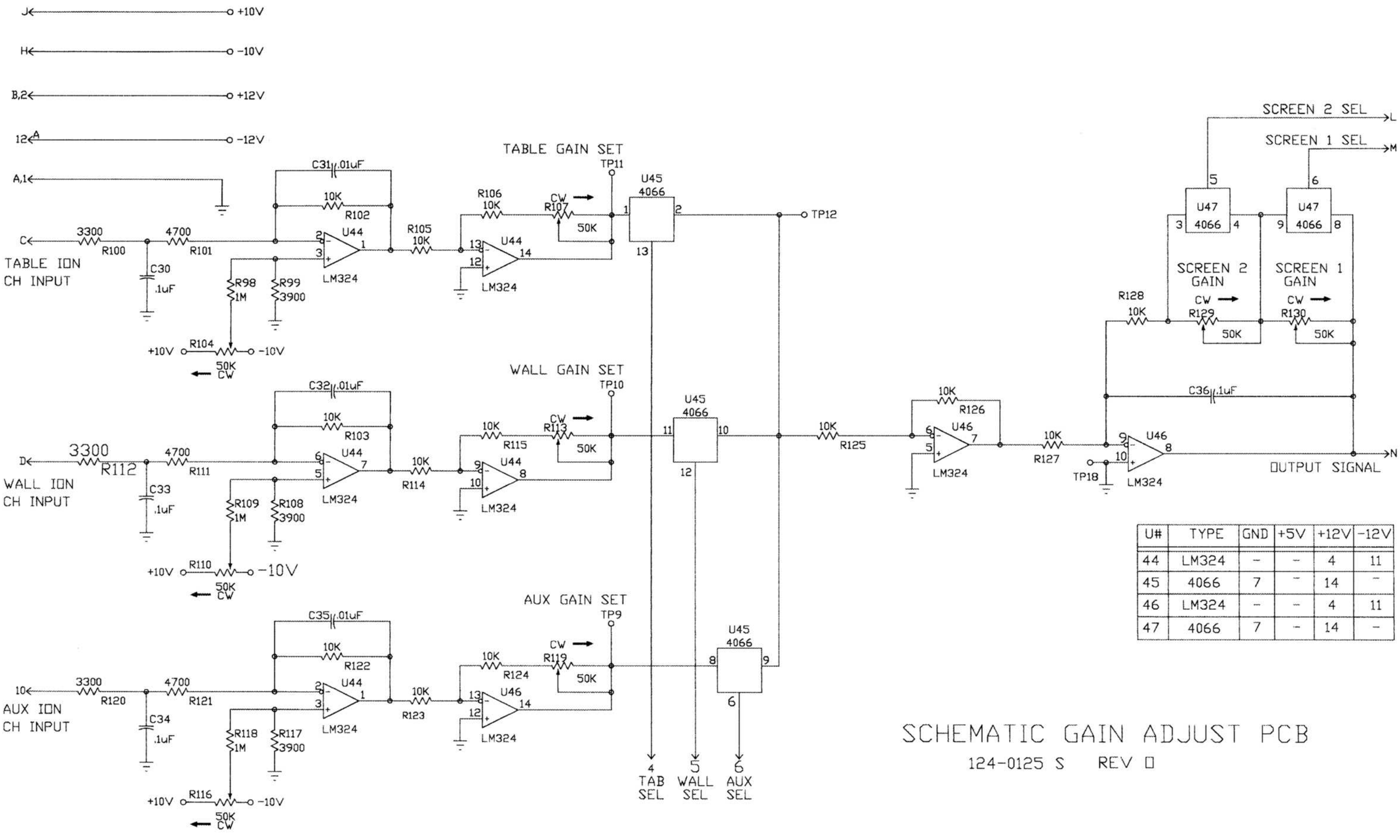
Schematics



U#	TYPE	GND	+5V	+12V	-12V
48	LM324	-	-	4	11
49	REF01	4	-	2	-
50	LM324	-	-	4	11
51	4066	7	-	14	-
52	4066	7	-	14	-
53	4066	7	-	14	-

SCHEMATIC, KV COM ADJUST PCB

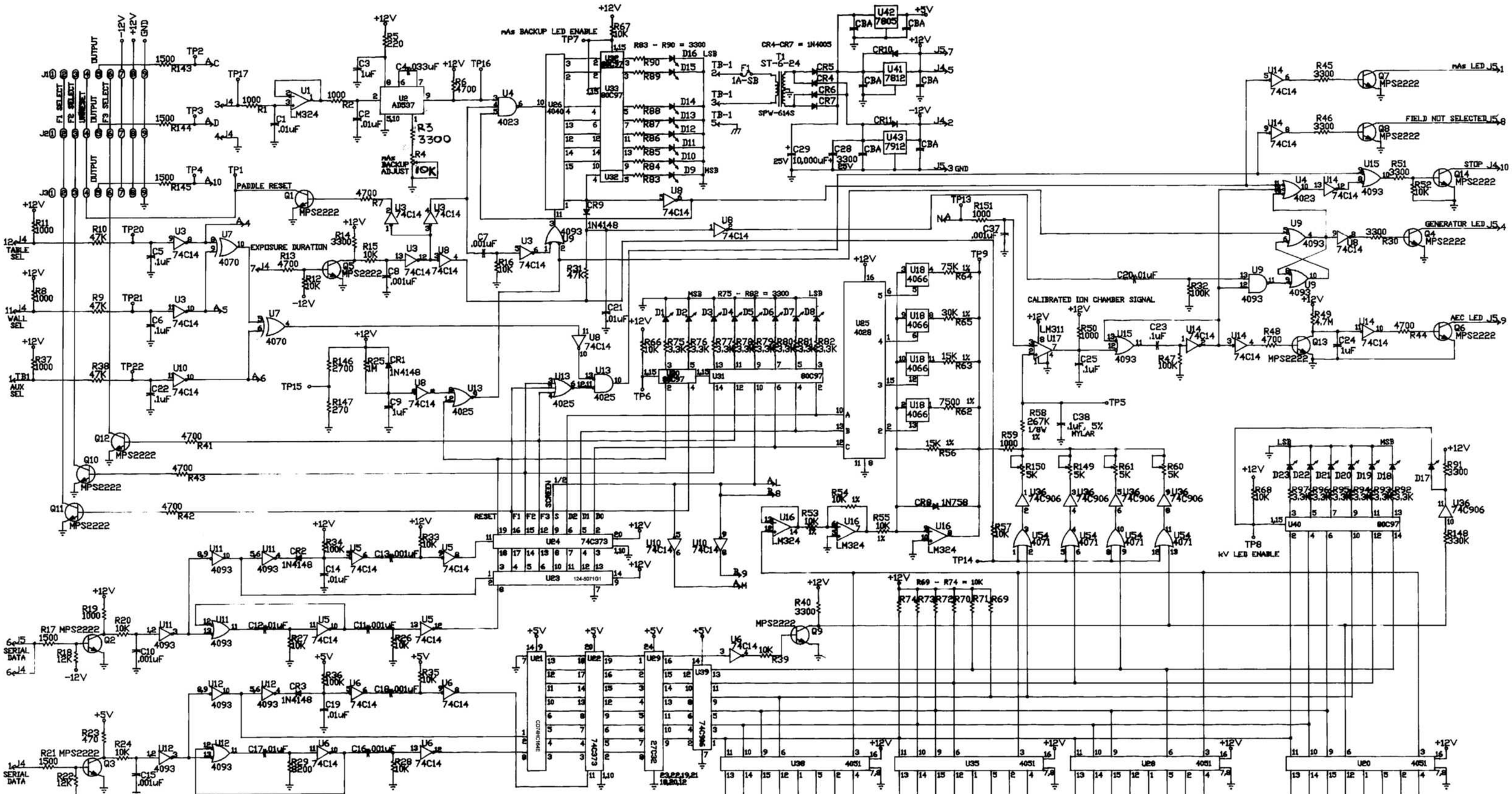
124-0124 S REV D



U#	TYPE	GND	+5V	+12V	-12V
44	LM324	-	-	4	11
45	4066	7	-	14	-
46	LM324	-	-	4	11
47	4066	7	-	14	-

SCHEMATIC GAIN ADJUST PCB

124-0125 S REV □



U#	TYPE	GND	+5V	+12V	-12V
1	LM324	-	-	4	11
2	AD537	5-10	-	8	-
3	74C14	7	-	14	-
4	4023	7	-	14	-
5	74C14	7	-	14	-
6	74C14	7	14	-	-
7	4070	7	-	14	-
8	74C14	7	-	14	-
9	4093	7	-	14	-
10	74C14	7	-	14	-
11	4093	7	-	14	-
12	4093	7	14	-	-

U#	TYPE	GND	+5V	+12V	-12V
13	4025	7	-	14	-
14	74C14	7	-	14	-
15	4093	7	-	14	-
16	LM324	-	-	4	11
17	LM311	1-4	-	8	-
18	4066	7	-	14	-
19	DIP-R	-	-	-	-
20	4051	7	-	16	-
21	CD74HC164E	7	14	-	-
22	74C373	10	20	-	-
23	124-5071G1	7	-	14	-
24	74C373	10	-	20	-

U#	TYPE	GND	+5V	+12V	-12V
25	4028	8	-	16	-
26	4040	8	-	16	-
27	DIP-R	-	-	-	-
28	4051	8	-	16	-
29	27C32	12	24	-	-
30	80C97	8	-	16	-
31	80C97	8	-	16	-
32	80C97	8	-	16	-
33	80C97	8	-	16	-
34	DIP-R	-	-	-	-
35	4051	8	-	16	-
36	74C906	7	-	14	-

U#	TYPE	GND	+5V	+12V	-12V
37	DIP-R	-	-	-	-
38	4051	8	-	16	-
39	74C906	7	14	-	-
40	80C97	8	-	16	-
41	7812	-	-	-	-
42	7805	-	-	-	-
43	7912	-	-	-	-
54	4071	7	-	14	-

CHAPTER 8
MAINTENANCE

GENERAL NOTES

The following routine maintenance should be performed 30 days after installation and semi-annually thereafter. This inspection must be carried out by trained service personnel familiar with the equipment and maintenance procedures.

△ WARNING △

The main SCR capacitor bank (bottom of power module) contains a very high charge when power is applied. This charge is a fatal shock hazard. After power has been disconnected from the system, either by line disconnect or control console power off, allow a minimum of five minute for capacitor bank to discharge. CHECK THE CAPACITOR BANK CHARGE FOR ZERO VOLTS WITH A DC VOLT METER BEFORE WORKING ON ANY INTERNAL CIRCUITRY.

Test Equipment Required:

- Digital multimeter (true RMS)
- Dynalyzer or kV meter
- Oscilloscope - dual trace storage with algebraic addition capabilities

INSPECTIONS

1. Clean all exterior surfaces of the control console, power module and high tension transformer.
2. Inspect for loose, broken or missing hardware.
3. Inspect all accessible electrical cables for fraying or abrasion.
4. Remove high tension cables, clean, regrease with vapourproof compound and reinsert high tension jacks into federal receptacles. Insure cables are well seated and pins make good contact. Carefully spread pins with pocketknife if necessary and reseat cables.
5. Insure that insert of tube matches tube insert selected in the system installation file. If not, call GENDEX-DEL Technical Support.
6. Observe WARNING as hazardous voltages may be present. Turn disconnect off. Open power module front panel.
7. Inspect for loose or corroded connections. Insure all circuit boards and wiring harness plugs to assure they are well seated in their proper receptacles.
8. Verify the accuracy of Kilovoltage, milliampseconds, and milliamperes. Calibrate as necessary.
9. Relays. Inspect electromechanical contactors and relays for pitting, poor contact, loose or missing parts. Replace if necessary.

10. HIGH VOLTAGE TRANSFORMER
    a. Check transformer oil level. Proper oil level should be within 1/4" below the bottom side of the cover. To replenish transformer oil, fill with Diala-Ax oil only.
    b. Check electrical and mechanical connections of the transformer. Clean and tighten as necessary.
11. AUDIBLE & VISUAL EXPOSURE INDICATORS

Confirm that the audible indicator which indicates an X-ray exposure, and the visual indicator, which indicates the production of X-rays, are functioning correctly.

NOTE

Always observe the tube manufacturer's duty cycle recommendations.

Avoid unnecessary or excessively long prep periods, as they will shorten tube life. The tube filament and rotor are activated during prep.

Record inspection date and comments on the maintenance log provided on the following pages.

PREVENTIVE MAINTENANCE LOG

Date Performed	Performed By	Customer Initial	Discrepancies Noted and Corrective Action Taken

MANUFACTURER'S EQUIPMENT UPGRADE/MODIFICATION LOG

Date Performed	Performed By	Customer Initial	Upgrade/Modification Number or Description

