



## Feedback-Controlled Modular High Voltage DC Power Supply (FCM-HVPS)



### ❖ Description of the Technology

The technology used in Feedback-Controlled Modular High Voltage DC Power Supply (FCM-HVPS) has been granted Indian patent (no. 403371) on August 11, 2022 and its German patent is pending. This technology implements multiple DC to DC converter modular blocks. Each block consist of an inverter, high frequency transformer, high frequency full bridge rectifier, low capacitance filter and high speed switches.

It is a true feedback controlled system wherein the desired output voltage is controlled and regulated.

In addition to many other features, this technology has:

- (i) Ability to operate in grounded (i.e. either of the positive or negative terminal referred to ground) as well as lifted potential mode or floating mode (i.e. either of the positive or negative terminal referred to or lifted to high voltage potential up to 100kV DC).
- (ii) Ability to withstand repetitive breakdowns or short-circuits up to 200 numbers at the output side with each breakdown event followed by fast output voltage cut-off ( $<10\mu\text{s}$ ). If required, the output voltage rises automatically with fast rise time ( $<1\text{ms}$ ) to the last set value after each breakdown with a pre-set delay ( $\geq 20\text{ms}$ ).
- (iii) Ability to restrict the dumped energy in the load during load-end breakdowns or short-circuits to  $< 10\text{J}$ .
- (iv) Ability to cut-off the output voltage fast ( $< 10 \mu\text{Sec}$ ) during load side faults

❖ Photos



Module section of 11kV 35A and 35kV 15A DC Power supplies installed at IPR



Rectifier section of 11kV 35A and 35kV 15A DC Power supplies installed at IPR



Control section of 11kV 35A and 35kV 15A DC Power supplies installed at IPR

### ❖ Salient Features of the technology

1. Modular design
2. True feedback control of the output voltage
3. Fast output cut-off during output faults ( $< 10 \mu\text{Sec}$ )
4. Low dumped-energy during breakdown or short circuit in load ( $< 10 \text{ Joules}$ )
5. Continuous duty and modulated ( $\leq 5 \text{ Hz}$ ) operation up to full power
6. Ability to float at high potential (up to  $100\text{kV}$ )
7. Fast voltage rise and fall time. ( $< 1 \text{ ms}$ )
8. Low output voltage ripple ( $< 2\%$ )
9. Ability to withstand & allow repeated breakdowns (short-circuits) at output (200 nos.)
10. Local as well as remote mode operation
11. Forced air cooling

### ❖ Status of the technology

Two DC power supplies of ratings  $-11\text{kV}, 35\text{A}$  &  $35\text{kV}, 15\text{A}$  are developed and are in operation at the Institute for Plasma Research (IPR) since 2015.

### ❖ Applications

- a) Ion sources
- b) RF systems,
- c) Industrial applications requiring HVDC
- d) DC power generation

### ❖ Eligibility criteria and Facilities required for commercial Production

- a) The applicant should have experience in manufacturing HVDC power supply of rating at least  $5 \text{ kV}, 1\text{A}$ .
- b) 3-phase AC input feeder (Depends upon the rating of the power supply)
- c) Manufacturing infrastructure and testing space (as applicable to any HVDC power supply manufacturer)
- d) Testing facilities with required components, instruments and tools (as applicable to any HVDC power supply manufacturer).