

-

-

2003 .

- 350/450/550/650/650-60HF

1.	3	
2.		4
3.	7	
3.1	7	
3.1.1		7
3.1.2		8
3.1.3		10
3.2		
3.3		12
3.3.1		13
3.3.2		24
4.		
4.1		
4.1.1		(TPCON)
4.1.1.1		
4.1.1.1.1		
4.1.1.1.2		
4.1.1.1.3		(SIO2)
4.1.1.1.4		
4.1.1.1.5		
4.1.1.2		
4.1.1.3		
4.1.1.4		
4.1.1.5		
4.1.1.6		
4.1.2		(TXFRC)
4.1.2.1		
4.1.2.1.1 LCD		
4.1.2.1.2		
4.1.2.1.3		TPCON1
4.1.2.1.4		
4.1.2.2		
4.1.2.3		
4.1.2.4		
4.1.2.5		
4.1.2.6		
4.2		
4.2.1	(TXPWS)	
4.2.1.1		
4.2.1.2		
4.2.1.3		
4.2.1.4		
4.2.1.5		
4.2.1.6		
4.2.2		(TXCTR)
4.2.2.1		

4.2.2.1.1		
4.2.2.1.2	SIO	
4.2.2.1.3	(ABS)	
4.2.2.1.4		
4.2.2.1.5		
4.2.2.1.6		
4.2.2.1.7		
4.2.2.1.8	PS	
4.2.2.2		
4.2.2.3		
4.2.2.4		
4.2.2.5		
4.2.2.6		
4.2.3		(TXRIF)
4.2.3.1		
4.2.3.1.1	(	Bucky)
4.2.3.1.2		
4.2.3.1.3		
4.2.3.1.4		
4.2.3.1.5		
4.2.3.1.6		
4.2.3.2		
4.2.3.3		
4.2.3.4		
4.2.3.5		
4.2.3.6		
4.2.4		(TXFIF)
4.2.4.1		
4.2.4.1.1	(Spotfilm	,)
4.2.4.1.2	(Spotfilm)
4.2.4.1.3		
4.2.4.2		
4.2.4.3		
4.2.4.4		
4.2.4.5		
4.2.4.6		
4.2.5		ABS (TXABS)
4.2.5.1		
4.2.5.1.1		
4.2.5.1.2		
4.2.5.1.3	()
4.2.5.1.4		
4.2.5.1.5		ABS
4.2.5.1.6		ABS
4.2.5.1.7		
4.2.5.2		
4.2.5.3		
4.2.5.4		
4.2.5.5		
4.2.5.6		
4.3		
4.3.1		TXREM

—

- 4

2.

TOP-X HF -

:

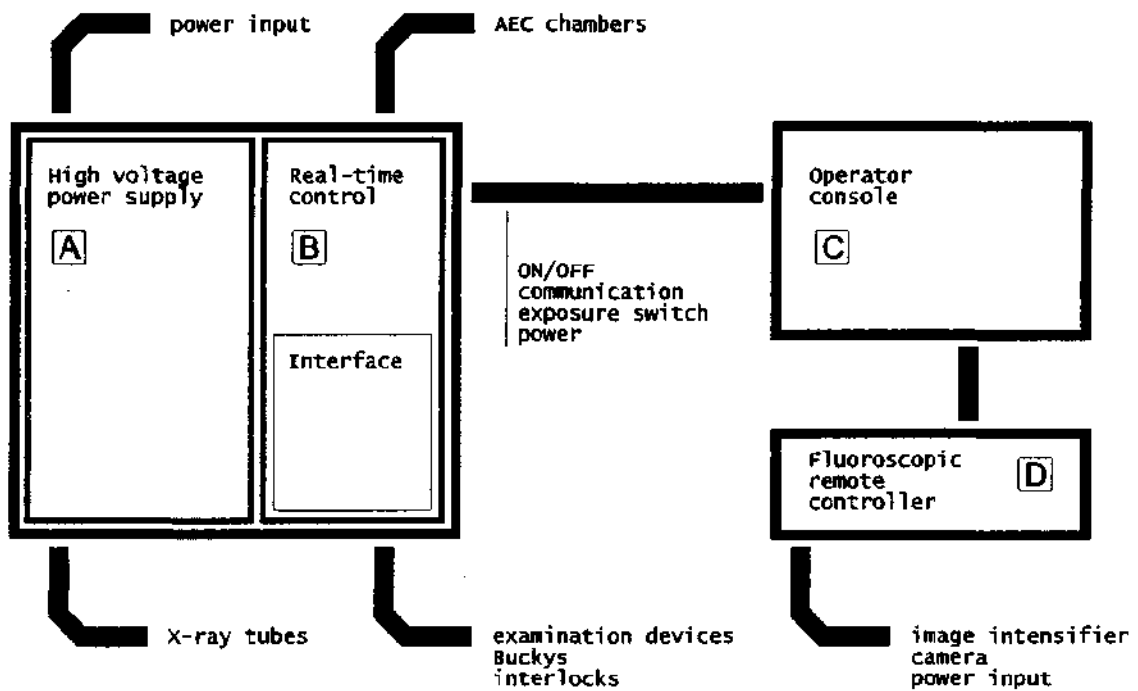
- 450HF	30 kW	400	IG-450HF
- 550HF	40 kW	500	IG-550HF
- 650HF	50 kW	600	IG-650HF
- 850HF	65 kW	800	Varian/CPI VPW2904
- 1050HF	80 kW	1000	Varian/CPI VPW2905

:

C

(D)

,
(, 3000 /), (9000
/)



(power input)
 (AEC chambers) ()
 (Operator console)
 (High voltage power supply)
 (Real-time control)
 (Interface)
 (Fluoroscopic remote controller)
 (X-ray tube)
 (examination devices Buckys interlocks) (image
 intensifier camera power input)
 (ON/OFF communication exposure switch power) , / :

RS-232C

IBM

PC,

APR (), : , , , , .

PC,

· , , · · ·

(),

· , ,

·

3.

3.1

3.1.1

- IBM PC, .

- IBM PC 386 , 1 , (,

VGA, ()

RS-232C. -

VGA (- VGA

).

PC , COM1.

- , - ,

VGA, ,

VGA , (

).

RS-232C.

VGA () , ().

COM1 :

COM2 :

COM3 ()

()

3.1.2

PC (

).

(.):

1. , :
2. -
TOPX.EXE HFX.EXE
data files HFX.OVR
data files
()
MTSAPDL.SYS
MTSTOUCH.SYS

:
:
: - 5.0 , ,
- : - (

),
: - 600 ,

1. :
2.). (,
3.), (,

3. , IBM PC 640 ,

, , ,

:

, p, , s, () c

, , (AEC).

(APR).

3.1.3

(TOPX HFX)

CONFIG.SYS
files=20
device=himem.sys
dos=high
AUTOEXEC.BAT
prompt \$p\$g
path c:\dos cd \topx
topx

CONFIG.SYS
files=20
device=himem.sys
dos=high
device=c:\mtsapdi.sys
device=c:\mtstouch.sys
AUTOEXEC.BAT
prompt \$p\$g
path c:\dos
cd \hfx
hfx

3.2

-

- ,
-

-

:

-
-

-

- (Bucky)
- (, , . .)
-
- ()
-

(, spotfilm), (i ge intensifier), . .

()

:

-

- (DC)
- (CPU): +5 V, +15 V, -15V
-
- (ZK1)

-

(CPU):

:

-
- ,
- ()
- ,
- ()

-

-

-

-

-

"

. "

. "

3.3

，
：
.
.
(). . CPU ().

.
.
(). . CPU ().

HVPS

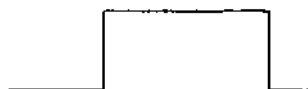
- ，
：
- A. HVPS ， HVPS
 - B. HVPS
 - C. ， HVPS
 - D. ， HVPS
 - E. HVPS
 - F. (，)
 - G. ，
 - H. ，
 - I. ，
 - J. (Bucky)
 - 1. (， ，
 - K. ， . .)

3.3.1

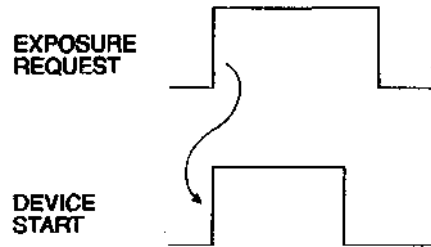
1. $\frac{1}{2}$
2. HVPS, ()
- 3.
4. ()

,
 ,
 ,
 (AEC).
 / :
 (, ,), AEC:
 : ()
 : - :
 -f 25 % ()
 :
 + 50 % ()
 AEC : ()
 (,), AEC:
 : - :
 + 25 % ()
 :
 + 50 % ()
 : ()
 AEC : ()
 AEC :
 : - :
 + 25 % ()
 :
 + 50 % ()
 : - :
 ()
 :
 + 50 % ()
 AEC : , , , ()
 ,
 .
 .
 .
 ,
 .
 :
 1. ,
 2. ,
 ,
 (,)
 ,
 ,
 ,

EXPOSURE REQUEST



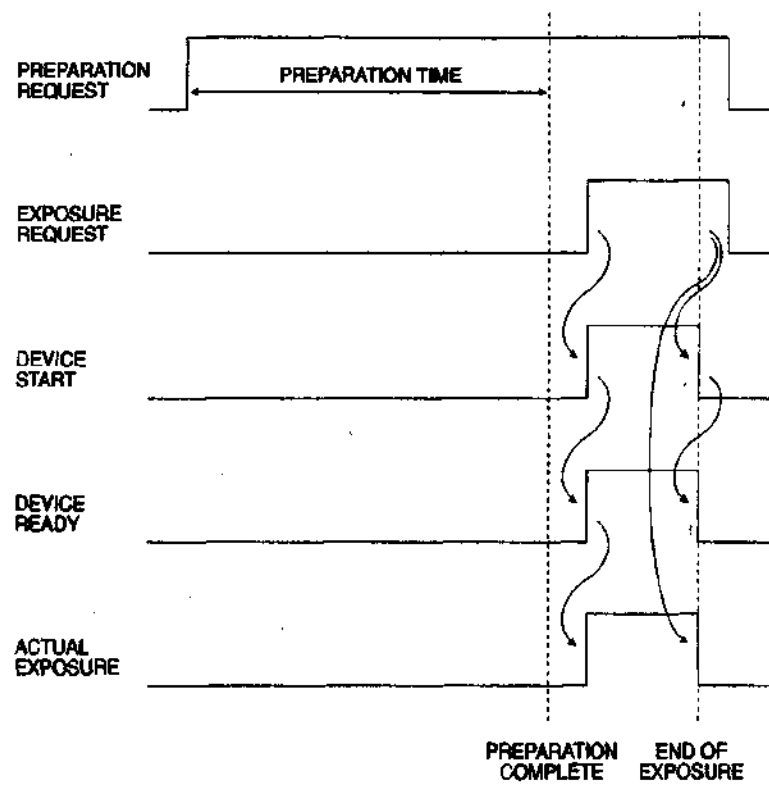
(EXPOSURE REQUEST)



(EXPOSURE REQUEST)
(DEVICE START)

(EXPOSURE REQUEST)
(DEVICE START).

(Bucky).



()

(PREPARATION REQUEST)
 (EXPOSURE REQUEST)
 (DEVICE START)
 (DEVICE READY)
 (DEVICE START)
 (ACTUAL EXPOSURE)
 (PREPARATION COMPLETE)
 (END OF EXPOSURE)
 (PREPARATION TIME)

(Bucky)

(DEVICE START),

(
).

HVPS.

,

"

:

",

"

.

,

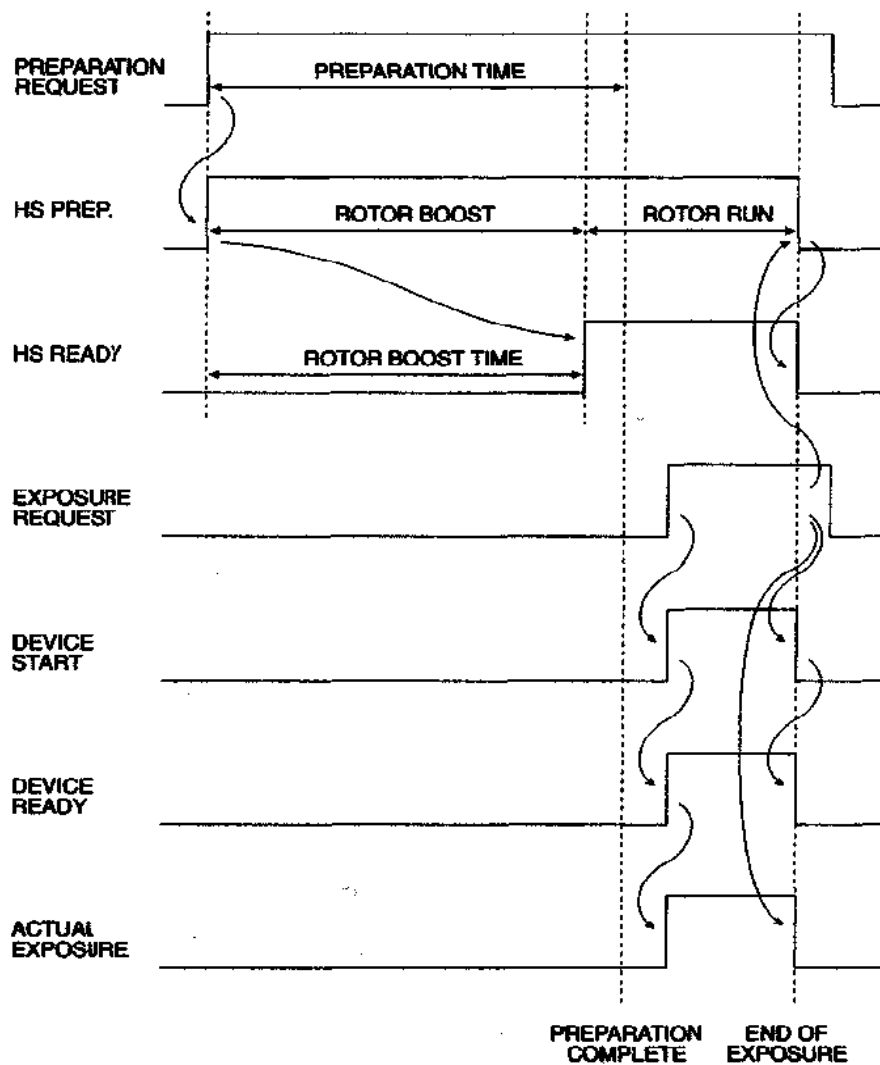
"

,

.

:

.



()

(PREPARATION REQUEST)
 (EXPOSURE REQUEST)
 (DEVICE START)
 (DEVICE READY)
 (DEVICE START)
 (ACTUAL EXPOSURE)
 (PREPARATION COMPLETE)
 (END OF EXPOSURE)
 (PREPARATION TIME)
 (ROTOR BOOST)
 (ROTOR BOOST TIME)
 (ROTOR RUN)

HS (HS PREP), (ROTOR
 BOOST TIME)" "

(PREPARATION TIME)",
 (INSTALL)).

HS (HS SELECT) HS
 (HS PREP) HS
 (HS PREP).

().

(AEC)

(spotfilm-), (spotfilm-),

.

(

- 1.
- 2.

- 1.

(DEVICE READY)

- 2.

(AEC)

(Bucky). (Bucky),
 (DEVICE RTADY), 5

0.4 (

(spotfilm),).

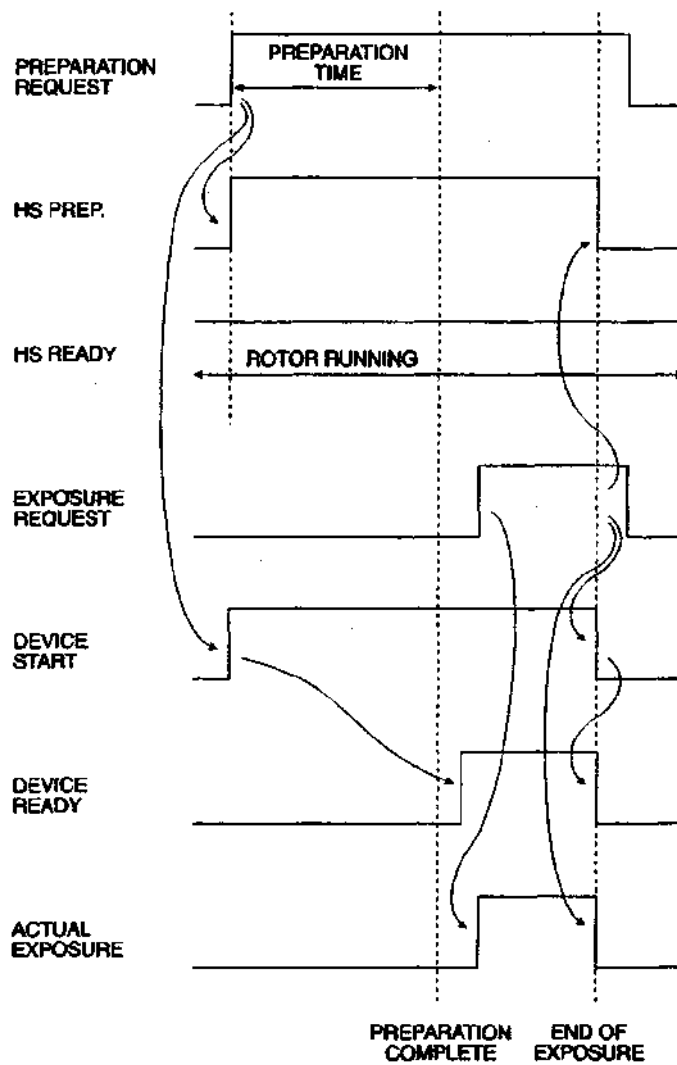
0.4

(). HS2-MPX

(HS READY)

0.4

HS



(PREPARATION REQUEST)

(HS PREP.)
 (HS READY)
 (EXPOSURE REQUEST)
 (DEVICE START)
 (DEVICE READY)
 (ACTUAL EXPOSURE)
 (PREPARATION COMPLETE)
 (END OF EXPOSURE)
 (PREPARATION TIME)
 (ROTOR RUNNING)

HS (HS READY) ,
 ,
 , HS (HS READY) .
 ,
 (START DEVICE) (spotfilm).
 (spotfilm).
 (spotfilm),
 (DEVICE READY) ,
 ,
 (Bucky). (Bucky) (

READY). , (DEVICE START)

A.

