SYNCHROTACT®

Synchronizing and Paralleling devices and systems
Data sheet

ABB

Content

ABB Switzerland Ltd is a world-leading manufacture of synchronization equipment. Application-oriented solutions are developed, produced, commissioned and serviced.

Advantages
- Maximum reliability
- Guaranteed availability
- Lowest project-engineering costs
- Quick commissioning using convenient PC tool SynView
- Synchronizes up to 7 power circuit breakers with different requirements
- Design 100 % compliant with CE guidelines
- Advanced technology
- Universal use
- Decades of experience with synchronization systems
- After-sales service: 24 h hotline 365 days a year & remote servicing via the internet
- Training program for commissioning and service personnel

An optimum, profit-bringing solution from the very beginning!

SYNCHROTACT® 5
Synchronizing and Paralleling devices

SYN 5100
SYN 520v
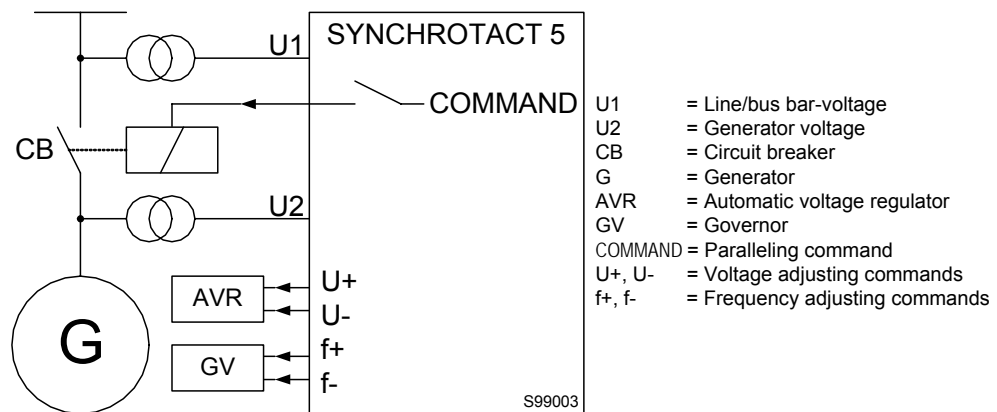# SYN 5302

Variety of applications

Synchronization units are widely used in power stations or industrial installations with their own power generating facilities, where the generators need to be paralleled with an island line or a public line, or in power distribution systems.

Power circuit breakers may only be closed if both voltages are at least approximately synchronous (coincident). Otherwise, faults in line operation, loading of the generators and, in extreme cases, damage to the generators can result.

SYNCHROTACT® 5 performs these functions safely and reliably, whether as a monitoring element for manual paralleling or as an independent fully-automatic synchronization unit.

SYNCHROTACT® 5 covers the following areas of application:

1. Automatic synchronization and paralleling of synchronous generators with line.

|	
U1	= Line/bus bar-voltage
U2	= Generator voltage
CB	= Circuit breaker
G	= Generator
AVR	= Automatic voltage regulator
GV	= Governor
COMMAND	= Paralleling command
U+, U-	= Voltage adjusting commands
f+, f-	= Frequency adjusting commands

2. Automatic paralleling for synchronous and asynchronous lines, transmission lines and busbars.
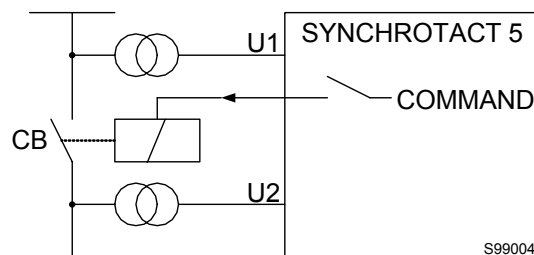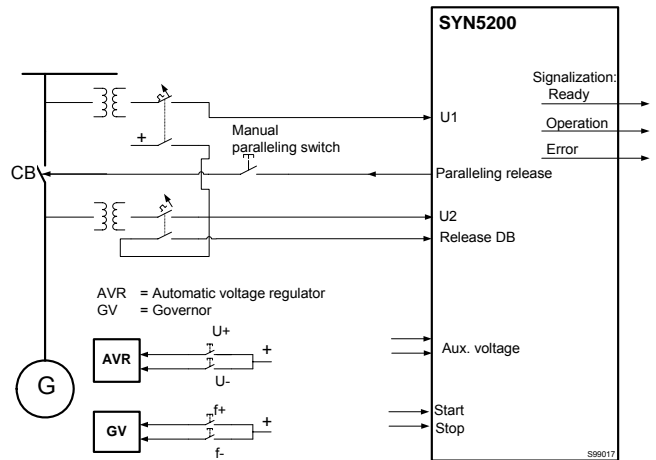

3. Paralleling monitoring (synchrocheck) for the monitoring of automatic or manual paralleling procedures including the connection of voltage-free lines (dead bus).

CHK RELEASE = Paralleling command release

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ABB - 5 - **SYNCHROTACT 5**
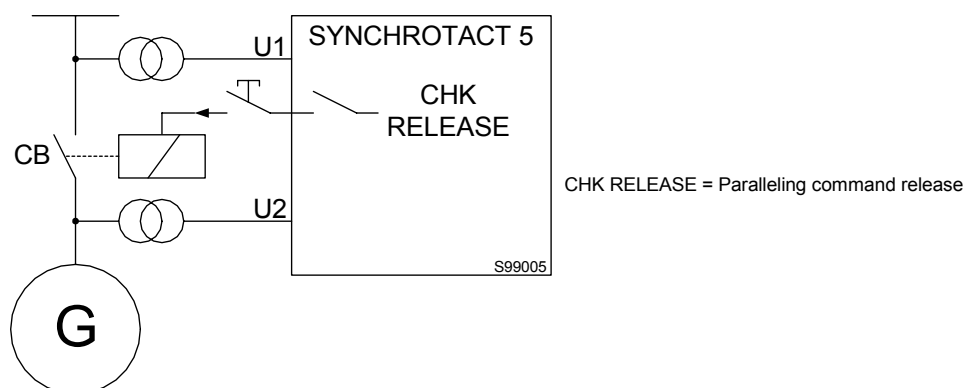
Typical applications
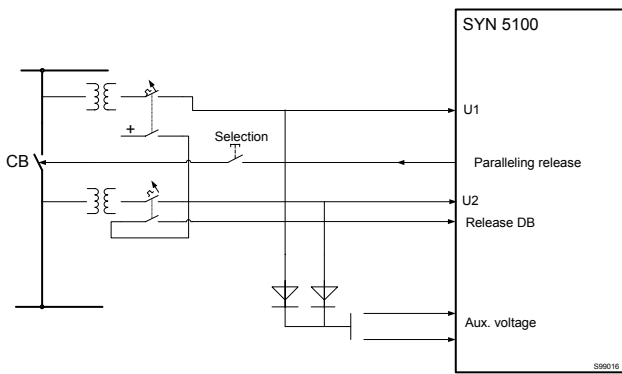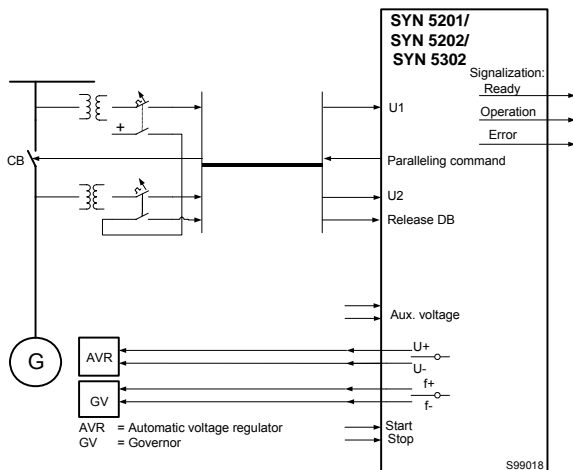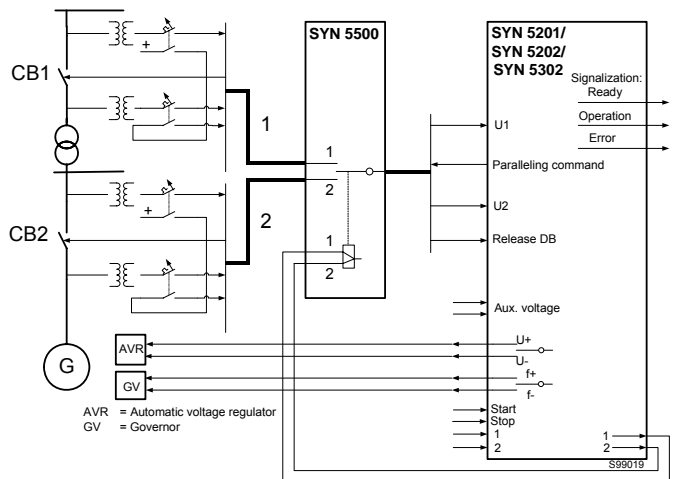

Simple, permanently-operated synchrocheck for paralleling of two lines

Synchrocheck for monitoring manual paralleling of a generator.

Automatic synchronization and paralleling of a generator.

Automatic synchronization and paralleling of two power circuit breakers with the same synchronization unit. The switching can be carried out by means of the auxiliary device SYN 5500.

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Clearly-structured principle of operation

The synchronization and paralleling process can be divided into the following blocks:

Measuring

The values voltage difference (amplitude) ΔU, slip (frequency difference) s and phase-angle difference α, which are required for paralleling, are formed from the two measurement signals U1 and U2 (see illustration below).

Matching

Voltage and frequency matching functions reduce the voltage difference ΔU and slip s by sending adjusting pulses to the voltage or turbine regulators.

Monitoring of paralleling conditions

This function compares the actual values with their set maximum values and releases paralleling (CHK RELEASE) if all conditions are fulfilled simultaneously.

Command generation

The command generation calculates the necessary lead angle αv by which the paralleling command must be advanced due to the delay through the closing times in order that the main contacts close exactly at the precise instant of coincidence. If α reaches αv at the same time as paralleling release (CHK RELEASE), the command is issued. Under synchronous conditions, i.e. permanent paralleling release during the adjustable monitoring time tsup, the command is also issued without taking the lead angle into consideration.
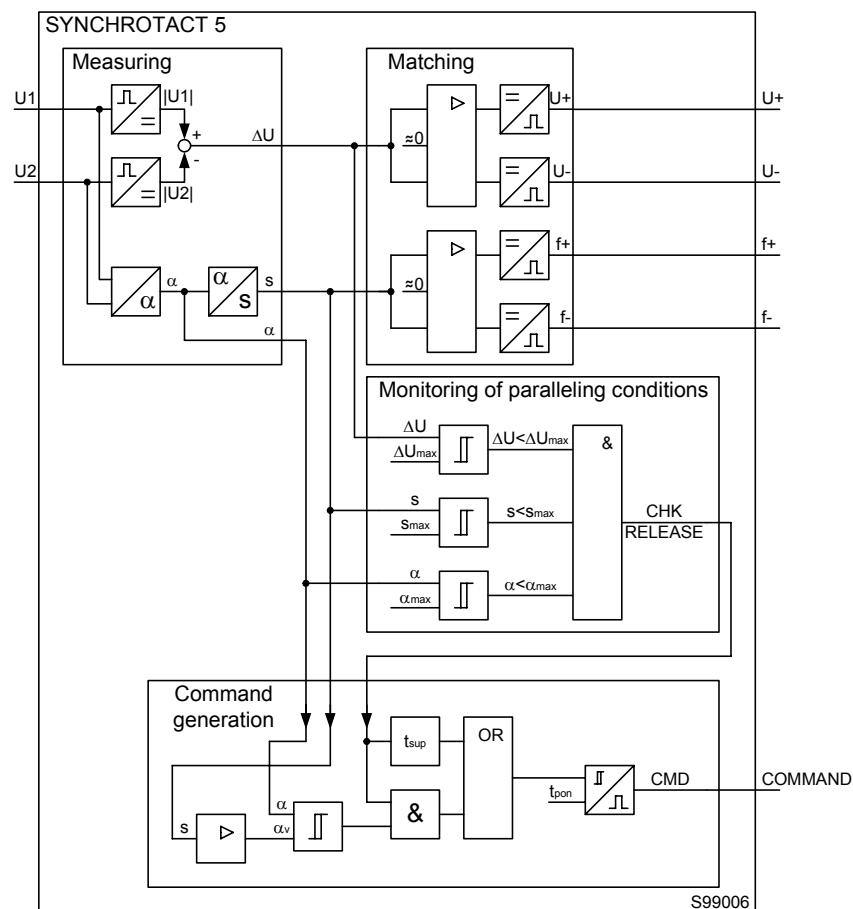

Synchrocheck mode (paralleling monitoring):

In Synchrocheck mode, only the measuring and monitoring function blocks are active. The output relay is closed during paralleling release.

