

## 4.6 RASTER GENERATOR DEFLECTION UNIT (RGDU) OPTION

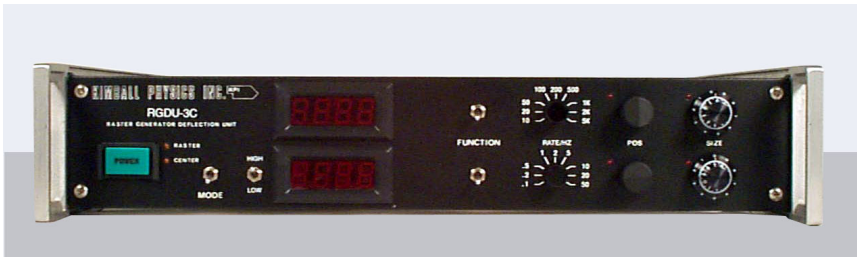


Fig. 4.6-1 Raster Generator Deflection Unit (RGDU)



Fig. 4.6-2 Raster cable

Rastering can be added to any electron or ion gun system with 4-pole electrostatic deflection and a separate 8-pin deflection connector on the gun. Rastering involves movement of the beam in a pattern and is used to cover an area of the target region fairly uniformly over time. It is produced by applying cyclical voltages to the X and Y deflection plates in the gun. These voltages are controlled by a separate power supply, the Raster Generator Deflection Unit (RGDU). The system can be used either to center the spot manually as a deflection unit or to raster the beam.

### INSTALLATION OF RASTER GENERATOR DEFLECTION UNIT

1. Follow the Power Supply and Electron or Ion Gun installation procedures in Sections 2.2 and 2.3.
2. On the RGDU, the green **POWER** pushbutton switch should be off, in the out position.
3. Connect the included ground strap onto the grounding screw on the back panel of the RGDU. Then connect the other end of the ground strap to a proper earth ground connection.
4. Plug the 8-pin gray Raster cable into its keyed 8-pin mating connector on the back of the RGDU, tightening the ring by hand. Support the cable along its length and do not twist it.  
**NOTE: Use the gray raster cable. Although the pinout is the same, do not use the standard black Deflection cable for rastering, as it will not give the proper response.**
5. On the back of the RGDU, select either 115 or 230 VAC with the red switch. Plug the power cord into the LINE outlet.
6. The four output BNCs (X POS, X NEG, Y POS, and Y NEG) on the back panel may be used to connect user-supplied equipment, such as an oscilloscope.
7. An **optional** BNC labeled **TTL OUTPUT** on the back panel may be used to synchronize the RGDU with other user-supplied equipment or with the blanker on electron guns with a Beam Blanking option. Connect a coaxial cable from this BNC on the RGDU to the Blanker BNC labeled **TTL INPUT** on the front of the EGPS Power Supply or to a BNC on some other equipment.

### DESCRIPTION OF CONTROLS

The only **Inputs** are Remote Control Inputs (+10 V to -10 V) for X and Y positioning on the back of the RGDU.

The following is a description of the **Manual** controls on the front of the RGDU:

**Power Switch:** A green push button labeled **POWER** that enables or disenables the power supplies in the RGDU. (When off, outputs are grounded, so the deflection plates are grounded).

**Mode Switch:** A toggle switch that selects either **Centering** or **Rastering**.

**CENTER:** When the Mode Switch is in the Center position, the unit will operate like a Manual Control Deflection Unit (MCDU-4C) to position the beam.

**RASTER:** When the Mode Switch is in the Raster position, the X Channels and the Y Channels raster according to the preset conditions of rate, position, and size.

**Voltage Switch:** A toggle switch labeled **HIGH / LOW** that selects the output voltage range of either  $\pm 100$  volts peak to peak or  $\pm 10$  volts peak to peak.

**Function Switches:** Two toggle switches that select metering of either **Size** or **Position** for the X and the Y channels.

