

2019

# ASTROL Solid-State Switches

15th China Intelligent Electro-Technique Forum  
Shanghai 2019

Michael Geissmann  
CEO  
Astrol Electronic AG, Switzerland



Sun.King Power Electronics Group Limited  
賽晶電力電子集團有限公司

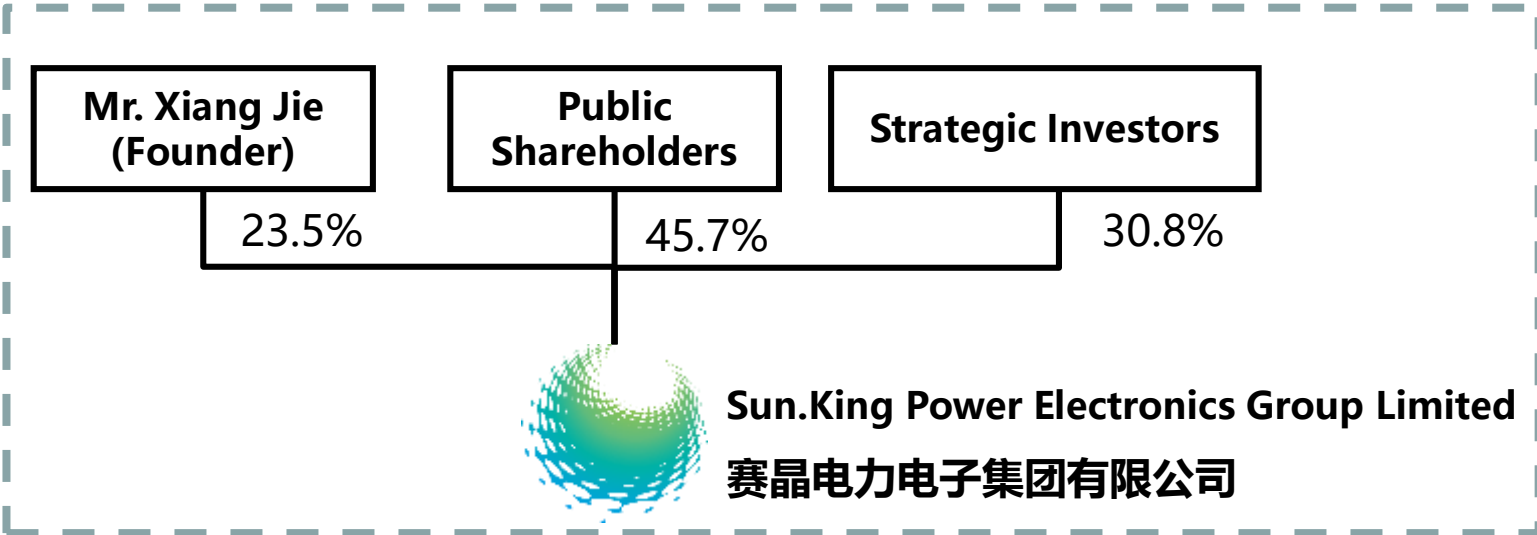
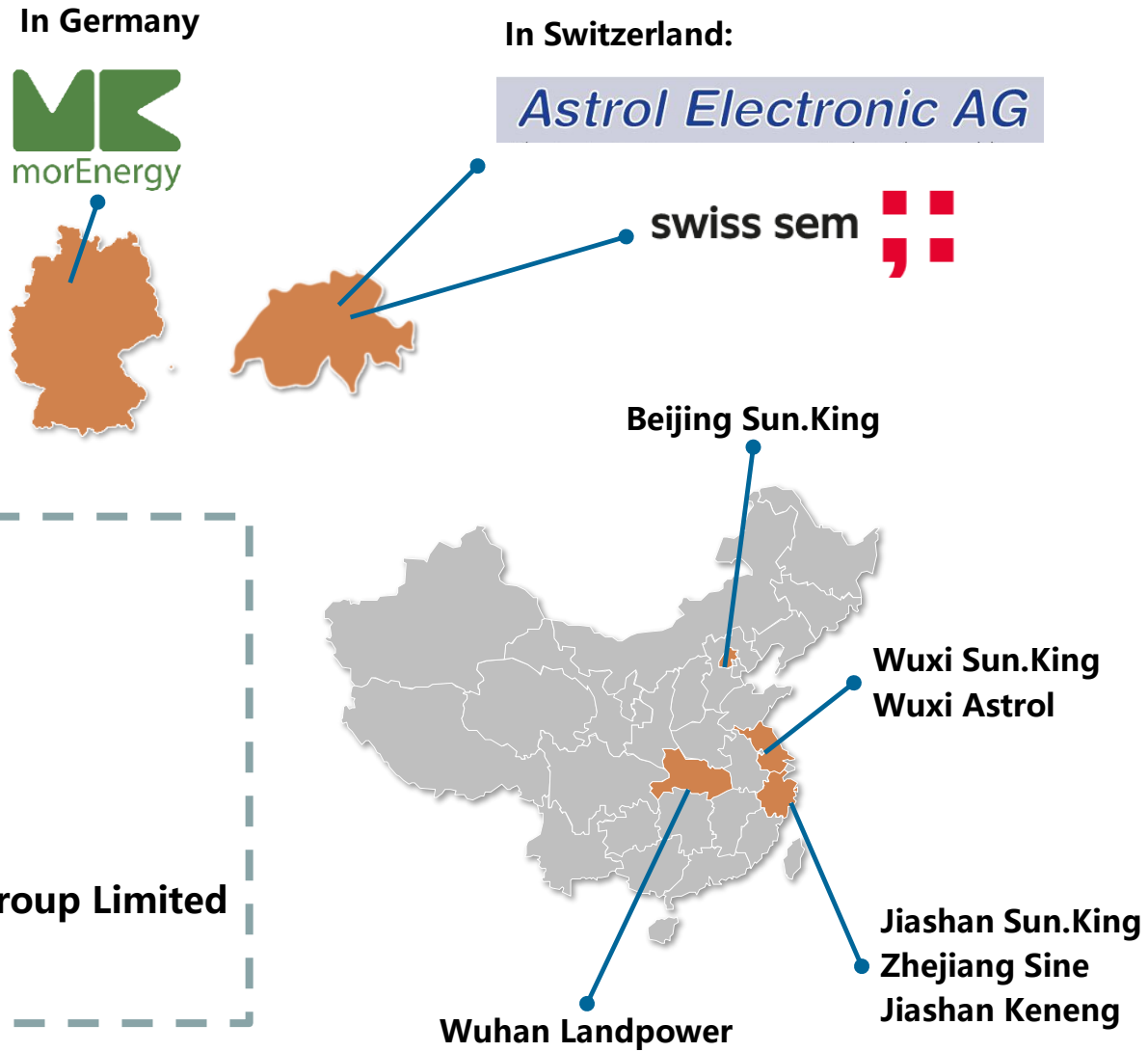
*Astrol Electronic AG*



