



SPM-D10/YB Synchronizing Unit



Manual
from Version 4.0xx

**WARNING**

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment. Practice all plant and safety instructions and precautions. Failure to follow instructions can cause personal injury and/or property damage.

The engine, turbine, or other type of prime mover should be equipped with an overspeed (overtemperature, or overpressure, where applicable) shutdown device(s), that operates totally independently of the prime mover control device(s) to protect against runaway or damage to the engine, turbine, or other type of prime mover with possible personal injury or loss of life should the mechanical-hydraulic governor(s) or electric control(s), the actuator(s), fuel control(s), the driving mechanism(s), the linkage(s), or the controlled device(s) fail.

Any unauthorized modifications to or use of this equipment outside its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment. Any such unauthorized modifications: (i) constitute "misuse" and/or "negligence" within the meaning of the product warranty thereby excluding warranty coverage for any resulting damage, and (ii) invalidate product certifications or listings.

**CAUTION**

To prevent damage to a control system that uses an alternator or battery-charging device, make sure the charging device is turned off before disconnecting the battery from the system.

Electronic controls contain static-sensitive parts. Observe the following precautions to prevent damage to these parts.

- Discharge body static before handling the control (with power to the control turned off, contact a grounded surface and maintain contact while handling the control).
- Avoid all plastic, vinyl, and Styrofoam (except antistatic versions) around printed circuit boards.
- Do not touch the components or conductors on a printed circuit board with your hands or with conductive devices.

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Important definitions**WARNING**

Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.

**CAUTION**

Indicates a potentially hazardous situation that, if not avoided, could result in damage to equipment.

**NOTE**

Provides other helpful information that does not fall under the warning or caution categories.

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Revision History

Rev.	Date	Editor	Changes
NEW	03-10-17	Tr	Release
A	04-11-24	TP	Correction: Wide-range power supply (wiring diagram, power supply)
B	05-05-10	TP	Improved: Controller setting description, wide-range power supply, technical data; language review
C	06-03-08	TP	Minor corrections; Package harmonization
D	2014-09-17	GG	Voltage range changed from “90 to 250 Vac/dc” to “90 to 250 Vac”. Protection (from back) changed from “IP21” to “IP20”.

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Chapter 1.

General Information

The SPM-D10/YB is a three-phase synchronizing unit with expanded dead bus start functionality. The following functions can be realized by using the appropriate discrete inputs:

- Synchronization
- Synch-check
- Dead bus start

The SPM-D starts as a standard unit that may have additional functions added with each package. The model of the SPM-D is designated as follows:

SPM-D10	4	0	B/	YB
<p>Packages according to the Package list. These packages can be found in the manual. Each headline points out if the described function is standard or part of a package.</p>				
<p>Mounting [B].. Flush-mounting</p>				
<p>CT's, current transformers, secondary [0] = no CT</p>				
<p>Voltage transformers/PT's, secondary [1] = 100 Vac [4] = 400 Vac</p>				
<p>Type</p>				

Examples:

- SPM-D1040B/YB (standard unit with 400 Vac PT measuring inputs, no CT inputs, flush mounted, 24 Vdc power supply)
- SPM-D1010B/NYB (standard unit with 100 Vac PT measuring inputs, no CT inputs, flush mounted, 90 to 250 Vac power supply)

Intended Use The unit must only be operated as described in this manual. The prerequisite for a proper and safe operation of the product is correct transportation, storage, and installation as well as careful operation and maintenance.



NOTE

This manual has been developed for a unit equipped with all available options. Inputs/outputs, functions, configuration screens and other details described, which do not exist on your unit, may be ignored.

The present manual has been prepared to enable the installation and commissioning of the unit. Because of the large variety of parameter settings, it is not possible to cover every possible combination. The manual is therefore only a guide. In case of incorrect entries or a total loss of functions, the default settings can be taken from the enclosed list of parameters at the rear of this manual.

Chapter 2.

Electrostatic Discharge Awareness

All electronic equipment is static-sensitive, some components more than others. To protect these components from static damage, you must take special precautions to minimize or eliminate electrostatic discharges.

Follow these precautions when working with or near the control.

1. Before doing maintenance on the electronic control, discharge the static electricity on your body to ground by touching and holding a grounded metal object (pipes, cabinets, equipment, etc.).
2. Avoid the build-up of static electricity on your body by not wearing clothing made of synthetic materials. Wear cotton or cotton-blend materials as much as possible because these do not store static electric charges as much as synthetics.
3. Keep plastic, vinyl, and Styrofoam materials (such as plastic or Styrofoam cups, cup holders, cigarette packages, cellophane wrappers, vinyl books or folders, plastic bottles, and plastic ash trays) away from the control, the modules, and the work area as much as possible.
4. **Opening the Control unit will void the warranty!**
Do not remove the printed circuit board (PCB) from the control cabinet unless necessary. If you must remove the PCB from the control cabinet, follow these precautions:
 - Make sure that the unit is completely de-energized (all connectors have to be disconnected).
 - Do not touch any part of the PCB except the edges.
 - Do not touch the electrical conductors, connectors, or components with conductive devices or with bare hands.
 - When replacing a PCB, keep the new PCB in the plastic antistatic protective bag it comes in until you are ready to install it. Immediately after removing the old PCB from the control unit, place it in the antistatic protective bag.



WARNING

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual 82715, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Chapter 3. Installation



CAUTION

A circuit breaker must be provided near to the unit and in a position easily accessible to the operator. This must also bear a sign identifying it as an isolating switch for the unit.



NOTE

Connected inductive devices (such as operating current coils, undervoltage tripping units, or auxiliary or power contacts) must be connected to a suitable interference suppressor.



WARNING

All technical data and ratings indicated in this chapter are not definite! Only the values indicated in Appendix B: Technical Data on page 41 are valid!

The following chart may be used to convert square millimeters [mm²] to AWG and vice versa:

AWG	mm ²	AWG	mm ²	AWG	mm ²	AWG	mm ²	AWG	mm ²	AWG	mm ²
30	0.05	21	0.38	14	2.5	4	25	3/0	95	600MCM	300
28	0.08	20	0.5	12	4	2	35	4/0	120	750MCM	400
26	0.14	18	0.75	10	6	1	50	300MCM	150	1000MCM	500
24	0.25	17	1.0	8	10	1/0	55	350MCM	185		
22	0.34	16	1.5	6	16	2/0	70	500MCM	240		

