EVA – HF 325/525

SERVICE MANUAL

（ HIGH FREQUENCY RADIOGRAPHY X-RAY SYSTEM ）

Technical Publication

Ver 4.0P

CE
0499

Only EVA-HF 525 model

Technical Publication
Ver 4.1P

INSTALLATION

EVA-HF325/525

TABLE OF CONTENS

1. INTRODUCTION

Installation person, operator and patient always be careful their head at the tube or assembling collimator

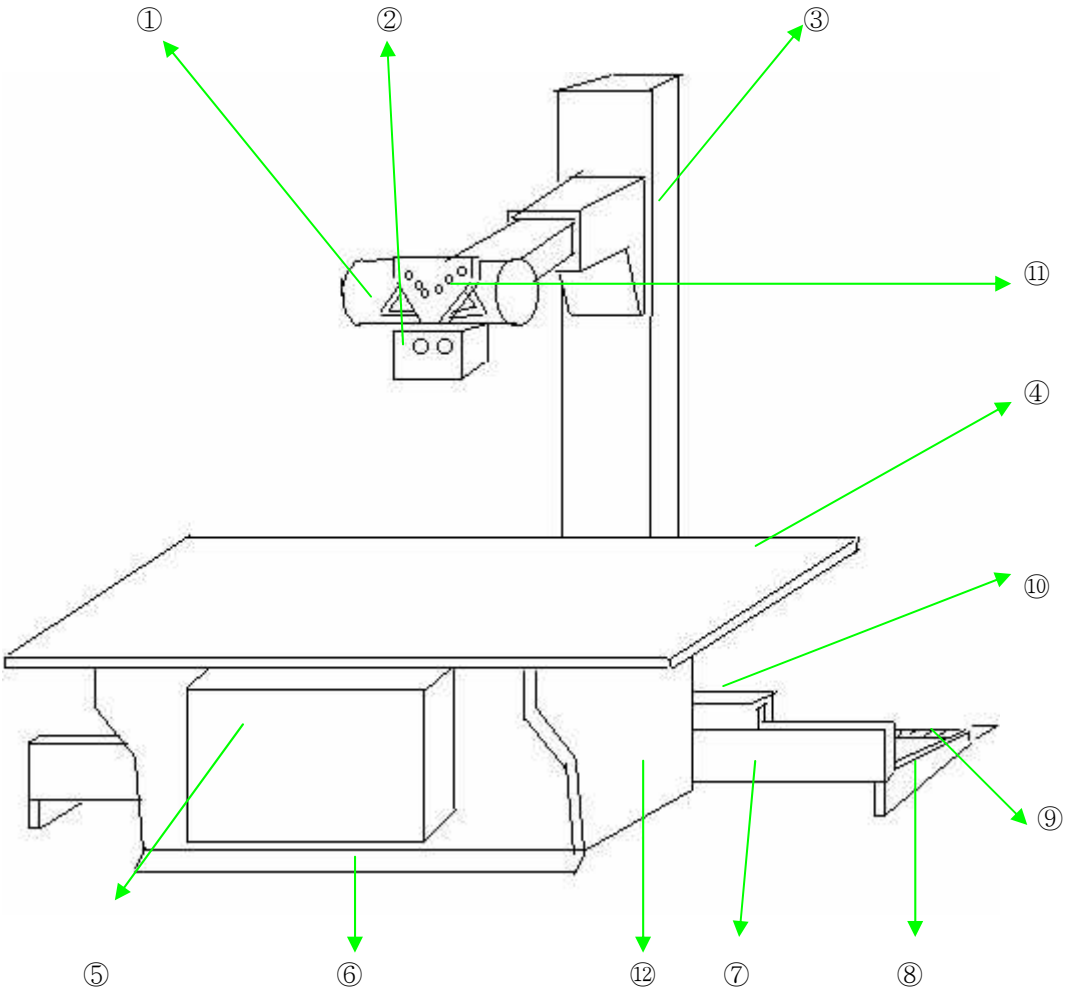
Installation person, operator and patient always be careful their leg and foot under the table when moved or used machine.

Installation person, operator and patient always be careful their hand at the sharp part or need the electronic safety

I Installation person, operator and patient always be

of electrical shock or damage

2. COMPOSITION



①TUBE
②COLLIMATOR
③STAND
④TOP TABLE
⑤X-RAY GENERATOR
⑥TABLE MOVEMENT S/W
⑦ RAIL
⑧RAIL SURPPORT
⑨CABLE DUCT
⑩STAND GUIDE
⑪HANDLE BAR
⑫TABLE

3. ELECTRIC ENVIRONMENT

Table. Line Power requirement

GENERATOR MODEL	EVA-HF325	EVA-HF525
Max.Power kW	37.5kW	40kW
Maximum mA	300mA	500mA
Maximum kVp	125kVp	125kVp
Power Line	210 -230VAC, Single-Phase, 50/60Hz	

Table. Line impedance requirement

LINE VOLTAGE	GENERATOR POWER(37.5 kW)
208 VAC	0.053Ω
230 VAC	0.065Ω
240 VAC	0.070Ω

The installation should comply with all the electrical requirements indicated in this document. These requirements should be upgraded if Local Standards are more stringent.

RMS Line current during a X-ray exposure, generator stand-by consumption(W),
the differential sensitivity(mA) and the thermomagnetic breaker should be:
Maximum power line impedance :

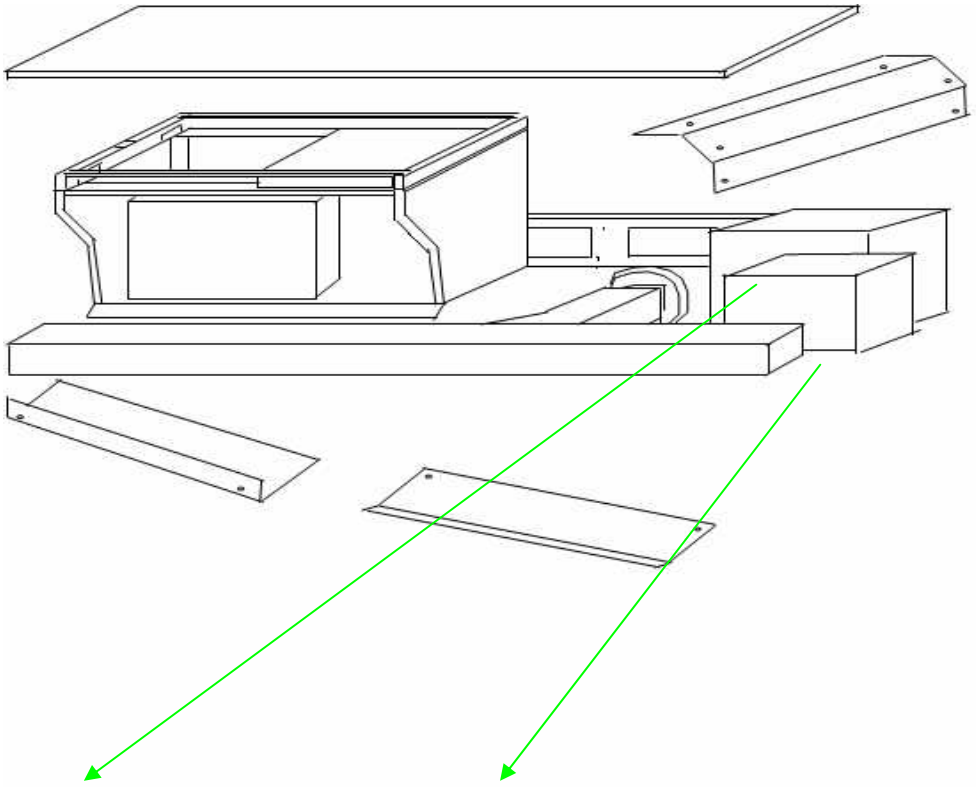
Table. Magnetic breaker requirement

LINE VOLTAGE	SINGLE-PHASE(37.5kW)
208VAC	273 A
230VAC	245 A
240VAC	232 A
Minimum kVA required	Maximum kW ×1.2
Stand-by Consumption	500 W
Differential Sensitivity	30 mA
Thermomagnetic Breaker	*50% of the RMS line current* *(RMS = momentary line current based on 100ms X-ray exposures)*
Below 210VAC requires an auxiliary boost transformer to adequate the line voltage to the generator input	

Table. Wire size requirement
(SINGLE-PHASE 1Ø)

Line voltage	Wire size at ;	
	15m	30m
208 VAC	50 ㎟	105 ㎟
230 VAC	50 ㎟	105 ㎟
240 VAC	50 ㎟	95 ㎟

4. PACKING



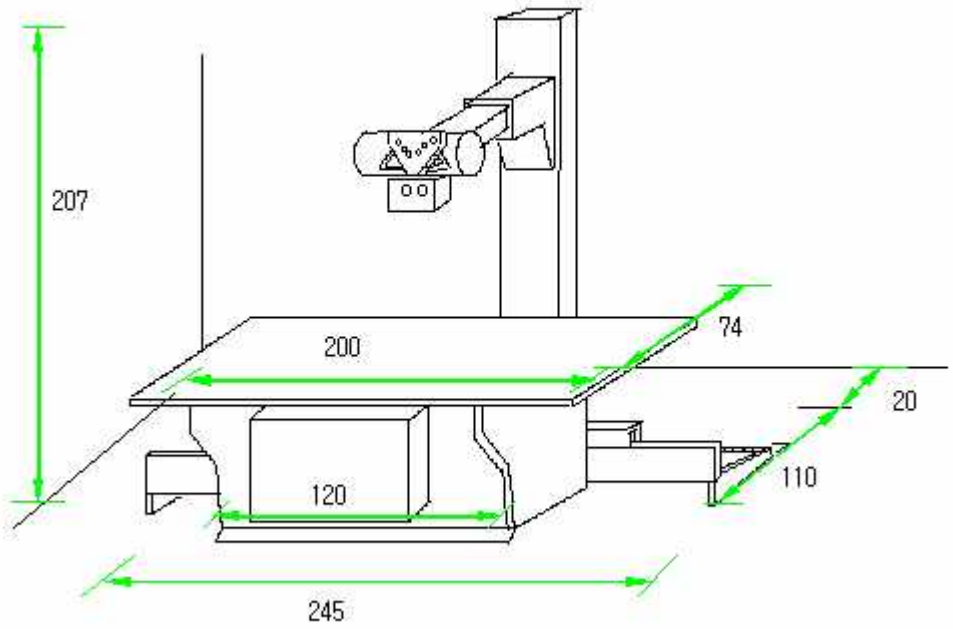
tube assembly

stand guide

The generator is shipped in Table to facilitate transport and installation.
Upon receipt of the X-ray unit and associated equipment, inspect all shipping containers for signs of damage. If damage is found, notify the carrier or his agent immediately.

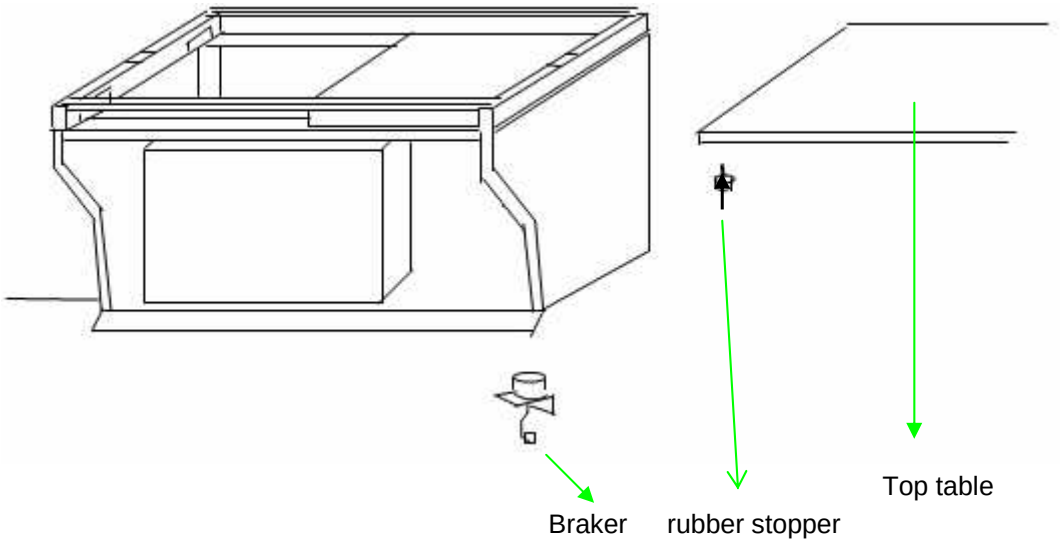
5. DIMENSION

1. Tube forward and backward movement range : 185mm
2. X-axis center rotation angle range : over ± 90˚
3. Z-axis center rotation angel range : over ± 90˚
4. Ttube max upward movement : above ground 1720 mm
5. Tube max downward movement : above ground 650 mm
6. Tube up and down movement range : 1170 mm
7. Tube left and right movement range : 1940 mm
8. Table forward and backward movement range : 200mm
9. Table left and right range : 600mm



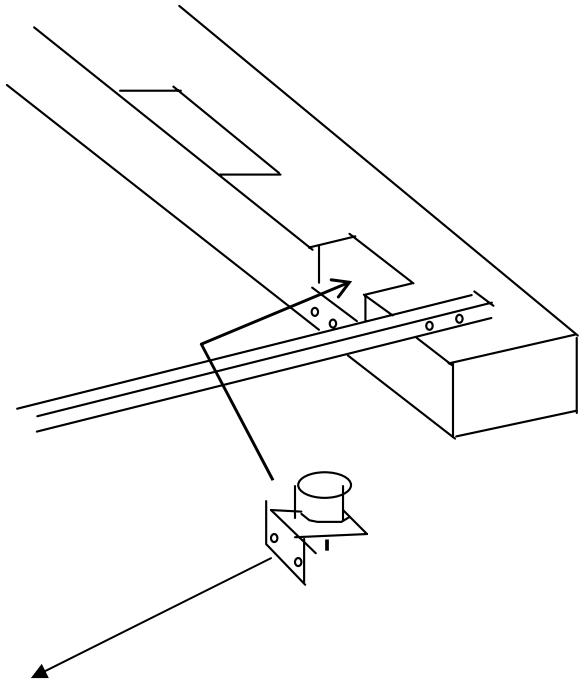
Total weight : 430kg

6. INSTALLATION

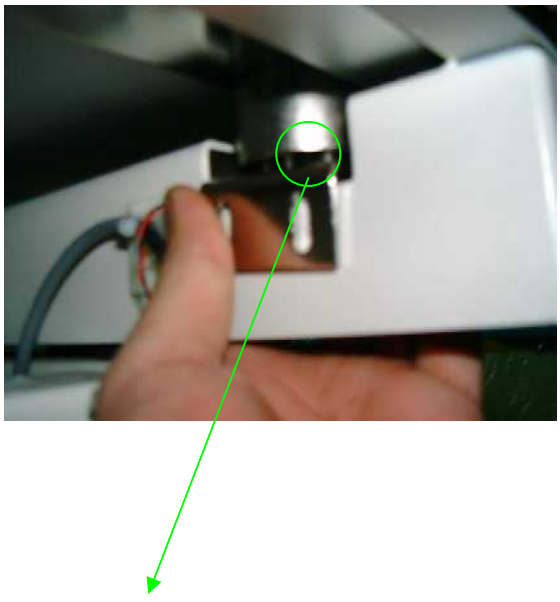


1. Put in top table to table.(first, remove rubber stopper and insert rubber stopper after insert top table)

2.connect braker into table.



Breaker



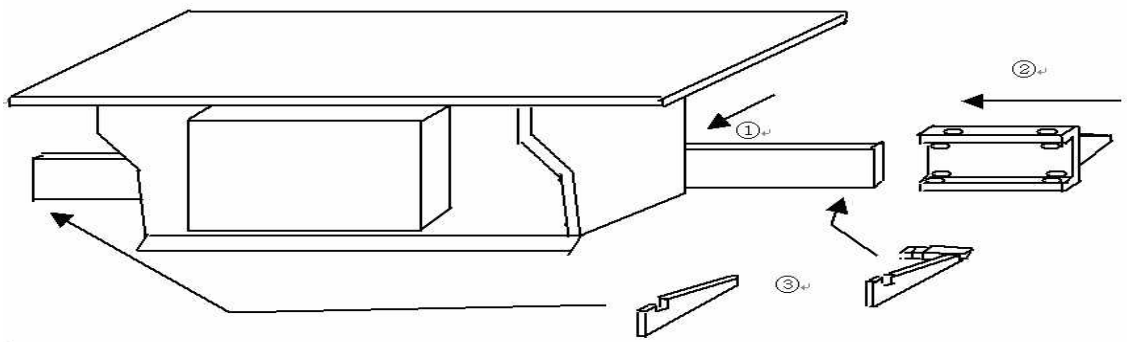
interval : 4 - 6mm

When heavy person be on the bed, consider interval of locker and bed (about 5 mm)
And fix with volts and wind tightly.

3.Connect rail to table.

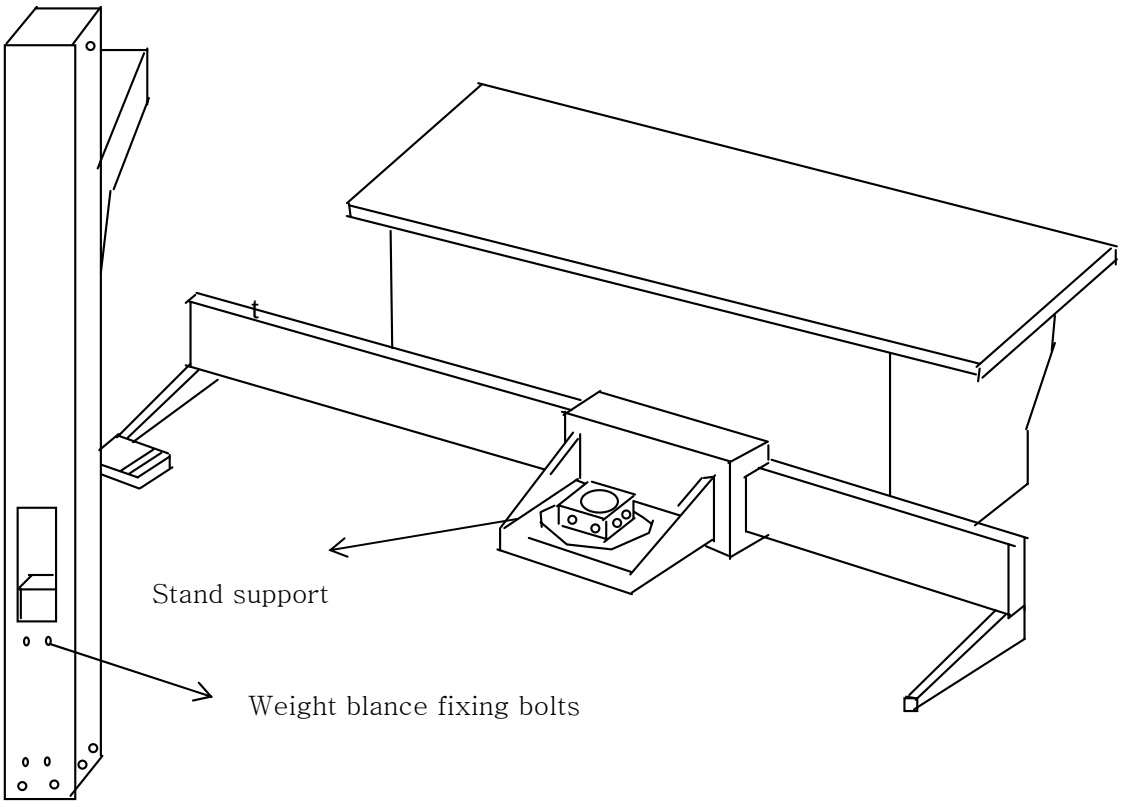
4.Put in stand support to rail.

5.Lift up rail with rail support.



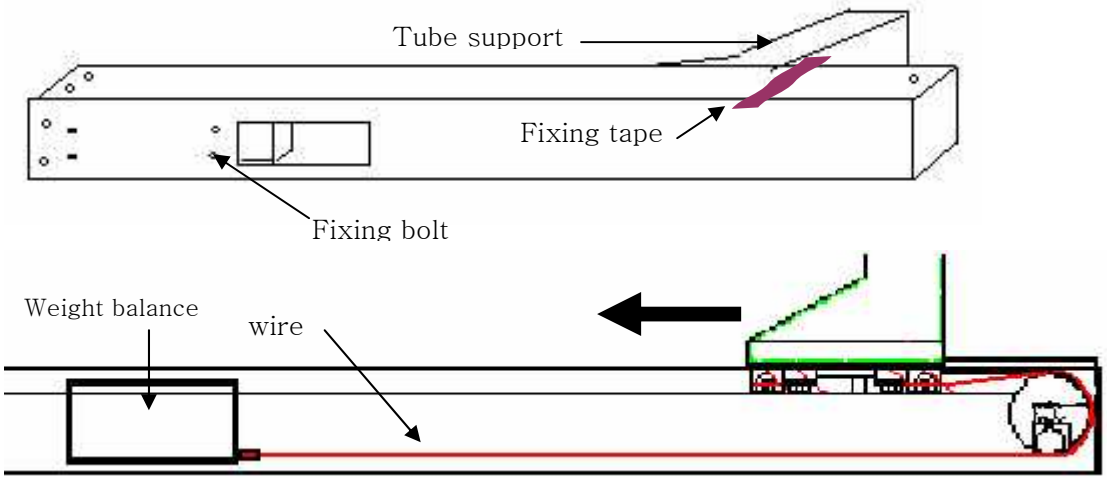
① Rail ②Stand support ③Rail support

6.Connect stand into stand support.

