# Operating manual of controller
# INDU iMAX 500/510 MAS


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## *1. Introduction*

Thank you for choosing MIKSTER products.

iMAX 500/510MAS microprocessor controller is a compact All-in-One device, i.e., it integrates the functions of a controller and a touchscreen operator panel.

It is enhanced with communication options and built-in support for input and output signals.

## *2. Design, intended use, capabilities*

INDU iMAX 500/510 MAS controller is designed to automatically control the tumbling process in vacuum tumblers.

Basic features of the controller:

- Automatic execution of the process program
- 50 Programs
- 6 Cycles/program
- 2 Phases/cycle
- Temperature control and regulation
- Vacuum (pressure) control and regulation
- Smooth setting of drum rotation speed
- Software control of executive devices (contactors, solenoid valves, etc.)
- Manual operation mode
- AUTOSTART function
- Weight control during loading
- Water dosing
- Additional function keys – for iMAX510 MAS version

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### *3. Start screen*

An intuitive user interface, operated via touch panel, was created to meet the high demands of our customers. When the controller is turned on, the start screen is displayed.


**Start Screen**

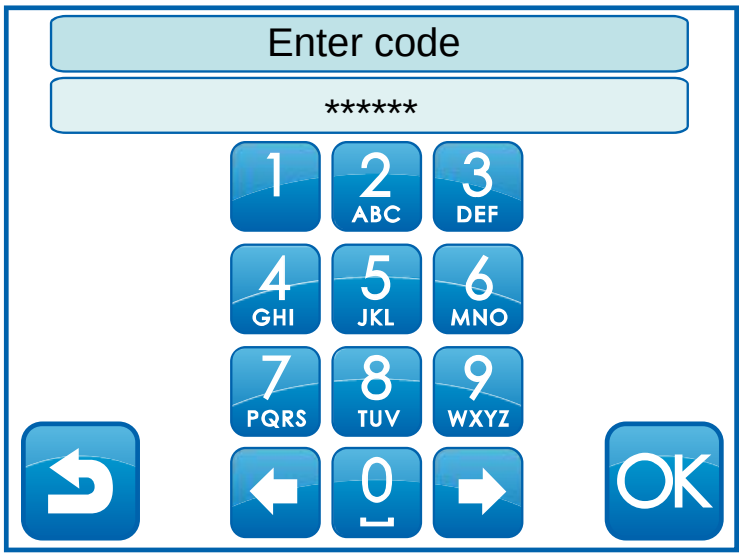
**Settings**

**Manual work**


**Program start**

### *4. Access codes*

For security reasons, access to certain functions is protected by a code.




**Code entry screen**

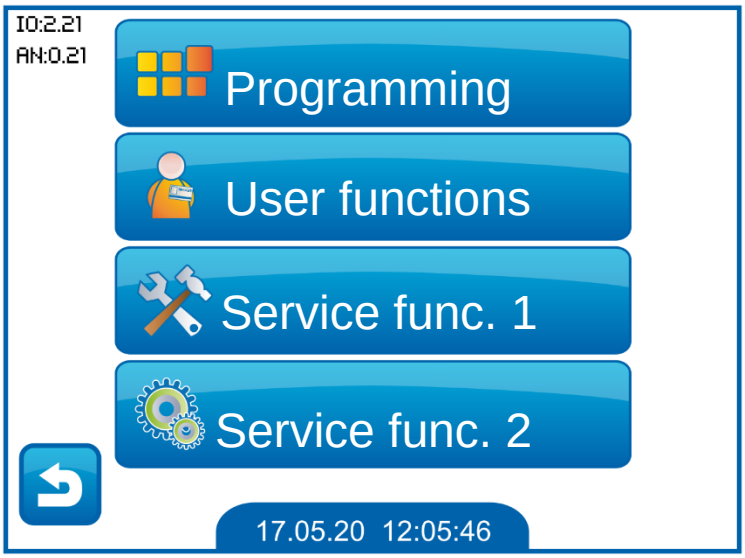
Codes are defined in the setup cells.

**F08** - Programming access code. Default **111**.
Access to: Programming, User functions, Service f.1.

**F10** - Access code for manual operation – disabled by default **0**.

## *5. "Settings" menu*

With "Settings" menu, we access the advanced settings of the controller.

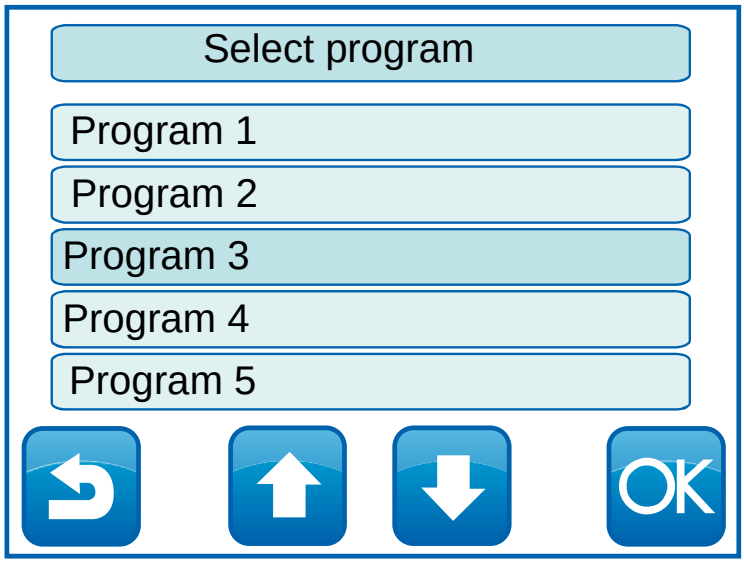



**Settings screen.**

- **Programming**: creating new or editing existing process programs.
- **User functions**: change language, set time, activate autostart.
- **Service functions 1**: setup settings, configuration of relays for loading and unloading.
- **Service functions 2**: Input test, Output test, Initialisation, Calibration.

