4.5 REMOTE CONTROL / METERING OF POWER SUPPLIES

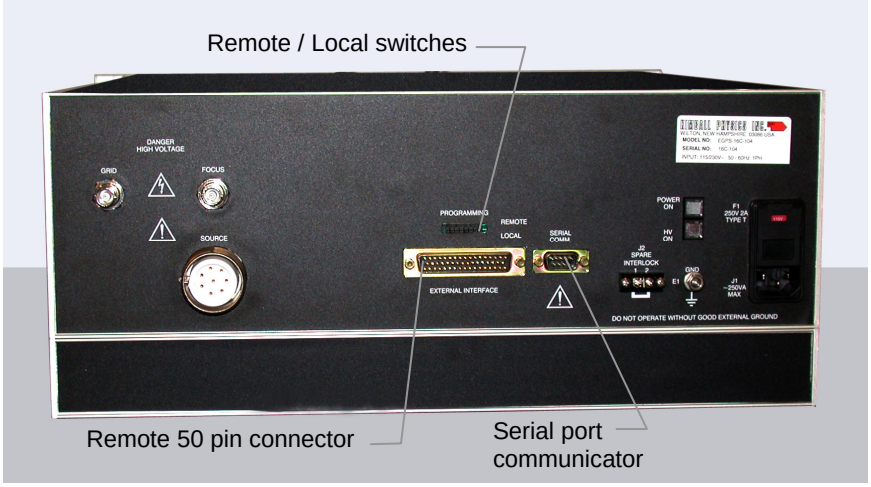

Fig. 4.5-1 A typical power supply rear panel with 50 pin EXTERNAL INTERFACE connector and RS-232 serial port for remote control and metering of included power supplies (Gun connectors and details will vary with the supply model).

The Power Supply provides two different methods of remote access: (1) analog voltage input/outputs via the external interface (50-pin connector) and (2) RS-232 (or RS-422/485) programming input/output via the serial communicator (9-pin serial port). Either method allows both remote programming control of all individual power supplies, and remote monitoring of all meters. A computer program or other system may be designed by the user to control the power supplies in particular ways or to collect data from the supply meters.

The standard analog remote access uses a 50-pin D-sub connector labeled **EXTERNAL INTERFACE** on the back of the Power Supply (Fig. 4.5-1). In addition for programming, there are individual slide switches labeled **PROGRAMMING REMOTE/ LOCAL** for each supply to be controlled. Note that when a supply is in the remote mode, it can not be controlled manually with the front panel FlexPanel Controls. The encoder wheel will have no effect, but the meter values will still be displayed.

Remote control allows the operation of the gun to be somewhat automated. The programming voltage signal can be obtained from any source, such as a simple analog supply or a computer with a digital to analog converter. For example, a computer program can be used to control the output of an individual power supply (such as Energy or Focus) and increase that parameter in systematic steps.

Remote metering allows any meter on the front panel be read using a digital voltmeter or a computer with a data acquisition board (DAQ). For example, the Emission Current meter signal can be connected to a computer, so that emission data can be recorded directly. General guidelines for analog voltage control and metering using the external interface are given in Section 4.5.1.

The supplies that can be controlled and the meter signals that can be monitored depend on the particular gun model and are listed in the tables below. Note that there may be extra pins and switches which are not used with a particular gun.

Separate, optional Power Supply units, such as a stand-alone Rastering unit, also have supplies that can be controlled remotely in a similar manner. However, the units may use a terminal block (Jones strip) that can be wired for connections, rather than a D-sub external interface.

The serial communicator port labeled **SERIAL COMM.** (or **COMM PORT** or **RS-232**) is linked directly to the FlexPanel digital control programming board in the Power Supply. This allows programming of the controller using either the Kimball Physics protocol or a protocol designed by the user. For this type of remote access the **REMOTE/ LOCAL** switches must be in the **LOCAL** mode so that the FlexPanel is operable. Detailed information about the RS-232 serial port and program protocol are given below in Section 4.5.2.

