

VET-20BT

Battery Powered Portable X-ray System

Product Manual (Operation & Service)



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***See page 7, section 2.5 for important battery care and safety information.**

****See page 8, section 3.3 for important battery storage information.**

PART 1 : OPERATION MANUAL

1. General Description

1.1 Introduction

Thank you for purchasing the VET-20BT, BATTERY POWERED portable x-ray system. The VET-20BT is the lightest weight, most compact sized high frequency x-ray machine on the market today. All POSKOM Portable series x-ray units are equipped with ripple free, high frequency generators that produce up to 40~50% stronger power output efficiency when compared to conventional x-ray systems. The ideal balance of power and portability makes this the perfect solution for all your indoor and outdoor radiographic needs.

****Unique Features**

- Compact sized body and ultra-light weight
- High frequency type x-ray generator
- Maximum output: 90kV / 20mA
- 15 APR memory settings
- Duel laser collimator
- R/F module for wireless communication (DR interface)
- Remote control software
- Power requirements: 16VDC / 1.5A
- Accessories: Aluminum carrying case, hand switch, power plug and charging adapter

1.2 Product Manual

This consolidated manual consists of operating and service instructions. The product manual provides VET-20BT operating instructions for veterinary x-ray and medical personnel trained in the use of x-ray equipment. The service manual provides installation, calibration and routine maintenance instructions for field service personnel.

This manual is not designed to replace or substitute certified training in the radiological or medical fields. Operators should be pre-qualified in the use of this type of equipment before reading this manual. This X-ray system is only to be used by licensed operators in diagnostic, operative and post-operative procedures. VET-20BT can be integrated with several types of radiographic accessories such as mobile stands and x-ray tube mounting tables.

1.3 Important Safety Information

This manual provides guidelines for the safe use and operation of this medical radiographic system. The operator should be trained in the use of this equipment and refer to this manual in conjunction with that training.

It is owner's responsibility to ensure that the system is operated by properly trained and qualified personnel who have obtained credentials from local, state, and federal authorities (where required). Potential hazards exist in the use of medical electronic devices and X-ray systems. All users and operators must understand all safety and emergency procedures and operating instructions found in this manual.

POSKOM certifies that each system complies with the Radiation Control for Health Safety Act in Title 21, Chapter I, subchapter J of the Code of Federal Regulation in the USA and EN 60601, general requirements for radiation protection in diagnostic X-ray equipment for IEC 601-1-3 in European Nations.

POSKOM and distributors assume no responsibility or liability for after-sales operating and safety practices, nor can it be responsible for personal injury or damage resulting from misuse of its x-ray systems. Please address questions and comments regarding safety issues to a certified POSKOM service organization and/or distributor in your region.


We certify that our product have been approved below Standards:

- 1.EN60601-1:1990+A1:1993+A2:1995+A13:1996** Medical electrical equipment—
Part 1: General requirements for safety and essential performance.
- 2.EN60601-2:2001/A1:2006** Medical electrical equipment—Part 1-2:General requirements for safety-collateral standard: Electromagnetic compatibility-Requirements and tests.
- 3.EN60601-2-32:1994** Medical electrical equipment—Part 2:Particular requirements for the safety of associated equipment of X-ray equipment.
- 4.EN60601-1-3:1994** Medical electrical equipment—Part 1:General requirements for safety—3.collateral standard: General requirements for radiation protection in Diagnostic X-ray equipment.
- 5.EN6061-2-7:1998** Medical electrical equipment—Part 2-7:Particular requirements for the safety of high-voltage generators of diagnostic X-ray generators.
- 6.EN60601-2-28:1993** Medical electrical equipment—Part 2:Particular requirements For the safety of X-ray source assemblies and X-ray tube assemblies for medical diagnosis.

If you have any inquiries, please contact POSKOM or our distributors.

1.4 Cautions and Warnings

Possible hazards are associated with the improper operation of x-ray equipment. These hazards are described on the following warning or caution signs with the appropriate safety precautions.


	<p>CAUTION</p> <p>Excessive X-ray radiation may be dangerous to patients and operators unless the following safety regulations are strictly observed.</p>
---	--

2 Operational Safety

2.1 Safety Instructions

The user's safety, ease of operation and product reliability are our major concerns in the design of this generator. Please observe the following instructions and guidelines for the safe operation of this equipment:

- 1) This product should only be operated by certified personnel.
- 2) The VET-20BT is designed for radiographic use only and is not intended for fluoroscopic or any other associated applications.
- 3) The VET-20BT should be used for diagnostic purposes only. There are no therapeutic applications or effects associated with this device.
- 4) The VET-20BT is specified as a Class I Type B device under IEC 601-1, 2 standards.

	<p>CAUTION</p> <p>This equipment is not protected against the ingress of water or other liquids.</p>
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- 5) There are no user modifications available on this device. In case a modification is required, please contact POSKOM or an authorized dealer for service.
- 6) This system has been pre-calibrated for optimal operation.
- 7) If you experience any problems with this device, please turn off and unplug the power immediately. Notify POSKOM or an authorized dealer for further assistance and servicing.
- 8) If you need to connect a 3rd party device and/or accessories made by another manufacturer to this equipment, please contact POSKOM or an authorized dealer for compatibility and installation assistance.

2.2 Disposal Instructions

This equipment and its accessories must be disposed of safely at the end of the device's life span. All local and national regulations pertaining to the safe disposal of such devices must be observed. This equipment and accessories are to be disposed of according to the law governing the safe disposal of such equipment through standardized means or use of a specialized waste service company.

2.3 Electromagnetic Disruption Warning

This equipment has been tested and found to comply with the limits for medical devices in IEC 60601-1-2:1994. These limits are designed to provide reasonable protection against harmful interference in a typical medical installation.

This equipment generates and can radiate radio frequency energy. If not installed and used in accordance with the instructions, this device may cause harmful interference to other devices in the vicinity. There is no guarantee that interference will not occur in any particular installation. If this equipment does cause harmful interference to other devices, check to see if this device is the source by turning the equipment off. The user is encouraged to try to correct the interference by using one or more of the following measures:

- Reorient or relocate the receiving device.
- Increase the separation space between the equipment.
- Connect the equipment into an outlet on a circuit different from that to which the other device(s) are connected.
- Consult the manufacturer or field service technician for further assistance.

2.4 General Battery Care Instructions



Caution

Failure to properly abide by the following instructions may lead to personal injury or permanent damage of your battery and x-ray unit.

- 1) Consumed batteries should be disposed of properly. Please check local laws and ordinances regarding the proper and safe disposal of batteries.
- 2) Only use batteries pre-approved and designated by POSKOM in this device.
- 3) Avoid contact with foreign metal objects during storage or transport of the battery. Excessive current from direct contact with metal objects can permanently damage the battery.
- 4) Batteries are not alterable or replaceable by the end user. Approved replacement batteries are only available through POSKOM and its authorized dealers and may only be serviced by POSKOM or an approved POSKOM service agency. Unapproved batteries have the potential danger of damaging the device and should not be attempted.
- 5) Do not subject batteries to excessive heat.

2.5 IMPORTANT Battery Maintenance and User's Safety Instructions

- 1) Charge your Lithium-Ion batteries to full capacity (preferable overnight) before beginning use of your unit in battery mode.
- 2) Try to use the Lithium-Ion battery every 2-3 weeks.
- 3) Keep Lithium-Ion batteries at a minimum 30% charge when not in use.
- 4) Charge Lithium-Ion batteries regularly and at the end of every day of use.
- 5) Avoid regularly running Lithium-Ion batteries too low (below a 30% charge).
- 6) Unplug your unit from the charger after the battery is fully charged.
- 7) Never leave Lithium-Ion batteries discharged for any lengthy period of time as the batteries will self-discharge when not in use and over time, the charge could drop low enough to damage the battery permanently.
- 8) Keep lithium-Ion batteries away from high heat. High heat may cause premature battery failure and the battery to explode or catch fire. DO NOT leave this battery powered unit in a closed vehicle in direct sunlight or any other potential high heat areas.

3. Operating Environment

3.1. For proper operation and maintenance, please avoid the following areas:

- 1) Exposure to a moist or highly humid atmosphere.
- 2) Exposure to extended periods of direct sunlight and high heat conditions.
- 3) Exposure to heavy dust and other airborne contaminants.
- 4) Exposed to a corrosive and salty atmosphere.
- 5) Exposure to harsh chemicals or other toxic gases.
- 6) Areas with insufficient ventilation.

3.2. Keep away from strong vibrations. Maintain and use this device in the following environmental conditions:

Operational Environment

Temperature range	10°C ~ 40°C (50°F ~ 104°F)
Humidity range	30% ~ 75%RH
Atmosphere Range	700 ~ 1060hPa

Optimal Working Environment

Temperature range	17°C ~ 23°C (63°F ~ 73°F)
Humidity range	40% ~ 60%RH
Atmosphere Range	700 ~ 1060hPa

3.3. Please maintain the following environmental conditions for safe storage and transportation:

Storage and Transportation*

Optimal Temperature Range	20°C~25°C (68°F ~ 77°F)
Min./Max. Temperature Range (w/o battery)	-20°C~60°C (-4°F ~ 140°F)
Min./Max. Temperature Range (w/ battery)	-20°C~33°C (-4°F ~ 91°F)
Humidity range	10% ~ 95%RH
Atmosphere Range	500 ~ 1060hPa

4. Radiation Safety

**CAUTION**

Ionized radiation may be dangerous to patients and operators unless the following safety regulations are strictly observed.

- 1) Users and patients are requested to wear appropriate protective gears when operating this unit.
- 2) Users must leave a minimum safe distance from the radiation source and secondary radiation areas.
- 3) Users and patients are requested to remove all unnecessary objects near the exposure areas.
- 4) Users are requested to leave a minimum gap of 20cm (\approx 8 inches) between the unit and target area.
- 5) Users and are requested to use minimum kV and mAs values when testing this equipment.
- 6) Users must exercise caution as to not to exceed the radiogram limits in any exposure area.