## *6. Programming/program editing*

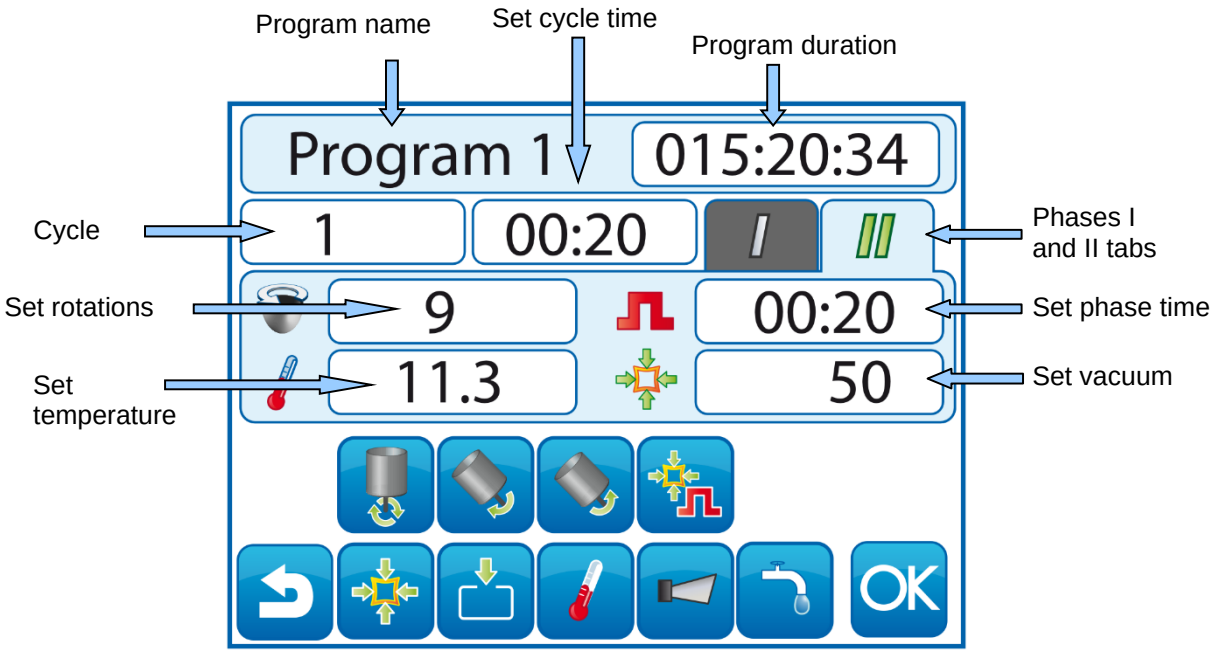

To create a new program or edit an existing one, enter the “Settings” menu and select the “Programming” icon.
On the “Select program” screen that appears, indicate the item and confirm with OK icon.




**Program list screen**

“Up” and “Down” arrows are used to scroll the screen by 5 items on the list.
The process program consists of a maximum of 6 consecutive cycles.
Each cycle consists of two alternating phases.
Phases are executed as long as the cycle time is declared.
The program duration is the total time of all cycles declared in the program.
The following parameters must be declared in order to execute the program automatically:

- **Program name**
- **Cycle time**
- **Phase duration**
- **Bowl rotations for each phase**
- **Temperature for each phase**
- **Vacuum value**
- **Equipment and regulators involved in a relevant phase**




**Programming screen.**

Set values are edited by pressing the icon, with a numerical or text value displayed (e.g., white bar with cycle time or program name).

**Set rotations** – speed of drum rotations, proportional to current output scaling.
**Set temperature** - Temperature setpoint [℃], for regulators.
**Set vacuum** - Vacuum setpoint [%].
**Program duration** - total time of all programmed phases.
Maximum time displayed: 599:54:00.
**Set cycle time** - duration of a single cycle made up of two phases.
Number of all cycles in the program: 6
Maximum set time of a single cycle: 99:59.
**Set phase time** - duration of the selected phase, performed for the duration of the current cycle, alternating with the second phase.
Maximum set time of a single phase: 99:59.

Possible formats for displaying time bases, depending on the configuration of F43 in setup.

| F43 value | Program duration | Cycle duration | Phase duration |
|---|---|---|---|
| 0 | HHH:MM:SS | HH:MM | MM:SS |
| 1 | MM:SS | MM:SS | MM:SS |

**Icons for activating digital outputs that control the executive devices connected to them**


**High-speed rotations**


**Rotations left**


**Rotations right**


**Vacuum impulse**


**Vacuum pump**


**Air block**


**Temperature regulator**


**Sound signal**

The relevant device is switched on or off in the selected phase by pressing the corresponding pictogram.

Changing the cycle is done by pressing the bar with the displayed cycle number. Pressing the phase tab changes the number of the currently edited phase.

The simultaneous activation of the left and right rotation functions causes the rotation directions to cyclically switch through the phase.

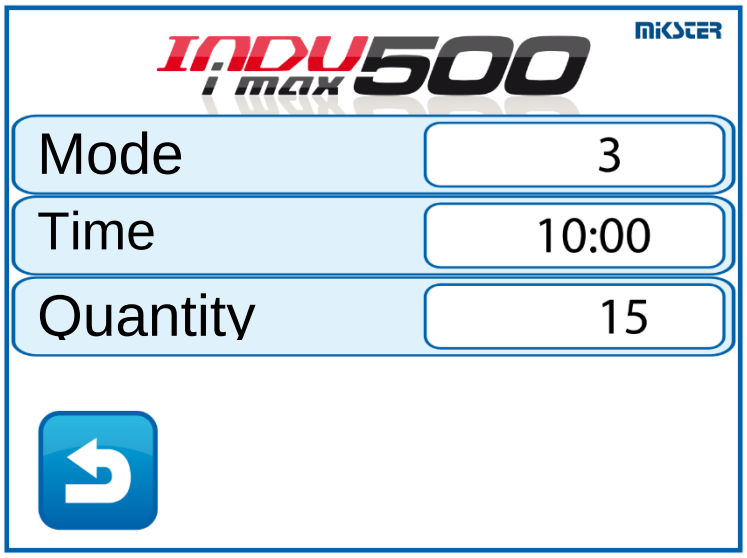
Press OK icon to save the settings. The controller will save the values entered and go to the previous screen (“Program selection” screen).

## *7. Water dosing*

If the water dosing function is activated in setup cell F58, an icon will appear on the programming screen, which, when pressed, allows the basic dosing parameters for the program to be configured. Additional parameters are in the remaining cells F59 and F60.

**NOTE!**

Water dosing can be declared only for the first program cycle. The activation of the vacuum pump and air block valve for this cycle is automatically blocked.




**Water dosing configuration screen**

**Water dosing modes:**

**Mode 0** - Dosing switched off

**Mode 1** - When the process is activated, the controller feeds the water quantity set in the configuration.

**Mode 2** - After switching on, the controller waits a set amount of time and feeds the water quantity set in the configuration, and after the set time it cyclically renews the feeding of the specified water quantity.

**Mode 3** - After switching on, the controller waits a certain amount of time and feeds the water quantity set in the configuration.

## 8. *Vacuum impulse*

The vacuum impulse function allows the additional impulsing of the vacuum value in the tumbler. The following setup cells are responsible for the configuration:

- F15 Vacuum impulse value
- F16 Vacuum impulse switch time
- F17 Duration of vacuum pulse

The vacuum impulse can be switched on in any tumbling phase.
The function is intended to change the value of the vacuum setpoint in a given phase, to the value set in cell F15. This change will take place after time F16 from the start of the phase, for the time set in cell F17.

## 9. *Temperature regulators*

The controller has the temperature regulation function.
It supports two types of regulators:

Cooling regulator.
Setup cells used to set the operation of the regulator:

- F11 - Cooling temperature setpoint allowed to be exceeded
- F40 - Lower hysteresis of the cooling regulator
- F41 - Upper hysteresis of the cooling regulator

Heating regulator.
Setup cells used to set the operation of the regulator:

- F64 - Lower hysteresis of the heating regulator
- F65 - Upper hysteresis of the heating regulator
- F66 - Heating temperature setpoint allowed to be exceeded

In addition, alarms can be configured in the setup cells, relating to the operation of the regulators, such as:

- Temperature exceeding alarm
- Min/max temperature exceeding alarm
- Sensor failure alarm
- Missing sensor alarm

### *10. Calculation of weight on loading*

The controller is able to calculate weight during loading. Calculation is carried out by means of a current signal, fed via a special U/I adapter, to the controller's current input (Ch3).
In order for the calculation function to be carried out, it must be activated in the setup settings, and the current input, responsible for charging, must be scaled accordingly (scale for 0mA, scale for 20mA).
The weight is set by entering the desired quantity in the “Set weight” window.


