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The MCD-120 Microprocessor Controller Operating Manual "The PP_30 Vacuum Packaging Machine"

Issue: A

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1. The Packaging Machine Controller Operation

1.1 Getting ready to work

After switching on the packaging machine, the controller liquid crystal display will show the message: '*The PP_30 Vacuum Packaging Machine*' and the program version number. At the same time, the controller correct operation is tested. After few seconds the display will show current date and time, and the message: '*Packaging Machine off*'. If the machine is in good working order and ready to work, the display bottom line will be showing: '*F1-switching on*'. In case if the controller detects the packaging machine emergency state, bottom line will show the message: '*FAILURE:* ', including failure source description. This message will remain on the display even when failure source is eliminated, thus allowing to spot short emergency states. It is possible to delete the emergency message and resume the device operation by eliminating failure source and pressing the <**F1**> key.

1.2 Moving in the Menu, program parameters preview

While the packaging machine is in operation, the controller display shows number and name of the currently selected program. Moreover, the display presents information on currently executed packaging process phase, and selected operation mode and number of completed cycles. Press the <**ENTER**> key to display detailed information regarding parameters of currently executed program. Besides program parameters, the display shows pump temperature and daily cycle counter (added second screen line). Use arrow keys <↑> and <↓> to move to the next or previous screen. Press the <**ESC**> key to leave the parameter display mode.

Press the <**MENU**> key in order to access functions allowing to select or modify program parameters and device configuration. To select required function, press the <↑> and <↓> keys to set the indicator on its name, and press <**ENTER**>. Press the <**ESC**> key to return to higher menu level, or to leave it. Numbers visible in the display upper right corner make it easier to move through the menu. First of them is the number of currently selected function, while the second specifies total number of functions available at certain menu level.

1.3 Parameters edition

Selected numerical parameter is edited digit by digit, starting from the oldest one. Currently edited digit is highlighted and blinks, and its value may be modified either using numerical keyboard or the <↑>, <↓> keys. Press the <→> or <←> keys to switch to editing the next or preceding digit. Press the <**ESC**> key to quit edition and save new parameter value.

1.4 Function keys

Next to numerical keyboard and cursor keys, the packaging machine controller has the following function keys:

F1- packaging machine switching on and off
F3- 'step' - immediate shifting to the next packaging stage, without having reached preset vacuum parameters for current phase
F4-'reset' – interruption and termination of packaging process, and getting air in chamber.

2. Main Menu Functions

2.1 Program selection

Select the '*program selection*' function in the main menu to change current program. Then, select desired program using the <↑>, <↓> keys, and press <**ENTER**>.

2.2 Programming

The '*programming*' function allows to modify the packaging process parameters for individual products, and to add new programs to the existing collection. When you have selected the '*programming*' function from the main menu, select the program to be modified, and press <**ENTER**>. As a result, the list of parameters with their current values appears on the display. As soon as desired values are assigned to individual parameters, press the <**ESC**> key, which will allow to save the entered values and to switch to edition of another programs.
Parameters, which indicate the '*--.-*' symbol instead of numerical values, are inactive in current packaging machine configuration, and they are not editable. It is possible to secure access to the '*programming*' function with a code.

2.3 Operation mode selection

The '*operation mode*' function allows to select between the '*manual'* mode, in which the next packaging cycle is initiated by pressing the 'START' pushbutton, and the '*automatic*' mode, in which the next cycle starts immediately after completion of preceding cycle. When automatic operation mode is selected, it is possible to determine the number of cycles to be completed. When preset number of cycles in the automatic mode is completed, the packaging machine will be stopped after the final cycle. Press the 'START' pushbutton to resume operation and to repeat execution of preset number of cycles. It is possible to protect this function with a code.

2.4 Cycle counter clearing

The packaging machine controller is provided with the function of daily cycle counter. Each completed cycle is added to this counter, and its content is not cleared after switching off the device. It is possible to read off current indication of this counter by viewing program parameters (the last line). The 'cycle counter' function is used to clear counter readout. When you select this function in the main menu, current number of cycles will be displayed. Press <**ENTER**> to clear the counter. It is possible to protect this function with a code.

2.5 Clock setting

The '*clock setting*' function allows to correct date or time indicated by the controller. When you modify minute readout, seconds will be set to zero, which allows to set time precisely. It is possible to protect this function with a code.

2.6 Code change

The '*code change*' function allows users to modify access code to protected functions. When you enter new code value, press <**ENTER**> to confirm it.

2.7 Configuration

The '*configuration*' function allows to access a set of configuration and service functions. This function is protected against unauthorised access with a service code. This code is different than user code.

3. Configuration Menu Functions

Select the '*configuration*' function in main menu and enter correct service code to get access to the configuration menu.

3.1 Packaging machine configuration

The packaging machine configuration requires the '*On*' or '*Off*' values to be assigned to individual packaging process stages ('*pumping pause*', '*gas removal*', '*cutting off*', '*soft getting air in*', etc.), in order to determine, whether these phases will be active in a given device. Modify these settings in analogical way as numerical parameters.

3.2 User code

From configuration menu level, it is possible to activate of deactivate verification of user code protecting access to the following main menu functions: '*programming*', '*operation mode*', '*cycle counter*', '*clock setting*'.

3.3 Language version

This function allows to select language for messages displayed by the controller. Available language versions are: Polish, English and Czech.

