Service and Operations Manual

for the

UP-200

Digital Electrostatic Power Supply

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Version 1.05 Rev E

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Section 1
Description

The UP-200 power supply is a monumental improvement and a key element in a modern electrostatic finishing system. The basic operation is to provide a controlled low voltage (0 to –21VDC) output to the electrostatic atomizer that is capable of providing up to 100,000 volts. The UP-200 incorporates state of the art safety features and fail-safes to provide for a safe operating environment. These include:

- Over voltage detection
- Over current detection
- Fast current slew rate detection and limiting
- Turn-on proximity detection
- Open and short line detection and protection
- Current limiting via voltage fold-back

plus several other innovations.

The UP-200 is capable of being operated by a Central Controller in a fully automated system. Furthermore, the UP-200 has remote and local data communication capabilities, allowing for remote management of the power supply.

The UP-200 has a convenient three-button front panel interface for adjusting the supply's most critical operating parameters and safety thresholds. A front panel data port allows access to additional options, diagnostics, and reporting features. The unit is also designed to provide access via a remote terminal. A special feature of the UP-200 is its direct input of operating parameters using standard units; i.e. the Current Fault threshold is input in microamps. This feature permits precise and repeatable operation of the supply and eliminates the need for personnel to enter the paint booth for setting and checking parameters.

Section 2
Controls and Operation

2.1 Front Panel Description

The UP-200 allows viewing and setting important operational and safety parameters from the front panel. The front panel features clear display of output voltage and current values.

2.1.1 KV Status Window

At the top of the front panel is a 3-digit window that normally displays the voltage (kV) at the tip of the atomizer. This is based on the output voltage of the power supply. A display of "FLt" in this window indicates that a system fault has occurred and the supply has been temporarily shut down.

2.1.2 Status Window

The lower 3-digit window on the front panel displays the value for the parameter indicated by the Parameter LED. A set of 3 yellow LED's to the right of the Status Window indicates the units of the value being displayed. When the Parameter LED is positioned on Mode, or high voltage delivery has been enabled, the value displayed in the Status Window is the output cascade current in microamps.

2.1.3 HV Enabled Warning LED

This LED indicates that the UP-200 is delivering high voltage. High Voltage can be enabled either by the front HV Enable Switch or by the Remote Controller.

2.1.4 Parameter LED's

This group of LED's is used for three purposes:

1. In normal use, the lighted Parameter LED indicates what value is being displayed in the Status Window. The lighted LED can be moved among the settable parameters by using the Up Arrow and Down Arrow buttons.
2. When setting up the power supply, a slow blinking Parameter LED indicates that the value of a parameter value is being changed.
3. After a fault condition has occurred, a fast-blinking Parameter LED indicates the threshold that was exceeded.

The parameters are:

- Mode – selects among four modes of voltage control operation
- Current Limit – level (μA) where voltage fold-back begins
- Current Fault – level (μA) where the unit will shutdown
- dI/dt – maximum slew rate (μA/s) fault level

- Hi Set – specifies the High voltage for HI/LO control
- Lo Set – specifies the Low voltage for HI/LO control
- Voltage – specifies output voltage (kV) when in Local Mode

2.1.5 Mode LED's

This grouping of four LED's is used to indicate what mode the power supply is in. The lighted LED indicates which voltage control method will be used when the high voltage is enabled.

- EXT VOLT CTRL
  External Voltage Control. A 0 to 10V signal from the Controller selects the output voltage. Control is linear, and a 10V input yields 100kV at the atomizer.
- EXT CURR CTRL
  External Current Control. A 0 to 20mA signal from the Controller selects the output voltage. Control is linear, and a 20mA input yields 100kV at the atomizer.
- HI/LO
  External High/Low Control. The output voltage is set to either the HI SET or LO SET parameter value via the Hi/Lo signal from the Controller.
- LOCAL
  Local Control Mode. The output voltage is specified by the VOLTAGE parameter.

2.1.6 Up Arrow, Down Arrow, and SET Buttons

These buttons are used both for selecting a parameter to view as well as to modify its value. When navigating, the Up Arrow and Down Arrow buttons cause the front panel Parameter LED to move up and down along the names of the settable parameters. The value displayed in the Status Window is that of the selected parameter.

The SET button is used to change the value of the selected parameter. When the Parameter LED is next to the name of the parameter to be modified, press the SET button. At this point, the Parameter LED will blink slowly. The Up/Down buttons can be used to increment/decrement the parameter's value. When setting the Mode, the Up/Down buttons move the Mode LED. Press and hold the Up/Down buttons to rapidly change the value. Once the desired value is obtained, press SET again to save the new setting.

2.1.7 HV Enable Switch

The HV Enable switch allows high voltage output to be engaged from the front panel. This is normally used for testing.

2.1.8 Power On/Off Switch

The main power switch on the front panel controls the incoming AC power. When in the off position, all power to the supply is turned off.

2.1.9 Local Data Port

This is the front panel interface to a terminal or PC running a terminal program like HyperTerminal. The interface is RS232, 9600bps, 8 Bits, No Parity, 1 Stop Bit, Xon/Xoff flow control. Emulation is VT100. For detail of its operation, refer to Section 3.0. See also appendix B for cabling and C for communications setup.

2.1.10 HV Circuit Breaker

This is the last line of protection for the power output of the supply. The HV circuit breaker is tripped if the output is shorted and the processor cannot protect the circuit in time. When tripped the breaker's button will stick out indicating a fault. Press the button back in to reset the breaker.

2.1.11 Front Panel Local RS232 Data Port

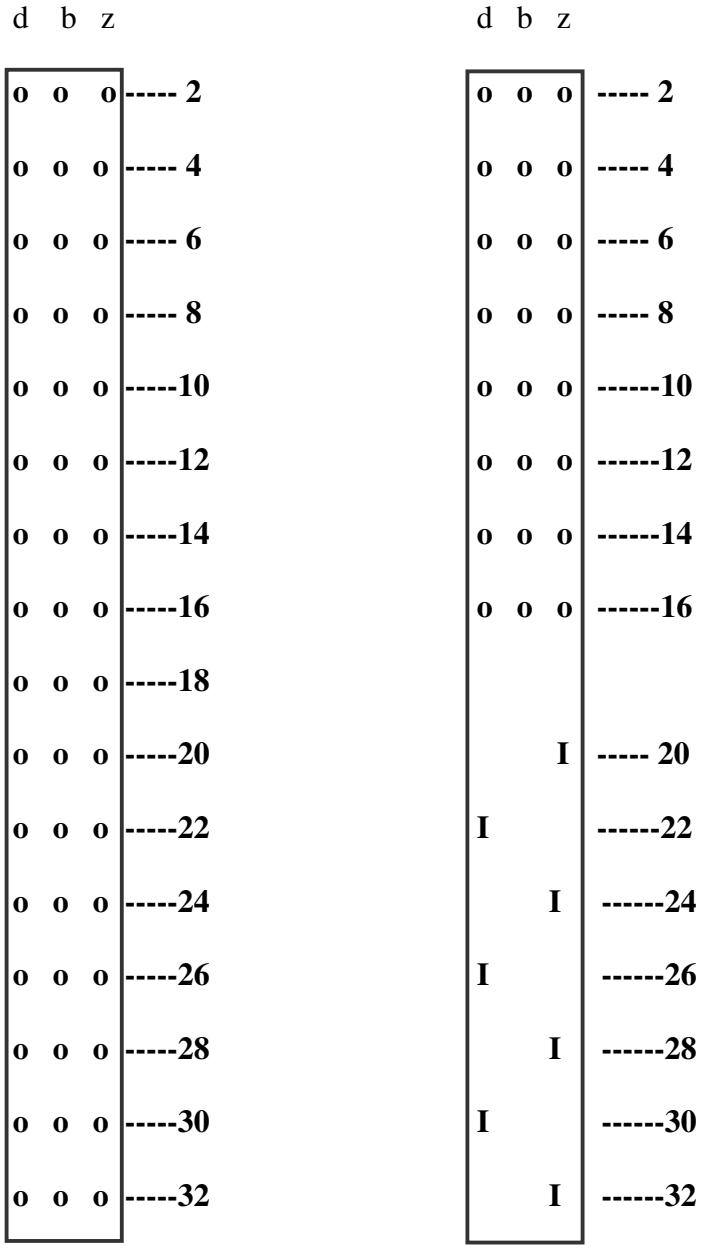
This port gives access to power supply information and control via a laptop or other handheld terminal. It also is used with a special electronic key to control access to special configuration information called the "Plant Setup".

The communication interface is asynchronous serial connection to a standard PC Com port at 9600/8/N/1. Refer to Appendix B for pin out and cable specifications. Refer to Appendix C for detailed Communication Setup Parameters. When connected, this port provides a menu driven console interface described in detail in Section 3.

The electronic "Plant Setup" key gives the supervisor the ability to create a default configuration for the power supply. This feature allows the supply to be tailored for the special requirements of each paint shop. Whenever the key is installed, the UP-200's parameters are restored to the last saved Plant Setup. While installed, any changes made to the power supply settings and parameters become part of the Plant Setup. When the key is removed, the Plant Setup is saved. While the key is removed, the supply's operating parameters can be changed, but if they are, the decimal point appears in the KV Status Window. Re-installing the electronic key restores the Plant Setup.

Section 2.2
Back Plane Connectors (A/B)

The rear panel consists of two connectors. These are referred to as A (Top) and B (Bottom). These connectors provide the interface to the backplane of the supply. Refer to Appendix A for details on these connectors.



Connector A (Top)
Rear View
Mate: EFC 60-1A69

Connector B (Bottom)
Rear View
Mate: EFC 60-1A70

Section 3
Console User Interface

The UP-200 console user interface is accessed via the front panel Local Data Port.

