Static Bond®
SB-30A
Installation and Operation Manual

Electrostatic Charging Power Supply

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1. Introduction

The SB-30A is a 150W 30kV DC power supply designed for bonding materials by using electrostatic charging applicators. The programmable output of the supply ranges from zero to greater than full rating (30kV potential and 5.0mA current).

The SB-30A local console provides a simple, reliable user interface for manual operation. An identical remote console is available for manual operation of an SB-30A that is situated in an inconvenient or inaccessible location (e.g. within a closed electrical cabinet) during operation. Peripherals providing alternative remote-manual operations (e.g. on/off foot switch) are also available for the SB-30A. Such accessories can be connected to the Remote-Manual port of the SB-30A supply and require no other connections (such as power) for operation.

I/O for automated control and monitoring of the SB-30A is provided at the Remote-Auto port. This includes optically-isolated switching and industry-standard analog transmit/receive interfaces for connection to computer-based systems such as PLCs.

The supply is capable of output regulation in either constant-voltage (CV) or constant-current (CC) mode. The output mode is electronically programmable. Hence, the mode can be conveniently switched by local or remote control and selection does not require opening of the power supply enclosure.

2. Description

The SB-30A family of power supplies is available factory-configured for either of two input-voltage ranges and two (or both) output polarities with the following model codes:

SB-30A-115-N: Input 100─120V_{AC} (±10%), negative output potential.
SB-30A-115-P: Input 100─120V_{AC} (±10%), positive output potential.
SB-30A-115-B: Input 100─120V_{AC} (±10%), negative and positive output potential (bipolar).
SB-30A-230-N: Input 200─240V_{AC} (±10%), negative output potential.
SB-30A-230-P: Input 200─240V_{AC} (±10%), positive output potential.
SB-30A-230-B: Input 200─240V_{AC} (±10%), negative and positive output potential (bipolar).

Supplemental accessories for the SB-30A power supplies can be wired to the Remote-Manual I/O port and include the following:

SB-30A-RC: Remote console with keypad and display identical to that of the SB-30A local console.
SB-30A-FS: Remote foot-switch providing momentary-on/normally-off control of the SB-30A output.

Performance and Features

Output Power: The SB-30A is capable of delivering >150W of peak power, and 150W of continuous power under normal conditions (e.g. adequate ambient ventilation). Built-in thermal protection prevents the power electronics from being damaged by overheating in the event of an abnormal condition (such as internal fan failure) by forcing electronic shutdown of the power-supply output while an excessive internal temperature is detected.

High-Voltage Connection: The SB-30A provides four quick-connect/disconnect ports for coupling of the high-voltage output to the application-specific ionizing apparatus. The output-connector receptacle jacks are compatible with Static Clean International and other name-brand applicators and high-voltage connector plugs.

⚠ *Safety Precaution:*

The power supply must always be disconnected from the mains while connecting to or disconnecting from the output ports. Failure to observe this precaution may expose the user to serious or lethal injury.

Remote I/O: Two ports are provided for remote-manual and remote-automated operation of the power supply. Both ports are wired with industry-standard D-subminiature connectors.

Console Key-Switch Lockout: Both local and remote consoles are supplied with a key switch for lockout of the command functions (monitoring functions are not disabled).

Automated Operation: The power supply may be set for either manual mode or automated mode of operation using a front-panel key switch. When in automated mode a front-panel indicator lamp is lit and console keyboard commands are automatically locked out.

Internal Convection Cooling with Fan-Failure Detection: A fan inside the SB-30A cabinet provides forced internal air circulation to enhance cooling of the switch-mode power converter and high-voltage output stage. The convection design is solely internal to the cabinet and hence no air-filter and cleaning maintenance is required of the power supply.
The internal fan is continually monitored for proper operation and a warning indicator alerts the user in the event of a fan failure.

Power Input/Output Protection with Out-of-Compliance Detection: The power supply and load (i.e. application apparatus) are protected by current limiting, voltage limiting and power limiting at the output for out-of-compliance load conditions of short-circuit, open-circuit and arc-over respectively.
The power-supply is also protected for under-voltage (i.e. brown-out) and over-voltage (i.e. surge) conditions on the input by automatic electronic shutdown of the switch-mode power converter. Recovery from shutdown is also automatic as soon as the input voltage comes back within the compliance range.
Console and electronic indicators are provided for out-of-compliance status on the input and at the output.

Stacked Dual-Supply Configuration: Two power supplies may be ordered in a stacked configuration. This results in a reduced footprint for bipolar (dual-polarity) applications.

Factory-Configuration Options

Vertical-Mount Console Orientation: [1] This option supports a vertical mounting of the power supply with the base against a wall or vertical bracket. The local console is installed in the opposite (vs. standard) orientation at-the-factory. Hence the graphics are correctly oriented for viewing with the output connectors on the lower face (i.e. toward to the floor) and the console on the upper face (i.e. toward the ceiling) of the SB-30A cabinet. This option should normally be specified at the time of order. A console orientation modification may also be performed at-the-factory if requested.

[1]Note: The console key-switch (i.e. console-command manual-disable function) is not included with the vertical-mount orientation option.

Field-Configuration Options

Dual Input-Voltage Range: The required input voltage can be changed between lower (100─120V_{AC}) and higher (200─240V_{AC}) ranges by reversing the position of the fuse-holder cartridge (located in power-entry module on SB-30A rear panel). The configured voltage appears in the cartridge-door window as either "115V" or "230V".
The user is responsible for replacing fuses with the specified type and current rating (see Specifications section below) when the input-voltage configuration is changed in-the-field.
The user is also responsible for wiring to a mains voltage consistent with the input-voltage configuration. [2]

[2]Note: A power supply configured for the lower range and wired to a higher-range voltage (e.g. 230V) may sustain permanent damage requiring factory repair. A power supply configured for the higher range and wired to a lower-range voltage (e.g. 115V) will not be damaged but also will not function at the lower input voltage. It is strongly recommended that the voltage indication showing in the fuse-holder cartridge window be checked prior to wiring the input to the mains in a new installation.

Remote-Auto Interface Modes: Five switches (located on the SB-30A rear panel) configure the remote-automation I/O interface to user-selected modes. Details are presented in a later section.

