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. SYNCHROTACT products 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 is 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. Otherwise 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 as a monitoring element for manual paralleling or as an independent fully-automatic synchronizing unit.

Application areas are illustrated with below schemes:

**Fig. 1.** Automatic synchronization and paralleling of generators with power lines

**Fig. 2.** Automatic paralleling for synchronous and asynchronous lines and busbars

**Fig. 3.** Monitoring (Synchrocheck) of automatic or manual paralleling of power lines, generators and voltage-free lines (dead bus)

Legend:

- **U1** Network / busbar voltage
- **U2** Generator voltage
- **CB** Circuit breaker
- **G** Generator
- **AVR** Automatic voltage regulator
- **TR** Speed governor
- **COMMAND** Paralleling command
- **U+, U-** Voltage adjusting commands
- **f+, f-** Frequency adjusting commands
- **CHK RELEASE** Paralleling command release
Thanks to its flexible design, SYNCHROTACT 5 can be used in many different configurations in order to ensure maximum safety and availability.

Definition
In synchronizing, the term “dual channel” applies to a configuration of two channels in series, where one channel blocks the faulty operation of the other. This configuration increases 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 configuration increases the availability of the synchronizing system.

Maximum safety in automatic and manual operation
The first requirement during synchronizing process is the safety of the generator and the network.

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 (Fig. 4). The first channel performs the automatic synchronization and the other channel implements independent monitoring (Synchrocheck) of the first one. The hardware and software of each channel are designed by different development engineers using different microprocessors to 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 (Fig. 5). An automatic synchronizer may also be used as Synchrocheck for manual synchronization.

Optimum availability
The family range of SYNCHROTACT 5 offers various redundant configurations (Figures 6, 7 and 8) that ensure both maximum safety and full availability.

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

Special features
- One device can store up to seven sets of parameters for seven different paralleling points
- Freely configurable digital inputs and outputs
- Operating with rated frequencies 50 Hz, 60 Hz and 16 2/3 Hz
- For retrofit of previous SYNCHROTACT systems or synchronization units of other manufacturers

Lower engineering costs
- Output contacts can carry higher currents, thus fewer auxiliary relays required; all I/Os are isolated
- Separate power supply unit is not required
- Prefabricated unit is available for the selection of several paralleling points (SYN 5500)
- Reduced cabling due to integration in a bus control system (IEC 61850, MODBUS, Profibus etc.)

Fast commissioning
- User-friendly SynView software for simple and fast commissioning
- SynView software recommends parameter values and indicates min/max/default values for each parameter
- The system includes an intelligent program, which after interaction with the generator can recommend values for parameters that are dependent on the power system’s circuit breaker, voltage regulator and speed governor
- SYNCHROTACT 5 commissioning can also be comfortably performed without a PC, using the controls on the front panel of the casing

Fig. 9: SYNCHROTACT 5 family:
SYN 5200/SYN 5201/SYN 5202 (top left); SYN 5100 (top right); SYN 5302 (below)
Easy plant control integration, including IEC 61850
SYNCHROTACT 5 can be easily integrated in a modern bus control system. The communication interface supports IEC 61850 and 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.

Less travelling costs thanks to remote servicing
Another interface is provided for remote servicing. SYNCHROTACT 5 gets its own IP address, and communication is done via Ethernet interface with TCP/IP protocol. Thus SynView software can directly access the device via internet. The access can be 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</td>
</tr>
<tr>
<td></td>
<td>frequency and voltage adjustment</td>
</tr>
<tr>
<td>SYN 5202</td>
<td>Automatic dual-channel synchronizing system with</td>
</tr>
<tr>
<td></td>
<td>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>

Fig. 10: The conventional connections are made via plug-contact strips. These are largely unnecessary where the communications interface is used; instead, the signals are passed via the 9-pin Sub-D connector at the lower left. The connection to the Ethernet for remote servicing is made via the RJ45 socket.

Fig. 11: Auxiliary device SYN 5500 (for top-hat rail mounting)
SynView enables a simple and quick commissioning of SYNCHROTACT 5 equipment. The software runs under Microsoft® Windows™ 95, 98, 2000, NT or XP and has German, English or French language interfaces. The program can also be used during operation, for example to display the actual values in order to follow the synchronization progress.

Main functions of SynView program
- Parameters setting, using a simple and user-friendly parameter setting display
- Display of actual values, like Synchroscope, voltage and frequency with real-time data
- Transient recorder displays the recorded data, thus a separate recorder during commissioning is not necessary
- Event and error logging in clear text with time stamp for the last 256 events

Fig. 12: SynView tools (from left to right):
- Parameter setting tool
- Transient recorder tool
- Event recorder tool
- Measuring tool
**Technical Data**

**Auxiliary voltage**
- Nominal voltage ranges: 24 to 250 V\text{dC} and 100 to 230 V\text{AC}
- Permissible voltage range: 0.8 to 1.2 × Uₙ
- Maximum power consumption (SYN 5302): 25 W/35 VA

**Measuring inputs U1, U2**
- Nominal voltage range: 50 to 130 V\text{AC}
- Permissible voltage range: 0 to 1.3 × Uₙ
- Nominal frequency: 16²/³ / 50 / 60 Hz

**Digital inputs**
- Nominal voltages: 24 to 48 V\text{dC}
- Current consumption: 6 to 8 mA

**Paralleling relays**
- Maximum switching voltage: 250 V\text{AC/DC}
- Maximum switching current, continuous: 6 A\text{AC/DC}
- Max. switching power: DC/AC ON: 1500 W/VA, DC/AC OFF: 150 W/1000 VA

**Adjusting, command and signalling relays**
- Maximum switching voltage: 250 V\text{AC/DC}
- Maximum switching current, continuous: 1.5 A\text{AC/DC}
- Max. switching power: DC/AC ON/OFF: 50 W/VA

**Serial interface**
- for PC software SynView: Ethernet

**Emission/immunity (EMC)**
- Emission, conducted disturbance: CISPR 22, Class B
- Emission, radiated disturbance: CISPR 11, Class A
- Electrostatic discharges: IEC 61000-4-2, Contact: 8 kV, Air: 15 kV
- Electromagnetic fields: IEC 61000-4-6, 0.15 to 80 MHz, 10 V, 80% AM; 10 V/m, 80% AM and PM/900 MHz
- Fast transients/Bursts: IEC 61000-4-4, ±4 kV
- Surge voltage: IEC 61000-4-5, ±1 kV/±2 kV
- Voltage dips: IEC 61000-4-11, AC: 30%; 10 ms, 60%: 100 ms/1000 ms, > 95%: 5000 ms
- 1 MHz burst disturbance: IEC 60255-22-1, common mode & differential mode

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

**Construction data**

**SYN 5100**
- Modular casing designed to snap onto top-hat rail
- Orientation: Horizontal
- Casing size: W × H × D: 205 × 128 × 82 mm
- Weight: 0.3 kg

**SYN 5200, SYN 5201, SYN 5202**
- Orientation: Horizontal
- Table cutout: W × H: 222 × 164 mm
- Device profile: W × H × D: 221 × 163 × 220 mm
- Front frame: W × H: 226 × 171 mm
- Weight: 4.0 kg

**SYN 5302**
- Orientation: Horizontal
- Table cutout: W × H: 443 × 155 mm
- Device profile: W × H × D: 442 × 154 × 220 mm
- Front frame: W × H: 447 × 171 mm
- Weight: 8.0 kg

**SYN 5500**
- Board designed to snap onto top-hat rail
- Dimensions: W × H × D: 381 × 128 × 50 mm
- Weight: 1.4 kg