

JST-F SERIES

EB SOURCE POWER SUPPLIES

For the proper use of the instrument, be sure to read this instruction manual. Even after you read it, please keep the manual on hand so that you can consult it whenever necessary.

NOTICE

- This instrument generates, uses, and can radiate the energy of radio frequency and, if not installed and used in accordance with the instruction manual, may cause harmful interference to the environment, especially radio communications.
- The following actions must be avoided without prior written permission from JEOL Ltd. or its subsidiary company responsible for the subject (hereinafter referred to as "JEOL"): modifying the instrument; attaching products other than those supplied by JEOL; repairing the instrument, components and parts that have failed, such as replacing pipes in the cooling water system, without consulting your JEOL service office; and adjusting the specified parts that only field service technicians employed or authorized by JEOL are allowed to adjust, such as bolts or regulators which need to be tightened with appropriate torque. Doing any of the above might result in instrument failure and/or a serious accident. If any such modification, attachment, replacement or adjustment is made, all the stipulated warranties and preventative maintenances and/or services contracted by JEOL or its affiliated company or authorized representative will be void.
- The term of warranty on the instrument shall be 12 months after acceptance inspection at delivery to you on the premise that the product should be used in the normal operating conditions specified in this instruction manual. If the product is repaired within the term of warranty, the time required for repair shall not be added to the term of warranty.
- We shall perform troubleshooting on the instrument according to the condition, contents, and other information of the trouble. When a failure occurs within the term of warranty and the product has been used in the specified operating conditions, we shall repair the product free of charge if we recognize that the cause of the failure is attributable to our responsibility. In the other cases, the product shall be repaired with charge.
- When we judges that a failure of the instrument should be repaired on our responsibility, we shall replace the product with an alternative one or repair it free of charge. We shall hold the right of choice in this case. Even if a failure occurs within the term of warranty, the product shall be repaired with charge in the following cases.
 1. The cause of a failure is attributable to improper handling or storage on your side or the software or hardware installed on your side.
 2. A failure is caused by modifying our product on your side.
 3. A failure is caused in the product which has been partly modified according to the specifications submitted by you that are different from our specifications.
 4. Wear is caused by your operating conditions.
 5. Proper maintenance is omitted.
 6. The product has been destructed or failed by natural disasters (earthquake, lightning, fire, storm and flood, etc.).
 7. We admit that the cause is not attributable to our responsibility.
- Regardless of the term of warranty, the indemnity for damage or loss of devices or machines other than our product on your side that is attributable to a failure of our product shall be exempted from our warranty. A warranty for the liability for manufacturing and maintenance of the equipment that was delivered to you 10 years or more ago shall also be exempted from our warranty.
- Replacement parts for maintenance of the instrument functionality and performance are retained and available for seven years from the date of installation. Thereafter, some of those parts may be available for a certain period of time, and in this case, an extra service charge may be applied for servicing with those parts. Please contact your JEOL service office for details before the period of retention has passed.
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- The information described in this manual, and the specifications and contents of the software described in this manual are subject to change without prior notice due to the ongoing improvements made in the instrument.
- Every effort has been made to ensure that the contents of this instruction manual provide all necessary information on the basic operation of the instrument and are correct. However, if you find any missing information or errors on the

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MANUFACTURER

JEOL Ltd.
1-2, Musashino 3-chome, Akishima, Tokyo 196-8558 Japan
Telephone: 81-42-543-1111
Facsimile: 81-42-546-3353
URL: <http://www.jeol.co.jp>

Note: For servicing and inquiries, please contact your JEOL service office.

SERVICE PROVIDER

JEOL DATUM Ltd.
1156, Nakagami-cho, Akishima, Tokyo 196-0022 Japan
Telephone: 81-42-542-2327
Facsimile: 81-42-542-2156

SAFETY PRECAUTIONS

1. Before use

- Before using this product, read this manual carefully and understand the correct method of use.
- Fully understand safety precautions before operation. Also exercise utmost caution never to perform erroneous operation. In the worst case, personal injury or death can result.
- After going through this manual and the leaflets attached to component units, keep them at hand for immediate reference.

2. Cautions

The following are general precautions to be followed in using this product. Always comply with them. This product has been carefully checked for normal operation before shipment from the factory, but in the initial stage, abnormal actions can happen due to a fault, in aging or for other causes. To prevent possible accidents, the operator is requested to take multiple safety measures against accidents by considering possible malfunctions of this product and their aftereffects, and incorporate multiple safety features in the system or product.

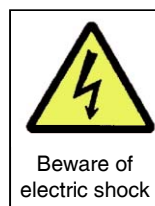
Safety notations are classified into “WARNING” and “CAUTION”.

⚠ WARNING : Failure to comply with WARNING can be very dangerous and can lead a serious accident, such as loss of life or serious personal injury.

⚠ CAUTION : Failure to comply with CAUTION can be dangerous and can damage the product or cause personal injury. It can also lead to a serious accident depending on the situation. Always comply with CAUTION.

Labels using the following graphic symbols are affixed to dangerous locations of the instrument. Follow these cautions.

Examples:





WARNINGS

■ Wiring arrangement

Always ground the grounding terminal of JEOL instruments to Class A ground (ground resistance less than 10Ω) at one point. Otherwise, electric shock or fire can result.

■ Operation

High voltage is present in this instrument. Never touch the internal components of the power supply nor touch an internal component with a tool when it is energized with power. Do not turn on power nor operate this instrument with the panel removed. You may get electric shock. Also keep your hand off a rotating part. You may get injured on contact with it.

■ Maintenance

High voltage is present in this instrument. Never touch the internal part of the power supply when it is energized with power. You may get electric shock. Before access to components in the power supply, turn off the main power to the instrument.



CAUTIONS

■ Receiving check

Upon receipt of an instrument or part, make sure that it is the correct one you ordered.

■ Installation location

Never use the instrument in a place where temperature and/or humidity is high, the instrument may be splashed with water, in an atmosphere of corrosive or combustible gas or in the vicinity of inflammable gas nor in a place where dust or metal particles are present. Failure of the instrument, electric shock, fire or explosion can result.

■ Wiring

Arrange all cables correctly and connect them securely.

■ Operation

- In the initial stage of test run, do not run the instrument under full load to avoid unforeseen accidents.

- If the instrument is used as a component of a system, provide an interlock and emergency stop switch to eliminate the risk of danger. Otherwise, you may get injured.
- If an alarm is given, eliminate its cause and reset the instrument after checking for safety before restarting operation. Otherwise, you may get injured.

■ Inspection and Maintenance

Do not change the wiring to this instrument and to the user's equipment energized with power. You may get electric shock or injured or the instrument may be damaged.

● Cautions in installing the instrument

■ Operate the instrument at an ambient temperature of 5°C to 40°C and an ambient humidity of 90% or less.

- Do not install the instrument in a place where conductive powder like dust particles or metal powder, oil mist, cutting fluid, water content, salt, organic solvent, etc. are present.
- Do not install the instrument in a place bathed with direct sunlight or radiation heat.
- Do not install the instrument in a place where high intensity electric field or high intensity magnetic field is generated or a place where the instrument may be subject to electromagnetic interference, electrostatic discharge or radio frequency interference.
- Do not install the instrument in a place where vibration or impact is transmitted to the instrument.
- Provide the following space around the instrument for ventilation, heat exhaust and maintenance.
1 m on the front, 1 m on the back, 1 m on the side, 0.3 m above the instrument
* Secure space for maintenance.
- The floor should be rigid enough to withstand the instrument weight and be free from vibration from outside.

● Cautions in incorporating the instrument into user's system

- When installing a part of this instrument in a system, make sure that the temperature in the instrument does not exceed 5°C to 40°C by cooling components in the system, and others.
- If there is a source of vibration near the instrument, install a shock absorber or other to hold the vibration transmitted to this instrument below the specified level of 0.5 G.

● Cautions in Wiring Arrangement

■ In wiring arrangement, see to it that the diameter of wiring, type of wiring and maximum wiring length do not exceed the specified values.

■ Take the following actions against noise.

- Install a noise filter as close to the controller as possible.
- Install surge absorbing circuits for relays, electromagnetic contactors, solenoids, and other coils.
- In making wiring arrangement, lay power lines (AC power line, motor line, etc.) and signal lines more than 30 cm away from each other. Do not pass them in the same duct nor bind them together.

Keep high voltage cables and other wiring more than 50 cm away from each other (except when accommodating them in a shielded wiring duct.) Do not accommodate them in the same duct or bind them together.

- If the instrument is operated on the same power as that for an electric welding machine, electric discharge machine or other or if there is a high-frequency noise generating source nearby, though the same power is not used, install noise filters in the power supply and input circuit, .
- When a load (electron beam gun for deposition) is connected to the instrument, arc discharge may be produced depending on the operating conditions on the load side and may generate high-frequency spike noise. This may cause malfunction of and damage to components of the user's system. Check the entire system for earth wiring and wiring arrangement to make the instrument immune from them. Also install a surge absorbing circuit and an insulation amplifier on parts that may be affected by such noise.

■ See to it that cables are free from bend or tension.

Beware of High-Voltage Parts!!

Since this power supply uses a high-voltage generating circuit, its handling requires great care.

Be sure to turn off the power supply nonfuse breaker (NFB) especially when exchanging electron gun filaments or making maintenance and checks of the power supply inner parts.

When making maintenance checks of the power supply inner parts, it is recommended that the three-phase 200 V switchboard also be turned off. Maintenance checks should be done by an operator skilled in handling high-voltage circuits.

When using two guns (option), never attempt to carry out filament exchange and maintenance checks of one electron gun during the operation of the other gun.

**SERIAL NUMBERS OF MAIN INSTRUMENTS, COMPONENTS
AND ATTACHMENTS**

Date:

- [1] EB Source Power Supply** (Ser. No.)
- | | | | |
|--------|----|---|----|
| JST- F | BS | . | PC |
|--------|----|---|----|
- [2] EB Source Power Supply Attachments**
- Arc Suppressor
- | | | | |
|---------|----|---|----|
| ST-AS10 | BS | . | PC |
|---------|----|---|----|
- For electron gun selective operation
- | | | | |
|-------|----|---|----|
| ST-20 | BS | . | PC |
|-------|----|---|----|
- For electron gun simultaneouse operation
- | | | | |
|-------|----|---|----|
| ST-20 | BS | . | PC |
|-------|----|---|----|
- [3] Electeron Gun**
- | | | |
|-------|--|----|
| JEBG- | | PC |
| JEBG- | | PC |
| EBG- | | PC |

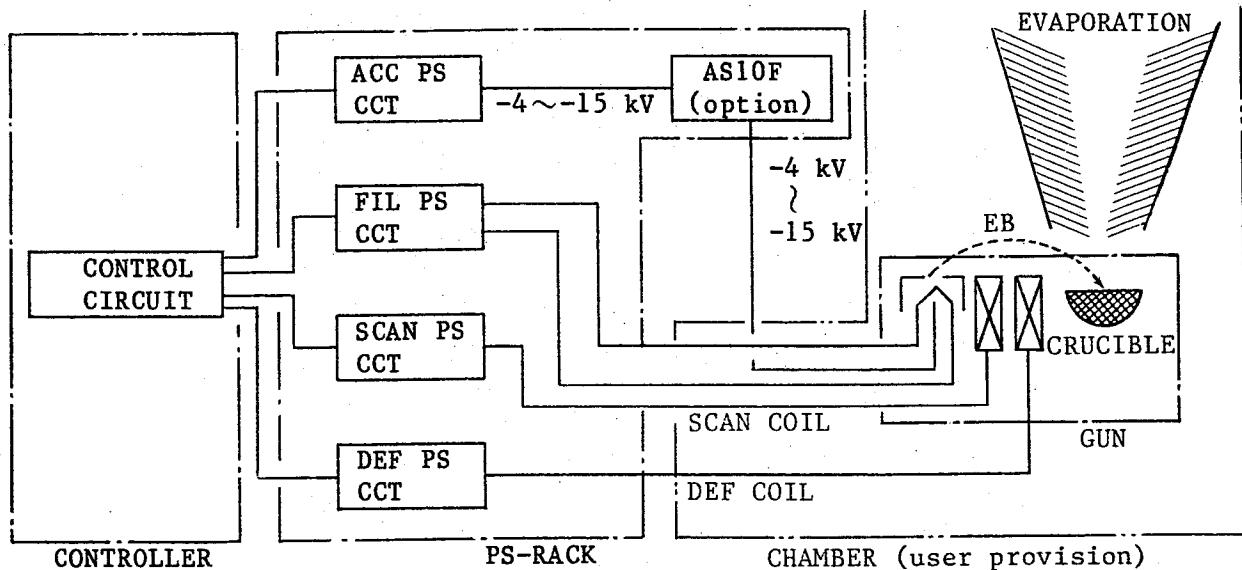
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[1] GENERAL

The JST-F Series EB Source Power Supply is used to operate electron guns (JEBG-102U, -203U, -163M, -303U, etc.) for electron beam (EB) evaporation. It is composed basically of an accelerating voltage power, filament heating, scanning coil and deflection coil power supply circuits, and their control circuits.



The following abbreviations are used in the above diagram and will be used herein after:

JST-F: JST-F Series EB Source Power Supply
GUN: Electron gun
PS-RACK: Power supply rack of JST-F
CONTROLLER: Control unit of JST-F
ACC PS CCT: Accelerating voltage power supply
FIL PS CCT: Filament heating power supply
SCAN PS CCT: Scanning coil power supply
SCAN COIL: Scanning coil
DEF PS CCT: Deflection coil power supply
DEF COIL: Deflection coil
EB: Electron beam
AS10F: ST-AS10F Arc Suppressor

1. Basic Circuit Operation

Thermionic electrons, the amount of GUN EMISSION is controlled by FIL, are accelerated at -4 kV to -15 kV ACC to form EB, and by using a deflection coil (electromagnet) or a permanent magnet, EB is deflected by 180° or 270° and made incident upon a evaporant placed in a crucible. This EB heats and evaporates the evaporant, allowing it to be deposited on a substrate as a film.

The EB position and EB diameter on the crucible that time can be controlled by the deflection and scanning control circuits. (When The JEBG-163M Electron Gun is used, however, EB diameter cannot be controlled.)

2. Features

- A)** The following models are available to meet various operating conditions of EB source such as the type of evaporant and the evaporation rate.
- JST- 3F: 6 kW (-8 kV, 0.8A)
 - JST-10F: 10kW (-10 kV, 1 A)
 - JST-16F: 16 kW (-10 kV, 1.6 A)
- B)** JST-F is an energy-saving type utilizing SCR control.
- C)** Installation of the Arc Suppressor (ST-AS10F, option) allows arc discharges to be suppressed in a short time. Also, the noise due to discharges can be reduced to about 1/2 to 1/10 (according to measurement results obtained with JEOL-made device).
- D)** There are provided 14 inputs and 9 outputs, and when options are added, there are 39 inputs and 18 outputs, to make the system better suited for automated operation.
- E)** Setting of external signals for SCAN control is possible with signal levels of 0 to +10V DC.
- F)** Setting of external signals for EMISSION control is possible with signal levels of 0 to -10 V DC, and COARSE/FINE changeover is possible to improve EMISSION control accuracy.
(When FINE is selected, it is possible to set from maximum EMISSION to low EMISSION at -10V.)
- G)** The setting unit for EMISSION. X/Y POSITION, X/Y SCAN is installed on CONTROLLER by means of a magnet catch. Removing it and installing with extension cable converts the unit into a remote controller.
Note: Control is possible while watching the crucible of GUN.
- H)** Many options are installable.
Addition of various options allows selective or simultaneous use of two GUNs, and external signal control.
- I)** It is not necessary to add an option or modify the circuitry according to GUN to be used; it is only necessary to install switches in CONTROLLER.
- J)** Trouble or abnormality on JST-F is detected and indicated by ALARM system.
- K)** GUN's filament burnout and shorting is detected and indicated.
- L)** Maximum setting of X/Y POSITION and X/Y SCAN can be carried out easily, eliminating the fear of erroneously applying EB from GUN directly to the crucible.
- M)** Provided with a detection circuit for the phase rotation abnormality of a 3-phase 200 V input.

3. Basic Cautions

A) Vacuum degree in CHAMBER

Operation of GUN requires a vacuum degree of 6.65×10^{-2} Pa (5×10^{-4} Torr) or better. But it is possible to operate GUN under a lower vacuum degree of 3×10^{-1} Pa (3×10^{-3} Torr) (lower limit), depending on the type of the evaporant or film depositing conditions. In this case, however, the evaporation rate is lowered and more vapor particles reach even shaded portions, due to the influence of the mean free path of evaporant molecules. Also, it is necessary to pay full attention to the frequency of discharges at GUN.

Since GUN uses O rings and molded coils, its ultimate vacuum degree is of the order of 10^{-4} Pa (10^{-6} Torr).

B) Cooling water for GUN

Be sure to let flow a larger-than-specified amount of cooling water to GUN. Keep the temperature of the water below 25 C. Pay full attention to the amount of water, as the lack of water may result in the breakdown of the vacuum device.

The cooling water pipe must be periodically cleaned, as fur may be produced in it depending on the quality of the water used, resulting in lowering the cooling efficiency.

Be sure to keep GUN cooling water flowing during the baking of the vacuum evaporation chamber (CHAMBER). Otherwise, the O rings and molded coils may be damaged.

C) Selection of evaporant

While increasing the purity of an evaporant is important, the amount of residual gas of the evaporant also poses a problem. A large amount of residual gas causes splashes, which induce discharges, make evaporation unstable and deteriorate the film quality.

D) Arc discharge

GUN is apt to cause arc discharges since high voltage (-4 kV to -15 kV) is applied to it. Reduction of discharges is essential for stable evaporation. For that purpose, use of a shield cover (a nonmagnetic material such as SUS) on high voltage (HV) parts is important, as well as the selection of an adequate vacuum degree and an evaporant.

It is necessary to keep the HV parts and ground potential parts more than 10 mm away from each other in vacuum. When the vacuum degree deteriorates, however, they need to be kept more away from each other.

E) Generation of noise

- o Use the shortest possible HV cable to the HV feedthrough terminal (HVT) of CHAMBER on which GUN is installed. Never attempt to wind the cable like a coil when the cable is too long; otherwise, discharge may be caused which exerts an adverse influence on other equipment.

Keep the HV cable more than 0.5 m away from other cables or parts. When keeping it at less than 0.5 m from them, place it in a metal flexible tubing or the like to isolate it from other cables.

- o When the power input line has no reserve capacity or when the input impedance is especially high, harmonics are readily generated in the 3-phase 200 V input line, leading to JST-F uncontrollability and equipment damage.
- o It is necessary to connect separate 3-phase 200 V input lines to the JST-F and other equipment. When the same input line has to be used commonly, attach a line filter on the input of other equipment.
- o When a computer (CPU), etc. is used, be sure to use a noise cut transformer for the CPU power supply, which has large surge resistance.

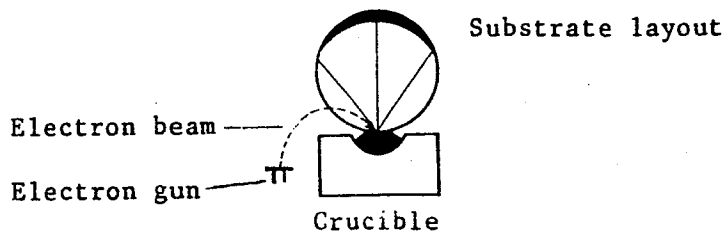
F) Distances between CONTROLLER, PS-RACK and GUN

CONTROLLER and PS-RACK: 5 m
PS-RACK and GUN: 5 m

The standard distances are as shown above. It is especially necessary to provide the shortest possible HV cable and emission return cable between PS-RACK and GUN.

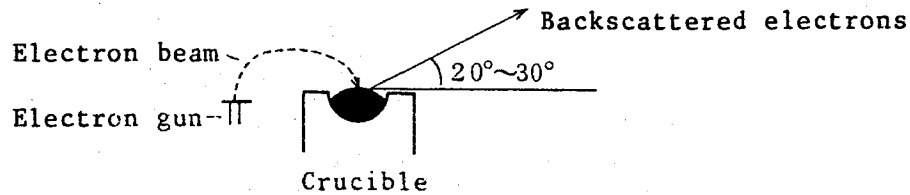
G) GUN position in CHAMBER

- o A GUN shutter should be positioned more than 70 mm above the crucible surface.
- o Since EB is deflected by a magnetic field, no magnetic material should be placed within 100 mm of GUN.
- o To obtain uniform deposit distribution on a substrate, The substrate should be placed as shown in the figure below:



Ideally, deposit distribution should be a $\cos \theta^4$ curve, but it changes into a $\cos \theta^{5 \sim 10}$ curve as the evaporation rate increases. For uniform distribution, the distance between the crucible and substrate should be made as long as possible.

- o Backscattered electrons are emitted in the area opposite to the filament with some evaporants, as shown in the figure below. Do not place anything in this area.



Evaporants from which backscattered electrons are easily generated.
(Au, Pt, etc.)

H) Evaporation of magnetic material

The EB position is deviated by the magnetic field in the direction opposite to the filament. When the temperature rises due to EB irradiation, however, the influence is reduced as the temperature approaches Curie point of the magnetic material, thus bringing the EB position to the filament side. Note that when a crucible 60 mm or more in diameter is filled with magnetic material to the brim, X-POSITION control may become impossible.

I) Distance between two GUNs (option)

Since two GUNs are influenced by each other's magnetic field, it is necessary to install them 100 mm or more apart in the opposite GUN directions.

[2] SPECIFICATIONS

1. Input Power Supply for JST-F Series EB Source Power Supply (JST-F)

- A) **Input power:** 3-phase 200 V ($\pm 10\%$), 10 kVA for JST-3F or
15 kVA for JST-10F or
25 kVA for JST-16F

B) **Frequency:** 50/60 Hz

C) **Waveform:** Sine wave

Note: No harmonic component should be contained.

D) **Grounding:** 10 ohms or less

Note: An input power supply, input cable and grounding cable should be provided by the user.

2. Outputs

A) Accelerating voltage (ACC)

Power supply: 1 set

ACC output: 4 kV to 8 kV (continuously variable) for JST-3F or
4 kV to 10 kV (continuously variable) for JST10F and JST-16F

Note: Ripple component is 5% or less at maximum output

B) Emission current

(EMISSION/EMSN): 0 to 0.8 A (continuously variable) for JST-3F or
0 to 1.0 A (continuously variable) for JST-10F or
0 to 1.6 A (continuously variable) for JST-16F

C) **Maximum output:** 3 kW (at 6 kV ACC) for JST-3F or
10 kW (at 10 kV ACC) for JST-10F or
16 kW (at 10 kV ACC) for JST-16F

D) Deflection coil exciting power (DEF)

Power supply: 1 set

Max. output current for
deflection coil: 2A

E) Scanning coil exciting power (SCAN)

Power supply: 1 set

Max. output current

1) For X scanning coil (X SCAN COIL)

- For EB deflection: DC +2 A
- For EB scanning: AC 8 Ap-p (50 Hz triangular wave)

2) For Y scanning coil (Y SCAN COIL)

- For EB deflection: DC +2 A
- For EB scanning: AC 8 Ap-p (500 Hz triangular wave)

Note: Outputs for DEF COIL and SCAN COIL have been adjusted according to the type of GUN, the size of the crucible, etc. (Adjusted outputs are less than the above max. outputs.)

F) Quick auto return function

When JST-F is over loaded due to discharge, etc. ACC output is cut off for about 200ms and then return to the set ACC.

3. Composition

A) Power supply rack (PS-RACK)

- 1) Center unit (V-UNIT) 1
 - o V101 Center unit for JST-3F or
 - o V111 Center unit for JST-10F or
 - o V121 Center unit for JST-16F
- 2) P101 DC power supply unit (P-UNIT) 1
- 3) H101 ACC thyristor control unit (HS-UNIT) 1
- 4) G101 FIL power supply unit (G-UNIT/FILAMENT POWER G) 1
- 5) M101 SCAN/DEF power supply unit (M-UNIT) 1
- 6) Central A unit (A-UNIT/CENTRAL A)
 - o A101 Central unit (A101-UNIT) 1
 - o A102 Central board (A102-PCB) 1
 - o H101 ACC control unit (H-UNIT, PCB) 1
 - o F101 FIL control unit (H-UNIT, PCB) 1
 - o S101 SCAN control unit (S-UNIT, PCB)..... 1
 - o X101 DEF control unit (X-UNIT, PCB) 1

Note: Unnecessary when JEBG-203U/-303U Electron Gun used.
- 7) E101 Connection unit (E101-UNIT)1

B) Control unit (C-UNIT/CONTROLLER)

- 1) C101 Control unit (C101-UNIT) 1
- 2) C102 Control board (C102-PCB) 1

C) Cables

- 1) R101 Cable set 1 set
- 2) Extension cable for remote control (6 m) 1 pc

D) Spare parts

- 1) MF61-10A 10 A fuses 2 pcs
- 2) MF61-1A 1 A fuses 2 pcs
- 3) MF61-5A 5 A fuses 2 pcs
- 4) JX-2 Jumper pins 5 pcs

Note: The above unit numbers (e.g., V101) are subject to change due to modification, improvement, installation of option, etc.

4. Components

A) PS-RACK

1) Panel switches and indicators

o V-UNIT panel

- . POWER switch (NFB): Nonfuse breaker
Sets main power (3-phase 200 V) ON or OFF
- . PL1 (red) and
PL2 (white): Lights up when NFB is ON

o A-UNIT panel

- . POWER ON switch
w/indicator (green): Sets power (except fan circuit) ON and green
lights up
- . OFF switch
w/indicator
(red): Sets power (except fan circuit) OFF and red
lights up. (Red lights up at NFB ON.)
- . White-capped switch
(VS SW)*: Set to upward when the VS (HV vacuum relay,
option) is used
- . Red-capped switch
(0.8/0.55 SW)*: Selects type of filament
Upward.....0.8 mm dia. filament
Downward...0.55 mm dia. filament
- . Yellow-capped switch
(DCCT SW)*: Set to upward when DCCT (DC current transformer,
option) is used for EMISSION detection in
optional 2 GUN simultaneous operation spec.
- . Blue-capped switch
(FIL/EMI SW)*: Selects filament current/emission current feed-
back system
Upward.....FIL (filament current feedback)
Downward...EMI (emission current feedback)

Note: * marked switches are located in the panel recess of A-UNIT

2) Check circuits and indicators

When the following indicators go out, outputs of ACC and FIL power supplies are stopped.

- . FUSE(P) indicator
(green): Goes out when P-UNIT fuse burnout
- . FUSE(MG) indicator
(green): Goes out when M-UNIT fuses burnout and/or G-UNIT
NFB tripped
- . DOOR Indicator
(green): Goes out when V-UNIT panels and/or panel of
ST-AS10F (option) are not correctly installed
- . VS indicator (green): Operates only when VS (HV vacuum relay, option)
is used. Indicator goes out when VS is abnormal

B) CONTROLLER

1) Panel switches and indicators (including meters)

- o GUN 1/GUN 2 selection switch
(GUN 1/2 SW): Selects GUN 1 or GUN 2 operation (used only in 2 GUN selective operation spec.)
- o GUN 1 indicator (red): Lights up when GUN 1 is selected
- o GUN 2 indicator (red): Lights up when GUN 2 is selected
- o EXT/INT selection switch
(EXT/INT SW): Selects external or internal control
- o EXT indicator (green): Lights up when EXT is selected with EXT/INT SW
- o INT indicator (green): Lights up when INT is selected with EXT/INT SW
- o ACC ON switch w/indicator
(white): Sets ACC(accelerating voltage) ON and white lights up
- o FIL ON switch w/indicator
(white): Sets FIL (filament heating current) ON and white lights up
- o OFF switch w/indicator
(white): Sets ACC and FIL OFF and white lights up
- o RESET switch: Resets when ACC and/or EMSN ALARM are lit
- o MODE SELECT switch and ACC/DEF/XY SCAN meter
 - . ACC button w/indicator
(red): Selects ACC indication on the meter and red lights up

 Indication: On black scale, 0 to 15 kV
 - . DEF button w/indicator
(green): Selects meter indication of GUN DEF COIL parameter and green lights up
 (only for JEBG-102U/-163M GUN)

 Indication: On green scale
 0 to 10 corresponds 0 to 1 A DEF COIL current
 with 102U GUN or 0 to 2 A with 163M GUN
 - . XP button w/indicator
(orange): Selects meter indication of X position of EB and orange lights up

 Indication: On orange scale
 0 to ± 2 corresponds to 0 to ± 2 A SCAN COIL current

- . XS button w/indicator
(green): Selects meter indication of GUN X SCAN COIL parameter and green lights up
(only for JEBG-102U/-203U/-303U GUN)
- Indication: On green scale
0 to 10 corresponds to 0 to 8 Ap-p X SCAN COIL current
- . YP button w/indicator
(orange): Selects meter indication of Y position of EB and orange lights up
(only for JEBG-102U/p202U/303U GUN)
- Indication: On orange scale
0 to ± 2 corresponds to 0 to ± 2 A SCAN COIL current
- . YS button w/indicator
(green): Selects meter indication of Y SCAN COIL parameter and green lights up
(only for JEBG-102U/-202U/303U GUN)
- Indication: On green scale
0 to 10 corresponds to 0 to 8 Ap-p Y SCAN COIL current

Note 1: If none is selected, ACC is indicated.

Note 2: Full scal values of meter indication have been adjusted according to the type of GUN.

o RANGE selection switch and EMISSION meter

- . RANGE 1 button w/indicator
(red): Selects EMISSION meter range-1
- Indication: 0 to 120 mA
- . RANGE 2 button w/indicator
(red): Selects EMISSION meter range-2
- Indication 0 to 720 mA
- . RANGE 3 button w/indicator
(red): Selects EMISSION meter range-3
- Indication: 0 to 2,250 mA

Note 1: IF none is selected, the meter indication is in RANGE 3.

Note 2: Filament heating parameter is indicated on the EMISSION meter when the FIL ON switch is pressed with ACC OFF.
300 mA indication corresponds to about 30 A FIL (filament heating current)

o White-capped switch
(SW-EXT SW)*:

Upward setting allows external switch control (ACC and FIL ON/OFF) when EXT/INT SW is EXT

o Blue-capped switch
(EMI-EXT)*: Upward setting allows external EMISSION control
when EXT/INT SW is EXT

o Red-capped switch
(SP-EXT)*: Upward setting allows external setting of X/Y
POSITION and X/Y SACAN references when EXT/INT
SW is EXT

Note: * marked switches are located in the panel recess of CONTROLLER
panel.

o Electron gun choice switch
(GUN CHOICE SW): Used when changeover from the currently used
gun to the different type gun.
JEBG-102U, JEBG-203U/-303U, or JEBG-163M is
selectable

2) Check circuits and indicators

o ALARM indicators

When the following item abnormalities are detected by the check
circuits, output of ACC and FIL power supplies are stopped and the
ALARM indicators are light up:

- . ACC indicator (red): Accelerating voltage
- . EMSN indicator (red): Emission current
- . FIL indicator (red): Filament
- . DEF indicator (red): DEF COIL current

o INTERLOCK indicators

Lit when the following items (indicated by the user's interlock
signals) are normal.

- . V indicator (green): Vacuum of the vacuum evaporation chamber
(CHAMBER)
- . W indicator (green): Cooling water condition for GUN
- . AUX indicator
(green): For interlock other than V and W
Selectable by the user

o PS indicator (green): Lit when PS-RACK indicators, FUSE(P), FUSE(MG)
and DOOR are all lit (when an optional VS is
used, VS is also lit)

3) Controls on CONTROLER

o ACC adjustor:

Sets ACC

o EMISSION dial:

10-turn potentiometer
Controls EMISSION (emission current)
Controls FIL (filament heating current) when
FIL ON and ACC OFF

- o X POSITION knob: Controls X position of EB
(with JEBG-102U/-203U/-303U/-163M)
- o X SCAN knob: Controls X scanning range of EB
(with JEBG-102U/-203U/-303U)
- o Y POSITION knob: Controls Y position of EB
(with JEBG-102U/-203U/-303U)
- o Y SCAN knob: Controls X scanning range of EB
(with JEBG-102U/-202U/-303U)

Note: The above controls except ACC adjustor are instaled on the setting unit and the unit can be removed for remote control.

5. INTERLOCK Signal Connection

In order to operate INTERLOCK on CONTROLLER, user provided interlock signals are required.

- A) INTLK cable (6 m):** Provided for interlock signal connection.
- . Brown wire: For V INTERLOCK (INTLK)
 - . Red wire: For W INTLK
 - . Yellow wire: For AUX INTLK
When AUX INTLK is unnecessary, between the yellow and black wires should be shorted for AUX INTLK lighting
 - . Black wire: For common line

B) Contacts (should be provided by the user)

- 1) Capacity: 24 V/2 A or more
- 2) Contact operation
 - o For V INTLK: Should be closed at a vacuum pressure of 5×10^{-4} Torr or less for V INTLK lighting
 - o For W INTLK: Sholud be closed at a cooling water pressure of 0.15 MPa or more and a water flow rate of 5 lit./min or more for W INTLK lighting
 - o For AUX INTLK: Should be closed at specified condition of user selected interlock item

6. External Control

A) External signals to CONTROLLER

Signals and contacts should be provided by the user.

1) Signals

- o For EMISSION control: 0 to -10 V
Max. EMISSION can be obtained at -10 V
(Input impedance: 100k ohms)

Note: When EMSN FINE (low EMISSION control) is externally selected, max. EMISSION output at -10 V can be adjusted lower than that in the standard EMISSION control mode, using variable resistor VR9 of CONTROLLER.

- o For X POSITION control: 0 to ± 10 V (Input impedance: 100k ohms)
- o For Y POSITION control: 0 to ± 10 V (ditto)
- o For X SCAN control: 0 to +10 V (ditto)
- o For Y SCAN control: 0 to +10 V (ditto)

Note: Maximum values of X/Y POSITION and X/Y SCAN control signals can be adjusted corresponding to the crucible to be used.
(Only when the crucible diameter is the standard or less.)

2) Contacts (a capacity of DC 24 V/2 A or more and no potential are required)

- o For POWER ON switch control:
M-C (momentary contact),
N-O (normally open)
Closed time should be 0.5 s or more
- o For OFF (POWER) switch control:
M-C, N-O
Closed time should be 0.5 s or more
- o For ACC ON switch control:
M-O, N-O
Closed time should be 0.5 s or more
- o For FIL ON switch control:
M-C, N-O
Closed time should be 0.5 s or more
- o For OFF (ACC and FIL) switch control:
M-C, N-C (normally closed)
Open time should be 0.5 s or more
- o For EMI-FINE selection:
A-C (alternative contact),
N-O (EMI-FINE is not selected)

Note: External EMISSION control can be set below max. EMISSION output at -10 V input signal, using VR9 of CONTROLLER.

- o EXTSIG selection: A-C, N-O (EXTSIG is not selected)
Used when triangular wave signals are input for EB scanning.

B) Output Signals from CONTROLLER

1) GUN ON connector with cable

- o GUN ON cable(6 m): Provided for external monitoring with the user's console
 - . White wire: ACC ON signal via N-0 contact (DC 24 V/1 A)
 - . Red wire: GUN ON signal via N-0 contact (DC 24/1 A)
 - . Black wire: Common line

2) EXT 1 connector

- o READY contact: N-0 for ACC ON and FIL ON operation
- o SW-EXT contact: N-0 for ACC ON, FIL ON and OFF external control by external signals
- o EMI-EXT contact: N-0 for EMISSION external control by external signals
- o ACC ON contact: N-0
- o FIL ON contact: N-0

3) EXT 2 connector

- o SP-EXT contact: N-0
- o SCAN EXT SIG contact: N-0 for X/Y SCAN external control by external triangular wave signal

4) X/Y MONITOR connectors: X and Y scanning waveforms can be monitored

- Max. output: AC: 0 to 4 Vp-p
DC: 0 to ± 1 V
(Output impedance: 1k ohms)

7. Connection

A) PS-RACK and CONTROLLER

- 1) E1 cable with connectors: 1 set, 6 m
- 2) E2 cable with connectors: 1 set, 6 m
- 3) GND (grounding) cable: 1 set, 6 m

B) PS-RACK and GUN

- 1) COIL cable with COIL connector: 1 set, 6.5 m
- 2) HV (high voltage) cable: 2 sets, 5.5 m
- 3) Emission return cable: 1 set, 5.5 m

Note: The HV cable and other cables should be at least 0.5 m away from each other. If it is unavoidable, the HV cable should be isolated from other cables by using a metal flexible tube, etc.

C) CONTROLLER and user's console

- 1) INTLK cable with connector: 1 set, 6 m
- 2) GUN ON cable with connector: 1 set, 6 m
- 3) EMSN connector w/dummy connector: For external EMISSION control
- 4) EXT I connector w/dummy connector: For external ACC and EMISSION controls
- 5) EXT 2 connector w/dummy connector: For external X/Y SCAN and X/Y POSITION controls
- 6) X/Y MONITOR connector: For X and Y scanning waveform monitoring

8. Special Functions

A) CONTROLLER on PS-RACK

CONTROLLER is installable on PS-RACK when a single GUN is used.

B) Remote controller for GUN parameter setting

The setting unit with EMISSION, X/Y POSITION, X/Y SCAN controls can be removed from CONTROLLER and used as a remote controller using an extension cable for remote control. (One 6 m extension cable is provided.)