3. Specifications

Mechanical

Mass / Weight
$6^2/_3$ kg / $14^2/_3$ lb. (for bipolar/dual-supplies value is doubled)

Dimensions
Single-Supply: 26.2×11.3×34.0cm / $10^5/_{16}$×$4^7/_{16}$×$13^3/_8$" (W×H×D)
Bipolar/Dual-Supply: 26.2×21.9×40.0cm / $10^5/_{16}$×$8^5/_8$×$15^3/_4$" (W×H×D)

Enclosure
epoxy-coated steel, blue

Mounting
4 base-located 6-32 UNC threaded inserts ($^1/_4$" [6.4mm] maximum screw insertion)

Mains-Input Connection
IEC-320 receptacle
Mains-Input Fusing
removable dual 5x20mm (or 3AG–$^{1}/_{4}$”x1$^{1}/_{4}$”) fuse-holder cartridge (externally accessible on rear panel)
Mains-Voltage Selection
reversible fuse-holder cartridge position (w indicator) for dual line-voltage configuration
High-Voltage Connection
4 output jack sockets
7/16-14 UNC thread, .37” dia. bore, 2.9” depth for mating HV quick-connect spring-contact plug(s)
Chassis-Ground Connection
rear-panel threaded stud/nut, 8-32 UNC for output-return (load-ground electrode) wiring

Remote I/O Connection
2 DB-25F rear-panel connectors (power supply); DB-25M (remote console)
Cooling
Internal: $24V_{DC}$ (monitored) fan, enclosed cabinet
External: convection/radiation over outer cabinet surface
Operating Temperature
0C to 40C / 32°F to 104°F ambient

User Configuration
console lock-out (command disabling) by removable key (CCW position)
front-panel UI-mode by removable key (CW: auto, CCW: manual)
5 rear-panel DIP switches for automated I/O-mode configuration
Console
flat-panel keyboard with membrane-switch commands and LED–optical display/indicators

Electrical

Input Ratings
SB-30A-115: 100–120V_{AC} @ 50/60Hz nom. ±10%, 3A_{RMS} max.
SB-30A-230: 200–240V_{AC} @ 50/60Hz nom. ±10%, 1-$^{1}/_{2}A_{RMS}$ max.
Output Ratings
Potential: 0–30kV
Current: 0–5.0mA
Output Polarity
fixed, negative or positive based upon model-name suffix (N or P)
Output Power
≥150W peak, 150W continuous (for typical ambient conditions)
Output Regulation
CV (constant-voltage) and CC (constant-current) modes
programmable mode selection
out-of-compliance indicator for overload (short-circuit, open-circuit and/or arc-over)
Output Rise Time
<20ms in CV mode
<25ms in CC mode

Remote I/O

Automated Control:	4 selectable ranges (0–5V / 0–10V / 0–20mA / 4–20mA) compatible with industry-standard transmit module(s) adjust/program output level
Automated Monitor:	2 selectable ranges (0–5V / 0–10V) compatible with industry-standard receive module(s) read/indicate output levels (voltage and current)
Automated Logic:	optically-coupled switch inputs program operation optically-coupled switch outputs indicate status OC-input (supply) requirements 12-to-24V_{DC} nom., 5mA max. OC-output (load) capability up to 24V_{DC} nom., 8mA min. floating internal 12V/40mA DC supply available for OC-interface power
Manual Operation:	interface supports remote-wired console (functionally equivalent to local console)

Remote Wiring

foil-shielded cable with drain wire connected to DB-25 metal shell (both auto/manual ports)

Output Protection

Short-Circuit:	6mA typ. output current limit
Open-Circuit:	30.6–31.5kV typ. output voltage limit
Arc-Over:	165–180W typ. output power limit

Input Protection

Over-Current:	external (replaceable) line/neutral fusing
Over-Voltage:	MOV surge arrestors and automatic power-converter shutdown
Under-Voltage:	automatic power-converter shutdown

Thermal Protection

power-converter and output-stage temperature monitoring
automatic power-converter shutdown (over-temperature)
internal-fan monitoring with failure indicator

Console Meter

Keyboard:	output-parameter (voltage/current) selection
Display:	green LED, 3 digits and sign (polarity), 20mm/0.8” height,
Resolution:	0.1kV (1 decimal places) / 0.01mA (2 decimal places)

Console Set-Point

Keyboard:	increment/decrement adjust and non-volatile memory store
Resolution:	~0.5kV / ~87µA (64 settings)

Input Fusing

Location:	2 positions, line(s) and neutral
Type:	metric (5×20mm) or North American (3AG) time-delay (slow-blow) cartridge
Rating:	2A (230V_{AC}) or 4A (115V_{AC})

4. Installation

Prior to operation the power supply must be securely mounted to a vibration-free platform.

The SB-30A is factory-assembled with rubber-bumper feet screwed to the cabinet base in four locations.

The power supply may be directly bolted to a plate or bracket using four 6-32 UNC machine screws. Screw length should be selected so that penetration depth does not exceed $^1/_4$ in. (6.4mm) in order to prevent possible damage to internal electronics.

Connection to the mains must be installed via the rear-panel IEC-320 connector and tested to verify continuity from the chassis (cabinet) to earth through the AC line cord. This test can be performed by measuring the conductance from the ground stud on the rear panel to a proven earth terminal. The ground stud application wiring must be disconnected and the rear-panel input-power rocker switch must be off to perform a valid test.

⚠ *Safety Precaution:*

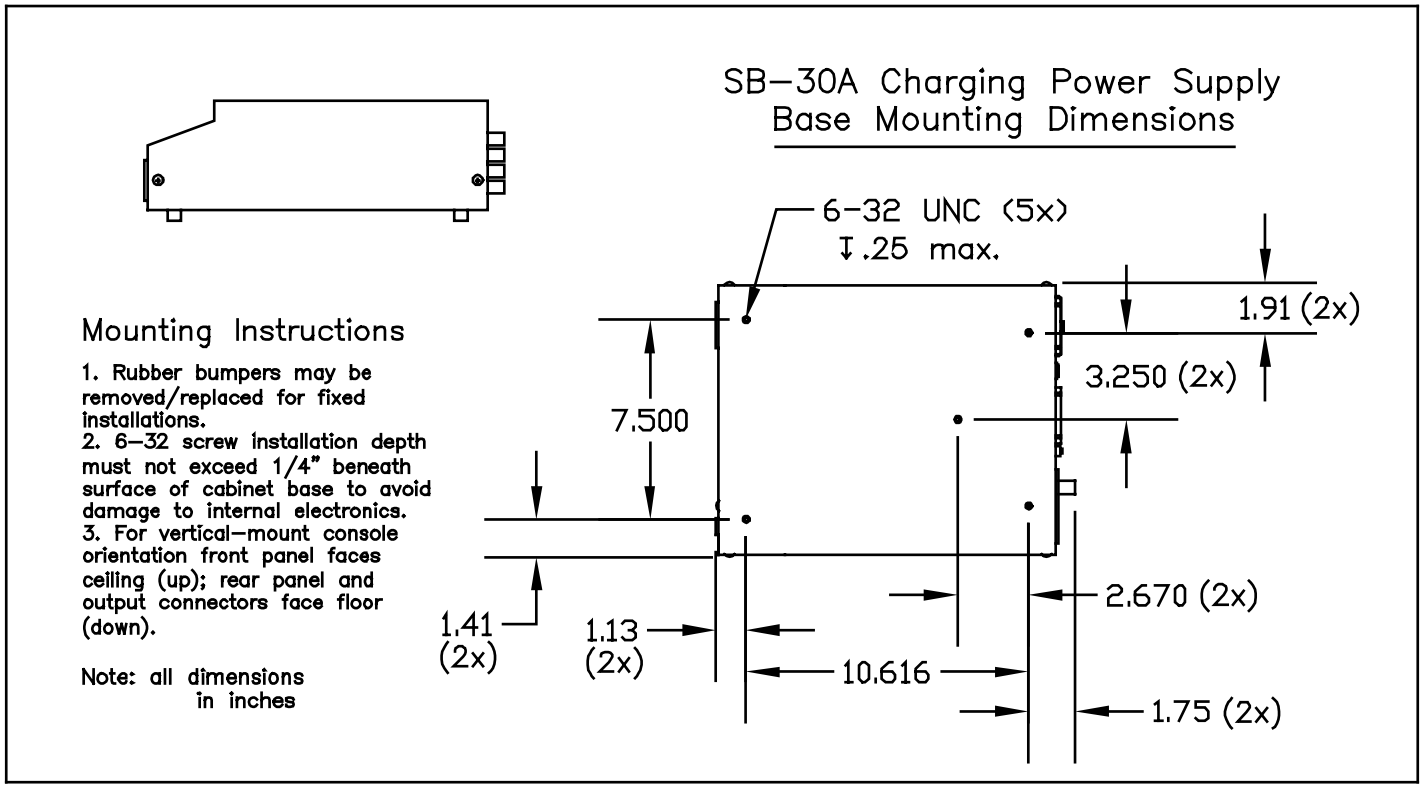
Failure to ensure a proper ground connection through the IEC-320 input may result in elevated power-supply chassis potential and consequent hazard to the operator.