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Optimum reliability

From a synchronization unit, It is expected to close the power circuit breaker at the correct time but also that, if required, paralleling can also take place whenever permissible. Although the series connection of the output contacts of two independently-functioning channels (dual-channel system) which is usual in synchronization systems greatly increases security against incorrect paralleling, it necessarily leads to an reduction in availability.
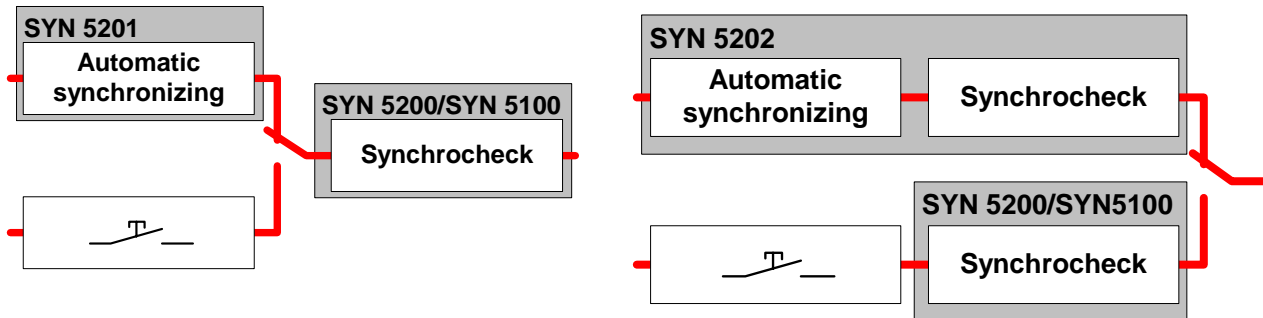
High levels of safety and reliability can be achieved through the use of a second, redundant synchronizing system. If system 1 is no longer able to synchronize, it is possible to switch over to the second system and synchronize with this.
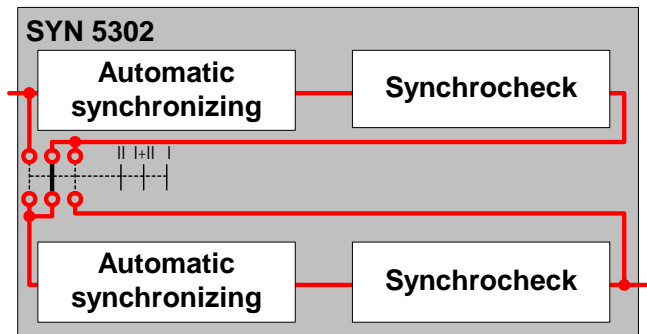
In this configuration, two automatic dual-channel systems are housed in one unit. Normally, the output contacts of both systems are connected in series (4 channels!). One of the two systems can be bridged by means of a system selector switch.

Advice:

Single or dual-channel?
Not every synchronization system necessarily needs to be structured according to the above pattern. The SYNCHROTACT single-channel synchronization units offer a high degree of security and are often used in practice. However, security can be further increased to a **significant** degree by means of dual-channel systems. It is unlikely that the two channels, which are structured differently in both hardware and software terms, will have the same malfunction simultaneously. The extra cost of a dual-channel system frequently bears a profitable relationship to the possible consequential costs arising from incorrect paralleling.

Second, redundant synchronizing system?
Often, two redundant synchronizing systems are installed in a plant so that, in the event of failure of one system, it is possible to switch over to the other and thus increase availability. The second system is often designed for manual synchronizing with or without synchrocheck.

In addition to this solution, with SYNCHROTACT® 5 ABB offers two automatic dual-channel systems in a single casing, thus allowing manual synchronization to be dispensed with. The advantages of this solution:
• No engineering and wiring costs for the second system
• Further increased security since all four output contacts are normally operated in series
• No problems with synchronization in cases where the manual synchronizing system is very seldom used.

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The seven-in-one Synchronizing device!

The specific settings for the synchronization and paralleling are stored in a parameter set. Devices with 7 parameter sets have seven times the same parameters, with the possibility of individual setting. That way, seven paralleling points with individual settings may be operated. First the parameter set or the circuit breaker to be synchronized has to be selected and then the synchronizing process can be started.

The software-driven link between parameter set and paralleling point guarantees the correct assignment of the setting values to the related plant components.
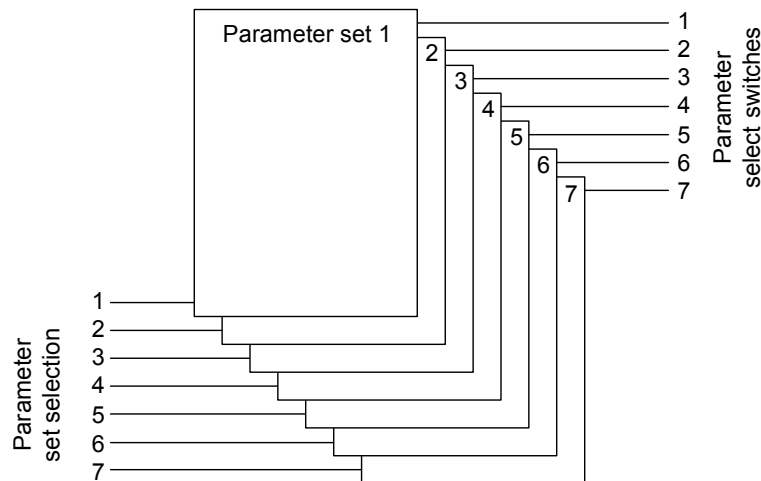
S00016

Possible means of control

Service control for commissioning and servicing:
1. Built-in service controls: keypad & LCD (standard)
2. SynView PC tool (accessory) for local control: PC/Ethernet (standard)
3. SynView PC tool (accessory) via LAN (standard)

Operating control for normal synchronizing operation:
1. Digital inputs/outputs: conventional wiring (standard)
2. Interface (modbus, profibus, LON): remote-controlled synchronizing operation (option)

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Device types

The SYNCHROTACT® 5 family of devices consists of 5 device types:

Type	Function	Symbol
SYN 5100	Synchrocheck	SYN5100 — Synchrocheck — S99008
SYN 5200	Synchrocheck or automatic paralleling unit without matcher	SYN5200 — Synchrocheck — S99009
SYN 5201	Automatic single-channel synchronization unit	SYN5201 — automatic Synchronizer — S99010
SYN 5202	Automatic dual-channel synchronization unit	SYN5202 — automatic Synchronizer — Synchrocheck — S99011
SYN 5302	Redundant automatic dual-channel synchronization unit	SYN5302 — automatic Synchronizer — Synchrocheck / II I+II / automatic Synchronizer — Synchrocheck — S99012

**Difference between SYN 5302 and SYN 5202:**
The SYN 5202 is a dual-channel system with two differently-structured independent channels in the same casing.
SYN 5302 consists of two SYN 5202 dual-channel devices in one casing. The two systems are normally all wired in series (4 channels!). In the event of failure of one system, it is possible to switch over without danger to the other dual-channel automatic system. This allows paralleling to be carried out fully automatically and with maximum security at all times. Additional costs for a redundant synchronization system are saved.

Difference between SYN 5100 and SYN 5200:
SYN 5100 offers a parameter set with 5 parameters, the auxiliary voltage range is 50 to 130 VAC or 100 to 125 VDC.
SYN 5200 features communications interfaces, seven parameter sets, a wider auxiliary voltage range and the convenient PC tool SynView with all its functions. In addition, because of its command generation, SYN 5200 can also be used as an automatic paralleling unit.

Type code

$$\text{SYN 5202}$$
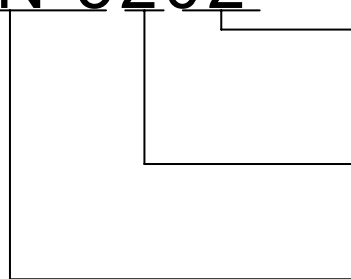
Synchronization type
00: Synchrocheck
01: Single-channel device
02: Dual-channel device

Construction size
1: Small size
2: Medium size
3: Large size

SYNCHROTACT
SYN = SYNCHROTACT
5: Fifth generation

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Device types
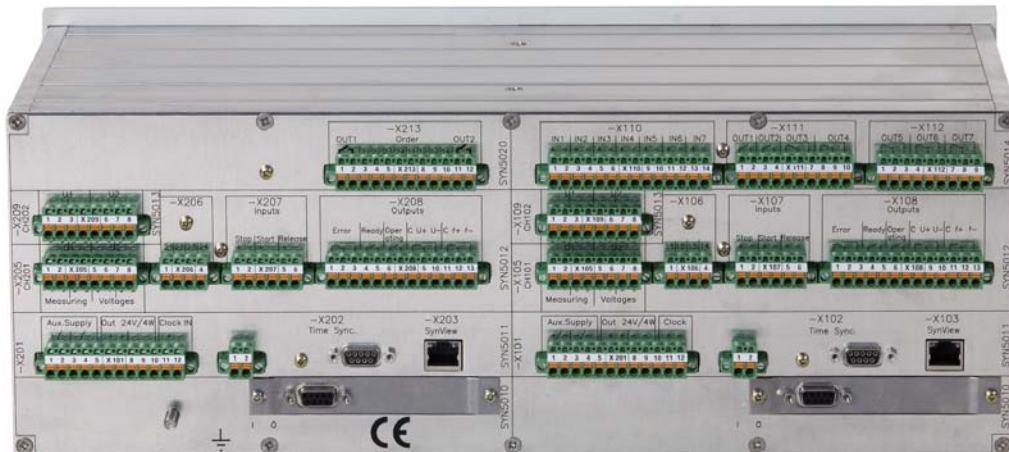
SYN 5100:

Front view of SYN 5200, SYN 5201, SYN 5202:   **Rear view of SYN 5202 with 7 parameter sets:**

Front view of SYN 5302:

Rear view of SYN 5302 with 7 parameter sets:

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Scope of functions at a glance

