SYNCHROTACT® 5

Synchronizing and Paralleling Equipment and Systems for Synchronous Machines and Networks
SYNCHROTACT® 5 is the fifth generation of synchronizing equipment produced by ABB Switzerland Ltd in Switzerland. SYNCHROTACT products from ABB are used for automatic synchronization of generators with power lines and for paralleling of synchronous lines. They are designed for fully automatic operation by dual-channel or single-channel systems.

Synchronizing equipment are used in power stations where a generator needs to be paralleled with a power line or in substations to parallel two synchronous lines.

Power circuit breakers can only be closed if voltage at both ends is synchronous. If it is not, it will cause a disturbance in the power network, trip the breaker, shock the generator and unit transformer. In extreme cases, it can damage both.

SYNCHROTACT 5 guarantees a safe and reliable synchronization whether as a monitoring element for manual paralleling or as an independent fully-automatic synchronizing unit.

SYNCHROTACT 5 covers the following areas of application:

1. Automatic synchronization and paralleling of generators with power lines (see Fig. 1 below),
2. Automatic paralleling for synchronous and asynchronous lines and busbars (see Fig. 2 below),
3. Monitoring (Synchrocheck) of automatic or manual paralleling of power lines, generators and voltage-free lines (dead bus), see Fig. 3 below.

**Legend:**
- U1: Network / busbar voltage
- U2: Generator voltage
- CB: Circuit breaker
- G: Generator
- AVR: Automatic voltage regulator
- TR: Turbine regulator (governor)
- ORDER: Paralleling command
- U+ U−: Voltage adjusting commands
- f+: f−: Frequency adjusting commands
- CHK RELEASE: Paralleling command release
Thanks to the flexible design of SYNCHROTACT 5 it can be used in many different configurations in order to ensure the required maximum safety and availability.

Definition
In synchronizing, the term “dual channel” applies to a configuration of two channels in series, in which one channel blocks the faulty operation of the other. This is to increase the safety of operation.

The term “redundancy” applies to a configuration of two devices in parallel. If one fails the other one can take over the function. This is to increase the availability of the synchronizing system.

Maximum safety in automatic and manual operation
The safety of the generator and network, while synchronizing, is the first requirement for such an equipment.

The safe automatic synchronization is guaranteed by a compact dual-channel system including two devices with independent hardware and software which are connected in series (see Fig. 4). The first channel performs the automatic synchronization and the other one is an independent monitoring (Synchrocheck) of the first one. The hardware and software of each channel is designed by different development engineers using different microprocessors which protect the operation from any possible systematic failure.

The safe manual synchronization is ensured by a monitoring device (Synchrocheck), which is in series with the manual paralleling switch (see Fig. 5).

Optimum availability
For higher availability of synchronizing equipment, the family range of SYNCHROTACT 5 offers various redundant configurations. See figures 6, 7 and 8. With those configurations both maximum safety and full availability is achieved.

The dual channel, automatic channel and single monitoring channel (Synchrocheck) systems are each provided in one casing. The redundant dual-channel system is in one casing, including interconnection wiring.
SYNCHROTACT 5 is utilizing state-of-the-art hardware and software technology, which includes a fundamentally improved service and maintenance tool.

**Fast commissioning**
- A user-friendly software called “SynView” allows simple and fast commissioning of a SYNCHROTACT 5 system.
- The SynView program recommends a value for each parameter and indicates minimum, maximum and default value for each parameter.
- The system includes an intelligent program, which after interaction with the generator, can recommend values for certain parameters that are dependent on the power system’s circuit breaker, voltage regulator and speed governor.
- The commissioning of SYNCHROTACT 5 can also be comfortably performed without a PC, using the controls on the front panel of the casing.

**Special features**
- Up to seven sets of parameter for seven different paralleling points can be stored in one device.
- Freely-configurable digital inputs and outputs.
- Operating with rated frequencies 50 Hz, 60 Hz and 16 2/3 Hz.
- For replacement of elder SYNCHROTACT systems or synchronization units made by other manufacturers.