CHAPTER 9
BLOCK DIAGRAMS AND SCHEMATICS

kV REGULATOR . . . . . 124-0110 S

DATA BOARD . . . . . 124-0101 S

mAs CONTROL PCB . . . . . 124-0145 S

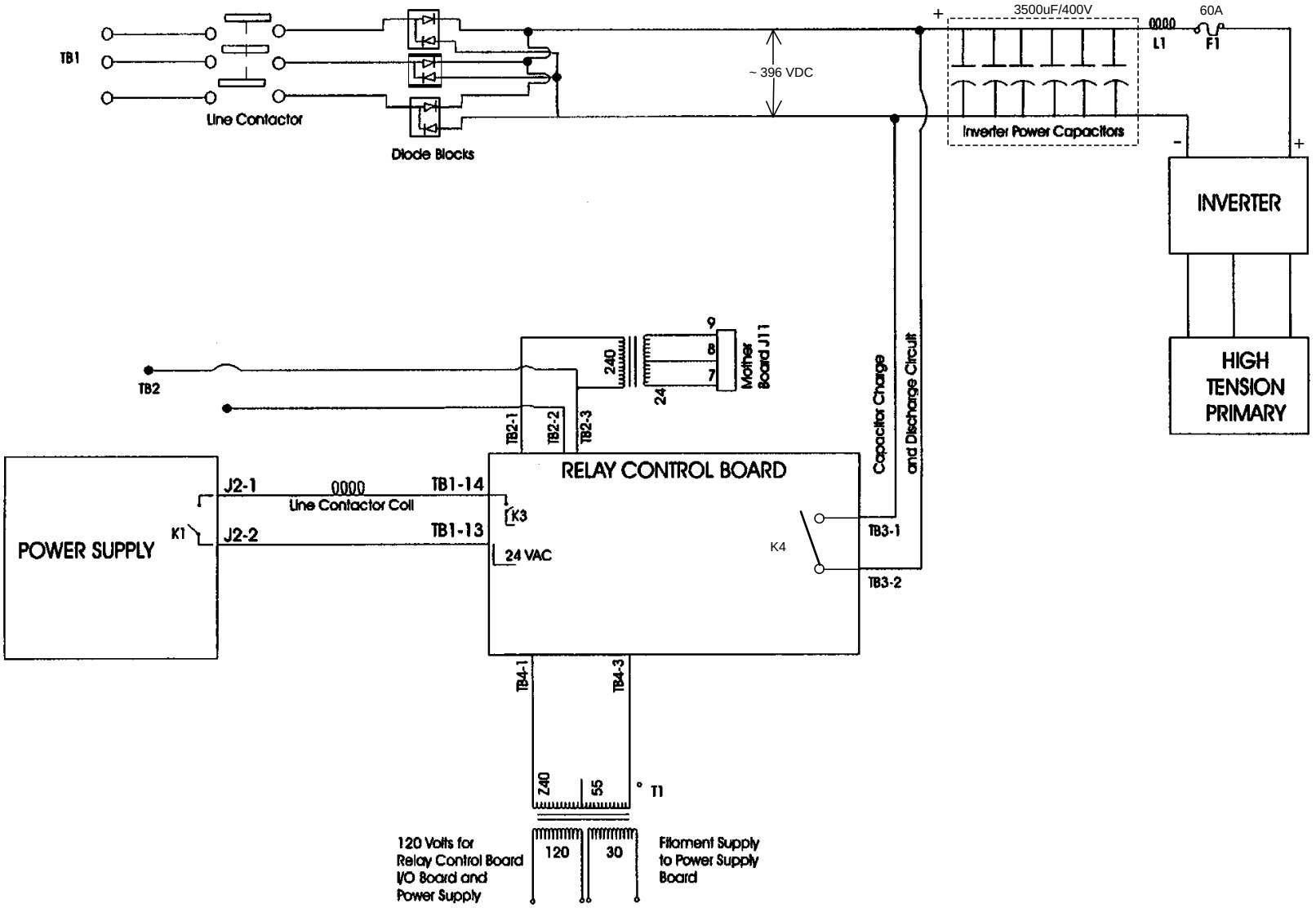
LOGIC BOARD . . . . . 124-0096 S

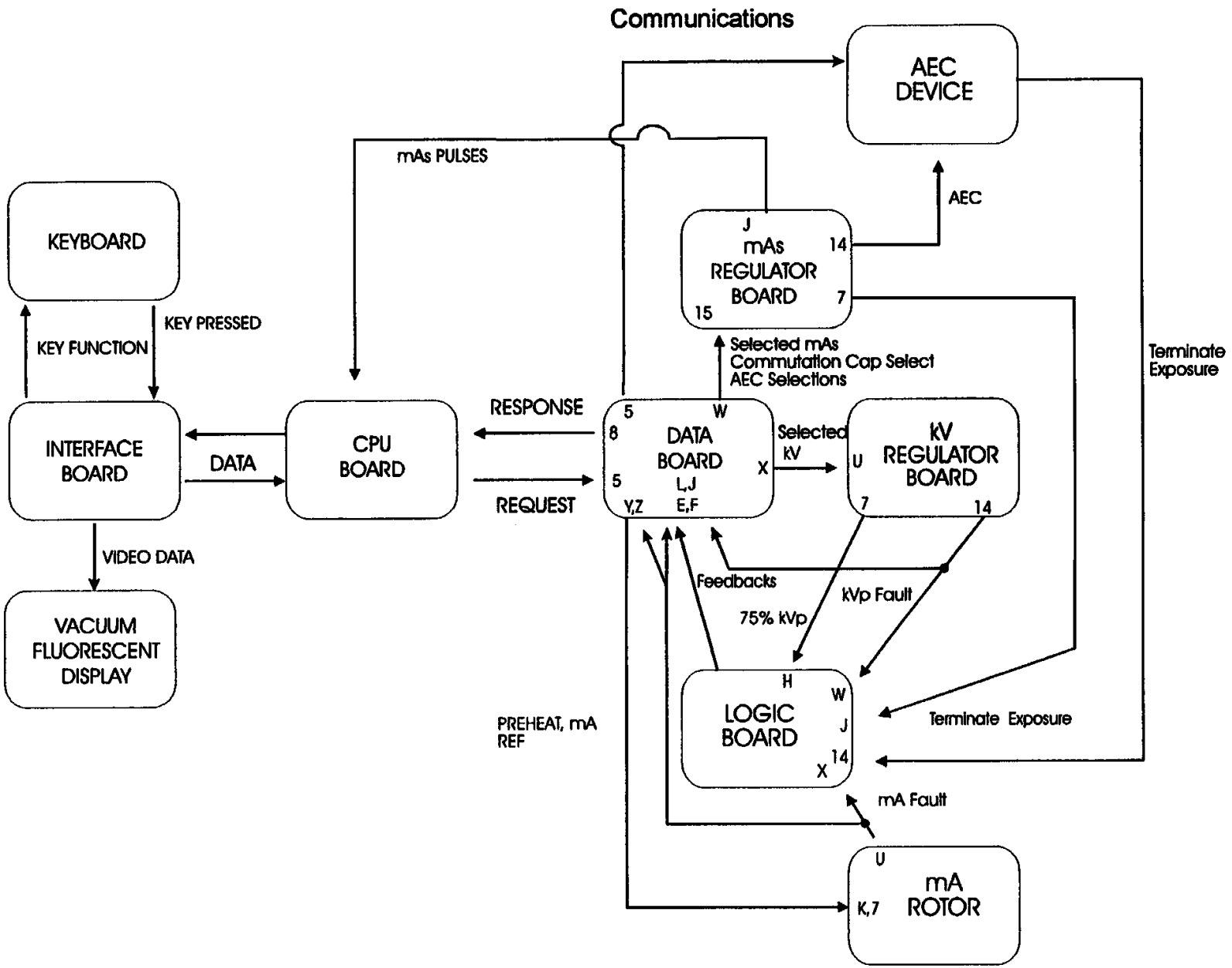
MOTHER BOARD . . . . . 124-0106 S

I/O BOARD . . . . . 124-0107 S

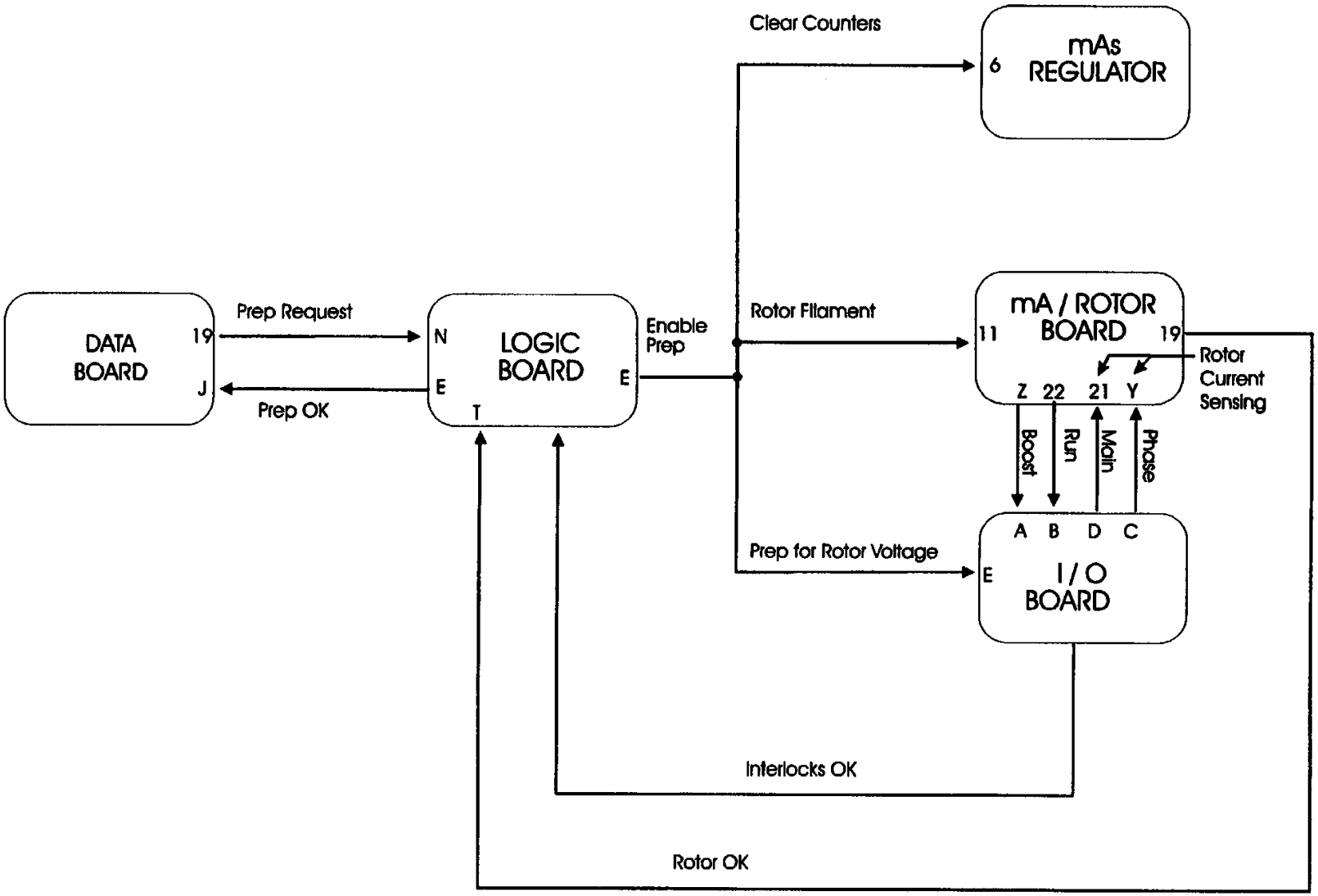
APR INTERCONNECT . . . . . 034-0071 S

Inverter Power Supply

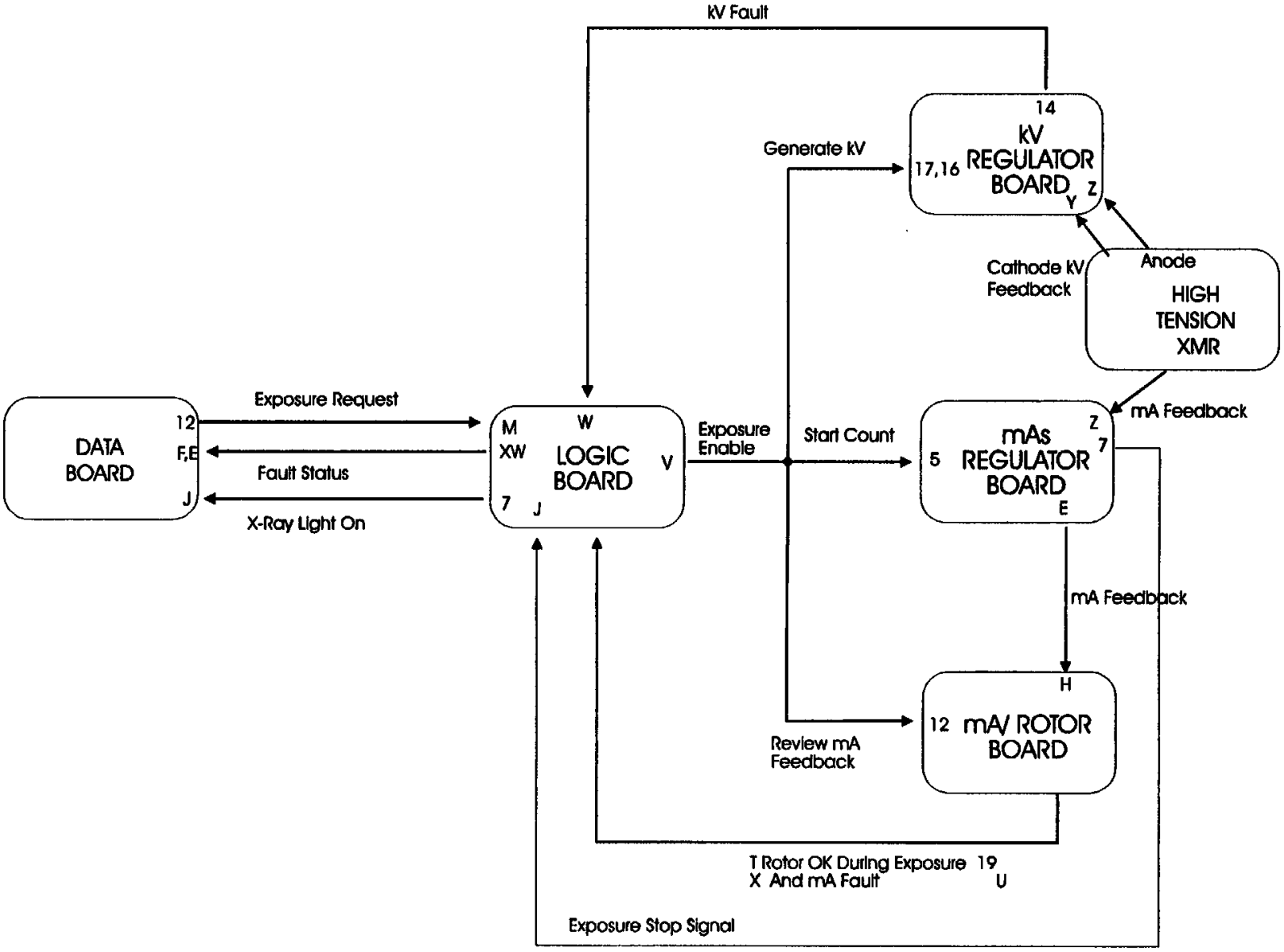



Communications
AEC DEVICE
mAs PULSES
AEC
KEYBOARD
J
mAs REGULATOR BOARD
14
15
7
KEY FUNCTION
KEY PRESSED
Selected mAs
Commutation Cap Select
AEC Selections
Terminate Exposure
INTERFACE BOARD
DATA
CPU BOARD
RESPONSE
REQUEST
5
W
8
DATA BOARD
5
L,J
Y,Z
E,F
X
Selected kV
U
kV REGULATOR BOARD
7
14
VIDEO DATA
VACUUM FLUORESCENT DISPLAY
Feedbacks
kVp Fault
75% kVp
H
W
LOGIC BOARD
J
14
X
PREHEAT, mA REF
Terminate Exposure
mA Fault
U
K,7
mA ROTOR