## Introduction

Stock Code	: 0580.HK
Listing Date	: October 2010
Issued Shares	: 1.616 Billion

## Group Companies



## Expansion of distribution business to drive growth

### 2002 - 2009

- 2002 , Sun.King is established and become ABB power semiconductors exclusive agent in China
- 2004 , Jiashan Sun.King was established
- 2008 , Wuxi Sun.King was established
- 2009 , Sun.King has become the **exclusive supplier of IGBT power module in China** for China North Railway 9600KW electric locomotive
- 2009 , anode saturable reactor was launched and Sun.King became the **sole provider in China**.

## Remarkable R&D achievements to establish market leadership

### 2010 - 2015

- 2010 , the Company was listed on the main board of HKEx
- 2011 , its 4 subsidiaries (including Jiujiang Sun.King) were established.
- 2012 , it became exclusive **IGBT power module** supplier for Zhoushan flexible DC transmission project
- 2013 , it won the first **laminated busbar** contract for flexible DC project, the first **power reactor** contract from the centralized tender program of the State Grid
- 2014 , it won the first **power reactor** contract for UHVDC transmission project
- 2014 , it completed the **first aluminum electrolytic isolated operation project in China**
- 2014 , it became the **exclusive IGBT supplier** for Xiamen flexible DC transmission project

## Globally leading technology to continue rapid growth

### 2016 - now

- 2016, the Company acquired Astrol and established its **R&D center in Europe**
- 2016, it launched **digital IGBT driver, solid-state DC circuit breaker, pulse power** and other products with cutting-edge technology
- 2017, **CHTC** and **CVCFL** became its strategic shareholders
- 2018, it successfully developed the **first prototype** of power electronic capacitor for flexible DC transmission in China
- 2018, it started R&D of **digital IGBT driver** for electric vehicles
- 2018, it started R&D of **new type of traction rectifier for railway transportation**
- 2019, it acquired MorEnergy and launched **impedance measurement products**
- 2019 , SwissSEM was established to leverage high-caliber European R&D team to carry out **IGBT development**



