INSTRUCTION MANUAL

RA 19-4C-26464
RACK ADAPTER

HOT SWAP RACK ADAPTER FOR
HSF 300W, 600W, 1200W, 1500W SERIES POWER SUPPLIES

KEPCO INC.
An ISO 9001 Company.

MODEL
RA 19-4C-26464
RACK ADAPTER

ORDER NO.	REV. NO

IMPORTANT NOTES:

1) This manual is valid for the following Model and associated serial numbers:

MODEL	SERIAL NO.	REV. NO.

2) A Change Page may be included at the end of the manual. All applicable changes and revision number changes are documented with reference to the equipment serial numbers. Before using this Instruction Manual, check your equipment serial number to identify your model. If in doubt, contact your nearest Kepco Representative, or the Kepco Documentation Office in New York, (718) 461-7000, requesting the correct revision for your particular model and serial number.

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MODIFICATION OF STANDARD

KEPCO MODEL RA 19-4C-26464

The Kepco Model RA 19-4C-26417 has been modified to a Kepco Model RA 19-4C-26464 by installing two bus bars at the rear panel.

1) ELECTRICAL CHANGES:

None

2) MECHANICAL CHANGES:

See Figure 1.

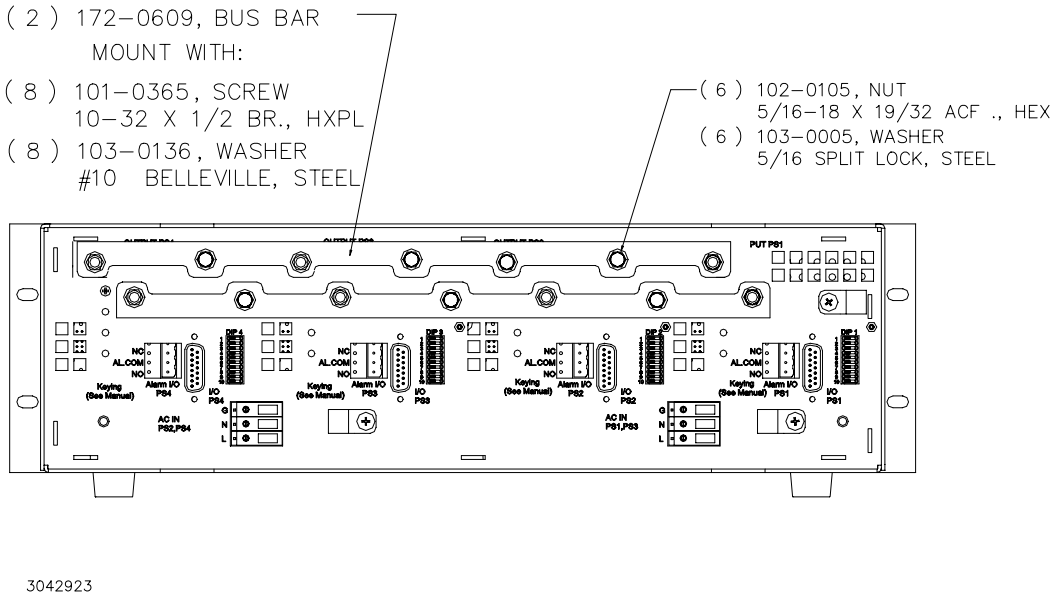

FIGURE 1. BUS BARS MOUNTED AT REAR PANEL

3) INSTRUCTION MANUAL CORRECTIONS:

None

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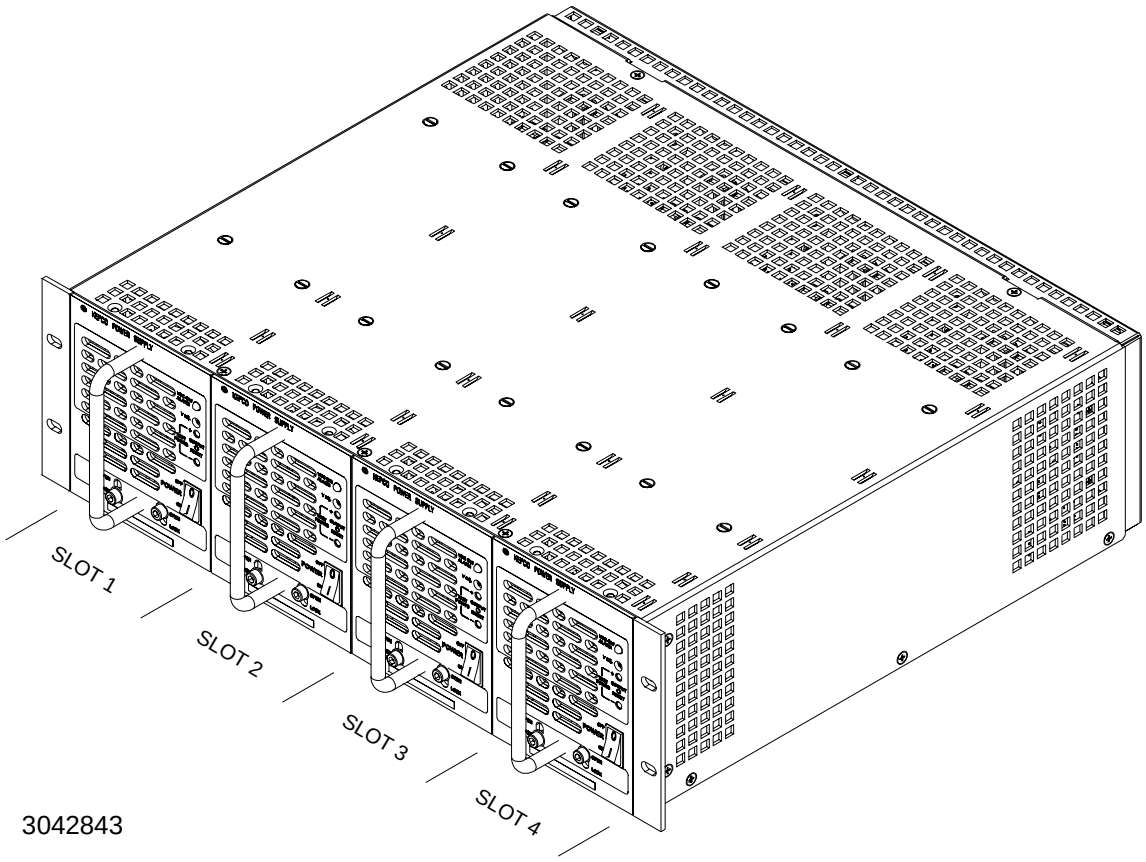

FIGURE 1-1. RA 19-4C-26417 RACK ADAPTER

SECTION 1 - INTRODUCTION

1.1 SCOPE OF MANUAL

This manual contains instructions for the installation and operation of the RA 19-4C-26417 plug-in rack adapter (Figure 1-1) used with 1200W and 1500W HSF power supplies, manufactured by Kepco, Inc., Flushing, New York, U.S.A.

1.2 GENERAL DESCRIPTION

Kepco RA 19-4C-26417 rack adapters are specifically designed for the installation of Kepco 1200W and 1500W HSF Power Supplies into 19-inch EIA-RS-310D standard equipment racks. The RA 19-4C-26417 Model accommodates up to four 1200W or 1500W HSF power supplies (Figure 1-2).

The rack adapter is user-configurable for parallel, series, or independent power supply operation. Forced current sharing and OR'ing diodes for N+1 redundancy are built into the HSF power supplies. Redundant a-c inputs are provided to deliver independent source power to each power supply in a redundant pair. User-configurable keying ensures that only the correct power supply can be installed in a keyed slot.

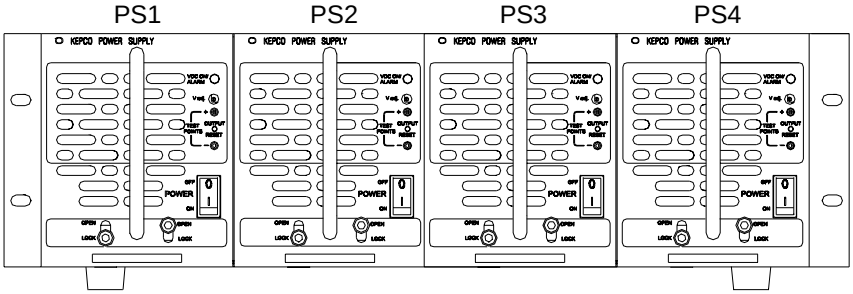

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FIGURE 1-2. RA 19-4C-26417 RACK ADAPTER WITH 1200W OR 1500W HSF POWER SUPPLIES INSTALLED

1.3 ELECTRICAL

An internal PCB back plate mounts connectors which interface directly with the power and signal connectors of 1200W and 1500W HSF power supplies, permitting hot swappable insertion and extraction. The other side of the back plate assembly, available from the rear, contains the fixed power and signal connections. Figure 1-3 shows RA 19-4C-26417 Rack Adapter interconnections as well as details of the connectors and DIP switches located on the rear panel (see Figure 1-4). Dual input terminal blocks on the rear panel (Figure 1-4) distribute input power to each of the four power supplies. Figure 1-5 is a schematic diagram of the RA 19-4C-26417 Rack Adapter.

All mechanical specifications are contained in the mechanical outline drawing, Figure 1-6.

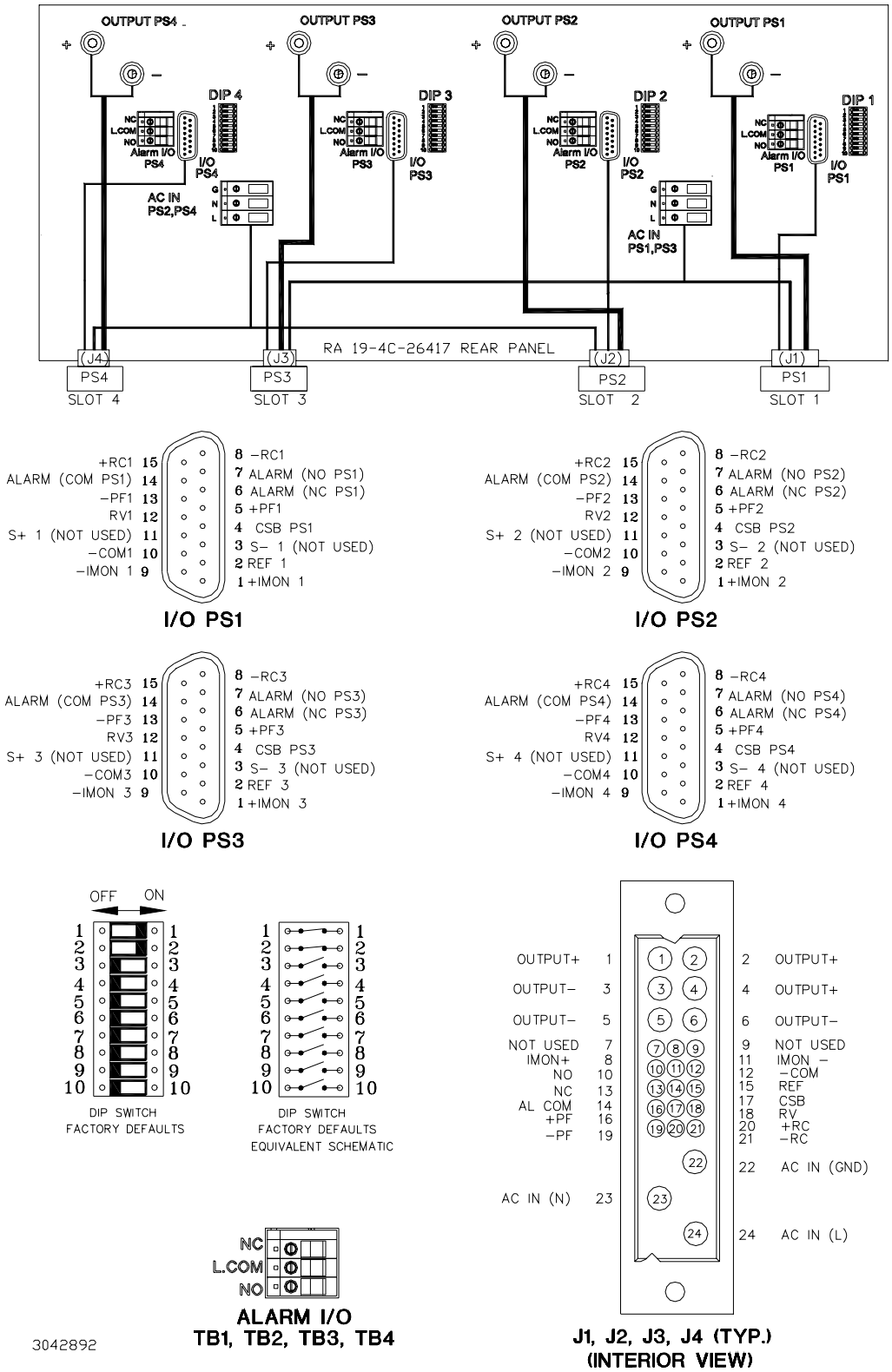


FIGURE 1-3. RA 19-4C-26417 REAR PANEL INTERCONNECTIONS

1.4 MECHANICAL

The rack adapter is equipped with mounting ears for mounting in EIA-RS-310D standard 19-inch racks. For mounting in non-standard racks, consult Kepco Applications Engineering. The rack adapter is not configured for slides. Optional blank filler panels (see Table 1-2) are available if the full complement of power supplies is not utilized.

Mechanical dimensions, material, and finish of the RA 19-4C-26417 Rack Adapter are provided in Figure 1-6.

1.5 ACCESSORIES

Accessories for RA 19-4C-26417 Rack Adapters are listed in Table 1-2; see also Table 2-1 for additional accessories supplied with the unit.

1.6 OPTIONS

Table 1-1 describes the standard model options available with the RA 19-4C-26417 rack adapter. For non-standard options, contact Kepco Applications Engineering for assistance.