Function	Type				
	SYN 5100	SYN 5200	SYN 5201	SYN 5202	SYN 5302
Automatic synchronization	No	Yes	Yes	Yes	Yes
Paralleling of two lines	Yes	Yes	Yes	Yes	Yes
Synchrocheck mode	Yes	Yes	Yes	Yes	Yes
Voltage matching	No	No	Yes	Yes	Yes
Frequency matching	No	No	Yes	Yes	Yes
Dual channel system	No	No	No	Yes	Yes
Integrated, redundant system (bypass)	No	No	No	No	Yes
Number of parameter sets	1	either 1 or 7	either 1 or 7	either 1 or 7	either 1 or 7
Paralleling of synchronous lines	Yes	Yes	Yes	Yes	Yes
Paralleling of asynchronous lines	Yes	Yes	Yes	Yes	Yes
Paralleling of voltage-free lines	Yes	Yes	Yes	Yes	Yes
Signalling	No	Yes	Yes	Yes	Yes
Parameter setting by PC-Tool SynView	No	Yes	Yes	Yes	Yes
Parameter setting without PC	Yes	Yes	Yes	Yes	Yes
Semi-flush mounting	No	Yes	Yes	Yes	Yes
Surface mounting	No	on request	on request	on request	on request
Hat rail mounting (DIN)	Yes	No	No	No	No

Options

	Option	SYN 5100	SYN 5200, SYN 5201, SYN 5202, SYN 5302
w	Communication (Operating interface)	0 none	0 none 2 Modbus 3 Profibus 4 Lon-Bus
x	Code for internal use	2 internal code	2 internal code
y	Auxiliary voltage / nominal frequency	**Un = 50** to **130** VAC & **100** to **125** VDC: 2 fn = 50/60 Hz 5 fn = $16^2/_3$ Hz	**Un = 100** to **230** VAC & **24** to **250** VDC: 7 fn = 50/60 Hz 8 fn = $16^2/_3$ Hz
z	Parameter sets	1 1 Parameter set	1 1 Parameter set 7 7 Parameter sets

Ordering details

Device type	Options
SYN 5u0v	- wxyz

Examples:

SYN 5100 – 0221	Synchrocheck with nominal frequency 50 or 60 Hz and 1 parameter set
SYN 5200 – 0271	Synchrocheck with nominal frequency 50 or 60 Hz and 1 parameter set
SYN 5201 – 0287	Automatic single-channel synchronization unit with nominal frequency $16^2/_3$ Hz and 7 parameter sets
SYN 5202 – 2277	Automatic dual-channel synchronization unit with communication (Modbus), nominal frequency 50 or 60 Hz and 7 parameter sets
SYN 5302 – 4277	Redundant automatic dual-channel synchronization unit with communication (LON), nominal frequency 50 or 60 Hz and 7 parameter sets

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Captions to the options

Option w: Communication (Operating interface)

Characteristics of the operating remote control:

Supported protocols:	Modbus RTU; Profibus; Lon
Interface type:	Modbus and Profibus: RS 485 Lon: optical
Connector type:	Modbus and Profibus: D-Sub9 (female) Lon: HP BFOC/2,5 (optical)
Transmitted signals:	Digital inputs/outputs; status indicators (LEDs); actual values (analogue); new event
Addressing:	Slave address, depending on fieldbus

SYN 5302: the interfaces are duplicated, i.e. each system can be controlled individually. Commands, for example starting synchronizing, have to be given separately for each system.

Option z: Parameter sets
SYNCHROTACT 5 - devices with 7 parameter sets include additional hardware with seven digital inputs and seven relay outputs. They are normally used for the selection of both, parameter set and paralleling point. The inputs and outputs not used can be configured for other functions. The possible functions are shown in the table below:

Configurable functions of digital inputs
Selection of parameter set or paralleling point
Selection of TEST mode
Starting, stopping and blocking of synchronization process
Reset of the device

Configurable functions of digital outputs
Selection or acknowledgement of paralleling point/ parameter set
Switchover contact for the command circuit which must be connected in series with the manual paralleling circuit in synchrocheck mode
Signalling of the following variables: Paralleling command in TEST mode Dead bus released Synchronization process stopped Phase-angle difference within tolerance band Slip within tolerance band Voltage difference within tolerance band Paralleling command released U1 leading or lagging f1>f2; f1<f2 U2>U1; U2<U1 U1 or U2 outside of permissible range Monitoring of paralleling contacts tripped Single-system operation (only SYN 5302)

Construction

SYN 5100:

SYN 520x:

Panel cut-out w*h = 222*164 mm

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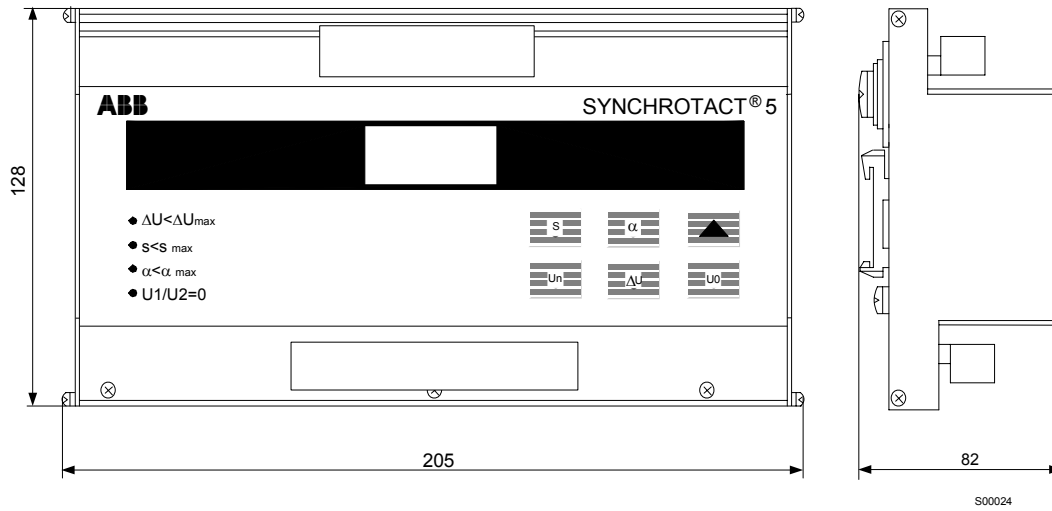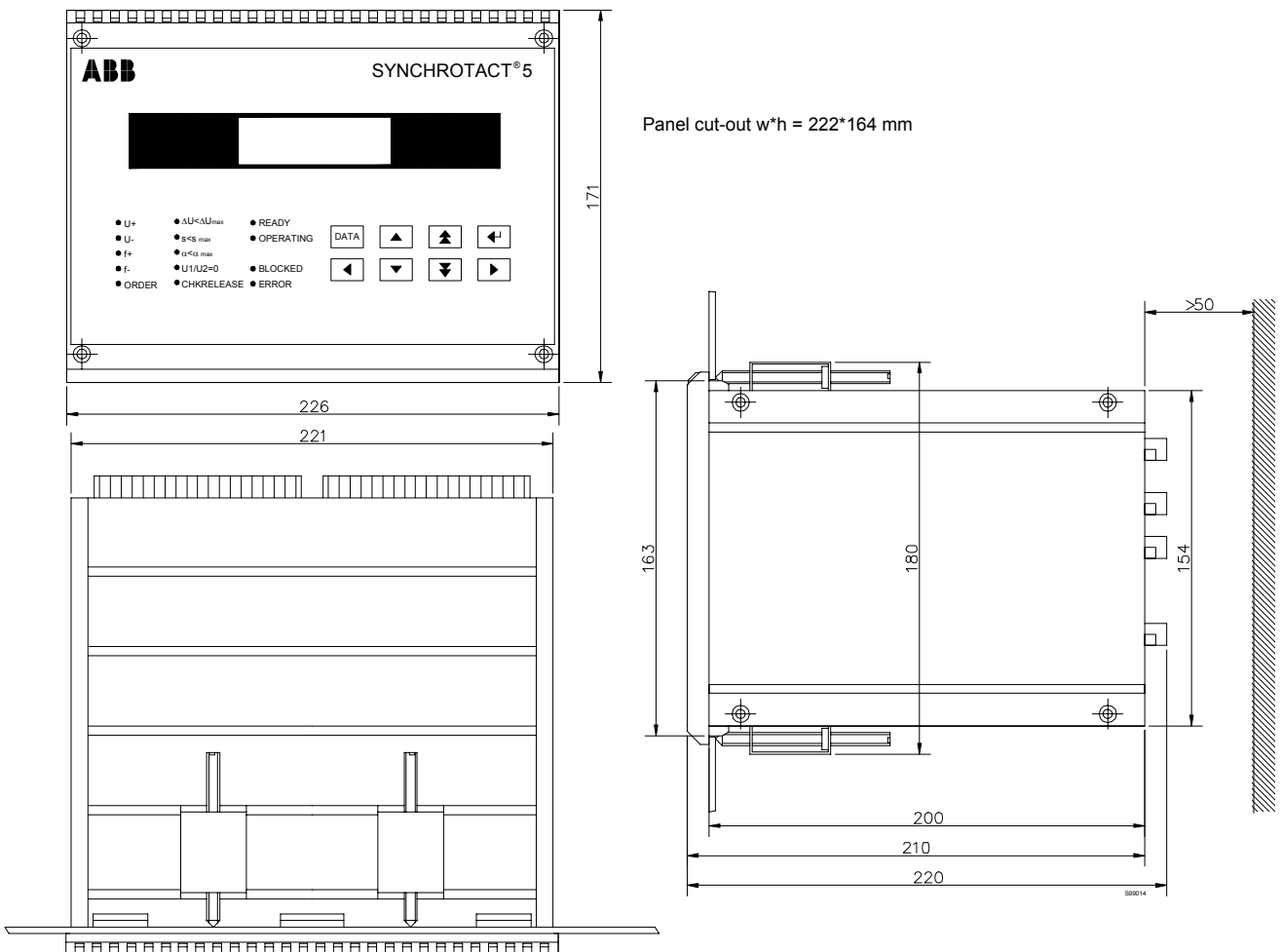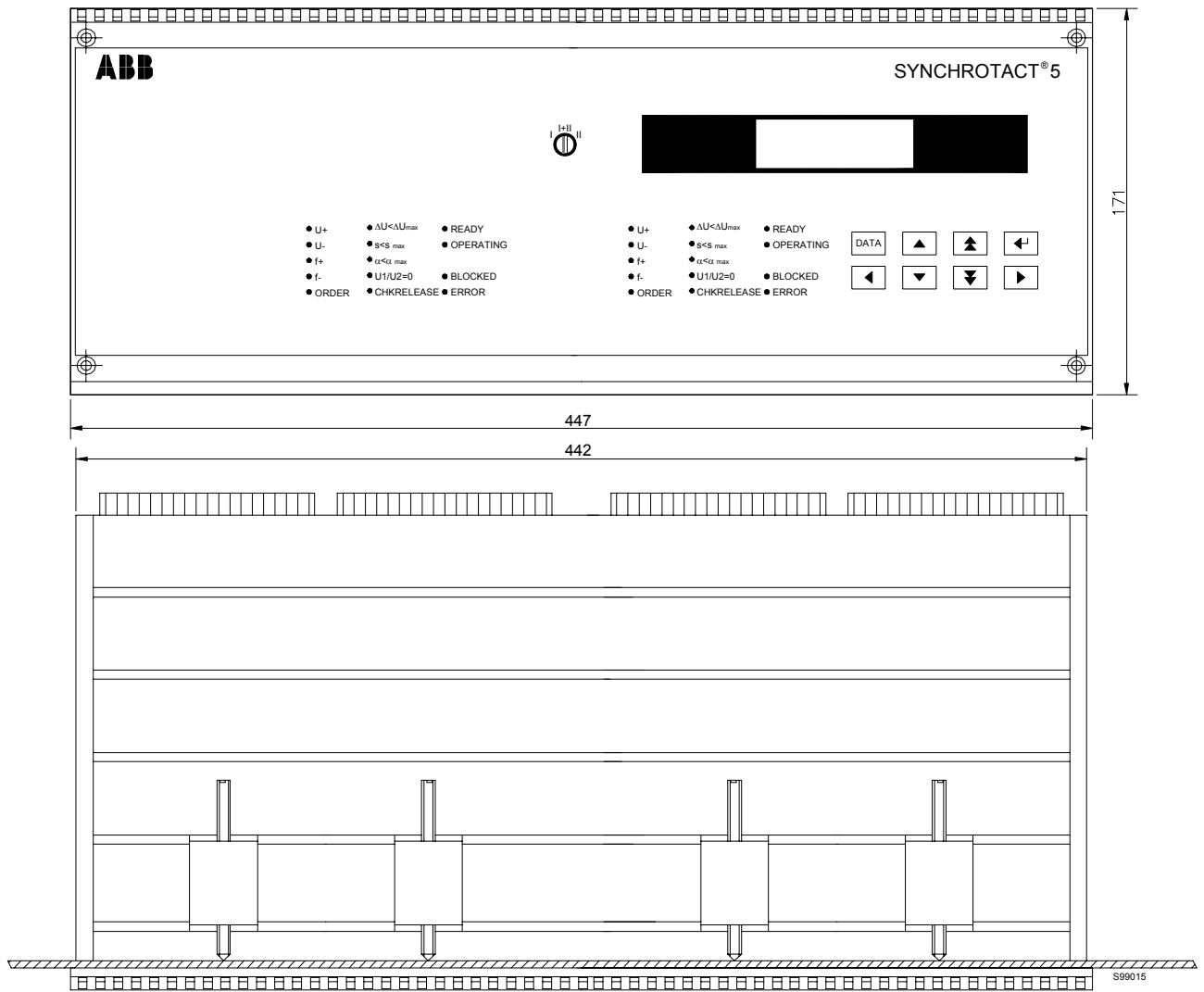
SYN 5302:

Panel cut-our w*h = 443 x 155 mm

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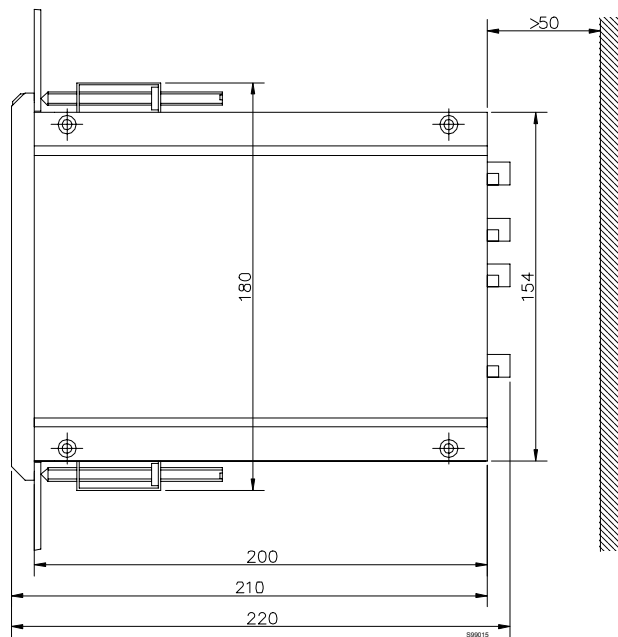
Technical data

INPUTS

Auxiliary voltage

Nominal voltage range		24 to 250 VDC
		100 to 230 VAC
Permissible voltage range		18 to 300 VDC
		75 to 300 VAC
SYN 520v/SYN 5302		
Maximum power consumption	READY	25 W/35 VA
	OPERATING	25 W/35 VA
SYN 5100		
Maximum power consumption		2 W/4 VA

Measuring inputs U1, U2

Nominal voltage range	50 to 130 VAC
Voltage range	0 to 130 % Un
Nominal frequency	$16^2/_3$, 50, 60 Hz
Frequency range	10 to 100 Hz

Digital inputs

Nominal voltages	24/48 VDC
Current consumption	6 to 8 mA

OUTPUTS

Paralleling relays

Maximum contact voltage	250 VAC/VDC
Limiting continuous current	10 A
Maximum switching power ON AC/DC	1500 VA/W
Maximum switching power OFF AC/DC (resistive)	1500/150 VA/W

Adjusting command and signalling relays

Maximum contact voltage	250 VAC/VDC
Limiting continuous current	1.5 AAC/ADC
Maximum switching power ON/OFF AC/DC	50 VA/W

INTERFACE

PC-Tool 'SynView' Ethernet

Bridgeable distance	100 m

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PARAMETER SETTING RANGES

SYN 5200, SYN 5201, SYN 5202 (channel 1), SYN 5302 (channels 1)

Actual value calibration	Step	Setting range
Nominal voltage	1 V	50 to 130 VAC
Voltage matching (between U1 & U2)	0.1 %	±12 %
Angle matching (SYN 5200 & SYN 5201 only)	1 DEG	±180 DEG

Command generation		
Paralleling time	10 ms	0 to 990 ms
Duration of paralleling command	10 ms	50 to 990 ms
Monitoring time	1 s	0 to 99 s

Paralleling conditions		
Slip limit*	0,01 %	0 to 6 %
Angle limit (angle window)*	1 DEG	1 to 99 DEG
Maximum voltage difference*	1 %	0 to 40 %
Maximum voltage	1 %	100 to 130 %
Minimum voltage	1 %	50 to 95 %

* Positive and negative limit values can be set separately.

Dead bus conditions		
Maximum zero voltage for dead bus	1 %	0 to 49 %

Note: The following possibilities - and all combinations thereof - can be allowed or ruled out for paralleling by means of programming: U1 = dead bus; U2 = dead bus; both sides dead bus

Voltage matcher		
Voltage adjustment characteristic	0.01 %/s	0 to 5 %/s
Interval between pulses	1 s	1 to 20 s
Minimum pulse duration	0,01 s	0.05 to 2 s

Note: The length of adjusting pulses are proportional to the voltage difference. The proportionality factor (0.01 to 5 %/s) is adjustable. Alternatively, it is possible to work with fixed pulse lengths (0.05 to 2 s), in which case the interval times are inversely proportional to the voltage difference.

Frequency matcher		
Frequency adjustment characteristic	0.01 %/s	0 to 5 %/s
Interval between pulses	1 s	1 to 120 s
Minimum pulse duration	0.01 s	0.05 to 2 s

Note: The length of adjusting pulses are proportional to the slip. The proportionality factor (0.01 to 5 %/s) is adjustable. Alternatively, it is possible to work with fixed pulse lengths (0.05 to 2 s), in which case the interval times are inversely proportional to the slip.

General parameters		
Blocking time following start signal	1 s	1 to 10 s
Total paralleling time	0.5 min	0.5 to 15 min; OFF

SYN 5100, SYN 5202 (channel 2), SYN 5302 (channels 2)

Slip limit	0.1 %	0.1 to 2 %
Angle limit	5 DEG	5 to 40 DEG
Maximum voltage difference	5 %	5 to 40 %
Maximum zero voltage for dead bus	5 %	0 to 50 %
Nominal voltage	5 V	50 to 130 VAC

Note: The percentages refer to the nominal values

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ENVIRONMENTAL VALUES

Isolation

Dielectric test	IEC 60255-5	2 kV
Impulse voltage test	IEC 60255-5	5 kV

Temperature ranges for devices without communication

Transport/storage	-40 to +85 °C
Functionable	-25 to +70 °C
Operation (compliance with technical data)	-10 to +55 °C

Temperature ranges for devices including communication

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; cl. 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		
Single axis sine sweep seismic test	IEC 60255-21-3	Method A
		5g in each axis
	IEEE STD 344-1987	

Emission/immunity (EMC)

Emission AC mains conducted disturbance	CISPR 22	Class B
		0.15 to 0.5 MHz:
		66..56 dB/56..46 dB
		0.5 to 5 MHz: 56 dB / 46 dB
		5 to 30 MHz: 60 dB / 50 dB
Emission, enclosure radiation disturbance	CISPR 11	Class A
		30 to 230 MHz: 30 dB
		230 to 1000MHz: 37 dB
Electrostatic discharges	IEC 60255-22-2	Class IV
	IEC 61000-4-2	Contact: 8 kV
	IEEE C37.90.3-2001	Air: 15 kV

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Electromagnetic fields	IEC 61000-4-16	0 to 150 kHz: 30 V continuous 300 V; for 1 s
	IEC 61000-4-6	0,15 to 80 MHz 10 V; 80 % AM
	IEC 60255-22-3 IEC 61000-4-3	Frequency sweep: 80 to 1000 MHz: 10 V/m; 80 % AM 1.4..2 GHz: 20 V/m; 80 % AM Spot frequencies: 80/160/450/900 MHz: 80 % AM; Testing time >10 s
	IEEE C37.90.2-2004	25 to 1000 MHz: 20 V/m; 80% AM (max. result. field strength: 35 V/m)
Fast transient	IEC 60255-22-4 IEC 61000-4-4	Class IV; 4 kV
	IEEE C37.90.1-2002 (fast transient)	4 kV common & transverse mode
	IEC 61000-4-12	2.5 kV
Surge voltage	IEC 61000-4-5	Installation classification: class 3 ±1 / ±2 kV
Voltage dips	IEC 61000-4-11	AC: 30 %: 10 ms 60 %: 100 ms >95 %: 5000 ms
1 MHz Burst disturbance	IEC 60255-22-1	Class III 2.5 kV common & transverse
	IEEE C37.90.1-2002 ("oscillatory")	2.5 kV common & transverse

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RELEVANT STANDARDS

CE-conformity

EMC-Directive:	89/336/EEC	
Generic standard	EN 50081-2	Emission
	EN 50082-2	Immunity
LV-Directive:	73/23/EEC	
Safety of information technology equipment	EN 60950	

Product standards

Measuring relays and protection equipment	IEC 60255-6
Product standard for measuring relays and protection equipment	EN 50263
Hydro Québéc standard for electronic equipment and relays	SN-62.1008d
IEEE standard for relays	IEEE C37.90-1989

CONSTRUCTION DATA

Degrees of protection in accordance to IEC 60529

Front	IP 54
Rear	IP 50

Dimensions

SYN 5100

see illustration of dimensions

Modular casing designed to snap onto rail

SYN 520x

see illustration of dimensions

SYN 5302

see illustration of dimensions

SYN 5500

Casing size (WxHxD)	381*128*50 mm
Modular casing designed to snap onto rail	

Weight

SYN 5100	0.3 kg
SYN 5200 (maximum variant)	4 kg
SYN 5302	8 kg

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Spare parts

PCB designation	Type
Communications board	SYN 5010
Processor and power supply board (Indication of device type required, e.g. SYN 5201)	SYN 5011
Basic I/O unit	SYN 5012
Processor for channel 2 (synchrocheck)	SYN 5013
Extended I/O / 7 parameter sets (option)	SYN 5014
Bus board for SYN 520x	SYN 5015
System control	SYN 5020
Bus board for SYN 5302	SYN 5025

Ordering information:
When ordering, please state the complete type designation of the synchronizing unit.

Recommendation:
No individual parts are available for the SYN 5100 unit. It is therefore recommended that an identical, pre-set replacement unit be kept in store.
In the case of SYN 520x units, it is recommended that an identical, pre-set replacement unit be kept in store.
In the case of the SYN 5302, the following PCB modules are recommended as spare parts: SYN 5020 system control and SYN 5014 extended I/O card, if the latter is installed.

