USERGUIDE

Programming
MPA-II v2 XN, XS or YN,YS Robots

Software version 1.0

⚠️ WARNING - Reliance on this Manual Could Result in Severe Bodily Injury or Death!
This manual is out-of-date and is provided only for its technical information, data and capacities. Portions of this manual detailing procedures or precautions in the operation, inspection, maintenance and repair of the product forming the subject matter of this manual may be inadequate, inaccurate, and/or incomplete and cannot be used, followed, or relied upon.
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Logo definitions:

⚠️  Warning, risk
🗑️  Sepro robotique inventions
❓  What to do?

→ Key pulses.
  Example: press 📡 → 📡
  means: press 📡 then 📡

🎵  Document evolutions
💡  Handy hints
🖼️  Example

🔍  Innovation or information concerning a particular software version
– CONTENTS –

I – STUDYING AN APPLICATION EXAMPLE ........................................... 1

I – 1. Description of the robot cycle ...................................................... 1

II – PROGRAMMING A CYCLE .............................................................. 5

II – 1. Selecting a program ................................................................. 5

II – 2. Entering a program ................................................................. 6

II – 2. 1. Accessing the editor ............................................................ 6

II – 2. 2. Deleting program steps ....................................................... 6

II – 3. Writing the cycle in SEPRO MPA–II v2 language ......................... 8

II – 4. The program editor functions ................................................... 9

II – 4. 1. Moving about within a program ............................................ 9

II – 4. 2. Deleting an instruction ....................................................... 10

II – 4. 3. Deleting a step ................................................................. 10

II – 4. 4. Changing a value ............................................................. 10

II – 4. 5. Inserting a step : ............................................................... 10

III – PROGRAM STRUCTURE ............................................................. 11

III – 1. Main program ................................................................. 11

III – 2. Subroutine ................................................................. 11

III – 3. The program options .......................................................... 11

III – 4. Advice for cycle time optimization ........................................ 11

IV – PROGRAMMING INSTRUCTIONS ................................................. 13

IV – 1. The robot’s pneumatic movements .......................................... 13

IV – 1. 1. Wrist rotations ............................................................... 13

IV – 1. 2. Part grips ................................................................. 14

IV – 1. 3. The Sprue–picker arm (Option) ........................................... 14

IV – 2. The robot’s numeric movements ............................................. 15

IV – 2. 1. Programming a speed ....................................................... 15

IV – 2. 2. Programming an imprecision ............................................. 15

IV – 2. 3. Programming a slow approach .......................................... 17

IV – 2. 4. Programming a free axis .................................................. 18

IV – 3. The commands concerning the IMM ....................................... 19

IV – 4. The other instructions .......................................................... 20

IV – 4. 1. Programming an auxiliary input ......................................... 20

IV – 4. 2. Programming an auxiliary output ....................................... 20

IV – 4. 3. Switching to the subroutine .............................................. 20

IV – 4. 4. End and loopback instruction ............................................. 20
IV - 4. 5. Programming a time delay ............................................. 21
IV - 5. The program options ...................................................... 23
IV - 5. 1. Time delays associated with auxiliary outputs ................. 23
IV - 5. 2. IMM anticipated restart (option) .................................. 24
IV - 5. 3. Memorizing a switching input ...................................... 24
IV - 5. 4. Part grip control ....................................................... 24
IV - 5. 5. Cycle counter ......................................................... 25
IV - 5. 6. Start–up conditions after having stopped a stacking sequence . 26
IV - 5. 7. Offset wait position .................................................. 26
IV - 5. 8. Memorizing the index positions ................................. 27
IV - 5. 9. Length of the high speed pulses for the vertical axes ......... 27
IV - 5. 10. Type of IMM access ................................................. 28

V – SPECIAL PROGRAMMING FUNCTIONS .................................... 29
V – 1. Release and part stacking (palletization) ............................ 29
V – 1. 1. Introduction .......................................................... 29
V – 1. 2. Defining a stacking sequence ..................................... 30
V – 1. 3. Programming the stacking movements ......................... 31
V – 1. 4. Examples of stacking sequences .................................. 32
V – 1. 5. Viewing the stacking sequences : .................................. 34
V – 2. Programming in Teach mode .......................................... 35
V – 3. Programming a cycle with offset wait compared to the IMM axis .... 36
V – 3. 1. Signalling ............................................................... 37
V – 4. IMM anticipated restart (option) .................................... 38
V – 4. 1. Anticipated restart with a programmed delay .................. 40
V – 4. 2. Auto–adaptive anticipated restart .............................. 40
V – 5. Unloading tie–barless Injection Moulding Machines ............. 41

VI – MEMORY MANAGEMENT : COPY MODE .................................. 42
VI – 1. The local memory ....................................................... 42
VI – 1. 1. List of the programs ............................................... 42
VI – 1. 2. Copying a program .................................................. 43
VI – 2. The memory card (option) .......................................... 44
VI – 2. 1. Formatting the card .................................................. 44
VI – 2. 2. Identifying the card ................................................ 44
VI – 2. 3. Saving a program .................................................... 45
VI – 2. 4. Restoring a program ............................................... 46

FIGURES .............................................................................. 48

INDEX ................................................................................. 49
This document is for users of the MPA–II v2 robots:

- with a numeric axis on X (XN, XS),
- with two numeric axes on X and Y (YN, YS).

In both cases, the Z vertical movement is always pneumatic.

You are advised to read at least the first two chapters of the MPA–II User Manual.

I – STUDYING AN APPLICATION EXAMPLE

This chapter describes an unloading application from an injection moulding machine (IMM). The example starts with the need analysis and goes as far as entering the program on the MPA–II terminal (chapter II). This example can be used as a basis for all new users of the Sepro MPA–II control unit who wish to create programs.

I – 1. Description of the robot cycle

The cycle described in the example is an IMM unloading application with a single part release on a conveyor belt.

Figure 1 : Cycle movements
### THE CYCLE

<table>
<thead>
<tr>
<th>The main sequences</th>
<th>The actions and movements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disengaging sequence</td>
<td>– Release part.</td>
</tr>
<tr>
<td></td>
<td>– Y back.</td>
</tr>
<tr>
<td></td>
<td>– Z up.</td>
</tr>
<tr>
<td>IMM cycle start and await opening</td>
<td>– X positioned above the IMM, gripper head vertical, IMM cycle started and ejectors back authorised.</td>
</tr>
<tr>
<td>Part grip in the mould sequence</td>
<td>– Z descent into the mould.</td>
</tr>
<tr>
<td></td>
<td>– Y forward towards the part.</td>
</tr>
<tr>
<td></td>
<td>– Ejectors forward and await ejectors completely forward.</td>
</tr>
<tr>
<td></td>
<td>– Grip part.</td>
</tr>
<tr>
<td></td>
<td>– Y back for part demoulding, ejectors back and await ejectors completely back.</td>
</tr>
<tr>
<td></td>
<td>– Z up to exit mould.</td>
</tr>
<tr>
<td>IMM cycle restart</td>
<td>– Restart IMM cycle.</td>
</tr>
<tr>
<td>Part release on belt sequence</td>
<td>– X positioned above the belt.</td>
</tr>
<tr>
<td></td>
<td>– Gripper head horizontal.</td>
</tr>
<tr>
<td></td>
<td>– Z down.</td>
</tr>
<tr>
<td></td>
<td>– Release part.</td>
</tr>
<tr>
<td></td>
<td>– Z up again.</td>
</tr>
<tr>
<td>Belt indexing</td>
<td>– Belt indexed one step for 5 seconds.</td>
</tr>
</tbody>
</table>

#### Starting conditions

The positions needed to start up the robot cycle are programmed in Step 1. If this is not necessary, it is better not to write anything in Step 1 and start the program in Step 2.