Table 3-1: Conversion chart - wire size

Wiring Diagram



SPM-D10/YB

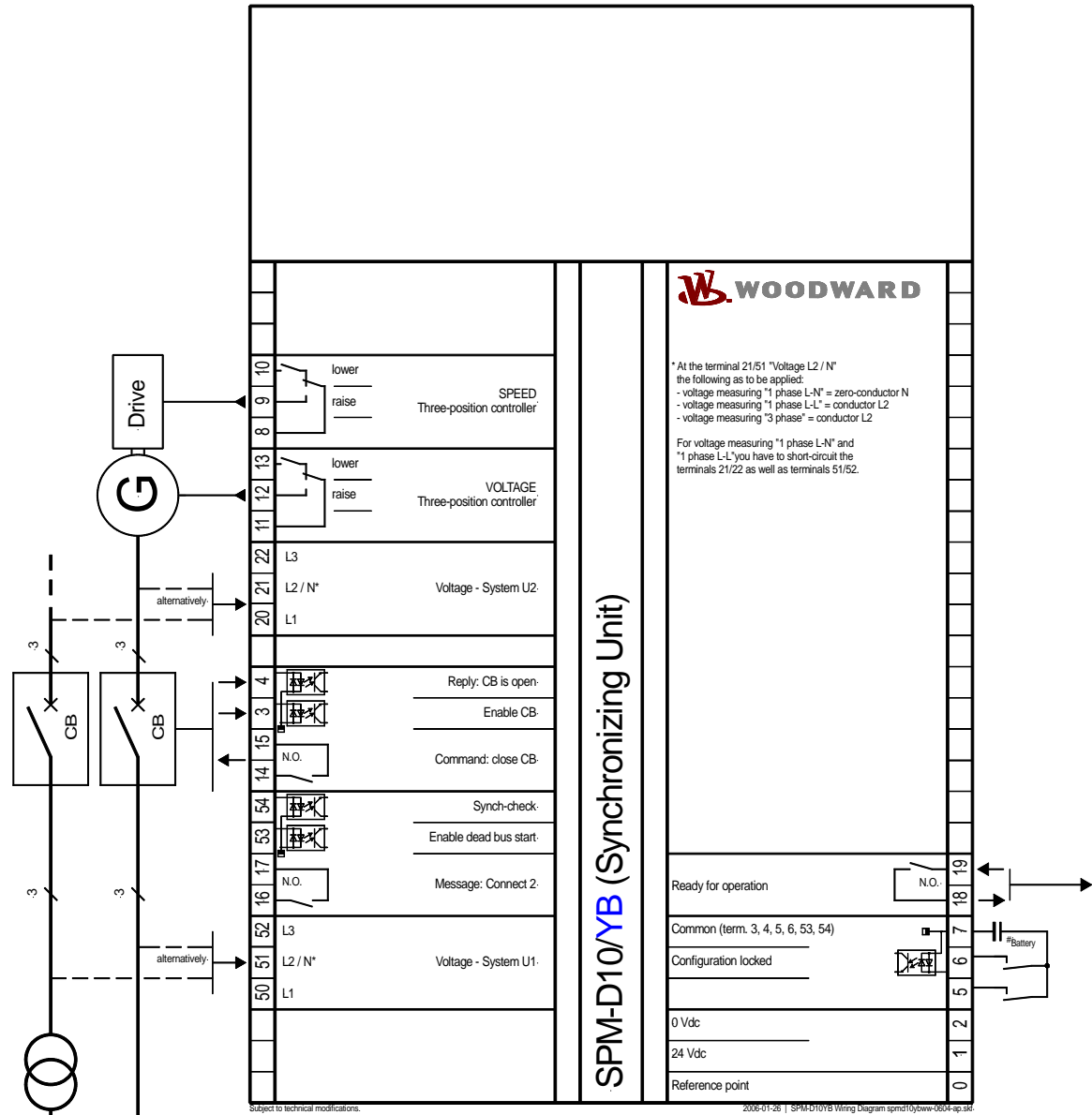


Figure 3-1: Wiring diagram SPM-D10/YB

SPM-D10/NYB

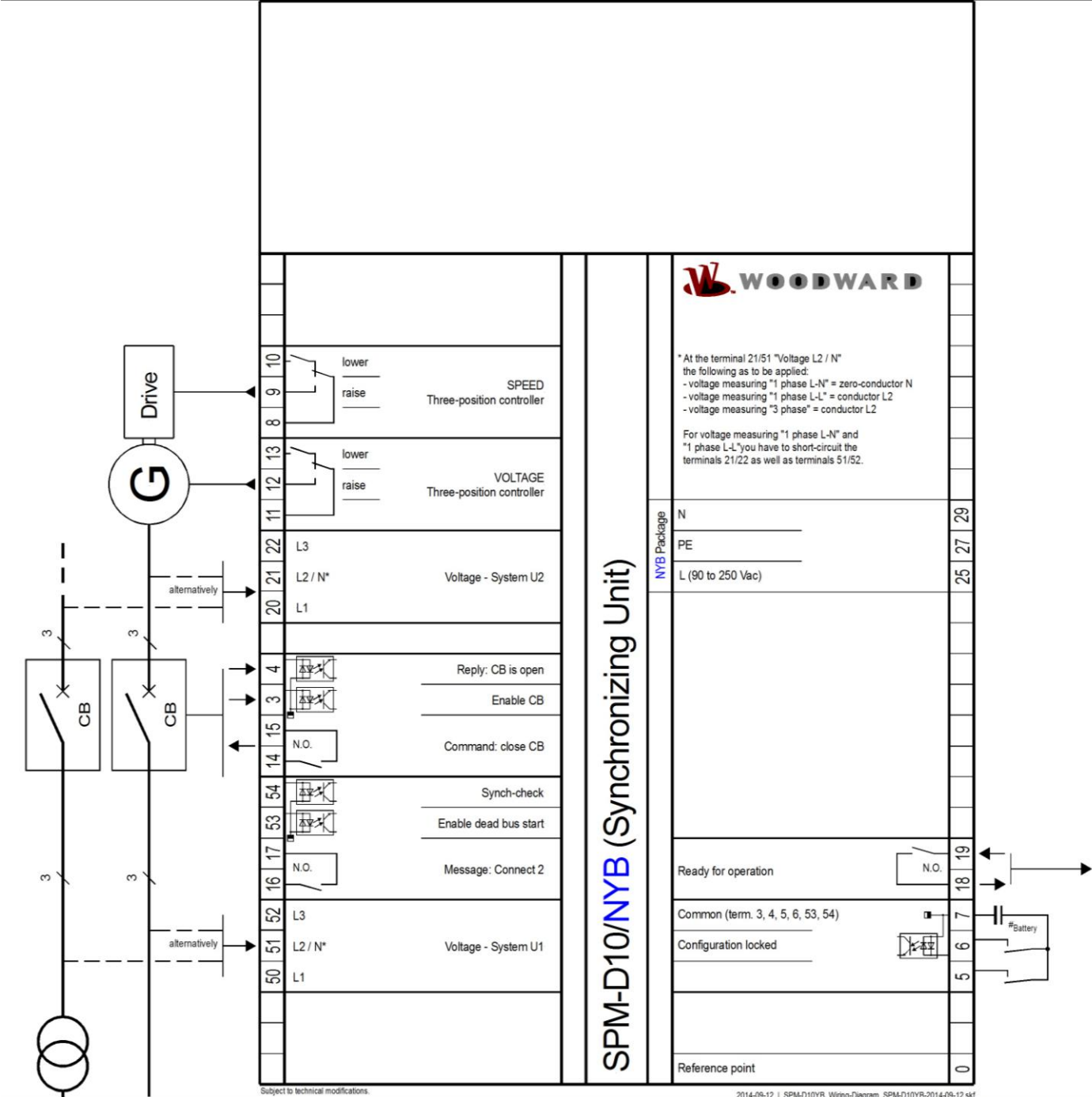


Figure 3-2: Wiring diagram SPM-D10/NYB

Reference Point

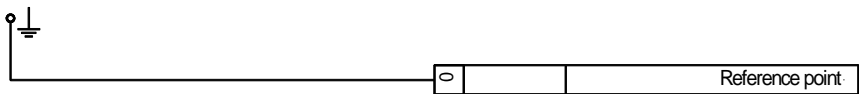


Figure 3-3: Reference point

Terminal	Description	A _{max}
0	Reference point: Neutral point of the three-phase system (3Ph4W) or neutral terminal of the voltage transformer (Measuring reference point); → with three-conductor systems (3Ph3W), do not connect	Sold.lug

Power Supply

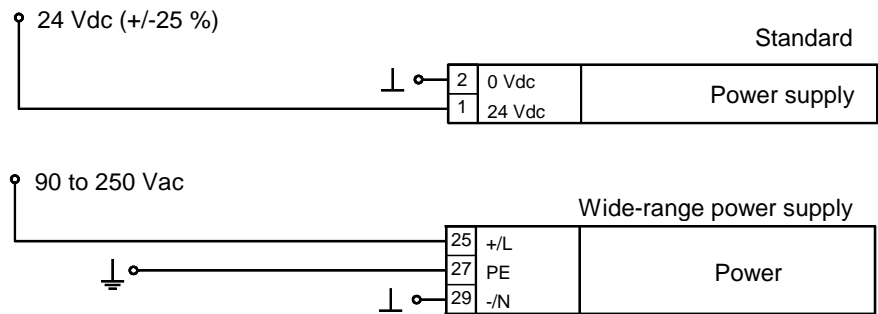


Figure 3-4: Power supply

Terminal	Description	A _{max}
YB Package - standard		
1	+24 Vdc (+/-25 %), 10 W	2.5 mm ²
2	0 V reference potential	2.5 mm ²
NYB Package - wide range power supply		
25	90 to 250 Vac, max. 10 W	2.5 mm ²
27	PE (protective earth)	2.5 mm ²
29	0 Vac	2.5 mm ²

Measuring Inputs

Mains/System U1

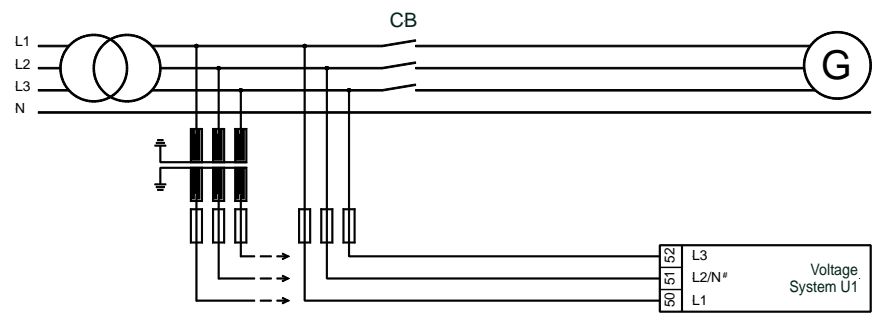


Figure 3-5: Measuring inputs - mains - system U1

Terminal	Measurement	Description	A _{max}
50	Direct or measuring transducer ..../100 V	Voltage L1	2.5 mm ²
51		Voltage L2 / N [#]	2.5 mm ²
52		Voltage L3	2.5 mm ²

Note: If voltage measuring is "single-phase L-N", the neutral conductor N has to be connected.
Note: If voltage measuring is "single-phase L-N" or "single-phase L-L" the terminals 51/52 must be connected with a bridge.

Generator/System U2

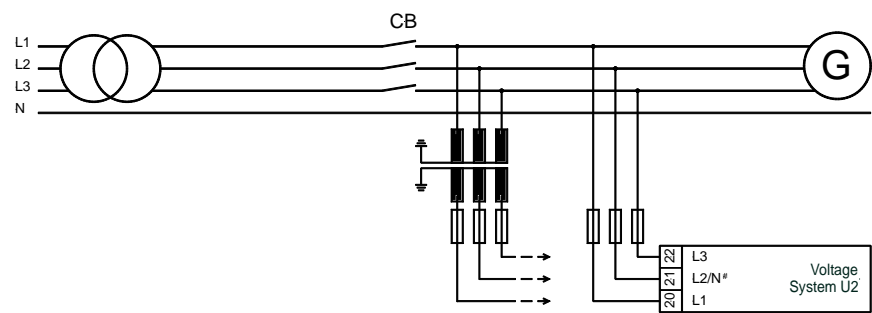


Figure 3-6: Measuring inputs - generator - system U2

Terminal	Measurement	Description	A _{max}
20	Direct or measuring transducer ..../100 V	Voltage L1	2.5 mm ²
21 ^{##}		Voltage L2 / N [#]	2.5 mm ²
22 ^{##}		Voltage L3	2.5 mm ²

Note: If voltage measuring is "single-phase L-N", the neutral conductor N has to be connected.
Note: If voltage measuring is "single-phase L-N" or "single-phase L-L" the terminals 21/22 must be connected with a bridge.

Discrete Inputs



CAUTION

Please note that the maximum voltages which may be applied at the discrete inputs are defined as follows. Voltages higher than those specified will damage the hardware!

- Maximum input range: +/-18 to 250 Vac.

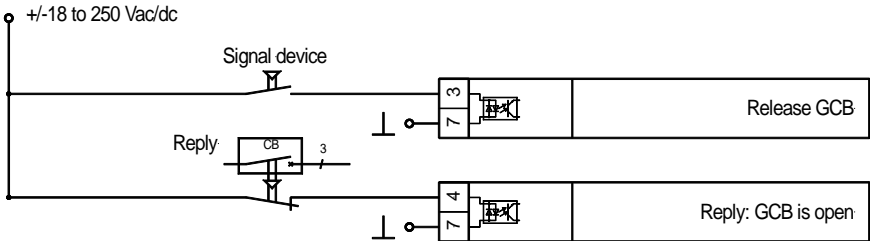


Figure 3-7: Discrete inputs - control inputs - power circuit breaker

Input terminal	Common terminal	Description (acc. DIN 40 719 part 3, 5.8.3)	A _{max}
NO (make contact)			
3	7	Enable CB	2.5 mm ²
NC (break contact)			
4	7	Reply: CB is open	2.5 mm ²

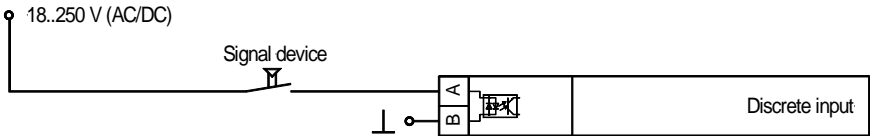


Figure 3-8: Discrete inputs - control inputs - operation

Input terminal	Common terminal	Description (acc. to DIN 40 719 part 3, 5.8.3)	A _{max}
A	B		
NO (make contact)			
6	7	Configuration locked	2.5 mm ²
53		Enable dead bus start	2.5 mm ²
54		Synch-check	2.5 mm ²

Relay Outputs

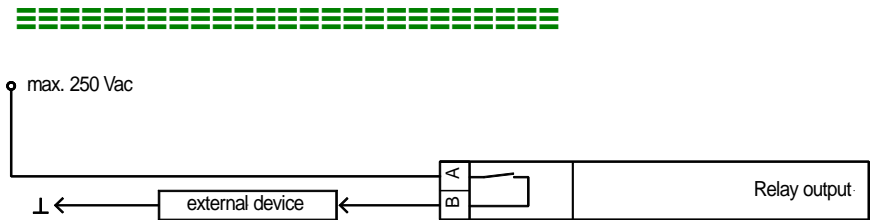


Figure 3-9: Relay outputs - control output #1 (CB operation)

Root	Switched	Description	A _{max}
14	15	Synchronizing pulse; Command: close CB	2.5 mm ²

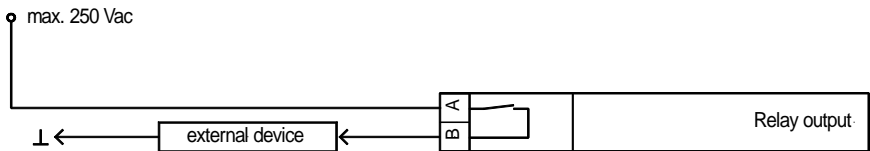


Figure 3-10: Relay outputs - control output #2

Root <i>A</i>	switched <i>B</i>	Description Note: The relays change state when the described function is met.	A _{max}
18	19	Ready for operation	2.5 mm ²
16	17	Message: connect 2	2.5 mm ²

Controller Outputs

The controller is equipped with two three-position controllers (made of a form C and form A relay) for raising and lowering voltage and frequency.