HS (HS SELECT) ,

3.3.2.

("CONE IN").

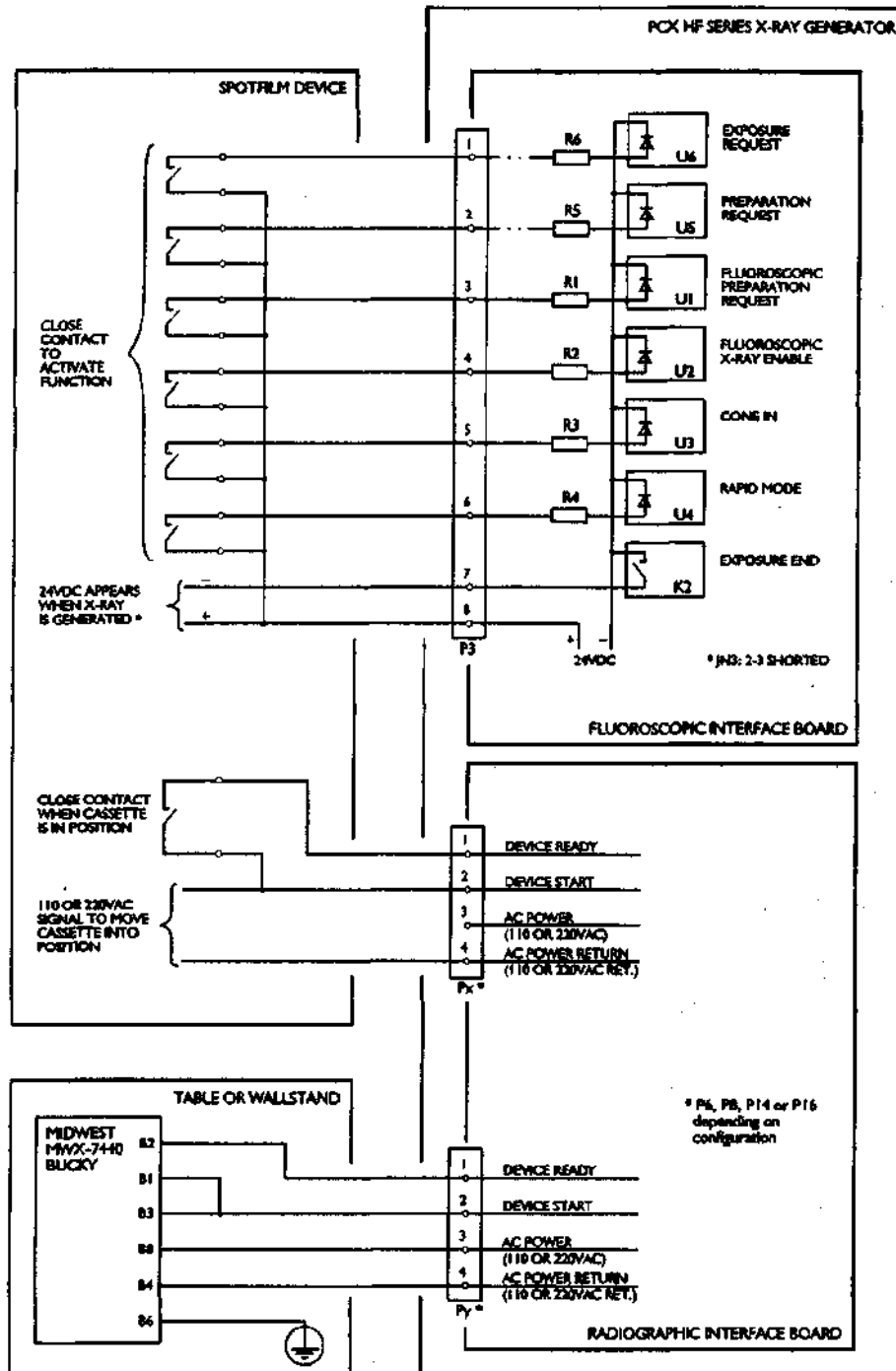
" ("RAPID MODE"),

A.

" ("EXPOSURE END")

80

().



TYPICAL SPOTFILM DEVICE INTERFACING

(SPOTFILM DEVICE)
(CLOSE CONTACT TO ACTIVE FUNCTION)

(24VDC APPEARS X-RAY IS GENERATED) 24VDC
(CLOSE CONTACT WHEN CASSETE IS IN POSITION)

(110 OR 220VAC SIGNAL TO MOVE CASSETE INTO POSITION) (110
220VAC)
(TABLE OR WALLSTAND)
(BUCKY)
(PCX HF SERIES X-RAY GENERATOR)

(FLUOROSCOPIC INTERFACE BOARD)

(EXPOSURE REQUEST)
(PREPARATION REQUEST)
(FLUOROSCOPIC PREPARATION REQUEST)

(FLUOROSCOPIC X-RAY ENABLE)
(CONE IN)
(RAPID MODE)
(EXPOSURE END)
(JN3: 2-3 SHORTED) JN3: 2-3
(RADIOGRAPHIC INTERFACE BOARD)

(DEVICE READY)
(DEVICE START)

(AC POWER (110 OR 220VAC))	110	220	()
(AC POWER RETURN (110 OR 220VAC RET.))	110	220	()
(P6, P8, P14 OR P16 depending on configuration)	P6, P8, P14	P16		

3.3.2

4.

4.1

4.1.1

(TPCON)

4.1.1.1

4.1.1.1.1

8 Motorola MC68HC11E1,
8 , U9 (74HC573)
8
(PC) , EEPROM (U28 - 24C65).
LCD,
(U7 - 74HC574 P3) (U10 -
RTC-72421A). U3
(GAL16V8) U8 (74HC138).
EPROM U4 (27C512).

4.1.1.1.2

U11 - U15 (74HC574) ,
- WR5. JP3 JP4. WR1

4.1.1.1.3

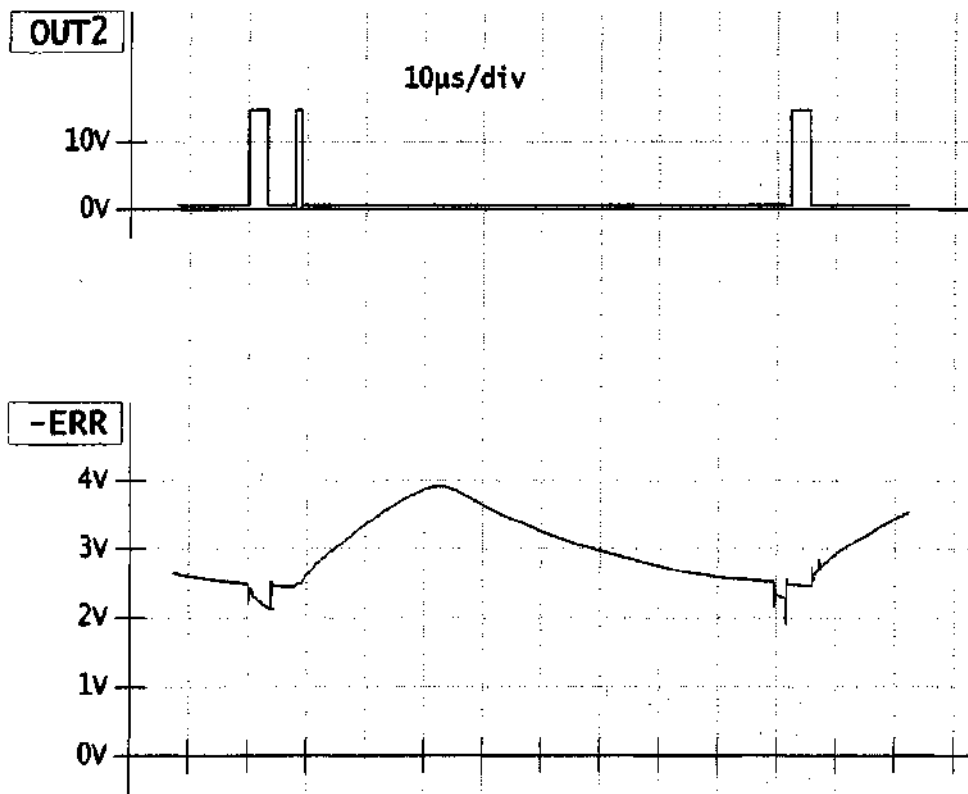
(SIO2)
SIO - U19 (D71051C). TxD RxD TTL
TXCTR
U33
(74HC191).
DIVO - DIV3.

4.1.1.1.4

6 x 9.
KEY_ROW0 - KEY_ROW5. U31 (74HC574).
KEY_IN0 - KEY_IN7 (CONFIG ()).
DIP (DS1)
()

4.1.1.1.5

24VDC P5/8,15
 P5/5,13 TP8 TP11.
 , PWM U26 (SG3526). OUT1 OUT2
 (FETS) Q3 Q5, TR1 , 24V.
 (9 12)
 AC D59 .. D64, ,
 + 5V + SIO, -SIO. OUT1 OUT2 ,
 TR1, C15 C16 (47)
 D59, D60, D63, D64 (BYV27-100) 18 (220
 D61 D62.
 R18 (5.1) C14 (1)
 OUT1 OUT2 3 4 .
 U27 (PS2501),
 , U20 (+ 5V) U27 (PS2501), Vref (+
 5V) U26 (SG3526) -ERR. -ERR + 2.
 5V (R19 R20 10) OUT1 OUT2 .
 , TR1
 (18) U20 (+ 5V)
 , OUT1 OUT2 U26 (SG3526)
 OUT2 -ERR



), 13 8 (75 125 (-
 18, L3 C17 (220).
 D58 , D58 -
 D58
 OUT1 OUT2
 (U22, U23)
 JP2)
 P5/4 P5/12.
 U24 U25

4.1.1.2

BZ1 2

1

2 VCC (+ 5VDC)

JN7 2

1 __ROWO

2 __INO

JP1 DIN-5

1

2

3

4 GND

5 VCC (+ 5VDC)

JP2 4

1,2 PREP/EXP

3 EXP

4 PREP

JP3 (LED)

1 LEDO

2 LED13

3 LED1

4 LED14

5 LED2 APR1

6 LED15 TOMO

7 LED3 APR6

8 LED16 AUX. ()

9 LED4 APR2

10 LED17 BUCKY

11 LED5 APR7

12 LED18 HS

13 LED6 APR3

14 LED19 LF

15 LED7 APR8

16 LED20 AEC3

17 LED5 APR4

18 LED21 SF

19 LED9 APR9

20 LED22 TUBE2

21 LED10 APR5

22 LED23 TUBE1

23 LED11 APRO

24 LED24 AEC1

25 LED12 AEC2

26 VCC (+ 5VDC)

JP4 (LED)

1 LED26 HU100

2 LED39
 3 LED27 HU95
 4 LED40 + 2
 5 LED28 HU90
 6 LED41
 7 LED29 HU85
 8 LED42 + 1
 9 LED30 HU80
 10 LED43
 11 LED31 HU75
 12 LED44
 13 LED32 HU70
 14 LED45 0
 15 LED33 HU65
 16 LED46
 17 LED34 HU60
 18 LED47
 19 LED35 100
 20 LED48 -1
 21 LED36 H
 22 LED49 -2
 23 LED37 .
 25 LED38 D
 24,26 VCC (+ 5VDC)

JP5

1 _IN0
 2 _IN3
 3 _IN1
 4 _IN4
 5 _IN2
 6 _IN5
 7 _ROW0
 8 _IN6
 9 _ROW1
 10 _IN7
 11 _ROW2
 13 _ROW3
 15 _ROW4
 12,14,
 16,18 VCC (+ 5VDC)
 17
 19
 20 /

JP6

1 " . / ." MOLEX 3055
 2 ()
 3 . ()
 4 / ()
 5 .

LCD1 LCD
 1,14
 16,29 VCC (+ 5VDC)
 2..9,
 17.. 24 D7 .. D0
 10 LCD2
 11,26 RD/-WR
 12,27 A0
 13 LCD2
 15,30 GND
 25 LCD1
 28 LCD1
 31.. 34

P3 DB-25
 1
 2.. 9 1... P7
 10
 11 ()
 12.. 14
 15
 16,17
 18.. 25 GND

P4 SIO2 () DB-9
 1 + SIO ()
 2 TxD ()
 3 RxD ()
 4
 5 GND_SIO (+ SIO -SIO)
 6 -SIO ()
 7,8,9

P5 () DB-15
 1 GND_SIO (+ SIO -SIO)
 2 -SIO ()
 3 + SIO ()
 4 " "
 5,13 24V (())
 6 .
 7 . ()
 8,15 24V (())
 9 RxD ()
 10 xD ()
 11 24V prep/exp
 11 " "
 14 . () / . ()

4.1.1.3

D58 PWS OK ()

D95	.	-	(	0)
D96	.	-	(	0)
D70	.	-	(	0)
D71	.	-	(	0)
D104				
D106	TIM		()

4.1.1.4

TP2	DGND			
TP3	VCC (+ 5V)			
TP4	GND_SIO (	+ SIO	-SIO)	
TP5	-SIO ()		
TP6	+ SIO ()		
TP7		(BT1)		
TP8		24V ()
TP9	DGND			
TP10	DGND			
TP11		24V ()

4.1.1.5

DS1.1			
DS1.2			
DS1.3	FLUORO		
DS1.4			
JN1			
JN2	MOD A		
JN3	MOD B		
PI		LCD2 (1 ?)	
P2		LCD2 (1 ?)	

4.1.1.6

F1	F1A	
F2	F1A	
F3	F315	
F4	F315	
F5	N630	

5x20mm.

4.1.2

(TXFRC)

4.1.2.1

TXFAC,

(TPCON1)
TPCON1,

4.1.2.1.1 LCD

LCDWR (TP12) LCDRS (TP13) (KEYO KEY1).

- 3 C. J2.
PI.

4.1.2.1.2

4x4 H
L ,
R31 .. R34 (4.7 B 3
C.
L. (LED 10) (D3)

4.1.2.1.3

TPCON1

TPCON
RS-232C ($\pm 12V$), TTL,
U1 (X3100),
500
(Y1 - 3.6864M).
TP6 (TxD2 TPCON 1) TP7 (Rx D2
TPCON1). TP2 .. TP4.

4.1.2.1.4

RS-232C UART.
(Q1-U3 U2),
(TXCTR). Rx D Tx D TPCON1
J1 , . Tx D1 (
) Rx D1 (
TTL TP8 TP9
" "
JP2.

4.1.2.2

J1 (TPCON1),

1	
2	
3	(1)
	(2)
4	TPCON1 (TxD2)
5	TPCON1 (RxD2)
6	(1) (2)
7	+ 5V
8	+SIO ()
9	-SIO ()
10	

J2 LCD,

1,14	+ 5 V
2.. 5	LCDDAT3 .. LCDDATO, 4
6... 9	NC
10	LCDEN
11	KEYO (LCDWR)
12	KEY1 (LCDRS)
13	
15	GND

J3,

1... 10	LED00 ... LED09 ()
11,12	+ 5 V ()
13.. 16	KEY0 ... KEY3,
17.. 20	KEY4 ... KEY7

4.1.2.3

D1, JP3 ()
D3

4.1.2.4

TP1	-IRQ	U1 (X3 100)
TP2		U1
TP3		U1
TP4		(U1)
TP5		(U1)
TP6	TxD2	
TP7	RxD2	
TP8	TxD1	
TP9	RxD1	
TP10	-	U4 (MC68HC81 1E2)
TP11	LCDEN	

TP12 KEYO (LCDWR)

TP13 KEY1 (LCDRS)

TP14 PI (5)

4.1.2.5

JP1 ()

JP2 (Bootloader)

JP3

JP4

JP5

4.1.2.6

4.2

4.2.1 (TXPWS)

4.2.1.1

• + 24 \ ,
 • + 5, -15 + 15 VDC

+ 24 \ .
 RY1, RY2, . (ON)

110 220 VAC (T1 ..
 S02,
 T4)
 TR1, , 20VAC, CI C2,
 , 24 .. 26 VDC. D2
 TP1 (+ 24 VDC) TP3 (GND -)

),
 (, ,
).

() . (ON) , 4, 5
 PL2 RY1. (3 5)
 RY1 (, . (ON)).
 PL2). () . (ON) (4
 2 PL2, (24 VDC) . (OFF).
 . (ON) RY2. RY2 110 220
 VAC. RY2 , S01
 (ZK1) S04 ().

() . (OFF) ,
 3 4 PL2. RY1, .
 (OFF) (, ()
 . (ON) (2 4 PL2). RY1 , RY2
 S01 S04.

EMI/RFI .

4.2.1.2

PL2 ()
 1 24V (+)
 2 . (OFF)
 3 . (OFF)
 4 . (ON) / . (ON)

5 24V (-)

PL3 (TXCTR)

+ 15V

GND

-15V

+ 5V

GND

S01 Phoenix,

1,2

S02 Phoenix,

1,3 (110VAC 220VAC)

2

S04 Phoenix,

1,3 (110VAC 220 VAC)

2

4.2.1.3

D2 . - (24VDC)

4.2.1.4

TP1 24VDC

TP2

TP3 24VDC

4.2.1.5

1... 4

2 - 3 220...240VAC

1 - 3 4 - 2 110...120VAC

4.2.1.6

F1 N63

F2 N5

F3 N5

F4 N1

F5 N500

4.2.2

(TXCTR)

4.2.2.1

SIO
ABS

PS

()

4.2.2.1.1

(U2 - 68HC811).

B C.
E. U3 (74HC138)

(JP5 JP6)

• :
TXCON (50kW CPI 65kW 80kW (Varian).)

JP1 JP2 : (TXFIF)
(TXRIF) D86
PS.

JN6 .. JN9 -

4.2.2.1.2 SIO

RS232C CPU
TPCON1.



