

Synchroniser – Relay SYN-7



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1 General Remarks

The synchroniser relay SYN-7 adjusts voltage and frequency of a generator to the mains, in order to connect it to the mains at a minimum of frequency and voltage deviation, and with identical phasing. Depending on its configuration, the SYN-7 is monitoring sense of rotation, voltage difference and asymmetry.

Voltage measurement is done as 2-, 3- or 4- conductors measurement, according to the respectively preset parameterisation. Frequency measurement generally is carried out on L1 and L2. In island mode, the desired frequency and voltage are internally set by the device. A separate variant of the SYN-7 is available for measuring voltages ≤ 100 V.

For parameterisation of SYN-7 it's recommended to use of the supplied parameterisation software 'Device Manager', which is also available on website of the manufacturers www.koralewski.de (download of the current version).

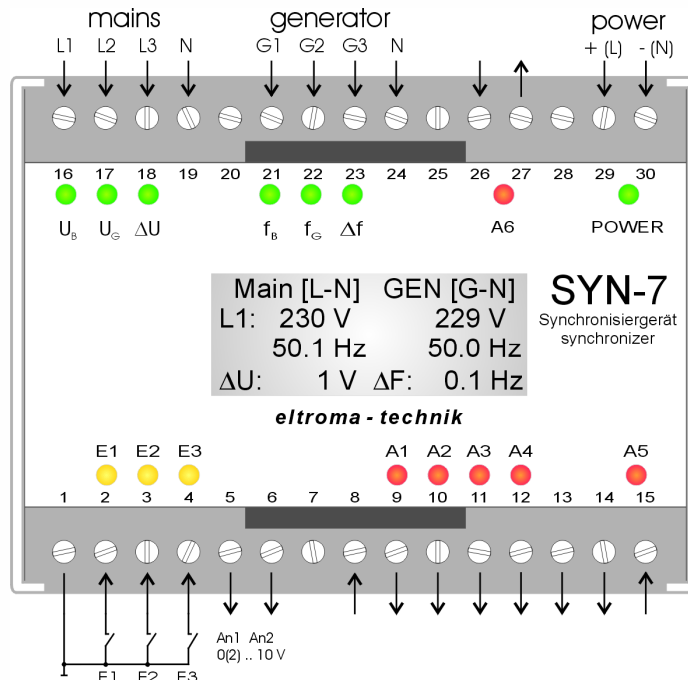


Note: Depending on the version of the used parameterisation software (device management) the, in this context used images of this document may differ from the actually appearance within the software.

2 Operating Principle

The synchroniser relay captures the voltage and frequency of two AC mains by means of a differential amplifier. The measurement can be configured either for 2-, 3- or 4- conductors systems (3 phases + N). If synchronisation is allowed via the release input (E1 standard), the device generates adjustment impulses for the generator voltage and the generator frequency. The pulse length is internally generated; the pause length (pulse frequency modulation) is determined by the deviation to the setpoint. Pulse width modulation is in preparation. The target point of the controlling is always the middle between Delta Fmin and Delta Fmax.

If the release input (ex works setting: E1) is active, and voltage and frequency of the generator are within the set tolerances to the leading mains, a synchronous impulse is generated at parallelism of phases. In order to compensate delays of the switching elements, the output of synchronous impulse occurs the lead time prior to the calculated time point of synchronisation. The LEDs ΔU and Δf will only be activated, if synchronisation is released.



After a failure of one of the measuring voltages, voltage and frequency are regulated on return of the voltage. The first synchronous impulse will be given at the earliest after 2 seconds.

Measuring values can be output to recorders, respectively correcting variables can be output to controllers via analog outputs (0/2 ... 10 V - optionally orderable).

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2.1 Isolated Operation (Firmware Version V1.14 or higher)

If the isolated operation input (standard E2) is released, the generator frequency is regulated by an internally leading frequency (isolated operation). In isolated operation, frequency-control and voltage-control can be independently adjusted, respectively activated / deactivated, to leading frequency and nominal voltage.

The nominal frequency, the actual frequency, generator voltage as well as ΔF or ΔU can be shown on device's display. A corresponding LED indicates, whether the respective values are within the set range.

The isolated operation input is subordinated to the release input, that means synchronisation takes place if both inputs are actuated at the same time.

During isolated operation, the frequency will only be controlled outside of the window 'leading frequency + dead zone'. Whilst the generator frequency moves within this window, no frequency-adjusting pulses are outputted.

2.2 Usage as a locking Relay

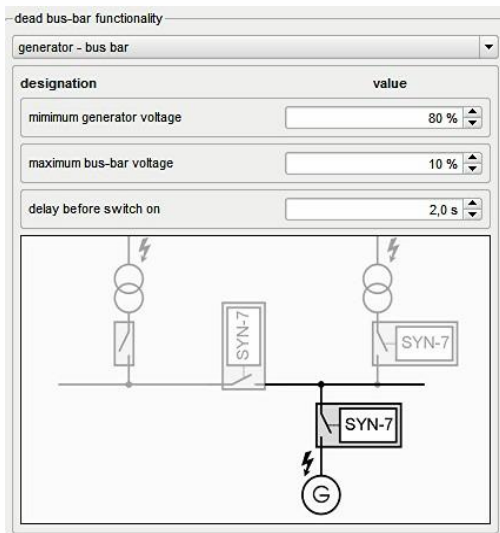
The SYN-7 can also be used as a locking relay. This functionality is activated via the device manager. Synchronisation is locked if the difference between the phase angles of generator and leading mains is outside of an adjustable permissible value. Relevant settings and measuring values of this are the phase-window 'Delta Phi max' as well as frequency- and voltage-difference.

