

REDKOH INDUSTRIES' SWITCH MODE POWER SUPPLY DEMO UNIT



These Demo Units are typically available for 30 day loans.

Redkoh Requests that the customer pays the freight of the unit to and from the site.

Redkoh Requests that the customer covers the expenses of one of our technicians for the purposes of installation support and start-up.

Typically a day on site is required.

If a technician is required for a longer period, we request our time be covered in accordance with our Standard service Terms and Conditions in place at the time.



Redkoh Industries' Switch Mode Power Supply For Electrostatic Precipitators

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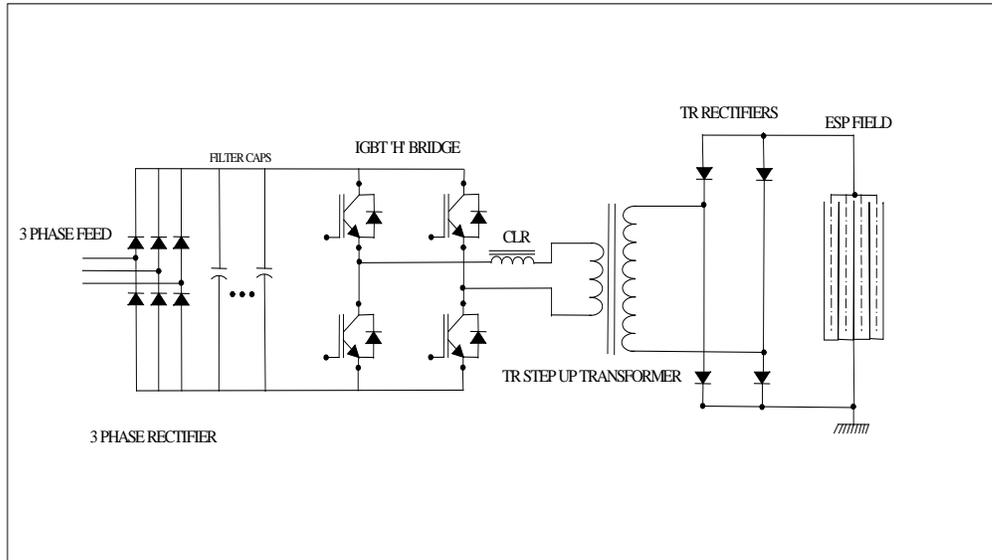
1. Introduction:

- a. Redkoh's Switch Mode Power Supply (SMPS) uses frequencies of 100 – 400 Hz for powering Electrostatic Precipitators (ESP's) and has been proven to yield significant performance improvement. These frequencies result in lower ripple, higher average voltage (KV) and higher ESP field current (Ma).
- b. The improved performance is due to the lower ripple voltage delivered by the Power Supply. The SMPS operating at a frequency of between 100 and 400 Hz, has been demonstrated to achieve ripple reduction to negligible value while avoiding the complexity and reliability problems of higher frequency Power Supplies.
- c. The Redkoh system provides the significant advantages of higher frequencies while permitting the use of **existing** Transformer Rectifiers and existing interconnecting wiring. The control system can be housed in existing TR Controls cabinets.

2. Demo System Equipment:



- a. To facilitate ease of installation, the Demo equipment is housed in a NEMA enclosure, approximate size 48”H x 42”W x 20”D. The enclosure has internal fans for cooling and is delivered in a wood crate. The unit is on wheels to allow it to be easily moved into place. Internal to the enclosure are all the components, pre-wired for the control of a conventional 60 Hz TR.
- b. The enclosure contains the following components:
 - i. 3 Phase Circuit Breaker
 - ii. 3 Pole mcb and resistors for soft energization of DC capacitors
 - iii. 3 Pole Contactor for full power bus energization
 - iv. 3 Phase rectifiers
 - v. DC Capacitor bank
 - vi. IGBT ‘H’ Bridge assembly with trigger circuits
 - vii. Redkoh Microprocessor Controller with LCD readout and membrane panel controls
 - viii. Front panel Analog KV and Ma Meters
 - ix. Front panel Stop / start switches



Simplified Electrical Diagram

3. Site Preparation

a. Power Feed:

- i. Installation requires the use of 3 Phase Delta connected 480 VAC. The Ampacity of the feed is determined in consultation with Redkoh's installation engineer at the outset of the trials. The power connections are made internal to the cabinet with wiring lugs capable of accepting up to 300 mcm cable.

b. TR Power Feed Connection:

- i. The TR system consists of the TR as well as the existing CLR. To accomplish this, the feed cable (wire) that runs from the existing SCR assembly and the associated return cable must be disconnected and re-routed to the Demo unit.

