SSPC (Solid State Power Controller)

Aerospace Equipment Works
Engineering Dept.
Power Control Equipment Group

April 21, 2016

SINFONIA TECHNOLOGY CO., LTD.
Company name changed from SHINKO ELECTRIC CO., LTD.
What is SSPC?

SSPC (Solid State Power Controller) is a switching control unit by solid state but not by circuit breaker.
SSPC Switching Image

- Start-up with power input from Aircraft Power supply through D-sub connector.
- Power ON/OFF with input of Overwrite signal 1 from Operation Panel.
- Power ON/OFF with input of Overwrite signal 2 from Load Equipment.
- Power shut-down with Overload detection function

※High design flexibility and wide functional extension with lift control function
Ex. Indicating power distribution status and overall power management on operation panel as well as remote controlling are possible.
Advantage of SSPC

1. Size and Weight
   ① Volume; less than Half, Weight 30%-50% of C/B size (ref. size image drawing)
   ② No restriction of casing material. Aluminum is acceptable.
   ③ Power vs Volume density; SSPC:CB=7:1*, Power vs Weight density; SSPC:CB=5:1*
      * According to industry source information

2. Reliability
   ① Rapid Overload Protection, Quick Short-cut Protection
   ② Minimum loss switching with controlled starting-up and turning-off

3. Maintainability and Flexibility
   ① Long life against effect of ark, oxidization, corrosion, welding such as moving parts
   ② Less effect of performance failure by contact bounce and vibration
   ③ MTBF is much improved, hence system operation rate is much improved
   ④ Standardize the hardware and individualize it with software modification

4. Extendability
   ① Data bus access and networking access is possible as well as real time feedback of load status.
      ➢ Remote monitoring of status signal (ON/OFF) is possible
      ➢ Monitoring of over all channel load status is possible.
   ② High freedom of overwrite signal
      ➢ Discrete (Switch ON/OFF), and Switching of load equipment
      ➢ Communication (Input from higher level device)
## AC115V (400Hz) SSPC Development

### 1. Spec Comparison between SSPC and Circuit Breaker

<table>
<thead>
<tr>
<th>Spec item</th>
<th>SFT (Planned)</th>
<th>Other (Example)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSPC or C/B</td>
<td>SSPC</td>
<td>C/B</td>
</tr>
<tr>
<td>Type name</td>
<td>AC SSPC (TBD)</td>
<td>Remote Control Circuit Breaker (RCCB)</td>
</tr>
<tr>
<td>Type No.</td>
<td>(TBD)</td>
<td></td>
</tr>
<tr>
<td>Voltage Rating Ue</td>
<td>AC115V 400Hz</td>
<td>AC115V 400Hz DC28V</td>
</tr>
<tr>
<td>Current Rating Range In</td>
<td>10A, 20A (50A is TBD)</td>
<td>5 ... 100A</td>
</tr>
</tbody>
</table>

### Basic Spec

- **Standard current ratings and typical voltage drop values**
  
<table>
<thead>
<tr>
<th>Current ratings</th>
<th>Voltage ratings</th>
<th>Signal output Aux</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistive load</td>
<td>DC28V, AC115V (400Hz)</td>
<td>Auxiliary contacts</td>
</tr>
<tr>
<td>Inductive load</td>
<td>resistive load: 3.0A</td>
<td>change over contacts</td>
</tr>
<tr>
<td>Lamp load</td>
<td>inductive load: 1.5A</td>
<td>S1–S2 is open, when SSPC(SFT) main contact is open</td>
</tr>
<tr>
<td></td>
<td>lamp load: 0.5A</td>
<td>S1–S2 is open, when RCCB main contact is open</td>
</tr>
<tr>
<td></td>
<td></td>
<td>change over contacts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S1–S2 is open, when SSPC(SFT) main contact is open</td>
</tr>
</tbody>
</table>

### Other Spec

- **Ontacts**
  - S1–S2 is open, when SSPC(SFT) main contact is open
  - change over contacts

- **Voltage ratings**
  - DC28V, AC115V (400Hz)

- **Current ratings**
  - Resistive load: 3.0A
  - Inductive load: 1.5A
  - Lamp load: 0.5A
**AC115V (400Hz) SSPC Development**

### 2. Size and Weight Comparison with Circuit Breaker product

<table>
<thead>
<tr>
<th>Item</th>
<th>SFT</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SSPC or C/B</strong></td>
<td>SSPC</td>
<td>C/B</td>
</tr>
<tr>
<td><strong>Type Name</strong></td>
<td><strong>AC</strong> SSPC (TBD)</td>
<td><strong>Electrical Control Unit</strong></td>
</tr>
</tbody>
</table>

#### ① 9ch (10ea) Spec
- **Appearance**
- **Dimension**
- **Weight**

![Diagram](Front)

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 x 300</td>
<td>m = aprx3.7 kg</td>
</tr>
</tbody>
</table>

#### ② 15ch (17ea) Spec
- **Appearance**
- **Dimension**
- **Weight**

![Diagram](Front)

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 x 300</td>
<td>m = aprx7.4 kg</td>
</tr>
</tbody>
</table>

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AC115V (400Hz) SSPC Development

3. Appearance

![Diagram of Solid State Power Controller (SSPC)]

<table>
<thead>
<tr>
<th>Application / Function</th>
<th>Aircraft Utility Electric Circuit Overload Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating Voltage</td>
<td>Single Phase (twin) 115VAC (400Hz)</td>
</tr>
<tr>
<td>Rating Current</td>
<td></td>
</tr>
<tr>
<td>① 10A (1.15kVA)</td>
<td></td>
</tr>
<tr>
<td>② 20A (3.3kVA)</td>
<td></td>
</tr>
<tr>
<td>Channels</td>
<td>10ch (115VAC)</td>
</tr>
<tr>
<td>Overload Protection Level</td>
<td>Rating amp. × 100% ?sec.</td>
</tr>
<tr>
<td></td>
<td>Rating amp. × 120% ?sec.</td>
</tr>
<tr>
<td>Cooling method</td>
<td>Natural Air Cooling</td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 3.7kg</td>
</tr>
</tbody>
</table>

Status Indicator

Metal Case (Aluminum)
Arc fault protection
~ High Voltage DC Series arc~

- High-voltage DC causes high energy arc in case of series arc.

Arc fault test stand

Series arc

Electrode

Arc

DC270V 5A
Detect of series arc fault

- DC Series arc fault can be detected by the method applying quality engineering technology.

High: Arc fault is more likely to occur

No arcing
SSPC Development Plan

- Primary Electric Power Distribution Bus
  - High Voltage DC (270V)
  - High Current (Target: 300A)

- Improvement of Arc fault detection and protection technology

※2007 (Utility Management Center)
  - 230V AC [WF] (~15A)
  - 270V DC (~15A)

※2004 (Load Management Center)
  - 115V AC [CF] (~15A)
  - 28V DC (~15A)