



SYNCHROTECT® 5

Synchronizing and Paralleling Equipment and Systems for Synchronous Machines and Networks

Application

SYNCHROTECT® 5 is the fifth generation of synchronizing equipment produced by ABB. SYNCHROTECT 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.

SYNCHROTECT 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

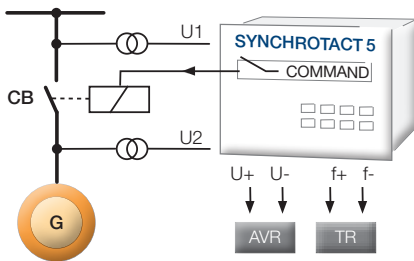


Fig. 2. Automatic paralleling for synchronous and asynchronous lines and busbars

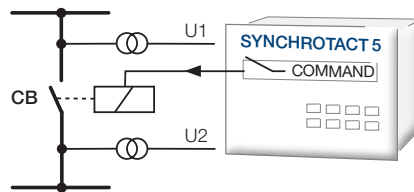
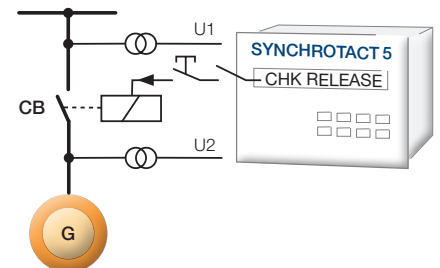


Fig. 3. Monitoring (Synchrocheck) of automatic or manual paralleling of power lines, generators and voltage-free lines (dead bus)



Legend:

U1	Network / busbar voltage	TR	Speed governor
U2	Generator voltage	COMMAND	Paralleling command
CB	Circuit breaker	U+, U-	Voltage adjusting commands
G	Generator	f+, f-	Frequency adjusting commands
AVR	Automatic voltage regulator	CHK RELEASE	Paralleling command release

Safety and Availability

Thanks to its flexible design, SYNCHROTECT 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

Fig. 4: Dual-channel system with automatic synchronizing device and Synchrocheck in series

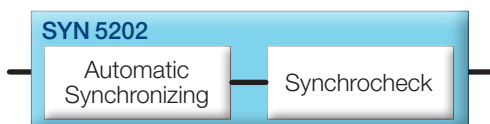
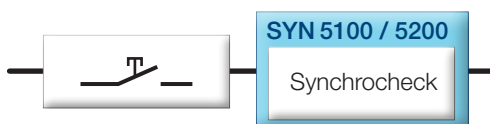


Fig. 5: Manual paralleling switch and synchrocheck in series



paralleling switch (Fig. 5). An automatic synchronizer may also be used as Synchrocheck for manual synchronization.

Optimum availability

The family range of SYNCHROTECT 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.

Fig. 6: Dual-channel system with automatic synchronizing device, manual paralleling switch in parallel and Synchrocheck in series

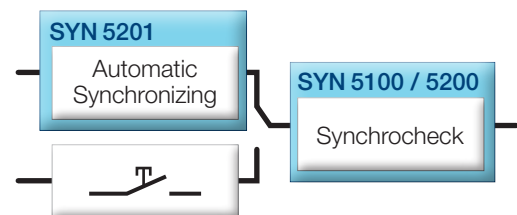


Fig. 7: Dual-channel main synchronizing system with bypass synchronizing system of manual paralleling switch and a Synchrocheck

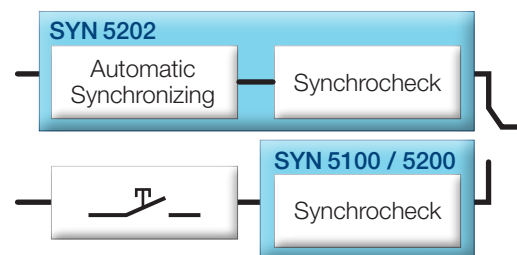
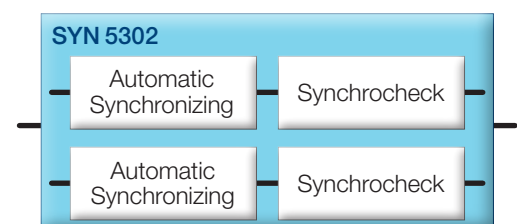


Fig. 8: Two automatic dual-channel systems for highest security and maximum availability



Functionality and Types

SYNCHROTECT 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 16²/₃ Hz
- For retrofit of previous SYNCHROTECT 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
- SYNCHROTECT 5 commissioning can also be comfortably performed without a PC, using the controls on the front panel of the casing

Fig. 9: SYNCHROTECT 5 family:
SYN 5200 / SYN 5201 / SYN 5202 (top left); SYN 5100 (top right); SYN 5302 (below)



Easy plant control integration, including IEC 61850

SYNCHROACT 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

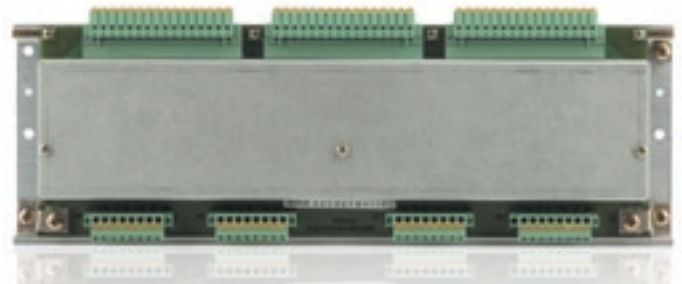
Another interface is provided for remote servicing. SYNCHROACT 5 gets its own IP address, and communication is done via Ethernet interface with TCP/IP protocol. Thus SynView software can directly access the device via internet. The access can be switched on and off on the rear plate of the device.

