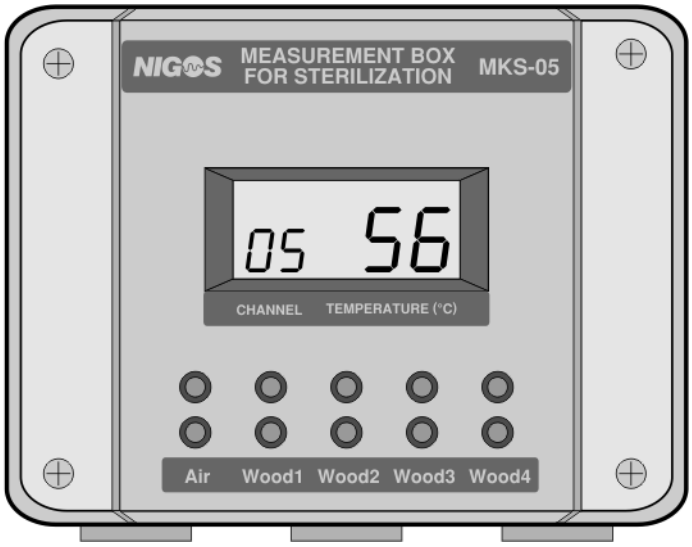
Installation and operation manual for heat treatment (sterilization) box MKS-05

MKS-05



- **Channel display**
- **Temperature display**
- **5 temperature inputs**

Measurement box MKS-05 is a device which is used in heat treatment - sterilization process of wood material and palettes according to ***International Standard for Phytosanitary Measures - ISPM 15*** as defined by ***Food and Agriculture Organization - FAO***.
MKS-05 purpose is to collect data from temperature probes during sterilization process, display of measured values and transmission of collected data to PC or NIGOS process controller.
Up to 5 temperature probes can be connected to this device. Display will cycle through each channel and display measured temperature on specific probe.
Data received from wood core and air temperature probes are converted in the MKS-05 box into a signal suitable for sending to some NIGOS process controller, or a PC which will then control the sterilization process based on received data.

MKS-05 TECHNICAL SPECIFICATION

Main characteristics		
	Power supply	230Vac
	Number of inputs	5
	Displays	One 2-digit x 7-segment LED, 9mm, red; One 3-digit x 7-segment LED, 13mm, red
	Operating conditions	T: 0 ÷ 50 0C; RH: 5 ÷ 90%
	Storage	T: - 40 ÷ 85 0C; RH: 5 ÷ 90%
	Dimensions (W x H x D)	195 x 170 x 96
	Weight	650g

Inputs		
Temperature input	Number of inputs	5
	Range	-20 ÷ 110 °C; -200 ÷ 1100mV
Accuracy	Error	<1%
	Resolution	0.1

Communication		
Digital	Communication standard	EIA 485
	Protocol	S - NIGOS

1. INSTALLATION

Dimensions are provided in technical specification table. Device is mounted on the wall through the openings on the back side of the case.

