Wedge Motion

WMZ Precision Lift Table

Introduction

The WMZ is a precision vertical lift table suited for applications requiring a low profile. A wedge is used to perform the lift action. The wedge is actuated by a ball-screw coupled to a stepper or brushless motor. The WMZ table includes two limit switches. As an option, a knob can be added for manual control. The design, which makes use of flexures, enables a smooth operation and guarantees a longer life to the bearings.
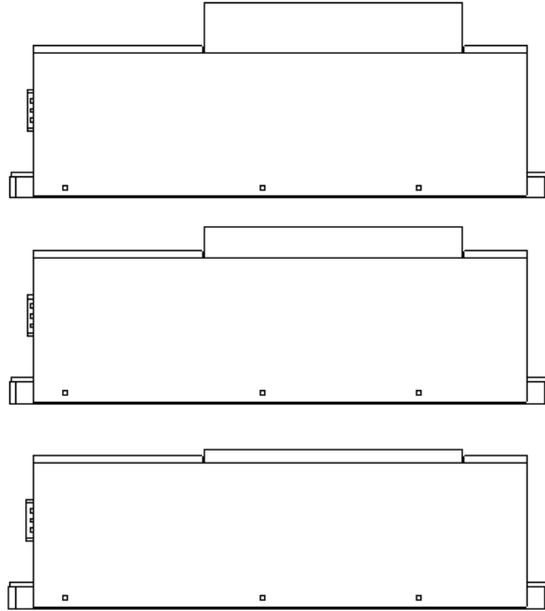
Fig.1: Illustration showing the plateau's lift action

Specifications

Moving plateau = 100mm x 100mm
Total length = 210mm
Total width = 104mm
Total height = from 61mm (lower position) to 75mm (higher position)

Total weight = 2.7kg
Maximum load = 5kg

Lift per motor revolution = 1mm/rev
Lift coefficient = 0.4 (21.8deg)
Backlash = none (ball-screw technology)
Machined parts made out of steel (base) and aluminum alloy

Nominal vertical lift = 14mm
Maximal vertical speed = 10mm/sec

Z resolution = 0.5µm (based on encoder and motor control)
Repeatability = ±2µm (unidirectional and bidirectional)
Z accuracy = ±5µm (at 1kg and after calibration of the lift coefficient)

Lateral error (Y) < ±10µm
Longitudinal error (X) < ±10µm

Parallelism between base and plateau < ±15µm
Roll error = ±20µrad (for all loads)
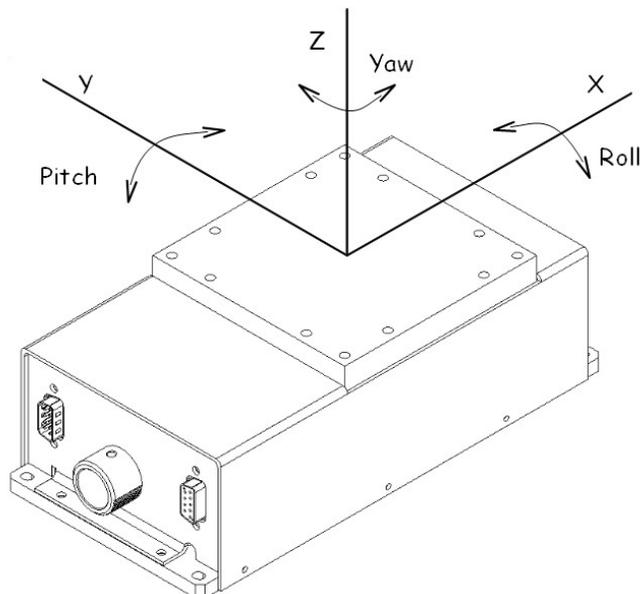Pitch error = ±20µrad (1kg centered and 25µrad/kg beyond)
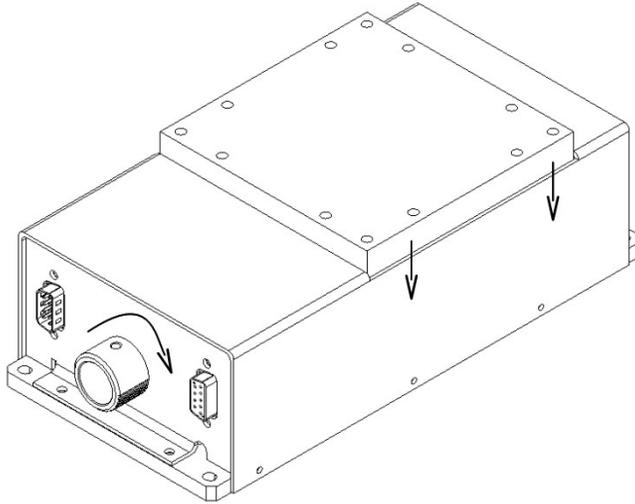
Fig.2: Roll, pitch and yaw definitions

