

LUMEL

ISO 9001
CERTIFIED

DIGITAL SYNCHRONIZING UNIT

KS3.1



144 x 144 x 77 mm

SERVICE MANUAL

CE

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1. APPLICATION

The KS3-1 digital synchronizing unit is destined to synchronize generators during their coupling in parallel to the network or other generators working at the rated 50 or 60 Hz frequency. The full synchronization is obtained at the moment when follows the equalization of the voltage, frequency and phase angle. The phase angle, voltage and frequency differences of generator and network signals are shown on digital displays.

At the synchronization moment, the zero or other values of the interval settled by the user, are shown on suitable displays.

The unit has two relay outputs. One of the relay indicates the moment when the synchronization is reached, the second relay signals the measuring range exceeding of the selected quantity.

2. DELIVERY SPECIFICATION

The KS3-1 synchronizing unit set includes:

- KS3-1 synchronizing unit 1pc
- screw holders fixing the unit on a panel 4pcs
- service manual 1pc
- warranty card 1pc

3. BASIC REQUIREMENTS AND USER'S SAFETY

KS3-1 digital synchronizing units are intended to be installed in panels, switchboards and cubicles. They are in conformity with IEC 1010+1-A1/A2 standard requirements.

Remarks concerning safety:

The unit installation should be carried out by a qualified staff.

One must consider all accessible aspects of the protection.

The instrument leaves the factory in perfect condition regarding technical safety. In order to maintain this condition and to ensure safe operation, the user must comply with indications and markings contained in the following instructions:

- Before mounting, ensure that the operating voltage and mains voltage set are the same, and then proceed with installation.
- The power supply must be connected as shown in the relevant diagram.

- Before the switching on, check the correctness of meter connections.
- Before any maintenance and/or repairs, whenever the instrument must be opened, it must be disconnected from all power sources.
- Maintenance and/or repairs must be carried out only by a qualified authorized personnel.
- If there is ever the suspicion that safe use is no longer possible, the instrument must be taken out of service and precautions taken against accidental use.
- Operation is no longer safe when:
 - there is clearly visible damage,
 - the instrument no longer functions,
 - after lengthy storage in unfavorable conditions,
 - after serious damage incurred during transport.

Operator safety

The instrument described in this service manual is intended for use by properly trained staff only.

Maintenance and/or repairs must be carried out only by authorized personnel.

For proper, safe use of the instrument and for maintenance and/or repairs, it is essential that the persons instructed to carry out these procedures follow normal safety precautions.

Precautions in case of breakdowns

If it is suspected that the instrument is no longer safe, for example due to damage incurred during transport or use, it must be taken out of service and precautions taken to prevent accidental use.

Contact authorized technicians for checks and any repairs.

4. INSTALLATION

4.1. Fixing way

One should cut-out a hole of $138^{+0.5} \times 138^{+0.5}$ mm dimensions in the panel and fix the synchronizing unit by means of four screw holders. The unit housing, which overall dimensions are $144 \times 144 \times 77$ mm, is made of self-extinguishing plastics. The screw terminal strips enable the connection of external conductors which maximal cross-section is 2.5 mm^2 .

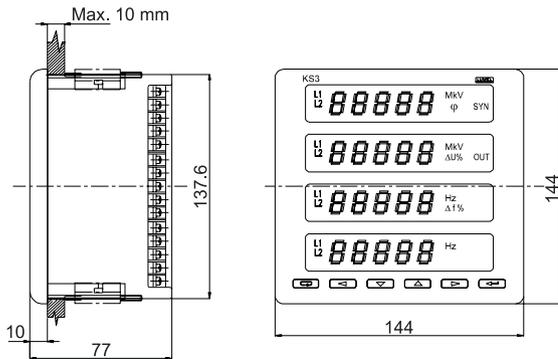
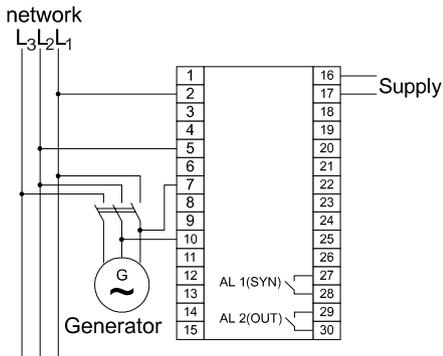