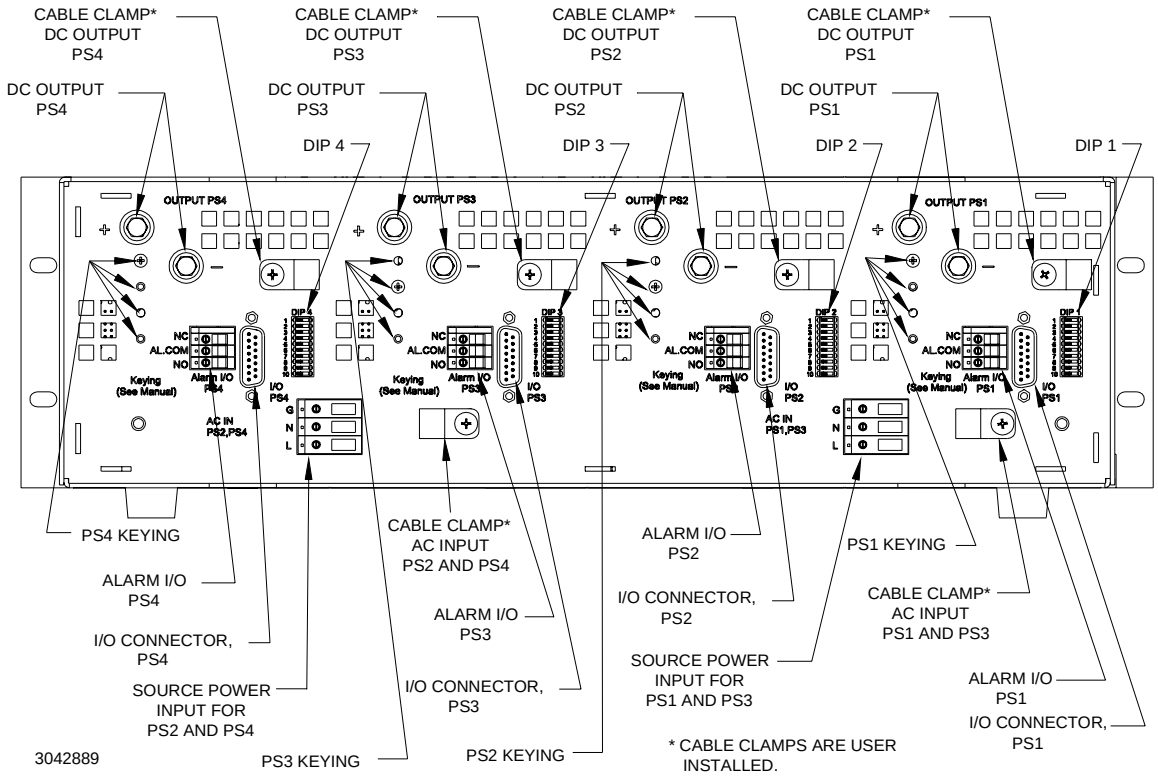


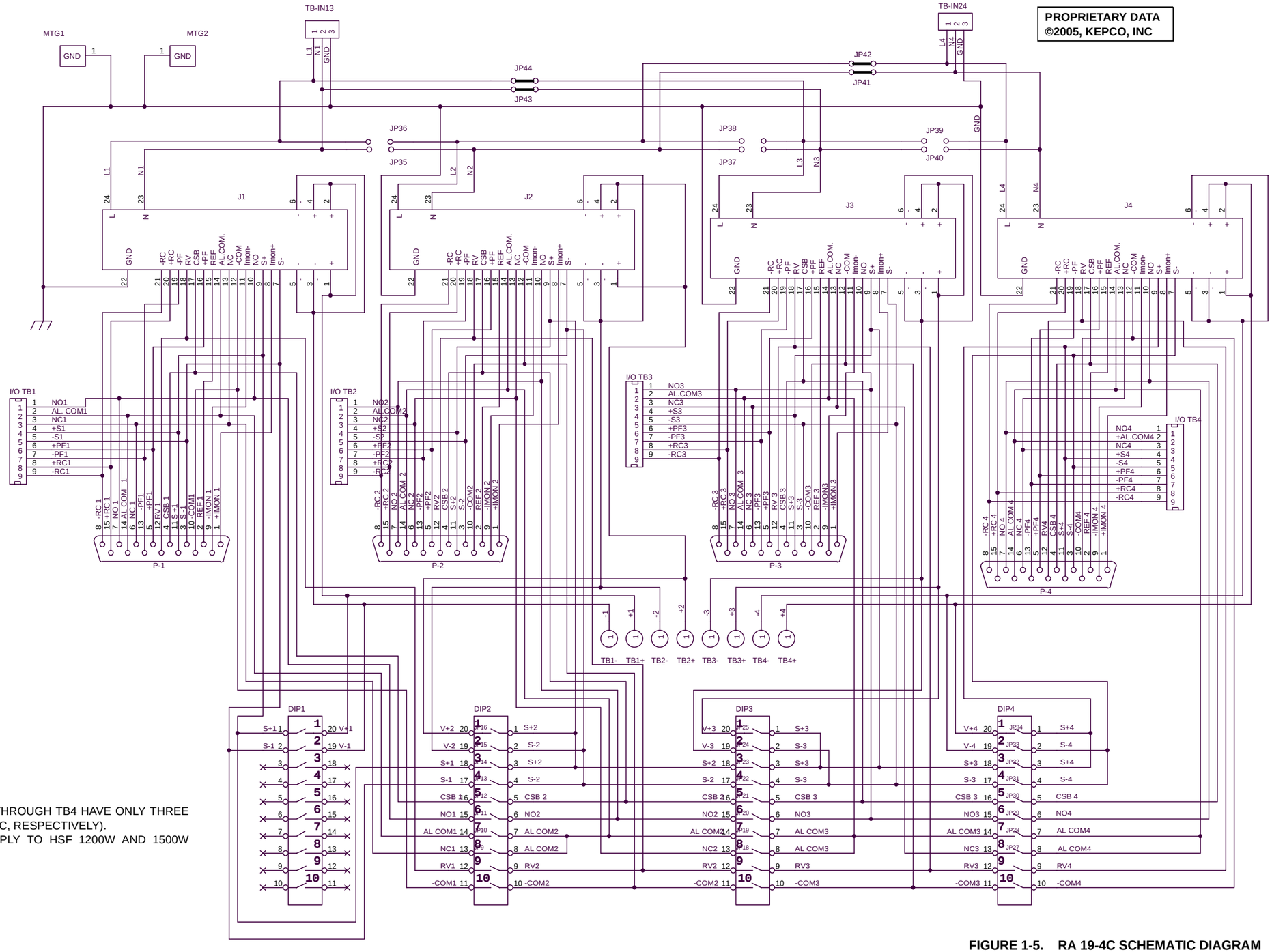
FIGURE 1-4. RA 19-4C-26417 RACK ADAPTER REAR PANEL

TABLE 1-1. COMPATIBLE HSF POWER SUPPLIES

MODEL	Total	Compatible HSF Models	
		1200 Watt	1500 Watt
RA 19-4C-26417	4 (max)	HSF 24-50	HSF 48-32
* Contact Kepco Applications Engineering for assistance with non-standard configurations.			

TABLE 1-2. RA 19-4C-26417 ACCESSORIES

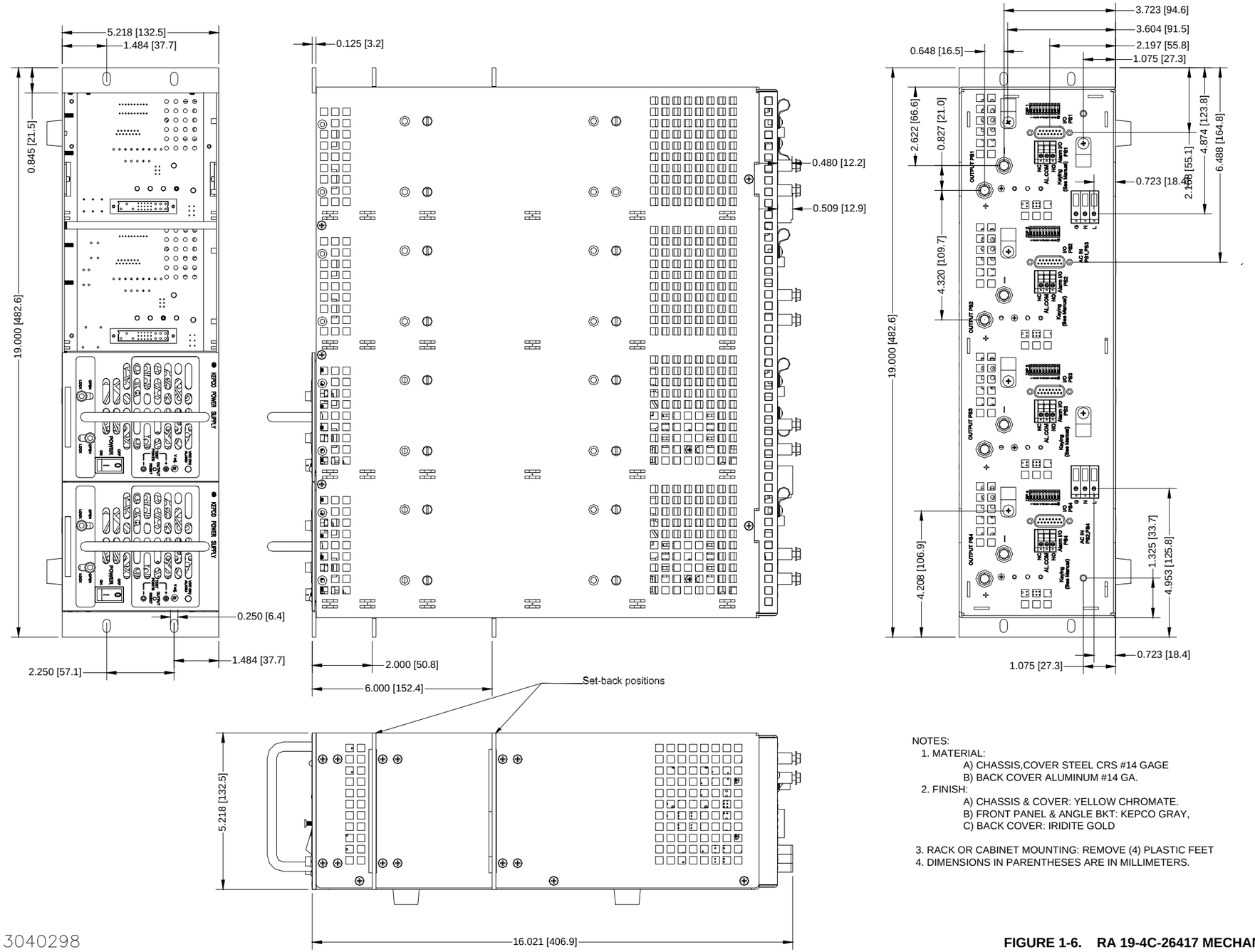
ACCESSORY	PART NUMBER	USE
Screw, Thread forming (4-40, 0.75 in. long, PHPH)	101-0480	Module Keying. eight (8) supplied with unit. Installed by user (see PAR. 2.3).
Line cord	118-1145	Connect to 30A, 125-250V a-c source power via NEMA 10-30P connection.
Line cord	118-1146	Connect to 32A, 250V a-c source power via IEC 309 connection.
Connector	142-0449	Mating Connector for I/O connector. Four (4) supplied with unit.
Filler Panel (1/4 Rack)	RFP 19-14C	Cover one unused 1/4 rack slot.
Filler Panel (1/2 Rack)	RFP 19-12C	Cover two unused 1/4 rack slots.
Bus bar, Series	172-0593	Connect Output Terminals, (–) to (+) for series operation.
Bus bar, Parallel	172-0590	Connect slots 1 and 2, 2 and 3, or 3 and 4 in parallel; two bus bars required for each paralleled slot: one for (+), one for (–).
Bus Bar, Parallel	172-0591	Connect slots 1, 2 and 3, or 2, 3 and 4 in parallel; two bus bars required for each paralleled set of slots: one for (+), one for (–).
Bus Bar, Parallel	172-0592	Connect slots 1 through 4 in parallel; two bus bars required for each rack adapter: one for (+), one for (–).
Protective cover	137-0145	Clear plastic cover, protects against accidental contact with DC output terminals.
Setback Ear Brackets (2 required)	128-2168	Used to mount rack adapter in 19-inch rack using “set back” position for applications that require reduced depth protrusion (see Figure ???)
Screws ((8 required, 4 for each ear bracket)	101-0446	Used to attach ear brackets to rack adapter chassis.(6-32 x 1/4, Flat Head Phillips Tri-torq, Tubular Self Forming



NOTES:

1. ALARM I/O TERMINAL BLOCKS TB1 THROUGH TB4 HAVE ONLY THREE PINS: 1, 2, AND 3 (NO, AL COM AND NC, RESPECTIVELY).
2. SENSE CONNECTIONS DO NOT APPLY TO HSF 1200W AND 1500W UNITS.

FIGURE 1-5. RA 19-4C SCHEMATIC DIAGRAM



NOTES:
1. MATERIAL:
   A) CHASSIS,COVER STEEL CRS #14 GAGE
   B) BACK COVER ALUMINUM #14 GA.
2. FINISH:
   A) CHASSIS & COVER: YELLOW CHROMATE.
   B) FRONT PANEL & ANGLE BKT: KEPCO GRAY,
   C) BACK COVER: IRIDITE GOLD

3. RACK OR CABINET MOUNTING: REMOVE (4) PLASTIC FEET
4. DIMENSIONS IN PARENTHESES ARE IN MILLIMETERS.

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FIGURE 1-6. RA 19-4C-26417 MECHANICAL OUTLINE DIMENSIONS

SECTION 2 - INSTALLATION

2.1 UNPACKING AND INSPECTION

This equipment has been thoroughly inspected and tested prior to packing and is ready for operation. After careful unpacking, inspect for shipping damage before attempting to operate. If any indication of damage is found, file an immediate claim with the responsible transport service. See Table 2-1 for a list of equipment supplied.