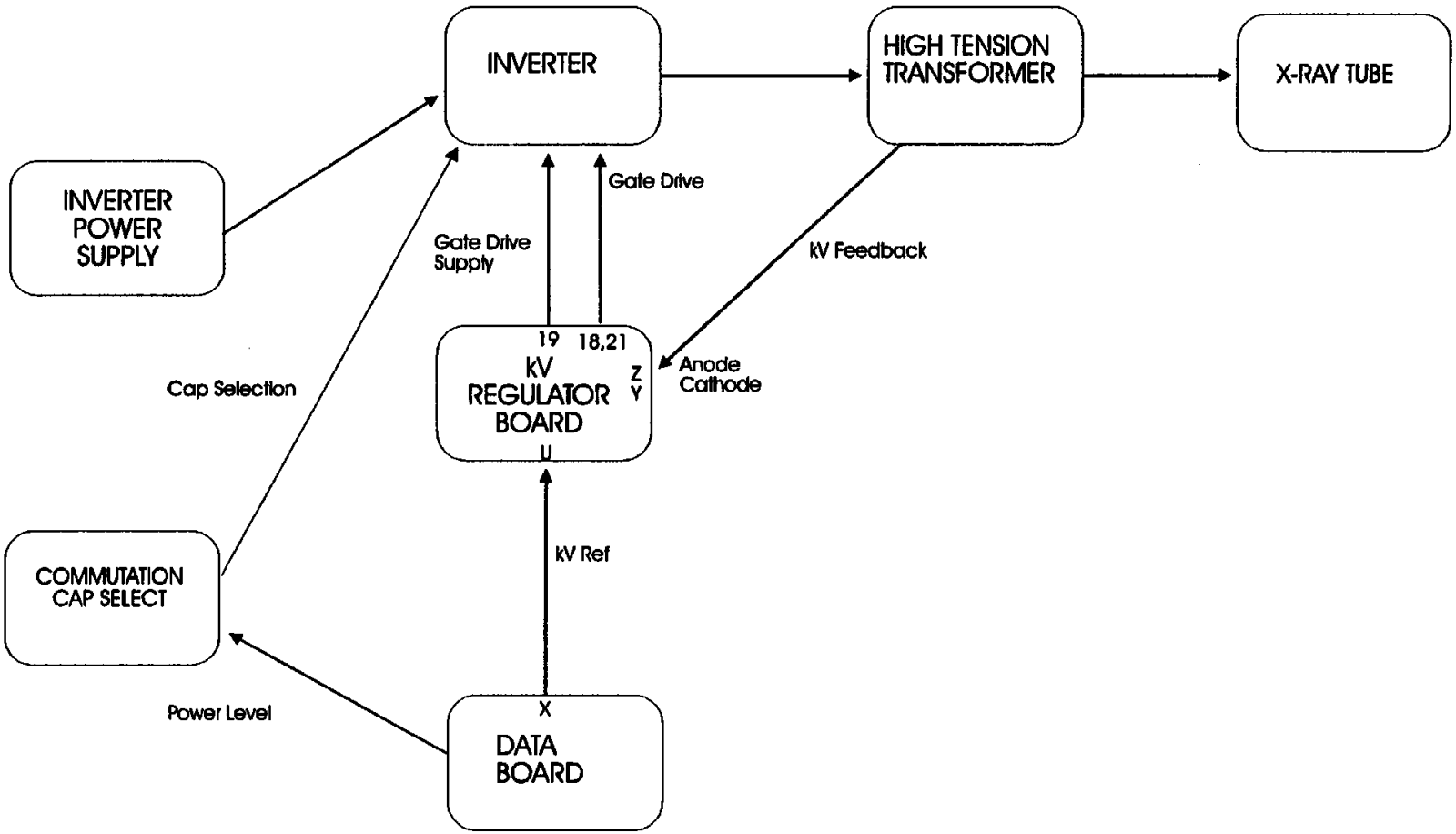
Prep Functions



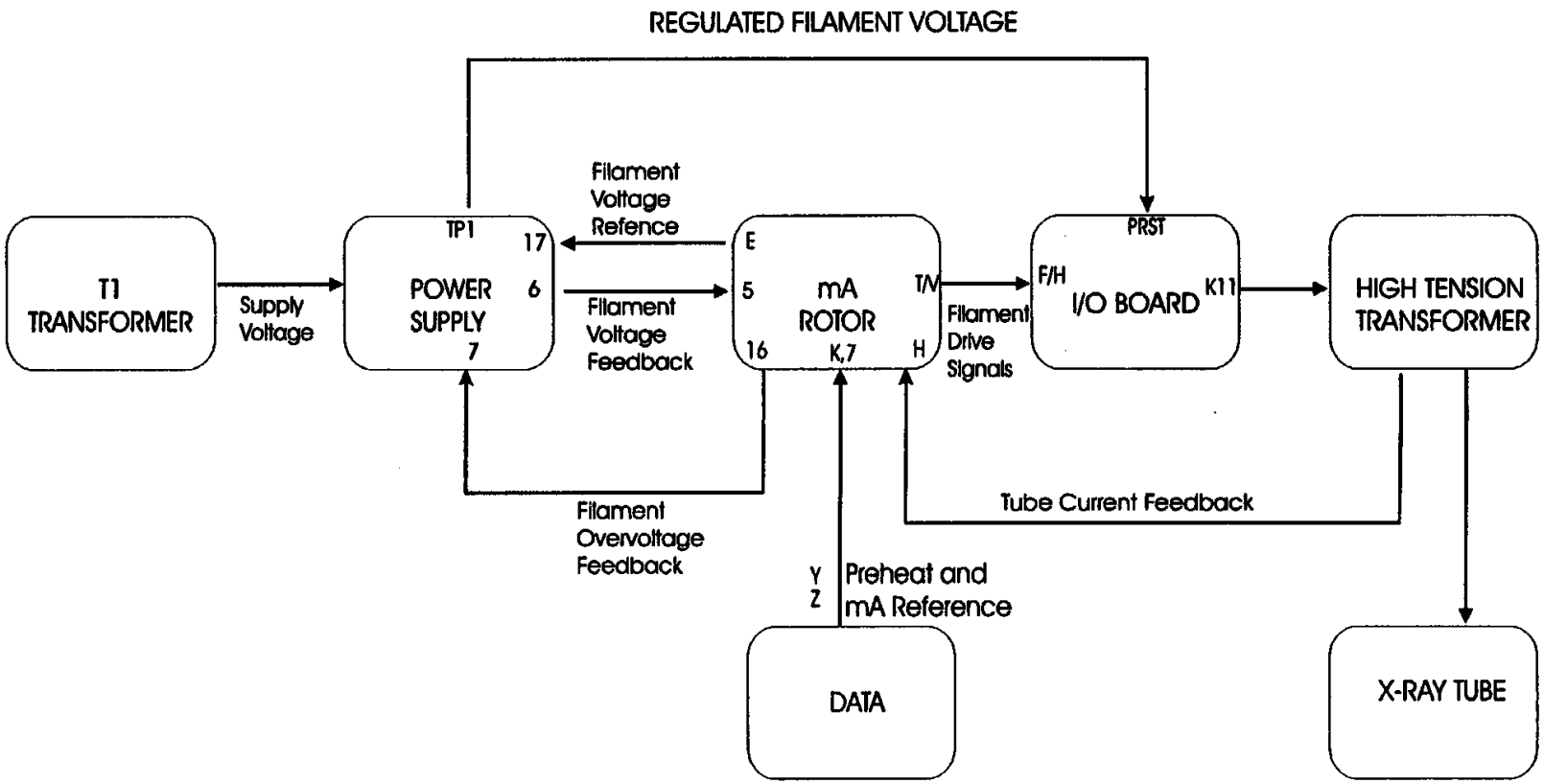
Exposure Functions



Kilovoltage Control



Filament Control



PAL TRUTH TABLE

	BPCS0	BA0	BA1	BWR	BRD
INTCLR *	0	0	0	0	1
DRD *	0	0	0	1	0
D1WR *	0	1	0	0	1
D2WR *	0	0	1	0	1
D3WR *	0	1	1	0	1

CS * = BPCS0 * + BPCS1 *

COMPUTER
J1

DISPLAY
J2

KEYBOARD
J3

74HC245
74HC541
74HC30
74HC74
74HC14
74HC541
16L8
SA5090
HLMP-2400
HLMP-2550
4N26
BUZZER

NOTES: D4
G1= HLMP-2350
G1= HLMP-2450

REV	INITIAL	DATE	ECO NO	CHANGE DESCRIPTION
2	FJP	6/23/98	6509	RENAMED D4 HLMP2550 TO 2350G1 & 2450G2
1	BN	11/19/97	0310296	RENAMED RP1 AND RP2; REDRAWN IN ORCAD
0		8/10/94		RELEASED

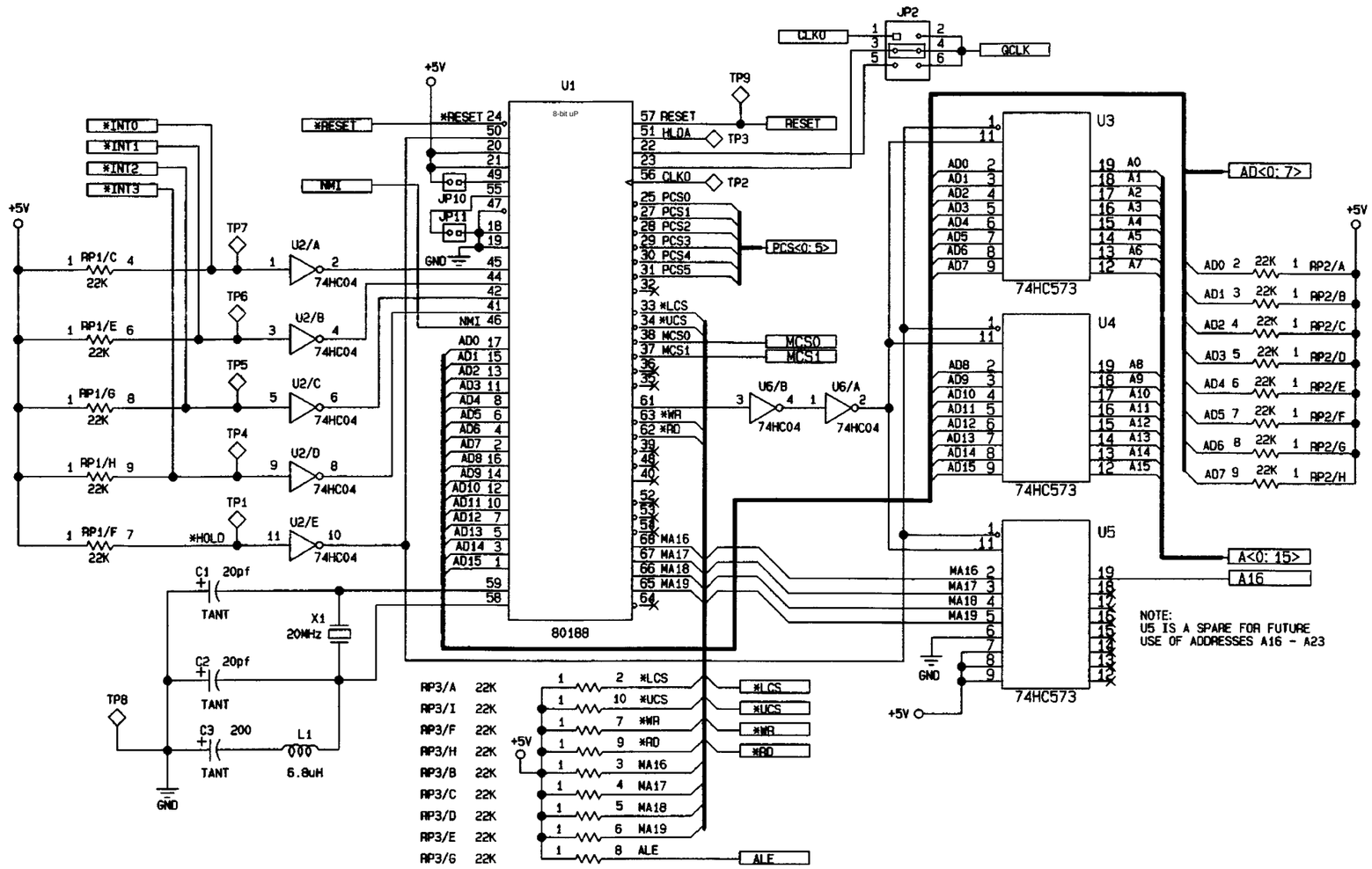
APPROVAL: BN 6/94

GENDEX-DEL
11550 W. KING STREET
FRANKLIN PARK, IL 60131

CONTROL INTERFACE PCB

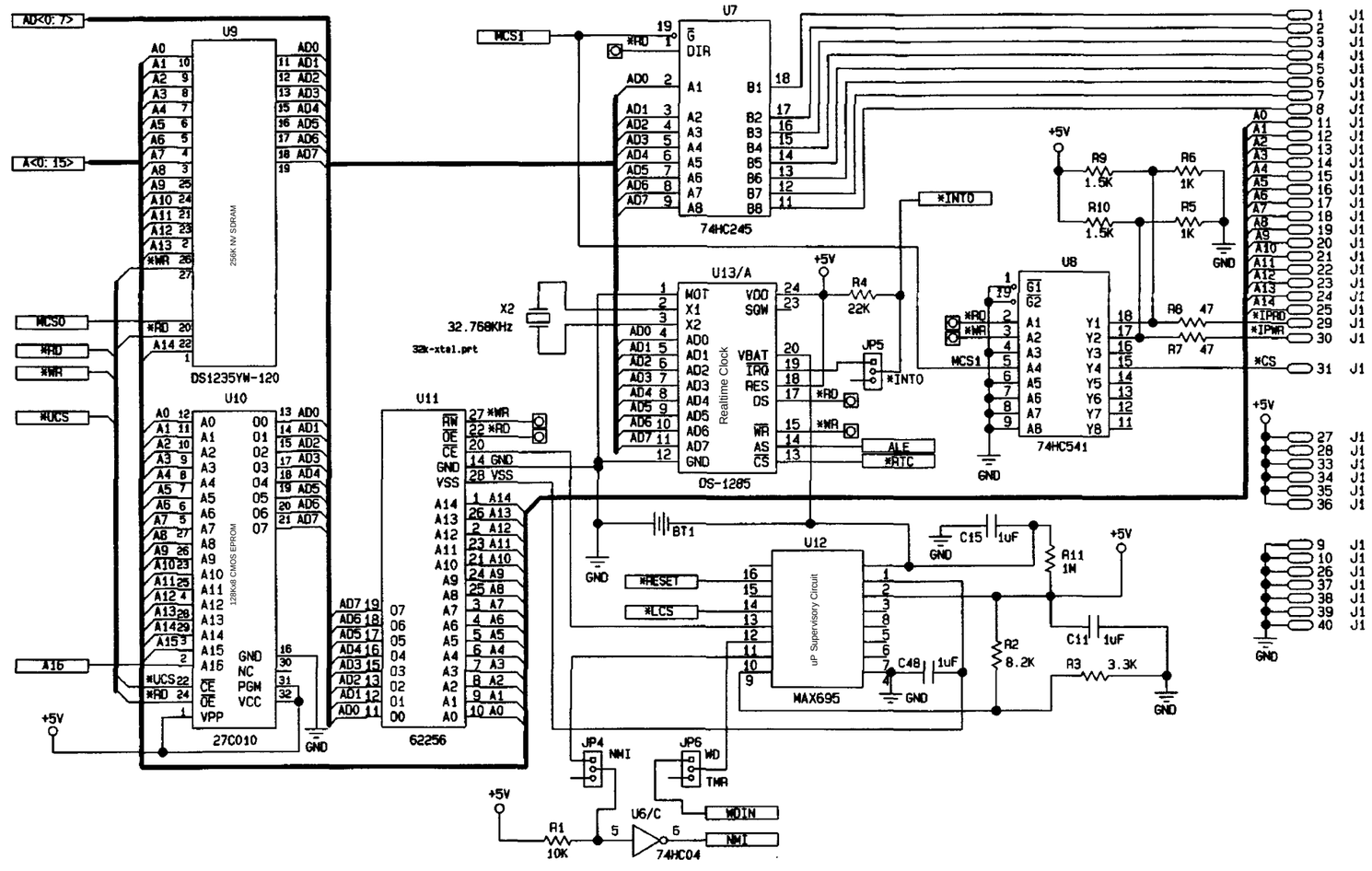
Size: B | Document Number: 124-0177S | Rev: 1