Fig. 1. Overall dimensions and fixing way of the KS3-1 unit

4.2. Scheme of external connections



CAUTION: before connection check the phase sequence

Fig. 2. Connection scheme

5. SERVICE OF THE KS3-1 UNIT

5.1. Frontal plate

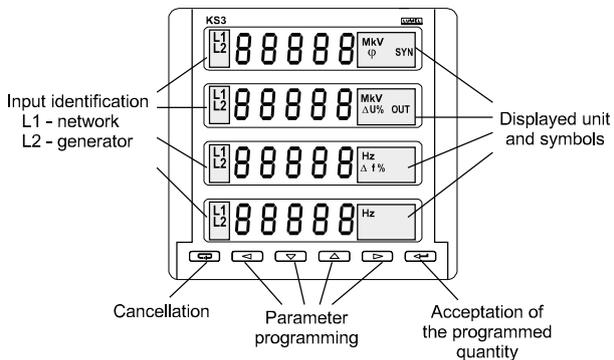


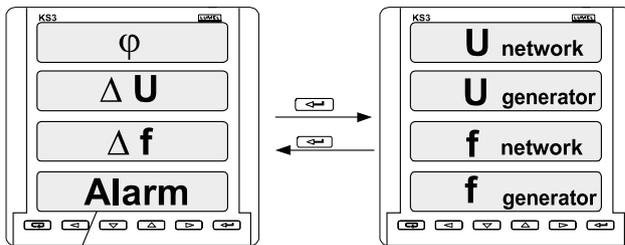
Fig. 3. View of the KS3-1 unit frontal plate

5.2. Working modes of the KS3-1 synchronizing unit.

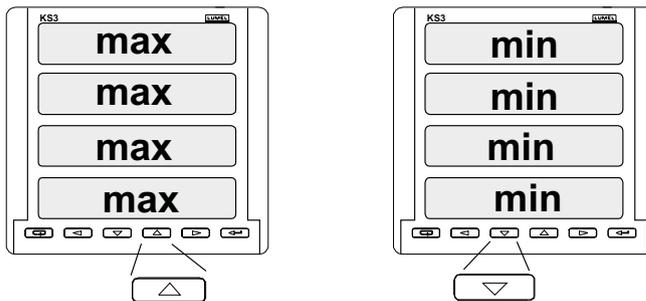
The KS3-1 synchronizing unit has 3 working modes (table 1)

Mode		Calling	
Name	Calling symbols	Input	Output
measuring			
Parameter configuration	S	In the configuration procedure	after the last parameter
Alarm configuration	A	In the configuration procedure	after the last parameter

After its switching on, the unit makes an autotest:



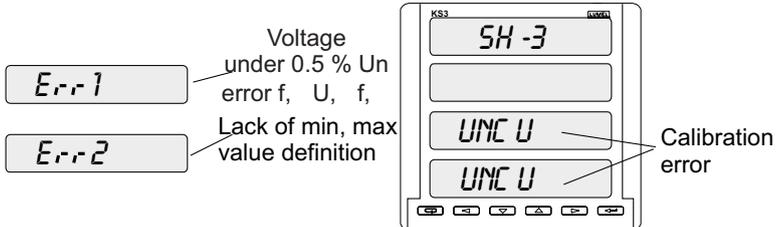
Messages about alarms



Displaying of minimal and maximal values.

Erasing by pressing the  key during their monitoring (e.g.  and next ).

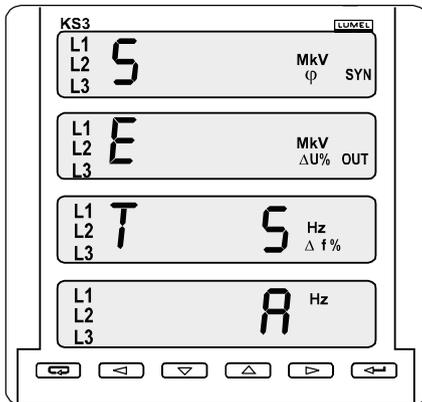
5.2.2. Errors codes



Calibration values written in EEPROM are damaged. The unit need to be serviced.