C) Optional functions

Refer to details described in “[7] OPTION 1” and “[8] OPTION 2”

- 1) Arc discharge suppression (ST-AS10F)
- 2) 2-CUN selective operation spec. (ST-202, ST-204, ST-206 and ST-207)
- 3) 2-CUN simultaneous operation spec. (ST-203 and ST-205)
- 4) External control spec. (ST-EXTSIG)

9. Dimensions and Weight

- A) PS-RACK:** 570(W) x 760(D) x 1,545(H) mm,
350 kg (JST-3F) or
350 kg (JST-10F) or
450 kg (JST-16F)

- B) CONTROLLER:** 480(W) x 300(D) x 150(H) mm,
9 kg

[3] COMPOSITION, COMPONENT LAYOUTS, and FUNCTIONS of UNITS

1. Composition

A) Power supply rack (PS-RACK)

- 1) Center unit (V-UNIT) 1
 - o V101 Center unit for JST-3F or
 - o V111 Center unit for JST-10F or
 - o V121 Center unit for JST-16F
- 2) P101 DC power supply unit (P-UNIT) 1
- 3) HS101 ACC thyristor control unit (HS-UNIT) 1
- 4) G101 FIL thyristor control unit
(G-UNIT/FILAMENT POWER G) 1
- 5) M101 SCAN/DEF power supply unit (M-UNIT) 1
- 6) Central A unit (A-UNIT/CENTRAL A)
 - o A101 Central unit (A101-UNIT) 1
 - o A102 Central board (A102-PCB) 1
 - o H101 ACC control unit (H-UNIT, PCB) 1
 - o F101 FIL control unit (F-UNIT, PCB) 1
 - o S101 SCAN control unit (S-UNIT, PCB)..... 1
 - o X101 DEF control unit (X-UNIT, PCB) 1Note: Unnecessary when 203U/303U electron gun used.
- 7) E101 Connection unit (E101-UNIT)..... 1

B) Control unit (CONTROLLER or C-UNIT)

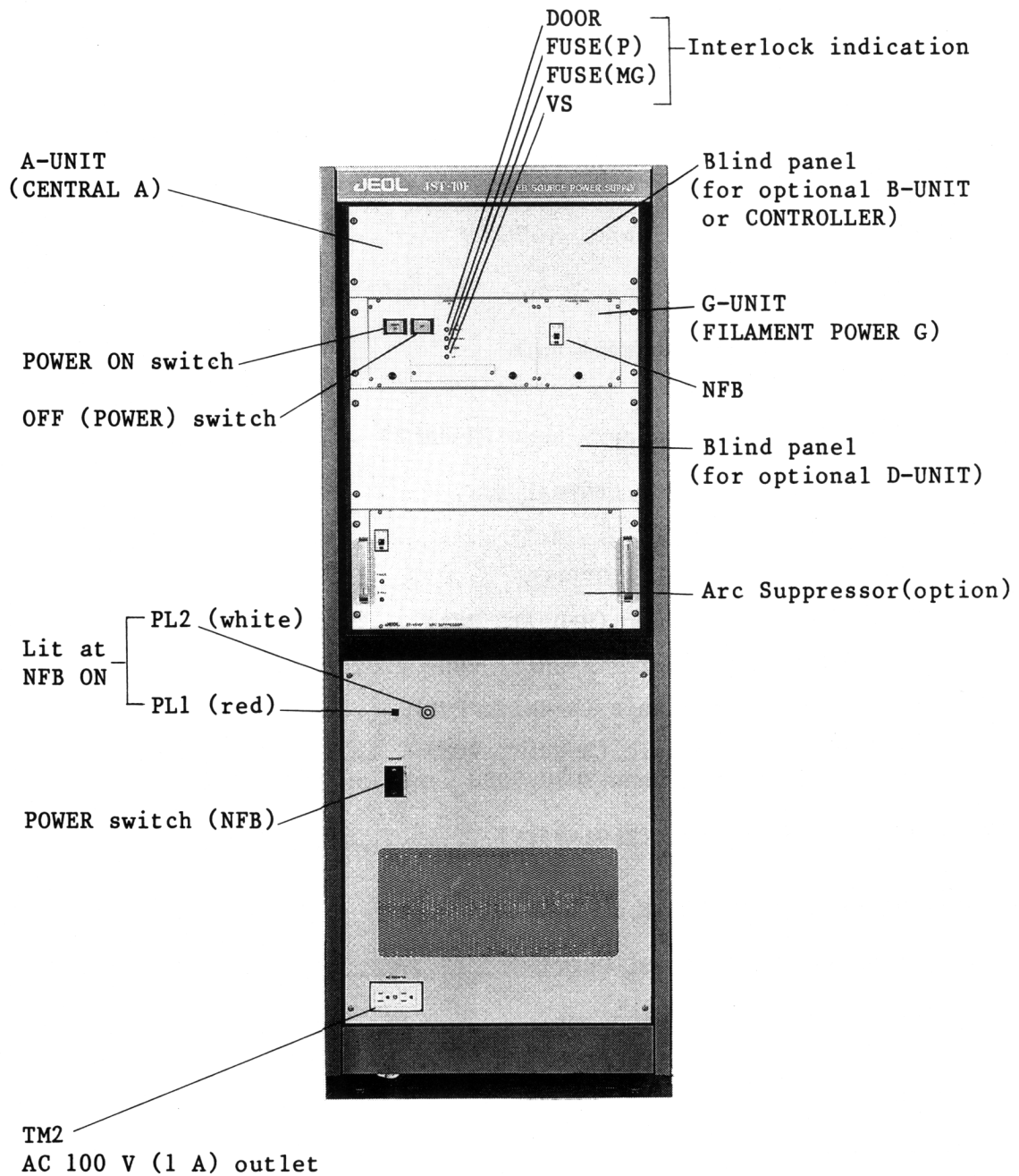
- 1) C101 Control unit (C101-UNIT) 1
- 2) C102 Control board (C102-PCB) 1

C) Cables

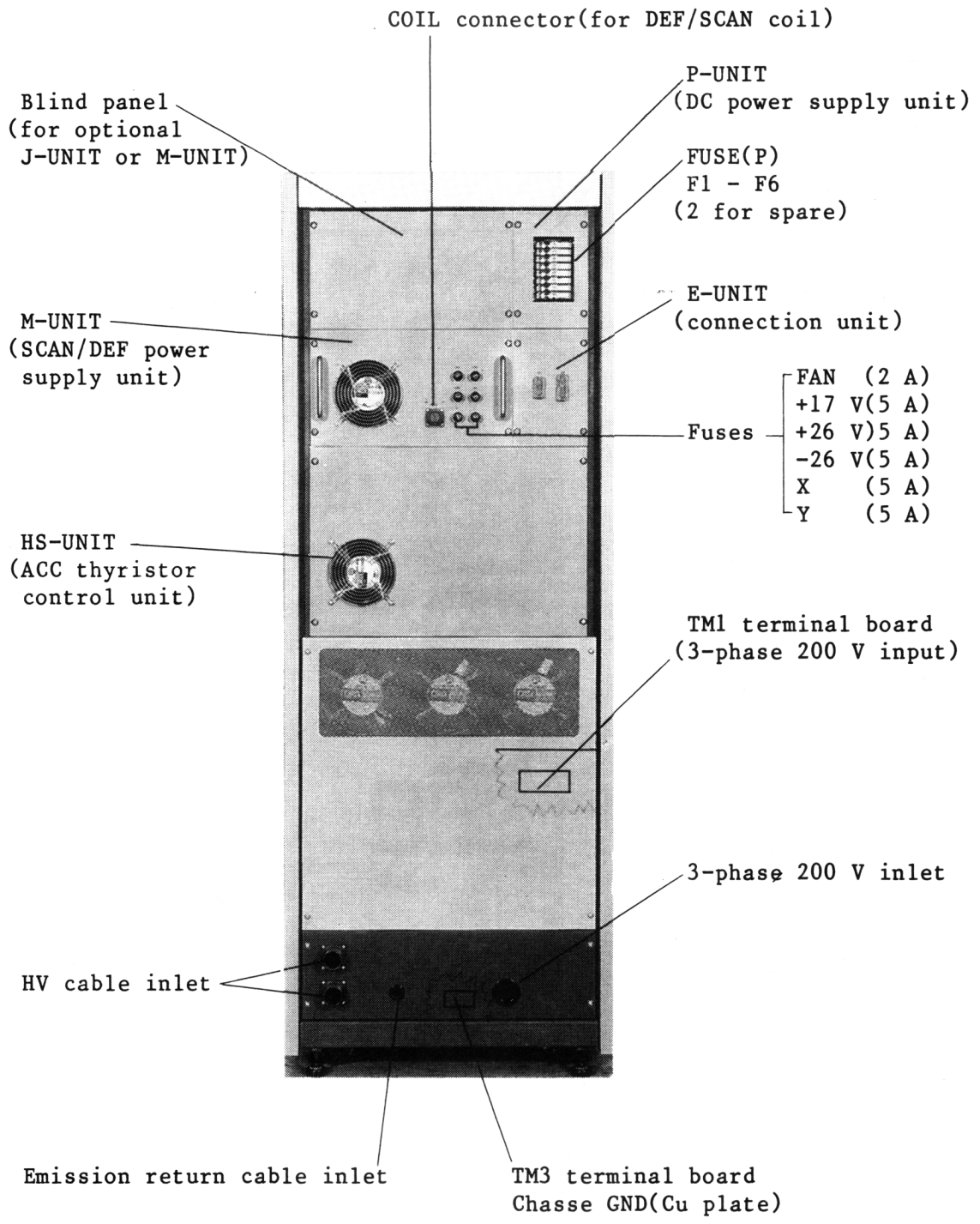
- 1) R101 Cable set 1 set
- 2) Extension cable (for remote control) 1

Note: The above unit numbers (e.g., V101, etc.) and the following component layouts (shown in Figs. 3-1, 3-2, 3-3, 3-4) are subject to change due to modification, improvement, option installation, etc.

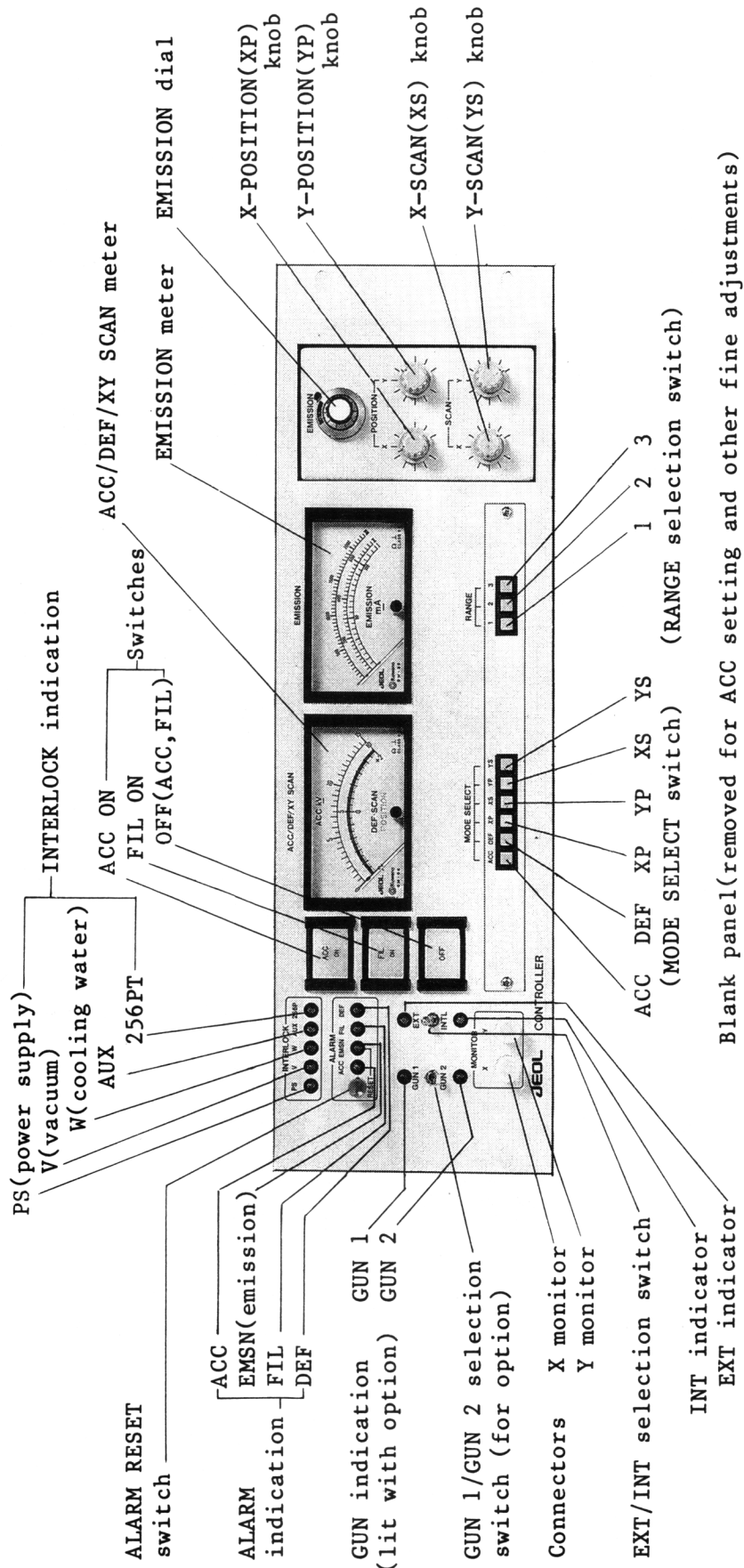
2. Component Layouts



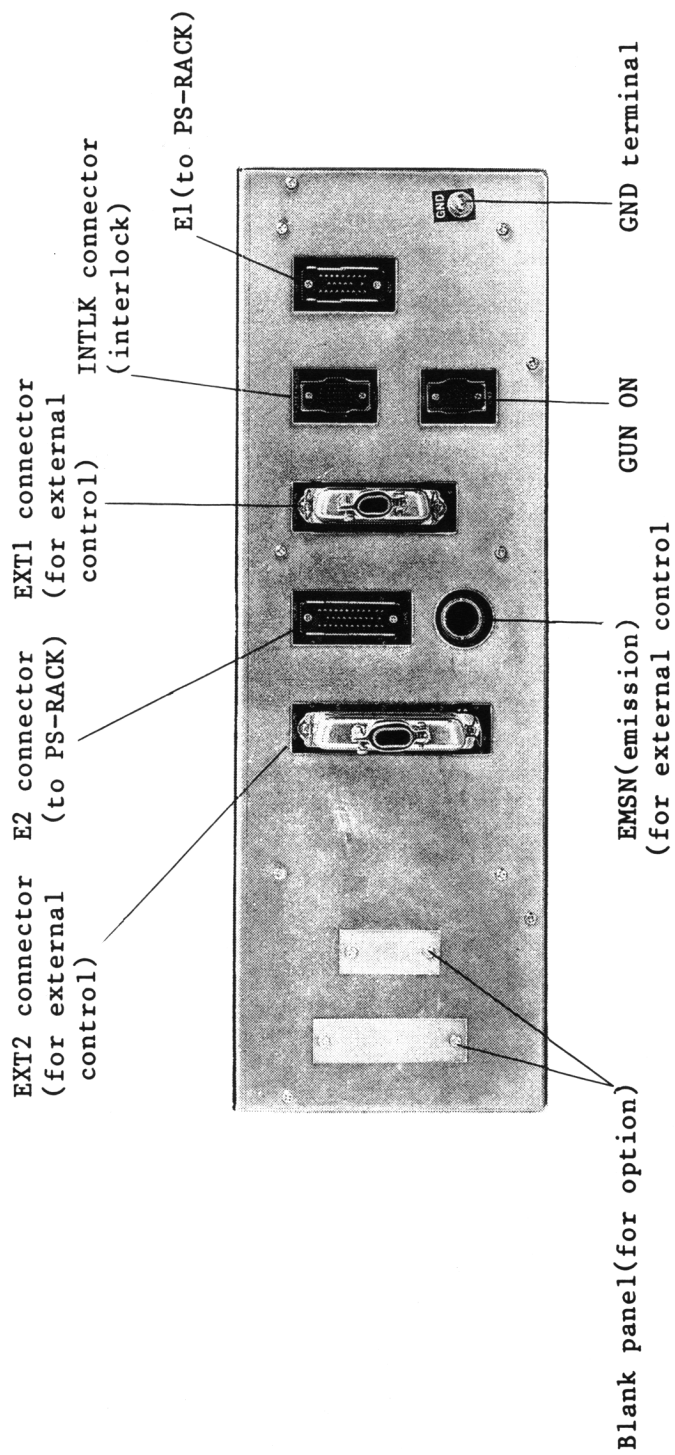
[Fig. 3-1] Front View of Power Supply Rack (PS-RACK)



[Fig. 3-2] Rear View of PS-RACK



[Fig. 3-3] Front View of Cnotrol Unit (CONTROLLER/C-UNIT)



[Fig. 3-4] Rear View of CONTROLLER

3. Functions of Units (standard circuits)

This section describes the operation of the standard circuits and their components. In case modification, etc. are required for using an option, refer to “[7] OPTION 1/[8] OPTIONS 2”. Since unit numbers may be changed by the use of an option, the HS101 ACC thyristor control unit will be described as HS-UNIT for instance.

A) Center unit (V-UNIT)

Structurally, this unit forms a power supply rack (PS-RACK) and incorporates all units other than the control unit (CONTROLLER).

Electrically, this unit is composed of a power supply (PS) section of a 3-phase 200 V line and a high-voltage (HV) section, and uses different parts depending on the output (6 kW, 10 kW or 16 kW).

The PS section, accommodated mainly in the middle rack of the PS-RACK, is composed of a nonfuse breaker, relays, current-limiting reactor, etc.

The HV section, accommodated in the lower rack of PS-RACK, is composed of a HV step-up transformer, rectifying and smoothing circuits, accelerating voltage (ACC) detection circuit, emission current (EMISSION) detection circuit and a filament transformer. This section is dangerous and therefore requires due care for its handling. Also, opening the front, rear, right or left panel of the HV section actuates the door switch to cut off the application of ACC and filament heating current (FIL).

1) Operation

Turning the POWER switch (nonfuse breaker) to ON supplies 3-phase 200 V to PS-RACK, which enters a relay contact via the current-limiting reactor (the relay operates at ACC ON). At the same time, 200 V is supplied also to P-UNIT, bringing each fan into operation.

The voltage supplied to HS-UNIT from the relay contact and controlled by a thyristor (SCR), is supplied to the primary side of the HV step-up transformer, thus generating a HV output in the secondary side. This voltage, after going through a rectifying circuit and a smoothing circuit, is supplied to the neutral point of the secondary side of the filament transformer. To the primary side of the filament transformer, the output (0 to 200 V) from G-UNIT is supplied to control FIL.

The detection of ACC is carried out by resistance division at a reduction rate of 1/1500. The circuit for EMISSION detection is designed so that voltage is +5 V at each maximum output.

2) Description of components

○ POWER switch (NFB)

This is a nonfuse breaker, with which the power needed for JST-F is supplied. When excessive current flows, this switch trips (the lever lowers to the halfway position) to open the circuit. When the switch has tripped, the switch can be set to ON by lowering the lever.

When the switch is set to ON, the fan goes into operation (if the fan does not operate, check the input power supply and the fuse FI (10A) of P-UNIT). Also, the OFF (POWER) switch on A-UNIT lights up.

o POWER indicator (PL1, red)

This indicator lights up when the input power is supplied to PS-RACK by setting the POWER switch (NFB) to ON. However, if the phase rotation of 3-phase 200 V is reversed, this indicator does not light up. In that case, replace connection of two wires out of three of 3-phase 200 kv.

o POWER lamp (PL2, white)

This lamp lights up when the input power is supplied to PS-RACK by setting NFB to ON.

o Fans (FN1 to FN5)

Used for cooling the HV section of V-UNIT. The two fans in the front are for sucking air and the three in the rear are for discharging air; namely air flows from the front to rear. On the sides are holes for air sucking, allowing air also flow from the sides to the rear.

There is a fuse (F1) for the fan in P-UNIT.

o Door switches (S1 to S4)

Installed on the four sides of PS RACK for the interlock of the front, rear, right and left panel installation on the HV section to cut off the application of ACC and FIL when the panels are poorly installed.

In addition, door switches for the ST-AS10F Arc Suppressor (option) are arranged in series. When the arc suppressor is not in use, attach a dummy connector (with pins 6 and 7 shorted) to the connector CN5.

o HV cable inlet ports

Two HV cables are connected to PS-RACK and HV feedthrough terminal (installed on the base plate of the vacuum evaporation chamber for the electron gun) via these ports. PS-RACK side is connected to the secondary side (5.5 V terminal) of the filament transformer, and the shield wire (green) is secured to the chassis ground (copper plate), using screws.

When wiring the HV cable to the filament transformer, the right side panel should be removed beforehand.

When two electron guns (GUNS) are used, an optional V-UNIT's panel with four inlet ports should be used.

o Emission return cable inlet port

The emission return cable from GUN is connected through this port. PS-RACK side is secured to the chassis ground (copper plate) with screws, and GUN side is secured to the ground point of GUN (vicinity of GUN) with screws.

o Input power inlet port

A 3-phase 200 V input cable is connected through this port to the R, S, T, and E terminals. When making this connection, take care not to wrongly wire the R, S, T and E. If the phase rotation of R, S and T is wrong, ACC control becomes impossible. (The power input cable varies with the outputs of JST-3F, -10F and -16F.)

o Nameplate

The nameplate put on the left side plate indicates the name and SER. No. of JST-F. Please let us know the SER. No. when you need our service. The rating plate put on the upper part of the input power inlet port shows the input power capacity required.

o Relay (RY1)

This relay operates at ACC ON to supply 3-phase 200 V to HS-UNIT. The capacity of this relay varies with the outputs of JST-3F, -10F, and -16F.

o Main transformer (T1)

An output transformer for generating high voltage. The capacity of this transformer varies with the outputs of JST-3F, -10F, and -16F.

o Current-limiting reactor (CH1)

Used for 3-phase 200 V line, this reactor is intended to protect the SCR of HS-UNIT and to alleviate the SCR noise.

o HV rectifying diodes (D1 to D3)

Used for HV output rectification.

o Smoothing choke coil (CH2)

Used for the smoothing circuit for HV rectified output.

o Smoothing capacitor (C2)

Used for the smoothing circuit for HV rectified output.

o Filament transformer (T2)

A transformer for the HV final output section. To the primary side is connected the cable with CN2 connector to be connected to G-UNIT. To the neutral point of the secondary side is connected to the HV output (-4 kV to -15 kV). The 5.5 V terminals are connected via the HV cables and HV feedthrough terminals to GUN.

o Connector (CN1, 2-pin)

Used to supply AC 200 V line (single-phase) to G-UNIT.

o Connector (CN3, 4-pin)

Used for current and voltage detection. Connected to A-UNIT.

Pin No. 1 for EMISSION meter indication

Pin No. 2 for ACC detection

Pin No. 3 for emission feedback detection

Pin No. 4 for grounding

o Connector (CN4, 2-pin, for option)

Used to supply AC 200 V line (single-phase) to G-UNIT (for GUN 2, option). Only used when an option is in use.

o Connector (CN5, 8-pin)

Used when the ST-AS10F Arc Suppressor (option) is installed.

Normally, a dummy connector (pins 6 and 7 shorted) is kept installed.

- o Connectors (CN10, 2-pin and CN11, 3-pin)
Used for connecting HS-UNIT. (CN10 for fan power supply and CN11 for synchronizing signals.)
- o Connectors (CN12, CN13)
Used for connecting indicators PL1 and PL2.

B) DC power supply unit (P-UNIT)

Structurally, this unit is incorporated into the upper right of the rear of PS-RACK. Consisting of a step-down transformer, relays, rectifiers, resistors, and capacitors, this unit supplies low voltage power to each unit.

1) Operation

AC 200 V is supplied from V-UNIT through the fuse F1 (10 A) to the primary side of the step-down transformer and also to the fans of V-UNIT.

AC 200 V is also supplied from CN2, CN3, and CN4 2-pin metal connectors to M-UNIT, D-UNIT (option) and M-UNIT (option).

The AC 12 V output from the step-down transformer is used for POWER ON/OFF (+24 V and ± 15 V), and the relays RY1, RY2 and RY3 are operated with the POWER ON/OFF switch of A-UNIT, or by switching external ON/OFF signals.

Also, the temperature detection circuit of the main transformer of V-UNIT is wired to RY1, forcibly turning off the POWER switch when the transformer temperature becomes abnormal.

The AC 19 V output is used to generate and supply +24 V that is used by each unit. It is supplied via the connector CN1 to A-UNIT and switched ON/OFF by the relay RY3.

Two AC 14 V outputs are supplied to A-UNIT via ± 15 V (constant voltage) used by each unit, and switched ON/OFF by relay RY3.

Relays RY5 and RY6, provided in the AC 14 V line, are used for checking fuses for burnout. If one of the two AC 14 V outputs becomes faulty, both outputs of ± 15 V are stopped.

An auxiliary relay (RY4) is installed to actuate ACC ON relay in V-UNIT. It is operated by a signal from A-UNIT.

Among the relays used in this unit (RY1 to RY6), only RY4 is used with DC 24 V and the others are used with AC 12 V. This must be kept in mind when replacing parts.

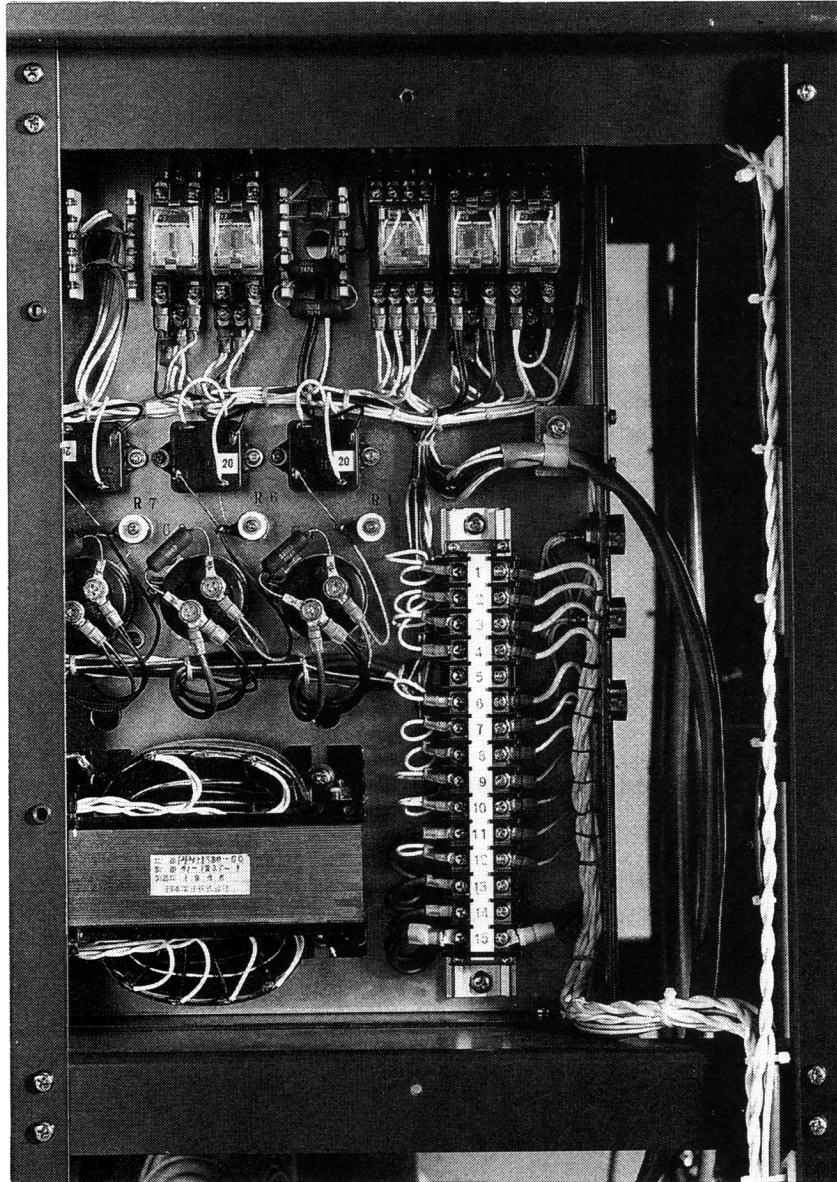
The interlock indication of FUSE(P) of A-UNIT is given when it is ascertained by relays RY5 and RY6 that F5 and F6 of this unit are in normal state.

The door switches of V-UNIT are also checked by DOOR interlock indicator on A-UNIT via this unit.

The power for the AC 100 V service outlet on V-UNIT is also supplied from this unit.

2) Description of components (see Fig. 3-5)

- o F1 fuse (10 A)
For AC 200 V line primary side. In case it burns out, all circuits including that for the fan of V-UNIT stop operation.
- o F2 fuse (1 A)
For AC 100 V line. In case it burns out, the power cannot be switched ON.
- o F3 fuse (1 A)
For AC 100 V outlet.
- o F4 fuse (5 A)
For +24 V line used for sequence and indication related circuits.
- o F5 fuse (5 A)
For AC 14 V line feeds +15 V line (constant voltage) related circuits.
- o F6 fuse (5 A)
For AC 14 V line feeds -15 V line (constant voltage) related circuits.
- o Relay (RY1, AC 12 V)
For POWER OFF.
- o Relays (RY2 and RY3, AC 12 V)
For POWER ON.
- o Relay (RY4, DC 24 V)
For ACC ON.
- o Relay (RY5, AC 12 V)
For checking F5 burnout.
- o Relay (RY6, AC 12 V)
For checking F6 burnout.
- o Connector (CN1, 20-pin)
For connection to A-UNIT.



[Fig. 3-5] DC Power Supply Unit (P-UNIT)

C) ACC thyristor (SCR) control unit (HS-UNIT)

Structurally, this unit is installed in the left part of the rear middle rack. Electrically, this unit receives gate signals from H-UNIT and supplies them to the gates of SCRs via the pulse transformer, and controls the 3-phase 200 V line for stabilization of the ACC output. (It controls the voltage on the primary side of the main transformer of V-UNIT.)

1) Operation

Gate signals from H-UNIT are supplied via connector CN1 to the base of transistor TR1 to TR6 and enter the primary sides of pulse transformers T1 to T6. The secondary sides of T1 to T6 are connected to the gates of SCRs D20, D21, and D22 to control SCR phase for ACC control.

2) Description of components

o Printed circuit board (PB1)

Incorporating transistors TR1 to TR6, pulse transformers T1 to T6, and a +15 V stabilized power supply. PB1 supplies gate signals from H-UNIT to SCRs.

o Thyristors (SCRs, D20 to D22)

These SCR, used for ACC control, carries out phase control upon receiving a signal from PB1.

o Surge absorber (D23 to D25)

Used for protection of SCRs.

o Transformer (T7)

Outputs AC 13 V used for stabilizing +15 V.

o Transformer (T8)

Used for synchronizing signal that is the basis of SCR phase control. The secondary side outputs 3-phase 10 V which is supplied to H-UNIT.

o Fan (FN1)

Used for cooling SCRs. (Power is supplied via fuse F1 of P-UNIT.)

o Connector (CN1, 12-pin)

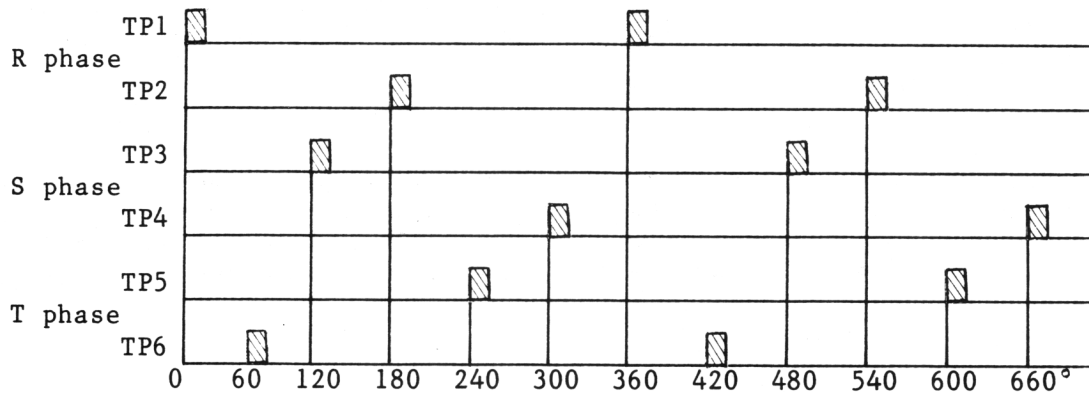
Connected to A-UNIT. (Finally, signal is supplied to H-UNIT)

o Connectors (CN2, 2-pin ; CN3, 3-pin)

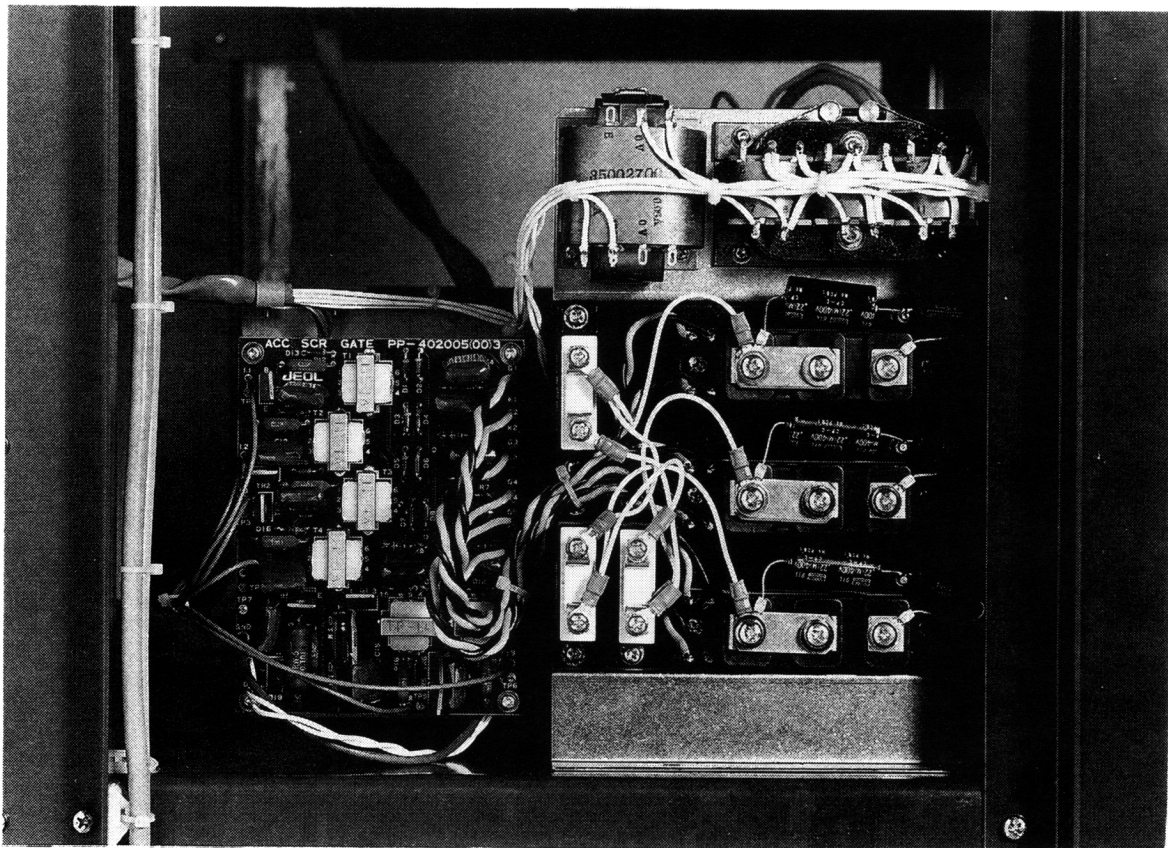
Connected to V-UNIT.

2) Discription of components (cont'd)

o TP1 to TP6 signals (gate pulse signals)



[Fig. 3-6]



[Fig. 3-7] ACC Thyristor Control Unit (HS-UNIT)

D) FIL thyristor control unit (G-UNIT/FILAMENT POWER G)

This unit is incorporated into the unit chassis rack in the front upper part of PS-RACK.

Electrically, the unit carries out phase control of SCR with gate signals from F-UNIT to control FIL (filament heating current) for emission current control.

1) Operation

Gate signals from F-UNIT are supplied via connector CN3 to the base of transistors TR3 and TR4, and enter the primary sides of pulse transformers T3 and T4. The secondary sides of T3 and T4 are connected to the gate of SCR D1 to carry out phase control of SCR for FIL control.

2) Description of components

o Printed circuit board (PB1)

Incorporating transistors TR3 and TR4, pulse transformers T3 and T4, and +15 V stabilized power supply, PB1 supplies gate signals from F-UNIT to SCR.

o SCR (D1)

Used for FIL control. Carries out phase control by signals from PB1.

o NFB (nonfuse breaker, NF1)

Used to protect the single-phase 200 V line. When excessive current flows, it trips to stop the 200 V line.

o Relay (RY1)

Operates by FIL ON signal and supplies single-phase 200 V.

o Relay (RY2)

Changes over the taps on the filament transformer of V-UNIT.

When the red-capped switch (for filament diameter selection) on A-UNIT is set to 0.8 mm diameter, the relay is connected to the 200 V tap on the filament transformer. When the switch is set to 0.55 mm diameter, the relay is connected to the 170 V tap.

o Transformer (T1)

Outputs AC 13 V for +15 V stabilized power supply.

Outputs AC 10 V for synchronizing signal of SCR, as the basis of SCR phase control.

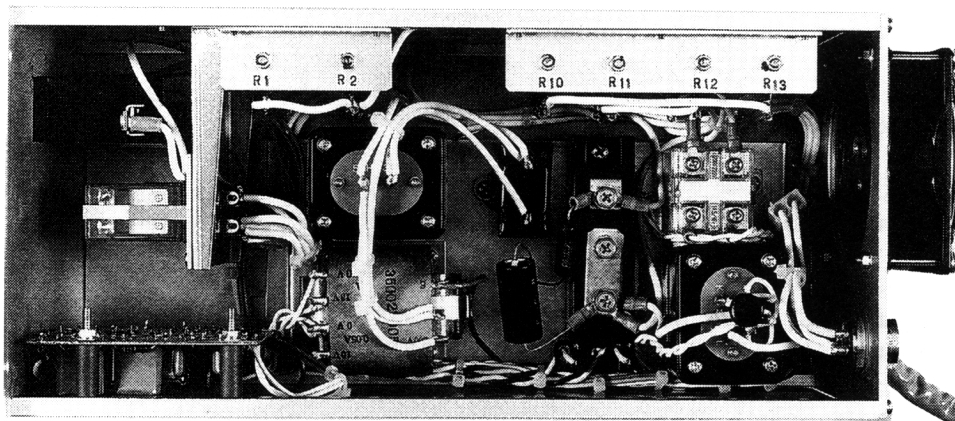
o Transformer (T2)

Detects SCR output voltage, for detection of filament abnormality.

o Current transformer (CT1)

Detects SCR output current, for meter indication of FIL (filament heating current), for check signals, and for filament abnormality detection. FIL is indicated on the EMISSION meter only at FIL ON with ACC OFF.