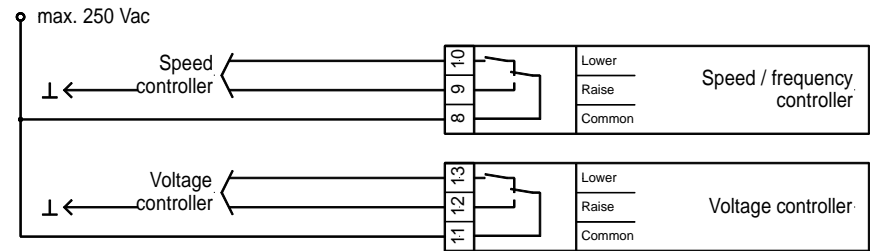


Figure 3-11: Controller - three-position controller

Terminal		Description	A _{max}
8	common	Speed-/frequency controller	2.5 mm ²
9	raise		2.5 mm ²
10	lower		2.5 mm ²
11	common	Voltage controller	2.5 mm ²
12	raise		2.5 mm ²
13	lower		2.5 mm ²

Chapter 4.

Description of Functions

Functionality



Table of Functions



NOTE

The following table is only valid, if terminal 54 is not set

Input signal			Operating condition	Condition
Release Dead bus start	Reply: CB is open	Release CB		
x	1	0	No-load control	C
0	1	1	Synchronizing No-load control	A D
1	1	1	Synchronizing Dead bus start No-load control	A B D

0: "OFF" / 1: "ON" / x: Signal has no importance (0 or 1)

Table 4-1: Operating modes

For the explanation of the operating conditions please notice chapter "Functionality" see after page 15.

Conditions: The function of the unit also depends on the condition of the measuring voltages. The functions may also be switched on or off by configuration.

Condition	Function
A	For system U1 the following must apply: $85\% V_{rated} < \text{voltage} < 112\% V_{rated}$ $96\% f_{rated} < \text{frequency} < 104\% f_{rated}$ For system U2 the following must apply: $75\% V_{rated} < \text{voltage} < 115\% V_{rated}$ $88\% f_{rated} < \text{frequency} < 112\% f_{rated}$ (if time monitoring expires, the synchronization will be aborted)
B	Parameter "dead bus start gen. switch" configured to "ON" One of the three dead bus start options must be switched on and the voltages U1 and U2 must be within the configured limits for the dead bus start
C	Parameter "Automatic no-load control" configured to "ON"
D	voltage U2 > 80% rated voltage V_{rated} voltage U2 > 80% rated voltage V_{rated}

Table 4-2: Operating modes - operating conditions

Control Inputs



Release CB Terminal 3	Enabling for the operation of the power circuit breaker. In order to enable synchronization or a dead bus start, this input must be energized.
Reply: CB is open Terminal 4	The status of the CB must be transmitted to the control unit through this input. The input must be energized if the CB is open. (The status of this input is checked for plausibility and is indicated with the LED "Gen CB - ON".)
Enable: Dead bus start Terminal 53	In order to carry out a dead bus start, this input must be energized.
Configuration locked Terminal 6	Energizing this input avoids an unwanted switching into the configuration mode by pressing "Digit↑" and "Cursor→". For the setting, a detachable-key switch can be used, for instance.
Synch-check Terminal 54	By energizing this input, the unit is switched into the synchronization control mode. While this operating mode is selected, there is no output of higher/lower orders of the three-position controllers. This means that no voltage or frequency regulation is possible. The relay "synchronizing pulse: close CB" will then work like a synch-check relay (see chapter "Control Outputs" starting on page 19).



CAUTION

If several generators feed one busbar, it has to be ensured with external interlocking that only one of the generators is released for dead bus start at a time. If several generators are released for dead bus start at the same time, it may happen that the generator circuit breakers close at the same time, which might cause serious damage to the generators!

Isolation of the Power Supply from the Discrete Inputs



The common reference point for the discrete inputs (terminal 7) may be electrically isolated from the supply voltage (0V, terminal 2) through proper external wiring. This permits the control to utilize more than one voltage in the control wiring. This is necessary for example if the supply voltage for the control is +24 Vdc and electrical isolation of the system control voltage (e.g. 220 Vdc or 220 Vac) must be ensured.

The control should be wired as follows:

- If the discrete inputs are to utilize the same voltage as the supply voltage:
Install a jumper between terminal 7 and terminal 2 (0 V)
- If the supply voltage and control voltage are not the same ...
Terminal 2: connect to 0 V of the supply voltage
Terminal 7: connect to 0 V or N of the control voltage

Operating Conditions



No Load Control

With the relays of the three-position controller and speed switching appropriately, voltage and frequency of the system U2 are adjusted to the configurable set point values. (Also see chapter "Table of Functions" starting on page 15).

Synchronizing

The system U2 is adjusted to system U1 as far as voltage and frequency are concerned, the relays of the three-position controller for voltage and speed switching correspondingly. Taking the switcher time element into account, the add-on order for the power circuit breaker is output in the synchronous point. The synchronization or add-on is effected under the following conditions (also see chapter Table of Functions" on page 15):

- The unit is in automatic mode (LED "automatic" is illuminated)
- The synchronization function is enabled by configuration
- Voltage and frequency of system U1 and U2 are within a certain range (see chapter "Table of Functions" starting on page 15),
- The discrete input "Release CB" is energized
- The discrete input "Release: CB is open" is energized
- The synchronization time monitoring is not enabled or has not expired

During the synchronization the unit may output a so-called kick pulse. The kick pulse is an individual pulse "raise speed " The output of a kick pulse avoids that a status is maintained where the frequencies of the systems U1 and U2 are almost equal for a long time, whereas the phase angle between the systems does not equal zero and remains almost unchanged. In this state there is no synchronism and thus, no add-on of the power circuit breaker is possible. Since in this case, the frequency controller does not output any actuating pulses, reaching the synchronous point would take too long. With the output of a kick pulse the phase angle is changed. Thus, the synchronous point is reached faster.

Dead Bus Start (Asynchronous Add-On)

Output of an add-on order for the power circuit breaker without synchronization, if the following conditions are fulfilled:

- The dead bus start function is in principle activated by configuration
- One of the three possible dead bus start functions is selected by configuration
- The discrete input "Dead bus start release" is energized
- The discrete input "Release CB" is energized
- The discrete input "Release CB" is energized
- The conditions for one of the preset dead bus start functions are fulfilled:
 - a) U1 has the value U_n (taking the configured rated voltage difference into account $dV |V - V_{rated}|$) and U2 is zero (taking the configured zero voltage difference into account $dV |V - 0|$).
 - b) U1 is zero (taking the configured zero voltage difference into account $dV |V - 0|$) and U2 has the value V_{rated} (taking the configured rated voltage difference into account $dV |V - V_{rated}|$).
 - c) U1 is zero and U2 is zero (taking each configured zero voltage difference into account $dV |V - 0|$).

Moreover, in case a) and b) the frequency of U1 and U2 must be within the configured limits.

Synch-Check

In this condition, the unit can be used as a synchronization control. No control is carried out. The relay "CB close" remains picked up, as long as the following conditions are met:

- The voltage differential is within the configured limit (screen "synchronization dV_{max} ")
- The frequency differential is within the configured limit (screens "synchronization df_{max} and df_{min} ")
- The phase angle is within the configured limit (screen "slip synchron. ϕ_{max} ")
- The discrete input "Reply: CB is open" is energized
- The discrete input "Enable CB" is energized
- The systems U1 and U2 are within the permitted limits (see Table 4-2: Operating modes - operating conditions, condition A, page 15).

The synchronization time monitoring must be deactivated.

Control Outputs



- Synchronizing pulse:** Through this relay, the CB receives the order to add-on. In normal operation, the contact assembly in the synchronous point only closes for the configured time of the add-on pulse. When in synchronizing control mode, a continuous signal is output through this relay (see chapter "Control Inputs" on page 16). If the CB has made contact and the unit gets this information through a corresponding discrete input, this relay de-energizes.
- close CB**
Terminals 14/15
- Ready for operation** The contact assembly is closed when the unit is ready for operation. The relay will de-energize if the following occurs:
- Terminals 18/19
- The internal self-monitoring system has detected an alarm condition.
Trouble-free operation of the unit cannot be guaranteed and appropriate corrective measures must be taken.
 - The synchronization time monitoring system is enabled and the configured time has expired before synchronization has occurred.
- "Message:** For the description of these control inputs please refer to chapter "Relay Output 16-17" on page 36
- Connect 2"**
Terminal 16/17
- Three-position controller speed** Through these relays, pulses are output from the internal speed governor, in order to adjust the frequency of system U2 to the frequency of system U1 (synchronization), or to adjust the frequency to the configured set point frequency (no-load control). In order to obtain the speed variation required, the relays have to be connected with the appropriate inputs of an external speed governor. The order "lower" is output through the terminals 8/10, the order "higher" is output through the terminals 8/9.
- higher/lower**
Terminals 8/9/10
- Three-position controller voltage** Through these relays, pulses are output from the internal speed governor, in order to adjust the voltage of system U2 to the voltage of system U1 (synchronization), or to adjust the voltage to the configured voltage set point (no-load control). In order to obtain the voltage variation required, the relays have to be connected with the appropriate inputs of an external voltage controller. The order "lower" is output through the terminals 11/13, the order "higher" through the terminals 11/12.
- higher/lower**
Terminals 11/12/13

Chapter 5. Display and Operating Elements

The foil of the front plate is made of coated plastics. All keys have been designed as touch-sensitive membrane switch elements. The display is a LC-display, consisting of 2 rows each with 16 characters, which are indirectly illuminated red. Contrast of the display is infinitely variable by a rotary potentiometer on the left side.

