

Explanation of Terms

(This terminology is related to IAI products, and so the definitions are more limited than usual.)

10,000km service life

Around 10,000 hours are guaranteed for actual use in the field. When considering the speed, work ratio, etc, this translates to a distance of 5,000 to 10,000km. While the life of a guide is sufficiently long for radial loads, it is the uneven loads due to moment loads that are problematic to its service life.

For this reason, the 10,000km service life is established by specifying the rated dynamic load moment that can guarantee 10,000km of travel distance.

50km service life

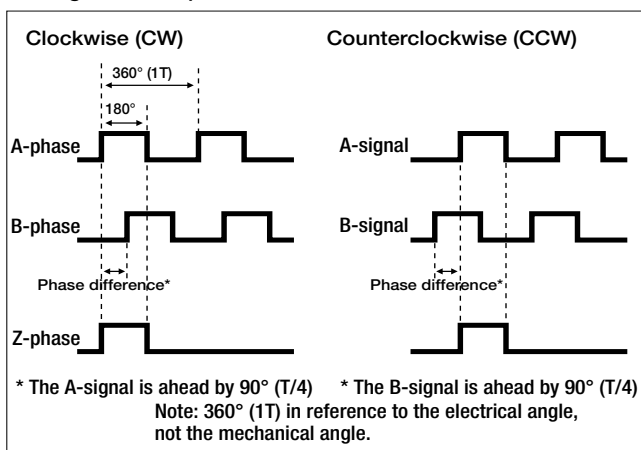
A way of expressing the allowable load capacity, submitted by the guide manufacturer. This is the value at which the probability of the guide not breaking (i.e. survival probability) when used with this allowable radial load (basic dynamic rated load) is 90%.

Calculating the actual distance of travel, considering the motion velocity and work rate, etc, an actual industrial equipment, it is necessary to ensure 5,000km to 10,000km of travel. From that viewpoint, this data is difficult to understand and difficult to utilize.

A-phase (signal) output / B-phase (signal) output

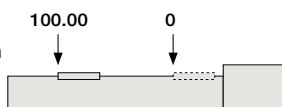
The direction of rotation (CW or CCW) of the axis is determined from the phase difference between the A-phase and the B-phase of the incremental encoder output, as shown in the diagram below. In a clockwise rotation, the A-phase is ahead of the B-phase.

■ Diagram of Output Modes



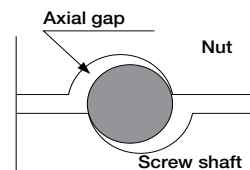
Absolute positioning accuracy

When positioning is performed to an arbitrary target point specified in coordinate values, the difference between the coordinate values and the actual measured values.



Backlash

As shown in the figure on the right, there is a gap between the nut and the ball (steel ball) and the screw shaft. Even if the screw shaft moves, the nut will not move the extent of the gap. The mechanical play in the



direction of this slider movement is called the backlash. The measurement method used is to feed the slider, then use the reading for the slight amount of movement time shown on a test indicator as a standard. Also, in that condition, without using the feed device, move the slider in the same direction with a fixed load, then without the load. Then find the difference between the standard value and the time when the load was removed. This measurement is conducted at the midpoint of the distance of movement and at points nearly at the two ends. The maximum value obtained among the values is used as the measurement value.

Bellows

A cover to prevent the infiltration of dust or debris from outside.

Brake

Primarily used for the vertical axis to prevent the slider from dropping when the servo is turned off. The brake activates when the power is turned off.

C10

One of the grades of a ball screw. The lower the number, the higher the precision.

Grade C10 has a typical movement error of ±0.21mm for a 300mm stroke.

CCW (Counterclockwise rotation)

Abbreviation for counterclockwise rotation.

It describes a rotation to the left, as viewed from above, i.e. opposite of the rotation of a clock's hands.

Explanation of Terms

Cleanliness

Class 100 and Class 10, etc. are units for expressing cleanliness. Class 10 (0.1 μ m) indicates an environment in which there are fewer than 10 pieces of debris 0.1 μ m or smaller per cubic foot.

Coupling

A component used as a joint to join a shaft to another shaft.
e.g. The joint between the ball screw and the motor.

Creep sensor

An optional sensor to allow high-speed homing operation.

Critical speed

Ball screw resonance with slider speed (No. of ball screw rotations). The maximum physical speed limit that can be utilized.

CW (Clockwise rotation)

Abbreviation for clockwise rotation.

It describes a rotation to the right, as viewed from above, i.e. same as the rotation of a clock's hands.