5.3. Configuration

In order to enter in the configuration mode one must press two keys:  and  during ca 3 seconds, until the sound signal switching off.



By means of  and  keys we change the display brightness.

By means of  and  keys we choose the suitable mode: S or A and next we accept by pressing the  key. The return to the measuring mode by pressing the  key after the last parameter.

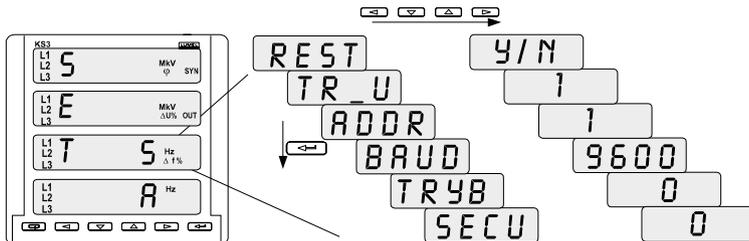
5.3.1. Configuration of S parameters.

The entry into the parameter configuration mode is protected by the access code. In case of the 0000 code, the asking for the password is omitted. If the access code is different from zero, there is only the possibility of the parameter reviewing.

Table 2

Parameter name	Symbol	Range	Description	Manufacturing code (value)
Entry of the access code*	SECU	0000...9999	0000, without code	0000
Setting of manufacturer's parameter	rEST		Y/n	n
Ratio of the voltage transformer	tr_U	1...4000		1
Device address	Addr	1...32		1
Baud rate	bAUd	4800, 9600, 19200		9600
Type	MODE	0...6	Interface working mode: 0 - interface out 1 - Modbus ASCII 8N1 2 - Modbus ASCII 7E1 3 - Modbus ASCII 7O1 4 - Modbus RTU 8N2 5 - Modbus RTU 8E1 6 - Modbus RTU 8O1	0
Access code	SECU	0000...9999	Change of the access code	0

* If the access code has not been introduced, the position is not active.



By means of keys we set the required values, i.d.: the position of the decimal digit by means of the or key and the digit value by the or key. The cursor signals the active position. The value is accepted by the key, after pressing we set the next parameter. After pressing the key, we come back to the measuring mode.

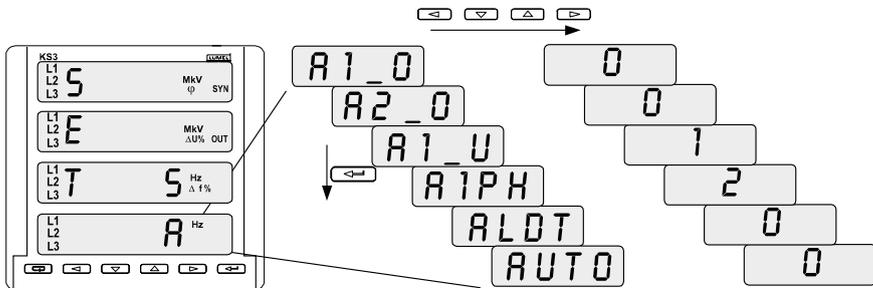
5.3.2. Configuration of A parameters.

Setting of synchronization alarm thresholds (on and off) settlement of the time delay.

Table 3

Parameter name	Symbol	Range	Remarks / Description	Manufacturing code (value)
Entry of the access code*	SECU	0000...9999	0000, without code	0
Synchronization alarm output on switched on	A1_0	0.1	0 - off, 1 - on	0
Alarm output access code*	A2_0	0.1	0 - off, 1 - on	1
Synchronization alarm. Variation range of the voltage difference	A1_U	0.2...2 [%] m.v. step 0.2 [%] m.v. 2...5 [%] m.v. step 1 [%] m.v	1...10 (for interface) 11...13 (for interface)	1
Synchronization alarm Variation range of the angle	A1Ph	1...10 [°]		2
Delay in alarm action	ALdt	0...10 sec.	delay of synchronization alarm switching on	0
Automatic activation of the alarm synchronization	AUto	0.1	behaviour of the unit after a voltage decay	0

* If the access code has not been introduced, the position is not active.
m.v.: measured value



The entry into the mode of alarm setting is protected by the access code. Without this code, alarms can only be reviewed. Alarm outputs are active if the value 1 was assigned to them (Table 3, parameter 1, 2).