D , , H
L
D H, OK L .
AEC (U15, U9) AEC

AEC	
AEC 1	JP8
AEC 2	JP9
AEC 3	JP10
AEC 4	JP11

1	AEC (H)
2	(L)
3	AEC
4	1 (L)
5	2 (L)
6	+ 15VDC
7	3 (L)
8	-15VDC
9	AGND

D10, D11 D12
U16 (CD4052) AEC.
(SO, S1, INH)
D8, D9 D14.
TP18. P2
U18
(VFC32). (IC)
1. (: AEC_FREQ.)
(A/D)
TP18 P3.
(AEC_SIGNAL).
P10. U16
" ".
AEC_EXIST , , U22
(74HC245). C U11 U12
SEL_R2 SEL_R1
JP4.

JP4	()
1	PREP+ ()
2	PREP/EXP ()
3	EXP + ()

U19 U20.
24VDC JP4. ,
,
U17A U17B
(D.PREP D.EXP,
CON.SEL ().
(L) , ,
D17, ().
PREP.REQ ().
, D20 D21 .
FL.RDY ()
FL.SEL ()
, :
EXP.REQ (). FOOT.SW ()
FL.REQ ().
FL.RDY, D22 FOOT.SW
:

D15	PREP.REQ	*
D16	FOOT.SW	()**
D17	CON.SEL	
D18	FL.SEL	
D19	(RAD.EXP.REQ)	

* D20 D21
** D22.

PREP.REQ (COMP),
R35-R36-R37 -3.
9VDC, PREP.REQ , U21
R35. COMP -6. 3VDC , PREP.REQ
t .

4.2.2.1.5

:
p () (UA feedb.)
() (IS feedb.)
() (IL feedb.)
() (IF feedb.)
() (IA feedb.)

. " ' (invisibly)"
 . " p
 . 8 A/D
 () 0 .. 4V,
 8 OO .. FFH.
 - U39A
 (TL084). 1.
 , 10
 / . ,
 . ,
 , 0.5
 . TP8.
 .
 1V 20 , TP8 1V ,
 40 , 4V,
 , - 0 .. 160 p.
 - , (IS feedb.) U39C
 (TL084). 1.3.
 1V 1A .
 0.65V TP9. 1A
 0 6.15A. 4V,
 - , (IL feedb.) U39B
 (TL084). 1.3.
 1V 1A .
 0.65V TP10. 1A
 0 6.15A. 4V,
 - , (IF feedb.) U39D
 (TL084). ,

1V 1 1V 5 .

:

*	**	R85, R86		TP11 ***
1V 1	0.5V 1	13	1.3	0.29 .. 0.54V 1
IV 5	0.5V 5	68	6.8	0.31 .. 0.56V 1

* HVPS
 ** HVPS
 *** P5

TP11. 0 .. 10 . 0 4V, 1 0.4V
 P5. CMR
 P9.

- , (IA feedb.) , U40 (TL084).

100 (1V 100) 0.5V
 100 .
 10V , 5.555V (1.8 P6.
 TP7. R101) 12 A/D
 () U41 (ADC912A), 0 .. 10V.
 A/D

:

HV	A/D ref.	(R101)	TP7	
-350,450,550,650	3V	0 .. 3.333V	0 .. 6V	0 .. 666
-850, 1050	5V	0 .. 5.555V	0 .. 10V	0 .. 1111

A/D ()
 (TXCTR1).

:

HV	A/D ref	(R101)	TP7	
-350,450,550,650	5V	0 .. 3.333V	0 .. 6V	0 .. 666
-850, 1050	5V	0 .. 5.555V	0 .. 10V	0 .. 1111

P8, CMR
 P7. 12
 C.

4.2.2.1.6

:
 (UA ref.)

(IS ref.)
(IL ref.)

(),
10V 150 , .8
D/A () U37 (AD7524) U35D (TL084)
0 .. 10V, TP17.
10V / 256 - 0.039V 150 / 256 - 0.586
B (-10V.

(IS ref.)
(IL ref.)

,
6V
6A.
12 D/A () U36 (DAC8248) U35A
U35B (TL084) 0...-6V, TP15 TP16.

		D/A		
	IS ref.	U36 (DAC8248)	U35A (TL084)	TP15
	IL ref.	U36 (DAC8248)	U35B (TL084)	TP16

:
6V / 4096 - 1.46mV 6A / 4096 = 1.46
B (6.6V R55-R56.
U36 (11)
R55 R56.

RY1
Q3 (BC184) RY1 ,
:
(
) COMP. D42 D43
10 U35C (TL084),
(0.5 .. 0.6V).
, COMP, U35C ()
Q3 .
COMP -6. 3V,
() -3. 9V
(.).

$$(-3.9V) + (-0.6V) = (-4.5V)$$

Q3, 4.5A

$$(-6.3V) + (-0.6V) = (-6.9V)$$

D74, H, -OK, L, WD, U38A (74HC123), D72, Q3, U35C, -13V, Q3, (13) U38A, H, -0.7 D73, Q3, D44, D74, Q3, U35.

4.2.2.1.7

+5VDC, +15VDC -15VDC. JP3.

	JP3			
+ 15VDC	1	TP6	D3	F1 (500)
AGND	2	TP23		
-15VDC	3	TP2	D4	F3 (500)
+ 5VDC	4	TP1	D2	F2 (3)
DGND	5	TP22		

D7, D6 D5

(DGND), (AGND), JN4, : + 10VDC U42 (REF01), TP5, -10VDC U6B (TL082), TP4 -5VDC U6A (TL082), TP3, PI, U7 (PS2501-1), (P_SENS) (H), + 10VDC -15VDC.

4.2.2.1.8 PS

74HC574 (U25)

ULN2803A (U26).

H-L-H SEL_WO.

L OK.

"

(5VDC)

+15VDC /

RN5 (200).

U26 +15VDC RN5

5VDC +15VDC.

U25() H,

L. EXP.REQ (

L) - U24A, (

- (1 U24A)

U38B (74HC123)

H 1 U24A

Q5 (BC184). L-H-L U38B

5U38B. Q5

"Remote ()",

24VDC. (U26 11)

U28 , 30VDC (+ 15VDC -15VDC)

R53 (100) (HV)

U34. L,

U27 (74HC245). U27

(PREP.REQ EXP.REQ). U27

SEL_RO, (L).

(Rot.run) (Ready) (4 U33 U34) L, D81

D82 FL.SEL.

(Rot.run) L, 4 U33

D86 (). (HS_READY).

2 3. , U33 , JN5
). (Rot.def.)
 IN6 L.
 (,).

4.2.2.2

JP1

1 ABS + ABS (+)
 2 ABS - ABS (-)
 3,4 DGND
 5 OUT7 ()
 6 OUT12 ()
 7 OUT13 ()
 8 OUT14 ()
 9 OUT15 ()
 10 OUT6 ()
 11 FL.SEL
 12 TUBE2_SEL 2 (L)
 13 XRAY-ON. (L)
 14 PREP. (L)
 15,16 DGND
 18 IN8 () (L)
 17 IN9 () (L)
 19 IN10 () (L)
 20 IN11 (L)
 21 IN12 B (L)
 22 IN13 ()
 23 FOOT.SW (L)
 24 FL.RDY (L)
 25 D.EXP (L)
 26 D.PREP (L)

JP2

1 OUT9 (L)
 2 OUT6 HS (spot) () (L)
 3 OUT5 2 (L)
 4 OUT4 1 (L)
 5 OUT3 4 (L)
 6 OUT2 3 (L)
 7 OUT1 2 (L)
 8 OUT0 1 (L)
 9,10 DGND
 11 IN7 HS (HS (L)
 12 HS_READY HS (L)
 13 IN5 (L)
 14 IN4 (L)
 15 IN3 () (L)
 16 IN2 (L)

17 INI (L)
 18 INO (L)
 19 INI 5 ()
 20 IN14 ()
 21 D.EXP (L)
 22 D.PREP (L)
 23.. 26 DGND
 27 OUT11 ()
 28 OUT10 ()
 29 + 15V
 30 OUT7 (L)
 31 FL.SEL (L)
 32 TUBE2 SEL 2 (L)
 33 XRAY-ON (L)
 34 PREP. (L)

JP3

1 + 15V
 2 (AGND)
 3 -15V
 4 + 5V
 5 (DGND)

JP4

1 PREP + ()
 2 PRE/EXP ()
 3 EXP + ()

JP5 PS 2 ,
 + -
 1,2 (IF)
 3,4 (IS) *
 5,6 (IS) *
 7,8
 9,10,16 NC
 11,13 SEL (....?)
 14 + 15V
 15 DGND
 *

JP6 PS 1 ,
 + -
 1,2
 3,4
 5,6 (PS)
 7,8
 9,10
 11,12
 13,14 V (UA)
 15,16
 17,18 *
 19,20 . (PS .)

21,22 A (IA)
 23,24 V (UA)
 25,26 (IL)*
 27,28 V (UA)
 29,30
 31,32
 33,34
 35,37 2
 36 DGND
 38.. 40 NC
 *

JP7 SIO
 1 ()
 2
 3 ()
 4
 5 ()

JP8...JP11 AEC
 1 AEC (H)
 2 AEC
 3 AEC
 4 1 (L)
 5 2 (L)
 6 + 15 V
 7 3 (L)
 8 -15V
 9 AGND

4.2.2.3

D2 + 5V
 D3 + 15V
 D4 -15V
 D8 AEC 1 2 1 AEC
 D9 AEC 2 . 1
 . 2
 . 3
 . 4
 D10 AEC 1 . -
 D11 AEC 2 . -
 D12 AEC 3 . -
 D13 AEC . - , . -
 D14 AEC . - AEC
 D15 . -
 D16 . -
 D17 . -
 D18 . -

D19		.	-		
D28	(PS)	.	-	(PS),	.
D29		.	-		
D30		.	-		
D31	2	.	-	2	
D32		.	-		
D33	V (UA)	.	-	V (UA)	
D34		.	-		
D35		.	-		
D36		.	-		
D37		.	-		
D38	PS	.	-	HVPS	
D39		.	-		
D40		.	-	(HVPS	HSS
				JN5)	
D41		.	-		
D70	SIO RxD	.	-	(0)	
D71	SIO TxD	.	-	(0)	
D72	WD	.	-		
D74		.	-		

4.2.2.4

TP1	+ 5V				
TP2	-15V				
TP3	IA ()	A/D ()	-5V	-3V	JN10
TP4	-10V				(PI)
TP5		+ 10V			P1
TP6	+ 15V				
TP7		IA (A) (1V - 111 A)			P6, P7, P8
TP8		UA (V) (1V - 40 V)			
TP9			IS ***		
TP10			IL **		
TP11		IF (A)			P5, P9
TP12		+ 4V			(PI)
TP13		ABS (0 ... 4V)	P4		
TP14		D/A () 6. 6V			(PI)
TP15				SF (-1V - 1A) * ***	
TP16				LF (-1 V - 1A) * **	
TP17		UA (V) (1V - 15 V)			
TP18	AEC				
TP19	AEC	A/D ()			P10
TP20	AGND				
TP22	DGND				
TP23	AGND				
TP24	AGND				
TP25	AGND				

TP26 DGND
 TP27 AGND
 TP29 DGND
 TP30 EXP. TRIGGER
 TP31 PREP. TRIGGER

*
 ** /

4.2.2.5

JN1 CPU RESET
 JN2
 JN3 (: + 15V JP5)
 JN4 AGND-DGND (.)
 JN5 : HS LS (LS: 1-2)
 JN6* . -
 JN7* . - AEC ()
 JN8* . - ABS (AEC-?) () . -
 ABS (AEC-?) ()
 JN9* . - ABS ABS , . -
 ABS
 JN10 (), . - A/D () - 3V,
 - 660 , . -
 () - 5V, - 1100
 PI + 10V
 P2 VFC AEC
 P3 VFC AEC
 P4 ABS
 P5 ()
 P6 ()
 P7 CMR ()
 P8 (A)
 P9 CMR ()
 P10 AEC A/D ()
 *

4.2.2.6

F1 N500
 F2 N3.15A
 F3 N500

4.2.3

(TXRIF)

4.2.3.1

(Bucky),

110VAC 220VAC,
24VDC. TR1 F3 (200 A) AC

24VDC. (+ 24V.LOG DGND)

LD26. (+ 24V.IF GND.IF) LD25.

AC
(Bucky) F4 (6A)
IFVAC IFVAC RET.

4.2.3.1.1 (Bucky)

(Bucky),
P6, P8, P14 P16.
K3, K4, K7 K8 (
(Bucky)).

(Bucky) K6,
IFVAC (110 220VAC) (Bucky).
2 K6,
(DEVICE START)

(Bucky) 1
, IFVAC IFVAC RET.
2, 1, (Bucky)

(Bucky) TTL
() U2,
(PI.18).
(DEVICE READY) LD16.

(Bucky):

				CPU ()
1	P6	K3	LD3	P1. 8
2	P8	K4	LD4	P1. 7
3	P14	K7	LD7	P1. 6
4	P16	K8	LD8	P1. 5

(Bucky) 3 4 (IFVAC IFVAC RET)

(110VAC 220VAC). 3 4
(Bucky) 2A.

4.2.3.1.2

,
()
IFVAC. , 2 ,
PI.32 K5 IFVAC
P10 P12.

/				CPU ()
1	P10	K5	LD5	PI.32 HI
2	P12	K5	LD5	PI.32 LO

K5
3A 110VAC 220VAC.

4.2.3.1.3

P2.
HS2-MPX.
(+ 24IF. GND.IF),
:
HS PREP ()
(PREP) P1.34 (L)
U3 HS PREP P2.1.
(FLUORO SEL) P2.31, HS PREP
U3 , HS SELECT
HS FLUORO ()
(FLUORO SEL)
P1.31 (L), HS PREP.
U4. U3
FLUORO SEL
(L).
, ,
()
HS SELECT ()

PI.30 (L)
U6 , HS SELECT

HS FLUORO.

HS SPOT SELECT ()

1.2 U6

TUBE 2 SELECT (2)

1.32. 2 , K9
TUBE 2 SELECT

HS VERIFY ()

U7 , P1.11 D9.

HS READY ()

U8 P1.12 ()
D10.

FLUORO

SEL

:

	*	P2	**			CPU
HS PREP		1		U3	LD9	P1.34
HS FLUORO		2		U4	LD10	P1.31
HS SELECT		3		U5	LD11	P1.30
HS SPOT SEL.		4		U6	LD12	P1.2
TUBE 2 SEL.		5		K9	LD5	P1.32
+24V.IF		6				
HS VERIFY		7		U7	LD13	Pl.11
HS READY		8		U8	LD14	P1.12

*

** GND.IF

4

TTL.

	/			CPU
1	P11.2 -P11.4	U13	LD20	P1.13
1	P11.3 -P11.4	U12	LD19	P1.14
1	P9.1 -P9.2	U11	LD18	P1.15
1	P7.1 -P7.2	U10	LD17	P1.16
2	P13.2 -P13.4	U15	LD22	P1.13
2	P13.3 -P13.4	U14	LD21	P1.14
2	P17.1 -P17.2	U17	LD24	P1.15
2	P15.1 -P15.2	U16	LD23	P1.16

: 4

TUBE2, , K9 TUBE1
+ 24V.IF P5.2 P5.1 U9 P1.17

4.2.3.1.5

"", (PREP),
P1.34, IF VAC
U1 (DP6610 DPA6119)
P4.1 P4.2. P4 1A.

4.2.3.1.6

FILT1 FILT2
P1.4 P1.3 K1 K2
P3.

	P3			CPU ()
1	4 (NC) -5 (C) - 6 (NO)	K1	LD1	P1.4
2	1 (NC) -2 (C) -3 (NO)	K2	LD2	P1.3

4.2.3.2

PI
1 OUT9 (L)
2 OUT6 HS (spot) (L)

3 OUT5 2 (L)
 4 OUT4 1 (L)
 5 OUT3 4 (L)
 6 OUT2 3 (L)
 7 OUT1 2 (L)
 8 OUT0 1 (L)
 9,10 DGND
 11 IN7 HS (HS)(L)
 12 HS_READY HS (L)
 13 IN5 (L)
 14 IN4 (L)
 15 IN3 ()(L)
 16 IN2 (L)
 17 INI (L)
 18 INO (L)
 19.. 22 NC
 23.. 26 DGND
 27.. 29 NC
 30 OUT7 (L)
 31 FL_SEL (L)
 32 TUBE2_SEL 2 (L)
 33 NC
 34 PREP. (L), . " "

P2 Phoenix,

1 HS
 2 HS
 3
 4 HS (spot)
 5 2
 6 + 24V IF
 7 HS
 8 HS

P3 Phoenix,

1 2 NC
 2 2
 3 2 NO
 4 1 NC
 5 1
 6 1 NO

P4 Phoenix,

1 AC
 2 AC

P5 Phoenix,

1
 2 + 24V IF

P6. P8

P14, P16 (Bucky) Phoenix,

1
2
3 AC
4 AC

P7, P15 Phoenix,
1
2 + 24V IF

P9,P17 Phoenix,
1
2 + 24V IF

P10, P12 Phoenix,
1 AC
2 AC

P11,P13 Phoenix,
1 NC
2
3
4 + 24V IF

P18
1.. 4 + 24V IF
5 ..8 IF
9 .. 11 + 24V LOG
12 ..14 LOG

P19 Phoenix,
1 AC
2 AC

4.2.3.3

LD1	1	.	-	
LD2	2	.	-	
LD3	1	.	-	1
LD4	2	.	-	2
LD5	2	.	-	2
LD6		.	-	
LD7	3	.	-	3
LD8	4	.	-	4
LD9	HS	.	-	
LD10	HS	.	-	
LD11		.	-	
LD12	HS (spot)	.	-	
LD13	HS	.	-	(,)
LD14	HS	.	-	
LD15		.	-	()

LD16			.	-		,
LD17	1		.	-	1,	
LD18		1	.	-		1,
LD19	1		.	-		
LD20		1	.	-		
LD21	2		.	-		
LD22		2	.	-		
LD23	2		.	-	1,	
LD24		2	.	-		2,
LD25	+ 24V IF					
LD26	+ 24V LOG					

4.2.3.4

TP1	+ 24V IF
TP2	GND IF
TP3	DGND (LOG)
TP4	+ 24V LOG

4.2.3.5

J1, J2	TR1		AC:
	J1.2-J2.2	220-240VAC	
	J1.1- J1.2	J2.1- J2.2	110 .. 120VAC

4.2.3.6

F1	T315	A
F2	T500	A
F3	T100	A
F4	T5A	

4.2.4

(TXFIF)

4.2.4.1

(spotfilm)
(spotfilm).
ABS
().