5. Composition

5.1. VET-20BT consists of following parts and devices:

- 1) Operation Panel
- 2) Inverter
- 3) HV Tank (including X-ray Tube)
- 4) Laser Collimator
- 5) Hand Switch
- 6) Li Ion Battery

5.2. Supplemental Accessories and Equipment:

- 1) Aluminum Carrying Case
- 2) Operation/Service Manual
- 3) AC Cord and Adaptor

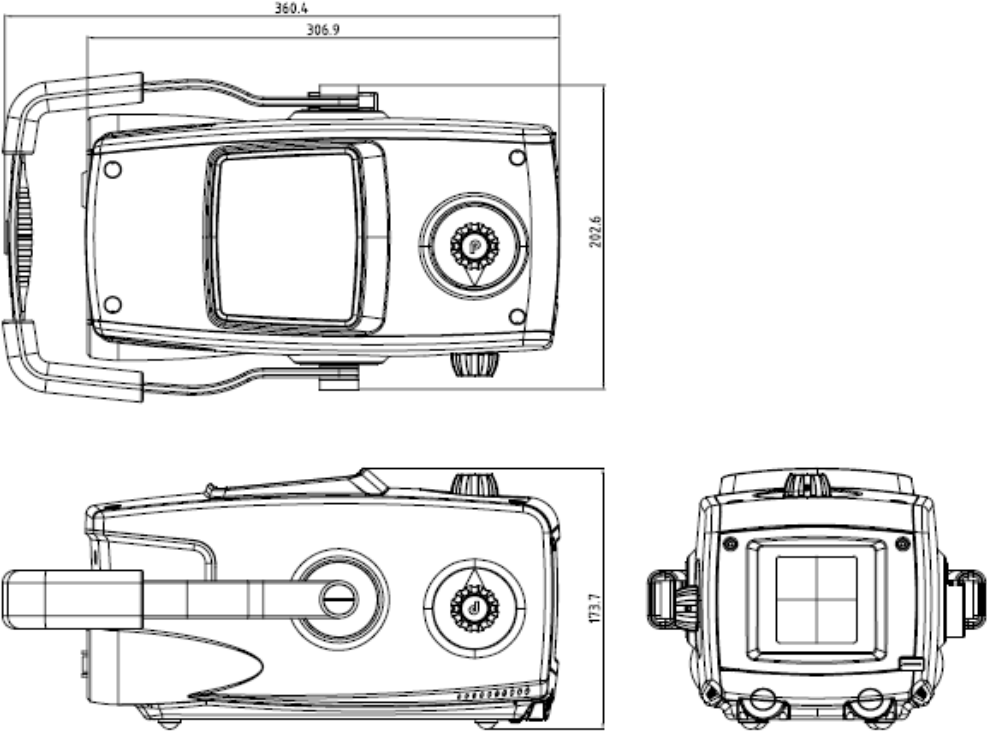
6. Specification

6.1 Technical specifications

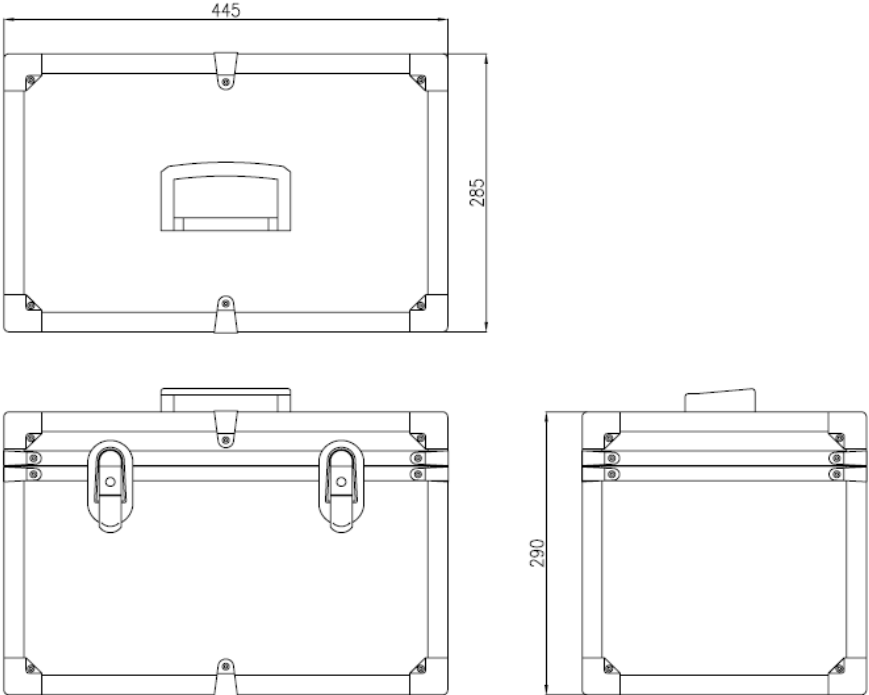
Output Power		1.6 kW
Input Power1	Battery Voltage	14.8VDC
	Capacity	4.8AH 20C
	Current	Short time 96 A
Input Power2	Capacitor Voltage	15VDC
	Current	Short time 96 A
Radiography kV Range in 1Kv Steps		20mA (50 ~ 80kV / 0.4 ~ 3.2mAs) 10mA (50 ~ 80kV / 3.6 ~ 20mAs) 15mA (81 ~ 90kV / 0.4 ~ 3.2mAs) 8mA (81 ~ 90kV / 3.6 ~ 20mAs)
mAs Range		0.4 ~ 20mAs in 25steps 0.4, 0.6, 0.8, 1.0, 1.2, 1.4, 1.6, 1.8, 2.0, 2.2, 2.5, 2.9, 3.2, 3.6, 4.0, 4.5, 5.0, 6.4, 8.0, 9.0, 10, 12, 15, 18, 20
Max. kV Deviation		±4%
Max. mAs Deviation		±7%
Indication		kV (error code) /mAs: 7-segment LED
x-ray Tube	Focal Spot	1.2mm x 1.2mm
	Target Angle	19 degree
	Anode Heat Storage	10 kJ
	Heat Dissipation	110W
Total Filtration		2.2 mm Al eq. @ 90kV
Compensation for the Supply Power Regulations		Automatic
Collimator with Laser Pointer	Type	Double slit type, Manually operation
	Min. X-ray Field Size	5cm x 5cm @1m SID
	Max. X-ray Field Size	35cm x 35cm @ 65cm SID
	Laser Pointer	Class : III A 5mW Dual Laser
	Timer	Push button illuminator with 30 sec timer
	Lamp	5mW Dual Laser X 2EA
APR		15EA(Compounding of 5 keys)
Net Weight		6.8kg(15lbs)
Battery charger		INPUT 100VAC~240VAC (Free Voltage)
		OUTPUT 16.8VDC, 1.5A

6.2 Dimension

1) Main Body



2) Carrying Case

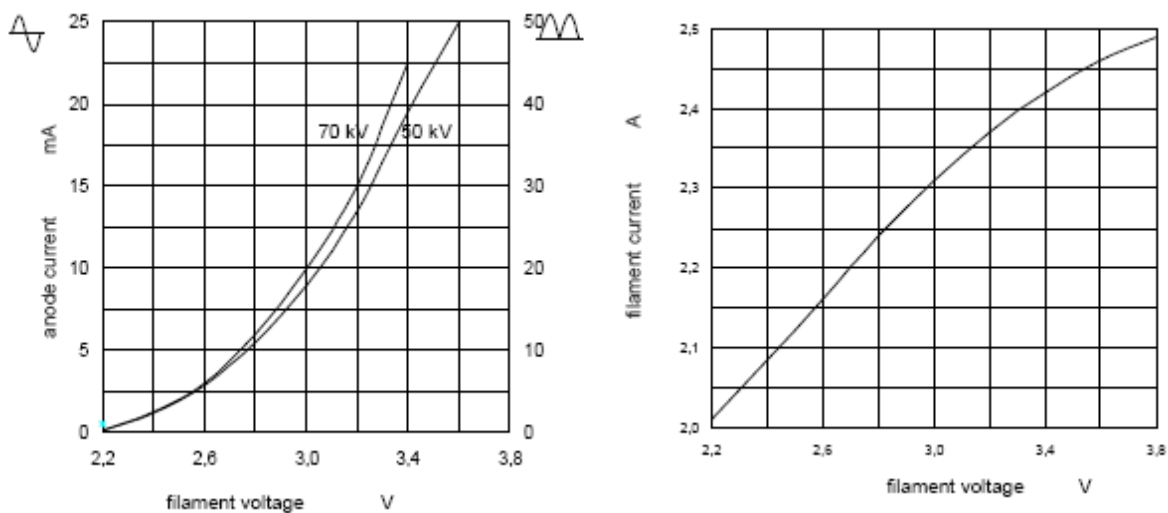


6.3 Tube Specifications

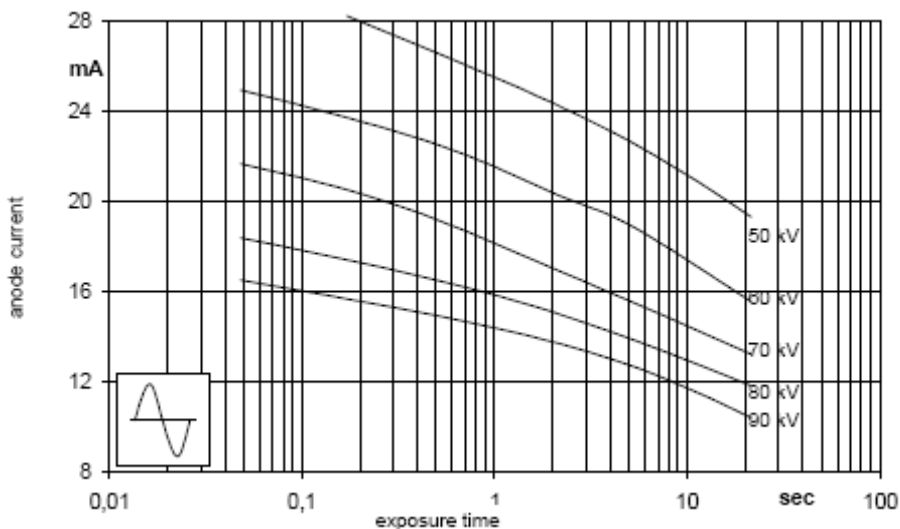
1) General Data

- A. kV scope(Max. kV): 50 – 100kV
- B. Focal spot size: 1.2mm
- C. Heat Storage: 10kHU
- D. Cooling rate: 110W
- E. Inherent Filtration: 0.5mmAl
- F. Target angel: 19°

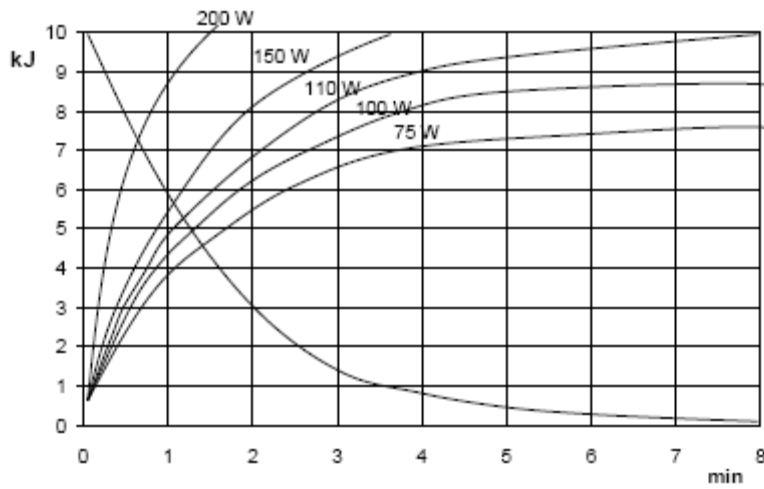
2) Filament Feature Curve



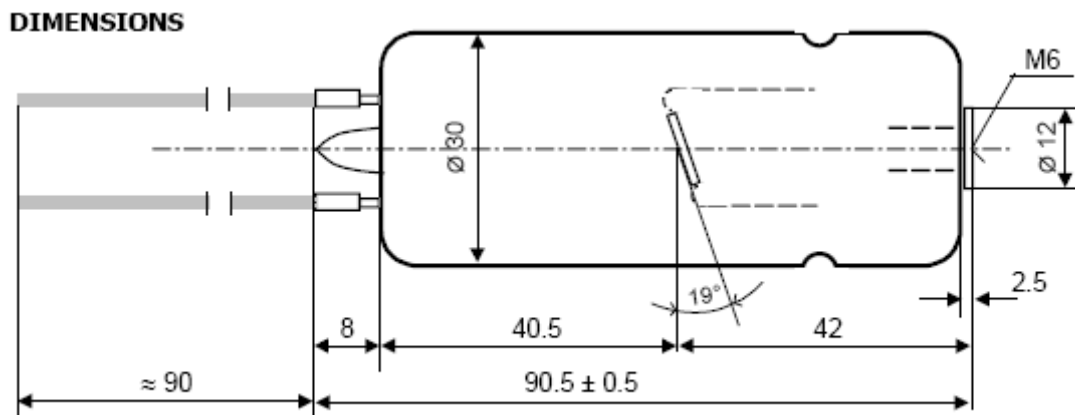
3) Max. Output Table



4) Anode Thermal characteristics



5) Dimension



7. Parts List

7.1 OP Consol and Panel Display




[1]	kV Control Switch	[7]	Wait Mode LED
[2]	mAs Control Switch	[8]	On / Off Switch
[3]	APR Store Switch	[9]	Battery Charge Display
[4]	Laser Pointer Switch	[10]	APR Selection Switch
[5]	Ready Mode LED	[11]	Reverse Display
[6]	Exposure Mode LED	[12]	Fast Exposure Switch

7.2 Product Label

Warning: This X-ray unit maybe dangerous to patients and operators unless safe exposure procedures and operational instructions are observed.