- o Fan (FN1)
Used for cooling the whole unit and especially enamel resistors R10 to R13.
- o Connector (CN1, 2-pin)
A single-phase 200 V input connector. Connected to the cable with connector from V-UNIT.
- o Connector (CN2, 3-pin)
An output connector. Connected to the primay side of the filament transformer by a cable with connector from V-UNIT.
- o Connector (CN3, 16-pin)
Connected to A-UNIT.
- o Connector (CN4 and CN5, 2-pin)
Connected to fans.



[Fig. 3-8] FIL Thyristor Control Unit (G-UNIT/FILAMENT POWER G)

E) SCAN/DEF power supply unit (M-UNIT)

Structurally, this unit is mounted on the rear upper rack of PS-RACK. Electrically, there is provided a power amplifier section for generating deflection and scanning outputs, which are supplied to the deflection coil (DEF COIL) and scanning coil (SCAN COIL). The power supply section generates +13 V and ± 26 V.

1) Operation

This unit amplifies the DEF COIL signal from X-UNIT by using transistor TR1 and output it to drive DEF COIL. Also, to eliminate the hysteresis of DEF COIL, the unit lets flow a current of DC 1 A or more to DEF COIL for two seconds after POWER ON (a countermeasure against residual magnetic field).

M-UNIT also amplifies SCAN COIL signals (X, Y) by using transistors TR2 to TR5, and outputs the signals to drive SCAN COIL.

2) Description of components.

- o Relay (RY1, DC 24 V)

Operates at POWER ON. Turns on the +13 V and ± 26 V from the power supply section, DEF COIL, and hysteresis elimination circuit.

- o Timer relay (T11, DC 24 V, 2 seconds delay)

Operates at POWER ON. Turns on the DEF COIL hysteresis elimination circuit for about two seconds.

- o Relay (RY2, AC 24 V)

Checks fuse F3.

- o Relay (RY3, AC 24 V)

Checks fuse F4.

- o Transformer (T1)

Outputs AC 13 V for DEF COIL driving.

Outputs two AC 25 V for X- and Y-SCAN COIL driving.

- o Transistor (TR1)

Amplifies output for DEF COIL driving.

- o Transistors (TR2, TR3)

Amplifies output for X-SCAN COIL driving.

- o Transistors (TR4, TR5)

Amplifies output for Y-SCAN COIL driving.

- o Fuse (F1, 2 A)

Used in single-phase, 200 V input line.

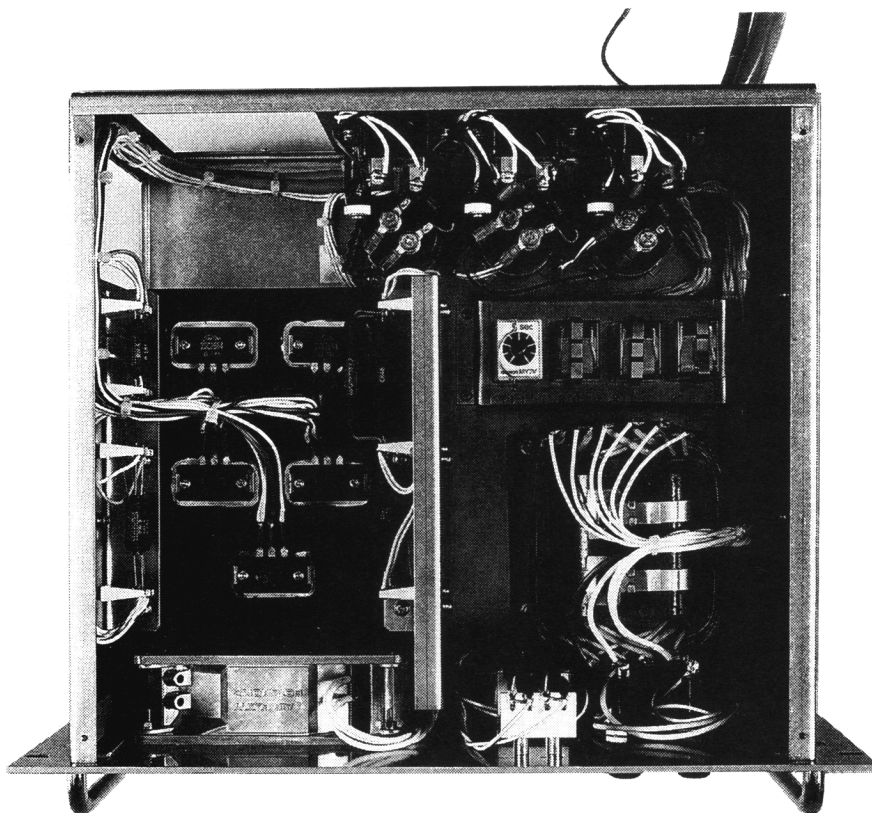
- o +17 V fuse (F2, 5 A)

Used in 13 V output line for DEF COIL power supply

- o +26 V fuse (F3, 5 A)

Used in 25 V output line for X-SCAN COIL power supply.

- o -26 V fuse (F4, 5 A)
Used in 25 V output line for Y-SCAN COIL power supply.
- o X fuse (F5, 5 A)
Used in output line for X-SCAN COIL.
- o Y fuse (F6, 5 A)
Used in output line for Y-SCAN COIL.
- o Fan (FN1)
For cooling the transistors.
- o Connector (CN1, 2-pin)
A connector with cable for single-phase 200 V line input connection.
(Connected to P-UNIT.)
- o Connector (CN2, 24-pin)
A connector with cable connected to A-UNIT
- o COIL connector (CN3, 6-pin)
A connector for power supply outputs for DEF and SCAN COILs.
Connected to low voltage feedthrough terminal (LVT) of CHAMBER by
the COIL cable.



[Fig. 3-9] SCAN/DEF Power Supply Unit (M-UNIT)

F) Central A unit (A-UNIT/CENTRAL A)

Structurally, this unit is mounted on the front upper rack of PS-RACK.

Electrically, this unit forms the nucleus of ACC PS (accelerating voltage power supply), FIL PS (filament heating power supply), DEF PS (DEF COIL power supply), SCAN PS (SCAN COIL power supply), signal circuit, and sequence circuit. Also it is constructed to be fitted with the ACC, FIL, DEF, and SCAN control units (printed circuit boards, PCBs).

1) Operation

This unit receives +24 V and ± 18 V (for IC to generate ± 15 V) and supplies them to each unit.

Circuit operations are all carried out via this unit.

In the circuit diagram, this unit is divided into two sections-- The A101 central unit (A101-UNIT consists of a connecting section to other units, and a switching and indication section) and the A102 central board (A102-PCB which is the mother board for the sequence relay/signal control unit).

2) Description of components (A101-UNIT)

o P connector (CN1, 20-pin)

The cable with connector from P-UNIT is connected to this connector for receiving +24 V, ± 18 V, and interlock signals for DOOR and FUSE(P) indicators.

POWER ON-OFF signals are supplied to P-UNIT.

o E1 connector (CN2, 24-pin)

Supplies +24 V signals to CONTROLLER via E-UNIT.

The cable with connector from E-UNIT is connected to this connector. The sequence for ACC and FIL are input.

o E connector (CN3, 28-pin)

Used for connecting B-UNIT, which is added when two CONTROLLERS are used (option).

o V connector (CN4, 4-pin)

The cable with connector from V-UNIT is connected to this connector. The various check signals for ACC, EMISSION, and EMISSION meter are input from V-UNIT.

o D connector (CN5, 12-pin)

Connected when D-UNIT (option) is used. Used only in changeover/simultaneous use of two GUNs (option).

o E2 connector (CN6, 34-pin)

Inputs and outputs signals to CONTROLLER via E-UNIT. The cable with connector from E-UNIT is connected to this connector.

o M connector (CN-7, 24-pin)

The cable with connector from M-UNIT is connected to this connector to supply signals (from X-, S-UNIT) to M-UNIT.

- o G connector (CN-8, 16-pin)
The cable with connector from G-UNIT is connected to this connector to supply signals (from F-UNIT) to G-UNIT.
- o HS connector (CN9, 12-pin)
The cable with connector from HS-UNIT is connected to this connector to supply the signals (from H-UNIT) to HS-UNIT.
- o Connectors (CN10, CN11)
Used for connecting A102-PCB.
- o Connectors (CN12, CN13, CN14)
Connects gate signals by the flat cables between H-UNIT/F-UNIT, and HS-UNIT/G-UNIT via A102-PCB.
- o Connector (CN-15) with flat cable
For connecting to indication switch (connects to CN1 on A102-PCB).
- o POWER ON switch (S1)
A switch for low-voltage circuit (+24 V \pm 18 V). Setting this switch to ON (green lights up) actuates the sequence circuit and signal circuit.
- o OFF(POWER) switch (S2)
A switch to shut off the low-voltage circuit.
Note: The red button lights up when NFB of V-UNIT at ON and this switch is pressed.
- o FUSE(P) indicator (D1)
For checking the burnout of fuses 1, 2, 4, 5 and 6 on P-UNIT. The fuses are installed on the upper right of the rear of V-UNIT.
- o FUSE(MG) indicator (D2)
For checking the burnout of fuses 1, 3, and 5 on M-UNIT. Indicates G-UNIT NFB trip.
- o DOOR indicator (D3)
For checking the door switches of V-UNIT and ST-AS10F (option)
- o VS indicator (D4)
For checking the high-voltage vacuum relay (VS) to be used when selectively or simultaneously using the two electron guns (option).

Note: The above indicators are lit green when the above items are normal. However, VS is lit when VS is normally operated only in optional specifications.

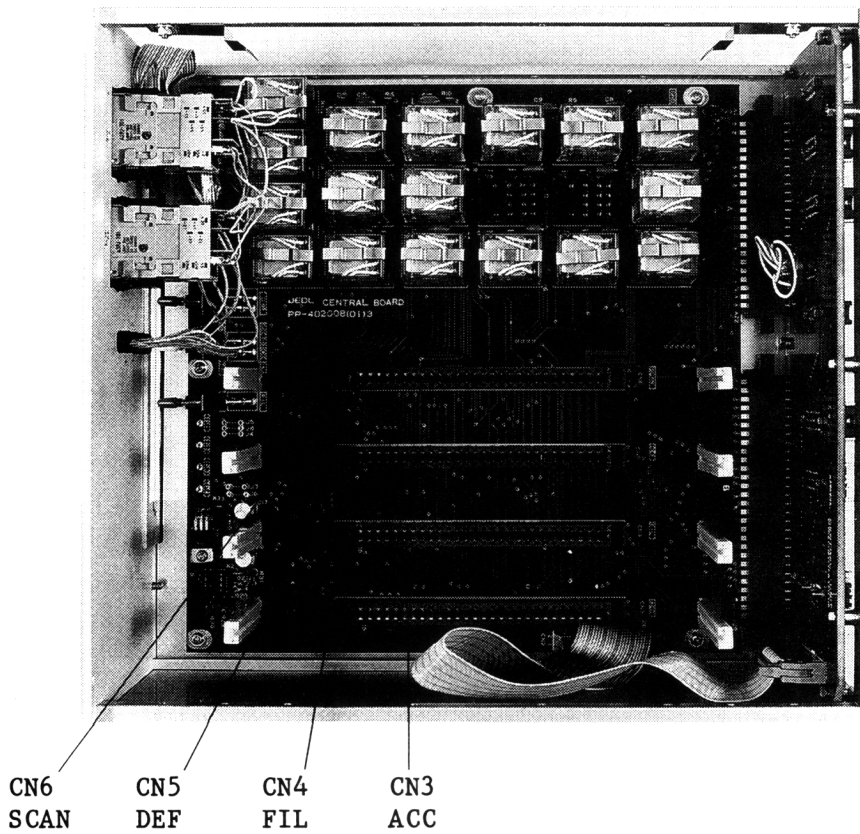
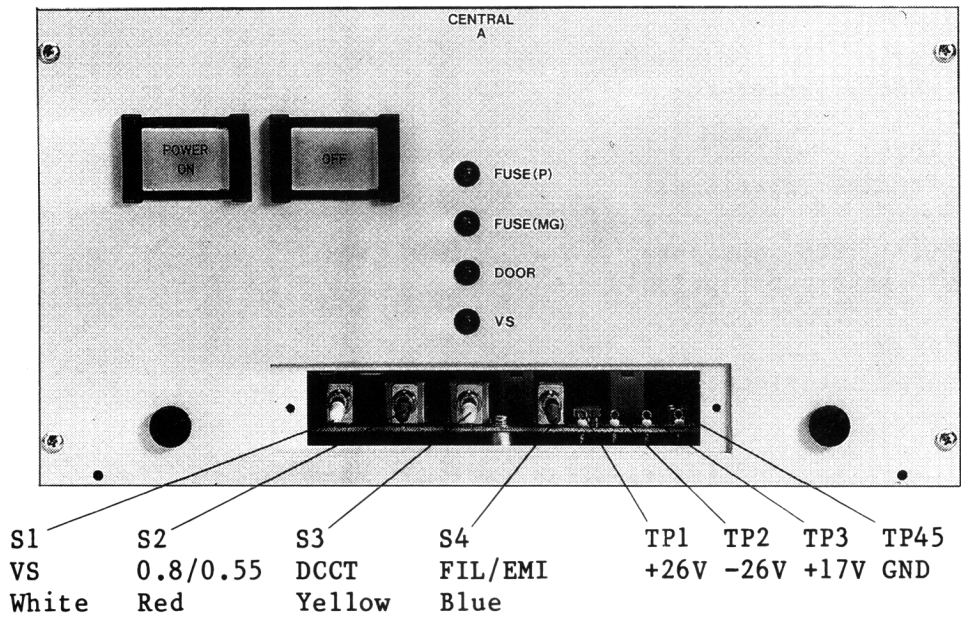
3) Description of components (A102-PCB)

- o Overcurrent protection circuit
When the emission current rating is exceeded for three seconds, IC1 and transistor TR1 detect it and actuates relay RY8. As a result, the EMSN (emission) ALARM on CONTROLLER lights up, with ACC and FIL coming to a stop.

- o White-capped switch (S1, VS SW)
Thrown upwards when using the high-voltage vacuum relay (VS) under optional specifications.
- o Red-capped switch (S2, 0.8/0.55 SW)
Used for selecting the filament type. Thrown upward for a 0.8 mm diameter filament and thrown downward for a 0.55 mm diameter filament.
- o Yellow-capped switch (S3, DCCT SW)
Thrown upward when detecting emission current by using the DC current transformer (option, for simultaneous use of two electron guns)
- o Blue-capped switch (S4, EMI/FIL SW)
For setting the feedback of emission control by emission current (EMI) or filament heating current (FIL). Thrown upward for FIL feedback.
- o Jamper pin terminal (J1)
A jamper pin is inserted when one CONTROLLER is used.
- o Jamper pin terminal (J2)
A jamper pin is inserted when two CONTROLLERS are used (option).
- o Jamper pin terminals (J3, J4)
Jamper pins are inserted when two CONTROLLERS are used simultaneously (option).
- o Jamper pin terminal (J5)
A jamper pin is inserted when two CONTROLLERS are used in cangeover operation (option).
- o Jamper pin terminals (J6 to J10)
Not used with this A-UNIT.
- o Connector (CN1, 16-pin)
Output connector to the switches and indicators on A101-UNIT.
- o Connector (CN2, 26-pin)
Gate signal output connector to G-UNIT and H-UNIT.
- o ACC connector (CN3, 28-pin)
Used for installing H-UNIT (PCB).
- o FIL connector (CN4, 28 AB-pin)
Used for installing F-UNIT (PCB).
- o DEF connector (CN5, 28 AB-pin)
Used for installing X-UNIT (PCB).
- o SCAN connector (CN6, 28 AB-pin)
Used for installing S-UNIT (PCB).

- o Relay (RY1)
For DOOR interlock.
- o Relay (RY2)
For FUSE(P) interlock.
- o Relay (RY3)
For FUSE(MG) interlock.
- o Relays (RY4, RY5; options)
For VS interlock (option).
- o Relay (RY6)
For total interlock.
- o Relay (RY7)
For operating ACC (accelerating voltage) ALARM.
- o Relay (RY8)
For operating EMSN (emission) ALARM.
- o Relay (RY9)
For operating FIL (filament) ALARM.
- o Relay (RY10)
For operating DEF (deflection) ALARM.
Normal at closed, abnormal at open.
- o Relay (RY11)
For OFF switch operation at ACC and FIL OFF.
- o Relays (RY12, RY13, RY14, RY19)
For operating ACC ON.
- o Relays (RY15, RY16, RY17, RY18)
For operating FIL ON.
- o Test point (TP1)
For +26 V line (for X-SCAN COIL).
- o Test point (TP2)
For -26 V line (for Y-SCAN COIL).
- o Test point (TP3)
For +17 V line (for DEF COIL).
- o Test point (TP4)
Ground

Note: Setting of S1, S2, S3, and S4 and voltage check with TP1, TP2, TP3, and TP4 are carried out by removing the small blank panel held by two screws on the front panel.



[Fig. 3-10] Central A Unit (A-UNIT/CENTRAL A)

G) ACC control unit (H-UNIT)

Structurally, this unit (PCB) is installed on CN3 of A-UNIT. It generates gate signals for SCR in order to control ACC (accelerating voltage).

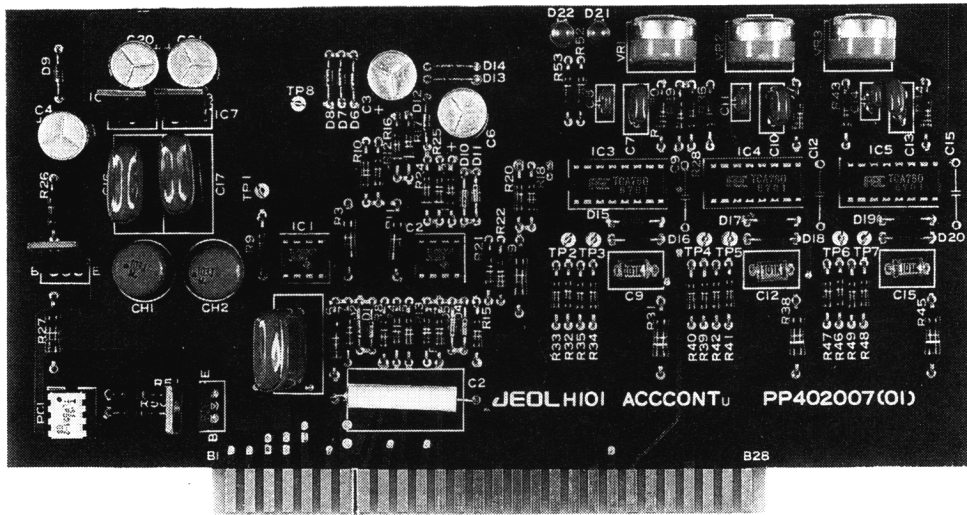
1) Operation

This unit compares an ACC setting signal from CONTROLLER and ACC check signal from V-UNIT by means of a differential amplifier (IC1) to obtain difference as a signal, and supplies the signal to the SCR controlling ICs (IC3 to IC5), which generate gate signals for SCR control.

If ACC continuously exceeds the set value by $\pm 15\%$ for more than two seconds, IC2 detects it and actuates the relay on A-UNIT and stops the application of ACC and FIL. At that time, ACC ALARM on CONTROLLER lights up.

2) Description of components

- o Indicator (D21, green)
Lit with the +15 V line on.
- o Indicator (D22, green)
Lit with the -15 V line on.
- o IC (IC1)
Differential amplifier for ACC control.
- o IC (IC2)
Used to detect the upper and lower limits of ACC.
- o ICs (IC3, IC4 and IC5)
Used for SCR control. (Gate signal generation.)
- o IC (IC6)
+15 V stabilized power supply
- o IC (IC7)
-15 V stabilized power supply
- o Transistors (TR1, TR2) and photocoupler (PC1)
Actuate the relay on A-Unit, using abnormality detection signals for the upper and lower limits of ACC.
- o Variable resistors (VR1, VR2 and VR3)
Used for phase shift correction of gate signals generated at R, S and T phases. Used for ripple adjustment of ACC output.



[Fig. 3-11] ACC Control Unit (H-UNIT)

H) FIL control unit (F-UNIT)

Structurally, this is a PCB connected to CN4 on A-UNIT. It generates SCR gate signals for controlling FIL (filament heating current). EMISSION (emission current) is controlled by FIL control.

1) Operation

The EMISSION setting signal from CONTROLLER and the EMISSION check signal from V-UNIT are compared with each other using a differential amplifier (IC1) and the difference is supplied to the SCR gate signal generator (IC7) via transistor TR1. The controlled gate signal is output to G-UNIT.

When the FIL ON switch is pressed (at ACC ON) and blue-capped switch S4 (FIL/EMI SW) of A-UNIT is set at FIL, filament heating current is detected from G-UNIT, input to differential amplifier IC1, compared with the EMISSION setting signal, and then controls the SCR gate signal.

The EMISSION check signal is input to the differential amplifier (IC1) via the maximum adjusted variable resistor. At ACC ON and FIL ON, even when the EMISSION dial is set at 0, small EMISSION flows and the preheat setting signal is input from CONTROLLER to IC1.

EMISSION check is carried out by using the detection resistor on the V-UNIT. When two electron guns are used simultaneously (option), however, the check is carried out by DCCT on D-UNIT (option).

Excessive current caused by discharge, etc., is detected by a comparator (IC2), and pulses of 150 to 200 ms are generated by IC8 to stop ACC temporarily for 150 to 200 ms. This circuit is called an "automatic return circuit (AUTO RETURN)". When AUTO RETURN operates more than three times per second, EMSN (emission) ALARM on CONTROLLER lights up via the relay on A-UNIT, with ACC and FIL switching OFF.

FIL and primary side voltage of the filament transformer are detected from G-UNIT. Filament burnout and shorting are detected by a comparator (IC1 and IC3) to lights up FIL ALARM via the relay on A-UNIT, with ACC and FIL switching OFF.

2) Description of components

o IC (IC1)

A differential amplifier for EMISSION and FIL control and a comparator for FIL ALARM.

o IC (IC2)

A comparator for AUTO RETURN and EMSN ALARM detection.

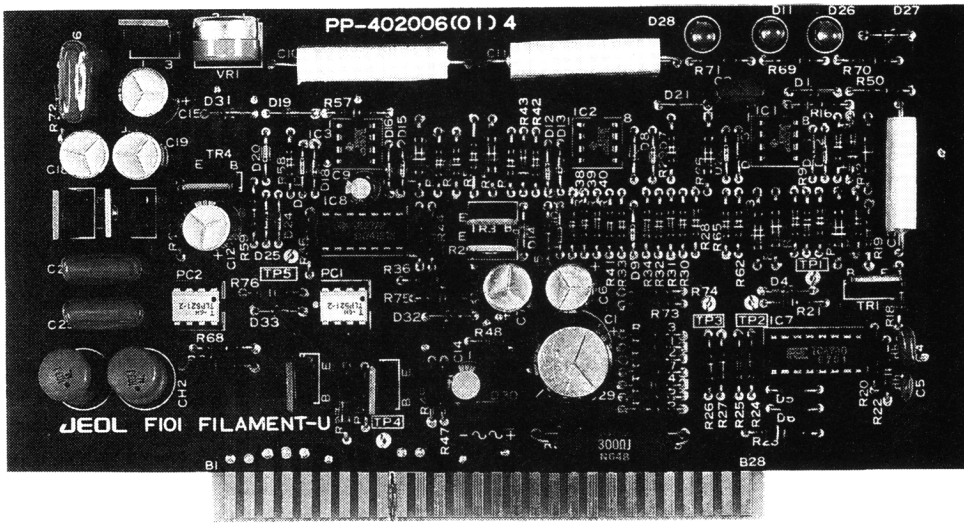
o IC (IC3)

A comparator for FIL ALARM detection.

o IC (IC4)

Used for generating +5 V constant voltage.

- o IC (IC5)
Used for generating +15 V constant voltage.
- o IC (IC6)
Used for generating -15 V constant voltage.
- o IC (IC7)
Used for generating SCR gate signal.
- o IC (IC8)
Used for AUTO RETURN and pulse generation (150 to 200 ms).
- o Photocoupler (PC1)
Stops H-UNIT's gate signal generation and sets ACC setting 0 when AUTO RETURN operates.
- o Photocoupler (PC2)
For driving A-UNIT relay at the time of FIL and/or EMSN ALARM ON.
- o Variable resistor (VR1)
Used for EMISSION upper limit (FULL POWER) setting.
(Adjust so that the maximum output is obtained when the EMISSION dial is set to the maximum)
- o Diode (D29)
Used for detecting and rectifying the primary side input of DCCT.
- o Diode (D30)
Used for detecting and rectifying the primary side input of the filament transformer.
- o Indicator (D11, green)
Lights up when -15 V is normal.
- o Indicator (D26, green)
Lights up when +15 V is normal.
- o Indicator (D28, green)
Lights up when +5 V is normal.
- o Test point (TP1)
Used to check input signal for SCR gate signal generating IC.
Minimum output at +10 V, maximum output at about +1.5 V
- o Test points (TP2 and TP3)
Used for gate signal check.



[Fig. 3-12] FIL Control Unit (F-UNIT)

I) SCAN control unit (S-UNIT)

Structurally, this unit is a PCB installed on CN6 of A-UNIT. It generates triangular wave for controlling EB scanning width, supplies it to M-UNIT, and outputs it to SCAN COIL of GUN.

The EB scanning width output includes the X-SCAN output and Y-SCAN output. X-SCAN employs triangular wave of 50 Hz and Y-SCAN triangular wave of 500 Hz.

This unit is not used when JEBG-163M is used.

1) Operation

50 Hz triangular waves (for X-SCAN) are generated by triangular wave generating circuit IC1 and 500 Hz triangular waves (for Y-SCAN) by IC4. VR2 adjusts X-SCAN frequency and VR10 for Y-SCAN.

Each triangular wave enters waveform deforming circuit IC2 which, used for correcting the shape of the melt on the evaporant, deforms the waveform of triangular wave signals, with half peaking for X-SCAN and with peaking for Y-SCAN. Each deformed triangular wave enters multiplier IC6 and IC7, and after its output is adjusted by X/Y-SCAN setting from CONTROLLER, is input to differential amplifiers IC3 and IC5.

The differential amplifier amplifies the voltage difference by comparing the triangular wave signal with the current flowing in SCAN COIL and supplies it to transistors TR1 to TR8, from which the signals are output to M-UNIT.

The POSITION setting signals from CONTROLLER, like triangular wave, are supplied to M-UNIT by the differential amplifier. X-POSITION is used only with JEBG-203U and -303U. Y-POSITION is used only with JEBG-102U, -203U, and -303U.

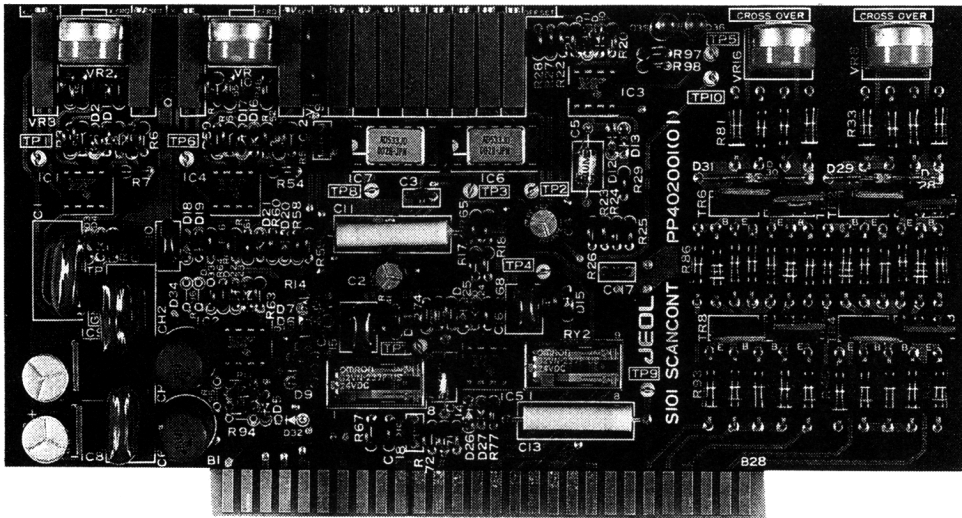
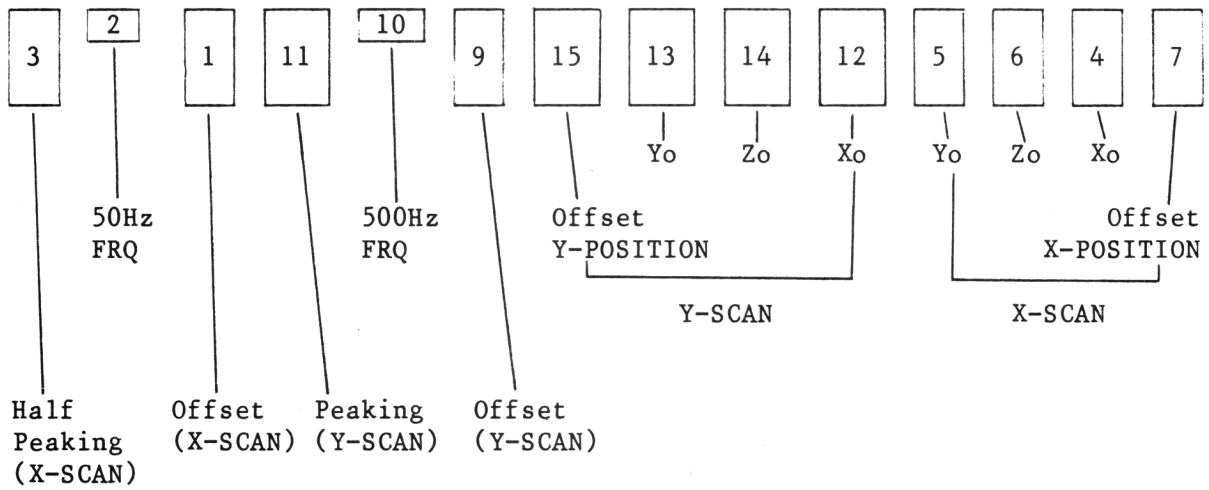
When SCAN EXTSIG ON is selected, relay RY1 operates, causing triangular wave and point scan signals to be input to the multiplier from outside and the output to be adjusted by X/Y SCAN setting from CONTROLLER.

2) Description of components

- o IC (IC1)
Generates triangular waves for X SCAN.
- o IC (IC2)
Deforms waveform for X/Y-SCAN.
- o IC (IC3)
A differential amplifier for X-SCAN.
- o IC (IC4)
Generates triangular waves for Y-SCAN.
- o IC (IC5)
A differential amplifier for Y-SCAN.
- o IC (IC6)
A multiplier for X-SCAN.

- o IC (IC7)
A multiplier for Y-SCAN.
- o IC (IC8)
Generates +15 V constant voltage.
- o IC (IC9)
Generates -15 V constant voltage.
- o Transistors (TR1 to TR4)
For power amplification (for X-SCAN).
- o Transistors (TR5 to TR8)
For power amplification (for Y-SCAN).
- o Variable resistor (VR1)
Adjusts triangular wave offset for X-SCAN.
- o Variable resistor (VR2)
Adjusts triangular wave frequency (50 Hz for X-SCAN).
- o Variable resistor (VR3)
For half peaking adjustment (for X-SCAN).
- o Variable resistors (VR4, VR5 and VR6)
For zero adjustment of multiplier (IC6) for X-SCAN.
- o Variable resistor (VR7)
For X-POSITION offset.
- o Variable resistor (VR9)
Adjusts triangular wave offset for Y-SCAN.
- o Variable resistor (VR10)
Adjusts triangular wave frequency (500 Hz for Y-SCAN).
- o Variable resistor (VR11)
For peaking adjustment (for Y-SCAN).
- o Variable resistors (VR12, VR13, VR14)
For zero adjustment of multiplier (IC7) for Y-SCAN.
- o Variable resistor (VR15)
For Y-POSITION offset.
- o Indicator (D35, green)
Lights up when +15 V line is normal
- o Indicator (D36, green)
Lights up when -15 V line is normal

Positions of Variable Resistors



[Fig. 3-13] SCAN Control Unit (S-UNIT)

J) DEF control unit (X-UNIT)

Structurally, this unit is a PCB installed on CN5 of A-UNIT.

X-UNIT is used for X-POSITION (X-position of electron beam) control by DEF COIL, this unit is used when the JEBG-102U or -163M Electron Gun is used.

1) Operation

The X-POSITION setting signal, BALANCE signal, and ACC ADJ signal from CONTROLLER are compared with the DEF COIL current from M-UNIT, and the difference is amplified and output to M-UNIT to control the DEF COIL current for X-POSITION control.

The EB position is roughly set by ACC ADJ signal and set to the crucible center by BALANCE signal, and then the EB moving range on the crucible is set by X-POSITION setting signal.

With JEBG-163M, ACC ADJ signal is not used, and the EB position is set to the crucible center by the BALANCE signal, and then the EB moving range on the crucible is set by X-POSITION setting signal.

Also, there is provided a detection circuit for abnormalities in DEF COIL current, which outputs an abnormality signal to A-UNIT to actuate the relay when the current goes beyond the upper and lower limits, or when DEF COIL is shorted, or when the current exceeds the absolute lower limit that is used only for JEBG-102U. The relay operation lights up DEF ALARM indicator on CONTROLLER, with ACC and FIL switching OFF.

2) Description of components

o IC (IC1)

For generation of +15 V constant voltage.

o IC (IC2)

For generation of -15 V constant voltage.

o IC (IC3)

A differential amplifier to control DEF COIL current

o IC (IC4)

Used to detect abnormalities in DEF COIL current.

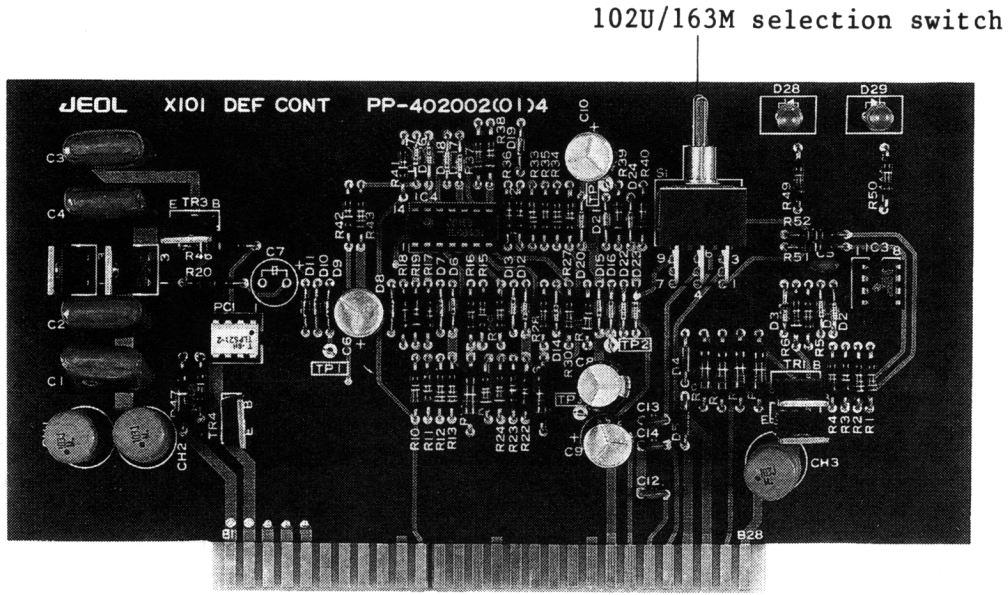
Outputs an abnormality signal when the following abnormalities continue for more than 2 seconds.

- . The current is 10% or more above the set level.
- . The current is 10% or more below the set level.
- . The current is below 0.15 A when JEBG-102U is used.
- . When DEF COIL is shorted

o Photocoupler (PC1)

Upon receiving an abnormality signal, actuate relay RY10 on A-UNIT. (DEF ALARM on CONTROLLER lights up, with ACC and FIL switching OFF.)

- o Indicator (D28, green)
Lights up when +15 V is normal.
- o Indicator (D29, green)
Lights up when -15 V is normal.



[Fig. 3-14] DEF Control Unit (X-UNIT)

K) Connection unit (E101-UNIT)

Structurally, this unit is installed on the upper right of the rear of PS-RACK. Two cables to CONTROLLER are connected.

When CONTROLLER is built into PS-RACK, this unit is not necessary. Also, when two CONTROLLERS are used with two electron guns (GUN 1 and GUN 2), this unit is replaced by an optional connection unit (E102-UNIT) with four connectors.

1) Description of components

o E1 connector (CN1, 24-pin)

The E1 cable with connectors from CONTROLLER is connected.

o E2 connector (CN2, 34-pin)

The E2 Cable with connectors from CONTROLLER is connected.

o Connector (CN3, 24-pin)

Connected to E1 on A-UNIT.

o Connector (CN4, 34-pin)

Connected to E2 on A-UNIT.

Note: When an option is installed, the following are added.

o Connector (CN5, 24-pin)

The cable with connectors from CONTROLLER is connected.

o Connector (CN6)

The cable with connectors from CONTROLLER is connected.

o Connector (CN7, 24-pin)

Connected to E1 on B-UNIT.

o Connector (CN8, 34-pin)

Connected to E2 on B-UNIT.

L) Control unit (C-UNIT/CONTROLLER)

This unit is provided with functions to control ACC (accelerating voltage), EMISSION (emission current), X/Y-SCAN (X/Y scanning) and X/Y POSITION (X/Y position).

Inputs and outputs of external signals are all done via this unit; therefore, the operating condition of the electron gun (GUN) can be seen from the indications on this unit.

The setting unit with EMISSION, X/Y POSITION and X/Y SCAN controls is installed by a magnet chuck, and can be remotely operated by connecting the extension cable (for remote control) attached. On its circuit diagram, this unit is divided into two sections--a connection, and indicator and switch section [C101 control unit (C101-UNIT)] and a sequence relay and signal control section [C102 control board (C102-PCB)].

1) Description of components (C101-UNIT)

o PS INTERLOCK indicator (D1, green)

Lit when PS-RACK interlock [DOOR, FUSE(P), and FUSE(MG) indicators located on A-UNIT] are normal. When an optional D-UNIT is used, the VS indicator shows the high voltage vacuum relay (VS) is also normal.