TABLE 2-1. EQUIPMENT SUPPLIED

ITEM	QUANTITY	PART NUMBER
Rack Adapter	1	RA 19-4C-26417
I/O Connector (Mating)	4	142-0449
Instruction Manual	1	243-1130
Keying screws (4-40 x 0.75 in., thread forming)	8	101-0480
Hood for I/O Connector (Mating) P/N 142-0449	4	108-0204
Cable clamp	6	138-0063
Chassis Feet	4	158-0008
Output connection screw (10-32 x 1/2, Hex head)	8	101-0365
Output connection washer #10 (ID: 0.210, OD: 0.433 .039 thk, steel)	8	103-0136

2.2 CONFIGURING THE RACK ADAPTER

Prior to installation the rack adapter must be configured by the user. Configuration consists of the following:

- For configurations that use multiple output voltages it is possible to key the rack adapter to accept only a power supply with corresponding keying (see PAR 2.3).

- Configuring slots for independent, parallel, or series operation. This can be done by means of DIP switches mounted on the rear panel, or externally by wiring the associated I/O mating connector and DC OUTPUT terminals (see PAR. 2.4).

2.3 RACK ADAPTER KEYING INSTRUCTIONS

RA 19-4C-26417 rack adapters incorporate a keying mechanism to prevent accidental insertion of the incorrect model HSF power supply into any position. The HSF power supplies are keyed by voltage at the factory. The keying mechanism will prevent engagement of any of the HSF power supply's connectors with those on the rack adapter's back plate unless the key and keyway align. The key pins are on the HSF power supply and are set at the factory. DO NOT ALTER THE KEYING AT THE POWER SUPPLY. The keyway is established by installing screws (provided) so that the only open holes match the power supply pins; maximum torque is 5 in.-lbs. The user can configure each power supply slot for the desired voltage in the desired position. Figure 1-4 shows the location of key positions for each slot and Figure 2-1 shows the configuration required for voltage selection.

2.3.1 ESTABLISHING KEY POSITIONS

To establish the keying of any position, simply install the 4-40 x 0.75 in. thread-forming screws (Kepco P/N 101-0480) into the corresponding holes as indicated in Figure 2-1. DO NOT OVERTIGHTEN these screws (max torque 5 in.-lbs. (0.6 N x m). DO NOT ALTER THE KEYING AT THE POWER SUPPLY.

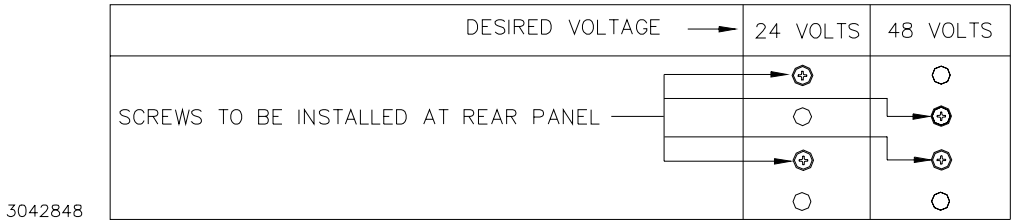

FIGURE 2-1. RA 19-4C-26417 RACK ADAPTER KEYING

2.4 SLOT CONFIGURATION

Configuring slots of the rack adapter for independent, parallel or series operation is accomplished either by means of DIP switches mounted on the rear panel associated with each slot (see Figure 1-3), or externally by connecting the appropriate pins of the associated I/O mating connector. DIP switch functions are explained in Table 2-2.

Slot configuration requires the following selection:

1. Select independent (PAR. 2.4.1), parallel (PAR. 2.4.3), or series (PAR. 2.5) operation.

2. Optional: Select close-on-failure or open-on-failure alarm (PAR. 2.6).

TABLE 2-2. REAR PANEL DIP SWITCH FUNCTIONS

DIP SWITCH POSITION	FUNCTION	DIP SWITCH SET TO ON (CLOSED)	DIP SWITCH SET TO OFF (OPEN)
NOTE: **BOLD TYPE** INDICATES FACTORY SETTINGS.			
1, 2	Not applicable	**Not applicable, not used (factory default is ON).**	Not applicable.
3, 4	Not applicable	Not applicable, not used .	**Not used (factory default is OFF).**
5	Current Balance	Required ON for parallel operation (connects current share lines in parallel) unless connections are made via external wires (see PAR. 2.4.3).	**Required OFF (factory default) for a) independent and series configurations. b) Parallel configurations using external wires at I/O connector to connect CSB (current share bus) lines in parallel.**
6, 7	Close on Failure Alarm	When set to ON, individual power supplies produce closure between I/O connector N.O. and COM pins upon failure (see PAR. 2.6.1).	**When set to OFF (factory default), allows a single alarm to provide failure indication (contact closure between N.O. pin and COM pin) if any one of many power supplies fails (see PAR. 2.6.1).**
8	Open on Failure Alarm	When set to ON, individual power supplies produce open between I/O connector N.C. and COM pins upon failure (see PAR. 2.6.2).	**When set to OFF (factory default), allows a single alarm to provide failure indication (contact open between N.C. pin and COM pin) if any one of many power supplies fails (see PAR. 2.6.2).**
9	Remote Voltage	When set to ON, enables control of multiple supplies from power supply designated as the Master. Used only for power supplies with Current Share capability.)	**When set to OFF allows independent voltage control of each power supply**
10	-Common	When set to ON, enables control of multiple supplies from power supply designated as the Master. Used only for power supplies with Current Share capability.)	**When set to OFF allows independent voltage control of each power supply**

2.4.1 INDEPENDENT OPERATION

The rack adapter is preconfigured at the factory for independent operation of all slots. DIP switch positions 1 through 5 associated with each slot must be set to OFF (open) for each power supply to be operated independently.

2.4.1.1 USING ONE POWER SUPPLY TO CONTROL MULTIPLE POWER SUPPLIES

Figure 2-2 shows the connection of three power supplies each having an independent load. In this configuration the output voltage of all three power supplies is controlled by one power supply (master) and the current drawn by each power supply is determined by the respective load.

The connections between RV and -COM may be made using the rack adapter DIP switches or by wiring the I/O mating connector as shown in Figure 2-2. Using external wiring at the I/O mating connector allows configuration of non-adjacent slots. Use shielded wire for connections to RV pins.

2.4.2 PARALLEL OPERATION

Compatible HSF Power Supplies (see Table 1-1) can be connected in parallel (with or without N+1 redundancy). The impedance of the load wires between each power supply and load should be the same. In addition, multiple RA 19-4C-26417 rack adapters that are fully populated with identical HSF power supplies may be paralleled using external wiring at the I/O connectors.

For a single remote ON-OFF signal to turn off all parallel-connected units, at the I/O mating connectors connect together all +RC pins (pin 15) and connect together all –RC pins (pin 8).

Three things must be considered when configuring the rack adapter for parallel operation:

- DC OUTPUT
- CURRENT BALANCING
- VOLTAGE CONTROL

The power leads must be connected in parallel externally by connecting each power supply directly to the load; DAISY CHAIN WIRING IS **NOT** PERMITTED, however bus bars are available as accessories to make these connections when paralleling adjacent slots (refer to Table 1-2).

Control of parallel-connected modules is by configuring one unit (the master) to control all the others (slaves). The master and slaves may be either preselected by the user (PAR. 2.4.1.1), or if the output voltage of all modules is set within 2% of each other, the master will be determined automatically (PAR. 2.4.1.1). In both cases control may be from either the HSF front panel or by remote means. Current balancing is implemented to equalize the load current (see PAR. 2.4.3.3).

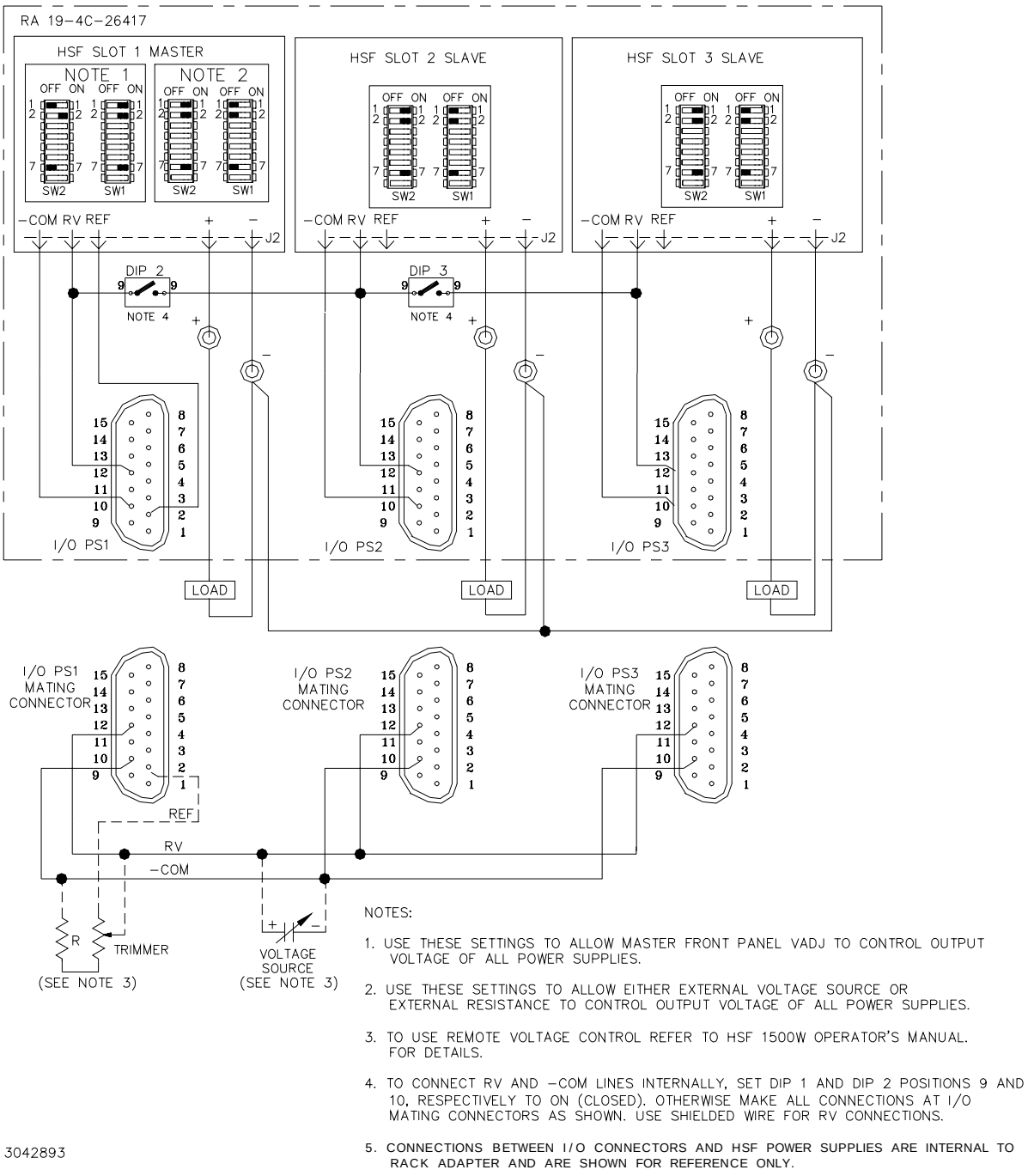

FIGURE 2-2. CONTROLLING MULTIPLE POWER SUPPLIES, MULTIPLE LOADS

2.4.3 PARALLEL OPERATION

Compatible HSF Power Supplies (see Table 1-1) can be connected in parallel (with or without N+1 redundancy). Refer to the appropriate HSF power supply manual for more details. The impedance of the load wires between each power supply and load should be the same. In addition, multiple RA 19-4C-26417 rack adapters that are fully populated with identical HSF power supplies may be paralleled using external wiring at the I/O connectors.