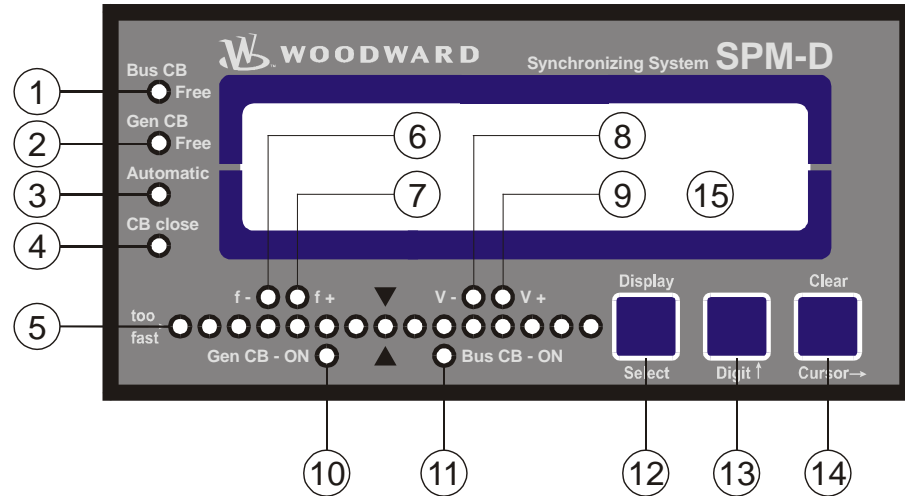


Figure 5-1: Front foil

Brief Explanation of the LEDs and Push Buttons



LEDs

No.	Description	Function
1	Bus CB Free	Non-functional
2	Gen CB Free	Enable CB
3	Automatic	Automatic mode
4	CB close	Close command to the CB issued
5	Synchroscope	Display of phase position
6	f-	Governor output: frequency lower (reduce speed)
7	f+	Governor output: frequency raise (increase speed)
8	V-	Governor output: voltage lower (reduce excitation)
9	V+	Governor output: voltage raise (increase excitation)
10	Gen CB - ON	Reply: CB is closed
11	Bus CB - ON	Non-functional

Buttons

No.	Description	Function
12	Display↓	Scroll display
12	Select	Confirm selection
13	Digit↑	Increase digit
14	Clear	Acknowledge alarm
14	Cursor→	Shift input position one digit to the right

Others

No.	Description	Function
15	LC-Display	LC-Display
	Potentiometer	Adjust LCD contrast

LEDs



- | | | | | | | | | | | | | | | |
|-------------------------|--|--|-------------------------|-----------|------------------|--|-----------|------------------|-----------------------|-----------|------------------|--|-----------|------------------|
| 1 | Bus CB Free
here: non-functional
Color: green | Enable mains circuit breaker <hr/> <p>NOTE: This LED is non-functional, as this control is only designed to operate one circuit breaker.</p> | | | | | | | | | | | | |
| 2 | Gen CB Free
Color: green | Enable power circuit breaker <hr/> <p>The LED "Gen CB Free" indicates that the power circuit breaker has been enabled for operation. The status of the LED illuminates when the discrete input "Enable/Release CB" is energized.</p> | | | | | | | | | | | | |
| 3 | Automatic
Color: green | Automatic mode <hr/> <p>The LED "automatic" is illuminated when the unit is in automatic mode. It will turn off as soon as the control unit is switched to the configuration mode.</p> | | | | | | | | | | | | |
| 4 | CB close
Color: green | CB close <hr/> <p>The "CB close" LED illuminates when the unit outputs a closure command to the power circuit breaker during synchronization. The "CB close" LED illuminates when the relay "command: close CB" is energized.</p> | | | | | | | | | | | | |
| 5 | LED-row: too fast →
Color: red/yellow/green | Phase position / Synchroscope <hr/> <p>The row of LEDs indicates the current phase relationship between the two voltages indicated in the display. The green LED in the center of the 15 LEDs indicates that the measured phase angle between the voltage systems is +/- 12 ° electrical. The phase position is only displayed if the controller is in automatic mode and only if the systems U1 and U2 are within the following limits:</p> <table border="0" style="margin-top: 10px;"> <tr> <td style="padding-right: 20px;">Frequency ranges</td> <td style="padding-right: 20px;">System U1</td> <td>96 to 104% f_N</td> </tr> <tr> <td></td> <td>System U2</td> <td>88 to 112% f_N</td> </tr> <tr> <td style="padding-right: 20px;">Voltage ranges</td> <td>System U1</td> <td>85 to 112% V_N</td> </tr> <tr> <td></td> <td>System U2</td> <td>75 to 115% V_N</td> </tr> </table> <p style="margin-top: 10px;">The synchroscope LEDs can move in two directions:</p> <p>left → right..If the LEDs illuminate from left to right, the generator (variable system) frequency is higher than the mains or reference voltage system (i.e. the generator or the variable system has a frequency of 60.5 Hz and the mains is 60 Hz).</p> <p>right → left..If the LEDs illuminate from right to left, the generator (variable system) frequency is lower than the mains or reference voltage system (i.e. the generator respectively the variable system has a frequency of 59.5 Hz and the mains is 60 Hz).</p> | Frequency ranges | System U1 | 96 to 104% f_N | | System U2 | 88 to 112% f_N | Voltage ranges | System U1 | 85 to 112% V_N | | System U2 | 75 to 115% V_N |
| Frequency ranges | System U1 | 96 to 104% f_N | | | | | | | | | | | | |
| | System U2 | 88 to 112% f_N | | | | | | | | | | | | |
| Voltage ranges | System U1 | 85 to 112% V_N | | | | | | | | | | | | |
| | System U2 | 75 to 115% V_N | | | | | | | | | | | | |

6	f- Color: yellow	Decrease frequency governor output
The "f-" LED indicates if the unit is outputting a pulse to decrease the frequency. The "f-" LED illuminates when the relay "speed lower" is energized.		
7	f+ Color: yellow	Increase frequency governor output
The "f+" LED indicates if the unit is outputting a pulse to increase the frequency. The "f+" LED illuminates when the relay "speed raise" is energized.		
8	V- Color: yellow	Decrease voltage governor output
The "V-" LED indicates if the unit is outputting a pulse to decrease the voltage. The "V-" LED illuminates when the relay "voltage lower" is energized.		
9	V+ Color: yellow	Increase voltage governor output
The "V+" LED indicates if the unit is outputting a pulse to increase the voltage. The "V+" LED illuminates when the relay "voltage raise" is energized.		
10	Gen CB - ON Color: green	Power circuit breaker ON
The "Gen CB - ON" LED indicates if the response of the power circuit breaker is open or closed. The "Gen CB - ON" LED illuminates if the discrete input "Reply: CB is open" is not energized and will turn off as soon as the discrete input is energized.		
The LED may also be flashing if one of the following cases occurs:		
<ul style="list-style-type: none"> • Discrete input "Reply: CB is open" is not energized and the systems U1 and U2 are not synchronized • Discrete input "Reply: CB is open" is energized and the systems U1 and U2 are synchronized 		
(The unit checks the status of the discrete input "Reply: CB is open" for plausibility. The unit assumes that the systems U1 and U2 are synchronized if the switch makes contact and that the systems cannot be synchronized if the switch breaks contact.)		
11	Bus CB – ON here: non-functional Color: green	Mains power circuit breaker ON
NOTE: This LED is non-functional, as this control is only designed to operate one circuit breaker.		

Push Buttons



Configuration may be performed by manually inputting the desired set points utilizing the pushbuttons and the LC display. In order to facilitate configuring the parameters, the push buttons have been enabled with an AUTOROLL function. This permits the user to advance to the next setting, configuration screen, digit, and/or cursor position more rapidly by pressing and holding the corresponding pushbutton.

12	Display / Select	Display / Select	<hr/> <p>Automatic mode: <u>Display</u> - By pressing this button, the user may navigate through the displayed measured parameters and alarm messages.</p> <p>Configuration: <u>Select</u> - Advances the LC display to the next configuration screen. If any values in a configuration screen have been modified with the "Digit↑" or "Cursor→", then the "Select" button must be pressed to save the new setting. By pressing this pushbutton again, the user causes the system to display the next configuration screen.</p>
13	Digit↑	Digit ↑	<hr/> <p>Automatic mode: <u>Digit↓</u> - no function</p> <p>Configuration: <u>Digit↑</u> - Numerical values over the cursor are increased by one digit. The increase is restricted by the admissible limits (refer to the list of parameters included in the appendix). If the maximum admissible number is reached, the number automatically returns to the lowest admissible number.</p>
14	Clear / Cursor →	Clear / Cursor→	<hr/> <p>Automatic mode: <u>Clear</u> - Alarms that have occurred may be acknowledged by pressing this button as long as the fault that triggered the alarm is no longer present.</p> <p>Configuration: <u>Cursor→</u> - This button moves the cursor one position from left to right. When the cursor is under the last digit that may be changed, it may be moved to the first number of the value by pressing the "Cursor→" button again.</p>

LC Display



15 LC-Display **LC display**

The two-line LC display outputs corresponding text messages and values depending on the mode that the SPM-D is operating. In the configuration mode, the monitoring parameters may be changed. When the SPM-D is in the automatic mode, the measured values are displayed.

Display Monitoring in Automatic Mode: Double Voltage/Frequency Display

LCD type 1 (V configured)

Double voltage and double frequency displays

1: 000 V 00.00Hz
2: 000 V 00.00Hz

Voltage and frequency of the systems U1 and U2 are indicated. The phase position between systems U1 and U2 is indicated by the synchroscope (LED-strap).

- 1: Voltage and frequency of system U1
- 2: Voltage and frequency of system U2.

LCD type (kV configured)

1:00.0kV 00.00Hz
2:00.0kV 00.00Hz

Display Monitoring in Automatic Mode: Alarm Indication

xxxxxxxxxxxxxxxxxx

Alarm indication, bottom line

The indications are displayed according to the following list:

Type of alarm	Displayed text
Synchronization time of CB is exceeded	Synchron.Time!

Chapter 6.

Configuration



CAUTION

Please note that configuration only should be done when the system is not in operation.



NOTE

Please note the parameter list located in the Appendix C of this manual.

The configuration mode is initiated by pressing the "Digit↑" and "Cursor→" pushbuttons simultaneously. The control is advanced through the various parameters by pressing the "Select" pushbutton. By pressing and holding the "Select" pushbutton the AUTOROLL function will be enabled permitting the user to rapidly advance through the parameter screens. The control unit will permit the operator to reverse up to four previous screens (exception: it is not possible to reverse from the first parameter to the last parameter or to backup through the service screens). To perform the reverse function through the parameter screens, the "Select" and "Cursor→" push buttons must be pressed and released simultaneously. If an entry, modification, or any other action is not carried out for 60 seconds, the unit reverts to the automatic mode. **It is only possible to change into configuration mode if the discrete input "Configuration locked" (terminal 6) is either not connected or not energized.**

Configure Basic Data



SPRACHE/LANGUAGE english

Language selection	German/English
--------------------	----------------

The desired language for the configuration and display screens is selected here. Either German or English may be selected.