110VAC 220VAC
110VAC 220VAC
+ 12VDC
TR1
(LD11)
AC BR1-C10
U10 (7812).
24VDC + 12VDC TP2 TP3 ().
(+24V LOG DGND)
(+24V IF GND.IF)

1 2
J2.
2 ,) K1 , 1 (J2 1-2) PI.12 ((2 , L) .

4.2.4.1.1 (Spotfilm ,)

P3. +24V.IF (8),

		P3			CPU
		1	U6	LD6	P1.25
		2	U5	LD5	P1.26
		3	U1	LD1	P1.23
		4	U2	LD2	P1.24
		5	U3	LD3	P1.17
		6	U4	LD4	P1.18
		7	K2		P1.13
+24V.IF		8			

() (spotfilm) (spotfilm) (spotfilm).

(spotfilm).

K3.

(+ 24V),

PI .

(spotfilm), K3.

K2.

J3,

(spotfilm).

4.2.4.1.2 (Spotfilm)

P4. +24V.IF (5),

		P4			CPU
		1	U6	LD6	PI.25
		2	U5	LD5	PI.26
		3	U7, K3	LD7	PI.19
		4	U8	LD8	
+24V.IF		5			
GND.IF		6			

() (spotfilm).

(spotfilm).

K3,

(spotfilm) (spotfilm).

(+ 24V),

PI .

(spotfilm),

K3, (spotfilm) .

4.2.4.1.3

P5. 24 .. 48VDC.

		P5			CPU
		1,2	U11	LD9	PI.20
B		3,4	U12	LD10	PI.21
NC		5			
+ 12VDC		6			
PMT		7			PI.1
AGND		8			

, (+ 24V)
 , PI .
 .
 PMT ().
 ,
 (AEC)
 .
 Pl.1,
 .

4.2.4.2

CXI () BNC

CX2 () BNC

PI ,
 1 ABS + ABS (+)
 2 ABS- ABS (-) (DGND)
 3,4 DGND
 5.. 11 NC
 12 TUBE2_SEL 2 (L)
 13 XRAY-ON. (L)
 14.. 16 NC
 17 IN8 (L)
 18 IN9 (L)
 19 IN10 (L)
 20 IN11 (L)
 21 IN12 B (L)
 22 NC
 23 FOOT.SW (L)
 24 FL.RDY (L)
 25 D.EXP (L)
 26 D.PREP (L)

P2 ,
 1.. 4 + 24V IF
 5 ..8 IF
 9 .. 11 + 24V LOG
 12 ..14 LOG (. J1)

P3 (Spotfilm) Phoenix,
 1
 2
 3 ()
 4
 5
 6
 7
 8 + 24V IF

P4 (Spotfilm) Phoenix,
 1

2
3 (Spotcamera)
4
5 + 24V IF
6 GND IF

P5 Phoenix,
1 (+)
2 A (-)
3 B (+)
4 B (-)
5 NC
6 + 12V
7 ABS (PMT)
8 AGND

P6 Phoenix,
1,2 AC

4.2.4.3

LD1 . -
LD2 . -
LD3 . -
LD4 . -
LD5 . -
LD6 . -
LD7 (Spotcamera) . - spotcamera
LD8
LD9 . -
LD10 -
LD11

4.2.4.4

TP2 + 12V ()
TP3 AGND

4.2.4.5

J2
J3
J8
J12 75
J10, J11 AC TR1:
J10.2-J11.2 220 .. 240VAC
J10.1-J10.2 J11.1- J11.2 110 .. 120V AC

4.2.4.6

F1 N63
F2 N63

4.2.5

ABS (TXABS)

4.2.5.1

(TXFIF) (TXABS1),
DC ABS
(TXCTR. TXABS1
ABS ()
ABS ,

4.2.5.1.1

AC (U3A5 R4, R7).
1.5, 700mV
1.05V. + 12V,
(6V).
R10 R11 C4 C9.
R9, D1 D2,
D1 1.2V. U3C 11,
U3C 1.2V.
(U3B, R185 R20) C10. BACKPORCH
U5D. U5C, C10
(J5) 1.2V, U3C.
(1.2V). TV,
U3C (1.2V).
J5.
2, 2.1V,
2.4V.
2.4V 4.5V

4.2.5.1.2

ABS
(BACKPORCH),
(U1 - LM1881). (VBUFF)
C3. RSET.
JP5. TV c

(625 525) JP5 , TV
(1249 1049) JP5 .

BACKPORCH
: J7 (), J8 ()
J9 (BACKPORCH). .

4.2,5.1.3 ()

ABS . , ,
TV ,
()
- , TV.
,
() (,
(spotfilm))
.
, , .

TXABS1 .
()
,
,
,
JP2 .

. U7A
(L-H-L) 6-8 . (TV 50).
J18 P7,
U7B (L-H-L) 5-6
J19
P5.

U8. U8A .
U8A (L-H-L)
() , J20
P6. U8B,
(DOMINANT)
J3,
P4.
() TV
20 ,
10 .
(DOMINANT) U8B.
TV

JP2

TV.

4.2.5.1.4

ABS

RC

P3, C6.

U5B,

RC

ABS

U2A.

ABS

2-3.

JP1

4.2.5.1.5

ABS

ABS

U2A

R16 JP1.

JP1

1-2.

InnoSpot ().

PWM ,

JP4. JP3

R16 C2,

4.2.5.1.6

ABS

ABS

P2

U2B

P1.

J10

J14. U2B
0.7V,

D3,

(Apelem CRM86).

U2C U2D

U5

R23

C5

U2D
ABS

U2B

U ffs,

Uoffs + U_{ABS}.
, U5

FLUORO_D
U2D 2xU ffs.

H (

U2

, U5A

, U2D

U2C

R2 R17

2x (U ffs + U_{ABS}),
J12 (ABSCTRL - J4)

2xU_{ABS},

2xU ffs.

-0V,

10V.

0 10V.

4.2.5.1.7

. + 24V
 .
 J17 (H).
 (),
 , U6 U9A, ,
 1
 . U6
 , U6
 100 .
 U9A ,
 1
 ,
 (FLUORO_D L, J22)
 L
 , 1 . 1
 , , ABS
 .

4.2.5.2

J6 2 ,
 1 (+)
 2 (-)
 TXFIF

TXFIF
 J1 ABS (EXT_BRIGHT) DC P5.7
 J2 CX1, CX2 (BNC)
 J4 ABS (DC) U10.3, P5.6
 J13, J21 + 12V U10.2, P5.8
 J15, J16 AGND

4.2.5.3

4.2.5.4

J3 P4 .. P7
 J5
 J7
 J8
 J9 Backporch
 J10 P2
 111 VBUFF
 J12 ABS (DC) P1, P2
 J14 P1, P2
 J17 (L)

J18		(	)	P7
J19		(	)	P5, (P7)
J20				P6
J22				
	L			
	H			

4.2.5.5

JP1		ABS		
	1 -2	ABS (DC)		
	2-3			
JP2				
	()
JP3				PWM
JP4		(Innospot)		
JP5				
PI		ABS		
P2		ABS		
P3		,		
P4		,	()
P5		,	()
P6		,	()
P7		,	()

4.2.5,6

4.3

RS-232C.

PCB - TXREM.

4.3.1 TXREM

4.3.1.1

4.3.1.1.1

(U9 - 68HC811E2FN) 4 (Q1).

(U1 .. U8 - LN514GK) (S0..S7) U10
(UDN2981A). (N0...N7) PC0 .. 7
PB0 .. 7
U11 (ULN2803A).

D2 D3, (U6 .. U8) R6.

4.3.1.1.2

P0 .. 7 U13 (ULN2803A),
RO .. R5 R0 .. 5
(RY1 .. RY8) - 12V SPDT. IO .. I15
JP3. JN2 ..
JN9,

4.3.1.1.3

(SW1 .. SW12) N2 N3 (.
) . 6 PE0 .. 5

4.3.1.1.4

RS-232C,

TXD - H (1, -) Q2 IC2 ,
 , R34 SIO1 (TxD)
 (SIO2), 1 RS-232C.
 (TXD) L (0), Q2 IC2 ,
 SIO1 .
 RxD (SIO3) - (0), IC1 , R D
 (0). R D (1).
 JP2 .

4.3.1.2

JP1 Phoenix,
 1 (+ 12VDC 9VAC)
 2 (- AC)
 JP2 SIO MOLEX 3055
 1 ()
 2
 3 ()
 4
 5
 JP3 , ,
 1 I0 (RY2)
 2 I1 (NC NO RY2, JN3)
 3 I2 (RY3)
 4 I3 (NC NO RY3, JN4)
 5 I4 (RY4)
 6 I5 (NC NO RY4, JN5)
 7 I6 (RY5)
 8 I7 (NC NO RY5, JN6)
 9 I8 (RY6)
 10 I9 (NC NO RY6, JN7)
 11 I10 (RY7)
 12 I11 (NC NO RY7, JN8)
 13 I12 (RY1)
 14 I13 (NC NO RY15 JN2)
 15 I14 (RY8)
 16 I15 (NC NO RY8, JN9)

4.3.1.3

D9 . - (0)
 D10 . - (0)
 D11 (+ 5 V)

4.3.1.4

TP1 + 5V
TP2 DGND

4.3.1.5

JN1			
JN2	RY1	I12-I13	1-2 NO 2-3 NC
JN3	RY2	I0-I1	1-2 NO 2-3 NC
JN4	RY3	I2-I3	1-2 NO 2-3 NC
JN5	RY4	I4-I5	1-2 NO 2-3 NC
JN6	RY5	I6-I7	1-2 NO 2-3 NC
JN7	RY6	I8-I9	1-2 NO 2-3 NC
JN8	RY7	I10-I11	1-2 NO 2-3 NC
JN9	RY8	I14-I15	1-2 NO 2-3 NC
JN10	()	

4.3.1.6

FIN2A

—

—

•

: 1 – JP8, 2 - JP9, 3 - JP10, 4 - JP11.

JP8, JP9, JP10 JP11

TXCTR....

TXCTR VacuTec

, TXCTR (JN7).

IG 350/450/550/650/650-60HF

:

TXCON7 TXGPS5
TXGPS5,

TXFIL5
TXROT5

(TXHVT2)
(TXHVT3)
IGBT TXIGB3

TXGPS5 TXCON7,
TXFIL5, TXROT5,
TXHVT2 TXHVT3.

- TXGPS5 :
J5 TXGPS5
- TXROT5 / J5 J5
- TXROT5
SWD / J5 J5
- (SWD)
- :
SWD / RL1 / 1L1 - SWD / TX3FF1 / 1
(SWD) 1 TX3FF1 1L1 RL1
(SWD).
- SWD / TXGPS5 / J7 - SWD / TXFIL5 / J1
TXGPS5 J1
TXFIL5.
- SWD

1. " " " " " "
2. " " ("ON") " " ("ON")
" , TXGPS5 " / 3.
" TXGPS5,
" / , 2.
3. " " (" GEN. NOT READY ") (012)
" , TXGPS5 "
" TXGPS5,
" / .
4. " " (" ROTOR ERROR ") (005)
" TXROT5 , ,
" / .
5. " " (" FILAMENT ERROR ") (004)
" TXFIL5 , , " /
" , , TXGPS5 " / 26, 27, 28.
" - / IG ... HF (TXHVT2)
/ .
6. " " (" BEAM FAULT ") (007) .
" TXCON7, "
, .
7. , ,
, (" FILAMENT ERROR ") (004)
" - / IG ... HF (TXHVT2)
/ .

001-

(). SIO INTERFACE CTR

002-

(). 220V
=12V
ON

003-

004-

(1 V =1) 1 1 2 FIL))
(. , R 9 15 16 10) (9
10 , 15 16).

005-

COMET). (XSTAR
SW2 ROT

006-

007-

+5%(150
157.5)
(7.5).
(- 600 , 660). +10%,
IGBT(IGBT
(IGBT).
(
). IGBT.

008-

2.

-

(

())

009- .

0010- .

.004

0011- .

.004

0012- .

PS GOOD,

,

0013- .

0014- s 25%.

1. . - .
2. R, S, T - 3X400V (3X380) -
(SWD) / F1, F2, F3 NB1 - 3X400V (3X380).
RY1 RY2.
3. 3X400V, T
SWD / F3, F6, SO1/ /3 - PL1/a/3
SWD / TXGPS5 / J19 /1.
1X240V 3X240V, R
SWD / F1, F6, SO1/ /3 - PL1/a/3
SWD / TXGPS5 / J19 /1.
4. TXGPS5 / TR3 TXGPS5 / D34 -
STANDBY ON (.) - .
5. OFF (.) .
6. .
7. , - ON (.) .
- :
1. TXGPS5 / D34 OFF (.) ,
SWD / F1, F2, F3, F6, SWD / ZSZ3
TXGPS5 / F7, F8.
2. TXGPS5 / J19. (, - .)
3. DC
TXGPS5 / J18 /1, 5. - 24 - 34V, TXGPS5 /
D34 OFF (.) .
4. 3. - 0V,
TXGPS5 / TR3 .
5. 1 TXGPS5 / D34 , OFF (.) ,
F5 , R22
TXGPS5 / J18.
6. 1
TXGPS5 / J18. , .

TXGPS5 / D34 ,

, .

7. 6 TXGPS5 / J18.

, ,

.

8. 6 TXGPS5 / TR3 , TXGPS5 / D33 C24

.

TXGPS5

1. , 1, 2, 3, 4 5 , "
2. TXGPS5 / D34 OFF (.) .
3. ON (.) .
4. TXGPS5 / RL1 RY3 TXGPS5 / D49 -
.(CONSOLE ON) - .(ON) , .(OFF)
5. TXGPS5 / J19, RY3 J14 TOKO MW15-11
(ACIN / L, N, FG) (SWD)).
6. DC (+ 15V, -15V + 5V), , (G1, VI, G2, G3, V2)
SWD / TXCTR3 / JP3.
7. TXCTR3 / D3, D4, D5
TXCTR3.
8. " " (REMOTE) -
TXCTR3 / JP6 / 19, 20. (- DC 24V,
JP6 / 19 - + JP6 / 20 - -. DC .)
9. , SWD / TXCTR3 / J6 / 19, 20 -
SWD / TXCON7 / JP2 / 19, 20.
10. , TXCON7 / JP2 / 19, 20
TXCON7 / JP9 / 9, 10.
11. , SWD / TXCON7 / JP9 / 9, 10
SWD / TXGPS5 / J4 / 9, 10.
12. (REMOTE) TXGPS5 / D2 -
(REMOTE ON) .
13. (REMOTE) TXGPS5 / U3
TXGPS5 TXGPS5 / J3.
14. SWD / TXGPS5 / J3 - (REMOTE) -
SWD / PL1/1/ , b - SO1/1/a, b (STARTER RELAY).
15. (STARTER RELAY) SWD / RY2 CHARGER :

3X400V

• SWD / R, S, T, F1, F2, F3, F4, F5, F10,
RY2 (11-14, 21-24 31-34), R2, R1, R4, TX3FF1,

-
- D1, D2, D3, TXDMP2
(Cl-4, C5, C6, C1 1, C12).
- SWD / T, F3 F4, RY2 (SO1/6/a, b- PL1/6/a, b
31-34), R4, F7, SWD / TXRIF1 / P19 SWD / TXFIF1 / P6.
 - SWD / S, F2 F5, RY2 (ZSZ2,
11-14), F8, SWD / TXGPS5 / J20.
SO1/4/a, b- PL1/4/a, b
- 1X240V 3X240V*
- SWD / R, S, F1, F2 F4, F5 , RY2 (Cl-6,
21-24 31-34), R1, D1, D2, (C1 1- 13).
TXDMP2
 - SWD / R1, F1 F4, RY2 (SO1/6/a, b- PL1/6/a, b
31-34), F7, SWD / TXRIF1 / P19 SWD / TXFIF1 / P6.
 - SWD / R, F1, RY2 (11-
14), F8, ZSZ2,
SO1/4/a, b- PL1/4/a, b SWD / TXGPS5 / J20.
16. TXGPS5 / J20
TXGPS5 / F1 TXGPS5 / J5.
17. SWD / TXGPS5 / J5
DC (+ 24V) SWD / TOKO 24V
18. DC TOKO 24V SW50-24F
TOKO 24V SW50-24F / LED1
DC (TOKO 24V SW50-24F / + V, -V) SWD /
TXGPS5 / J6.
19. TXGPS5 D28, D29, D30,
+ 5V, + 15V, -15V.
TXCON7 / D2, D3, D4; TXFIL5 / D1, D2 TXROT5 / D9
TXLHS / D39, D40.
TXGPS5, ∴ "
20. TXGPS5 / D11 - PS.GOOD
() - TXCON7 / D45 - PS.GOOD -
TXGPS5, ∴ "
21. , (,) , ,

- TXGPS5 / D45 (TUBE CHANGE ERROR) TXGPS5 / D11 TXCON7/D45 PS.GOOD
22. 15, (SWD / C1-C4, C5, C6, C11, C12 3X400V SWD/C1-6, C11-13 1X240V 3X240V TXRCB3 / D3, D4 3X400V TXRCB3 / D3 1X240V 3X240V 3X400V TXRCB3 / D3, D4
- TXCB3 6-8 TXGPS5
- TXCB3 6-8 " CAP. OK " (TXRCB3 / JP1 / 1,2.
23. " CAP. OK " SWD / TXRCB3 / JP1 SWD / TXCON7 / JP10 TXCON7 / JP9/12 SWD / TXGPS5 / J4 /12.
24. CAP. TXGPS5 / J4 / 12, (0V 12-15V. TXGPS5 / J4 / 4.) TXGPS5 / RY1 TXGPS5 / J2 / 1, 2. TXGPS5 / J2 / 4, 5
25. SWD / TXGPS5 / J2 / 1, 2 PL1/2/ , b - SO1/2/ , b SWD / RY1. SWD / RY1 TXGPS5 / D39 RY1 TXGPS5, ".
26. SWD / R, S, T SWD / RY1 (2T1-1L1, 4T2-3L2, 6T3-5L3) D1, D2, D3. SWD / R F1, RY1/ 2T1-1L1, F9, ZSZ1, SO1/5/ , b - PL1/5/a, b (SWD / TXFIL5/ J2 / 5, 6) (SWD / TXROT5/ J1 /1, 2).
27. TXFIL5

-

TXFIL5 / D29 " " .