## Wuxi Astrol Power Electronics Limited

Wuxi Astrol Power Electronics Limited is responsible for introducing products and technologies into Chinese market, including Digital IGBT Gate Unit, solid state DC circuit breaker, solid state AC switch and pulse power technology, which are developed by Astrol Electronic AG, and widely used in the field of high voltage and high power transmission. Wuxi Astrol is also responsible for the application and service of related products and the industrialization work in China.



Mr. Zhang: 180-1752-8812



No. 4, Zhongzhi Science and Technology Park, 22 Yanqiao Zhihui Road,  
Huishan District, Wuxi City, Jiangsu Province





Astrol established  
in Baden,  
Switzerland

*Astrol*

Sun.King IPO in  
Hong Kong



Astrol becomes part  
of Sun.King Group



*Astrol*

1996

2001

2006

2010

2011

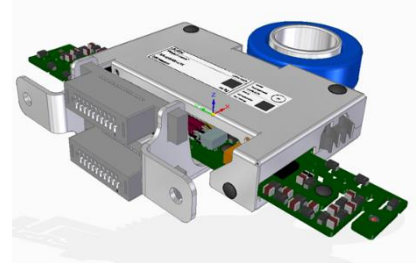
2016

2019

## Customized Electronic Solutions



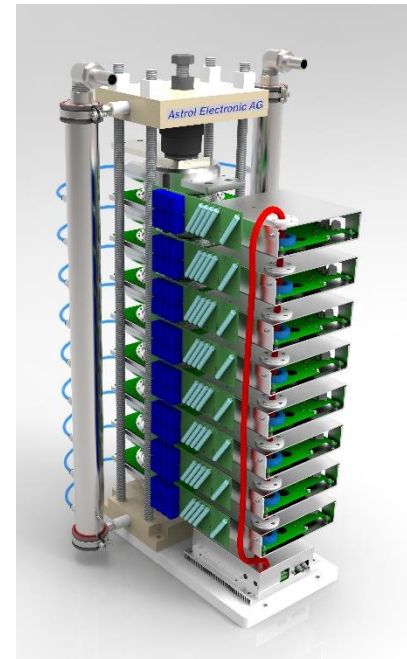
## Gate Drive Units and Power Supplies



## Trigger Controllers and Optical Interfaces



## Power Switches



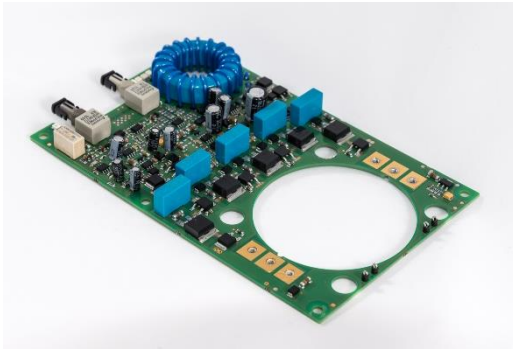
## AC- and DC- Breakers





## Products – Gate Drive Units

### Thyristor Gate Units



#### Optical controlled

GU-NT-RY-I1-01

- Phase control thyristors
- Current loop power supply

#### Electrical Controlled

- GU-SGMIII-RY-V1
- P• 24V input power supply

#### Current loop controlled

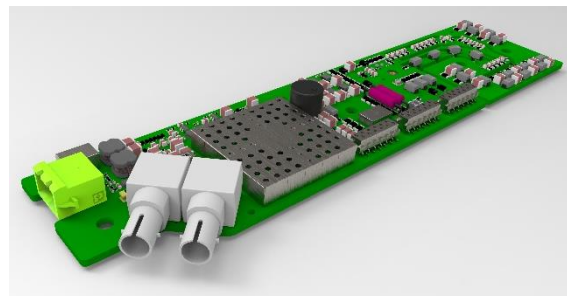
- GU-LCT-IND-01
- Inductive coupling for thyristors
- GU-TH39-RY-xx-01
- Designed for series connections of phase control thyristors with 39mm housing
- GU Crowbar 40kV
- Designed for series connections of crowbar thyristors