2.3 Switching onto Dead Bus-Bar (Firmware Version V1.13 or higher)



Note: In order to use the dead bus-bar functionality, the parametrisation-software **Geräteverwaltung 2** (device management GV_2.exe), version **V2.36_5.0.0** or higher, is required.

The SYN-7 can be parameterised in a manner, that a switching onto a so called dead bus-bar, that is a not energised bus-bar of the leading mains, is possible. This function has to be activated separately. If this function is activated, one of three different methods can be selected.

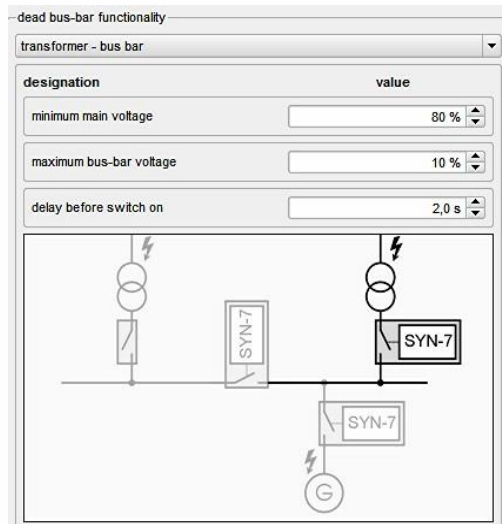


2. Transformer to dead bus bar

The switching-on takes place to the not energised bus-bar of the generator net (figured right).

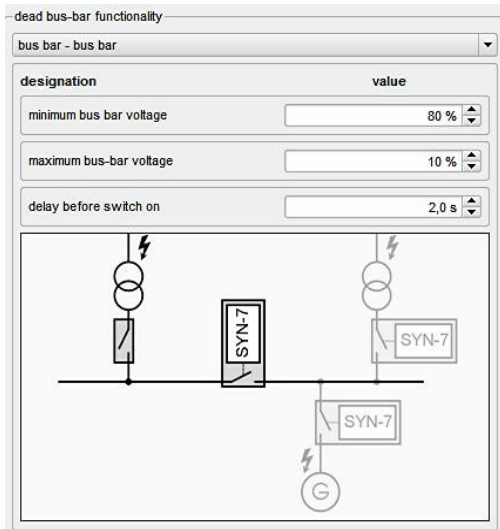
1. Generator to dead bus bar

The switching-on takes place to the not energised bus-bar of the leading mains (figured left).



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3. Dead bus bar to dead bus bar (figured left)

The switching-on can be done as well to the not energised bus-bar of the leading mains, as to the not energised bus-bar of the generator net.

The function "dead bus-bar active" may be assigned to an output (see chap. 4.2 – function No 22).

Three parameters are configurable for the dead bus-bar functionality:

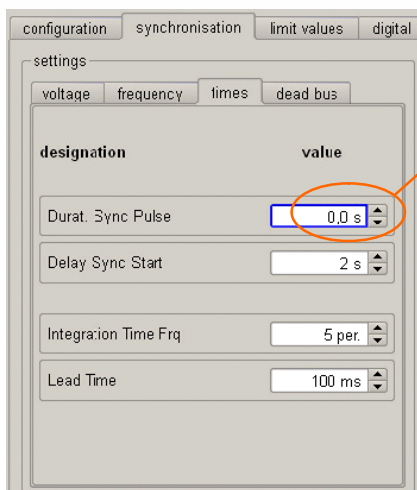
- maximum bus-bar voltage (in % of the nominal voltage)
- minimum generator voltage (in % of the nominal generator voltage)
- switching on delay (in seconds)

After the release of the synchronisation (see chap. 4.1 – function No 1), first the delay time for synchronisation (ex works setting: 2,0 s) elapses. After this time is elapsed, the switching on delay (ex works setting: 2,0 s) goes on. During this time lapse the SYN-7 checks, whether the mains voltage (all phases of the grid) is continuously below the adjusted limit value maximum bus-bar voltage (ex works setting: 10 %) and the generator voltage is continuously above the adjusted limit value for the minimum generator voltage (ex works setting: 80 %).

After the switch on delay time is elapsed, a sync pulse with the adjusted pulse length is emitted. When the sync pulse is ended, a new monitoring of 5 seconds starts and a once more a sync pulse will be emitted. This process will be repeated until either the synchronisation release is removed, or the limit value conditions for the activation of the "Dead Bus-Bar" are no longer met.

From firmware version V1.15 upwards, an output function for the controlling of a switching-on (see chap. 4.2 - function No 23) as both as locking relay and as synchroniser relay is supported. An output relay, which is parameterised with this function, is triggered according to the set guidelines, if the conditions are met (see above) and the synchronisation is released via a digital input (see Chap. 4.1).

2.4 Synchronisation Impulse as permanent Contact



The synchronisation impulse may also be output by the SYN-7 in form of a permanent contact.

The permanent contact setting is made by entry of the time '0,0 s' as duration for the synchronisation impulse (*setting via device management – see figure on the left*). With this setting, the relay picks up at the first synchronisation time point and remains tightened, until the synchronisation release is revoked.

3 Monitoring Functions

The SYN-7 features the option to activate various monitoring functions. The monitoring functions provide for the downstream control the possibility, to verify, whether voltage and frequency comply with the preset limit values, before a synchronisation release is granted.

3.1 Voltage Monitoring

With this setting for the SYN-7 the voltage range, in which the synchronisation shall be allowed, is specified. Values from 0 up to 150 % are adjustable here. In case of exceeding, respectively falling below preset limits, the associated relay is activated. The synchronisation impulse is output only, if measured values match the preset ΔU range.