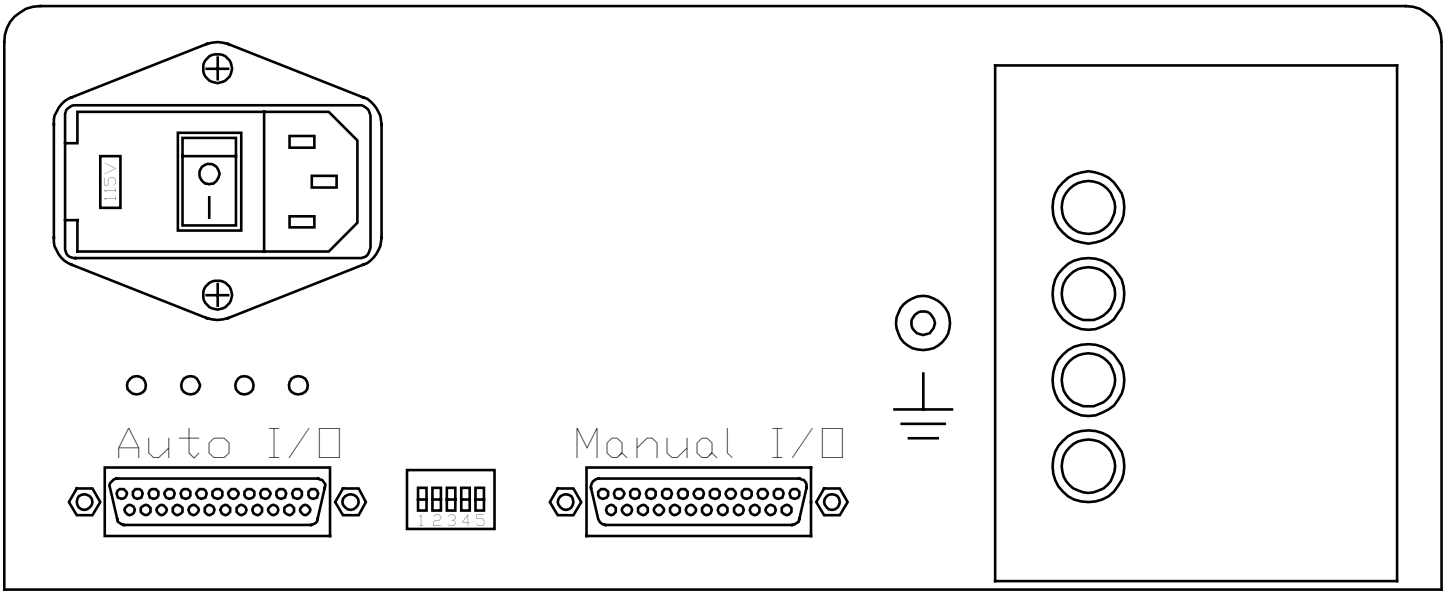
The rear-panel ground stud must next be wired to one or more appropriate application-specific reference conductors local to the ionizing apparatus (a.k.a. applicator). The applicator(s) must be wired to the quick-connect output connector(s) using an appropriate high-voltage cable. UL 3239 wire rated for 40kV (or greater) is recommended.

The power switch located on the rear panel of the power supply must finally be placed in the "on" position prior to operation of the power supply.

⚠ *Safety Precaution:*

The user is responsible for the proper installation of any emergency-off disconnects from the mains that are required for safety in each application and site of use of the power supply. The power supply rear-panel power switch is intended for independent disconnect of the SB-30A unit under normal circumstances and not for emergency use.





5. Application

The SB-30A power supply may be operated manually using either (local or remote) console, and also electronically using automatic equipment (such as a programmable logic controller) wired to a remote-I/O port.

Operation from Console(s)

Power-supply and output-meter commands may be actuated by pressing the membrane switches on the console keyboard. LED indicators and digital readout are also included for visual monitoring of the power supply status and output. The command and monitoring function groups are described below.

Output Arming: The high-voltage output can be electronically enabled or disabled using the ON and OFF commands. The selected output state is indicated by the adjacent LEDs.

Set-Point Adjustment: The output set-point can be incremented or decremented from zero to maximum using the UP-ARROW and DOWN-ARROW commands. If the switches are actuated continuously for more than a half second the set-point will increment or decrement at the rate of ten steps per second thereafter until the switch is released or until the maximum or minimum setting is achieved.

Set-Point Storage: The set-point may be stored in non-volatile memory using the M command. This set-point is restored after input-power cycling.

Output Regulation Mode: The output may be programmed in constant-voltage or constant-current mode using the CV and CC commands. The selected mode is indicated by the adjacent LEDs.

Meter Reading: The 3-digit LED output-meter display can be set for voltage or current reading using the kV and mA (units) commands. The selected reading mode is indicated by the adjacent LEDs.