Software version x.xxxx

Software version

Indicates the software version the control unit is utilizing.

General



Service Indication

Service display?
ON

Service indication ON/OFF

ON..... The subsequent screens are indicated. The screens of the service indication are intended to help the user start-up the unit.

OFF..... The screens of the service indication are not indicated.

000 000 000 V
000 000 000 V

Double voltage indicator

The voltages of system U1 (top line) and system U2 (bottom line) are indicated, taking into account the rated voltages of the transformer. Read from left to right, these are the respective phase-to-phase voltages at the terminals 20-21 or 50-51, 21-22 or 51-52, 22-20 or 52-50

PHI1 PHI2 PHI3
±000° ±000° ±000°

Indication display of the phase angles

The phase angles of the voltages are indicated here, which are displayed one below the other in the a.m. screen. If one of the measuring voltages is missing, the indication display of the corresponding phase angle is set to 180 °.

Sealing



NOTE

If a protection against the modification of setting values is not required, we recommend not to activate the sealing function, parameter to "OFF". If sealing should be necessary however, we recommend to activate it only after the system has been completely installed!

⇒ SEQUENCE CHART on next page.

Entering a five-digit code number protects the configuration mode against non-authorized interventions, operations or modifications. This function is the exact software equivalent of a mechanical seal.

<div>Encoding</div> <div>ON</div>	<div>Sealing function</div> <div>ON/OFF</div>
<div>Factory setting:</div> <div>OFF</div>	<div>ON .....The configuration of the subsequent values is protected by a codeword. The subsequent screens of this function are displayed.</div> <div>OFF .....There is no protection by a sealing function, and the subsequent screens of this function are not indicated.</div>
<div>Code no. 000</div> <div>Code? ?????</div>	<div>Code for seal number XXX</div> <div>1 to 60,000</div>
<div>Factory setting:</div> <div>00100</div>	<div>Code number correct If the code number for the active seal was entered correctly, the values are entered according to the sequence of the screens.</div> <div>Code number incorrect If the code number for the active seal was not entered correctly, the subsequent screens are indicated.</div>
<div>Wrong code!</div> <div>[Press "SELECT"]</div>	<div>Incorrect code has been entered</div> <div>Button "Select"</div>
<div>The code number for the active seal was entered incorrectly! Please confirm this announcement with button "Select".</div>	
<div>Code no. 000</div> <div>Break? YES</div>	<div>Break seal number XXX</div> <div>YES/NO</div>
<div>YES .....The seal can be broken and the configuration mode can be released. However the seal number is automatically increased by 1. This allows verifying at any time if there were modifications without entering the correct code number.</div> <div>NO .....The system asks for the code again. Interrogation can only be left by terminating the configuration mode.</div>	
<div>Code no. 001</div> <div>New code:?????</div>	<div>Code for seal 001 (new entry)</div> <div>1 to 60,000</div>
<div>After breaking the old seal the device requires the code number for the new seal. Sealing can now be done with the new code number.</div>	
<div>Adjust Settings</div> <div>[Press "SELECT"]</div>	<div>Enter values</div> <div>Button "Select"</div>
<div>Input: Button "Select".</div>	

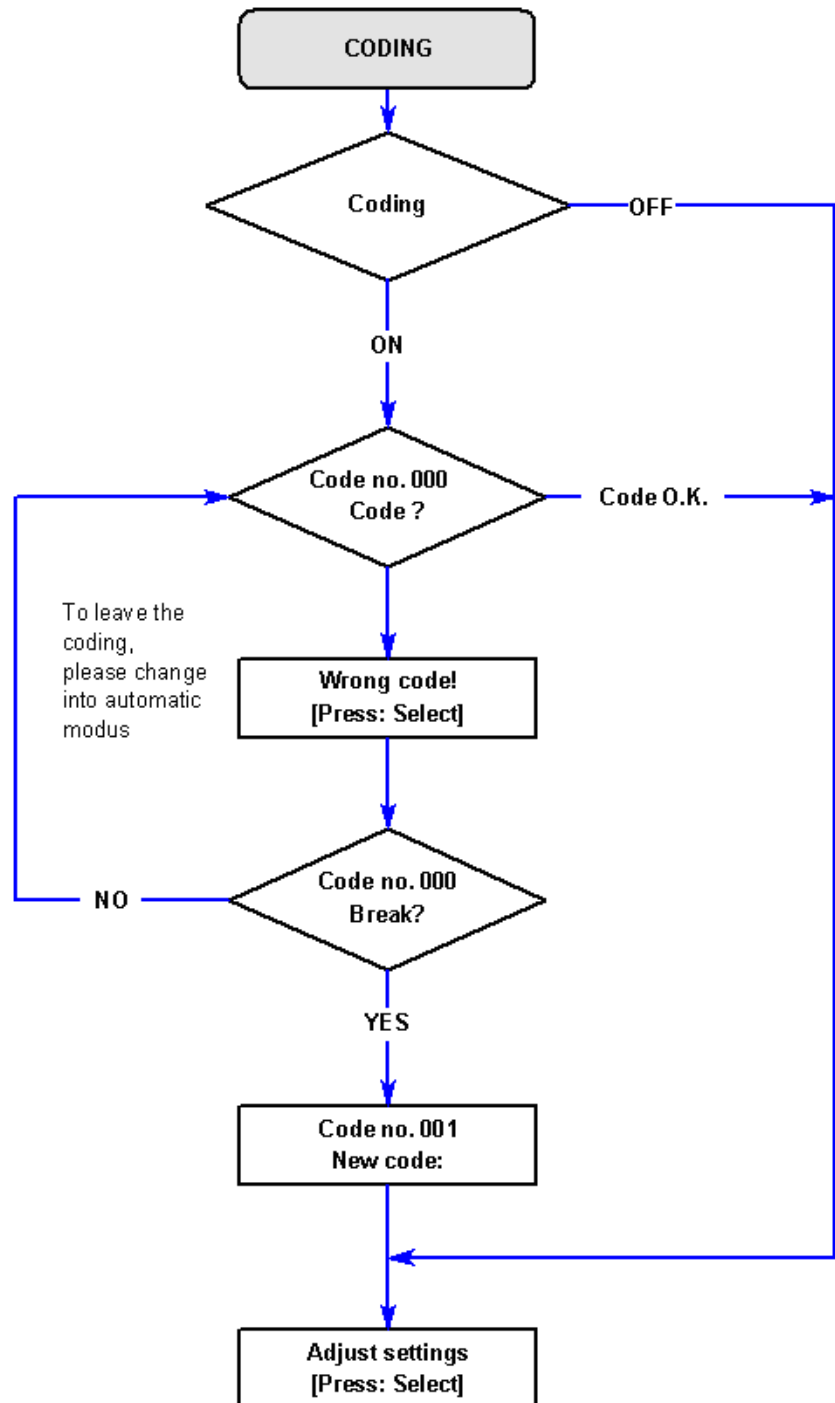


Figure 6-1: Sealing - sequence diagram

Configure Basic Settings



WARNING

The following values must be entered correctly to ensure proper monitoring of the generator. Failure to do so may lead to incorrect measuring of parameters resulting in damage to or destruction of the generator and/or personal injury or death!

Parameter 1	System rated frequency	48.0 to 62.0 Hz
Rated Frequency fn = 00.0Hz	The system rated frequency, which in most cases is 50 Hz or 60 Hz, is entered in this screen.	
Parameter 2	Generator frequency set point	48.0 to 62.0 Hz
Generator freq. Setpoint= 00.0Hz	The generator (variable system) frequency set point is entered in this screen. The frequency controller will reference this value for no-load and isolated operations.	
Parameter 3	Generator set point voltage	30 to 120/50 to 440 V
Gen. voltage U set = 000V	The generator (variable system) voltage set point is entered in this screen. The voltage controller will reference this value for no-load and isolated operations.	
Parameter 4	System rated voltage	30 to 120/70 to 420 V
Rated voltage Un = 000V	The system rated voltage is entered in this screen. The controller references this value to determine the permissible voltage range for synchronization.	
Parameter 5	Secondary rated voltage of the transformer U1	30 to 120/50 to 500 V
Volt. transf. U1 secondary 000V	The secondary rated voltage of the transformer U1 is set here in kV. This value is needed for the indication of the primary voltage U1 on the display.	
Parameter 6	Primary rated voltage of the transformer U1	0,1 to 650,0 kV
Volt. transf. U1 primary 000,00kV	The primary rated voltage of the transformer U1 is set here in kV. This value is needed for the indication of the primary voltage U1 on the display.	
Parameter 7	Secondary rated voltage of the transformer U2	30 to 120/50 to 500 V
Volt. transf. U2 secondary 000V	The secondary rated voltage of the transformer U2 is set here in V. This value is needed for the indication of the primary U2 on the display	
Parameter 8	Primary rated voltage of the transformer U2	0,1 to 650,0 kV
Volt. transf. U2 primary 000,00kV	The primary rated voltage of the transformer U2 is set here in kV. This value is needed for the indication of the primary voltage U2 on the display.	

Configure Controller



Entering values in the subsequent screens will result in changes to the dynamics of the controller.



CAUTION

The following values must be entered correctly to ensure proper operation of the generator. Failure to do so may lead to an uncontrollable operation resulting in damage to or destruction of the generator!

No Load Control

Parameter 9	Automatic no-load control	ON/OFF
Controll. in no-load oper. ON	ON..... If the power circuit breaker is in open position and there is no enabling signal, frequency and voltage are controlled (also see chapter "Table of Functions" starting on page 15)	
	OFF..... With the power circuit breaker in open position, frequency and voltage are controlled according to the following conditions (also see chapter "Table of Functions" starting on page 15)	
	<ul style="list-style-type: none">• Enable CB signals existing: Frequency and voltage control.• Enable CB signal not existing: No control.	

Voltage Measuring

Parameter 10	Voltage measuring	1 phase L-N / 1 phase L-L / 3 phase
Volt measur. 1 phase L-N	There are different ways to connect the measuring voltages to the device. The selected version has to be entered in this screen (also see Chapter Wiring Diagram on page 9).	
Volt measur. 1 phase L-L	1 phase L-N . For the measuring and synchronizing of the two systems U1 and U2, the voltage V_{LIN} is used as a reference. The other phases are not taken into account.	
Volt measur. 3 phase	1 phase L-L . For the measuring and synchronizing of the two systems U1 and U2, the voltage V_{L12} is used as a reference. The other phases are not taken into account.	
	3 phase..... For the measuring and synchronizing of the two systems U1 and U2 the voltages V_{L12} - V_{L23} - V_{L31} are used as a reference.	