The voltage monitoring can be deactivated using a configurable digital input.

3.2 Frequency Monitoring

With this setting for the SYN-7 the frequency range, in which the synchronisation shall be allowed, is specified. Herein values from 35.0 bis 65.0 Hz are adjustable. In case of exceeding, respectively falling below preset limits, the associated relay is activated. The synchronisation impulse is output only, if measured values match the preset Δf range.

The frequency monitoring can be deactivated using a configurable digital input.

3.3 Switching-on Release

With the two limit values switch-on voltage and switch-on frequency a general readiness for switching-on to the mains may be reported to the controller. The associated relay is activated when voltage and frequency of all measured phases lie above the preset values.

The switching-on release can be deactivated using a configurable digital input.

3.4 Impulse Monitoring

After a synchronisation release the SYN-7 monitors, whether a synchronisation impulse has been output within the preset monitoring period. If synchronisation does not occur within the preset time, the associated relay and the relay collective fault is activated. This message will automatically reset after 4 seconds. This procedure is repeated as long as the release input is closed and no synchronisation has occurred.

3.5 Release Monitoring

With this setting, the SYN-7 monitors the release period. If the release ongoing is set and not is reset, as expected after synchronisation, the associated relay as well as the relay collective fault will be triggered after the set time.

3.6 Delta F Monitoring

If Δf monitoring is activated, a synchronisation impulse will first be output, when the frequency control at least once has detected, that $f_g \geq f_n$, what means, that the frequency control is active. If this function is deactivated, the interconnection of transformers is possible.

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3.7 Collective Fault

The collective fault signal is composed of low voltage, high voltage, low frequency, high frequency and rotary field error, as well as impulse- and release-monitoring. If one of these events occurs, the associated relay is activated, if thus is configured.

3.8 Collective Fault 1 & 2

The signal 'collective fault 1' as well as 'collective fault 2' can be formed as independent compounded signal of low voltage, high voltage, low frequency, high frequency and rotary field error, as well as pulse- and release-monitoring using the device management. If one of this preselected events occurs, the corresponding relay will be activated, depending on its configuration.

Example:

voltage not OK or frequency not OK = collective fault 1
collective fault 1 = relay 5

This achieves Relay 5 to be activated, if one of both events mentioned above occurs.



Note: The output of an synchronisation impulse will always be prevented while the signal 'collective fault 2' is active.

4 Handling and Operation

The settings of the SYN-7 should expediently be done using the supplied parameterisation software 'device manager'. Here all available values can be set conveniently, and can be archived as well as printed out, referring to the respective device.

4.1 Digital Inputs

The SYN-7 features 3 digital inputs, which can each be assigned to one of the following functions:

No.	Function
1	synchronisation release (default E1)
2	isolated operation (default E2)
3	error reset (default E3)
4	disable voltage control
5	disable frequency control
6	disable switching-on
7	disable triggering (voltage & frequency control)
8	Δf release
9	synchronoscope (switchover display mode)
10	change language (switchover display mode)

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4.2 Digital Outputs

The SYN-7 features 3 groups of digital outputs (A1 – A4, A5 and A6) with in total 6 relays. These can be assigned the following functions:

No.	Function
1	pulse to adjust voltage lower (default A1)
2	pulse to adjust voltage higher (default A2)
3	pulse to adjust frequency lower (default A3)
4	pulse to adjust frequency higher (default A4)
5	ready for use (default A5 potential-free)
6	synchronisation pulse (fixed assigned to A6 potential-free)
7	voltage OK (X < U < Y)
8	voltage not OK (X > U > Y)
9	frequency OK (X < U < Y)
10	frequency not OK (X > U > Y)
11	voltage and frequency OK
12	switching-on enabled
13	rotary field error
14	input 1
15	input 2
16	input 3
17	collective fault
18	collective fault 1
19	collective fault 2
20	release error
21	sync pulse error
22	dead bus-bar active (firmware version V1.12 or higher)
23	bus-bar not energised (firmware version V1.15 or higher)

4.3 Analogue Outputs (optionally available)

The SYN-7 features two 0 (2) ... 10 V outputs, which optionally can be assigned to various functions. Current outputs 0 (4) ... 20 mA are not supported. In case of 0 (4) ... 20 mA applications adequate converters are needed.

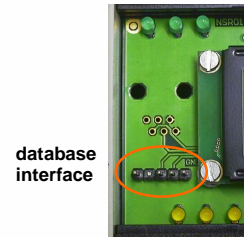
No.	Function
1	voltage L1-N (standard An1)
2	voltage L2-N (standard An2)
3	voltage L3-N
4	voltage L1-L2
5	voltage L2-L3
6	voltage L3-L1
7	frequency L1
8	frequency L2
9	frequency L3

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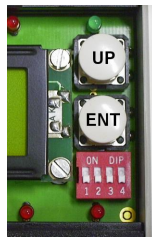
4.4 Communication Interfaces

The SYN-7 features standardly an RS-232 interface (database interface) for the configuration. A second interface is available on customers request. Here alternatively is an RS-232 or RS-485 version available.

For this, transfer protocols according to customer request can be created. For example: Modbus, RK-512, ...



4.5 Display



The SYN-7 features a range of display text images. The standard text image (standard-display) is selected using the device manager. Scrolling through the various text images is done by using the UP button. After scrolling through the text images, the SYN-7 returns back to the pre-selected standard-display after the view reset time, which is configured by the device management. If this time is set to the value 0 s via device management, the last selected text image remains until devices reset. This may be particularly useful for startup of plant.