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2.4.3.1 PARALLEL MASTER, USER SELECTION, SUPPLYING BALANCED CURRENT TO A SINGLE LOAD

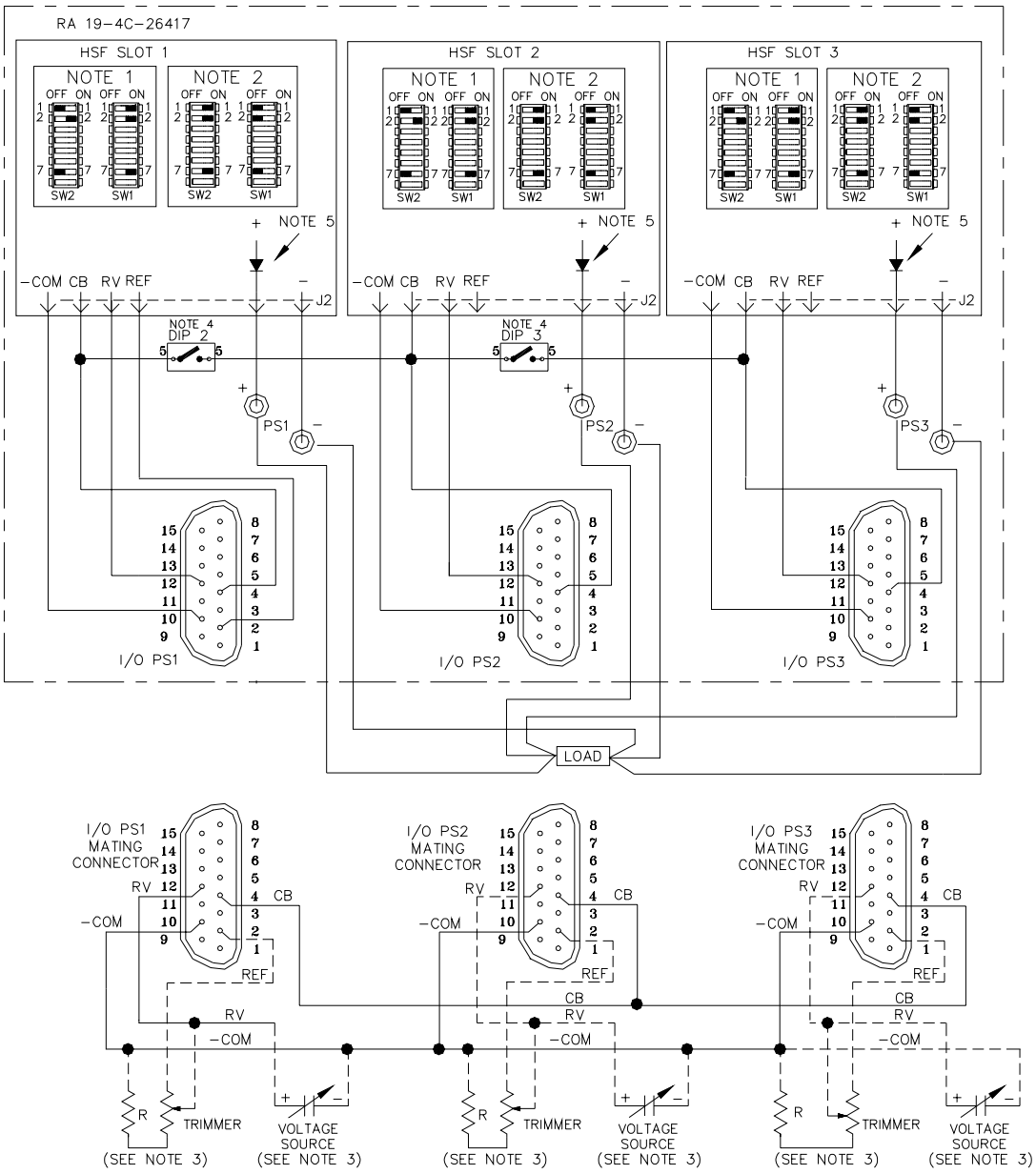
Figure 2-3 shows the connection of three power supplies in parallel to a single load. The output voltage of all slave power supplies tracks the master. The master and slaves are determined by the internal DIP switches, SW1 and SW2, of the HSF modules. In one case the Master is controlled by the HSF front panel Vadj control. In the other, the master is controlled remotely, either by an external voltage or an external resistance connected as shown in Figure 2-3.

This configuration requires that CB (Current Balance) and RV (Remote Voltage) of all modules be tied together, using either the DIP switches at the rear of the rack adapter, or by wiring the I/O mating connector as shown in Figure 2-3. Wiring of the I/O mating connector allows non-adjacent slots to be connected in parallel. If rack adapter DIP switches are used to connect the RV and CB lines, positions 9 and 5 of adjacent modules (DIP 2 and DIP 3 in Figure 2-3) must be ON (closed). If external wiring of the I/O connector is used, positions 9 and 5 of DIP switches for adjacent modules (DIP 2 and DIP 3 in Figure 2-3) must be set to OFF (open) and the RV and CB connections must be wired at the I/O mating connector as shown in Figure 2-3.

2.4.3.2 PARALLEL MASTER, AUTOMATIC SELECTION, SUPPLYING BALANCED CURRENT TO A SINGLE LOAD

Figure 2-4 shows a configuration in which the master is determined by whichever power supply has the highest voltage. In this configuration the output voltage of all power supplies must be set within 2% for current balancing to be in effect. The internal DIP switches, SW1 and SW2, of each HSF module must be configured to allow either the HSF front panel Vadj control or remote control of the output, either by an external voltage or an external resistance connected as shown in Figure 2-4.

This configuration requires that CB (Current Balance) and -COM (negative Common) of all modules be tied together, using either the DIP switches at the rear of the rack adapter, or by wiring the I/O mating connector as shown in Figure 2-4. Wiring of the I/O mating connector allows non-adjacent slots to be connected in parallel. If rack adapter DIP switches are used to connect the RV and –COM lines, positions 9 and 10 of adjacent modules (DIP 2 and DIP 3 in Figure 2-4) must be ON (closed). If external wiring of the I/O connector is used, positions 9 and 10 of DIP switches for adjacent modules (DIP 2 and DIP 3 in Figure 2-4) must be set to OFF (open) and the RV and –COM connections must be wired at the I/O mating connector as shown in Figure 2-4. NOTE: When connections are made at the I/O mating connector, use shielded wire for connections to RV pins. Match impedance of load wires between each power supply and load by using the same wire lengths and wire sizes.

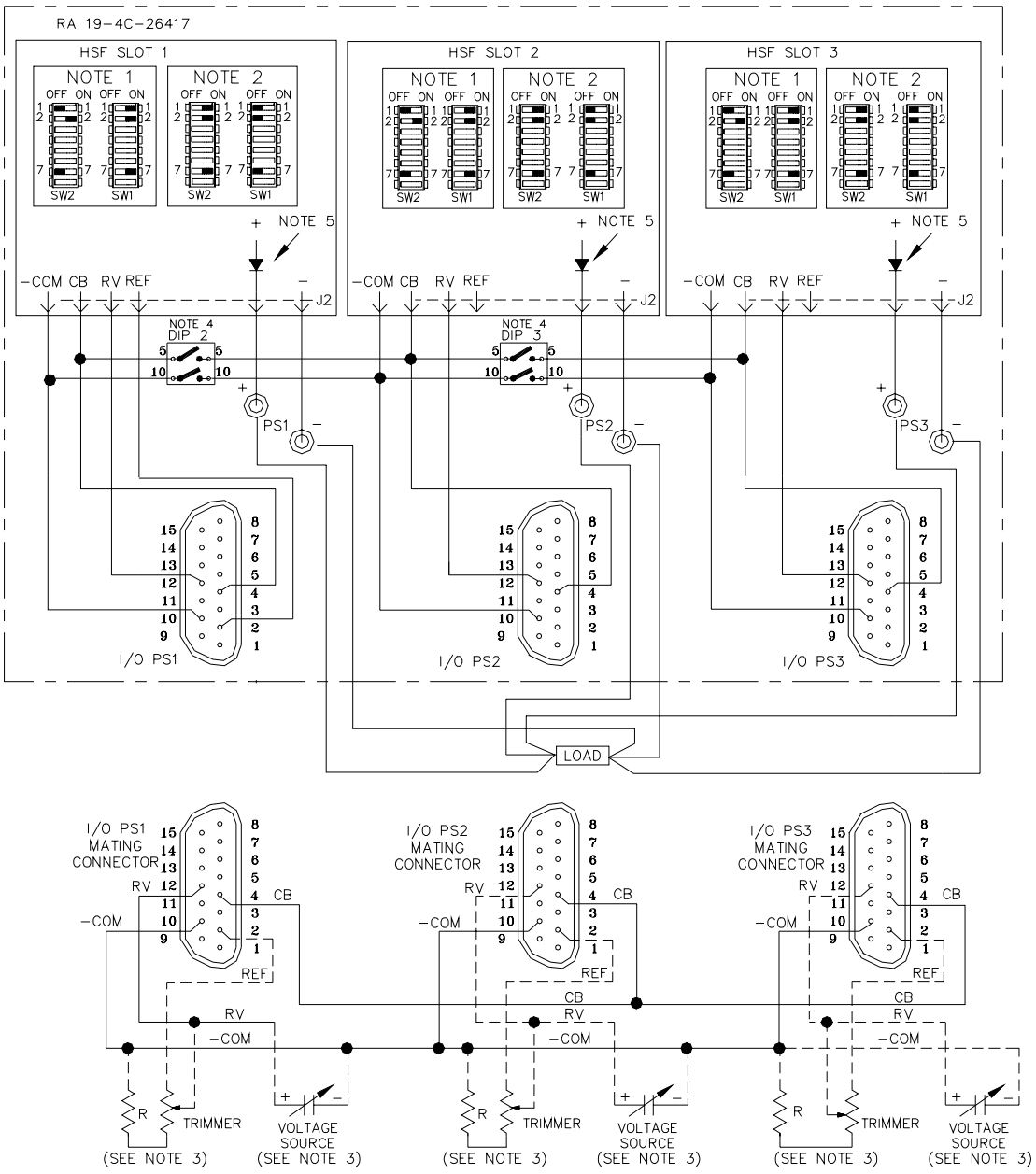


NOTES:

1. USE THESE SETTINGS TO ALLOW MASTER FRONT PANEL VADJ TO CONTROL OUTPUT VOLTAGE OF ALL POWER SUPPLIES.
2. USE THESE SETTINGS TO ALLOW EITHER EXTERNAL VOLTAGE SOURCE OR EXTERNAL RESISTANCE TO CONTROL OUTPUT VOLTAGE OF ALL POWER SUPPLIES.
3. TO USE REMOTE VOLTAGE CONTROL REFER TO HSF 1500W OPERATOR'S MANUAL FOR DETAILS.
4. TO CONNECT CB LINES INTERNALLY, SET DIP 2 AND DIP 3 POSITION 5, TO ON (CLOSED). OTHERWISE, MAKE ALL CONNECTIONS AT I/O MATING CONNECTORS AS SHOWN.
5. ISOLATION DIODES ARE PART OF HSF POWER SUPPLY.
6. CONNECTIONS BETWEEN I/O CONNECTORS AND HSF POWER SUPPLIES ARE INTERNAL TO RACK ADAPTER AND ARE SHOWN FOR REFERENCE ONLY.

3042896

FIGURE 2-3. PARALLEL CONNECTION, MASTER-SLAVE, SINGLE LOAD, MASTER DETERMINED BY DIP SWITCH SETTING



NOTES:

1. USE THESE SETTINGS TO ALLOW MASTER FRONT PANEL VADJ TO CONTROL OUTPUT VOLTAGE OF ALL POWER SUPPLIES.
2. USE THESE SETTINGS TO ALLOW EITHER EXTERNAL VOLTAGE SOURCE OR EXTERNAL RESISTANCE TO CONTROL OUTPUT VOLTAGE OF ALL POWER SUPPLIES.
3. TO USE REMOTE VOLTAGE CONTROL REFER TO HSF 1500W OPERATOR'S MANUAL FOR DETAILS.
4. TO CONNECT CB AND -COM LINES INTERNALLY, SET DIP 2 AND DIP 3 POSITIONS 5 AND 10, RESPECTIVELY, TO ON (CLOSED). OTHERWISE, MAKE ALL CONNECTIONS AT I/O MATING CONNECTORS AS SHOWN.
5. ISOLATION DIODES ARE PART OF HSF POWER SUPPLY.
6. CONNECTIONS BETWEEN I/O CONNECTORS AND HSF POWER SUPPLIES ARE INTERNAL TO RACK ADAPTER AND ARE SHOWN FOR REFERENCE ONLY.

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FIGURE 2-4. PARALLEL CONNECTION, MASTER-SLAVE, SINGLE LOAD, MASTER DETERMINED BY HIGHEST OUTPUT VOLTAGE

2.4.3.3 CURRENT BALANCING

The current equalization with up to four HSF 1500W units in parallel should be within 20 to 90% of the total output current rating. The output voltage of any Power Supply individually must be within 2% maximum of the other power supply output voltage setting. The expected current sharing is such that the output current variation for each power supply is less than or equal to 10% of each power supply rated output current.

N+1 Redundancy. An N+1 system requires one additional power supply than necessary to supply the load. If one of the parallel-connected units fail, the others will continue to provide power to the load without down time.

When units are configured for N+1 parallel redundant operation, it is desirable for current to be divided equally among the paralleled supplies. When the CB (Current Balancing) lines of paralleled HSF units are connected together, the load current is forced to divide equally between all paralleled units. If one unit fails, the remaining units will continue to supply the load, and the load current will be divided equally among the remaining operating units. The failed unit is automatically isolated from the circuit by a built-in isolation diode.

For parallel operation (see Figures 2-3 or 2-4) the conditions for current equalization are:

$$\frac{\text{Maximum Voltage} - \text{Minimum Voltage}}{\text{Rated Voltage}} = 2\% \quad \text{variation of output voltage in each power supply}$$

The maximum output current: Rated output current of each power supply x (number of power supplies) x (20 to 90 percent).

Variation of output current < ±10 % of each rated output current

To control the output from a single power supply without adjusting each one individually to within 2%, refer to PAR. 2.4.3.1 and Figure 2-3.