, TXFIL5 / D6 " S LL FOCUS " () .

() TXCON7 / JUMPER4.

- TXCON7 / JUMPER4 1-2, 3-4 . , ,
TXFIL5 / D29 ,
, TXFIL5 / D29 .
- TXCON7 / JUMPER4 1-3 . TXFIL5 / D29
TXFIL5 / D29 ,
.

28. .

TXGPS5,

:

- (OFF)
- (TXCTR3) . (ON)
- RELAY (SWD/R Y1)
- ,
- DC + 15V, -15V, + 5V
- TXFIL5
- TXIGB3 IGBT
- POWER GOOD (), +
- 15V, -15V, + 5V,
- CONTACTOR CLOSED (),

, :

- J19 .
- (STANDBY PWS),
- TR3, D33 C24.
- (+ 24V) J18 / 1, 5 D34
- RL1 - OFF (.)
- (J18 /1,2)
- ON (.) (J18 / 4, 5)
- RY3 RL1 . RL1 (RL1 / 7,
- 14) ON (.) (J18 / 1, 4)
- OFF (.) (RL1 / 1, 7).
- RY3 (J14)
- (SWD / MW - 11) J17, J14 J15.

:

- REMOTE () (J4 / 9, 10)
- SWD / TXCTR3
- U3
- SWD / RY1. RY1
- J20, J5
- + 24 V (J6)
- (PWS).
- SWD / TXCON7,
- TXGPS5 (J4 / 9, 10 J3)
- +24V (SWD/ TOKO 24V).

(+PULSE, -PULSE) (+ , -)
 PWM U6 Q4, Q5. (+PULSE, -
 PULSE) (+ , -) + 24V
 (TR1, TR2)
 (J7 / 4, 5, 6 J8 / 4, 5, 6)
 IGBT (J9 / 1, 2, 3).

, TR1, TR2, D18 ... 23, LI.. 2,
 U8 ... 10 18...23 DC
 + 15, -15V, + 5V (J4 / 1, 2, 3, 4, 5),
 (J7 / 1, 2, 3, J8 / 1, 2, 3) (J1 1 /
 3, 4, 5, 6).

POWER GOOD ():

+ 15V, -15V + 5V
 (U13 / 3 0 - R25, R61 U13
 U13 / 3 Q7 U14C / 8
 C25. C25
 U2D / 13 , U2D / 11 0 D11
 POWER GOOD .

:

, , (TXRCB3) J4 / 12 CAP. 0 + 15V,
 U14 / 7 (CHARGE ERROR) (
) + 15V - C6 R19, R20 R62.
 C6 U2C / 10 0 + 15 V Q3, U5 U3 U2C /
 8, SWD / RY1 (J2 / 1, 2) D39 CONTACTOR RY1.
 ON (.)

Q3 U5
 POWER GOOD, CAP, CHARGE ERROR,
 Q3 .

) J2 / 5 J4 / 7. CONTACTOR CLOSED (

:

D, Q1, RY2 U1 U2 / A, B, U14 / A, C,
 J12 / 2, 3 J21, TUBE SEL.
 () - 0, RY2 . TUBE SEL. + 15V,

RY2

D44

J12 / 1, 2 J21
TUBE SEL.,

RY2

HV

TXHVT2...HV.

:

TUBE SEL. - 0V HV
T.S.SENS - 0 (), J10 / 2, 3
U1 U2A / 1 - 0V.
TUBE SEL. - 0, U2A / 3 0. U14A / 1
U14C / 8 - 0V U14D / 14 - + 15V.

TUBE SEL. 0 + 15V, U2A / 2 15V,
U2A / 3 + 15V
C29 R67. U14A / 3 + 15V. U14A / 1
+ 12V C28 R64.

C28 U14A / 3 (1), U14A / 1 + 15V
Q1 RY2

U1 , U2A / 3 J10 / 2, 3
0V.
C29
R71 R66 (3-4), U14

U2A / 1 + 15V. U14A
() C29
R71 R66. U14D / 14 0V Q1.
U14C / 8 + 15V, U13
D45. U13, POWER GOOD,

:

U14B.
U14B / 5 7. 5V U14B / 7 + 15V. C30 R77.
(
TXRCB3) - J4 / 12 CAP.
0 + 15V - C30
U14B / 5 (7. 5V), U14B / 5 12 -13V. C30
C30 9 - 9. 5V U14B / 7 + 15V.

5V. , , J14 / 12 0V, U14B / 5 7.
C30 7. 5V U14B / 7

0V, D46

U15

:

RY3 OFF ()
RL1 . RL1 / 7, 14
RL1.
J18 / 3 5.
RL1 / 1,7
RY3
(SWD / TOKO MW 15-11)
(SWD / TXCTR3).
(SWD / RY2)
REMOTE
(SWD /
TXGPS5 -
(RY1) . -

:

J2 (SWD / RY1)

J2/1 - 0 ()
J2/2 - ()
J2/3 -
J2/4 -
J2/5 -
J2 / 4, 5 - .

J3 (SWD / RY2)

J3/1 - + 24V
J3/2 - 0 (+ 24V)

J4

(TXCON7)

J4/1 - + 5V
J4/2 - 0 (+ 5V)
J4/3 - + 15V
J4/4 - 0 (+ 15V, -15V)
J4/5 - 15V
J4/6 - (POWER GOOD)
J4/7 - (CONTACTOR CLOSED) (SWD / RY1)
J4/8 - (TUBE SEL.)
J4/9 - +REMOTE, (SWD / RY2)
J4/10 - -REMOTE, (SWD / RY2)
+REMOTE -REMOTE - + 24V.
-REMOTE 0V !
J4/11 - (PREP).
J4/12 - , (CAP.)

J5

DC

+ 24V (SWD / TOKO 24V SW50-24F)

J5/1 - 0 ()
J5/2 -
J5/3 -

J6

+ 24V

DC

24V TOKO

J6/1 - + 24 V
J6/2 - 0 (+ 24V)

J7

TXFIL5

J7/1 - + 15V
J7/2-0 (+ 15V, -15V)
J7/3- -15V
J7/4 - - PULSE (HF)
J7/5 - + 24 V (HF)
J7/6 - + PULSE (HF)
J7/7 -

J8

TXFIL5

J7.

J9

TXIGB3 IGBT

J9/1 - - PULSE (HF)
J9/2 - + 24 V (HF)
J9/3 - + PULSE (HF)
J9/4 -

J10

:

J10/1 - ()
J10/2 - 0 ()
J10/3 -

J11

J11/1 - + 24V
J11/2-0 (+ 24V)
J11/3 - + 15V
J11/4-0 (+ 15V)
J11/5 - + 5V
J11/6-0 (+ 5V)

J14

TOKO MW15-11 (TXCTR3.)

J14/1 - ()
J14/2 - 0 ()

J15

J15/1 - ()
J15/2 - 0 ()

J16

J16/1 - ()
J16/2 - 0 ()

J17

J14/1 - ()
J14/2 - 0 ()

J18 (ON () OFF (), ON () OFF ())
 J18/1 - + 24V
 J18/2 - OFF
 J18/3 - OFF
 J18/4 - ON ON
 J18/5 - 0 (+ 24V) ON OFF

J19
 J19/1 - ()
 J19/2 - 0 ()

J20
TXGPS5
 J20/1 - ()
 J20/2 - 0 ()

TP1 - PWM 20kHz (0V / + 15V) TP2 - PWM
 TP3 - PWM 20kHz (0V / + 15V)
 TP4 - DGND (24V)

D34 - + 24V (STAND BY)
 D29 - + 15V
 D30 - -15V
 D28 - + 5V
 D49 - (CONSOLE ON)
 D2 - (REMOTE ON)
 D39 - (CONTACTOR ON) (.)
 D45 - , ()
 D11 - , + 15V, -15V, + 5V (PS. GOOD)

1. TXGPS5 " TXGPS5 ".
 2. , (). J21 /1, 2 J12
 / 1,2 . RY2 1
 HV

1. TXGPS5 / D34 , OFF (.)
 - + 24 - 35V. (+ J18 / 5.)
 J1 8.

- 1.1. J18.
- 1.2. F5 (TPCON1 / F5).
- 1.3. , , .
- 1.4. **D34** J18 / 1, 5 - 0V, F7, F8. , J18 TR3, D33 C24 .
- 1.5. D34 J18. ,
- 1.6. F7 F8 J18 / 1, 5, J19. (.)
- 1.7. J19, SWD / F6 SWD / SO1 - PL1.
- 1.8. SWD / F1, F2, F3 SWD / NB1 - , 3X400V.
- 1.9. , .
- 1.10. 1 - 3 2 - 4 , SWD / ZSZ3.
- 1.11. , , TR3 .
2. **D49** ON (.) .
- 2.1. J18.
- 2.2. , ON RL1 / 2, 6. - + 24 - 35V. DC () .
- 2.3. - 0V, J18 1, 3. R109 (47 - 220 ,).

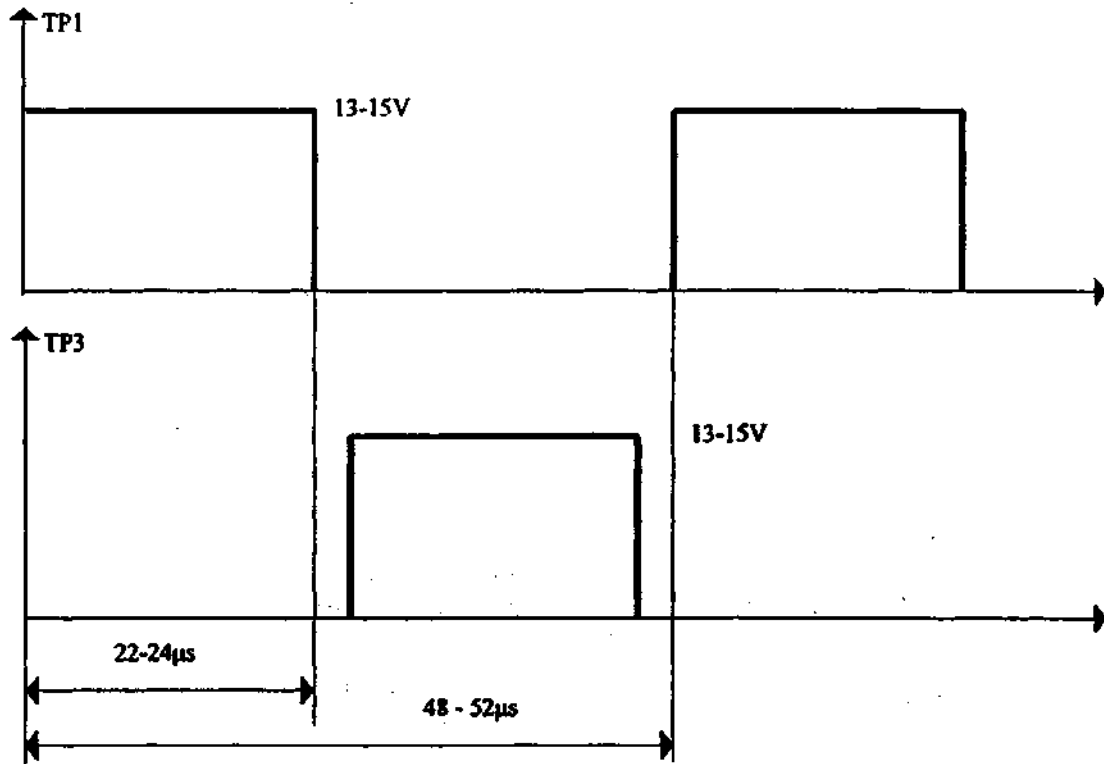
3. ON (.) , ON (.) D49
RL1, RY3 , D2
REMOTE () .
- 3.1. TXCTR3 / D3, D4, D5 DC
TXCTR3 / TP6, TP2, TP1. - TP22.
- + 15V, -15V, + 5V.
- 3.2. , TXCTR3 / JP6 / 19, 20 () - 24V DC, JP6 / 19 - + JP6 / 20 -
REMOTE () REMOTE ()
0V!). DC .
- 3.2.1. SWD/ TXCTR3 / J6 / 19, 20 REMOTE ()
SWD / TXCON7 / JP2 / 19, 20.
- 3.2.2. REMOTE () TXCON7 / JP2 / 19, 20
TXCON7 / JP9 / 9, 10.
- 3.2.3. REMOTE () SWD / TXCON7 / JP9 / 9, 10
SWD / TXGPS5 / J4 / 9,10.
- 3.2.4. REMOTE () TXGPS5 / J4 / 9, 10
TXGPS5 / J3 /1, 2. REMOTE ()
REMOTE ON (.) TXGPS5 / D2 .
- 3.3. 19, 20 - REMOTE () , TXCTR3 - J6 /
TXCTR3 ,
- 3.4. 3.1 ,
TXCTR3/F1, F2, F3.
- 3.5. ,
SWD / TOKO MW15-11
TXCTR3.
- 3.6. 3.4 ,
F6.
- 3.7. F6 , AC
CN1 / L, N TOKO MW15-11.
(TOKO MW 15-11 / F1).
4. REMOTE () , D2
, SWD / RY2 ,
.

- 4.1. AC J20
- 4.2. SWD / F8. SWD / SO1 - PL1
- 4.3. SWD / F2, F5
3X400V, SWD / F1
1X240V 3X240V
- 4.4. SWD / ZSZ2.
5. REMOTE () , D2 SWD /
RY2 J20,
- 5.1. F2, F3, F4.
- 5.2. + 24V J6.
- 5.3. + 24V (TP1 TP3
TXGPS500. SCH 3). TP4. 1.
() , , ,
() , ,
() , ,
Q4, Q5 . Q4, Q5 R31, R34, R32, R35.
- 5.4. 5.2, (0V), AC
SWD / TOKO SW50-24F. (TB1 / L, N).
- 5.5. J6.
TOKO SW50-24F / + V, -V - 0V,
(TOKO SW50-24F /).
- 5.6. 5.3. Q4, Q5 5.2. 0V, F2,
F3, F4 TOKO SW50-24F / LED1 .

5.7.

TOKO SW50-24F

LED1



5.8.

5.1.

F2,

(TXGPS500. SCH 3)

5.5.

F2

TOKO SW50-24F / LED1,

5.9.

5.1.

F3,

TR1, TR2

5.5.

F3

TOKO SW50-

24F / LED1,

5.10.

5.1.

F4,

J9, J7, J8

J11.

+ 24V, +PULSE (+
5.5.

) -PULSE (-
F4

TOKO SW50-24F / LED1,
7.1.

6.

5.8.

F3,

SWD / D1, D2, D3

F4,
 J7, J8, J11, J4.

6.1. , D28, D29 D30
 J7, J8, J11, J4
 F3
 D28, D29, D30
 + 15V, -15V, + 5V.
 J7 - TXFIL5, J8
 TXROT5 J11 -
 TXHSS ... -
 TXCON7.

6.2. 6. D285 D29, D30 F3
 TR2 TR1,
 5.5. F4 TOKO SW50-24F / LED1,

6.3. 1, 2, 3, 4 ()
 F3.

7. 5.9.
 F4,
 SWD / D1, D2, D3
 F3, F4
 J7, J8, J9, J11.

7.1. D28, D29 D30
 J7, J8, J9, J11
 , D28, D29, D30
 F4
 + 24V, +PULSE (+
 J7 -
), -PULSE (-
 TXFIL5, J8 -
 IGBT, J11 -
 TXHSS ... -
 J9 -
 TXROT5 TXIGB3

8. , D34, D49, D2 SWD / RY2
 D28, D29, D30 D11 , SWD /
 RY1 () 7-8
 ON () OFF
 ()

8.1. 3X400V SWD /
 F1, F2, F3, F4, F5, F10 R1, R2, R4.
 1X240V 3X240V SWD / F1, F2, F3, F4, F5
 R1.

- 8.2. 3X400V, DC
TXRCB3 / D3, D4 (TXRCB3 - IGBT). DC
DC
DC
1X240V 3X240V DC
TXRCB3 / D3 (TXRCB3 -
IGBT). DC
DC
- 8.3. 3X400V, DC
200V, 3-5
10
SWD / TXRCB3 / JP1, SWD / TXCON7 / JP10
SWD/TXGPS5/J4/12.
1X240V 3X400V, DC
200V, 3-5
10
SWD / TXRCB3 / JP1, SWD / TXCON7 / JP10
SWD / TXGPS5 / J4 /12.
- 8.4. TXGPS5 / U3.
DC U3 (U3 / 1, 2),
- 1-3V. (+ - U3/1.)
TXGPS5.
- 8.5. 3X400V, 8.2. DC
200V, 3-5
TXRCB3
TXRCB3.
1X240V 3X240V, 8.2. DC
200V, D3 3-5
TXRCB3
TXRCB3.

8.6. 3X400V, 8.2. DC
200V 4-5
0V, (

!) IGBT

1X240V 3X240V, 8.2. DC
200V 4-5
0V, () IGBT

! SWD /

TXRCB3
DC ! ,

8.7. SWD / TXCOM1, SWD / TXDCF2, 8.8. SWD / TXDRV1, SWD / D1, D2, D3,

8.7.1. SWD / TXDRVL.

8.7.2. 8.7.1. SWD / TXCOM1 TXCOM1.

8.7.3. TXCOM1, SWD / TXDCF2 TXDCF2.

8.7.4. TXDCF2, SWD / D1, D2, D3.

(240) AC

8.7.5.

8.7.1. - 8.7.4.

()
100V DC
(100) DC
DC
DC
1-2 , ,

8.8.

8.7.

() 1GBT
SWD / IGBT SWD / TXRCB3.

8.8.1.

IGBT

SWD / TXRCB3,

IGBT

TXRCB3.

TXRCB3.

8.8.2.

TXRCB3,

IGBT

IGBT

IGBT

(IGBT

.)

"

0.25 - 0. 45V.

- IGBT

(, 240) AC

9.