SYNCHROTACT®

Accessories

SynView
SYN 5500
Instruments
Adaptation VT's

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SYNCHROTACT Accessories
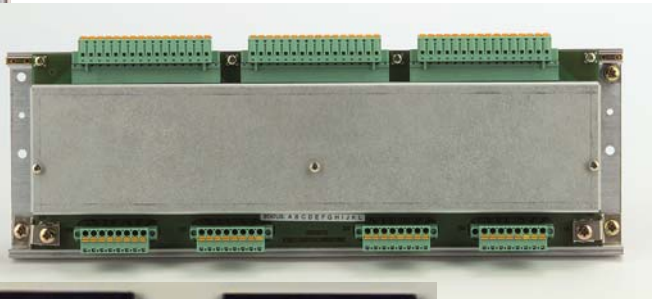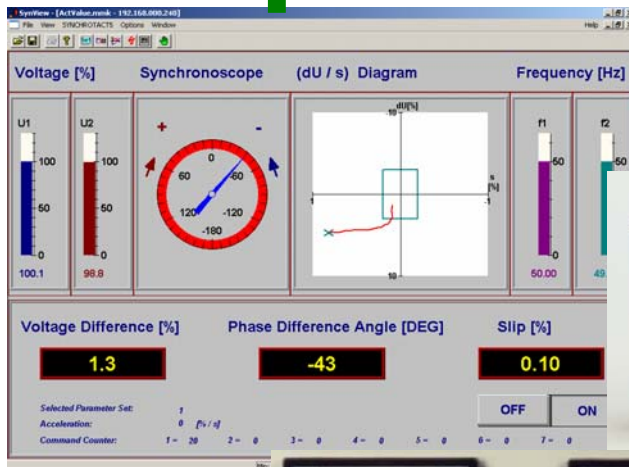
Fast commissioning with SynView

SynView is the appropriate aid for simple and fast commissioning of SYNCHROTACT® 5 devices. The PC software runs under MS® Windows™ NT, 95, 98, 2000 and XP in the standard languages German, English or French. Versions in other languages are possible. SynView consists of 5 functions which are explained in greater detail in the following.

Parameter tool

All parameter settings are carried out with this. The files can be stored on the PC and copied to other units. Helpful functions such as comparing parameter files with device settings or the display of recommended setting values greatly simplify commissioning and servicing work .

Transient recorder tool

The voltage difference and paralleling command from the last three synchronizing processes are displayed. The tool makes the use of a separate recorder unnecessary.
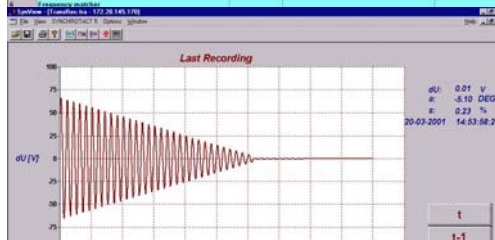
Actual values tool

A synchroscope, together with all the values important for paralleling, is displayed on the user interface. These simplify function-testing of the synchronizing process if no instruments are available.
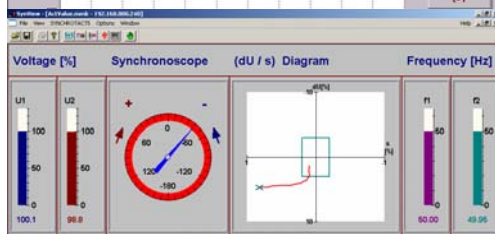
Fault-/Event log tool

The 256 events stored in SYNCHROTACT® 5 are displayed in plain text with date and timestamp. This greatly simplifies the localization of faults, e.g. wiring or control faults which sometimes occur during commissioning.
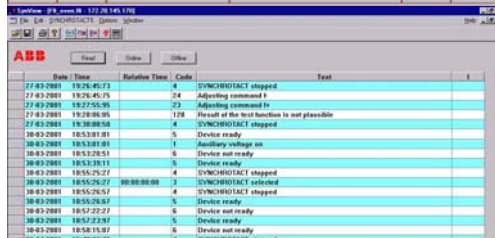
Diagnostic tool

In difficult cases which cannot be solved on site, this tool helps the manufacturer to identify the causes of the problem from the data stored here.

Ordering details

Designation	Type	Part no
PC-Tool for commissioning and maintenance	SynView	3BHE 021 768 R0002

ABB

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SYNCHROTACT Accessories

Auxiliary device SYN 5500

The auxiliary device SYN 5500 performs the connection of the measuring and command circuits where several paralleling points need to be switched. An SYN 5500 device can switch 2 paralleling points, each with a maximum of 16 contact pairs, or alternatively, 4 paralleling points, each with 8 contact pairs. Several devices can be used in combination.
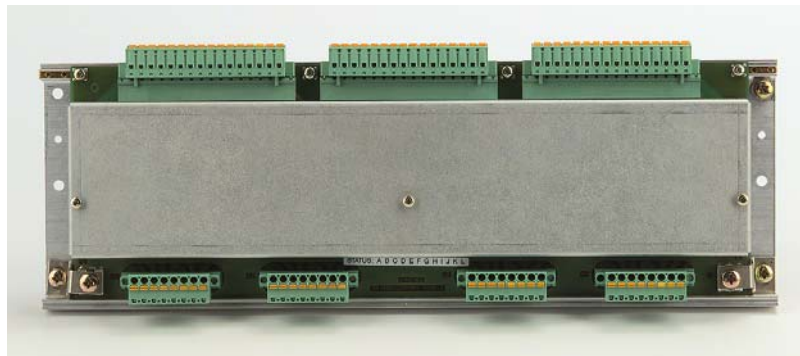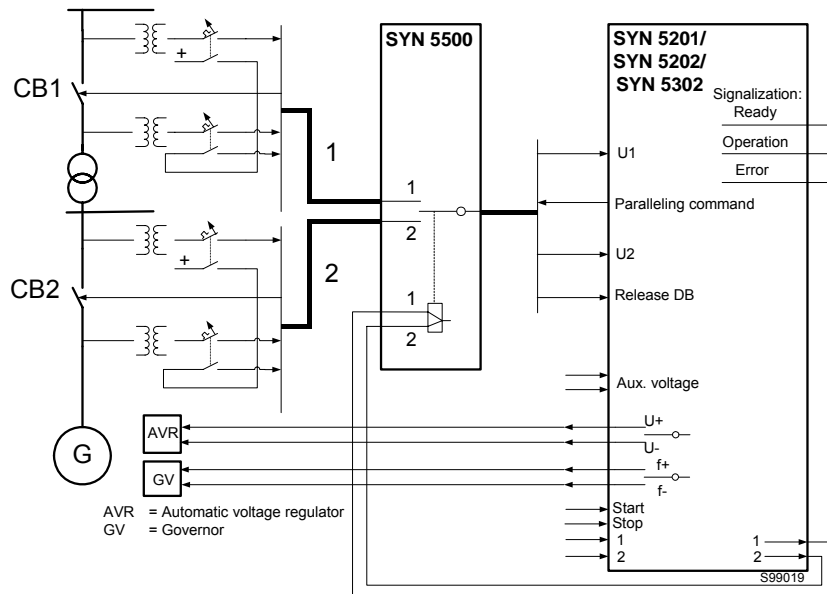
Ordering details

Designation	Type	Part no
Auxiliary device for switching several paralleling points	SYN 5500	3BHB 006 500 R0001

Technical Data

Maximum contact voltage	250 VAC/VDC
Limiting continuous current	10 A
Maximum switching power ON AC/DC	1500 VA/W
Maximum switching power OFF AC/DC (resistive)	1500/150 VA/W
Coil nominal voltage	24 VDC
Operate voltage	$\geq$18 VDC
Release voltage	$\leq$3.6 VDC
Coil resistance	1152 Ω
Coil inductivity	1000 mH

ABB   - 24 -   **SYNCHROTACT Accessories**

Synchronizing instruments

Electromechanical instruments are commonly used if the synchronizing system provides a manual synchronization feature. Sometimes the instruments are used in automatic synchronizing systems for information only, e.g. for servicing purposes. This case can also be covered by the SYNCHROTACT® 5 PC-tool 'SynView'.

Options

	Option	Code
w	Nominal voltage	1 $100/\sqrt{3}$ = 57.7 V 2 $110/\sqrt{3}$ = 63.5 V 3 $115/\sqrt{3}$ = 66.4 V 4 $120/\sqrt{3}$ = 69.3 V 5 100 V 6 110 V 7 115 V 8 120 V
x	Nominal frequency	5 50 Hz 6 60 Hz
y	Labeling	1 Standard labeling 2 Labeling according to separate specification
z	Size	0 96*96 mm 1 144*144 mm

Ordering details

Designation		Type	Part no
Double volt meter		SYN 5U96-wxy0 SYN 5U144-wxy1	3BHE022'313Rwxy0 3BHE022'313Rwxy1
Double frequency meter		SYN 5F96-wxy0 SYN 5F144-wxy1	3BHE022'314Rwxy0 3BHE022'314Rwxy1
Synchroscope		SYN 5S96-wxy0 SYN 5S144-wxy1	3BHE022'315Rwxy0 3BHE022'315Rwxy1

General technical data

Isolation		IEC 60255-5	2 kV
Temperature range		Operation	-25 °C to +40 °C
		Storage	-25 °C to +65 °C
Relative humidity			≤75 % annual average, no condensation
Shock			15 g, 11 ms
Vibration			2.5 g, 5 to 55 Hz
Protection degree	casing	IEC 60529	IP 54
	connections	IEC 60529	IP 00
Dimensions width * height * installation depth		Size 96	96 * 96 *115 mm
		Size 144	144 * 144 * 164 mm
Front frame		96 / 144	96 mm / 144 mm
Casing		96 / 144	90 mm / 136 mm
Panel cut-out		96 / 144	$92^{+0,8}$ mm / 138^{+1} mm

ABB   - 25 -   **SYNCHROTACT Accessories**

Fixing   Screw clamps
Electrical connections   Screw-type terminals

Technical data double volt meter
Measuring range voltage   0 to 120 % Un
Scale arrangement   vertical
Power consumption   with Un ≤ 110 V   96: 2*<2 VA / 144: 2*<2.3 VA
Accuracy   Class 1.5
Weight   96 / 144   1.2 kg / 1.5 kg

Technical data double frequency meter
Measuring range frequency   fn ±5 Hz
Number of reeds   2*21
Measuring range voltage   0 to 120 % Un
Scale arrangement   vertical
Power consumption je Messwerk   with Un ≤ 110 V   2 * <1.1 VA
Accuracy   Class 0.5
Weight   96 / 144   0.65 kg / 1 kg

Technical data synchroscope
Voltage range   0.9*Un to 1.1*Un
Overload limit   1.2*Un
Power consumption   with Un ≤ 110 V   <4.0 VA (line side)
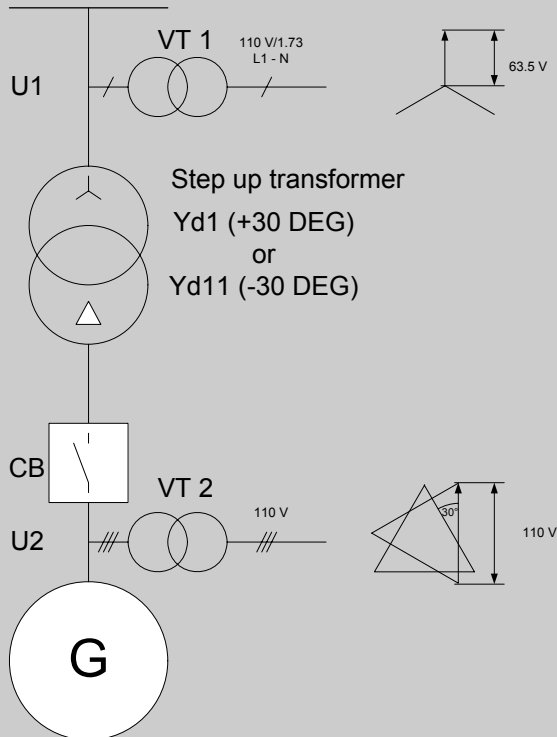   <0.7 VA (generator side)
Weight   96 / 144   1.0 kg / 1.8 kg