Frequency Controller

Parameter 11	Frequency controller	ON/OFF
Freq. controller ON	<p>ON .....The generator frequency is controlled by the SPM-D. The generator frequency is controlled in various manners depending on the task (no load / isolated operation / synchronization). The subsequent screens of this function are displayed.</p> <p>OFF .....The frequency control is not performed by the SPM-D, and the subsequent screens of this function are not displayed.</p>	
Parameter 12	Insensitivity frequency controller	0.02 to 1.00 Hz
Freq. controller Insens. = 0,00Hz	<p>Through the relays "higher/lower" the three-position frequency controller outputs actuating pulses as long as the system deviation is higher than the pre-set insensitivity. While in operating condition "no-load control" the system deviation means the deviation of the frequency of U2 from the rated generator frequency. While in operating condition "synchronization", it means the deviation of the frequency of U1 from the frequency of U2.</p>	
Parameter 13	Minimum turn-on time frequency controller	10 to 250 ms
Freq. controller Time pulse>000ms	<p>A short impulse duration of the relays is sufficient to control the desired set point for small control deviations and low gain. But the pulse must always last long enough that it can be detected by the subsequent adjustment device. The minimum turn-on time of the relays should be selected accordingly.</p>	
Parameter 14	Gain factor frequency controller	0.1 to 99.9
Freq. controller Gain Kp=00,0	<p>The gain factor Kp is used to optimize the dynamical behavior of the three-step controller. It affects the turn-on time of the relays, the pulse/pause ratio and the frequency of the pulses emitted via the control algorithm. The higher Kp is set, the higher is (for a fixed control deviation) the influence of the three-step controller on the subsequent adjustment device.</p>	
Parameter 15	Maximum pause between two governor outputs	0.0 to 52.0 s
Freq. controller T break < 00,0s	<p>The control algorithm calculates increasing intervals between the control pulses for a decreasing control deviation. These pauses may be very long, especially for a low gain Kp, and may be limited to a maximum here.</p>	
Parameter 16	Differential frequency for the output of a kick pulse	0.01 to 0.10 Hz
Kick pulse df < 0,00Hz	<p>If the value of differential frequency between the two systems U1 and U2 is less than the pre-set value (for the duration of the activation time), a kick pulse is output (also see chapter "Synchronizing" on page 17)</p>	
Parameter 17	Activation time until a kick pulse is output	1 to 99 s
Kick pulse activate 00,00s	<p>If, for the pre-set time, the value of the differential frequency between the two systems U1 and U2 is smaller than the kick pulse limit adjusted as described above, a kick pulse is output. (also see chapter "Synchronizing" on page 17)</p>	
Parameter 18	Duration of the kick pulse	10 to 250 ms
Kick pulse Time 000ms	<p>The value to be adjusted for the duration of the kick pulse can be selected in relation to the minimum turn-on time which was already adjusted above. (also see chapter "Synchronizing" on page 17)</p>	

Voltage Controller

Parameter 19	<div>Volt. controller ON</div>	<div>Voltage controller</div> <div>ON..... Generator voltage control is performed by the SPM-D. Depending on the task (no-load control/ synchronization), the generator voltage is controlled in different ways. The subsequent screens of this function are displayed.</div> <div>OFF..... Voltage control is not performed by the SPM-D, and the (otherwise) subsequent screens of this function will not be displayed.</div>	<div>ON/OFF</div>
Parameter 20	<div>Volt. controller Insens. =00,0V</div>	<div>Insensitivity voltage controller</div> <div>Via the three-position voltage controller, actuating pulses are output through the re-lays "higher/lower" as long as the system deviation is higher than the pre-set insensi-tivity. While in operation condition "no-load control", the system deviation is the de- viation of the voltage U2 from the rated generator voltage. While in operating condition "synchronization" it is the difference between the voltages U1 and U2.</div>	<div>0.1 to 15.0/0.5 to 60.0 V</div>
Parameter 21	<div>Volt. controller Time pulse>000ms</div>	<div>Minimum turn-on time voltage controller</div> <div>Short impulse duration of the relays is sufficient to control the desired set point for small control deviations and low gain. But the pulse must always last long enough that it can be detected by the subsequent adjustment device. The minimum turn-on time of the relays should be selected accordingly.</div>	<div>20 to 250 ms</div>
Parameter 22	<div>Volt. controller Gain Kp=00,0</div>	<div>Gain factor voltage controller</div> <div>The gain factor Kp is used to optimize the dynamical behavior of the three-step con-troller. It affects the turn-on time of the relays, the pulse/pause ratio and the frequen- cy of the pulses emitted via the control algorithm. The higher Kp is set, the higher is (for a fixed control deviation) the influence of the three-step controller on the subse- quent adjustment device.</div>	<div>0.1 to 99.9</div>
Parameter 23	<div>Volt. controller T break < 00,0ms</div>	<div>Maximum pause between two governor outputs</div> <div>The control algorithm calculates increasing intervals between the control pulses for a decreasing control deviation. These pauses may be very long, especially for a low gain Kp, and may be limited to a maximum here.</div>	<div>0.0 to 52.0 s</div>

Synchronization



Configure Synchronization



NOTE

The unit detects if the systems have a different rotating field and prevents a CB closure.

Parameter 24	Synchronous functions	ON/OFF
<div>Synchron. Gen. ON</div>	<p>ON .....The generator frequency and voltage is adjusted to the permissible differential ranges for the busbar/mains prior to issuing a connect command. The subsequent screens of this function are displayed.</p> <p>OFF .....Synchronization does not occur, but no-load control is performed if necessary. A connect command is not output. The subsequent screens of this function are not displayed.</p>	
Parameter 25	Max. admissible diff. frequency for synchroniz. (pos. slip)	0.02 to 0.49 Hz
<div>Synchron. Gen. df max = 0.00Hz</div>	A required condition for the output of an add-on order is that the pre-set differential frequency is not reached. This value indicates the upper frequency (positive value corresponding to positive slip → frequency of U2 exceeding frequency of U1).	
Parameter 26	Max. admissible diff. frequency for synchroniz. (neg. slip)	0.00 to -0.49 Hz
<div>Synchron. Gen. df min = -0.00Hz</div>	A required condition for the output of an add-on order is that the pre-set differential frequency is exceeded. This value indicates the lower frequency (negative value corresponding to negative slip → frequency of U2 falling below frequency of U1).	
Parameter 27	Maximum admissible differential voltage for synchronization	0.5 to 10.0 %
<div>Synchron. Gen. dU max = 00.0%</div>	A required condition for the output of an add-on order is that the pre-set differential voltage is not reached.	
Parameter 28	Minimum admissible differential angle for synchronization	0 to 99 °
<div>Synchron. Gen. phimax < 00°</div>	A required condition for the output of an add-on order is that the pre-set differential angle is not reached.	
Parameter 29	Pulse time of the add-on relay for synchronization	50 to 1,000 ms
<div>Synchron. Gen. T. pulse >0000ms</div>	The duration of the connect pulse can be adjusted to meet the requirements of the switchgear.	
Parameter 30	Switcher time element of the power circuit breaker	40 to 500 ms
<div>Synchron. Gen. Pick-up t. 000ms</div>	The pick-up time of the power circuit breaker corresponds to the lead time of the add-on order. The add-on order is output at the pre-set time, before the synchronous point is reached.	

Dead Bus Start

Parameter 31	Asynchronous switching	ON/OFF
<div>Gen. circ.break.</div> <div>Asyn.connect ON</div>	<p>ON..... Asynchronous switching of the power circuit breaker is admitted. The subsequent screens of this function are displayed.</p> <p>OFF..... Asynchronous switching is not admitted, and the subsequent screens of this function are not displayed.</p>	
Parameter 32	Dead bus start function 1: U1=U2=0	ON/OFF
<div>Asyn. Switching</div> <div>U1=0/U2=0 ON</div>	Release of the dead bus start function 1. In this case, both systems, U1 and U2, must fall below an adjustable threshold value in order to enable the output of an add-on order (dead bus-dead line).	
Parameter 33	Dead bus start function 2: U1=0, U2=Un	ON/OFF
<div>Asyn. Switching</div> <div>U1=0/U2=Un ON</div>	Release of the dead bus start function 2. In this case, the approximate value of the voltage of system U1 must be zero, and the voltage of system U2 must be applied (dead line-live bus).	
Parameter 34	Dead bus start function 3: U1=Un, U2=0	ON/OFF
<div>Asyn. Switching</div> <div>U1=Un/U2=0 EIN</div>	Release of the dead bus start function 3. In this case, the approximate value of the voltage of system U2 must be zero and the voltage of system U1 must be applied (live bus-dead line).	
Parameter 35	Min. monitoring time of the dead bus start conditions	0 to 20 s
<div>Asyn. Switching</div> <div>T min > 00s</div>	Before a dead bus start can be carried out, all conditions for the add-on of the power circuit breaker must be at least maintained for the pre-set time.	
Parameter 36	Max. adm. zero voltage diff. for switching to the dead bus busbar	3 to 50 %
<div>Asyn. Switching</div> <div>dU |U-0| < 00%</div>	To ensure that the value of a voltage is detected as "approximate zero" the maximum deviation from zero must not exceed the pre-set value (referring to the rated voltage).	
Parameter 37	Mini. rated voltage diff. for switching to the dead bus busbar	1 to 20 %
<div>Asyn. Switching</div> <div>dU |U-Un| < 00%</div>	To ensure that a voltage is detected as "applied", the deviation from the rated voltage must not exceed the pre-set value.	
Parameter 38	Max. rated voltage diff. for switching to the dead bus busbar	0.05 to 5.00 Hz
<div>Asyn. Switching</div> <div>df max = 0,00Hz</div>	To make sure that a power circuit breaker can be closed, the deviation of the frequency of the voltage-carrying system from the rated frequency must not exceed the differential frequency pre-set.	

Relay Output 16-17

" Message: Connect 2" The method of functioning of the relay "Message: Connect 2" depends on the
Terminal 16/17 setting of the screen "Rel. connect 2".

Parameter 39

Relay function connect 2

OFF /asynch.only/ synchr. only/ syn/asyn.

Rel. "connect 2" xxxxxxxxxxxxxxxxxxxx
--

For the relay "Annunciation: Connect 2" the following setting options are possible:

OFFThe relay "Annunciation: Connect 2" is not active.

CB ON: asyn.only The relay "Annunciation: Connect 2" **only** switches simultaneously with relay "Command: Close CB" (terminal 14/15), if the add-on order is released due to the detection of a dead bus start condition. ("Asyn. switching"). With this setting, the relay can bridge a contact of a synch-check relay which is externally connected in series with the add-on order (terminal 14/15). Thus, a two-channel relay control is possible during synchronization, but also an add-on order in case of a dead busbar.

CB ON: syn. only The relay "Annunciation: Connect 2" **only** switches simultaneously with the relay "Command: close CB" (terminal 14/15), if the add-on order is released due to the detection of the synchronism. With this setting, a second output is possible with the relay, which will not respond in case of a dead bus start.