In our example, you must consider that it is not necessary to define a position to start the robot cycle. Do not write anything in Step 1 and go on to Step 2.

#### The disengaging sequence

This is used to free the robot after it has been stopped to position it above the machine. To ensure that the mould is not damaged, it is preferable to imagine that the robot could be in the IMM. The disengaging sequence is therefore as follows:

![Disengaging_sequence](image)

Each action or movement will be programmed in a Step.
Positioning the robot above the IMM and starting the IMM cycle:
This sequence is to prepare the robot for its descent into the mould. You must therefore position it in the machine axis and orientate the gripper head correctly.
You must also send a part to be produced. For this, the robot must validate the IMM cycle.

The part grip sequence:
The part grip sequence can vary from one application to another depending on the type of part to be unloaded. The questions to be considered are, for example:
- Is the part held at the end of the ejectors when they are fully forward?
- Is the part freed before the end of ejection?
- Is it possible to put the ejectors forward before the Y axis has completed its forward movement?
- Is it necessary to wait for the ejectors to be completely back before raising arm Z?
- Etc...

For our example, the answer to these 4 questions is YES for the cycle which follows:

Part grip sequence

Restarting the machine cycle:
Now that the part grip sequence has been completed, we must program the restart of the machine cycle so that a new part can be produced.

Releasing the part:
Final sequence to program: releasing the part on the belt.
The release cycle in our example is as follows:
Belt indexing, the program end and loopback:

The belt indexing is controlled by an auxiliary output whose activation time is entered in the program options. See chapter IV – 5. page 23 for the description of all the program options.

The program end is programmed by pressing $I_{ED}$ in the step containing the last instruction. The following question appears when the last step of the program is validated: which step should you loopback to when the program is finished?

You do not have to loopback to Step 1: the aim is to separate the program into two parts. The first part is only carried out when a cycle is restarted and the second is the normal unloading cycle. You will loopback to the beginning of this 2nd part.

1st part: cycle restart

loopback

2nd part: normal unloading

When you exit Auto, Step by Step or Stop mode or following a part grip fault, the cycle starts again at the beginning of the first part and therefore carries out the disengaging sequences and the machine cycle start.

If we look at our program more closely, we can see that steps 1, 2, 3 and 4 are only carried out in the 1st cycle.

The program can therefore be instructed to loopback to Step 5.

Step 1 ———
Step 2
Step 3 } Disengaging cycle
Step 4
Step 5 } Machine cycle start and positioning above the IMM
Step 6
Step 12 IMM cycle restart
Step 17 Ascent
Step 18 Belt indexing and end

Looping back to Step No. 5 triggers the movements that are programmed in this step apart from the IMM cycle which has already been programmed in Step No. 12. As long as the part has not been taken, the IMM cycle command is ignored.
II – PROGRAMMING A CYCLE

II – 1. Selecting a program

The internal memory of a SEPRO MPA–II robot can contain up to 15 program numbered from 0 to 14.

See chapter VI – 2, page 44 “Memory card”, for the program numbers contained in the external memory.

When you create a program, you can:

► either, create a new program,
► or, rewrite a program that already exists.

The list of programs that already exist can be consulted in COPY mode (see chapter VI – page 42 “Memory management”).

---

**Figure 2 : Selecting a program**
II – 2. Entering a program
II – 2. 1. Accessing the editor

A step of the selected program now appears on the screen.

Figure 3 : Accessing the editor

II – 2. 2. Deleting program steps

If the program steps already contain instructions that you do not want to keep, it is better to delete the entire contents of the program at this stage.

To access step 1 of the program

To delete the contents of all the steps (up to the end of the program)

. To delete the program options (see page 23) and the stacking definitions (see page 30).
* It is better to start from an empty program, so choose this option.

. To keep the program options (see page 23) and the stacking definitions (see page 30).

Figure 4 : Deleting the program steps

Note : Pressing deletes the program steps from the step being edited up to the end of the program.
<table>
<thead>
<tr>
<th>Start-up conditions</th>
<th>STEP 1</th>
<th>Page 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disengaging sequence</td>
<td>STEP 2</td>
<td>Page 2</td>
</tr>
<tr>
<td></td>
<td>STEP 3</td>
<td>Page 2</td>
</tr>
<tr>
<td></td>
<td>STEP 4</td>
<td>Page 2</td>
</tr>
<tr>
<td>IMM cycle start and positioning of the robot above the IMM</td>
<td>STEP 5</td>
<td>Page 3</td>
</tr>
<tr>
<td></td>
<td>STEP 6</td>
<td>Page 3</td>
</tr>
<tr>
<td></td>
<td>STEP 7</td>
<td>Page 3</td>
</tr>
<tr>
<td></td>
<td>STEP 8</td>
<td>Page 3</td>
</tr>
<tr>
<td></td>
<td>STEP 9</td>
<td>Page 3</td>
</tr>
<tr>
<td></td>
<td>STEP 10</td>
<td>Page 3</td>
</tr>
<tr>
<td></td>
<td>STEP 11</td>
<td>Page 3</td>
</tr>
<tr>
<td>IMM cycle restart</td>
<td>STEP 12</td>
<td>Page 3</td>
</tr>
<tr>
<td>Release sequence</td>
<td>STEP 13</td>
<td>Page 3</td>
</tr>
<tr>
<td></td>
<td>STEP 14</td>
<td>Page 3</td>
</tr>
<tr>
<td></td>
<td>STEP 15</td>
<td>Page 3</td>
</tr>
<tr>
<td></td>
<td>STEP 16</td>
<td>Page 3</td>
</tr>
<tr>
<td></td>
<td>STEP 17</td>
<td>Page 3</td>
</tr>
<tr>
<td>Belt indexing and loopback</td>
<td>STEP 18</td>
<td>Page 4</td>
</tr>
</tbody>
</table>
II – 3. Writing the cycle in SEPRO MPA–II v2 language

******************************************
*** SEPRO MPA–II.v2 YN number 3000 ***
******************************************
*** PROGRAM No.01                     ***
*** date:                             ***
*** by :                              ***
******************************************
******************************************
*** Main program                      ***
******************************************
Step 1
Step 2
Release part 1
Step 3
Y ABSOLUTE 100.0(YN,YS)or Arm 1 back(XN,XS)
Step 4
Arm 1 up
Step 5
X ABSOLUTE 150.0
Gripper vertical
Ejectors in validation
machine cycle
Step 6
Arm 1 total descent
Step 7
Y ABSOLUTE 250.0 (YN,YS) or Arm 1 forward (XN,XS)
Step 8
Ejectors out validation
Ejectors out control
Step 9
Grip part 1
Step 10
Y ABSOLUTE 100.0(YN,YS)or Arm 1 back(XN,XS)
Ejectors in validation
Ejectors in control
Step 11
Arm 1 up
Step 12
machine cycle
Step 13
X ABSOLUTE 1400.0
Step 14
Gripper horizontal
Step 15
Arm 1 total descent
Step 16
Release part 1
Step 17
Arm 1 up
Step 18
Auxiliary Output No.0 maintained for: 5.0 sec
Program loopback to Step : 5
II – 4. The program editor functions

Changes are always made in “Direct Programming” mode. PRGD must be marked on the display.