3.1 Event Log

On initial entry to the console interface, the Event Log is active. An example of a log containing a slew rate (dI/dt) fault is shown in the box below. Each log entry consists of a timestamp and a textual message describing the event. The UP-200 does not contain a real-time clock, so the timestamp is relative to the time the supply was turned on.

```
  0.00:00:00.000  Warm Restart
  0.00:00:00.000  Entering Local Control Mode
  0.00:00:00.000  Begin Operation
  0.00:00:00.000  High Voltage Disabled

Log is On,  Off = [Space Bar]   Exit = [X]

  0.00:13:43.779  UP-200 Enabled
  0.00:13:43.785  High Voltage Enabled
  0.00:13:44.060  High Voltage Disabled
  0.00:13:44.063  SHUTDOWN: dI/dt Fault (224 uA/s)
  0.00:13:51.905  UP-200 Disabled
  0.00:13:51.909  Maxima: 52 uA   50 kV   11 uA/s
```

Press [X] or [Escape] to leave the Event Log and return to the top-level System Control menu.

3.2 System Control

```
UP-200 System Control

  A - Display Event Log
  B - Display Output Maxima
  C - Voltage Control Parameters
  D - View/Modify Settings
  E - Set Default Settings
  F - Save Settings to Flash
  G - Download Monitor
  H - System Restart

Select [A..H]:
```

The System Control menu is the top-level menu of the console user interface. Select a menu item by pressing the appropriate key. Most of the choices lead to other menus, and they are described below.

A.	Display Event Log	- Time stamped log of system events
B.	Display Output Maxima	- Record of maximum output values
C.	Voltage Control Parameters	- Menu for tuning of voltage control software
D.	View/Modify Settings	- Menu for safety thresholds and Mode setting
E.	Set Default Settings	- Restore factory default mode and thresholds
F.	Save Settings to Flash	- Save parameter settings to flash memory
G.	Download Monitor	- Allows software upgrade of boot monitor program
H.	System Restart	- Restarts software and enters boot monitor program

3.3 Output Maxima

The Output Maxima is a menu offering a selection of various intervals of historical power supply performance data that is recorded by the UP-200. The performance data include voltage, current, and slew rate values that are recorded by the system while enabled. This information can be useful in optimizing parameter settings and understanding the causes of fault conditions.

```
UP-200 Output Maxima Archive

  A - Last 250 milliseconds
  B - Last 60 seconds
  C - Last 60 minutes
  D - Last 24 hours
  E - Clear Archive
  X - Exit

Select [A..E,X]:
```

```
Output Samples Over Last 250 ms of Operation (Page 1)

         kV   uA uA/s             kV   uA uA/s             kV   uA uA/s

    0.   48   52  224       10.   48   32   41       20.   46    0    0
    1.   48   52  198       11.   48   26   25       21.   46    0    0
    2.   48   49  171       12.   48   20   12       22.   41    0    0
    3.   50   39  147       13.   47    6    2       23.   41    0    0
    4.   49   26  127       14.   46    0    0       24.   40    0    0
    5.   48   26  115       15.   46    0    0       25.   40    0    0
    6.   48   26  101       16.   46    0    0       26.   40    0    0
    7.   48   30   89       17.   45    0    0       27.   40    0    0
    8.   48   32   74       18.   45    0    0       28.   40    0    0
    9.   48   33   58       19.   46    0    0       29.   40    0    0


Exit=[X]  Any other key to continue:
```

3.4 Voltage Control

The Voltage Control Parameters is a menu displaying the settings of some parameters that are used to tune the performance characteristics of voltage control software in the supply.

```
Voltage Control Parameters

             Update Interval = 2 ms
              Max dV/dt Rate = 25 kV/s
              Damping Factor = 10 +/-kV
                 dI/dt Limit = 25 %
              dI/dt Foldback = 50 %
                 dI/dt Delay = 1 s
           Proximity Current = 10 uA
       LineFault Sensitivity = 0 +kV
    Dynamic Current Interval = 10 s

Select Item to Modify

  A - Update Interval
  B - Max dV/dt Rate
  C - Damping Factor
  D - dI/dt Limit
  E - dI/dt Foldback
  F - dI/dt Delay
  G - Proximity Current
  H - LineFault Sensitivity
  I - Dynamic Current Interval
  X - Exit

Select [A..I,X]:
```

A. Update Interval

Voltage update period in milliseconds. A smaller number yields faster control, but default is recommended. Changing this value affects other parameters in this list.

B. Max dV/dt Rate

Maximum voltage increase rate. Limits how fast the output voltage will increase. Lower numbers are safer, but slow the response time of the supply in tracking the controller.

C. Damping Factor

A number that determines how the fast the supply converges on the desired voltage. Lower numbers converge faster at the expense of smoothness. Decrease this number to get faster response. Increase this number if the output voltage is not stable.

D. dI/dt Limit

Maximum current increase rate. Limits how fast the supply will allow the current to increase. Specified as a percentage of the dI/dt fault threshold. Chiefly used when ramping up voltage after the supply is enabled. When the current rises to this percentage of the dI/dt fault level, the voltage increase will halt until the rate of current increase subsides.

E. dI/dt Foldback

Similar to dI/dt Limit, but when the rate of current increase rises to this percentage of the dI/dt fault level, the voltage will be decreased in an attempt to avoid a fault condition.

F. dI./dt delay

At startup, sometimes an initial rush of current takes place that may cause false dI/dt fault detection. This parameter establishes a short delay between enabling the UP-200 and before dI/dt is evaluated. In cases of high start up current (use of High voltage lines, water based paint, etc.) increasing this number will eliminate dI/dt faults.

G. Proximity Current

Each time high voltage is enabled, the supply performs a short proximity check. It adjusts itself to produce 25kV and then looks for current. If it sees more than this number of microamps, the atomizer is presumed to be close to some object and the supply is shutdown.

H. Line Fault Sensitivity

This parameter adjusts the level at which the UP-200 will start evaluating the feedback to determine if a line fault has happened. In cases of extremely long LV cables, this may need to be increased to eliminate improper line faults.

I. Dynamic Current Interval

This controls a special mode in the UP-200 to enhance current faults due to extremely slow rise in current. The higher the number the longer the UP-200 will wait for the current to rise before adjusting current fault parameters automatically.

3.4 Power Supply Settings

The Power Supply Settings menu displays the safety and configuration parameters that are accessible from the front panel.

```
Power Supply Settings

           Operational Mode = Local
       Current Limit Ceiling = 200 uA
         Current Fault Level = 150 uA
   Maximum Slew Rate (dI/dt) = 200 uA/s
     External "High" Voltage = 80 kV
      External "Low" Voltage = 40 kV
       Local Voltage Setting = 79 kV

Select Item to Modify

  A - Operational Mode
  B - Current Limit Ceiling
  C - Current Fault Level
  D - Maximum Slew Rate (dI/dt)
  E - External "High" Voltage
  F - External "Low" Voltage
  G - Local Voltage Setting
  X - Exit

Select [A..G,X]:
```

A. Operational Mode
   Selects among four modes of voltage control operation:
   A) Local – voltage set to fixed value when enabled
   B) Hi/Lo – voltage set to High or Low value based in input signal
   C) External Current – 0-20mA input for 0-100kV output
   D) External Voltage – 0-10V input for 0-100kV output
   E) External 4-20mA – 4-20mA input for 0-100kV output

B. Current Limit Ceiling
   Threshold (µA) where voltage fold-back begins. This feature is used to avoid current faults by temporarily reducing voltage output when the delivered current exceeds this threshold.

C. Current Fault Level
   Threshold current (µA) where the UP-200 will shut down. If current delivery exceeds this threshold, the system will signal a fault back to the controller and shut down the supply.

D. Maximum Slew Rate (dI/dt)
   The maximum current slew rate (µA/s) fault level. A rapid increase in current is a precursor to arcing. Careful adjustment of this parameter affords protection against sparks.

E. External "High" Voltage
   Specifies the "high" voltage when working in the Hi/Lo operational mode. The UP-200 will deliver this voltage when the Hi/Lo contacts are shorted (closed). Refer to Appendix A, Connector B, pins B12 and D12.

F. External "Low" Voltage
   Specifies the "low" voltage when operating in Hi/Lo mode. The UP-200 will deliver this voltage when the Hi/Lo contacts are open. Refer to Appendix A, Connector B, pins B12 and D12.

G. Local Voltage Setting
   Specifies output voltage (kV) when operating in Local mode. In local mode, the UP-200 provides 0kV when disabled and this voltage when enabled. The enable signal is described in Appendix A, Connector A, pins Z2 and B2.

3.5 Set Default Settings

Use the Set Default Settings option on the top-level menu to restore all of these parameters to their original factory default values.

3.6 Save Settings to Flash

The Save Settings to Flash option causes the supply to archive the parameter values into its flash memory.

3.7 Download Monitor

The Download Monitor feature allows for the downloading of new Boot Monitor software.

3.8 System Restart

Choosing the System Restart option from the top-level menu causes the UP-200 to perform a warm restart of the system. Console control will fall back to the Boot Monitor software after the restart. The Boot Monitor interface contains some self-diagnostic tests and allows for downloading/upgrading of the UP-200 operational software.

Section 4
Theory of Operation
Patent Pending

The operation of the UP-200 can be broken down into 4 sections (Refer to figure 1), Input, Output, Process and Power. The CPU gathers Input from the various sources, and processes the information to determine the proper Output.