When this indication lights go out, check the indications on A-UNIT to find the abnormal part.

o V INTERLOCK indicator (D2, green)

Lit when the vacuum in the vacuum evaporation chamber (CHAMBER) is normal. Lights up when pin Nos. 1 and 2 of the INTLK (interlock) connector (CN2) are connected.

Provide a contact that is closed when the vacuum degree is better than 10^{-4} Torr.

When GUN 2 is selected in the selective operation of two GUNS, this indicator lights up when pin Nos. 1 and 5 of the connector are connected.

o W INTERLOCK indicator (D3, green)

Lit when GUN cooling water conditions are normal.

Provide a contact which closes to light up the W indicator when pin Nos. 1 and 3 of the INTLK connector are connected, and which closes pins 1 and 3 when the amount of cooling water reaches 10 l/min (2 kg/cm²) or more.

When GUN 2 is used in the selective use of two GUNS, W lights up when pins 1 and 6 of the connector are connected.

o AUX INTERLOCK indicator (D4, green)

Lit when pins 1 and 4 of the INTLK connector (CN2) are connected. As for the purposes to connect pins 1 and 4, please select what you need in your work. When not necessary, short between pins 1 and 4 of CN2.

When GUN 2 is selected in the selective operation of two GUNS, AUX lights up when pin Nos. 1 and 7 of CN2 are connected.

- o 256P INTERLOCK indicator (D12, green)

Used when an option is used. Lit when the operation of the option is normal. Not lit normally.

Note: When PS, V, W, or AUX goes out, ACC and FIL switching OFF.

- o ACC ALARM indicator (D17, red)

Lights up when ACC becomes abnormal, with ACC and FIL switching OFF. When the RESET switch (S6) is pressed, the indicator light goes out, making it possible to switch on ACC and FIL. For abnormality checks, refer to the troubleshooting instructions in "[6] 2."

- o EMSN ALARM indicator (D18, red)

When EMISSION becomes abnormal (excessive), AUTO RETURN operates; however, if it operates more than three times per second, EMSN ALARM lights up with ACC and FIL switching OFF. When the RESET switch (S6) is pressed, the indicator goes out, making it possible to switch on ACC and FIL. As for abnormality checks, refer to "[6] 2."

- o FIL ALARM indicator (D19, red)

Lights up when the GUN filament is burnt out or shorted, with ACC and FIL switching OFF. FIL light goes out when the OFF(POWER) switch on A-UNIT is pressed. As for abnormality checks, refer to "[6] 2."

- o DEF ALARM indicator (D20, red)

Lights up when the DEF COIL currents of GUN (JEBG-102U or -163M) are abnormal, with ACC and FIL switching OFF. As for abnormality check, refer to "[6] 2.". When the currents become normal, DEF ALARM light automatically goes out, making it possible to switching on ACC and FIL.

- o ALARM RESET switch (S6)

Used to release ALARM hold when ACC and EMSN ALARM light up. When switching on ACC and FIL after ACC and EMSN ALARM lights up, be sure to press this switch once.

- o EXT/INT selection switch (EXT/INT SW, S2)

A lever lock type switch for changeover between external/internal operation. Changeover is done while pulling the lever.

When the switch is set at EXT, external-signal operation becomes possible when CONTROLLER's white-capped switch (external switch operation), blue-capped switch (external EMISSION control), and red-capped switch (external SCAN and POSITION control) thrown upward. (Since these switches are located in the panel recess of CONTROLLER, removing small blank panel with lossing two screws required.)

When EXT/INT SW is set at INT, operation is possile with controles on the setting unit installed on CONTROLLER.

Before operating this switch, be sure to press OFF (ACC & FIL) switch.

- o EXT indicator (D7, green)

Lights up when EXT/INT SW (S2) is set to EXT, and operations such as switch operation, EMISSION setting, POSITION setting and SCAN setting become possible with external signals.
- o INT indicator (D8, green)

Lights up when (S2) is set to INT. The above operations are possible with controls on CONTROLLER.
- o GUN 1/GUN 2 selection switch (GUN 1/2 SW, S1)

Operable only when two GUNs are selectively used (option). Used to select GUN 1 or GUN 2. At the time of GUN changeover, the outputs and INTERLOCK for GUN to be used are changed over.
- o GUN 1 indicator (D5, red)

Lights up when GUN 1 is selected with GUN 1/2 SW (S1). (Lights up only when a single GUN of two GUNs are used selectively.)
- o GUN 2 indicator (D6, red)

Lights up when GUN 2 is selected with S1. (Lights up only when a single GUN of two GUNs are used selectively.)
- o ACC ON switch and indicator (S3 and D9)

Lights up when this switch is pressed for setting ON. This switch cannot be set to ON while FIL (filament heating power) is ON. For setting ACC and FIL to ON, they should be once set to OFF, after which ACC and then FIL are set to ON. This is possible only when the INTERLOCK indicators (PS, V, W, AUX) are lit and the ALARM indicators (ACC, EMSN, FIL, DEF) are not lit.
- o FIL ON switch and indicator (S4 and D10)

Lights up when this switch is pressed for setting ON. When the EMISSION dial is turned only with FIL ON, FIL (filament heating current) is indicated on the EMISSION meter.

When the EMISSION dial is turned with ACC ON and FIL ON, the emission current is indicated on the EMISSION meter. The conditions that allows FIL ON are the same as ACC ON.
- o OFF switch and indicator (S5, D11)

The switch is used to set ACC and FIL to OFF. It lights up when the switch is pressed for OFF setting.
- o Connector (CN12, BNC) for X-MONITOR

Connects to the oscilloscope for the waveform monitor for X SCAN and X POSITION (only with JEBG-203U and -303U).

Max. 4 Vp-p, triangular wave (50 Hz) corresponds to ± 1 V DC on the oscilloscope.

o Connector (CN13, BNC) for Y-MONITOR

Connects to the oscilloscope for the waveform monitor for Y SCAN and Y POSITION.

Max. 4 Vp-p triangular wave (500 Hz) corresponds to ± 1 V DC on the oscilloscope.

Note: Connecting the output from the X/Y MONITOR connector to a dual sweep oscilloscope allows SCAN and POSITION observation with resurge waveform.

o ACC/DEF/XY SCAN meter (M1)

Indicates ACC (accelerating voltage), DEF COIL exciting parameter, X/Y SCAN COIL exciting parameter. The indication can be selected using the MODE SELECT switch under the meter.

. ACC indication (black scale)

When the ACC button of the MODE SELECT switch is pressed or any of the switches is not pressed, the red indicator of the ACC button lights up with the ACC value being indicated.

Indication range: 0 to 15 kV.

. DEF, SCAN indications (green scale)

Gives an indication when DEF, XS (X-SCAN), or YS (Y-SCAN) of the MODE SELECT switch is pressed.

However, when JEBG-203U and -303U are used, DEF does not operate. When JEBG-163M is used, XS and YS do not operate.

Indication range: 0 to 10

DEF indication

With 102U: 0 to 10 (on meter) corresponds to 0 to 1 A (DEF CIOL)

With 163M: 0 to 10 (on meter) corresponds to 0 to 2 A (DEF COIL)

SCAN indication

0 to 10 (on meter) corresponds to 0 to 8 Ap-p (SCAN COIL)

Note: No indication is given when 163M GUN is used.

. POSITION indication (orange scale)

Gives an indication when XP (X-POSITION) or YP (Y-POSITION) of the MODE SELECT switch is pressed. XP does not operate when JEBG-102U is used, and both XP and YP do not operate when JEBG-163M is used.

Note: SCAN meter full scale indication is adjusted to correspond to 8 Ap-p, and POSITION meter full scale indication corresponds to ± 2 A, but it is possible to make full scale adjustment to the size of the standard crucible to be used.

- EMISSION meter (M2)

Indicates the EMISSION (emission current) at ACC ON and FIL ON, and FIL (filament heating current) parameter at only FIL ON.

There are the following three meter ranges selectable with the RANGE selection switch:

 - RANGE 1: 0 to 120 mA
 - RANGE 2: 0 to 720 mA
 - RANGE 3: 0 to 2250 mA

Note: In the case of filament current indication:
300 mA (on the meter) corresponds to about 30 A (FIL).
- EMISSION dial (VR5, 10-turn potentiometer)

Used for setting the emission current (EMISSION). The maximum setting is 0.8 A (JST-3F), 1A(JST-10F) and 1.6 A (JST-16F).

When only FIL is ON with ACC OFF, this dial controls the filament heating current (FIL). FIL, though varying with the type of filament, is controlled to 30 to 40 A at max. (300 to 400 mA on the meter).
- X-POSITION control (XP ADJ, VR1)

Used for setting the EB X position.

DEF indication on the meter is varied with JEBG-102U and -163M, and XP indication with JEBG-203U and -303U.

The operation range of XP ADJ can be adjusted to the crucible size by using XP GAIN controller (VR11 on CONTROLLER).
- Y-POSITION control (YP ADJ, VR2)

Used for setting the EB Y position.

Varies the YP indication on the meter. However, when JEBG-163M is used, no indication is given.

The operating range of YP ADJ can be adjusted to the crucible size by using YP GAIN controller (VR13 on CONTROLLER).
- X-SCAN control (XS ADJ, VR3)

Used for setting the EB X-SCAN (X scanning width).

The XS indication on the meter is varied. However, when JEBG-163M is used, no indication and operation are carried out.

The operating range of XS ADJ can be adjusted to the crucible size by using XS GAIN adjustment (VR12 on CONTROLLER).
- Y-SCAN control (YS ADJ, VR4)

Used for setting the EB Y-SCAN (Y scanning width).

The YS indication on the meter is varied. However, when JEBG-163M is used, no indication and operation are carried out.

The operating range of YS ADJ can be adjusted to the crucible size by using YS GAIN controller (VR14 on CONTROLLER).
- E1 connector (CN1,24-pin)

Used for connector (E1) to PS-RACK, +24 V line and for sequence line.

- o INTLK connector (CN2, 12-pin)
Used for INTERLOCK signal input.

pin No. 1	Common	5	VACUUM (for GUN 2)
2	VACUUM (for GUN 1)	6	WATER (ditto)
3	WATER (ditto)	7	AUX (ditto)
4	AUX (ditto)		

- o GUN ON connector (CN3, 8-pin)
Used for GUN ON check signal output.

pin No. 1	Common	4	ACC ON (for GUN 2)
2	ACC ON (for GUN 1)	5	GUN ON (ditto)
3	GUN ON (ditto)		

Note: GUN ON = ACC ON and FIL ON

- o EXT 1 connector (CN4, 36-pin)
A connector for EXT1 external signal. (Fitted with dummy connector.)
Used for ACC, EMISSION related external signal.

- o E2 connector (CN5, 34-pin)
A connector to PS-RACK. Used for signal line.

- o EXT 2 Connector (CN6, 50-pin)
A connector for EXT2 external signal. (Fitted with dummy connector.)
Used for SCAN, POSITION related external signal.

- o EMSN connector (CN7, 10-pin)
A connector for EMISSION external signal input. (Fitted with dummy connector.)

Pin No. 4	0 to -10 V input
5	GND

- o Connectors (CN8 and CN9, 56-pin)
Connectors for C102 control board (PCB)

- o Connector (CN10, 10-pin)
Used when an option is used.

- o Connector (CN11, 16-pin)
Connects to EMISSION, X/Y SCAN, and X/Y POSITION control.
A connector with flat cable for CONTROLLER internal wiring.

- o Connector (CN14, 16-pin)
A connector wired from CN11. CN15 is connected.

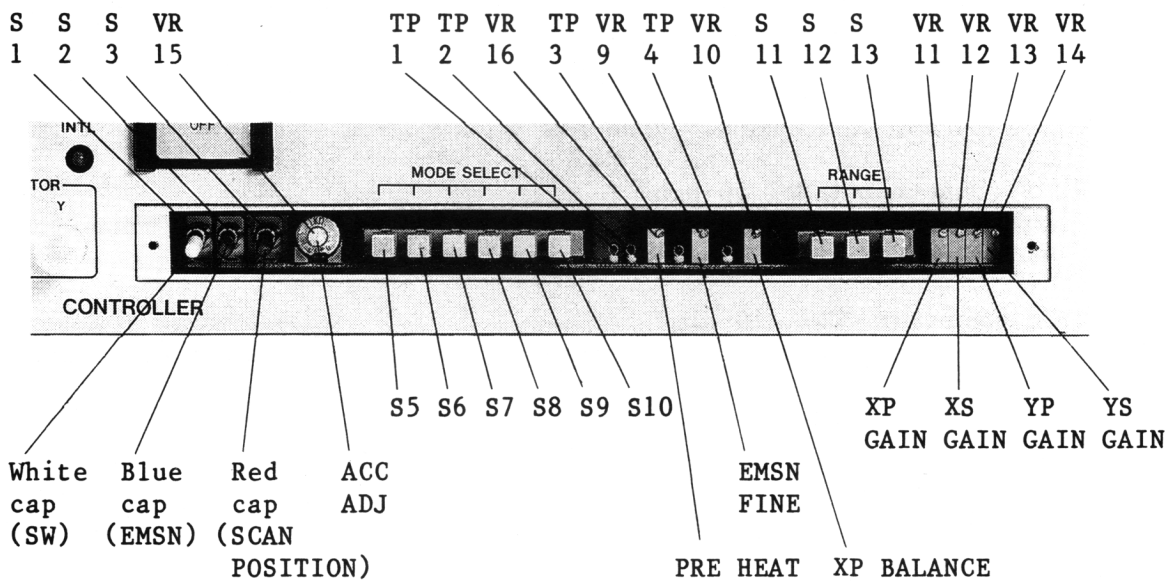
- o Connectors (CN15 and CN16, 16-pin)
Connectors to CN11 and CN17.
When EMISSION, X/Y POSITION and X/Y SCAN controls on the setting unit are carried out remotely, this connector is exchanged with an extension cable (for remote control, 6 m cable with connectors).

- o Connector (CN17, 16-pin)
For connecting EMISSION, X/Y POSITION, and X/Y SCAN controls.

- o Connector (CN18)
A connector with flat cable for connecting CONTROLLER front panel.
- o Connectors (CN19 and CN20) options
Installed on the rear blind panel when 16 POINT, 256 POINT, or TRIPLE POINT is used.
A signal is input to connector CN19 and connected to SCAN-F-BOARD (option) by connector CN20 with flat cable (CN21).

2) Description of components (C102-PCB components located in the panel recess of CONTROLLER panel)

Note: Removing the small blank panel at lower part of CONTROLLER panel by loosening the two screws exposes the panel recess layout shown below.



[Fig. 3-15] Component layout in CONTROLLER panel recess

- o White-capped switch (S1, SW-EXT)
Thrown upward when switch control is to be done by external signal. External control is unavailable when EXT/INT SW is set to INT. The following switch control can be done by external control:
ACC ON, FIL ON and OFF (standard spec.)
GUN 1/GUN 2 selection and 16 POINT ON (optional spec.)
- o Blue-capped switch (S2, EMSN-EXT)
Thrown upward when EMISSION control is to be done by external signal. External control is unavailable when EXT/INT SW is set to INT.
- o Red-capped switch (S3, SP-EXT)
Thrown upward when SCAN and POSITION setting is to be done by external signal. External setting operation is unavailable when EXT/INT SW is set to INT.

- Accelerating voltage controller (VR15, ACC ADJ)
 - The voltage range varies with the models.
 - JST-3F: 4 kV to 8 kV
 - JST-10F: 4 kV to 10 kV
 - JST-16F: 4 kV to 10 kV

- MODE SELECT ACC switch and indicator (S5, D24 red)
 - Pressing the switch lights up the switch button red and indicates the value of ACC on the ACC/DEF/X SCAN meter (M1). When none of the MODE SELECT switches (S5 to S10) is pressed, ACC is selected and the red button lights up.

- MODE SELECT DEF switch and indicator (S6, D25 green)
 - Pressing the switch lights up the switch button green and indicates the DEF COIL current factor on M1. When JEBG-203U or -303U is used, the indicator and meter do not function.

- MODE SELECT XP switch and indicator (S7, D26 yellow)
 - Pressing the switch lights up the switch button yellow and indicates the factor of the POSITION current flowing through X-SCAN COIL. When JEBG-I02U or -163M is used, the indicator and meter do not function.

- MODE SELECT XS switch and indicator (S8, D27 green)
 - Pressing the switch lights up the switch button green and indicates the factor of the SCAN (scan width) current flowing through X-SCAN COIL. When JEBG-163M is used, the indicator and meter do not function.

- MODE SELECT YP switch and indicator (S9, D28 yellow)
 - Pressing the switch lights up the switch button yellow and indicates the factor of the POSITION current flowing through Y-SCAN COIL. When JEBG-163M is used, the indicator and meter do not function.

- MODE SELECT YS switch and indicator (S10, D29 green)
 - Pressing the switch lights up the switch button green and indicates the factor of the SCAN (scan width) current flowing through Y-SCAN COIL. When JEBG-163M is used, the indicator and meter do not function.
 - Note: Turning on two or more MODE SELECT switches simultaneously will result in an abnormal meter indication. It is therefore necessary to press them on one by one.

- Test points (TP1 and TP2)
 - TP2 is used for DEF COIL current check terminal, and TP1 for ground.
 - 0 to +2 V (read out) correspond to 0 to 2 A (DEF COIL current).

- Test points (TP3 and TP4)
 - TP3 is used as a check terminal to measure VR9-adjusted voltage when low EMISSION control (EMSN FINE) is performed to improve the control accuracy in the external EMISSION control mode.
 - TP3: 0 to -10 V, TP4: Ground

- o Filament preheating control (PRE HEAT, VR16)
Used to preheat the filament by a small amount of heating current when the EMISSION dial set to 0 at ACC ON and FIL ON.
The filament heating current is set at about 1 mA to 5 mA.
- o Emission current fine control (EMSN FINE, VR9)
Controls external voltage when EMSN FINE is selected to raise resolution in the external emission control mode.
Example: Set so that an external voltage of 0 to -10 V correspond to a control voltage of 0 to -1 V.
Note: This method is suited for carrying out evaporation rate control at low emission current.
- o X position balance control (XP BALANCE, VR10)
Sets the beam so that it comes to the crucible center when the X-POSITION knob is set to the center during use of JEBG-102U or -163M.
- o X position gain control (XP GAIN, VR11)
Sets the maximum operating range (max. range) of the X-POSITION knob.
Used when the max. range is adjusted to the crucible size.
- o X scanning gain control (XS GAIN, VR12)
Sets the max. range of the X-SCAN knob.
Used when the max. range is adjusted to the crucible size.
- o Y position gain control (YP GAIN, VR13)
Sets the max. range of the Y-POSITION knob.
Used when the max. range is adjusted to the crucible size.
- o Y scanning gain control (YS GAIN, VR14)
Sets the max. range of the Y-SCAN knob.
Used when the max. range is adjusted to the crucible size.
- o RANGE 1 switch and indicator (S11 and D30 red)
Pressing the switch selects the 0 to 120 mA range on EMISSION meter (M2) and lights up the switch button red.
- o RANGE 2 switch and indicator (S12 and D31 red)
Pressing the switch selects the 0 to 720 mA range of M2 and lights up the switch button red.
- o RANGE 3 switch and indicator (S13 and D32 red)
Pressing the switch selects the 0 to 2,200 mA range of M2 and lights up the switch button red.

Note: When any of RANGE 1 to 3 is not pressed, RANGE 3 is selected and the RANGE 3 red button is lit.

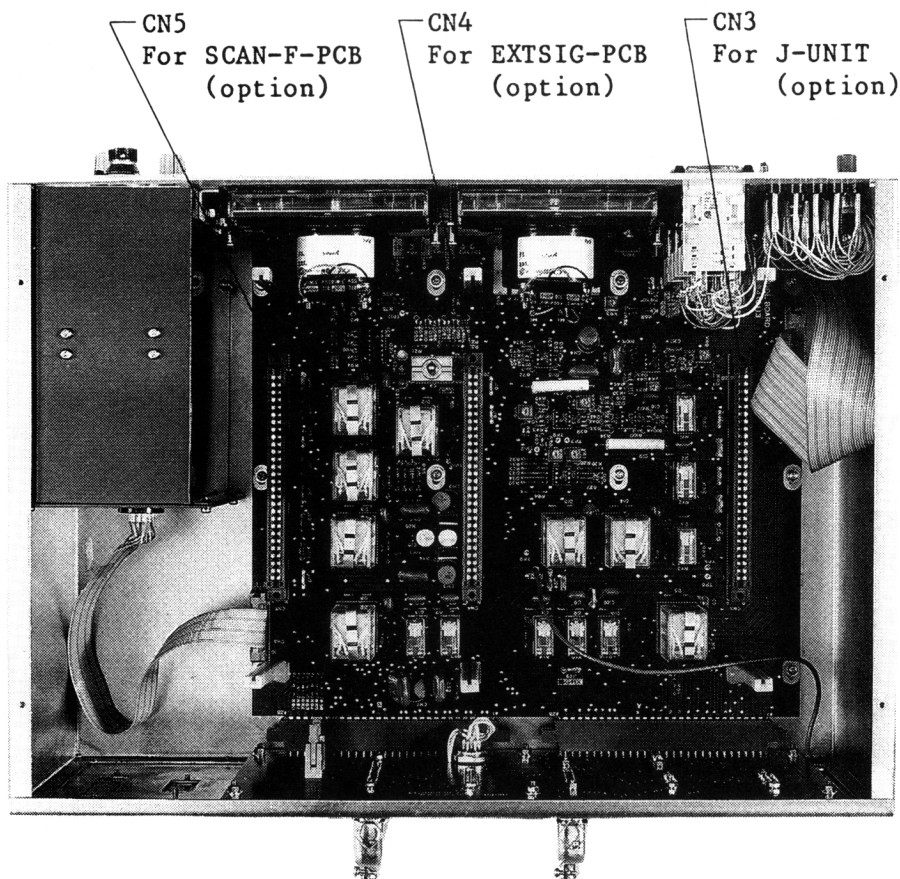
3) Description of components (C102-PCB)

- o GUN selection switch and indicators (GUN CHOICE, S4; D21 red, D22 green and D23 yellow)
Sets operating condition of GUN to be used.
Throw to rear panel side: For JEBG-102U (red D21 lights up)
Neutral: For JEBG-203U/-303U (green D22 lights up)
Throw to front panel side: For JEBG-163M (yellow D23 lights up)
- o X position zero control (XP ZERO, VR2)
Used for X POSITION meter 0 adjustment.
Adjusts the needle to the meter center when X POSITION current is 0.
- o X position full scale control (XP FULL, VR1)
Adjusts so that full scale is obtained at X POSITION current of ± 2 A.
- o X scanning full scale control (XS FULL, VR4)
Adjusts so that full scale is obtained at X SCAN current of 8 Ap-p.
- o Y position zero control (YP ZERO, VR6)
Adjusts the needle to the meter center when Y POSITION current is 0.
- o Y position full scale control (YP FULL, VR5)
Adjusts so that full scale is obtained at Y POSITION current of ± 2 A.
- o Y scanning full scale control (YS FULL, VR8)
Adjusts so that full scale is obtained at Y SCAN current of 8 Ap-p.
- o ACC meter control (VR3)
Used for ACC meter calibration.
- o Connector (CN1)
A connector from front panel.
- o Connector (CN2)
A connector from the EMISSION, X/Y POSITION and X/Y SCAN controls.
- o Connector (CN3)
The selection unit (J-UNIT, PCB) is connected when two GUNS are selectively used (option).
- o Connector (CN4)
EXITSIG-PCB is connected when external signals are used for external control (option).
- o Connector (CN5)
SCAN-F-PCB is connected when an option is used.
- o Jumper pin terminals (J1 to J3)
Jumper pins are installed normally, but they should be removed when installing an optional selection unit.

- o Jumper pin terminals (J8, J9 and J32)
Jumper pins are installed normally, but they should be removed when installing optional EXTSIG-PCB.
- o Jumper pin terminals (J11 to J17)
Jumper pins are installed normally, but they should be removed when installing optional SCAN-F-PCB.
- o Jumper pin terminals (J18 and J21)
Jumper pins are used for higher output power supplies than the JST-3F/JST-10F/JST-16F.
- o Jumper pin terminals (J19 and J22)
Jumper pins are used in case of JST-10F or JST-16F.
- o Jumper pin terminal (J20 and J23)
Jumper pins are used in case of JST-3F.
- o Jumper pin terminal (J24)
A jumper pin is installed when emission current control is carried out by external signal for EMSN FINE control.
- o Jumper pin terminal (J25)
A jumper pin is used when external SCAN signals are input.
- o Jumper pin terminal (J30)
The jumper pin is installed normally, but should be removed when carrying out POSITION setting internally and SCAN setting externally.
- o Jumper pin terminal (J31)
A jumper pin is used when an option is installed.
- o Test point (TP5)
For +24 V check.
- o Test point (TP6)
Ground terminal for +24 V check.
- o Test point (TP7)
For +15 V check.
- o Test point (TP8)
For -15 V check.
- o Test point (TP9)
Ground terminal for ± 15 V check.
- o X scanning zero control (X-SCAN ZERO, VR17)
For zero adjustment of X-SCAN meter indication.
- o Y scanning zero control (Y-SCAN ZERO, VR7)
For zero adjustment of Y-SCAN meter indication.

- o Test point (TP10)
For measuring emission current (max. emission current corresponds to +5 V read out).
- o Test point (TP11)
Ground terminal for ACC (accelerating voltage) and EMISSION (emission current) measurement.
- o Test point (TP12)
For measuring ACC (-15 kV corresponds to -10 V readout).
- o IC (IC1)
For X-POSITION meter indication.
- o IC (IC2)
For X-SCAN meter indication.
- o IC (IC3)
For Y-POSITION meter indication.
- o IC (IC4)
For Y-SCAN meter indication.
- o IC (IC5)
For DEF current setting and EMISSION control external signal.
- o IC (IC6)
For generating +15 V constant voltage.
- o IC (IC7)
For generating -15 V constant voltage.
- o IC (IC8)
A buffer amplifier to input external control signals for X/Y POSITION and X/Y SCAN control.
- o Relay (RY1)
For V (vacuum) INTERLOCK detection.
- o Relay (RY2)
For W (cooling water) INTERLOCK detection.
- o Relay (RY3)
For AUX INTERLOCK detection.
- o Relay (RY4)
For selecting EMSN FINE in the external emission control mode.
- o Relay (RY5)
For selecting switch operation by external signals.
- o Relay (RY6)
For selecting EMISSION control by external signals.

- o Relay (RY7)
For selecting POSITION control by external signals.
- o Relay (RY8)
For selecting SCAN control by external signals.
- o Relay (RY9)
For selecting SCAN signal (triangular wave) external control.
- o Relay (RY10)
For selecting JEBG-102U GUN.
- o Relay (RY11)
For selecting JEBG-102U/-163M GUN.
Note: Reverse contact is used for selecting JEBG-203U/303U GUN.
- o Relay (RY12)
For selecting JEBG-163M GUN.
- o Relay (RY13)
For using with options.



[Fig. 3-16] C102 Control Board (C102-PCB)

M) Cable set (R-UNIT)

These cables are used to connect PS-RACK and GUN, PS-RACK and CONTROLLER, and CONTROLLER and the user's equipment.

1) PS-RACK and CONTROLLER

- o E1 cable (W1, 24-wire, 6 m)
Provided with 24-pin connectors at both ends, this cable connects E-UNIT and CONTROLLER.
- o E2 cable (W2, 36-wire, 6 m)
Provided with 34-pin connectors at both ends, this cable connects E-UNIT and CONTROLLER.
- o GND cable (W8, 8 mm² green, 6 m)
Connects GND terminal of CONTROLLER and the GND board (TM3 of V-UNIT) of PS-RACK.

2) PS-RACK and GUN

- o COIL cable (W3, 6-wire, 6.5 m)
Used for DEF/SCAN COIL power feeding, this cable connects M-UNIT and the low-voltage feedthrough terminal (LVT) of the vacuum evaporation chamber (CHAMBER) to feed COIL power to GUN.
This cable is provided with 7-pin connectors at both ends.
- o HV cables (W4, 5.5 m x 2)
Connects two 5.5 V terminals of the filament transformer (T2) of V-UNIT and the high-voltage feedthrough terminals (HVTs) of CHAMBER to feed ACC to GUN.
- o Emission return cable (W5, 8 mm² red, 5.5 m)
Connects the GND board (TM3 of V-UNIT) of PS-RACK and the GND point of CHAMBER (near GUN).

3) CONTROLLER and user's equipment

- o INTLK cable (W6, 7-wire)
Only the JST-F Series side is fitted with a 12-pin connector.
Used for INTERLOCK signal input.

Wire color	Use		Contacts provided by user
Black	Common		
Brown	V (vacuum)	For GUN 1	
Red	W (cooling water)	For GUN 1	
Yellow	AUX	For GUN 1	
Green	V	For GUN 2	
Blue	W	For GUN 2	
White	AUX	For GUN 2	

Note: The wires for GUN 2 need to be connected only when two GUNS are used selectively (optional spec.).

o GUN ON cable (W7, 5-wire)

Only the JST-F Series side is fitted with an 8-pin connector.
Used for ACC ON and GUN ON check signal output.

Wire color	Use	
Black	Common	
White	ACC ON check	For GUN 1
Red	GUN ON check	For GUN 1
Green	ACC ON check	For GUN 2
Yellow	GUN ON check	For GUN 2

Note: The wires for GUN 2 output check signals only when two GUNs are used selectively (optional spec.).

o Extension cable (W9, 14-wire, 6 m)

Used when EMISSION, X/Y POSITION and X/Y SCAN controls on the setting unit are removed from CONTROLLER to use as a remote controller.

[4] INSTALLATION

1. Electron Gun and Feedthrough Terminal

Note: Before proceeding with the operation below, read the instruction manual of the electron gun (GUN) to be used.

- o The distance between the high voltage (HV) parts and the other parts should be at least 10 mm.
- o Keep a gas inlet well away from the HV portion of GUN in case gas is introduced into the vacuum evaporation chamber (CHAMBER) for ion plating, etc. because vacuum pressure of CHAMBER will partially increase and arc discharge (discharge) may result.
- o It is necessary that the HV feedthrough terminals (HVTs) of CHAMBER be installed near the accelerating voltage terminals (ACCTs) of GUN to make the shortest wiring from HVT to ACCT for stable GUN operation.
- o Install the grounding point (6-mm-dia. bolt) near the GUN mount portion of the base plate of CHAMBER. Since this point is the grounding point of the entire vacuum device, it is very important.
- o The cable from the low voltage feedthrough terminal (LVT) of CHAMBER to the low voltage connection terminals of GUN (GUN LVT) is covered with a metal tubing. The minimum bend radius of the metal tubing is 20 mm.
- o Do not install a strong magnetic device in the vicinity of GUN. (It should be at least 100 mm away.)
Since the electron beam (EB) is deflected by a magnetic field, the surrounding magnetic field might adversely affect the EB shape, etc.

A) JEBG-102U Series Electron Gun (102U GUN)

(Refer to Fig. 4-1 when installing 102U GUN.)

- 1) Install 102U GUN on the base plate of CHAMBER, using the two 6-mm-dia bolts.
- 2) A cooling water flow rate of at least 10 lit./min (pressure₂ difference between water inlet and outlet should be 2 to 2.5 kg/cm²), and a temperature of 25°C or less are required. Since a pipe fixture (8 mm O.D.) and a union nut are provided, connect the user's cooling water system (including water feedthroughs of CHAMBER) to the pipe fixture.
- 3) 102U GUN has a shaft of 8 mm diameter to rotate the hearth with 4 crucibles, and one rotation₂ of the shaft results in one crucible shift. (Rotation torque: 6 kg/cm²)
A mechanism to drive the rotation shaft from the outside of CHAMBER should be provided by the user.
- 4) The ideal mounting position of HVT is given in Fig. 4-1.
The distance between HVT and ACCT of 102U GUN should be as short as possible for discharge prevention.

- 5) Install LVT within 400 mm of 102U GUN.
- 6) Wire to deflection coil (DEF COIL) and scanning coil (SCAN COIL).
Remove the cover of the low voltage connecting terminals (GUN LVT) of 102U GUN and connect the LV lead cable from LVT. The wires of the cable have different colors for each coil connection.

White/green for DEF COIL, Red/black for X-SCAN COIL and Blue/yellow for Y-SCAN COIL
- 7) Connect HVTs (two units) of CHAMBER and ACCTs (two units) of 102U GUN by the two Cu wires of more than 2 mm dia.
- 8) HV cover should be provided by the user.
To minimize the effect of discharge, it is necessary to cover HVT, HV lead wire, and the HV portion of 102U GUN with a non-magnetic material (stainless steel, Cu, etc.) cover. The cover must always be grounded to the base plate of CHAMBER or the like.

B) JEBG-203U Series Electron Gun(203U GUN)

(Refer to Fig. 4-2 when installing 203U GUN.)

- 1) Install 203U GUN on the base plate of CHAMBER, using the four 5-mm-dia. bolts.
- 2) A cooling water₂ flow rate of at least 10 lit./min (pressure difference 2 to 2.5 kg/cm²), and a temperature of 25°C or less are required. Since a pipe fixture (8 mm O.D.) and a union nut are provided, connect the user's cooling water system (including water feedthrough of CHAMBER) to the pipe fixture.
- 3) 203U GUN has a shaft of 8 mm diameter to rotate the hearth with 6 crucibles, and one rotation₂ of the shaft results in one crucible shift. (Rotation torque: 6 kg/cm².)
A mechanism to drive the rotation shaft from the outside of CHAMBER should be provided by the user.
The rotation shaft is installable at the right or left side of 203U GUN.
- 4) The ideal installing position of HVT is given in Fig. 4-2.
The distance between HVTs and ACCTs of 203U GUN should be as short as possible for discharge prevention. ACCTs of 203U GUN is installable at the right or left side of 203U GUN.
- 5) Install LVT within 400 mm of 203U GUN.
- 6) Wire to scanning coil (SCAN COIL).
Remove the cover of the low voltage connecting terminals (GUN LVT) of 203U GUN and connect the LV lead cable from LVT. The wires of the cable have different colors for each coil connection.

Red/black for X-SCAN COIL, and Blue/yellow for Y-SCAN COIL.

- 7) Connect HVTs (two units) of CHAMBER and ACCTs (two unit) of 203U GUN by the two Cu wires of more than 2 mm dia.
- 8) HV cover should be provided by user.
To minimize the effect of discharge, it is necessary to cover HVT, HV lead wire, and the HV portion of 203U GUN with a non-magnetic material (stainless steel, Cu, etc.) cover. The cover must always be grounded to the base plate of CHAMBER or the like.

C) JEBG-163M Series Electron Gun (163M GUN)

(Refer to Fig. 4-3 when installing 163M GUN.)

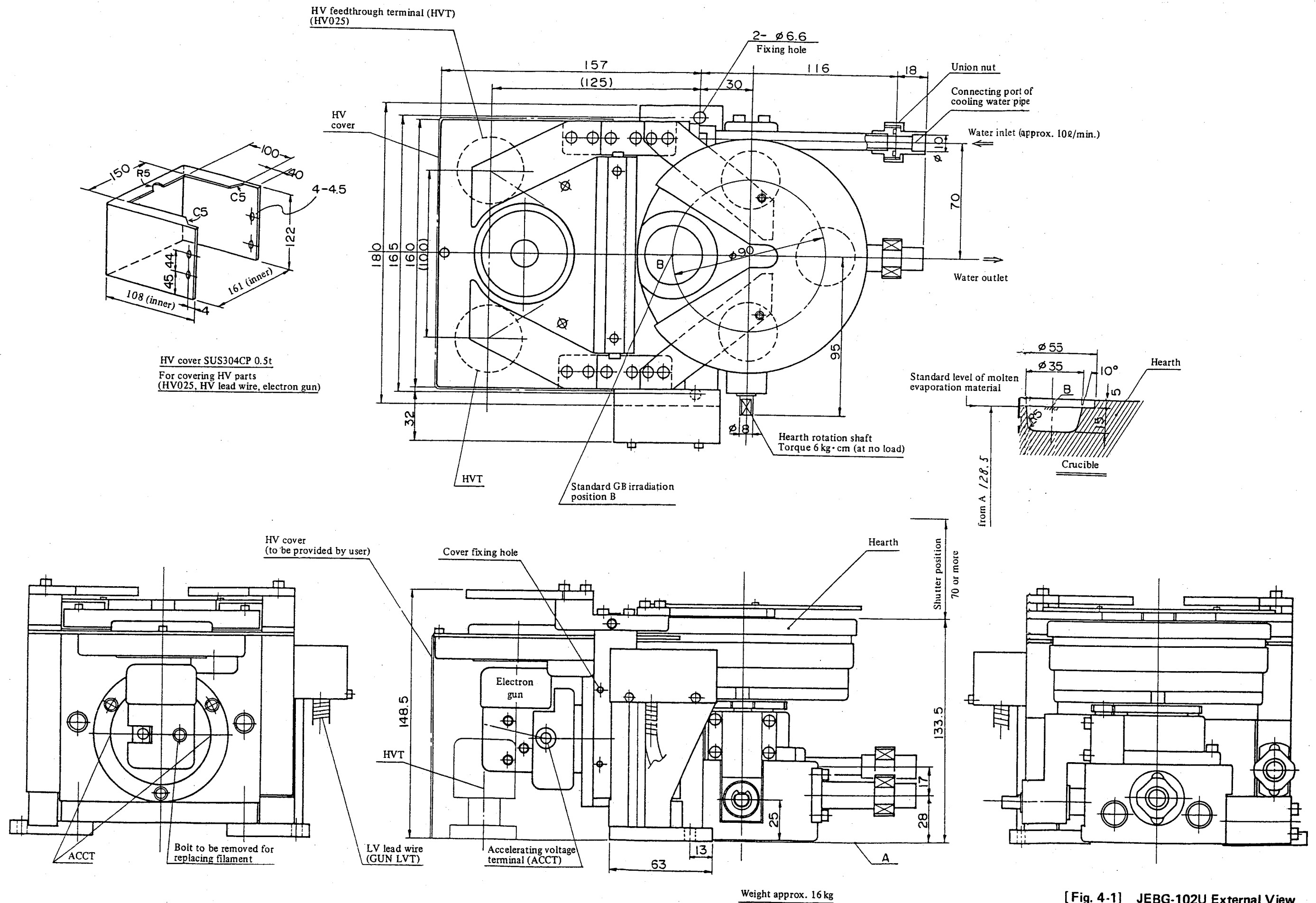
- 1) Install 163M GUN on the base plate of CHAMBER, using the four 5-mm-dia. bolts.
- 2) A cooling water flow rate of at least 10 lit./min (pressure difference: 2 to 2.5 kg/cm²) and a temperature of 25°C or less are required.
Since a pipe fixture (8 mm O.D.) and a union nut are provided, connect the user's cooling water system (including water feedthroughs of CHAMBER) to the pipe fixture.
- 3) The ideal installing position of HVT is given in Fig. 4-3.
The distance between HVTs and ACCTs of 163M GUN should be as short as possible for discharge prevention.
- 4) Install LVT within 400 mm of 163M GUN.
- 5) Wire to deflection coil (DEF COIL).
Connect LVT and the coil terminals of 163M GUN by the LV lead cable. The white wire of the cable should be connected to the right side of the DEF COIL terminal, and the green wire to the left side of the DEF COIL terminal.
- 6) Connect HVTs of CHAMBER and ACCTs of 163M GUN by the two Cu wires of more than 2 mm dia.
When the HV lead wire is passed through the front side of the filament, the wire should be passed through the outside of the polepiece. Otherwise, the EB shape may be distorted resulting in poor evaporation rate.
- 7) HV cover should be provided by the user.
To minimize the effect of discharge, it is necessary to cover HVT, HV lead wire, and the HV portion of 163M GUN with a non-magnetic material (stainless steel, Cu, etc.) cover. The cover must always be grounded to the base plate of CHAMBER or the like.