ON (,)

, D34, D49, D2 SWD / RY2

D28, D29, D30 D11

RY2

2

3

RY2

D45 (TUBE CHANGE ERROR) (

D11 (P.S. GOOD)

RY1,

D39

SWD / RY1 (

RY1,

D39,

SWD / RY1 (

TXCON7

:

•

,

,

•

,

,

,

•

()

•

,

,

,

,

,

•

•

JP1

		(TXCTR ...)
1.-	(+)	(-)
2.-	(-)	(1V=1)
3.-	(+)	
4.-	(-)	(1V=1A)
5.-	(+)	
6.-	(-)	(1V=1A)
7.-	(+)	(ROT.DEF.)
8.-	(-)	(

9.-	(CAP.ERR) “	"ROTOR.OK".)
10.-	(AGND)	
11.-		
12.-		
13.-		
14.-		
15.-	(AGND)	
16.-		

JP2

		(TXCTR ...)
1.-	(+)	(ROT.RUN)
2.-	(-)	
3.-	(+)	(ROT.BOOST)
4.-	(-)	(
5.-	(+)	(1-2, 7-8, 9-10, 11-12, 29-
6.-	(-)	30, 31 -32
7.-	(+)	(FILL.ERROR)
8.-	(-)	(
9.-	/	(+)
10.-	/	(-)
11.-	(+)	(. CL.)
12.-	(-)	(
13.-	(+)	(
14.-	(-)	(1V=30)
15.-	((+)
16.-	((-)
17.-		(+)(1V=1A)
18.-		(-)
19.-	(+)	((REMOTE)

20.-		(-)		,	,	
21.-		(+)	(,	.)
22.-		(-)		(1V = 100)	
23.-			(+)			
24.-			(-)	(1V=20)	
25.-			(+)			
26.-			(-)	(1V=1A)		
27.-			(+)	(	.ENABLE)	
28.-			(-)			
29.-	(+)	(PREP)	(	27-28	29-30	
30.-	(-))
31.-				(X-RAY ENABLE)(
32.-	(-)				.)	
33.-	()		(+)		
34.-	()		(-)		
35.-		(-)		(TUBE SEL.)		
36.-	(AGND)					
37.-		(+)				
38.-			(		)(+) (FLUORO)	
39.-						
40.-			(		)(-) (FLUORO)	

JP3

1.-					
2.-				(	+, 1V=11.7)
3.-				(	-, 1V=11.7)
4.-				(	+, 1V=500)
5.-				(	-, 1V=500)
6.-					

JP4

(TXFIL ...)

1.-			(+)	
2.-			(-)	(1V=1A)
3.-			(+)	
4.-			(-)	(1V=1A)
5.-	OK			(
6.-		OK		
7.-		()	(

JP5

(TXFIL ...).

7.-				
			JP4	

JP6**IGBT (TXIGB...)**

- | | |
|-------|----|
| 1.- | 1. |
| 2.- 0 | |
| 3.- | 2. |
| 4.- 0 | |
| 5.- | 3. |
| 6.- 0 | |
| 7.- | 4. |
| 8.- 0 | |

JP7**(TXROT ... TXHSS ...)**

- | | | | |
|-------------|-----|-----|-------------|
| 1.- | (+) | (|) |
| 2.- | (-) | | |
| 3.- | | (+) | (BOOST) |
| 4.- | | (-) | |
| 5.- | OK | (| 0) |
| 6.- | OK | | |
| 7, - | | | (TUBE SEL.) |
| 8. - | | | |
| 9. - +15V | | | |
| 10. - | | (| 0) |
| 11. - + 15V | | | |
| 12. - | | (| 0) |

JP9**(TXGPS ...).**

- | | |
|----------------------|-----------------------|
| 1. - +5V | |
| 2. -DGND (+5V) | |
| 3. - + 15V | |
| 4. AGND (+15V, -15V) | |
| 5. - - 15V | |
| 6. - | (PS.GOOD |
| | (|
| |) |
| | .) |
| 7. - | , () |
| | . |
| 8. - | (TUBE SEL.) |
| 9 - | (REMOTE +) |
| 10.- | (REMOTE -) |
| 11. - | (PREP) |
| 12. - | OK |
| | (+13-15V = OK, 0V =) |

JP10**(TXRCB****...)**

- | | |
|------------|-----------------------|
| 1. - + 15V | |
| 2. - | OK |
| | (+13-15V = OK, 0V =) |

JP11

- | | |
|-----------|-----|
| 1. - + 5V | () |
|-----------|-----|

2.- AGND
3.- / - ()
4.- IGBT
5.- UK > UA
6.- UA > UK
7.- IGBT
8.- / + ()
9.-
10.-
11.-
12.-
13.- KW
14.- KWS
15.- ,
16.- BEAM FAULT

CONDIS1 JP11 CON7. JP11/1, ,
JP7.

JP12 PTC IGBT IGBT
1.- IGBT.HOT.1 (,
2.- IGBT.HOT.2)
3.- 1 (- , (IGBT.OC.) ,
- .)
4.-
5.- 2 (- , (IGBT.OC.) ,
- .)

JP13 (TXAVB ...)
1.- , (-)
2.- , (+) (INV.CURR.)
3.-

:

D2- +15V
D3- -15V
D4 - +5V

D18 - - (). D18 D35,
, () ,
.
, (BEAM.ERR).
. (

() ,
) .
 D19 - IGBT. D19 D35, IGBTs
 . ,
 (BEAM.ERR). D19 , D35
 . , D19 D35
 , (. :), D19
 . ,
 , CON7/J12.
 , JP12/1,2 D19 - OK,
 . JP12
 TXCON7, U24, U7B, U16. 4
 D20 - (-) D20 D35.
 (+) (BEAM.ERR).
 ,
 ,
 . (. D18 D27.)
 " "
 (TXHVT2) "
 D21 - (+) D21 D35.
 (-) (BEAM.ERR).
 ,
 ,
 . (. D18 D27.)
 " "
 (TXHVT2) "
 D22 - IGBT. D22 D35,
 IGBT
 ,
 (BEAM.ERR).
 IGBT
 D18, D27 D29,

-

D18, D27

D29.

D27 - + (). D27 D35,

, () ,

. ,

(BEAM.ERR).

. (

() ,

) .

D29 - . , (TP27).

(TP6),

D29 D35, ,

()

, ,

- ,

. ,

(BEAM.ERR).

TXCON7/TP6, - TP21.

8V 2-3ms 6.6V

. (1V=100)

.

- .

D18 D27,

D18 D27.

D30 - . D30 D35,

. U17 PIC.

, (BEAM.ERR).

(40-60)

. " "

(TXHVT2)

D31 - . D31 D35,

. ,

(BEAM.ERR).

D22,

. (,

, ,

.).

D18, D27 D29,

D18, D27 D29.

- ,

D33 - (JN8/2-3), D33 D35
(380-400V 180-200V
,
,
(BEAM.ERR).

D34 - D34 D35 (U17 PIC
) ,
(10 %) ,
U17 D34 D35 .
(BEAM.ERR).

D35 - ,
(BEAM.ERR). D35, D18, D19, D20, D21, D22,
D27, D28, D29, D30, D31, D32, D33, D34, D41 D42 .

D41 - kW_s . D41 D35, -
() - (10 %)
() kW_s .
,
(BEAM.ERR).
, , 6.6 .

D42 - () . D42 D35,
(5ms).
(BEAM.ERR).

D45 - POWER GOOD.
D2,3,4 1 .

JN6.

1-3 -

2-3 -
"

4-3 -

" (UA.ENABLE)

4-3

TP1- (-) (1V~7.8)
 TP2- (+) (1V~7.8)
 TP3- (1V=20)
 TP4- (1V=30)
 TP5- (1V=30)
 TP6- () (1V=100)
 TP7- + () (- ! 1V~500)
 TP8- - () (+ ! 1V~500)
 TP9- () (1V=1)
 TP10- (PWM,
 TP11- I () (PWM,
 TP12- 1 IGBT (+13-15V, IGBT)
 TP13- 2 IGBT (+13-15V, IGBT)
 TP14- 3 IGBT (+13-15V, IGBT)
 TP15- 4 IGBT (+13-15V, IGBT)
 TP16- (PWM aux.)
 TP17-
 TP18- I I. (c PWM aux.)
 TP19- +15V
 TP20- +5V
 TP21- AGND
 TP23- -15V
 TP24- 4 JN6
 TP25-26 , , C58,
 TP27-
 TP28- (EXP)

PI -
 P2 - - " "
 P4 - - " "
 P5 - - " "
 P6 - - " "
 P7 - ()
 P8 - ()
 P9 - ()
 P10- ()
 P11- PWM
 P12- I. PWM
 P13- PWM (.)
 P14- PWM

P15- I I. PWM

:

JN1- :

JN2- :

JN3- : TUBE SELECT

JN4- :

JN5- :

JN6- (BEAM ERR.) :

1-3 -

2-3 -

" (UA.ENABLE)

4-3 -

4-3

JN7- :

1-3 -

3-4 -

1-2 -

JN8- :

2-3 -

1-3 -

JN9- ROT.RUN. READY:
- ROT.RUN. READY
- ROT.RUN. READY

JN10- : IGBT

SW1-

SW2-

- AMPLIFIER, (2 7.)
- AMPLIFIER, (3 7.)
- PROTECTIONS(), (4 7.)
- CONTROL, (5 7.)
- LOGIC UNIT, (6 7.)

CON7 (1 7)

(7 7)

(CAP.ERR.)

(1 7)

SWD/TXRCB .../JP1
IGBT

JP10.
(380-400V
)

180-200V

0V JP10/2 TP21.
12-15V. JN8/2-3
U21/6

(CAP.ERR).

(BEAM.ERR),

D33 D35

JN8/2-3

JN8/1-3
(CAP.ERR)

U21/6. (+5V)

JP10/2 () TP21 (GND).
+12-15V, (3-5V)

(2 7)

(+ .SENS., - .SENS.)

JP3/1,2,3

U5, U6, U3/C, .

R23,R24, R25,R26 -

. R15, 15, 16, 17, 18, 19 R17, 20, 21, 22, 23, 25

SW1, SW2.

(.)

D23-26

PI. (TP3 1V=20)

(- .S. + .S.)

(U12/A).

(.S)

U3/B

(U18/2),

(U11/B),

PIC (U17/17)

(+UA.FEEDB. -

UA.FEEDB.)

JP2/23, 24.

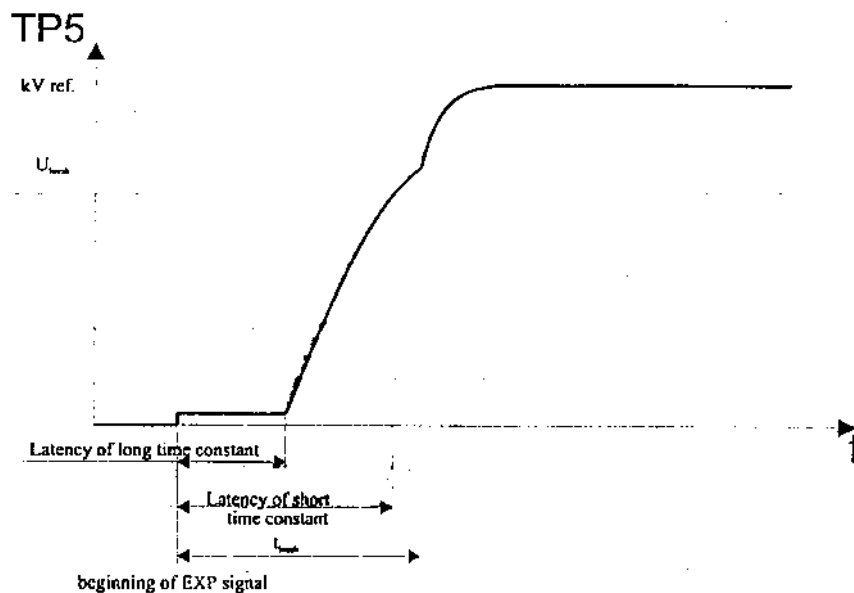


figure 1.
1.

(+UA.REF. -UA.REF.)
 (JP2/13.14) U3/A.
 (.REF.C) (U12/),
 (U23/D) (U23B,C)
 (PWM) U18 (1) (.REF.F.)
 U2/A...D U3D.
 EXP ()
 () PWM (R111-112) ()
 () P2, () P6.
 () P4, ()
 P5.
 (.REF.F TP5) ,
 U3/A,
 U2/C,D. EXP , U2/A
 C4-R22. C4 R22 U2/B
 R111-112. D28
 . (0,1V).
 C4 (, P6) U2/C
 RC R44, P2, R16-C125,
 (D11)
 D28.

P5) U2/D RC C4 (P4, R28-C3, ,
 D11. , 70 %
 1. , ,
 , ,
 .
 U7/C
 Q20.
 , (3 7)
 , (+ .SENSE. - .SENSE.)
 JP3/4,5,6 ,
 U4/A, , .
 (- .S. + .S.)
 () (U7/A, U10/A).
 U8. ()
) P8 ()
 U8 P7 (1V = 100).
 U11/A, PIC (U17/18),
 (-IA.FEEDB +IA.FEEDB)
 JP2/21,22.
 U9, ,
 () P10
 P9 (1V=1). U9 (-IF.FEEDB.
 +IF.FEEDB.) JP1/1, 2.
 , (4 7)
 () ,
 U17 PIC, () ,
 () +5V. ,
 0V. PIC
 GAL
 () (U16, U21), (LED)
 D35, BEAM.ERR.
 (0V), (. 6 7),
 , (BEAM.ERR.)
 :

PREP (U16, U17 U21)
(PS.GOOD, PS.GOOD.5.)

JN6.

1-3 - ,
2-3 - “
4-3 - ”(UA.ENABLE)
4-3 ,

IGBT

IGBTS , JP12/1,2
(IGBT.HOT1, IGBT.HOT2).

U7/B , 0V, U16/3 U24
OVERHEATING). IGBT (IGBT
(BEAM.ERR), D19 D35 . (.
, D19)

IGBT

IGBT (IGBT.OC)
JP12/2,4,5 IGBT U14,
U7/D U16/6. (BEAM.ERR), D22 D35 . (. :
, D22)

U11/A.

U11/A/7, U21/2 ,
(OVERCURRENT).
Q2.
(660) (R51-81),
(C47-R182)
(EXP).

(BEAM.ERR), D29 D35 . (. : ,
D29)
PIC U17 . (U 17/18)
PIC,
(BEAM.ERR), D34 D35 .
(. : , **D34)**
.
.
JP13 U11/C, (INV.CURR),
R103-206,
(INVERTER OVERCURRENT) U21/4.
(BEAM.ERR), D31 D35 . (. : ,
, D31)
.
U4D U12A (U12/A U12/B)
U7C, U10B (U7C, U36, U37).
(.REF.C) + - (+ .S - .S).
.
(U37) (U36) , U16/4
U16/5 ASYMMETRY UA>UK ASYMMETRY UK>UA.
(BEAM.ERR), D20 D35 D21 D35 . (. :
, D20, D21)
.
U11/B.
(.S)
R100-101, (OVERVOLTAGE)
U21/3.
(BEAM.ERR), D30 D35 . (. :
, D30)
.
PIC U21/9. , U17
.
.
()
U7/A U10.
(- .S. + .S.)

U16/2 -SIDE TUBE OR HV.ARC,
 U16/7 +SIDE TUBE OR
 HV.ARC.
 (BEAM.ERR), D18 D35 D27 D35 . (.
 : , D18, D27)

(JN8/2-3) , (380-400 V
 180-200V) CAP.ERR
 +5V 0V U21/6 CAPACITOR VOLTAGE ERROR.
 (BEAM.ERR), D33 D35 . (. :
 , D33)

KW
 (U17/17,18), (10 %) U17 PIC
 KW LIMIT EXCEEDING
 U21/11 U19/8, 9, 10. (BEAM.ERR), D34 D35 . (.
 : , D34)

KWS (
)
 (U17/17,18,11), (kW)
 U17 PIC (10 %)
 KWS LIMIT EXCEEDING U21/11 U19/8, 9, 10.
 (BEAM.ERR),
 D41 D35 . (. : , D41)

MIN.

U17 PIC (U17/17)
 (40) (5).
 MIN NOT REACHED EXCEEDING U21/11 U19/8, 9, 10.
 (BEAM.ERR), D42 D35 . (. :
 , D42)

U17 PIC
 6.6 ..

D35 (BEAM.ERR), D41
 (5 7)
 U18.
 (.REF.F)
 U18 (U18/1).
 U18 (U18/2). U18
 (U18/13, 16).
 C56,
 (C59), R122, P11
 IGBT P12.
 (IGBT1,2,3,4) U18
 U19 GAL20V8 U1 GAL16V8
 U20, U15/A...D.

PWM U18
 11 TP21, GND.
 (ON). 2.

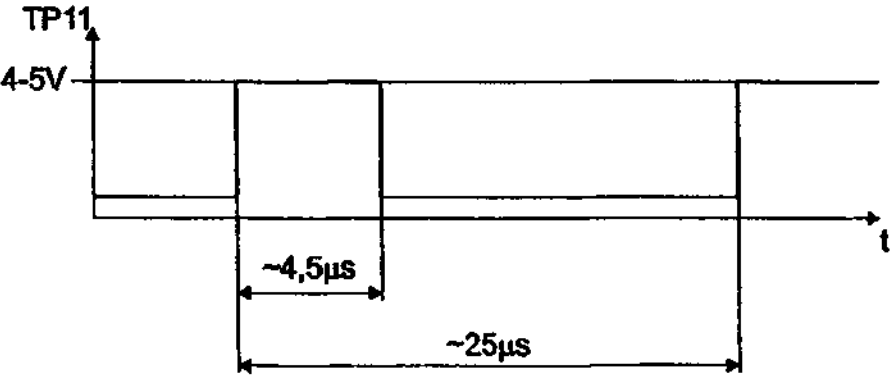


figure 2.

0V 5V,
 U18,
 JN1, JN2
 +FLUORO, -FLUORO

1. +FLUORO, -FLUORO
 , JN1 JN2

(TP17 U23A/7 +5V,

U22/10,11) () C57 C58. TP17 U23A/7 0V, U22/10,1 1 C58.