3.4 Pump maximum temperature

The '*pump maximum temperature*' parameter determines pump temperature threshold. When this value is exceeded, the packaging machine will be switched of in an emergency. This situation is indicated by a message: '*FAILURE: exceeded pump temperature*'.

3.5 Extension of time for getting air in

The '*extension of time for getting air in*' parameter specifies duration of extra opening of the air valve after having reached pressure value corresponding to the end of getting air in.

3.6 Actuator parameters

This function allows to edit time parameters: tCKAL1, tCKAL2, tCKAP1, tCKAP2, set for the release valves in cover control system.

3.7 Service

Select the '*service*' option in configuration menu to switch to the service menu providing access to calibration and test functions. When using these functions, remember that no safeguards are active then.

4. Service Functions

4.1 Pressure calibration

Pressure calibration requires two standard pressure values to be preset. Then, the controller has to perform and store a computation, after which its readouts will correspond to standard instrument readouts.
Pressure shall be calibrated in two stages, by presetting and calibrating pressure for both standard values (*p_min, p_max*) separately. Calibration order for these values is unimportant. During the calibration, the top display line shows current value of pressure measured by the controller.
Specify suitable pressure value for the controller to calibrate 'lower' (*p_min*) pressure value. Then, select option '*p_min*' and enter this value using numerical keyboard. The next step is to select option '*calibration of p_min*'. When this operation is complete, the pressure value shown by the controller should be equal to entered standard value. Perform calibration for the second standard value (*p_max*) in an analogical way.

4.2 Temperature calibration

Temperature calibration requires standard 100Ω resistor. If, after having connected this resistor, the temperature readout differs from 0°C, then press <**ENTER**> to have possible deviation corrected. When this deviation is too high, the following message is displayed at any calibration attempt: '*Calibration error ! temperature out of acceptable range*'. This proves slotted (measuring) line damage. After completed zero calibration, additional check of readouts for the temperature of 100°C (standard 138.5Ω resistor) is required. If necessary, correct slotted line amplification with a potentiometer.

4.3 Tests

The following test functions are available:

- **[inputs-outputs]**
  When you select this test, the display shows current status of the controller digital inputs (upper line) and outputs (lower line). Individual inputs and outputs are indicated by a cursor. Move the cursor using <↑>, <↓> and <→>, <←> keys. Name describing their use is displayed for inputs and outputs currently indicated by the cursor. If the cursor indicates one of outputs, then press <**ENTER**> to change its status to the opposite. When you quit this function, all inputs are deactivated.

- **[measuring inputs]**
  The test of measuring inputs allows to view pressure and temperature values measured on the grounds of current calibration values. Additionally, on the right side of the display you may see voltage values (expressed in hexadecimal system) read off directly from analog-to-digital converter.

- **[chamber tightness]**
  Enter desired values of pressure and dripping time in order to perform chamber test. Then, select option '*START*' to initiate the test. The leak proof test is carried out in two stages. First, air is pumped out of the chamber, until vacuum of '*p_zad*' is reached. When this happens, the pump is switched off and supply valves are closed. Dripping time '*t_zad*' is counted from this moment. When preset dripping time counting is complete, current vacuum value is stored in memory, and further pressure changes no longer have any effect on pressure readouts visible on the right side of the display. We may interrupt the leak proof test any time, by pressing the <**ESC**> key.

4.4 Cycle counter clearing

Cycle counter available in the service menu counts total number of packaging cycles completed by the device, which allows to determine its wear level. This counter is not available for users. Press the <**ENTER**> key to clear summary cycle counter.

4.5 User code change, service code change

These functions allow to modify user access code and service code. When you enter new code value, confirm it by pressing the <ENTER> key. When you enter code value of '000000' , then the code will be deactivated.

5. Safeguards and Emergency States

The controller detects the following emergency states of the machine:

- wrong power supply (phase loss or wrong order of phases)
- pump overload (signal from thermics)
- temperature sensor breakdown
- pump overheating
- emergency STOP

Occurrence of an emergency state results in the device shut down and displaying of message indicating failure source. It will be possible to switch on the controller again

only when failure source is eliminated (all necessary signals sent to control inputs). In case if a failure takes place, the '*FAILURE: ...*' message will be displayed even if alarm source is eliminated, until you press the <**F1**> key.

5.1 Controller Activation in the Service Mode

Since it is not impossible to start the controller without sending required signals to control inputs, a mechanism has been created, which allows to bypass safeguards check at the output to configuration and test functions. In order to activate the controller in the service mode, press and hold (for approximately 1 s) the <**MENU**> key after switching on the controller, when the program version number is being displayed. Then enter the service code.

6. Specification of Inputs and Outputs

inputs:

70- pump thermics
71- phase sequence sensor (CKF)
72- emergency STOP
73- hands protection
74- activate cycle L
75- activate cycle P.
76- Limit switch - KR1
77- Limit switch - KR2
78-
79- KTRZ1
80- KTRO1
81- KTRZ2
82- KTRO2
83- CKA1
84- CKA2
85- CKA3
86- CKA4

outputs:

40- pump
41- actuator L
42- actuator P.
43- valve ZG
44- valve ZZA
45- valve ZZG
46- valve ZUL
47- valve ZUP
48- valve ZP
49- valve ZD
50- TRZ1
51- TRO1

52- TRZ2
53- TRO2
54- transport system 1
55- transport system 2

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