DIAGNOSTIC X-RAY UNIT (MODEL : VET-20BT)

SN 

Input Power : 16.8V \equiv / 1.5A(Used with AC/DC Adaptor: AD27)


Li-ion Polymer Battery Pack: 14.8V \equiv , 4800mAh


Output Range : 50~90kV / 8~20mA


Total Filtration : Min. 2.3mmAl




X-ray Tube Model : OX/70(C.E.I.) SN:


Focal Spot : 1.2mm x 1.2mm

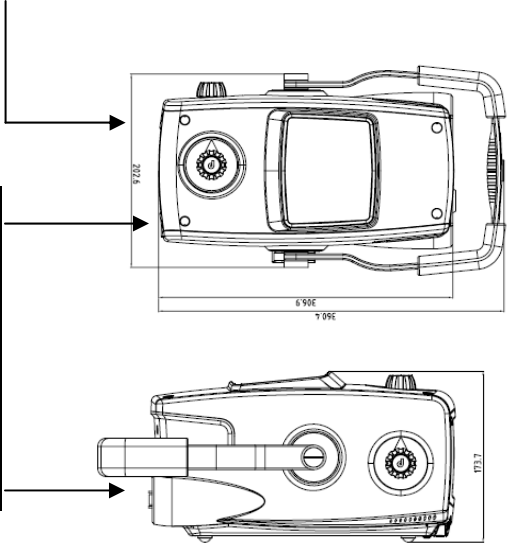
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 Medical ECONET GmbH. Im Erlengrund 20 D-46149 Oberhausen, Germany

 Take adequate precautions to prevent the possibility of any persons carelessly exposing themselves or others to radiation.


  





HIGH VOLTAGE TANK

MODEL : VET-20BT

Tube Model : OX-70(C.E.I.) SN 


TUBE NO.:

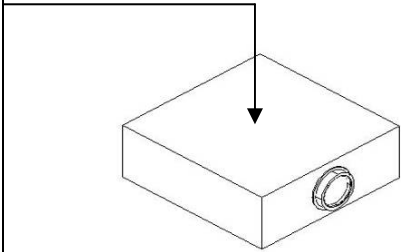
Focal Spot : 1.2mm x 1.2mm

Inherent filtration : 0.5mmAl Eq. @ 100


Rating : Max. 90kV, 15mA, 80kV, 20mA


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 **Warning: dangerous voltage.**
Do not remove cover. Reserve servicing to qualified personnel.



BEAM LIMITING DEVICE

MODEL : PCMAX-20H SN 

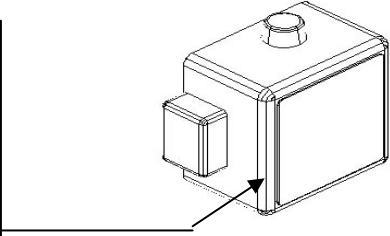
Input voltage : 12VDC, 10W 

Min. X-ray field size : Below 5cm x 5cm at SID 100cm

Max. X-ray field size : Below 47cm x 47cm at SID 100cm

Max. Tube Voltage : 90kV, Inherent filtration : 0.5mmAl Eq. @90 kV

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8. Preliminary Operating Procedures

8.1 Preparation

- 1) Always wear a lead apron during x-ray exposures.
- 2) Please leave at least 2 meters (\approx 6.5 feet) between the operator and the unit. Use the supplied extended hand switch cable in order to keep minimum safe distance from the unit.
- 3) Use the proper beam size and technical values to produce the best radiographic results while minimizing exposure dose.
- 4) Please make special note of the decimal point on the mAs display in order to acquire the appropriate intended mAs values.
- 5) During indoor radiographic use, remember to keep all bystanders at a minimum safe distance and use the appropriate safety gear while producing exposures.
- 6) Please pay attention to the proper management and regular maintenance of this equipment.
- 7) Cumulative doses of radiation are a serious hazard to patients and users of this device. Please observe the guidelines set forth by your local authorities regarding additional requirement for protective devices when dealing with machines producing high kV and mAs radiation values.

WARNING



Please check if the voltage and current of your power supply observes the specifications written on the system's labels, found on the backside of the machine's body. The levels of voltage must be within $\pm 10\%$ of these standard values.

CAUTION



Please check all connection lines before operating and producing x-ray exposures from this machine.

8.2 Collimator Checklist

- A. Place the loaded cassette on the patient's backside.
- B. Arrange the SID (Focal Spot to Image Receptor Distance) with measuring tape.
- C. Turn on the collimator laser pointer with the "Laser Pointer Switch."
- D. Arrange the beam size according to the scale of the x-ray film with the collimator knob.
- E. Collimator and laser pointers will turn off automatically.

8.3 Preheat

1) Overview

All portable x-ray units require preheat procedure to protect the x-ray tube from an instant surge of current that may damage your device and to insure the longevity and continued safe operation of your system. Preheating of the x-ray tube is required under the following circumstances:

- A. Initial use or installation.
- B. Non-use of the equipment after 1 month, stored at lower than room-temperatures.
- C. Temperature of the x-ray tube is below 0°C (32°F). (Cold tube)

2) Preheat Procedures

Following preheat procedure is recommended.

- A. Wear the appropriate safety gear and make sure your equipment is set up in a “radiation safe” location.
- B. In case outdoor temperatures are below 0°C (32°F), move the equipment indoors and wait until the equipment is warmed up before proceeding.
- C. In order to preheat the filament of x-ray tube, produce x-rays exposures in 15 second time intervals.

First Step: 3 quick exposures at a low value (50 kV, 0.4 mAs)

Next Step: 3 more quick exposures at a higher kV (60 kV, 1.2 mAs)

Final Step: the last 3 quick exposures at the max. kV setting (80 kV, 2.0 mAs)



CAUTION


During the X-ray exposures, the equipment makes a “beep” sound.

After the X-ray exposure and while on “Wait” mode, DO NOT push the “Exposure” button.

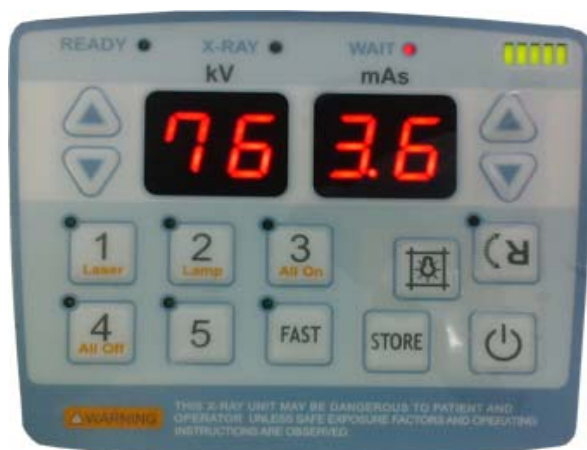
9. Standard Operating Procedures

9.1 General Notes

- A. Open the carrying case and make sure all the parts are accounted for and there is no damage to your device.
- B. Connect the hand switch to VET-20BT's main body via the provided hand switch cord.

 **CAUTION** Third party parts (i.e. adaptors, hand switches, etc.) are not compatible and cannot be used with this equipment (except those provided by POSKOM and its affiliates).

- C. Startup display:



- D. The "Wait LED" will be lit while the Ultra Capacitor is charging.
- E. Select your kV value via the kV up/down switch. You can quickly scroll up/down these values by holding the key down.
- F. Select your mAs value via the mAs up/down switch.
- G. After inputting your values, push the hand switch to the "first step" position of the 2 step controls and your unit is ready for the exposure.
- H. When the "Ready Mode LED" is lit, push the hand switch to the "second step" position of hand switch and produce your exposure. During the exposure, the "X-ray LED" will be lit.
- I. After the exposure, the Ultra-Capacitor will recharge and the "Wait LED" will again be lit.

9.2 APR Procedures

A. After turning your unit on, the below display will appear:



B. Select 1-5 APR switch. (15EA APR available)

Switch Combination : 1, 1+2, 1+3, 1+4, 1+5, 2, 2+3, 2+4, 2+5, 3, 3+4, 3+5, 4, 4+5, 5

C. Select the kV value by pressing the kV up/down switch.

D. Select the mAs value by pressing the mAs up/down switch.

E. Store selected kV/mAs value by pushing the “STORE” button.

F. After properly positioning your device in relation to the patient, use the hand switch in “Prep Mode” by pushing Hand switch to the 1st (Ready) step.

G. When the “Ready LED” is ON, push the hand switch to the 2nd step to expose.

During the exposure, the “X-ray LED” will be lit.

H. After the exposure, the capacitor will need a moment to recharge and the “Wait LED” will be lit.

I. After selecting another APR the unit will return to “Normal Mode.”



Notice

When selecting an APR Mode, the latest memory setting will be recalled and displayed.

10. Hand Switch Functions & Operation

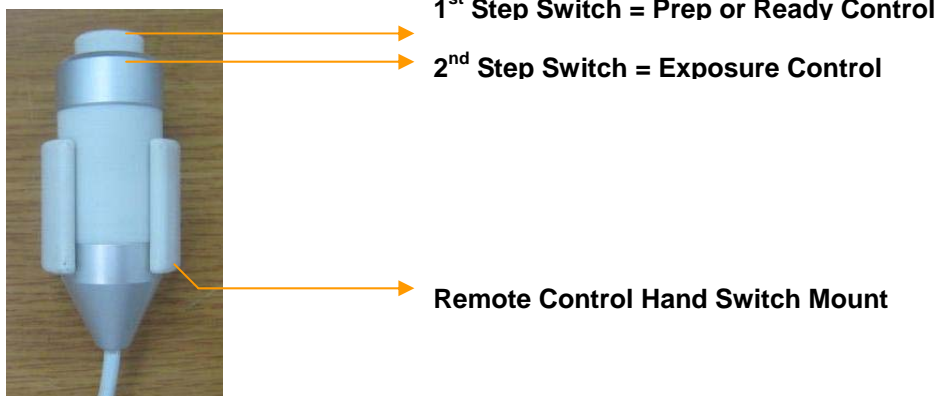
10.1 Introduction

The remote control hand switch is capable of controlling all technical parameters, collimator lamp and laser pointer functions.

The hand switch is designed with two stages or steps. The first stage of the hand switch preps and readies your unit while the second stage of the hand switch controls the exposure.

Every function of Remote control is, as explained above, operated by pushing Hand switch in "Prep Mode". Each Remote Control function and exposure value selection is as below.

(Fig. 1)



10.2 Remote Control Hand Switch Mode

All of remote control functions are operated by depressing the first stage of the hand switch (Ready Step). Further explanation on each function and the setting of technical values are as follows:



<Triple Click>



NOTICE

Click the "Ready Step" switch 3 times to enter the operation mode of the "Remote control" menu.

10.3 kV Selection

Rapidly click the hand switch 3 times to the “Ready Step” position. The APR selection LED, kV and mAs display will begin to flash. Press the “Ready Step” of hand switch one time while the APR switch is flashing and you are ready to enter the kV setting mode. Click the hand switch once to move the kV value by one. The kV value can be rapidly moved by keep depressing the hand switch and holding it in the PREP position to circulate from low to high numbers quickly. The kV value is set by releasing the hand switch button for a few seconds.