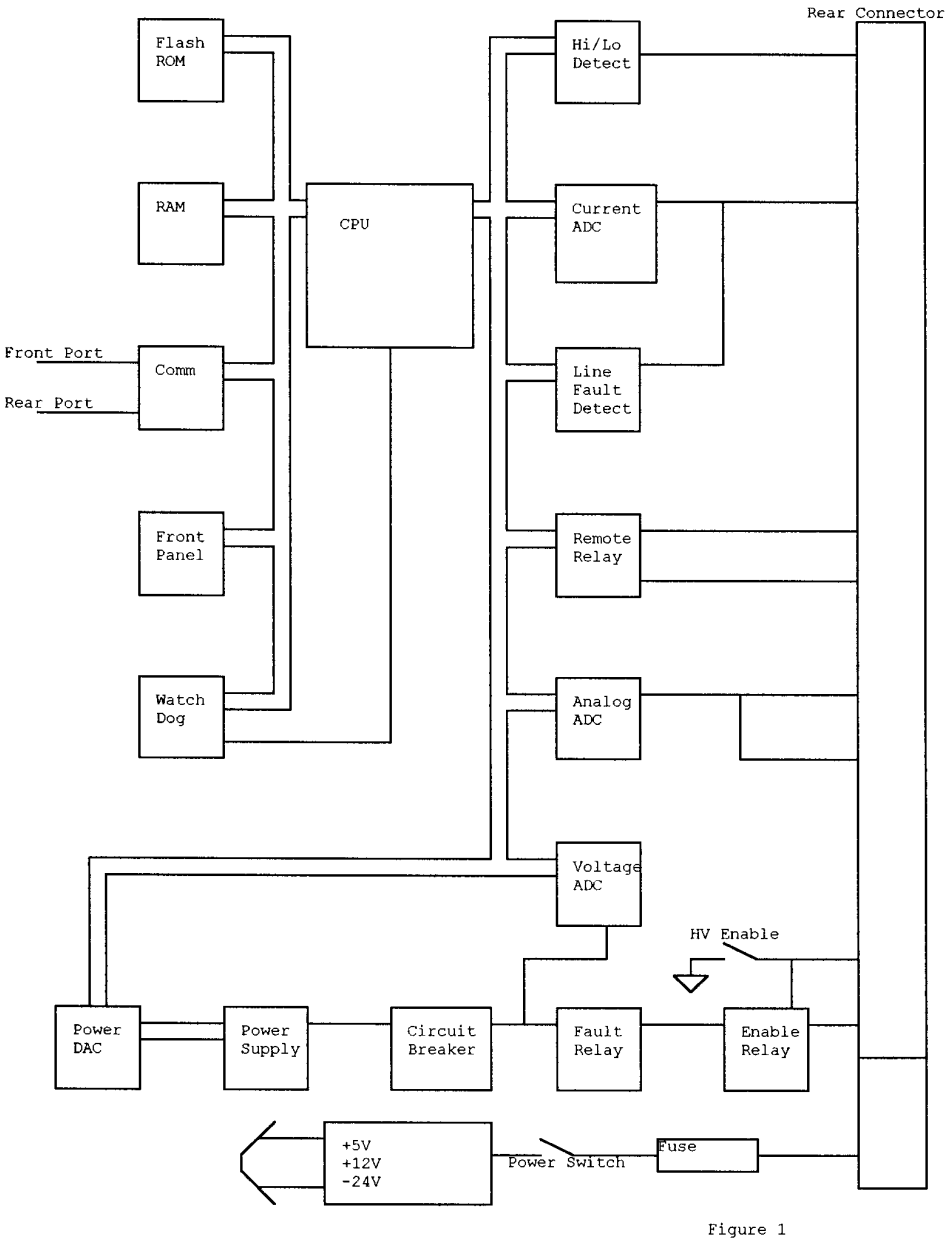


Figure 1

Due to the design and "soft" nature of the UP-200, many intelligent features have been added to enhance the safety of the painting operation and to aid in the troubleshooting of system problems. Furthermore, the added communication ability of the UP-200 allows it to report and be configured from a remote location.

4.1 Fail Safe Features

Many Fail Safe Features have been added to the product as follows:

- 5V Fail - If the +5V is lost the Fault Relay will open and disengage the power from the output leads.

- 12V Fail – If the +12V is lost the Enable Relay will open and disengage the power from the output leads.

- CPU Watchdog – If the CPU stops or gets stuck in a loop, a watchdog circuit will reset it. The reset will also clear the fault relay and thus turn off the power to the output leads. The Watchdog also resets the Fault relay to the off position at power up. The processor must reinitialize the Fault circuit in order for output power to be re-established.

- Power Fail – If the Secondary Supply should fail the microprocessor will detect this, shut down the supply and open the Fault Relay.

- Main Power Fuse – If an internal short or power surge happens the main fuse will blow and shut down the supply.

- Secondary Power Circuit Breaker – If a short happens on the secondary power supply and the microprocessor fails to catch it, the front panel circuit breaker provides the last line of defense.

- Thermal Shut Down of Secondary Supply – The secondary supply has a thermal shutdown mechanism built it. If these parts should exceed a preset limit, the secondary supply will shutdown.

4.2 Software Control

The software monitors many items in sequence to determine proper operation and fault situations. The processor, running at approximately 1 Million Instructions Per Second (MIPS), appears to be doing all these functions simultaneously. The system is designed for real-time (sub-millisecond) management of the safety systems and accurate control of output power.

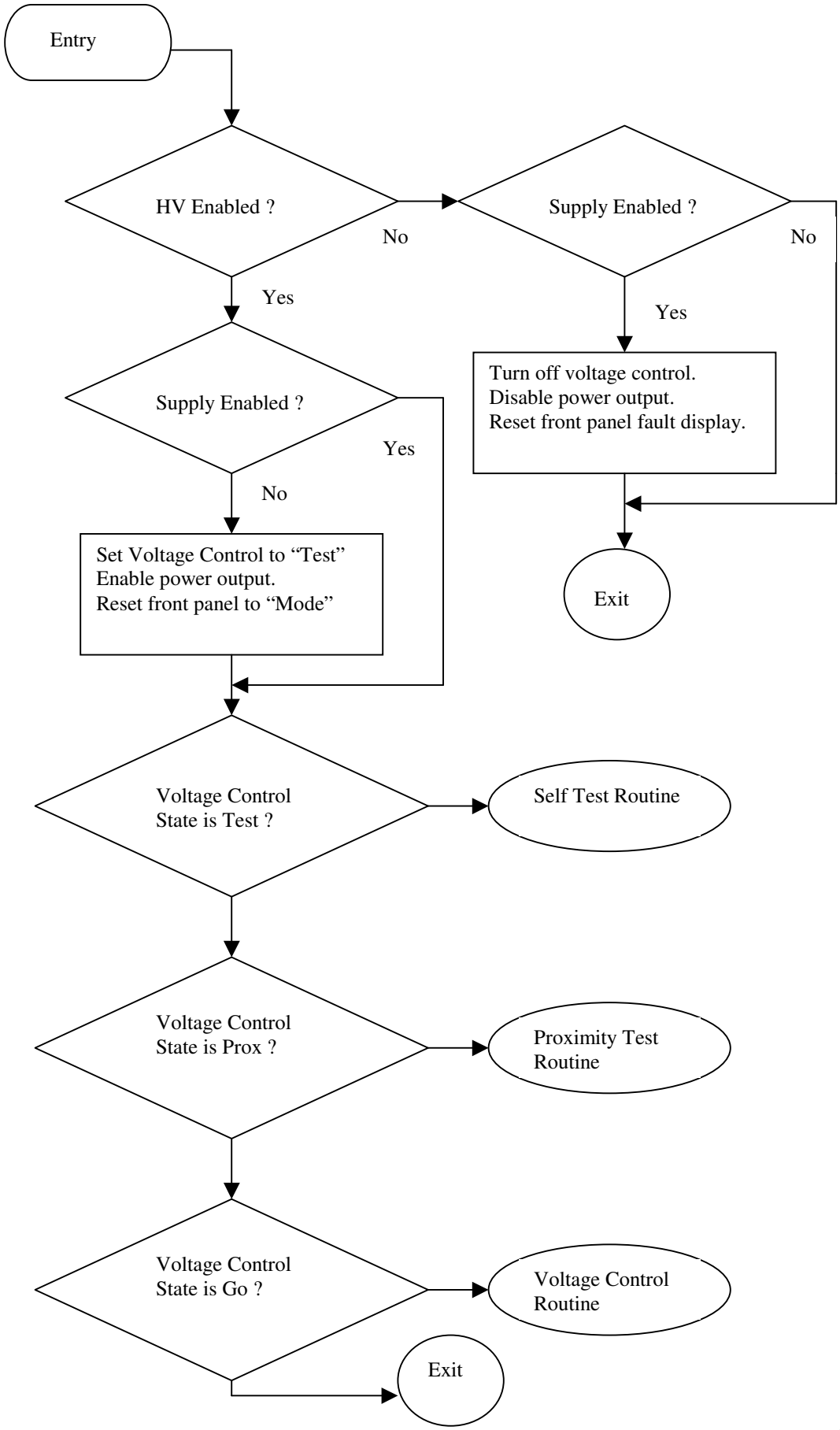
- Monitor the output voltage to allow for a closed loop control, display and report functions.
- Monitor the Cascade Current to allow for current limit, current fault, dI/dt fault, and dI/dt foldback, as well as display and report these functions.
- Monitor the External Control Inputs, (0-20ma External Current Control or 0-10V External Voltage Control, Hi/Lo External Control, and the Enable line) to determine the proper output for the power supply.

