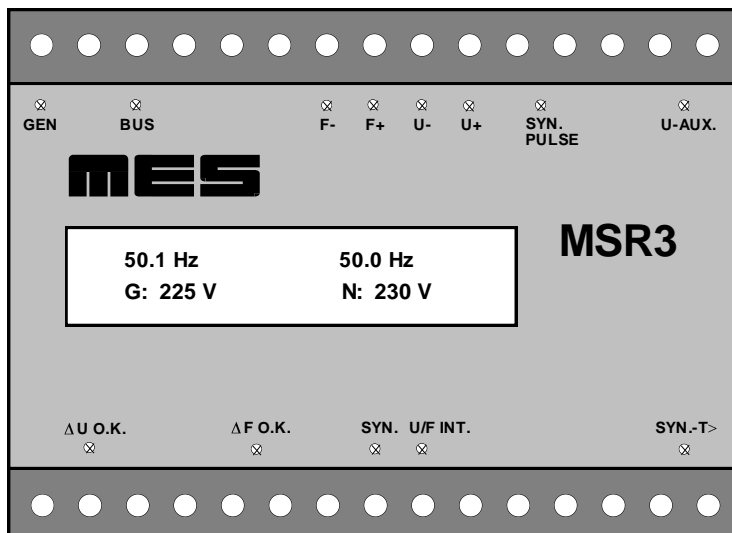


Synchronizing Unit

MSR3

Version08 31.10.2007



FEATURES

- integrated voltage and frequency regulation
- internal reference frequency pre-set
- display of voltage and frequency of two systems
- LCD indication of functions
- illuminated LCD indication
- adjustable setting parameters
- compact design
- displaytext german/english

[View 1](#)

1.0 SCOPE OF APPLICATION

The synchronizing unit **MSR3** is used for automatic paralleling of three-phase AC generators with three-phase mains network systems. Thereby voltage and frequency are adjusted. During generator island operation mode the generator is regulated to a pre-set nominal frequency and/or nominal voltage.

2.0 METHOD OF OPERATION

The synchronizing unit detects the voltage and the frequency of two AC systems by means of differential amplifiers. Measurement takes place between L1 and L2 each.

The voltages and the mean frequencies are permanently indicated on the text display during operation. By pressing the SELECT-key the actual frequency and the phase angle can be indicated. ([view 3](#)).

During control action the **MSR3** device generates +/- actuating pulses. The frequency control pulses (F+ and F-) are to be meant for the speed control governor of the generating set. The voltage control pulses (U+ and U-) can be passed on to the voltage regulator of the generator.

LEDs provide information about all switching conditions of inputs and outputs. Observance of the voltage- and frequency deviations, permissible for synchronizing, is indicated by LEDs as well.

3.0 FUNCTION

3.1 Commissioning

The synchronising device has to be connected according to the terminal allocation ([view 3](#)).

After connection of the auxiliary voltage the LED "U-AUX" lights and as soon as the measuring voltages are alive, the LEDs "GEN" and "BUS" will light as well. Control action can start as soon as the inputs E1 and E2 are triggered ([view 3](#)). The actual measuring values are indicated on the display ([view 1](#)). Measurement takes place after the input voltage of approximately 45 V has attained.

3.2.1 Classifying

For correct adaptation to the respective case of application, classifying is required. The response values are to be checked and adapted to the plant if necessary. The set ranges and response values can be taken out of the table under [point 5](#).

The front cover has to be removed in order to get access to the SELECT-key, to the ENTER-RESET-key and to the DIP-switches.

3.2.2 Parameter setting

Parameter setting can be found under [point 5](#) and contains [17 parameters](#). In order to attain the classifying mode, the **DIP-S2** must be switched on. For leaving that mode, it is necessary to terminate the actual inputs at first and set the DIP-back to OFF position. For greatest possible data safety all set values are memorized in an EEPROM. No buffer battery is required for this.

A short function discription of each parameter appears in the following schedule.