To select this mode, see “Accessing the editor” chapter II – 2. 1. page 6.

The step marked is the one where the robot was stopped.

The tools used for modifying a program are given below:

II – 4.1. Moving about within a program

- Direct access to Step 1: 

- Direct access to the last step of the program: 

- Direct access to the first step of the subroutine: 

- Moving between steps: This is done using + and -

![Diagram of program steps](image)

Figure 5: Moving between program steps

Note: Press ./. to move between the main page and the auxiliary page (or + for the double arm robots).
II – 4.2. Deleting an instruction

Press the instruction key and # simultaneously and confirm with or press the key of the instruction you want to delete for a second time.

II – 4.3. Deleting a step

# − simultaneously : Deletes the step marked.

Before : step marked  →  STEP 3  Release part 1
STEP 4  Sprue-picker arm up
STEP 5  Sprue-picker arm back

After :  →  STEP 3  Sprue-picker arm up
STEP 4  Sprue-picker arm back

II – 4.4. Changing a value

The following example explains how to change an X position (← or →). Use the same procedure to change a Y position (↓ or ↑).

First, go to the step containing the value to be changed :

X : 1200.0

Enter the new value in 1/10 mm

Confirm the value

Confirm the step

Figure 6 : Changing a value

II – 4.5. Inserting a step :

# + simultaneously : to insert an empty step before the step marked

Before : step marked  →  STEP 3  Release part 1
STEP 4  Sprue-picker arm up
STEP 5  Sprue-picker arm back

After :  →  STEP 3  ← Empty
STEP 4  Release part 1
STEP 5  Sprue-picker arm up
STEP 6  Sprue-picker arm back
III – PROGRAM STRUCTURE

III – 1. Main program
A program is made up of series of steps corresponding to the movements a robot makes in a cycle.
A program can contain up to 45 Steps, numbered from 1 to 45.

III – 2. Subroutine
- A main program can be diverted to a subroutine upon the appearance of a data item.
- A subroutine consists of a series of Steps like the main program. It can contain up to 15 steps numbered from 46 to 60.
- At the end of the subroutine, the loopback step to the main program is entered.
- The data item that enables you to switch to the subroutine may be:
  - The appearance of an AIG (Switching) input which may be memorised or not (Chapter IV – 5. 3. page 24)
  - or the internal data item : Cmd at End of layer or Cmd at End of stacking if requested in the stacking header (see ”Stacking” chapter V – 1. 2. page 30).
  - or the internal data item : End of cycle counting if requested (see Counters chapter IV – 5. 5. page 25).

III – 3. The program options
Each program can be characterised by the options described in chapter IV – 5. page 23

III – 4. Advice for cycle time optimization
The IMM cycle time is often greater than the robot’s one. Even so, it is always interesting to reduce it, especially the IMM immobilization time.
The IMM immobilization time is the length of time that separates:

- the mould access authorization that the IMM gives to the robot: Mould Open (MO) or Partial Opening Reached (OPA) signal

from

- the Machine Cycle Validation (VCM) that the robot gives to the IMM to authorize the fabrication of a new part.

To reduce the IMM immobilization time, you can use a certain number of instructions and options offered by Sepro, and several rules must be respected to guarantee the equipment safety and the reliability of the cycle.

- The cycle time reduction MUST NEVER increase the number of incidents. In this case, the time lost restarting after an incident cancels out the few tenths of a second gained during optimization.

- The paths obtained after optimization must not lead to a risk of collision if, for one reason or another, a part of the movement slows down.

The robot arm must be stopped as close as possible to the mould to wait for the latter to open. The IMM cycle must be restarted as quickly as possible. For this to be possible, the Outside Mould Area (ZHM) cam must be adjusted correctly: the lowest position of the robot arm that enables the mould to open and close without colliding with the robot gripper head.

The “imprecise” instruction is used to optimize the cycle time. Its use is described in chapter IV – 2.2. page 15.

Using this tool enables you:

- to round the robot’s path as the movements follow on from one another
- to mask the part demoulding movements (ejectors and/or core pullers) by doing them during the robot’s movements.

So that the cycle time optimization is efficient, some of the IMM adjustment parameters must be checked or modified:

- the Partial Opening position (OPA) must be adjusted to authorise the robot arm’s descent as soon as possible (avoiding any risks of collision)
- the IMM movement speeds and accelerations (mould, ejectors and core pullers) must be optimized to a maximum, whilst at the same time respecting the quality of the parts produced and the safety of the equipment.
- if possible, the fastest movements must be respected: for example, if the mould opening is quicker than the part ejection, the cycle time will be less penalised if the opening is large enough to mask the ejectors and/or core pullers back and forward time during the robot movements.

Reminder: the equipment’s productivity is calculated over long production periods. Consequently, stops due to incidents are taken into account.

- An efficient cycle time optimization MUST:
  - Reduce the part fabrication time
- An efficient cycle time optimization MUST NOT:
  - Increase the number of reject parts
  - Increase the number of incidents

Sepro proposes, as an option, an additional means of cycle time optimization: anticipated restart that enables you to mask the IMM reaction time (see chapter V – 4. page 38).
IV – PROGRAMMING INSTRUCTIONS

IV – 1. The robot’s pneumatic movements

Y demoulding axis (if the Y axis is pneumatic)

<table>
<thead>
<tr>
<th></th>
<th>Arm 1 forward (XN, XS)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Arm 1 back (XN, XS)</td>
</tr>
</tbody>
</table>

The demoulding movement can be controlled either physically or by a timer (see Configuration mode in the Configuration Manual).

If the robot is equipped with a 3–state pneumatic circuit on the Y axis, it is possible to program a “Y free” command in the same way as for a numeric axis: see chapter IV – 2. 4. page 18.

This instruction leads to the purging of the cylinder’s 2 chambers which enables the ejectors to push the robot’s arm back, for example.

Z vertical axis

<table>
<thead>
<tr>
<th></th>
<th>Arm 1 up</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Arm 1 total descent</td>
</tr>
<tr>
<td></td>
<td>Arm 1 partial descent</td>
</tr>
<tr>
<td></td>
<td>Arm 1 down slowly</td>
</tr>
</tbody>
</table>

The ascents are always controlled physically, but the descents can be controlled either physically or by a time delay (see Configuration mode in the Configuration Manual).