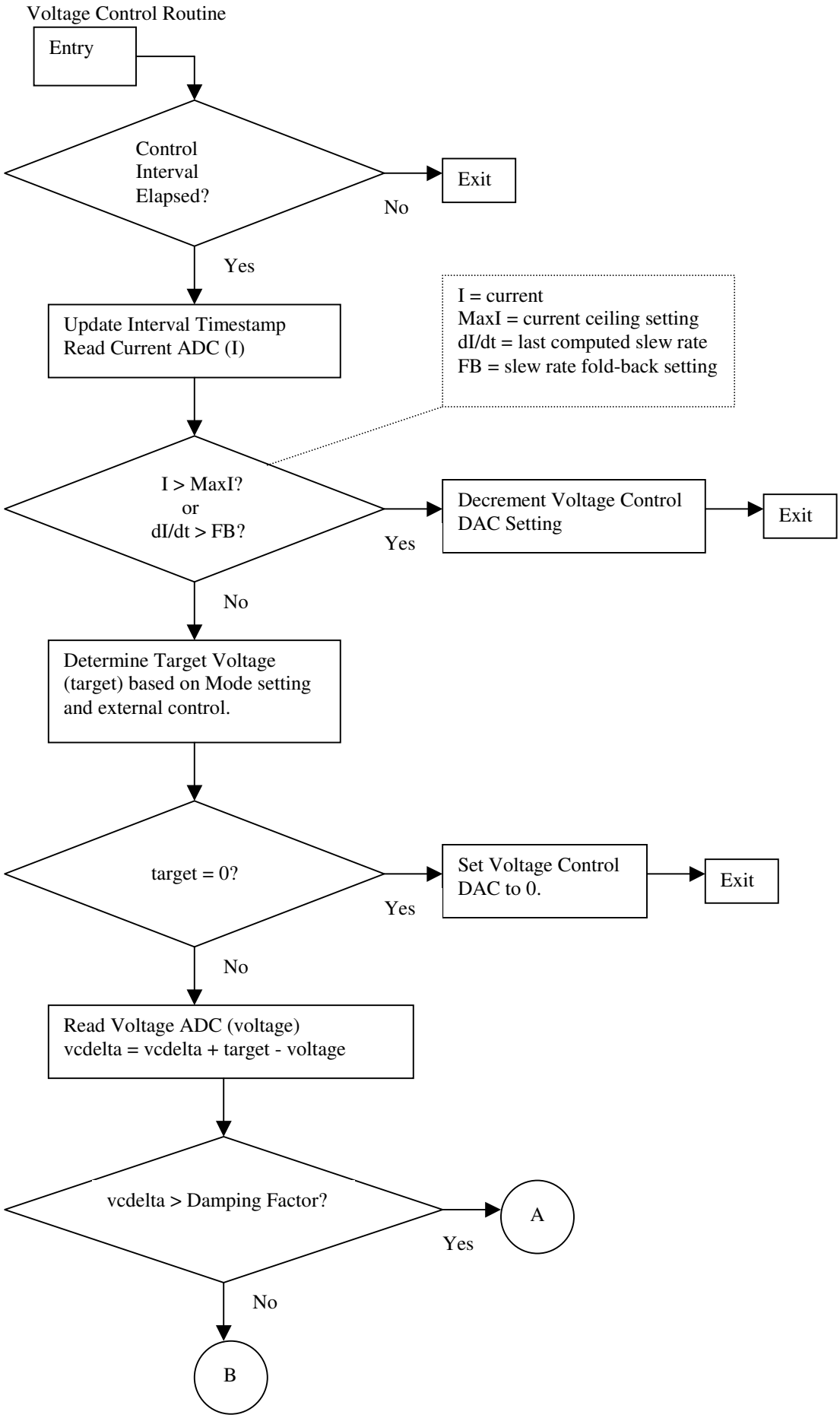
- Monitor the User interfaces (Front Panel, Local Data Port, Main Data Port) to determine proper setup and report operations.

The Following Flow Diagrams show some of the procedures that are used in controlling the Voltage and Faults of the UP-200:

Notice in the voltage control state machine that when the UP-200 is instructed to apply power it does so in a manner as to prevent false faults (i.e. the voltage ramps up at a rate not to exceed 50% of dI/dt and current fault) and yet, provide protection from sparks in the event of a catastrophic incident. dI/dt is not turned off and if a rapidly approaching object, such as a falling grounded pipe, were to come in proximity of the cascade the UP-200 would fault out even at power up.

Voltage Control State Machine




Voltage Control Routine
Entry
Control Interval Elapsed?
No
Exit
Yes
Update Interval Timestamp
Read Current ADC (I)
I = current
MaxI = current ceiling setting
dI/dt = last computed slew rate
FB = slew rate fold-back setting
I > MaxI? or dI/dt > FB?
Yes
Decrement Voltage Control DAC Setting
Exit
No
Determine Target Voltage (target) based on Mode setting and external control.
target = 0?
Yes
Set Voltage Control DAC to 0.
Exit
No
Read Voltage ADC (voltage)
vcdelta = vcdelta + target - voltage
vcdelta > Damping Factor?
Yes
A
No
B

4.3 Communications

The UP-200 has two modes of communications, Analog and Digital. In order to keep compatible with the existing controllers, Analog is the interface that is used. Digital is used to provide setup and reporting functions, however the UP-200 is designed to allow complete digital control via RS422 interface located on connector A. These interfaces are described in the Appendix in more detail.

Section 5
Installation

The UP-200 is designed to fit into an EFC 6U – 19" rack. The rack will provide up to six sets of connectors (DIN 41612) for the UP-200 to plug into. When placing units in the rack, be careful that the connectors mate before pushing the power supply in. When the unit is completely seated, lock the unit in place with the four quarter-turn latches. The UP-200 has been designed to be electrically compatible with any existing configuration of equipment for the UP-100, PS-100 or GN3002 Electrostatic Power Supplies. Depending on connector spacing, a 7hp filler panel may be needed. This power supply is specifically designed for the EFC 4X4 Rack, which can contain:

- Four UP-200s
- TSC-400 Quad Turbine Speed Controller
- AFC-400 Quad Flow Rate Controller

This combination is a complete Electrostatic / Turbine Solution for four robots. After installation, refer to the Operations Section (2.0) for detail about setup. For more detail, refer to the Rack Installation Manual.

Section 6
Troubleshooting

The UP-200 is designed to provide as much information as possible in the case of non-operation or Fault conditions. However, due to the limited display space on the front panel some of the errors are encoded.

6.1 Setup Problems

These problems usually indicate a problem in the setup:

Problem	Action / Check
Front Panel Meters are blank.	Is the "Power" switch on, or is the power switch broken. Is AC power being supplied to the unit? Is it Low? Is the Main Power Fuse blown? Is the 115/230 switch in the right position? Is the power pin bent in the B connector? Is the UP-200 pushed fully into the rack?
LED windows are on, Unit goes into fault as soon as Enabled	Depending on which parameter, that is causing the fault, check to make sure that it is set properly, some parameters such as "Proximity Level" is set up by the terminal interface. Are these set correctly? Is the UP-200 pushed fully into the rack? Is there a pin bent on the rear connectors? Is the Circuit breaker button popped up? Is there a broken wire to the cascade?

6.2 Fail Safe Problems

These problems usually indicate a problem with the power supply:

Problem	Action / Check
Front Panel Meters flash on and off.	Check for Low AC input voltage. Also, if unit is cold, condensation may have formed on the circuit board, let unit dry and try again.
Front Panel is blank, and Enable relay clicks when Enable switch is turned on/off	This usually means the +5V PS has failed, return the unit for repair.
Front Panel is ok, but no output, The Enable relay does not click when the Enable switch is turned on/off.	Check the Interlock input on Connector B, if this is not used these input must be shorted. This could also be an indication that the +12V power supply has failed.

Front Panel is ok, Enable relay can be heard when the Enable switch is turned on/off, but no output.	Check the Circuit Breaker on the front panel, if unit is warm the secondary power supply may be in thermal shutdown (let cool). If this continues, check the cascade and wire to make sure excessive current is not being drawn. If none of these fix the problem return unit for repair.

6.3 System Fault Problems

These indicators usually indicate a problem in the system. When the system finds a system fault the top LED window will flash "FLt", the Status Window will display the failing parameter, (Current draw, dI/dt level, Voltage) and the other LEDs on the front panel will indicate what the problem is.

Fault Mode	Action / Check
Current Limit Flashing	This will flash each time the current has tried to exceed the user set limit and the UP-200 has folded back the voltage. This is not a problem, but an indicator to the user that this parameter has been reached. No corrective action needed.
Current Fault Flashing	This can indicate three different faults: Over-Current Fault, Under-Current Fault or Power Up Proximity Fault. When any current fault occurs, the UP-200 will discontinue power output. The value in the Status window is the value of the current when it faulted. If the displayed current is 000 microamps, then the fault occurred because too little current was detected. Possible cause is an incorrectly installed cascade. If the value in the Status Window is low, (around 10uA) then a proximity Fault is the cause, check to make sure that the atomizer is not near a grounded object when the UP-200 is enabled. If the current displayed in the Status window is high (150uA; depending on the user set level) then the unit faulted because the user set Current Fault Limit has been exceeded. Check the path of the atomizer during operation to make sure it is not coming too close to a grounded object.
dI/dt Flashing	This will flash when the dI/dt has exceeded the user set value. The UP-200 will discontinue power output. This could be caused from the atomizer approaching a grounded surface too quickly. The value in the Status window is the value of the dI/dt when it failed.

Voltage Flashing	This usually indicates that the maximum voltage (105kV) has been exceeded. A voltage fault can also be caused at startup when the system measures current before applying voltage or while running when applying high voltage but measuring no current. These are fail-safe faults that indicate an internal failure of the UP-200.
Line Fault Flashing	This indicates that something is wrong with the cascade circuit, usually a wire or bad cascade.
Line Fault and Voltage Fault	This indicates that a short has happened in the cascade circuit, usually a wire or bad cascade.
Flashing Line Fault and dI/dt Fault Flashing	This indicates a open in the cascade circuit, usually a wire or bad cascade.