10.4 mAs Selection

Use the same procedures to set the mAs values as used for the kV set up procedures above. Rapidly click the hand switch 3 times to the “Ready Step” position. Press the “Ready Step” of hand switch one time while the APR switch is flashing and you are ready to enter the mAs setting mode. Click the hand switch once to move the mAs value by one. The mAs value can be rapidly moved by keep depressing the hand switch and holding it in the PREP position to circulate from low to high numbers quickly. The mAs value is set by releasing the hand switch button for a few seconds.

10.5 Cross Beam/Laser Pointer Modes & Programing Setup



<Double Click>




NOTICE

Rapidly click the hand switch twice (2x) to the “Ready Step” position to operate the x-ray lamp and collimation settings.

The appropriate positioning of the device for a proper exposure is important. The collimator lamp should be lit after checking the beam and film size. The center of the subject should also be confirmed before the final exposure is produced. Collimator lamp and laser pointers are lit by 2 consecutive clicks of the “Ready Step” or PREP position of the hand switch. Both lamp and lasers turn off automatically are the x-ray exposure is complete.

These functions are activated automatically when the first stage (PREP mode) of the remote hand switch is pushed and held at the beginning of the X-ray exposure sequence as follows:


- 1) Turn the power on.
- 2) Press and hold the lamp button for 3 seconds. The LED lights on APR buttons (numbers 1-4) will turn on and the LED light of the selected mode will blink for 20 seconds.
- 3) To change between modes, press the appropriate APR button (numbers 1-4) that conforms to the desired setting as follows:
 - APR No. 1: Dual Laser Pointer "ON".
 - APR No. 2: Cross Laser Beam "ON".
 - APR No. 3: Both Lasers "ON".
 - APR No. 4: Both Lasers "OFF" (Factory Default)
- 4) After making your selection, press and hold your selected APR button for 3 seconds and wait for 2 audible beeps that will confirm your selection has been successfully saved and stored.



NOTICE

When the factory default is selected (APR #4), the cross laser beam and dual laser pointers will not be activated by the "Prep" mode of the hand switch. However, it will be activated by a "double click" of the "Prep" mode of the exposure hand switch.

10.6 X-Ray Exposure



WARNING

Minor radiation scattering may occur while x-rays are being exposed. Operators and patients should always wear a lead apron and any other protective gear as required by law.

Set the kV and mAs settings for your radiography and adjust beam size with the collimator knob before producing x-ray exposures.




< 1st Step >



< 2nd Step >

Steps for X-ray Exposures:

- 1) Press the PREP switch and hold.
- 2) Press the second stage of the hand switch when the ready LED is lit. The "exposure timer" will automate the exposure process.



NOTICE

All functions and operations for the remote control hand switch are executed via the operation panel.

All exposures and technical parameters are operable via the display panel before the final exposure. Refer to the “Standard Operating Procedures” section for more details.

10.7 Fast Exposure (Rapid Exposure Mode)

The “Fast Exposure Button” allows for quick, repeated exposures without the need for the standard “Prep” cycle. One (1) second after the first exposure is completed, the “Ready” (Prep) statue will remain lit for 6 seconds, during which time another expose can be taken.

Directions for Rapid Exposure Mode use:

- 1) After selecting the Fast Exposure Button, make a standard x-ray exposure.
- 2) One (1) second after the x-ray exposure is completed, the “Ready” status will automatically begin.
- 3) Two (2) seconds after the x-ray exposure is completed, the “Ready” lamp will turn on.
- 4) The next x-ray image is now ready for exposure. Press the hand switch completely (through the first and second steps) to produce an exposure.
- 5) If hand switch’s first step is not pushed for 5 seconds after the “Ready” light is lit, “Ready” status will be lost and you will once again need to “Prep” for a new exposure or reset the Rapid Exposure Mode (see Step 1).

10.8 RF Mode Settings**NOTICE**

Wireless RF devices (main & sub-modules) are optional accessories (e.g. DR flat panels) to be integrated with the VET-20BT generator and a DR controller computer. RF mode setup is only applicable with compatible DR systems. The RF Mode should be set to the “OFF” position if the VET-20BT is not integrated with a DR system.

Directions for RF Mode:

- A. Press and hold the LAMP button for more than 3 seconds to enter the RF Setup Mode.
- B. Press the kV “Up” button until the letters “**rF**” shows on the kV display window.
- C. RF “ON/OFF” model is selected by pressing the mAs “Up/Down” button.
- D. Press mAs “Up” or “Down” buttons and select “ON” or “OFF” on the mAs display window.

(Refer the photos on the following page for more details)

i. mAs Up Button = RF ON



ii. mAs Down button = RF OFF



E. After making your selection, press and hold the LAMP button for 3 seconds and wait for 2 audible beeps that will confirm your selection has been successfully saved into the VET-20BT's PROM Memory.

EQUINE CHART FOR THE VET-20BT BATTERY PORTABLE

26" (66 cm) Distance

400 Speed Rare Earth Film / Screen

<u>Anatomy</u>	<u>View</u>	<u>High Contrast</u>		<u>Mid- Contrast</u>	
		<u>kV</u>	<u>mAs</u>	<u>kV</u>	<u>mAs</u>
Navicular	AP	64	1.8	72	1.2
	LAT	64	1.6	72	1.0
	P3	62	1.4	---	---
Fetlock	AP	64	1.8	72	1.2
	LAT	64	1.6	72	1.2
Knee	AP/Flex	64	1.8	68	1.2
	LAT/Obi	64	1.6	72	1.0
Splint Bone	LAT	60	1.6	70	1.0
Hock	AP/ High	65	2.2	72	1.6
	AP/ Low	65	1.8	72	1.4
	LAT	65	1.6	72	1.2
Stifle	LAT	---	---	80	2.5
	PA	---	---	80	4.5
Elbow	AP	---	---	80	2.5
	Other	---	---	80	2.0
< Alternative Techniques >					
Stifle	LAT	45 cm distance		80	1.8
	PA	45 cm distance		80	3.2
Navicular	AP	65 cm distance		70	3.2
	LAT	65 cm distance		70	2.9
Chest	Foal	85 cm distance		90	1.6
	300 lbs	85 cm distance		90	2.5
	500 lbs	85 cm distance		90	6.4
Sinus	LAT	85 cm distance		88	2.0
Shoulder	LAT	75 cm distance		88	5.0
	Obi	75 cm distance		88	6.4

**SMALL ANIMAL TECHNIQUE CHART
FOR THE
VET-20BT HYBRID BATTERY PORTABLE**

100 cm (40") SID,

GRID : 103 lines / 6:1 ratio

Film/Screen : Fuji RX-U/ Rare earth

Thickness (cm)	Skull / Pelvis / Extrim kVp /(mAs)	Thorax kVp/ (mAs)	Abdomen kVp / (mAs)
2-3	No grid : 50 / (0.8)		
4-5	No grid : 54 / (0.8)		
6-7	No grid : 54 / (1.0)	No grid: 66 / (0.8)	No grid : 60 / (1.2)
8-9	No grid : 60 / (1.2)	No grid: 70 / (0.8)	No grid : 60 / (1.6)
10-11	66 / (2.5)	No grid: 74 / (0.8)	No grid : 60 / (2.0)
12-13	70 / (2.5)	78 / (1.4)	64 / (3.2)
14-15	72 / (2.2)	80 / (1.4)	68 / (4.5)
16-17	72 / (3.6)	86 / (1.6)	68 / (4.5)
18-19	74 / (3.6)	90 / (1.6)	70 / (5.0)
20-21	76 / (4.0)	90 / (2.2)	74 / (6.4)
22-23	80 / (4.0)	90 / (2.4)	80 / (6.4)

NOTE: The above settings are recommended starting radiographic techniques. The quality of a final radiography depends on many factors including proper image density measurements and resolution.

Please follow the recommended adjustments and common rules below as necessary:

1. Add or subtract 2 kVp for 1 cm increase or decrease in thickness of any individual body section.
2. If images are too dark, decrease mAs value to the next lower value.
3. If images are too light, increase mAs value to the next higher value.

PART II. SERVICE MANUAL

1. Notice

- 1.1. Please observe following protocols when calibrating your device between periodical inspections or repairs.



CAUTION

Ionized radiation may be dangerous to patients and operators unless the following safety regulations are strictly observed.

- 1.2. This manual is designed to ensure correct use and operation of the VET-20BT. Please read this manual entirely before using this equipment.
- 1.3. Incorrect use and operation exceeding described conditions in this manual may cause permanent damage to this machine. Please pay special attention to all the warnings, cautions and notes incorporated herein.
- 1.4. This equipment should be used only by certified persons and practitioners.
- 1.5. Only use the AC cable and software developed and supplied by POSKOM.
- 1.6. POSKOM is not responsible for any infringement of patients or other rights for third parties alterations which may result from the misuse of this manual.
- 1.7. Always keep the manual for your reference.

2. Regular Maintenance

2.1. Overview

This device should be inspected regularly in accordance with the instructions described in this manual.

2.2. Periodical Inspections

1) Every 6 Month:

- A. Check all visual displays: display readout windows (FNDs), LEDs and other indicators.
- B. Check all functions: operation switches, collimator, laser pointer and program pad.
- C. Check all calibrations in accordance with section 4 of this service manual.
- D. Execute additional tests as required by local laws and regulations.

2) Every 12 Month:

- A. Check for damages to the outer case and operation console, including all buttons.
- B. Check cable connections to main body, hand switch cable, collimator cable and other connections.
- C. Open the top cover and check for any visible damage including missing or loosened ground connections, oil leakage, damaged cables, etc.
- D. Execute additional tests as required by local laws and regulations.