The speed of this movement is controlled by high speed pulsed commands whose length is adjusted in the program options (see chapter IV – 5. page 23) or changed when the robot is operating in Automatic (see User Manual).

When a program is empty, reference values are placed in it. These “default” values are entered in configuration mode (see Configuration manual).

IV – 1. 1. Wrist rotations

<table>
<thead>
<tr>
<th></th>
<th>Gripper vertical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gripper horizontal</td>
</tr>
<tr>
<td></td>
<td>Rotation 2 + direction</td>
</tr>
<tr>
<td></td>
<td>Rotation 2 – direction</td>
</tr>
</tbody>
</table>

These rotations can either be controlled physically or by time delays (see configuration mode in the Configuration manual).
IV – 1. 2. Part grips

<table>
<thead>
<tr>
<th>If the robot has one part grip circuit</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Grip part 1</td>
<td></td>
</tr>
<tr>
<td>Release part 1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>If the robot has 2 part grip circuits</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Grip part 1</td>
<td></td>
</tr>
<tr>
<td>Release part 1</td>
<td></td>
</tr>
<tr>
<td>Grip part 2</td>
<td></td>
</tr>
<tr>
<td>Release part 2</td>
<td></td>
</tr>
</tbody>
</table>

The part presence control can either be permanent or only active in the machine (see programming options page 23)

The number of part grip circuits to be controlled is also entered in the program options (see chapter IV – 5. 4. page 24).

IV – 1. 3. The Sprue–picker arm (Option)
IV – 2. The robot’s numeric movements

The X axis of an MPA–II robot is always numeric. The Y axis is numeric for the YN or YS robots. The special commands for the numeric axes are accessible behind the keys. The left one is for the X axis and the right one for the Y axis.

IV – 2. 1. Programming a speed

- The speed of a numeric axis can be changed from 15 to 100% of its maximum value.
- The change made to the speed in a given step is maintained until it is changed later on in the program.

Programming:

- Using the and keys, move to the step where the numeric movement whose speed you want to change is programmed
- Press (left key for X, right key for Y).

The robot displays:

```
PROG/Step
ABSOLUTE 150.0 Vel 20 Imprecise : 0.0
[0,1,2]=No. STCKG [#] Free
```

- Press to change the active field. The Vel message should blink.
- Enter the value of the speed percentage, for example 20.
- Confirm with.

The robot displays:

```
PROG/Step
ABSOLUTE 150.0 Vel 20 Imprecise : 0.0
[0,1,2]=No. STCKG [#] Free
```

- Press.

IV – 2. 2. Programming an imprecision

Using this function, you can anticipate moving on to the next step in order to gain time. However, the final programmed value is still reached.

Programming:

```
X movement to the position 1500.0 with an imprecision of 100 mm

Z descent
```

01T01831_0

3.3.00
– Using the [−] and [+] keys, go to the step where the numeric movement that you want to make imprecise is programmed.

– Press [−−−] (left key for X / right key for Y)

The robot displays:

![Robot display showing ABSOLUTE 150.0 Vel 20 Imprecise: 0.0, [0,1,2]=No. STCKG [#] Free]

– Press [+] several times to make Imprecise the active field. Imprecise should flash.

– Enter the imprecision value, for example: 100.0

– Confirm with [←].

The robot displays:

![Robot display showing Imprecise movement]

\(i\): indicates an imprecise movement

**Display in automatic mode:**

– The value of an imprecision can be seen using the [−−−] key when the robot is carrying out this movement.
IV – 2.3. Programming a slow approach
(Only possible on the X and Y numeric axes)

A movement whose final position is not known. The end of the movement is carried out at slow speed as from a value given in the program step. The movement is stopped by:

- the disappearance of the “End of Slow Approach” FAL input (sensor placed on the wrist when the elastic accompaniment option is present).

or

- the appearance of the part presence control input if the part grip function is programmed in the same step as the slow approach.

Programming:

Slow approach in the mould from 400.0 until contact is made with the part.

- In the step you have chosen, press the key (left for X / right for Y).
- Press several times to move the active field to Imprecise. “Imprecise” should flash.
- Press to select “SLOW APPROACH”.

The robot displays:

![Diagram of slow approach movement]

- Confirm with .
- Press then .
- Confirm with .

The robot displays:

![Robot display for slow approach]

L : indicates a slow approach movement
IV – 2.4. Programming a free axis

This command enable you:

▲ to free an axis’ brake without controlling its motor. This is only possible for the X and Y axes.

When the Y axis must accompany the part ejection movement.

Programming:

Y axis free during ejectors forward until the ejectors forward control

– At the step where the ejectors forward validation is programmed, the robot displays:

```
PROG/Step
ABSOLUTE 150.0
[#] Free
```

– Press (left key for X / right key for Y).

The robot displays:

```
Y: AXIS FREE
[#]=absolute
```

– Press #.

The robot displays:

```

```

– Press .

The robot displays:

```

```

Note: When the X axis is free, the “—” symbol appears on the bottom left of the screen.
IV – 3. The commands concerning the IMM

This instruction validates the machine cycle.

- This validation is memorized until a part is produced. During this time, the robot can no longer enter the area occupied by the mould. This is a software safety.
- During normal operation, if the robot has not entered the mould, the IMM closing validation will be ignored. There is no risk that the IMM cycle will be started twice.
- Each time this key is pressed, the corresponding command’s status will be reversed.

This instruction operates in different ways depending on the robot’s position.

- Robot outside mould: Wait for mould open with a part.
- Robot in the mould: Validation and waiting for complete mould opening.

Ejector validation is checked or not, depending on the need.

- Press one of these 2 keys once to program the validation.
- Press twice to control this validation.
- Press three times to cancel the instruction.

Core puller validation is controlled or not, depending on the need.

- Press one of these 2 keys once to program the validation.
- Press twice to control this validation.
- Press three times to cancel the instruction.
IV – The other instructions

IV – 4. Programming an auxiliary input

There are 8 auxiliary inputs:

- Standard: E0 – E1 – E2 – E3
- Optional: E4 – E5 – E6 – E7

An input is programmed by pressing the following keys simultaneously:

- and to test a high level input (logic 1)
- and to test a low level input (logic 0)

Programming a high level tested input.

- Press and simultaneously.

The robot displays:

```
<table>
<thead>
<tr>
<th>PROG/Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>* *</td>
</tr>
<tr>
<td>*</td>
</tr>
<tr>
<td>. 2 .</td>
</tr>
<tr>
<td>. . . .</td>
</tr>
<tr>
<td>. . . .</td>
</tr>
</tbody>
</table>
```

- Confirm by pressing .

IV – 4. 2. Programming an auxiliary output

There are 8 auxiliary outputs:

- Standard: S0 – S1 – S2 – S3
- Optional: S4 – S5 – S6 – S7

An output is programmed by pressing the following keys simultaneously:

- and

The length of time an auxiliary output is maintained is declared in the OPTION menu using the key. This length of time does not affect the duration of the step in which the output is programmed.

Programming output 3.

- Press and simultaneously.