**Loading screen with weight calculation**

Calculation takes place with a resolution of 0.1kg in the 0-100kg range, and 1kg in the remaining range, and is dependent on the scale range and sensitivity of the strain gauge.

## *11. User functions*


User functions allow to change: the language, set the system clock and autostart function parameters.


**User Screen**

**Language.**

The controller has the option of displaying the interface in different languages.
The language is changed by pressing the flag icon of the desired language.

**Enter time.**

Menu for setting the date and time.

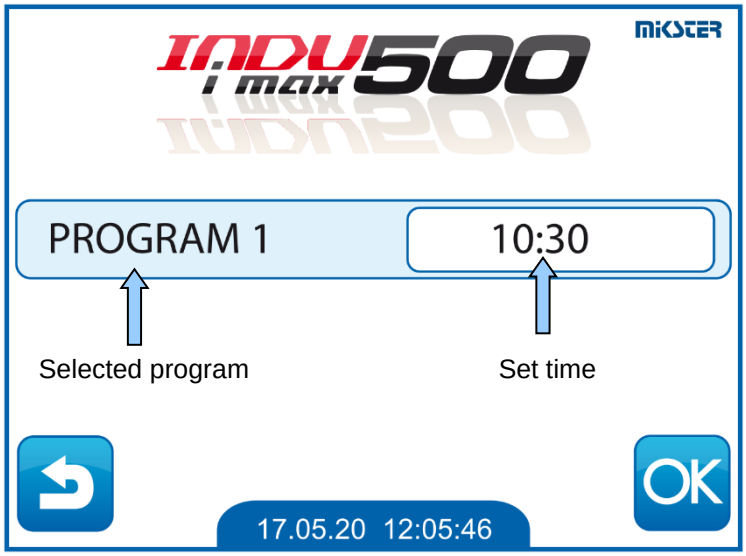
**Autostart.**

The autostart function allows to automatically turn on the device at a set time.
The device will automatically activate the pre-selected program.

### *12. "Autostart" configuration*


The "Autostart" function allows the controller to start up on its own, at the selected time.
To activate the autostart function you need to:

- On the "User functions" screen, select the Autostart window.
- Select the program to be started from the list and confirm with "OK" button.
- Next to the selected program set the time at which it is to be activated, confirm with "OK".
- Exit to the home screen using the "Back" button.




**Autostart setting screen**

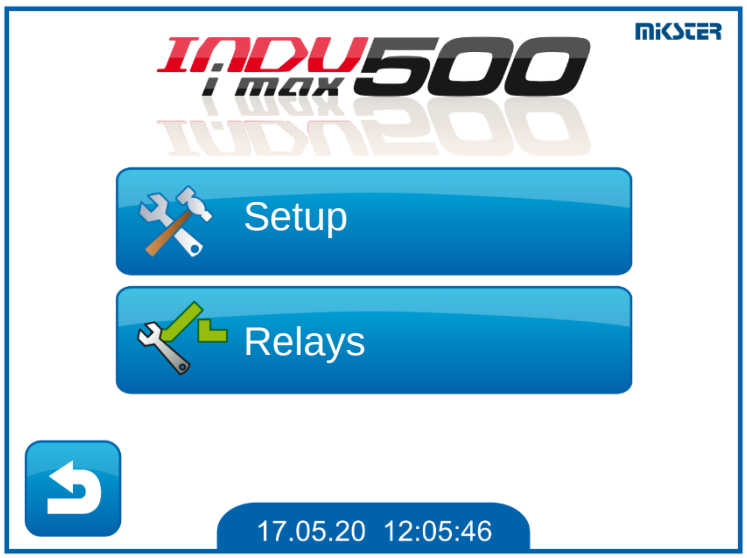

**Screen with active Autostart**

Cancellation of the autostart is carried out in the same way as setting; enter 00:00 in the time field and confirm.

## *13. Service functions 1*


“Service functions 1” enable:

- Access to SETUP parameters
- Relay declarations for loading and unloading cycles



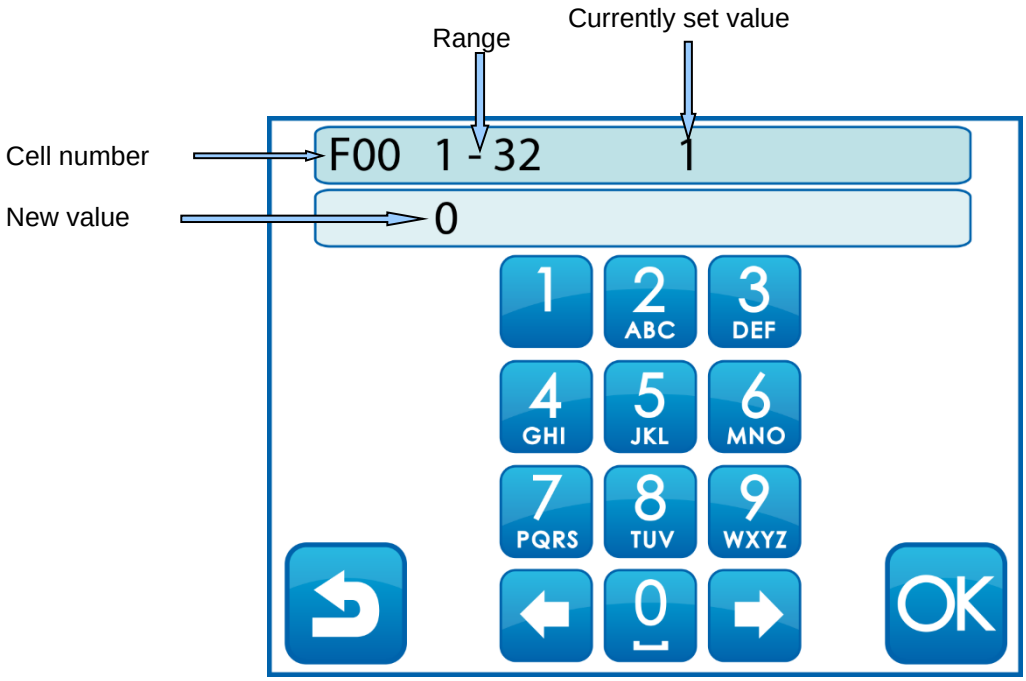

**Service functions 1 screen**

## *14. Setting up setup cells*


Configuration of the setup parameters should be carried out by an authorised person who is familiar with the operation of the entire device.
The setup cells are numbered F00 to F69.
To change the value of the setup cell:

- select the desired cell from the list and confirm with the “OK” button
- using the numeric keypad, set the desired value and confirm with “OK”

If you exit the screen with the “Back” button, you exit without saving the set new value.
In the top bar, along with the cell number, the previously set value is displayed.




**Setup cell screen**

After making changes, in the setup parameter settings, restart the controller by switching the power off and on. This ensures that the newly set parameters are loaded correctly.