CB ON: syn./asyn. The relay "Annunciation: Connect 2" always switches simultaneously with the relay "Command: close CB" (terminal 14/15). With this setting, a second output is possible with the relay, which is completely identical with the relay "Command: close CB" (terminal 14/15). If a single-channel system is used for a two-terminal control of the circuit breaker, this relay can be used for the switching of the second terminal. Please note that this second contact assembly cannot be used as a substitute for a synch-check relay!

Synchronizing Time Monitoring

Parameter 40	<div>Sync.time contr. ON</div>	Synchronizing time monitoring	ON/OFF
		ON.....No time monitoring for the synchronization is carried out. As soon as the synchronization starts, a time counter is started simultaneously. If the power circuit breaker is not closed after the pre-set time, a warning is released "Synchron. time". The synchronization is interrupted and the relay "readiness for operation" drops out. (While in synch-check mode, the synchronizing time monitoring is not activated). Resetting of the protective unit by depressing the button "Acknowledgement" for at least 3 s. The subsequent screens of this function are displayed.	
		OFF.....No time monitoring of the synchronization. The subsequent screens of this function are not displayed.	
Parameter 41	<div>Sync.time contr. Delay time 000s</div>	Final value of the synchronizing time monitoring	10 to 999 s
		For the description of this screen, please refer to the description of the previous configuration screen.	
Parameter 42	<div>Auto clearing Display ON</div>	Auto-acknowledgement of annunciations	ON/OFF
		ON.....As soon as the alarm condition is no longer detected and the ramp-down delay "annunciations" has expired, the corresponding annunciation is deleted on the display.	
		OFF.....Annunciations are indicated on the display until they are acknowledged. The subsequent screen is not displayed.	
Parameter 43	<div>Clearing display after 00s</div>	Ramp-down delay "annunciations"	1 to 99 s
		This screen is only visible, if the screen "auto acknowledgement of annunciation" is set to "ON".	

Chapter 7. Commissioning



DANGER - HIGH VOLTAGE

When commissioning the unit, please observe all safety rules that apply to the handling of live equipment. Ensure that you know how to provide first aid in the event of an uncontrolled release of energy and that you know where the first aid kit and the nearest telephone are. Never touch any live components of the system or on the back of the system:

LIFE THREATENING



CAUTION

Only a qualified technician may commission unit. The "EMERGENCY-STOP" function must be operational prior to commissioning of the system, and must not depend on the unit for its operation.



CAUTION

Prior to commissioning, ensure that all measuring devices are connected in correct phase sequence. The connect command for the unit circuit breaker must be disconnected at the unit circuit breaker. The field rotation must be monitored for proper rotation. Any absence of or incorrect connection of voltage measuring devices or other signals may lead to malfunctions and damage the unit, the engine, and/or components connected to the unit!



NOTE

The unit detects if the systems have a different rotating field and prevents a CB closure.

Procedure

1. Disconnect the breaker closing circuit directly at the power circuit breakers.
2. After wiring the unit and ensuring all voltage-measuring devices are phased correctly, apply the control system voltage (24 Vdc). The "automatic" LED will illuminate.
3. By simultaneously pressing the two pushbuttons "Digit↑" and "Cursor→", the configuration mode is accessed. Prior to entering the configuration mode, ensure that the "configuration locked" discrete input is de-energized. After entering the access code number, the unit may be configured according to the application requirements (see the chapter regarding the parameters). The "automatic" LED will be extinguished.
4. Configure the control unit. The setting limits can be read either from the description of the screen or from the list of parameters at the end of the operating manual.
5. After configuring the measuring variables, the unit will display the measured values. These values should be confirmed with a calibrated measuring instrument prior to enabling any breaker or control functions. **If a measuring voltage has been wired incorrect or not at all, this may lead to an asynchronous breaker closure in an active dead bus start!**
6. Check the status of all control and auxiliary inputs and the appropriate LEDs on the front foil of the unit. Check the status of all control and auxiliary outputs as well as the setting of the controller outputs.

7. Synchronizing the power circuit breaker:
 - a) Open the power circuit breaker.
 - b) Ensure the reference voltage that the system has to synchronize to is within the permissible limits.
 - c) Energize terminal 3 "Enable CB".
 - d) Configure the parameters of the governor.
 - e) If the generator voltage is 50% lower than the rated value, the voltage controller starts to operate. Configure the controller parameters so that the set point value is efficiently controlled.
 - f) Prior to the automatic closing of the circuit breaker, ensure that all measuring values have been wired and applied correctly. At the synchronous point, verify if the synchronizing functions have been configured correctly. It is recommended that a differential voltage meter be used for this test at the power circuit breaker connection.
8. Dead bus start:

The output of an add-on order on a dead busbar can be simulated during you are in the configuration mode. The LED "CB close" indicates that at this moment an add-on order would be output for the corresponding breaker if the automatic mode was selected.
9. After successfully closing the power circuit breaker the "Gen CB - ON" LED must illuminate.

Appendix A. Dimensions

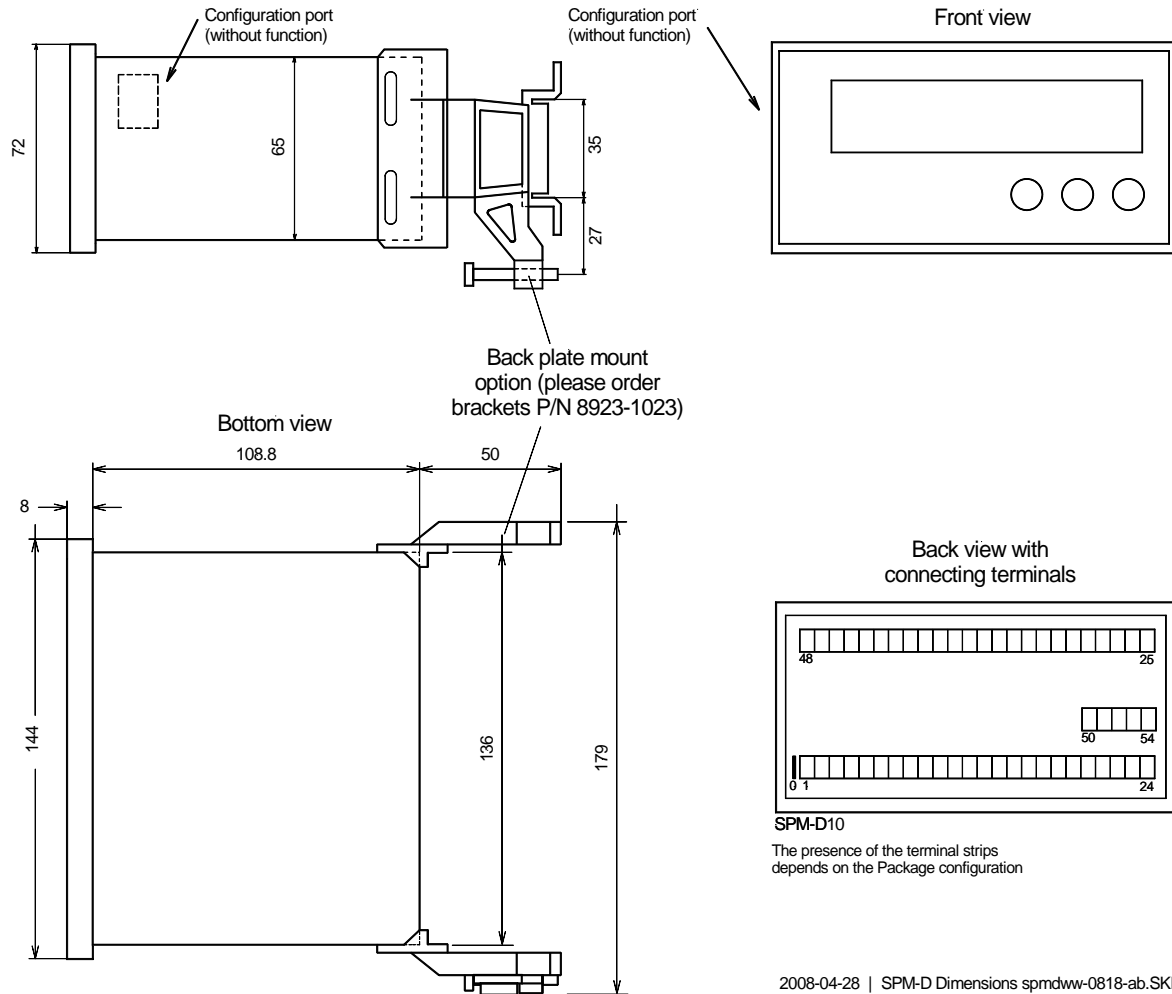


Figure 7-1: Dimensions

Appendix B.

Technical Data

Measuring voltage -----	
Measuring voltage	Rated value (V_{rated}) λ/Δ [1] 66/115 Vac [4] 230/400 Vac
	Maximum value V_{Ph-Ph} (UL/cUL) [1] max. 150 Vac [4] max. 300 Vac
	Rated voltage $V_{Ph-ground}$ [1] 150 Vac [4] 300 Vac
	Rated surge voltage [1] 2.5 kV [4] 4.0 kV
- Measuring frequency	..... 40.0 to 70.0 Hz
- Accuracy	..... Class 1
- Resistance	..... 0.1%
- Linear measuring range up to	..... $1.3 \times V_{rated}$
- Input resistance	..... [1] 0.21 M Ω , or [4] 0.696 M Ω
- Maximum power consumption per path	..... 0.15 W
Ambient variables -----	
- Power supply	YB Package 24 Vdc (+/-25%) NYB Package 90 to 250 Vac
- Intrinsic consumption	YB Package max. 10 W NYB Package max. 10 W (10 VA or 10 W)
- Ambient temperature	YB Package -20 to +70 °C NYB Package -20 to 60 °C
- Ambient humidity t	..... 95%, not condensing
Discrete inputs ----- isolated	
- Input range ($V_{Cont, digital input}$)	..... 18 to 250 Vac/dc
- Input resistance	..... approx. 68 k Ω
Relay outputs ----- isolated	
- Make contact	..... potential free
- Contact material	..... AgCdO
- General purpose (GP) ($V_{Cont, relay output}$)	AC 2.00 Aac@250 Vac DC 2.00 Adc@24 Vdc 0.36 Adc@125 Vdc 0.18 Adc@250 Vdc
- Pilot duty (PD) ($V_{Cont, relay output}$)	AC DC 1.00 Adc@24 Vdc 0.22 Adc@125 Vdc 0.10 Adc@250 Vdc

Housing

- Type.....APRANORM DIN 43 700
- Dimensions (W × H × D).....144 × 72 × 122 mm
- Front cutout (W×H) 138 [+1.0] × 67 [+0.7] mm
- Wiring.....Screw-type terminals depending on
plug connector 1.5 mm² or 2.5 mm²
- Recommended tightening torque.....0.4 Nm or 0.5 Nm
use 60/75 °C copper wire only
use class 1 wire only or equivalent
- Weight approx. 800 g

Protection

- Protection system..... IP42 from front at professional installation
IP54 from front with gasket (gasket: P/N 8923-1037)
IP20 from back
- Front foil insulating surface
- EMV test (CE)..... tested according to applicable EN guidelines
- Listings CE marking; UL listing for ordinary locations
UL/cUL listed, Ordinary Locations, File No.: E231544

Appendix C.