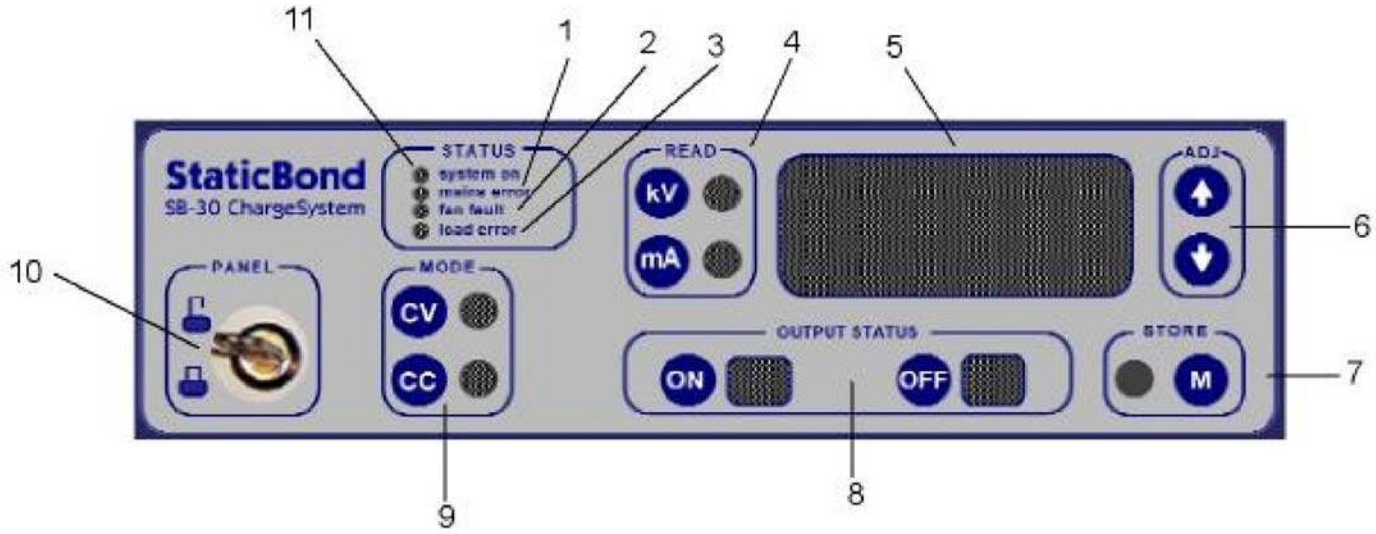
Console Key Switch [3]: All keyboard commands are enabled or disabled by the keyed switch on the console. A counterclockwise position disables the commands and a clockwise position enables the commands. The key can be removed from the console switch to achieve a locked state.

Status Indicators: Four LEDs are provided to indicate system power and alarm conditions.

[3]Note: The console key-switch is not included with the vertical-mount orientation option. Hence, console commands cannot be manually disabled with this option.

It is possible to combine manual and automatic control of the power supply using both the console and the Remote-Manual I/O port (detailed in later sections). For example, a typical application might require output on/off switching synchronized to a cyclic robotic operation with all other control static. In this case the output-on/off remote input can be wired to external equipment and all other programming can be performed at the console.

Further details of the console are illustrated below and described in the following section.



Console User Interface

1) STATUS / MAINS ERROR compliance alarm LED indicates under-voltage or over-voltage line potential at power input.
2) STATUS / FAN FAULT alarm LED indicates thermal fault due to cooling-fan failure or over-temperature condition. [4]
3) STATUS / LOAD ERROR compliance alarm LED indicates loss of regulation due to overload at output.
4) READing / kV-mA meter-units switches and LEDs select and indicate the output parameter (voltage or current) displayed (5).
5) Signed 3-digit LED display monitors output voltage or current (i.e. selected reading parameter).
6) ADJust / ↑-↓ switches increment or decrement the output setting.
7) STORE / Memory switch retains currently programmed output setting in non-volatile EEPROM.
8) OUTPUT / ON-OFF switches and LEDs program and indicate normal or standby operation.
9) MODE / CV-CC switches and LEDs select and indicate programmed output parameter (voltage or current).
10) CONSOLE removable key switch disables (CCW) or enables (CW) keyboard switch commands.
11) STATUS / SYSTEM ON LED indicates the SB-30A is powered-on.

⚠ *Safety Precaution:*

Power-supply connectors and other apparatus wired or connected to the high-voltage output must not be handled while this or any other console LEDs are on, thus indicating that the live mains is connected to the input. Failure to observe this precaution may expose the user to serious or lethal injury.

[4]Note: A solid-on LED indicates a fan fault (i.e. failure). A blinking (alternately on-and-off) LED and lowered, unstable output voltage reading indicates an over-temperature condition.

When a remote console is connected to the Remote-Manual I/O port the local console commands may nevertheless also be actuated and remain operational unless disabled by the local-console key switch or by activation of the remote-automated operating mode with the front-panel key switch.

Operation via Remote-Manual I/O

If the Remote-Manual I/O interface is not used to connect an SB-30A remote console it may be used instead to connect other control-and-monitoring equipment. The discrete I/O functions are equivalent to those of the console as described above.

The electronic interface at the Remote-Manual I/O port consists of five groups of signals that are each described below.

Logic-Input (Command) Signals

The signals at P2, P4, P5, P9, P14, P20 and P21 are active-low 5V logic inputs. These inputs are pulled up to +5V by ~100kΩ of resistance (requiring ~50µA current to drive low) internal to the charging power supply. The commands can be activated by pulsing (or driving) the inputs to ~0V using an electronic or mechanical switch for at least one millisecond. It is also recommended that the set-point adjustment (increment or decrement) command pulse duration be limited to well under one half second because otherwise the set-point may change by multiple steps as described above for manual set-point adjustment. Complementary latch inputs (P2/14, P20/21) should be driven low one-at-a-time (i.e. opposing input must be open/high to set or reset latch).

Logic-Output (Indicator) Signals

The signals at P8, P15, P18, P19 and P22 are 5V logic outputs.

Those at P8, P15 and P22 are low-side switched and are capable of exciting an LED with anode connected to a supply of $+5V_{DC}$ at up to ~20mA. Adequate current-limiting resistance should be inserted in series with the LED for an excitation current well below 20mA. Little or no series resistance may be required at ~20mA excitation current. These outputs are internally pulled up by ~180kΩ to $+5V_{DC}$.

The outputs at P18 and P19 are high-side switched and are also capable of exciting an LED with cathode connected to system ground at up to ~20mA. These outputs are internally pulled down by ~180kΩ to ground.

Console Meter Signals

The signals at P10-13 and P23-25 are reserved for use by the remote-console meter circuit. These positions should not be wired to other remote equipment.

System Ground and DC Power

Chassis ground (0V) is available at P1, P3 and P16 and at least one position should be wired to the remote equipment. If power is required for remote low-impedance circuitry such as LED indicators (up to) ¼A of current at $+5V_{DC}$ is available at P6, P7 and P17.