The following text images will be displayed by scrolling with the UP button:

Main [L - N]	Gen [L - N]
L1: 231 V	230 V
50.0 Hz	50.1 Hz
ΔU: 1 %	ΔF 0.1 Hz

text image 1

Main [L - L]	Gen [L - L]
L: 399 V	402 V
50.0 Hz	50.1 Hz
ΔU: 3 %	ΔF 0.1 Hz

text image 1

Main	[L - N]
L1: 231 V	50.0 Hz
L2: 230 V	50.0 Hz
L3: 232 V	

text image 2

Main[[L - L]
L1: 401 V	50.0 Hz
L2: 400 V	50.0 Hz
L3: 398 V	

text image 3

Generator	[L - N]
L1: 228 V	50.0 Hz
L2: 230 V	50.2 Hz
L3: 231 V	

text image 4

Generator	[L - L]
L1: 398 V	50.0 Hz
L2: 401 V	50.0 Hz
L3: 400 V	

text image 5

Main [L-N]	Gen [L-N]
L1: 101 %	G1: 98 %
L2: 99 %	G2: 102 %
L3: 100 %	G3: 99 %

text image 6

Main [L-L]	Gen [L-L]
L1: 100 %	G1: 99 %
L2: 99 %	G2: 101 %
L3: 101 %	G3: 99 %

text image 7

L1: 231 V	50.0 Hz
G1: 230 V	50.1 Hz
<< 0 >> 15°	
██████████>██████████	

text image 8

Note: If one of the digital inputs is configured with the function synchronoscope or synchronisation release (standard E1 - see chap. 4.1), the device display switches over automatically to 'synchronoscope' (text image 8) while a signal is applied to this input.

4.6 Language Selection

Basically the display texts of device are available in two languages. The standard ex works is german (factory default) and english, between which the user can choose when creating a device specific database. Additional languages, suitable to the customers requirements, can be configured and made available, by means of the device management.

Switching between the two display languages, which are stored within the device, can be done either using the device management, the switch DIL-3, or via an appropriate configured input. If DIL-3 or the appropriate input closes, then the device switches over to the 2nd language.

Netz [L - N]	Gen [L - N]
L1: 231 V	230 V
50.0 Hz	50.1 Hz
ΔU: 1 %	ΔF 0.1 Hz

1st language

Main [L - N]	Gen [L - N]
L1: 231 V	230 V
50.0 Hz	50.1 Hz
ΔU: 1 %	ΔF 0.1 Hz

2nd language

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4.7 Synchronisation Release

The release of the synchronisation is primarily done via the digital input, which is configured therefor. Further conditions may be set, for example:

- voltage monitoring
- frequency monitoring
- rotary field monitoring
- delta f release

4.8 Settings

First, the nominal voltage of the installation as well as the converter ratios are to be checked. The corresponding values are to adjust, if necessary. Factory default setting for the nominal voltage of the installation (*not rated voltage of device!*) is 230 V. For the converter voltage (L-L) primary as well as secondary 230 V and '3-conductors + N - system' are adjusted ex works. The entering of voltage limit values is done solely as percentage, relative to the nominal voltage. Each limit value may be deactivated by entering the value '0', or activating the respective switch within the device manager.

The screenshot shows the 'settings' tab of the SYN-7 configuration interface. It is divided into several sections:

- display:** language (english), format (999 V), standard-display (mains [L-N] gen [L-N]), view reset time (10 s).
- transformer data:** primary and secondary mains and generator voltages, all set to 230 V.
- installation data:** nominal voltage (230 V), nominal frequency (50 Hz), and system type (3-wire + N - system selected).
- security:** parameter input lock (unchecked), parameterisation-PIN (1).
- rotary field:** monitoring active (unchecked).

Note: It is recommended to make the entry of all limit values with the device manager.

4.9 Voltage Indication / Transducer Factors

For a correct adjustment to the respective switching system the transformer ratios have to be entered. The input format is transducer voltage primary / transducer voltage secondary. The depiction of numbers of the devices display (format) is adjustable via the exponent for voltage indication.

exponent	display
-1	99.9 V
0	999 V
1	9.99 kV
2	99.9 kV (max. 30.0 kV [LL])

Main	[L - N]
L1: 231 V	50.0 Hz
L2: 230 V	50.0 Hz
L3: 232 V	

Exponent = 0

Main	[L - N]
L1: 15.5 kV	50.0 Hz
L2: 15.6 kV	50.0 Hz
L3: 15.5 kV	

Exponent = 2

For the star point voltage up to 17 kV maximum can be set. The setting for the phase-conductor voltage shall not exceed 30 kV. The input of higher values is possible as well, but this may lead to faulty indications or functions.

When setting the display option for the text display with the device management, the exponent is automatically adjusted internally. This setting has no effect on the triggering of limit values, which always are analysed on a percentage basis.



Note: The voltage phase to N may not exceed 270 V AC (480 V AC between two phases). Up to this voltage range the device may be connected directly. In case of higher voltages voltage converters must be connected upstream.

5 Measurement

The voltage measurement is a true effective value measurement. The three measuring paths of both networks are measured simultaneously, and frequency and phase relation are captured independently from each other.

5.1 2-Conductors – , 3-Conductors – and 3-Conductors + N – Systems

Measuring with or without star point may be selected by the choice of the measurement method. When measuring without star point it is not necessary to connect a neutral conductor. At measuring voltages ≤ 100 V, we recommend the SYN-7 in its 100 V - version.



Note: If the SYN-7 is used with a 2- or 3-conductors system, then the unneeded text images, which contain N - values, are not indicated on device's display.