Date: Tuesday, July 07, 1998 | Sheet 1 of 1



ATC MICROPROCESSOR

124-0148S
REV 5 7/28/00
SHT 1

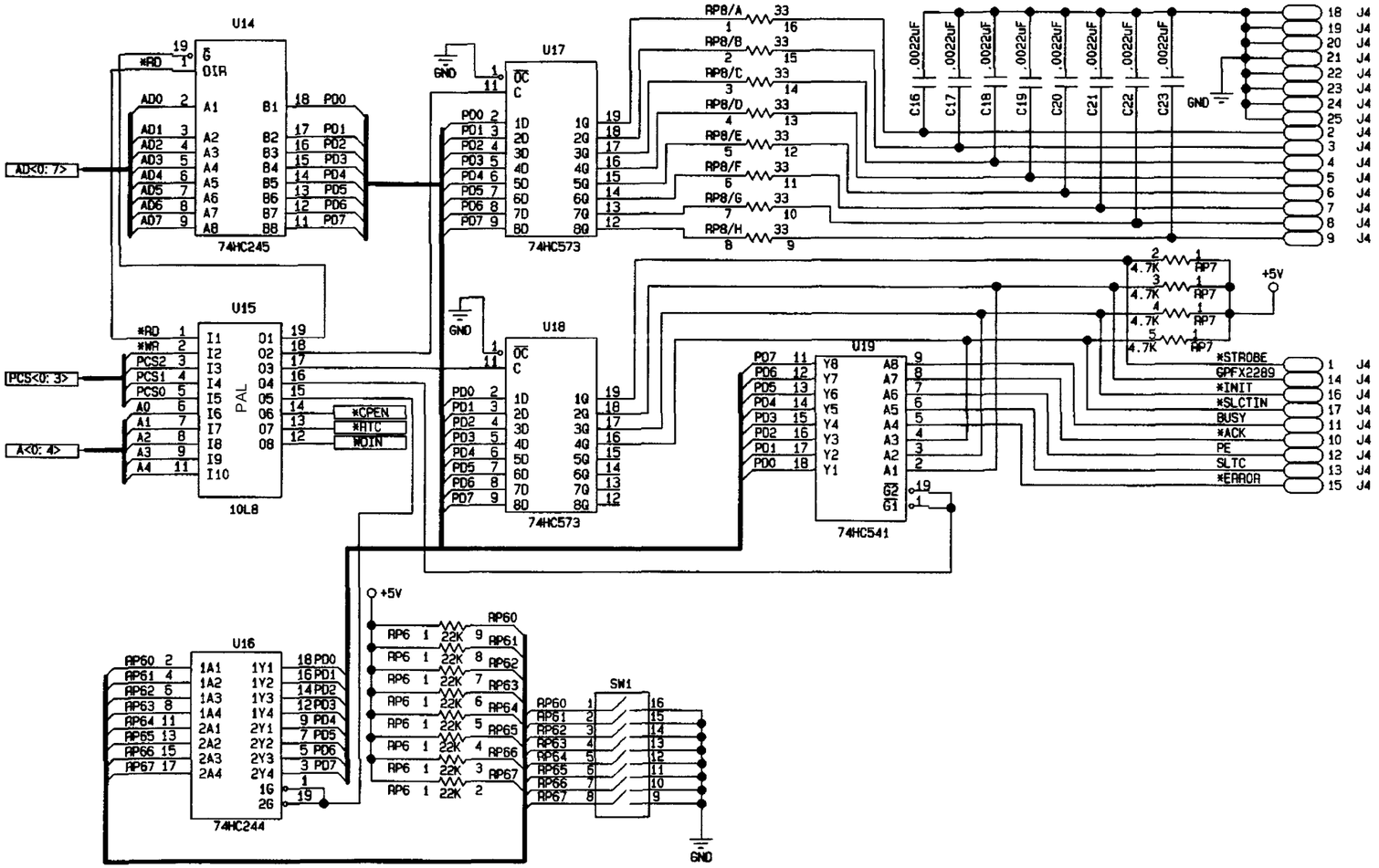


ATC MICROPORCESSOR

124-0148S

REV 5 7/28/00

SHT 2

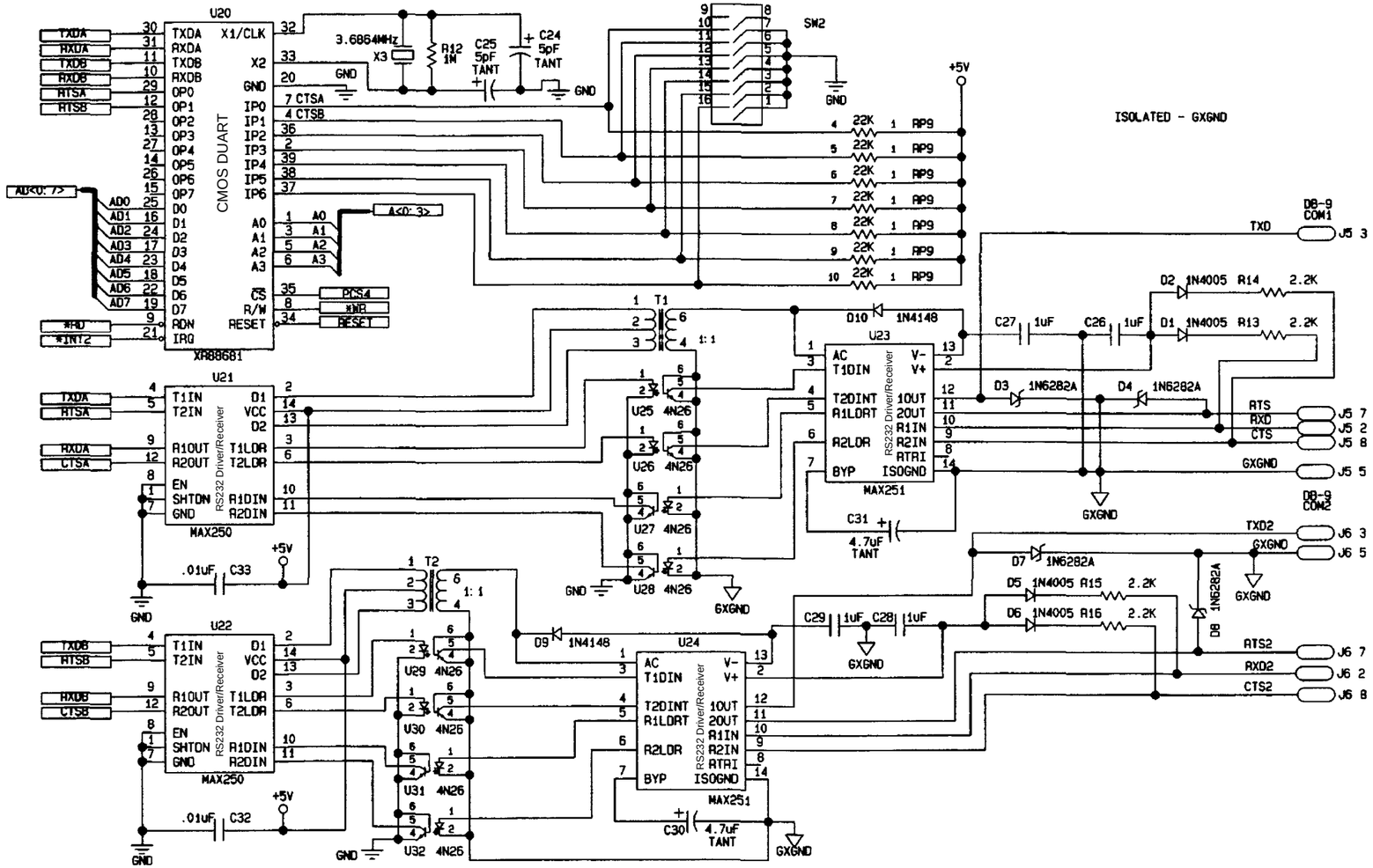


ATC MICROPROCESSOR

124-0148S

REV 5 7/28/00

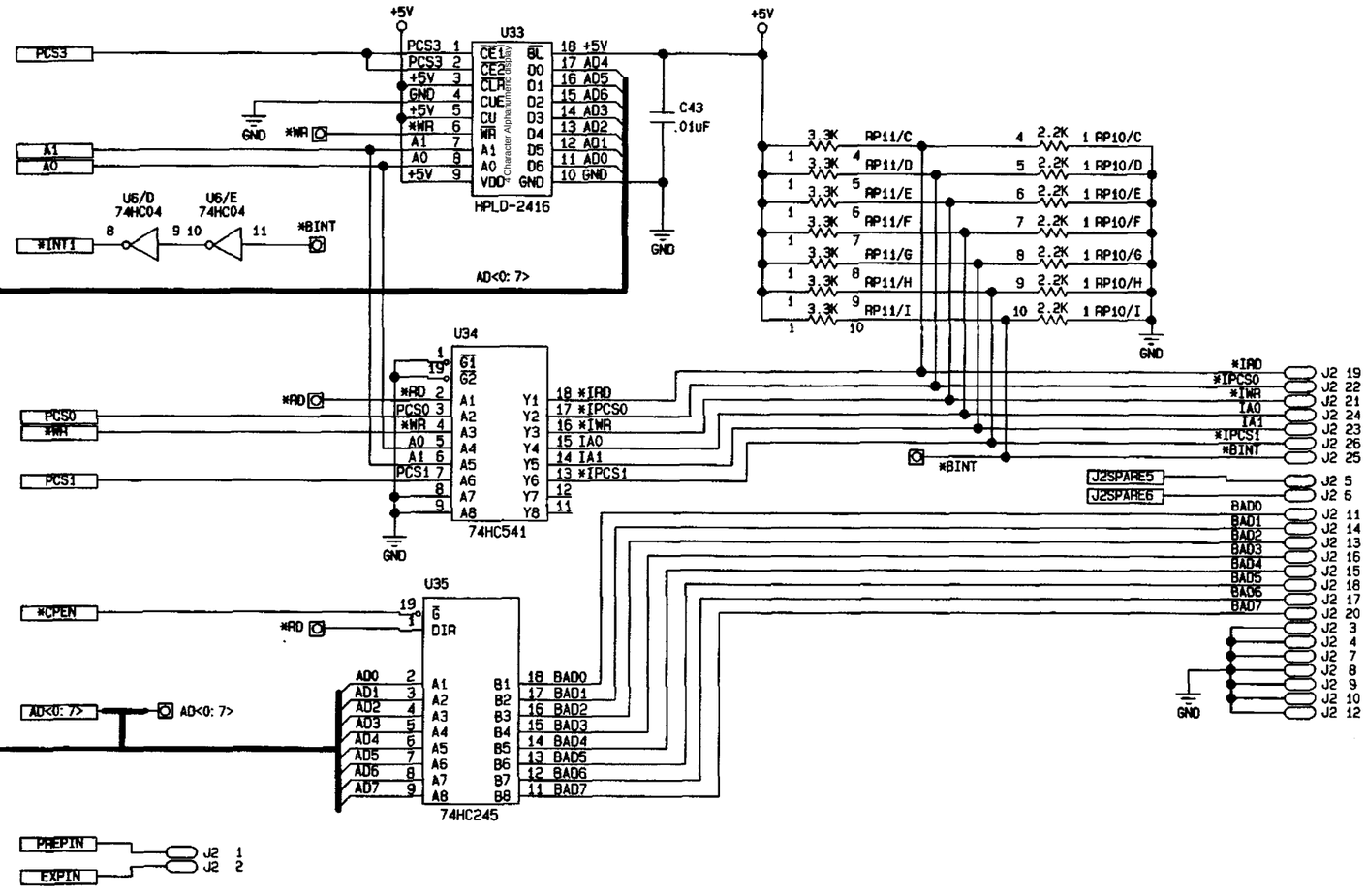
SHT 3



ATC MICROPROCESSOR

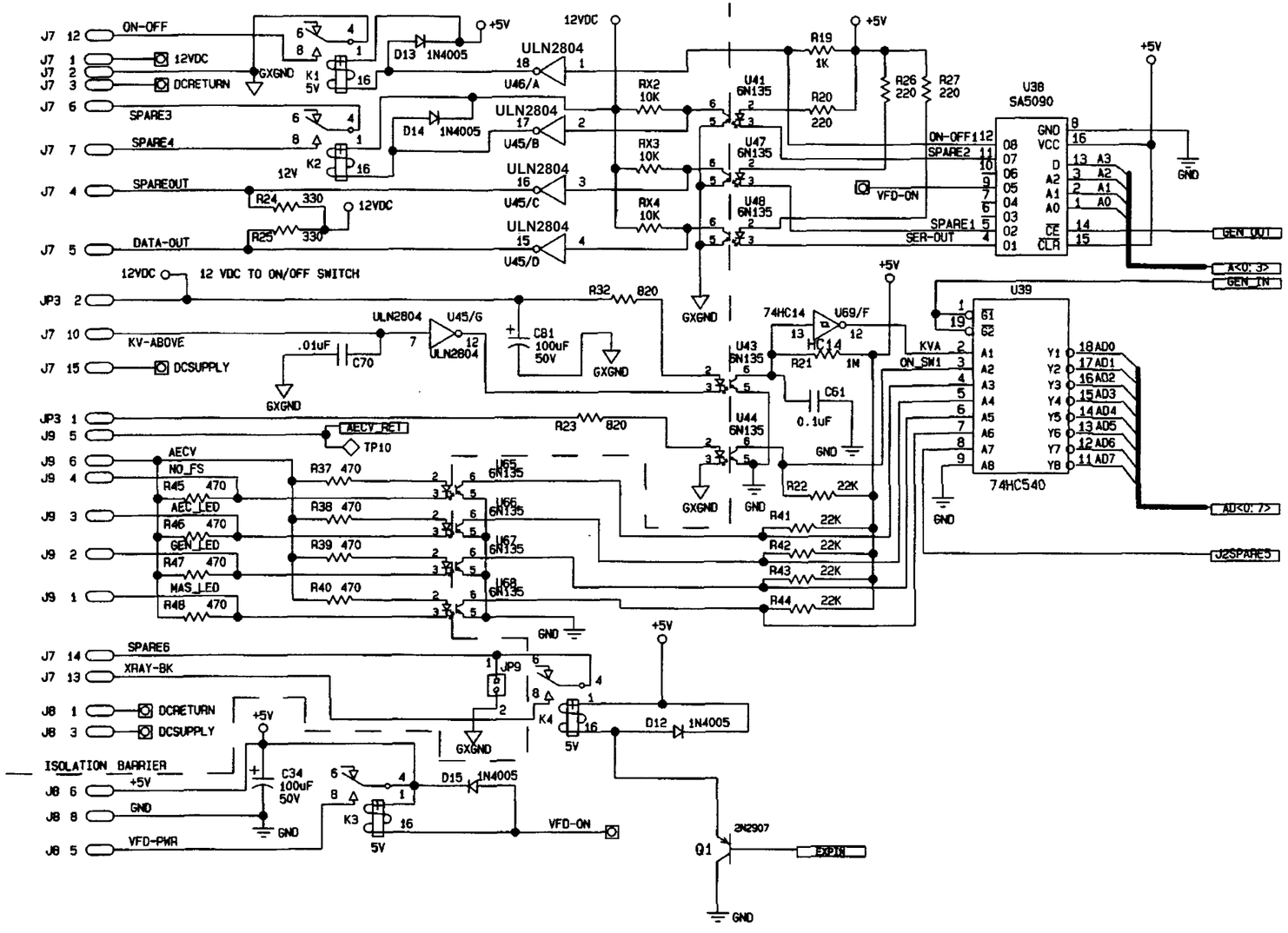
124-0148S
REV 5 8/3/00
SHT 4

(OPTION FOR DIAGNOSTIC DISPLAY)



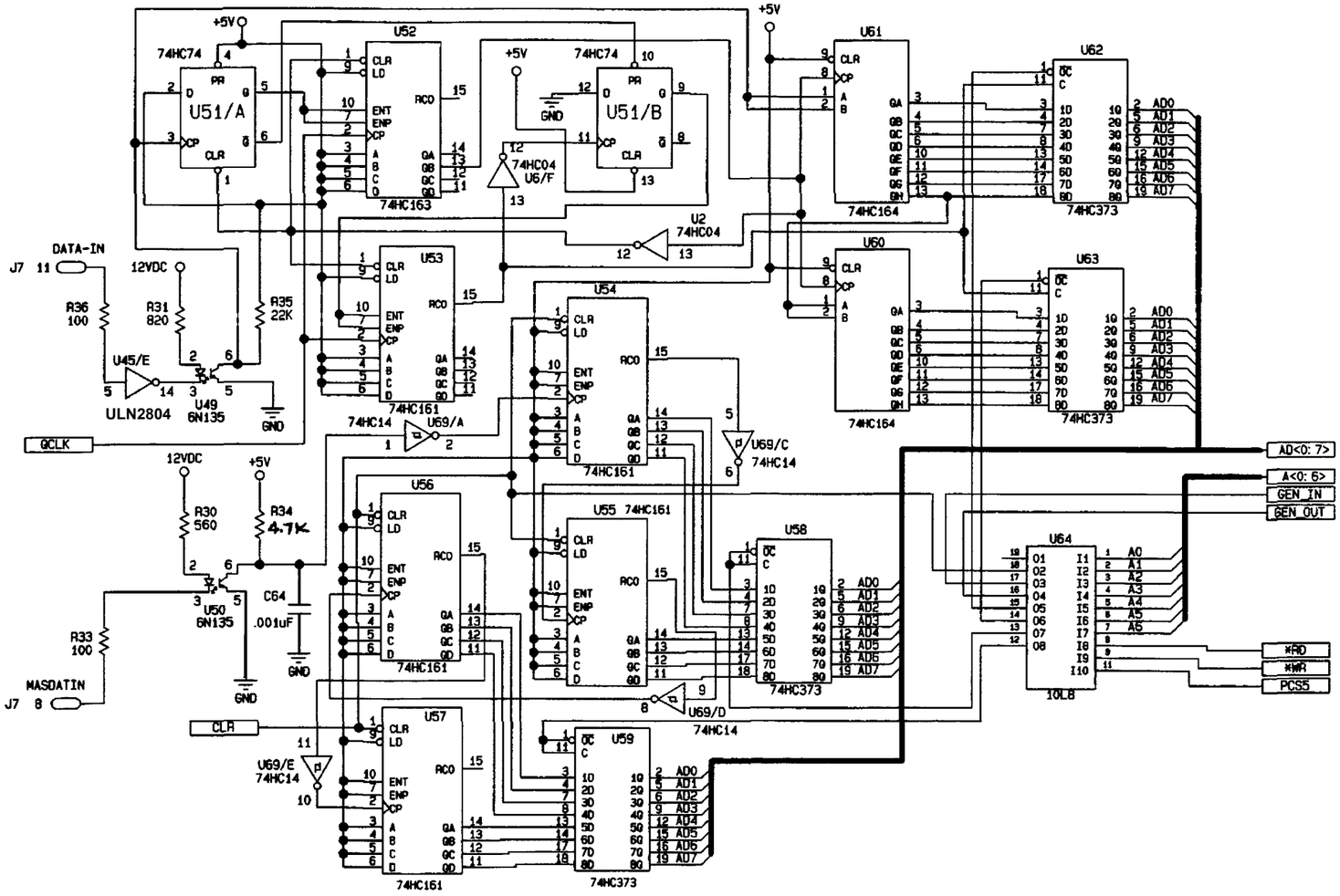
ATC MICROPROCESSOR

124-0148S
REV 5 8/3/00
SHT 5



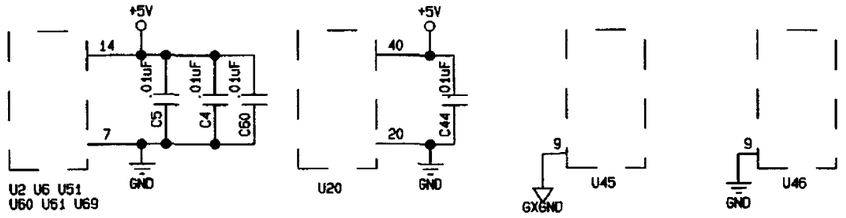
ATC MICROPROCESSOR

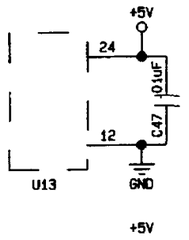