2. **+FLUORO, -FLUORO** , JN1, - (.), JN2, . JN2 TP17 U23A/7 + 5V U22/10.11) C57, C58, C74, C75 (.).

2. **+FLUORO, -FLUORO** , / JN1, - (.), JN2, . (+FLUORO, -FLUORO) U25 JN2 TP17 U23A/7 +5V, (U22/10,11 C57, C58, C74, C75 (.). (+FLUORO, -FLUORO) U25 TP17 0V (U22/10,11, C58.

- (JN1) (U22/10, 11) (40-75 R130, 131), U23/D U22/6, C59 C56 U22/8,9 , PWM . U22/6 , C58.

(JN2) (U22/10,11) R127, R128, R129 (U23/B U22/13, U23/C U22/5) U22/1,2 U22/3,4 . C58, C57, C74 C75. U22/13, U23/C U22/5) U22/1,2 , U22/3,4 R127, R128, R129, (U23/B U22/13, U23/C U22/5) U22/1,2 U22/3,4 . C58, C57, C75. R127, R128, R129, (U23/B U22/13, U23/C U22/5) U22/1,2 U22/3,4 . C58, C57.

Q3, Q9, R157, R158 ... PS.GOOD , Q5-8.

U18 (U18/8) PS.GOOD INHIB (4 7) BEAM.ERR.

R125, R126, Z2 (D43)
(U17, U16, U21).

PS.GOOD

+5V

U1, PWM, U18 (U18/5) IGBT (U19/7). (Q4) / U19

(6 7)

TXCON7 CTR....,

(CTR)

(JP1, JP2).

TXCON7

(PREP.2.)
(PREP.)

TXGPS (JP9/11)
CTR.

PREP

(PR U27/A HS U27/B) (PREP.), (ROT.DEF) CTR, (UA.ENABLE) Q1

CTR. Q11 U27/C U26/D (ROTOR.O.K.) JP7/5, (ROT.RUN.)

ROT.DEF. CTR, Q11
(ROT.RUN.).

ROT.DEF. TXCON7 (HS.SEL. JP7/10).

JN9, ROT.RUN. READY.
JN9, ROT.RUN. READY.

ROT.RUN. READY
CTR

(JP4/5 FIL.ERR.1.) (JP5/5 FIL.ERR.2.)
Q12 U34/A, U32/B, O.K.
(FIL.ERROR.), CTR. READY.

1-3 - JN7 (

U32/B.

3-4 1-2 -

(BEAM.ERR.) (4 7)
 Q16 (1 7) -BEAM.ERR. +BEAM.ERR.
 CTR. BEAM.ERR. READY (6 7).
 , (ROT.RUN.),
 (BEAM.ERR.), (U32B/4)
 (PS.GOOD JP9/6) U33/A,
 U32/C,D Q14 (-READY, +READY) CTR.
 READY X-RAY ENABLE, CTR,
 X-RAY ENABLE (EXP) U26/E, U27/D,
 U26/F PWM U18. (EXP
 2 7) 4 7) U17 PIC
 kW_s
 U33C, U34C, R185, C79
 +5V (U33C/10) (CLEAR.5.)
 UA.ENABLE ().
 (4 7), . (.
 :).
 PREP , EXP U33D,
 :
 - CONTACTOR.CL. - TXCON6
 CONTACTOR.CL () JP9/7,4 - JP2/11,12
 +REMOTE, - REMOTE JP9/9,10 - JP2/19,20
 +ROT.BOOST, -ROT.BOOST () JP7/3,4 - JP2/3,4
 +IL.REF., -IL.REF. () JP4/1,2 - JP2/17,18
 +IL.FEEDB., - IL.FEEDB. () JP4/3,4-JP2/25,26
 +IS.REF., -IS.REF. () JP5/1,2 - JP1/3,4
 +IS.FEEDB., -IS.FEEDB. () JP5/3,4 - JP1/5,6

TXFIL5

:

•

•

•

•

•

•

(EMC)

:

•

•

•

•

(FET)

,

•

J3/1, 2,3.
LI, L2,
(D13) -

C34 R21. C9, C1 1, C29, C30, C13,

() DC

C23, C24, C26 R24, R25.

(FET) Q1 Q2

D14, D15, R27, R28 C27, C28

() Q1 Q2.

C25 R26 TR1 TR2, D3, 4, 33, 34, D8, 9, 35, 36 CE1, 2, 3, 4

Q1 Q2. U2 U3 Q1 Q2.

,

TR3. U5 (IC

RMS) U5 U7A, DC

U5

U7A,

(U4),

(J4/3,4) (U6D, U8B, TIR1). R37.

U7B (U7B/5)

(U7B/6) (J4/5). 2V,

2A. (".)

J4/1, 2.

U6B U6B

R50, R51, R33 JN9. 6.5A.

(".).

U4 (REF)

(-ERR)

(U4/13, 16).

20 ,

R10 C18.

U4

(U4/6, 7)

(100[°]),

(U4/1, 2).

6. 5A. (

".)

Q5, Z13, Z8, R71, R72, R73, R74.

U4,

+ U⁻ -U⁺ (|+ U| + |-U|)

Z8.

U6D, U8A, U8B.

4A. (

".)

U8A/1

Q4

TIR1

U8B/7

4A (

".),

U8A/1

Q4

C38

R56.

U8B/7

TIR1

U4.

R66, R6, C38, R83.

TIR1,

JN1,

R63.

1

R63.

4

±10

R63 ()	()						
	3.0	3.5	4.0	4.5	5.0	5.5	6.0
2.4		30	18	13	9	8	7
2.7			29	15	10	8	7
3.0			40	22	17	11	8
3.3				24	16	12	10
3.6				42	19	14	11
3.9					23	16	12
4.7					40	22	17
5.1						32	20
5.6							24

1.

J1.

C4-8

+ 15V -15V

J1/4,5,6,7

TR1, TR2.

RY1,
J2/3,4.

J2/1, 2
J4/7,6.

(
").

"

:

J4

J4 / 1 - (+) / $1V = 1A / ($ ".)

J4 / 2 - (-
J4 / 3 - (+) / $1V = 1A / ($ ".)

J4 / 4 - (-
J4 / 5 - / Q3 = < 2A (".)

J4 / 6 - / () /
J4 / 7 - (".)

J1

J1/1 - + 15V
J1/2 - 0 (+ 15V, -15V)
J1/3 - 15V
J1/4 - + (+pulse)
J1/5 - + 24V
J1/6 - - (-pulse)
J1/7 - ()

J2

J2 / 1 -
J2 / 2 -
J2 / 3 - *
J2 / 4 - *
*

J3

J3 / 1 -
J3 / 2 -
J3 / 3 -

:

TP1 - (1V = 1A) (".)

TP2 - (1V = 1A) (.

TP3 - TP 1,2,4 - 8,10
 TP4 - + 15V
 TP5 - -15V
 TP6- 2 PWM
 TP7 - PWM
 TP8 - 1 PWM
 TP9 - TP 1,2,4 - 8,10
 TP10 - (6A = 0. 93V) (

TP12 - Q2 (

TP14 - Q1 (

TP12 TP14

D1 - + 15V
 D2 - -15V
 D6 - (

D29 - (D29 , > 1.5 .)
 D32 - (D32 ,

RY1

4-3 7-6

61, 64, 65, 66, 83, 69, 76, 62, 63, 75, 4, 77 78, C38, 41, 39 40, R66, 60,
 JN1, D30, 31 32, Z11, Q4,
 U8 680 TIR1

D32
 TIR1.

JN1

JN1-JN9,

J4/7,

JN1 -

JN1

JN3

1.

JN2

JN4

JN5

JN6 2-3

JN7 1-3

JN8 1-3

JN9

: 6A

/

TP1, TP2: 1V = 1A

: 6.5A

: 6.5A

J4/7:

2.

I.

JN2

JN4

JN5

JN6 2-3

JN7 1-3

JN8 1-3

JN9

: 8A

/

TP1, TP2: 1V = 1.3A

: 8.5A

: 8.5A

J4/7:

3

II.

JN2

JN4

JN5

JN6 2-3

JN7 1-3

JN8 1-3

JN9

: 6.5A

/

TP1, TP2: 1V = 1.05A

: 6.8A

-

: 6. 8A

J4/7:

4

JN2

JN4

JN5

JN6 2-3

JN7 1-3

JN8 1-3

JN9

: 4A

/

TP1, TP2: 1V = 1.05A

: 4. 5A

: 6. 8A

J4/7:

5

,

J4/7.

J4/7.

JN2

JN4

JN5

JN6 2-3

JN7 1-3

JN8 1-3

JN9

: 4.0 -

J4/7 0 ,

6.5 -

J4/7 15

/

TP1, TP2: 1V = 1.05 A

:

4.5 -

J4/7 0 ,

6.5 -

J4/7 15

: 6. 8A

J4/7:

:

1.

,

(. "

"

".)

-

-

,

.

2.

-

-

D1, D2 -

D29

-

,

.

D6

(S LL FOCUS).

DC

TP4 TP5 TP3. - +
 15 + 2.5 % -15 ±2.5%. D32 .
 3. J3 /2, 3 AC
 4. F1.
 F1 - 3.15 A.
 5. TP1 TP3
 TP1 TP2
 6. TP2 TP3
 7. 5 6 -
 1. 0,
 2. 0,
 SWD / TXCTR3 / JP5, JP6, SWD / TXCON7 / JP1, JP2,
 TXCON7, SWD / TXCON7 / JP4 JP5 (
) SWD / TXFIL5 / J4 /1,2.
 3. TP1
 TP2 0.4 - 0.8 ,
 ()
 3.a. (HV)
 3.b. HV
 HV
 3.c. HV ()
 HV
 3.d. HV (TXHVT2 / J5 / 1, 2 3, 4 TXHVT3 / TXHVF1 / J1 / 1,2 3, 4).

TP2. (TP2 (0.4 - 0.8V), HV .

4. TP1 , 0,

4.1. (J2) , (HV (TXHVT2 / J5 (TXHVT3 / TXHVF1 / J1) HV .

4.2. (J2) J3, C23, C24. (TP12 TP14.) DC

4.3. PWM , TP1 TP6 TP8 1. 1, PWM (U4)

4.4. , JN1. TP3 U4 / 5 + 3.5 - 5V. DC

4.5. Q1 Q2. TP14 D3, TP14 D33. - +15±2 -15±2 TP12 D8, TP12 D35.

4.6. Q1 Q2 . TP11 TP13 4.3 TP14 TP12. + - ±2B 2. 2,

Q1, Q2, Z3, Z4, Z5, Z9, R16 R17.

4.7.

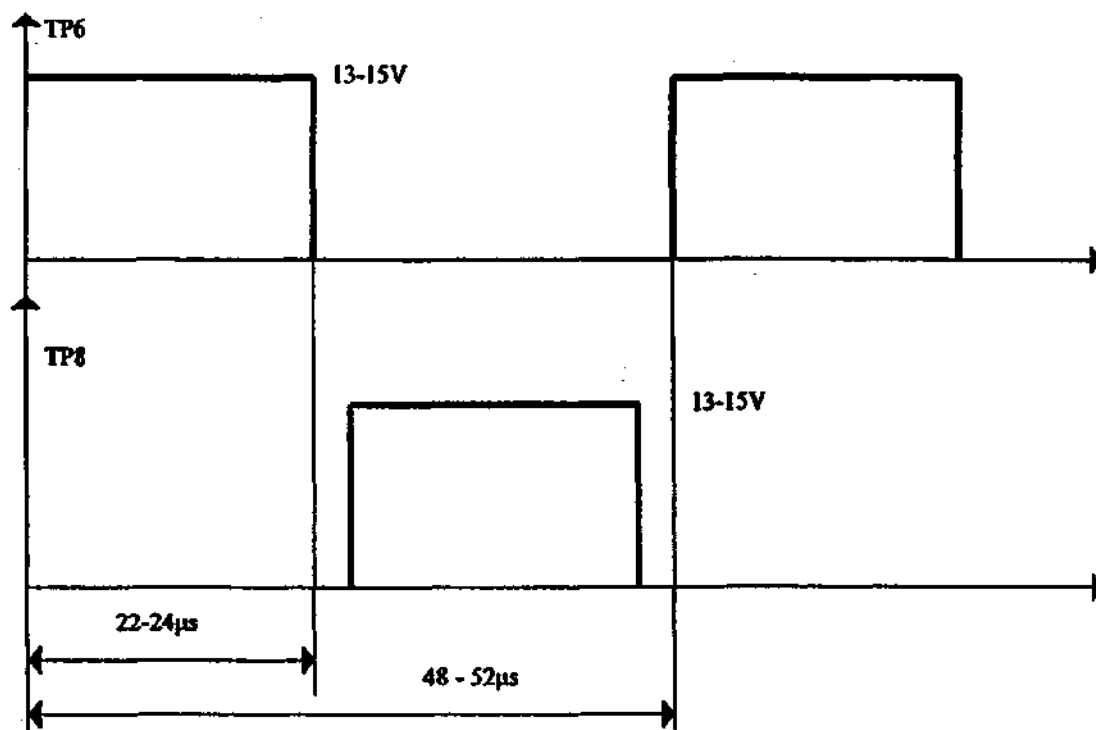
4.3. - 4.5

J2 J3

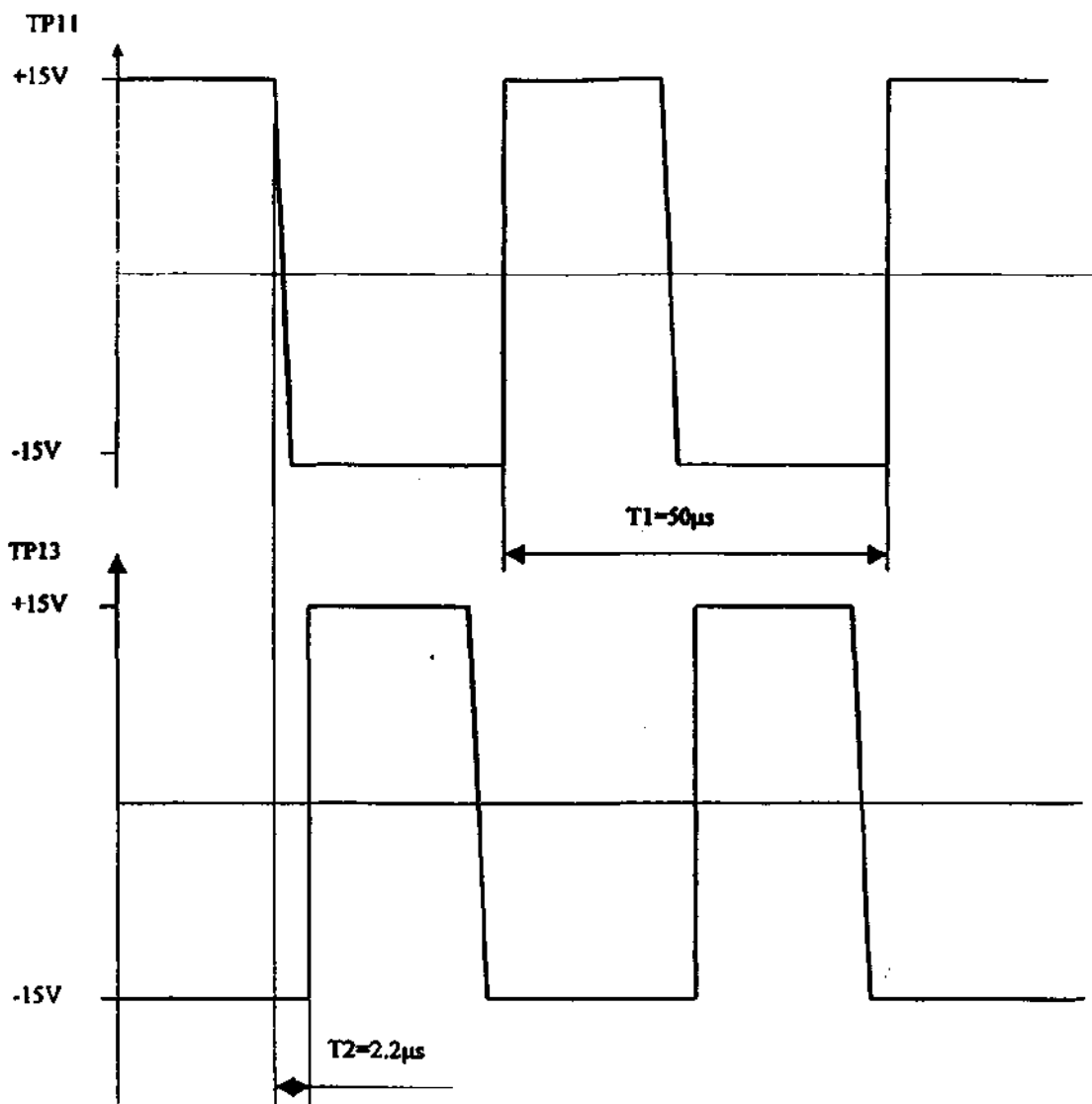
J2 J3.

"

"



1.



2.

,

•

•
•
•

()

,

()

10s

•

(

)

(EMC)

$$:$$

•

-
-
-
-

J1/1,2,3
L3,

C8, C9, C16, C17

R31.

J3/1, 4

()

TRI1 ()

—

LI RY1

J3/3, 6

TRI2 ()

L2 RY1

J3/2, 5

$$(\quad)$$

RY1

(1

2).

J2/7, 8

TRI1

R25, R26, R27,

C26

U4,

TRI 2

C25 C27

R32, R33, R34,
R35 R28

C24

U8.

 $du/dt,$

TRI1 TRI2.

,

U2

U1.

U9. U10

:

(U3, U5) Q1 Q2 ,

TRI1 TRI2 U3

(PREP) Q1

U1B. U1B/9 0 D3

U1A. , U1A/7 1

Q2. , TRI1 TRI2, U4

U8, , , U1B - C2,

R18 R17, R38, R39.

SW1.

U1B/9

1 U1A. Z1, Z2, R1, R2, U2 U10

(TP4)

U1A. U1A/7

U1A

Q2 U4 U8 TRI1 TRI2. U1A

C1, R37, R4, R5 R36.

SW2.

U1A, U1A/7 1

Q2, TIR1 TIR2

(ROTOR BOOST) (U5) D4 -

U1B/9 - U1A U5

TP3 + 15V Q5

L2 LI,

RR1 RR2 -

U6

(J2/5,6).