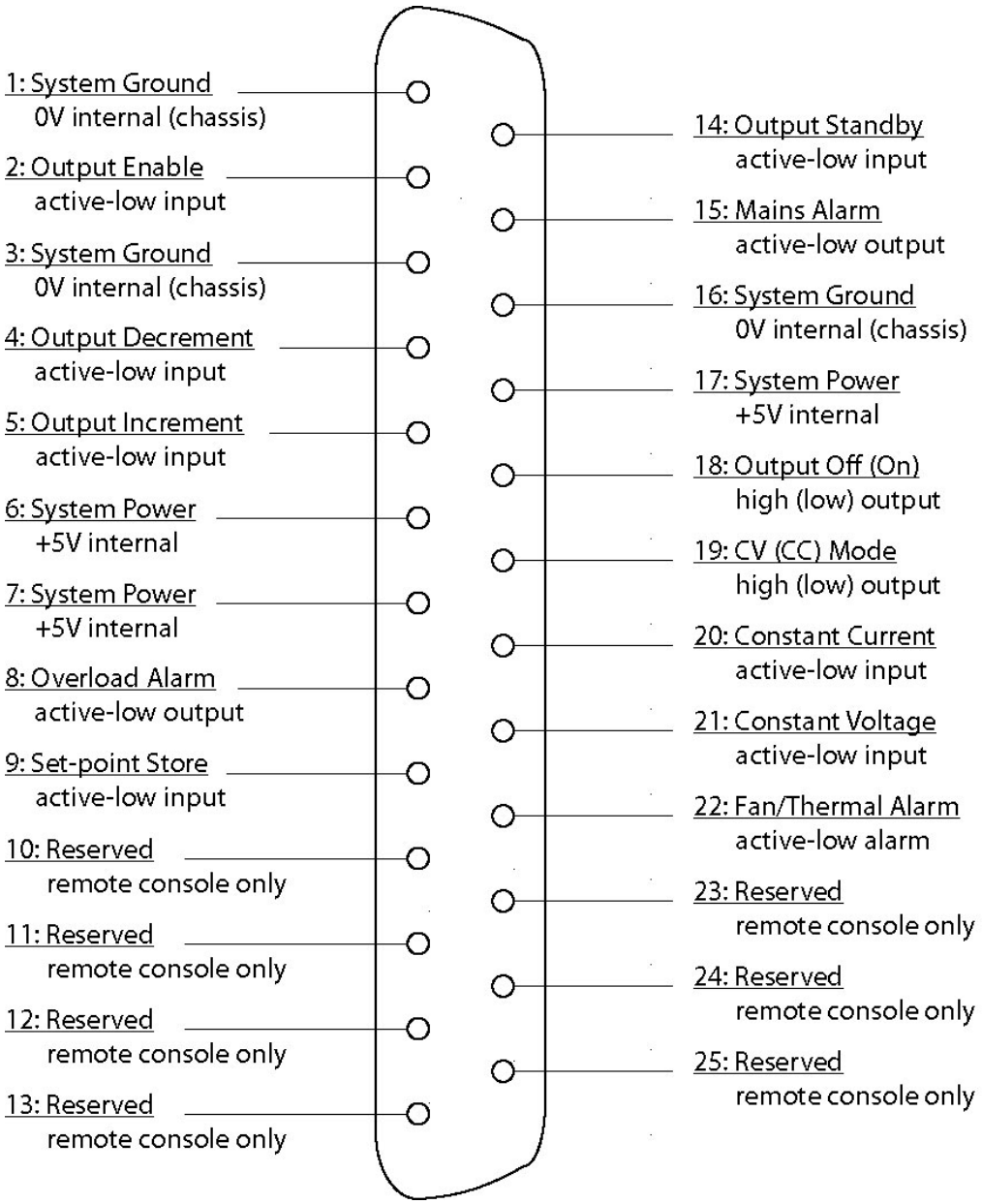
The wire gauge for ground and power connections should be adequate to avoid excessive DC ohmic voltage drops between the SB-30A chassis and the remote equipment. The user must also take care to avoid excessive AC (usually at power-line harmonic frequencies) ohmic voltage drops between the SB-30A chassis and the remote equipment. This may require careful mains and ground wiring of other application equipment in order to

prevent heavy AC currents from flowing in "ground loops" common to the SB-30A remote wiring and that of other equipment. Ground-loop problems can more easily be avoided by using the Remote-Auto I/O port, as this interface is designed for full optical isolation between the SB-30A and the remote equipment.

Remote-Manual I/O Location and Pin-out

Both Remote-Manual and Remote-Auto I/O ports are wired using 25-position D-subminiature (DB-25) connectors located on the SB-30A rear panel. The Remote-Manual I/O connector is to the right (as viewed from the rear of the power-supply cabinet) of the Remote-Auto I/O connector and configuration switches, and immediately to the left of the high-voltage output connectors.

The pin-out of the Remote-Manual I/O connector is illustrated below.



Operation via Remote-Auto I/O

Although the Remote-Manual I/O interface may be used for automated electronic control and monitoring of the SB-30A, the Remote-Auto I/O interface is provided specifically for this purpose and is designed for compatibility and ease of use with commonly-employed equipment such as PLCs.

Industry-standard analog-I/O interfaces are included for control and monitoring of the high-voltage output.

Optically-isolated I/O switches support command and status logic functions. An internal $12V_{DC}$ floating auxiliary supply is available to provide power for remote circuitry and equipment.

Configuration switches accessible on the rear panel allow for selection amongst various analog-I/O interfaces and operating modes.

Front-Panel Auto-Mode Switch

The SB-30A is changed between local/remote-manual operating mode and remote-automated operating mode by means of the key switch located on the front panel (below that on the local console). A counterclockwise (CCW) position enables manual operation and a clockwise (CW) position enables automated operation.

Console commands are automatically locked-out (i.e. disabled) when the switch is in the CW position and the adjacent LED lamp is illuminated, indicating that the SB-30A is in the remote-automated mode.
Conversely, control via the Remote-Auto I/O port is locked-out when the switch is in the CCW position and the adjacent LED lamp is unlit.
Indicators, displays and output signals for status and monitoring are always operational at consoles and I/O ports, regardless of key-switch position.

The electronic interface at the Remote-Auto I/O port consists of five groups of signals that are each described below.

Analog I/O Signals

The analog I/O interface comprises ground-referenced, positive-polarity signals. If isolation is required between the power supply and remote equipment, the user transmit/receive modules should be selected for optical-coupling between digital and analog circuits. The connector positions indicated below are for signal/ground terminals respectively.

Set-Point (P3 [Signal] / P16 [Ground]):

An analog input signal (i.e. DC voltage or current) controls the high-voltage output set-point (potential in CV mode, current in CC mode). The output is programmed from zero to ~111% of full rating (30kV or 5.0mA) in proportion to set-point signals of 0–5V, 0–10V, 0–20mA, or 4–20mA depending upon the rear-panel switch-configured set-point signal range. For example, a 18mA input (for 0-20mA current loop) would program a ~30kV (CV) or ~5.0mA (CC) output set-point.

Voltmeter (P4 [Signal] / P17 [Ground]):

An analog output signal monitors the high-voltage output potential. The signal level varies from zero to maximum (5V or 10V depending upon the rear-panel switch-configured voltmeter signal range) in proportion to

output potential. Maximum signal level corresponds to approximately 111% of full-rated voltage (33.3kV) at the output. For example, a 4.5V voltmeter reading (on 10V range) would indicate ~15kV at the output.

Ammeter (P5 [Signal] / P18 [Ground]):

An analog output signal monitors the high-voltage output current. The signal level varies from zero to maximum (5V or 10V depending upon the rear-panel switch-configured ammeter signal range) in proportion to output current. Maximum signal level corresponds to approximately 111% of full-rated current (5.56mA) at the output. For example, a 2.25V ammeter reading (on 5V range) would indicate ~2.5mA at the output.