Fig.3: Motion direction

Drawings

The following drawings show the main dimensions of the product. The base plate mounts using four (4) through holes for M4 screws. Those holes have a slightly elongated shape so as to accommodate both metric (200mm x 90mm) and imperial (7.875" x 3.5") systems.
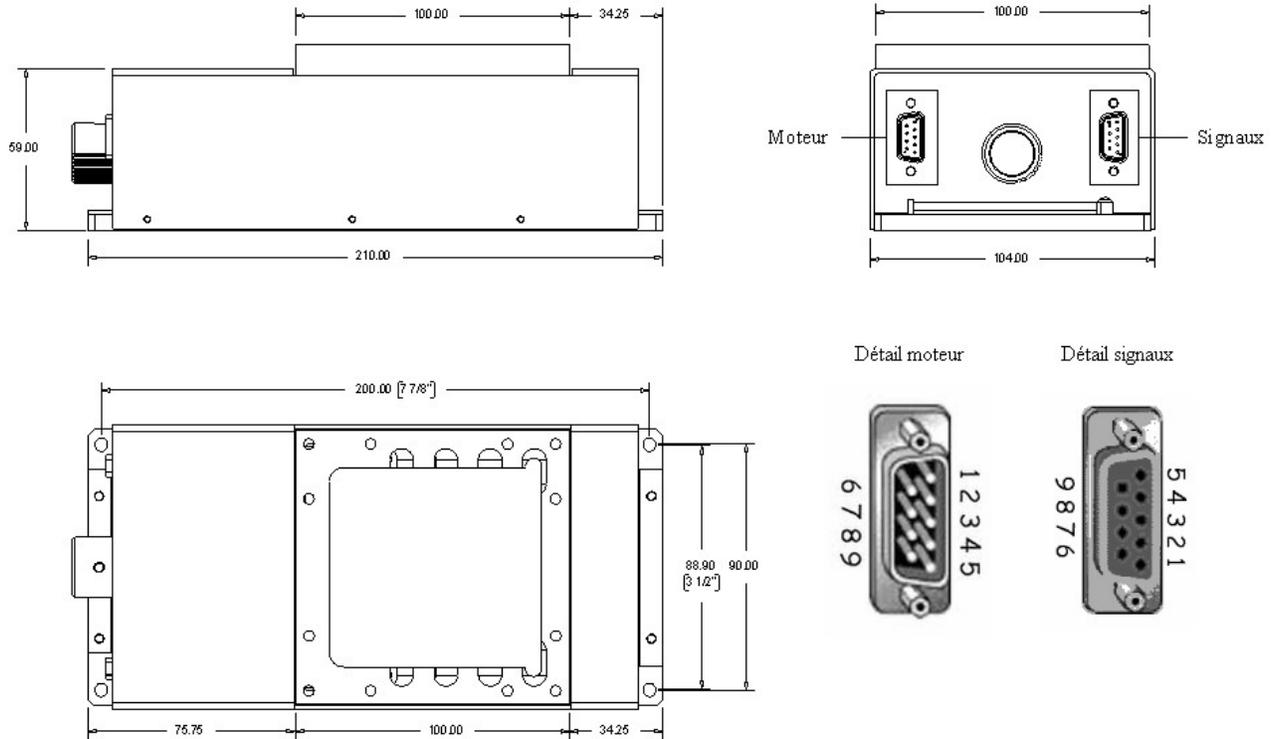

Fig.4: Principal views and dimensions

The plateau has twelve (12) threaded M4 holes. See figure 5.
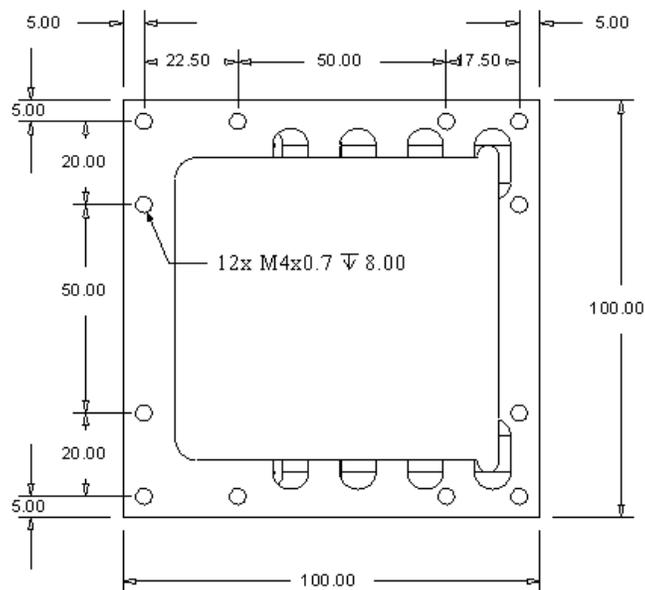

Fig.5: Detailed view of the plateau

Connections

Two (2) DSUB9 connectors are used to connect the motor and the signals (limit switches and encoder). Figures 6-7 depict the connections.