If specified at the time the unit is ordered, circuitry for RS-422 or RS-485 programming is available as an alternative to RS-232. This option uses the same-pin D-sub connector.

4.5 REMOTE CONTROL / METERING OF POWER SUPPLIES cont.

4.5.1 ANALOG VOLTAGE CONTROL / METERING via EXTERNAL INTERFACE

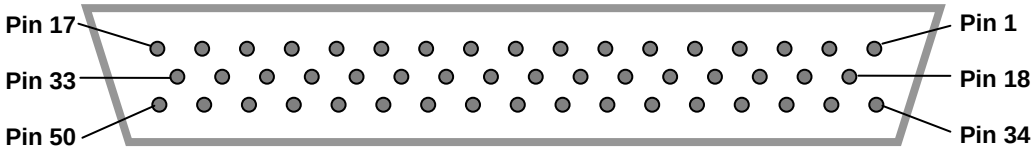

Fig. 4.5-2 Pin out of 50-pin EXTERNAL INTERFACE connector as seen from outside the unit. (All even-numbered pins are at ground.)

User-designed Remote Programming Control /Metering System

1. Set up a user-supplied system (break-out boards, computer program, DAQ boards etc.) to provide a source for analog input to the external interface to control the supplies and to receive output from the external interface for metering.

2. Mating 50-pin D-sub connector parts are provided with the Power Supply so that the user can wire a cable for analog input/output. See Fig. 4.5-2 and Table 4.5-1.

3. H. V. WARNING: Ensure that all Power Supplies are OFF and that power cords are disconnected before making electrical connections.

4. For remote control: Provide a voltage source that produces a **0 to +10 V signal or a -10 to +10 V signal** depending on the power supply.
   a. The voltage source signal maps linearly onto the supply-dependant range shown in Table 4.5-1 below.
      i. For example, with a 0 to –5 keV Energy power supply, a +10 V signal supplies –5000 eV, and a +5 V signal supplies –2500 eV.
      ii. However, with a –150 V to +150 V Deflection power supply, a +10 V signal supplies +150 V, and a -10 V signal supplies -150 V, and a 0 V signal supplies no deflection.
   b. Refer to Table 4.5-1 and Fig. 4.5-2 for the pinout of the **EXTERNAL INTERFACE** connector. For each supply, there are a pair of pins: (1) signal program to connect to the voltage programming signal and (2) common to reference the system to ground.

5. **For remote metering:** The output signal is either **0 to+2 V or -2 to+2 V** depending on the meter.
   a. The meter output signal maps linearly onto the supply-dependant range shown in Table 4.5-1 below.
      i. For example, with a 0 to 500 µA Emission meter, a +2 V signal represents 500 µA, and a +1 V signal represents 250 µA.
      ii. However, with a –150 V to +150 V Deflection supply, a -2 V signal represents –150 V, a +1 V signal represents +75 V, and a 0 V signal represents no deflection.
   b. Refer to Table 4.5-1 and Fig. 4.5-2 for the pinout of the **EXTERNAL INTERFACE** connector. For each meter, there are a pair of pins: (1) signal output to connect to the output measuring device and (2) common to reference the system to ground.

6. On the back of the main Power Supply, set the small remote/ local slide switches labeled **PROGRAMMING** to the **REMOTE** position (up) for each supply that is to be remotely controlled. Individual supplies can be run in either local or remote mode. (Fig. 4.5-3)

NOTE: Once in the Remote mode, the individual power supply is not controllable by the front panel controls. Front panel meters are not affected by these switches.

7. Connect a user-supplied cable from the remote control system to the 50-pin D-sub connector labeled **EXTERNAL INTERFACE** on the back of the Power Supply.

8. Reconnect the power cord.

9. Follow the Normal Start Up Procedure to energize the system and operate the controls that are not programmed remotely.
   a. Front panel rocker switches need to be on (**I** position, lighted) for the remote programmed supplies to operate.
   b. All controls should be set to zero initially.