Parameter	Note	Display-Range
Advance time	Serves to compensate delays caused by auxiliary switching elements. The synchronous pulse is emitted, corrected by the advance time, before the calculated synchronous moment has reached; typical delay of a breaker: 50ms.	LEADT. : 10...500 ms
Max. differential frequency	Max. permissible frequency deviation at which connection can take place.	Dfmax : 0.01...0.99 Hz
Min. differential frequency	At synchronizing operation the generator is always regulated to a small frequency deviation to the mains frequency in order to keep the generator frequency in beat with the mains frequency, to make synchronizing possible at all.	Dfmin : 0.05...0.50 Hz
Max. difference voltage	Max. permissible deviation of generator voltage against the synchronizing voltage, at which connection to the system can take place.	DUmax. : 1...15 %
Correction factor mains voltage	For correction of possibly interconnected voltage transformers.	M-Corr : 0.50...2.00
Correction factor gen. voltage	For correction of possibly interconnected voltage transformers.	G-Corr : 0.50...2.00
Duration of synchronizing pulse		SYNCIMP : 50...999 ms
Pulse width of voltage adjustment pulses	By an increasing ΔU and depending on the pre-adjusted amplification of the controller the break period will be shorter. If the break period is shorter than the pulse, a permanent pulse is emitted.	VOLIMP. : 50...999 ms
Pulse width of frequency adjustment pulses	By an increasing Δf and depending on the pre-adjusted amplification of the controller the break period will be shorter. If the break period is smaller than the pulse, a permanent pulse is emitted.	FRQIMP. : 50...999 ms
Amplification of frequency control circuit	Quantity of pulses which will be given in one time period, is calculated as follows: $1/\Delta f \times 60 = \text{sec}$. The amplification will affect the response time of the controller in case of frequency deviations.	V-FRQ. : 1...600 IPM
Amplification of voltage control circuit	Quantity of pulses which will be given in one time period, is calculated as follows: $1/\Delta U \times 60 = \text{sec}$. The amplification will affect the response time of the controller in case of voltage deviations.	V-VOL. : 1...100 IPM
Integration time for frequency control	The frequency, which is actual value basis of the frequency control, is averaged over several periods in order to keep the control circuit calm.	F-INTEG : 1...999 PER
Max. synchronizing time	In case after release of E1 the pre-set time has elapsed, the relay A6 is deenergized for 4 sec. and is automatically reset as long as the release of E1 remains active.	TSYNmax : 1...999 s
Reference frequency at island operation	In case input E2 is triggered, the generator is regulated to the pre-set frequency.	GEN.-FRQ : 45...65 Hz
Reference voltage at island operation	In case input E2 is triggered, the generator is regulated to the pre-set voltage. If OV has set, control action is deactivated.	GEN.-VOL: 0 . . . 500V
Delay time after released synchr.	In case input E1 is triggered, the MSR3 starts synchronizing after pre-set time has elapsed.	DELAY-T.: 0 . . . 99 s
Monitoring of synchronizing time	Monitoring of synchronizing pulse or of synchronizing release. Relay 6 deenergized after elapsed time, set at "max. synchronizing time".	IMPULSE-SURVEIL. E1 – SURVEIL.
Language	Displaytext language	LANGUAGE ENGLISH SPRACHE DEUTSCH

3.2.3 Parameter selection

Within the parameter setting mode the parameters are scrolled through the display by means of the SELECT-key until the value to be modified has reached.

3.2.4 Input

Input or modification of the selected parameter is initiated by the ENTER-key. The cursor position is then changed by the ENTER-key as well. Pressing the SELECT-key causes an up-counting of the digit, marked by the cursor. When all cursor positions having been touched through, returning back to parameter selection takes place by means of the ENTER-key.

3.2.5 Codification

In order to make an unauthorized modification as difficult as possible, the selection mode may be left after coding as well.

Text window:

PARAMETERANWAHL
CODIERUNG m. ENT

and then press the ENTER-key.

Now all parameters are protected against unauthorized or accidentally modification and can be viewed only!

In case the coding shall be cancelled, the **DIP-S2** has to be set to ON position, the ENTER-key must be pressed then and kept and the SELECT-key pressed three times.

3.3 Synchronizing procedure

In case control action has enabled via the control input E1, the **MSR3** device generates +/- control pulses for the frequency- (A1 and A2) and for the voltage regulator (A3 and A4). The pulse width is internally classified. The break length is determined by the deviation against the reference value.

When the control input E1 has set and the generator voltage and generator frequency are within the pre-set difference values compared to the leading system, a synchronous pulse is emitted in case of phase matching condition. In order to compensate delays caused by auxiliary switching elements, the synchronous pulse is emitted earlier than the calculated synchronous moment, predetermined by the pre-set advance time.

In case of measuring voltage failure the voltage and the frequency is regulated after re-established measuring voltage. At the earliest after 2 s the first synchronous pulse is emitted.

3.4 Island operation mode

When the control input E2 has released, the generator frequency is regulated by the internal frequency control system. The reference frequency can be pre-selected as a parameter ([para. no. 14](#)). At this mode of operation voltage control takes place only in case a value higher than 0 has been entered for the voltage reference value ([para. no. 15](#)). The display indicates the reference frequency, the actual frequency and the generator voltage.

The input E2 is subordinated to input E1, i.e. at simultaneous activation of E1 and E2 synchronizing operation takes place.