### IGBT Gate Units

- **Ideal for serial and parallel connection of IGBTs**
- **Digital gate unit with fully programmable**
  - Turn-on / turn-off behavior
  - Saturation detection and automatic turn-off signal
  - Overcurrent / overvoltage detection
  - Gate voltage supervision
  - Power supply supervision
  - Status feedback via optical link to overall controller
- Available for ABB's LinPak and BIGT upon request
- Available for other manufacturer's IGBTs upon request

#### ABB HiPak IGBT

- 1.7kV - 6.5 kV IGBT modules
- Direct mounted on HiPak modules
- Available with voltage source and current loop power supply



#### ABB StakPak IGBT

- 2.5 kV - 4.5 kV IGBT modules
- Fits directly on Stakpak module, for other press-pack modules upon request
- Available with voltage source and current loop power supply
- Available as dual version for parallelization of IGBT modules



4.5kV Stakpak – Current Source Power Supply



Single 4.5 kV Stakpak – Current Source Power Supply



4.5kV Stakpak – Voltage Source Power Supply



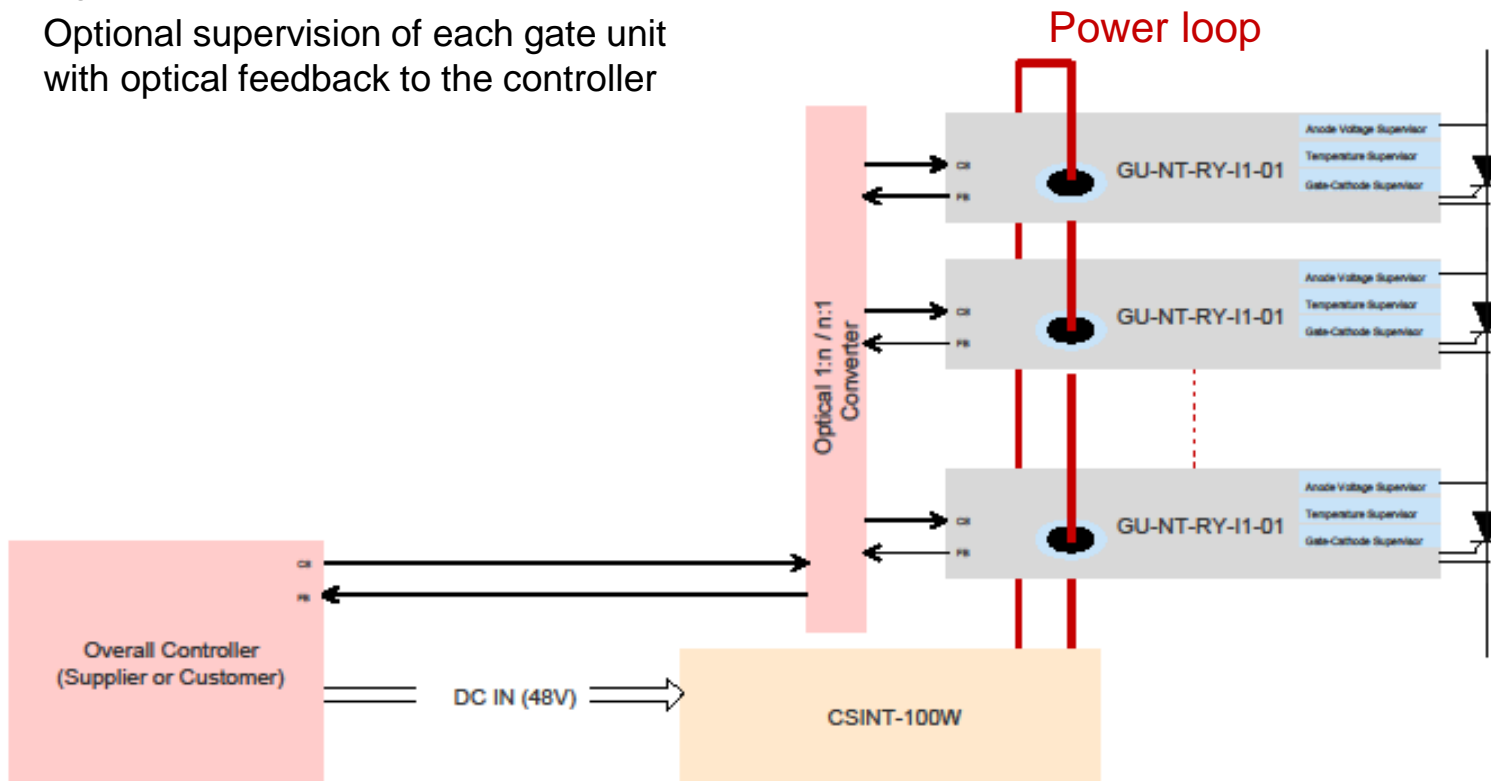
Dual 4.5kV Stakpak with HV-Power Power Supply