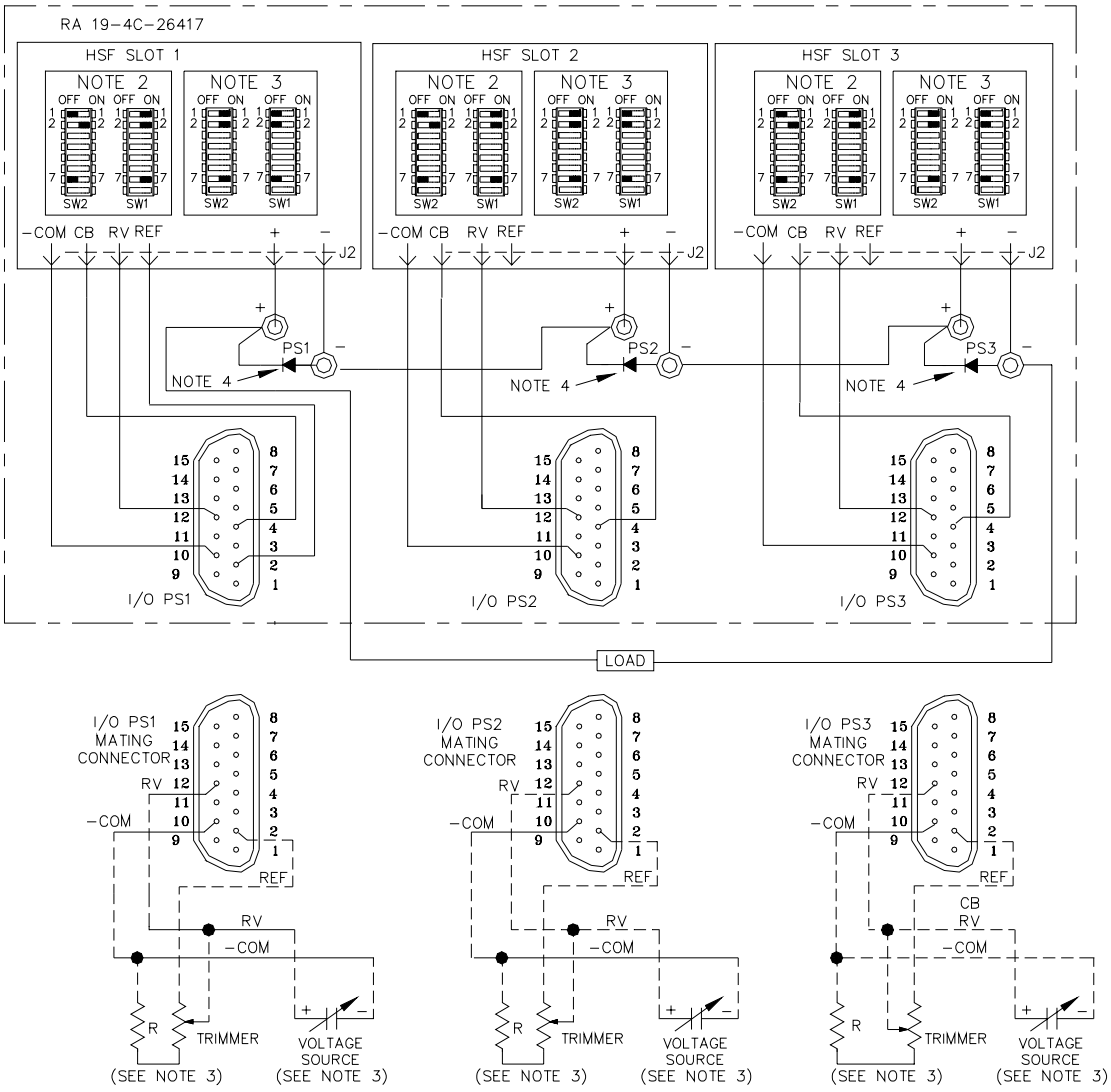
2.5 SERIES CONNECTION

HSF power supplies may be connected in series to obtain higher output voltages. The power supply with the lowest rated value of maximum current establishes the maximum load current allowed. Series configurations can only be accomplished by **external wiring** of the I/O mating connector.

The DC OUTPUT + terminal of one supply must be connected to DC OUTPUT – terminal of the next supply. Each Power Supply in series should be protected by a diode connected in parallel with the output as shown in Figure 2-5. The diode protects against reverse voltages. For convenience bus bars are available as accessories to make these connections when connecting adjacent slots in series (refer to Table 1-2). Protection diodes must conform to the following specifications:

- $V_{REV} > 2 \times V_{NOM} \times N$ where V_{NOM} is the output voltage of the HSF power supply (24V or 48V) and N is the number of power supplies connected in series.
- $I_{FWD} > 1.5 \times I_{NOM}$ where I_{NOM} is the output current of the HSF power supply (50A or 32A)

Rack adapter DIP switches positions 1 through 5 must be set to OFF (open) on all DIP switches between series-connected modules (refer to Figure 1-5.



NOTES:

1. EACH POWER SUPPLY OUTPUT VOLTAGE MAY BE CONTROLLED FROM THE FRONT PANEL OR BY USING AN EXTERNAL TRIMPOT OR VOLTAGE SOURCE. TO USE REMOTE VOLTAGE CONTROL REFER TO HSF 1500W OPERATOR'S MANUAL FOR DETAILS.
2. USE THESE SETTINGS TO ALLOW MASTER FRONT PANEL VADJ TO CONTROL OUTPUT VOLTAGE OF ALL POWER SUPPLIES.
3. USE THESE SETTINGS TO ALLOW EITHER EXTERNAL VOLTAGE SOURCE OR EXTERNAL RESISTANCE TO CONTROL OUTPUT VOLTAGE OF ALL POWER SUPPLIES.
4. PROTECTION DIODES ARE REQUIRED.
5. CONNECTIONS BETWEEN I/O CONNECTORS AND HSF POWER SUPPLIES ARE INTERNAL TO RACK ADAPTER AND ARE SHOWN FOR REFERENCE ONLY.

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FIGURE 2-5. SERIES CONNECTION

2.6 ALARM CONFIGURATIONS

The HSF Power Supplies each provide a normally closed (N.C.) and normally open (N.O.) line referenced to common (COM) for use as an alarm at the users discretion. The N.C. line opens upon failure, the N.O. line closes upon failure. The RA 19-4C-26417 is configured at the factory for independent operation of these lines. It is possible to configure these alarm lines to allow multiple power supplies to provide a failure indication using the N.O. (close on failure) lines, N.C (open on failure) lines, or both. Each alarm circuit can be configured in two ways: either by rear panel DIP switches or by external wiring of the I/O mating connector.

CAUTION: The user is responsible for ensuring that the alarm circuit does not exceed DIP switch specifications: 100mA, 50V d-c, maximum.

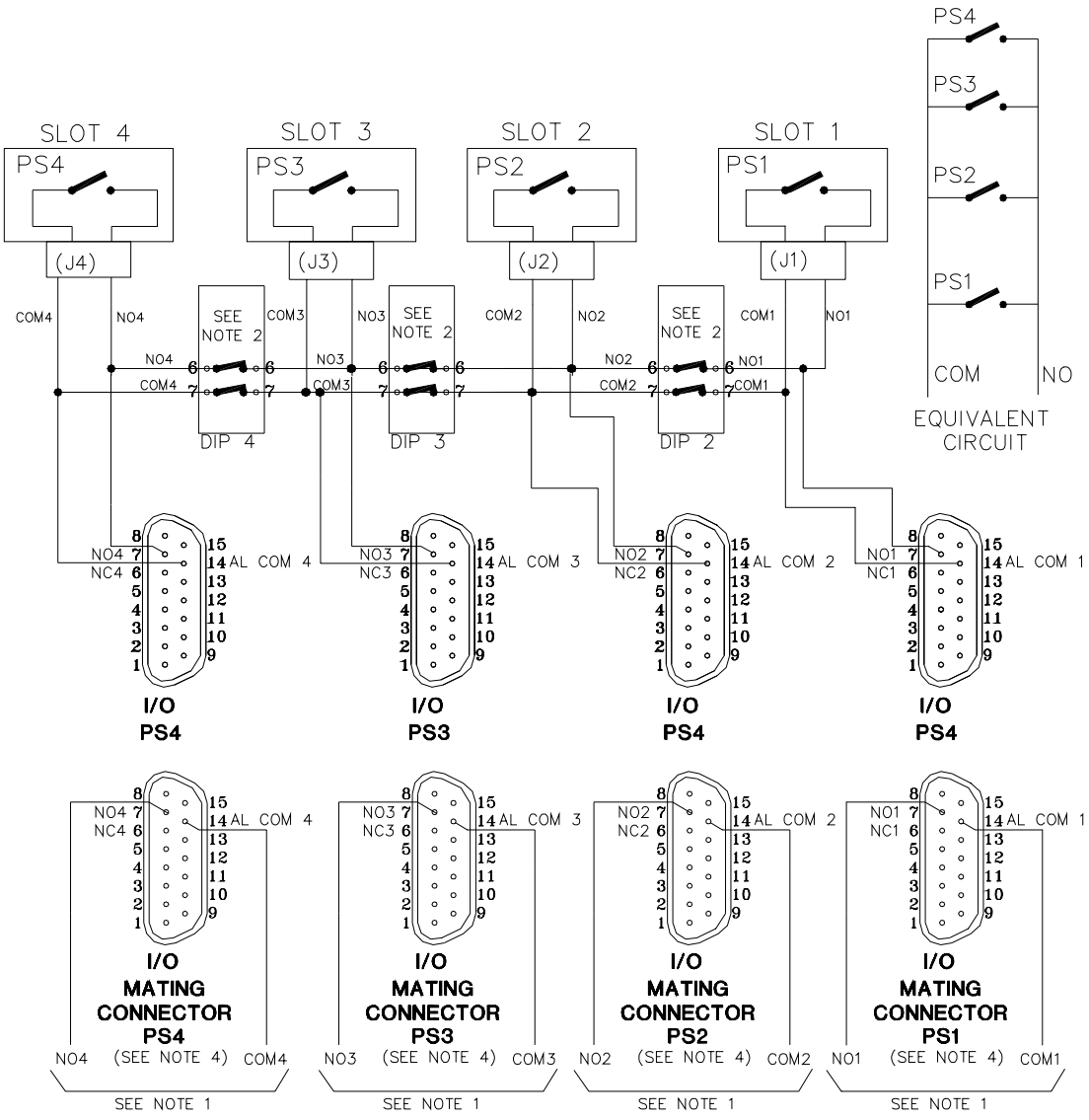
2.6.1 N.O. ALARM LINE (CLOSE ON FAILURE)

The N.O. and COM line of each HSF supply provide a closed contact (short circuit) upon failure. To configure multiple power supplies so that a failure of any supply produces a failure indication, it is necessary to connect the N.O. lines in parallel and the COM lines in parallel. The following paragraphs describe three ways to accomplish this:

- Use the rear panel DIP switches to make the connections (PAR. 2.6.1.1).
- Use external connections from the I/O mating connectors (PAR. 2.6.1.2).
- Use external connections from the Alarm I/O terminal blocks (PAR. 2.6.1.1).

2.6.1.1 CLOSE ON FAILURE USING REAR PANEL DIP SWITCHES

Close on failure for multiple power supplies can be accomplished by setting DIP switch positions 6 and 7 to ON (closed). associated with each adjacent slot included in the alarm circuit. For example, for PS1 and PS2, set DIP switch 2, positions 6 and 7 to ON (closed). The failure indication (short circuit) will be present across both N.O.1 and COM1, and N.O.2 and COM2. Figure 2-6 is a simplified diagram illustrating a close on failure alarm configuration for four power supplies using rear panel DIP switches.



NOTES:
1. USE ANY PAIR OF NO() AND COM() LINES FOR CLOSE ON FAILURE ALARM.
2. SET ALL ASSOCIATED DIP SWITCHES, POSITIONS 6 AND 7, TO ON (CLOSED).
3. CONNECTIONS TO I/O CONNECTOR ARE INTERNAL AND SHOWN FOR REFERENCE ONLY.
4. I/O MATING CONNECTOR VIEWED FROM FRONT (MATING FACE) FOR EASE OF LOCATING CORRESPONDING I/O CONNECTOR PINS.

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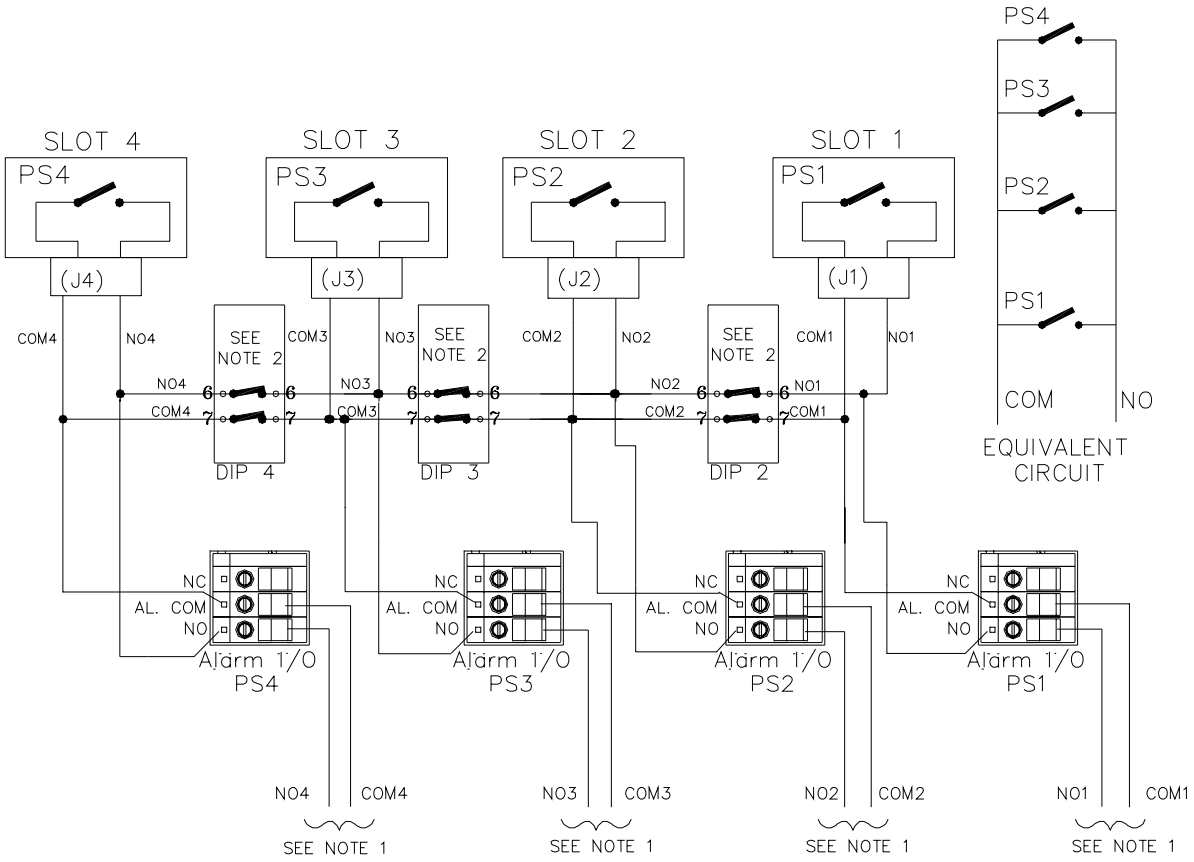
FIGURE 2-6. TYPICAL CLOSE ON FAILURE ALARM CONFIGURATION USING REAR PANEL DIP SWITCHES, WITH OUTPUT FROM I/O MATING CONNECTOR, SIMPLIFIED DIAGRAM