Connection diagram

3BHS 901 067 E

ABB   - 26 -   **SYNCHROTACT Accessories**
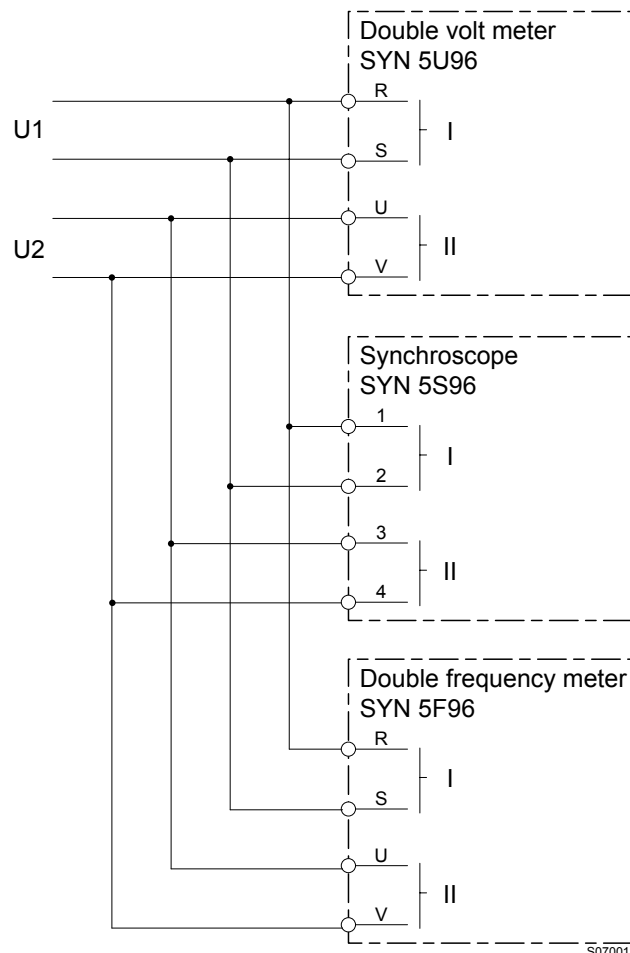
Adaptation and compensation VT's

When are adaptation or compensation VT's needed?

- If the two nominal measuring voltages are out of admissible range (50 to 130 VAC).
- If the two nominal measuring voltages are different. With the types SYN 5200 and SYN 5201, differencies of the nominal values up to 10 % can be tuned by parameter setting.
- If there is a step up transformer between measuring VT and circuit breaker, which shifts the phase by a fixed value, it can be compensated with types SYN 5200 and SYN 5201. With the types SYN 5100, SYN 5202, SYN 5302, or with the use of electromechanical synchronizing instruments, compensation VT's shall be used in order to compensate the phase shift.

Hints to select compensation VT's

If possible the compensation should be done in a way that a single phase compensation VT is required only:

VT 1   110 V/1.73
        L1 - N
U1

63.5 V

Step up transformer

Yd1 (+30 DEG)
or
Yd11 (-30 DEG)

CB

VT 2   110 V
U2

110 V

G

If there is a step up transformer between measuring VT and circuit breaker, the connection group is usually Yd1 (+30 DEG) or Yd11 (-30 DEG).

With the appropriate selection of the phases, the phase shift can be compensated without any additional components. In this example the compensation of the amplitude by factor $\sqrt{3}$ remains. This can be done by a single phase compensation VT.

In order to achieve higher accuracy, especially if higher load (synchronizing instruments) is connected, the compensation should be carried out on the generator side.

If a three phase compensation is inevitable, 3 single phase VT's have to be selected which will then be connected according to the needs. Be aware that the single phase ratio has to be calculated.

Ordering details

Designation	Type	Part no
Single phase VT	SYN 5T66-0001	3BHE024'870R0001

Dimensioned drawing / connection diagram
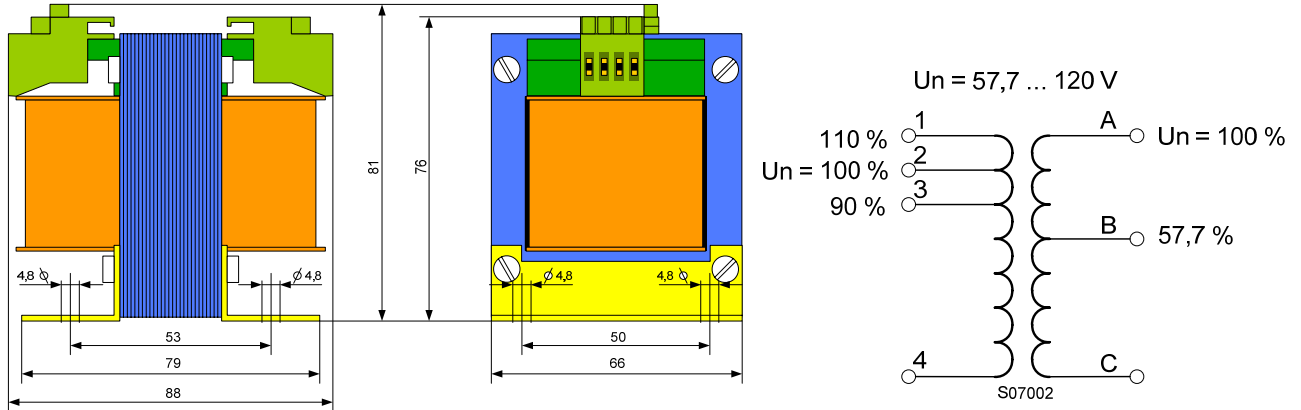
Examples

Example	Ratio	Connection	Example	Ratio	Connection
100 V -> 100 V 110 V -> 110 V 120 V -> 120 V 63,5 V -> 63,5 V 57,7 V -> 57,7 V	1	**2-4** **A-C**			
110 V -> 100 V	0,909	**1-4** **A-C**	100 V -> 110 V	1,1	**A-C** **1-4**
100 V -> 57,7 V 110 V -> 63,5 V 120 V -> 69,3 V	$1/\sqrt{3} = 0{,}577$	**2-4** **B-C**	57,7 V -> 100 V 63,5 V -> 110 V 69,3 V -> 120 V	$\sqrt{3} = 1{,}73$	**B-C** **2-4**
100 V -> 63,5 V	$1{,}1/\sqrt{3} = 0{,}635$	**3-4** **B-C**	63,5 V -> 100 V	$\sqrt{3}/1{,}1 = 1{,}57$	**B-C** **3-4**
110 V -> 57,7 V	$1/(1{,}1*\sqrt{3}) = 0{,}525$	**1-4** **B-C**	57,7 V -> 110 V	$1{,}1*\sqrt{3} = 1{,}91$	**B-C** **1-4**

Technical data

Nominal voltage range primary & secondary		57.7 to 120 VAC
Accuracy / power w/o synchronizing instruments		Class 1 / 0.05 VA
Accuracy / power with synchronizing instruments		Class 2 / 4 VA
		Class 5 / 7.5 VA
Dimensions	w * h * d	66 * 81 * 88 mm
Weight		1.0 kg

SYNCHROTACT®
Synchronizing systems

SYNCHROTACT CSS

ABB   - 30 -   **SYNCHROTACT CSS**
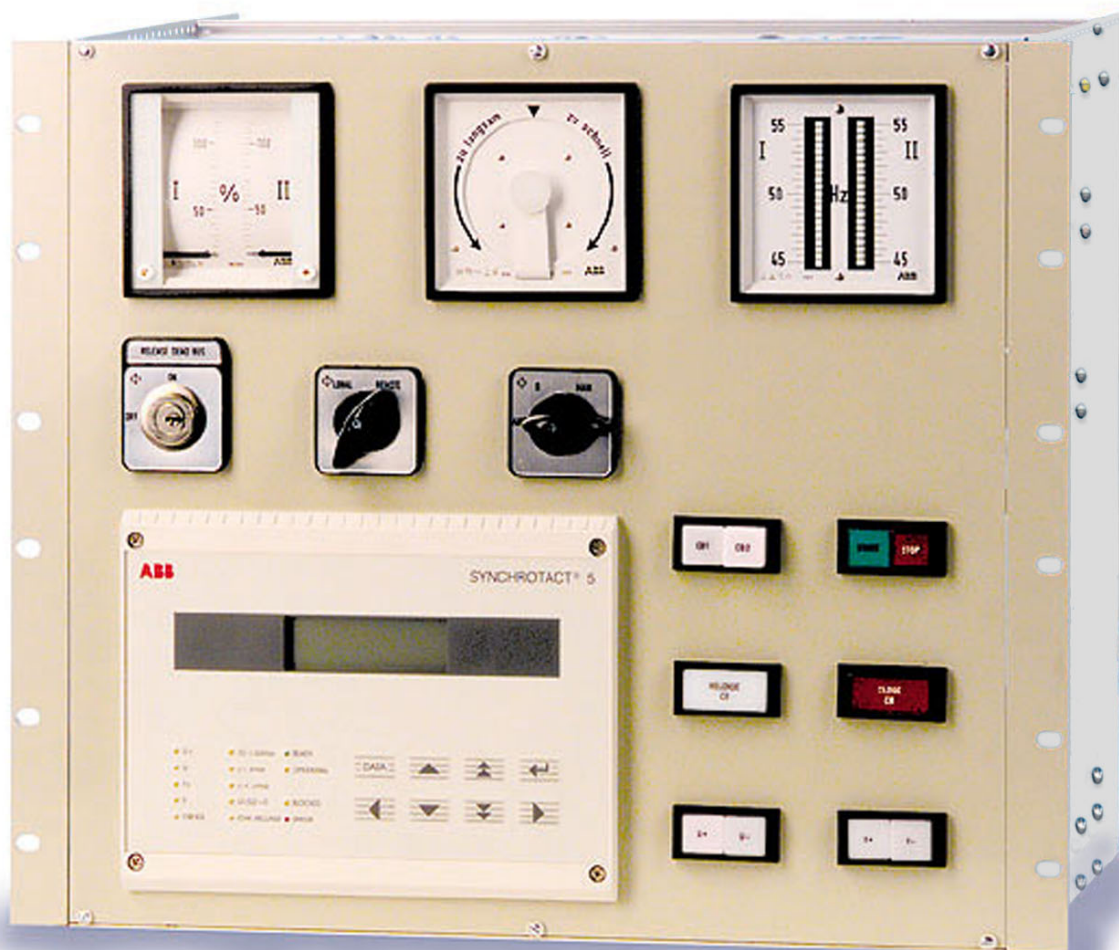
Application

The use of the already planned and tested synchronizing system saves all project planning costs and inreases the safety of the plant. SYNCHROTACT® CSS only needs to be installed, connected and commissioned.

The system uses the proven and reliable SYNCHROTACT® 5 - components and is suitable to be built into a 19"-frame.

To ensure high availability of the plant SYNCHROTACT® CSS consists of a fully automatic and an independent manual synchronizing.

Different versions are available either for one or for two circuit breakers and both either in single or dual channel configuration.

The PC software SynView which is included with the delivery allows commissioning to be carried out quickly and simply.

Functionality

SYNCHROTACT® CSS supports the following operating modes, which can be selected by means of a selector switch.

- **Operating mode AUTO**: generator voltage and frequency are automatically matched by the synchronizing equipment. The circuit breaker will be closed subsequently and exactly with phase-coincidence, taking the breaker closing time into consideration.

- **Operating mode MAN**: the functions are carried out manually by means of push buttons on the front panel. The necessary values are displayed on the synchronizing instruments. The paralleling command is issued by holding down the releasing button and pushing the command button if phase-coincidence is reached.