## Products – Isolated Power Supplies

### Insulated Power Supplies and Optical control units

- Power loop for inductive power supply
- Powers up to 16 gate units
- Triggering by power loop or by optical signal
- Optional supervision of each gate unit with optical feedback to the controller



Power loop



CSINT-200W





## Products – Trigger Controllers and Optical Interfaces



### Compact Trigger Controller „COMICON“

- 48 optical interfaces for GU trigger and feedback
- 20 Relais in-/outputs for system control signals
- Modbus communication interface
- Analoge signal inputs for voltage / current / temperature measurements etc
- Configuration with additional Linux board available



Opto interface module



Dual Rogowski Interface Card

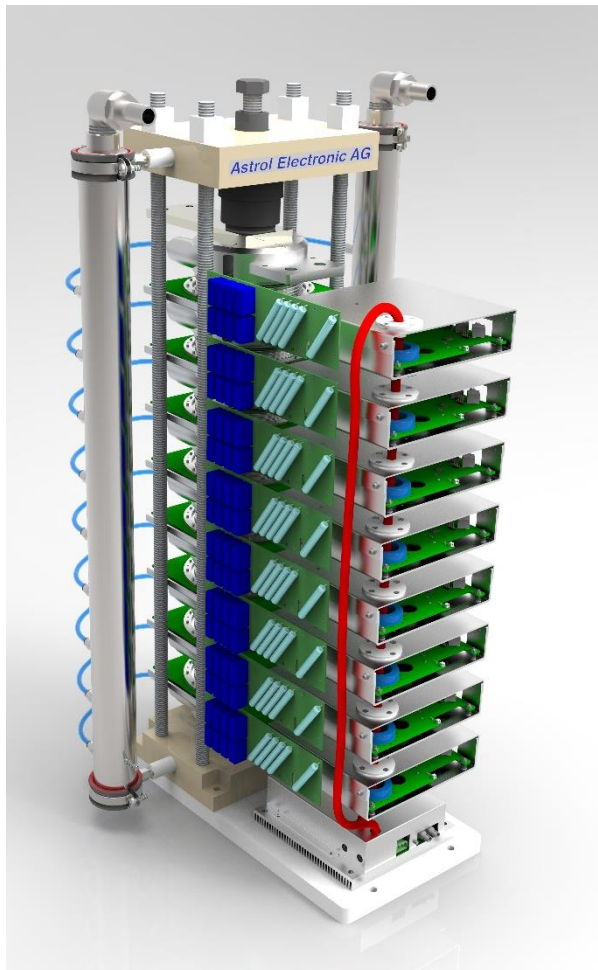


19"-inch Interface Box „SSB“





## Products – Power Switches



### Pulsed Power Switches

- Special high di/dt-thyristors
- Pulse length:  $\mu\text{s}$  – ms
- Up to 100kV and several hundred kA possible
- Thyristor or IGBT based switches

#### Applications:

- Radar systems
- Metal forming
- Material treatment
- Environmental protection
- Nuclear Research
- Impedance measurement