The robot displays:

```
<table>
<thead>
<tr>
<th>PROG/Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>* *</td>
</tr>
<tr>
<td>*</td>
</tr>
<tr>
<td>. 2 .</td>
</tr>
<tr>
<td>. . . .</td>
</tr>
<tr>
<td>. . . .</td>
</tr>
</tbody>
</table>
```

- Confirm by pressing .

IV – 4. 3. Switching to the subroutine

(see chapter III – 2. page 11).

IV – 4. 4. End and loopback instruction

(see “program end” page 4).
IV – 4. 5. Programming a time delay

Three types of time delays can be programmed. The time delays to maintain the auxiliary outputs are described in chapter IV – 5. 1. page 23.

The step change time delay

This time delay only commences once the movements requested in the step have been completed. It delays the step change by the value programmed using the key.

This value is given in 1/10 secs in 2 figures (9.9 secs max).

Note: The auxiliary commands programmed in the same step are maintained.

![Diagram showing step changes](image_url)

The time delay is entered as follows:

- In Step 7, press then then then then .

The robot displays:

```
PROG/Step 7
0* 7* X:2000.0
```

- Validate the step by pressing .

Result:

```
Movement along horizontal axis
```

![Diagram showing time delay](image_url)

```
3 seconds
```

```
Movement along vertical axis
```
The ejection time delay

If the “Y advance” and “Ejectors forward” movements are programmed in the same step n, their execution speed can never be the same.

The waiting time marked on the diagram may lead to the following problems:
- the part is dropped,
- conflict between the robot arm and the part.

The special ejector time delay enables you to synchronise the end of the execution of the two movements.

The delay value is entered in or or mode by pressing the keys simultaneously. Only one value is possible per cycle and it can be changed during operation. It is given in 1/100 secs with 3 figures (9.99 secs max).

Note: If the ejection movement is very long, it can be programmed at the same time as the descent into the mould. The delay is then corrected to synchronise the part grip with the end of the ejection.
IV – 5. The program options

In direct programming mode ([SET] + [SET])

Press [RESET] and the following menu appears:

![Menu Image]

- Press [SET] to go directly to the first step of the program.
- Press [SET] to go directly to the end of the program.
- Press [SET] to go directly to the first step of the subroutine (Step 46).

**Figure 8: Access to program options**

This menu is used to define the operating conditions for a given program.

**IV – 5.1. Time delays associated with auxiliary outputs**

Used to assign a holding time to outputs S0 to S7 with a maximum value of 25 secs.

**Access:** [SET] + 0 ... 7

Use the [SET] key to select the following auxiliary output.

![Menu Image]

The time delay operates in adjust mode [SET], which means that you can index a belt for example.

Press [SET] -> to access output 3.

![Menu Image]

Press [SET] then [SET].

![Menu Image]

Output S3 will be maintained for 3.8 secs starting from the step where it was programmed, whatever the length of the step.
IV – 5.2. IMM anticipated restart (option)

Access: (see description in chapter V – 4. page 38)

IV – 5.3. Memorizing a switching input

Access: 

This enables the switching input to be memorized or not. Depending on the applications, it may be preferable to take the current status of the switching input into account or, on the contrary, to memorize the active status of this input before carrying out a particular function.

IV – 5.4. Part grip control

Access:  

Used to define the areas where the part grip controls are actuated.

Using , you can change the selection

Used to define which part grip circuits are controlled when the part is gripped.

Using , you can change the selection.

- TOTAL : part grips 1, 2 and 3 (selected by default)
- 1 & 2 : part grips 1, 2; the presence of part 3 is not controlled
- 1 & 3 : part grips 1 and 3; the presence of part 2 is not controlled
- 1 only : part grip 1 only; the presence of parts 2 and 3 are not controlled

Confirm with .
This window is used to define how the robot should react when it loses a part.

<table>
<thead>
<tr>
<th>PROG/Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENABLE PART CHECK : TOTAL</td>
</tr>
<tr>
<td>DISENGAGE IF FAULT [#] Stop</td>
</tr>
</tbody>
</table>

Using [#], you can change the selection:

- Disengaging if part fault (selected by default): if the part is not taken after 6 secs, the robot disengages automatically and stops as soon as the mould area is free.
- Stop if part fault: if the part is lost, the robot stops.

In both cases, an alarm is activated.

Confirm with ←.

IV – 5.5. Cycle counter

Access: 

This is used:

- to select a number of cycles to be completely carried out,
- to define an action to be carried out when the counter reaches the selected value.

The counter increases at every loopback in the program or subroutine.

However, the loopback step must be inferior to the actual step.

<table>
<thead>
<tr>
<th>PROG/Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX CYCLES No. : 1500 no final command</td>
</tr>
<tr>
<td>Command choice: P , !</td>
</tr>
</tbody>
</table>

Enter the cycle number (from 1 to 9999)

Confirm with ←.

Enter the type of action at the end of counting:

- P to select switching; in this case, you need the P instruction in the program.
- ! to select a stop at the end of the cycle,
- ? then the output No. then the Step No. where this auxiliary output is activated,
- # to select nothing.

Confirm with ←.
IV – 5. 6. Start-up conditions after having stopped a stacking sequence

Access:

Two possibilities :

▸ Following a stoppage, the stacking counters are not changed.

The selection is :

![Restart without checking the stackings or the cycle counter]

▸ Following a stoppage, the robot asks if it should set the stacking counters back to zero and carry out the end of stacking actions respectively.

The selection is :

![Restart and check the stackings & the cycle counter]

If the counters are neither at zero or their maximum, the robot asks the following question each time you start it up again :

![Stacking in progress, + to continue, - to go to final action]

▸ Press + to continue : the cycle is continued without changing the counters.

▸ Press - to go to the final phase. The end of stacking counters (and not end of layer or stack) are validated. The stacking counters are set to zero.

If the counter is neither at zero or at its maximum, the following question is asked :

![Cycle counter= 486, + to continue, - to reset to zero, final action]

The action is the same as for the stackings. # is used to reset the counter to zero.

IV – 5. 7. Offset wait position

Access: ← or →

This function described in chapter V – 3. page 36 depends on the robot’s configuration (see the Configuration manual, file R).
IV – 5. 8. Memorizing the index positions

**Access:**

The indices are memorized positions that can be used in programming and adjust modes.

When a numeric axis key is pressed in Programming mode, the associated index is automatically displayed (providing its value has already been entered).

In Adjust mode, an index position acts as a stop as soon as the key has been pressed.

There are 2 index positions for the X axis (indices 1 and 2), 2 for the Y axis when the robot is on the machine side (indices 3 and 4) and 2 for the Y axis when the robot is on the release side (indices 5 and 6).

Move the axis to the position to be memorized.

[Image]

The robot displays:

![Image]

Press [+] or [-] until the index number that you want to use appears.

Press the 2 axis' keys simultaneously:

- for X: [←] and [→] simultaneously.
- for Y: [↙] and [↘] simultaneously.

=> The robot's actual position is taken for the index.

Confirm with [→].

A different value can also be entered using the numeric keyboard.

---

**Note:** The indices are very useful as they make the Y axis manual movements in the IMM safer in particular and make it easier to enter values when programming. You are advised to enter the values before you start programming the cycles.