If all values of the quantity related to the synchronization alarm are placed in the declared interval, then the two-state output (relay) is switched on, the SYN symbol is lighted and the AL1 message (if the AL1 relay has been activated) is displayed.

If whichever of the quantity values goes out beyond declared alarm intervals, the two-state output will be switched off. Alarm 2 (OUT) will be switched on if measured values go out beyond measuring ranges. The value of the AUTO parameter equal 0 causes a lack of reaction in the synchronization moment after the switching on or the decay of the supplying voltage. To activate the signalling one must enter into the configuration procedure and next, resign of further modifications. The value 1 of the parameter causes the return to the automatic signalling, regardless of supply decays.

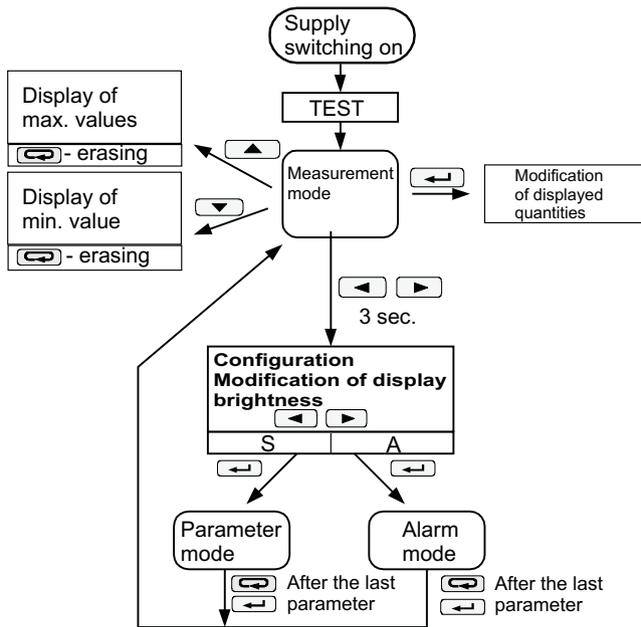


Fig. 5. Working modes of the KS3-1 unit.

6. RS-485 INTERFACE

6.1. Description

32 devices can work on one bus in the RS-485 standard. Interface sockets (2 x DB9) are situated at rear of the housing. One must use a screened strand to make the connection. The screening is necessary and the length of the installation can not exceed 1200m. The hardware configuration defines the device number, the baud rate and parameters of the communication port.

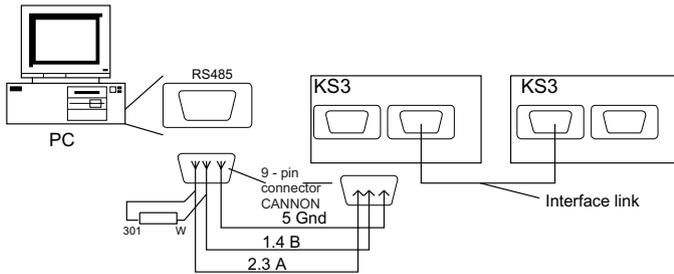


Fig. 6. Connection way of the KS3-1 interface.

Device number: 1...32
 Baud rate: 4800, 9600, 19200 Kbit/sec
 Working mode: 8N1, 7E1, 7O1, 8N2, 8E1, 8O1
 where:
 N - no parity
 E - even parity
 O - odd parity

An asynchronous character communication protocol MODBUS is used in the device. This protocol is a standard taken by producers of industrial controllers for the asynchronous, character exchange of information between devices of measuring and control systems.

It possesses such features as:

- simple access rule to the bus, based on the master-slave principle,
- safeguard of transmitted messages against errors,
- confirmation of remote command execution and signalling of errors,
- efficient mechanisms to secure against the system suspension,
- taking advantage of asynchronous character transmission.