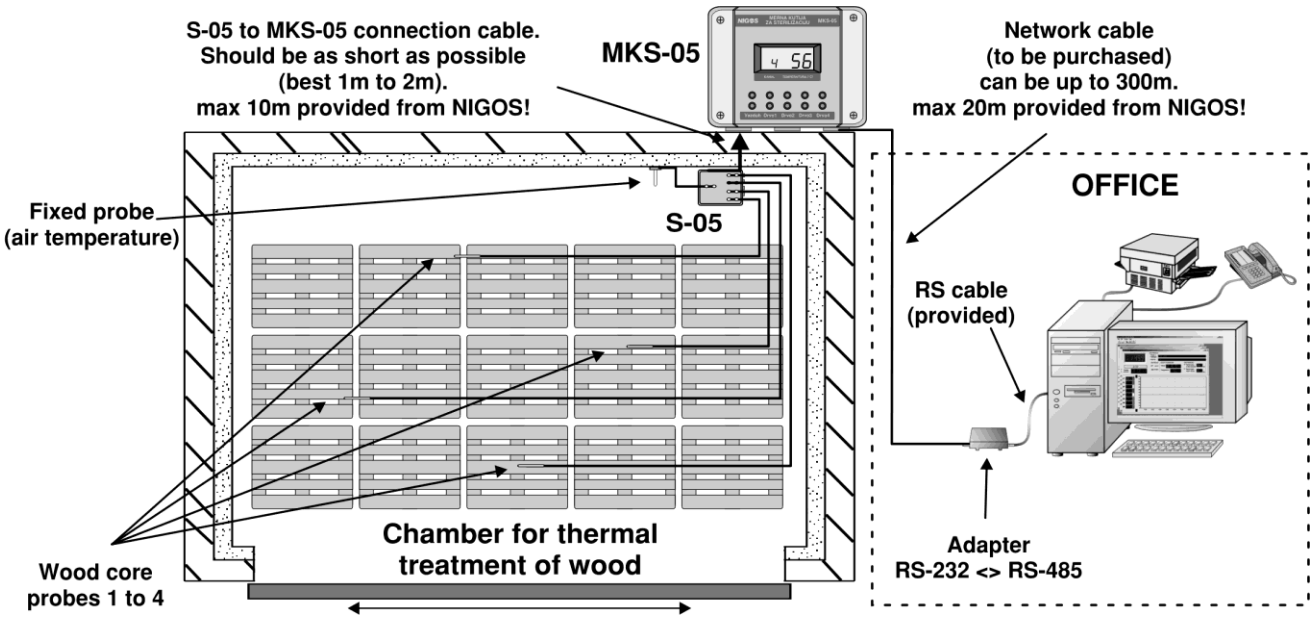
1.1. Power supply

- Alternate current voltage 230Vac/50Hz connected via pins N and L on clamp 3.

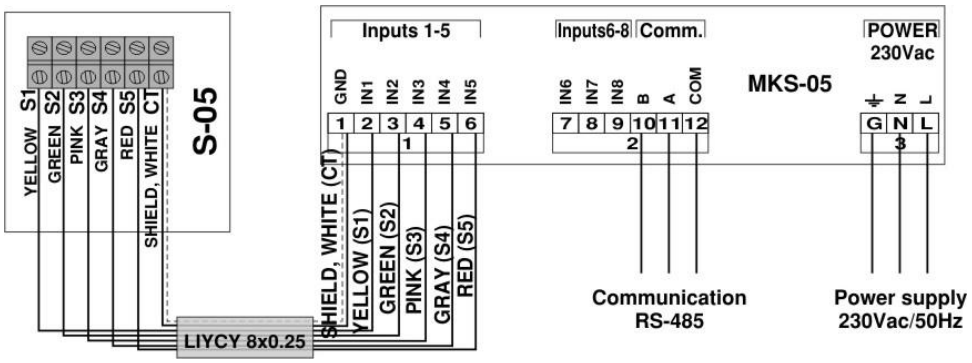
Device will start operation immediately after powering up.

1.2. Connection diagram

Picture 1.1 shows connection scheme for wood thermal treatment equipment MKS-05.
NOTE: In case this equipment is installed in steaming chamber, then S-05 box must be installed outside the chamber, or direct probes connection to MKS-05 must be used!



Picture 1.2 shows MKS-05 clamp layout. It can be connected to S-05 box to enable connection with temperature probes at greater distances. **For short distances temperature probes can be connected directly to MKS-05 without the need to install connection box S-05!**



Picture 1.2. **MKS-05 clamp layout**

- Signals coming from temperature probes (2-wire Pt1000 sensor must be used) are connected to temperature clamp 1 (labeled with numbers 1 to 6). Connection should be made according to provided scheme and wire colors. This connection is accurate for cables provided by NIGOS. If a different cable is used, then disregard shown wire colors, and pay attention to clamps labels.
- Communication clamp 2 (labeled with B, A and GND) is used for communication cable connection between MKS-05 and PC. There is 120Ω pull down resistor fitted between A and B clamps. This resistor is fitted to all devices in factory, but should be removed on all devices in the middle of communication line except for the LAST device on the communication line (see picture 1.3).
- Power is connected to clamp 3.

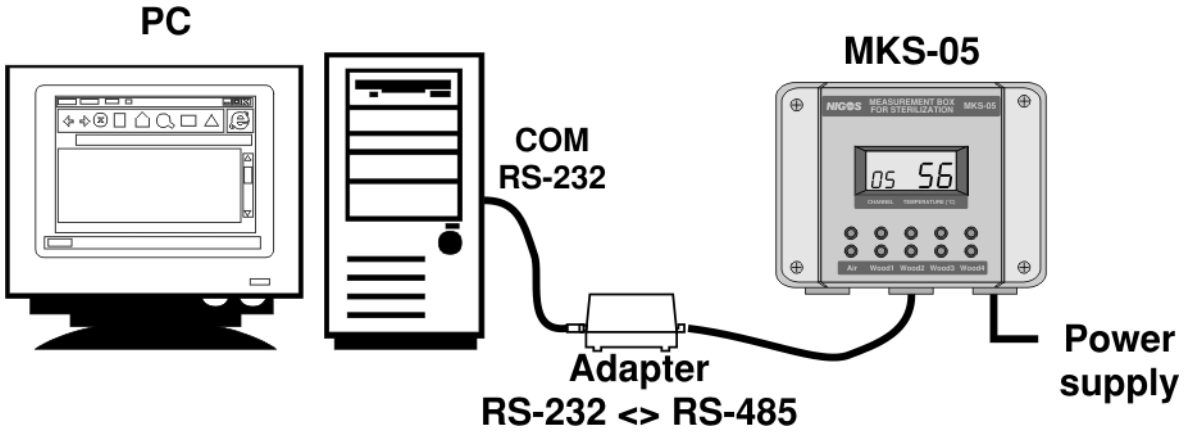
1.3. Connection to Windows operated PC computer

In this configuration, MKS-05 is connected to PC via RS-232 <> RS-485 adapter.