Section 7
Specifications

7.1 Electrical Specifications

POWER REQUIREMENTS:	115/230 VAC +/- 10%, 50/60 Hz., SINGLE PHASE
POWER CONSUMPTION:	57VA MAX AC
POWER OUTPUT:	50 WATTS DC
VOLTAGE OUTPUT:	0 TO -21VDC (USER ADJUSTABLE)
ANALOG CONTROL INPUT:	
VOLTAGE:	0 TO 10VDC, Z=20K ohms 0VDC INPUT = 0KV OUTPUT 10VDC INPUT = 100KV OUTPUT
CURRENT:	0 TO 20mA, Z= 50 ohms 0mA INPUT = 0KV OUTPUT 20mA INPUT = 100KV OUTPUT
HI/LO CONTROL INPUT:	CLOSED CONTACT OPEN = LOW SETTING CLOSED = HI SETTING
INTERLOCK CONTACTS:	1A 12VDC RESISTIVE LOAD
MAIN POWER FUSE:	3AG 250V, 2 AMP FAST ACTING
RELAY CONTACTS:	
ENABLE RELAY	1A, 24VDC / .3A, 115VAC, ISOLATED
FAULT RELAY	1A, 24VDC / .3A, 115VAC, ISOLATED
LOCAL/REMOTE RELAY	0.5A, 100VDC, ISOLATED
METER FEEDBACK	
VOLTAGE	4-20MA = 0 TO 100KV
CURRENT	4-20MA = 0 TO 200UA

7.2 Mechanical Specifications

Height	10.3", (266.70mm), 6U
Width	2.79", (70.86mm), 14HP
Depth	7.7", (172.50mm)
Weight	4.5lb, 2.04Kg
Connectors	
Rear:	A - EPT-109-40064-2 B - EPT-117-40064-2
Front:	DB9-S - AMP 745781-4

7.3 Environmental Specifications

The UP-200 should not be placed in an environment that exceeds these specifications:

Temperature
Range: 0 to 40degrees C (32 to 104 degrees F)

Relative humidity: 5 to 90% non condensing

Section 8

Appendix

Appendix - A

Rear Panel – Connectors A & B
The rear panel has two connectors (top A, and bottom B). These mate with connectors in the card cage. The pin out for each is as follows:

Connector A

Pin Number	Signal	Notes
Z2	REMOTE HV ENABLE - SIGNAL	| Short these two signals
B2	REMOTE HV ENABLE - COMMON	| together to enable supply
Z4	GROUND	
D2	ENABLE RELAY - COMMON	| Enable Relay Feedback
D4	ENABLE RELAY - NO	|
D6	ENABLE RELAY – NC	|
Z8	ATOMIZER – COMMON (RED)	
B8	ATOMIZER – POWER 0 – -21V (WHITE)	
D8	ATOMIZER – FEEDBACK (BLACK)	
Z12	ATOMIZER – 4W ENABLE	
Z32	ATOMIZER – SHIELD	
D10	FAULT RELAY 1 – NO	| Fault Relay Feedback 1
D12	FAULT RELAY 1 – NC	|
Z16	FAULT RELAY 1 – COMMON	|
D16	FAULT RELAY 2 – NO	| Fault Relay Feedback 2
D18	FAULT RELAY 2 – NC	|
D14	FAULT RELAY 2 – COMMON	|
B26	COM 422 TDB	| RS 422 Data Com Port
B28	COM 422 TDA	|
B30	COM 422 RDB	|
B32	COM 422 RDA	|

Connector B

Pin Number	Signal	
Z2	ENABLE INTERLOCK 1 +	| Conveyer Interlock 1
D2	ENABLE INTERLOCK 1 –	| (Must be shorted to Enable)
Z4	ENABLE INTERLOCK 2+	| Conveyer Interlock 2
D4	ENABLE INTERLOCK 2-	| (Must be shorted to Enable)
Z6	CURRENT METER OUTPUT COMMON	| 4-20ma Current Usage
D6	CURRENT METER OUTPUT SIGNAL	| Feedback
Z8	VOLTAGE METER OUTPUT COMMON	| 4-20ma Voltage Usage
D8	VOLTAGE METER OUTPUT SIGNAL	| Feedback
Z10	ANALOG VOLTAGE CONTROL IN (0-10VDC)	* Use only one!
D10	ANALOG VOLTAGE CONTROL COMMON	
Z12	ANALOG CURRENT CONTROL IN (0-20mA)	* Use only one!
B12	ANALOG CURRENT CONTROL COMMON	
D12	HI./LO CONTROL IN	* Use only one!
B12	HI/LO CONTROL COMMON	
D14	LOCAL/REMOTE SWITCH +	| Mode Local/Remote
D16	LOCAL/REMOTE SWITCH –	| Feedback
20	AC 1 POWER MAIN	| AC Power Input
24	AC 2 POWER MAIN	|
32	AC GROUND	|

Appendix - B

Communications Cable

Local Data Port (Front Panel)

To PC		UP-200
DB9-S		DB9-P
1		1
2	----------	2
3	----------	3
4		4
5	----------	5
6		6
7		7
8		8
9		9

Appendix C

Comm Parameters

Emulation:	VT100
Speed:	9600
Stop Bits:	1
Data Bits:	8
Parity:	None
Flow Control	Xon, Xoff

Appendix D (Rev D, Version 3 or above)

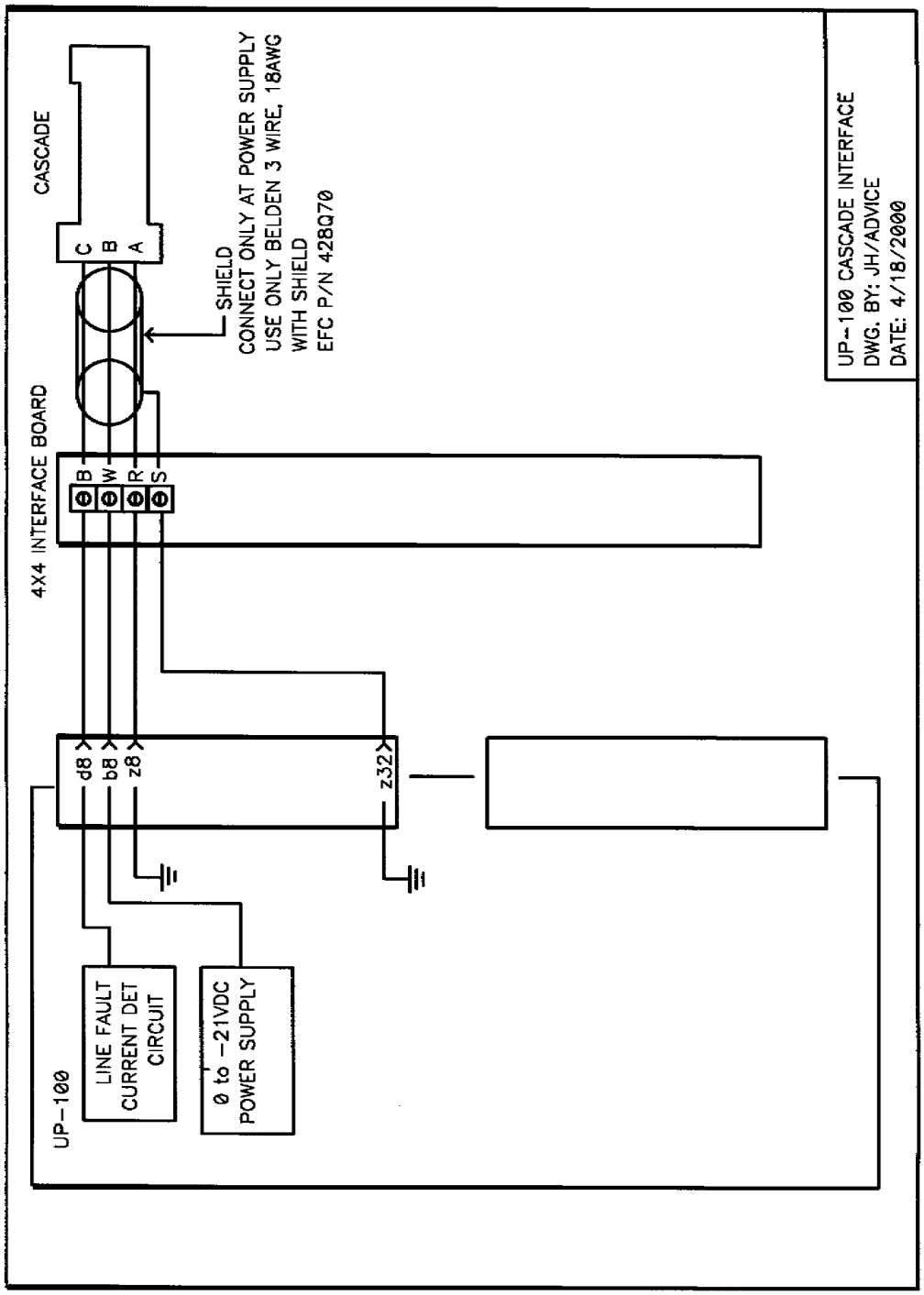
4-20ma Voltage and Current feedback information