D) JEBG-303U Series Electron Gun (303U GUN)

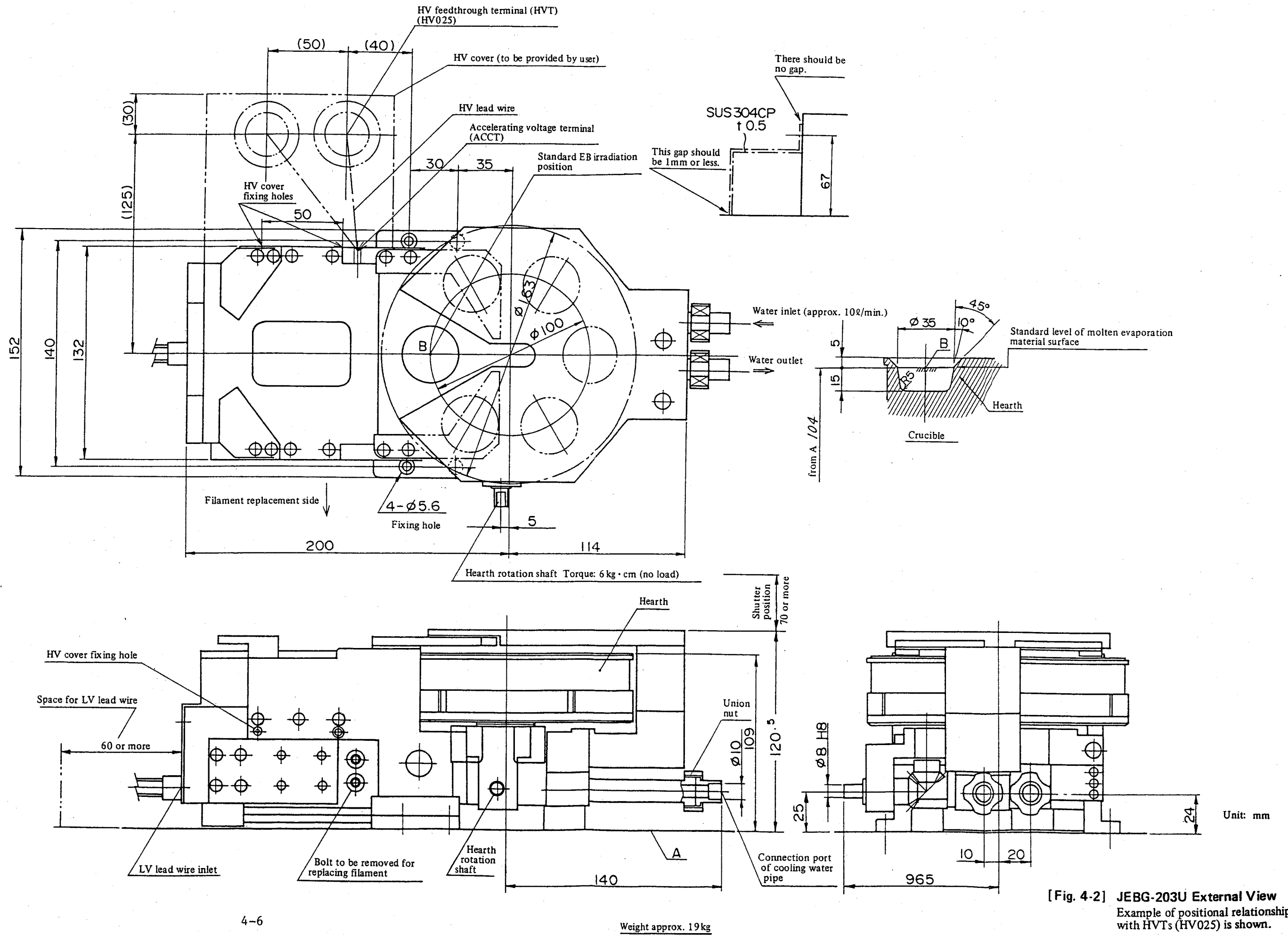
(Refer to Fig. 4-4 when installing 303U GUN.)

- 1) Install 303U GUN on the base plate of CHAMBER, using the four 5-mm-dia. bolts.
- 2) A cooling water flow rate of at least 10 lit./min (pressure difference: 2 to 2.5 kg/cm²), and a temperature of 25°C or less are required. Since a pipe fixture (8 mm O.D.) and a union nut are provided, connect the user's cooling water system (including water feedthroughs of CHAMBER) to the pipe fixture.
A hearth with crucible is separated from 303U GUN, so the cooling water system for the hearth is also required separately.
- 3) The ideal installing position of HVT is given in Fig. 4-4. The distance between HVTs and ACCTs of 303U GUN should be as short as possible for discharge prevention.
- 4) Install LVT within 400 mm of 303U GUN.
- 5) Wire to scanning coil (SCAN COIL).
Remove the cover of the low voltage connection terminals (GUN LVT) of 303U GUN, and connect LVT of CHAMBER and GUN LVT by the LV lead cable. The wires of the cable have different colors for each coil connection.

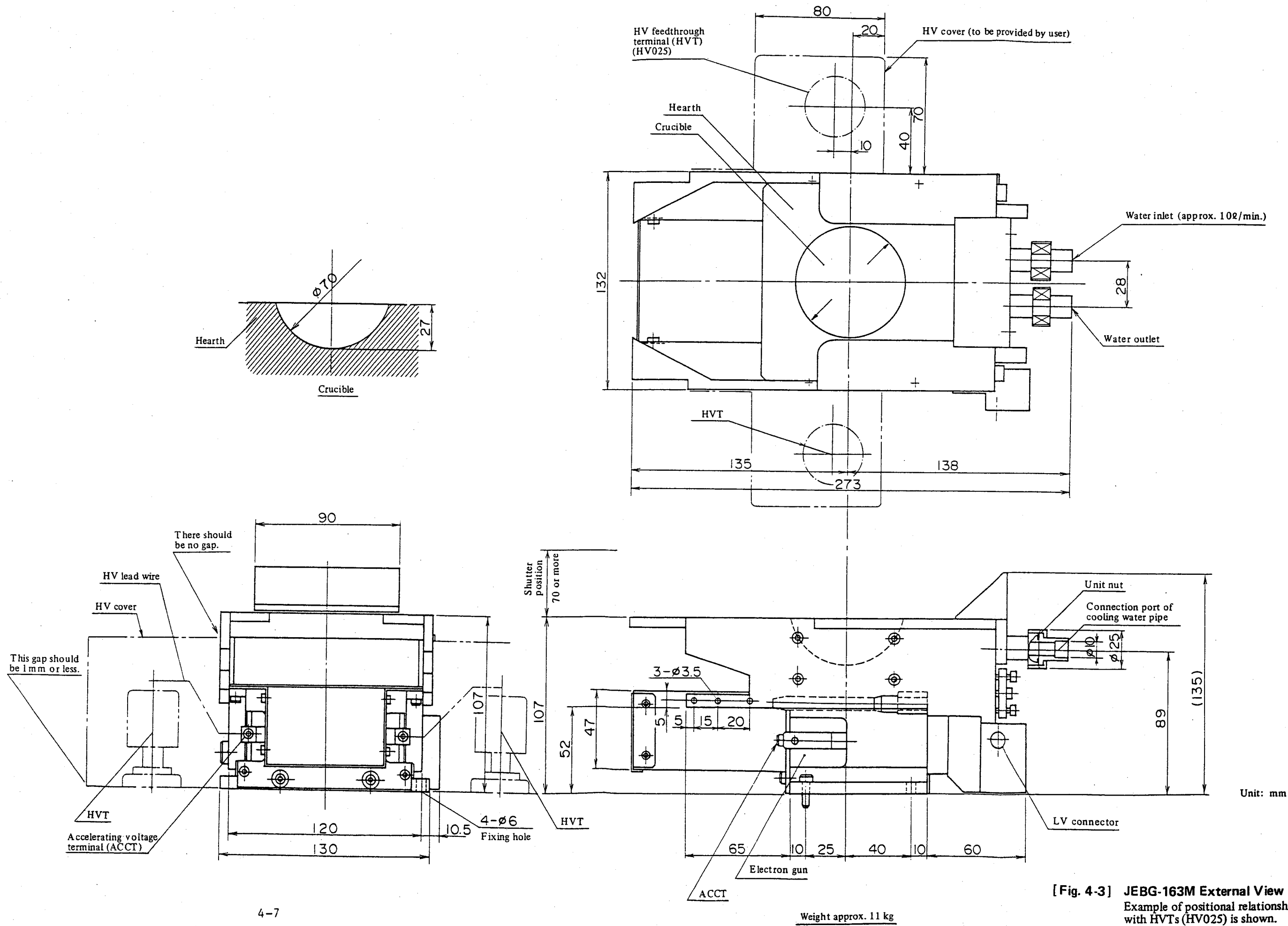
Red/black for X-SCAN COIL, and Blue/yellow for Y-SCAN COIL.
- 6) Connect HVTs of CHAMBER and ACCTs of 303U GUN by the two Cu wires of more than 2 mm dia.
- 7) HV cover should be provided by the user.
To minimize the effect of discharge, it is necessary to cover HVT, HV lead wire, and the HV portion of 303U GUN with a non-magnetic material (stainless steel, Cu, etc.) cover. The cover must always be grounded to the base plate of CHAMBER or the like.



[Fig. 4-1] JEBG-102U External View
Example of positional relationship with HVTs (HV025) is shown.



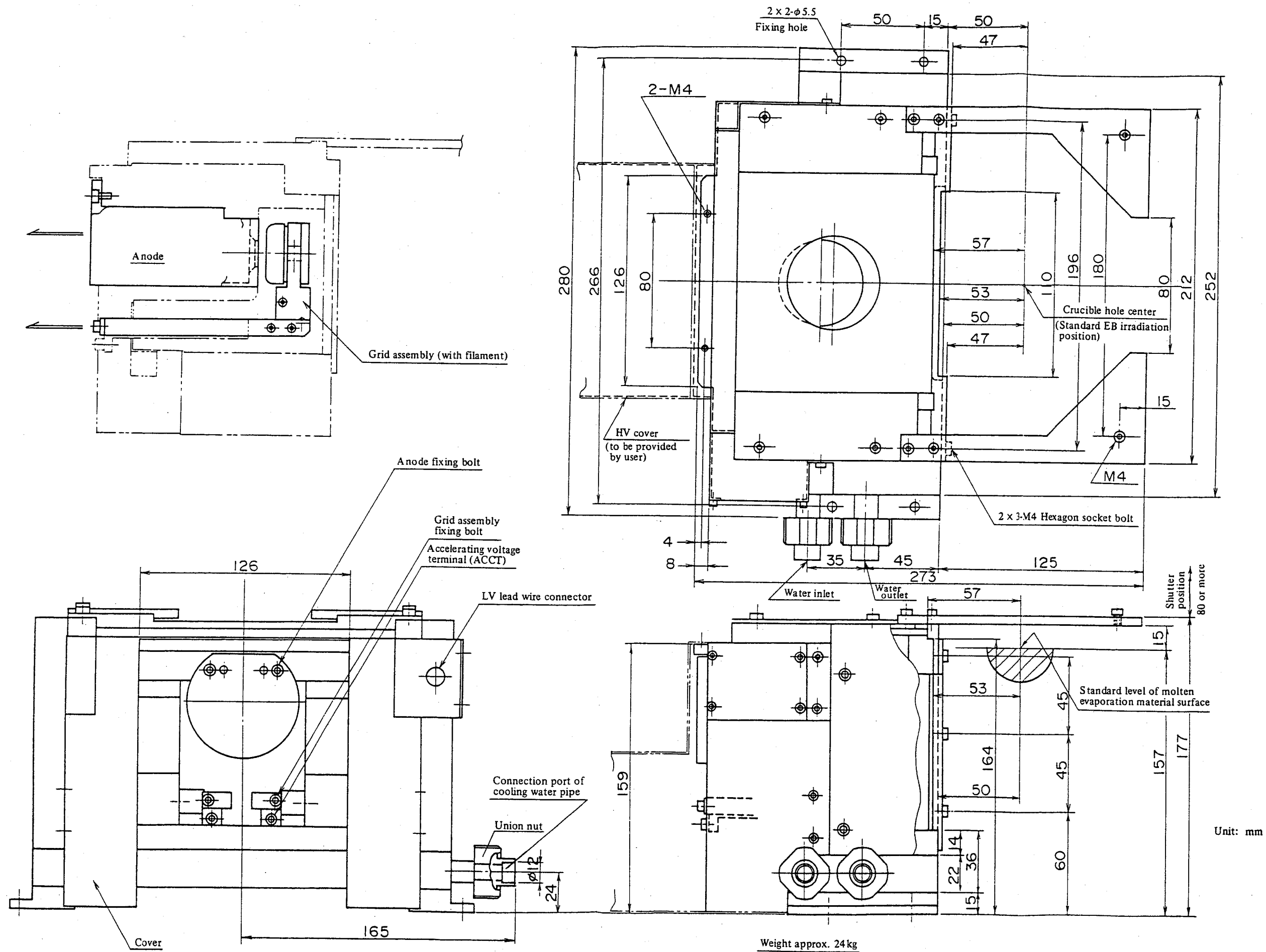
[Fig. 4-2] JEBG-203U External View
 Example of positional relationship with HVTs (HV025) is shown.



[Fig. 4-3] JEBG-163M External View
 Example of positional relationship
 with HVTs (HV025) is shown.

Weight approx. 11 kg

Unit: mm



[Fig. 4-4] JEBG-303U External View (without crucible)

2. Shutter and Crystal Sensor of Film Thickness Monitor

A) Shutter

- 1) Install the shutter in an area that is at least 70 mm away from the top of the hearth (with crucible).
- 2) The shutter should be made of a non-magnetic material such as stainless steel.

B) Crystal sensor of thickness monitor

- 1) Install the sensor at least 250 mm away from the evaporation source.
- 2) Use a water cooling cover to cover the sensor if the temperature in the vacuum evaporation chamber (CHAMBER) reaches 250 C or more. Otherwise, the sensor crystal may malfunction.
- 3) Cover the lead wire of the sensor with aluminum foil or the like.
- 4) Do not expose the sensor directly to a heat source such as a halogen lamp.

3. Power Supply Rack (PS-RACK) and Control Unit (CONTROLLER)

A) Power supply and cables (to be provided by the user)

- 1) Input power supply: 3 phase 200 V \pm 10% 50/60 Hz
 - For JST- 3F: 10 kVA NFB(nonfuse breaker) capacity 40 A or more
 - For JST-10F: 15 kVA NFB 60 A or more
 - For JST-16F: 25 kVA NFB 100 A or more

Note: When using a leakage breaker, select a rating of 70 to 100 mA. If the rating is lower, the breaker may operate at the time of discharge.

- 2) Power input cables
 - For JST- 3F: 8 mm² 3-wire cable (4-wire)
 - For JST-10F: 8 mm² 3-wire cable (4-wire)
 - For JST-16F: 14 mm² 3-wire cable (4-wire)
- 3) Grounding
 - Ground resistance: 10 ohms or less
 - Grounding cable: 14 mm² or more
- 4) Interlock: Contact capacity should be 24 V/2 A or more...L load
 - Vacuum interlock: Provide a contact that closes at a vacuum evaporation chamber (CHAMBER) pressure of 6.65 x 10⁻²Pa (5 x 10⁻⁴ Torr) or less.

4) Interlock(cont'd)

- o Cooling water (for GUN) interlock: Provide a contact that closes at a water flow rate of 5 lit./min or more.
- o AUX interlock: For aux. use if necessary. If unnecessary, contact can be shorted with cable.

Notes: Provide two systems for optional two-GUN operation spec.

When the voltage fluctuation of the power supply is too large, use of the separate automatic voltage regulator (AVR) is recommended.

B) JST-F Series EB Source Power Supply (JST-F)

1) Installation of power supply rack (PS-RACK) and control unit (CONTROLLER or C-UNIT)

- o Install PS-RACK on a level floor. Keep the left, right, and back sides at least 0.5 m away from other devices for air cooling. For maintenance, however, PS-RACK should be movable to keep a 0.8 m or more clearance.

Note: Air is drawn in from the front and both sides, and discharged from the rear.

- o Secure PS-RACK with the stoppers. Four stoppers are near the casters. By turning them, they lower to secure PS-RACK to floor.
- o Install CONTROLLER on user's control console or on PS-RACK.

Note: Installation on PS-RACK is possible only with one GUN operation spec.

CONTROLLER dimensions: 481(W) x 300(D) x 150(H) mm

2) Input wiring (3-phase 200 V)

- o Delta connection input
 - . Since the S phase is grounded, the 0 V phase from ground (measured with the multimeter) should be connected to the S terminal. The electric potential between phases (R-S, S-T, and T-R) should be 200 V \pm 10%.
 - . Connect the phases to R, S, and T of terminal board Tm1 via the power line inlet of V-UNIT.
 - . The balance between the phases should be within 2 to 3%. (Erroneous operation sometimes results)
- o Star connection input
 - . Connect the neutral point to the E terminal of the terminal board Tm1.
 - . Connect the phases to R, S, and T of Tm1 via the power line inlet of V-UNIT.

C) Grounding wiring

The grounding wiring is very important for protecting human life, protecting the instrument against damage, and preventing noise leak. Although the basic diagram of grounding wiring is shown in Fig. 4-5, this diagram is not necessarily the best, considering the conditions at the installation site. By referring to this diagram, provide the best grounding condition at the user's site.

- 1) Connect the grounding point and the GUN mounting portion, by a copper belt (approx. 150 mm x 1 mm thickness).
- 2) Connect the grounding point and the₂portion of CHAMBER isolated from the groundng point, by a cable (5.5 mm² or more).
- 3) The isolated portions of the feedthrough terminals (HVT and LVT)s, where especially O-rings are used, should be connected to the grounding point.

D) Connection of CONTROLLER, PS-RACK, GUN and user's console

Note: Remove the right side and backside lower panels.

1) PS-RACK and CONTROLLER (Refer to Fig. 4-6.)

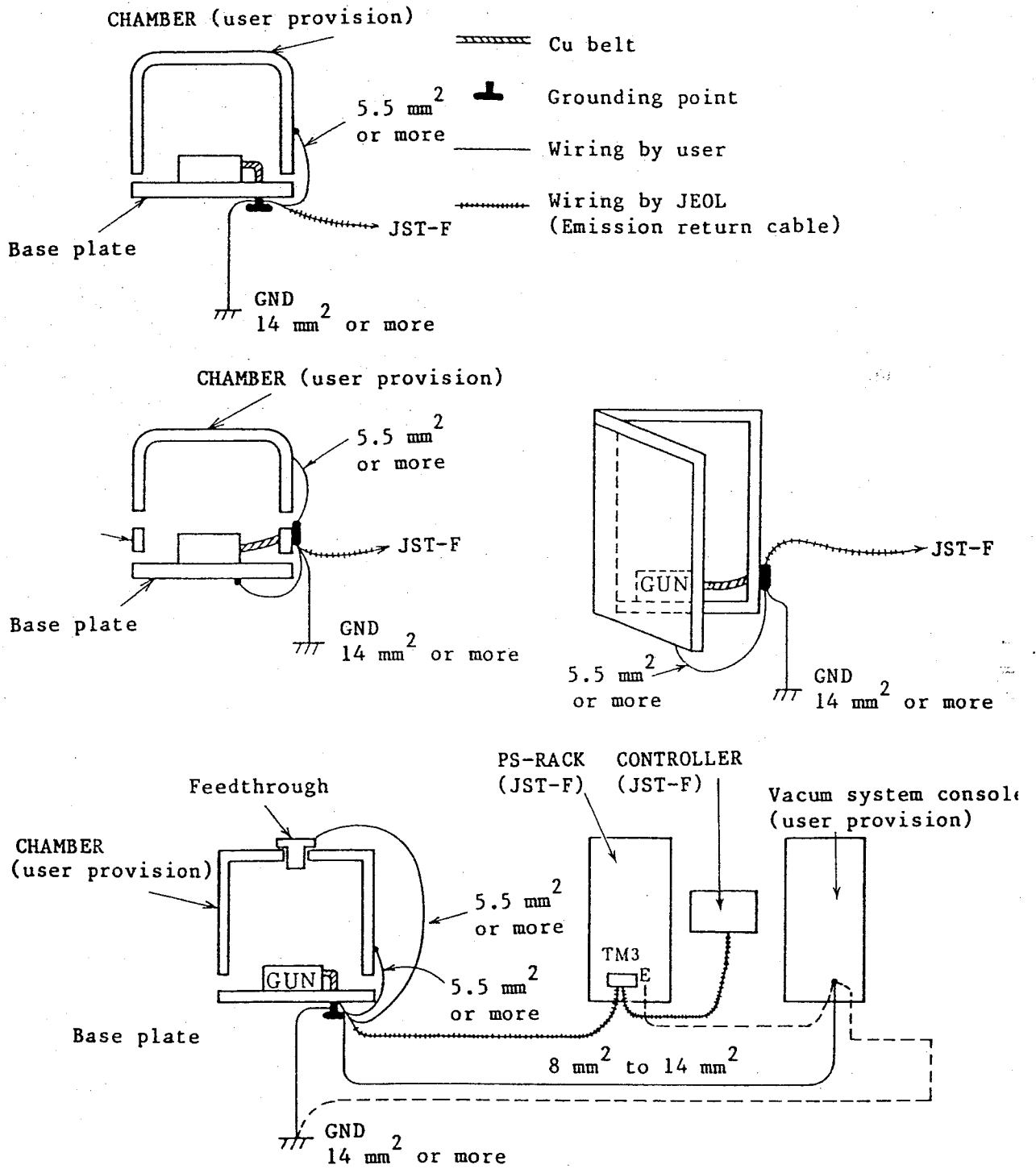
- o Connect the E1 connecor of E-UNIT and the E1 connector at the rear of CONTROLLER, by the W1 cable (24-wire with 24-pin connectors at both ends).
- o Connect the E2 connector of E-UNIT and the E2 connector at the rear of CONTROLLER, by the W2 cable (36-wire with 36-pin connectors at both ends).
- o Connect the TM3 terminal of V-UNIT₂ and the GND terminal at the rear of CONTROLLER, by the W8 cable(5.5 mm², green color).

2) PS-RACK and GUN (Refer to Fig. 4-6.)

- o Connect the COIL connector of M-UNIT and LVT of CHAMBER, by the W3 cable (6-wire with 7-pin COIL connectors at both ends).
- o Connect the 5.5 V terminals of V-UNIT's filament transformer T2 and two HVTs of CHAMBER, by the two W4 HV cables (black color) via the HV cable inlets of V-UNIT.
The shield grounding (green color) of the HV cable should be connected to grounding board TM3 of V-UNIT. Tighten the HV cable clamp and the HV cable inlets of V-UNIT.

Note: The HV cables and other wirings should be at least 0.5 m away from each other. Do not make coil-shaped wiring when the cable is too long for actual wiring distance. It is necessary to provide cable length to match actual wiring distance. Tighten well the 6-mm-dia. bolts and nats of HVTs for HV connection, otherwise, HVTs may be heated.

- o Connect the GND board of V-UNIT₂ and the GND point of CHAMBER, by the W5 emission return cable (8 mm², red color) via the emission return inlet of V-UNIT.



Solid-lines show principal wiring.

Dot-line wirings can be changed practical installation condition.

[Fig. 4-5] Grounding Wiring

3) CONTROLLER and user's console (Refer to Figs. 4-7, -8, -9.)

- o INTLK cable (7-wire with 12-pin connector at one end)

The connector side of the cable is connected to the INTLK connector at the rear of CONTROLLER.

The 7 wires of the cable end are connected to the interlock check contacts provided by the user. (Refer to Fig. 4-7.)

Wire color	Use
Black:	Common line for all contacts
Brown:	V (vacuum) interlock (For GUN 1, standard)
Red:	W (cooling water) interlock (ditto)
Yellow:	AUX (ditto)
Green:	V interlock (For GUN 2, in 2-GUN select. spec.)
Blue:	W interlock (ditto)
White:	AUX (ditto)

- o GUN ON cable (5-wire with 8-pin connector at one end)

The connector side of the cable is connected to the GUN ON connector at the rear of CONTROLLER.

The cable side is used to output check signals for the user's console. Since the contact capacities are 24 V/1 A, carefully monitor the loads when using these contacts. Otherwise, the contact may melt and weld. (Refer to Fig. 4-7.)

Wire color	Use
Black:	Common line for all contacts
White:	ACC ON (For GUN 1)
Red:	GUN (GUN, SCAN and DEF coils) ON (ditto)
Green:	ACC ON (For GUN 2, in 2-GUN select. spec., option)
Yellow:	GUN ON (ditto)

- o EMSN connector (10-pin) (Refer to Fig. 4-7.)

A dummy connector is attached.

Used for emission current control by external signals provided by the user.

Outputs of the connector are the following:

Pin No. 4: 0 to -10 V (-10 V corresponds to max. emission current)

Pin No. 5: Ground

Pin No. 3: 0 to -10 V (used for an optional spec. only)

- o EXT 1 connector (36-pin) (Refer to Fig. 4-8.)

A dummy connector is attached.

Used for input/output of signals and sequences for accelerating voltage (ACC) and emission current (EMISSION) controls. (Wiring should be done by the user.)

- o EXT 2 connector (50-pin) (Refer to Fig. 4-9.)

A dummy connector is attached.

Used for input/output of scanning coil (SCAN) and deflection (POSITION) related signals and sequence external signals. (Wiring should be done by the user.)

3) CONTROLLER and user's console(cont'd)

o X/Y MONITOR connectors (BNC)

Used for X/Y SCAN and X/Y POSITION monitoring. When a dual sweep oscilloscope is connected to the connectors, a lissajou waveform can be observed.

Note: The oscilloscope and probe should be provided by the user.

4. Electron Gun (GUN) and JST-F Series EB Source Power Supply (JST-F) Test Run

Note: Be sure to read the description of options when an option is installed.

- 1) Be sure that installation and wiring have been carried out as directed.
- 2) Be sure that the 3-phase 200 V input is normal. (3-phase 200 V \pm 10%, 50/60 Hz at the user's switchboard.)
- 3) Be sure the presence of evaporant in the crucible, and evacuate CHAMBER on which GUN is installed.
- 4) Install the panels which had been removed from PS-RACK.
- 5) Turn on the switches of the user's switchboard.
- 6) Turn on the POWER switch(NFB) of PS-RACK.
 - o The OFF(POWER) switch of A-UNIT, and PL1(red) and PL2(white) located above NFB light up and fans operate.
In case neither occurs, either 3-phase 200 V is not being supplied or fuses F1 to F4 on the rear of PS-RACK are burnt out.
 - o In case all but PL1(red) are lit, the phase rotation of the 3-phase 200 V input is not correct. Open the panel at the rear and replace the R-T wiring on the terminal board T1. (At this time, be sure to turn off the 3-phase 200 V line on the user's switchboard.)
- 7) Press the POWER ON switch of A-UNIT. (Green lights up.)
In case the green not lights up, the fuses F2 and F4 may burnout.
- 8) FUSE(P), FUSE(MG) and DOOR indications (under POWER ON/OFF switches of A-UNIT) light up. VS indication, however, will light up only in 2 GUN changeover/simultaneous operation spec.(option) when the HV vacuum relay (VS) and panel installation of D-UNIT are correct.
 - o FUSE(P) green light is ON when the fuses F5 and F6 at the rear of PS-RACK are normal.
 - o FUSE(MG) green light is ON when the nonfuse breaker(NFB) of G-UNIT and the fuses(FAN, +26 and -26) of M-UNIT are normal. However, for 2 to 3 seconds after POWER ON, the timer relay activates and stops indication.
 - o DOOR green light is ON when the panels on the front, rear, left and right sides of PS-RACK are correctly installed. In case the front panel of the optional AS-10F Arc Suppressor is installed correctly, DOOR also lights up.

- 9) Remove the front blank panel (the cover of the panel recess) removing the two screws holding it. Set the following switches to a position to be operated.
 - o Set the white capped switch (VS SW) upward for optional 2 GUN selective operation using the HV vacuum relay (VS).
(Set it to downward for standard.)
 - o Set the red capped switch (0.8/0.55 SW) for GUN filament selection. Set the switch to upward for the 0.8 mm dia. filament, and to downward for the 0.55 mm dia. filament.

Note: The 0.8 mm dia. filament is standard for the JEBG-303U, 203U and 168M GUNS, and the 0.55 mm dia. one is for the JEBG-102U. Since both filaments are usable for any GUNS, the switch should be set for the filament to be used.

- o Set the yellow capped switch (DCCT SW) to upward for 2 GUN simultaneous operation (option).
 - o Set the blue capped switch (FIL/EMI SW) for feedback selection. Upward setting selects FIL (filament heating current feedback) for low emission current control (5 mA or less).
- 10) Jumper pin setting of A-UNIT
The jumper pin was inserted into J1 only for standard spec.
 - 11) Remove the top panel and front blank panel from CONTROLLER.
 - 12) Set the GUN CHOICE switch (no colored cap, in the center by viewing) to GUN to be used.

102U.....Throw the switch toward the rear panel (red lights up)
203U/303U...Throw the switch to neutral (green lights up)
168M.....Throw the switch toward the front panel (yellow lights up)

- 13) Jumper pin setting of CONTROLLER
 - o For JST-3F: The jumperpin terminals J1 to 5, J8 to 17, J20, J23, J30 and J32 are shorted with jumper pins.
 - o For JST-10F and JST-16F: J1 to 5, J8 to 17, J19, J22, J30 and J32 are shorted with jumper pins.
 - o J24: No jumper pin in the standard spec.
A jumper pin is used when emission current is externally controlled but FINE (low emission current control) is only selected internally.]
 - o J25: No jumper pin in the standard spec.
A jumper pin is used when the scan signal (triangular wave) is input externally.

Note: The accompanying jumper pins can be used in case J24 and J25 should be shorted.

- 14) Set EXT/INT SW of CONTROLLER to INT, and throw the white, blue and red capped switches downward. (The front blank panel should be removed by removing the 2 screws.)
- 15) Be sure that INTERLOCK PS (green) is lit.
- 16) INTERLOCK V indication (green) lights up when the user provided contact closes at CHAMBER's vacuum pressure of less than 6.5×10^{-2} Pa (5×10^{-4} Torr).
- 17) INTERLOCK W indication (green) lights up when the user provided contact closes at a flow rate of GUN cooling water of 10 lit/min or more.
- 18) INTERLOCK AUX indication (green) lights up when the user provided AUX interlock item is normal.
- 19) INTERLOCK 256P indication (green) lights up when an option is used. No indication in the standard spec.
- 20) The OFF(POWER) switch lights up. OFF also lights up when the +24 V line is normal. It goes out when the ACC ON or FIL ON switch is pressed.

Note: The GUN 1 or GUN 2 indicator is lights up only when an optional 2 GUN changeover operation spec. is used.

A) JEBG-102U Series Electron Gun test run ... After execution of steps 1) to 20), the following steps should be carried out.

- 21) Throw the switch on X-UNIT outward (A-UNIT panel side).
- 22) Set CONTROLLER's GUN CHOICE switch to 102U (red lights up).
- 23) Be sure that CONTROLLER's INTERLOCK indicators (green lights of PS, V, W, and AUX) are lit.
- 24) Be sure that CONTROLLER's ALARM indicators (red lights of ACC, EMSN, FIL and DEF) are not lit.
- 25) Select CONTROLLER's RANGE 2 (red lights up) for the EMISSION meter and set the EMISSION dial to 0.
- 26) Press the FIL ON switch (white lights up).
- 27) Gradually turn up CONTROLLER's EMISSION dial and set it in the 250 mA to 350 mA (max.) range indication of the EMISSION meter.
If the dial is turned too rapidly, the filament shape may change. Follow the same procedure after filament exchange to prevent filament shape change and abnormal initial discharge.
- 28) Set the X and Y POSITION knobs to the center.

- 29) Set the X and Y SCAN knobs to minimum.
- 30) Set the EMISSION dial to 0, and press the OFF switch (white lights up).
- 31) Select ACC (red lights up) of the MODE SELECT switch.
- 32) Press the ACC ON switch (white lights up).
- 33) Set the accelerating voltage (ACC) with the ACC ADJ knob in CONTROLLER's panel recess while viewing the ACC/DEF/XY SCAN meter (black scale).

For JST-3F:	ACC range 4 kV to 8 kV
For JST-10F and JST-16F:	ACC range 4 kV to 10 kV
- 34) Press the FIL ON switch (white lights up).
- 35) Turn up the EMISSION dial to increase the emission current (EMISSION) while viewing the evaporant in the crucible, and set EMISSION allowing the electron beam (EB) position observation.
(Several mA to 100 mA varies with the evaporant.)
- 36) Align the EB position to the crucible center by turning the X POSITION knob.
- 37) Select DEF (green lights up) of MODE SELECT, and remember the meter (green scale) indication.
- 38) Set the X POSITION knob to the center, and adjust the variable resistor XP-BALANCE (5th from right, in the panel recess of CONTROLLER).
Set it to the value that was remembered from the meter in step 37) above.
Note: Set the X POSITION knob to the center. The EB position is set to the crucible center.
- 39) Adjust the variable resistor XP-GAIN (4th from right, in the panel recess of CONTROLLER) so that the maximum EB position shift range in X direction is equal to the crucible diameter when the X POSITION knob is fully turned to the left and right.
- 40) With the X POSITION knob set at its center position, adjust the variable resistor YP-GAIN (2nd from right, in the panel recess of CONTROLLER) so that the maximum EB shift range in Y direction is equal to the crucible diameter when the Y POSITION knob is fully turned left and right.
At the same time, select YP (yellow lights up) of MODE SELECT, and be sure that the meter (orange scale) needle deflects 0 to left and right.
Note: To adjust the meter operating range, use the variable resistor VR5 in CONTROLLER.

- 41) Set the X/Y POSITION knobs to the center, and adjust variable resistor XS-GAIN (3rd from right, in the panel recess of CONTROLLER) so that the maximum scanning width (in X direction) is equal to the crucible diameter when the X SCAN knob is set to the maximum. At the same time, select XS (green lights up) of MODE SELECT, and check that the meter (green scale) needle deflects.

Note: To adjust the meter operating range, use the variable resistor VR4 in CONTROLLER.

- 42) Set the X SCAN knob to minimum, and the Y SCAN knob to maximum. Adjust variable resistor YS-GAIN (on right, in the panel recess of CONTROLLER) so that the maximum scanning width in Y direction is equal to the crucible diameter. At the same time, select YS (green lights up) of MODE SELECT, and check the meter (green scale) needle deflects.

Note: To adjust the meter operating range, use the variable resistor VR8 in CONTROLLER.

- 43) Set the X and Y POSITION knobs to center, and the X and Y SCAN knobs to maximum, and turn up the EMISSION dial to check the emission current flows while changing over from RANGE 1 to RANGE 2 then RANGE 3.
- 44) To obtain low emission current for filament preheating even the EMISSION dial is set at 0, adjust the variable resistor EMSN (7th from right, in the panel recess of CONTROLLER).
- 45) Set the EMISSION dial to 0, and press the OFF switch (white lights up).

B) JEBG-203U or 303U Series Electron Gun test run ... After execution of steps 1) to 20), the following steps should be carried out.

- 21) Set the GUN CHOICE switch in CONTROLLER to 203U/303U (green lights up).
- 22) Be sure that CONTROLLER's INTERLOCK indications (green lights for PS, V, W, and AUX) are lit.
- 23) Be sure that CONTROLLER's ALARM indications (red lights for ACC, EMSN, FIL and DEF) are not lit.
- 24) Select CONTROLLER's RANGE 2 (red lights up) for the EMISSION meter and set the EMISSION dial to 0.
- 25) Press the FIL ON switch (white lights up).
- 26) Gradually turn up the EMISSION dial of CONTROLLER and set it in the 250 mA to 350 mA (max.) range indication of the EMISSION meter. If the dial is turned too rapidly, the filament shape may change. Follow the same procedure after filament exchange to prevent filament shape change and abnormal initial discharge.

- 27) Set the EMISSION dial to 0, and press the OFF switch (white lights up).
- 28) Set X/Y POSITION knobs to center, and X/Y SCAN knobs to minimum.
- 29) Remove the COIL cable from the COIL connector(7-pin) of M-UNIT at the rear of PS-RACK.
- 30) Select ACC (red lights up) of MODE SELECT, and press the ACC ON switch (white lights up).
- 31) Set the accelerating voltage(ACC) with the ACC ADJ knob in CONTROLLER's panel recess (the blank panel should be removed) while viewing the ACC/DEF/XY SCAN meter(black scale).