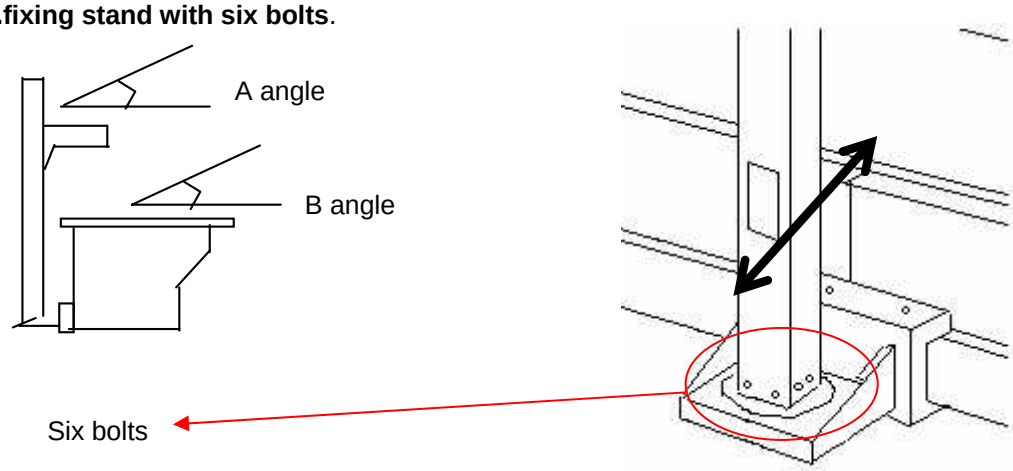


Tube support and stand ware fixed with tape(or wire).
This fixing tape should be remove the last.
Because, wire inside stand would be not tangle.
Tube support must be face below direction(direction of weight balance)

Pic. Stand assembly and inside drawing

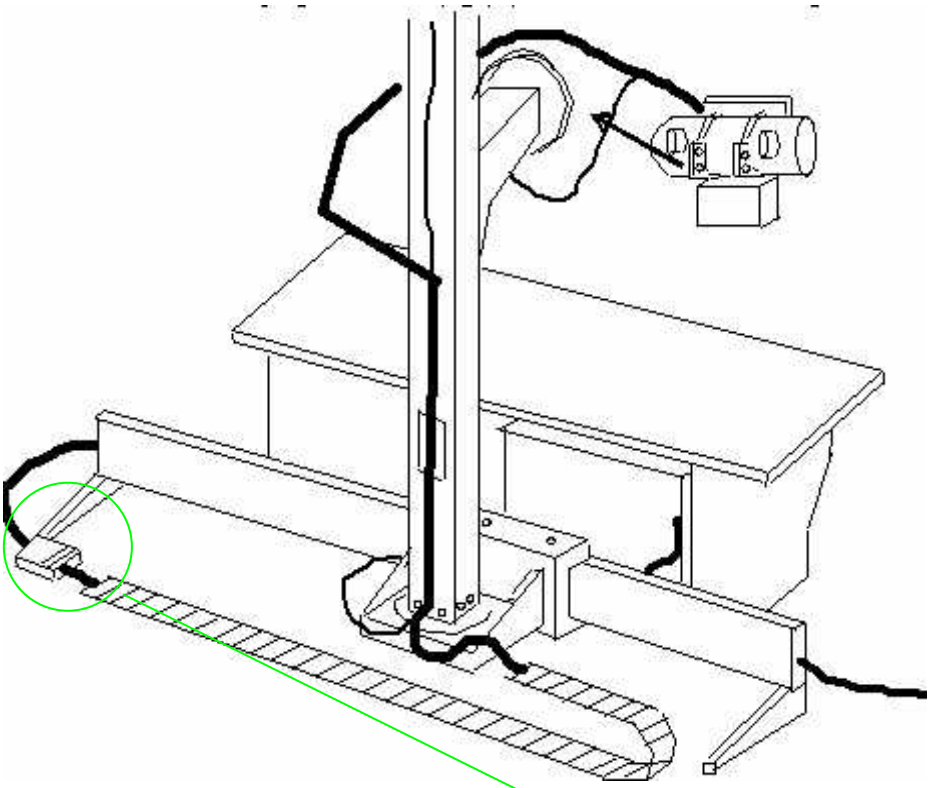


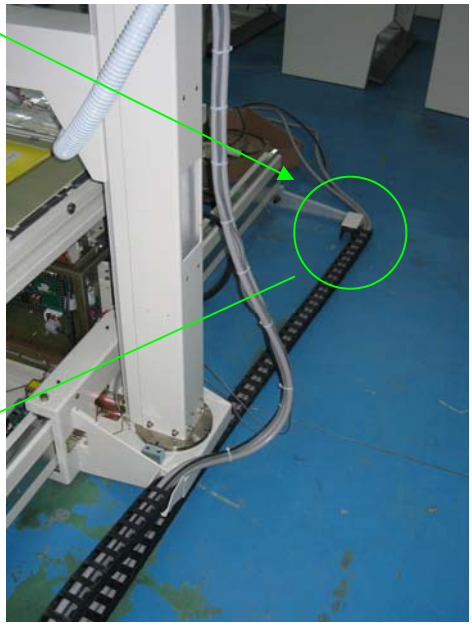
7.fixing stand with six bolts.



Using the six bolts contrast A angle and B angle equaled
And then remove fixing bolt in weight balance.

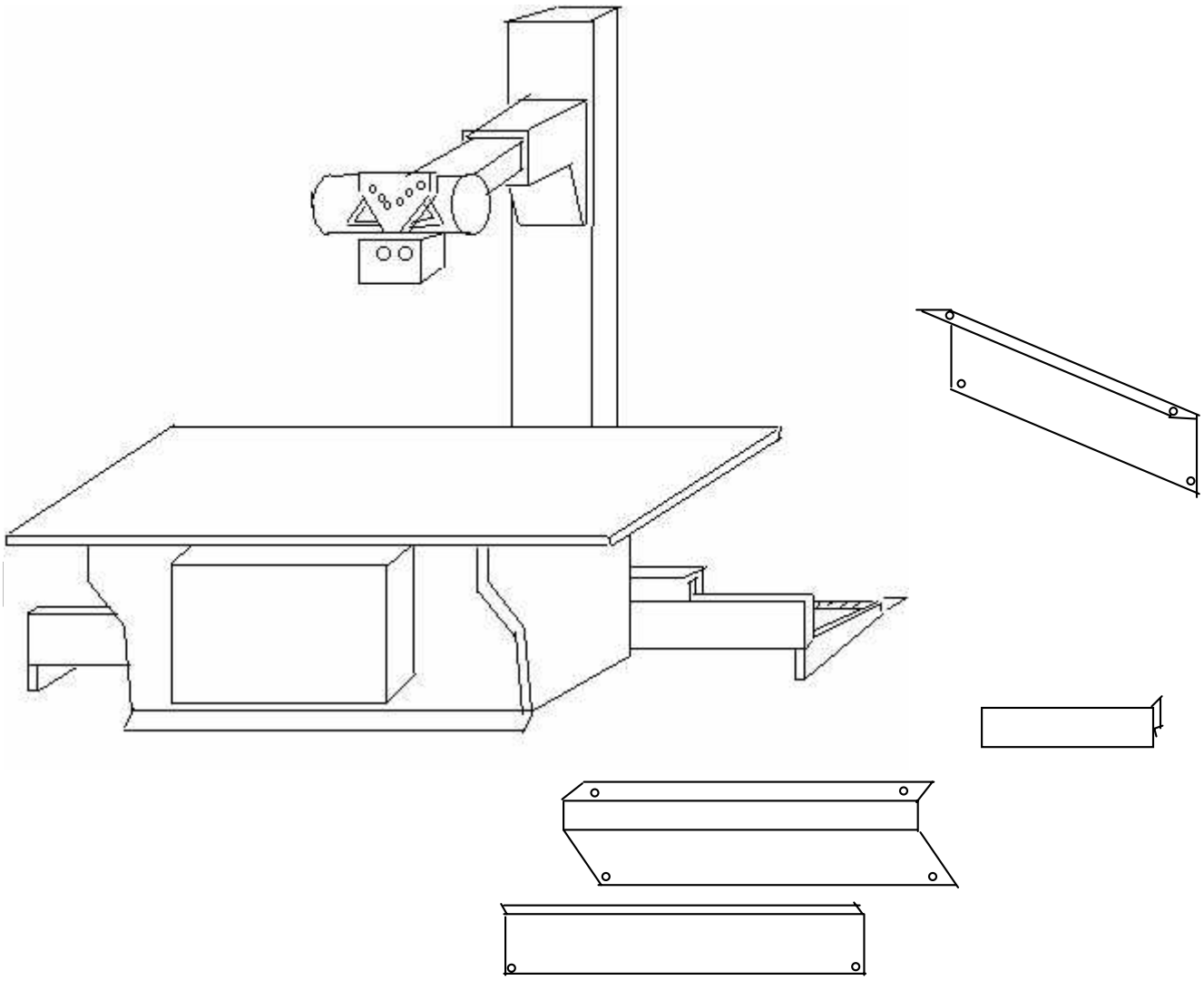
8.fixing the tube assembly into tube support and cable connection.





Connect cable duct into rail support

9.fixing all cover.



Insert rail-cover into rail and sticking.
(Release the dish-head-bolt and tighten with the rail-cover by the bolt.)

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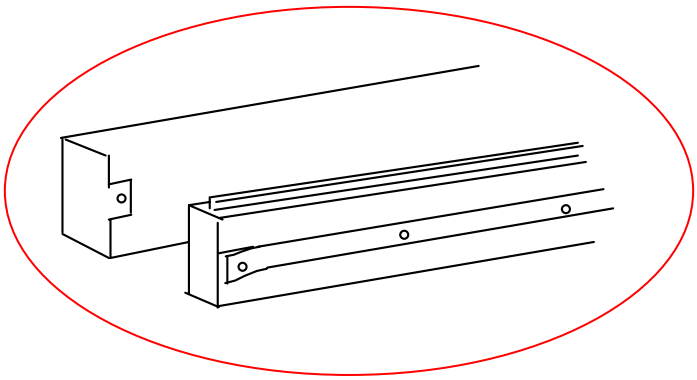
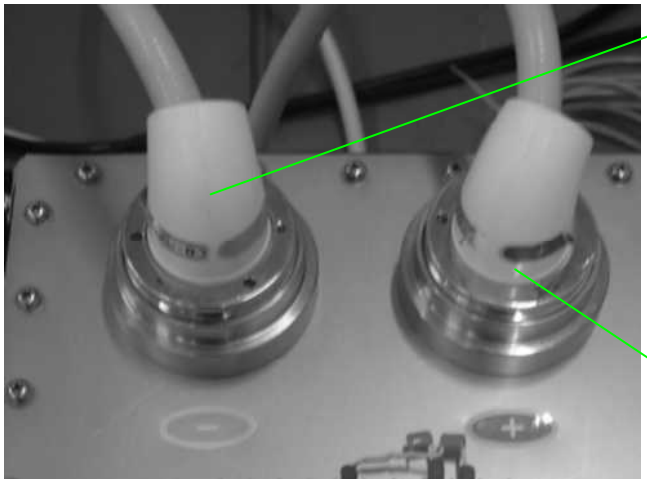


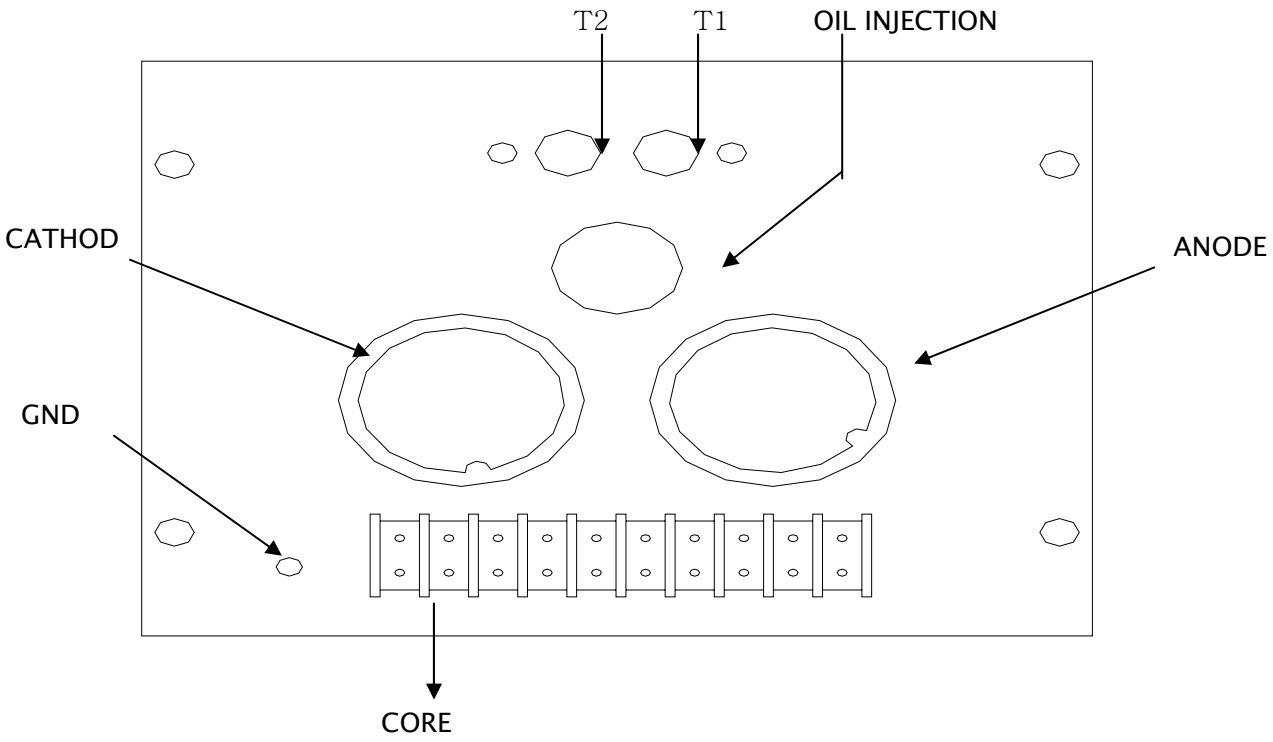
10.connection HV cable and terminal connection

HV cable Connection

When you are connecting high voltage cable, be careful of its polarity.

*CAUTION: Cable must be connected deep into the hole.



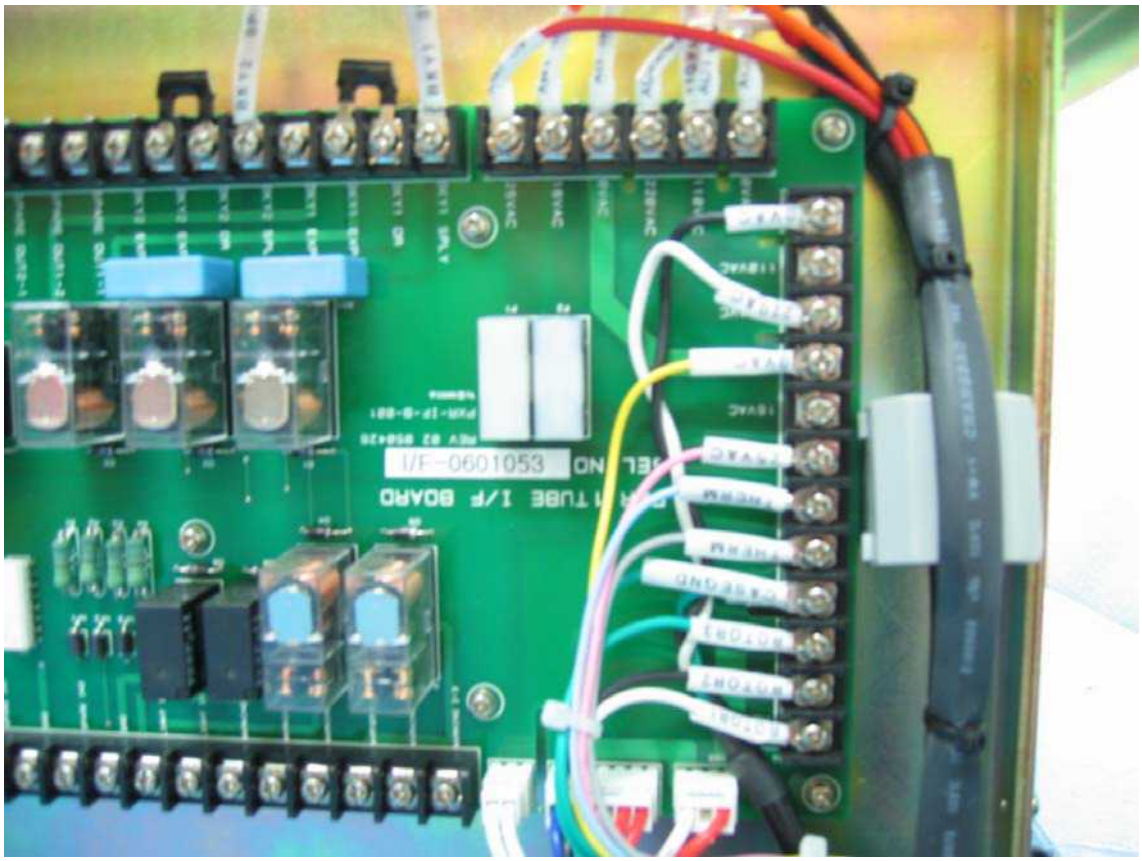


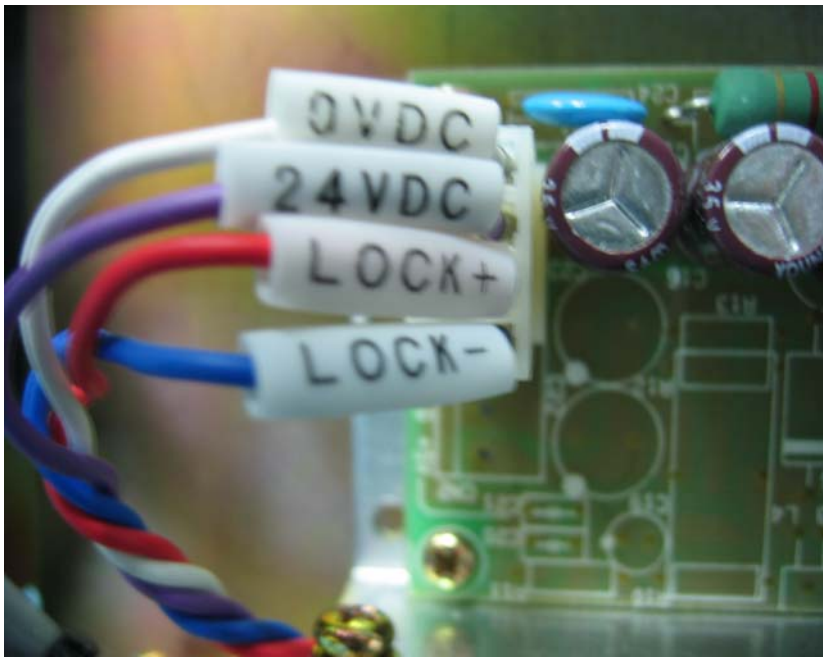
* CORE

No.	Symbol	Description	Remark
1	mA TP+	mA Test Point (+)	mA & mAs Meter Connection
2	mA TP-	mA Test Point (-)	
3	F-L	Large Focus of Filament	
4	F-COM	Common	
5	F-S	Small Focus of Filament	
6	mA +F/B	mA Feedback (+)	
7	mA -F/B	mA Feedback (-)	
8	kV +F/B	kV Feedback (+)	
9	INT	Tank Interlock	
10	GND	Ground(Earth)	

11. Board and terminal connection

11.1 I/F Board and terminal connection





Terminal connection

1. +24VB : Handel Bar Board Relay Power (+) AND (LAMP Power)
   Stand Bulky Driving Magnetic Conductor Power (+) AND (LAMP Power)

2. +24VB GND : Handel Bar Board Relay Power (-)
   Stand Bulky Driving Magnetic Conductor Power (-)3.

3. 0VAC : Collimator Power Cable

4. 25VAC : Collimator Power Cable

5. 0VAC : Table Bulky Power Cable (Table Board Power 0VAC com)

6. BKY1 EXP2 : Table Bulky Power Cable

7. 0VAC : Table Bulky Power Cable

8. BKY2 EXP2 : Stand Bulky Power Cable

9. 0VAC : Stand Bulky Power Cable

10. THERM : TUBE Over-Heat Protection Cable

11. THERM : TUBE Over-Heat Protection Cable

12. ROTOR1(W/COM) : Tube Rotor Connection Cable

13. ROTOR2(B/MAIN) : Tube Rotor Connection Cable

14. ROTOR3(G/AUX) : Tube Rotor Connection Cable

15. 110VAC : Table Board Power Cable

16. 0VAC : Table Board Power Cable

17. CASE GND : Ground

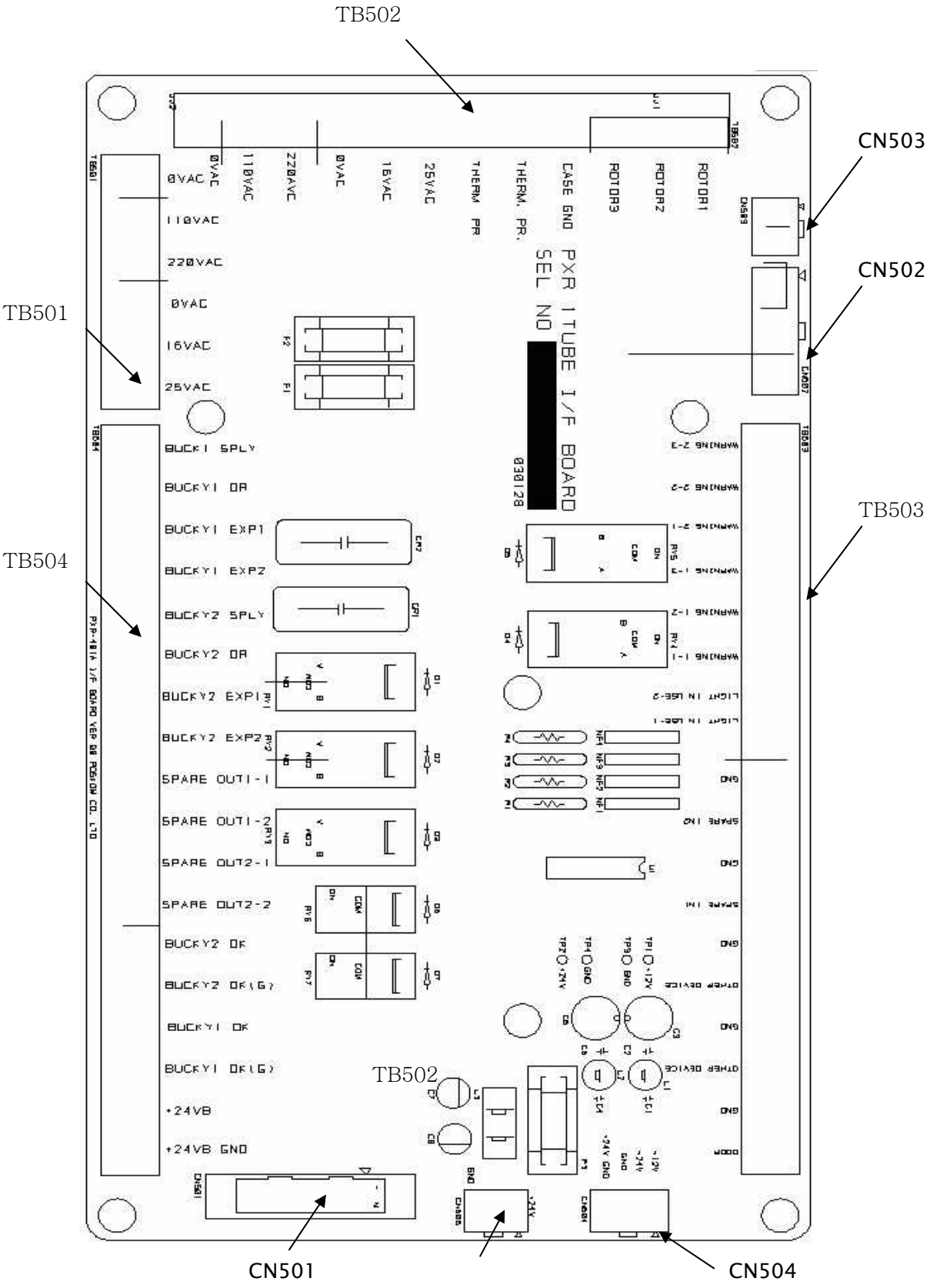
18. WARNING 2-1 : PSU Charge ON Signal(OPTION)