In case the actual voltage and/or the actual frequency are within the value windows pre-determined by the pre-set parameters, this condition will be indicated by means of the LEDs "ΔU OK" or "ΔF OK".

3.5 Monitoring of synchronizing time

The **MSR3** is able to monitor the synchronizing process or the release ([para. no. 17](#)).

— Monitoring of the synchronizing pulse:

After performed synchronizing release the **MSR3** monitors whether a synchronizing pulse has emitted within the pre-set monitoring time ([para. no. 13](#)). If no paralleling takes place within the pre-set period of time, the relay A6 is de-energized and the LED "SYN.-T>" goes off. After 4 s the relay is energized again and the LED is on again as well. This procedure is repeated as long as E1 is closed and no paralleling took place.

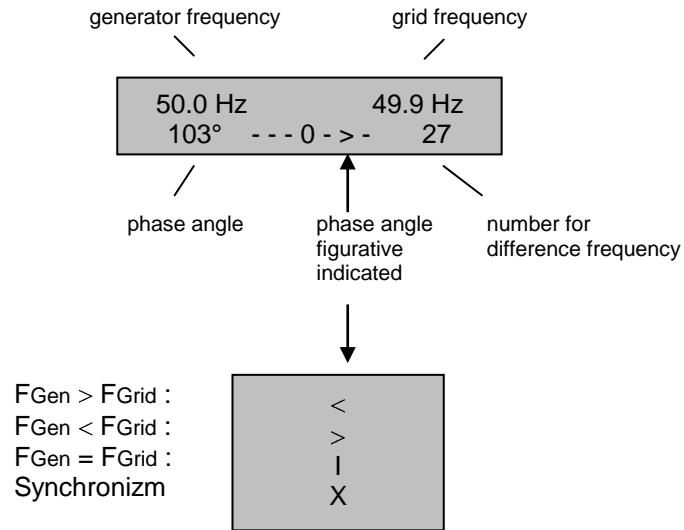
— Monitoring of release of E1:

At this setting the **MSR3** monitors the release time. After running out of the pre-set period of time the relay A6 is de-energized and the LED "SYN.-T>" goes off.

3.6 Synchroscope

In case the synchroscope has selected, following information is indicated on the LCD display:

Text window:



View 2

Fgen > Fmains : genset too fast ⇒ speeding down

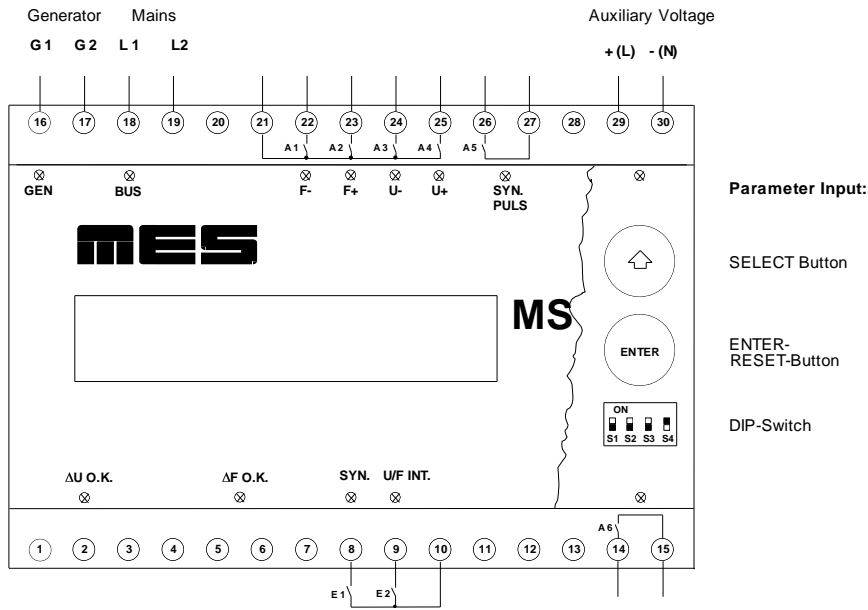
Fgen < Fmains : genset too slow ⇒ speeding up

When mains- or generator voltage is no longer alive, automatically the standard indication is activated again (view 1).