For JST-3F: ACC range 4 kV to 7 kV

For JST-10F and JST-16F: ACC range 4 kV to 10 kV

- 32) Press the FIL ON switch (white lights up), and check that EB position is in the crucible center by turning up the EMISSION dial to increase the emission current(EMISSION) while viewing the evaporant in the crucible. If the EB position is not in the crucible center, press the OFF(ACC/FIL) switch and vent CHAMBER to readjust the adjust-bar and fine-adjust-block of 203U GUN or readjust the fine-adjust-block of 303U GUN.

Note: When the EB position is close to the filament, use thicker adjust-bar than the currently used one for shifting the fine-adjust-block toward the magnet to align EB to the crucible center by weaken the magnetic field of the magnet. When EB is far from the filament, use the thinner bar to shift the block closer toward the magnet to align EB to the crucible center by strengthen the magnetic field.

- 33) Connect the removed COIL cable connector to M-UNIT's COIL connector.
- 34) Select XP (yellow lights up) of MODE SELECT of CONTROLLER.
- 35) Adjust the variable resistor XP-GAIN (4th from right, in the panel recess of CONTROLLER) so that the maximum EB position shift range in X direction is equal to the crucible diameter when the X POSITION knob is fully turned to the left and right. Check that the meter (orange scale) needle deflects 0 to left or right.

Note: To adjust the meter operating range, use the variable resistor VR1 in CONTROLLER.

- 36) With the X POSITION knob set at its center position, adjust the variable resistor YP-GAIN (2nd from right, in the panel recess of CONTROLLER) so that the maximum EB position shift range in Y direction is equal to the crucible diameter when the Y POSITION knob is fully turned left and right. At the same time, select YP (yellow lights up) of MODE SELECT, and check that the meter (orange scale) needle deflects 0 to left and right.

Note: To adjust the meter operating range, use the variable resistor VR5 in CONTROLLER.

- 37) Set the X/Y POSITION knobs to the center, and adjust the variable resistor XS-GAIN (3rd from right, in the panel recess of CONTROLLER) so that the maximum scanning width in X direction is equal to the crucible diameter when the X SCAN knob is set to the maximum.
At the same time, select XS (green lights up) of MODE SELECT, and check the meter (green scale) needle deflects.

Note: To adjust the meter operating range, use the variable resistor VR4 in CONTROLLER.

- 38) Set the X SCAN knob to minimum, and the Y SCAN knob to maximum. Adjust the variable resistor YS-GAIN (on right, in the panel recess of CONTROLLER) so that the maximum scanning width in Y direction is equal to the crucible diameter.
At the same time, select YS (green lights up) of MODE SELECT, and check the meter (green scale) needle deflects.

Note: To adjust the meter operating range, use the variable resistor VR8 in CONTROLLER.

- 39) Set the X and Y POSITION knobs to center, and the X and Y SCAN knobs to maximum, and turn up the EMISSION dial to check the emission current flows while changing over from RANGE 1 to RANGE 2 then RANGE 3.

40) to 43) None

- 44) To obtain low emission current for filament preheating when the EMISSION dial is set at 0, adjust the EMSN variable resistor (7th from right, in the panel recess of CONTROLLER).

45) Set the EMISSION dial to 0, and press the OFF switch (white lights up).

C) JEBG-163M Series Electron GUN test run ... After execution of steps 1) to 20), execute the following steps.

- 21) Set the switch of X-UNIT to the PCB (printed circuit board) side, and remove photocoupler PC1.
- 22) Set GUN CHOICE SW in CONTROLLER to 163M (yellow lights up)
- 23) Check that CONTROLLER's INTERLOCK indicators (green lights of PS, V, W, and AUX) are lit.
- 24) Check that CONTROLLER's ALARM indicators (red lights of ACC, EMSN, FIL, and DEF) are not lit.
- 25) Select RANGE 2 for the EMISSION meter, and set the EMISSION dial to 0.
- 26) Press the FIL ON switch (white lights up).

- 27) Gradually turn up the EMISSION dial of CONTROLLER and set it in the 250 mA to 350 mA (max.) range indication of the EMISSION meter. If the dial is turned too rapidly, the filament shape may change. Follow the same procedure after filament exchange to prevent filament shape change and abnormal initial discharges.
 - 28) Remove the COIL cable connector from the COIL connector (7-pin) of M-UNIT at the rear of PS-RACK, and set the X POSITION knob to the center.
 - 29) Set the EMISSION dial to 0, and press the OFF switch (white lights up).
 - 30) Select ACC (red lights up) of MODE SELECT, and press the ACC ON switch (white lights up).
 - 31) Set the accelerating voltage (ACC) to 10 kV by turning the ACC ADJ knob (in the panel recess of CONTROLLER) while viewing the meter (black scale).
 - 32) Press the FIL ON switch (white lights up).
Turn up the EMISSION dial while viewing the crucible, and set the emission current to a value whereby the EB position can be recognized. The EB position should be at the edge of the crucible (farther from the filament).
- Note: For EB positioning, press the OFF(ACC and FIL) switch, vent CHAMBER, and adjust the short plate of 163M GUN. The EB position is far from the filament when the gap between the short plate and magnet is narrow; it is close to the filament when the gap is wide.
- 33) Connect the COIL cable to the COIL connector of M-UNIT, and connect the photocoupler PC1 of X-UNIT.
 - 34) Set the X POSITION knob to the center, and select DEF of MODE SELECT (green lights up).
 - 35) Adjust the variable resistor XP-BALANCE (5th from right, in the panel recess of CONTROLLER) and set the EB position so that it comes to the crucible center.
 - 36) Adjust the variable resistor XP-GAIN (4th from right, in the panel recess of CONTROLLER) so that the maximum EB position shift range in X direction is equal to the crucible diameter when the X POSITION knob is fully turned to the left and right. At the same time, check that the meter (green scale) needle deflects.
 - 37) Set the X POSITION knob to the center, turn up the EMISSION dial and check the EMISSION meter needle deflects.
 - 38) to 43) None
 - 44) To obtain low emission current for filament preheating when the EMISSION dial is set at 0, adjust the variable resistor EMSN (7th from right, in the panel recess of CONTROLLER).
 - 45) Set the EMISSION dial to 0, and press the OFF(ACC and FIL) switch (white lights up).

D) External control (When the user's external control system is available.)

46) Switch operation (by input signals)

Note: Connect the user's signal lines to the defined pin Nos. of the EXT 1 (36-pin) and EXT 2 (50-pin) connectors at the rear of CONTROLLER. (Refer to Figs. 4-8 and 4-9.)

- o Throw the white capped switch (in the panel recess of CONTROLLER) upward.
- o Set EXT/INT SW to EXT (red EXT lights up).
- o Be sure that the switches of A-UNIT are operated by the external POWER ON/OFF signals. (This can be done even at INT setting.)
- o Be sure that the switches of CONTROLLER are operated by the external ACC ON, FIL ON and OFF signals.
- o Be sure that FINE (low emission current control) can be selected when EMISSION is controlled externally.
- o Be sure that the scanning (SCAN) can be controlled by the external SCAN signal (triangular wave).

47) Contact check (for output signals)

Note; Connect the user's signal lines to the defined pin Nos. of the EXT 1 (36-pin) and EXT 2 (50-pin) connectors at the rear of CONTROLLER. (Refer to Figs. 4-8 and 4-9.)

- o Ready check
(ACC ON and FIL ON should be controllable.)
- o SW-EXT check
(The white capped switch should be throw upward and EXT/INT SW at EXT.)
- o ACC ON and FIL ON check
- o SCAN/POSITION-EXT check
(The red capped switch should be throw upward and EXT/INT SW at EXT.)
- o SCAN-EXT check
(In case of X/Y SCAN are controlled by the external triangular wave signals.)

48) EMISSION external control

Note: Connect the user's signal lines to the defined pin Nos. of the EMSN connector(10-pin) at the rear of CONTROLLER. (Refer to Fig. 4-7.)

- o Throw the blue capped switch (in the panel recess of CONTROLLER) upward.
- o Set EXT/INT SW to EXT (red lights up).

- o Control the emission current from 0 to max current by the external signals (0 to -10 V) with ACC ON and FIL ON.

Note: The above cannot be controlled with the EMISSION dial of CONTROLLER.

- o In case of low emission current control, FINE can be selected to improve the control accuracy.
Exsample: -10 V(external signal) corresponds to 100 mA(emission current).
- o FINE can be selected if the FINE signal is input externally or if the jumper pin terminal J24 of CONTROLLER is shorted. In case J24 is shorted, external control of the emission current is always set in the FINE mode.
- o Connect a multimeter (DC voltmeter) to TP3 and TP4 (FINE) in the panel recess of CONTROLLER, and adjust FINE variable resistor (6th from right, in the panel recess of CONTROLLER) while inputting -10 V externally. (Set to -1 V when 1/10 of max. emission current.)

49) SCAN and POSITION external control

Note: Connect the user's signal lines to the defined pin Nos. of the EXT 2 connector(50-pin) at the rear of CONTROLLER. (Refer to Fig. 4-9)

- o Throw the red capped switch (in the panel recess of CONTROLLER) upward.
- o Set EXT/INT SW to EXT (red lights up).
- o X POSITION is controlled by the external signals (+10 V to -10 V). The meter (orange scale) needle deflects when the MODE SELECT switch is selected to DEF (yellow lights up) for 102U/163M GUN or XP (yellow lights up) for 203U/303U GUN. (Minus current by +10 V, and plus current by -10 V.)
- o Y POSITION is controlled by the external signals (+10 V to -10 V). The meter (orange scale) needle deflects when MODE SELECT is selected to YP (yellow lights up). (Minus current by +10 V, and plus current by -10 V.)
- o X SCAN is controlled by the external signals (0 to +10 V). The meter (green scale) operates when MODE SELECT XS (green lights up) is selected. (Maximum scanning width by a external signal of +10 V.)
- o Y SCAN is controlled by the external signals (0 to +10 V). The meter (green scale) operates when MODE SELECT YS (green lights up) is selected. (Maximum scanning width by a external signal of +10 V.)

Note: X/Y SCAN and X/Y POSITION controls are only carried out externally. However, if the jumper pin is removed from J30 of CONTROLLER, POSITION control is carried out with the X/Y POSITION knobs of CONTROLLER.

50) SCAN signal for external control

Used when triangular wave signals for scanning control are externally input.

Note; Connect the user's signal lines to the defined pin Nos. of the EXT 2 connector (50-pin) at the rear of CONTROLLER. (Refer to Fig. 4-9.)

- o To select external control, set EXT/INT SW to EXT, and throw the white capped switch (in the panel recess of CONTROLLER) upward. (Refer to "step 46").)
- o Short the jumper pin terminal J25 of CONTROLLER with a jumper pin when carrying out steps not related to switch operation referred to "step 46)"
- o X SCAN control signal
50 Hz, 4 Vp-p(max.) triangular wave should be input.
- o Y SCAN control signal
500 Hz, 4 Vp-p(max.) triangular wave should be input.

Note: Scanning width control can be carried out with the X/Y SCAN knobs, and by the external signal in "step 49)".

E) With ST-AS10F Arc Suppressor (option)

51) Refer to "[7] OPTION 1 ".

F) With ST-202 (option)

The following steps should be carried out for only this option is used.

52) Install the ST-202 according to the description of "[8], (A) ST-202".

53) Press POWER ON of A-UNIT, and set the GUN 1/GUN 2 selection switch (GUN 1/2 SW) to GUN 1. (GUN 1 red indicator lights up.)

54) CONTROLLER's INTERLOCK green indicators light up.

Note: 256P indicator lights up only an option is used.

55) Check that the ACC/DEF/XY SCAN meter operates by turning the X/Y POSITION and X/Y SCAN knobs (MODE SELECT should be set to XP, YP, XS, YS or DEF).

56) Carry out a test run of GUN 1 according to "4., A) to C), 21) to 45)".

57) Set GUN 1/2 SW to GUN 2. (The GUN 2 red indicator lights up.)

58) Carry out the steps 55) and 56) for GUN 2.

F) With ST-202 (cont'd)

59) The following items are added to "4., D) External control".
(Refer to Fig. 4-10.)

- o Check that GUN 1/2 SW operation is carried out by the external GUN 1/GUN 2 selection signals. (contact input)
- o Check that GUN 1 or GUN 2 is selected. (contact output)

60) None

G) With ST-203 (option)

(When this option is used, the following steps should be carried out.)

52) Install the ST-203 according to the description of "[8], (B) ST-203".

53) Carry out test runs on both GUN 1 and GUN 2 according to "4., A) to D)".

Note: ACC setting can only be performed with CONTROLLER 1 for GUN 1.

54) to 60) None

H) With ST-204 (option)

(When this option is used, the following steps should be carried out.)

52) Install the ST-204 according to the discription of "[8], (C) ST-204".

53) Carry out a test run according to "4., F), 54) to 59)".

54) to 60) None

I) With ST-205 (option)

(When this option is used, the following steps should be carried out.)

52) Install the ST-205 according to the description of "[8], (D) ST-205.

53) Carryout a test run according to "4., G), 53)".

54) to 60) None

J) With ST-206 (option)

(When this option is used, the following steps should be executed.)

52) install the ST-206 according to the description of "[8], (E) ST-206".

53) GUN 1/2 SW of CONTROLLER 2(for GUN 2) should be set to GUN 2. If the switch is set to GUN 1, the switch not operates and the indicator also not lights up.

J) With ST-206 (cont'd)

54) Press POWER ON of A-UNIT, and set GUN 1/2 SW of CONTROLLER 1 (for GUN 1) to GUN 1. The GUN 1 red indicator of CONTROLLER 1 lights up.

55) Check that the indicators of INTERLOCK of CONTROLLER 1 are lit.

Note: The 256P indicator is lit only with an option is used.

56) Carry out a test run of GUN 1 according to "4., A) to C), 21) to 45)".

57) Set GUN 1/2 SW of CONTROLLER 1 to GUN 2. (The GUN 2 red indicator of CONTROLLER 2 for GUN 2 lights up.)

58) Be sure that the indicators of INTERLOCK of CONTROLLER 2 are lit.

Note: The 256P indicator is only lit when an optioin is used.

59) Carry out a test run of GUN 2 according to "4., A) to C), 21) to 45)".

Note: ACC should be set with CONTROLLER 1 for GUN 1 and CONTROLLER 2 for GUN 2.

60) External control(refer to Fig. 4-10)...The following are added to "4. D)"

Note: External control signals are input to CONTROLLER 1 and 2, and output from CONTROLLER 1 and 2 for GUN 1 and GUN 2 respectively.

- o GUN 1 and GUN 2 check signals

- o When a GUN 1 selection signal is input to CONTROLLER 1, GUN 1 related switch operation of CONTROLLER 1 can be carried out by external signals.

- o A GUN 2 selection signal should be input to both CONTROLLER 1 and 2 for GUN 2 selection.

K) With ST-207 (option)

(When this option is used, the following steps should be carried out.0

52) Install the ST-207 according to the description of "[8], (F) ST-207".

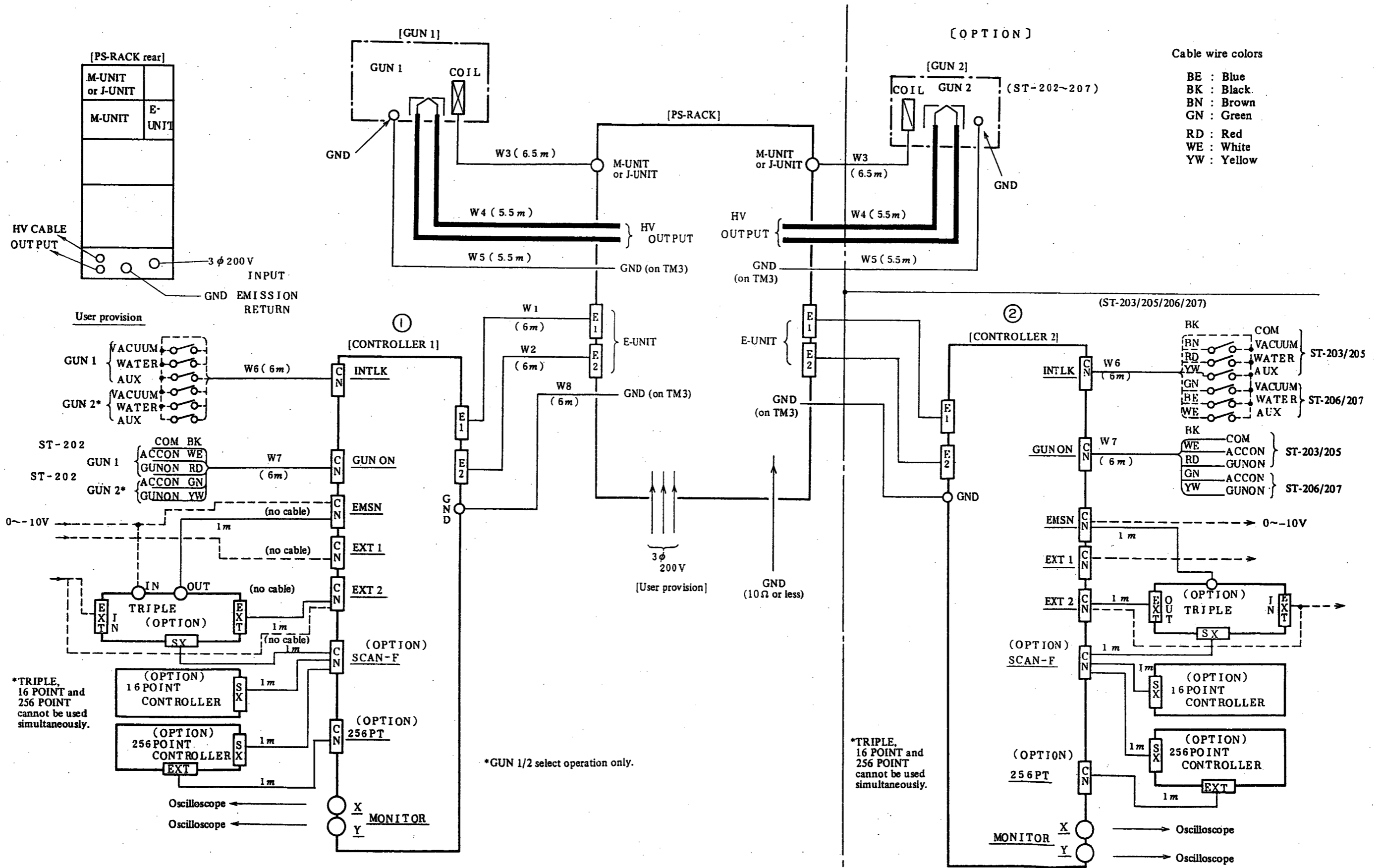
53) Carry out a test run according to "4., J), 53) to 60)".

L) With ST-EXTSIG (option)

(When this option is used, the following steps should be carried out.)

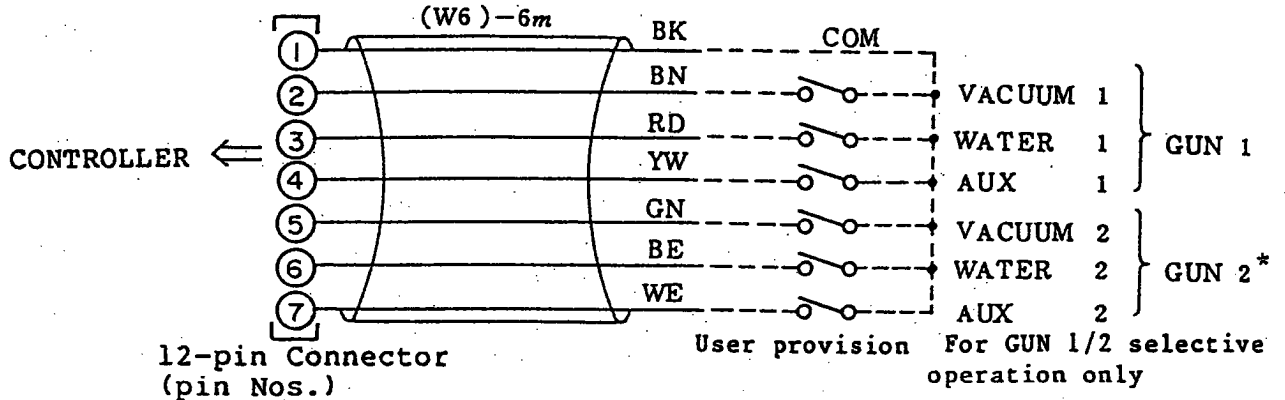
Note: Use two ST-EXTSIGs when two CONTROLLERS are employed.
(each CONTROLLER uses one ST-EXTSIG each.)

- 61) Install the ST-EXTSIG according to the description of "[8], (G) ST-EXTSIG".
- 62) Connect the user's signal lines to the defined pin Nos. of the EXT 1 (36-pin) and EXT 2(50-pin) at the rear of CONTROLLER.
(Refer to Figs. 4-10 and 4-11.)
- 63) Throw the white capped switch (in the panel recess of CONTROLLER) upward.
- 64) Set EXT/INT SW to EXT.
- 65) The following items are added to "4., D)":
 - [8], (G) ST-EXTSIG 1. Contacts for input
 2. Contacts for output
 3. Signal outputs



[Fig. 4-6] Connection

INTLK (interlock) CABLE

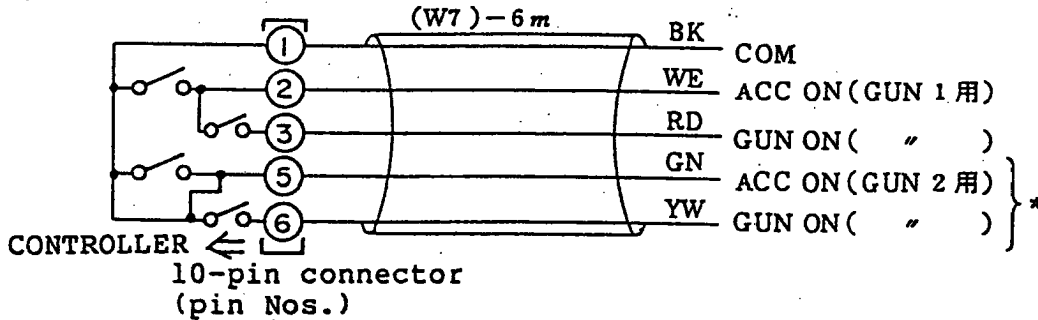


Note: When CONTROLLER 1 (for GUN 1) and CONTROLLER 2 (for GUN 2) are used in selective operation.

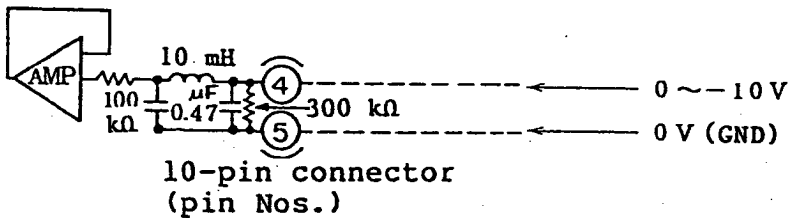
GUN 1 INTLK is connected to CONTROLLER 1 (for GUN 1).
 GUN 2 INTLK is connected to CONTROLLER 2 (for GUN 2).

When CONTROLLER 1 and 2 are used in simultaneous operation.
 GUN 1 and GUN 2 INTLKs are connected to CONTROLLER 1.
 (Pin Nos. 5, 6 and 7 are not used.)

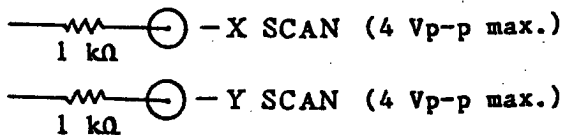
GUN ON CABLE



EMSN (emission) CONNECTOR with DUMMY CONNECTOR



X/Y MONITOR CONNECTORS

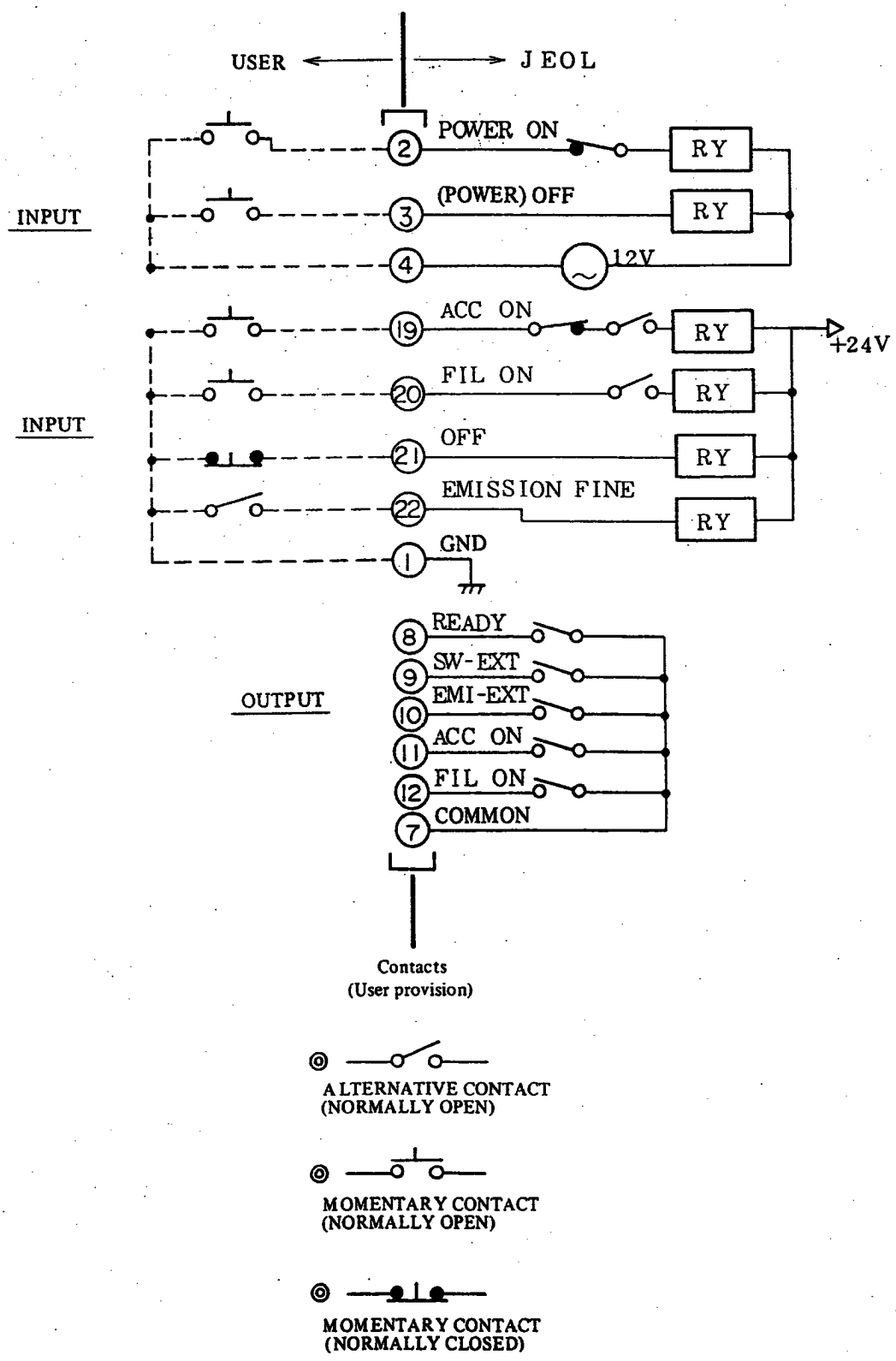


BNC connectors

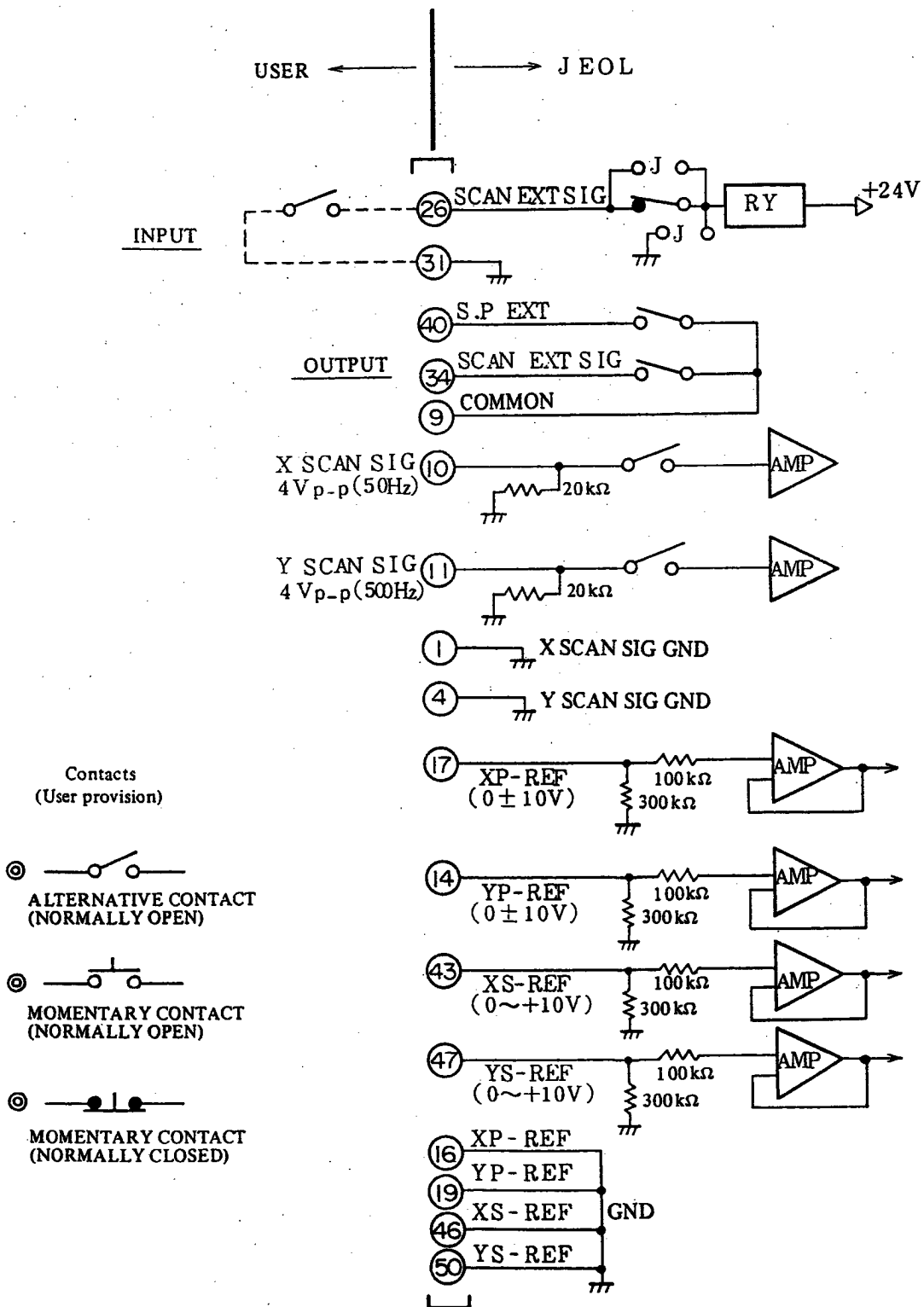
Cable wire colors

- BE: Blue
- BK: Black
- BN: Brown
- GN: Green
- RD: Red
- WE: White
- YW: Yellow

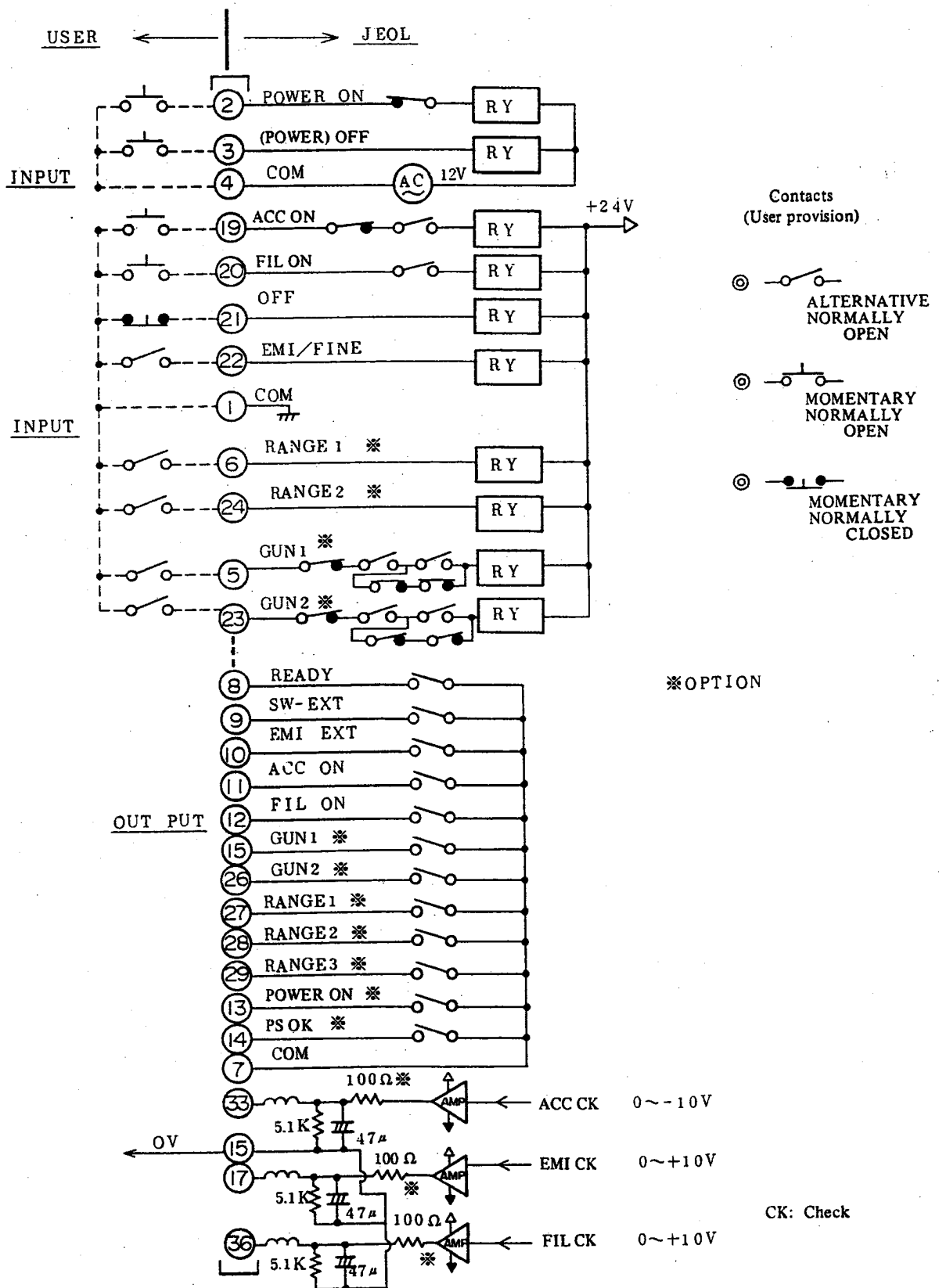
[Fig. 4-7] Cables



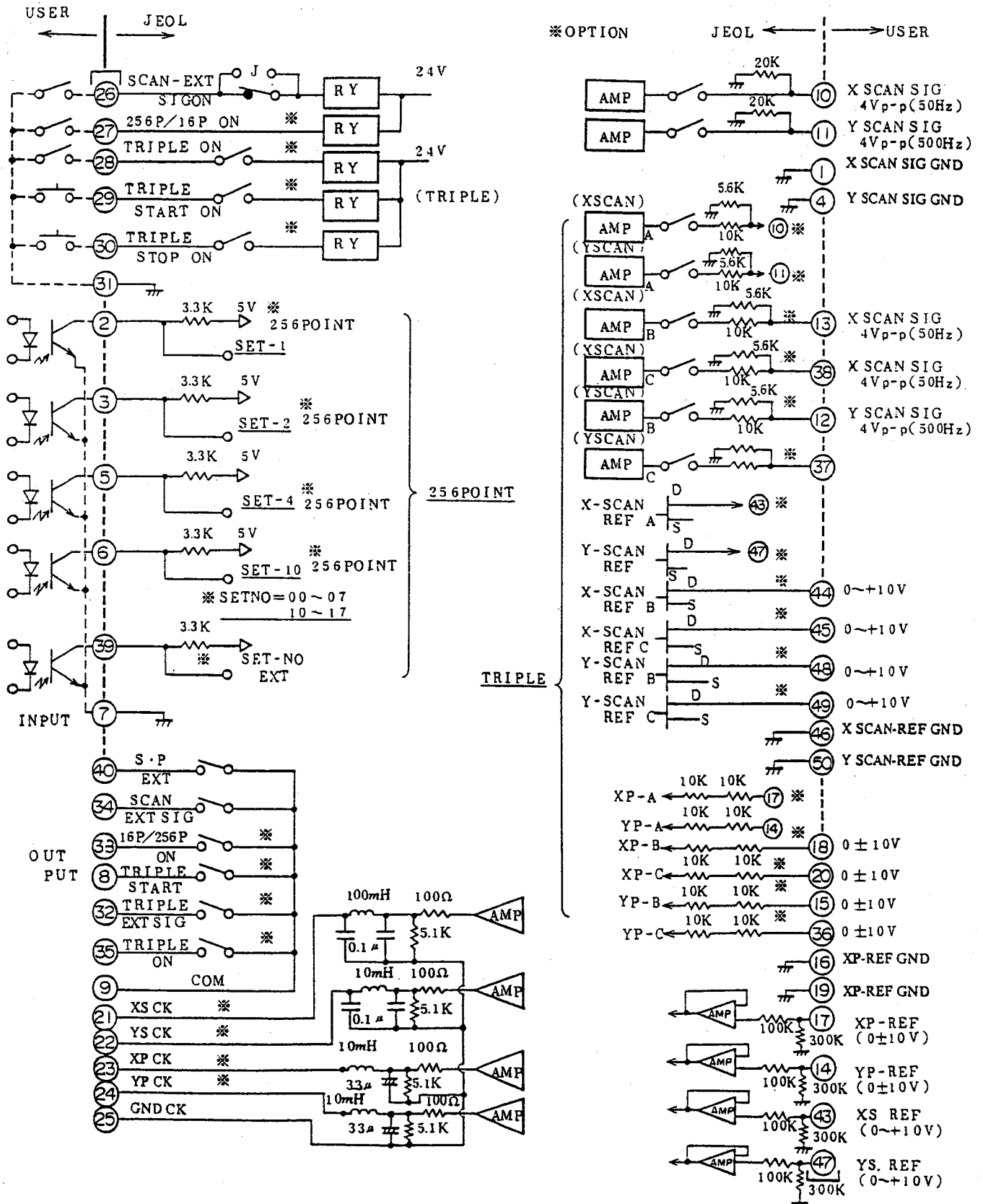
[Fig. 4-8] External Signal Connection to EXT 1 Connector (36-pin)



[Fig. 4-9] External Signal Connection to EXT 2 Connector (50-pin)



[Fig. 4-10] External Signals
EXT 1 Connector (36-pin)



[Fig. 4-11] External Signals
EXT 2 Connector (50-pin)
or to TRIPLE EXT SIG Connector

[5] OPERATION

It is essential that checks have been completed according to the test run instructions in "[4], 4."