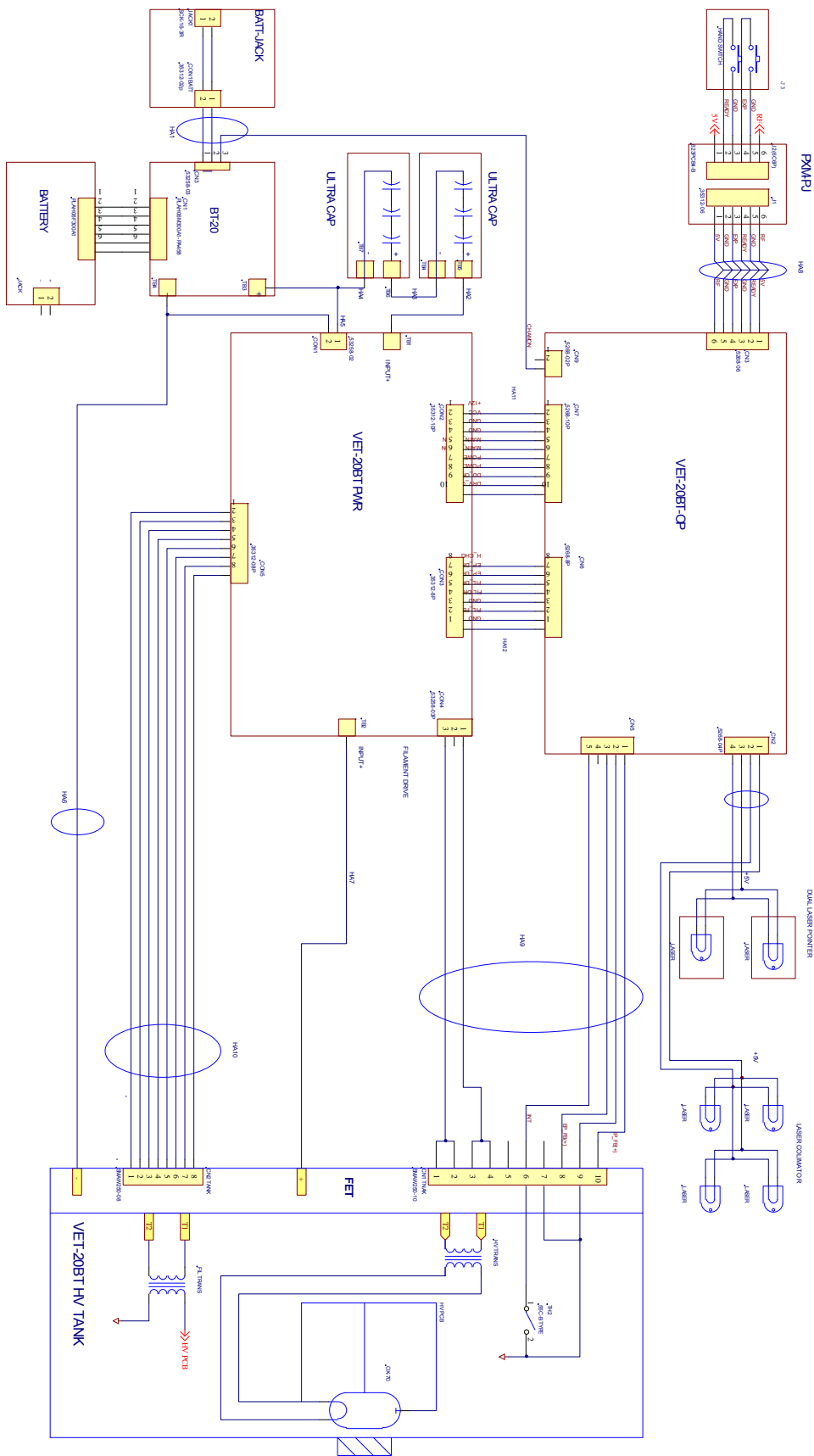
**NOTICE**

When cleaning, use a soft (microfiber) cloth. A slightly damp cloth may be used for excessive dirt. Harsh chemicals such as benzene should not be used in cleaning and may cause permanent damage to your device and its surfaces.

**WARNING**

This equipment should be handled and operated by certified persons and practitioners only.

3. Block Diagram



Materi: S. 19/15		Aspek/Detail		Identifikasi		POSKOM	
D		Tipe/Model		Tipe		VET-20BT	
C		No. Dokumen		No. Dokumen		VET-20BT-001	
B		Revisi		Revisi		1	
A		No. Dokumen		No. Dokumen		VET-20BT-001	
NO.		Konten		Konten		VET-20BT-001	

4. Calibration

* Preparation

Following tools and instruments are required for technical calibration.

- 1) Tools: Screwdrivers (No.1 & 2), Straight slot screwdriver
- 2) Instruments: DVM, oscilloscope (Tektronix TDS 3032 or equivalent device)

4.1 Power Supply

- 1) The device should be turned off before beginning.
- 2) Turn on the device.

4.2 Calibration 3 step process:

- Tube kV confirmation and calibration
- Tube mA confirmation and calibration
- Filament Preheat Calibration

A. Tube kV confirmation and calibration

- Turn the power OFF.
- Make sure all DIP switches on OP B/D are in the OFF position.

(Note: DIP switches are normally in this position.)

- **Channel 1:** Connect your oscilloscope probe to TP12 (IP F/B) and GND (TP2)
- **Channel 2:** Connect your oscilloscope probe to TP8 (EP F/B) and GND (TP2).


Channel 1 : mA, 1V = 5mA

Channel 2 : kV, 1V = 20kV

- Initial display of the OP console:



- Set kV to 50kV and mAs to 0.4mAs (20mA), then check the mA waveform of Oscilloscope **Channel 1**.
- If Oscilloscope **Channel 1** is not at 4V (20mA), adjust the mA output via the Calibration Mode.
- Next, observe the kV waveform 50kV (2.5V) of Oscilloscope **Channel 2**.
- Set kV to 90kV and mAs to 0.4mAs (15mA), then observe the mA and kV waveforms of Oscilloscope **Channel 1 and 2**.
- If **Channel 1** is not at 3V (15mA), control the mA via the Calibration Mode.
- Next, observe the kV waveform 90kV (4.5V) of Oscilloscope **Channel 2**.



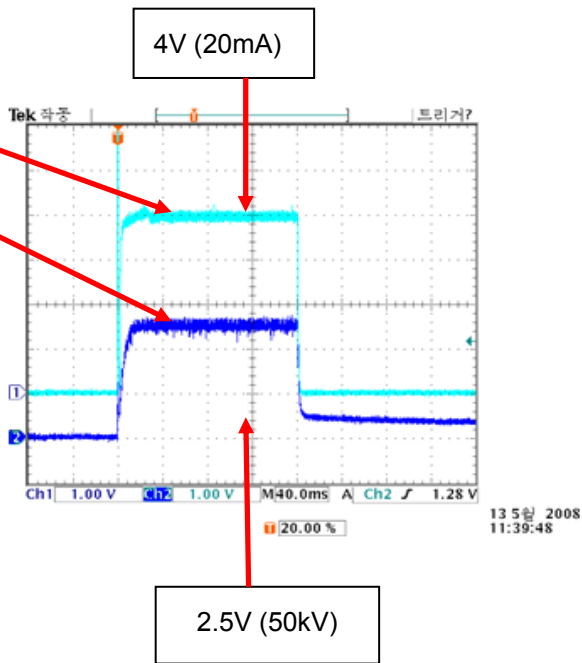
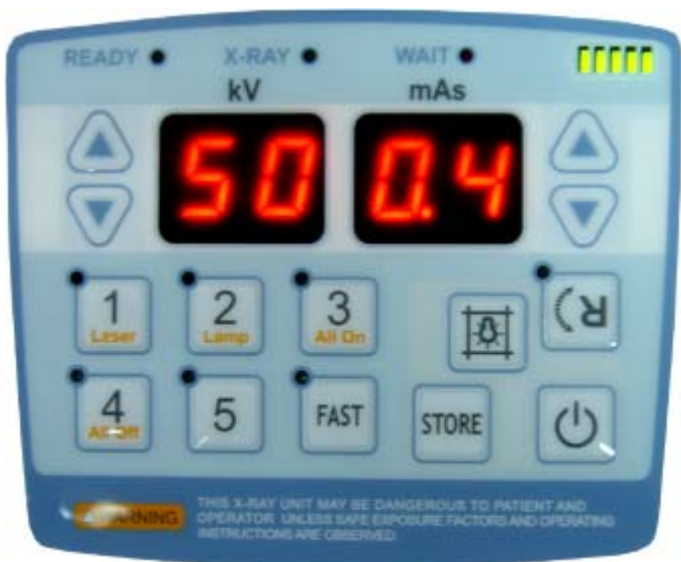
CAUTION
The kV value of **Channel 2** is auto-calibrated. There is no need for additional calibration.

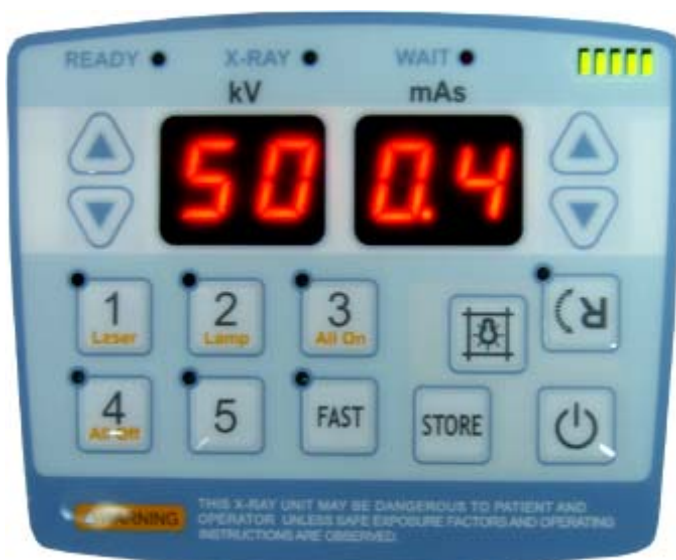
B. Tube kV confirmation and calibration

- Turn power OFF.
- Uncover the upper section where the OP board is attached.
- Check to see that OP Board SW1 DIP switch is OFF. (Note: This is the standard DIP switch position.)
- **Channel 1**: Connect oscilloscope probe to TP12 (IP F/B) and GND (TP2).
- **Channel 2**: Connect oscilloscope probe to TP8 (EP F/B) and GND (TP2).

Channel 1 : mA, 4V = 20mA
Channel 2 : kV, 2.5V = 50kV

As you turn the power on, the following display will be seen:





- Set kV to 50kV and mAs to 1.2mAs (20mA), then observe the mA waveform on oscilloscope Channel 1.
- If Channel 1 is not at 4V (20mA), the mA output may be adjusted on the OP B/D controls.
- Turn SW1 dip s/w pin 1 to the ON position (found on the soldered side of the OP board).

- kV indicator FND is displayed as "CX".



Calibration Code Calibration Data

- Push the kV up switch. (Refer to the "OP sheet").
You will see the following display:



Calibration Code Calibration Data

C1 is the calibration code of the tube current. (15mA at 81kV~90kV).
50 is the calibration value of the tube current. (15mA at 81kV~90kV).

- You can adjust the value by pressing the “mAs up/down” arrows. (Refer to the “OP sheet”).
- Press and hold the “Store Key” to set the new value. (Refer to the “OP sheet”).
- After storing the reset value, make an exposure.
- If the measured value is not 4V (20mA), you will need to re-set the calibration value.

C. Self-Measurement of kV, mAs & Sec.

- The VET-20BT generator has a built-in, Self-Measurement Tool (SMT). Technique factors, KV, mAs & time (seconds) can be measured without an external meter and the actual technique factors will be displayed on VET-20BT’s display window immediately after exposure. Please follow the next steps:
 - A. Turn the power on.
 - B. Select the KV & mAs values as such: 50KV/2 mAs
 - C. Click the “Reverse Display” (R) button twice (2x).
 - D. Press the “Exposure” control on the hand-switch and produce an exposure.
 - E. The actual KV, mA and time will be display sequentially in the KV & mAs windows.

D. Filament Preheat Calibration

- If the preheat calibration value or the VR1 calibration are off, there might be an over or under current to the tube.
- There are 2 ways to set Preheat calibration. Calibration data can be changed according to tube’s condition.
- VR1 calibration is applied to all scope of Tube kV on PCB.
Filament Preheat calibration data is applied to each Tube mA.
- Power ON.
- Turn “SW1 Dip S/W pin 1” on OP.
- As you press “APR Key No.1” once. The following display will be seen:



Preheat Calibration Code Preheat Calibration Data

P0 is the Filament Preheat Calibration Code. (Preheat Calibration Code of 20mA).

55 is the Filament Preheat Calibration Value. (Preheat Calibration Data of 20mA).

- You can adjust the value with mAs up/down Switch. (Refer to the “OP sheet”).
- After adjustment, push the “Store” key for more than 1 sec. (Refer to the “OP sheet”).
- If the waveform is over or under the intended value, you will need to re-set the calibration value. Push the kV up switch. (Refer to “OP sheet”).

The following display will be seen:



Preheat Calibration Code Preheat Calibration Data

P1 is the Filament Preheat Calibration Code. (Preheat Calibration Code of 15mA).

47 is the Filament Preheat Calibration Value. (Preheat Calibration Data of 15mA).

- You can adjust the value with mAs up/down Switch. (Refer to “OP sheet”).
- After adjusting, push the “Store” key for more than 1 sec. (Refer to “OP sheet”).
- After storing, make an exposure.
- If the waveform is over or under the intended value, you will need to re-set the calibration value.-

Table 1 shows the calibration code and value of each tube’s kV.