U3 (PREP U4, U8) Q1 , ,

TRI1 TRI2

:

(U3 U5)

U9B

1. JP3 , D13, JP4

R53, Q4, ,

AC :

JP3 JP4 . JP1 JP2.
 , U9B. U3 (PREP),
 C20, R44, R40, R420 R43.

U9B/9 SW4. U9B,
 D12. 1, Q4 U1A
 , U8 U1A/7 1
 Q2 TRI2.
 U1A ,
 . U9B, Q4 TRI2 .

AC :

JP1 JP3 , JP2 JP4 . ,
 U3 (PREP) U9B.
 U9B C20, R44, R40, R42 R43.

U9B/9 SW4. U9B
 U1A/7 1 U1A D12.
 Q4 " " 1 Q2.
 Q4 , D13, D14, D15 D19.
 (U3 Q1 D15 0
 U9B/9).
 D14 D13 0.
 TP4. ,
 , D14 0.
 , Q4
 D19 (U9A/6). U9A
 U9A C32, R41, R45, R47 R48.
 SW3. U9A, U9A/6
 1 Q4. U9A, U9A/6
 0 Q4
 Q2 Q4
 U8 TRI2 .
 ,
 U9A,
 U9B Q4 TRI2.

DC :

JP2 JP3 , JP1 JP4 . ,
 U3 (PREP) U9B.
 U9B C20, R44, R40, R42 R43.

SW4. U9B, U9B/9

1 U1A D12. U1A/7
 1 Q2. Q4
 " " D13, D14, D15 D19. Q4
 , 0 Q4
 (U3 Q1 D1 5
 U9B/9 D13 0. D14 TP9.
 (U10) D14 0. ,
 , D14 0.
 , D19 (Q4
 U9A U9A/6).
 . U9A C32, R41, R45, R47 R48.
 U9A/6 SW3. U9A,
 U9A, U9A/6 1 Q4.
 , Q4 0 Q4
 , U8 Q2 Q4
 TRI2
 , U9A,
 U9B Q4
 TRI2.
 :
 Q3, Z5, D16, R55 C23.
 U1A/7 1 (+ 15V). C23
 R24. C23
 Z5 (12 .) JP5 , Q3 Q2.
 , 10 .,
 U1A/7 (.).
 U1A , C23
 (R24) (D16 R55) .
 , ,
 C23 Z5.
 , JP5.
 :
 JP1 JP2 JP3 JP4
 AC

 AC
 DC
 , JP5 .

SW1,					
	SW1/1	SW1/2	SW1/3	()
1	.	.	.	2.5	
2	.	.	.	1.2	
3	.	.	.	1.6	
4	.	.	.	0.9	
5	.	.	.	2.0	
6	.	.	.	1.0	
7	.	.	.	1.4	
8	.	.	.	0.8	
SW2, (50Hz)					
	SW2/1	SW2/2	SW2/3	. 50	
				()
1	.	.	.	40	
2	.	.	.	70	
3	.	.	.	65	
4	.	.	.	90	
5	.	.	.	60	
6	.	.	.	85	
7	.	.	.	80	
8	.	.	.	105	
SW4,					
	SW4/1	SW4/2	SW4/3	(.)
1	.	.	.	8.0	
2	.	.	.	2.0	
3	.	.	.	4.0	
4	.	.	.	1.5	
5	.	.	.	5.0	
6	.	.	.	1.7	
7	.	.	.	3.0	
8	.	.	.	1.3	
SW3					
	SW3/1	SW3/2	SW3/3	DC ()
				50	
				()
1	.	.	.	45	110
2	.	.	.	90	220
3	.	.	.	60	170
4	.	.	.	85	----
5	.	.	.	50	140
6	.	.	.	90	----
7	.	.	.	65	180
8	.	.	.	95	----
$\pm 20 \%$					
$\pm 20 \%$					
AC DC					

J1

J1/1 - ()
 J1/2 - ()
 J1/3 -
 J1/4 -
 J1/5 -

J2

J2/1 - (PREP) +
 J2/2 - (PREP) -
 J2/3 - +
 J2/4 - -
 J2/5 - (Q5 =)
 J2/6 - (())
 J2/7 - 1 / 2
 J2/8 - 1 / 2 (())

J3

J3/1 - (1)
 J3/2 - (1)
 J3/3 - (1)
 J3/4 - (2)
 J3/5 - (2)
 J3/6 - (2)

J4

J4/1 - + 15V
 J4/2-0 (+ 15V)

:

TP1 - () TP2 - TP8
 TP2 - + 15V
 TP3 - (0)
 TP4 - -
 TP5 - -
 TP6 - -
 TP7 - (+ 15V)
 TP8 - " (Rotor OK) (> 5V,
)

D1 - (PREP), ()
 D4 - (DOOST),
 D20 - () (, 2)
 D6 - 2 (TUBE2) (, 2)
 D2 - ()
 D9 - + 15 V
 D17 - (OPERATIONAL ERROR) (

- TP4)
1. :
2. D9 (+ 15V) +15V DC
+ 15V. TP2 TP1.
3. D2 .
4. AC
J1 /1, 2.
5. F2 10A
6. 2 , RY1 D6
7. 2 - 8 V TP5 ()
TP3 13-15V DC .
8. (PREP) . (TRIAC FIRE)) D1 ((PREP))
D2 (. (D2 .)
(0,8 - 2. 5s) TP3 0
(1-2 V) TP5 13 - 15V.
J3 / 1, 2 (1) J3 / 4, 5 (-
2) 230V + 10V RMS -
AC .
9. TP5 TP3, 7.
10. D2,
3. D20 ,
11. J3 /1, 2 (1) J3 / 4, 5 ()
2) (±10% RMS)
AC .
12. (PREP). D1 D20 ,
D2 ,
D2
3. (PREP),
D2
3.

13. - JP5 - 10 (
-) D2 -
- 3 - D17 (
- (OPERATIONAL ERROR)) .
- :
1. / D20 , ,
- TXROT5 / J3 .
2. , 1, 2 , TXROT5 / J2,
- 1, 3. () 1 (TUBE1).
- 4, 5 , TXROT5 / J2, , 4, 6.
- () 2 (TUBE2).
3. 2. ,
- TXROT5 / J1 / 4, 5.
4. , ,
- , .

—

J1 - () **HV** :

J1.1 - +

J1.2 - +

J1.3 -
J1 ,

J2 - () **HV** :
J2.1 - -
J2.2 - -
J2.3 -

J2 ,

J3 - :
J3.1 - +
J3.2 - -
J3.3 - +
J3.4 - -
J3.5 -

J5 - :
J5.1 - (LF)
J5.2 - (LF)
J5.3 - (SF)
J5.4 - (SF)

J6 -
J6. 1 - ()
J6. 2 - (,)
J6. 3 - (,)

GND - HV

TUBE1 (1)
TUBE1 (1)
TUBE2 (2)
TUBE2 (2)

HV .

.

,

,

.

:

1. PL1 PL2.

.

.

,

.

2. PL1 PL1 PL2.
PL2 .
.

3. " " ()
.
TP1 TP2 TXCON7
TXCON7. 500 V/ IV/DIV.
(10 - 40ms) 40, 60 80
100 ,
(TP1 , TP2).
() 5 %.

J3 HV .
J3:

1	1-5	75±2.5
2	2-5	75±2.5
3	3-5	2±0.2
4	4-5	2±0.2

1 2 3 4 (HV),

TXFIL5 :

1. TXGPS5 / J10 TXHVT2 / J6

2. J10 TXGPS5.
1 2 20 60 .

3.

3.

J10 TXGPS5

2
- (
-).

220 240V AC
- 1

2

1
- ,

,
- ,

,
- ,

,
4.

2

3
- ,

,
- ,

,
- ,

,
5.

HV,
- ,

,
- ,

,
- ,

,

(TXHVT3)

TXHVT3,

(TR1 HIGH VOLTAGE
TRANSFORMER)? (TXHVP10,
TXHVN10), (TUBE1 ANODE / PL3 TUBE1
CATHODE / PL4), (TR2 TR3), (TXDIV16)
(TXHF1)

HV
PL1 PL2. (L1 .)
TXHVP10 TXHVN10,
(+ , -) (+ OUTPUT, - OUTPUT)
HV

TXHVP10 TXHVN10 (+ FEEDB, GND; -
FEEDB, GND) (+ FEEDB, GND; -
TXDIV16. J1 () J2 ()
TXDIV16.
J3 TXDIV16, TXCON7.

J6 /1,2 TXDIV16.
J6 /2,3 TXDIV16.

TXHVF1. J1
HV

HV

PL1, PL2

PL1 -
PL2 -

TXDIV16 / J1 -

J1.1 - +
J1.2 - +
J1.3 -
J1 ,

() HV :

TXDIV16 / J2 -

J2.1 - -

() HV :

J2.2 - -
J2.3 -

J2 ,

TXDIV16 / J3 - :

J3.1 - +
J3.2 - -
J3.3 - +
J3.4 - -
J3.5 -

TXHVF1 / J5 - :

J5.1 - (LF)
J5.2 - (LF)
J5.3 - (SF)
J5.4 - (SF)

TXDIV16 / J6 –

J6. 1 -
J6. 2 -
J6. 3 –

GND - HV

TUBE1 (1)
TUBE1 (1)

HV

1. PL1 PL2.

2. PL1 PL2.
PL1 PL2

3. " " ()

TP1 TP2 TXCON7

TXCON7. (10 - 40ms) 500 V/ IV/DIV. 40, 60 80

100 , (TP1 , TP2).

() 5 %.

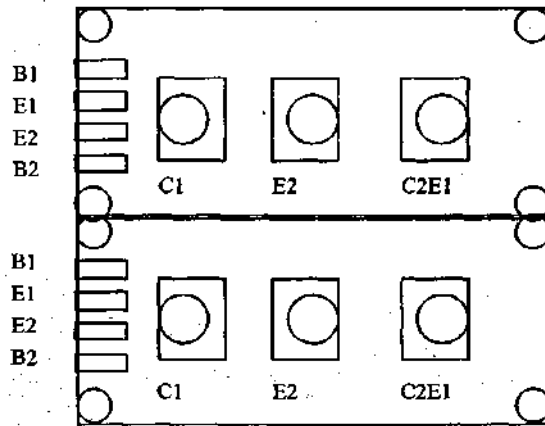
J3: J3 HV .

1	1-5	75±2.5
2	2-5	75±2.5
3	3-5	2±0.2
4	4-5	2±0.2

1 2 3 4 (HV), ,

TXFIL5 :

-
IGBT TXIGB3
IGBT
TXIGB3
IGBT.
IGBT TXIGB3 TXGPS4".
IGBT TXIGB3
:" IGBT TXIGB3 "
:
1. : " BEAM FAULT"
() : -
- TXCON5 D52 (CURR. LIM / SYMMETRY)
/ D65 () D88 (ERROR),
- TXCON6/ 7 D22 (IGBT OVERCURRENT)
D31 (INVERTER OVERCURRENT) D29 (OVERCURRENT)
D35 (BEAM FAULT).
2. 0 .
1. IGBT.
10 , IGBT.
IGBT IGBT ,
TXIGB3. IGBT
2. IGBT.
, - 2 1 - 2,
2 1 - 1 IGBT (. 1).
()
2 1,
0.28 - 0.35 , IGBT 1,
, IGBT .
, IGBT
TXIGB3.



.1

3.

IGBT.

1 - 1 2 - 2.

1- 1 2- 2.

(),

IGBT

TXIGB3.

IGBT)

IGBT.

4.

IGBT (

TXIGB3).

()

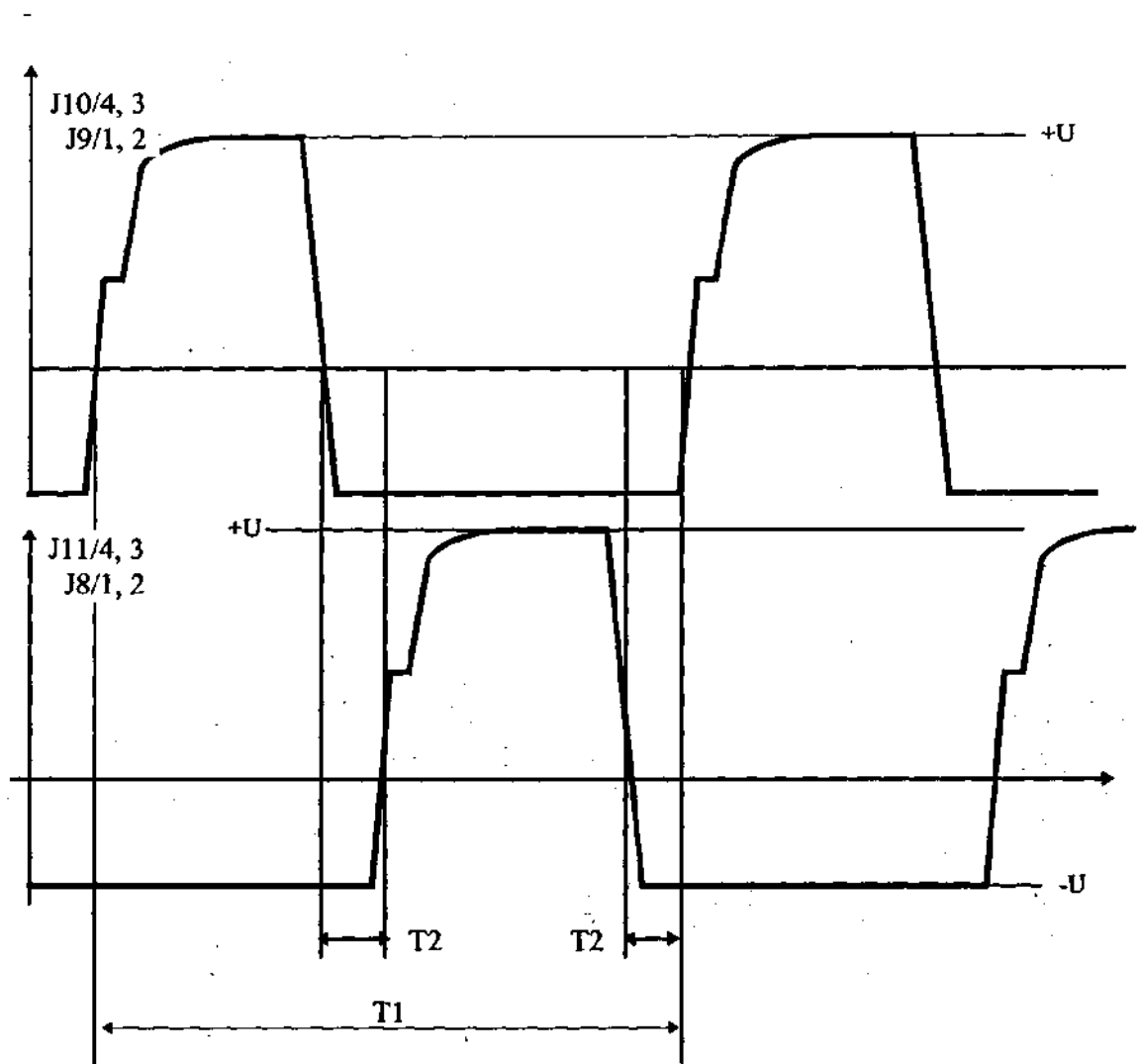
JP10 (CON 5/6/7)

JP10

. (,

1 ,)

(J10/ 4,3 J8/1,2 J11 / 4,3 J9/ 1,2.
3, 2, 3, 2



.2.

4.1. IGBT (TXIGB3)
(INSTALL
J10/4,3 J8/1,2 J11/4,3 J9/1,2).
- 4,5 ±1 .

4.2. IGBT (TXIGB3) ..
INSTALL : , 40 , 40-10
(,
) .
3-5 .
10 .
(BEAM FAULT)

.2.

.2. : -U = -4,5 ±1 , +U = +15 +1,5-2 ,
2 = 3,8 - 4,2 , 1 = 47 - 53 .

-

c JP10 XCON.

IGBT

TXIGB3

/

TXIGB3

:"

IGBT

TXIGB3 "

TXIGB3,

1. IGBT

IGBT.

IGBT

TXIGB3,
!

IGBT.

!

2. IGBT.

IGBT

IGBT

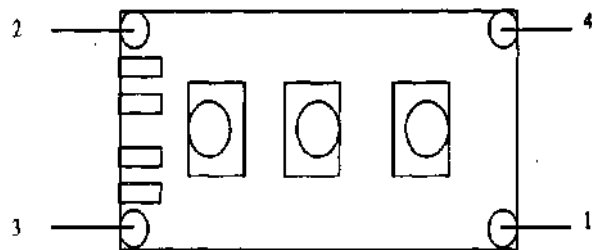
(1.0-

1.2

3)

IGBT

IGBT



3.

1 ,
3 ,

1 - 2 - 3 - 4
4 - 3 - 2 - 1 .

3.

IGBT

«MITSUBISHI» 3 ,

«FUJI» 4 .

-

- IGBT IGBT , IGBT.
- IGBT
3. IGBT.
- IGBT,
- 2 1 - 2, 2 1 - 1 IGBT (
- .1.) . (
- 2 1, 1,
- 0.28 - 0.35 , IGBT .
4. IGBT.
- 1 - 1 2 -
2. (1.)
- 1 - 1 2- 2.
- !
5. IGBT (TXIGB3).
- ()
- JP10 (CON 5/6/7)
- JP10 . (,
- 1 ,).
- (,)
- J10 / 4,3; J8 / 1,2; J11 / 4,3; J9/ 1,2.
- 3, 2, 3, 2 .
- 5.1. IGBT (TXIGB3)
- . (INSTALL
- 1,2; J11/ 4,3; J9/1,2, J10 / 4,3; J8 /
- 4,5 ±1 .
- 5.2. IGBT (TXIGB3)
- INSTALL :
- , 40 , 40-10 ., (,
-).
- 3-5 .
- 10 .
- (BEAM FAULT)
- 2.
- . 2 : - U= - 4,5 +1 , + U=+15 +1,5-2 , 2 = 3,8 - 4,2 ,
- 1 = 47 - 53 .
- JP10 TXCON.