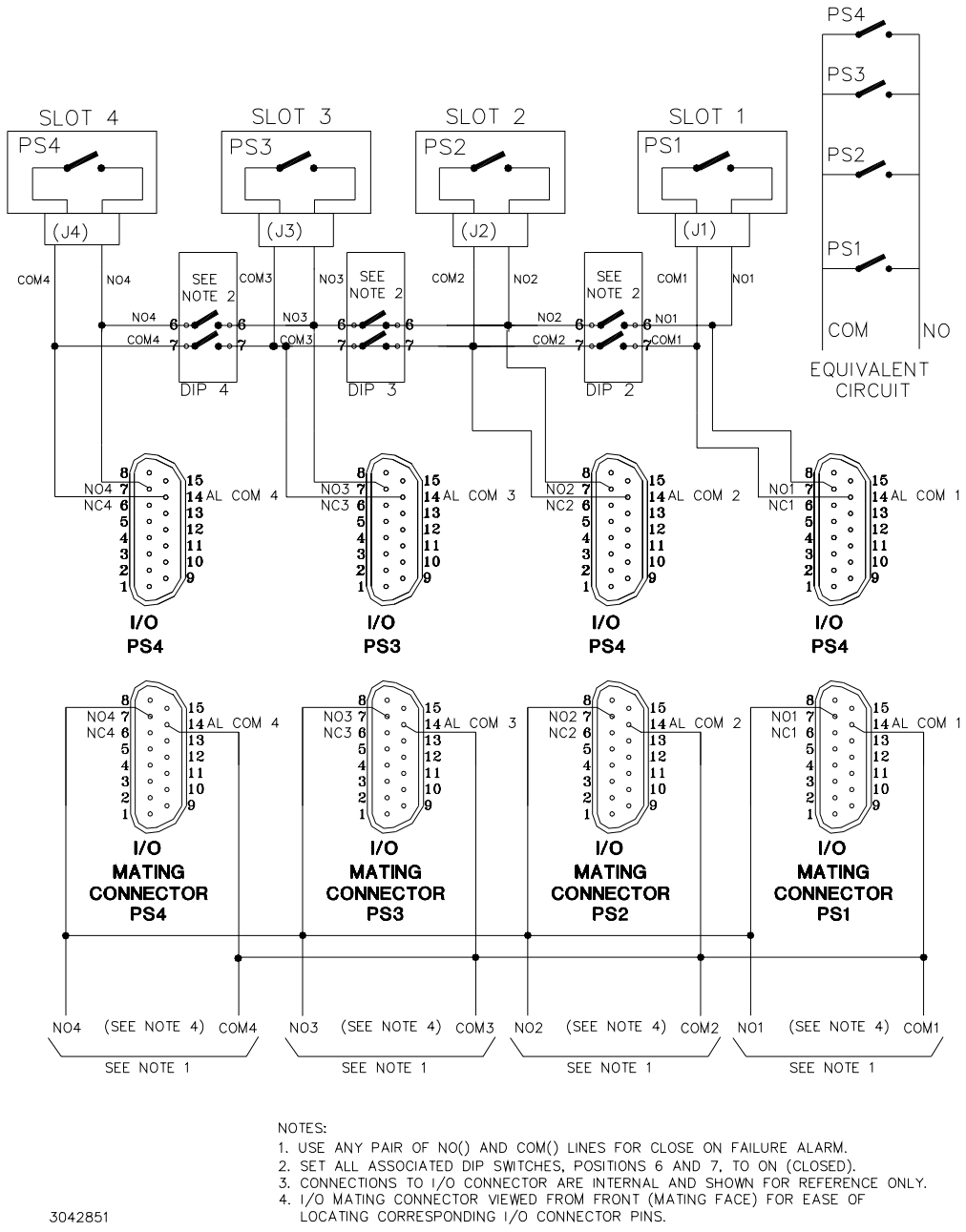
NOTES:
1. USE ANY PAIR OF NO() AND COM() LINES FOR CLOSE ON FAILURE ALARM.
2. SET ALL ASSOCIATED DIP SWITCHES, POSITIONS 6 AND 7, TO ON (CLOSED).
3. CONNECTIONS TO I/O CONNECTOR ARE INTERNAL AND SHOWN FOR REFERENCE ONLY.

3042901

FIGURE 2-7. TYPICAL CLOSE ON FAILURE ALARM CONFIGURATION USING REAR PANEL DIP SWITCHES, WITH OUTPUT FROM ALARM I/O TERMINAL BLOCKS, SIMPLIFIED DIAGRAM

2.6.1.2 CLOSE ON FAILURE USING EXTERNAL WIRING AT I/O MATING CONNECTOR

Close on failure for multiple power supplies can be accomplished by wiring N.O. and COM in parallel at the I/O mating connector. DIP switches associated with slots included in the alarm circuit must have positions 6 and 7 set to OFF (open). The failure indication (short circuit) will be present across any pair of N.O. and COM lines. Figure 2-8 is a simplified diagram illustrating a close on failure alarm configuration for four power supplies using external wiring at the I/O mating connector.



NOTES:
1. USE ANY PAIR OF NO() AND COM() LINES FOR CLOSE ON FAILURE ALARM.
2. SET ALL ASSOCIATED DIP SWITCHES, POSITIONS 6 AND 7, TO ON (CLOSED).
3. CONNECTIONS TO I/O CONNECTOR ARE INTERNAL AND SHOWN FOR REFERENCE ONLY.
4. I/O MATING CONNECTOR VIEWED FROM FRONT (MATING FACE) FOR EASE OF LOCATING CORRESPONDING I/O CONNECTOR PINS.

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FIGURE 2-8. CLOSE ON FAILURE ALARM CONFIGURATION USING EXTERNAL WIRING AT I/O MATING CONNECTOR, SIMPLIFIED DIAGRAM

2.6.1.3 CLOSE ON FAILURE USING EXTERNAL WIRING AT ALARM I/O TERMINAL BLOCK

Close on failure for multiple power supplies can be accomplished by wiring N.O. and COM in parallel at the Alarm I/O terminal block. DIP switches associated with slots included in the alarm circuit must have positions 6 and 7 set to OFF (open). The failure indication (short circuit) will be present across any pair of N.O. and COM lines. Figure 2-9 shows a close on failure alarm configuration for four power supplies using external wiring at the Alarm I/O terminal blocks.

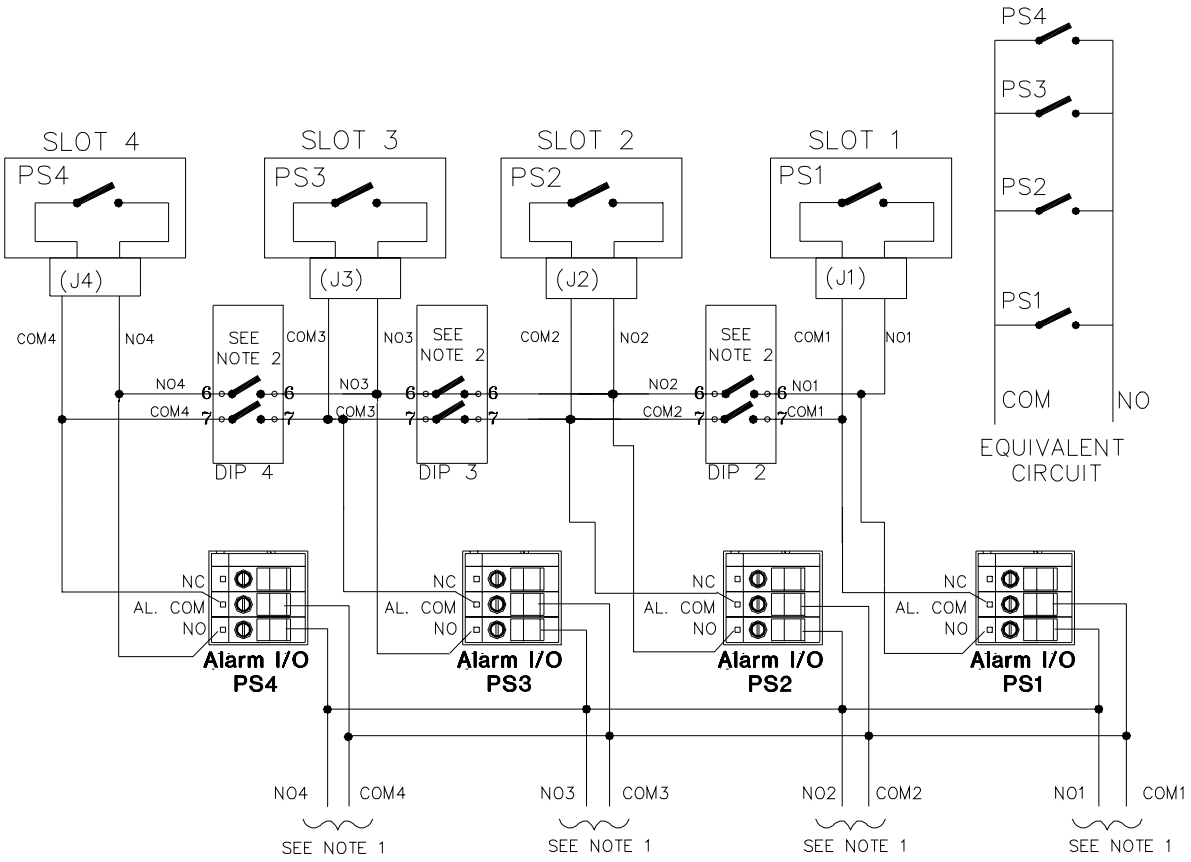

FIGURE 2-9. CLOSE ON FAILURE ALARM CONFIGURATION USING EXTERNAL WIRING AT ALARM I/O TERMINAL BLOCK, SIMPLIFIED DIAGRAM

2.6.2 N.C. ALARM LINE (OPEN ON FAILURE)

The N.C and COM line of each HSF supply provide an open contact (open circuit) upon failure. To configure multiple power supplies so that a failure of any supply produces a failure indication, it is necessary to connect the N.C. line with the COM line of the next power supply, so the alarm line is connected in series.

2.6.2.1 OPEN ON FAILURE USING REAR PANEL DIP SWITCHES

The open on failure alarm for multiple power supplies is accomplished by setting the associated DIP switch, position 8, to ON (closed) for each slot included in the alarm circuit as indicated in Figure 2-10. Setting DIP switch position 8 to ON (closed) connects the N.C. line to the COM line of the adjacent power supply. Figure 2-10 illustrates an open on failure alarm configuration for four power supplies where the alarm connections are made through the rear panel DIP switches and the alarm signals are applied to the user's alarm circuit via the I/O connector. Figure 2-11 is the same, except alarm signals are available at the Alarm I/O Terminal Blocks.

CAUTION: The user is responsible for ensuring that the alarm circuit does not exceed DIP switch specifications: 100mA, 50V d-c, maximum.

To configure PS1, PS2, PS3 and PS4 as open on failure, set position 8 of DIP switches DIP 2, DIP 3, and DIP 4 to ON (closed). The failure indication (open circuit) will be present across N.C.4 and COM 1.

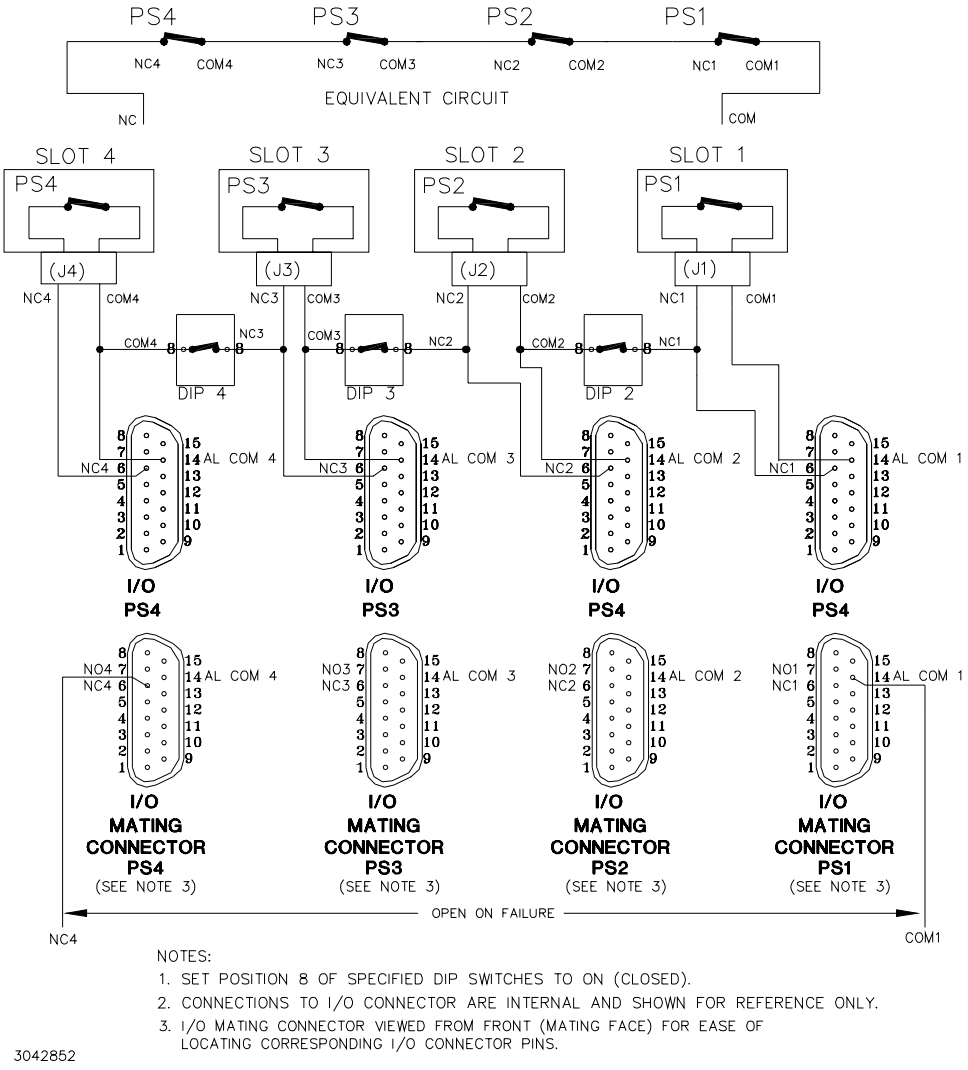

FIGURE 2-10. TYPICAL OPEN ON FAILURE ALARM CONFIGURATION USING REAR PANEL DIP SWITCHES WITH OUTPUT FROM I/O MATING CONNECTOR, SIMPLIFIED DIAGRAM