**Rate Controls:** Two rotary switches labeled **RATE**, one for setting the sweep rate of the X Channels (10 to 5 kHz) and one for the sweep rate of the Y Channels. (0.1 to 50 Hz).

**Digital Meters:** Two DVMs, one labeled **X** and one **Y**, that read either the **position** in volts (0 to 100 V or 0 to 10 V depending on the hi/low voltage switch) or the **size** in percentage of the possible window (0 to 100%).

## 4.6 RASTER GENERATOR DEFLECTION UNIT (RGDU) OPTION cont.

**Position Controls:** Two potentiometers labeled **POS**, one for offsetting the beam along the X-AXIS, and one for offsetting the beam along the Y-AXIS. These are used to manually control the electron beam position in center mode, or to position the window in raster mode.

**Size Controls:** Two potentiometers labeled **SIZE**, one for setting the sweep amplitude of the X Channels (so setting the sweep angle of deflection along the X-AXIS), and one for setting the sweep amplitude of the Y Channels (so setting the sweep angle of deflection along the Y-AXIS). These control the size of the raster window and do not function in center mode.

**Raster Mode Switch:** A three-position switch, located inside the RGDU under the top cover, that selects the rastering mode: Off, Synchronized, or Free run.

### DESCRIPTION OF OUTPUTS

The outputs of the RGDU consist of four channels: +X, -X, +Y, and -Y. In synchronized mode, the X Channels are blanked off during the retracing of the Y Channels.

Fig. 4.6-3 shows examples of the output wave forms, where X is set at four times the Rate of Y, Position has zero offset on both X and Y axes, and Size is set at 75 V for both X and Y Channels.