## *15. Table of setup cells*

| Cell no. | Cell name | Factory-set value | Range | Description |
|---|---|---|---|---|
| F00 | Controller number in network | 1 | 1..32 | Address in the RS485 network at which the controller is seen by the PC |
| F01 | Time signal of program end | 10 | 0.. 99 s | Time of the acoustic signal after the end of the program |
| F02 | Time signal of cycle begin | 5 | 0.. 99 s | Time of the acoustic signal at moving on to the next cycle |
| F03 | Delay of switching direction | 5 | 0.. 99 s | Delay time when switching the direction of drum rotation |
| F04 | Delay Pump/Valve Off | 0 | 0.. 99 s | Pump/valve shutdown delay time |
| F05 | Delay Pump/Valve On | 20 | 0.. 99 s | Pump/valve activation delay time |
| F06 | Hysteresis vacuum pump | 2 | 0.. 99 % | Hysteresis for the vacuum pump |
| F07 | Valve hysteresis | 2 | 0.. 99 % | Hysteresis for the air valve |
| F08 | Access code for programing | 111 | 0... 99999 | Access code for programming |
| F09 | -- | - | - | - |
| F10 | Access code of manual mode | 0 | 0... 99999 | Access code to controller parameters |
| F11 | Permissible excess of Tset cooling | 5 | 0.. 999,9 °C | °C Permissible exceeding of the set temperature of the "cooling" regulator, alarm active when F53=1 |
| F12 | Serial transmission speed | 1 | 0.. 1 | RS485 transmission speed - PC connection:<br>0 – 9600,<br>1 - 115200 |
| F13 | Process restart | 1 | 0.. 1 | Enabling process resumption after a power failure:<br>0 - Off<br>1 - On |
| F14 | Time for process restart | 10 min | 00:00 .. 99:59 | Time after which the process will not be restart if there is a power failure |
| F15 | Vacuum impulse value | 11 | 0.. 99 % | Vacuum pulse value |
| F16 | Vacuum impulse duration | 0 | 0.. 99 min | Vacuum pulse duration |
| F17 | Time of vacuum impulse On | 10 min | 0.. 99 min | Vacuum pulse activation time |
| F18 | Drum Speed for unloading | 5 | 0.. 99 | Drum rotation speed for the unloading phase |
| F19 | Drum Speed for loading | 5 | 0.. 99 | Drum rotation speed for the loading phase |
| F20 | Vacuum sensor type | 0 | 0.. 1 | Vacuum sensor type<br>0 - internal sensor<br>1 - external sensor 0..20mA |

| Cell no. | Cell name | Factory-set value | Range | Description |
|---|---|---|---|---|
| F21 | Loading weight On | 0 | 0.. 1 | Enabling weight control during loading via the controller's current input<br>0 - Off<br>1 - On |
| F-- | - | - | - | - |
| F40 | Lower hysteresis of cooling reg. | 2 | 0..10,0 °C | Lower hysteresis of the temperature controller: "cooling" |
| F41 | Upper hysteresis of cooling reg. | 2 | 0..10,0 °C | Upper hysteresis of the controller temperatures: "cooling" |
| F42 | Delay of T controller On/Off | 20 | 0.. 99 s | Delay time for turning on and off the temperature controller |
| F43 | Cycle time base | 0 | 0..1 | 0 - program HH:MM:SS; cycle HH:MM; phase MM:SS<br>1 - program MM:SS; cycle MM:SS; phase MM:SS |
| F44 | Max pressure set | 93 | 0.. 100 % | Maximum value of the set pressure |
| F45 | - | - | - | - |
| F46 | Engine type | 0 | 0.. 1 | Motor type<br>0 - single-speed motor<br>1 - three-speed motor – motor setting value relays: 1, 2, 3 |
| F47 | Max value Speeds | 9 | 0.. 99 | Value corresponding to 20mA at the AO1 output |
| F48 | Keysound | 1 | 0.. 1 | Sound signal when the touch panel is pressed<br>0 - off<br>1 - on |
| F49 | Vacuum external sensor 0 | 0 | 0.. 20 | Current value for the external vacuum sensor at a vacuum value of 0 |
| F50 | Vacuum external sensor 100 | 20 | 0.. 20 | Current value for the external vacuum sensor at a vacuum value of 100 |
| F51 | Weight for 0mA | 0 | 0.. 20000 kg | Weight value at 0mA current |
| F52 | Weight for 20mA | 0 | 0.. 20000 kg | Weight value at 20mA current |
| F53 | Alarm - T exceeded | 0 | 0..1 | Activation of the temperature exceedance alarm<br>0-off<br>1-on<br>Applies to values set from cells F11 and F66 |
| F54 | Alarm - no sensor | 0 | 0..1 | Activation of the alarm - no temperature sensor<br>0-off<br>1-on |

| Cell no. | Cell name | Factory-set value | Range | Description |
|---|---|---|---|---|
| F55 | Side panel | 1 | 0..1 | Enabling the side panel icon on manual work screens<br>0 - off<br>1 - on |
| F56 | Vacuum signaling | 0 | 0..1 | 0 - off<br>1 - on |
| F57 | Vacuum value | 0 | 0..100 | Vacuum signaling activation threshold |
| F58 | Dosing water | 0 | 0..1 | 0 - off<br>1 - on |
| F59 | Dosing - multiplier | 1 | 0..1000 | Multiplier value for the water meter |
| F60 | Dosing - divider | 1 | 0..1000 | Divider value for the water meter |
| F61 | Edit blockade | 0 | 0..1 | Blocking program editing during operation |
| F62 | Dosing alarm - time | 0 | 0..9999 | Time in seconds. No water gain |
| F63 | Dosing alarm - quantity | 0 | 0..9999 | Alarm. Alarm quantity exceeded |
| F64 | Lower hysteresis of heating reg. | 2 | 0..10,0 °C | Lower hysteresis of the temperature controller: "heating |
| F65 | Upper hysteresis of heating reg. | 2 | 0..10,0 °C | Upper hysteresis of the controller temperatures: "heating" |
| F66 | Permissible excess of Tset heating | 5 | 0..999,9 °C | Permissible exceeding of the set temperature of the "heating" regulator, alarm active when F53=1 |
| F67 | Alarm temperature MIN/MAX | 0 | 0..1 | Activation of the alarm when the temperature exceeds the values set in F68, F69<br>0-off<br>1-on |
| F68 | Temp. MIN | 0 | 0..999,9°C | Minimum temperature |
| F69 | Temp. MAX | 100 | 0..999,9°C | Maximum temperature |
| F70 | Type of analog output | 0 | 0..1 | 0 - 0…20mA<br>1 - 4..20mA |
| F71 | Alarm output | 0 | 0…1 | How the DO14 alarm output works in the event of an alarm.<br>0- continuous operation<br>1- 1s/1s pulse operation |

## *16. Relay configuration for loading and unloading*


**Screen for selecting the loading or unloading**


**Screen for selecting active relays during loading or unloading**

The setting of the relays during loading and unloading cycles is carried out on the following screens:

To declare a device to be switched on, select it by pressing the icon.
The colour of the active device will change from blue to green.
Drum rotation speeds, for the loading and unloading phase, are declared in setup cells F18, F19.
The values should be set according to the scaling setting of AO1 output in cell F47.