19. WARNING 2-3 : PSU Charge ON Signal(OPTION)

20. SMPS +24V : Table Stand Driving Magnetic Conductor Power (+)

21. SMPS -24V : Table Stand Driving Magnetic Conductor Power (-)

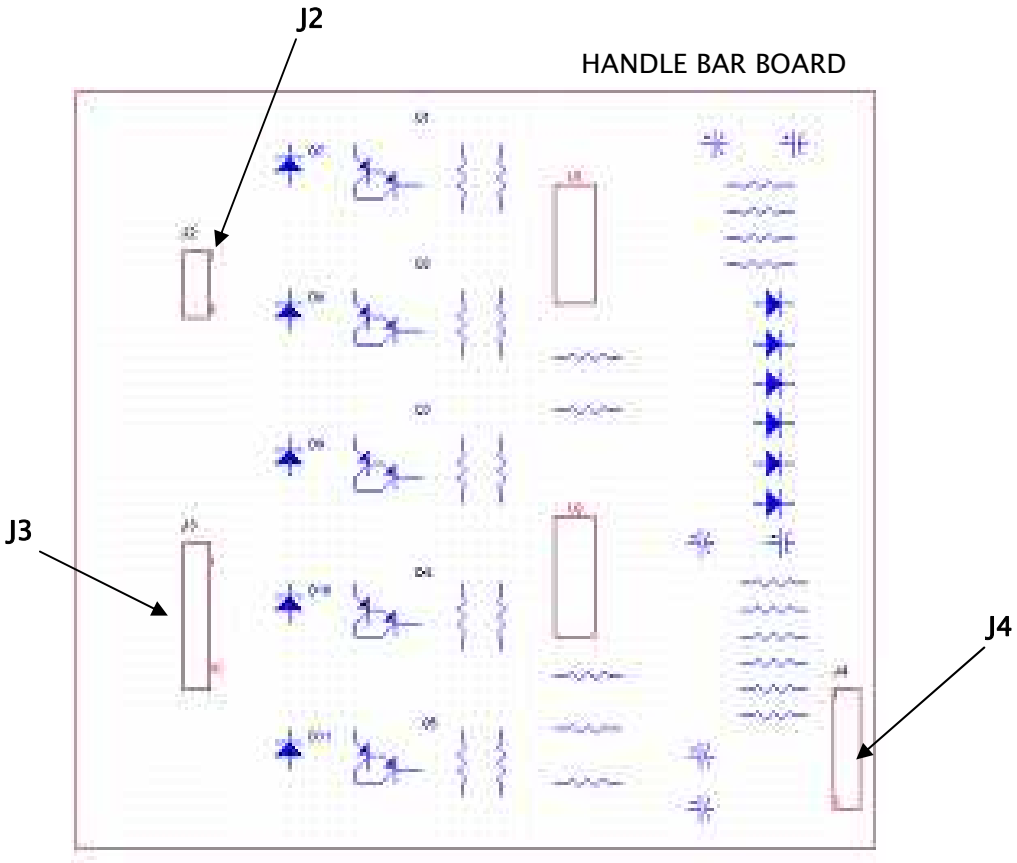
I/F Board connection

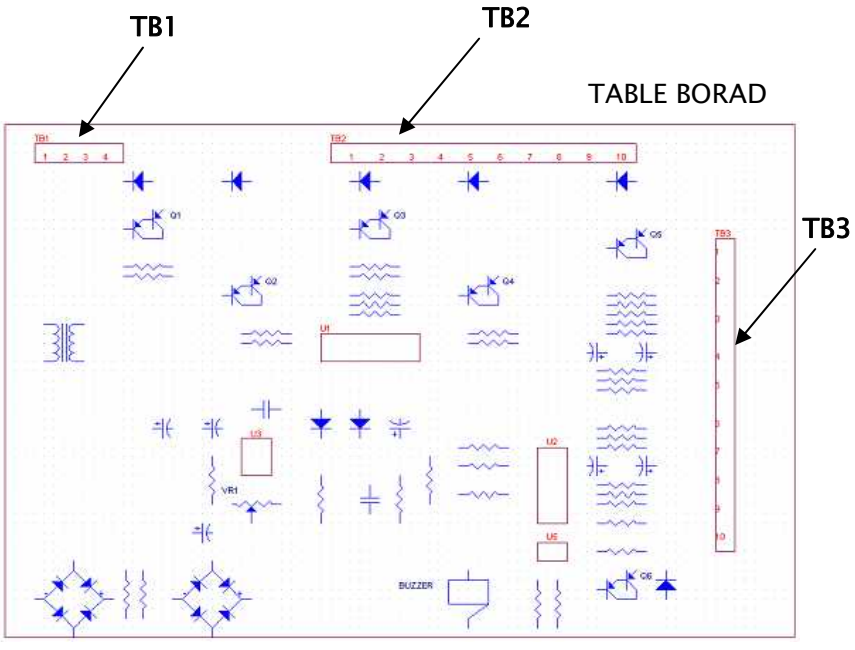


TB 504 (BR-944C)			TB 503 (BR-944C)		
PIN	I/O	Signal	PIN	I/O	Signal
1	O	BUCKY1 SPLY	1	I	DOOR
2	O	BUCKY1 DR	2	I	GND
3	O	BUCKY1 EXP1	3	I	OTHER DEVICE 1
4	O	BUCKY1 EXP2	4	I	GND
5	O	SPARE OUT1-1	5	I	OTHER DEVICE 2
6	I	SPARE OUT1-2	6	I	GND
7	I	SPARE OUT2-1	7	I	SPARE IN 1
8	O	SPARE OUT2-2	8	I	GND
9	O	BUCKY2 SPLY	9	I	SPARE IN 2
10	O	BUCKY2 DR	10	I	GND
11	O	BUCKY2 EXP1	11	O	LIGHT IN USE-1
12	O	BUCKY2 EXP2	12	O	LIGHT IN USE-2
13	I	BUCYK2 OK	13	O	WARNING 1-1
14	I	BUCYK2 OK (GND)	14	O	WARNING 1-2
15	O	BUCYK1 OK	15	O	WARNING 1-3
16	O	BUCYK1 OK (GND)	16	O	WARNING 2-1
17	O	+24V	17	O	WARNING 2-2
18	O	24V GND	18	O	WARNING 2-3

TB 502 (BR-944C)			TB 501 (BR-944C)		
PIN	I/O	Signal	PIN	I/O	Signal
1	O	ROTOR 1 (COM)	1		25 VAC
2	O	ROTOR 2 (MAIN)	2		16 VAC
3	O	ROTOR 3 (SHIFT)	3		0 VAC
4	O	GND	4		220 VAC
5	I	TUBE THERMAL	5		110 VAC
6	I	TUBE THERMAL	6		0 VAC
7	O	25 VAC (10A)	7		
8	O	16 VAC (10A)	8		

11.2 Handle Bar Board and Table Board terminal connection



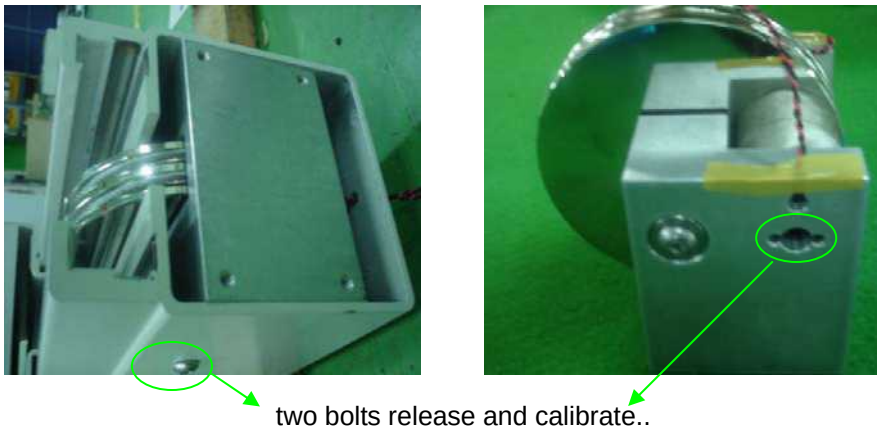


J4			J3		
PIN	I/O	Signal	PIN	I/O	Signal
1	O	24 VDC	1	O	F/B-
2	O	0 VDC	2	O	F/B+
3	I	RY1	3	O	U/D-
4	I	RY2	4	O	U/D+
5	I	RY3	5	O	90-
6	I	RY4	6	O	90+
7	I	RY5	7	O	ROT-
8	I	RY6	8	O	ROT+
9			9	O	R/L-
10			10	O	R/L+
J2			TB1		
1	I	LOCK-	1	I	110 VAC
2	I	LOCK+	2	I	0 VAC
3	I	0 VDC	3	I	BUCKY 2
4	I	24 VDC	4	I	BUCKY 2
TB2			TB3		
1	O	MG 1+	1	I	POS(RTN)
2	O	MG 1-	2	O	POS
3	O	MG 2+	3	I	TRAY(RTN)
4	O	MG 2-	4	O	TRAY
5	O	MG 3+	5	I	T/C(RTN)
6	O	MG 3-	6	O	T/C
7	O	MG 4+	7		
8	O	MG 4-	8		
9	O	MG 5+	9	I	BUCKY OUT(RTN)
10	O	MG 5-	10	O	BUCKY OUT

7. Installation trouble shooting

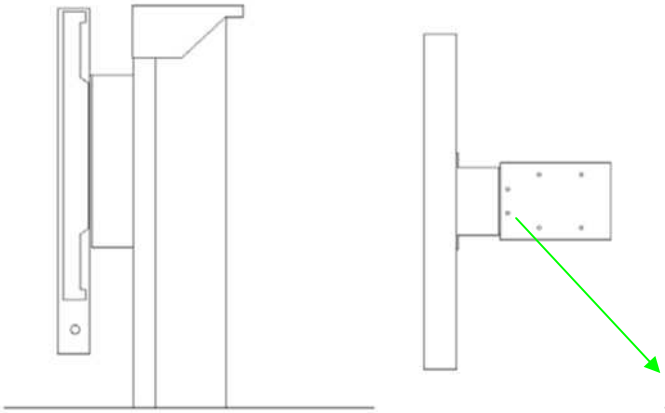
7.1 bucky stand trouble shooting

1) locker interval(top cover off)



two bolts release and calibrate..
(doing move bucky device)

2) If x-ray film image moved, you should fix bucky to wall

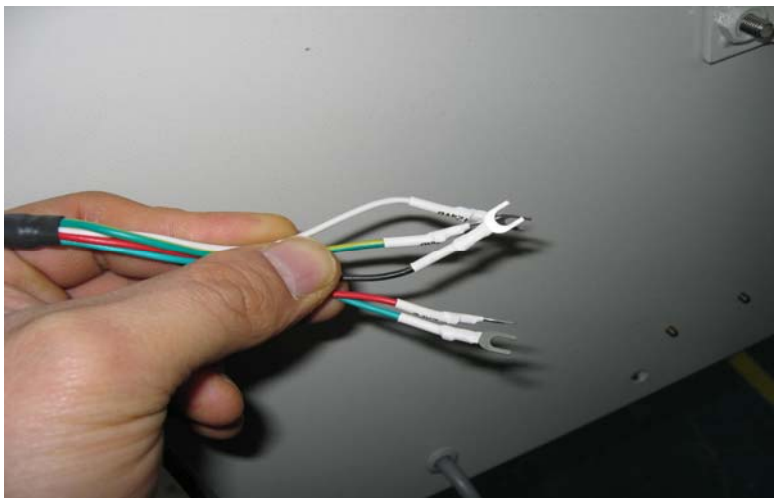


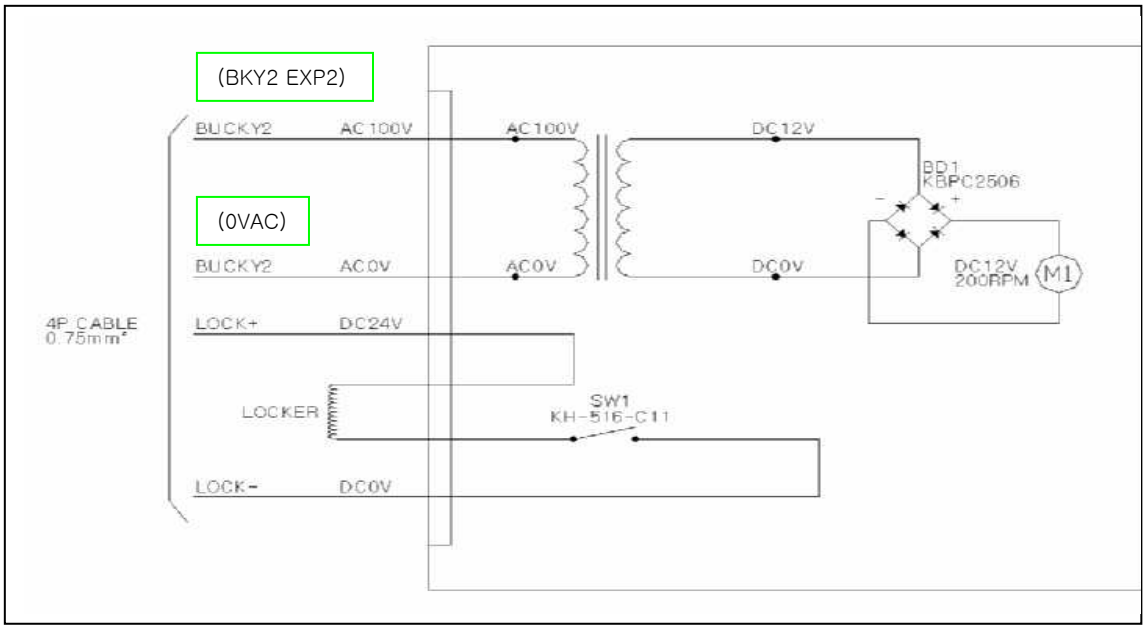
first, remove bolts(1) and top cover off

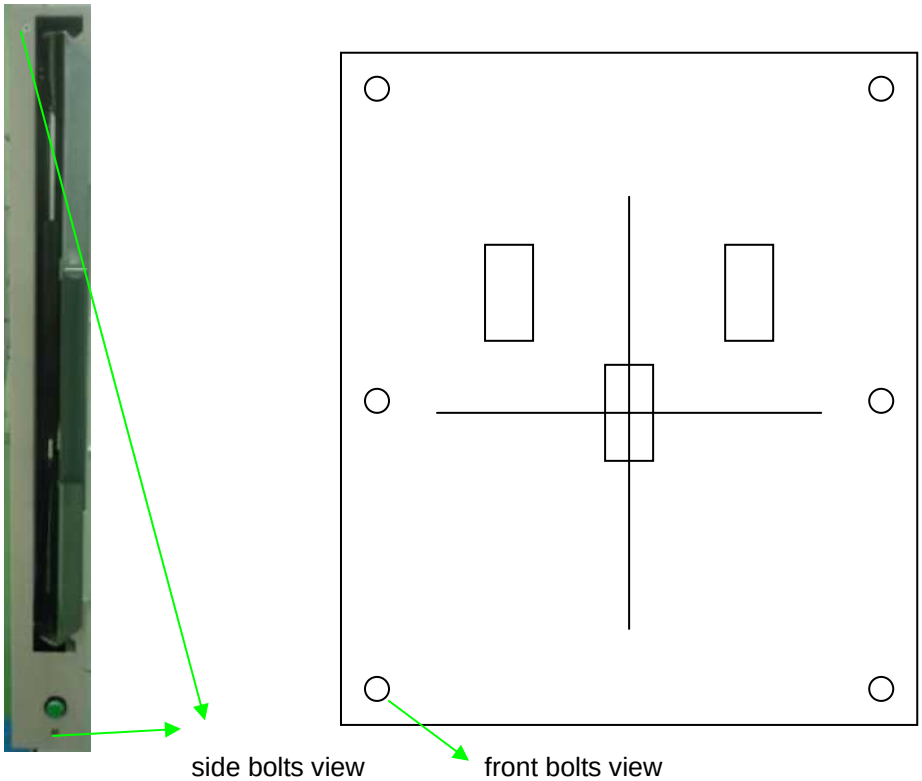
3)Bucky stand input signal

1. DC+ (locker power)
2. DC- (locker power)
3. START(BKY2 EXP2—moving motor power110VAC)
4. START(0VAC — moving motor power 110VAC)
5. CASE GND (Ground)

Pic1. Bucky stand wire







1) side bolts off and side cover off
2) front bolts off and front wood cover off

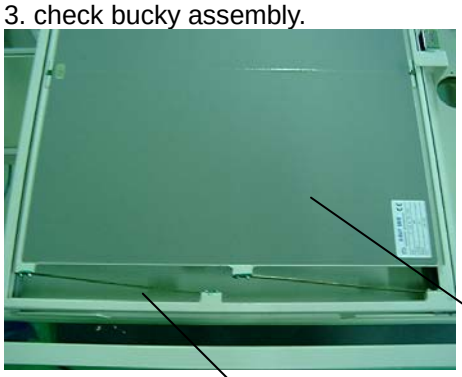
7.2 Table bucky trouble shooting

1. remove rubber stopper.

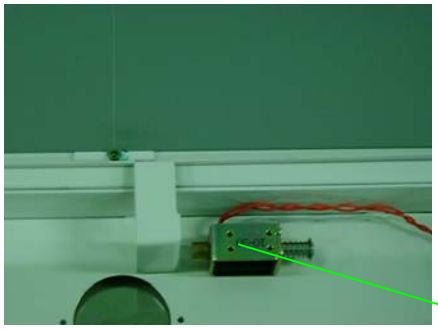
2. remove locker.

2. move top table a little.

3. check bucky assembly.



4. check hitter

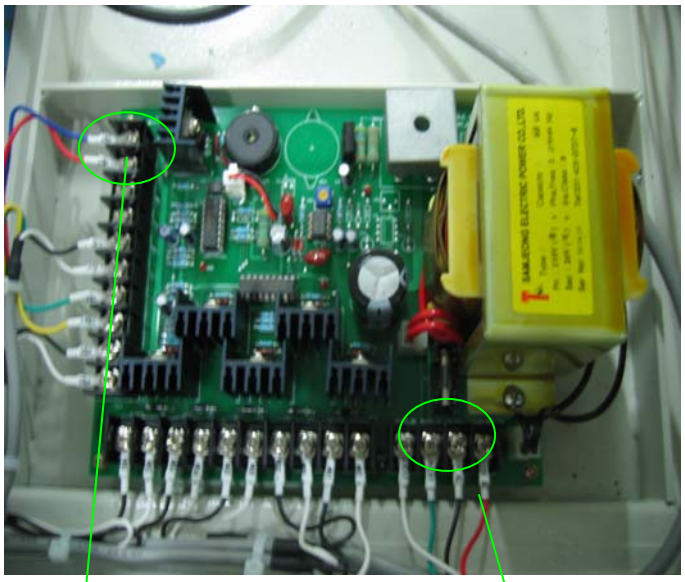


hitter

ready s/w push --→ hitter hitting spring

(check 24VDC in hitter when ready s/w is pushed)

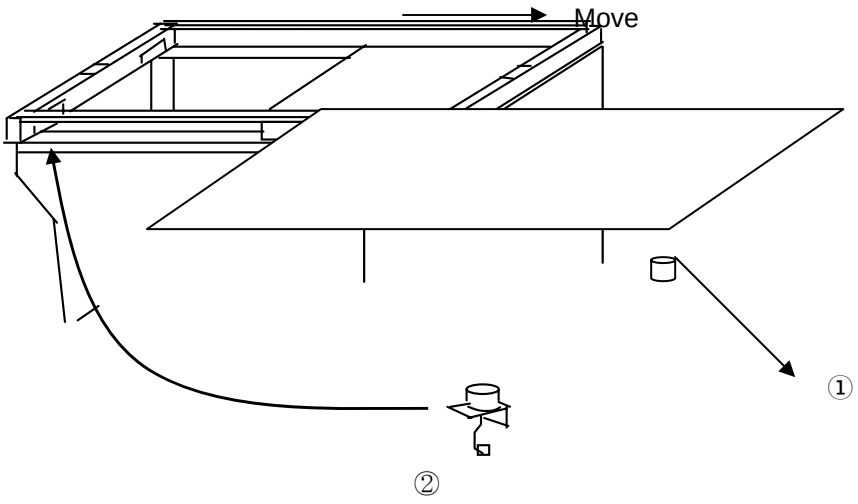
5. check bucky signal



to hitter(24vdc when ready s/w pushed)

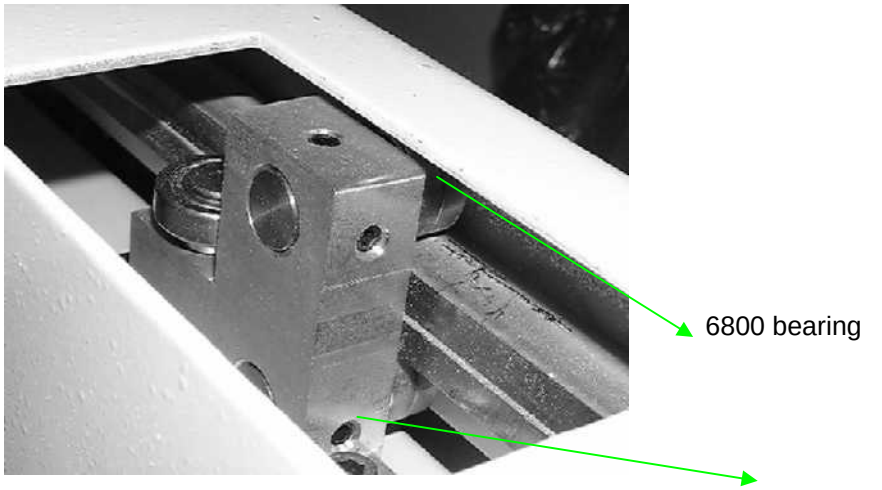
from bucky signal(AC110V when ready s/w pushed)

7.3 change brocken bearing in table



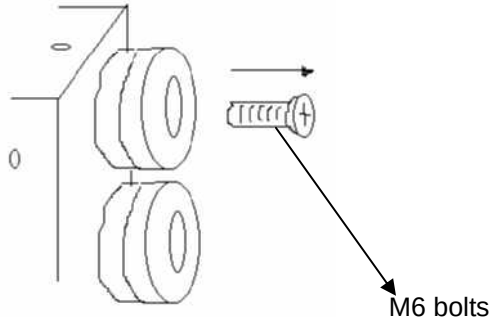
first, remove rubber stopper on top-table and remove breaker and move top-table to right-side little.(consider room size).
①rubber stopper on top-table ②breaker

Second, take out bearing assembly(refer picture)



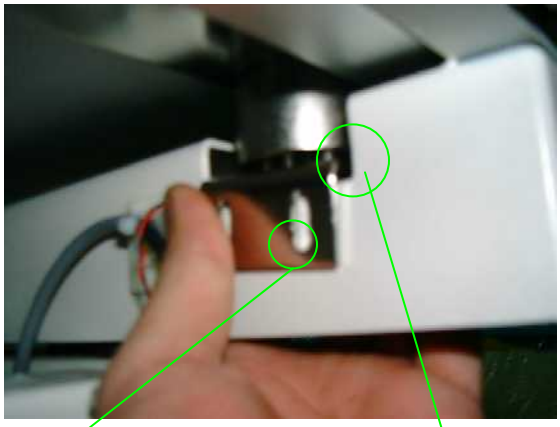
picture: bearing assembly

first, remove M5 bolts and take out bearing assembly



second, change broken bearing with same bearing
and put together reverse method

7.4 Locker interval change

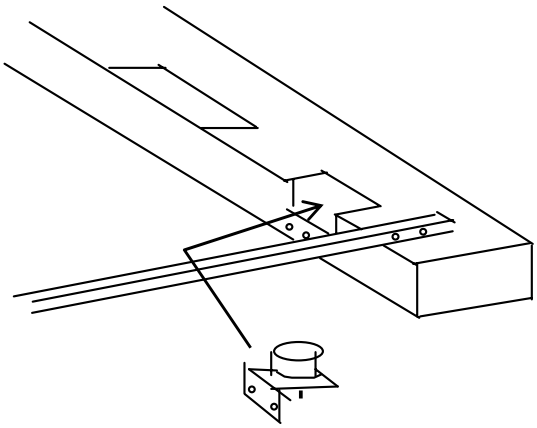


fix with volts and wind tightly.

interval : 4-5mm

when pushed foot s/w, check interval of locker
push foot s/w → release locker
not push foot s/w → attached locker

Locker fixing method



Technical Publication

Ver 4.0p

Calibration Manual

EVA-HF325/525

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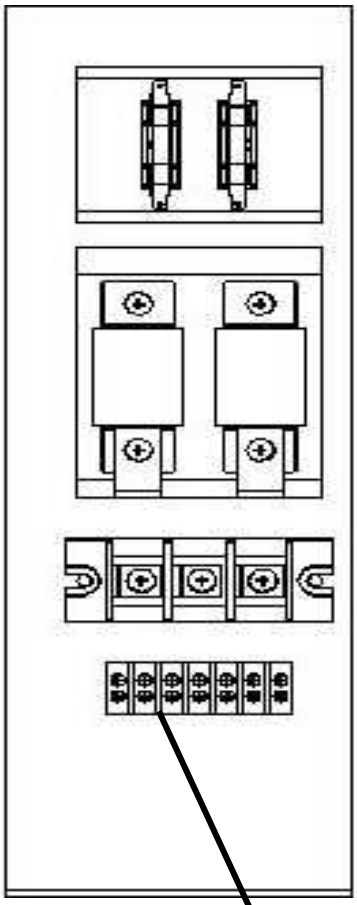
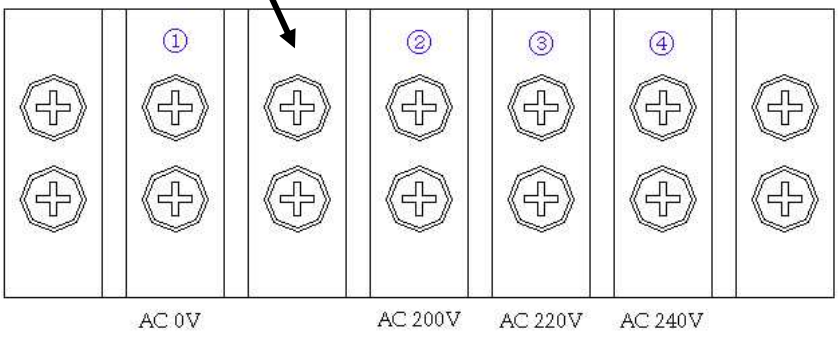
INPUT POWER SELECTION

1. INPUT POWER SELECTION



[Fig. 1]



[Fig. 2]

Input	Connection	Remark
AC 200V	①(AC 0V) + ②(AC 200V)	
AC 220V	①(AC 0V) + ③(AC 220V)	
AC 240V	①(AC 0V) + ④(AC 240V)	

BOARD kV & mA SELECTION

1. HT CONTROL CALIBRATION

VR1 Oscillator frequency calibration for filament drive

◈ Measuring Point : U18-3 PIN

◈ Adjust Frequency : 36 k Hz ± 0.5kHz (55.6±1.6μsec) .

