



Merlin Systems Corp. Ltd

**Miabot BT PRO
Gripper Attachment**

v1.1

Revision History

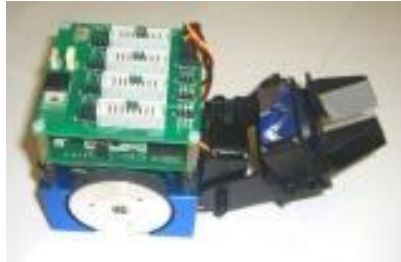
VO.1	11/10/05	pp	first version
V1.1	11/10/05	pp	fully revised

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Introduction

The Gripper is a lightweight add-on accessory which attaches to the front of a Miabot Pro robot. It can grasp, manipulate and lift a variety of small objects.



The gripper package comprises –

- a mechanical attachment operated by pulsewidth-controlled servo motors
- an extra pcb on top of the robot, with connectors linking the servo connections and power supply to the Pro expansion port
- a small test object suitable for the robot to pick up

The gripper fits onto extra mounting holes inserted in the standard robot body.
(An unmodified robot should be returned to Merlin to have this done)

Demonstration Sequence

The default robot command-sequence has been altered to provide a simple demonstration sequence for the gripper.

Prepare to execute the command sequence from turn-on by putting all 4 DIL switches to the 'ON' position.

Position the robot facing outward at the edge of a 2-3 foot circular area, and place the 'test object' between the jaws of the lowered gripper.

Turn the robot on.

It should now pick up the object, reverse to the centre of its 'test circle', turn, and then advance to place the object at a different point on the circle boundary before returning to the centre again.

The test sequence repeats indefinitely, until the robot is turned off or a radio command is executed.

Gripper Mechanics

The gripper is fitted to the front of the robot, and has two degrees of freedom – gripper width and elevation.

Gripper Action

The gripper servo is arranged so that the fully open position corresponds to a control value of about 0, while the maximum value 255 gives a fully closed position.

(see below for command values)

The grips are equipped with foam pads giving a limited compliance. However, there is no force or current feedback from the servos, so it is important to avoid gripping objects too tightly, which means the gripper control values must be carefully tailored to the object dimensions.

The prototype grips the test object provided well with a gripper control value of 185. Value 180 is too open (no grip), and 190 causes some strain to the servo (audible buzzing).

Elevation Action

The elevator servo gives a limited swing from a position just below horizontal to about 45° of elevation (giving a ground clearance of around 4cm).

Due to the compactness of the design, the full range of movement of the elevating servo is not available: It is necessary to avoid ever positioning the elevator servo beyond about 45° of elevation, or the gripper servo can strike the elevator servo: If this happens the mechanism binds + the servo is straining.

The prototype is horizontal with a control value of about 85, and is near maximum elevation at a value of 150.

N.B. Positions below horizontal do not strain the servo, but the front of the robot is lifted off the ground!

Software Controls

From version 2.6, the standard robot software has an extra command to control pulsewidth outputs to drive standard servos.

The command '**P**' takes a sequence of decimal values which determine the outputs, up to the number of servo outputs.

The control values can be in the range 0-255, giving an output pulse length of 1.0-2.0 mSecs nominal.

E.G.s

“[P 0 85]” puts the gripper open, and in a horizontal position

“[P 0 150]” puts the gripper open, and in a raised position

“[P 255]” closes the gripper

There are also two control parameters which affect the servo output behaviour :—

[**.ebP**] controls which pwm outputs are used

Up to five outputs can be supported, where each output is enabled by setting the appropriate bit in .ebP :—

<u>output</u>	<u>bit</u>	<u>EXP signal</u>	<u>EXP connector pin</u>
1	0	A2	11
2	1	A3	9
3	2	A4	7
4	3	A5	5
5	4	A1	13

NOTE: output#5 is not compatible with use of the I²C bus.

For the normal gripper setup, outputs 1+2 are connected to the gripper and elevator servos (in that order), and .ebP=3 (or more).

[**.PDT**] controls the startup pulse output delay

This is needed because controlling the servos while power is applied causes uncontrollable chatter (interaction with power-supply current limit).

Currently set to 100 (=milliseconds), which seems to work.

This should never need to be changed.