### *17. Service functions 2*


Functions only available for the service or authorised person.
The following options are available in these functions:

- Digital input test.
- Relay output test.
- Initialisation.
- Calibration.

### *18. Manual operation*

The manual operation screen, allows access to functions such as: start loading, start unloading, switch to manual control.

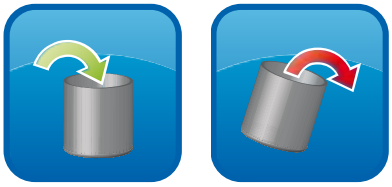

**Manual operation screen**

**Loading**

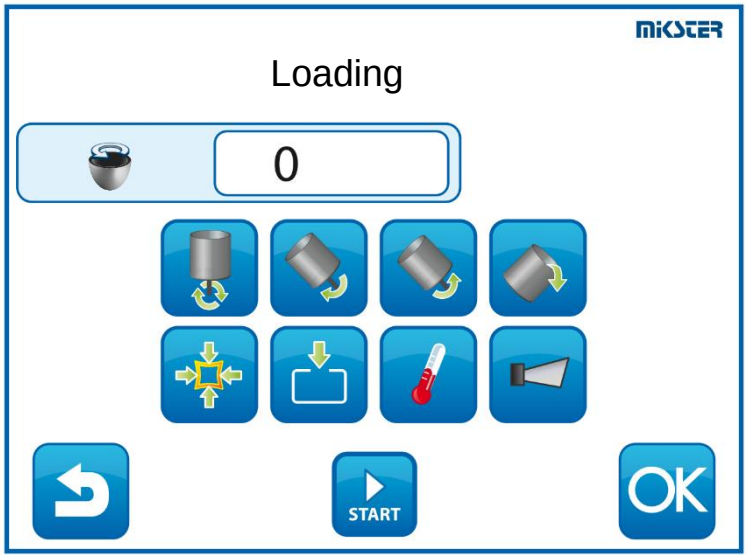
**Manual operation**

**Unloading**

## *19. Start of loading/unloading*



To start loading or unloading, select the appropriate icon and then press the “START” button.
The relays that were previously declared and the set speed are activated.
Pressing the “STOP” button stops the carrying out of the process.
For the loading process, pressing the “OK” button takes you to the program selection.



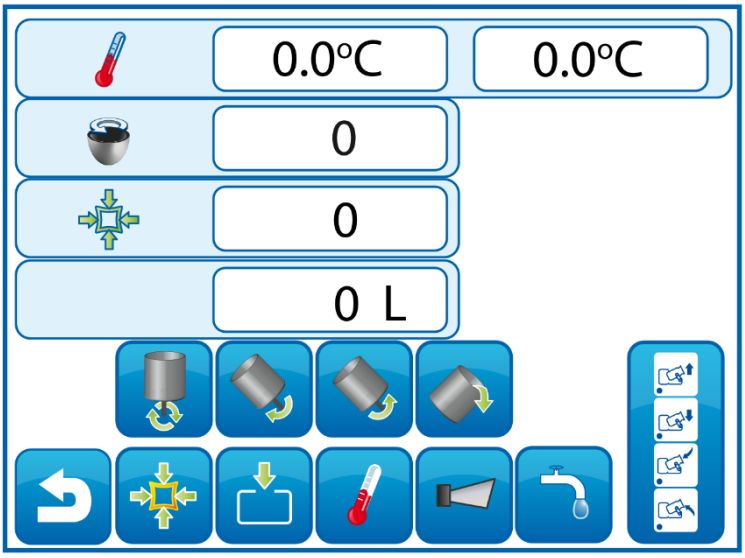

**Loading screen**

## *20. Manual operation*

The controller allows manual operation.
In this mode, it is possible to manually switch the executive devices on and off, with all the relay relationships controlling the directions of rotation maintained.
In addition, the following parameters, among others, can be manually set:

- temperature,
- drum rotation speed,
- vacuum value,
- temperature regulator type,
- water quantity.

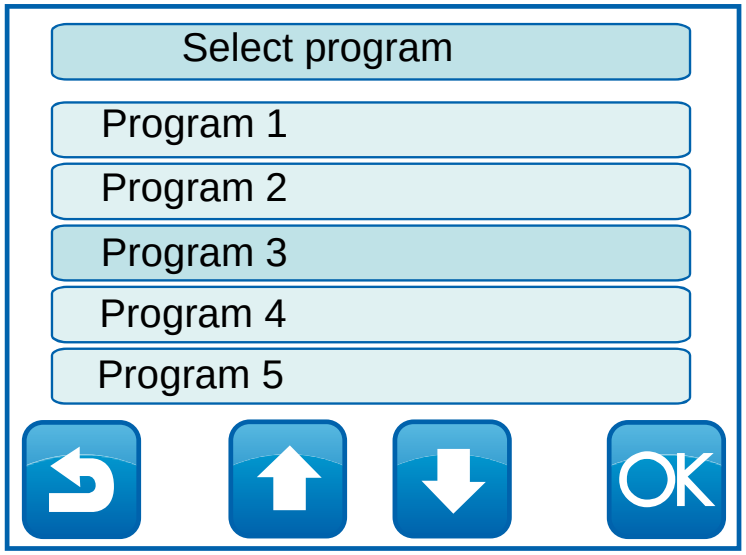
Buttons activating the side panel or water dosing are available after activating these functions in the setup settings.
In this mode, the following buttons are unavailable: **START, PAUSE, STOP**.



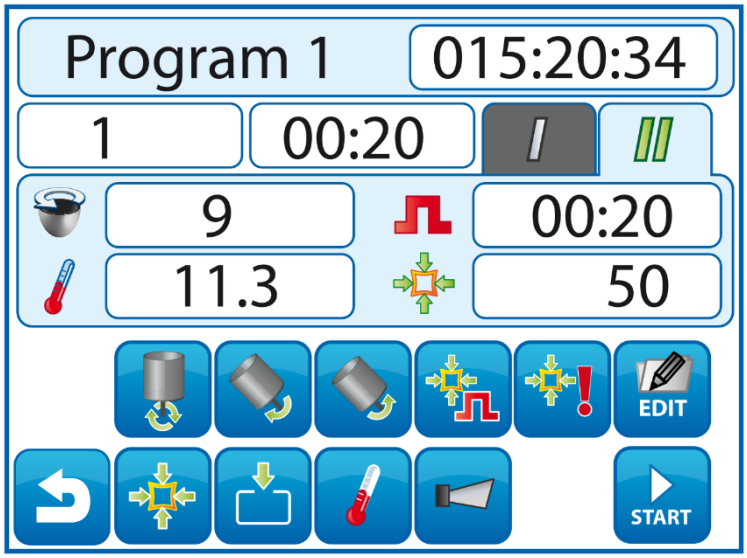

**Manual operation screen**

## *21. Automatic operation – START*


After pressing the START button, the main screen displays a list of previously declared process programs.
To start a program, select the program on the “Select program” screen that appears and confirm with the OK icon.