- Turn “Dip S/W No.1” OFF and then exit the calibration mode.



NOTICE

Calibration values are subject to change depending on the tube’s condition.



NOTICE

To repeat the P-> C (P: Preheat, C: mA) mode, push the APR Key No.1 once while in calibration mode.

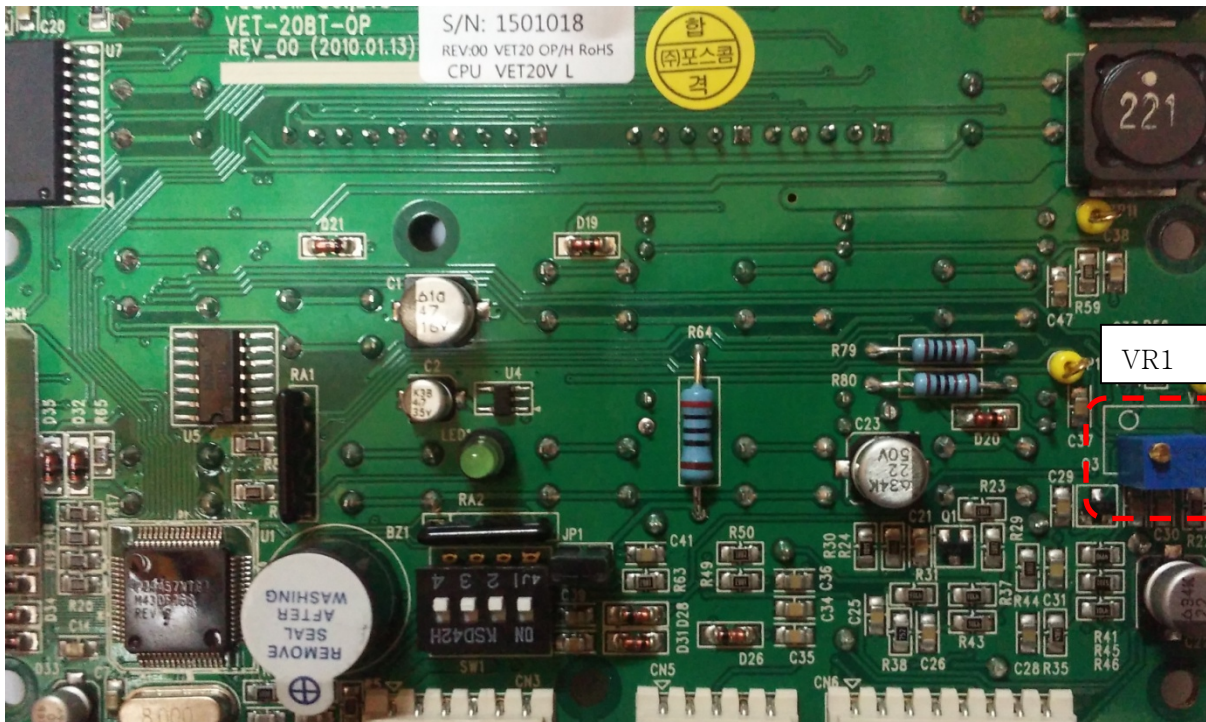


NOTICE

In regards to the “preheat calibration and mA calibration values,” please pay special attention to the decimal points in the preheat calibration codes.

EXAMPLE: P.1.00 = 200 and P1.00 = 100

E. VR Info



VR Number	Adjusted Values	Direction		REMARK
		LEFT (Anticlockwise)	RIGHT (Clockwise)	
VR1	Preheat	Increase	Decrease	

5. Calibration Code and Data

[TABLE 1. mA Calibration Data]

Code	Tube kV	Initial Data	Data Range	Tube mA	mAs
C0	50kV ~ 80kV	200	0 ~ 249	20mA	0.4 ~ 3.2
C1	81kV ~ 90kV	150	0 ~ 249	15mA	0.4 ~ 3.2
C2	50kV ~ 80kV	100	0 ~ 249	10mA	3.6 ~ 20
C3	81KV ~ 90kV	80	0 ~ 249	8mA	3.6 ~ 20

[TABLE 2. Filament Preheat Calibration Code and Data]

Code	Tube mA	Initial Data	Data Range
P0	20mA	152	0 ~ 199
P1	15mA	145	0 ~ 199
P2	10mA	142	0 ~ 199
P3	8mA	137	0 ~ 199



NOTICE

When encountering continuous “Err” messages, discontinue use of your device immediately and contact POSKOM or one of its authorized distributors for assistance.

6. Error Code and Resolutions

6.1 When the hand switch is non-operational, check to see if the hardware values are more than EP=10kV, IP=5mA, FIL=0.1V F/B,

Code No.	Description	Resolution
Err. 10	Filament feedback over	Calibration or change OP B/D
Err. 11	kV feedback over	Calibration or change OP B/D
Err. 12	mA feedback over	Calibration or change OP B/D.

6.2 When the "Ready Exposure" mode is malfunctioning, check the filament conditions and if the hardware value is less than FIL=0.35V F/B, this will be the cause of the error code.

Code No.	Description	Resolution
Err. 14	Filament feedback over	Calibration or change OP B/D

6.3 Error at Exposure

EP, IP Low Error: lower than Min. (30kV) value ->Error

EP, IP over Error: higher than Max. (100kV) value -> Error

EP, IP State Low Error: lower than output kV (-10kV) -> Error

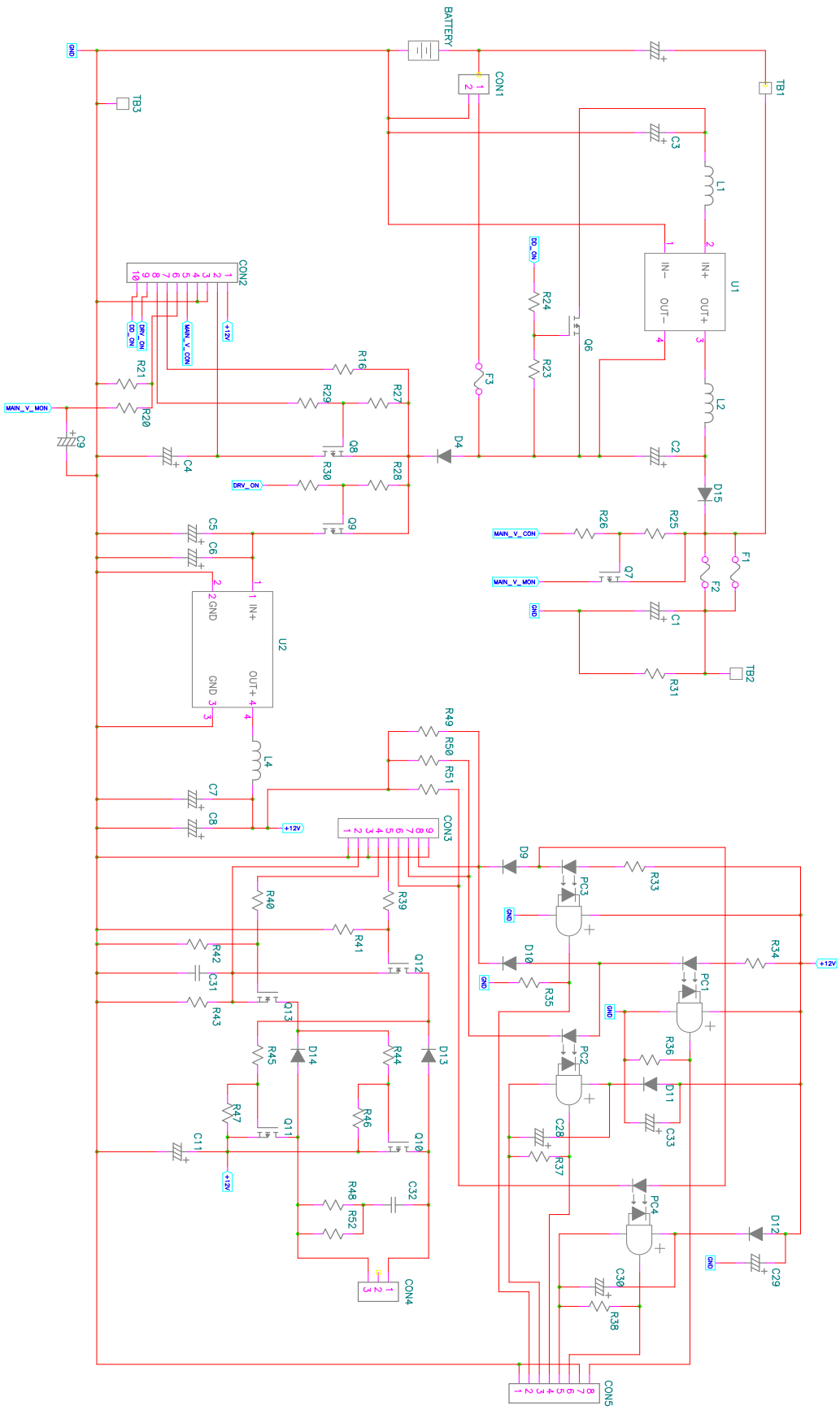
EP, IP State over Error: higher than output kV (+10kV) -> Error


Code No.	Description	Resolution
Err. 15	kV feedback low detect err at exposure	Calibration or change OP B/D
Err. 16	mA feedback low detect err at exposure	Calibration or change OP B/D
Err. 17	kV feedback over detect err at exposure	Calibration or change OP B/D
Err. 18	mA feedback over detect err at exposure	Calibration or change OP B/D
Err. 19	-10kV kV feedback low detect err at exposure	Calibration or change OP B/D
Err. 20	+10kV kV feedback low detect err at exposure	Calibration or change OP B/D
Err. 22	-10kV mA feedback low detect err at exposure	Calibration or change OP B/D
Err. 23	+10kV mA feedback low detect err at exposure	Calibration or change OP B/D