124-0148S
REV 5 8/3/00
SHT 6

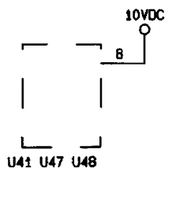


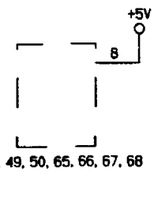
ATC MICROPROCESSOR

124-0148S
REV 5 8/3/00
SHT 7

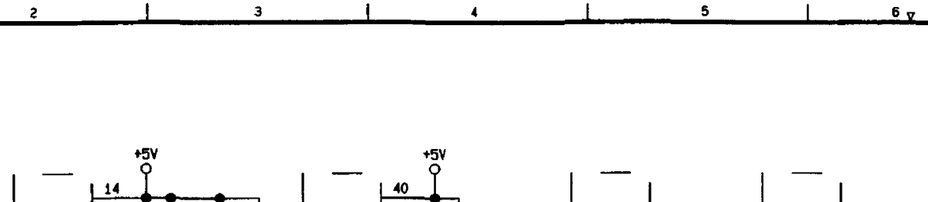


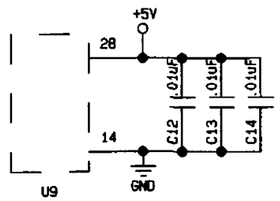


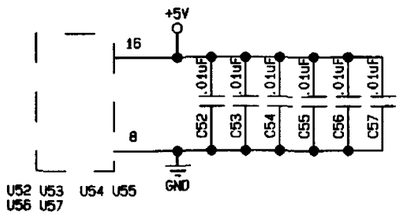


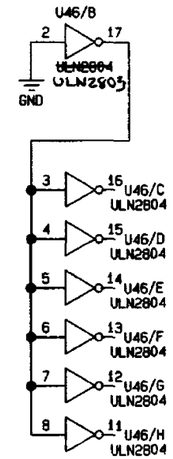


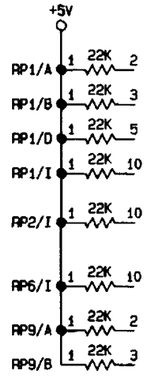
+5V

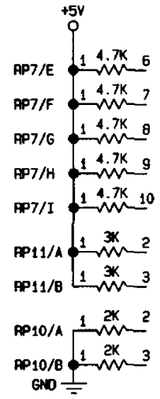




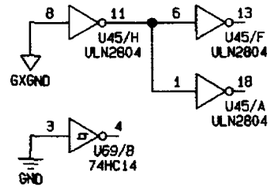






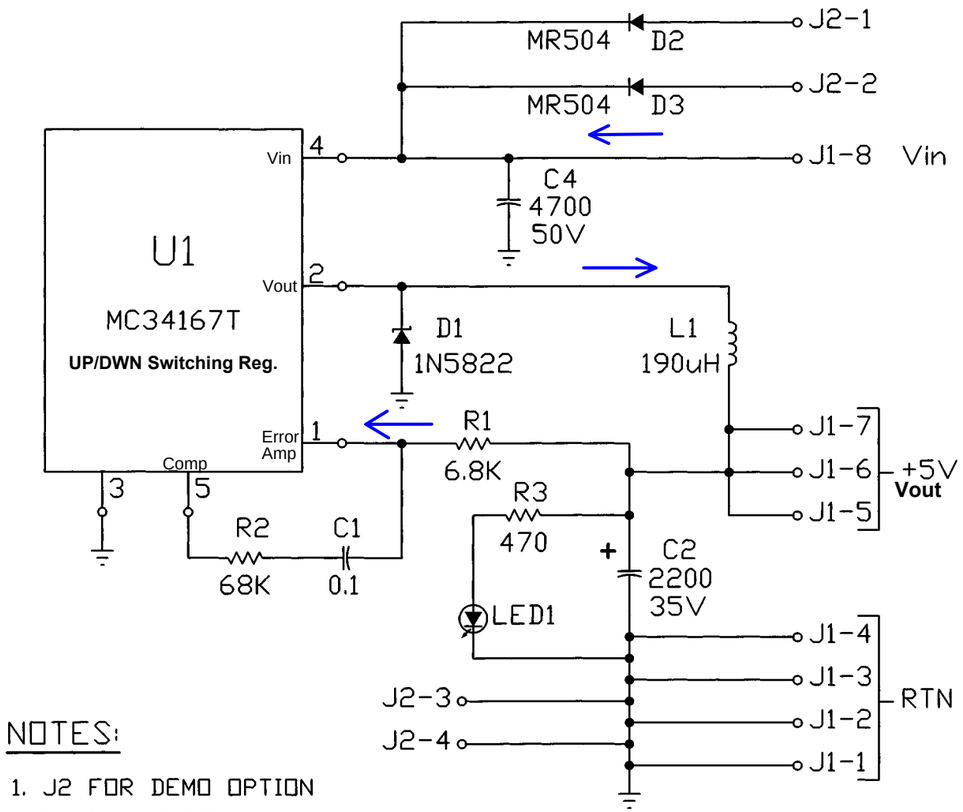


SPARES



ATC MICROPROCESSOR

124-0148S
REV 5 8/3/00
SHT 8



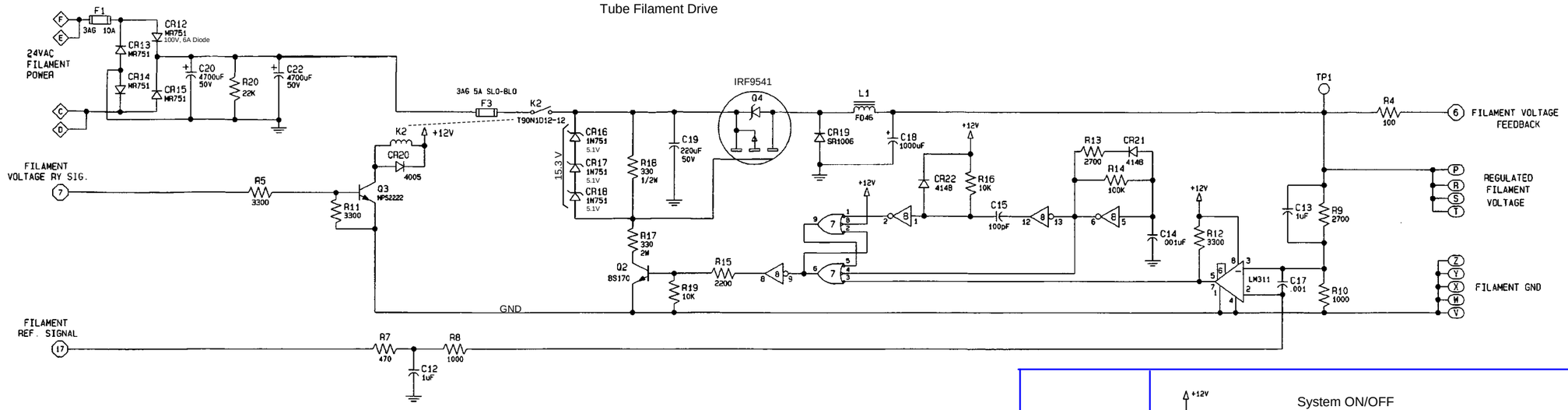
NOTES:

1. J2 FOR DEMO OPTION
2. C3 NOT USED

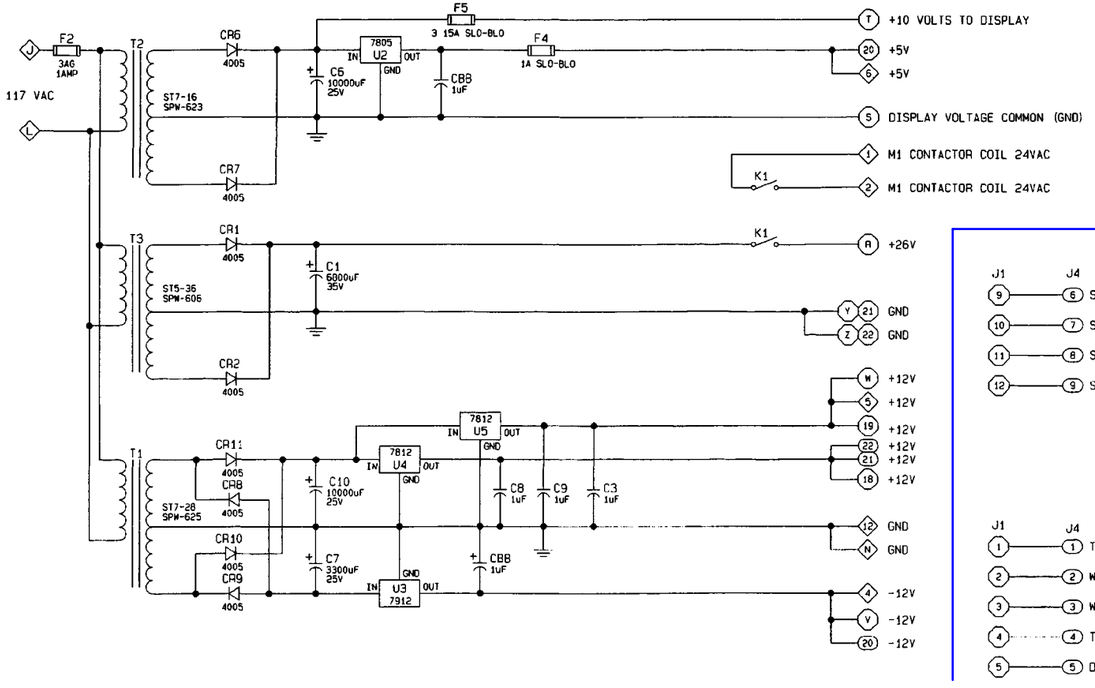
SCHEMATIC- POWER SUPPLY APR CPU

124-0151 S REV 1

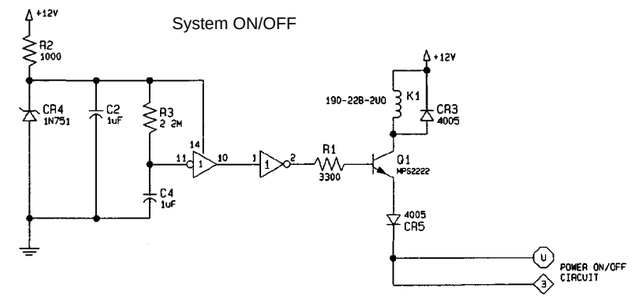
Tube Filament Drive



System DC Supply



System ON/OFF



J1	J4	
9	6	SPOT SELECT
10	7	SPARE
11	8	SPARE
12	9	SPARE

J1	J4	
1	1	TABLE SELECT
2	2	WALL SELECT
3	3	WALL F.B.
4	4	TABLE F.B.
5	5	DOOR INT

⬭ - J4
◇ - J2
⬡ - J1

J1	J4	
A	A	BOOST
B	B	RUN
C	C	ROTO CURRENT SIGNAL
D	D	ROTO CURRENT SIGNAL
E	E	PREP
F	F	FILAMENT DRIVE
H	H	FILAMENT DRIVE

SCHEMATIC, POWER SUPPLY PCB
124-0108 S, SHEET 1 OF 1
REV. 6

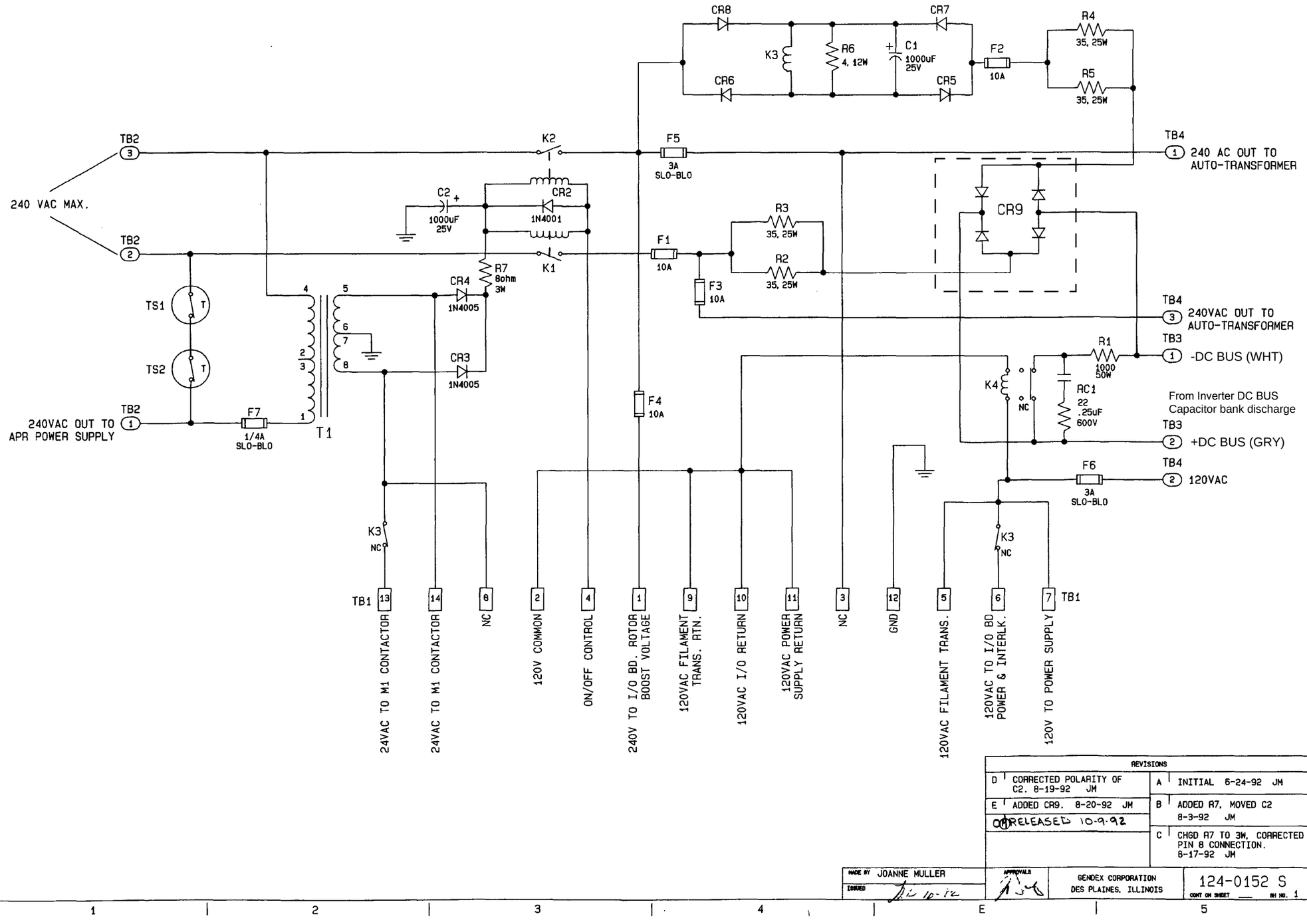
DRAWING NO. 124-0152 S
CONT ON SHEET — SH NO. 1

GENDEX

124-0152 S
CONT ON SHEET — SH NO. 1

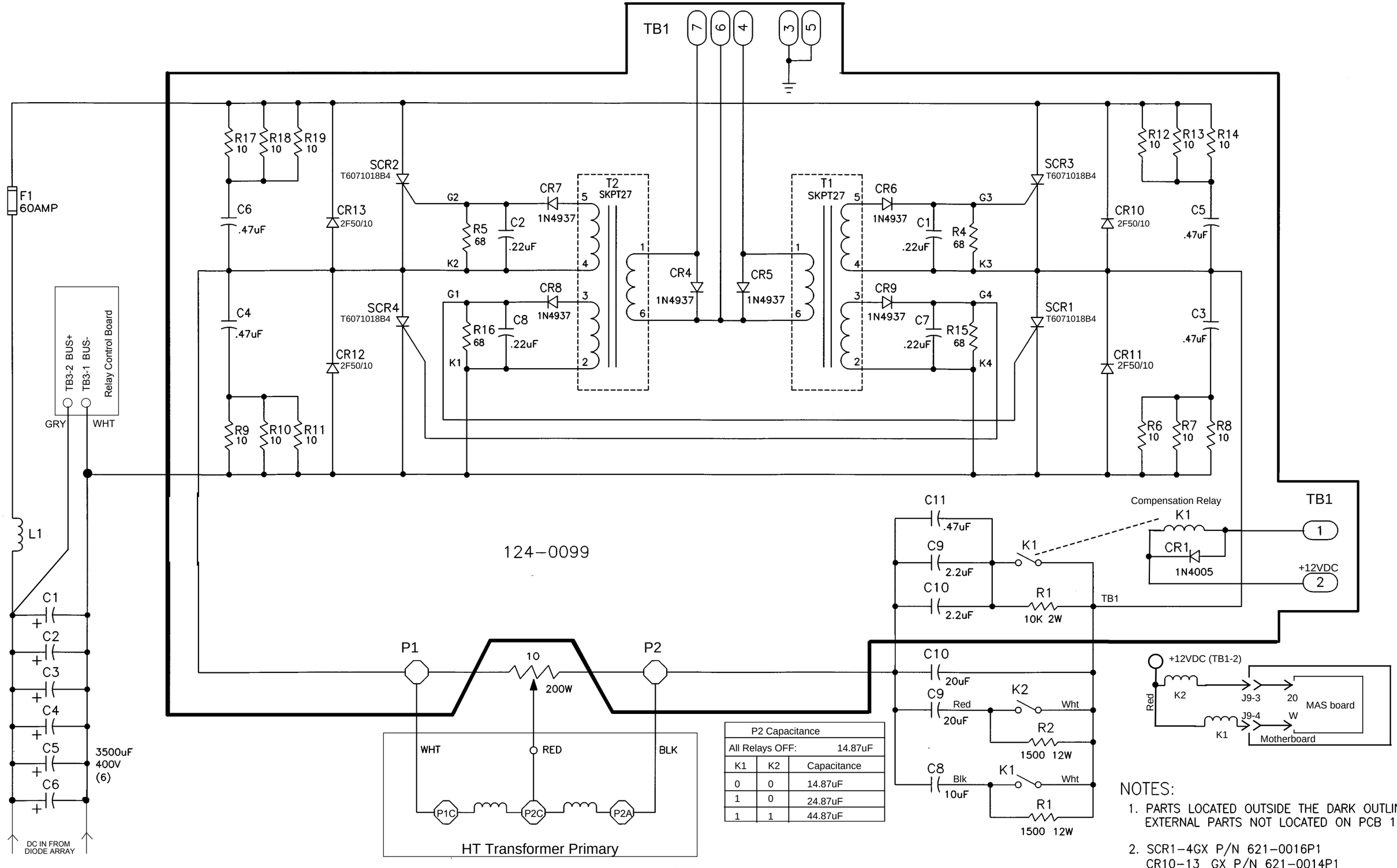
UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING: -					REV. A B C D E F O
APPLIED PRACTICES	SURFACES	TOLERANCES ON DIMENSIONS: DECIMALS (2 PLACES)	DECIMALS (3 PLACES)	ANGLES	124-0152 S
	✓	± .015	± .005	±1°	CONT ON SHEET — SH NO. 1

TITLE
RELAY CONTROL BOARD, SCHEMATIC
FIRST MADE FOR GX30



REVISIONS	
D | CORRECTED POLARITY OF C2. 8-19-92 JM	A | INITIAL 6-24-92 JM
E | ADDED CR9. 8-20-92 JM	B | ADDED R7, MOVED C2 8-3-92 JM
RELEASED 10-9-92	C | CHGD R7 TO 3W, CORRECTED PIN 8 CONNECTION. 8-17-92 JM

MADE BY JOANNE MULLER	APPROVALS	GENDEX CORPORATION DES PLAINES, ILLINOIS	124-0152 S
ISSUED 10-12			CONT ON SHEET — SH NO. 1



P2 Capacitance		
All Relays OFF:		14.87uF
K1	K2	Capacitance
0	0	14.87uF
1	0	24.87uF
1	1	44.87uF

NOTES:

1. PARTS LOCATED OUTSIDE THE DARK OUTLINE ARE EXTERNAL PARTS NOT LOCATED ON PCB 124-0099.
2. SCR1-4GX P/N 621-0016P1
   CR10-13 GX P/N 621-0014P1

SCHEMATIC, INVERTER PCB

124-0099S

REV 3 4-12-96

MAIN CURRENT FR I/O

PHASE CURRENT FR I/O

L/S

TUBE 1/2

PREHEAT REF

12VDC C,3

5VDC B,2

GND A,1

-12VDC B,4

PREP

KV STATUS

MA REF

MA FB

EXPOSURE

FILAMENT VOLTAGE FR P.S

SLEEP

FILAMENT PROTECTION ADJUST

ROTOR OK

BOOST I/O

RUN I/O

TURN OFF MACHINE

SPOT SELECT

TUBE SELECT

FILAMENT VOLTAGE REF SIGNAL

TUBE CURRENT PRESENT

MA TO AEC

FILAMENT DRIVE I/O

FILAMENT DRIVE I/O

FILAMENT VOLTAGE PASS TRANSISION P.S

FILAMENT VOLTAGE RY SIGNAL P.S

FAULT

BOOST TIME ADJUST

TUBE 2 L. SPOT

TUBE 2 S. SPOT

TUBE 1 L. SPOT

TUBE 1 S. SPOT

MA ADJUST

TO U3-13

U1,8

U2,3,4,5,6,7
U10,11,13,14
U16,17,19,20
U21,22,26,27

U9,12,15,18
U26

U23,25

U24

SCHEMATIC, MA/ ROTOR PCB
124-0095S PAGE 1 OF 1
REV 8

UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING:
APPLIED FINISHES | SURFACES ✓ | TOLERANCES ON DIMENSIONS: DECIMALS IN PLACES | DECIMALS IN PLACES | ANGLES