**Lower engineering costs**
- Fewer auxiliary relays are required because the output contacts can carry higher currents. All I/Os are isolated.
- No separate power supply unit is required.
- A prefabricated unit is available for the selection of several paralleling points (SYN 5500)
- Much of the cabling is rendered unnecessary through integration in a bus control system (MODBUS, Profibus etc.).
Easy integration in superimposed control system

SYNCHROTACT 5 can be easily integrated in a modern bus control system. The communication interface supports the protocols MODBUS RTU, Profibus DP or LON-Bus.

At the same time, as a safety-relevant component, the synchronizing device remains an independent and protected module within the system.

Remote servicing saves travelling costs

Another interface is provided for remote servicing. In this case, SYNCHROTACT 5 gets its own IP address, and communication is done via an Ethernet interface with TCP/IP protocol. This allows the PC software “SynView” to directly access the device via the Internet. This access is switched on and off on the rear plate of the device.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYN 5100</td>
<td>Simple Synchrocheck</td>
</tr>
<tr>
<td>SYN 5200</td>
<td>Synchrocheck with advanced functionality</td>
</tr>
<tr>
<td>SYN 5201</td>
<td>Automatic single-channel synchronizing device with frequency and voltage adjustment</td>
</tr>
<tr>
<td>SYN 5202</td>
<td>Automatic dual-channel synchronizing system with Synchrocheck in series as second channel</td>
</tr>
<tr>
<td>SYN 5302</td>
<td>Redundant automatic dual-channel synchronizing system</td>
</tr>
<tr>
<td>SYN 5500</td>
<td>Auxiliary device for connection of several paralleling points</td>
</tr>
</tbody>
</table>
SynView is for simple and quick commissioning of SYNCHROTACT 5 equipment. German, English or French can be selected in SynView which runs under Microsoft® Windows™ 95, 98, 2000 or NT.

Functions

SynView program offers the following four main functions:

- **Setting of parameters**
  Very simple and user-friendly parameter setting display (Fig. 12).

- **Display of actual values**
  Synchronoscope, voltage and frequency display with real-time data (Fig. 13).

- **Transient recorder function**
  Transient recorder data is displayed – a separate recorder during commissioning is not necessary (Fig. 14).

- **Event and error logging**
  Events and errors in clear text with time stamp for the last 256 events (Fig. 15).
## Technical Data

### Auxiliary voltage
- Nominal voltage ranges:
  - 24 / 48 V<sub>DC</sub>
  - 100 to 125 V<sub>AC/DC</sub>
  - 220 to 250 V<sub>DC</sub>
- Permissible voltage range: 0.75 to 1.25 × U<sub>n</sub>
- Maximum power consumption (SYN 5302): 25 W / 35 VA

### Measuring inputs U1, U2
- Nominal voltage range: 50 to 130 V<sub>AC</sub>
- Permissible voltage range: 0 to 1.3 × U<sub>n</sub>
- Nominal frequency: 16 2/3 / 50 / 60 Hz

### Digital inputs
- Nominal voltages: 24 / 48 V<sub>DC</sub>
- Current consumption: 6 to 8 mA

### Paralleling relays
- Maximum switching voltage: 250 V<sub>AC/DC</sub>
- Maximum switching current, continuous: 5 A<sub>AC/DC</sub>
- Max. switching power DC/AC ON: 1000 W / VA
- Max. switching power DC/AC OFF: 30 W / 30 VA

### Adjusting, command and signalling relays
- Maximum switching voltage: 250 V<sub>AC/DC</sub>
- Maximum switching current, continuous: 1.5 A<sub>AC/DC</sub>
- Max. switching power DC/AC ON/OFF: 50 W / 50 VA

### Serial interface
- for PC software “SynView”: RS 232

### Measuring ranges
- Voltage: U1, U2, 0 to 1.3 × U<sub>n</sub>
- Angle matching: α, −179 to +180 DEG
- Frequency: 10 to 100 Hz
- Slip: s, 0 to 50 %
- Acceleration: ds/dt, 0 to 10 %/s
- Paralleling time: t ON, 0 to 1 s