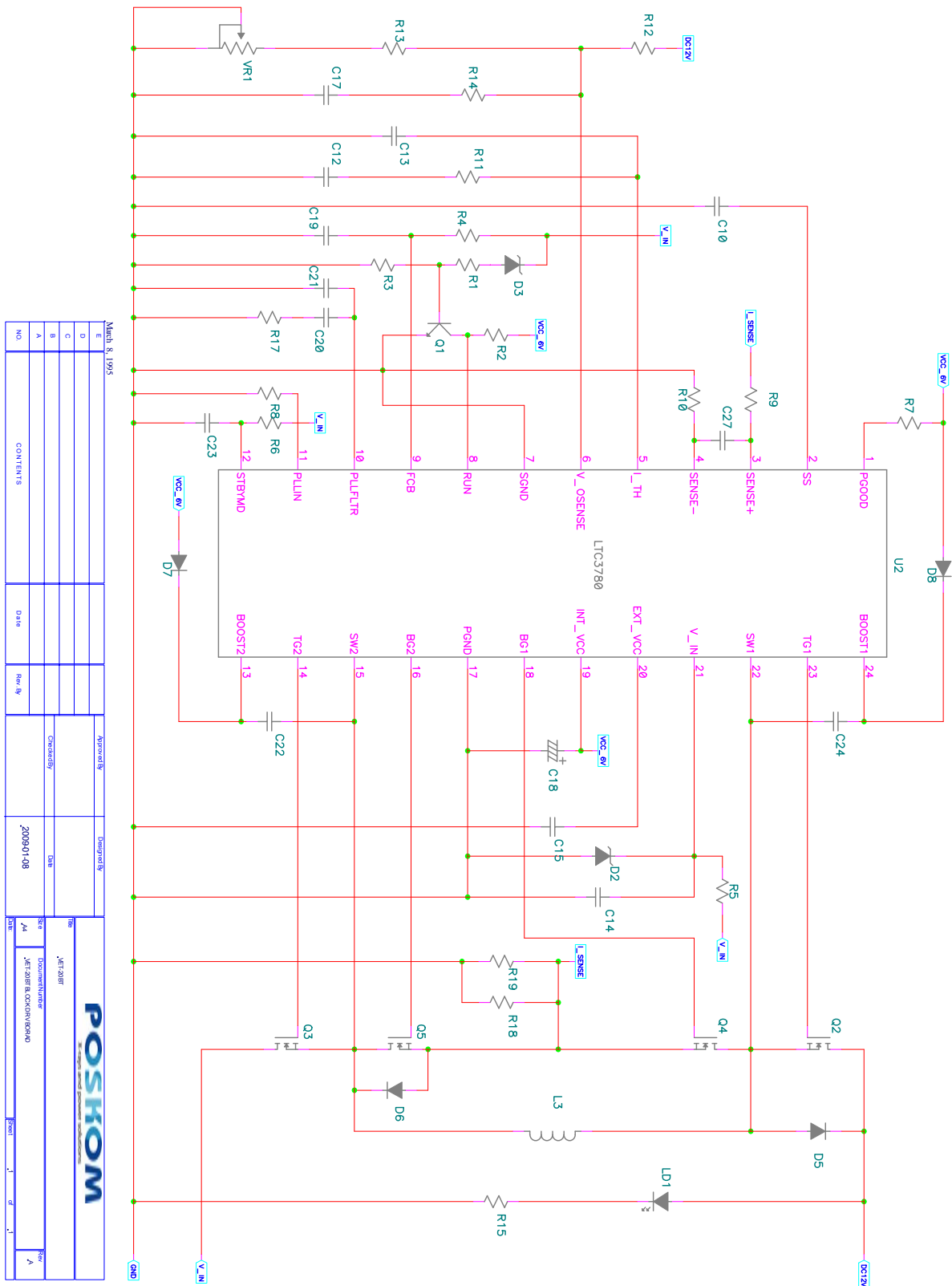
6.4 Inter_Lock Error

Err Code	Description	Resolution
Err. 21	Tank Thermal S/W check	

7. Schematics



March 8, 1995		Approved by		Designed by			
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D						VET-20BT	
C						Document Name	
B						J.VET-20BT10A.CHEM/REV.0	
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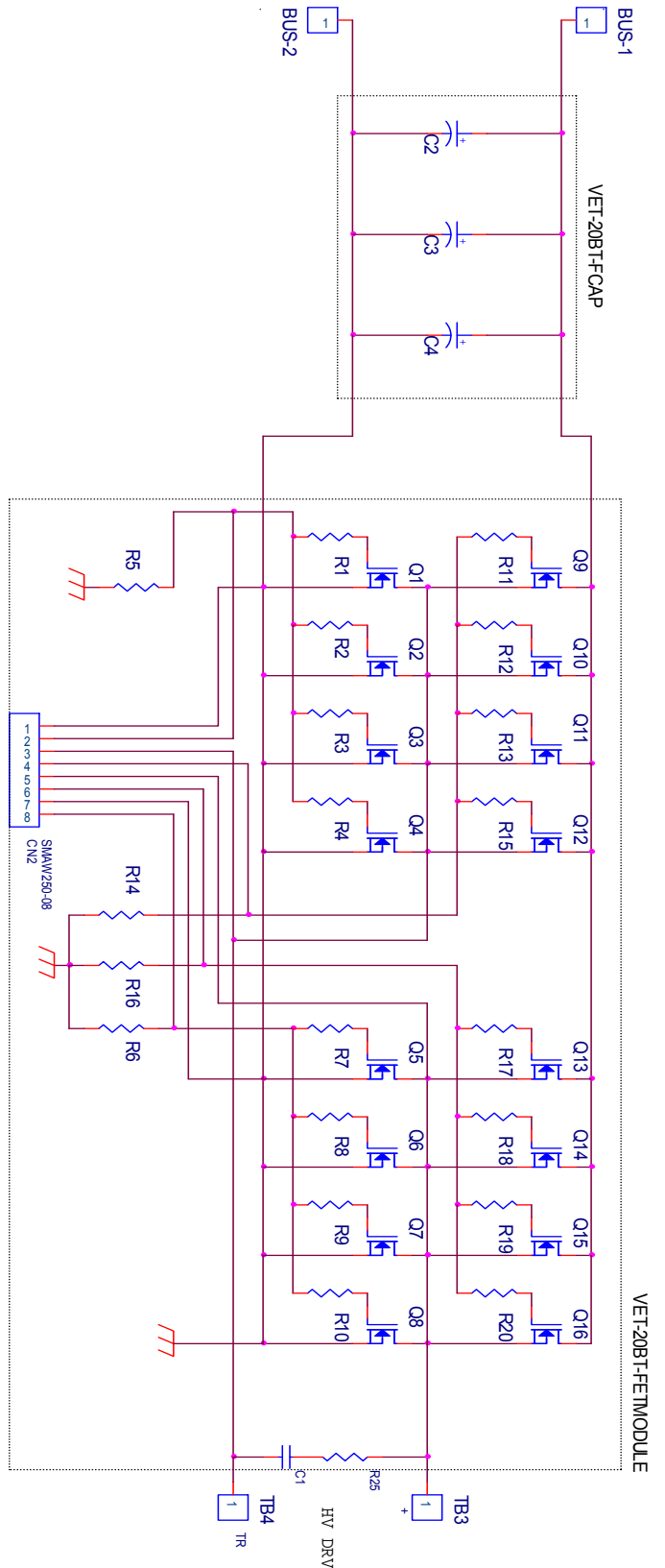


March 8, 1995

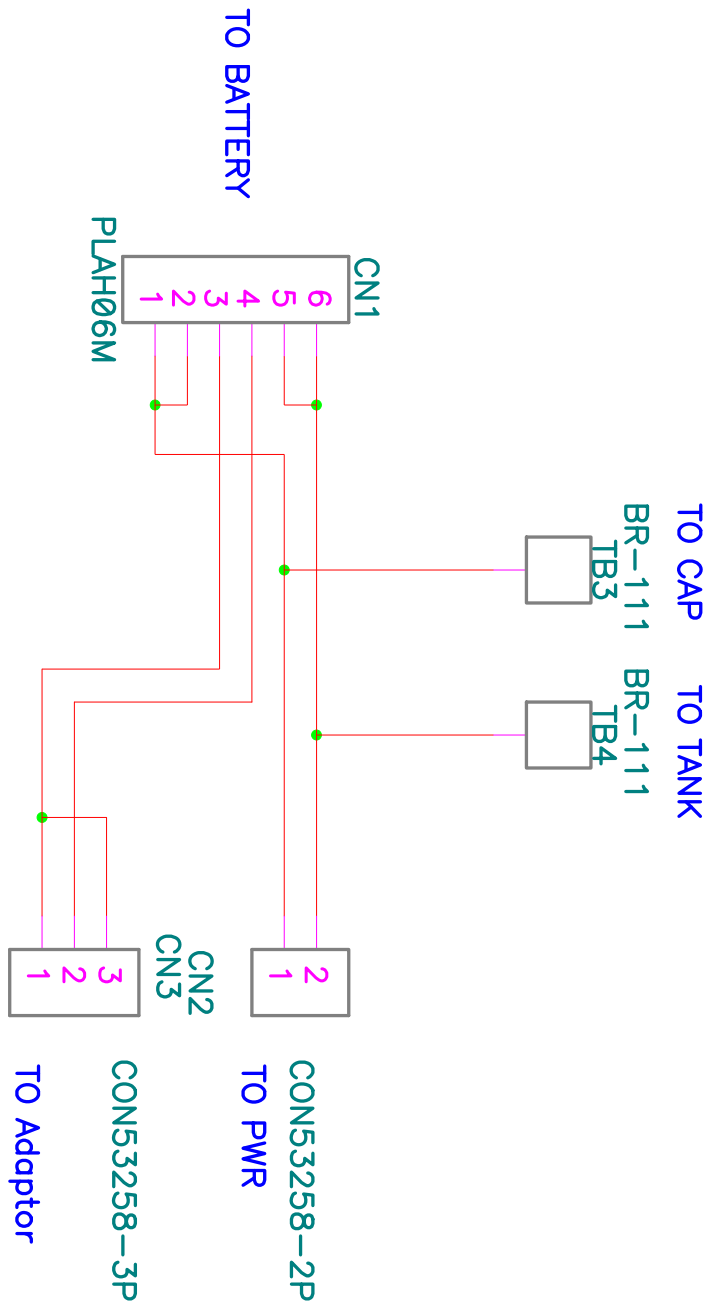
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 Checked By: _____
 DATE: 2009-01-08
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 DATE: _____

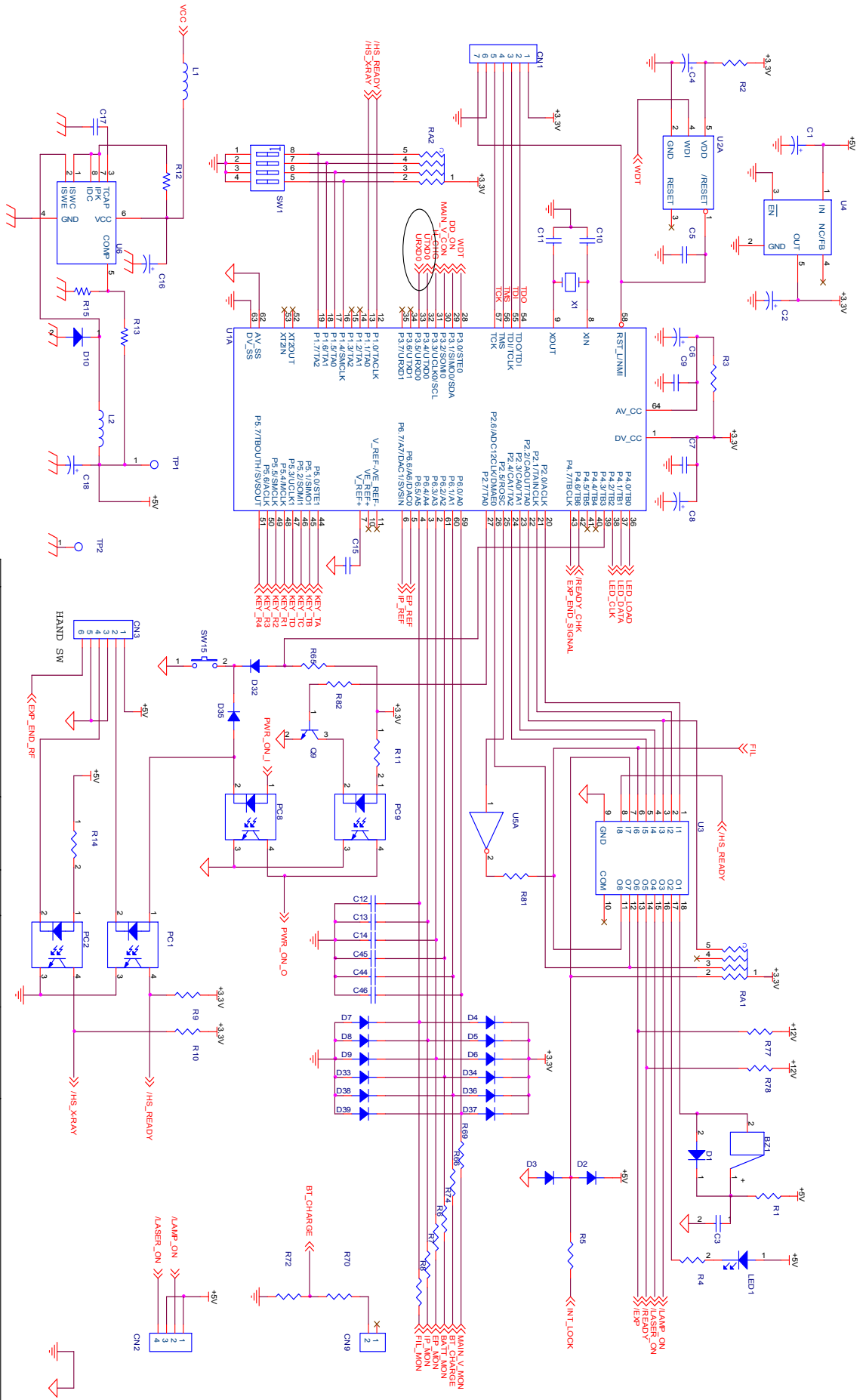
POSKOM
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 Jl. Raya Klaten - Sukoharjo
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D				VET-20BT	
C		Checked By	Date	Size	Document Number
B				A4	VET-20BT FET MODULE
A			2009-01-08	Date	Monday, January 12, 2009
NO.	CONTENTS	Date	Rev. By	Sheet	1 of 1