3.7 DISPLAYTEXT

Displaytext can be shown in german or english (para. No. 18)

4.0 CONNECTING DIAGRAM



Outputs:

- A 1: Frequency Regulation -
- A 2: Frequency Regulation +
- A 3: Voltage Regulation -
- A 4: Voltage Regulation +
- A 5: Synchronizing Pulse
- A 6: Syn.- Time Exceeded (deenergized at failure)

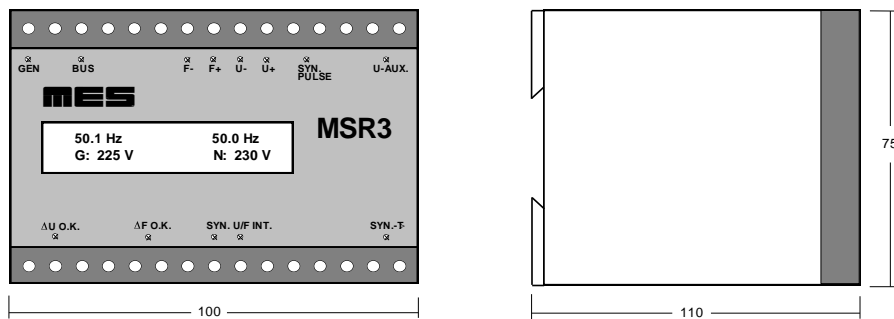
Inputs:

- E1 : Synchronizing
- E2 : Island Operation

For access to SELECT-, ENTER/RESET button and DIP-switch front cover to be removed

[View 3](#)

5.0 DIMENSIONS



[View 4](#)

5.0 SET VALUES AND PARAMETER SETTINGS

Para. No.	Parameter	Display range	Basic pre-set	Setting Factory	Setting Comm.
Threshold values DIP-Switch 2 = ON					
1	Advance time	LEADT. : 10...500 ms	50 ms		
2	Max. differential frequency	Dfmax : 0.01...0.99 Hz	0.10 Hz		
3	Min. differential frequency	Dfmin : 0.05...0.50 Hz	0.05 Hz DIL S4= on		
4	Max. difference voltage	DUmax. : 1...15 %	5 %		
5	Correction factor mains voltage	M-Corr : 0.50...2.00	1.00		
6	Correction factor gen. voltage	G-Corr : 0.50...2.00	1.00		
7	Duration of synchronizing pulse	SYNCIMP : 50...999 ms	200 ms		
8	Pulse width of voltage adjustment pulses	VOLIMP. : 50...999 ms	100 ms		
9	Pulse width of frequency adjustment pulses	FRQIMP. : 50...999 ms	100 ms		
10	Amplification of frequency control circuit	V-FRQ. : 1...600 IPM	60 IPM		
11	Amplification of voltage control circuit	V-VOL. : 1...100 IPM	60 IPM		
12	Integration time for frequency control	F-INTEG : 1...999 PER	50 PER		
13	Max. synchronizing time	TSYNmax : 1...999 s	180 s		
14	Reference frequency at island operation	GEN.-FRQ : 45...65 Hz	50 Hz		
15	Reference voltage at island operation	GEN.-VOL: 0 . . . 500V	400 V		
16	Delay time after released synchr.	DELAY-T.: 0 . . . 99 s	5 s		
17	Monitoring of synchronizing time	IMPULSE-SURVEIL. E1 – SURVEIL.	IMPULS- SURVEIL.		
18	Language	LANGUAGE ENGLISH SPRACHE DEUTSCH	SPRACHE DEUTSCH		

Coding switch					
Function	DIP S1	DIP S2	DIP S3	DIP S4	
Operation condition	OFF	OFF	OFF	ON	
Parameter setting	OFF	ON	OFF	OFF	
$F_{Gen>} = F_{Netz} + \Delta F_{min}$ activated *	OFF	OFF	OFF	OFF	

* : After release of E1 at least once $F_{Gen>} = F_{Netz} + \Delta F_{min}$ must be, in order to enable synchronizing, i.e. the coding switch DIL S4=OFF. The device recognizes as well when mains and generator are connected in parallel.

6.0 TECHNICAL DATA

Generator-/ mains voltage	100 - 400 VAC
Auxiliary voltage	19 - 32 VDC
Digital inputs terminal 8,9 and 10	12 V, 8 mA (opto-decoupled), wires no longer than 2.5 m
Power consumption	approx. 3 VA
Relay outputs	230 VAC/DC, 2 amps 4 volt.- free output relays with common input 2 volt.-free make contacts
Test voltage	2.5 kV
Ambient temperature	0 ... +50°C
Casing	plastics Makrolon 8020 grey / VDE 0100 / VBG4
Dimensions	W100 x H110 x D75 mm
Mounting	standard clip rail according to DIN 50022 or screw mounting
Degree of protection	IP 20
Weight	460 g
Mounting position	any
Regulations	VDE 0160 / EN50178 VDE 0435 part 303 VDE 0110 IEC 255-6

Subject to technical modifications!!

This device is the replacement type of previous types MSR1-1 and MSR1-2.



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