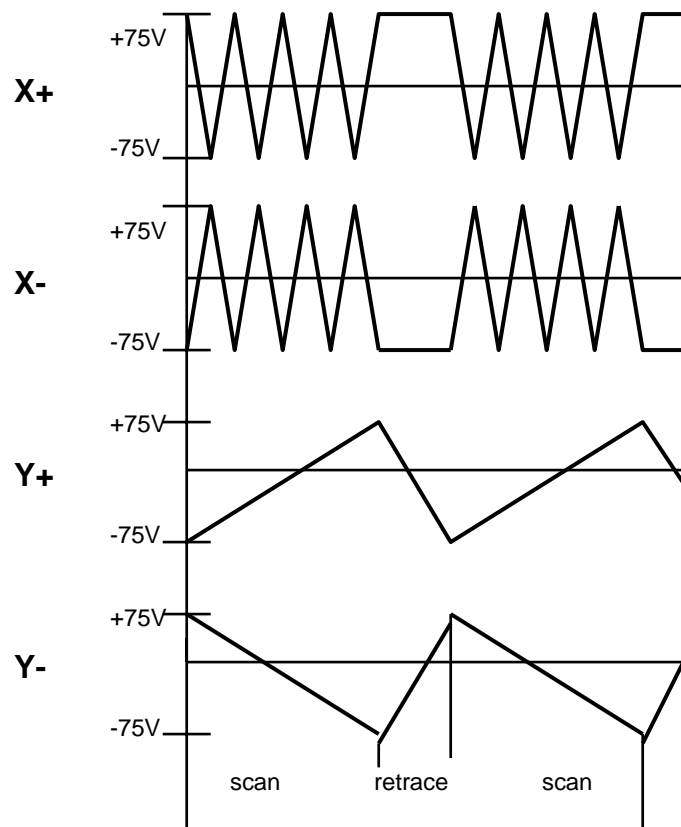




Fig. 4.6-3 Synchronized Raster Output Wave Forms

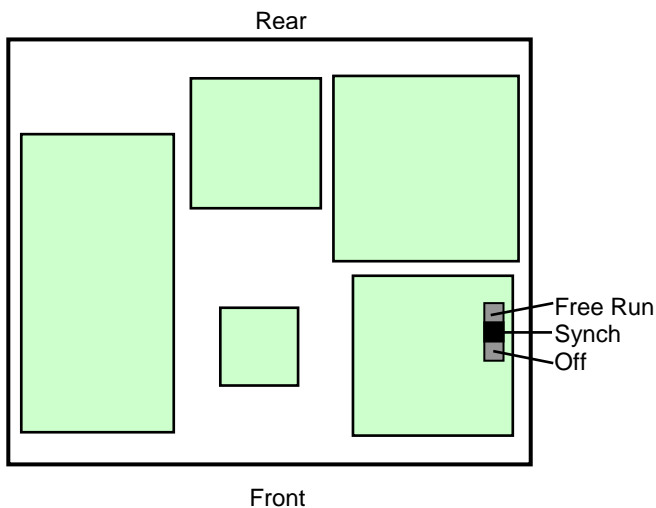
## 4.6 RASTER GENERATOR DEFLECTION UNIT (RGDU) OPTION cont.

	 <h1 style="margin: 0;">WARNING</h1>
	<h3 style="margin: 0;">HIGH VOLTAGE</h3> <p style="margin: 0;"><b>Can cause ELECTRIC SHOCK or BURN</b></p> <p style="margin: 0;">Turn off and unplug the RGDU before accessing the raster mode switch. Failure to do so could result in dangerous HIGH VOLTAGE when the cover is open.</p>

The raster generator has the possibility of running in one of two modes: synchronized or free run. These modes are selected using a three-position switch located under the top cover of the raster generator, as shown below in Fig. 4.6.4. The raster generator may be shipped in either mode depending on the gun; the mode can be checked by opening the cover and checking the switch position, or by observing the type of raster pattern produced.

In **synchronized mode**, the X- trace signal and the Y- trace signal are synchronized. This yields a raster pattern in which the pattern seen on the target appears to be stationary. During the Y-retrace, the X deflection signal goes to its maximum value producing a line that can be seen outside the target region. Whether the electrons during retrace are included in the total beam current would depend on the size of the target, on whether they fall off the target with maximum X deflection.

In **free run mode**, the X and Y signals are not synchronized; patterns on the target appear to move. This mode probably yields the most uniform electron dose over the target area.



**Fig. 4.6-4 Top view of opened RGDU, showing Raster Mode Switch positions**

### OPERATION OF RASTER GENERATOR DEFLECTION UNIT (RGDU)

1. Turn on the RGDU: Depress the green **POWER** pushbutton switch on (in position).; the pushbutton will light.
2. Set the Voltage switch to **HIGH** ( $\pm 100$  volts peak to peak) or **LOW** ( $\pm 10$  volts peak to peak) to set the maximum sweep size or maximum deflection. For low beam energy operation, the unit should be run in the **LOW** mode for increased control to reduce the ripple on the raster outputs.
3. **For manual deflection:**
  - a. Set the mode switch to **CENTER** and the two function switches to **POS** as indicated by the red LEDs.
  - b. Adjust the two **POSITION** potentiometers to center the electron beam along the X and Y axes.
  - c. Use the DVMS to monitor potentiometer settings.
4. For guns with Beam Blanking option only (see also Section 4.9):
  - a. On the EGPS Power Supply, disconnected the coaxial cable from the Blanker **TTL INPUT** BNC, if connected. Turn on the Blanker unit with the amber **BLANKER** pushbutton. Set the **INVERT/NORMAL** toggle switch to **NORMAL**.
  - b. Using the **BLANKER** potentiometer, adjust the Blanker voltage to that needed for beam cut-off.
  - c. Connect a coaxial cable from the optional BNC labeled **TTL OUTPUT** on back of RGDU to the Blanker **TTL INPUT** BNC on the front of the EGPS. This will synchronize the blanking of the retrace during rastering.
5. **For rastering:**
  - a. Set the sweep rates for X and Y using the two **RATE** rotary switches.
  - b. Set the mode switch to **RASTER** and the two function switches to **SIZE**, and then adjust the two **SIZE** potentiometers to give the desired window size of the raster pattern.
  - c. Set the function switches to **POS** and then adjust the two **POSITION** potentiometers to position the raster pattern window within the operating area.
  - d. Use the DVM to monitor potentiometer settings.
  - e. The optional **TTL OUTPUT** BNC can be used to synchronize other user-supplied equipment. It provides +5 V during X and Y sweeps (scan) and 0 V during the retrace.
6. Run the gun as described in normal or ECC operation, sections 4.2 and 4.3, readjusting deflection or rastering as desired.
7. To turn off the RGDU: Press the **POWER** pushbutton switch off (out position). Other controls may remain as set to simplify start up.