### Isolation
- Dielectric test: IEC 60255-5, 2 kV
- Impulse voltage test: IEC 60255-5, 5 kV

### Degrees of protection acc. to IEC 60529
- Front: IP 54
- Rear: IP 50

### Temperature ranges
- Transport/storage: +15 to +185 °F
- Functionable: +40 to +160 °F
- Operation (compliance with technical data): +40 to +130 °F

### Mechanical stability
- Vibration: IEC 60255-21-1, 10 to 150 Hz, Class 2
- Vibration response: 1 g
- Endurance: 2 g
- Shocks and Bumps: IEC 60255-21-2, Class 2
- Shock response: 10 g
- Withstand: 30 g
- Endurance: 20 g
- Earthquake: IEC 60255-21-3, Method A, 5g in each axis

### Emission / immunity (EMC)
- Emission, terminal disturbance: IEC 55011, 0.15 to 0.5 MHz: 79 / 66 dB, 0.5 to 30 MHz: 73 / 60 dB
- Emission, radiation disturbance: IEC 55011, 30 to 230 MHz: 30 dB, 230 to 1000 MHz: 37 dB
## Technical Data

### Emission / Immunity (EMC) (continued)

<table>
<thead>
<tr>
<th>Category</th>
<th>Standard</th>
<th>Contact / Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrostatic discharges</td>
<td>IEC 61000-4-2</td>
<td>6 kV</td>
<td>8 kV</td>
</tr>
<tr>
<td>Electrostatic discharges</td>
<td>IEC 61000-4-6</td>
<td>10 kV</td>
<td>10 kV</td>
</tr>
<tr>
<td>Electromagnetic fields</td>
<td>IEC 61000-4-3</td>
<td>8 kV</td>
<td>10 kV</td>
</tr>
<tr>
<td>Electromagnetic fields</td>
<td>IEC 61000-4-4</td>
<td>±1 kV</td>
<td>±2 kV</td>
</tr>
<tr>
<td>Surge voltage</td>
<td>IEC 61000-4-5</td>
<td>±0.5 kV ±1 kV ±2 kV ±4 kV</td>
<td></td>
</tr>
<tr>
<td>Voltage dips</td>
<td>IEC 61000-4-11</td>
<td>AC: 10 ms 60 %</td>
<td>100 ms &gt; 95 % 5000 ms</td>
</tr>
<tr>
<td>Voltage dips</td>
<td>IEC 60255-22-1</td>
<td>2.5 kV</td>
<td>1 kV</td>
</tr>
</tbody>
</table>

### CE conformity

- LV Directive: 73/23/ECC EN 60950
- EMC Directive: 89/336/ECC EN 50081-2, EN 50082-2

### Construction data

#### SYN 5100
- Modular casing designed to snap onto top-hat rail
- Orientation: Horizontal
- Casing size: \(W \times H \times D\)\(\frac{8}{16}\)\(\frac{5}{32}\)\(\frac{3}{16}\)
- Weight: 0.86 lbs

#### SYN 5200, SYN 5201, SYN 5202
- Plug-in type casing (Option: surface mounting)
- Orientation: Horizontal
- Table cutout: \(W \times H\)\(\frac{8}{16}\)\(\frac{7}{32}\)
- Device profile: \(W \times H \times D\)\(\frac{8}{16}\)\(\frac{6}{32}\)\(\frac{3}{16}\)
- Front frame: \(W \times H\)\(\frac{8}{16}\)\(\frac{7}{32}\)
- Weight: 8.82 lbs

#### SYN 5302
- Plug-in type casing for 19" rack
- Orientation: Horizontal
- Table cutout: \(W \times H\)\(17\)\(\frac{3}{16}\)\(\frac{7}{32}\)
- Device profile: \(W \times H \times D\)\(17\)\(\frac{3}{16}\)\(\frac{5}{32}\)\(\frac{3}{16}\)
- Front frame: \(W \times H\)\(17\)\(\frac{3}{16}\)\(\frac{7}{32}\)
- Weight: 17.6 lbs

#### SYN 5500
- Board designed to snap onto top-hat rail
- Dimensions: \(W \times H \times D\)\(15\)\(\frac{5}{8}\)\(2\)
- Weight: 3 lbs