Optically-Coupled Input Signals

The OC-input interface comprises floating circuits that may be energized by application of 12 to 24 V_{DC}. Energizing current is limited to less than 5mA. An energized input programs a <1> state; an open-circuit (de-energized) input programs a <0> (default) state, where the signal names below are denoted as <1 (0)>. The connector positions indicated below are for positive/negative-potential terminals respectively.

CC (CV) (P2 [+] / P15 [-]):

The output-regulation mode is programmed by the input voltage between P2 and P15. An energized input programs CC mode and an open-circuit input programs CV mode.

On (Off) (P1 [+] / P14 [-]):

The output-on/off state is programmed by the input voltage between P1 and P14. An energized input enables high-voltage power delivery at the output and an open-circuit input disables power delivery at the output. However, on/off control at this input can be overridden by either of two methods (configuration switch and Remote-Auto wired circuit) described in later sections, in which case the output remains enabled even when this input is de-energized.

Optically-Coupled Output Signals

The OC-output interface comprises isolated transistor switches that may energize active load circuits operating at up to 24 V_{DC} and requiring up to 8mA current. A closed switch indicates a <A*> (alarm) status; an open switch indicates a normal status, where the signal names below are denoted as <A*>. The connector positions indicated below are for positive/negative-potential (i.e. opto-coupler NPN open-collector/emitter) terminals respectively.

Overload* (P9 [OC] / P22 [OE]):

The power-supply output-compliance status is indicated by the output voltage between P9 and P22. A high output (i.e. open switch) indicates that the output is in-regulation and a low output (i.e. closed switch) indicates an out-of-compliance load condition (i.e. overload).

Mains Error* (P10 [OC] / P23 [OE]):

The power-supply input-compliance status is indicated by the output voltage between P10 and P23. A high output (i.e. open switch) indicates that the AC-line voltage is in-compliance and hence power can be delivered at the high-voltage output. A low output (i.e. closed switch) indicates a *mains error* due to an out-of-compliance line voltage at the input. The high-voltage output is automatically disabled while either an over-voltage or under-voltage input from the mains is detected by the SB-30A.

Thermal/Fan* (P8 [OC] / P21 [OE]):

The power-supply cooling-system status is indicated by the output voltage between P8 and P21. A steady high output (i.e. open switch) indicates a normal cooling condition. Specifically, this condition requires both that the internal fan is operational and that internally monitored temperatures do not exceed maximum limits above which damage to the electronics due to overheating can occur.
A low output (i.e. closed switch) indicates a *thermal* fault.
A steady low output usually indicates a failure of the internal fan.
An intermittently low output (i.e. alternately closed and open switch) indicates an over-temperature condition. In this event the SB-30A output is disabled until the monitored temperatures fall back within limits, and hence a limit cycle develops while the operating conditions causing the thermal overload persist.

Auxiliary Circuits

Auxiliary Power (P7 [+] / P20 [-]):

A floating $12V_{DC}$ power supply (internal to the SB-30A) is connected between P7 and P20. The auxiliary supply can deliver current of at least 40mA, and can be used to power remote-interface loads such as optically-coupled I/O circuitry.

Auxiliary On (Off) (P6 [+] / P19 [-]):

A short-circuit between P6 and P19 arms the high-voltage output and overrides the "on/off" input at P1 and P14. For example, wiring of a manually-operated switch connected between P6 and P19 can allow an operator to temporarily enable output power at an application site in which the SB-30A is normally controlled by remote automation equipment. This can be useful for routine manual diagnostics and testing in a typical production environment during machine downtime.
A switch closed between P6 and P19 will carry ~1mA current and should have an effective resistance of ~100Ω or less. P6 is internally pulled-down (to ground) and P19 is internally pulled-up (to +5V). Any circuit connected between P6 and P19 should be isolated (i.e. floating with respect to chassis) and/or passive (i.e. not powered by an external supply), because the internal switch circuit is not optically-coupled and is non-isolated.

Temperature-Monitoring Signals

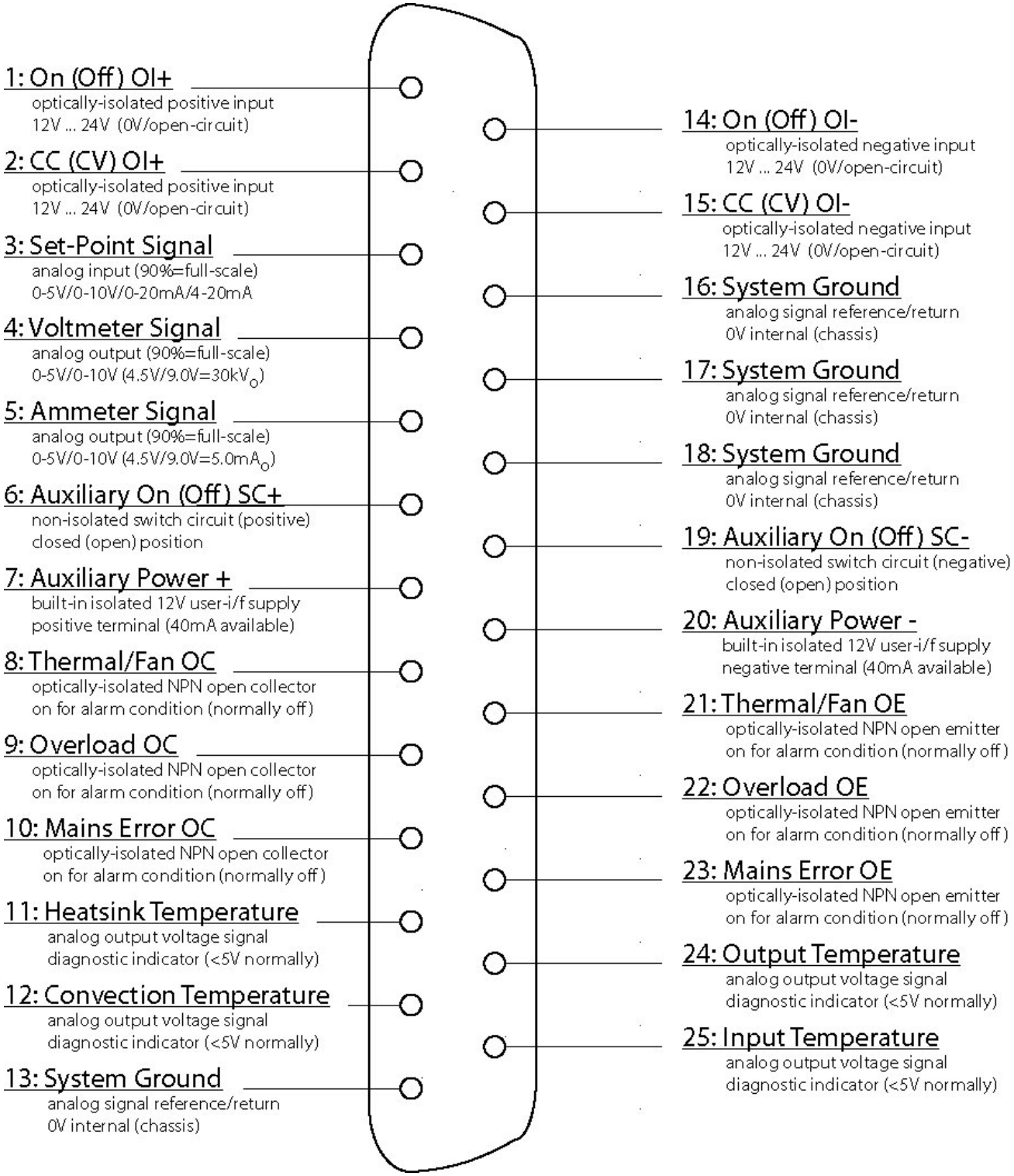
Analog-voltage outputs support monitoring of the temperatures at four locations within the SB-30A. These signals have a source impedance of ~2k Ω and should be monitored using a meter with a high input impedance (≥1M Ω). Under normal conditions the voltages should remain well below 5V with respect to ground.
This group of signals is provided solely for diagnostic purposes and can be left unused in normal application.