Important: When using SYN-7 in 2-conductors - systems it is absolutely necessary, that the terminals L2 - L3 at the mains side, respectively the terminals G2 - G3 at the generator side are each bridged. Otherwise errors may occur in frequency measurement!

As with the SYN-6.2 it's possible to work with two 2-conductors networks. In this case, the functions rotary field detection and synchronisation on dead busbar (in preparation) must be disabled.

Behaviour at low voltages:

Due to the construction, the frequency measurement occurs only above of an input voltage phase-N of about 50 V. If the voltage ranges below this value, the unit works with the set parameters of nominal frequency (35 up to 65 Hz). A correct frequency measurement is indicated by the green LED f_{ok} near the connecting terminals.

5.2 Phase Voltage



The voltage measurement starts at a phase voltage of about 35 V phase – N.

Note: The voltage phase to N may not exceed 270 V AC (480 V AC between two phases). Up to this voltage range the device may be connected directly. In case of higher voltages voltage converters must be connected upstream.

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6 Parameterisation

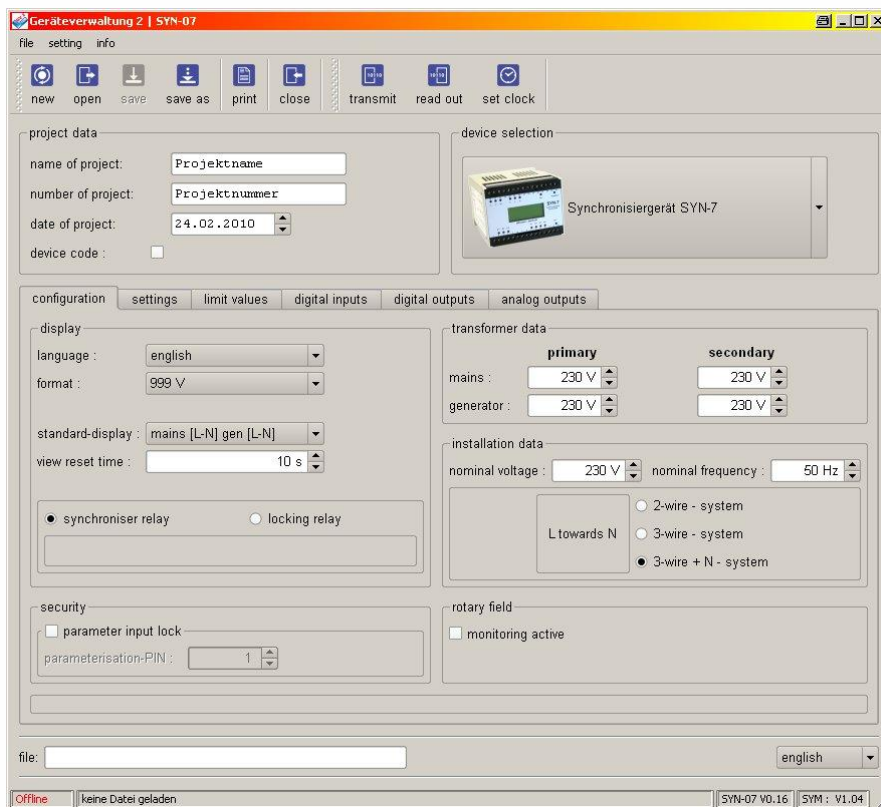
For a correct adjustment to each individual application, the parameterisation of the device is required. Before startup, trigger values, nominal voltage and transducer values have to be parameterised and adjusted. For parameterisation the use of the supplied, respectively for downloading on the manufacturers' homepage www.koralewski.de available parameterisation software 'device manager' is recommended. The modification of operating settings by direct input at the device is possible as well.



Note: To connect the data cable, which is required for parameterisation, to the database interface, respectively to carry out the input at the device, it is necessary to remove the front cover of the SYN-7 (see chap 4.4, 4.5 and 8). **Important:** Data transfer is only possible, if no synchronisation release (ex works setting: E1 – see chap. 4.1) is on.

6.1 Database

The setting values which are used by the SYN-7 and stored within the device, can be read out at any time from the device, stored on a PC and printed out for documentation purposes, using the parameterisation software 'device manager'. For detailed user instructions of device management, please refer the related user manual, available as download on the manufacturer's homepage www.koralewski.de.



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6.1.1 System Requirements

Minimum requirements:

- processor: Pentium or better
- random access memory: 512 MB
- CD- / DVD-ROM drive: 4x
- serial- or / and USB interface
- free harddisk capacity: min. 40MB
- graphics card / monitor: min. resolution 1.024 x 768 or higher
- operating system: Windows XP, Windows Vista, Windows 7, 8, 8.1 or 10

6.2 Editing at the Device

To enter parameters at the device it is necessary to close the switch DIL-2 (ON). Parameter data, listed in the tables on the following pages, have to be observed.

6.2.1 Protection of Input with PIN

synchronising Relay
SYN-7 English
PIN input : ___0

To protect the stored data a PIN - protection for input at the device may be activated using the device management. With activated PIN - protection inspection and altering of the setting values is possible only after entering of the correct PIN. For the PIN - code is a numeric value from 1 upto 9999 is required.

For the input of the PIN close DIL-2 and press ENTER - button. The cursor jumps to the last digit. The digit can be altered by actuating the UP - button. By pressing the ENTER - button, the cursor jumps to the next position. After all 4 digits have been adjusted the ENTER - button is one more time to actuate. If the PIN is entered correctly, the parameter input level is reached. At wrong PIN - entry the display jumps back to 0.

6.2.2 Parameter Setting

When closing DIL-2 (ON), one arrives into the parameterisation. The switching back of DIL-2 (OFF) will leave it. When leaving the parameterisation without finishing the current entry, the latest adjusted value is lost. The set values are permanently stored within the microcontroller. For this, no battery buffering is required.