### Crowbar Assemblies

### Solid State AC Switches

- Thyristor based
- Turn-off at zero-crossing

#### Application:

#### Railway Neutral Section Switch

- 25kV
- 500A @1minute
- Heat-pipe cooling

### IGCT Switches

### Diode Assemblies



## Products – Solid-State Breakers

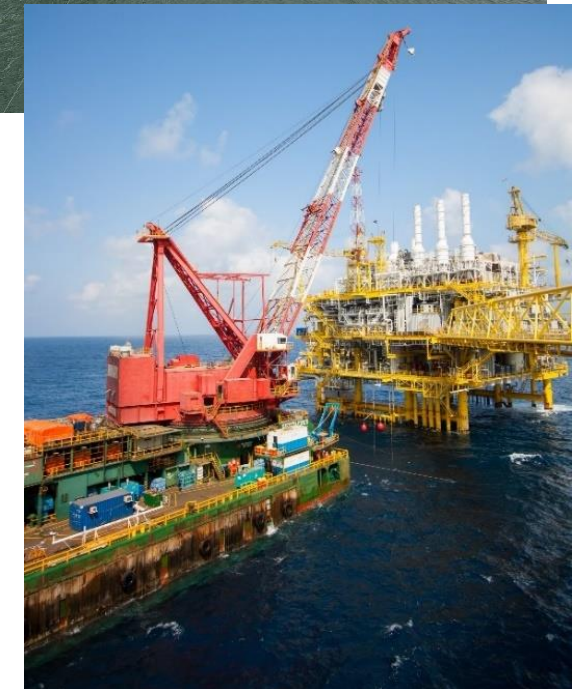
Typical examples where DC-Breaker is needed..



Diesel-electric ships with on-board DC-grid  
Emission reduction



Ships  
Offshore Platforms  
Short-circuit protection of  
working equipment







## Products – Marine DC-Breaker



- **Ultrafast switch OFF**
  - Fault detection in about 2  $\mu$ s
  - Switch-off starts within 4-5  $\mu$ s after fault detection
  - Reliable short-circuit protection
- **Autonomous system-independent building block**
- **High speed zone protection without any protocol overhead**
- **Ruggedized design for low losses and high reliability**
- **Fully integrated system including balancing and logic**
  - Avoid inrush current when switching on
  - Balance both sides of the switch by controlled precharging of the circuit
  - Automatic or remote control startup
- **Long life time**



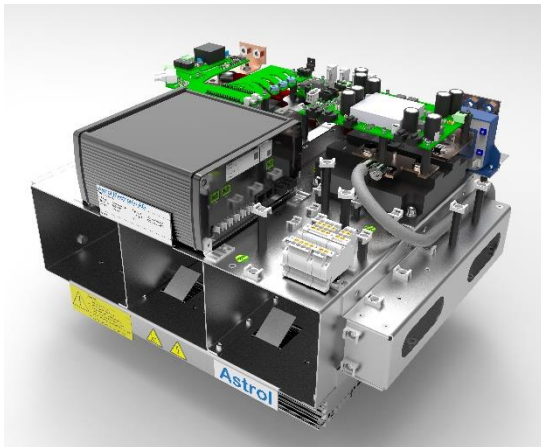


## Products – Marine DC-Breaker

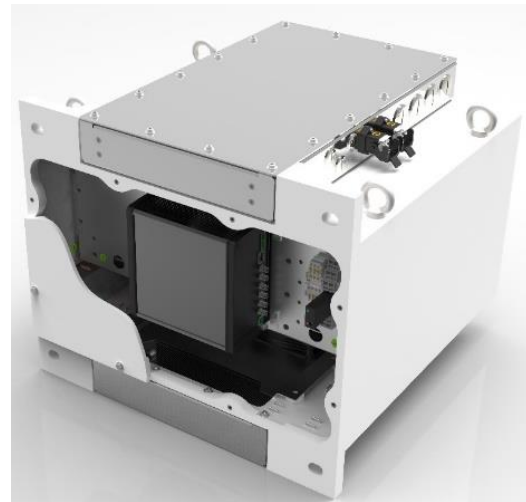
1kV - 200A, 500A, 1250A *Now available!*