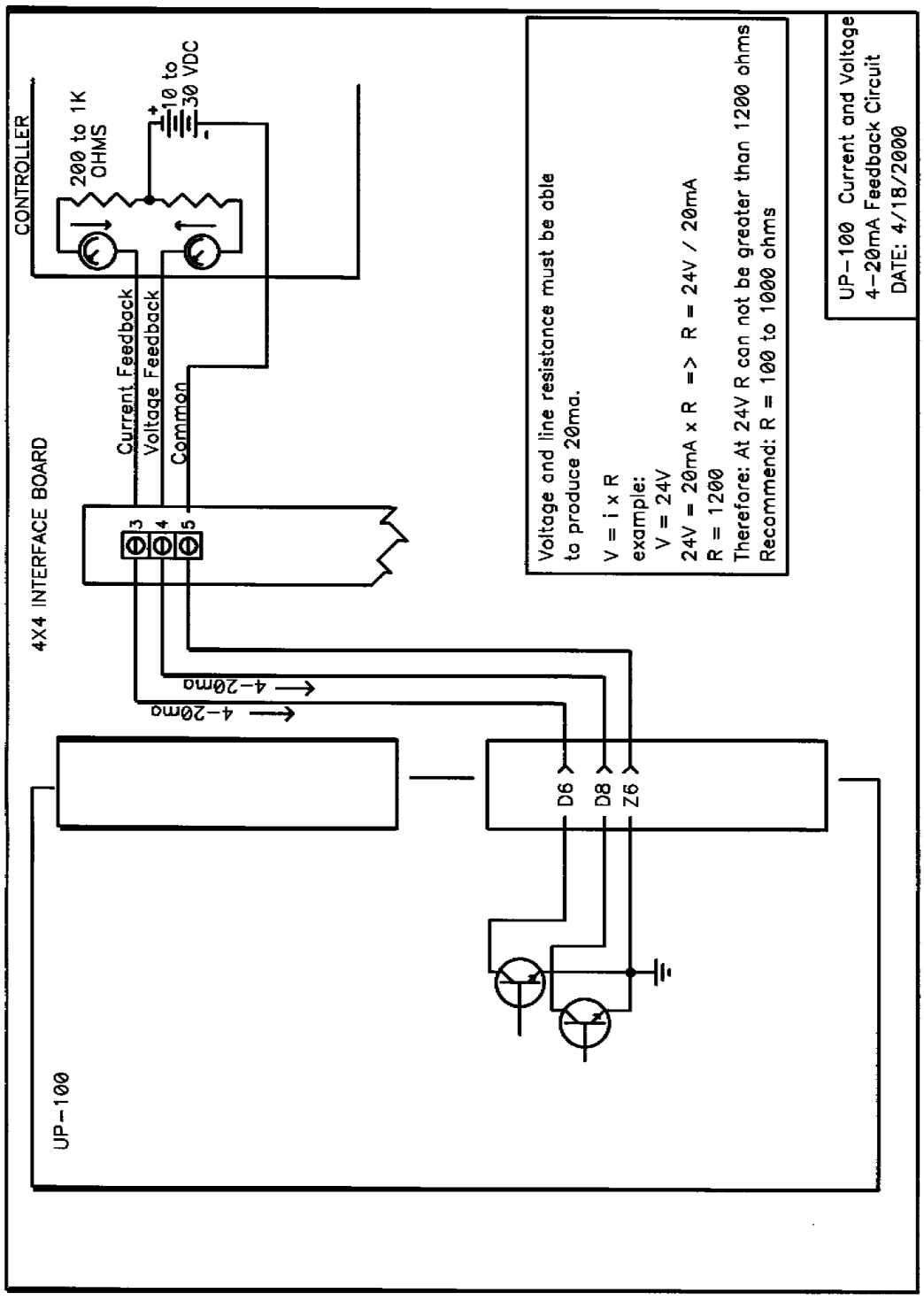
Voltage: 4-20ma output corresponds to 0 to 100KV respectively +/- 3%

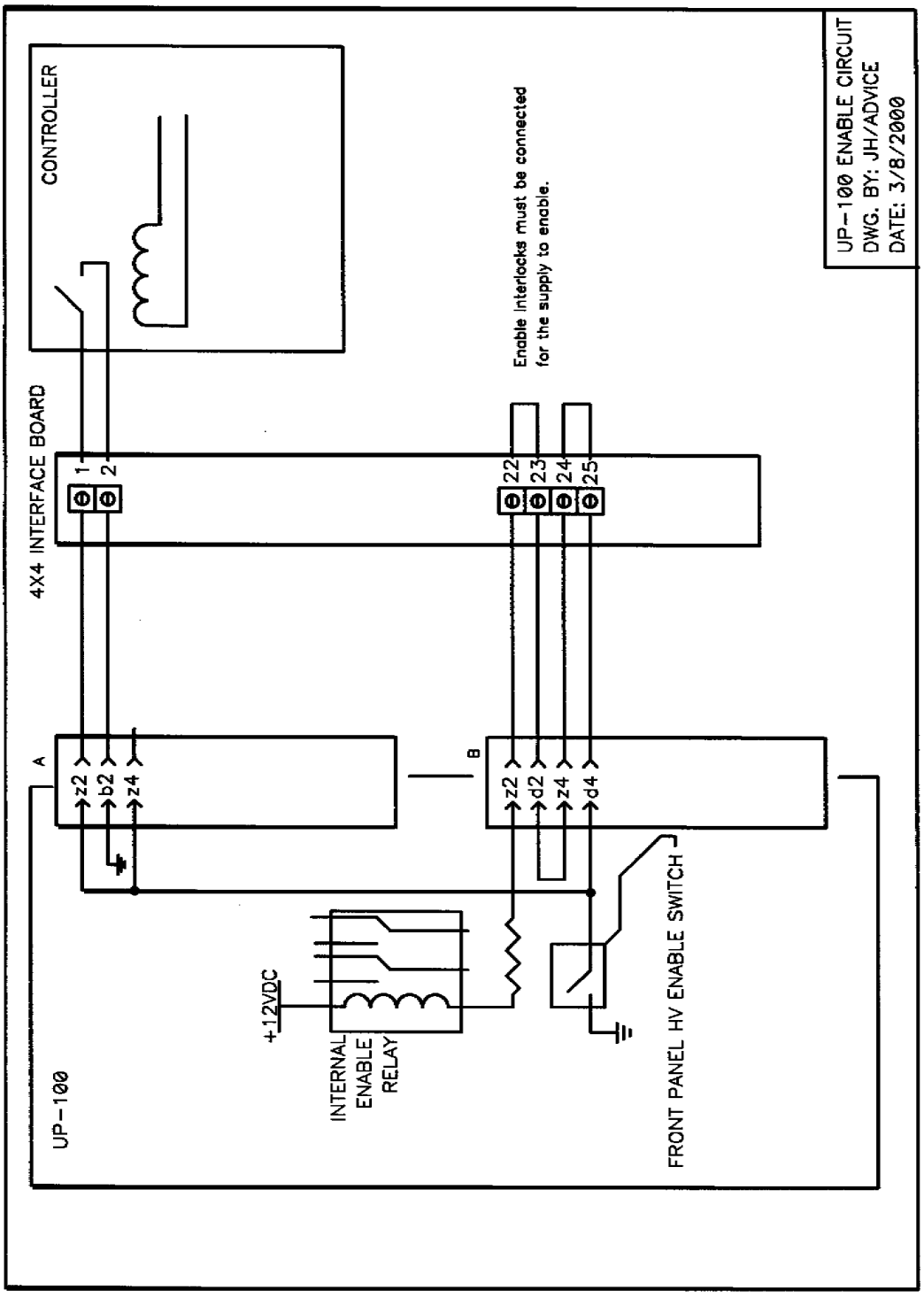
Current: 4-20ma output corresponds to 0 to 200uA respectively +/- 3%

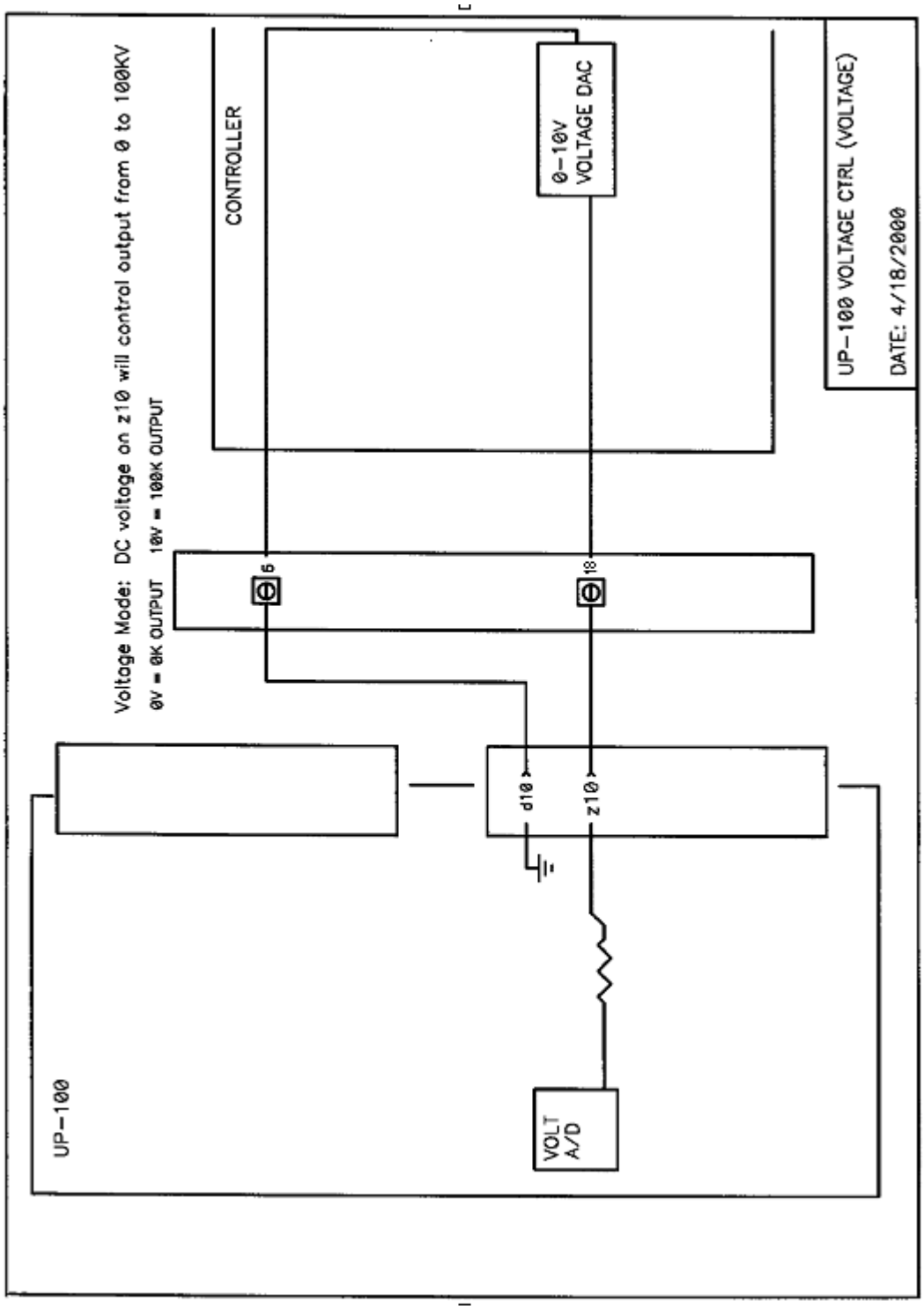
As the power supply has an automatic fine adjustment routine internally, it is not recommended that the supply be fine adjusted based on these outputs. These outputs are for reference only.