6.2.3 Manually Selection of Tables

Within the parameters, first the table with the values to change has to be selected, using the UP - button. The table name is indicated in the second line of display. If the desired table is selected, the choosing is confirmed by pressing Enter.

The following tables are available:

edit Table No 1
Analog. Ausg. / OUT
scroll – UP
Choosing – ENT

- 1: analogue values
- 2: digitale outputs
- 3: digitale inputs
- 4: limit values
- 5: stored text (view only)
- 6: options
- 7: configuration
- 10: setting values

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6.2.4 Manual Editing

The selection of the line is done, as described above, by actuating the UP - Button. The designation of the selected value is shown in the third line. After selecting the line, the column selection is opened by pressing the Enter button. After selecting of the column, the editing starts in turn by pressing Enter. Depending on the value that shall be altered, 3 or more digits are to be entered (see also chap. 6.2.1). Editing is finished, when the cursor jumps back again to the selection of columns.

Analog. Ausg. / OUT
Line : 1
Analog 1
Column 3 : 255

6.2.5 Return to the Selection of Line respectively Table

The return to the respective superordinated selection is made by pressing and holding down (about 2 seconds) of the UP – button.

7 List of Parameters – Table Summary

Column	Analogue Assignment Table (Output x) Line 1 upto 2		Default
3	voltage range	255 (0 up to 10 V) or 0 (2 up to 10 V)	0
4	initial value	value at 0(2) V	0 %
5	final value	value at 10 V	100 %
7	function	see chap. 4.3 Analogue Outputs	X

Column	Relay Assignment Table (Ox RELx) Line 1 upto 5		Default
3	function	see chap. 4.2 Digital Outputs	X
4	switching behaviour	open circuit (0), closed circuit (255)	0

Column	Input Assignment Table (INx) Line 1 upto 3		Default
3	function	see chap. 4.1 Digital Inputs	X
4	switching behaviour	open circuit (0), closed circuit (255)	0

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Line	Limit Values Table (Grenzwerte / Limits)					Default			
	Function	Range	Hysteresis	Delay Periods	Duration (in 100 ms)	Value	Hyst.	Delay Periods	Duration (in 100 ms)
1	low voltage	0 ... 150 %	0...50 %	0 ... 100	0 ... 100	90 %	5 %	5	20
2	high voltage	0 ... 150 %	0...50 %	0 ... 100	0 ... 100	110 %	5 %	5	20
3	low frequency [1/10 Hz]	350 ... 650 (35 ... 65 Hz)	1 ... 20 (0.1-2.0 Hz)	0 ... 100	0 ... 100	492 (49.2 Hz)	2 (0.2 Hz)	5	20
4	high frequency [1/10 Hz]	350 ... 650 (35 ... 65 Hz)	1 ... 20 (0.1-2.0 Hz)	0 ... 100	0 ... 100	508 (50.8 Hz)	2 (0.2 Hz)	5	20
5	switching-on voltage	0..150%	0..50 %	0 ... 100	0 ... 100	80 %	5 %	5	20
6	switch.-on frequency [1/10 Hz]	350 ... 650 (35 ... 65 Hz)	0 ... 20 (0.1-2.0 Hz)	0 ... 100	0 ... 100	480 (48.0 Hz)	2 (0.2 Hz)	5	20
7	synchronisation pulse monitoring	0 ... 200 s	0 s	0 ... 100	0 ... 100	200 s	0 s	5	20
8	release monitoring	0 ... 200 s	0 s	0 ... 100	0 ... 100	200 s (deact.)	0 s	5	20
9	rotary field monitoring	180 °	5 ... 45 °	0 ... 100	0 ... 100	180 ° (deact.)	10 °	5	20



Note: If for any of the limit values a value of 0 is configured, then the monitoring of this value is turned off (limit value deactivated). If the duration (minimum of pulse duration before reset of the triggering) is set to a value of 0 s, no automatic reset takes place. Resetting the triggering has to be done manually (reset manually) in this case.

Column	Options Table Line 1	Default
3	dead bus-bar	aktivating the function = 1 (see chap. 2.3)
		0