- Die **Operating mode TEST** is identical with the AUTO-mode, except the paralleling command which is not sent to the circuit breaker but displayed by the system only.

With models for **two circuit breakers** the paralleling point has to be selected by means of the appropriate selector switch before the synchronizing process is started.

By releasing by means of a key switch, the circuit breaker can be closed even if one or both measuring voltages are dead (**Dead bus**).

Changing the control mode selection from «**local**» to «**remote**» allows to use automatic synchronizing from remote location.

Versions

Type	Function	Symbol
CSS-1100	Single channel system for one circuit breaker	
CSS-1200	Single channel system for two circuit breakers	
CSS-2100	Dual channel system for one circuit breaker	
CSS-2200	Dual channel system for two circuit breakers	

Ordering details

CSS - Type:	Single/dual channel system and 1/2 circuit breaker
Auxiliary voltage:	Nominal value
Measuring voltage:	Primary/Secondary nominal values and nominal frequency
Synchronizing instruments:	Labelling: primary, secondary or percentage values and language

Example:

SYNCHROTACT CSS-2100 Auxiliary voltage: 110 VDC Measuring voltage: 11kV/110 VAC, 50 Hz Synchronizing instruments: primary values; english	Dual channel synchronizing system for one circuit breaker Auxiliary voltage: 110 VDC and measuring voltage primary 11 kV, secondary 110 V and 50 Hz nominal frequency Double voltmeter labelled with primary values and synchroscope labelled in english

Technical Data

Auxiliary voltage

Nominal voltage range	110 to 220 VAC/VDC
Permissible voltage range	85 to 265 VAC
	85 to 375 VDC
Maximum power consumption	25 W/35 VA

Measuring inputs

Nominal voltage range	50 to 130 VAC
Voltage range	0 to 110 % Un
Nominal frequency	$16^2/_3$, 50, 60 Hz
Frequency range	10 to 100 Hz

OUTPUTS and PARAMETER SETTING RANGES
Refer to SYNCHROTACT 5

ENVIRONMENTAL VALUES

Isolation

Dielectric test	IEC 60255-5	2 kV
Impulse voltage withstand test	IEC 60255-5	5 kV

Temperature ranges

Transport/storage	-25 to +65 °C
Operation	-25 to +40 °C

Interference immunity/transmission (EMC)
Refer to SYNCHROTACT 5

RELEVANT STANDARDS

CE conformity

EMC directive:	89/336/EEC	
Generic standard	EN 50081-2	Emission
	EN 50082-2	Immunity
Low voltage directive:	73/23/EEC	
Safety of information technology equipment	EN 60950	

Product standards

Measuring relays & protection equipment	IEC 60255-6

CONSTRUCTION DATA

Protection type according to IEC 60529

Front	IP 50
Rear	IP 00

Dimensions

Width*height*depth	482*399*297 mm

Weight

Depending on the version	15 to 16 kg

SYNCHROTACT®

Synchronizing systems

SYNCHROTACT MSP

ABB   - 34 -   **SYNCHROTACT MSP**

Application

SYNCHROTACT® MSP (Modular Synchronizing Panel) is a modular synchronizing system to synchronize generators and to parallel lines, built into a cubicle.

The measuring and metering feature, which is available in addition to the synchronizing system uses space conditions and already available signals in an optimum way.
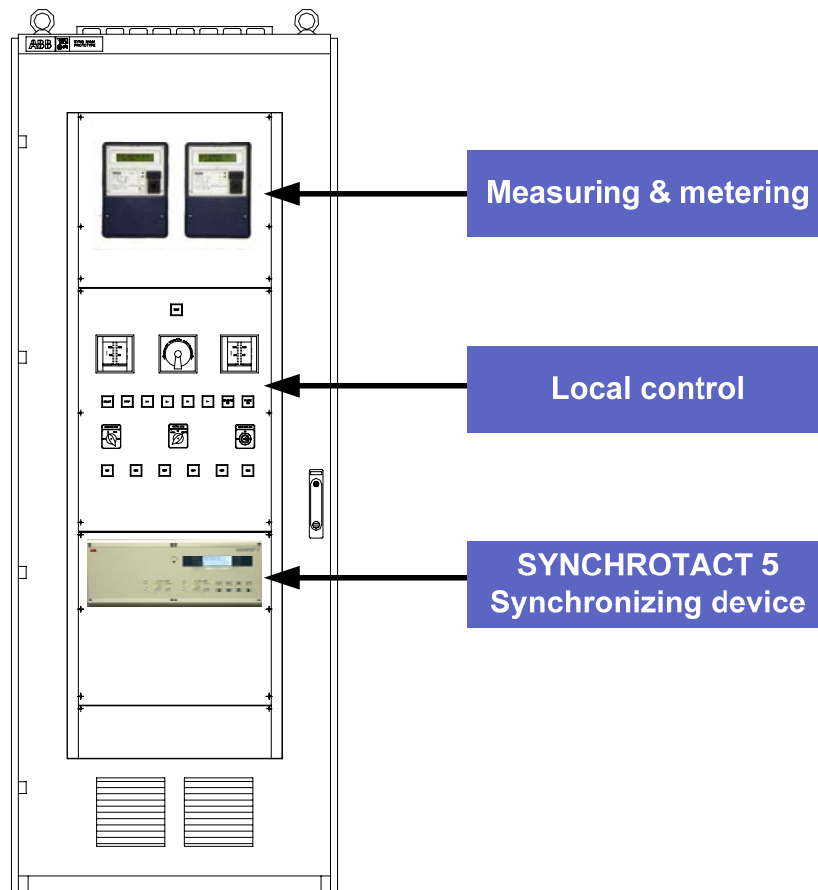
The SYNCHROTACT® MSP includes:

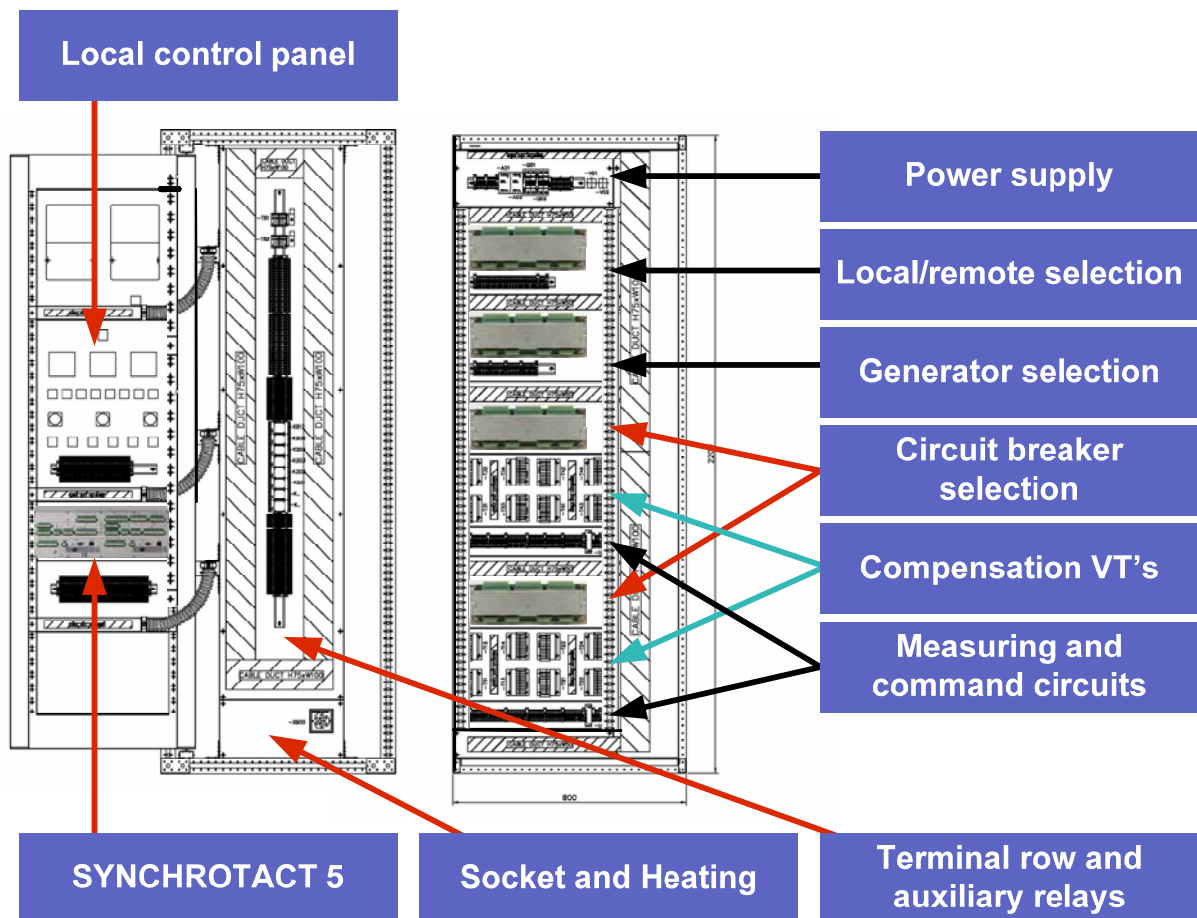### SYNCHROTACT 5 Synchronizing system
- Automatic single or dual channel synchronizing system
- Manual synchronizing by means of a synchrocheck
- Local control panel

Electrical measuring and metering system
- Measuring system using transducers
- Metering system using power and energy meters

Measuring & metering

Local control

SYNCHROTACT 5 Synchronizing device

ABB   - 35 -   **SYNCHROTACT MSP**

Functionality of Synchronizing

Local control panel

Power supply

Local/remote selection

Generator selection

Circuit breaker selection

Compensation VT's

Measuring and command circuits

SYNCHROTACT 5

Socket and Heating

Terminal row and auxiliary relays

The system uses the proven and reliable SYNCHROTACT® 5 - components. Basically the synchronizing part includes an automatic and a redundant synchronizing feature (automatic or manual).
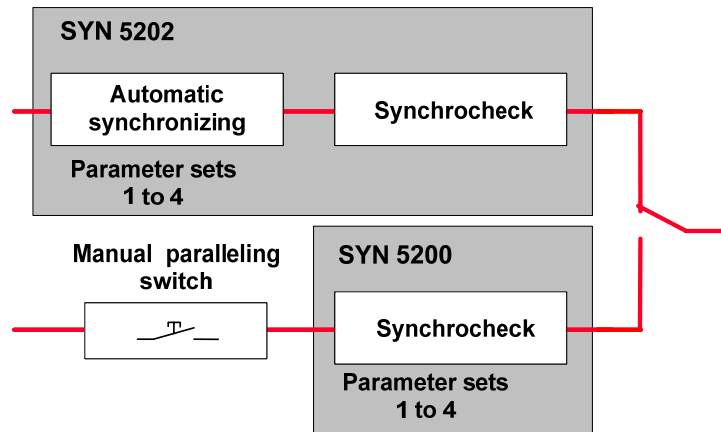
The modular concept allows to adapt the synchronizing system individually. The following options are available:

1. Safety: single or dual channel solutions

2. Availability: redundant manual synchronizing or redundant automatic synchronizing or both

3. Number of circuit breakers to be synchronized: 1 to 4 CB's, one or more of them may be generator breakers

4. Power supply: in case of a redundant synchronizing, the power supply on the cubicle entrance can be redundant too.

5. Control: The control of the synchronizing is possible from remote in any case. An alternative local control is available as an option.

6. Adaptation of the measuring voltages: especially with synchronizing of several circuit breakers it may occur that the two secondary voltages have different amplitudes and phase angles with closed circuit breaker.