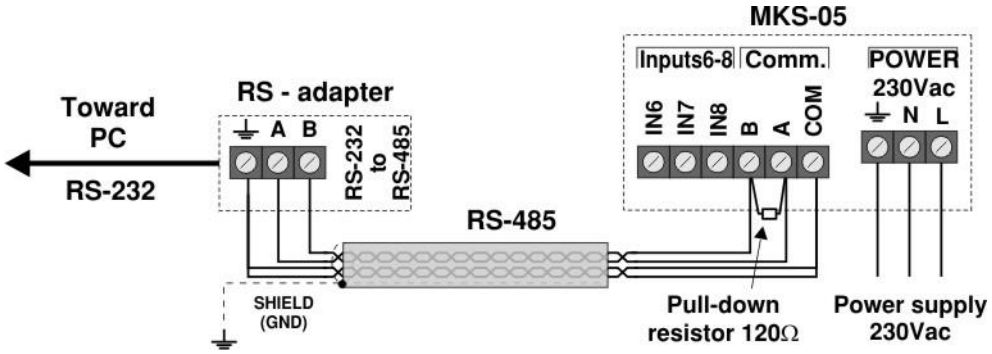
In order to connect MKS-05 to PC, RS-232 to RS-485 communication standard adapter is required. Almost every PC has available serial communication via COM port using RS-232 communication standard. This standard does not allow great distance between PC and measurement box. That is why RS-485 is used in MKS-05 for data transmit ion up to distance of 1km. Necessary adapter can be ordered from NIGOS. Adapter has isolated lines toward PC and measurement box in order to prevent damage caused by power surge. NIGOS however do not take responsibility for damage caused by atmospheric discharges (lightning). Adapter is connected on one side to PC via COM port and using serial cable, and on the other side 2 wires from twisted pair, shielded cable is used.
Connector clamp on RS-485 side has 3 pins: A(L+), B(L-) and COM.

- Pin A (L+) is connected to appropriate pin A (L+) on MKS-05, and pin B (L-) with appropriate pin B (L-) on MKS-05. Use 2 wires from same pair for connection! Pull down 120Ω resistor between A(L+) and B(L-) pins on MKS-05 box is left there if this box is only one, or last one on communication line. If MKS-05 is located between 2 other devices on communication line, this resistor must be removed.
- COM pin is used for common ground on communication line. It is connected to GND pin on RS-485 adapter.

Communication cable should be laid out using shortest possible route between adapter and measurement box. Cable shield should be connected to ground of the PC (ground of power supply cable or PC case). Use following scheme for proper connection:



Picture 1.2 **Schematic representation of MKS-05 connection to PC**

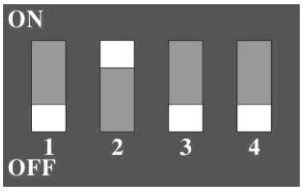


Picture 1.3 **Wiring layout of MKS-05 connection to PC**

2. PHYSICAL SETTINGS OF DEVICE

There are two DIP SWITCH switches marked with SW1 and SW2 on the main board of the device, through which it is possible to perform physical configuration of the device.

- Setting of SW1 is only for advanced functions and must be used only in contact with employees of NIGOS electronics.
- Each device on the communication line must have a unique address. Selecting the address of MKS-05 device on the communication line is done by adjusting the position of the switch to the DIP SWITCH SW2 according to next table.