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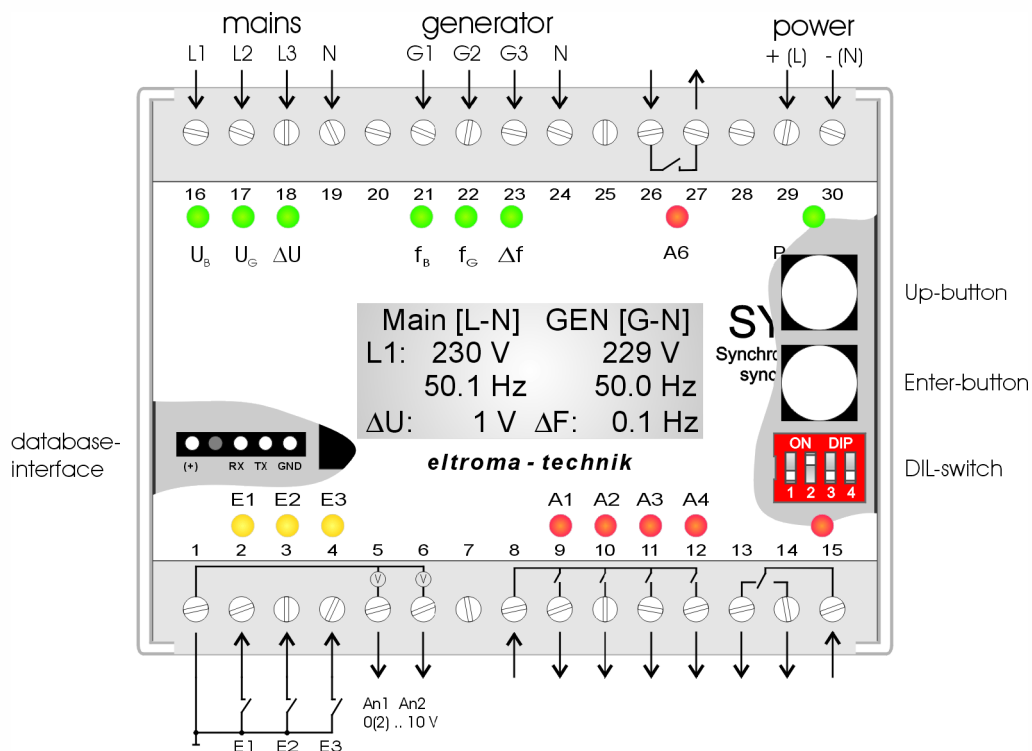
Column	Configuration Table (Konfig. / Config)	Default	
4	standard language (devices display)	1 or 2	1
6	three-conductors system	255 for 'yes' oder 0 for 'no'	0
7	two-conductors system	255 for 'yes' oder 0 for 'no'	0
8	PIN protection for parameterisation at device	255 for 'yes' oder 0 for 'no'	0
12	nominal voltage phase – N	0 up to 32.000 V	230
15	nominal frequency	35 Hz up to 65 Hz	50
16	usage of device	255 for 'synchroniser relay' 0 for 'locking relay'	255
18	exponent for voltage indication (see chap. 4.9 Voltage Indication)	- 1 up to 3	0
20	voltage transducer primary voltage mains	1 up to 32.000 V	230
21	voltage transducer secondary voltage mains	1 up to 32.000 V	230
22	voltage transducer primary voltage generator	1 up to 32.000 V	230
23	voltage transducer secondary voltage gen.	1 up to 32.000 V	230
24	standard – display (see chap. 4.5 Display)	0 ... 9	0
25	view reset time	0 ... 200 s	10
30	PIN (cf. Column 8 : PIN protection)	0 ... 9999	1
31	device code (device management ident.)	255 for 'yes' oder 0 for 'no'	0
33	rotary field monitoring	255 for 'yes' oder 0 for 'no'	0
34	rotary field monitoring / rotational direction	255 for 'right' oder 0 für 'left'	255

Line	Setting Values Table (Einstellwerte)	Default	
1	duration of voltage adjustment pulse (0 up to 100 s)	0 ... 1000 1/10s (0 up to 100 s)	1 [1/10 s] (0,1 s)
2	amplification of voltage adjustment pulse	0 ... 1000 impulse / minute * percent	60 Imp. / Min. %
3	duration of frequency adjustment pulse (0 up to 100 s)	0 ... 1000 1/10s (0 up to 100 s)	1 [1/10 s] (0,1 s)
4	amplification of frequency adjustment pulse	0 ... 1000 impulse / minute * percent	60 Imp. / Min. %
5	duration of synchronising pulse (0 up to 100 s)	0 ... 1000 1/10s (0 up to 100 s)	10 [1/10 s] (1 s)
6	leading time	0 ... 1000 ms	100 ms
7	minimum of frequency difference [ΔF min]	0 ... 100 1/100 Hz (0.00 ... 1.00 Hz)	1 [1/100 Hz] (0.01 Hz)
8	maximum of frequency difference [ΔF max]	0 ... 100 1/100 Hz (0.00 ... 1.00 Hz)	99 [1/100 Hz] (0.99 Hz)
9	minimum of voltage difference [ΔU min]	0 ... 15 %	0 %
10	maximum of voltage difference [ΔU max]	0 ... 15 %	10 %
11	frequency integration time	1 ... 100 periods	5 per.
12	synchronisation start delay time	1 ... 100 s	2 s
13	maximum phase angle difference [$\Delta \Phi$ max]	0 ... 60 °	10 °
14	maximum of mains voltage (dead bus-bar)	1 ... 50 %	10 %
15	minimum of generator voltage (dead bus-bar)	50 ... 100 %	80 %
16	switching on delay time (dead bus-bar)	0,1 ... 10,0 s	2,0 s

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8 Connection Diagram



8.1 DIL-Switch

The DIL-switches have the following functions:

DIL - Schalter	
	ON
	OFF
DIL-1: OFF - automatically reset	
DIL-2: ON - editing of parameters	
DIL-3: ON - change-over language	
DIL-4: ON - permanent ΔF release	

8.2 Accessories

- Parameterisation data cable for PC connection. Replenishment order under Part No. KC0034
- Parameterisation software is supplied on CD or available for download at www.koralewski.de.



Synchroniser – Relay SYN-7

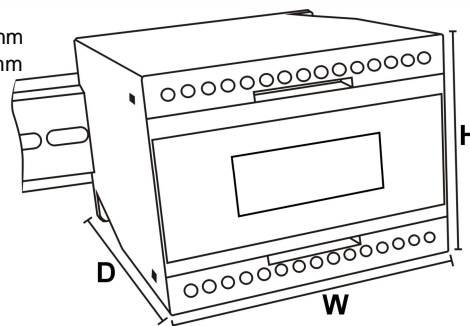
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9 Technical Data



Only properly trained personnel may be deployed for assembly and starting up.
Connexion in compliance with VDE 0160.