Fig.6: motor connections

Case of the stepper motor:

Pin 1: Phase A
Pin 2: Phase A
Pin 3: NC*
Pin 4: Phase B
Pin 5: Phase B
Pin 6: NC
Pin 7: NC
Pin 8: NC
Pin 9: NC

Case of the brushless motor:

Pin 1: Hall Vcc
Pin 2: Hall A
Pin 3: Hall B
Pin 4: Hall C
Pin 5: Hall GROUND
Pin 6: NC*
Pin 7: Phase A
Pin 8: Phase B
Pin 9: Phase C

*NC : not connected

Hall effect sensor:
- Power supply = 5V
- Current = 20mA
- Open collector output without pullp-up resistor
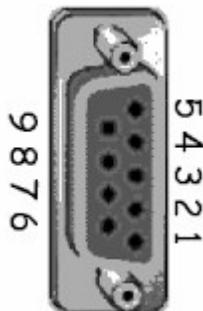

Fig.7: signals (limit switches + encoder)

Limit switches and encoder:

Pin 1: Encoder Vcc
Pin 2: Encoder phase A
Pin 3: Encoder phase B
Pin 4: Encoder index
Pin 5: Encoder 0V
Pin 6: Limit switch Vcc
Pin 7: Limit switch upper position
Pin 8: Limit switch lower position
Pin 9: Limit switch 0V

Limit switches:

- Power supply from 5 to 24V.
- Maximum DC current = 50mA
- Open collector output without pullp-up resistor

Encoders:

- Power supply = 5V
- TTL compatible output without pull-up resistor

Ordering Instructions

To place an order, please use the color-coded model: WMZ ▪️—▪️—▪️—▪️

Size of the moving plateau:
WMZ100 : 100x100mm
WMZ150 : 150x150mm (future product)

Motor options:
STEPPER : standard stepper motor (see specifications at end of document)
SERVO :   standard brushless motor (see specifications at end of document)
CUSTOM : your personalized motor (please specify vendor and model number)

Limit switch options:
Blank or NC : default setting is normally closed
NO :   normally opened

Encoder option:
Blank : default version is without encoder
ENC :   version with rotary incremental 500CPR encoder

Knob option:
Blank : default version is without knob
KNOB : version with manual knob

Order example: WMZ 100-STEPPER
The product is fitted with the standard NEMA17 stepper motor, without encoder. Two limit switches are installed. The limit switches are connected to be normally closed (opens at limits).

Order example: WMZ 100-STEPPER-KNOB
The product is fitted with the standard NEMA17 stepper motor, without encoder. Two limit switches are installed. A knob is installed so as to also move the table manually.

Order example: WMZ 100-STEPPER-NO
The product is fitted with the standard NEMA17 stepper motor, without encoder. Two limit switches are installed. The limit switches are connected to be normally opened (closes at limits).

Order example: WMZ 100-SERVO-ENC
The product is fitted with the standard NEMA17 brushless motor and rotary 500CPR encoder to control position and speed. Two limit switches are installed. The limit switches are connected to be normally closed (opens at limits).

Order example: WMZ 100-CUSTOM
The product is fitted with a personalized motor (NEMA17 size) chosen by the customer. For example, this can be a motor with integrated controller and driver.

Assembly

The product is provided with a temporary acrylic top to be removed during implementation.

Maintenance

The table WMZ requires an annual lubrication using a Lithium-based grease (fluid grease NLGI=00 for cross-roller bearings and soft grease NLGI=2 for ball-screw and linear guides). The table is greased at the factory and ready for use upon delivery. Ensure that the cover is put back in place after maintenance.

Warranty

The product is guaranteed for one year. See warranty terms and conditions.

Stepper motor specifications

Type of motor: NEMA 17 bipolar
Length: 39mm
Holding torque: 0.5 N.m
Step angle: 1.8°
Current per phase: 1.5A (RMS)
Nominal voltage: 24V

Brushless motor specifications

Type of motor : DC brushless motor NEMA 17
Length: 41mm
Rated voltage: 24V
Rated power = 26W
Rated torque = 63 mN.m (8.9 oz.in)
Rated speed = 4000 rpm
Rated current = 1.8 A
Torque constant = 35 mN.m/A (4.96 oz.in/A)
speed constant = 273 rpm/V = 29 (rad/sec)/V