5kA version coming soon

3kV versions upon request



**1kV – 200A**  
Air cooled



**1kV – 500A**  
Liquid cooled



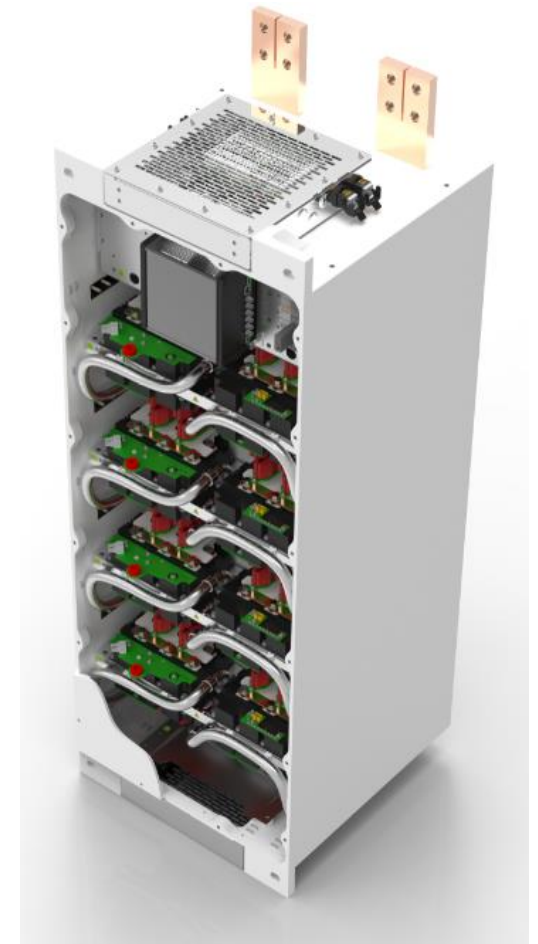
✓ **Certified**



**1kV – 1250A**  
Liquid cooled



✓ **Certified**



**1kV – 5kA**  
Liquid cooled



## Solid-State AC-Breaker

### Smart Grid Application

3-phase fast AC breaker  
11kV nominal voltage  
27kV peak voltage

300A nominal current  
600A peak current  
Liquid cooling

Switch-off in  $\mu$ s  
Compact IGBT design



12-level IGBT assembly  
with serial connected  
StakPak modules



## Solid-state DC-Breaker

### Nuclear Research Application

1kV - 2kA DC-Breaker  
Redundant protection with pyrofuse  
Design optimized for reduced conduction losses



- Modular Design  
19-inch rack  
mounted 1kV- DC-  
Breaker module
- Compact Design  
Housing Dimensions  
600 x 800 x 1300mm
- 1700V Hipak IGBT  
Modules