1. Operation

- 1) Evacuate the user's vacuum evaporation chamber (CHAMBER) on which the electron gun (GUN) is installed.

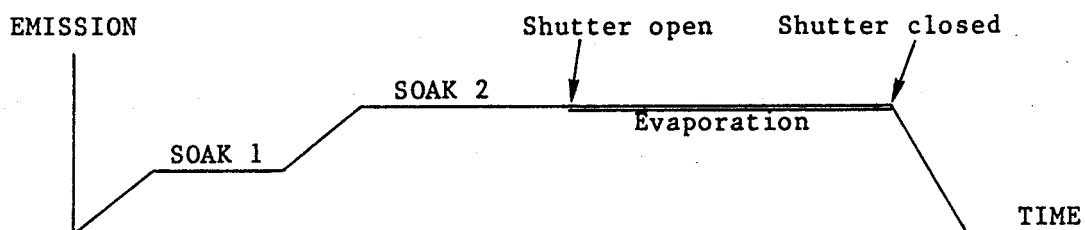
Note: The vacuum pressure should be 6.5×10^{-2} Pa (5×10^{-4} Torr) or less.

- 2) Send cooling water to GUN at a flow rate of 5 lit./min or more.
- 3) Set to ON the user's switchboard.
- 4) Set to ON the POWER switch (NFB) of the power supply rack (PS-RACK). The cooling fans rotate, and PL1 and PL2 on V-UNIT and OFF(POWER) switch of A-UNIT light up.
- 5) Press the POWER ON switch on A-UNIT.
FUSE(P), FUSE(MG), and DOOR indicators on A-UNIT light up.
VS lights up only when using an optional ST-202, ST-203, ST-205, or ST-206.

Note: FUSE(MG) lights up about 2 seconds after POWER ON is pressed.

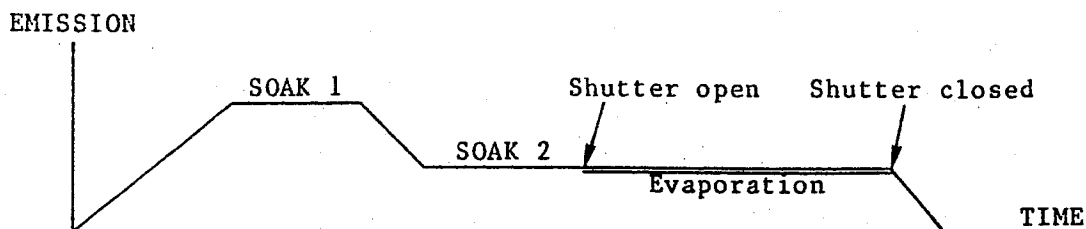
- 6) The following CONTROLLER indicators light up:
OFF(POWER) switch button, and INTERLOCK PS, V, W, and AUX indicators (256P lights only when using an option).
- 7) Make sure that ALARM indicators on CONTROLLER are not lit.
The procedure to follow when ALARM is lit is described in "[6]".
- 8) Set the EXT/INT selection switch (EXT/INT SW) to EXT when performing external control. 9) to 19) are performed by external signals. The contents of external control, however, change depending on settings of the switches (white, blue, and red capped switches in the panel recess of CONTROLLER)(see "[4], 4., D)").
No external control is possible without colored switch settings.
- 9) The GUN 1/GUN 2 selection switch (GUN 1/2 SW) on CONTROLLER is operable only when using options ST-202, ST-204, ST-206, and ST-207.
GUN 1/2 SW is not operable on the basic JST-F Series EB Source Power Supply (JST-F) and with other options. No GUN indicator will light up.
- 10) Select RANGE 2 for EMISSION meter and press the FIL ON switch of CONTROLLER.
- 11) Gradually turn the EMISSION (emission current) dial and set it at the maximum.
(The maximum is reached in about 2 minutes because rapidly increasing EMISSION may often deform the filament.)

- 12) After keeping the EMISSION setting at the maximum for about 1 minute, set it to 0 and press the OFF(ACC and FIL) switch.
Note: When the filament installed is a new one, set to the maximum in about 3 minutes and maintain the maximum setting for more than 5 minutes.
- 13) Press ACC button of the MODE SELECT switch, and press the ACC ON switch.
The ACC/DEF/XY SCAN meter (black scale) indicates the ACC value.
Note: ACC ON is not possible when the FIL ON switch is lit.
- 14) Press FIL ON. While watching the evaporant in the crucible of GUN, gradually raise EMISSION setting. When the electron beam (EB) can be recognized, set EB position by X/Y-POSITION knob operation.
- 15) Set EB diameter by X/Y-SCAN knob operation.
- 16) Perform degassing of the evaporant by raising EMISSION with EMISSION dial. The EMISSION value at this time differs with the evaporant used.
Note: Abnormal discharge and splashing will be the result if the degassing is not thoroughly performed.
- 17) Select needed RANGE for the EMISSION meter.
RANGE 1 = 0 to 120 mA, RANGE 2 = 0 to 720 mA, RANGE 3 = 0 to 2,250 mA
- 18) While watching the EMISSION setting on the meter, set EMISSION to the value desired.
The maximum values are:
JST-3F: 0 to 0.8 A, JST-10F: 0 to 1 A, JST-16F: 0 to 1.6 A
- 19) When evaporation is complete, set the EMISSION dial to 0 and press OFF
Press the OFF(POWER) switch on A-UNIT of PS-RACK.
- 20) Do not turn off NFB of PS-RACK for about 5 minutes so that its interior does not cool down.
- 21) Diagram of evaporation process



SOAK 1 = power for outgassing the evaporant
 SOAK 2 = power for obtaining necessary evaporation rate

Note: To obtain stable deposit film, setting of powers and times for SOAK 1 and SOAK 2 are important factors.



Depending on the evaporant, a stable deposit film will be obtained when SOAK 2 is made smaller than SOAK 1.

2. Protection Circuits

A) INTERLOCK indication on A-UNIT of PS-RACK (green LED)

- 1) FUSE(P): Lit when fuses F5 and F6 are normal.
- 2) FUSE(MG): Lit when G-UNIT's NFB is ON, and M-UNIT's fuses FAN, +26 V and -26 V are normal.
- 3) DOOR: Lit when V-UNIT's front and back panels, and right and left plates are correctly mounted. Lit also when the panel of an optional ST-AS10F is correctly installed.
- 4) VS: Lit when the HV vacuum relay (VS) and D-UNIT's panel installation are normal. (Operates when optional ST-202, ST-203, ST-205, or ST-206 is in use.)

B) INTERLOCK indication on CONTROLLER (Green LED)

- 1) PS: Lit when 1) to 4) above are normal
- 2) V: Lit when CAMBER vacuum is normal. (A vacuum interlock signal provided by the user is necessary.)
- 3) W: Lit when flow rate of GUN cooling water is normal. (A water interlock signal provided by the user is necessary)
- 4) AUX: Lit when an interlock function (provided by the user) is normal.
- 5) 256P: lit only when an option is used

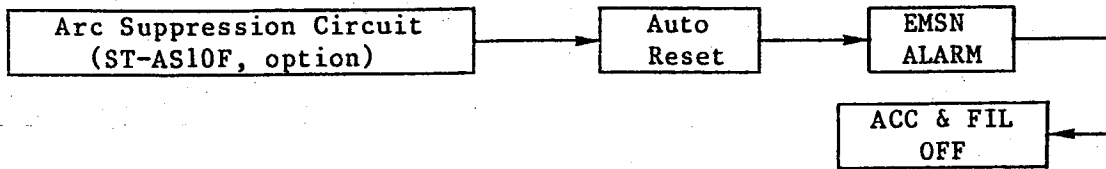
C) ALARM indication on CONTROLLER (Red LED)

- 1) ACC: Operates when the accelerating voltage (ACC) is more than $\pm 10\%$ off the set value for 3 seconds or more.
- 2) EMSN: Operates when the automatic reset circuit functions more than 3 times in one second, or when EMISSION continues to be larger than the rated value for 5 seconds.
- 3) FIL: Operates when the GUN filament is burnt out or shorted.
- 4) DEF: Operates when the DEF COIL current is more than $\pm 20\%$ off the set value for 3 seconds, or when the coil is shorted.

D) Main transformer temperature

Operates when the main transformer temperature becomes abnormally high. POWER goes OFF.

E) Procedure against abnormal discharge:



If EMSN ALARM operates very frequently, clean the electron gun.

[6] MAINTENANCE, CHECK and TROUBLESHOOTING

Note: Since the system generates high voltage, turn off PS-RACK's POWER switch (NFB) and the user's switchboard (3 phase 200 V) before checking the power supply rack interior, electron gun, and the feedthrough terminals.

1. Maintenance and Check

A) Electron gun (GUN) and high voltage feedthrough terminal (HVT)

- 1) For making stable film deposition, discharge must be held to minimum. Clean GUN and HVTs every 1 or 2 weeks. (Refer to the maintenance instructions of GUN in particulars.)
- 2) The high voltage (HV) lead wires (2 mm dia.) between GUN and HVTs must be replaced every 1 or 2 years.
- 3) The tightness of HVTs and HV lead wires must be checked every 6 months. Be sure to make this check especially after the evaporation system is moved.

B) Power supply rack (PS-RACK)

Once a year, remove the front, back, right and left panels of PS-RACK and clean with an air gun or a similar mean. Dust that has accumulated in PS-RACK (especially on HV parts) might cause trouble.

2. Troubleshooting

Note: If your trouble is not solved by the following checks, contact JEOL for assistance.

A) ALARM lights up (ACC and FIL power supplies turn OFF)

- 1) ACC (accelerating voltage abnormal)
 - o Press the RESET switch--ACC ALARM goes out.
 - o Press ACC ON and FIL ON again, and check that ACC ALARM is ON or OFF (repeat 2 or 3 times).
 - o If ACC ALARM lights up again, clean GUN and HVTs of the vacuum evaporation chamber (CHAMBER) according to GUN maintenance procedure.
- 2) EMSN (emission current abnormal)
 - o Press the RESET switch--the EMSN ALARM lamp goes out.
 - o Press ACC ON and FIL ON again, and check that EMSN ALARM is ON or OFF (repeat 2 or 3 times).
 - o If EMSN ALARM lights up again, clean GUN and HVTs of CHAMBER according to GUN maintenance procedure.
- 3) FIL (filament abnormal)
 - o Burnout or shorted filament may be the cause. Replace the filament and clean GUN and HVTs according to GUN maintenance procedure. (The FIL ALARM goes out when A-UNIT's OFF(POWER) switch is pressed.)

4) DEF (DEF COIL current abnormal)

Note: Operates only when 102U or 163M GUN is used.

- o Select DEF of MODE SELECT, and turn the X-POSITION knob to check if meter indication is in the following ranges:

102U GUN: 2 to 7 \pm 1 or so, 163M GUN: 0 to 10

Also check if the meter indication is linear to the X-POSITION knob rotation.

- o If the meter indication is normal, DEF-COIL may be shorted.
- o If the meter indication stays at 0, M-UNIT DEF fuse may be burnt out or DEF COIL may be shorted.

Note: The DEF COIL can be checked by measuring resistance between A and B of M-UNIT's COIL connector (6-pin, at the cable side) using the multimeter's resistance range.

102U GUN: approx. 10 ohms, 163M GUN: approx. 2 ohms

B) INTERLOCK indicator (green) goes out (ACC and FIL are OFF)

- o Check each item by referring to "[5], 2. Protection Circuit".

Note: In case of a burnout fuse or NFB trip, replace the fuse or reset NFB and recheck.

C) PL1 (red) and PL2 (white) do not light up when NFB is ON

- o The cause may be defect in the input power supply provided by the user (3-phase 200 V).

D) PL2 is on but PL1 off when NFB is ON

- 1) Open phase and reversed phase rotation of the input power supply provided by the user.
 - o Make voltage check of the 3 phase 200 V line by using the multimeter's AC range.
 - o If the voltage is normal, reversed phase rotation may be the cause. Replace the wiring of the R and T phases.

E) Fan does not operate with NFB ON

- o When PL1 and PL2 are lit, fuse F1 on P-UNIT is burnt-out.

F) The OFF(POWER) switch of A-UNIT does not light up at NFB ON

- o When PL1 and PL2 are lit, fuses F1, F2 and/or F4 of P-UNIT are burnt out

G) POWER ON is not possible (OFF switch is lit)

- o Sudden rise in temperature of the main transformer or defective relays (RY1 to RY3) of P-UNIT. Contact JEOL for assistance.

H) ACC ON is impossible

- 1) Check that FIL ON is not lit.
- 2) Check that the INTERLOCK indicators (PS, V, W, AUX) are lit.
- 3) Check that the ALARM indicators are not lit.
- 4) Check EXT/INT SW setting
 - o In the case of INT, manual setting of ACC ON is possible.
 - o In the case of EXT, external control of ACC ON is possible if the white-capped switch (in the panel recess) is thrown upward.

I) FIL ON is impossible

- 1) Check that the INTERLOCK indicators are lit.
- 2) Check that the ALARM indicators are not lit.
- 3) Check EXT/INT SW setting.
 - o In the case of INT, manual setting of FIL ON is possible.
 - o IN the case of EXT, external control of FIL ON is possible if the white-capped switch (in the panel recess) is thrown uoward.

J) Desired ACC output is unavailable

- 1) Select ACC of MODE SELECT at ACC ON and adjust ACC ADJ in the panel recess to obtain the desired value.

K) No EMISSION meter indication

- 1) Turn the EMISSION dial toward the maximum at FIL ON or ACC and FIL ON state.
- 2) Make RANGE selection for the EMISSION meter.
- 3) When ALARM operates, see "A)".

L) No Beam on evaporant surface or no beam settable to crucible center

- 1) Check the EMISSION meter at ACC ON and FIL ON.
 - o Since this check may not be possible at low power (emission current), increase the EMISSION setting. (In the case of insulators, charging may take place on the evaporant surface. In that case, it is necessary to increase the power.)

2) Change X/Y-POSITION setting

- o Select DEF/XP/YP of MODE SELECT and check the meter indication.

DEF/YP for 102U GUN, XP/YP for 203U/303U GUN, and DEF for 163M GUN.

- In case with 203U/303U GUN, if the meter does not operate when X/Y-POSITION setting is changed, the fuses F5/F6 of M-UNIT may be burnt out. (Replace the fuse and recheck.)
- If the meter operates with 203U/303U GUN, SCAN COIL may be shorted or broken.

Disconnect the COIL connector of M-UNIT and check with a multimeter the resistance between CD and EF on the cable side connector. (Normally, 0.2 ohm or so, against ground is ∞ .)

3) Reset X/Y-POSITION according to the test run procedures for GUN and JST-F Series given in "[4], 4."

M) No increment of beam diameter on evaporant surface

1) Change X/Y-SCAN setting

- o Select XS/YS of MODE SELECT and check the meter indication.

- If the meter does not operate when X/Y-SCAN setting is changed, the X/Y fuses F5/F6 of M-UNIT may be burnt out. (Replace and recheck)
- If the meter operates, SCAN COIL may be shorted or broken.

Disconnect the COIL connector of M-UNIT and check with a multimeter the resistance between CD and EF of the cable side connector. (Normally 0.2 ohm or so, against ground is ∞ .)

N) EMISSION meter fully deflects with ACC ON

Clean GUN and HVTs according to the GUN maintenance procedure.

O) EMISSION saturation before reaching the desired value

- 1) The HV lead wires between GUN and HVTs (2 mm diameter Cu wires in CHAMBER) is faulty, or the filament is faulty.
- 2) 3-phase 200 V line input is insufficient. (3-phase 200 V \pm 10%)

P) PS-RACK roars and operates unstably, or NFB turns OFF at EMISSION increment

- 1) Check if PL1 (red) on PS-RACK is lit at NFB ON.

- o When PL1 not lights up, poor phase rotation or open phase of the 3-phase 200 V line may be the cause. See the test run instruction in "[4], 4."

- 2) Defective SCR of HS-UNIT may be the cause.

Q) External control is impossible

Set EXT/INT SW to INT, and check if manual operation is possible. If it is possible, check the following items:

1) ACC ON, FIL ON and OFF switches are not operable

- o Check that EXT/INT SW is set at EXT, and that the blue-capped switch in the panel recess is thrown upward.
- o Check the user's external control signals.

2) EMISSION control is impossible

- o Check that EXT/INT SW is set at EXT, and that the blue-capped switch in the panel recess is thrown upward.
- o Check the user's external control signals (should be 0 to -10 V).

3) SCAN and POSITION setting is impossible

- o Check that EXT/INT SW is set at EXT, and that the red-capped switch in the panel recess is thrown upward.
- o Check the user's external control signals.

[7] OPTION (1)

- (A) ST-AS10F
- (B) ST-AS10G
- (C) ST-TRIPLE (F)
- (D) ST-256PT (F)
- (E) ST-16PNS (F)
- (F) ST-2PNS (F)

*These option manuals are parted another PDF files.

The file is named "PRODUCTS NAME-VERSION.pdf."

(Ex. ST-AS10F-E1-01.pdf)

[8] OPTION 2

(A) ST-202	.....	8-A-1
(B) ST-203	.....	8-B-1
(C) ST-204	.....	8-C-1
(D) ST-205	.....	8-D-1
(E) ST-206	.....	8-E-1
(F) ST-207	.....	8-F-1
(G) ST-EXTSIG	.....	8-G-1

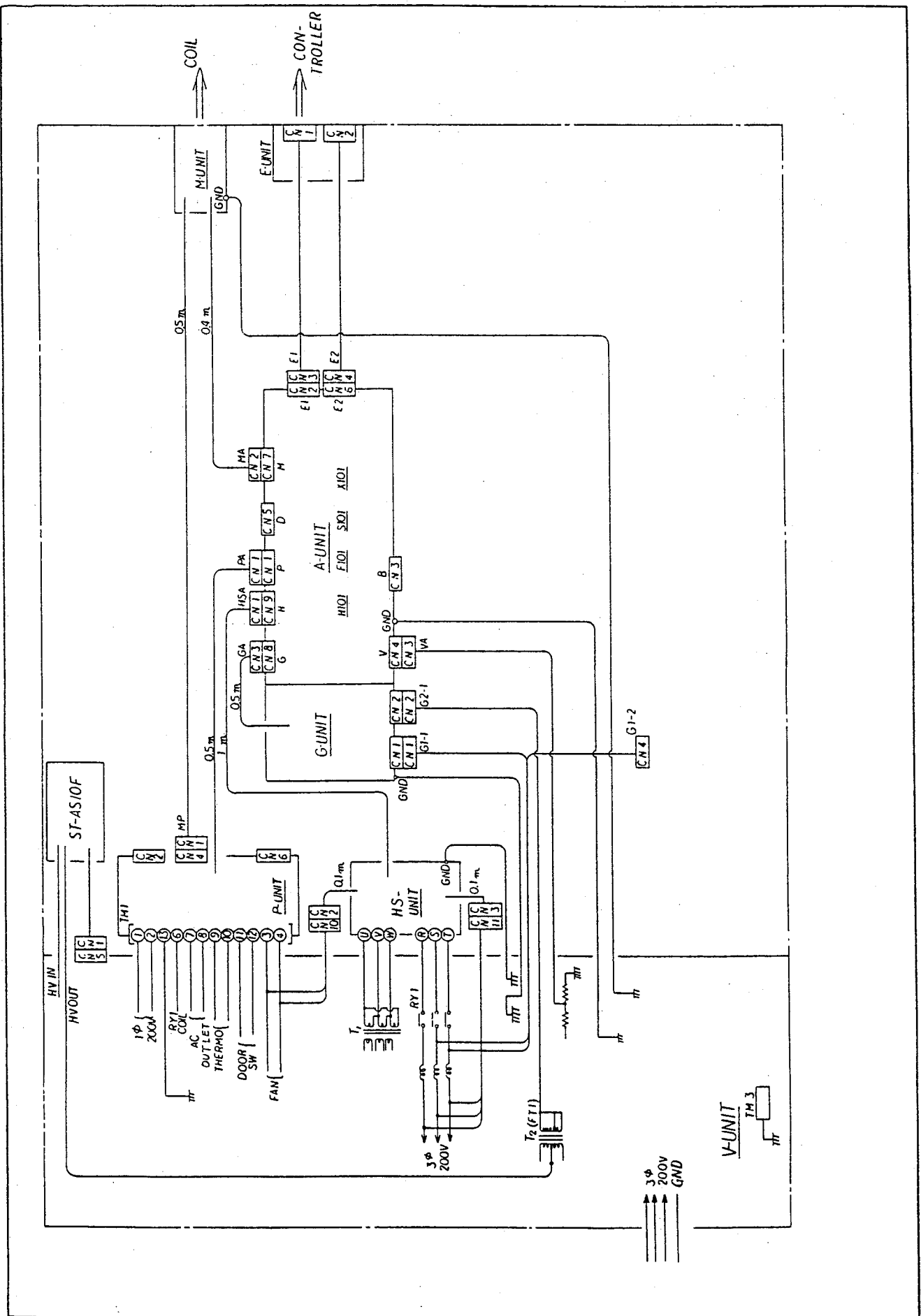
***These option manuals are parted another PDF files.**

The file is named "PRODUCTS NAME-VERSION.pdf."

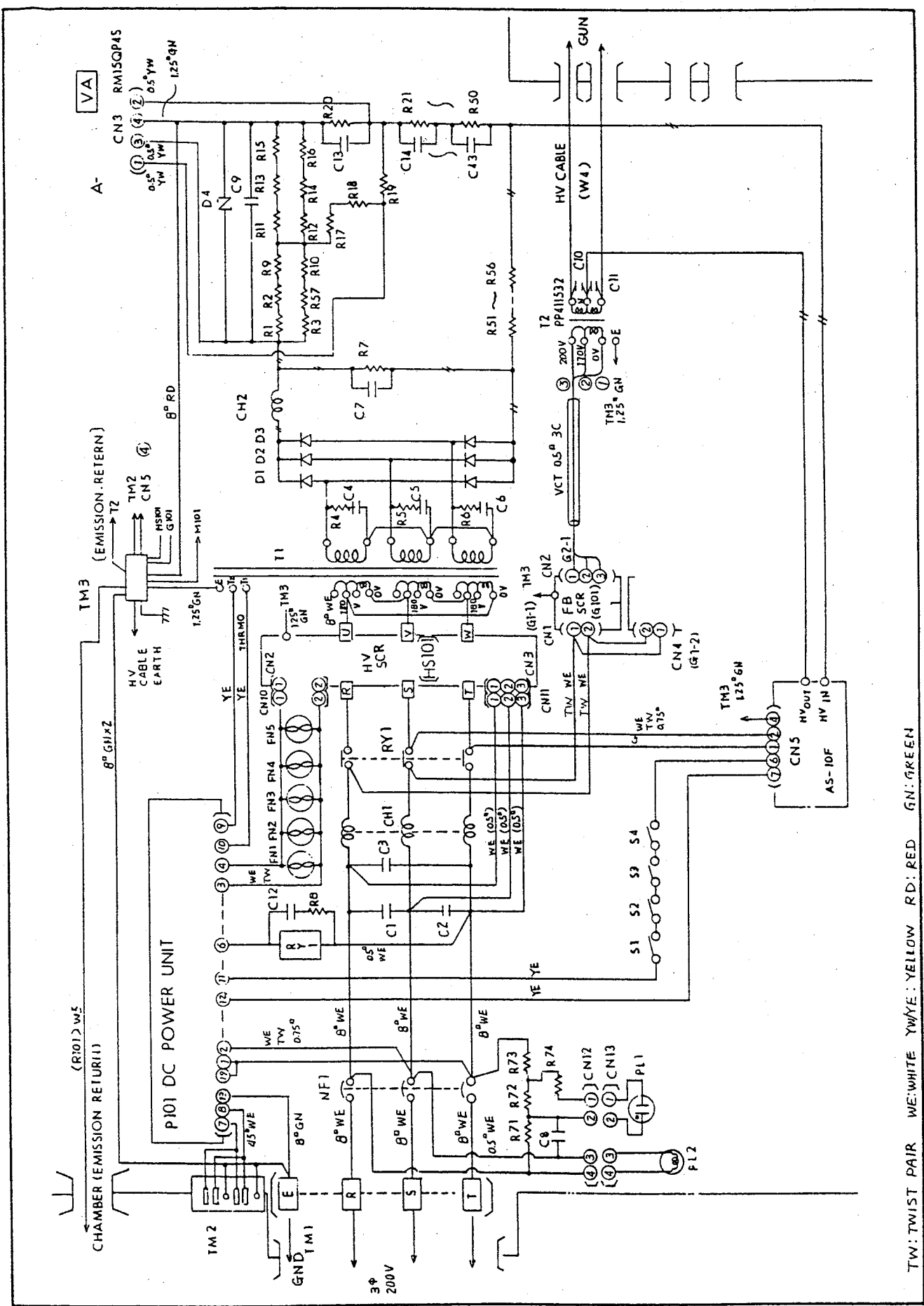
(Ex. ST-202-E1-01.pdf)

[9] STANDARD CIRCUIT DIAGRAMS

[Fig. 9-1] Connection	9-1
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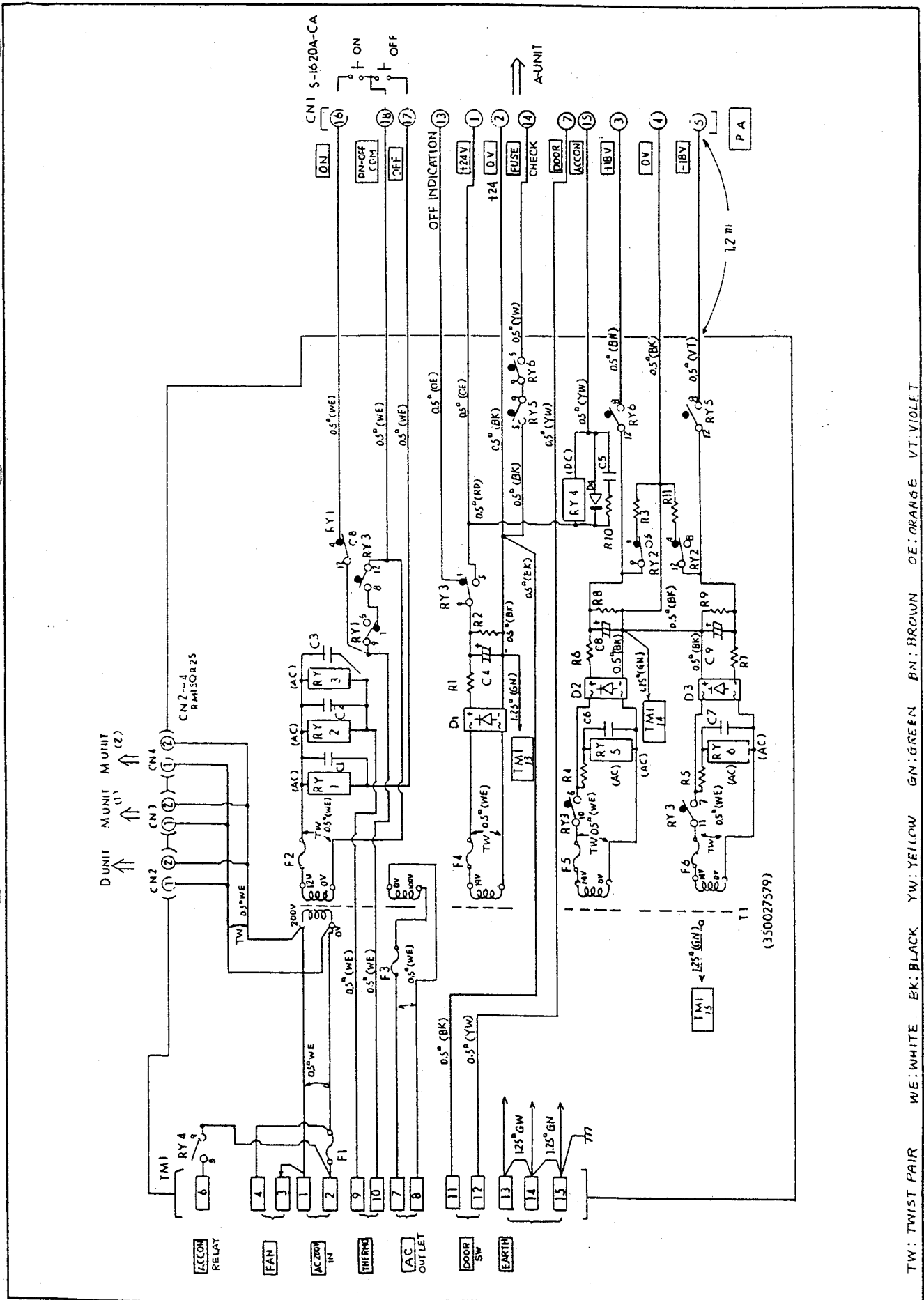


[Fig. 9-1] Connection



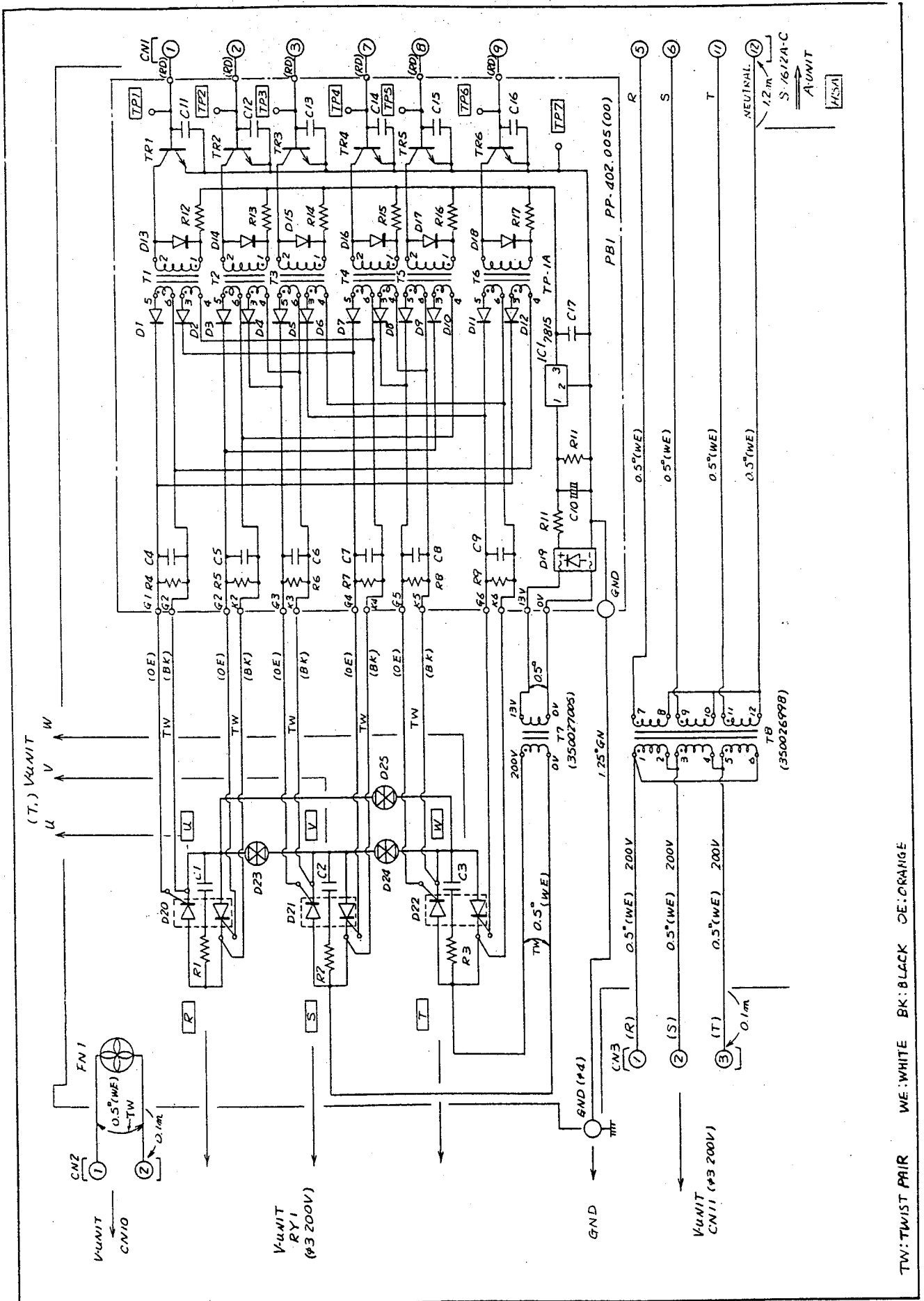
[Fig. 9-2] V-UNIT (Center Unit)

TW: TWIST PAIR WE: WHITE YW: YELLOW RD: RED GN: GREEN

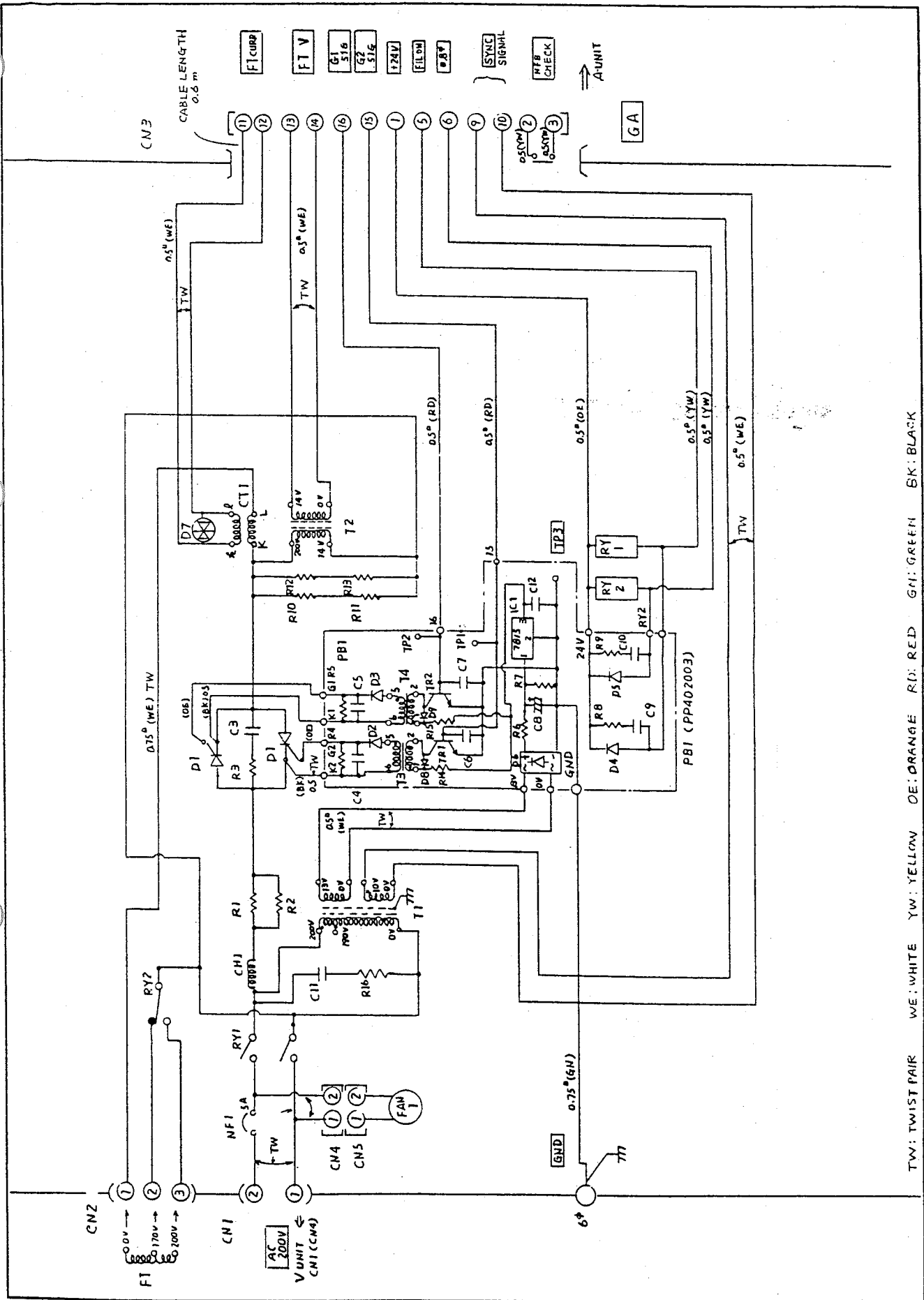


TW: TWIST PAIR WE: WHITE BK: BLACK YW: YELLOW GN: GREEN BN: BROWN OE: ORANGE VT: VIOLET

[Fig. 9-3] P-UNIT (DC Power Supply Unit)