◈ Caution : Measure as 2-PULSE since it is alternating current.

VR2 Filament LAMP DEAD TIME calibration

◈ Caution: Do not calibrate but just turn to the left (counter clock-wise).

VR3 Small Scale (10mA ~ 80mA) mA FEEDBACK to mAs adjustment with VF converter

◈ Measuring Point : TP5

◈ Adjust the VR3 until the TP5 set to 25kH z ± 0.5kHz.

◈ Simple Adjustment : Connect mAs tester to the connector 8,9 (mA TEST) of HV tank and shoot x-ray and adjust mAs.

◈ Conditions: 40kV 50mA / 10mAs

◈ Measuring: 10 ± 0.2mAs

VR4 Oscillator Frequency Adjustment for kV DRIVE

◈ Measuring Point : TP7

◈ Adjust Frequency : 40kHz ± 0.5kHz (50±1.2μsec)

◈ Caution : Measure as 2-PULSE since it is alternating current.

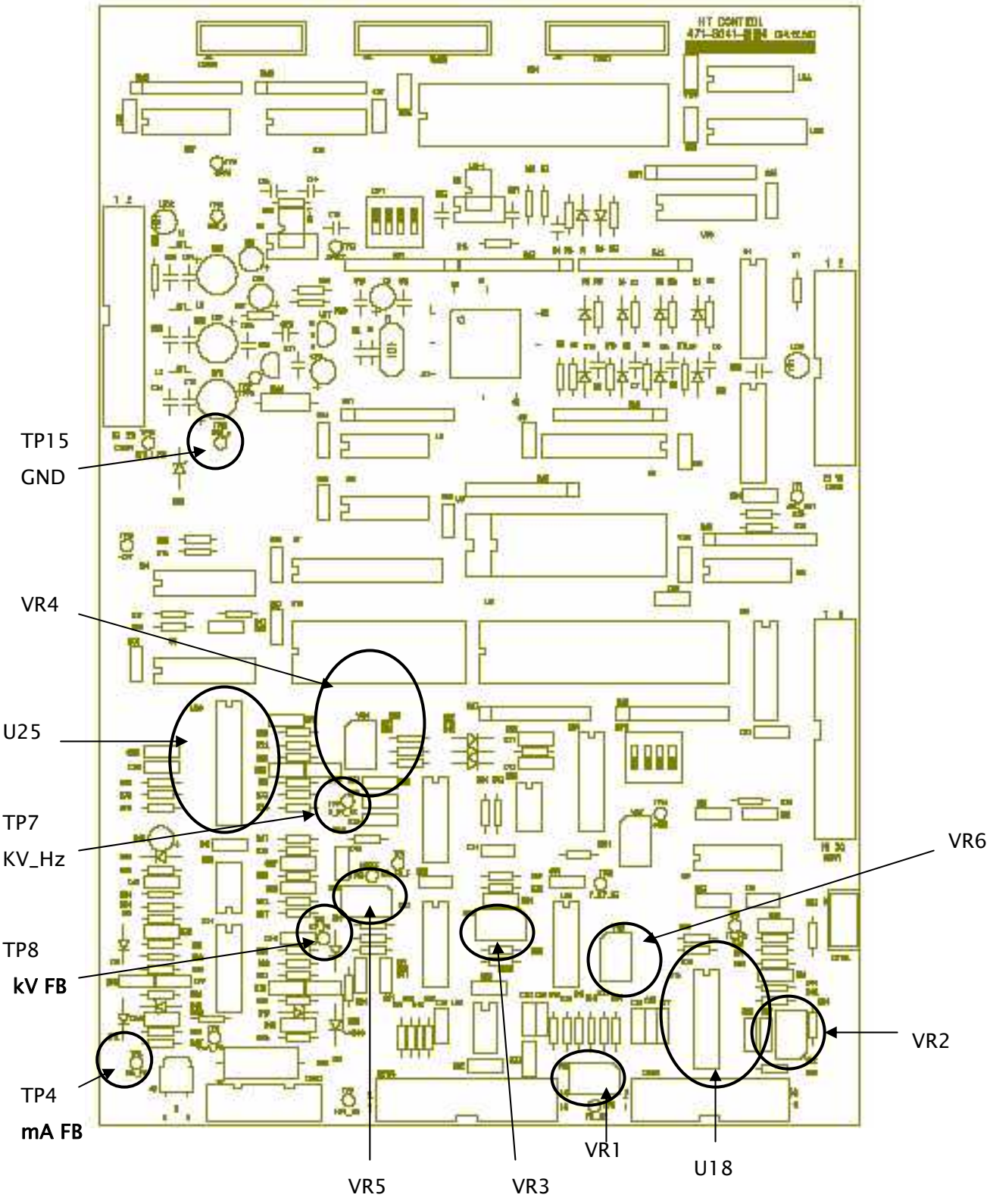
VR6 Floroscophy Scale Calibration

◈ Measuring Point : U19-9 Pin

◈ Adjust Frequency : 10.35kΩ

◈ Caution : Calibrate only when Floroscophy Calibration.

2. HT CONTROL SILK CIRCUIT



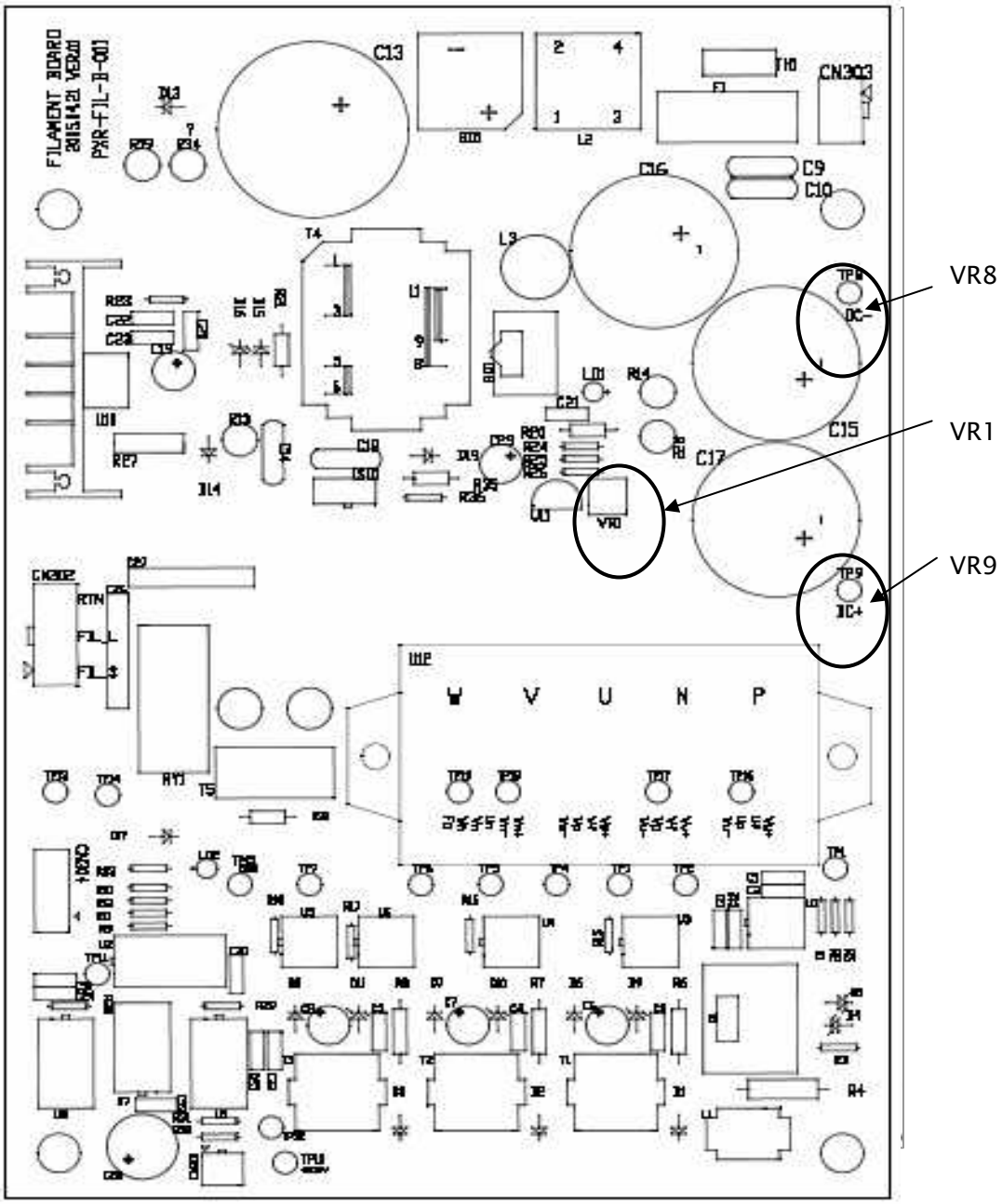
3. FILAMENT DRIVE CALIBRATION

VR1 FILAMENT TRANS DIRVE Power Voltage Calibration

◈ Measuring Point ： TP8, TP9

◈ Adjusting Point：DC130V±1V

4. FILAMENT DRIVE SILK CURCUIT



5. AGING

How to Calibrate : Execute on Operation Panel

Measuring Point : (Actual Current : less than 40mA)

CONDITIONS	SHOOTING TIME	SHOOTING INTERVAL
40kV/50mA 0.01sec	Two	20~30 Sec.
50kV/50mA 0.01sec	Two	20~30 Sec.
60kV/50mA 0.01sec	Two	20~30 Sec.
80kV/50mA 0.01sec	Two	20~30 Sec.
40kV/50mA 0.1sec	Two	50~60 Sec.
50kV/50mA 0.1sec	Two	50~60 Sec.
60kV/50mA 0.1sec	Two	50~60 Sec.
80kV/50mA 0.1sec	Two	50~60 Sec.
90kV/50mA 0.1sec	Two	20~30 Sec.
100kV/50mA 0.01sec	Two	20~30 Sec.
110kV/50mA 0.01sec	Two	20~30 Sec.
120kV/50mA 0.01sec	Two	20~30 Sec.

6. kV CALIBRATION

Calibration Method: Act in the panel calibration Mode（From C1-00 to 20）

◈ Setting range：

mA	Sec	kV	Remark
10mA	0.1sec	40kV, 80kV, 125kV	
100mA	0.1sec	40kV, 80kV, 125kV	
200mA	0.05sec	40kV, 80kV, 125kV	
320mA	0.05sec	40kV, 80kV, 125kV	

◈ Measuring Point：HT-CONT TP8：kV FEEDBACK

◈ Converted Value：1V = 33.3 kV

◈ Adjusting Value：±10% for the setting kV

◈ Caution： Execute the final test with correct mA value. kV could be changed by the mA.

7. mA CALIBRATION

Calibration Method: Execute in panel calibration mode. (from C1-21 39 : mA, from C2-21 39 : Pre_mA)

◈ Setting Range :

mA	Sec	kV	Remark
10mA	0.1sec	40kV, 80kV, 125kV	
100mA	0.1sec	40kV, 80kV, 125kV	
200mA	0.05sec	40kV, 80kV, 125kV	
320mA	0.05sec	40kV, 80kV, 125kV	

◈ Measuring point : HT-CONT TP4

◈ mA FEEDBACK conversion

(10~99mA : 1V = 10mA, 100~999mA : 1V = 100mA)

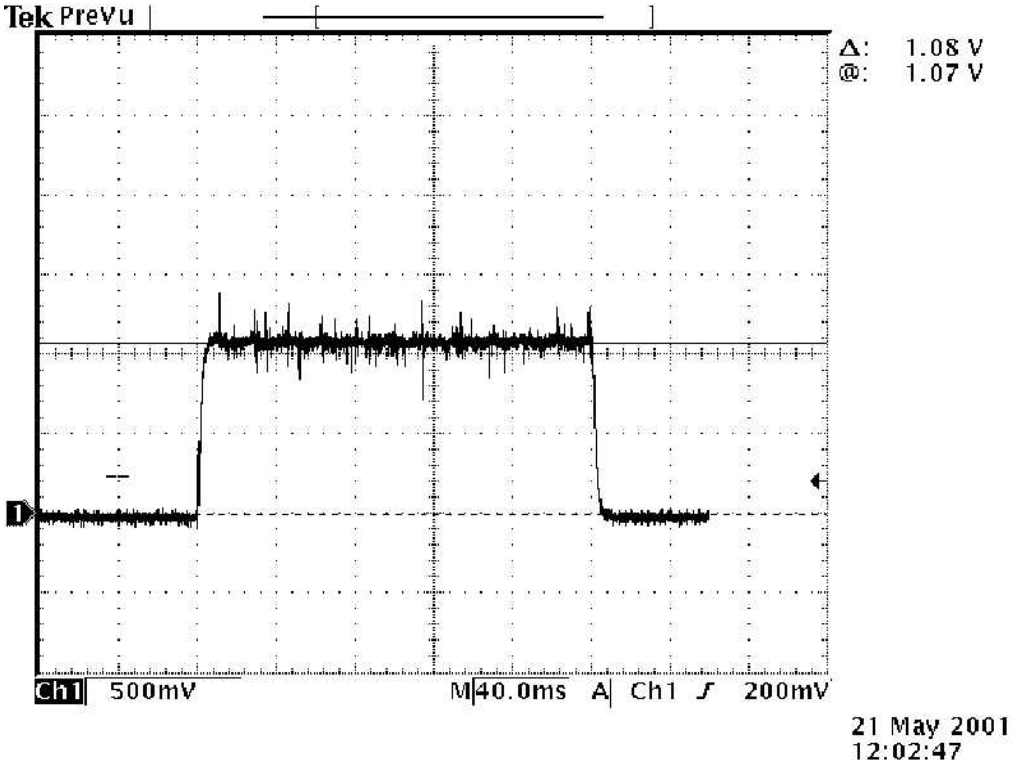
◈ Adjusting value : ±10% for the setting kV

◈ Caution : Execute the mA variation from C1-21 to 39.

In case of overshoot and undershoot、act from C2-21to 39 for the stable mA levels.

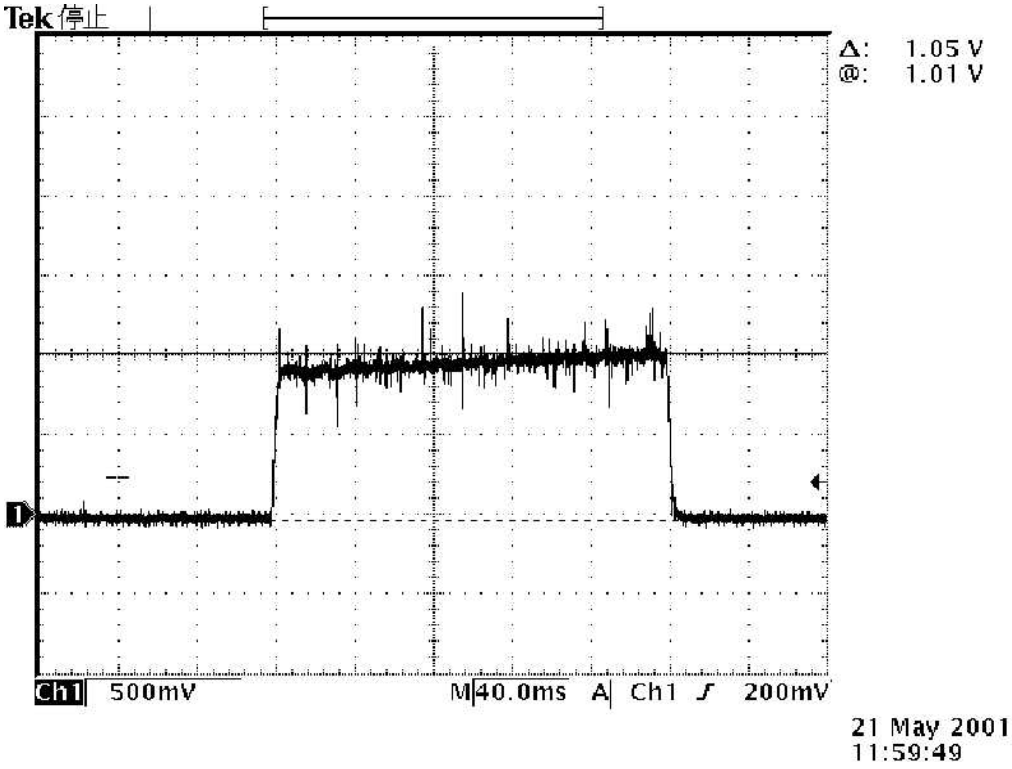
8. mA OSCILLOSCOPE WAVE FORM

1) NORMAL CONDITIONS



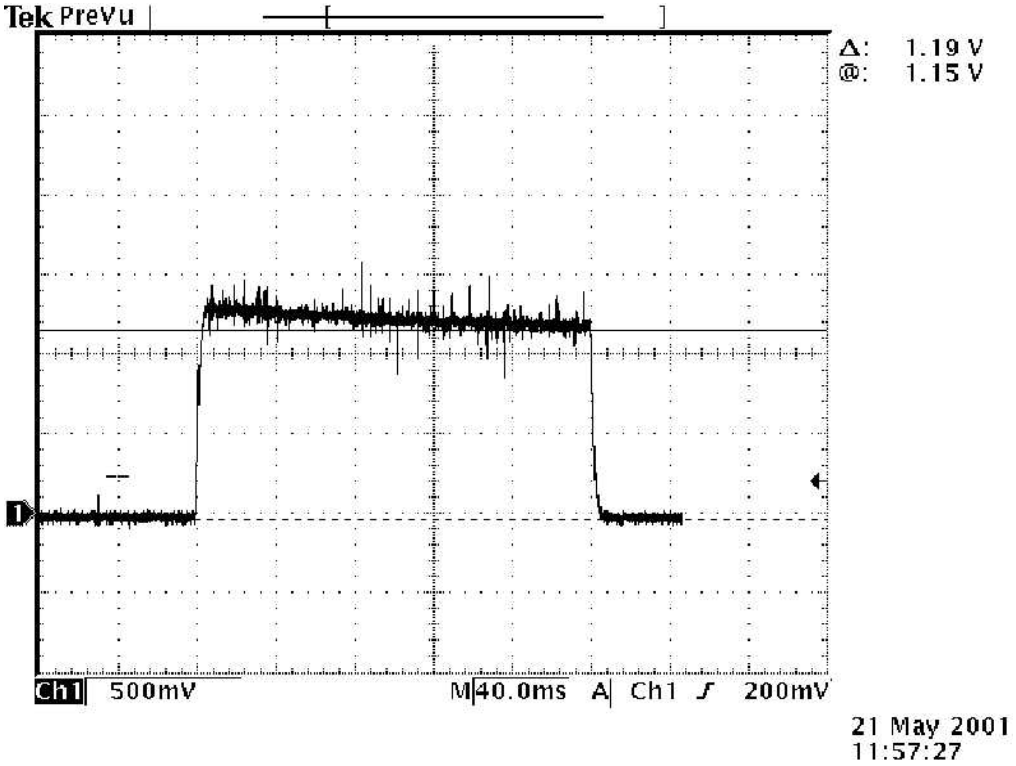
2) UNDERSHOOT WAVE FORM

Operate in panel calibration mode (From C2-21 to 39). Decrease DATA.



3) OVERSHOOT WAVE FORM

Act in Panel calibration mode (From C2-21 to 39). Decrease DATA.



9. BUCKY TYPE SELECTION

1) DIP SW MODE (HT_CONT DIP SW 1)

DIP SW 1~4	1	2	3	4
1 Mode	OFF	OFF	OFF	OFF
2 Mode	ON	OFF	OFF	OFF
3 Mode	OFF	ON	OFF	OFF
4 Mode	ON	ON	OFF	OFF

2) Bucky Type

	Bucky 1	Bucky 2
1 Mode	Motor Type	Motor Type
2 Mode	Solenoid Type	Solenoid Type
3 Mode	Motor Type	Solenoid Type
4 Mode	Solenoid Type	Motor Type

OPERATION PANEL CALIBATION

1. DIP SW FUNCTION

Adjust DIP Switch SW1 (8P) located on the back front of control panel and operate the each calibration.

DIP SW (SW 1: 8P) Function Display

DIPSW-1 OFF (DIPSW-2,3,4,5,6,7,8 ON) : Calibration Mode
DIPSW-2 OFF (DIPSW-1,3,4,5,6,7,8 ON) : Not in use
DIPSW-3 OFF (DIPSW-1,2,4,5,6,7,8 ON) : Not in use
DIPSW-4 OFF (DIPSW-1,2,3,5,6,7,8 ON) : Not in use
DIPSW-5 OFF (DIPSW-1,2,3,4,6,7,8 ON) : Not in use
DIPSW-6 OFF (DIPSW-1,2,3,4,5,7,8 ON) : Not in use
DIPSW-7 OFF (DIPSW-1,2,3,4,5,6,8 ON) : Not in use
DIPSW-8 OFF (DIPSW-1,2,3,4,5,6,7 ON) : Not in use
DIPSW-1,2,3,4,5,6,7,8, ON : Anatomical Mode

1)DIPSW-1 OFF (DIPSW-2,3,4,5,6,7,8 ON) : Calibration Mode

Execute the initializing of KVREF, mAREF, setting of each calibration and data.