---

IV – 5. 9. Length of the high speed pulses for the vertical axes

**Access:**

For the main arm and the sprue-picker arm.

![Image]

These values must be adjusted to obtain rapid movements with no shocks at the end of the stroke.

**Note:** The longer the length of the pulse, the more the axis is brisk and the more the shocks on the dampers are violent.
IV – 5. 10. Type of IMM access

This OPTION is only available if side-entry access has been defined as possible in Context mode (see the Configuration manual in File R).

Used to define the type of IMM access. Vertical access is when the robot enters the mould from above; side-entry access is when the robot accesses the IMM from the side. For the latter, the robot arm is down and it is the X axis that moves.

See description in chapter V – 5, page 41.
V – SPECIAL PROGRAMMING FUNCTIONS

V – 1. Release and part stacking (palletization)

V – 1. 1. Introduction

Each cycle includes 3 stacking sequences numbered from 0 to 2.

A stacking sequence is programmed in two stages:

- **1st Stage**: Defining the stacking

  Available using the \[\text{key}\] key, a dialogue menu appears that enables the pallet organization to be easily defined.

- **2nd Stage**: Programming the movements to stack the 1st part

  Using the \[\text{keys}\] keys

Before programming a stacking sequence, you should become acquainted with the following keys:

- \[\text{key}\] : to access the menus for the definition.
- \[\text{key}\] : to select an option.
- \[\text{key}\] : to validate and continue with the definition.
- \[\text{key}\] : to continue with the definition.
- \[\text{key}\] : to return to step programming.
V – 1. 2. Defining a stacking sequence

Press ![enter key] to enter the stacking information:

- see the screens in the example on page 32

- Defining the stacking N° : 0, 1 or 2
  and the type:

![Layer Stacking](image1)

By layer

- Defining the order in which the robot will stack the parts (only for YN)

![Order of Stacking](image2)

- Defining the number of parts on the X horizontal axis (max number of parts = 99)
- Defining the value of the X gap between parts (from 0 to ± 3200.0 mm) and the direction.

  - enter the value using the numerical keys and the negative/positive sign using #.

- Defining the number of parts on the Y horizontal axis (max number of parts = 99)
- Defining the value of the Y gap between parts (from 0 to ± 3200.0 mm) and the direction.

  - enter the value using the numerical keys and the negative/positive sign using #.

- Defining the number of layers (Max number = 999).
- Defining the command at the end of the layer.

Action that the robot must carry out at the end of each stacking layer. Warning: the end of the last stacking layer is not considered as an end of layer, but as an end of stacking.
Command possibilities at end of layer:

- **EXEC** : to execute a subroutine starting from the step where this instruction is programmed.
- **ACT** : to activate an auxiliary output
  - **OUT ?** : enter the output N° then **<**.
  - **ACT** at **S ??** : enter the Step N° from which the output will be controlled.

The text “at end of layer” corresponds to stacking in layers, otherwise you are asked “at end of stack”.

Definition of the command at the end of stacking

Action that the robot must carry out when the stacking has finished.

Command possibilities at end of stacking:

- **EXEC** : to execute a subroutine
- **ACT** : to activate an auxiliary output
  - **OUT ?** : enter the output N° then **<**.
  - **ACT** at **S ??** : enter the Step N° from which the output will be controlled.

**V – 1.3. Programming the stacking movements**

First of all a stacking number is allocated to a movement using the **<** key which displays the extended programming menu.

Absolutes  Vel Imprecise : 0.0

[X, Y] = No. STCKG [#] Free

Choose the stacking number using the **<** and **<** keys. The stacking number is validated with **<**.

Next, the value of the movement for the 1st cycle is entered. You must return to the step programming with the **<** key to do this.

The letter of the stacking axis is followed by the letter **r** (from the French word for stacking, ‘rangemen’) and the stacking number.

The position is now entered from the keyboard. This position will be increased for each cycle by the value of the gap defined in the stacking using the **<** key (see chapter **V – 1.1** page 29).
V – 1.4. Examples of stacking sequences

Defining a stacking sequence

The stages marked with YN only apply to YN type robots (2 numeric axes).

This is how you define this stacking sequence:

1. STACKING N°0: In LAYERS
   
2. STACKING N°0 Order X then Y
   
3. STCKG N°0: Number of parts in X=3
   
4. STCKG N°0: Gap in X = 400.0
   
5. STCKG N°0: Number of parts in Y=2
   
6. STCKG N°0: Gap in Y = -250.0
   
7. STCKG N°0: Number of layers
   
8. STCKG N°0: Cmd at layer end : NONE
   
9. STCKG N°0: Cmd at pallet end : NONE

Stacking sequence N° 0 has now been entered.
Programming the movements

The two numeric movements are programmed as follows:

Let us suppose that we are going to program Step 15.

1. located above the keys
2. 
3. EXIT
4. located above the keys
5. Press to continue onto the next step.
6. located above the keys
7. 
8. EXIT
9. located above
10. Confirm with
V – 1.5. Viewing the stacking sequences:

Key: 1st pulse: COUNTERS

Key: 2nd pulse: GAPS
V – 2. Programming in Teach mode

In the teach programming mode “TEAC”, the robot performs the cycle at the same time as you program it.

This mode is chosen after having selected the number of the cycle that you are going to create. The indices must already have been entered.

To access teach mode:

The robot displays:

Press

The robot displays:

This is to ensure that the program is empty before you start programming.

Press simultaneously.

The robot displays:

You must now decide whether to keep or delete the information associated with the program (information contained in Option (chapter IV – 5. page 23 ) and Stacking sequences (chapter V – 1. page 29)).

Press or depending on your choice.

The robot once again displays:

Enter the different cycle movements as for direct programming (see chapter II – “Programming a cycle” page 5), not forgetting that all the actions programmed in a same step are carried out simultaneously.

In Teach mode, the robot carries out the movements at the same time as they are programmed. The MVts COMPLETED message enables you to change step.
V – 3. Programming a cycle with offset wait compared to the IMM axis

If the robot is not able to approach the mould whilst it is not open because of the mould dimensions, we talk about a cycle with an offset wait compared to the IMM’s axis.

When the robot is in the IMM area, it must stop the mould closing whatever the operating mode (adjust, without robot, step by step or automatic).

When the mould is not open, the robot access must be prohibited whatever the operating mode (adjust, without robot, step by step or automatic).

**Programming:**

In this type of cycle, the first stage that describes the robot disengaging sequence, must contain the position of the X axis outside of the IMM.

Only then can you enter the machine cycle validation instruction (machine cycle) and machine opening control which is obligatory.

The return to the IMM axis, the descent, part grip, etc ... will be in the next step.

**Configuration:**

In the robot’s configuration, you define whether it is obligatory or not to enter an offset wait position (see Configuration manual).

► Facultative data :

In this case, you can choose in each program whether the “Machine Area Free” is programmed or determined automatically :

- Programmed “Machine Area Free” : you must enter an X position as from which the robot is sufficiently free from the IMM to authorize the mould to close.

As long as the cycle has not been executed, the Machine Area Free corresponds to ZBD. The mould must be open to authorize the robot movements outside of ZBD.