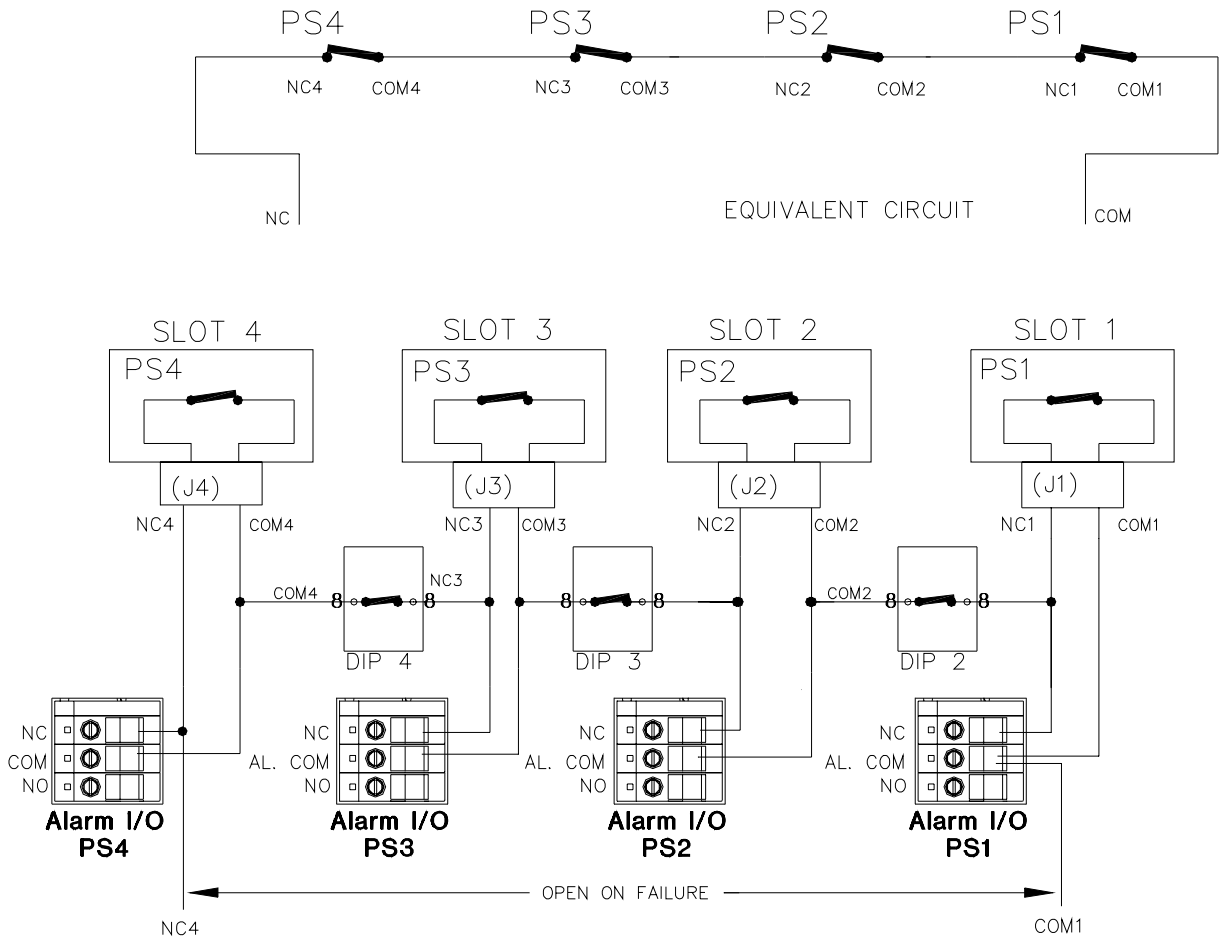

FIGURE 2-11. TYPICAL OPEN ON FAILURE ALARM CONFIGURATION USING REAR PANEL DIP SWITCHES WITH OUTPUT FROM ALARM I/O TERMINAL BLOCKS, SIMPLIFIED DIAGRAM

2.6.2.2 OPEN ON FAILURE USING EXTERNAL WIRING OF I/O MATING CONNECTOR

Figure 2-12 illustrates an open on failure alarm configuration using external wiring of the I/O mating connectors for four power supplies. It is necessary to set DIP switch position 8 to OFF (open) for each slot included in the open on failure alarm circuit.

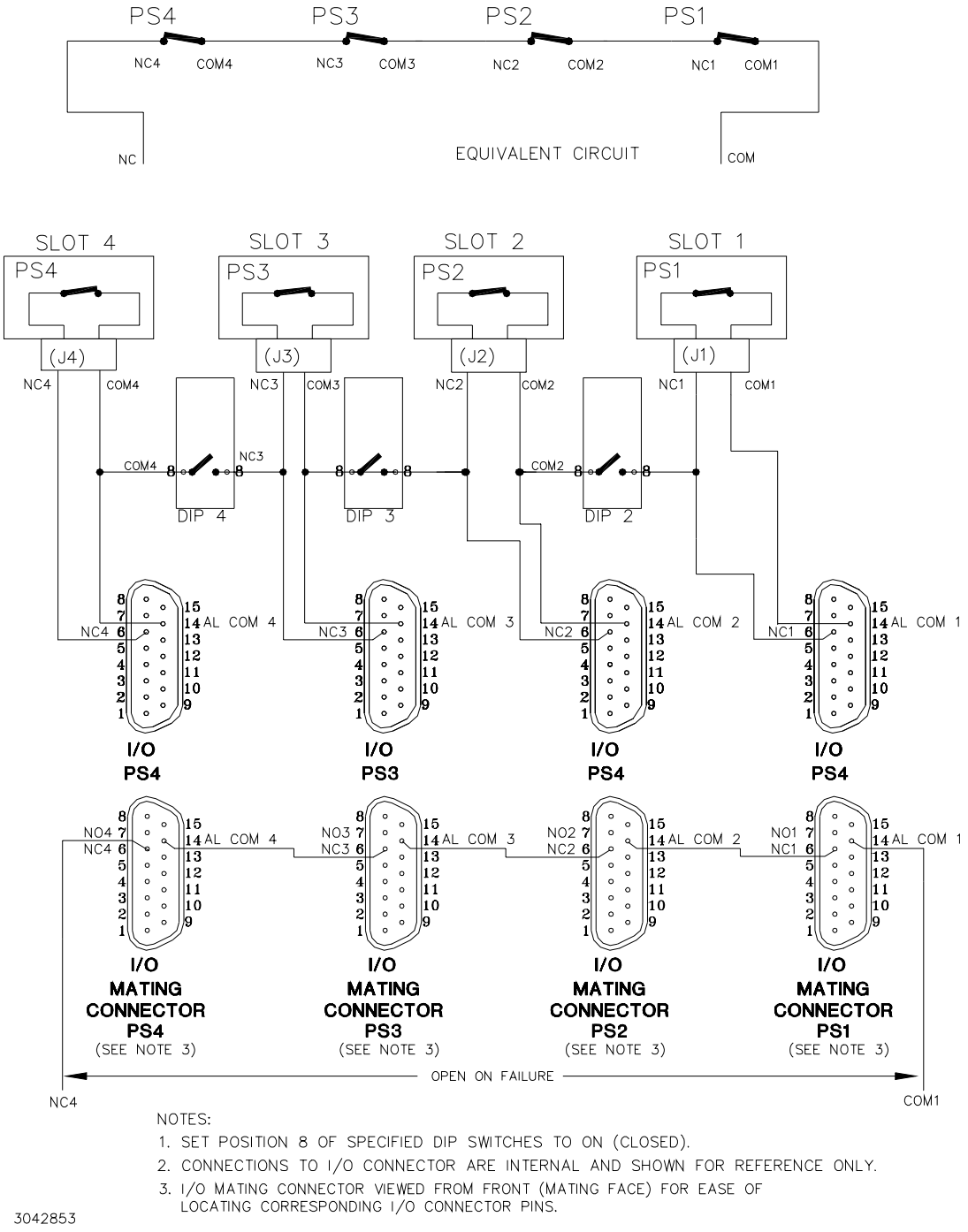

FIGURE 2-12. OPEN ON FAILURE ALARM CONFIGURATION USING EXTERNAL WIRING AT I/O MATING CONNECTOR, SIMPLIFIED DIAGRAM

2.6.2.3 OPEN ON FAILURE USING EXTERNAL WIRING OF I/O ALARM TERMINAL BLOCKS

Figure 2-12 illustrates an open on failure alarm configuration using external wiring of the I/O mating connectors for four power supplies. It is necessary to set DIP switch position 8 to OFF (open) for each slot included in the open on failure alarm circuit.

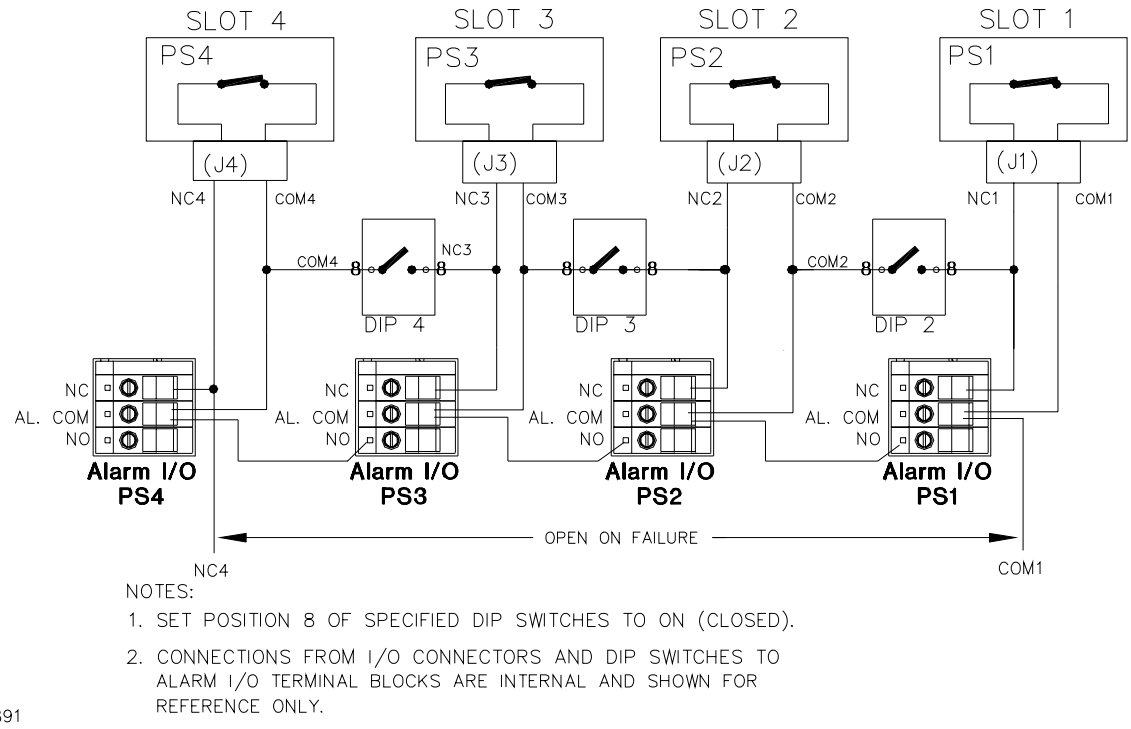

FIGURE 2-13. OPEN ON FAILURE ALARM CONFIGURATION USING EXTERNAL WIRING AT I/O ALARM TERMINAL BLOCKS, SIMPLIFIED DIAGRAM

2.7 TERMINATIONS

All input, output and control terminations are located on the rear panel of the rack adapter (see Figure 1-4).

2.8 SOURCE POWER REQUIREMENTS

The RA 19-4C-26417 rack adapter is designed to be used in conjunction with Kepco HSF series power supplies. Source power requirements are determined by the HSF power supply (see HSF power supply Instruction Manual); no adjustment or modification of the rack adapter is required. Source power is applied to two terminal blocks at the rear panel and distributed as indicated in Figure 1-3. Slots 1 and 3 are powered from one terminal block, slots 2 and 4 are powered from the other.

Maximum wire size for each terminal block is AWG 20-10/IEC, rigid: 0.5 - 6mm^2, or flexible (stranded): 0.5 - 4mm^2.

When each terminal block receives power from a separate source, input redundancy for adjacent pairs of power supplies is achieved.

CAUTION

DO NOT EXCEED MAXIMUM TERMINAL BLOCK RATING OF 500V AT 36A.

Source power can also be custom configured via jumpers on the internal PC board, e.g., all slots can be powered from a single terminal block, or slots 1 and 2 can be powered from one terminal block and slots 3 and 4 from the other. Contact Kepco Applications Engineering for further details.

2.9 COOLING

The HSF power supplies installed in the rack adapter are maintained within their operating temperature range by means of cooling fans within the power supplies. ALL OPENINGS AROUND THE RACK ADAPTER CASE MUST BE KEPT CLEAR OF OBSTRUCTION TO ENSURE PROPER AIR CIRCULATION. Care must be taken that the ambient temperature, which is the temperature of the air immediately surrounding the rack adapter, does not rise above the specified limits for the operating load conditions of the installed HSF power supplies. Kepco recommends providing additional space above and below the rack adapter where possible when the rack adapter is fully populated.