2)DIPSW-1,2,3,4,5,6,7,8, ON : Anatomical Mode

Execute X-ray Exposure after setting up radiographic conditions with selection of targetregions, directions and patient size. You can save each exposure conditions and levels

3)AEC Exposure Mode (Option)

Execute the X-ray exposure with Ion Chamber control.

You can calibrate the range(-3 ~±0~ +3) with density setting switch.

2. CALIBRATION MODE

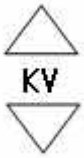
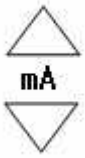
1) Initial LCD screen

KVP	MA	SEC
40	10	0.100

TUBE1 RAD CAL MODE	
KVP-SET	95+00
mA-SET	57-03
mA-COMP	-02

95 & 57: reference data fixed in the memory
+00, -03, -02: Actual data to be calibrated

2) DISPLAY OF PANEL IN CALIBRATION MODE

	Power OFF switch
	Power ON switch
	KV control switch 40KV ~ 125KV (86 levels by 1KV)
	mA control switch 10mA ~ 160mA : Small Focus (13 levels) 200mA ~ 500mA : Large Focus (5 levels)
	TIME control switch 0.001 SEC ~ 5.0 SEC (35 levels)

	Switch to raise KV condition up (max. +20)
	Switch to lower KV condition (min. -20)
	Switch to raise mA condition up (max. +20)
	Switch to lower mA condition (min. -20)
	Switch to raise mA COMP condition up (max. +00)
	Switch to lower mA COMP condition (min. -10)

3. SETTING MANUAL RADIOGRAPHY

1) Select the Anatomical Mode

Anatomical Mode will be ready as a default mode when power turned on.

A user can choose on Manual Mode.

2) Select “BUCKY1" or "BUCKY 2"

Appropriate bucky table or stand is matched for each Anatomical Mode as a default. A user can select another bucky table / stand or select none for his/her specific purpose using the switch.

3) A setup of tube voltage "kV"

Set up the tube voltage with “kV” setting switch.

Setting range: 40kV ~ 125kV (1kV step)

4) A set up of tube current “mA”

Set up the tube current with “mA” setting switch.

Setting range : 10、12.5、16、20、25、32、40、50、63、80、100、

125、160mA ---------- (Small Focus)

200、250、320、400、500mA ---------- (Large Focus)

5) Setup of Exposure mode (Time/mAs radiography)

6) Execute Exposure Mode with Time/mAs selection switch

mAs setting of Exposure accumulation time.
Select the exposure accumulation time with Time/mAs setting switch

- **Setting range** : 0.1mAs ~ 630mAs

- **Step** : 0.1、0.2、0.3、0.4、0.5、0.6、0.8、1.0、1.3、1.6、2.0、2.5、3.2、4.0、5.0、6.3、8.0、10.0、12.5、16、20、25、32、40、50、63、80、100、125、160、200、250、320、400、500、630mAs

7) Exposure time 『sec』 setting

Select the exposure time with Time/mAs setting switch.

- **Setting range** : 0.001sec ~ 10sec

- **Step** : 0.001、0.002、0.003、0.004、0.005、0.006、0.008、0.010、0.013、0.016、0.020、0.025、0.032、0.040、0.050、0.064、0.080、0.100、0.125、0.160、0.200、0.250、0.320、0.400、0.500、0.640、0.800、1.00、1.25、1.60、2.00、2.50、3.20、4 .00、5.00、6.300、8.00、10.00sec

If a user set a shooting condition over the maximum lode of the machine, "Over Lode" lamp will be on and X-ray will be not projected.

4. SETTING APR RADIOGRAPHY

1) Choose Subject Size

There are four preset subject size as Child, Small, Medium, and Large. A user can choose a subject size depends on actual size of person.

2) Choose Body Part for Shooting

A user can choose specific part for shooting from 42 preset body part of subject.

3) Changing Shooting Condition

(1) Choose subject Size

(2) Choose body part for shooting

(3) Changing shooting conditions to be saved in the memory including bucky selection.

(4) Press “SET” switch and changed shooting condition will be memorized after beep.

.

5. RADIOGRAPHY

1) X-ray Radiography using Radiography switch on the Control Panel

(1) Press “Ready” switch. Please make sure “Ready” switch lamp is on.

(2) When “Ready” switch is on, press “Exposure” switch. “Exposure” switch lamp will be on and alarm will sound.

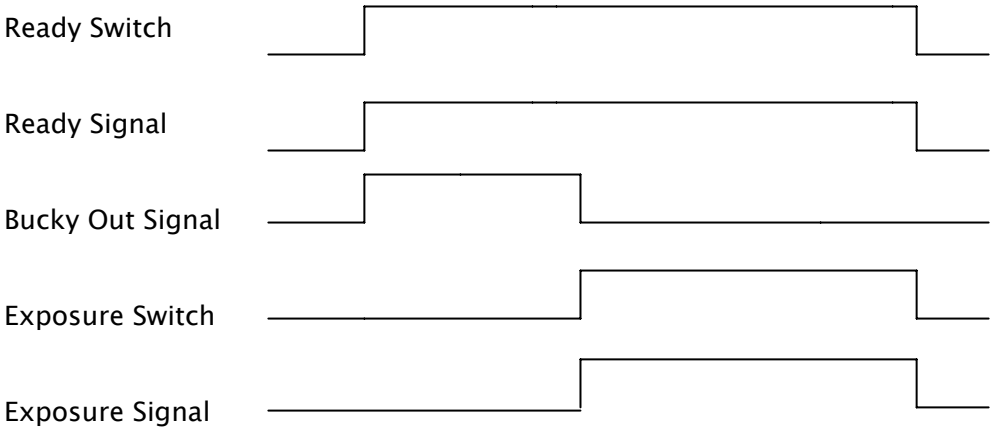
2) X-ray radiography with hand-switch

(1) Press Hand switch slightly. Make sure “Ready” switch lamp is on.

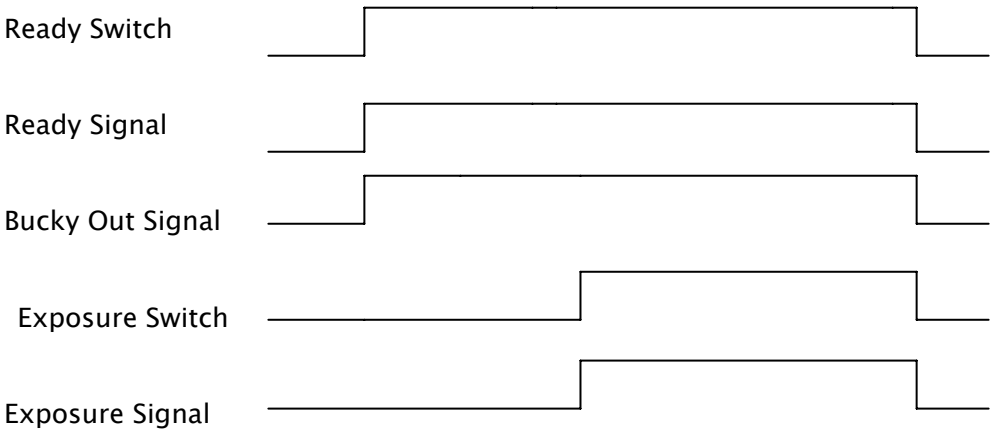
(2) When “Ready” switch is on, press “Hand” switch again with more pressure. “Exposure” switch lamp will be on and alarm will sound.

6. Bucky Time Chart

1) Solenoid Type



2) Motor Type



7. ERROR CODE

1) Error Code Display

Error Code 1
Charge Monitor Error

2) Error Code

The error code is displayed when problems, such as abnormalities, occur to equipment. While the error code is displayed, radiography operation is forbidden for safety.
A power supply is re-switched off and on, then an error code is cleared. If the problem of equipment is not solved at the time of a power-supply re-switched on, the display is lighted on again.

Caution

Please wait for 1~2 minutes before you turn on the machine again right after powering off.

3) Check code

Check codes are warning displays when an error is on operation of equipment unlike an error code. While the check code is displayed, radiography operation is forbidden for safety. Check code is cleared when the backup release switch is switched on. Please refer to the check code list for the case the clearance method is different.

Check code List

Ch_01	TUBE THERMOSTAT OPERATION ◈ The temperature of the slim and long shaped light bulb is higher than 80C. ◈ Thermo switch is in open position. ◈ Release the check code at Thermo switch off condition.
Ch_07	Shortage of power-supply capacity for exposure ◈ The power voltage drop is below AC160V and DC 150V. ◈ Release the check code with input of power.

ERROR CODE LIST

Error Code	Description
Err 01	CHARGE MONITOR ERROR ◈ When the power voltage drops below AC160V and DC150V.
Err 02	TIME OVER ERROR AT STANDBY(Serial Communication Fail Error) ◈ Standby position is not cleared after the 10 sec. at the operation panel power on(No reply from HT-CONT)
Err 03	READY OUT SIGNAL ERROR AT STANDBY ◈ Defects of Operation panel or HT control board
Err 04	X-RAY OUT SIGNAL ERROR AT STANDBY ◈ Defects of Operation panel or HT control board
Err 05	PANEL READY SWITCH INPUT ERROR AT STANDBY ◈ When the operation panel ready switch input is 'on' position.
Err 06	PANEL X-RAY SWITCH INPUT ERROR AT STANDBY ◈ When the operation panel ready switch input is 'on' position.
Err 07	Not Defined
Err 08	Not Defined
Err 09	ROTOR CURRENT ERROR AT NON-EXPOSURE POSITION ◈ TP18 (RTR_I_FB) of HT Control Board is higher than 1V at non-exposure action
Err 10	FILLAMENT CURRENT ERROR AT NON-EXPOSURE POSITION ◈ TP2 (FIL_I_FB) of HT Control Board is higher than 1.5V at non-exposure action
Err 11	kV FEEDBACK CURRENT ERROR AT NON-EXPOSURE POSITION ◈ TP8 (kV_FB) of HT Control Board is higher than 1V TP8 (33.3kV) at non-exposure action
Err 12	mA FEEDBACK CURRENT ERROR AT NON-EXPOSURE POSITION ◈ TP4 (mA_FB) 10-80mA setting of HT Control Board is higher than o.5V (5mA), In case of 100-500mA setting of HT Control Board is higher than o.1V (11mA) TP8 (33.3kV) at non-exposure action
Err 13	ROTOR CURRENT ERROR AT EXPOSURE POSITION ◈ TP18 (RTR_I_FB) of HT Control Board is lower than 3.0V at exposure ready action after the 0.8 sec. With ready switch input.
Err 14	FILLAMENT CURRENT ERROR AT EXPOSURE POSITION ◈ TP2 (FIL_I_FB) of HT Control Board is lower than 1.5V at exposure ready action after the 1.5 sec. With ready switch input.

Err 15	kV FEEDBACK CURRENT ERROR AT EXPOSURE POSITION ◈ After Exposure is ready, X-ray switch input and turn on HV-ENABLE signal and within 3msec HT8 (kV_FB)setting is under %70 During exposure TP8(kV_FB) setting is under 70% *kV Feedback monitoring data(70%) can be set on calibration mode[C-2_43]
Err 16	mA FEEDBACK CURRENT ERROR AT EXPOSURE POSITION ◈ Exposure Ready Condition TP4 (mA_FB) 10-80mA setting of HT Control Board is lower than o.5V (5mA), In case of 100-630mA setting of HT Control Board is lower than o.1V (11mA) after the 3 msec. with kV Feedback signal. ◈ During Exposure TP4 (mA_FB) 10-80mA setting of HT Control Board is lower than o.5V (5mA), In case of 100-630mA setting of HT Control Board is lower than o.1V (11mA) .
Err 17	Not Defined
Err 18	X-RAY TIME OVER ERROR AT SEC MODE EXPOSURE ◈ X-ray end signal is not reached to the panel from HT exceeding the setting time at the sec mode exposure
Err 19	X-RAY TIME OVER ERROR AT mAs MODE EXPOSURE ◈ X-ray end signal is not reached to the panel from HT exceeding the setting time calculated by the mA×(1/2) formula at the mAs mode exposure.
Err 20	X-RAY TIME OVER ERROR AT AEC MODE EXPOSURE ◈ X-ray end signal is not reached to the panel from HT exceeding the setting time calculated by backup-timer at the AEC mode exposure.
Err 21	HV INTERLOCK ERROR ◈ Unlink the HV trans connection
Err 22	IGBT FAULT ERROR ◈ HV Tans is under overloading condition about mA (350A).
Err 23	kV FEEDBACK OVER CURRENT ERROR AT EXPOSURE POSITION ◈ TP8 (kV_FB) of HT Control Board is higher than 20kV during the exposure.
Err 24	mA FEEDBACK OVER CURRENT ERROR AT EXPOSURE POSITION ◈ TP8 (mA_FB) of HT Control Board is higher than [mA setting value plus 50%] during the exposure.
Err 25	NO ZERO CROSS ERROR ◈ Impossible to detect the frequency signal.
Err 26	ZERO CROSS OVER ERROR ◈ Frequency signal detection over.

8. TROUBLE SHOOTING GUIDE

Error No.	Parts	Check Point
Error 01	IGBT	PC1(PC817)
		LED LD1, LD2
		CN404 Connection
		U2(MIC4584)
	POWER	Q2, Q3(MTD3055EL)
		CN208 Connection
	MAIN	R101(60W20Ω)
		BR1(VUO150-16NO7)
		SW1(Toggle Switch Position)
Error 02	POWER	+12V
		CN210 Connection
	HT-Cont.	CN103 Connection
		CN104 Connection
	MAIN	J1 Connection
Error 03	OP	Ready S/W
Error 04	OP	X-Ray S/W
Error 05	MAIN	J1 Connection
	HT-Cont.	U14(TLP521-4)
		U10(74HC14)
		CN103 Connection
Error 06	MAIN	J1 Connection
	HT-Cont.	U14(TLP521-4)
		U10(74HC14)
		CN103 Connection
Error 07	-	-

Error 08	-	-
Error 09	-	-
Error 10	-	-
Error 11	HT-Cont.	Check U24
Error 12	HT-Cont.	Check U24
Error 13	HT-Cont.	U29(VM48)
	I/F	Rotor Signal Connection
	POWER	F2(5A) Fuse
Error 14	FILAMENT	RY1(CH2-MD12)
		R11(5W2Ω)
		Q2, Q5(IRFP40B)
Error 15	HT-Cont.	Check TP8 (1V=33.3KV) CON 107 Connection
Error 16	HT-Cont.	Check TP4 1V=10mA (10mA ~99mA) 1V=100mA (100mA ~999mA)
Error 17	Not In Use	
Error 18	HT-Cont.	HT-Cont. PCB
Error 19	HT-Cont.	U22(VFC32)
Error 20	HT-Cont.	U22(VFC32)
Error 21	HT-Cont.	CN107 Connection
Error 22	HT-Cont.	-12V Check
Error 23	HT-Cont.	Check TP8 (1V=33.3KV)
Error 24	HT-Cont.	Check TP4 1V=10mA (10mA ~99mA) 1V=100mA (100mA ~999mA)
Error 25	HT-Cont.	HT-Cont. PCB
Error 26	HT-Cont.	HT-Cont. PCB

9. HT-CONTROLLER A/S REFERENCE

1) HT-Controller CPU Analog-to-Digital Input Value (1/5)

DEC	A/D Input	(A/D) X 2	DEC	A/D Input	(A/D) X 2
1	0.02	0.039	31	0.608	1.216
2	0.039	0.078	32	0.627	1.255
3	0.059	0.118	33	0.647	1.294
4	0.078	0.157	34	0.667	1.333
5	0.098	0.196	35	0.686	1.373
6	0.118	0.235	36	0.706	1.412
7	0.137	0.275	37	0.725	1.451
8	0.157	0.314	38	0.745	1.49
9	0.176	0.353	39	0.765	1.529
10	0.196	0.392	40	0.784	1.569
11	0.216	0.431	41	0.804	1.608
12	0.235	0.471	42	0.824	1.647
13	0.255	0.51	43	0.843	1.686
14	0.275	0.549	44	0.863	1.725
15	0.294	0.588	45	0.882	1.765
16	0.314	0.627	46	0.902	1.804
17	0.333	0.667	47	0.922	1.843
18	0.353	0.706	48	0.941	1.882
19	0.373	0.745	49	0.961	1.922
20	0.392	0.784	50	0.98	1.961
21	0.412	0.824	51	1	2
22	0.431	0.863	52	1.02	2.039
23	0.451	0.902	53	1.039	2.078
24	0.471	0.941	54	1.059	2.118
25	0.49	0.98	55	1.078	2.157
26	0.51	1.02	56	1.098	2.196
27	0.529	1.059	57	1.118	2.235
28	0.549	1.098	58	1.137	2.275
29	0.569	1.137	59	1.157	2.314
30	0.588	1.176	60	1.176	2.353

2) HT-Controller CPU Analog-to-Digital Input Value (2/5)

DEC	A/D Input	(A/D) X 2	DEC	A/D Input	(A/D) X 2
61	1.196	2.392	91	1.784	3.569
62	1.216	2.431	92	1.804	3.608
63	1.235	2.471	93	1.824	3.647
64	1.255	2.51	94	1.843	3.686
65	1.275	2.549	95	1.863	3.725
66	1.294	2.588	96	1.882	3.765
67	1.314	2.627	97	1.902	3.804
68	1.333	2.667	98	1.922	3.843
69	1.353	2.706	99	1.941	3.882
70	1.373	2.745	100	1.961	3.922
71	1.392	2.784	101	1.98	3.961
72	1.412	2.824	102	2	4
73	1.431	2.863	103	2.02	4.039
74	1.451	2.902	104	2.039	0.078
75	1.471	2.941	105	2.059	4.118
76	1.49	2.98	106	2.078	4.157
77	1.51	3.02	107	2.098	4.196
78	1.529	3.059	108	2.118	4.235
79	1.549	3.098	109	2.137	4.275
80	1.569	3.137	110	2.157	4.314
81	1.588	3.176	111	2.176	4.353
82	1.608	3.216	112	2.196	4.392
83	1.627	3.255	113	2.216	4.431
84	1.647	3.294	114	2.235	4.471
85	1.667	3.333	115	2.255	4.51
86	1.686	3.373	116	2.275	4.549
87	1.706	3.412	117	2.294	4.588
88	1.725	3.451	118	2.314	4.627
89	1.745	3.49	119	2.333	4.667
90	1.765	3.529	120	2.353	4.706

3) HT-Controller CPU Analog-to-Digital Input Value (3/5)

DEC	A/D Input	(A/D) X 2	DEC	A/D Input	(A/D) X 2
121	2.373	4.745	151	2.961	5.922
122	2.392	4.784	152	2.98	5.961
123	2.412	4.824	153	3	6
124	2.431	4.863	154	3.02	6.039
125	2.451	4.902	155	3.039	6.078
126	2.471	4.941	156	3.059	6.118
127	2.49	4.98	157	3.078	6.157
128	2.51	5.02	158	3.098	6.196
129	2.529	5.059	159	3.118	6.235
130	2.549	5.098	160	3.137	6.275
131	2.569	5.137	161	3.157	6.314
132	2.588	5.176	162	3.176	6.353
133	2.608	5.216	163	3.196	6.392
134	2.627	5.255	164	3.216	6.431
135	2.647	5.294	165	3.235	6.471
136	2.667	5.333	166	3.255	6.51
137	2.686	5.373	167	3.275	6.549
138	2.706	5.412	168	3.294	6.588
139	2.725	5.451	169	3.314	6.627
140	2.745	5.49	170	3.333	6.667
141	2.765	5.529	171	3.353	6.706
142	2.784	5.569	172	3.373	6.745
143	2.804	5.608	173	3.392	6.784
144	2.824	5.647	174	3.412	6.824
145	2.843	5.686	175	3.431	6.863
146	2.863	5.725	176	3.451	6.902
147	2.882	5.765	177	3.471	6.941
148	2.902	5.804	178	3.49	6.98
149	2.922	5.843	179	3.51	7.02
150	2.941	5.882	180	3.529	7.059

4) HT-Controller CPU Analog-to-Digital Input Value (4/5)

DEC	A/D Input	(A/D) X 2	DEC	A/D Input	(A/D) X 2
181	3.549	7.098	211	4.137	8.275
182	3.569	7.137	212	4.157	8.314
183	3.588	7.176	213	4.176	8.353
184	3.608	7.216	214	4.196	8.392
185	3.627	7.255	215	4.216	8.431
186	3.647	7.294	216	4.235	8.471
187	3.667	7.333	217	4.255	8.51
188	3.686	7.373	218	4.275	8.549
189	3.706	7.412	219	4.294	8.588
190	3.725	7.451	220	4.314	8.627
191	3.745	7.49	221	4.333	8.667
192	3.765	7.529	222	4.353	8.706
193	3.784	7.569	223	4.373	8.745
194	3.804	7.608	224	4.392	8.784
195	3.824	7.647	225	4.412	8.824
196	3.843	7.686	226	4.431	8.863
197	3.863	7.725	227	4.451	8.902
198	3.882	7.765	228	4.471	8.941
199	3.902	7.804	229	4.49	8.98
200	3.922	7.843	230	4.51	9.02
201	3.941	7.882	231	4.529	9.059
202	3.961	7.922	232	4.549	9.098
203	3.98	7.961	233	4.569	9.137
204	4	8	234	4.588	9.176
205	4.02	8.039	235	4.608	9.216
206	4.039	8.078	236	4.627	9.255
207	4.059	8.118	237	4.647	9.294
208	4.078	8.157	238	4.667	9.333
209	4.098	8.196	239	4.686	9.373
210	4.118	8.235	240	4.706	9.412

5) HT-Controller CPU Analog-to-Digital Input Value (5/5)

DEC	A/D Input	(A/D) X 2	DEC	A/D Input	(A/D) X 2
241	4.725	9.451	249	4.882	9.765
242	4.745	9.49	250	4.902	9.804
243	4.765	9.529	251	4.922	9.843
244	4.784	9.569	252	4.941	9.882
245	4.804	9.608	253	4.961	9.922
246	4.824	9.647	254	4.98	9.961
247	4.843	9.686	255	5	10
248	4.863	9.725			