Type	Description
SYN 5100	Simple Synchrocheck
SYN 5200	Synchrocheck with advanced functionality
SYN 5201	Automatic single-channel synchronizing device with frequency and voltage adjustment
SYN 5202	Automatic dual-channel synchronizing system with Synchrocheck in series as second channel
SYN 5302	Redundant automatic dual-channel synchronizing system
SYN 5500	Auxiliary device for connection of several paralleling points

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 Software

SynView enables a simple and quick commissioning of SYNCHROTECT 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

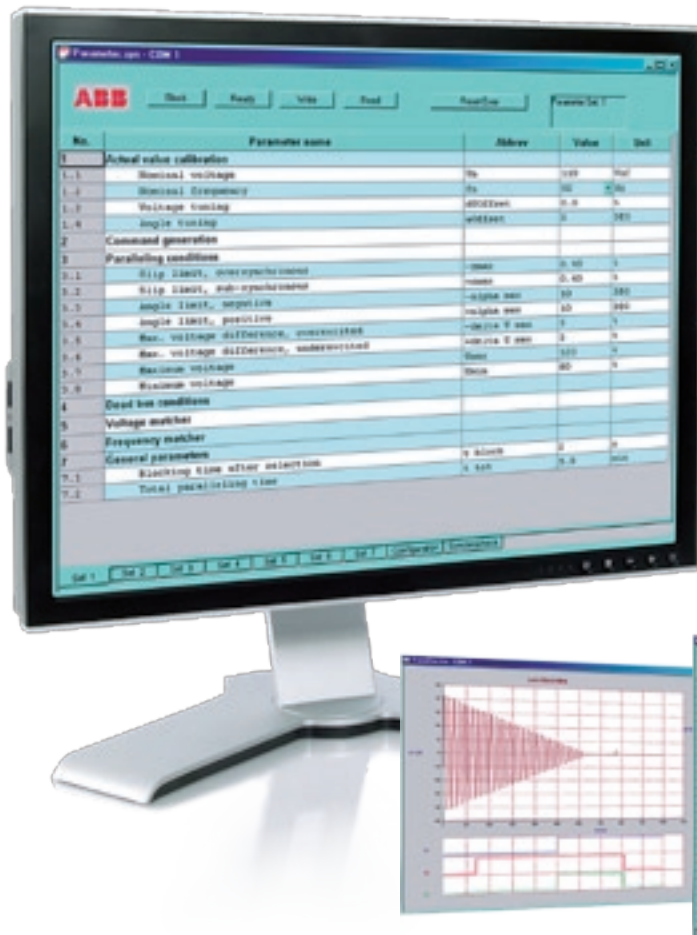


Fig. 12: SynView tools (from left to right):
 Parameter setting tool
 Transient recorder tool
 Event recorder tool
 Measuring tool

Technical Data

Auxiliary voltage

Nominal voltage ranges	24 to 250 V _{DC} and 100 to 230 V _{AC}
Permissible voltage range	0.8 to 1.2 × U _n
Maximum power consumption (SYN 5302)	25 W/35 VA

Measuring inputs U1, U2

Nominal voltage range	50 to 130 V _{AC}
Permissible voltage range	0 to 1.3 × U _n
Nominal frequency	16 2/3 / 50 / 60 Hz

Digital inputs

Nominal voltages	24 to 48 V _{DC}
Current consumption	6 to 8 mA

Paralleling relays

Maximum switching voltage	250 V _{AC/DC}
Maximum switching current, continuous	6 A _{AC/DC}
Max. switching power DC/AC ON	1500 W/VA
Max. switching power DC/AC OFF	150 W/1500 VA

Adjusting, command and signalling relays

Maximum switching voltage	250 V _{AC/DC}
Maximum switching current, continuous	1.5 A _{AC/DC}
Max. switching power DC/AC ON/OFF	50 W/VA

Serial interface

for PC software SynView	Ethernet
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Measuring ranges

Voltage	U1, U2	0 to 1.3 × U _n
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	-10 to +85 °C
Functionable	+5 to +70 °C
Operation (compliance with technical data)	+5 to +55 °C

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
Bump		20 g
Earthquake	IEC 60255-21-3	Method A 5 g in each axis

Emission/immunity (EMC)

Emission, conducted disturbance	CISPR 22	Class B
Emission, radiated disturbance	CISPR 11	Class A Group 1
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
	IEC 61000-4-3	80 to 1000 MHz 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 common mode & differential mode	IEC 60255-22-1	2.5 kV

CE conformity

LV Directive	73/23/ECC	EN 60950
EMC Directive	89/336/ECC	IEC 61000-6-4 IEC 61000-6-2

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

Panel mounting

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

Panel mounting

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

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