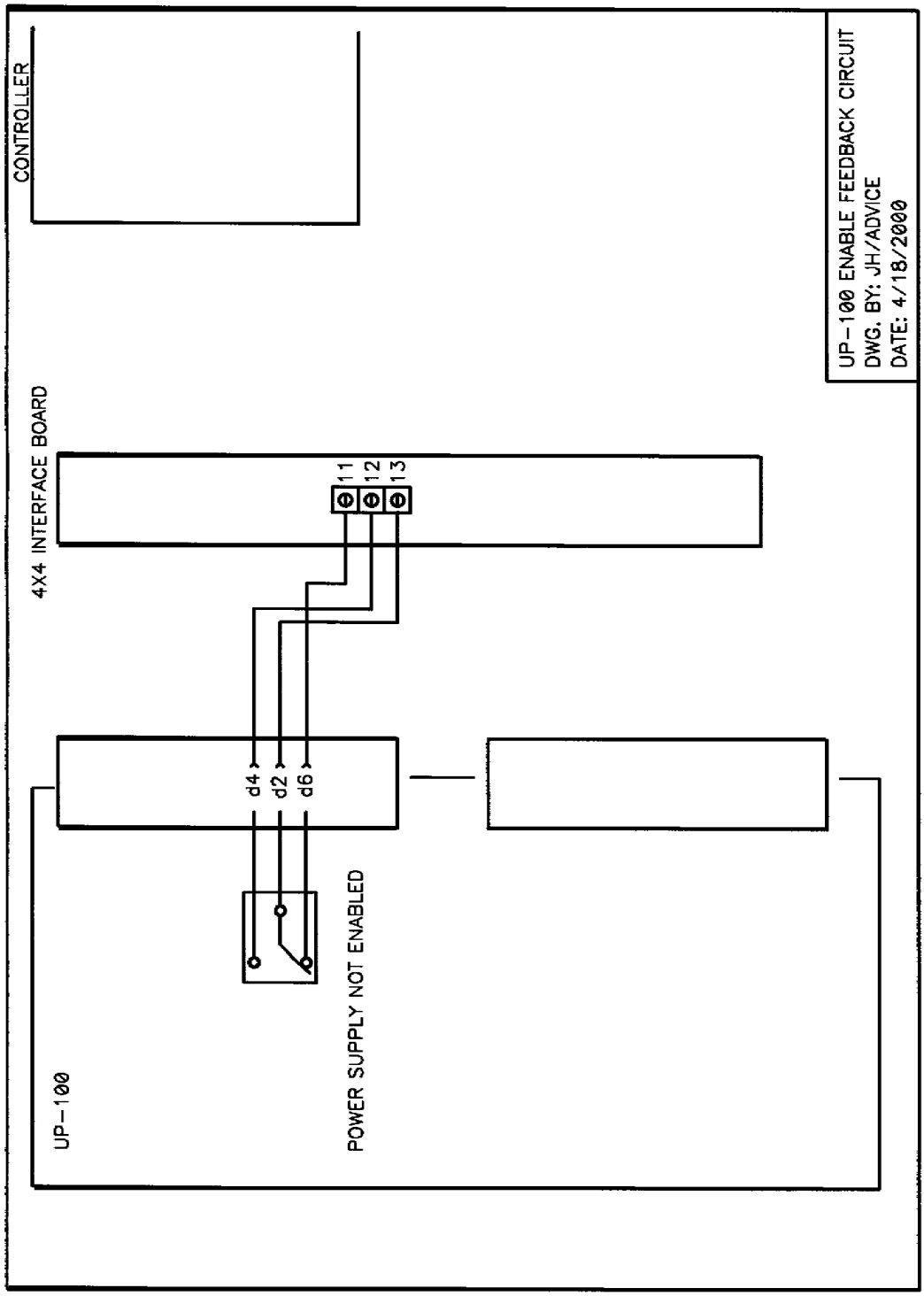
Appendix E Connection Diagrams

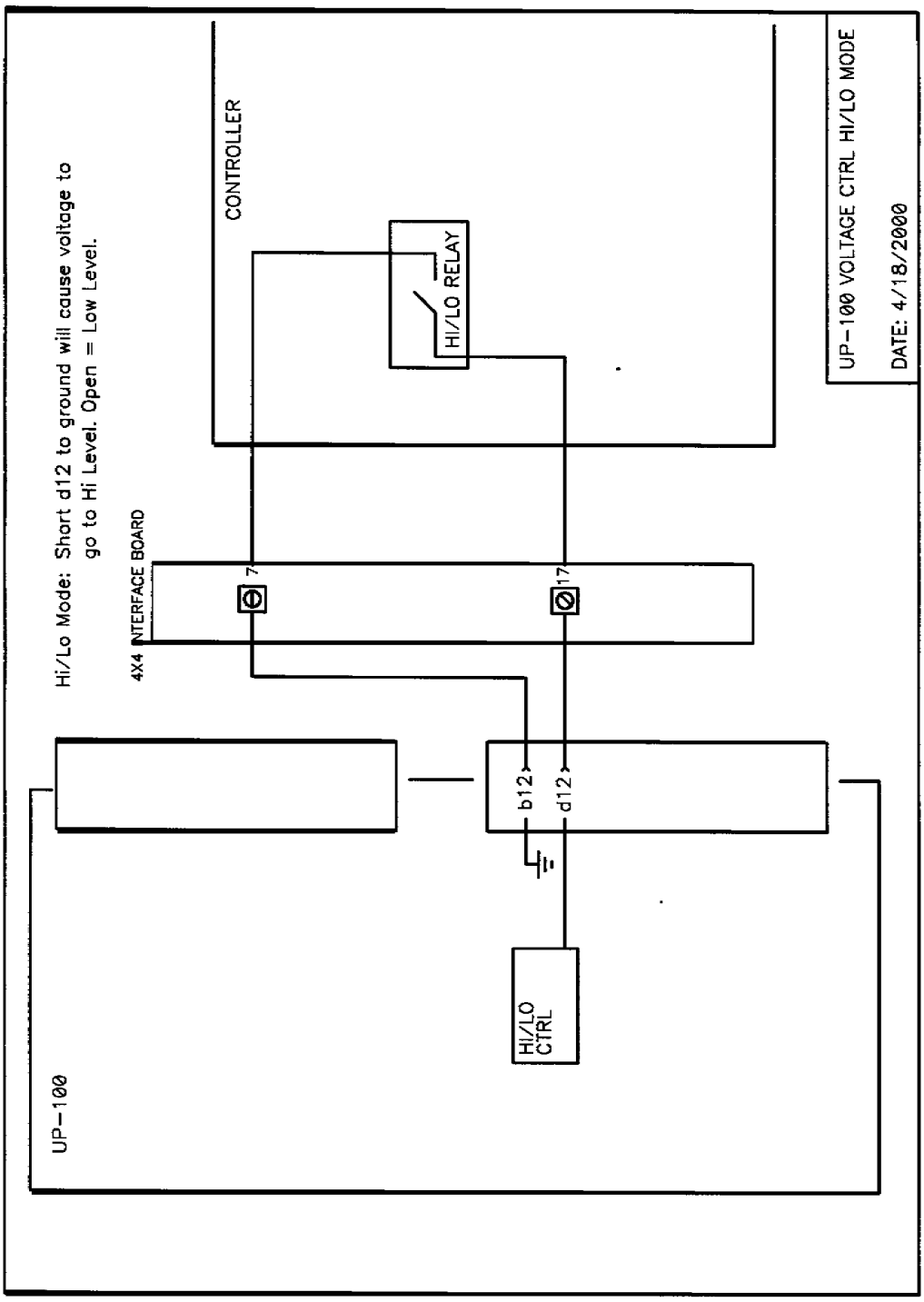


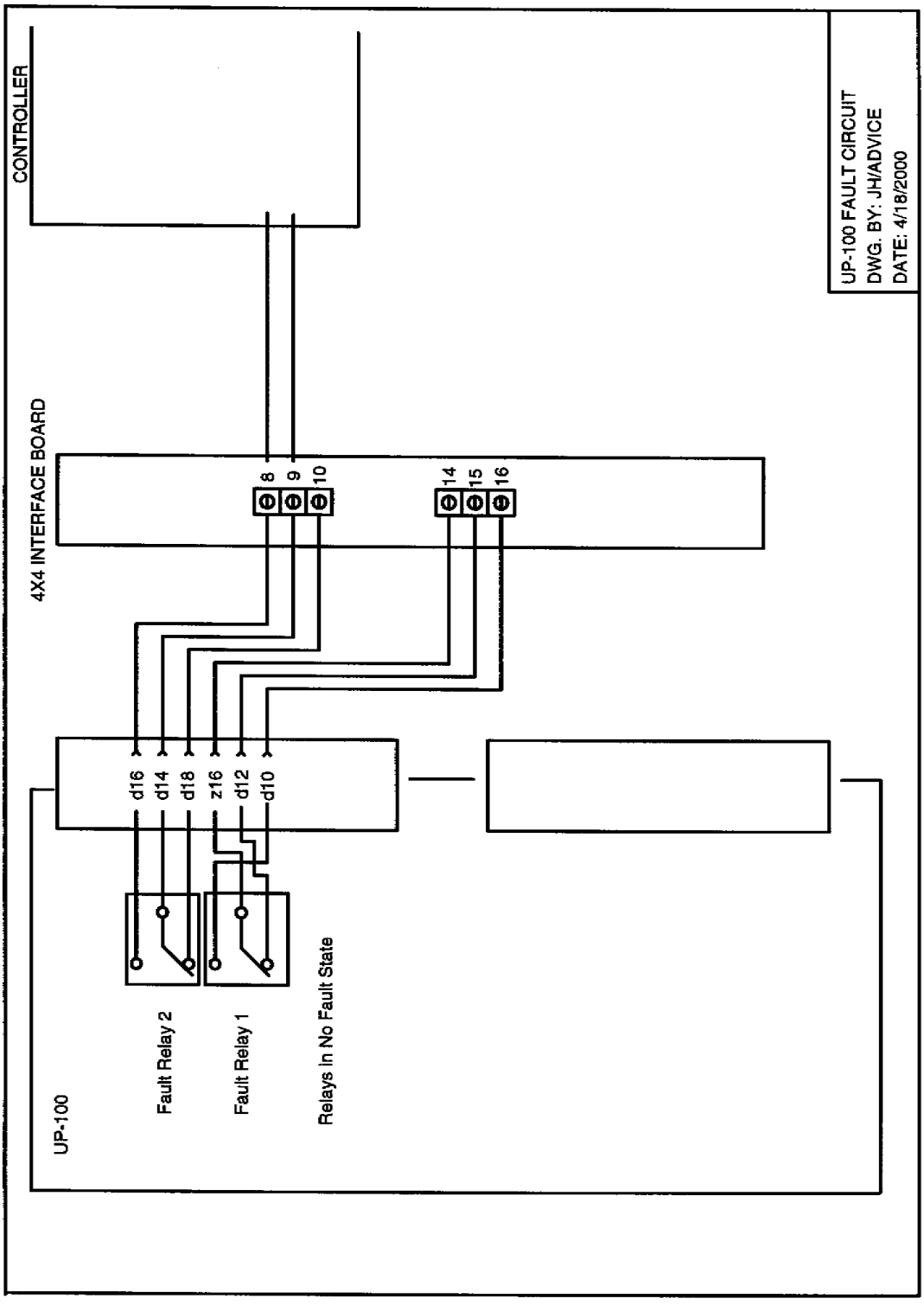

CONTROLLER
200 to 1K OHMS
10 to 30 VDC
+
-
Current Feedback
Voltage Feedback
Common
4X4 INTERFACE BOARD
3
4
5
4-20ma
4-20ma
D6
D8
Z6
UP-100
Voltage and line resistance must be able to produce 20ma.
V = i x R
example:
V = 24V
24V = 20mA x R => R = 24V / 20mA
R = 1200
Therefore: At 24V R can not be greater than 1200 ohms
Recommend: R = 100 to 1000 ohms
UP-100 Current and Voltage 4-20mA Feedback Circuit
DATE: 4/18/2000

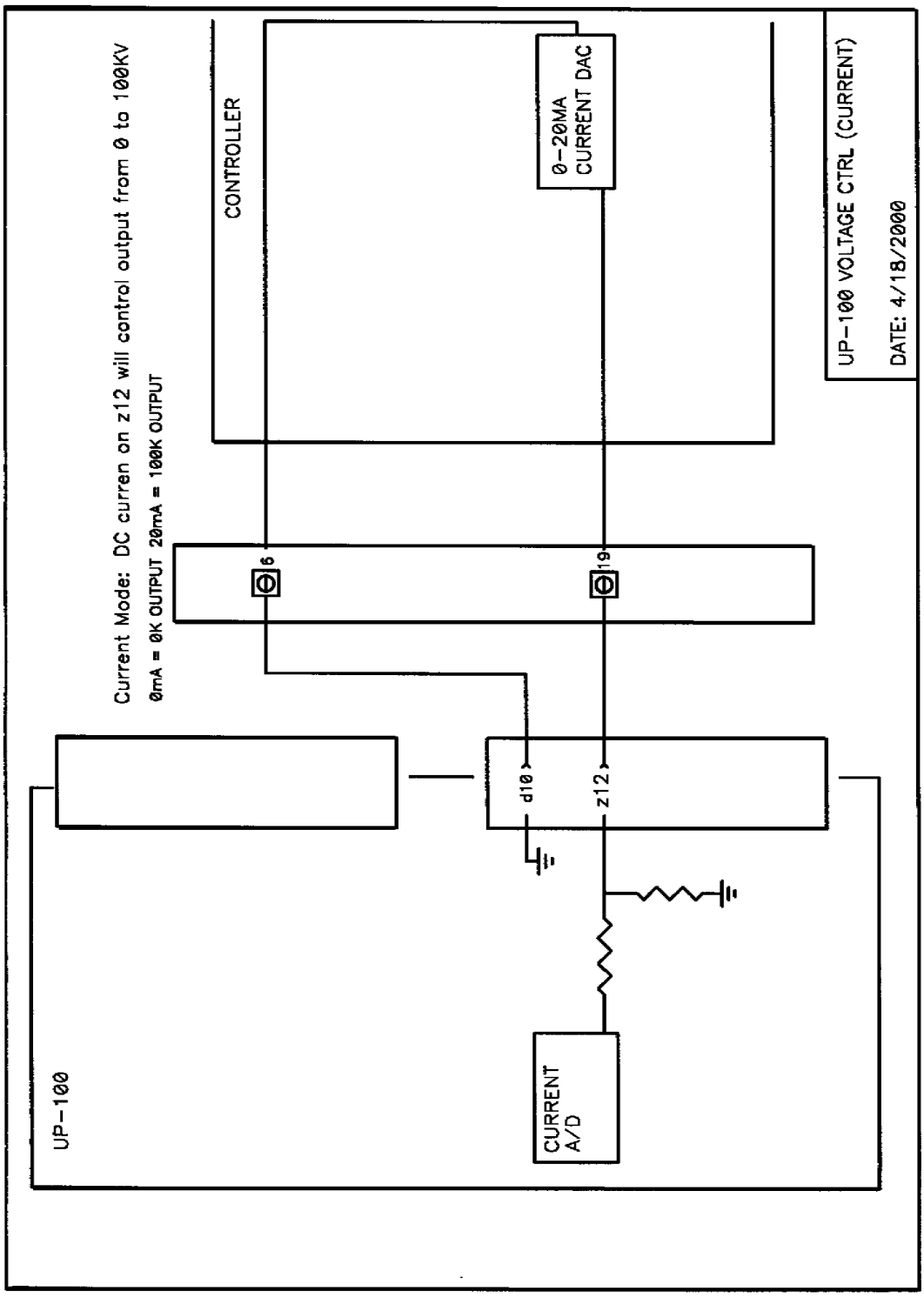

UP-100 ENABLE CIRCUIT
DWG. BY: JH/ADVICE
DATE: 3/8/2000
CONTROLLER
Enable interlocks must be connected for the supply to enable.
4X4 INTERFACE BOARD
1
2
22
23
24
25
A
z2
b2
z4
B
z2
d2
z4
d4
+12VDC
INTERNAL ENABLE RELAY
FRONT PANEL HV ENABLE SWITCH
UP-100


UP-100 VOLTAGE CTRL (VOLTAGE)
DATE: 4/18/2000
Voltage Mode: DC voltage on z10 will control output from 0 to 100KV
0V = 0K OUTPUT 10V = 100K OUTPUT
CONTROLLER