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C					
B		Checked By	Date		
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		Title		VET-20BT	
		Size		A4	
		Document Number		VET-20BT BT-20	
		Date		Monday, January 12, 2009	
		Sheet		1 of 1	
		Rev		00	

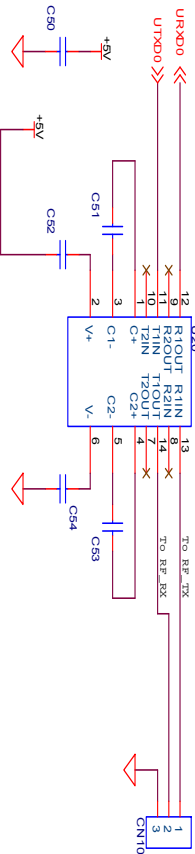
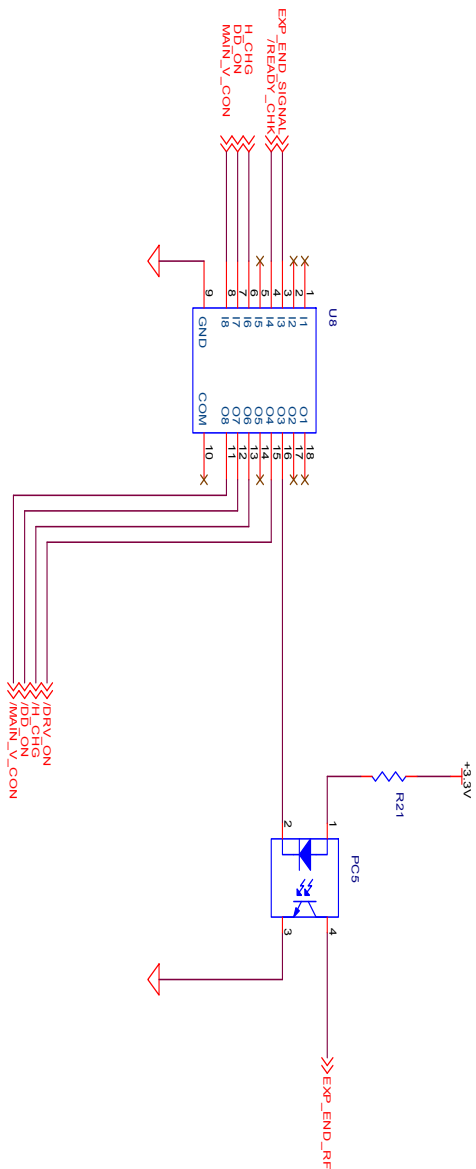


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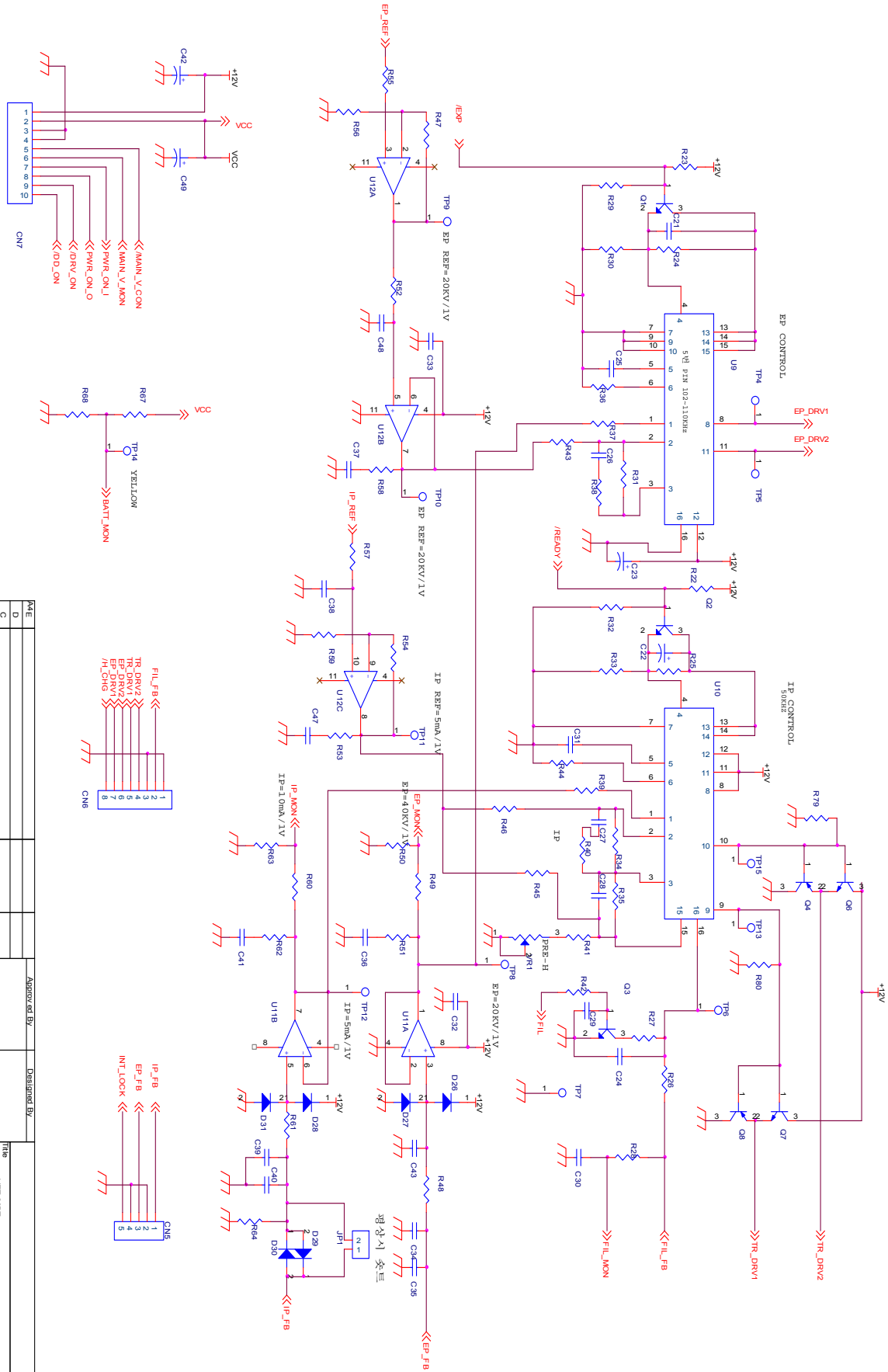
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A		Date	Rev. By	
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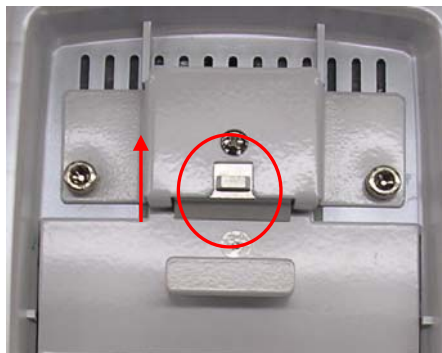
Rev	Rev A	Rev B	Rev C	Rev D	Rev E
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Date					
Rev. By					
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Checked By					
Date	2009-01-08				
Title	VET-20BT				
Document Number	QP (DRV)				
Size	1 of 1				
Rev	A				
Date	Wednesday, December 24, 2008 9:58 AM				

8. How to replace Battery

8.1 Loosen the bolt located on the bottom of the unit as seen below (red circle).



8.2 Move the grip towards the front of the unit as shown by the red arrow in the picture below.



The battery cover will slide off easily.

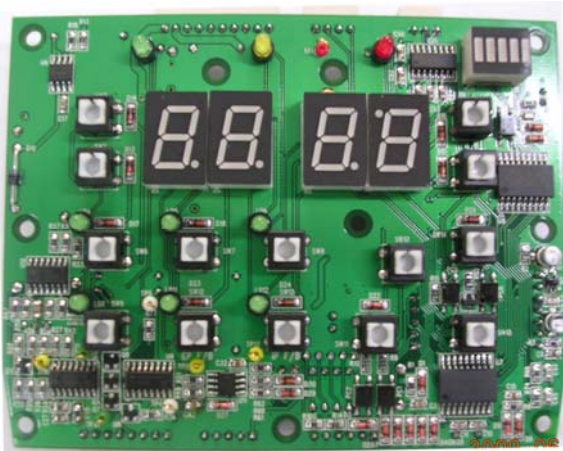
8.3 Grab a hold of the handle and gently pull upwards until the battery is separated from main body of the unit.



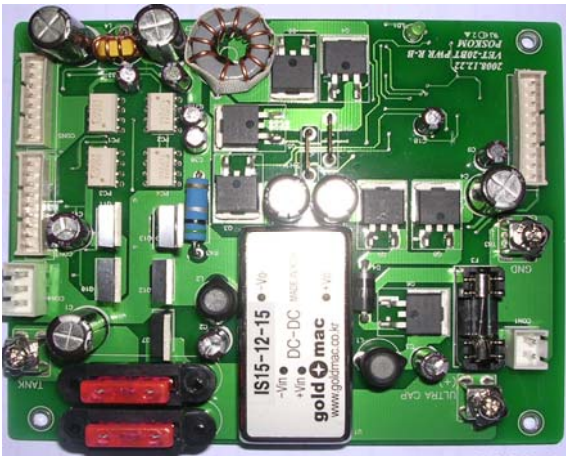
8.4 Replace the new battery into the body of the unit and follow the above steps in reverse order to reassemble your unit.

9. Composition

9.1 Operation Panel



9.2 Power Board



9.3 Ultra Capacitor Board



9.4 Battery



9.5 Battery Charger



Service Request Form

This form must be completed fully and submitted with any POSKOM x-ray products returned for warranty considerations or repair services.

A. General Information

- A. Product name : _____
- B. Serial number : _____
- C. Date received : _____
- D. Date installed : _____
- E. Date defective found : _____
- F. At what stage did your device fail:
 - At the initial inspection upon receipt? or After storage?
 - During the course of an installation? or During actual service in the field?

B. Detailed Information

- 1) Symptoms in detail: _____
Highest condition used at: _____ kV _____ mAs
Most frequently used at: _____ kV _____ mAs

- 2) Describe any problems experienced:

Setting at time of failure: _____ kV _____ mA/mAs _____ sec
Describe any unusual occurrences: _____
Abnormal symptoms prior to failure: _____
Abnormal symptoms at time of failure: _____

- 3) Please include any additional details or documentation (e.g., photos, purchase orders, receipts) that may assist in troubleshooting the problem.

Full Name _____	Phone _____
Signature _____	Fax _____
Company/Hospital _____	Email _____
Website _____	Date _____