Auxiliary voltage	24 V DC (18 ... 36 V) optionally 230 V AC or 12 V DC
Power consumption	approx. 4 W at 24 V DC, approx. 6 VA at 230 V AC
Digital inputs	LowActive (contact voltage 12 V, 5 mA, opto-decoupled), in accordance to DIN
Relay outputs	230 V / 50 Hz / 2 A (potential-free)
Analogue outputs	0 ... 10 V +/- 0.05 V max. 10,5 V
Measuring range	approx. 50 up to 230 / 400 V, tolerance < 0,5 % of full scale (270 / 480 V)
Frequency measurement	35.0 Hz to 65.0 Hz about approx. 50 V L-N +/- 0.05 Hz
Leading time	adjustable 50 ... 500 ms
Adjustment pulses	adjustable 0.1 s up to 100 s
Max. frequency difference	adjustable 0.1 ... 1.0 Hz
Max. voltage difference	adjustable 1 ... 15 %
Climatic Conditions:	according to DIN EN 60204-1 (05-2010)
Ambient Temperature	
in operation	-20 °C ... +55 °C
transport and storage	-25 °C ... +55 °C
Housing dimensions	W / H / D : 100 x 75 x 110 mm DIN top-hat rail mounting 35 mm



9.1 Ordering Information

Synchroniser – Relay SYN-7	Part number
SYN-7 / 230 V AC	E1348
SYN-7 / 24 V DC	E1349
SYN-7 / 100 V / 230 V AC	E1650
SYN-7 / 100 V / 24 V DC	E1651

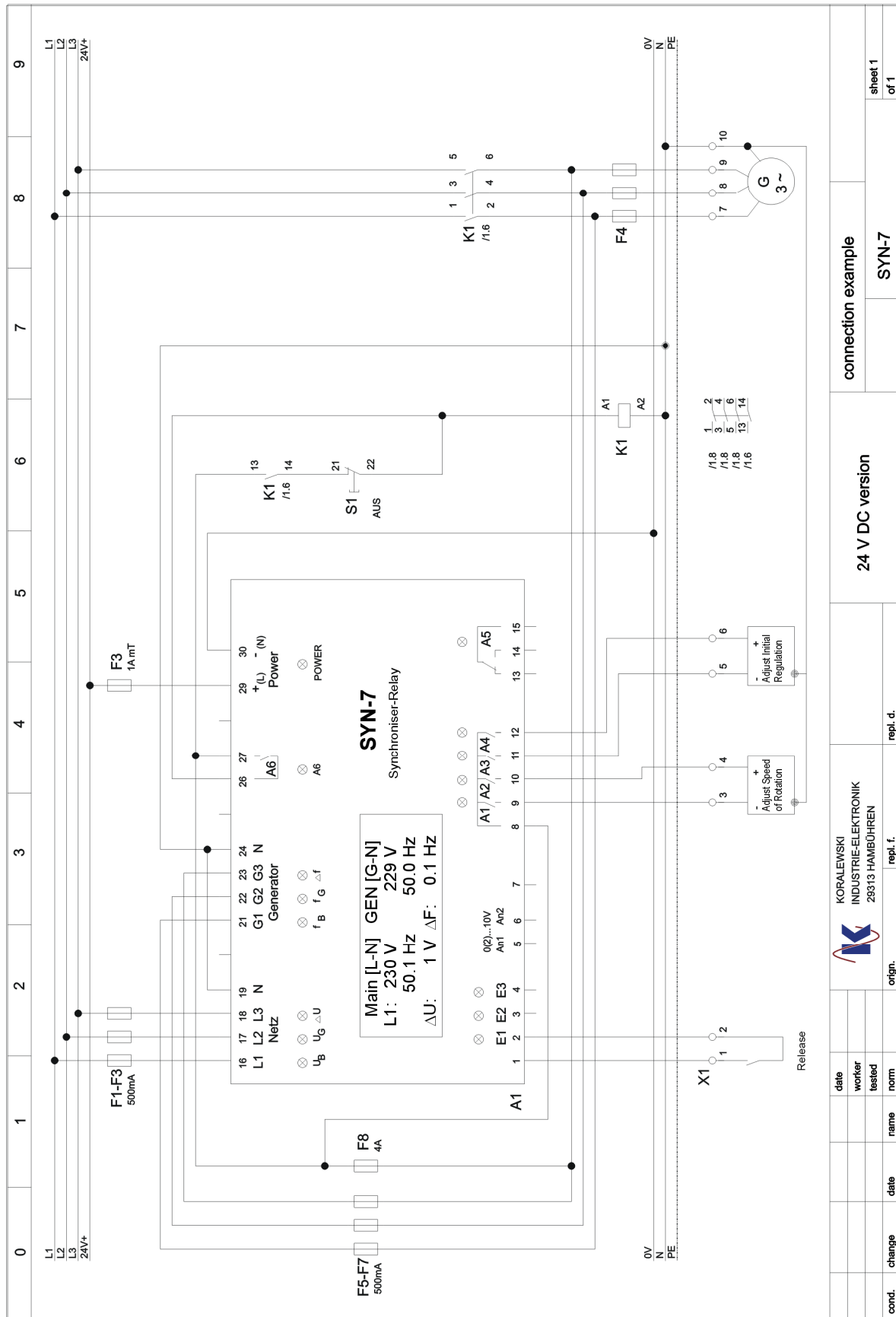
Note: optionally the SYN-7 is available in a 12 V DC – version.

Supplies	
Parameterisation data-cable	KC0034

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10 Connection Example



cond.		change	date	name	norm	tested	date	worker	date	KORALEWSKI INDUSTRIELELEKTRONIK 29313 HAMBÜHREN		24 V DC version		connection example		sheet 1 of 1
											orign.	repl. f.			SYN-7	