0-10V VOLTAGE DAC
6
18
d10
z10
VOLT A/D
UP-100


CONTROLLER
4X4 INTERFACE BOARD
11
12
13
d4
d2
d6
UP-100
POWER SUPPLY NOT ENABLED
UP-100 ENABLE FEEDBACK CIRCUIT
DWG. BY: JH/ADVICE
DATE: 4/18/2000


UP-100 VOLTAGE CTRL HI/LO MODE
DATE: 4/18/2000
Hi/Lo Mode: Short d12 to ground will cause voltage to go to Hi Level. Open = Low Level.
CONTROLLER
HI/LO RELAY
4X4 INTERFACE BOARD
7
17
b12
d12
HI/LO CTRL
UP-100


CONTROLLER
4X4 INTERFACE BOARD
8
9
10
14
15
16
d16
d14
d18
z16
d12
d10
Fault Relay 2
Fault Relay 1
Relays in No Fault State
UP-100
UP-100 FAULT CIRCUIT
DWG. BY: JH/ADVICE
DATE: 4/18/2000


UP-100 VOLTAGE CTRL (CURRENT)
DATE: 4/18/2000
Current Mode: DC curren on z12 will control output from 0 to 100KV
0mA = 0K OUTPUT 20mA = 100K OUTPUT
CONTROLLER
0-20MA CURRENT DAC
6
19
d10
z12
UP-100
CURRENT A/D

Change Log

REV	Description	Date	Author
A	Original Release	1/29/2003	JH
B	Corrections for FM	4/20/2003	JH
C	Correction to Current Control Drawing	9/2/2004	JH
D	Add Environmental Spec	10/22/2006	JH
E	Correction to Voltage Control Dwg	3/13/2007	JH