124-0110S

TITLE
KV-REGULATOR PCB
FIRST MADE FOR 37.5

124-0110S
CONT ON SHEET —— SH NO. 1

#	Type	Gnd	+12V	-12V	#	Type	Gnd	+12V	-12V
1	4093	7	14		13	4093	7	14	
2	74C14	7	14		14	741		7	4
3	4012	7	14		15	741		7	4
4	4023	7	14		15	741		7	4
5	4013	7	14		17	741		7	4
6	74C14	7	14		18	LP311P	1,4	8	
7	4093	7	14		19	LM324		4	11
8	LM324		4	11	20	4066	7	14	
9	4093	7	14		21	LM311	1,4	8	
10	74C14	7	14		22	LM311	1,4	8	
11	LM339		3	12	23				
12	74C14	7	14		24				

-KV IN (Y)
+KV IN (Z)
EXPOSURE (17)
(16)
CURRENT F.B. (12)
ANALOG KV REF. (U)
TP1
TP2
From Data Bd pin X
KV FEEDBACK
KV REF

(14) Fault
(22) +26V
(18) Scr Drive
(21) Scr Drive
(X) (20) Power Gnd
(19) Pulse Trans. Voltage
(7) KV Above
(E) KV to AEC

(20) (X) POWER GND
(1) (A) GND
(2) (B) +5V
(3) (C) +12V
(4) (D) -12V
(22) +26V

LAST USED: C28 TP2; CR20; RB1; U22; Q11
NOT USED: C25

ALL 10k RESISTORS 1/8 WATT 1%
* MYLAR C3, C8, C9, C21
4005 = 1N4005
4148 = 1N4148
2222 = MPS2222

REVISIONS

0	RELEASED 10-9-92	4	TV 5-16-06 5906 #18 TYPE LP393P WAS CMP02
1	ECN-9404033 R23 WAS 470 OHM JoMo 5-6-94	5	
2	ECN-0160695 R58 WAS 10.7K OHM 1% JK 8-22-95	B	
3	JoMo 10-17-02 2212 R49 WAS 15K	C	

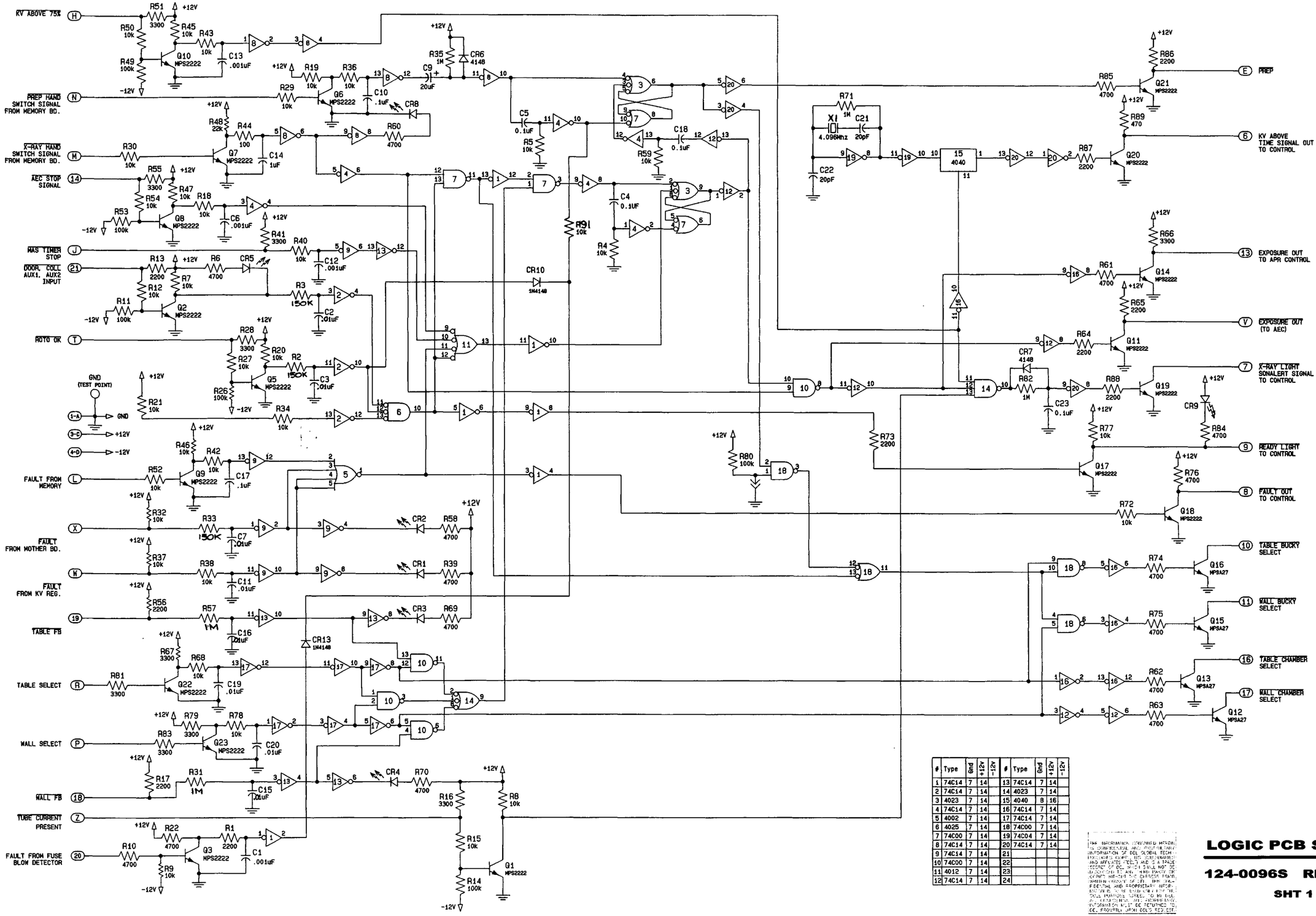
MADE BY
ISSUED
APPROVALS: T.PHAN 5/1/07
DEL MEDICAL FRANKLIN PARK, ILLINOIS
124-0110S
CONTINUED ON SHEET — SH NO. 1

SERIAL DATA INPUT
5VDC INPUT
12VDC INPUT
-12VDC INPUT
GND (DC RETURN)
TOMO TIME INPUT
TOMO TIME INPUT
TOMO TIME INPUT
TOMO TIME INPUT
TOMO TIME INPUT
TOMO TIME INPUT
READY LIGHT
X-RAY LIGHT
KV FAULT
MA FAULT
AUX
AUX
PREP HAND SW
X-RAY HAND SW
SERIAL DATA
CLOCK
MEMORY CLOCK
AUX OUTPUT
AUX OUTPUT
AUX OUTPUT
AUX OUTPUT
AEC SELECT
TOMO SELECT
SPOT L/S
TUBE 1/2
TABLE BUCKY SELECT
WALL BUCKY SELECT
X-RAY
PREP
MA REFERENCE
PREHEAT REFERENCE
KV REFERENCE
SERIAL DATA OUT
UNUSED GATES
TO U25-9
TO U18-4
U1,2,3,4,5,12,16, U17,18,21,22,24,27
U6,7
U26
U11,19,20,23
U25
U8,9,10
U13,14,15
NOTE: 'F' = 'F' MEANS MYLAR CAPACITOR

SCHEMATIC DATA PCB
124-0101S SHEET 1 OF 1
VER. 1

CLOCK
SERIAL DATA
MEMORY CLOCK
AUX CONTROL
PREP
MA IN
MA RET
EXPOSURE START
SERIAL DATA
MAS STOP SIGNAL
MA SIGNAL TO MA REG
MAS PULSES
TO U12-3
TO U2-10
U2, U3, 4, 6, 7, U8, 9, U5, 12, 13, 14, U15, 16, U10, 11

SCHEMATIC; MAS CONTROL
124-0145S PAGE 1 OF 1
REV 02



#	Type	End	+12V	-12V	#	Type	End	+12V	-12V
1	74C14	7	14		13	74C14	7	14	
2	74C14	7	14		14	4023	7	14	
3	4023	7	14		15	4040	8	16	
4	74C14	7	14		16	74C14	7	14	
5	4002	7	14		17	74C14	7	14	
6	4025	7	14		18	74C00	7	14	
7	74C00	7	14		19	74C04	7	14	
8	74C14	7	14		20	74C14	7	14	
9	74C14	7	14		21				
10	74C00	7	14		22				
11	4012	7	14		23				
12	74C14	7	14		24				

LOGIC PCB SCHEMATIC

124-0096S REV 4 2-22-95

SHT 1 OF 1

ACCESSORY PCB
124-0060/124-5002

MA / ROTOR PCB
124-0095

NAS PCB 124-0100/ 124-0145

DATA PCB 124-0101

KV REGULATOR PCB
124-0110

LOGIC PCB 124-0096

J2 J4 J3 2-TUBE J9 +12VDC RELAY CR9 CR10 CR8 1N4005 (3) J6 J8 AUX. 5VDC

12VDC K2 CR4 1N4005 K2 190-228-200 R7 330Ω Q1 MPSA27 -12VDC

J12 TO AEC
7 GND
5 +12VDC
2 -12VDC
10 MA SIGNAL
3 KV SIGNAL
4 GND
8 DISPL SERIAL DATA FOR AEC
11 WALL CHAMBER SELECT
12 TABLE CHAMBER SELECT
6 EXPOSURE DURATION
9 EXPOSURE STOP
1 SERIAL DATA

TO CONTROL DISPLAY
J13
5 TIME PULSES
3 SERIAL DATA OUT
4 EXP. OUT TO APR
6 SERIAL DATA IN
9 GND
2 MAS PULSES
1 X-RAY BACKUP
7 +10VDC
12 ON/OFF
11 DC SUPPLY
10 DC RETURN

CR8, 9, 15 & 16 P6KE16
CR10 & 11 SA30A

+5VDC 16VDC 4700UF TP18 C1 LED2 CR14 CR13 R5 470
+12VDC 16VDC 4700UF TP8 C2 LED1 CR15 CR12 R4 220Ω
-12VDC 16VDC 4700UF TP17 C3 LED3 CR16 CR11 R6 220Ω

J1 J14 J10

TP15 TURN OFF MACHINE
PREP TP7
TP3 FILAMENT DRIVE
TP4 FILAMENT DRIVE
FILAMENT VOLTAGE
FIL VOL REF SIGNAL
FIL VOL PASS TRANSISION
SPOT SELECT
FIL VOL RELAY SIGNAL
PHASE CURRENT SENSE
MAIN CURRENT SENSE
BOOST
RUN

J7 C4 10uF R3 220Ω TP14 MA + TP13 MA -
MA +
MA -
MA -

J5 TOMO

CR2 P6KE16 (2) TP10 TP11 CR1 R1 220Ω (2) R2
KV-
KV+
SCR PULSES
PULSE TRANS VOL
SCR PULSES

CR7 CR6 K1 TP9
+12VDC RELAY
DOOR, COLL LOCK
TABLE FB
WALL FB
WALL SELECT
TABLE SELECT

12VDC K1 190-228-200 CR5 1N4005
CR18 CR17 1N5404(2) C5 6800uF J11
TP14 (GND) TP12
10VDC GND

R8 10Ω JP5

TP16

G1

124-0106S
SCHEMATIC, MOTHER PCB
SHEET 1 OF 2
REV. 5

ACCESSORY PCB
124-0060/124-5002

MA / ROTOR PCB
124-0095

MAS PCB 124-0100/ 124-0145

DATA PCB 124-0101

KV REGULATOR PCB
124-0110

LOGIC PCB 124-0096

J12 TO AEC

7	GND
9	+12VDC
8	-12VDC
5	MA SIGNAL
3	KV SIGNAL
4	GND
6	DISPL SERIAL DATA FOR AEC
11	WALL CHAMBER SELECT
10	TABLE CHAMBER SELECT
2	EXPOSURE DURATION
9	EXPOSURE STOP
1	SERIAL DATA

TO CONTROL DISPLAY

J13

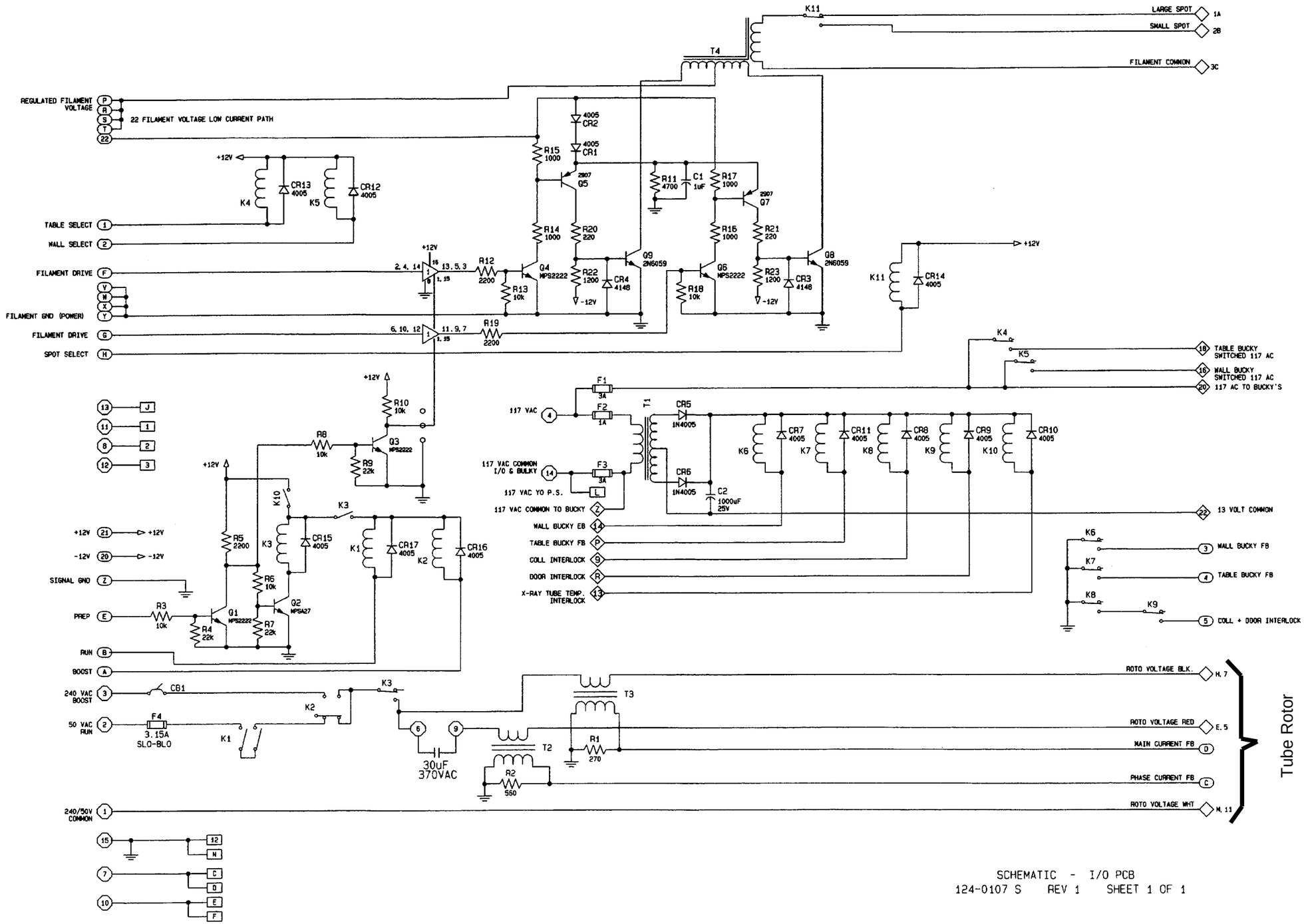
5	TIME PULSES
3	SERIAL DATA OUT
4	EXP. OUT TO APR
6	SERIAL DATA IN
9	GND
2	MAS PULSES
1	X-RAY BACKUP
7	+10VDC
12	ON/OFF
11	DC SUPPLY
10	DC RETURN