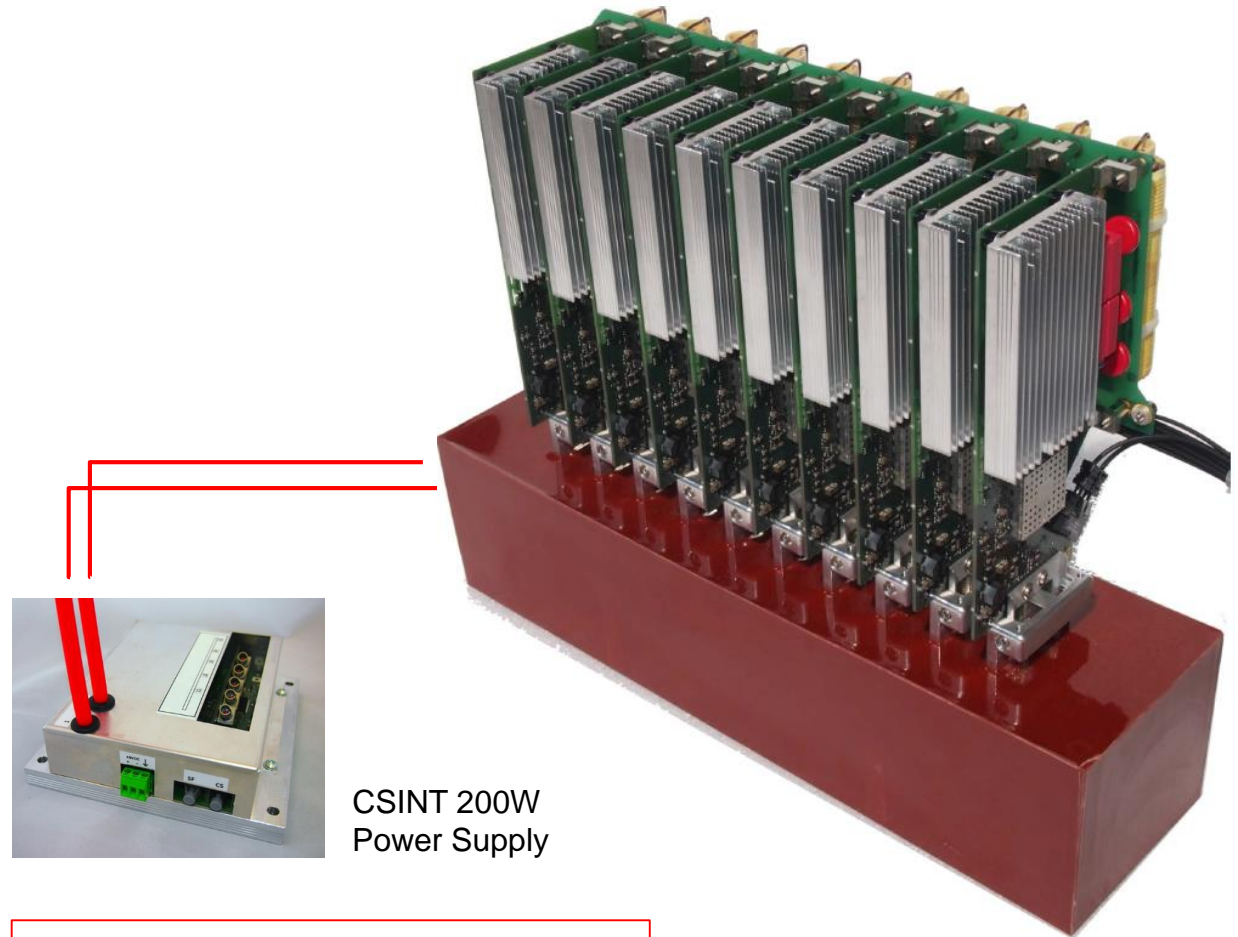


## Products – Compact HV-Switch

This compact switch assembly guarantees reliable switching for high-voltage applications. The modular concept allows customized designs based on components with proven performance.

### Features

- Rated voltage up to 18kV
- PD-free isolated power supply
- Up to 10kHz operating frequency
- Modular design for different voltage levels
- Compact design
- Air-cooled
- Integrated power moduls with IGBTs mounted on PCB
- Convection or forced-air cooling
- Programmable turn-on / turn-off behaviour
- di/dt limiting inductors



CSINT 200W  
Power Supply

**Compact Switch Design**  
425 x 115 x 322 mm

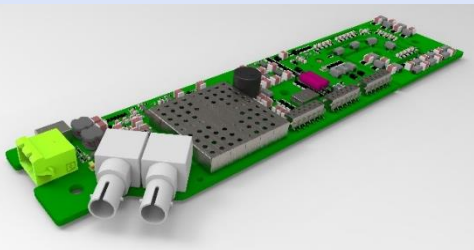




## Vertical Integration

Key components designed inhouse

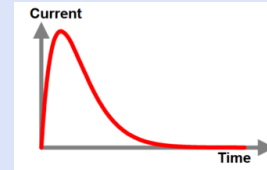
### Gate Drive Units and Power Supplies



Experience from HVDC Breakers

**IGBT LIFETIME**

### Pulsed Power



Over 100 different solution developed for our customers

**FAST SWITCHING BEHAVIOUR**

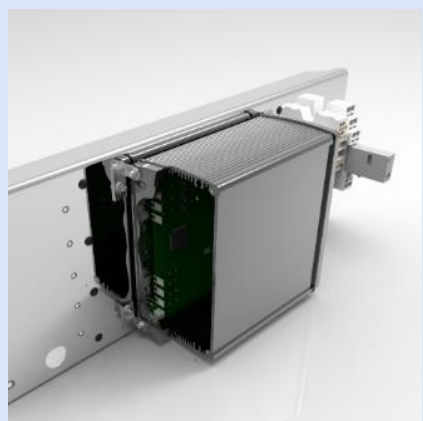
### Measuring Electronics

Over 20 years of experience as electronics developer



**ACCURATE MEASUREMENT AND DETECTION**

### Trigger Controllers and Opto Interfaces



Large international installed base

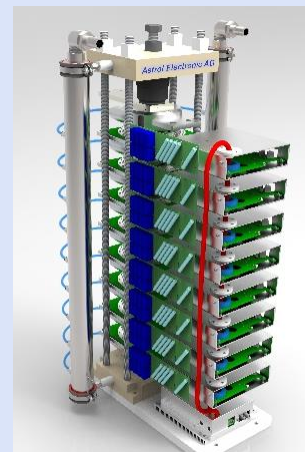
**RELIABLE CONTROL**



State-of-the-art solid-state breakers

### High Power Assemblies

Hundreds of units in operation for >10 years



**ROBUST MECHANICAL DESIGN**



## Wuxi Astrol Power Electronics Limited



Mr. Zhang: 180-1752-8812



No. 4, Zhongzhi Science and Technology Park, 22 Yanqiao Zhihui Road, Huishan District, Wuxi City, Jiangsu Province

## Astrol Electronic AG

info@astrol.ch



Ahornweg 14  
5504 Othmarsingen  
Switzerland