The information unit is the frame in ASCII or RTU code.

6.2. Register map

Data are located in 16-bit or 32-bit registers in the KS3 - synchronizing unit.

Process variables and meter parameters are located in the register address space in the way depended on the variable value type. Bits in the 16-bit register are numbered from the youngest to the oldest (b0 - b15). 32-bit registers include numbers of float type in the IEEE-754 standard.

The register map has been divided into following areas:

Address range	Value type	Description
4000 - 4007	Integer (16 bits)	The value is located in one 16-bit register. The table 5 includes the register description. Registers can be read out and written.
7500 - 7518	Float (32 bits)	The value is located in one 32-bit register. The table 6 includes the register description. Registers can only be read out.

Contents of 16-bit registers with addresses from 4000 to 4007.

Table 4

Register address	Symbol	Unit, address	Description address
4000	tr_U	1...4000	Voltage transformer ratio
4001	SECU	0...9999	Access code
4002	A1_0	0.1	Synchronization relay switching on
4003	A2_0	0.1	Range exceeding relay switching on
4004	A1_U	0...13	Settlement of the ΔV interval acc. table 3
4005	A1_Ph	0...10	Settlement of the ϕ interval acc. table 3
4006	Aldt	0...10	Delay of synchronization alarm switching on
4007	AUTO	0.1	Automatic activation A1_0

Table 5

Register address	Symbol	Unit	Description address
7500	U_1	V	Network voltage
7501	U_2	V	Generator voltage
7502	f_1	Hz	Network working frequency
7503	f_2	Hz	Generator working frequency
7504	ΔU	%	Voltage difference
7505	Δf	%	Frequency difference
7506	$\Delta \varphi$	° (el)	Phase angle
7507, 7508	$\min U_1, \max U_1$	V	Min. and max. value of the network voltage
7509, 7510	$\min U_2, \max U_2$	V	Min. and max. value of the generator voltage
7511, 7512	$\min f_1, \max f_2$	Hz	Min. and max. value of the network frequency
7513, 7514	$\min f_2, \max f_2$	Hz	Min. and max. value of the generator frequency
7515, 7516	$\min \Delta U, \max \Delta U$	%	Min. and max. value of the voltage difference
7517, 7518	$\min \Delta f, \max \Delta f$	%	Min. and max. value of the frequency difference

7. TECHNICAL DATA

• Measuring ranges and admissible basic errors

Table 6

Measured quantity	Range	Basic error	Notes	Resolution
Voltage U_i	100.0 V (Ku = 1) 110.0 V (Ku = 1) 230.0 V (Ku = 1) 400.0 V (Ku = 1)	$\pm(0.2\% \text{ m.v.} + 0.1\% \text{ of range})$	Ku=1...400 max.	-
Frequency f	15.0...500.0 Hz	$\pm 0.5\% \text{ m.v.} + 2d$		-
Voltage difference	-20...0...20%	$\pm 0.5\% \text{ of m.v.} + 2 d.$		0.6% U_{network}
Frequency difference	-10...0...10%	$\pm 0.5\% \text{ of m.v.} + 2 d.$		0.3% f_{network}
Phase angle	0...360°	$\pm 1^\circ$		5°

where: Ku = voltage transformer ratio
m.v. = measured values
d. = digit

- **Measuring inputs**

- phase-to-phase input voltage

- momentary overload capacity (5 sec)
- admissible voltage peak factor

- **Interface RS-485**

- baud rate
- protocol

- **Relay outputs**

- relays
- load capacity
- life time depending on $\cos\varphi$

- **Reading field:**

- displays
- colour
- digit height

- **Supply voltage**

- **Power consumption**

- supply voltage
- voltage circuit

- **Reaction to decays and supply recoveries**

- **Safety requirements**

- insulation ensured by the housing
- insulation between circuits
- installation category

Un = 100, 110, 230, 400 V
Frequency = 15...45...65...500 Hz
sinusoidal signal (THD ≤ 8%)
2Un (max. 1000 V)
2

4800, 9600, 19200
MODBUS, ASCII 8N1, ASCII 7E1,
ASCII 701, RTU 8N2, RTU 8E1,
RTU 801

voltageless make contacts
250 V~ / 0.5 A~
in the AC1 category:
 1.5×10^5 , $\cos\varphi = 1$
 10^5 , $\cos\varphi = 0.4$, 250 V a.c.