10. Run the user-supplied computer program /control system to operate the gun remotely.

11. Follow the Normal Shut Down Procedure, turning all supplies to zero with the remote system and tuning off the unit manually with the front panel rocker switches.

H.V. WARNING: For safety it is not sufficient just to turn off the computer program, the POWER and HV rocker switches on the Power Supply panel must be OFF.

4.5 REMOTE CONTROL / METERING OF POWER SUPPLIES cont.

IGPS-2101 Analog Remote Control / Metering

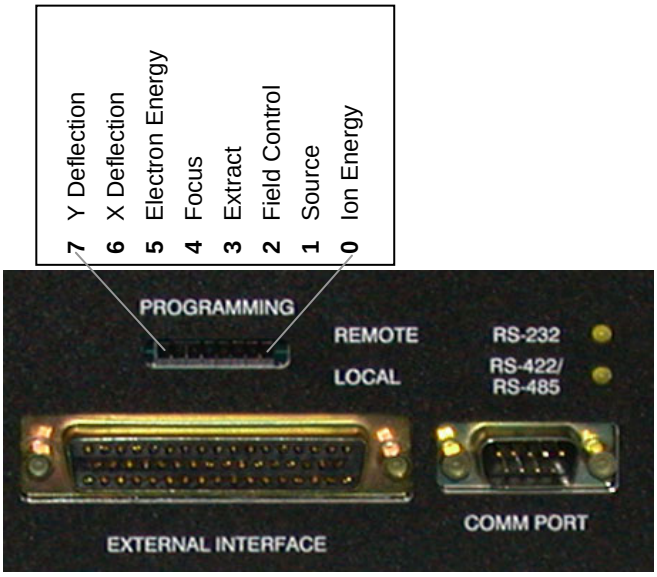

Fig. 4.5-3 Remote / Local switches on the back of the IGPS-2101

Table 4.5-1 IGPS-2101 Remote Programming / Metering Equivalency Table (50-pin D-sub connector)

Power Supply	External Interface		Type	Signal	Range	
	Signal pin	Ground pin			STANDARD	HIGH ENERGY
Ion Energy	1	2	Control	0 to +10 V	0 to +1000 V	0 to +3000 V
Source (in ECC mode)	3	4	Control	0 to +10 V (0 to +10 V)	0 to 2.0 V (0 to10 μA)	
Field Control	5	6	Control	0 to +10 V	0 to -200 V	
Extract	7	8	Control	0 to +10 V	0 to -5000 V	0 to -5000 V
Focus	9	10	Control	0 to +10 V	0 to -1000 V	0 to -3000 V
Electron Energy	11	12	Control	0 to +10 V	0 to -200 V	
X Deflection	13	14	Control	-10 V to +10 V	-150 V to +150 V	
Y Deflection	15	16	Control	-10 V to +10 V	-150 V to +150 V	
Ion Energy voltage	21	22	Meter	0 to +2 V	0 to +1000 V	0 to +3000 V
Source voltage	23	24	Meter	0 to +2 V	0 to 2.0 V	
Field Control voltage	25	26	Meter	0 to +2 V	0 to -200 V	
Extract voltage	27	28	Meter	0 to +2 V	0 to -5000 V	0 to -5000 V
Focus voltage	31	30	Meter	0 to +2 V	0 to -1000 V	0 to -3000 V
Electron Energy voltage	33	34	Meter	0 to +2 V	0 to -200 V	
X Deflection voltage	37	38	Meter	-2 V to +2 V	-150 V to +150 V	
Y Deflection voltage	39	40	Meter	-2 V to +2 V	-150 V to +150 V	
Electron current	41	42	Meter	0 to +2 V	0 to 10 mA	
Source current	43	43	Meter	0 to +2 V	0 to 5.0 A	
Ion current	45	45	Meter	0 to +2 V	0 to10 μA	

NOTE: Any even numbered pin can be used as a ground pin; for example, although pin 33 and 34 are wired internally as a pair, it may be more convenient externally to use pin 50 as a ground pin with pin 33.