4 OPERATION

## 4.6 RASTER GENERATOR DEFLECTION UNIT (RGDU) OPTION cont.

### OPERATION OF RGDU cont.

8. For computer/ remote control:
  - a. Remote control terminals can be used for X and Y positioning, not for rastering. The supplies may be either voltage programmed or resistance programmed.
  - b. Turn off the RGDU with the **POWER** switch, and **UNPLUG THE RGDU POWER CORD** before making electrical connections.
  - c. For voltage programming:
    - i. Set up a user-supplied system (analog supply, or computer program, breakout boards DAQ boards etc.) for controlling the individual power supplies. Provide a voltage source that produces a **-10 V to +10 V** signal for X and for Y.
    - ii. For example, with a  $-100\text{ V}$  to  $+100\text{ V}$  Deflection power supply, a  $-10\text{ V}$  signal supplies  $-100\text{ V}$ , a  $+5\text{ V}$  signal supplies  $+50\text{ V}$ , and a  $0\text{ V}$  signal supplies no deflection.
    - iii. Attach the voltage source signal (computer board, analog supply, etc.) to the program terminal labeled **PROG** by inserting a bare wire end and tightening the terminal screw.
    - iv. Reference the system to ground on the second terminal of the supply labeled **COM**.
  - d. For resistance programming:
    - i. Provide a **100 k $\Omega$**  potentiometer for X and for Y.
    - ii. For example, with a  $-100\text{ V}$  to  $+100\text{ V}$  Deflection power supply, if the potentiometer is turned fully counterclockwise, it will provide a  $-10\text{ V}$  signal which supplies  $-100\text{ V}$  deflection, if fully clockwise, it will provide  $+10\text{ V}$  which supplies  $+100\text{ V}$  deflection. At the mid-point, it will provide  $0\text{ V}$ , and so no deflection.
    - iii. Attach the wiper terminal of the potentiometer to the program terminal labeled **PROG** by inserting a bare wire end and tightening the terminal screw.
    - iv. Attach the clockwise potentiometer terminal to the **+10 V REF** terminal, and the counterclockwise potentiometer terminal to the **-10 V REF** terminal.
  - e. On the back of the RGCU, set the remote/local toggle switch to the **REMOTE** position.  
**NOTE: Once in the Remote mode (switch in right position), the X and Y supplies are not controllable by the front panel potentiometers.**
  - f. Plug in the power cord and turn on the RGDU as above. The **POWER** pushbutton must be on and the toggle switches must be set on the front panel before the X and Y position is controlled remotely.
9. To change the raster mode (synchronized or free run) if desired:  
**WARNING: Failure to disconnect the RGDU, could result in HIGH VOLTAGE hazard when the cover is open.**
  - a. Turn off the RGDU with the **POWER** switch, and **UNPLUG THE RGDU POWER CORD**.
  - b. Remove the top cover of the RGDU.
  - c. Set the raster mode switch on the front right board to either **synchronized mode (center)** or **free run mode (rear)** position. (See Fig. 4.6-4 above.)
  - d. Replace the top cover, plug in the power cord, and turn on the RGDU again.

**This completes the Raster Generator Deflection Unit Instructions.**