Heatsink:Output:Convection:Input Temp. (P11:P24:P12:P25 [Signal] / P13 [Ground]):

The signal at P11 responds to a sensor located near the switch-mode power-converter heatsink.
The signal at P24 responds to a sensor located in the high-voltage output module.
The signal at P12 responds to a sensor located in the cooling-air stream generated by the circulating fan internal to the SB-30A.
The signal at P25 responds to a sensor located in the power-input circuit.

Remote-Auto I/O Location and Pin-out

The Remote-Auto I/O connector is located to the left of the configuration switches (directly underneath power-entry module) on the SB-30A rear panel.
The pin-out of the Remote-Auto I/O connector is illustrated below.



Remote-Auto I/O-Mode Configuration

Five (DIP) switches located on the rear panel allow the user to select amongst various modes of operation via the Remote-Auto I/O port. The switch settings and corresponding modes are detailed in the table below:

Switch Position	*1*	*2*	*3*	*4*	*5*
closed (up)	O/p-Armed (always on)	0-10V Ammeter	0-10V Voltmeter	Current-Loop Set-Point	0-10V / 0-20mA Set-Point Range
open (down)	O/p-On/Off (P1/14 control)	0-5V Ammeter	0-10V Voltmeter	Voltage-Loop Set-Point	0-5V / 4-20mA Set-Point Range

Switch 1 (leftmost):

In the open/down position this switch configures on/off control of high-voltage output power by the signal at P1 and P14 of the Remote-Auto I/O connector (as described in an earlier section).
In the closed/up position this switch overrides the on/off control by the signal at P1 and P14 and high-voltage output power is always enabled (i.e. on).

Switch 2:

In the open/down position this switch configures an ammeter (P5/18) range of 0 to 5V.
In the closed/up position this switch configures an ammeter (P5/18) range of 0 to 10V.

Switch 3:

In the open/down position this switch configures a voltmeter (P4/17) range of 0 to 5V.
In the closed/up position this switch configures a voltmeter (P4/17) range of 0 to 10V.

Switch 4:

In the open/down position this switch configures the set-point signal (P3/16) for a voltage-loop input.
In the closed/up position this switch configures the set-point signal (P3/16) for a current-loop input.

Switch 5 (rightmost):

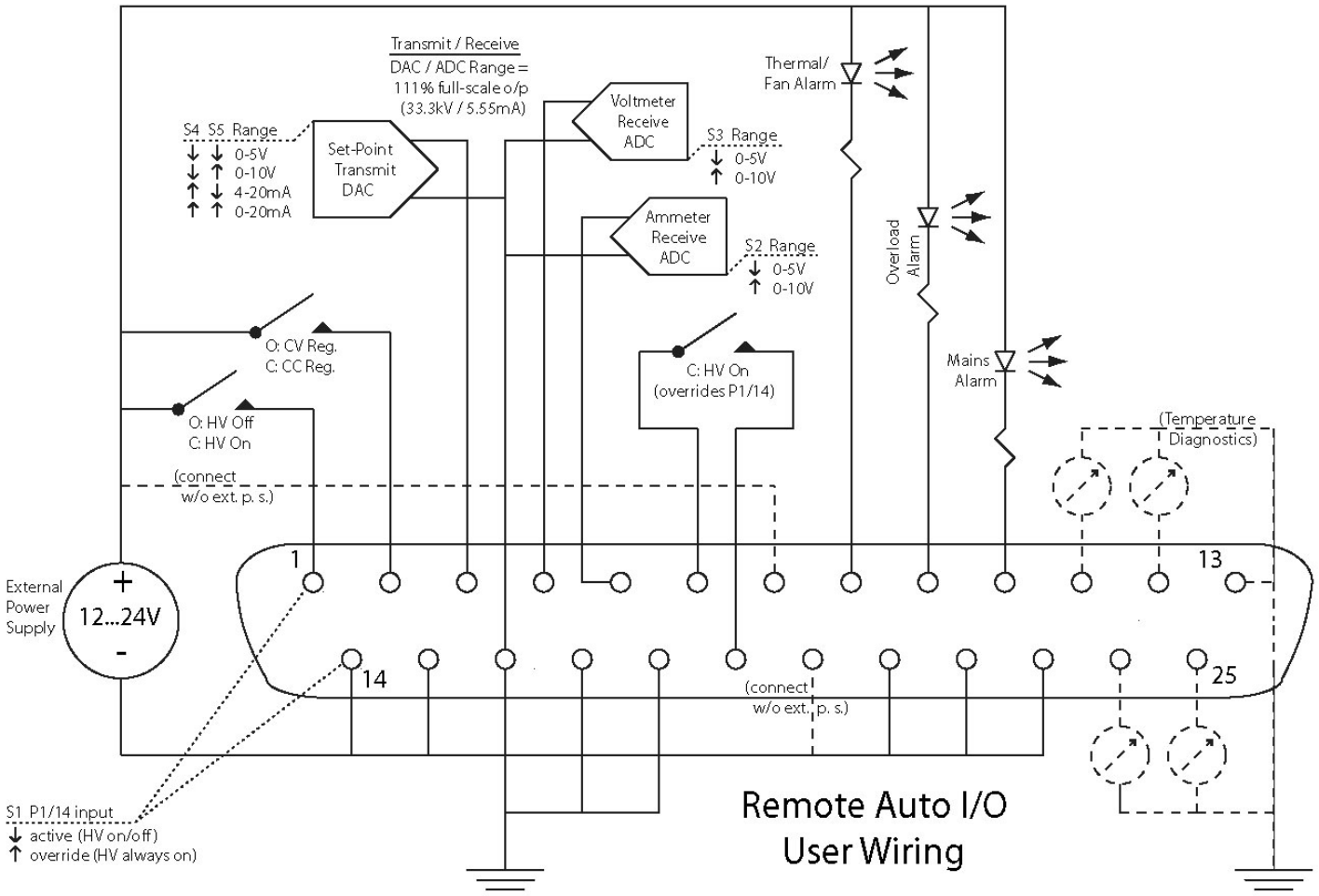
In the open/down position this switch configures a set-point range of 0 to 5V (voltage-loop) or 4 to 20mA (current-loop).
In the closed/up position this switch configures a set-point range of 0 to 10V (voltage-loop) or 0 to 20mA (current-loop).