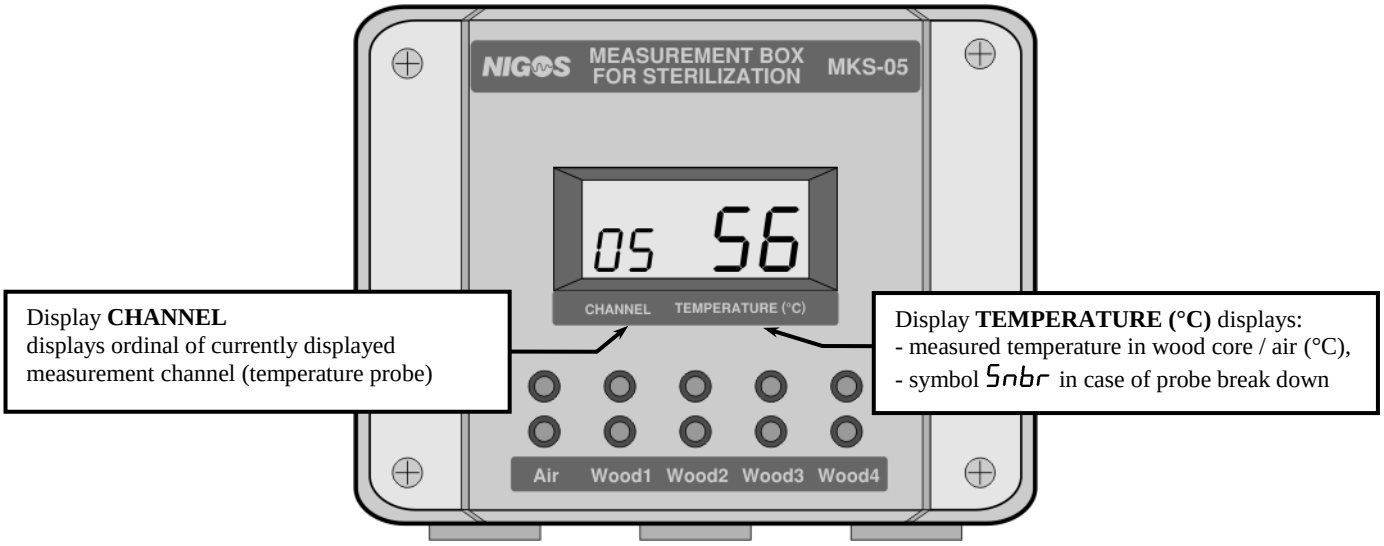
Picture 2.1 **DIP SWITCH SW2 and example of ON/OFF position (combination 0100-off/on/off/off)**

Table 2.1. **Choise of device's address by setting positions of switches in DIP SWITCH SW2**

SWITCH POSITION				DEVICE'S ADDRESS
1	2	3	4	Addr
off	off	off	off	1
on	off	off	off	2
off	on	off	off	3
on	on	off	off	4
off	off	on	off	5
on	off	on	off	6
off	on	on	off	7
on	on	on	off	8
off	off	off	on	9
on	off	off	on	10
off	on	off	on	11
on	on	off	on	12
off	off	on	on	13
on	off	on	on	14
off	on	on	on	15
on	on	on	on	16

3. OPERATION

Measurement box for heat treatment (sterilization) MKS-05 is a device intended for collection, display and transmission of data collected from temperature probes. These probes use Pt1000 temperature sensor fitted in stainless steel tubes ∅6mm. Probes are fitted into already drilled holes in the timber subject to heat treatment. Holes must be ∅6.5mm to ensure easy inserting and removal of temperature probes from timber. MKS-05 has inputs for 5 probes. NIGOS provides 6 probes in standard pack since ISPM15 requires minimum of 4 probes for wood core temperature, 1 probe is for air temperature and 1 should be kept as a spare probe in case of emergency repair of some probe.



3.1. Displays

Measurement box for heat treatment (sterilization) MKS-05 shows data on large display fitted in the middle of the box. Display is divided into 2 groups:
- First group is labeled CHANEL and it displays ordinal of the measurement channel (probe) whose measured value is currently showing on TEMPERATURE display.
- Second group is labeled TEMPERATURA (°C) and it shows measured temperature on appropriate probe. Temperature is displayed with decimal point in range -9.9 do 99.9 °C, whilst outside this range, display is without decimal point.

Beside measured temperature, MKS-05 also displays error message found in measurement signal. When the symbol Snbr is displayed on temperature display, it means that device has found that the signal coming to the corresponding temperature input has false value.
Main causes for this error are:

- cable fault between MKS-05 and appropriate probe
- irregular connection on the input clamps
- discrepancies between actual probe type and setting for probe type on the measurement box
- probe malfunction

3.2. Device maintenance

- Devices do not require any maintenance.
- In case temperature probe is damaged, or cable is torn, replace it with new temperature probe with Pt1000 sensor.
- Only intervention customer can perform is simple intervention on cables due to mechanical damage. Any damaged cable must be replaced with same or similar. All other repairs which require intervention on electrical parts are not possible on site and can be performed only in NIGOS service in Nis, Serbia.

3.3. Device calibration

Depending on the actual law for any specific country and local implementation of ISPM15 standard, periodic testing of measurement of device and probes and/or their calibration is required. Calibration is done in certified institution for each country.