- “Machine Area Free” determined automatically : the robot analyses the cycle and defines this area by itself. It corresponds to the ZBD cam if the cycle is programmed with an offset wait. It corresponds to the whole of the X stroke if the IMM cycle is restarted when the robot is on the Machine Axis (AM).

If the robot never interferes with the IMM when the Z arm is up, a value greater than the machine axis can be programmed.

► Obligatory data :

The cycle can only be used if a “Machine Area Free” has been entered in the program options (see figure 9 : page 37).
V – 3. 1. Signalling

When you run cycles containing an offset wait, the following messages may appear on the screen.

► If you try to command the mould closing or select the Without robot mode whilst the latter is badly placed, you may get:

*R Robinson BADLY PLACED !*

and MACHINE COMMAND: MOVE THE ROBOT

BEYOND POSITION...

or

MACHINE COMMAND: MOVE THE ROBOT

ONTO ZBD CAM

► If the mould is not open and if the robot is no longer in the Machine Free area:

ROBOT/MACHINE AREAS NOT INITIALIZED
MACHINE MUST BE OPEN OUTSIDE ZBD

or

ROBOT OUTSIDE MACHINE FREE AREA :

Must have MACHINE OPEN (or ADJ & START)

► If the robot configuration imperatively requires an “Machine Area Free” and this has not been entered in the program options for the current program:

- INCOMPLETE CYCLE : MACHINE FREE VALUE?
- Prog. then [RESET] then [ ]
V – 4. IMM anticipated restart (option)

**Aim:**
This shortens the cycle time by masking the IMM reaction time (time between the closing authorization from the robot and the actual mould movement).

**Principle:**
The machine cycle validation (VCM) and the arm free safety (SBD) are given when the robot is still inside the mould.

**Type of anticipated restart:**
There are two types of anticipated restart:
- anticipated restart with a programmed delay,
- auto-adaptative anticipated restart.

The type of restart is chosen in the options of each program.

**Conditions:**
The IMM anticipated restart is only effective if:
- the robot is in automatic mode,
- the overall speed coefficient Kv = 100 %

**Safety:**
If one of the data items mould open (MO) or partial opening reached (OPA) disappears whilst the robot is still inside the mould, the robot goes into fault and immediately interrupts the mould closing authorization commands.

If Mould Open (MO) or Partial Opening Reached (OPA) are lost and the robot is not outside of the mould, the robot stops and displays:

```
FAULT: PREMATURE ANTICIPATED RESTART
CHECK LENGTH OF THE DELAY
```
for anticipated restart with a programmed delay.

```
FAULT: PREMATURE ANTICIPATED RESTART
CHECK THE SAFETY MARGIN
```
for an auto-adaptative anticipated restart.

This option is only available if the software that validates it is installed.

A special cabling must also be added and defined in the configuration.
Reminder : accessing the program options

AUTOMATIC ADJUSTMENT
Validation of the auto–adaptative anticipated restart

SAFETY MARGIN=$$$s
(Min=0.05)

enter the margin value

DELAY PROGRAMMED=$$$s
Validation of the anticipated restart with a programmed delay

enter the delay value

Validate

Figure 10 : Anticipated restart
V – 4.1. Anticipated restart with a programmed delay

The programmed delay which enables you to optimize the IMM restart is applied between:

- the beginning of the movement which frees the robot from the mould,

and

- the activation of the commands that authorize the mould closing.

To optimize the anticipation, it is possible to change the length of the delay in automatic mode.

Enter the new value using the numeric keys and confirm with End of modification.

V – 4.2. Auto-adaptative anticipated restart

In this case, the robot calculates by itself the delay applied between the beginning of the movement that frees the robot from the mould and the activation of the commands that authorize the mould to close.

The margin represents the minimum tolerated duration between the arrival of the robot in an Out of Mould area and the loss of the Mould Open information. This is to avoid accidents if there are large differences in the IMM reaction times. Each time the robot stops, a delay of 5 seconds is applied. The calculation is made by successive tries. It will be optimal after several cycles in automatic mode.
V – 5. Unloading tie-barless Injection Moulding Machines

When the IMM does not have tie-bars, the MPA–II robot can be programmed and configured for side-entry access to the mould. This configuration is useful when it is not possible to access the mould vertically, as the X axis’ movement to reach and remove the part generally takes longer than the Z axis’ movement for the same operation.

To ensure the safety of the machines, this type of access is only possible if additional cams and sensors have been installed on the robot beam.

Side-entry access must be defined as being possible in Context mode (see the Configuration manual in File R).

The cycle must be defined with side-entry access in the program options (see chapter IV – 5. 10. page 28).
VI – MEMORY MANAGEMENT : COPY MODE

**Access:**
1. Identify
2. Save
3. Restore
4. Copy
5. List
6. Format

**Identify**
- Used to:
  - number the card,
  - give the robot a type and a number.

(See chapter VI – 2. 2. page 44)

**Save**
- Local memory Card
  1. Partial.
  2. General
  3. Configuration

(See chapter VI – 2. 3. page 45)

**Restore**
- Local memory Card
  0. Setup & Parameters
  1. Cycles

(See chapter VI – 2. 4. page 46)

**Copy**
- Duplicate and change number
  1. into Local memory
  2. into Memory – card

(See chapter VI – 1. 2. page 43)

**List**
- List of existing cycle N°,
- Gives the robot N° and the software version.
  1. into Local memory
  2. into Memory – card

(See chapter VI – 1. 1. page 42)

**Format**
- Format the card
  (See chapter VI – 2. 1. page 44)

---

**Figure 11 : Memory management (summary)**

**VI – 1. The local memory**

**VI – 1. 1. List of the programs**

This function lists the programs stored in:

- either the internal local memory,
- or the external memory card.
Press \[ \text{COPY & SAVE} \] to view the Copy mode main menu.

```
```

Procedure for listing the programs in the local memory:

1. Press \( \text{COPY & SAVE} \) (press \( \text{COPY & SAVE} \) to consult the list of programs in the memory card).

The robot displays:

```
LIST OF THE VALID PROGRAMS MEMORIZED
1.into Local memory 2.into Memory-card
```

Press \( \text{COPY & SAVE} \) (press \( \text{COPY & SAVE} \) to consult the list of programs in the memory card).

The robot displays:

```
LOCAL MEMORY robot No. MPA-II.v2 V 1.0
existing cycles
```

The robot displays the cycles stored in the relevant memory.

**VI – 1. 2. Copying a program**

This function is used to duplicate a program:

- either in the local memory (internal),
- or in the memory card (external).

Procedure for copying a program stored in the local memory:

1. Press \( \text{COPY & SAVE} \) (press \( \text{COPY & SAVE} \) to duplicate a program in the card).

The robot displays:

```
DUPLICATE CYCLES
1.into Local memory 2.into Memory-card
```

Press \( \text{COPY & SAVE} \) (press \( \text{COPY & SAVE} \) to duplicate a program in the card).

The robot displays:

```
LOCAL MEMORY: DUPLICATE CYCLE No.
existing cycles
```

The robot displays the cycles stored in the relevant memory.