**ABB**　　　　　　　- 36 -　　　　　　　**SYNCHROTACT MSP**

Synchronizing concept

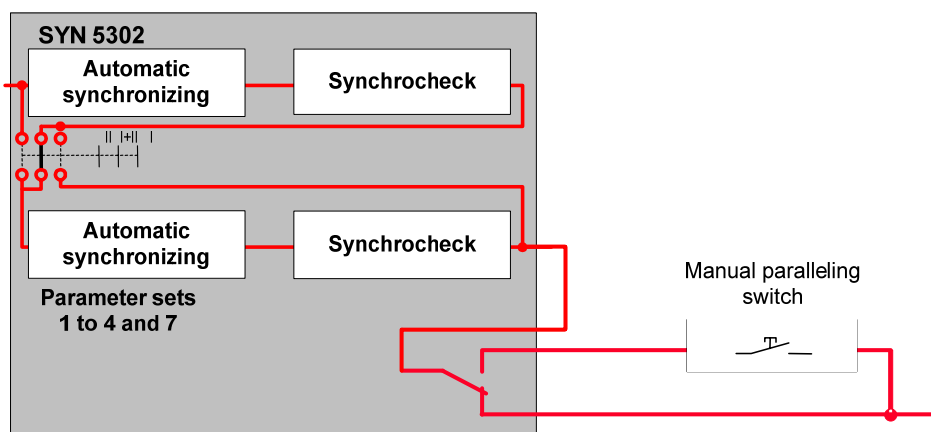Regarding availability, different solutions are possible:

Automatic synchronizing (sketch shows dual channel version) including separate synchrocheck for redundant manual synchronizing (with its own hardware and power supply)

SYN 5202

Automatic synchronizing — Synchrocheck

Parameter sets
1 to 4

Manual paralleling switch

SYN 5200

Synchrocheck

Parameter sets
1 to 4

Automatic synchronizing (sketch shows dual channel version) using parameter set 7 as synchrocheck for manual synchronization.

SYN 5202

Automatic synchronizing — Synchrocheck

Parameter sets
1 to 4 and 7

Manual paralleling switch
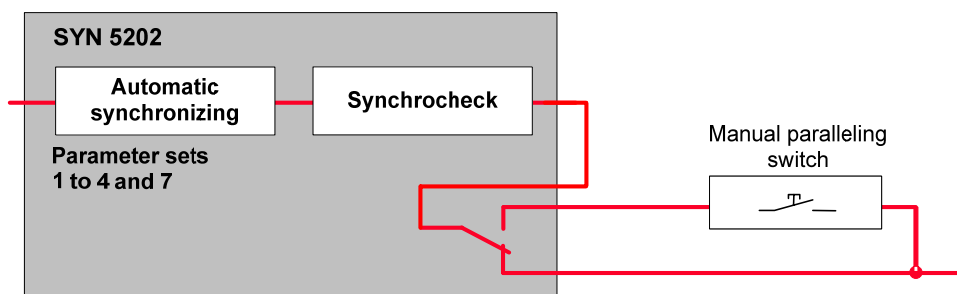
Redundant, automatic dual channel synchronizing with the additional possibility of a manual synchronization (using parameter set 7)

SYN 5302

Automatic synchronizing — Synchrocheck

Automatic synchronizing — Synchrocheck

Parameter sets
1 to 4 and 7

Manual paralleling switch

The PC software SynView which is included with the delivery allows commissioning to be carried out quickly and simply.

The dead bus function, i.e., connection of voltage-free lines is possible in any case. Each individual situation can be included or excluded individually by parameter setting.

3BHS 901 067 E

Functionality Measuring and Metering
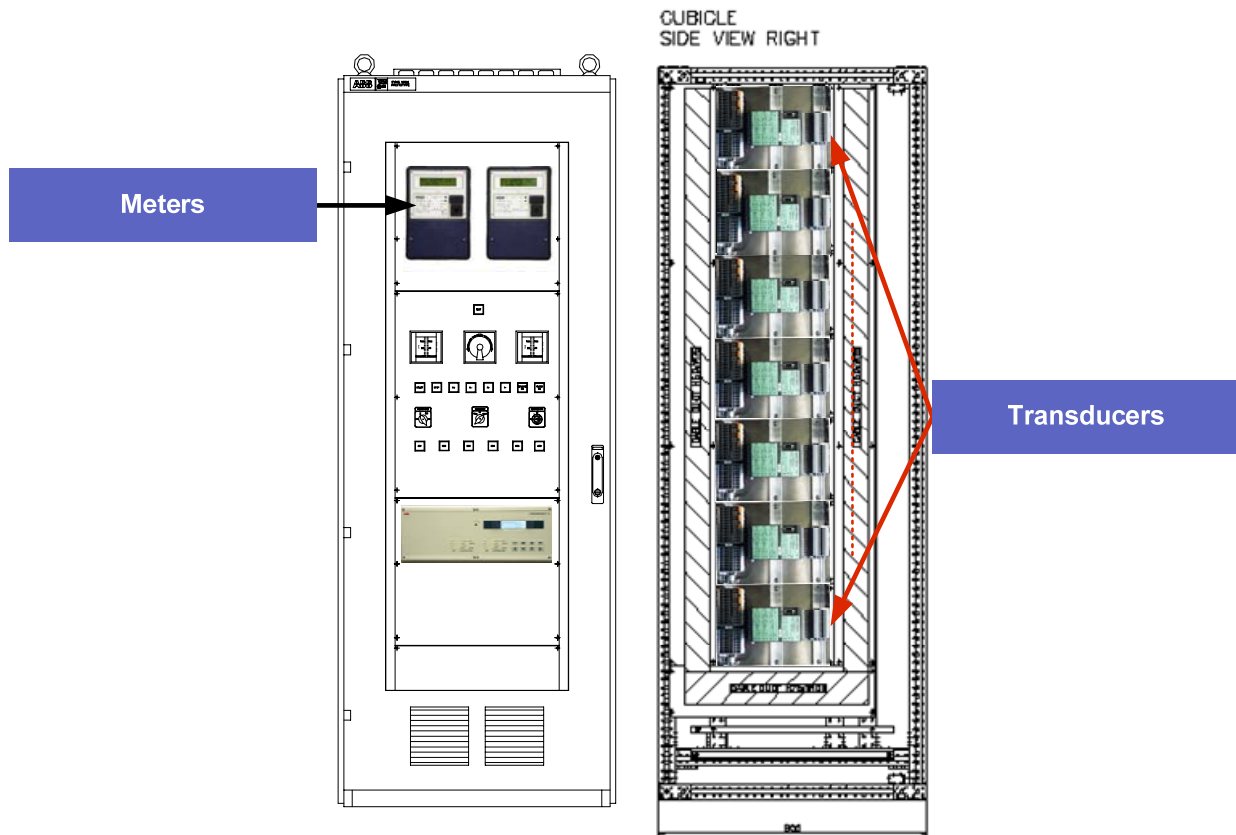
The measuring and metering part is available as an option. 3-phase voltage and current signals of a measuring point (e.g. gnerator, UAT, high voltage side) are used for measuring and metering.

The values calculated from these signals can be locally displayed or are available as output signals.
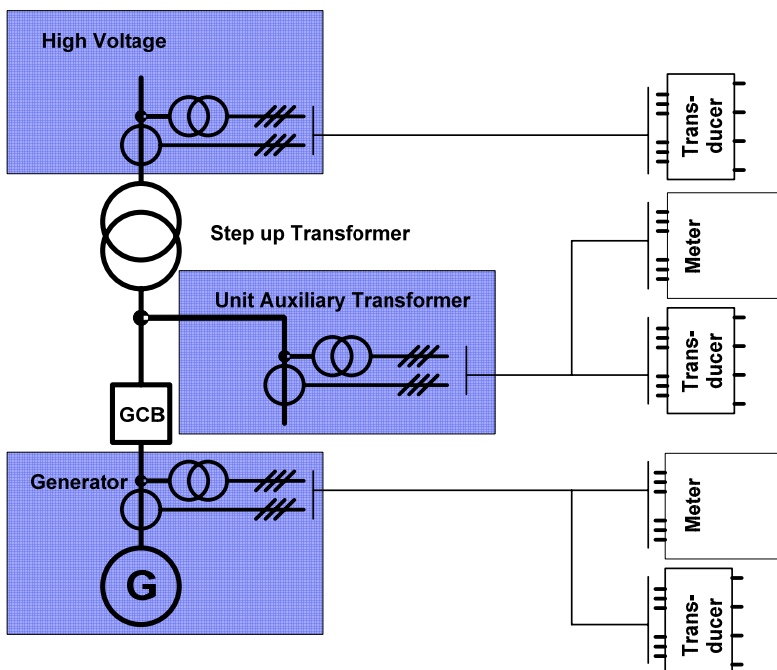
Up to seven programmable transducers with a three phase current and voltage input each, as well as four analog outputs to display P, Q, S, U, I, f, pf

Up to four multifunctional power meters with a three phase current and voltage input each, as well as four analog outputs to display P, Q, S, U, I, f, pf; accuracy class 0.5

Up to two energy meters with a three phase current and voltage input each; display of P, Q, S; accuracy class 0.2, 0.5 and 1.0; certified for clearing purposes

3BHS 901 067 E

ABB - 38 - **SYNCHROTACT MSP**

Technical Data

INPUTS

Auxiliary voltage

Nominal voltage range	110 to 220 VAC/VDC
Permissible voltage range	85 to 265 VAC
	85 to 375 VDC
Maximum power consumption	100 W/VA

Measuring inputs U1, U2 synchronizing

Nominal voltage range	50 to 130 VAC
Voltage range	0 to 110 % Un
Nominal frequency	$16^2/_3$, 50, 60 Hz
Frequency range	10 to 100 Hz

Digital inputs

Interrogation voltage for digital inputs	24 VDC

OUTPUTS

Paralleling relays

Maximum contact voltage	250 VAC/VDC
Limiting continuous current	10 A
Maximum switching power ON AC/DC	1500 VA/W
Maximum switching power OFF AC/DC (resistive)	1500/150 VA/W

Adjusting command and signaling relays

Maximum contact voltage	250 VAC/VDC
Limiting continuous current	1.5 AAC/ADC
Maximum switching power ON/OFF AC/DC	50 VA/W

Transducers

Range	4 to 20 mA

PARAMETER SETTING RANGES
Refer to SYNCHROTACT 5

ABB   - 39 -   **SYNCHROTACT MSP**

ENVIRONMENTAL VALUES

Isolation

Dielectric test	IEC 60255-5	2 kV
Impulse voltage test	IEC 60255-5	5 kV

Temperature ranges

Transport/storage	-10 to +70 °C
Operation	+5 to +55 °C

Electromagnetic compatibility

Emission	acc. to CISPR 11
Immunity	acc. to IEC 61000-4

RELEVANT STANDARDS

CE-conformity

EMC-Directive	89/336/EEC	IEC 61326
LV-Directive	73/23/EEC	IEC 60439-1

Product standards

Measuring relays and protection equipment	IEC 60255-6	EMC
Product standard for measuring relays and protection equipment	EN 50263	
Transducer and meter	IEC 61326 IEC 61010	EMC

CONSTRUCTION DATA

Protection type according to IEC 60529

Closed cubicle	IP 54

Dimensions

Width*height*depth	800*2200*800 mm

Weight

Depending on the version	350 to 400 kg

Installation height

<1000 m above sea level

Our services - your benefit!

- Product training courses

- Complete advisory and engineering services for system deliveries

- Installation

- Commissioning, maintenance and servicing

- Repair and spare parts service

- Disposal service

You can obtain information on individual solutions from your local ABB representative or directly from the manufacturer!

ABB

We reserve the right to change in the interest of technical development