Technical Publication

Ver.4.1P

Schemetics

EVA-HF325/525 generator

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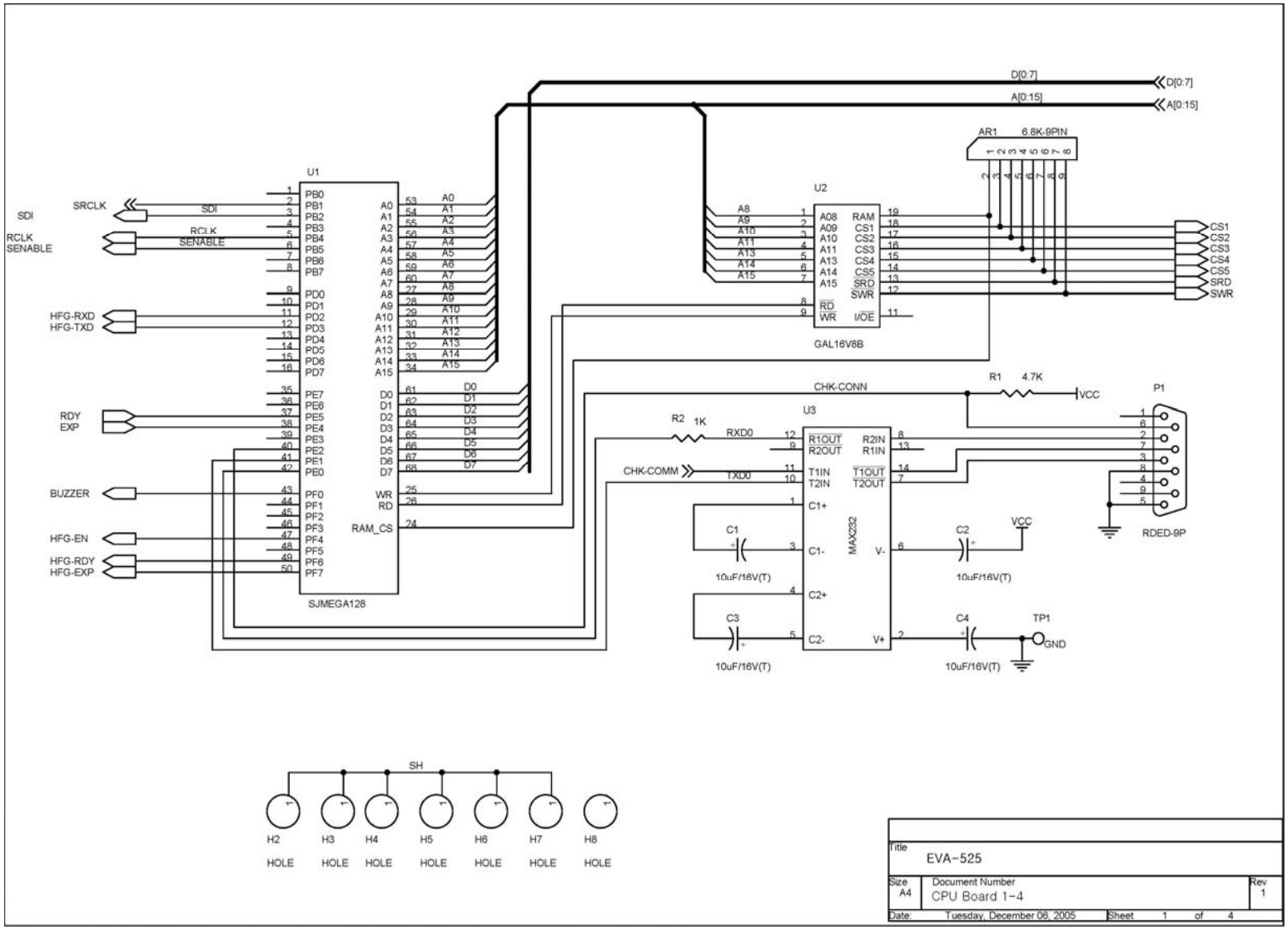
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U2
GAL16V8B
U3
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SDI
RCLK
SENABLE
HFG-RXD
HFG-TXD
RDY
EXP
BUZZER
HFG-EN
HFG-RDY
HFG-EXP
RAM_CS
WR
RD
CHK-CONN
R1 4.7K
VCC
R2 1K
RXD0
TXD0
CHK-COMM
C1
C2
C3
C4
10uF/16V(T)
P1
RDED-9P
TP1
GND
SH
H2
H3
H4
H5
H6
H7
H8
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Size
A4
Document Number
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Rev
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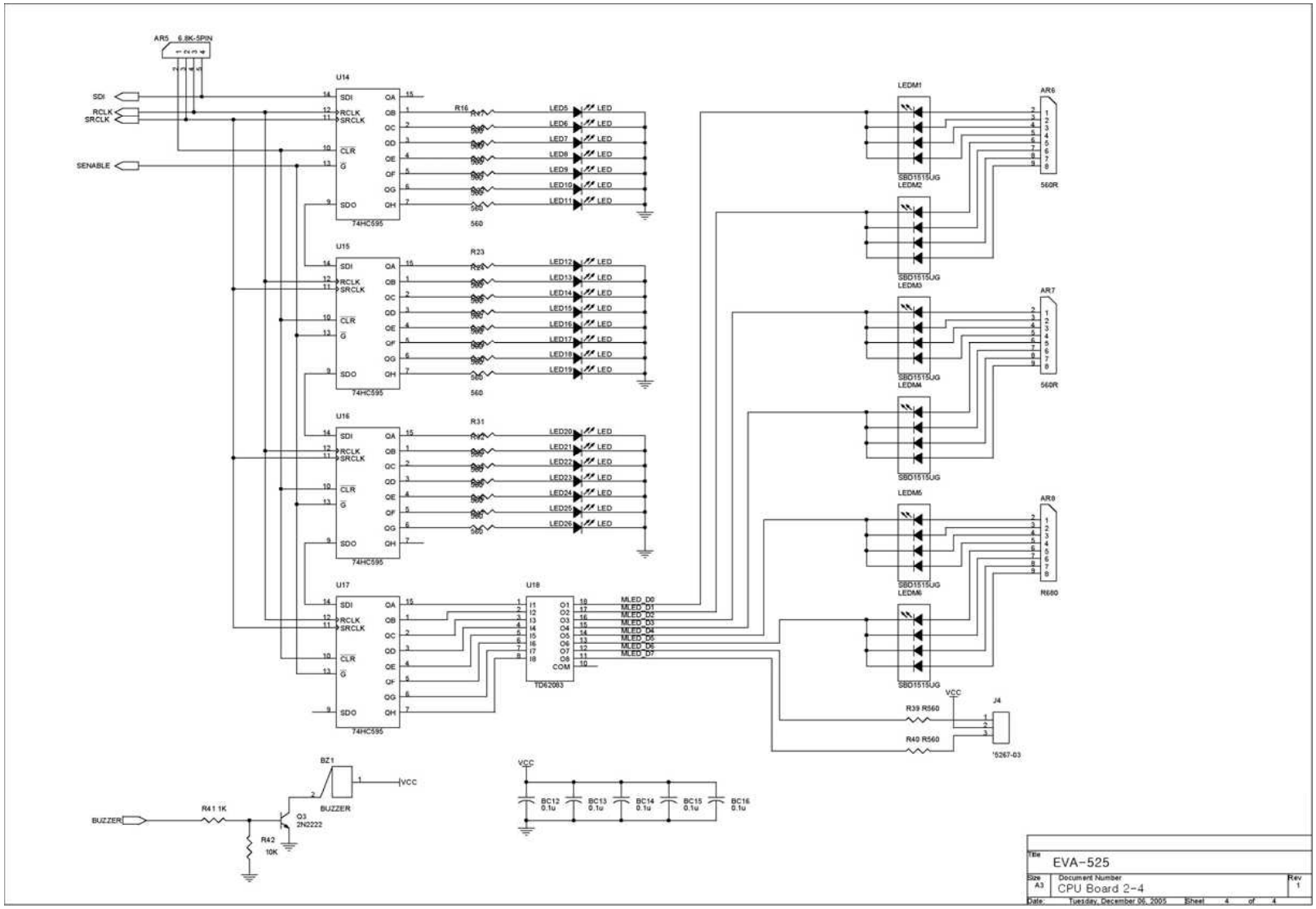
Sheet 1 of 4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SRCLK
SENABLE
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U15
U16
U17
U18
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TD62003
R16
R23
R31
560
LED5
LED6
LED7
LED8
LED9
LED10
LED11
LED12
LED13
LED14
LED15
LED16
LED17
LED18
LED19
LED20
LED21
LED22
LED23
LED24
LED25
LED26
MLED_D0
MLED_D1
MLED_D2
MLED_D3
MLED_D4
MLED_D5
MLED_D6
MLED_D7
LEDM1
LEDM2
LEDM3
LEDM4
LEDM5
LEDM6
SBD1515UG
AR6
AR7
AR8
560R
R680
VCC
R39 R560
R40 R560
J4
5267-03
BZ1
BUZZER
R41 1K
Q3
2N2222
R42
10K
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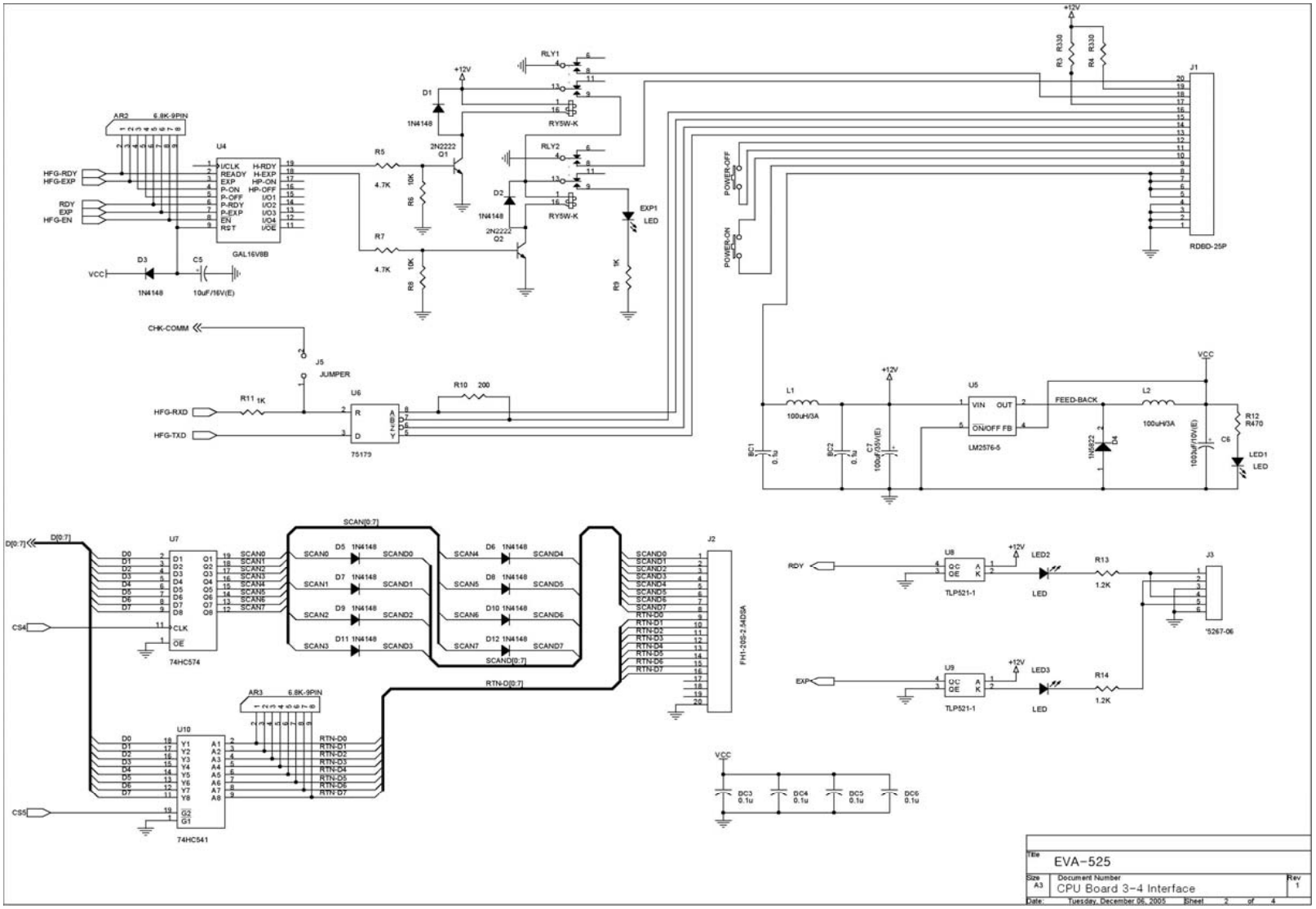
BC16 0.1u
EVA-525
CPU Board 2-4
Tuesday, December 06, 2005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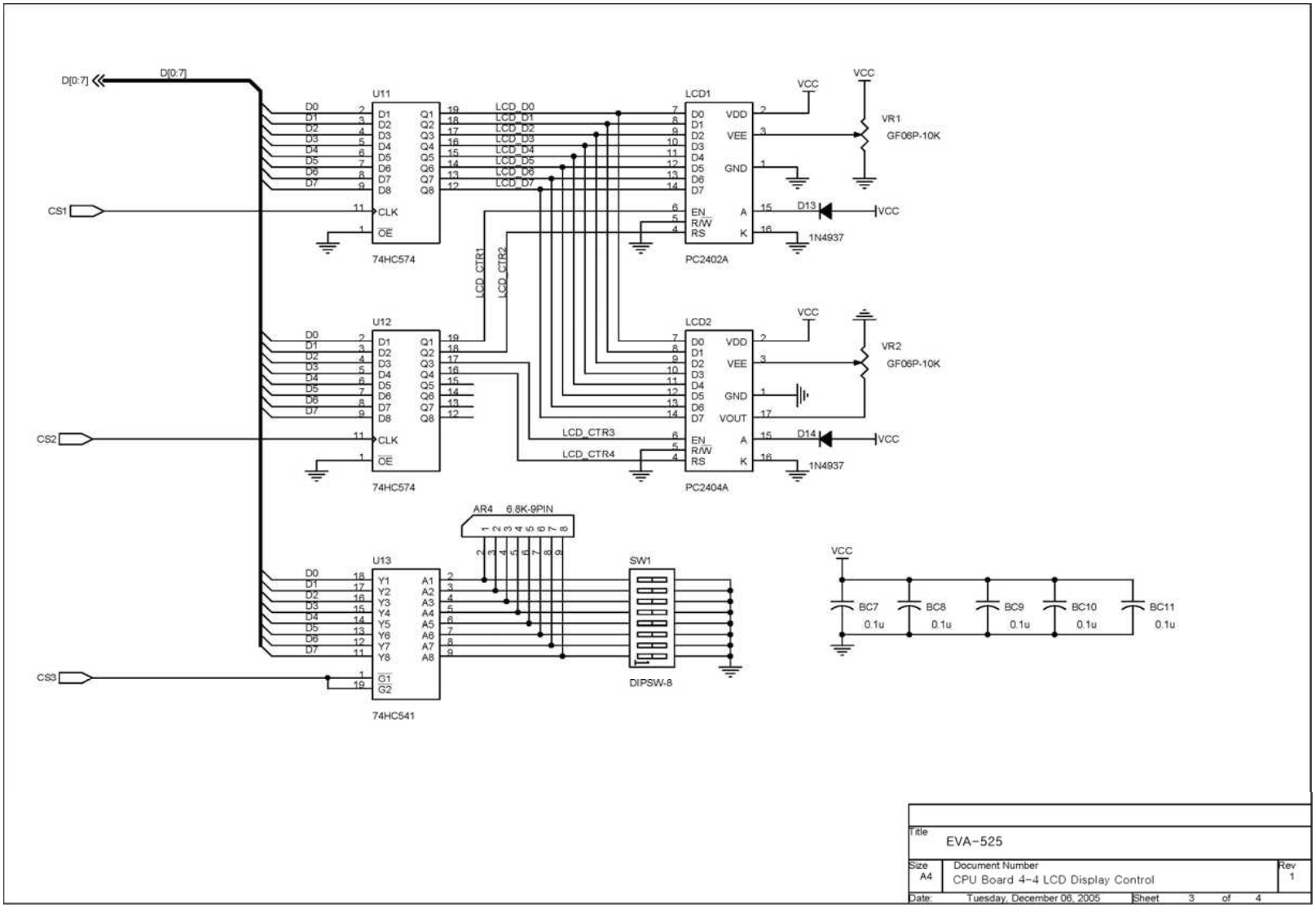
74HC541
75179
LM2576-5
TLP521-1
RDBD-25P
RY5W-K
1N4148
2N2222
HFG-RDY
HFG-EXP
RDY
EXP
HFG-EN
CHK-COMM
HFG-RXD
HFG-TXD
POWER-OFF
POWER-ON
FEED-BACK
LED
JUMPER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VR1
GF06P-10K
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LCD_D3
LCD_D4
LCD_D5
LCD_D6
LCD_D7
LCD_CTR1
LCD_CTR2
CS1
U12
74HC574
LCD2
PC2404A
VR2
GF06P-10K
D14
1N4937
LCD_CTR3
LCD_CTR4
CS2
AR4 6.8K-9PIN
SW1
DIPSW-8
U13
74HC541
CS3
VCC
BC7 0.1u
BC8 0.1u
BC9 0.1u
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Rev 1
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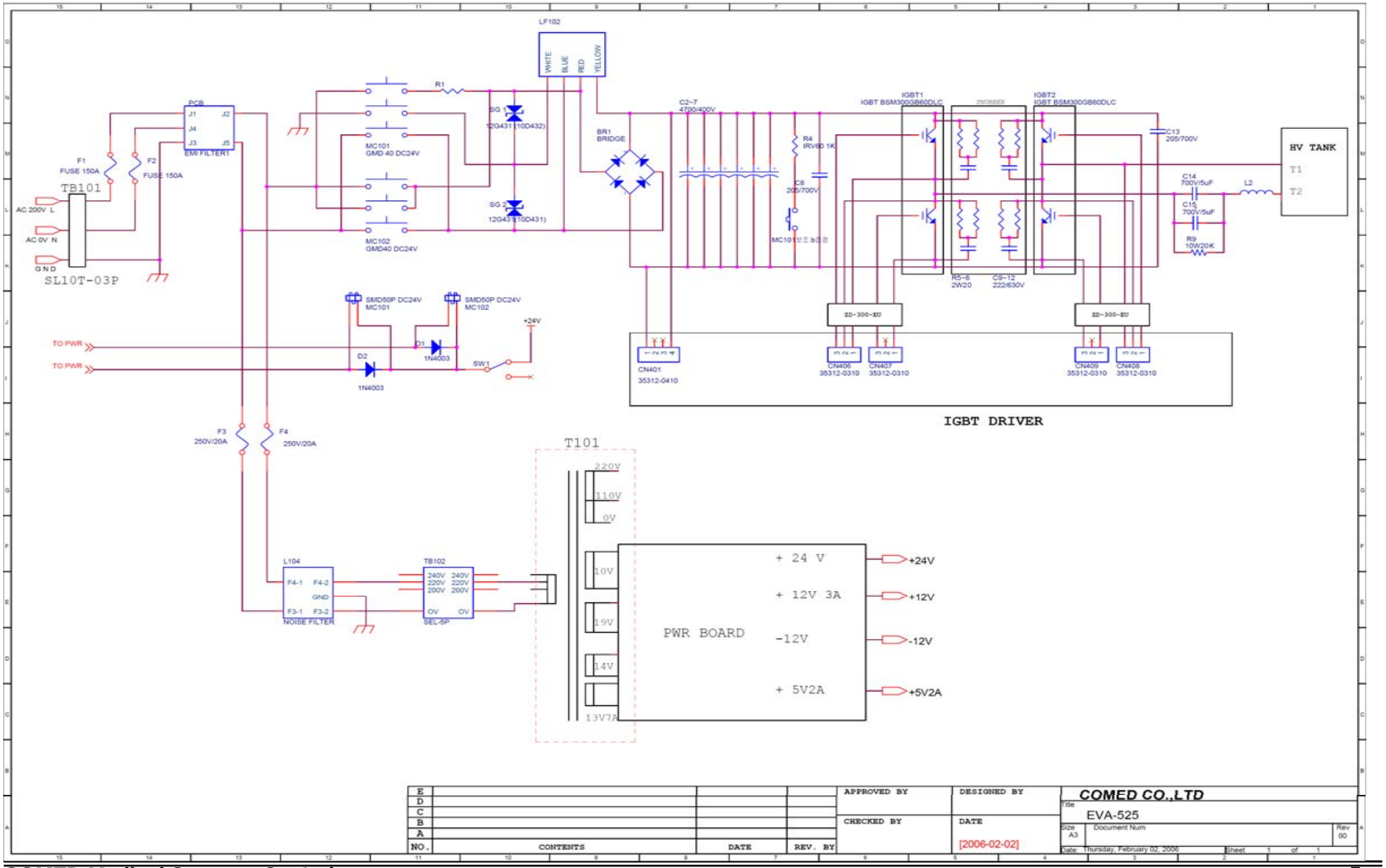
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RED
YELLOW
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J2
J4
J3
J5
EMI FILTER1
F1
FUSE 150A
F2
FUSE 150A
TB101
AC 200V L
AC 0V N
G N D
SL10T-03P
R1
MC101
GMD 40 DC24V
MC102
GMD40 DC24V
SG 1
12G431(10D432)
SG 2
12G431(10D431)
BR1
BRIDGE
C2~7
4700/400V
R4
IRV60 1K
C8
205/700V
IGBT1
IGBT BSM300GB60DLC
IGBT2
IGBT BSM300GB60DLC
C13
205/700V
C14
700V/5uF
C15
700V/5uF
L2
R9
10W/20K
R5~8
2W/20
C9~12
222/630V
HV TANK
T1
T2
ED-300-EU
ED-300-EU
CN401
35312-0410
CN406
35312-0310
CN407
35312-0310
CN409
35312-0310
CN408
35312-0310
IGBT DRIVER
SMD50P DC24V
MC101
SMD50P DC24V
MC102
+24V
TO PWR
TO PWR
D1
1N4003
D2
1N4003
SW1
F3
250V/20A
F4
250V/20A
T101
220V
110V
0V
10V
19V
14V
13V7A
L104
F4-1
F4-2
GND
F3-1
F3-2
NOISE FILTER
TB102
240V 240V
220V 220V
200V 200V
0V 0V
SEL-5P
PWR BOARD
+ 24 V
+ 12V 3A