CR8, 9, 13 & 16 P6KE16
CR10 & 11 SA5DA

J1
J14
J10

124-0106S
SCHEMATIC, MOTHER PCB
SHEET 2 OF 2
REV. 1

G2

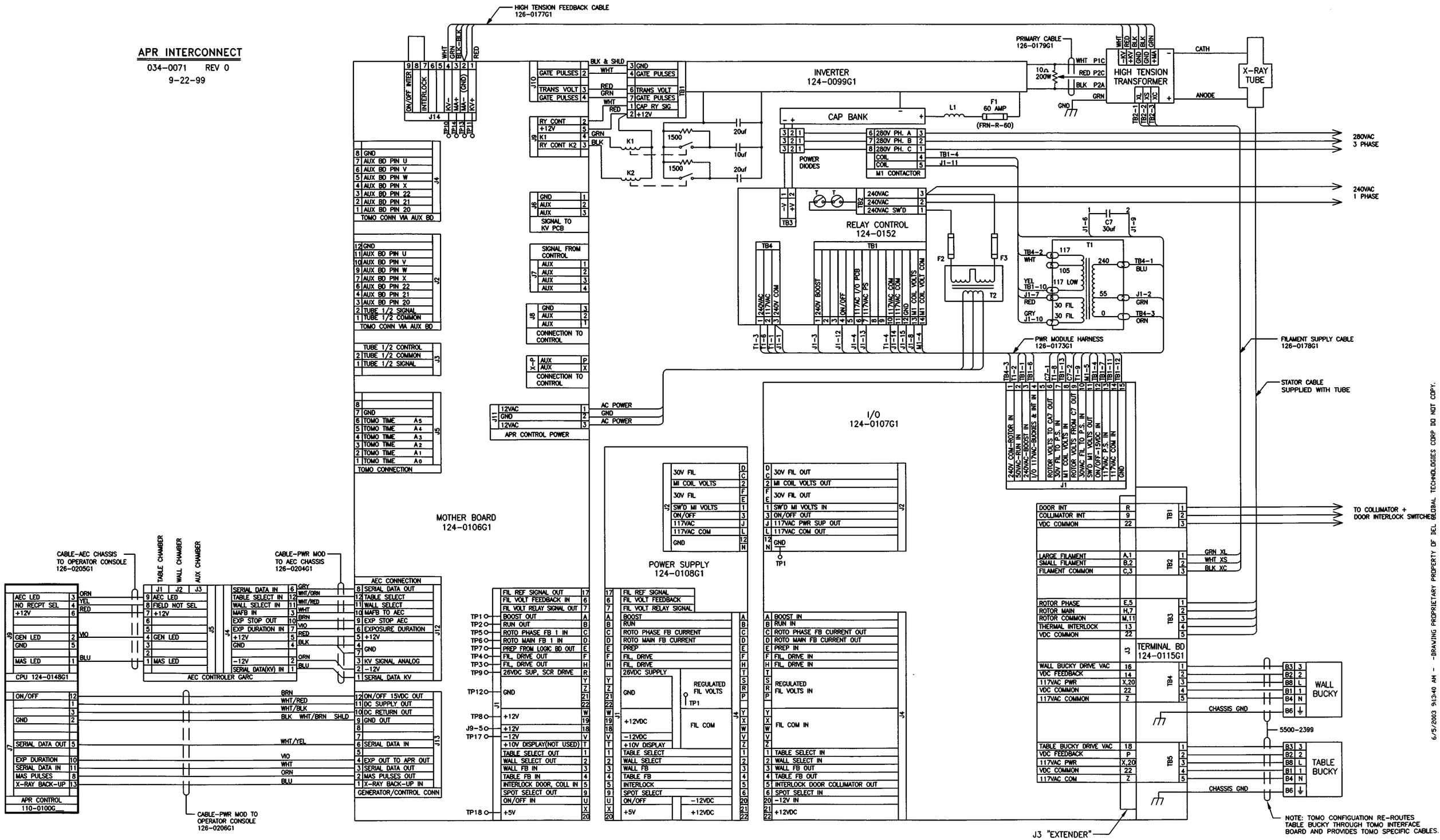


SCHEMATIC - I/O PCB
124-0107 S REV 1 SHEET 1 OF 1

APR INTERCONNECT

034-0071 REV 0

9-22-99

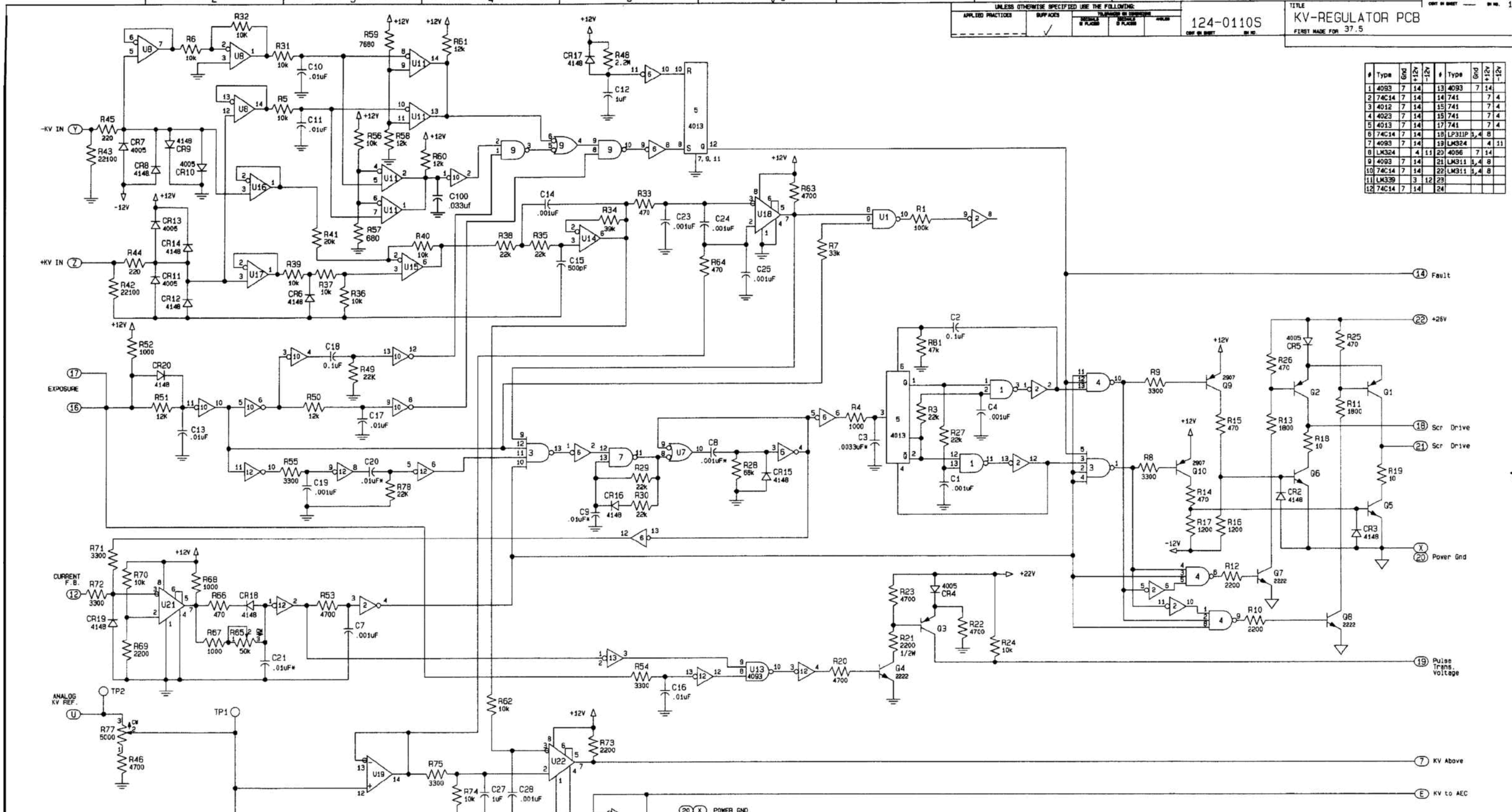


124-0110S

KV-REGULATOR PCB

FIRST MADE FOR 37.5

UNLESS OTHERWISE SPECIFIED USE THE FOLLOWING: APPLIED PRACTICES / SURFACES ✓ / TOLERANCES ON DIMENSIONS / ANGLES



#	Type	Gnd	+12V	-12V	#	Type	Gnd	+12V	-12V
1	4093	7	14		13	4093	7	14	
2	74C14	7	14		14	741		7	4
3	4012	7	14		15	741		7	4
4	4023	7	14		16	741		7	4
5	4013	7	14		17	741		7	4
6	74C14	7	14		18	LP311P	1,4	8	
7	4093	7	14		19	LM324		4	11
8	LM324		4	11	20	4066	7	14	
9	4093	7	14		21	LM311	1,4	8	
10	74C14	7	14		22	LM311	1,4	8	
11	LM339		3	12	23				
12	74C14	7	14		24				

(20)(X) POWER GND
(1)(A) GND
(2)(B) +5V
(3)(C) +12V
(4)(D) -12V
(22) +26V

LAST USED: C28, CR20, R81, U22, Q11, TP2

NOT USED: C25

ALL 10k RESISTORS 1/8 WATT 1%

* MYLAR C3, C8, C9, C21
4005 = 1N4005
4148 = 1N4148
2222 = MPS2222

REVISIONS

0	RELEASED 10-9-92	4	TV 5-16-06 5906 #18 TYPE LP311P WAS CMP02
1	ECN-9404033 R23 WAS 470 OHM JoMo 5-6-94	5	[illegible]
2	ECN-0160695 R58 WAS 10.7K OHM 1% JK 8-22-95	B	[illegible]
3	JoMo 10-17-02 2212 R49 WAS 15K	C	[illegible] ADDED TP1 & 2. [illegible]

MADE BY / ISSUED

APPROVALS T.PHAN 5/1/07

DEL MEDICAL
FRANKLIN PARK, ILLINOIS

124-0110S CONTINUED ON SHEET — SH. NO. 1

CHAPTER 10

PARTS LIST

ATC-725 CONTROL, POWER MODULE & AEC DEVICE

DESCRIPTION	PART NUMBER
Three phase, 480 volt line match transformer	112-0612G1
Three phase 240 volt line match transformer	112-0612G1
Three phase 208 volt line match transformer	636-0072P1
Three phase line match transformer to power Module Cable (#6 AWG)	126-0214G2
Low power line match transformer to power Module Cable (#16 AWG)	126-0211G1
Split Bolt Connector	642-0086P1
Screw Type Connector	642-0073P1
Software NV RAm which contains APR Data Base	622-0332G1 or G2 *
Operating System Software (ATC-725 only)	622-0331G10 or G11 *
Control Keyboard	632-0036P5
CPU Power Supply	124-0151G1
CPU Board	124-0148G1
Control Interface Board	124-0177G1
mA/Rotor Board	124-0095G1
Logic Board	124-0096G1
Data Board	124-0101G1
kV Regulator Board	124-0110G1
mAs Regulator Board	124-0145G1
Mother Board	124-0106G1
I/O Board	124-0107G1
Power Supply Board	124-0108G1
Relay Control Board	124-0152G1
Inverter Board	124-0099G1
AEC Main Board	124-0126G2
AEC kV Compensation Board	124-0124G1

* The difference is due to what is contained in the tube library. Order the version by inspecting the part number on the device, or consult Technical Support.

ATC-725 CONTROL, POWER MODULE & AEC DEVICE (cont.)

DESCRIPTION	PART NUMBER
AEC Gain Adjust Board	124-0125G1
Line Contactor	645-0016P1
Diode Block	621-0015P3
Inverter Capacitor	611-0029P5
Inverter Fuse (Bussman FRN-R-60)	646-0041P1
Single Tube High Voltage Transformer	110-0028G2
Control to Power Module Cable	126-0206G1
Control to AEC Cable	126-0205G1
AEC to Power Module Cable	126-0204G2
Commutation Select Relay	645-0033P1
20uF/600V Peak, SCR Capacitor 610-0019P2	(SCRN227R-F / 86D79206K80)
10uF/600V Peak, SCR Capacitor 610-0019P3	(SCRN224R-F / 86D79106K80)
1200 Ohm Commutation Resistor	112-0132G2
Extender Board	124-0044G1
30 Microfarad Rotor Capacitor	610-0022P1
kV Balance Resistor	603-0017P1
10 amp Fuse (RCB, PS)	46-170021P42
3 amp Fuse (RCB	46-170021P52
1/4 amp Fuse (RCB)	46-170021P73
1 amp Fuse (IO)	46-170021P41
3 amp Fuse (PS)	100124P4
5 amp Fuse (PS)	46-170021P29
High Voltage Transformer	110-0028G2
Vacuum Fluorescent Display (Noritake GU256X64-352)	633-0005P1
Power Module Transformer T1	636-0034P1
Power Module Transformer T2	636-1141P1
I/O Transistors	622-0211P1
Handswitch Assembly	112-0736G1
High Tension Primary Cable	126-0179G1

110-0028G2 HIGH FREQUENCY TRANSFORMER

DESCRIPTION	PART NUMBER
Tank	114-0066G2
Dielectric Oil (One Gallon)	4463-0102
Capacitor Board	124-0034G2
Rectifier	621-0017P1
High Tension Transformer	112-0098G1
Filament Transformer	112-0118G1
Spark Gap Board	124-0046G1
Vertical Board	124-0035G1
Voltage Divider Resistor (36 Megohms)	603-0008P1
Voltage Divider Resistor (100 Kohms)	46-136207P297
Surge Resistor	603-0002P3