Power Converters for **Industrial** Application

FRIEM

Power Converters for Industrial Application

Since 1950 FRIEM has designed, manufactured and delivered all over the World Power Converters for:

Chlor-Alkali
Metal Refining
DC Arc Furnaces
Graphite Refining
Heating Process

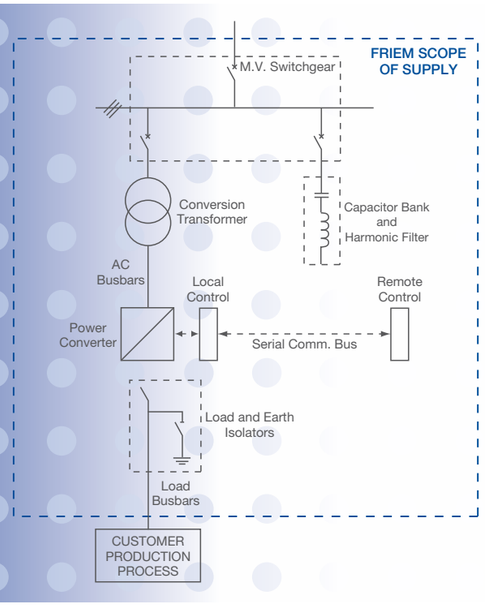
Thanks to the experience matured in sixty years of activity FRIEM is now capable of supplying air, water and deionised water cooled Rectifiers giving the customer a complete Conversion System tailored on his application and complying with IEC or ANSI/IEEE Standards.
FRIEM designs all the equipment of the Conversion System in accordance to the customer's plant requirements to grant the maximum efficiency and reliability.

Protection Features

- O/C, O/V, U/V Phase Sequence Protection
- Automatic Protection against Output Circuit Opening
- Semiconductor Protection and Alarm devices
- (N-1) or (N-2) Semiconductor redundancy
- Supervision and control of Current Sharing between Electrolysis Cell Lines in parallel
- DC Earth Fault Protection
- Full Temperature Monitoring and Thermal Protection
- Cooling Circuit Monitoring (Pressure, Flow Rate, Conductivity)

FRIEM is capable of providing to the customer a complete package, including:

- MV Switchgear
- Conversion Transformer
- Power Converter
- High Current Switching System
- Busbar System
- DCS System
- Remote System Supervision
- Interphase and Smoothing Reactors
- Power Factor Improvement and Harmonic Filter System



Operating Characteristics

- Connection: Bridge - Double Bridge (Series or Parallel) - Double Star - 2 Double Star - DC/DC Converters (Step-Down)
- Type: Diode, Thyristor, IGBT
- Cooling: Air, water, deionized water
- AC Input Voltage: Up to 220kV-3 Ph., 50 or 60 Hz
- DC Output Voltage: Up to 1500V
- DC Output Current: Up to 160kA in only one Rectifier Cubicle
- Modular Design: Flexible solutions
- Control: ±0,5% standard accuracy Digital Current Regulation by:
  - Thyristor phase firing delay
  - IGBT switching control
  - On Load Tap Changer and Saturable Reactors for Diode Rectifier

Voltage and Power Regulations are also available

FRIEM Rectifier Advantages

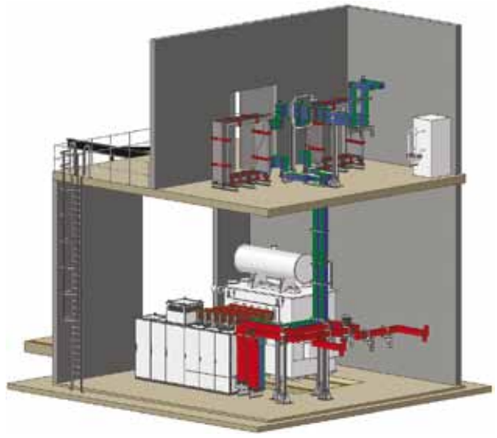
FRIEM's 60 Years Experience in Power Conversion grants:

Reliability and Continuity of production
- N+1 Semiconductors redundancy
- Cooling System redundancy
- Control System self diagnostic

Efficiency
- Proprietary internal Busbar design with reduced losses
- Simplified design of Transformer-Rectifier Connection

Fast Operation
- Reduced delivery time thanks to Modular Design
- Reduced installation and commissioning time
- Fast Start-up and operation tuning with the new Digital Regulator

Safety
- Latest IEC and ANSI/IEEE Standards
- FRIEM design protection devices



Design and Manufacturing Characteristics

Power Section
- Exclusive Aluminium extruded Busbars
- High efficiency and high dynamic stress withstand
- High reliability and long life operation due to reduced operating temperatures
- Optimised Nr. of Semiconductors and N+1 Valves redundancy as standard
- Non-Magnetic material Rectifier Cubicle
- Simplified design of Transformer's Phases Connections
- Easy maintenance

Cooling Section
- Deionised to raw water Cooling System (dWFWF)
- Deionised water to forced air Cooling System (dWFAF)
- Monitoring of temperature, underpressure, min flow, min and max level, high conductivity of deionised water
- 50% or 100% redundancy
- Open or enclosed section
- Easy maintenance

Control Section
- Digital regulation (FRIEM DRP) for Diodes, Thyristor and IGBT
- Original FRIEM electronic boards
- PLC and OP control and automation (different brands available)
- Hot and warm PLC redundancy
- Fiber Optics Control Connection
- All PLC brands available
- Local, Remote and SCADA control
- Remote control via Modem/Internet

DRP Digital Regulation
- 15kHz Sampling Frequency
- High accuracy regulation of current, voltage and power
- Reading and recording of all main measurements and events
- Current and Voltage Oscillographic recording and Load Profile
- Easy and fast setting of the Regulation and Protection Parameters
- Reduced commissioning and start-up time