2.10 INSTALLATION (Refer to "Mechanical Outline Drawing," Figure 1-6.)

The rack adapter mounts directly to EIA-RS 310D standard 19" racks via the two mounting ears; two screws are required per mounting ear for proper support.

CAUTION

RACK ADAPTER SHOULD BE MOUNTED BEFORE INSTALLING POWER SUPPLIES.

Provide adequate clearance around case and ensure that the temperature immediately surrounding the unit does not exceed the maximum specified ambient temperature for the operating conditions of the installed power supplies. For severe shock or vibration environments, see NOTE to PAR. 2.11 below.

2.11 INSTALLING HSF POWER SUPPLIES

HSF 1200W and 1500W power supplies are provided with two (2) retention latches located at each side of the bottom edge of the front panel (see Figure 1-2). These latches work in conjunction with the RA 19-4C-26417 rack adapter to prevent unauthorized or inadvertent module extraction from an operating power system.

Each latch is engaged by loosening the cap-head screw approximately 1/2 turn CCW (use 5/32" hex key) and sliding the latch down to the bottom of the slot, then retightening the cap-head screw CW until snug. DO NOT OVERTIGHTEN! To release, follow the same procedure, except lift the latch to the top of the slot. Be sure to move the latch completely up or down to ensure full engagement and disengagement of the latching mechanism. When the HSF power supply is not installed in its plug-in rack adapter, it is recommended that the latch be secured in the open (up) position to prevent damage.

Refer to Figure 1-1, for proper slot positions applicable to the RA 19-4C-26417 Rack Adapter. With the retaining latches disengaged (at the top of the slot) as described above, insert HSF power supply in selected slot until power supply front panel is flush with rack adapter chassis, then secure the retaining latches as described above.

NOTE: Retaining latches must ***not*** be used to secure the HSF power supply in the rack adapter for shipping purposes.

The rack adapter is supplied with six cable clamps equipped with release levers that can be snapped into holes provided in the rear panel (see Figure 1-4) to support the weight of the input, output and signal cables.

NOTE: For severe shock and vibration environments each HSF module must be secured to the rack adapter with four screws screw, P/N 101-0486 (flat head, M4, 82° undercut) through the top of the rack adapter chassis and two screws screw, P/N 101-0491 (flat head, 6-32, 1/2 in. lg., 100° CSK) through the bottom of the rack adapter chassis. **Do not overtighten these screws: max. torque is 10 in.-lbs (1.1N x m)**; side support for the populated rack adapter may also be required.

2.12 REMOVING HSF POWER SUPPLIES

WARNING

Removal of an HSF power supply from a "live" system must be done only by authorized service personnel after HSF power switch is set to OFF. Dangerous voltages may be accessible through the open slot after a power supply is removed.

Set the POWER ON/OFF switch to off, then loosen the two retaining latches (see PAR. 2.11) and pull the HSF power supply out of the rack adapter. Refer to PAR. 2.11 for replacement.

2.13 WIRING INSTRUCTIONS

Interconnections between an a-c power source and a stabilized power supply, and between the power supply and its load are as critical as the interface between other types of electronic equipment. If optimum performance is expected, certain rules for the interconnection of source, power supply and load must be observed by the user. These rules are described in detail in the following paragraphs and in the operating instructions for HSF Series power supplies.

2.13.1 SAFETY GROUNDING

Local, national and international safety rules dictate the grounding of the metal cover and case of any instrument connected to the a-c power source, when such grounding is an intrinsic part of the safety aspect of the instrument. The instructions below suggest wiring methods which comply with these safety requirements; however, in the event that the specific installation for the power system involves differences with the recommended wiring, it is the customer's responsibility to ensure that all applicable electric codes for safety grounding requirements are met.

2.13.2 SOURCE POWER CONNECTIONS

CAUTION

THE RA 19-4C-26417 DOES NOT INCORPORATE ANY SAFETY INTERRUPT DEVICES. PROTECTION OF INPUT WIRING REQUIRES USER-CONFIGURED SAFETY INTERRUPTS.

The rear panel of the RA 19-4C-26417 includes two 3-terminal terminal blocks to allow for the connection of source power. The connector positions are labeled L, N, and G. Their functions are as follows:

- **Terminal G (Ground)** is the safety ground connection for the RA 19-4C-26417, is connected to the RA 19-4C-26417 chassis and to the safety ground terminal of the input power connector for each of power supply mounting positions via the PCB backplane. Terminal G must be connected to safety ground in order to ensure proper grounding of the HSF power supplies.

- **Terminals L (Line Phase) and N (Neutral)** are connected to the input power entry connectors. Source power is provided to the power supplies indicated by the label on the rear panel. The source power connectors are independent of each other, allowing the user complete flexibility in wiring for common or redundant input power configurations.

The following standard wiring configuration is recommended by Kepco as being compliant with applicable national and international safety standards. Please consult local electrical codes for wire current ratings and other specific requirements:

- Connect Terminal G of each RA 19-4C-26417 input power terminal block to safety ground

- Connect a separate wire pair from each side of the input power to the L/N terminal pair of the input power terminal block.

- In North America where 115/230V a-c source power is used, Kepco recommends the use of the line cords supplied (P/N 118-1145, North American style plug, 30A maximum, 6 ft. long). European applications may require the use of Kepco line cord P/N 118-1146 (250V, 32A maximum).

- Wire size is determined by the maximum rated source current for each HSF power supply and the number of power supplies installed. For lower system power configurations, smaller wire can be used; contact Kepco Applications Engineering for assistance.

2.13.2.1 EMI COMPLIANCE

Depending on the application and system environment, special source power considerations may be required to meet listed Input EMI specifications for HSF power supplies, particularly FCC Class B. It may be necessary to add external source power filtering, such as installing snap-on ferrite beads on the line cord wires of the RA 19-4C-26417 as close to the input a-c terminal block as possible. Another option is to add an in-line cabinet-mounted EMI filter (available from a number of manufacturers) between the source power and the RA 19-4C-26417 line cord. For additional assistance, contact Kepco Applications Engineering.

2.13.3 CONTROL SIGNAL CONNECTIONS

Access to the control signal (I/O) connector for each HSF power supply is provided via four 15-pin D-subminiature connectors on the rear panel of the rack adapter (see Figure 1-4). Four mating connectors (Kepco P/N 142-0449) are provided in a plastic bag. Consult PAR. 2.4 and the HSF operator's manual for instructions on wiring and use of these control lines.

2.13.4 OUTPUT LOAD CONNECTIONS

Load connections to the rack adapters are achieved via four pairs (DC OUTPUT + and –) of output terminals located on the rear panel assembly.

2.13.4.1 REDUCING RIPPLE AND NOISE

Ripple and noise are measured under nominal load conditions to provide the rated output voltage/current of the HSF power supply. Measurement of ripple/noise is illustrated in Figure 2-14. It is most important to minimize impedance between the power supply output and the load. As the length of load wires increases, ripple and noise may increase proportionally, therefore length and placement are critical for minimum ripple and noise. A filter consisting of a 50μF electrolytic capacitor in parallel with a 0.01μF capacitor must be used to eliminate unwanted ripple and noise pickup on the load wire during measurements. For noise-sensitive applications the load wires and sense wires must be twisted.

2.13.4.2 PARALLEL/REDUNDANT OPERATION

WARNING

Removal of an HSF power supply from a "live" system must be done only by authorized service personnel after HSF power switch is set to OFF. Dangerous voltages may be accessible through the open slot after a power supply is removed.

Identical HSF power supplies can be connected in parallel to provide redundant operation or increased output current to a common load. Maximum output current for each pair of the DC OUTPUT terminals is 70 Amperes. Connect the DC OUTPUT terminals of each paralleled power supply directly to the load. DO NOT DAISY CHAIN load wire conductors (See Figure 2-3).

Bus bars are available as accessories to make the connections when paralleling adjacent slots (refer to Table 1-2). When using the bus bars, the output is available from 1/4"-20 studs or pemnuts at the busbar links. When using the bus bars, maximum output current is 140 Amperes for two paralleled units, 210 Amperes for three paralleled units, and 280 Amperes for four paralleled units.

NOTE: Verify that the current share bus lines are configured per PAR. 2.4.3.

2.13.4.3 SERIES/INDEPENDENT OPERATION

The rack adapter can be used for either independent or series operation of HSF power supplies; it is factory configured for independent operation.

For series operation, connect (+) and (–) terminals at the DC OUTPUT terminal block of power supplies to be connected in series. Bus bars are available as accessories to make these connections when connecting adjacent slots in series (refer to Table 1-2). The HSF power supplies are equipped with blocking diodes which allow series operation without further modification. The RA 19-4C-26417 rack adapter is designed to safely handle a maximum output voltage of 500 Volts.

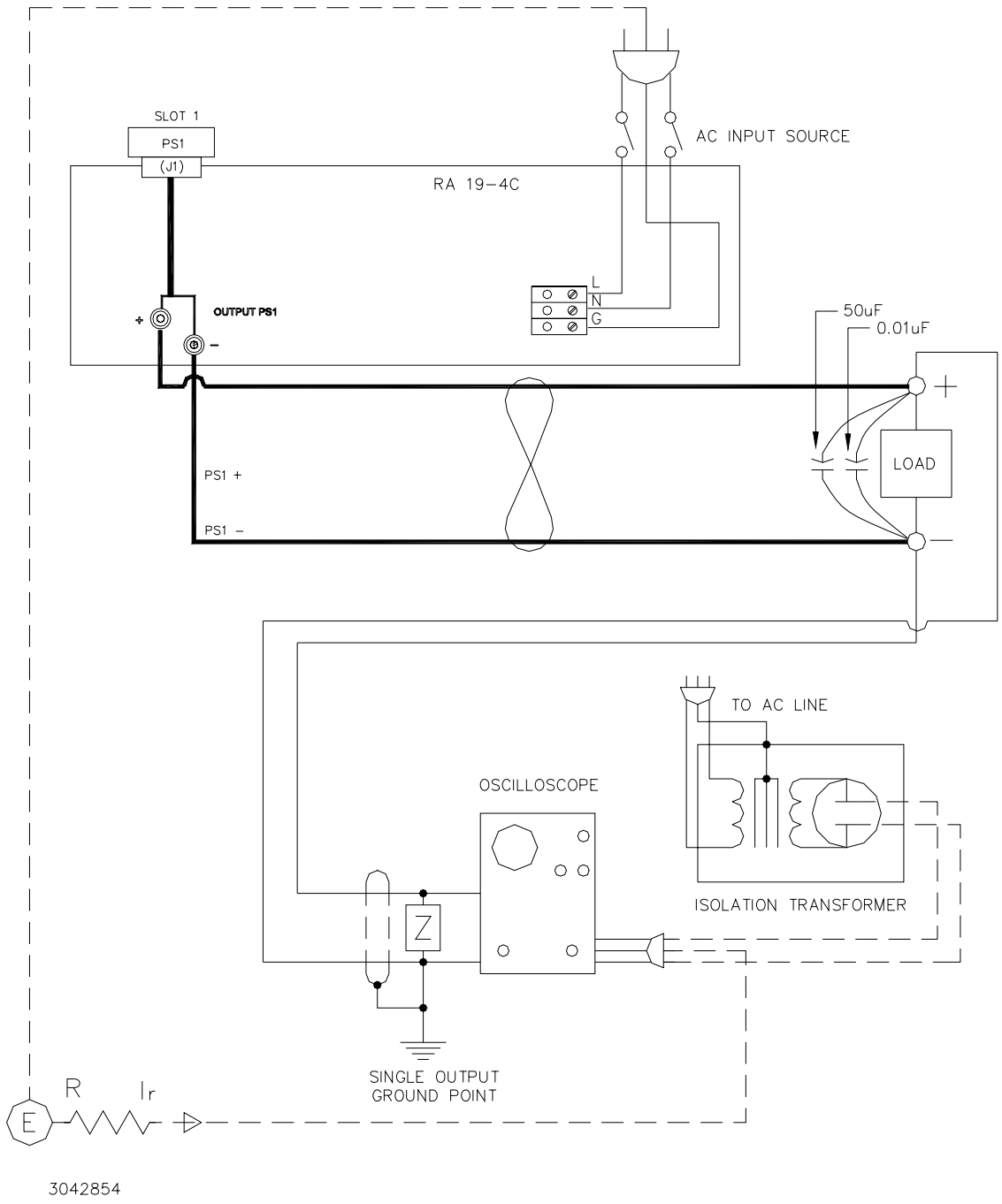

FIGURE 2-14. RIPPLE AND NOISE MEASUREMENT SETUP DIAGRAM

2.13.4.4 MIXED OPERATION

The design of the RA 19-4C-26417 rack adapters permits the user to configure HSF power supplies for almost any combination of independent, series and parallel operation, both within a single rack adapter and between different RA 19-4C-26417 rack adapters, within the limits of the

HSF operation envelope and the current and voltage ratings specified in PAR.s 2.13.4.2 and 2.13.4.3. The user must ensure that the requirements for each configuration stated above are met. If any questions or problems arise, the user is encouraged to contact the Kepco Applications Engineering group for technical assistance.

2.14 REMOVING/REPLACING HSF POWER SUPPLIES

WARNING

Removal of an HSF power supply from a "live" system must be done only by authorized service personnel after HSF power switch is set to OFF. Dangerous voltages may be accessible through the open slot after a power supply is removed.

Refer to PAR. 2.12 for instructions for removal and replacement of HSF power supplies.

2.15 SHIPPING

The rack adapter may be shipped with power supplies installed ***only*** after each HSF power supply has been securely fastened to the rack adapter using six screws, four at the top and two at the bottom of the chassis (see NOTE to PAR. 2.11). Contact Kepco Applications Engineering if further assistance is required. Without power supplies the rack adapter weighs 16 lbs. (7.3Kg).