- Enter the number of the program to be duplicated then \( \text{COPY & SAVE} \).
The robot displays:

```
LOCAL MEMORY: DUPLICATE CYCLE No. TO CYCLE No.
```

► Enter the number of the new program then ⏯.

**VI – 2. The memory card (option)**

This card is a PCMCIA type external memory in which can be saved:

► the programs and their options,
► the robot’s configuration (values entered in configuration, context and parameter modes).

It is possible to program a cycle directly into the card. It is also possible to execute this program.

**VI – 2.1. Formatting the card**

This function enables the card to be initialised by:

► erasing the memory,
► assigning areas to the programs and the robot configuration.

**Formatting procedure:**

► Press ⏯.

The robot displays:

```
MEMORY CARD NOT FORMATTED code ?.. to ERASE and FORMAT it
```

► Enter the code ⏯ then ⏯.

Formatting takes place immediately and you then return to Identification mode.

**VI – 2.2. Identifying the card**

This function enables you to customize the card by giving it:

► an identification number,
► the robot’s type and number.

**Identification procedure:**

► Press ⏯.

The robot displays:

```
MEMORY-CARD 1 for YN 6000 MPA-II.v2 1.0 IDENTIFICATION No. (1 to 9): ?
```
Enter the identification number then.

The robot displays:

```
TARGET ROBOT TYPE
1=XN 2=YN 3=XS 4=YS
```

- XN: numeric X / asynchronous motor
- YN: numeric XY / asynchronous motors
- XS: numeric X / Brushless servo-control motor
- YS: numeric XY / Brushless servo-control motors

Enter the robot type then.

The robot displays:

```
TARGET ROBOT No.
-> 0=Indifferent
```

Enter the robot’s serial No. then.

This number is preceded by PIP [_____] which you can find on:
- the end of the beam,
- the identification plate (X carriage or cabinet),
- the Customer File.

VI – 2. 3. Saving a program

This function enables the following to be stored on a memory card:
- one or all of the programs with their options,
- the robot’s configuration (values entered in configuration, context and parameter modes).

Procedure for saving a program:

- Install the memory card.
- Press.
The robot displays:

```
SAVING TO MEMORY CARD No. :
```

The robot displays the card number. See chapter on “Memory card”.

► Partial : for saving one program only.
► General : for saving all the programs and the configuration.
► Configuration : for saving the configuration.
► Press \[\text{OK}\].

The robot displays:

```
LOCAL CYCLE No. TO BE SAVED :
existing cycles
```

The robot displays the cycles present in the local memory.

► Enter the number of the program to be saved then \[\text{OK}\].

The robot displays:

```
LOCAL CYCLE No. TO BE SAVED :
CYCLE No. ON MEMORY CARD :
```

The number of a program stored on the card is always preceded by the card number.

Program 11 on card 8 will have the following number : 811.

► Enter the number that will be used for the program on the card, for example “11”, then \[\text{OK}\].

VI – 2. 4. Restoring a program

This function enables the following to be recalled from the memory card to the local memory :

► a program and its options,
► the robot’s configuration (values entered in configuration, context and parameter modes).

Procedure for restoring a program :

► Install the memory card.
► Press \[\text{OK}\].
The robot displays:

The robot displays:

The robot displays:

The robot displays:

The number of a program stored on a card is always preceded by the number of the card.

Program 11 on card 8 will have the following number: 811.

Enter the number of the program to be restored, for example “11”, then .

Enter the number that the program will have in the local memory then .
– FIGURES –

Figure 1 : Cycle movements ........................................ 1
Figure 2 : Selecting a program ........................................ 5
Figure 3 : Accessing the editor ....................................... 6
Figure 4 : Deleting the program steps ............................... 6
Figure 5 : Moving between program steps ......................... 9
Figure 6 : Changing a value ........................................... 10
Figure 7 : Ejection delay .............................................. 22
Figure 8 : Access to program options ............................... 23
Figure 9 : Offset wait ................................................ 37
Figure 10 : Anticipated restart ...................................... 39
Figure 11 : Memory management (summary) ....................... 42
# INDEX

## A
- Anticipated restart, 38
  - auto-adaptative, 38, 40
  - with programmed delay, 38, 40
- Arm free safety, 38
- Auxiliary input, 20
- Auxiliary output, 20, 23

## B
- Back-up, 45
- Belt, 1, 2

## C
- Changing a value, 10
- Command at end of layer, 11, 30
- Command at end of stacking, 11, 31
- Conveyor, 1, 2
- Copy mode, 42
- Copying a program, 43
- Core puller, 19
- Counter, 25, 26, 34
- Cycle, 1
- Cycle number, 5
- Cycle time, 11

## D
- Delete
  - a program, 6
  - a step, 10
  - an instruction, 10
- Disengaging sequence, 2, 25

## E
- Editor, 9
- Ejection delay, 22
- Ejector, 22
- End of counting, 11
- End of slow approach, 17

## F
- FAL, 17
- Formatting, 44
- Free, 18
- Free axis, 18

## G
- Gaps, 34

## H
- High speed pulses, 27

## I
- Identification, 44
- IMM cycle, 19
- Imprecise, 15
- Index, 27
- Inserting a step, 10

## J
- Jump, 11

## L
- Layer, 30
- List, 42
- Loopback, 4

## M
- Machine cycle validation, 19, 38
- Memorizing, an input, 24
- Memory card, 44

## O
- Offset wait, 26, 36
- OPA, 12
- Optimization, 11
P
Palletization, 26, 29
Part grip, 3, 24
Partial opening reached, 12
Password, 5
Program, 11
Program end, 4, 9
Program option, 6, 37
Program reminder, 46
Programming mode, 6

R
Releasing the part, 3
Restarting the machine cycle, 3
Return address, 4

S
SBD, 38
Serial number, 43
Slow approach, 17
Software version, 43
Speed, 15
Stacking, 26, 29
Stacking definition, 29
Subroutine, 9
Switching, 24

T
Teaching, 35
Time delay, 22, 23
Type of access, 28

V
VCM, 19, 38
Velocity, 15
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To contact Customer Service personnel, call:

From outside the United States, call: 814-437-6861

You can commission Conair service personnel to provide on-site service by contacting the Customer Service Department. Standard rates include an on-site hourly rate, with a one-day minimum plus expenses.

If you do have a problem, please complete the following checklist before calling Conair:

- Make sure you have all model, serial and parts list numbers for your particular equipment. Service personnel will need this information to assist you.
- Make sure power is supplied to the equipment.
- Make sure that all connectors and wires within and between loading control and related components have been installed correctly.
- Check the troubleshooting guide of this manual for a solution.
- Thoroughly examine the instruction manual(s) for associated equipment, especially controls. Each manual may have its own troubleshooting guide to help you.
- Check that the equipment has been operated as described in this manual.
- Check accompanying schematic drawings for information on special considerations.

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- Inspect the equipment and perform alterations or adjustments to satisfy performance claims. (Charges for such inspections and corrections will be waived unless failure to meet warranty is due to misapplication, improper installation, poor maintenance practices or improper operation.)
- Replace the original equipment with other CONAIR equipment that will meet original performance claims at no extra cost to the customer.
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