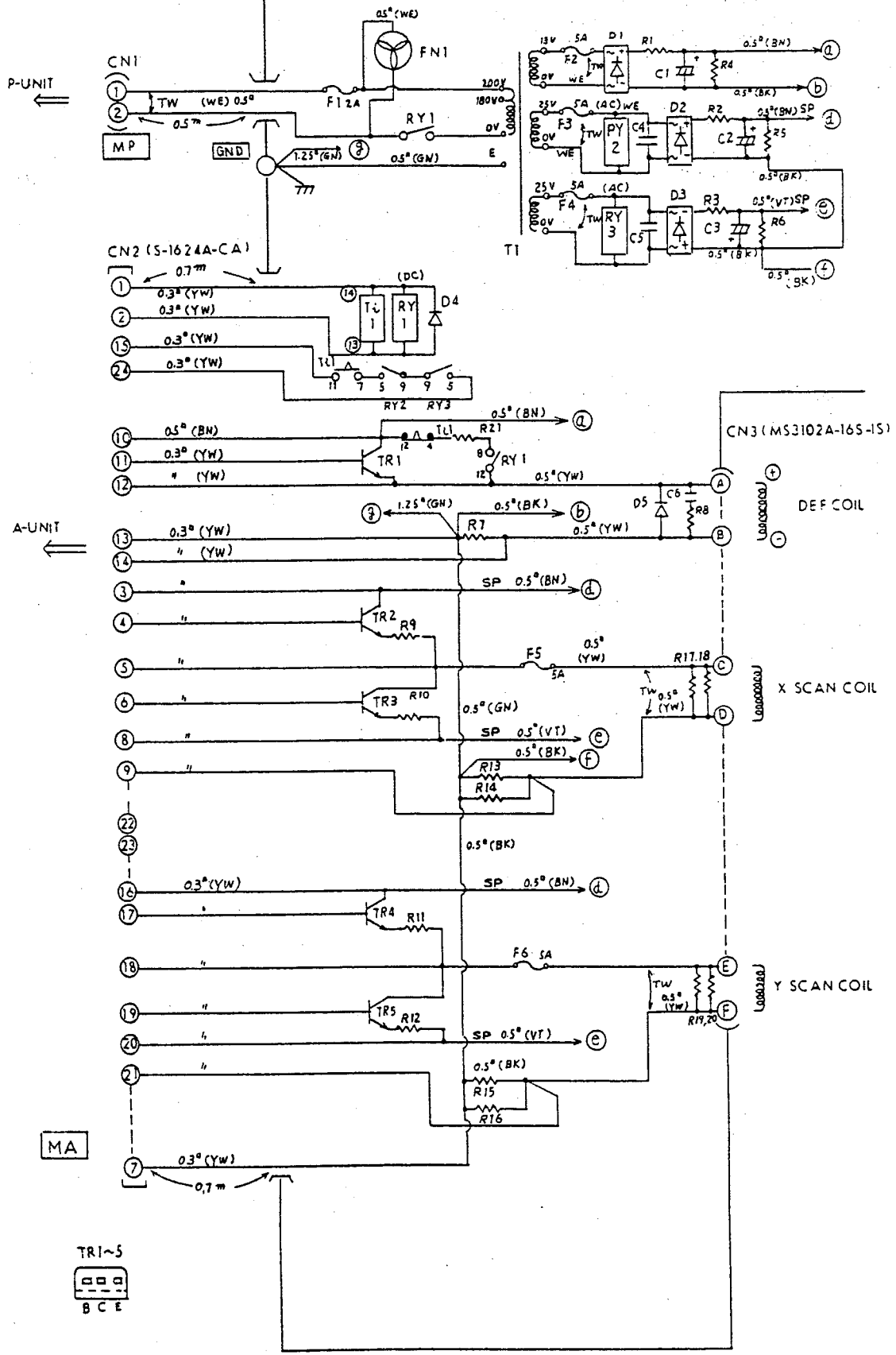


[Fig. 9-4] HS-UNIT
(ACC Thyristor Control Unit)



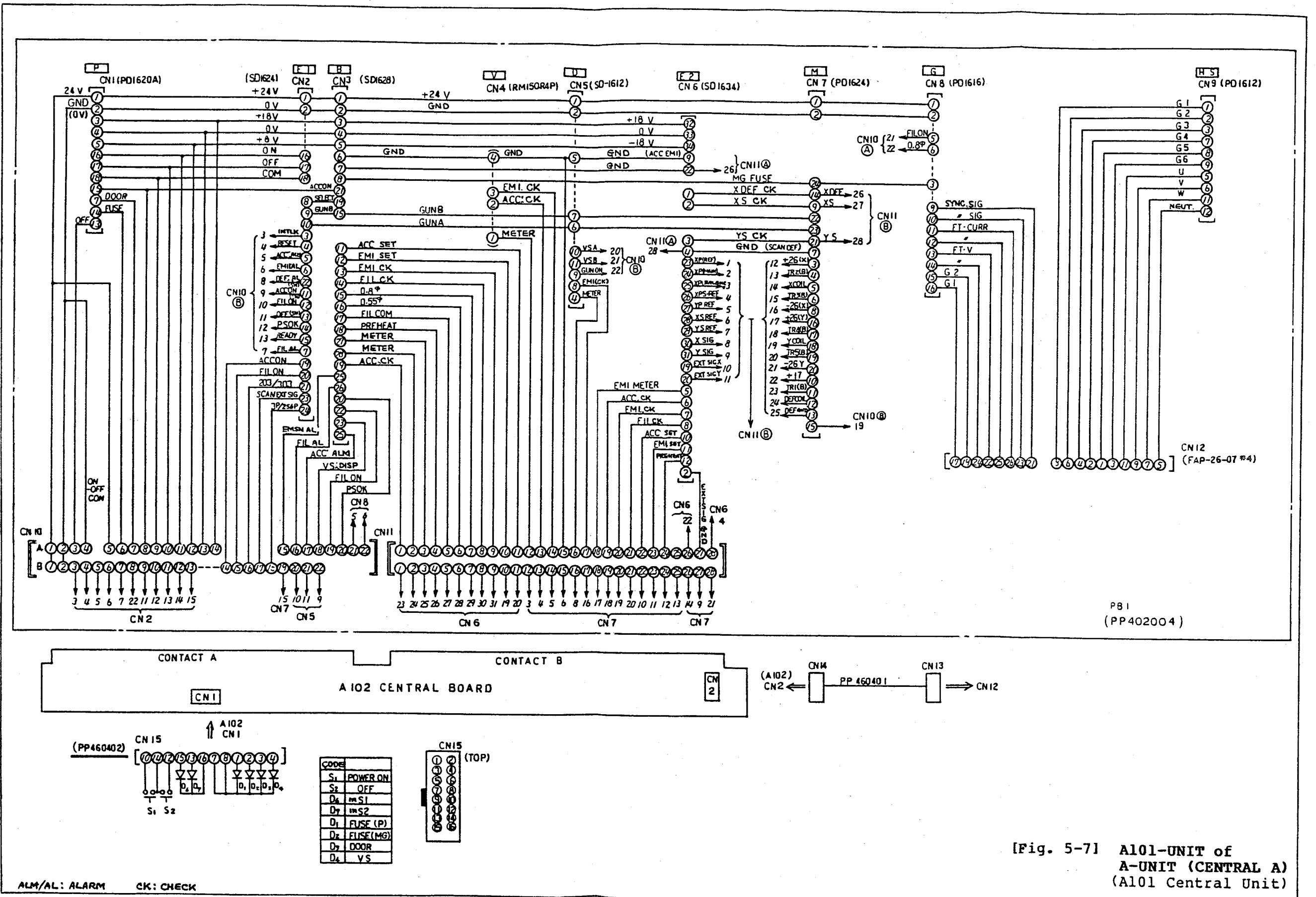
TW: TWIST PAIR WE: WHITE YW: YELLOW DE: ORANGE RD: RED GH: GREEN BK: BLACK

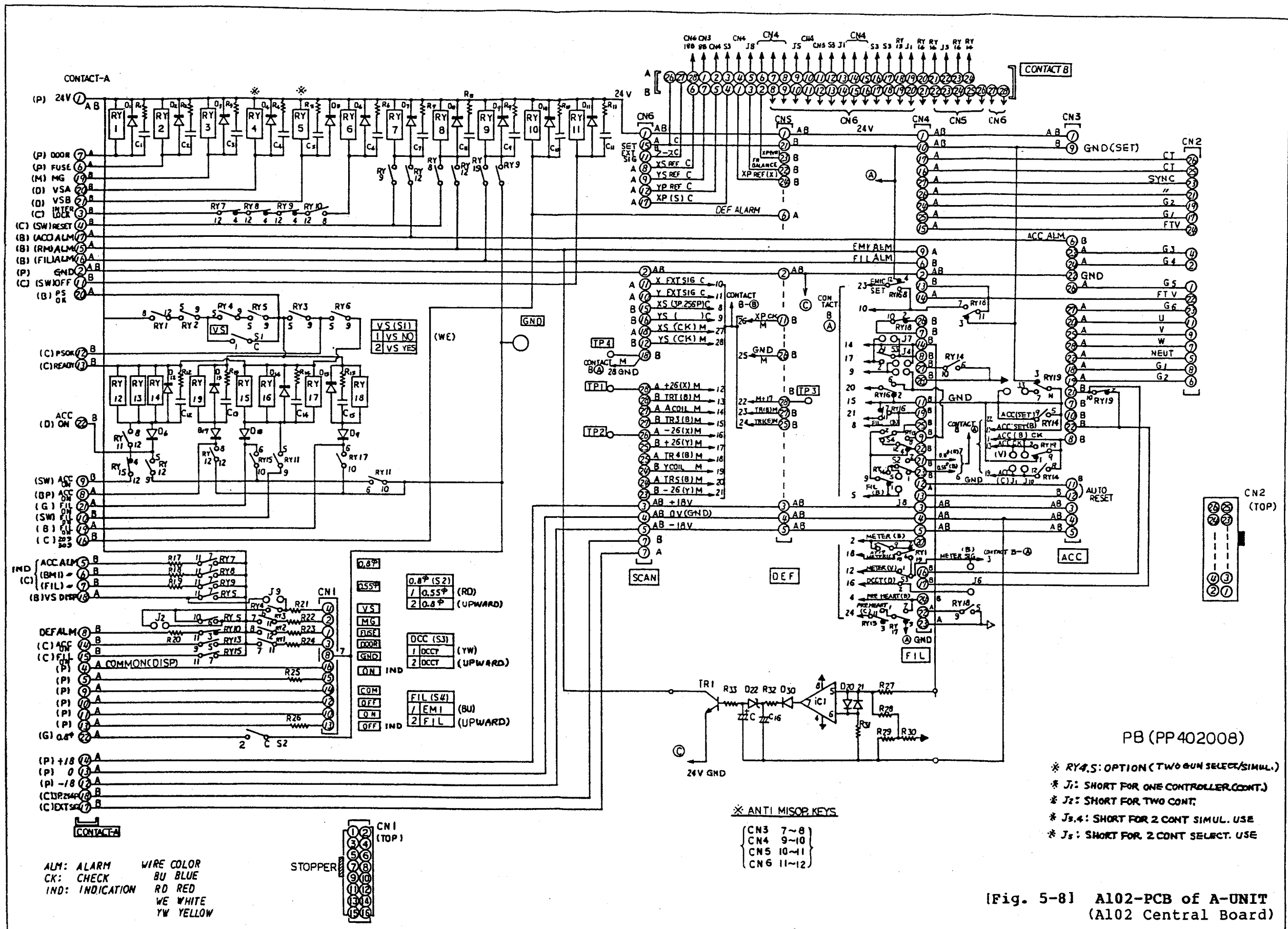
9-5 [Fig. 9-5] G-UNIT (FIL Thyristor Control Unit)



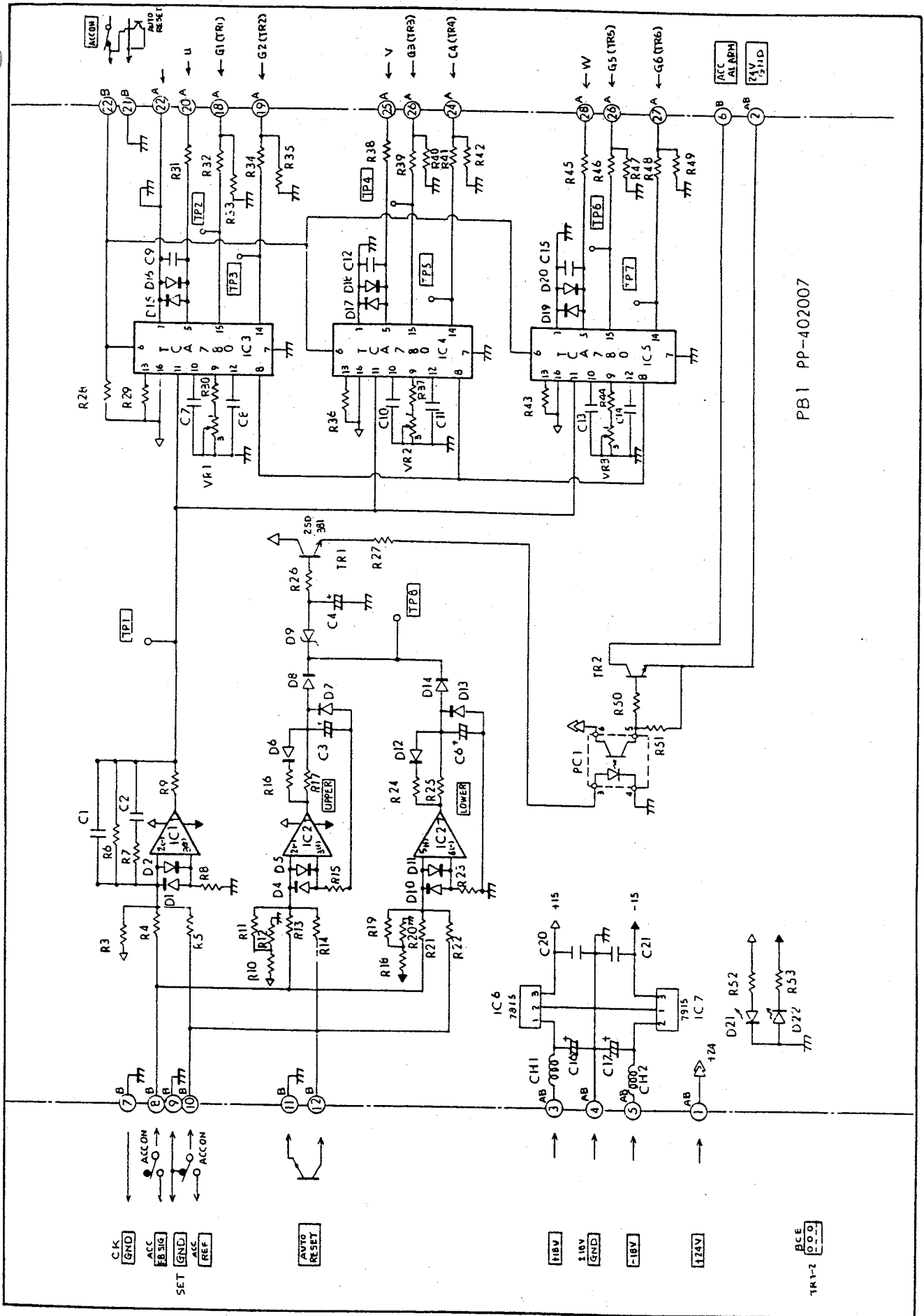
TW: TWIST PAIR SP: SPIRAL YW: YELLOW BN: BROWN WE: WHITE GN: GREEN BK: BLACK VT: VIOLET

[Fig. 5-6] M-UNIT (SCAN/DEF Power Supply Unit)

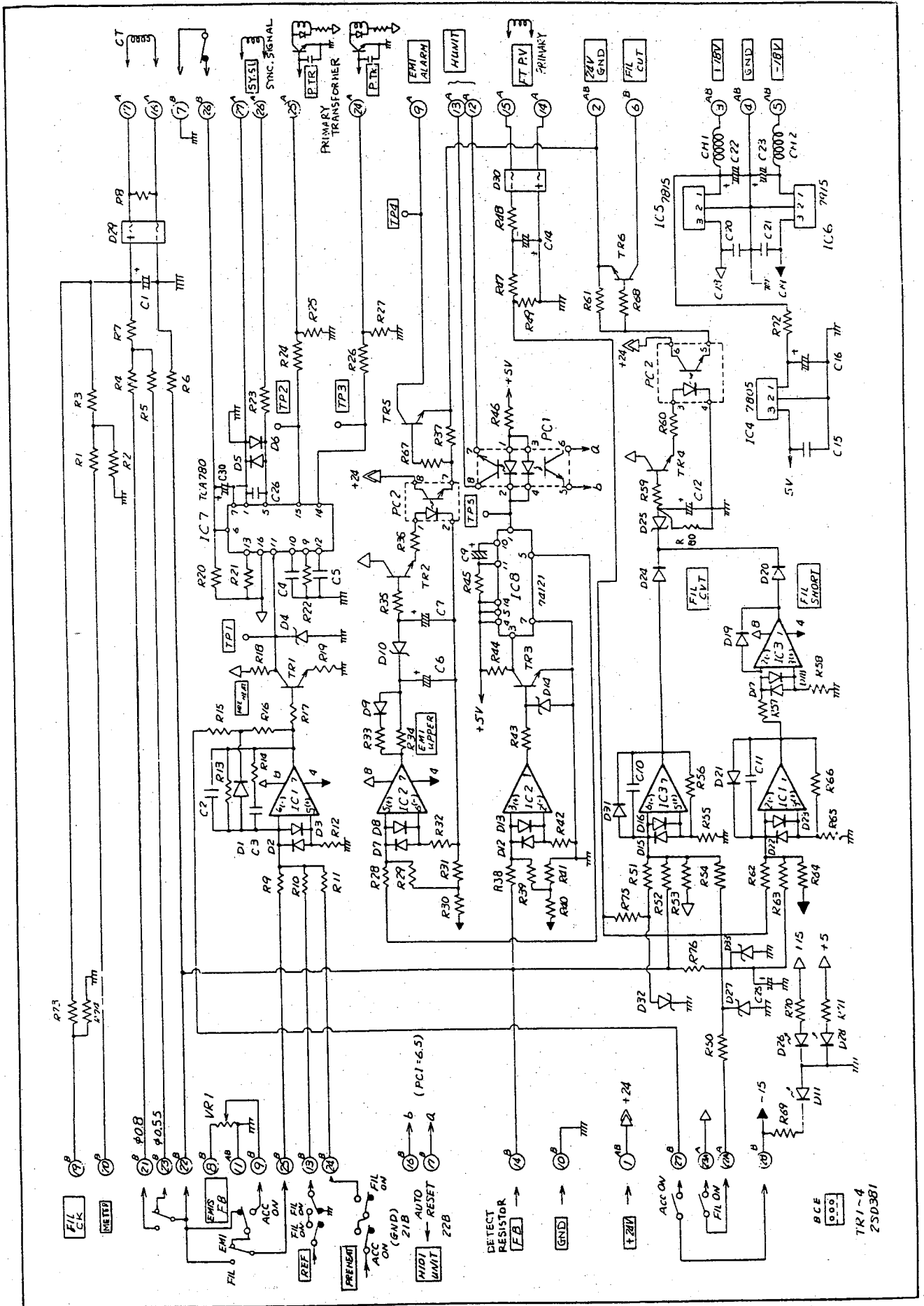




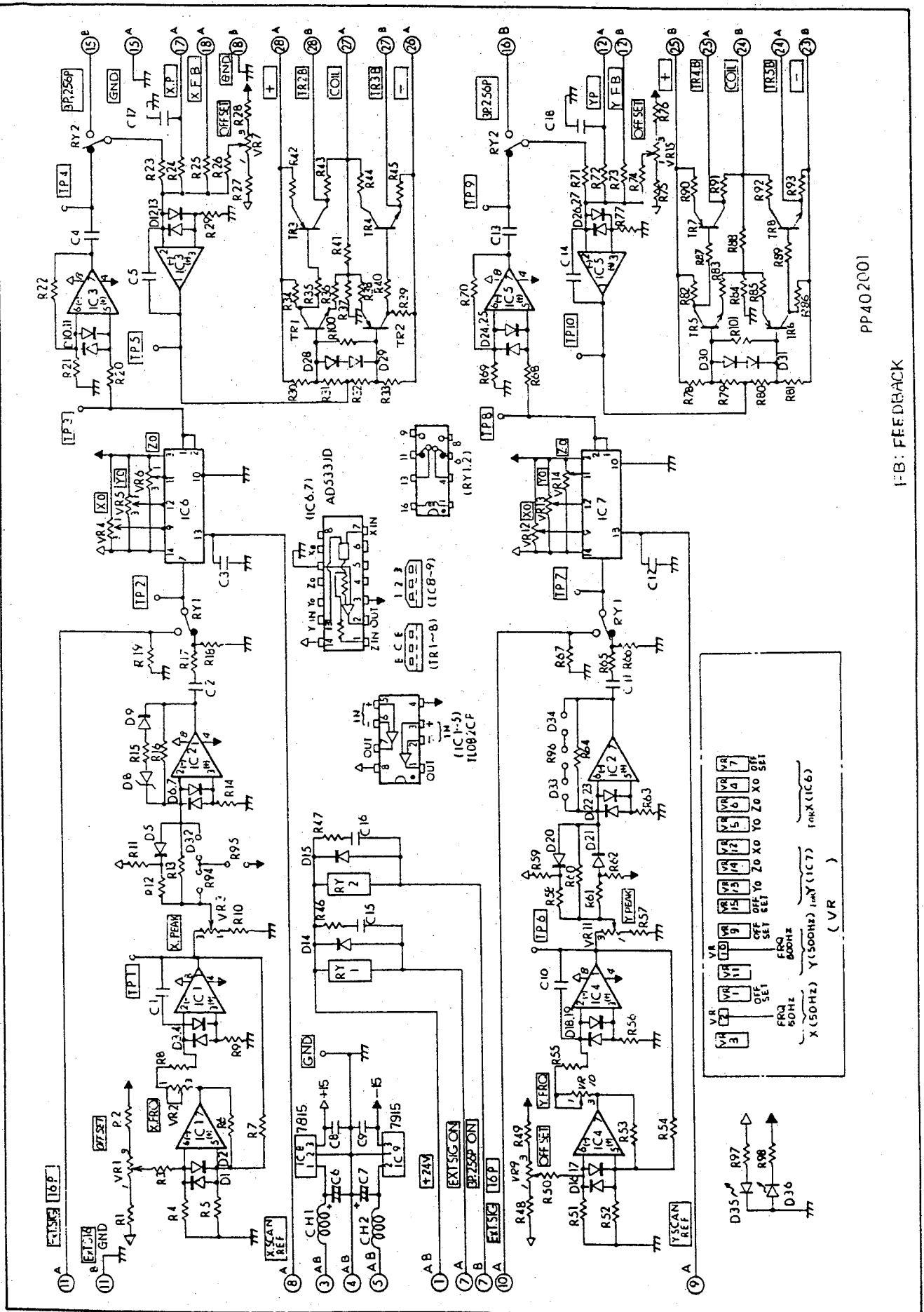
[Fig. 5-8] A102-PCB of A-UNIT (A102 Central Board)



[Fig. 5-9] H-UNIT
(ACC Control Unit)



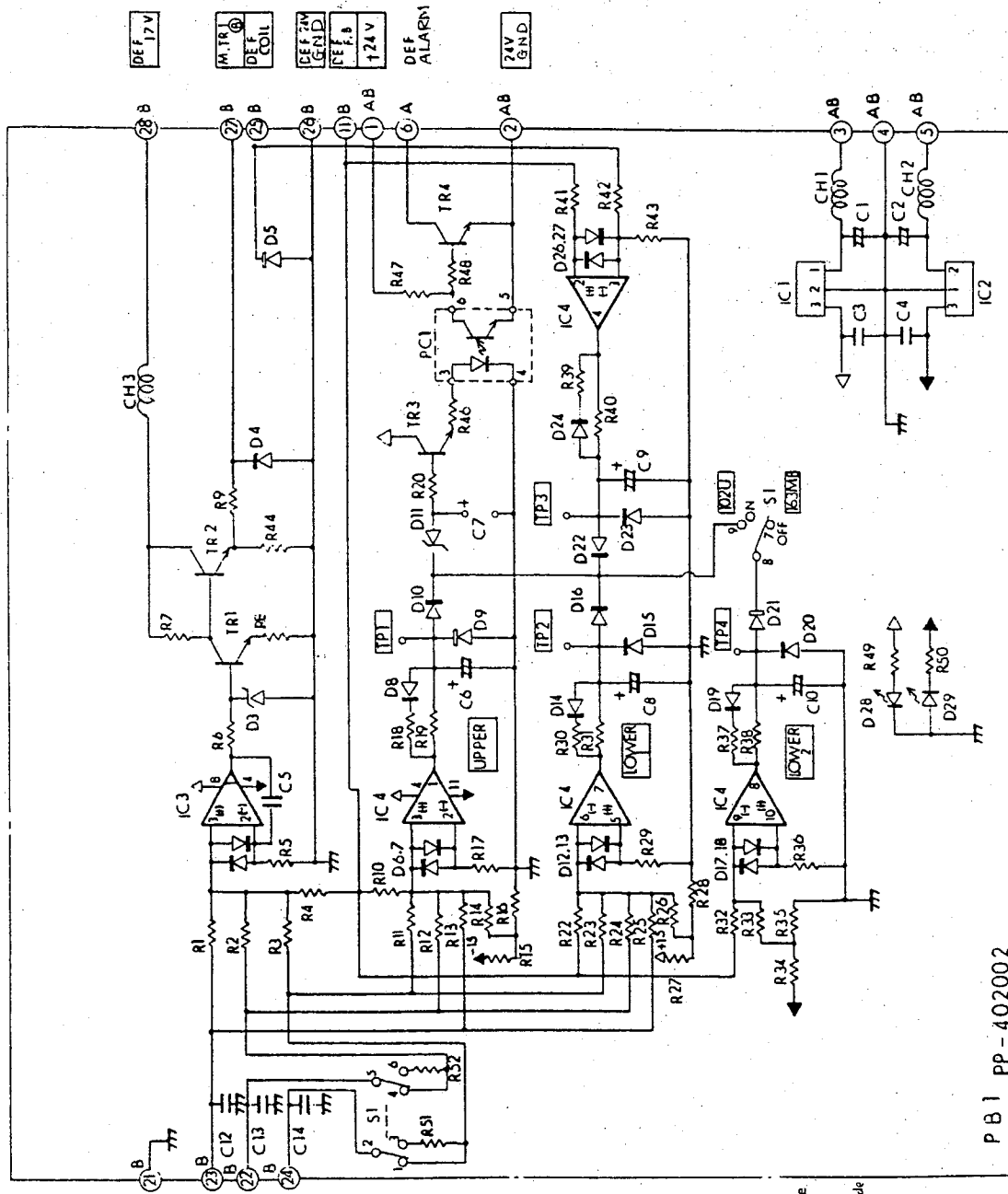
[Fig. 5-10] F-UNIT
(FIL Control Unit)



PP402001

I-B: FEEDBACK

[Fig. 5-11] S-UNIT (SCAN Control Unit)



SET GND
 XP VR
 XP BALANCE
 XP REF

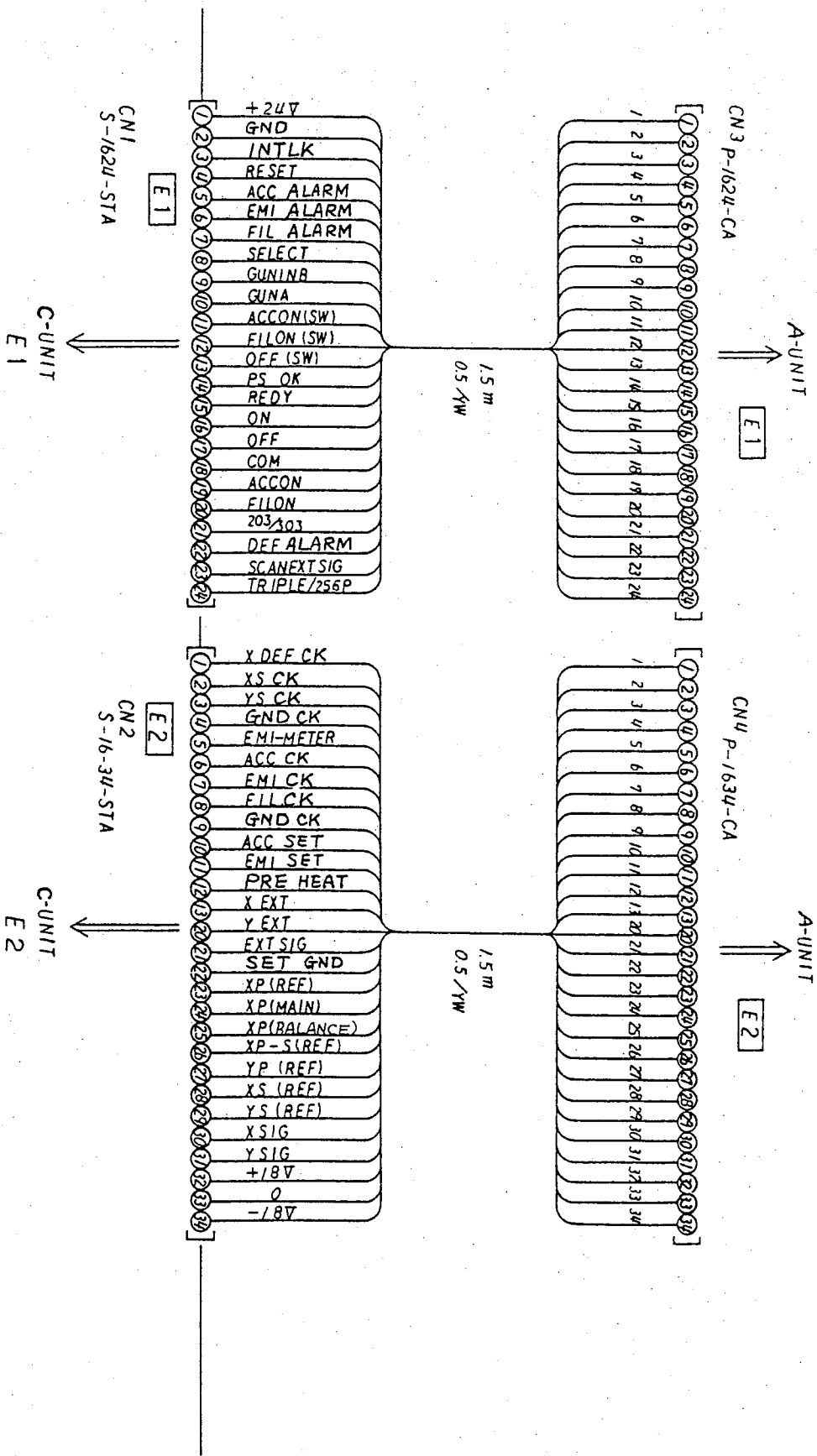
IC1.2
 1 2 3
 TRI.2
 BCE

* [S1] ON to PCB side
 - to 3 MB
 • ON to outside
 = 102 U

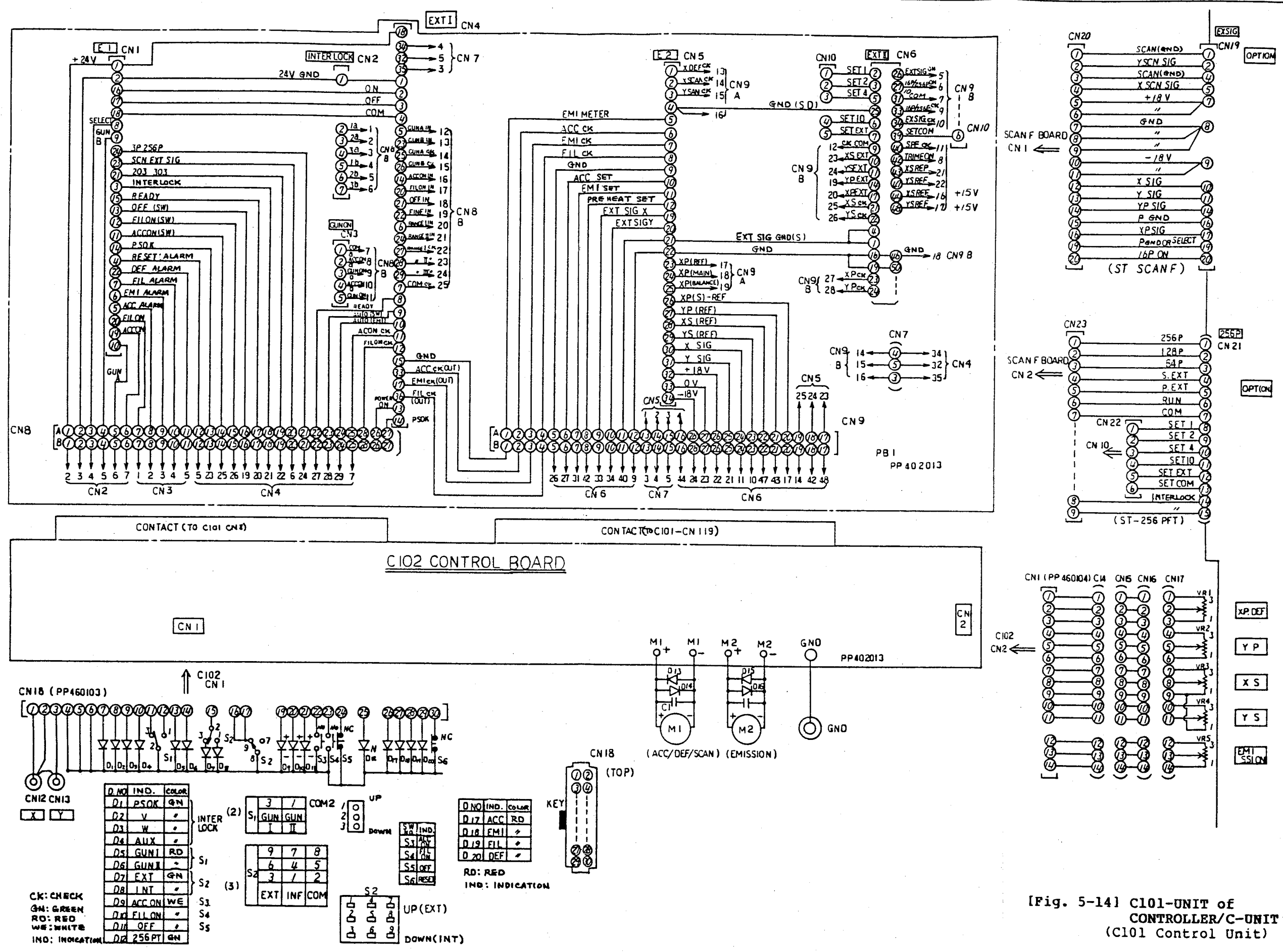
P B 1 PP-402002

[Fig. 5-12] X-UNIT
 (DEF Control Unit)

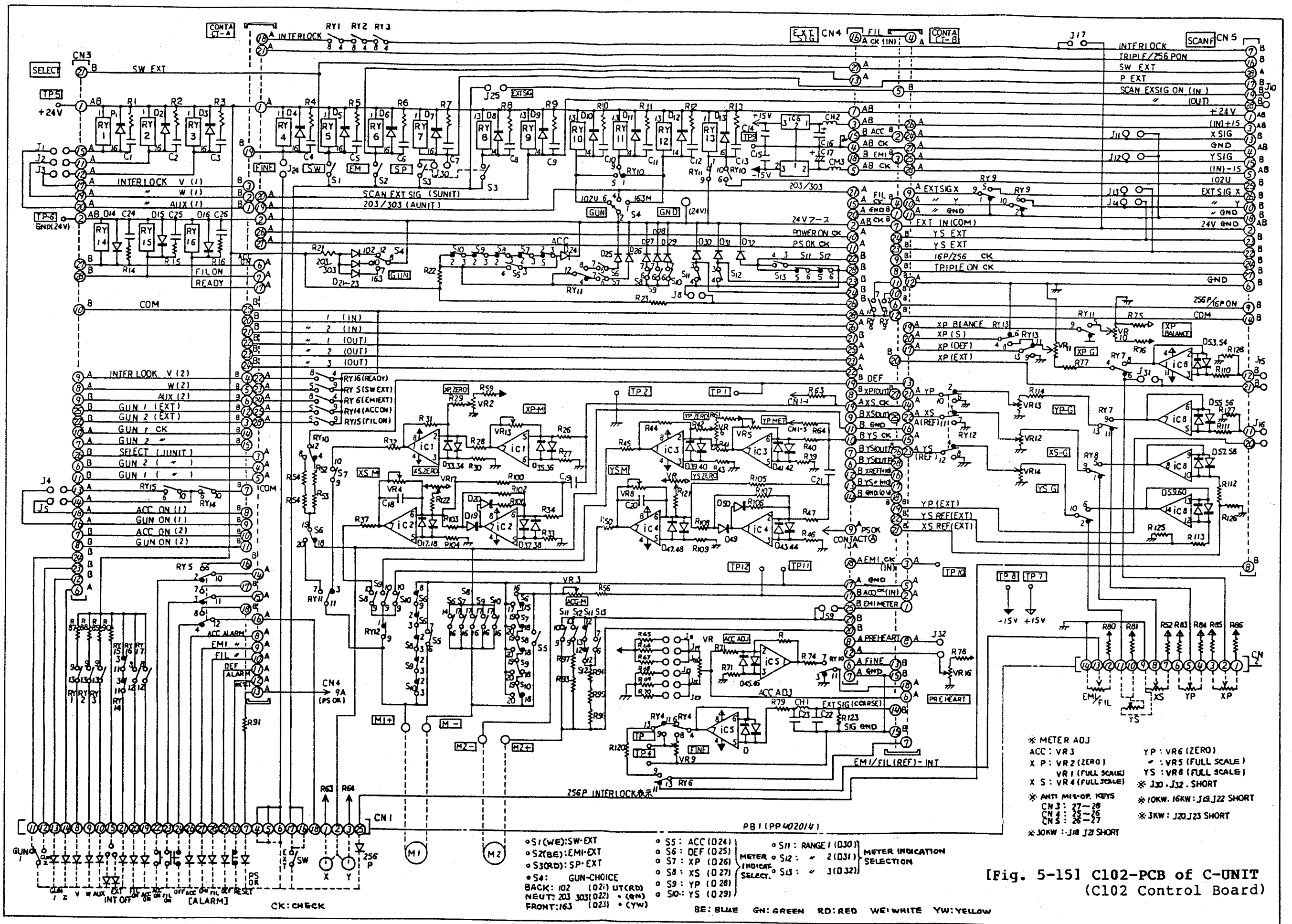
YW: YELLOW



[Fig. 5-13] E101-UNIT (E101 Connection Unit)



[Fig. 5-14] C101-UNIT of CONTROLLER/C-UNIT (C101 Control Unit)



[Fig. 5-15] C102-PCB of C-UNIT
(C102 Control Board)