List of Parameters

Product number P/N _____ Rev _____

Version SPM-D10/YB _____

Project _____

Serial number S/N _____ Date _____

Option	Parameter 100/400V; 1/5 A	Adjustment range	Default setting	Customer settings	
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CONFIGURE GENERAL PARAMETERS

Software version		4.0xxx		
Service display	ON/OFF	OFF	<input type="checkbox"/> on <input type="checkbox"/> off	<input type="checkbox"/> on <input type="checkbox"/> off
Encoding	ON/OFF	ON	<input type="checkbox"/> on <input type="checkbox"/> off	<input type="checkbox"/> on <input type="checkbox"/> off

CONFIGURE BASIC SETTINGS

Rated Frequency fn	48.0 to 62.0 Hz	50.0 Hz		
Generator freq. f set	48.0 to 62.0 Hz	50.0 Hz		
Gen. voltage U set	30 to 120/50 to 440 V	100/400 V		
Rated voltage Un	30 to 120/70 to 420 V	100/400 V		
Volt. transf. U1 secondary	30 to 120/50 to 500 V	100/400 V		
Volt. transf. U1 primary	0.1 to 650.0 kV	0.1/0.4 kV		
Volt. transf. U2 secondary	30 to 120/50 to 500 V	100/400 V		
Volt. transf. U2 primary	0.1 to 650.0 kV	0.1/0.4 kV		

CONFIGURE CONTROLLER

Controll. in no-load oper.	ON/OFF	OFF	<input type="checkbox"/> on <input type="checkbox"/> off	<input type="checkbox"/> on <input type="checkbox"/> off
Voltage measuring	1ph L-N / 1ph L-L / 3ph	3ph	<input type="checkbox"/> 1-n <input type="checkbox"/> 1-l <input type="checkbox"/> 3ph	<input type="checkbox"/> 1-n <input type="checkbox"/> 1-l <input type="checkbox"/> 3ph
Freq. controller	ON/OFF	ON	<input type="checkbox"/> on <input type="checkbox"/> off	<input type="checkbox"/> on <input type="checkbox"/> off
Freq. controller insens.	0.02 to 1.00 Hz	0.10 Hz		
Freq. controllerTime pulse	10 to 250 ms	80 ms		
Freq. controller Gain Kp	0.1 to 99.9	15.0		
Freq. controller T break <	0.0 to 52.0 s	50.0 s		
Kick pulse df <	0.01 to 0.10 Hz	0.05 Hz		
Kick pulse activate	1 to 99 s	5 s		
Kick pulse Time	10 to 250 ms	80 ms		
Volt. controller	ON/OFF	ON	<input type="checkbox"/> on <input type="checkbox"/> off	<input type="checkbox"/> on <input type="checkbox"/> off
Volt. controller insens.	0.1 to 15.0/0.5 to 60 V	1.0 V		
Volt. controllerTime pulse	20 to 250 ms	80 ms		
Volt. controller Gain Kp	0.1 to 99.9	15.0		
Volt. controller T break <	0.0 to 52.0 s	50.0 s		

Option	Parameter 100/400V; 1/5 A	Adjustment range	Standard setting	Customer settings	
CONFIGURE SYNCHRONIZATION					
	Synchron. Gen.	ON/OFF	ON	<input type="checkbox"/> on <input type="checkbox"/> off	<input type="checkbox"/> on <input type="checkbox"/> off
	Synchron. Gen. df max	0.02 to 0.49 Hz	0.18 Hz		
	Synchron. Gen. df min	0.00 to -0.49 Hz	-0.10 Hz		
	Synchron. Gen. dU max	0.5 to 10.0%	3%		
	Synchron. Gen. phimax	0 to 99 °	7 °		
	Synchron. Gen. T.impuls	50 to 1.000 ms	200 ms		
	Synchron. Gen. Pick-up t.	40 to 500 ms	80 ms		
CONFIGURE DEAD BUS START					
	Gen. circ.break.Asyn.connect	ON/OFF	OFF	<input type="checkbox"/> on <input type="checkbox"/> off	<input type="checkbox"/> on <input type="checkbox"/> off
	Asyn. Switching U1=0/U2=0	ON/OFF	OFF	<input type="checkbox"/> on <input type="checkbox"/> off	<input type="checkbox"/> on <input type="checkbox"/> off
	Asyn. Switching U1=0/U2=Un	ON/OFF	OFF	<input type="checkbox"/> on <input type="checkbox"/> off	<input type="checkbox"/> on <input type="checkbox"/> off
	Asyn. Switching U1=Un/U2=0	ON/OFF	OFF	<input type="checkbox"/> on <input type="checkbox"/> off	<input type="checkbox"/> on <input type="checkbox"/> off
	Asyn. Switching T min >	0 to 20 s	5 s		
	Asyn. Switching dU |U-0| <	3 to 50%	10%		
	Asyn. Switching dU |U-Un| <	1 to 20%	5%		
	Asyn. Switching df max	0.05 to 5.00 Hz	0.25 Hz		
	Rel.connect 2	OFF asyn.only syn.only syn./asyn.	OFF	<input type="checkbox"/> OFF <input type="checkbox"/> asyn. only <input type="checkbox"/> syn.only <input type="checkbox"/> syn./asyn.	<input type="checkbox"/> OFF <input type="checkbox"/> asyn. only <input type="checkbox"/> syn.only <input type="checkbox"/> syn./asyn.
CONFIGURE SYNCH TIME MONITORING					
	Sync.time contr.	ON/OFF	OFF	<input type="checkbox"/> on <input type="checkbox"/> off	<input type="checkbox"/> on <input type="checkbox"/> off
	Sync.time contr. Delay time	10 to 999 s	120 s		
	Auto clearing Display	ON/OFF	ON	<input type="checkbox"/> on <input type="checkbox"/> off	<input type="checkbox"/> on <input type="checkbox"/> off
	Clearing display after	1 to 99 s	1 s		

Appendix D. Service Options

Product Service Options



The following factory options are available for servicing Woodward equipment, based on the standard Woodward Product and Service Warranty (5-01-1205) that is in effect at the time the product is purchased from Woodward or the service is performed. If you are experiencing problems with installation or unsatisfactory performance of an installed system, the following options are available:

- Consult the troubleshooting guide in the manual.
- Contact Woodward technical assistance (see "How to Contact Woodward" later in this chapter) and discuss your problem. In most cases, your problem can be resolved over the phone. If not, you can select which course of action you wish to pursue based on the available services listed in this section.

Returning Equipment For Repair



If a control (or any part of an electronic control) is to be returned to Woodward for repair, please contact Woodward in advance to obtain a Return Authorization Number. When shipping the unit(s), attach a tag with the following information:

- Name and location where the control is installed;
- name and phone number of contact person;
- complete Woodward part numbers (P/N) and serial number (S/N);
- description of the problem;
- instructions describing the desired type of repair.



CAUTION

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual 82715, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Packing A Control

Use the following materials when returning a complete control:

- Protective caps on any connectors;
- antistatic protective bags on all electronic modules;
- packing materials that will not damage the surface of the unit;
- at least 100 mm (4 inches) of tightly packed, industry-approved packing material;
- a packing carton with double walls;
- a strong tape around the outside of the carton for increased strength.

Return Authorization Number RAN

When returning equipment to Woodward, please telephone and ask for the Customer Service Department in Stuttgart [+49 (0) 711 789 54-0]. They will help expedite the processing of your order through our distributors or local service facility. To expedite the repair process, contact Woodward in advance to obtain a Return Authorization Number, and arrange for issue of a purchase order for the unit(s) to be repaired. No work can be started until a purchase order is received.



NOTE

We highly recommend that you make arrangement in advance for return shipments. Contact a Woodward customer service representative at +49 (0) 711 789 54-510 for instructions and for a Return Authorization Number.

Replacement Parts



When ordering replacement parts for controls, include the following information:

- The part numbers P/N (XXXX-XXX) that is on the enclosure nameplate;
- the unit serial number S/N, which is also on the nameplate.

How To Contact Woodward



Please contact following address if you have questions or if you want to send a product for repair:

Woodward GmbH
Handwerkstrasse 29
70565 Stuttgart - Germany

Phone: +49 (0) 711 789 54-510 (8.00 - 16.30 German time)
Fax: +49 (0) 711 789 54-101
e-mail: stgt-info@woodward.com

For assistance outside Germany, call one of the following international Woodward facilities to obtain the address and phone number of the facility nearest your location where you will be able to get information and service.

Please contact the Woodward Customer Service Department or consult our worldwide directory on Woodward's website (**www.woodward.com**) for the name of your nearest Woodward distributor or service facility.

[For worldwide directory information, go to **www.woodward.com/ic/locations**.]

Engineering Services



Woodward Industrial Controls Engineering Services offers the following after-sales support for Woodward products. For these services, you can contact us by telephone, by e-mail, or through the Woodward website.

- Technical support
- Product training
- Field service during commissioning

Technical Support is available through our many worldwide locations or through our authorized distributors, depending on the product. This service can assist you with technical questions or problem solving during normal business hours. Emergency assistance is also available during non-business hours by phoning our toll-free number and stating the urgency of your problem. For technical engineering support, please contact us via our toll-free or local phone numbers, e-mail us, or use our website and reference technical support.

Product Training is available on-site from several of our worldwide facilities or at your location, depending on the product. This training, conducted by experienced personnel, will assure that you will be able to maintain system reliability and availability. For information concerning training, please contact us via our toll-free or local phone numbers, e-mail us, or use our website and reference *customer training*.

Field Service engineering on-site support is available, depending on the product and location, from our facility in Colorado, or from one of many worldwide Woodward offices or authorized distributors. Field engineers are experienced on both Woodward products as well as on much of the non-Woodward equipment with which our products interface. For field service engineering assistance, please contact us via our toll-free or local phone numbers, e-mail us, or use our website and reference *field service*.

Technical Assistance



If you need to telephone for technical assistance, you will need to provide the following information. Please write it down here before phoning:

Contact

Your company _____

Your name _____

Phone number _____

Fax number _____

Control (see name plate)

Unit no. and Revision: P/N: _____ REV: _____

Unit type SPM-D10/YB _____

Serial number S/N _____

Description of your problem

Please be sure you have a list of all parameters available.

We appreciate your comments about the content of our publications.

Please send comments to: stgt-documentation@woodward.com

Please include the manual number from the front cover of this publication.



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Homepage

<http://www.woodward.com>

Woodward has company-owned plants, subsidiaries, and branches, as well as authorized distributors and other authorized service and sales facilities throughout the world.

Complete address/phone/fax/e-mail information
for all locations is available on our website (www.woodward.com).

2014/9/Stuttgart