-12V
+ 5V2A
+24V
+12V
-12V
+5V2A
APPROVED BY
DESIGNED BY
CHECKED BY
DATE
[2006-02-02]
COMED CO.,LTD
EVA-525
Size
A3
Document Num
Rev
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Date: Thursday, February 02, 2006
Sheet 1 of 1
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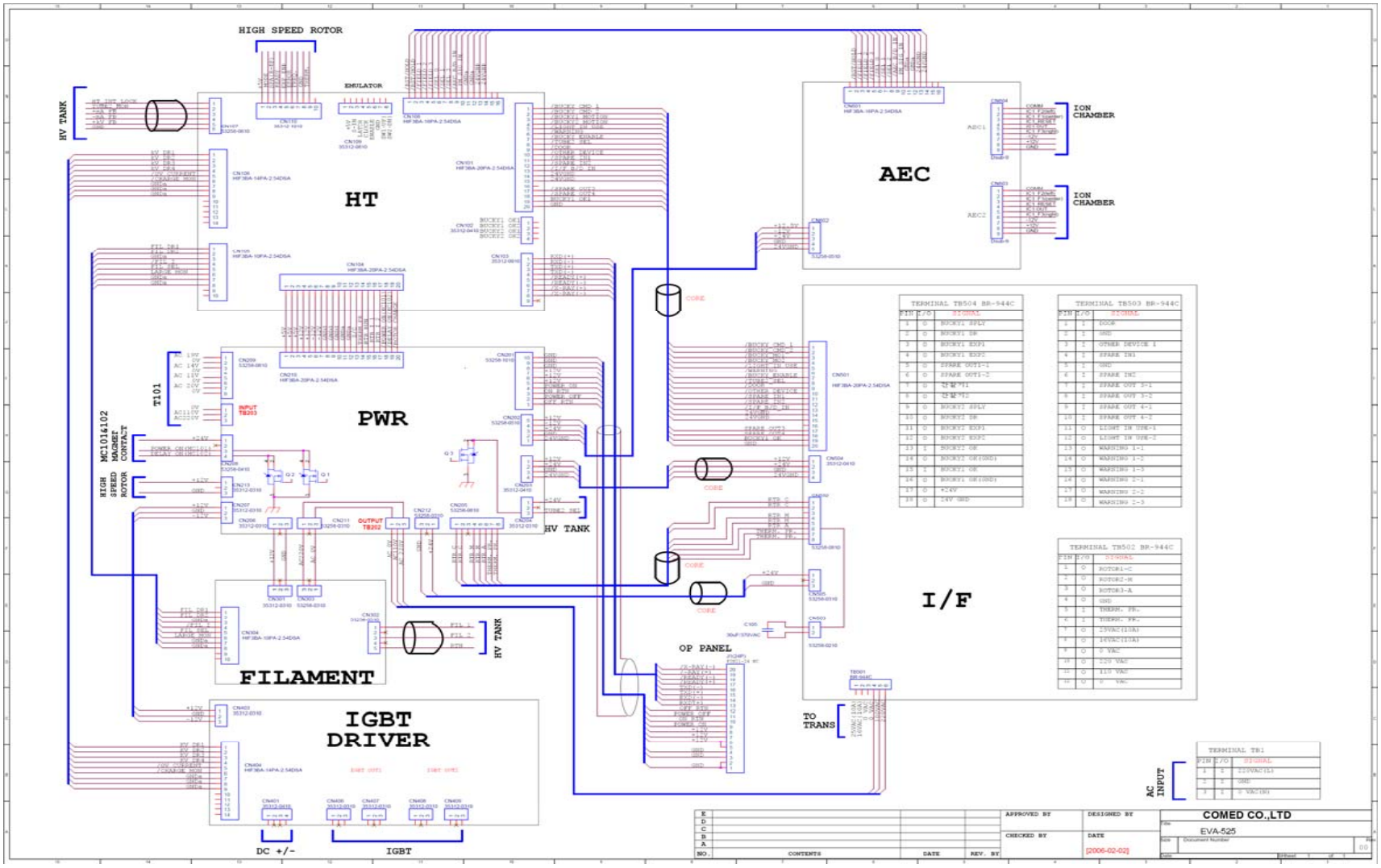
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EMULATOR
HV TANK
HT
PWR
AEC
ION CHAMBER
ION CHAMBER
I/F
T101
INPUT TB203
OUTPUT TB202
MC1016102
HIGH SPEED ROTOR CONTACT
HV TANK
OP PANEL
FILAMENT
HV TANK
IGBT DRIVER
TO TRANS
AC INPUT
DC +/-
IGBT
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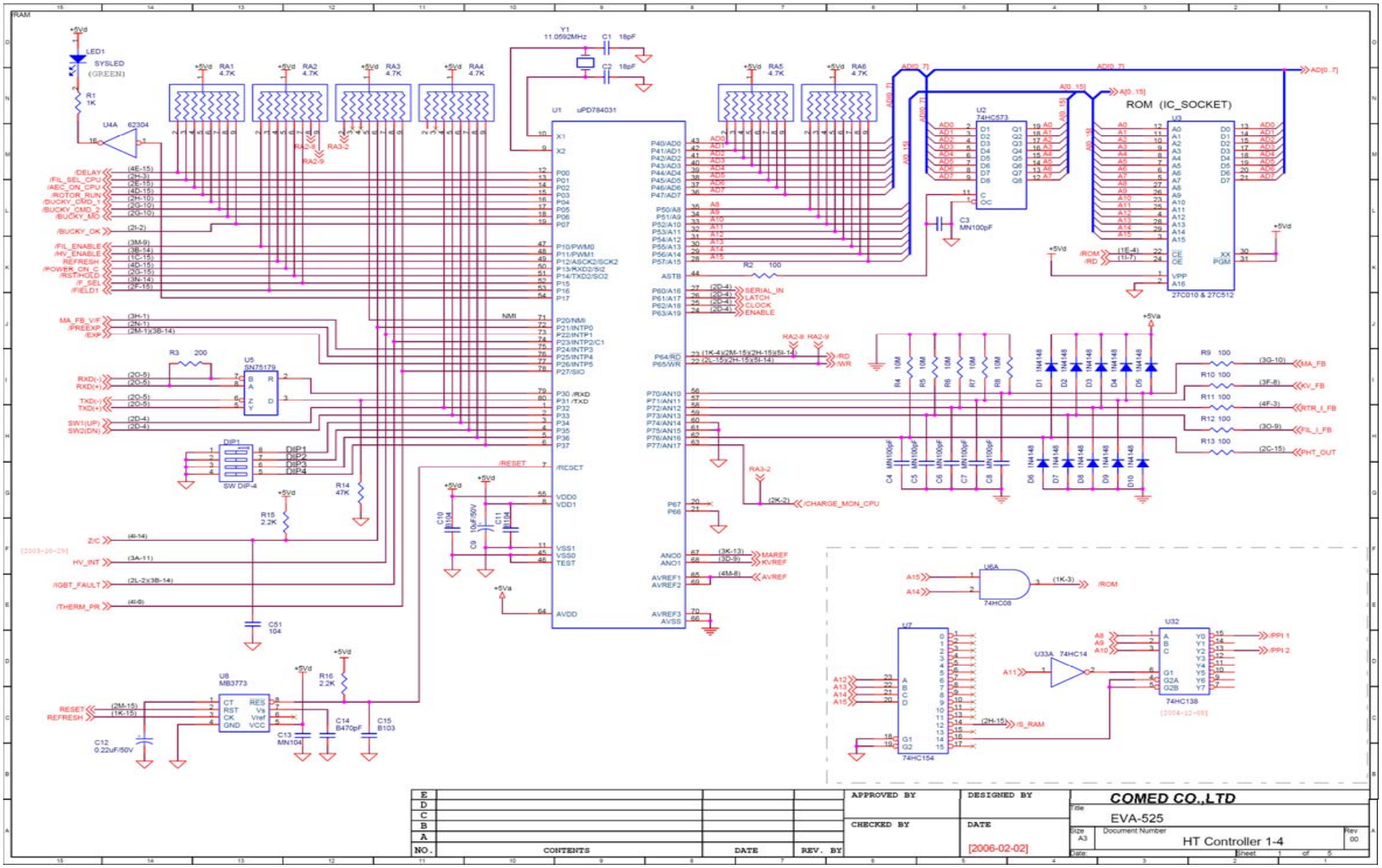
COMED CO.,LTD
EVA-525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U2 74HC573
U3
U4A 62304
U5 SN75179
U6A 74HC08
U7 74HC154
U8 MB3773
U32 74HC138
U33A 74HC14
Y1 11.0592MHz
SW DIP-4
27C010 & 27C512
APPROVED BY
DESIGNED BY
CHECKED BY
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COMED CO.,LTD
EVA-525
HT Controller 1-4
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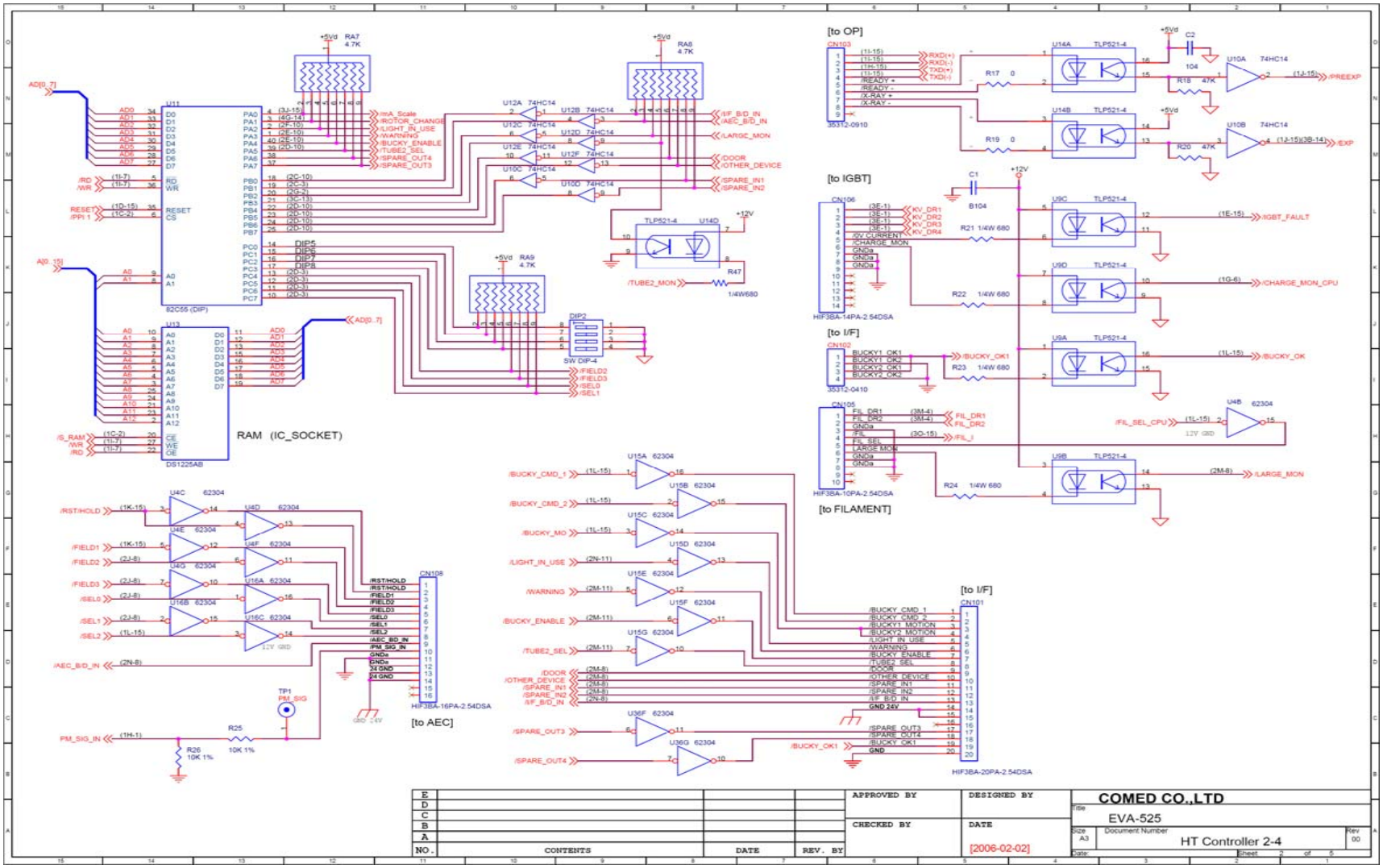
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[to IGBT]
[to I/F]
[to FILAMENT]
[to AEC]
[to I/F]
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DIS1225AB
SW DIP-4
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COMED CO.,LTD
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DESIGNED BY
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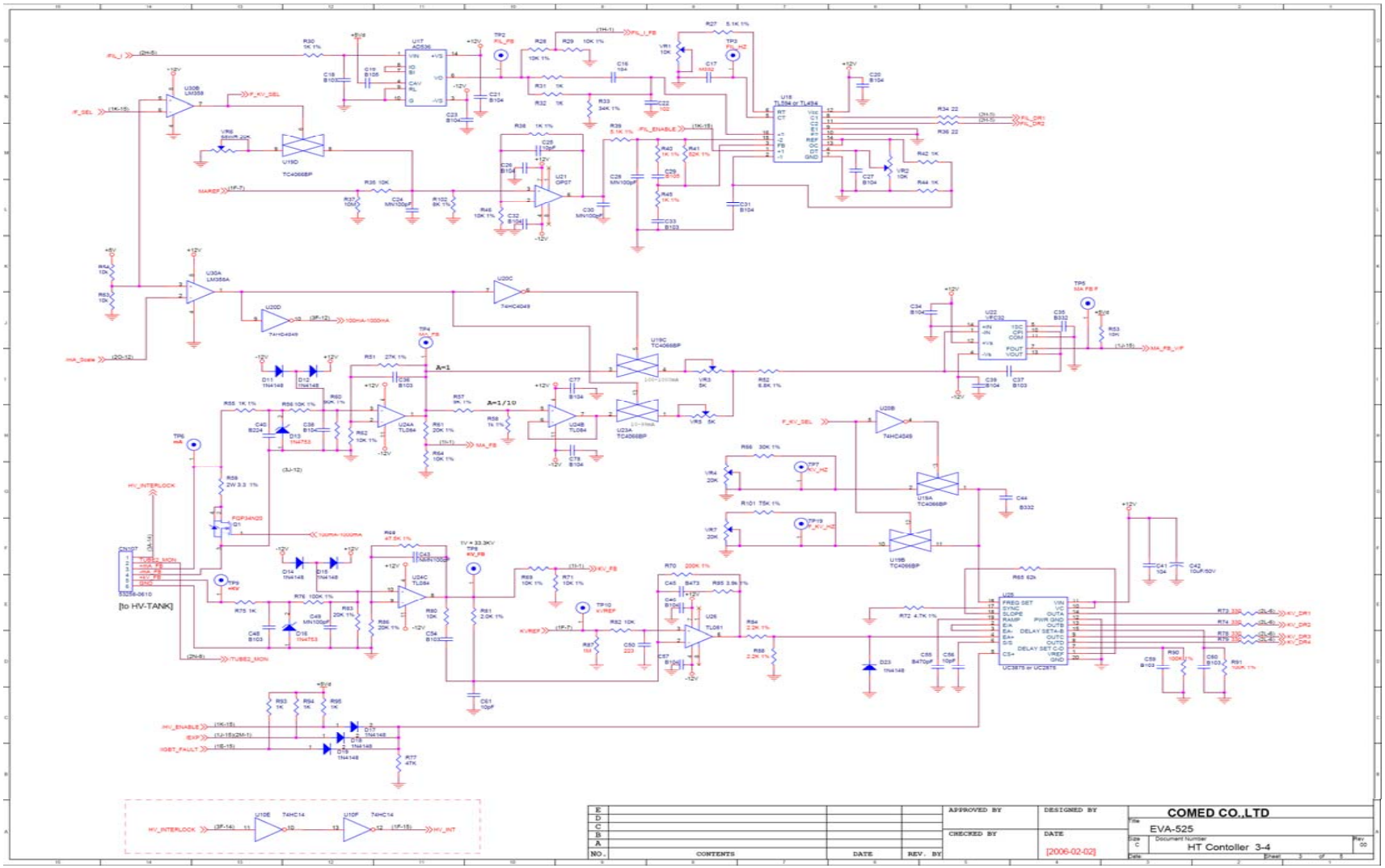
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HT Contoller 3-4
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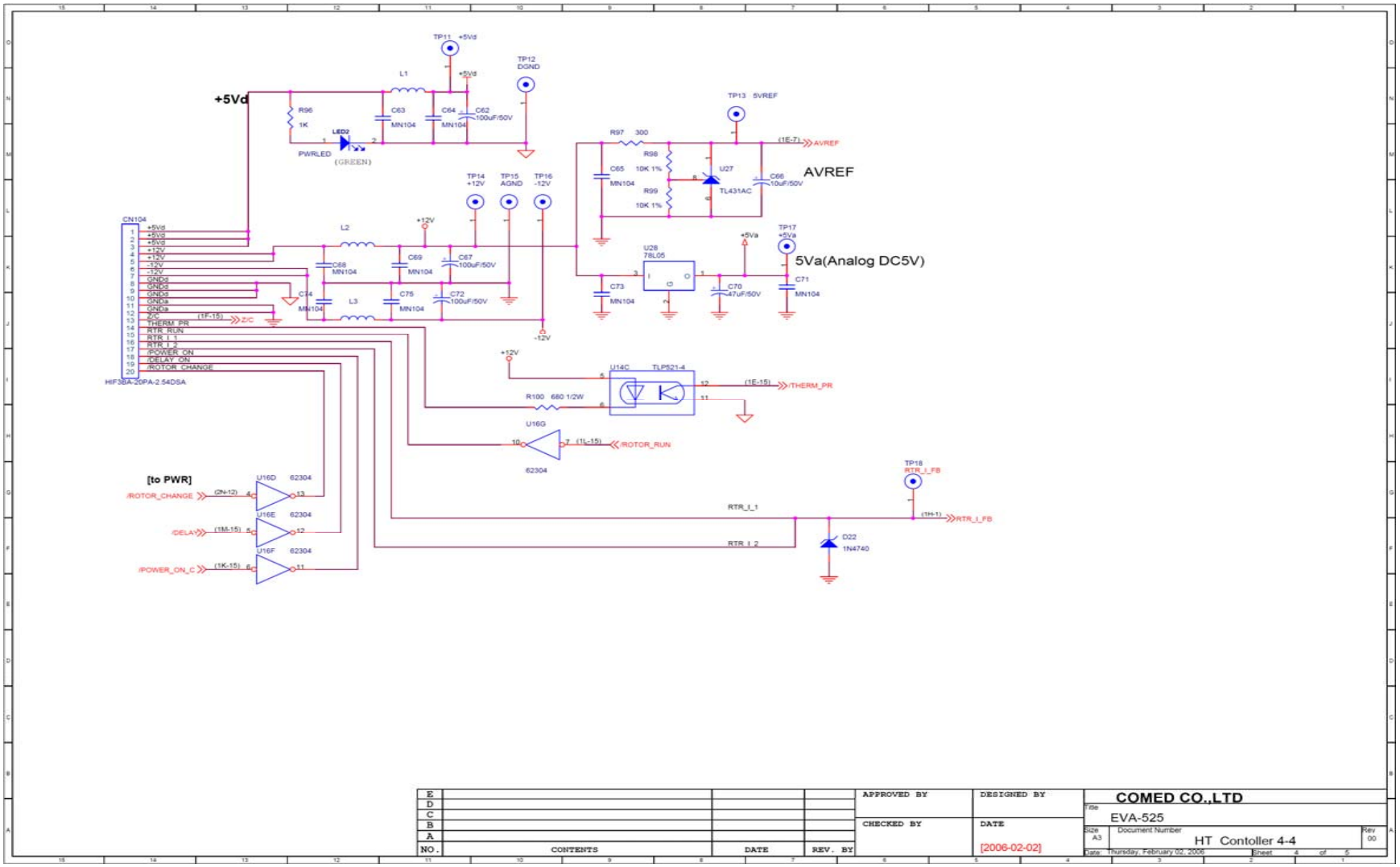
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AVREF
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EVA-525
HT Contoller 4-4
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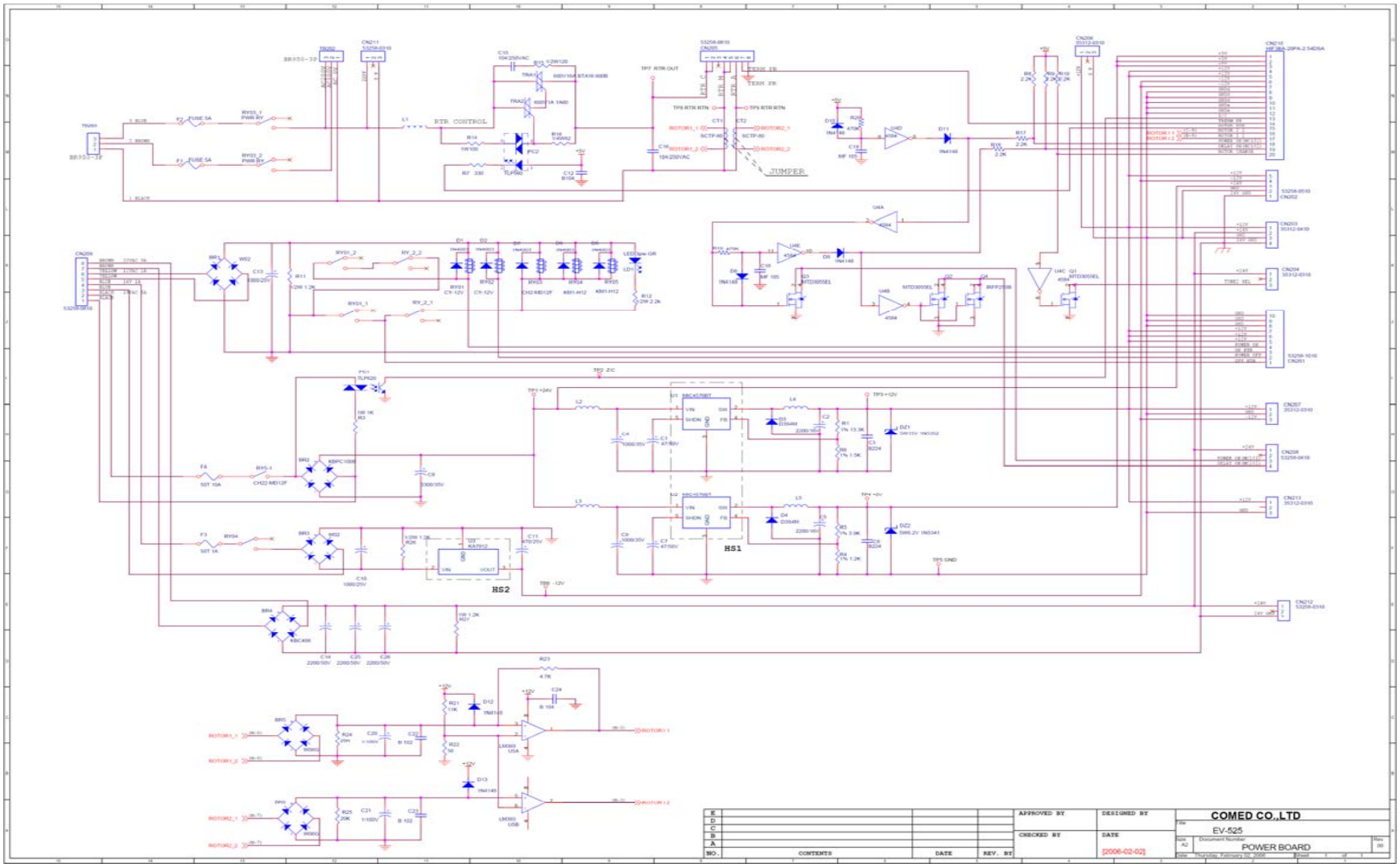
RTR CONTROL
JUMPER
HS1
HS2
COMED CO.,LTD
EV-525
POWER BOARD
APPROVED BY
DESIGNED BY
CHECKED BY
DATE
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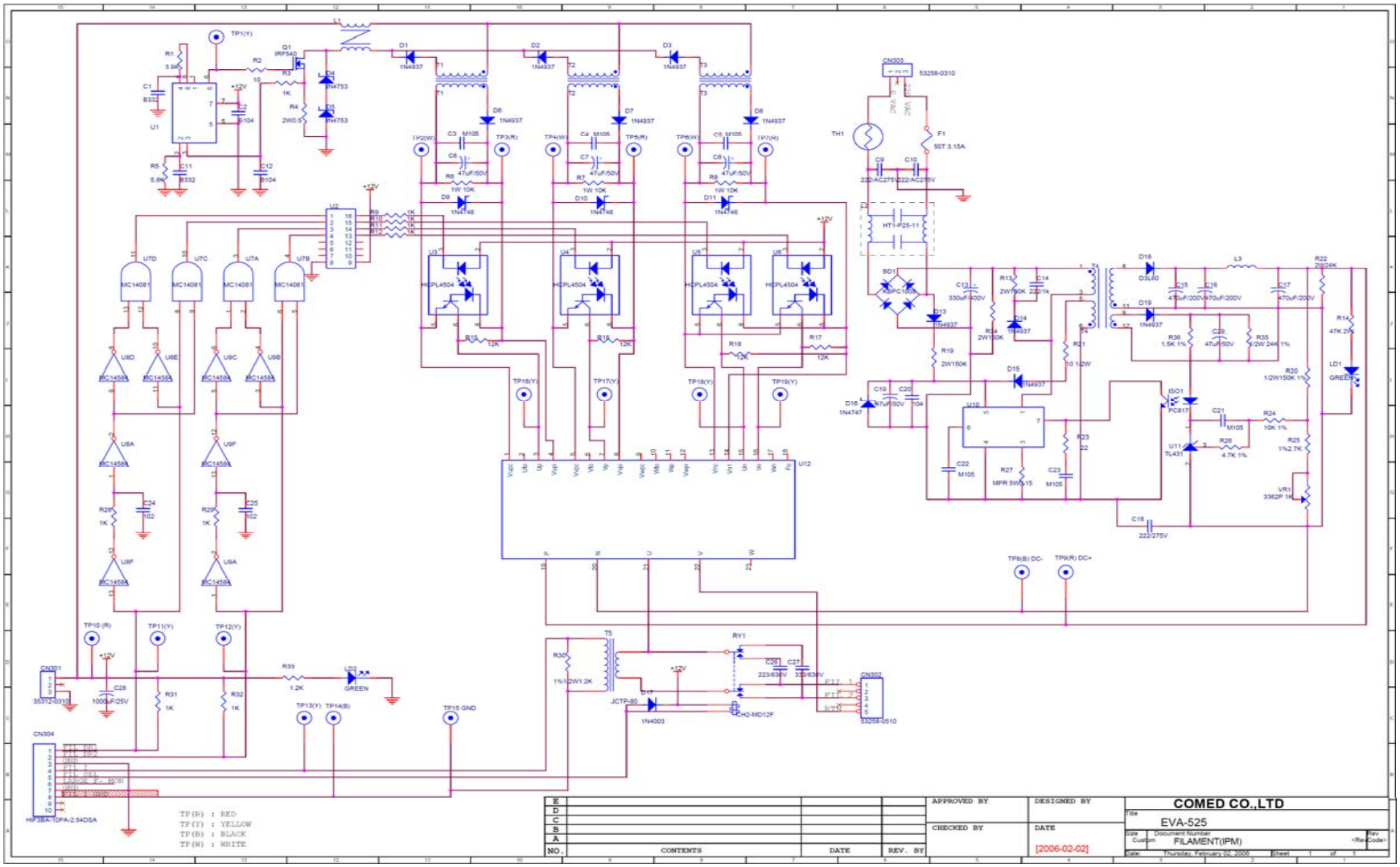
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EVA-525
FILAMENT(IPM)
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CHECKED BY
DATE
[2006-02-02]
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DATE
REV. BY
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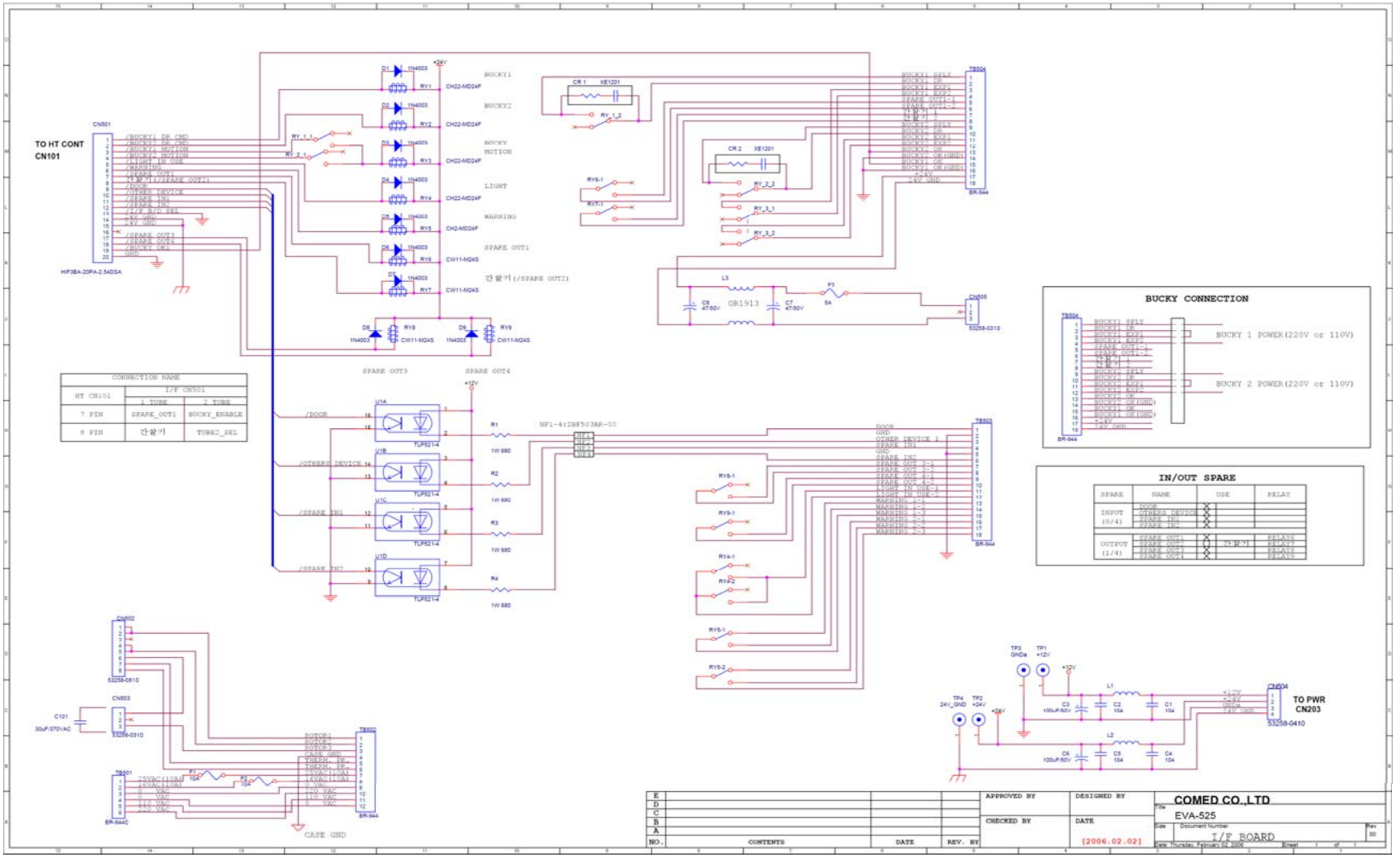
TP(Y) : YELLOW
TP(B) : BLACK
TP(W) : WHITE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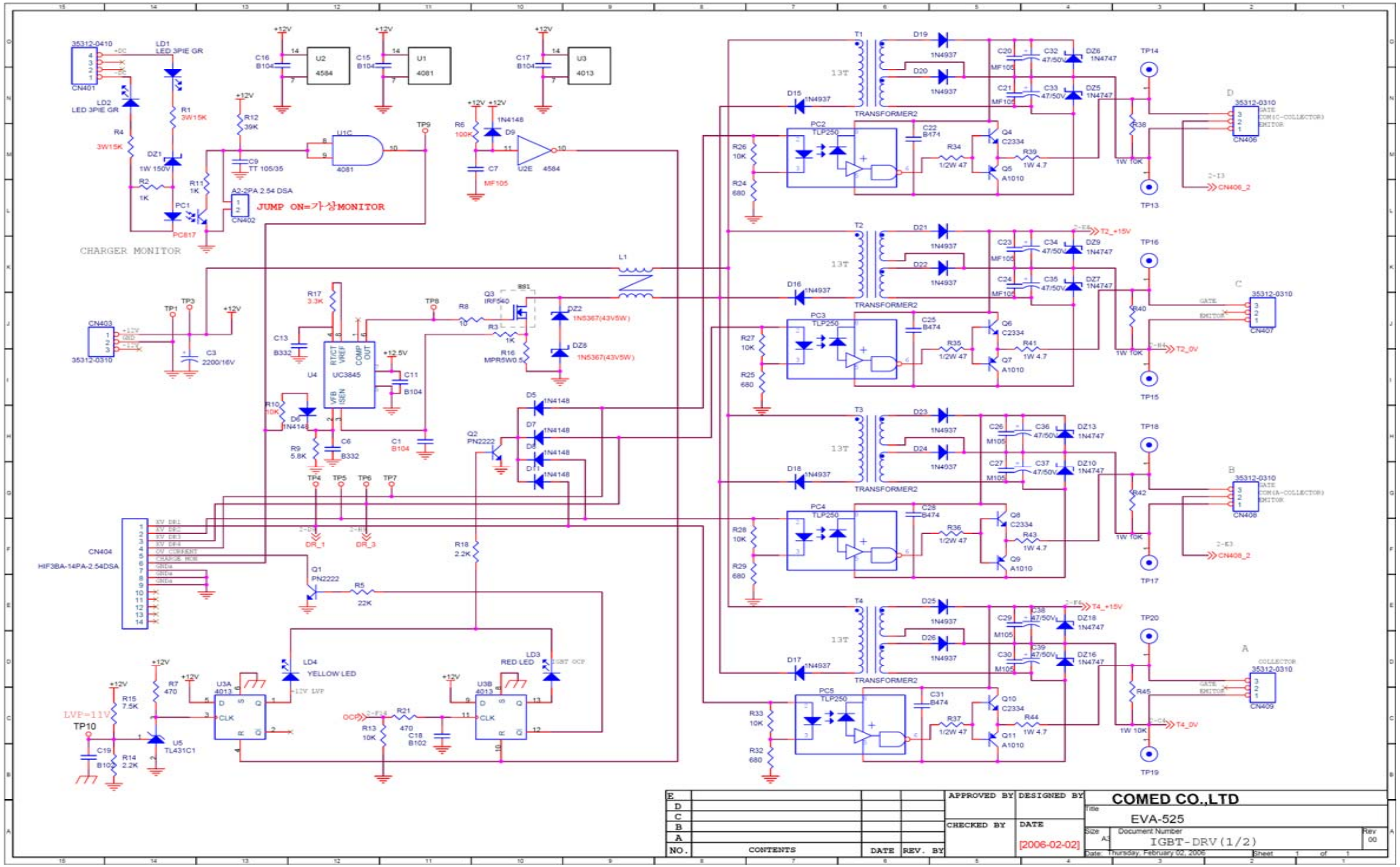
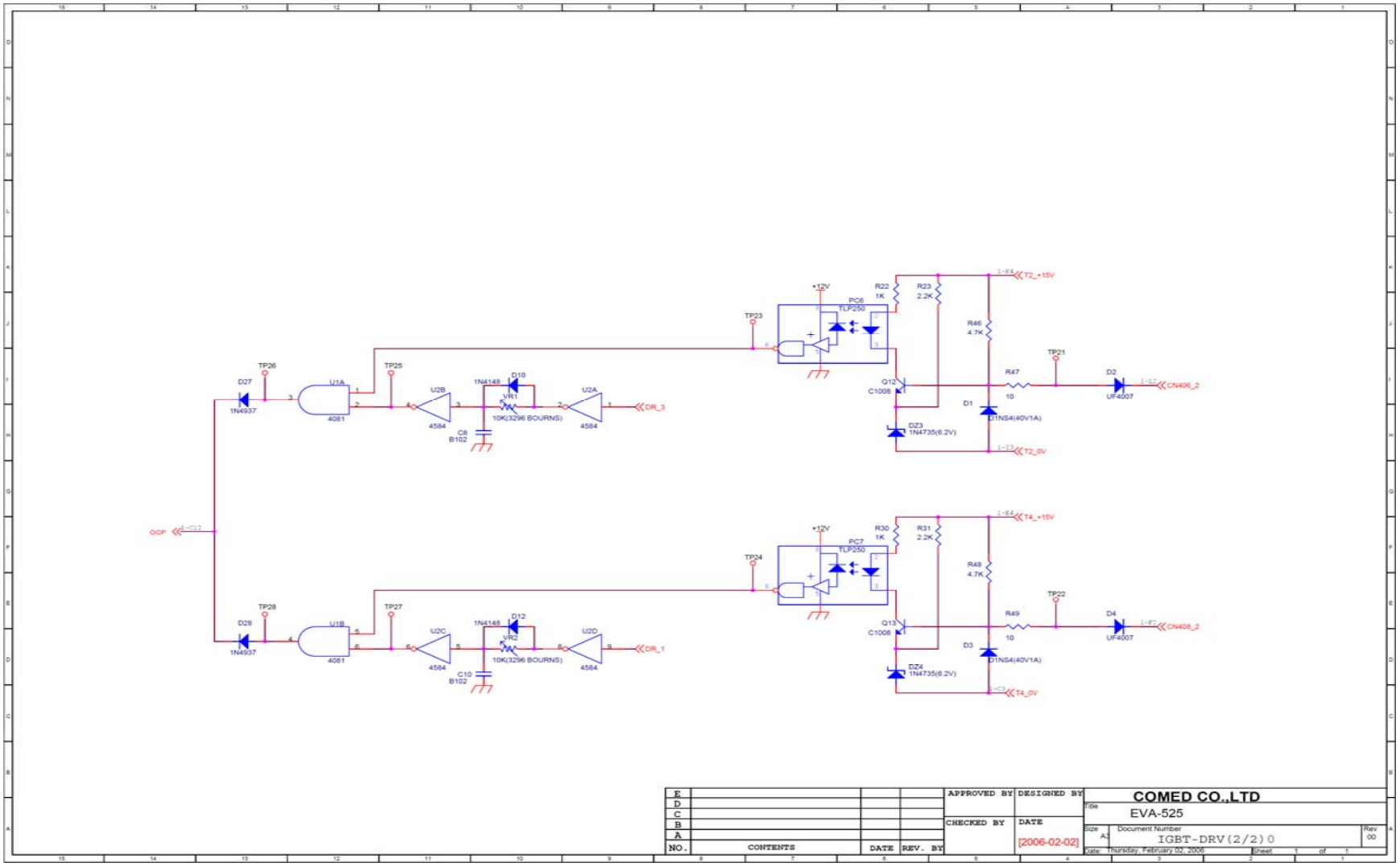
CN501
BUCKY1
BUCKY2
BUCKY MOTION
LIGHT
WARNING
SPARE OUT1
간발기(/SPARE OUT2)
SPARE OUT3
SPARE OUT4
CONNECTION NAME
HT CN101
I/F CN501
1 TUBE
2 TUBE
7 PIN
SPARE_OUT1
BUCKY_ENABLE
8 PIN
간발기
TUBE1_SEL
BUCKY CONNECTION
BUCKY 1 POWER(220V or 110V)
BUCKY 2 POWER(220V or 110V)
IN/OUT SPARE
INPUT (0/4)
OUTPUT (1/4)
TO PWR CN203
CASE GND
COMED CO.,LTD
EVA-525
T/F BOARD
APPROVED BY
DESIGNED BY
CHECKED BY
DATE
[2006.02.02]