**“Program selection” screen**

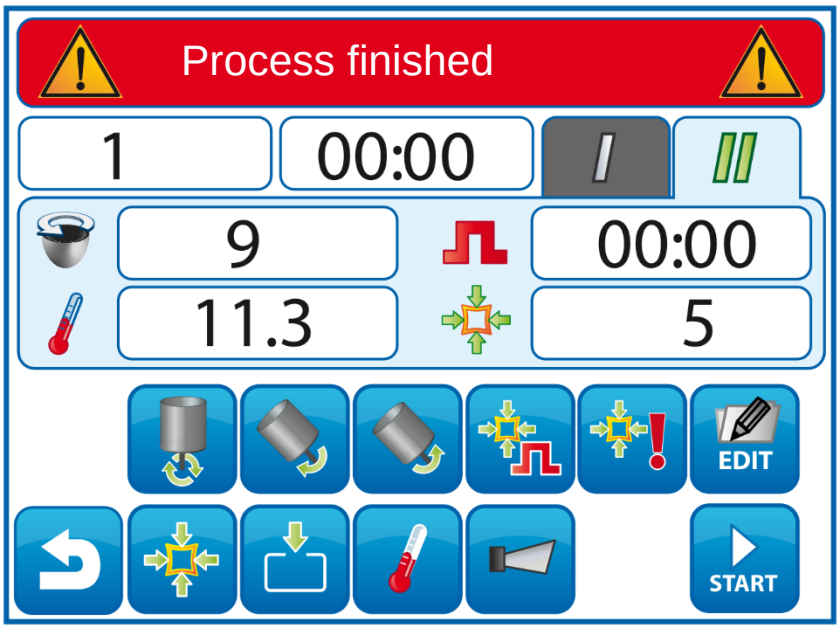



**Program screen**

The program is started by pressing the “START” icon.
The time remaining is displayed next to the program name.
By pressing the time window, the display mode changes – counting time forward or counting time backwards.

### *22. Automatic operation – END*

The program is automatically finished when the set time elapses.
On the main screen, the message “Process finished” will appear.




**Program finished screen**

### *23. Vacuum signalling*

The controller is capable of signalling the prevailing negative pressure inside the tumbler. The signalling and the activation threshold are set in the setup controller settings.

When the activation threshold is exceeded during program execution, the icon will change colour and the relay assigned to this event will be controlled continuously. Analogously, the signalling works during manual operation.

If a negative pressure value occurs when the device is stopped, only the relay will be activated, without icon signalling.

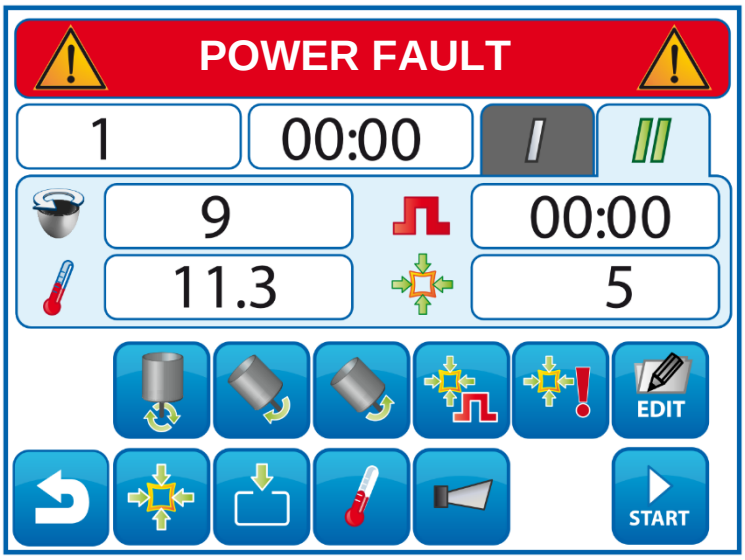
### *24. Power outage*

In the event of a power outage, the controller can react, in a manner set by the user.

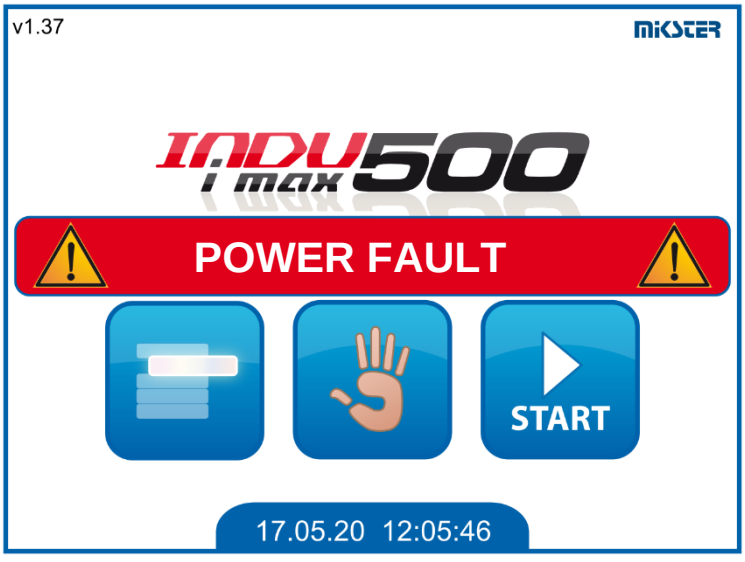
- **Do not restart the program and stop the unit at the stage where the power outage occurred.**
- **Resume or abort the program, after a power outage time allowed by the user.**

The parameters are configured in the setup settings.

If a power outage occurs during the program, a power outage message will be displayed on the controller screen.




**Screen after a power failure occurs that does not interrupt the program**




**Screen after a power failure occurs that interrupts the program**

The fault message is deleted when it is acknowledged by pressing on the screen.

### *25. EDIT button*


The controller allows the set parameters to be edited while the program is running, if such an option has been enabled in the controller configuration, in the setup parameters.

To edit the values, press the “EDIT” icon. The parameter editing process is analogous to the programming process. The devices are not switched off during editing. The program is resumed by pressing the “EDIT” button again.

***NOTE!!!***

***Changes made during the operation of the controller are only valid until the completion of the edited process program.***

***The new program will start according to the pre-programmed settings.***

### *26. PAUSE button*


Pressing the “PAUSE” icon stops the activated program and switches off all devices. The program is resumed by pressing the “START” button.

### *27. STOP button*


We can interrupt the program execution at any time by pressing the “STOP” button.

A program stopped with the STOP button can no longer be resumed.

### *28. Side panel button*

Side panel button appears when it is activated in the setup settings.
It is available for loading/unloading functions and manual operation.
It allows to switch on and off additional contacts which control devices.
It is only available in iMAX510 device.