4 x 5 fields, 7-segment LEDs
red
14 mm

18...30 V d.c. a.c., 40...400 Hz
85...250 V d.c. a.c., 40...400 Hz

≤ 12 VA
≤ 0.5 VA

Data and state preservation of the synchronization unit in case of any supply decay (battery support). Continuation of unit operation after the supply recovery.

IEC 1010-1+A1 (1996)
double
basic
III

- pollution degree	2
- max. working voltage in relation to the earth	600 V a.c.
• Housing protection degree	
- from the front side	IP40
- from the rear side	IP10
• Electromagnetic compatibility:	
- immunity	EN - 50082-2 (1996)
- emission	EN - 50081-2 (1996)
• Rated operational conditions:	
- input signal	0... <u>0.01</u> ... <u>1.2Un</u> , for voltage frequency 15... <u>45</u> ... <u>65</u> ...500 Hz sinusoidal (THD ≤ 8%)
- ambient temperature	0... <u>23</u> ...55°
- air relative humidity	25...95% (condensation inadmissible)
- external magnetic field	<u>0</u> ... <u>40</u> ...400 A/m
Housing	
- frontal dimensions	144 x 144 mm
- panel cut-out	138 ^{+0.5} x 138 ^{+0.5} mm
- depth	77mm
- weight	800 g (with packing)
- working position	arbitrary

8. EXECUTION CODES AND ORDERING PROCEDURE

Table 7

Synchronizing unit - KS3	X	XX	X	X	XX	X
Kind of display:						
- digital displays	1					
- bargraphs (diode lines)	2					
Input voltage:						
100 V		01				
110 V		02				
230 V		03				
400 V		04				
on request, after agreement*		XX				
Digital output:						
- without interface			0			
- with RS-485 interface			1			
Supply voltage:						
85...250 V d.c. a.c.				0		
24 V d.c. a.c.				1		
on request, according order				X		
Execution:						
- standard execution					00	
- custom-made execution*					XX	
Acceptance tests:						
- without additional requirements						0
- with a quality inspection certificate						1
- other requirements*						X

* The execution code will be settled by the manufacturer

ORDERING EXAMPLE

Code: KS3-1-01-1-0-00-1 means: a KS3-1 synchronizing unit with digital displays, input voltage: 100V, with an RS-485 interface, supply voltage 85...250 V d.c. a.c., standard execution, with a quality inspection certificate.

9. MAINTENANCE AND WARRANTY

The KS3-1 synchronizing unit does not required any periodical maintenance.

In case of some incorrect unit operation:

1. During the 18 months' period from the shipment date:

One should return the unit to the LUMEL's Quality Control Dept.

If the unit has been used in compliance with the instructions, LUMEL S.A. warrants to repair it free of charge.

The disassembling of the unit housing causes the cancellation of the granted warranty.

2. After the warranty period:

One should turn over the unit to repair it in a certified service workshop.

Spart parts are available for the period of 10 years from the date of purchase.

LUMEL S.A. reserves the right to make changes in design and specifications of any products as engineering advances or necessity requires.

SALES PROGRAM

1. DIGITAL AND BARGRAPH PANEL METERS
2. MEASURING TRANSDUCERS
3. ANALOG PANEL METERS (DIN INSTRUMENTS)
4. CONTROLLERS
5. PEN, DOT AND SCREEN RECORDERS
6. POWER CONTROL UNITS and INVERTERS
7. CAR INDICATORS
8. MEASUREMENT ACCESSORIES (shunts, sensors, C. T.)
9. MEASURING SYSTEMS (HEAT, ENERGY, CONTROL, etc.)
10. CUSTOM-MADE PRODUCTS
11. PRESSURE CASTINGS
12. TOOLS

QUALITY PROCEDURES: According ISO 9001 international requirements.

ISO certificate granted by KEMA Registered Quality.

November 2001



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