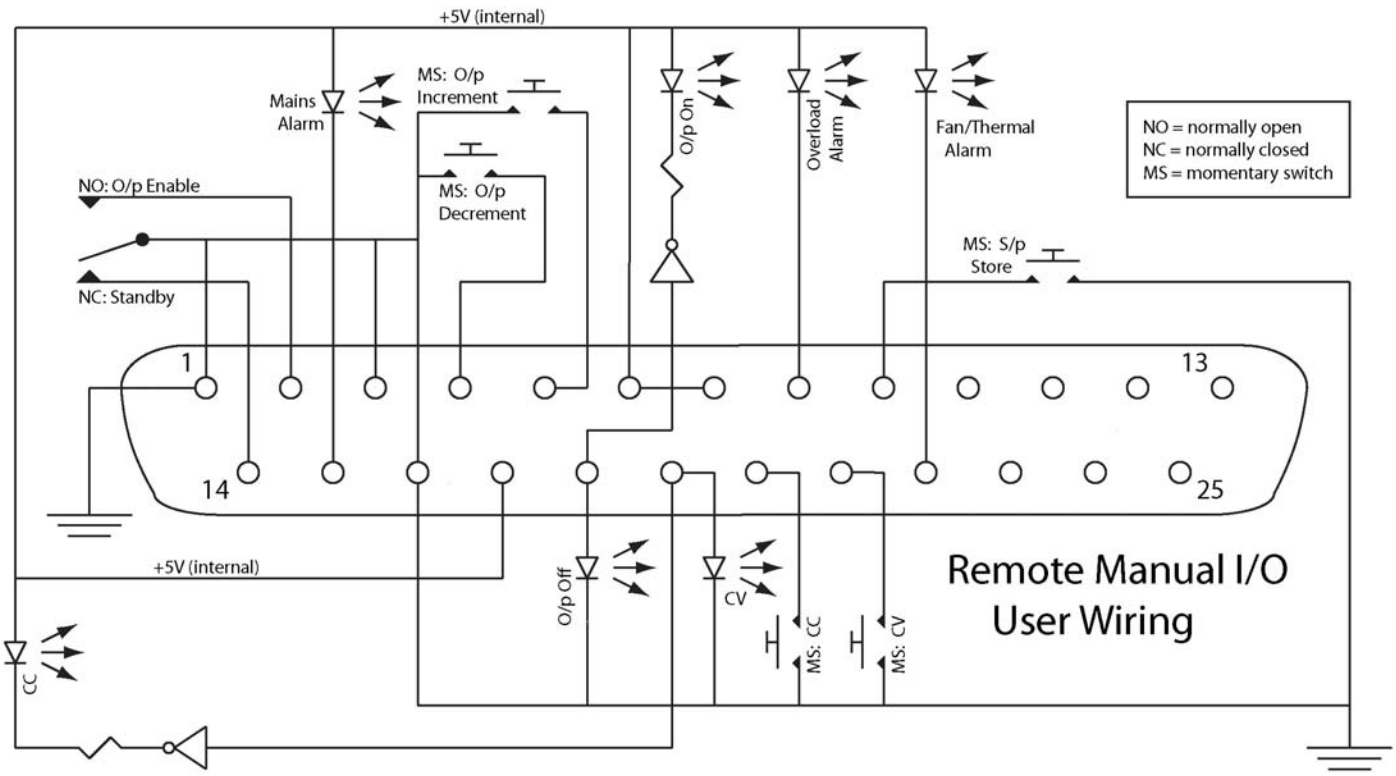
Wiring to Remote-I/O Ports

All wiring to either of the remote-I/O ports must include a full-length metal (foil or braid) shield tied to the end-connector shell conductors (e.g. by drain wire) to guarantee reliable operation in all intended application environments.

Standard (off-the-shelf) and custom-made cables meeting the remote-I/O requirements are available from a number of commercial manufacturers and distributors. An example is the L-com CSM25MF series, for which further information is available at this location: http://www.l-com.com/productfamily.aspx?id=1004

Following are functional user-wiring diagrams illustrating some examples of circuit connections to the remote-I/O ports:





Constant-Voltage Mode vs. Constant-Current Mode

Unintended Behavior of Power Supply

It is useful to understand the differences in behavior of the power supply between its two modes of output regulation, even if only one mode is normally programmed. It is possible, especially through accidental manual operation (via the console), for the power supply to be programmed to the other mode from that intended for a given application.

There is only one set-point used for programming the output in both modes. Hence, for a power supply programmed to one half of full-scale the output voltage in CV mode would be ~15kV and the output current in CC mode would be ~2.5mA. Depending upon the output load, however, the current might be far from 2.5mA in CV mode or far from 15kV in CC mode.

⚠ *Warning:*

With a set-point programmed for a low-current CV-mode application, the output voltage is likely to rise to >30kV (i.e. voltage limit) if the mode is switched to CC. An overload condition would be indicated in such an event, and unexpected arcing might occur at the high-voltage electrodes.

Selection of Optimum Mode for Application

A fundamental requirement for reliable charging operation is to maintain the power supply within its output compliance range. Hence, in CV mode the output current should not normally exceed 5.0mA and in CC mode the output voltage should not normally exceed 30kV.

CV mode may be required in many applications -- especially those with low output current. Generally, for applications with large or poorly regulated electrode air gaps (>> ~1cm) the output voltage cannot be reliably maintained in-compliance using CC mode.

So the CC mode is generally not useful in low-current applications. But it may produce better results in some high-current applications. High-current applications require a small and well-regulated electrode air gap, resulting in higher ionizing (electric) fields.

CC mode can provide greater stability of bonding force in automated applications with limited and fixed time intervals available for charging, because the total electrostatic charge generated is equal to the ionization (or output) current multiplied by the time interval. Hence, in CC mode the charge is directly regulated because the current is constant, whereas in CV mode the charge varies with changing ambient conditions, electrode contamination and wear, variations in web material and gap thickness, etc.

Another potential benefit is reduced electrode voltage during idle cycles or non-charging time. In CC mode the output voltage rises with the introduction of a charge-accumulating dielectric (e.g. plastic sheet or web material) into the electrode gap. And the output voltage falls when the electrode gap is filled completely with air. In applications for which the output is always “on” this may result in lower electrode wear and maintenance.

In summary, CV mode can be reliably employed in the majority of applications. CC mode can provide advantages in high-current or high-field applications. The choice of appropriate or best regulation mode is dependent upon many application-specific parameters and may require experimentation to determine.