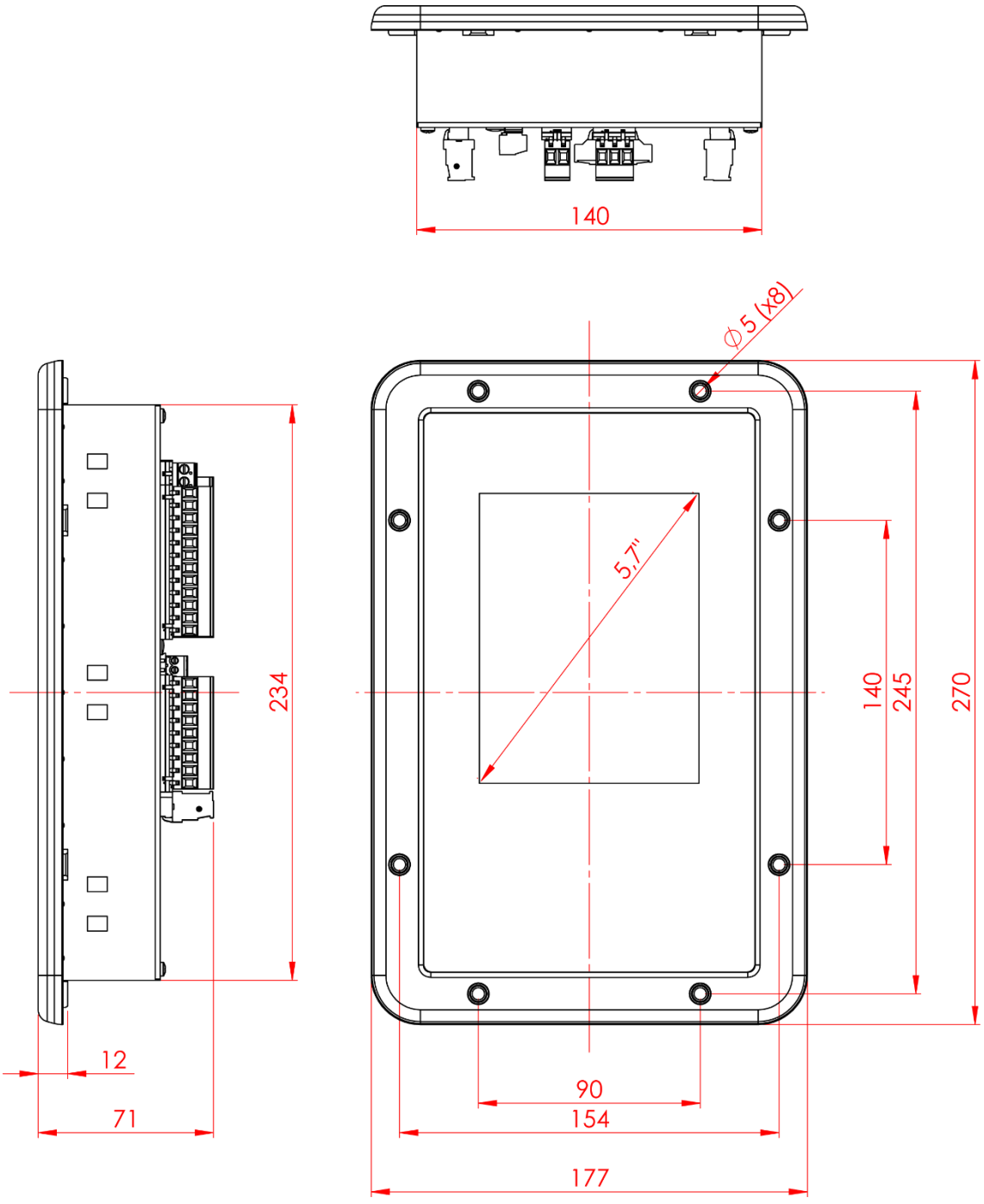
## *29. Technical data*

| Controller INDU iMAX 510 MAS | Specifications |
|---|---|
| Power supply: | 24VDC 1A MAX |
| Power consumption: | 15W |
| Dimensions: | Outside dimensions: 178x270mm<br>Dimensions of assembly opening: 140x234mm<br>Minimum depth of assembly opening: 90mm |
| Display: | TFT - GRB QVGA 5,6” 320x240px |
| Weight: | 1500g |
| Casing: | One-piece of the front panel type |
| Protection rating: | Front – IP65 (Casing with a silicone gasket)<br>Rear - IP21 |
| Operating conditions: | Operating temperature: 0°C..+50°C<br>Storage temperature: -18°C..+70°C<br>Humidity: 0..75% |
| Digital communication: | RS485 – Optoinsulated. Cable length up to 1200m, signal A B. |
| Real time clock: | YES |
| Measurements: | Temperature: PT100 (Ch1)<br>Relative vacuum measurement: internal sensor or external sensor of current input 0÷20mA (Ch2).<br>Scales: current input 0÷20mA (Ch3). |
| Outputs: | Relay DO: 1÷14<br>Current: AO1: 0÷20mA / 4÷20mA (speed regulation). |
| Control inputs: | DI1: Water meter |
| Auto-start: | YES |
| Rating of relay contacts: | External protection is recommended – fusible cut-out: 6,3 A<br>• Maximum current flowing through the relay - 4A<br>*NOTE ! Use of fuses stronger than 6,3 A is not recommended.* |
| Additional outputs controlled from function keys (only 520 version) | 24 V AC/DC max. 1A |

## *30. External dimensions and mechanical installation*

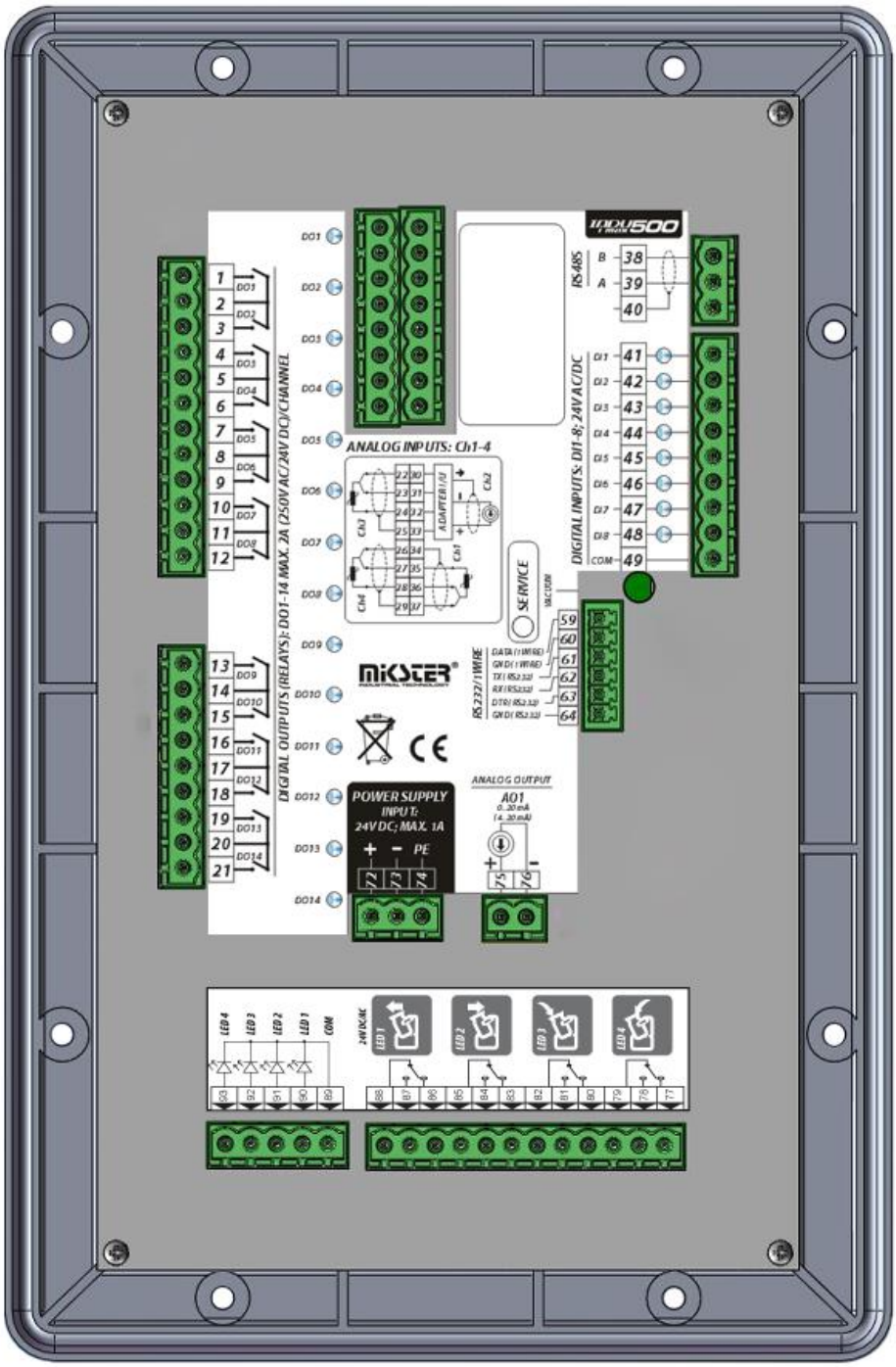
To mount INDU iMAX510 MAS panel:

- make a mounting hole,
- use the screws, bolts or mounting holders included in the set,
- cover the place of installation with blanking plugs (included in the set) to maintain tightness.

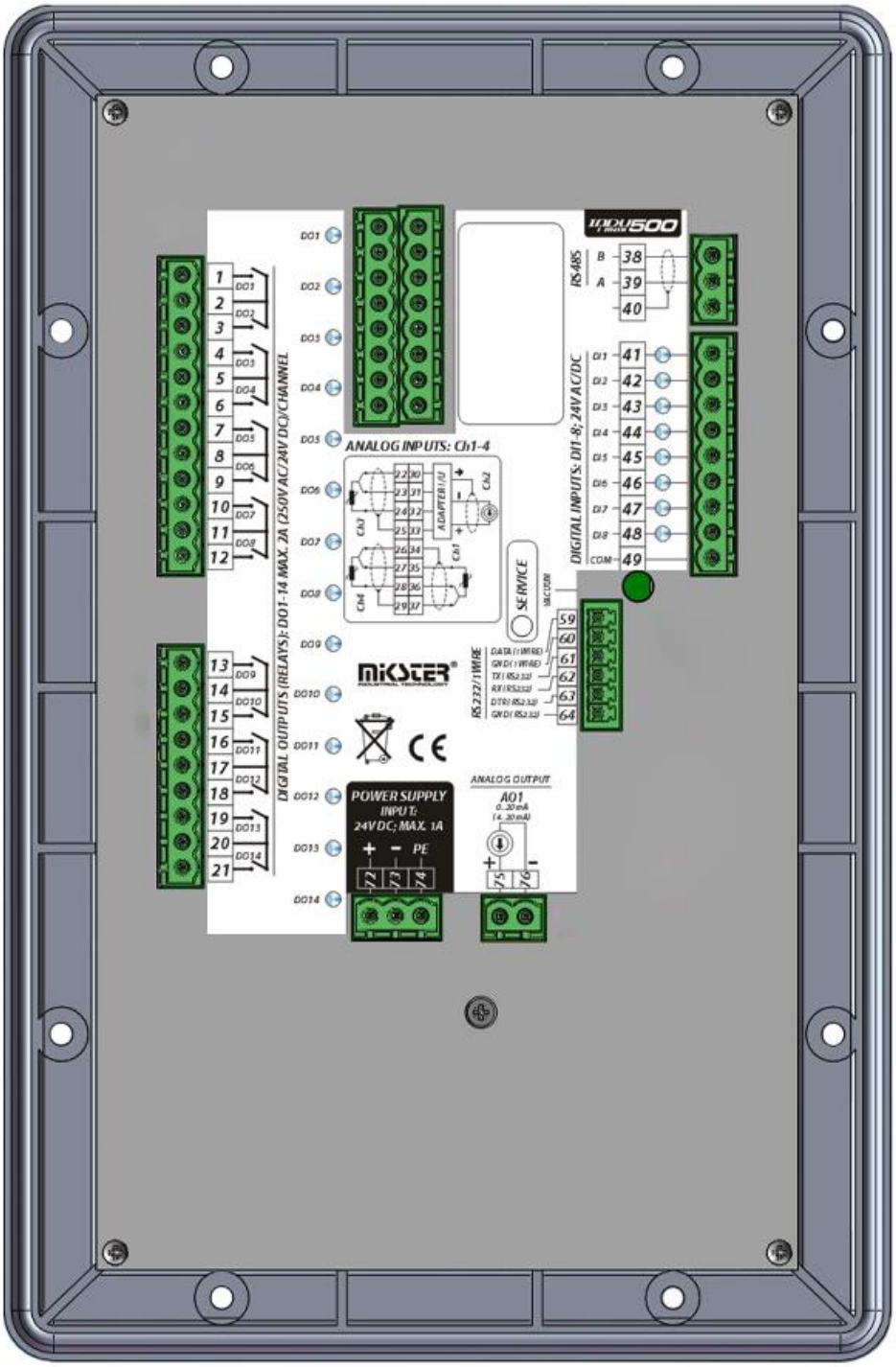



***NOTE!***
***Mikster shall not be liable for damage resulting from the incorrect installation of the equipment.***

## *31. Description of controller connectors*




***INDU iMAX510 MAS***




***INDU iMAX500 MAS***

## *32. Description of Inputs/Outputs*

| Relay Number | Description |
|---|---|
| DO1 | Fast rotation |
| DO2 | Left rotation |
| DO3 | Right rotation |
| DO4 | Unloading |
| DO5 | Vacuum |
| DO6 | Aeration |
| DO7 | Temp. regulator - cooling |
| DO8 | Sound signal (pip) |
| DO9 | Activation of the panel |
| DO10 | Dosing of water |
| DO11 | Vacuum signal |
| DO12 | Temp. regulator - heating |
| DO14 | Alarm output |

| Digital Input | Description |
|---|---|
| DI01 | Water meter input 24VDC |

| Analog Input | Description |
|---|---|
| Ch1 | Temperature sensor PT-100 |
| Ch2 | Vacuum sensor 0÷20mA |
| Ch3 | Weight sensor 0÷20mA |

| Analog Output | Description |
|---|---|
| AO1 | Current output 0÷20mA |

## *33. Alarm output*

DO14 alarm output is used for controlling an external signalling device to indicate the occurrence of an alarm on the controller.

The output can operate in one of two modes when an alarm occurs:
the output is continuously controlled,
the output is pulse controlled 1s on, 1s off.

## *34. Communication*

The controller has a built-in RS485 communication port.

It works with MPC4 software to record the running program.

The device must be connected to a computer, using a dedicated converter, and the transmission parameters, such as the number of the controller in the network and the transmission speed, must be configured accordingly. These parameters must be the same in the controller as in MPC4 program.

The software becomes fully functional once the controller has been authorised.

## *35. NOTES*