- ii. The SMPS power feed will therefore go from the Demo unit through the existing CLR and onto the existing TR. Depending upon the ratings of the TR and the CLR, the value of the CLR may need to be changed. In some cases the existing CLR will have taps that could be changed, in other cases a new CLR may be needed to permit the higher current at higher frequency.
- iii. For short time Demonstration the TR connection is often made by simply leaving the existing Control Cabinet door ajar with suitable warning tags and temporary safety barriers. The connection is typically done by the Redkoh installation engineer at the time of start-up
- iv. The output power connection from the Demo Unit to the TR system is also accommodated by a 300 mcm connector. Two conductors suitable for the predetermined current. (Existing TR Current Rating x Mains voltage / Mains Voltage *1.4) must be routed between the Demo unit to the existing TR system.
- v. The following is an example

vi.

Exiting TR Nameplate current	Mains Voltage	Factor	New TR Voltage	New TR Current
192	480	1.414	679	136

4. Feedback Connections:

- a. The Redkoh Demo Controller requires that feedback signals from KV and Ma be interfaced from the existing TR.
- b. The system requires these signals to be nominal full scale rating of 5 volts. 0 to +5 VDC for the Ma signal and 0 to -5 VDC for the KV signal.
- c. These signals along with the corresponding ground returns can be picked up from either the existing panel meters or from the interface terminal board on the existing controller.

- d. Twisted shielded cable is used to interface these signals.
- e. In most cases the existing controller can remain connected to the same feedbacks such that both systems can be used in parallel, even though the Redkoh unit is in control of the process.
- f. The hookup of the feedback signals is done by the Redkoh engineer at the time of installation and start-up.

5. System Operation:

- a. The existing 60Hz TR controller can usually be left in place complete with all wiring with the exception of the power feed to the TR.
- b. This capability is especially useful if the existing controller is part of a networked system with remote monitoring by DCS.
- c. When the existing controller is turned on, the feedback signals of KV and Ma can still be valid as well as the Primary Voltage (VAC) and primary Current (AAC). In most cases the PT and the CT can be used on the SMPS signal and properly sensed by the existing controller.
- d. As the existing 60Hz controller is turned on it will attempt to ramp up power via the SCR's even though the SCR's will no longer be in control.
- e. The feedback signals will provide data for both the old controller as well as for the SMPS demo unit.
- f. After power is applied to the Demo unit the Redkoh Keypad and Display Unit is used to enter the various operating parameters, such as operating limits, spark response parameters, and system ratings.
- g. These parameters would be determined and entered by the Redkoh installation engineer.
- h. After the setup parameters are entered the Demo system may be started from the "ON/OFF" switch on the front panel of the unit.
- i. After the TR Start switch is turned to the on Position, the unit will first delay action for several seconds to allow the capacitor bank to charge.

- j. After this delay the unit will ramp up the power to the TR in the very same way conventional 60Hz controller does.
- k. The unit will increase power level until an operating limit is reached (KV limit or Ma limit), spark is sensed, or maximum conduction angle is achieved.
- l. The Redkoh Demo unit uses both hardware and software spark detection systems to assure reliable response to ESP field disruptions.
- m. In response to such disruptions the controller reduces output to extinguish the spark or arc and the resumes operation after a programmed ramp time.
- n. The use of extremely fast data converters as well as fast CPU, allows micro-second response time. In addition to analog meters, all operating levels can be displayed on the Redkoh Alpha-Numeric display panel.

6. Contact

- a. For Further information, the following people can be contacted at Redkoh
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