CHARGER MONITOR
JUMP ON=가상MONITOR
TRANSFORMER2
UC3845
YELLOW LED
RED LED
COMED CO.,LTD
EVA-525
IGBT-DRV (1/2)
APPROVED BY
DESIGNED BY
CHECKED BY
DATE
[2006-02-02]
CONTENTS
DATE
REV.
BY
Thursday, February 02, 2006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TP23
R46 4.7K
TP21
R47 10
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Q12 C1008
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DZ3 1N4735(6.2V)
T2_+15V
T2_0V
CN406_2
TP26
D27 1N4937
U1A 4081
TP25
U2B 4584
D10 1N4148
VR1 10K(3296 BOURNS)
C8 B102
U2A 4584
DR_3
OCP
+12V
R30 1K
R31 2.2K
PC7 TLP250
TP24
R48 4.7K
TP22
R49 10
D4 UF4007
Q13 C1008
D3 D1NS4(40V1A)
DZ4 1N4735(6.2V)
T4_+15V
T4_0V
CN408_2
TP28
D28 1N4937
U1B 4081
TP27
U2C 4584
D12 1N4148
VR2 10K(3296 BOURNS)
C10 B102
U2D 4584
DR_1
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DESIGNED BY
CHECKED BY
DATE
[2006-02-02]
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EVA-525
IGBT-DRV(2/2)0
Thursday, February 02, 2006

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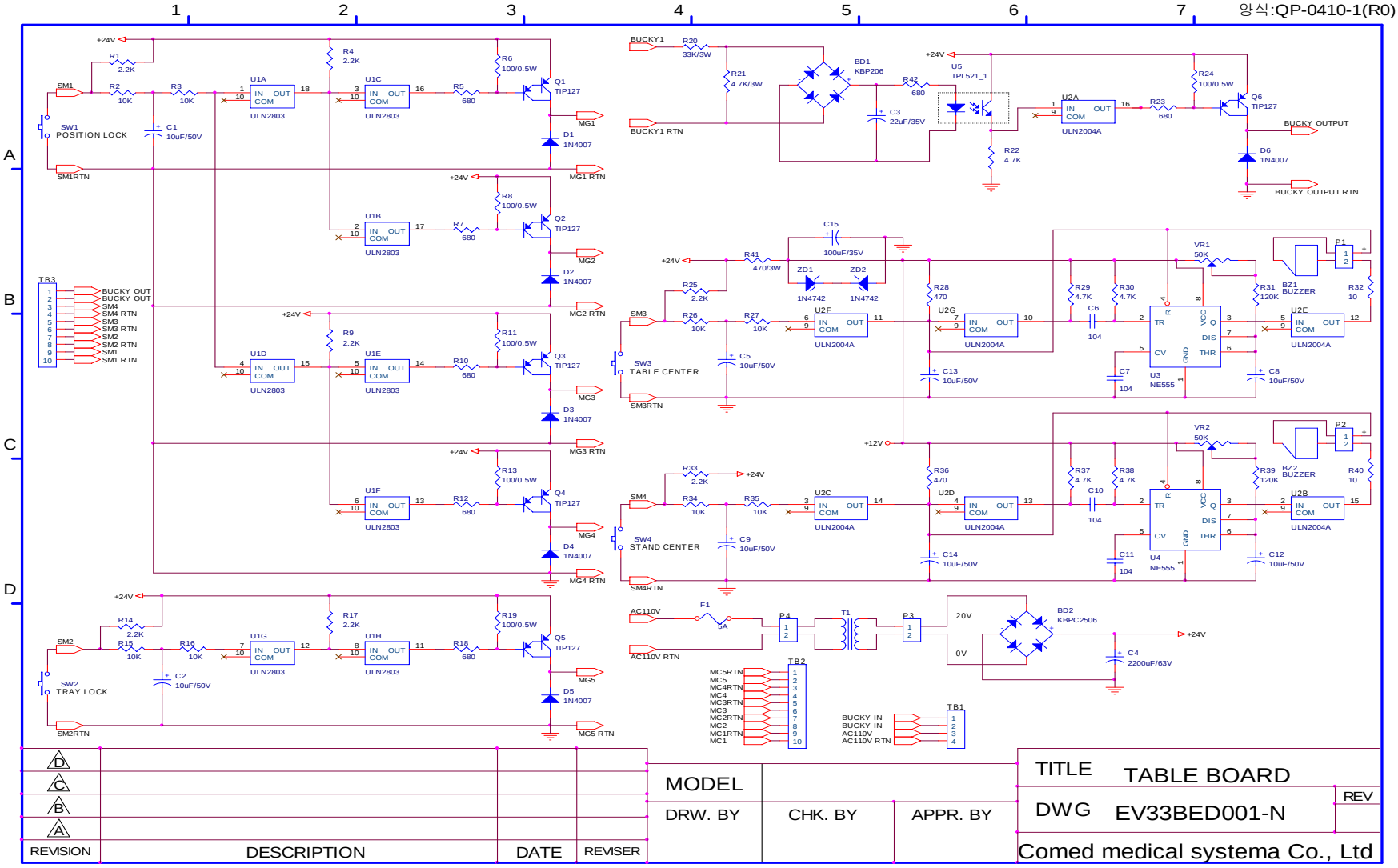

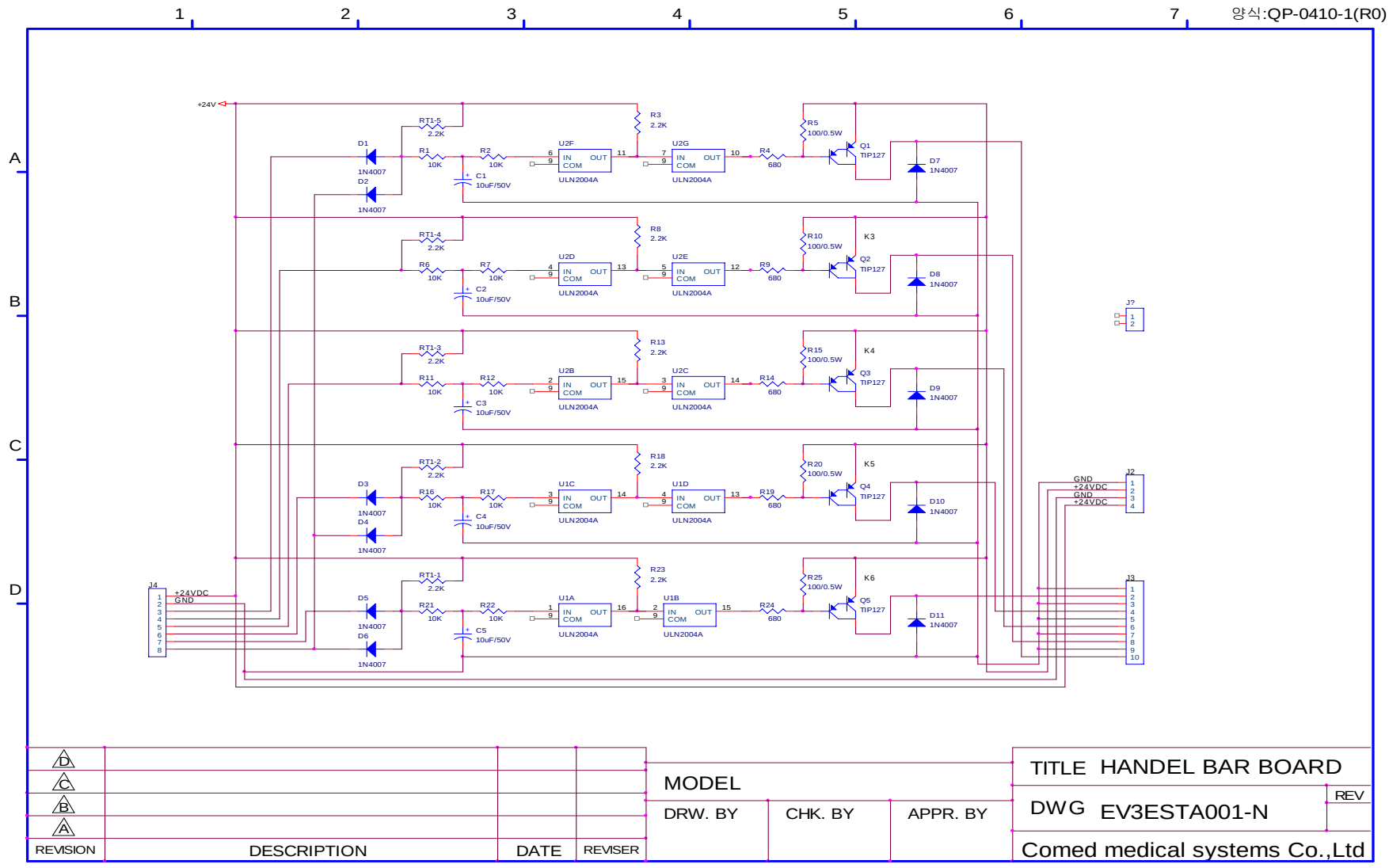
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D2
1N4007
R1
10K
R2
10K
C1
10uF/50V
U2F
U2G
ULN2004A
R3
2.2K
R4
680
R5
100/0.5W
Q1
TIP127
D7
1N4007
RT1-4
R6
R7
C2
U2D
U2E
R8
R9
R10
K3
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D8
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R12
C3
U2B
U2C
R13
R14
R15
K4
Q3
D9
RT1-2
D3
D4
R16
R17
C4
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R19
R20
K5
Q4
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J4
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GND
J7
J2
GND
+24VDC
GND
+24VDC
J3
REVISION
DESCRIPTION
DATE
REVISER
MODEL
DRW. BY
CHK. BY
APPR. BY
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