Cycle time

The time taken by one process.

Dispenser

A device that controls the flow rate of a liquid. This is integrated into devices for applying adhesives, sealants, etc.

Duty

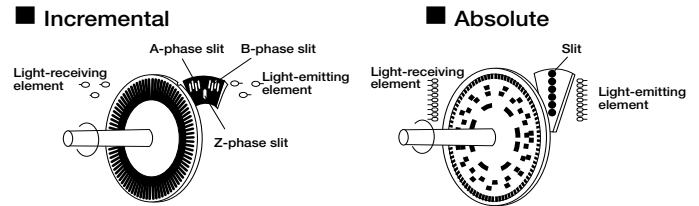
Indicates the work ratio in the equipment industry. (e.g. The time that the actuator operates in one cycle.)

Dynamic brake

A brake that uses the motor's regenerative energy.

Encoder

A device for recognizing the RPM and the direction of a rotation by shining a light onto a disc with slits, and using a sensor to detect whether the light is ON or OFF as the disc is rotated. (i.e. a device that converts rotation into pulses.) The controller uses this signal from the encoder to determine the position and speed of the slider.



An **incremental encoder** detects the rotational angle and the RPM of the axis from the number of output pulses. To detect the rotational angle and the RPM, a counter is needed to cumulatively add the number of output pulses. An incremental encoder allows you to electrically increase the resolution by using the rise and fall points on the pulse waveform to double or quadruple the pulse generation frequency.

An **absolute encoder** detects the rotation angle of the axis from the state of the rotation slit, enabling you to know the absolute position at all times, even when the rotating slit is at rest. Consequently, the rotational position of the axis can always be checked even without a counter. In addition, since the home position of the input rotation axis is determined at the time it is assembled into the machine, the number of rotations from home can always be accurately expressed, even when turning the power ON during startup or after a power outage or an emergency stop.

Excess voltage

Voltage applied to motor that exceeds regulation value when commanded speed is too fast.

External operation mode

This is the operation mode started by a start signal from an external device (PLC, etc.). This is also called automatic operation.

Flexible hose

Tube for SCARA Robot MPG cable that the user passes wiring through.

Gain

The numeric value of an adjustment of the controller's reaction (response) when controlling the servo motor. Generally, the higher the gain the faster the response, and the lower it is the slower the response.

Gantry

A type of two-axis (X and Y) assembly in which a support guide is mounted to support the Y-axis, so that heavier objects can be carried on the Y-axis.

Grease

High-viscosity oil applied to contact surfaces to make the guide and the ball screw move smoothly.

Greasing

Injection or application of grease to sliding parts.

Guide

A mechanism for guiding (supporting) the slider of the actuator. A bearing mechanism that supports linear motions.

Guide module

An axis in a two-shaft assembly that is used in parallel with the X-shaft to support the end of the Y-shaft when the Y-shaft overhang is long. Typical models include the FS-12WO and FS-12NO.

Home

Reference point for actuator operation. The pulse counts are determined and recorded for all positions the actuator moves to / from home.

Home accuracy

The amount of variation among the positions when home return is performed (if home varies, all positions vary).

Key slotted

A rotary shaft or mounting component is machined with a slot for key mounting.

(Key: One means of preventing positional slip in the rotation direction of the rotary axis and the mounting component)

Lead

The lead of the feed screw is the distance moved after the motor (hence the feed screw) has rotated one turn.

Understanding lead value

The lead value changes the actuator speed and thrust.

- Speed: With an IS AC servo motor, the rated rpm is 3,000rpm. In other words, this is 50 revolutions per second. In this case, with a 20mm screw lead, the speed is 50 revolutions/s×20mm/revolution = 1,000mm/s.
- Thrust: If the lead is large, then the thrust is small; and vice-versa.

Load capacity (Payload)

The weight of objects that can be moved by the actuator's slider or rod.

Lost Motion [mm]

First, for one position, run with positioning straight in front and then measure that position. Next, make a movement in the same direction by issuing a command. Then, issue the same command for movement in a negative direction from the position. Conduct positioning in the negative direction and measure that position. Again, issue a command for a movement in the negative direction, and issue the same command for a positioning movement straight ahead from that position. Then measure that position.

Using this method, repeat measurement in positive and negative directions, seven times each. Conduct positioning for each and obtain the deviation from the average value for each stop position. Determine the position for the center of the movements in these measurements and positions nearly at both ends. The measurement value will be the maximum value among those obtained. (Complies with JIS B6201)

Mechanical end

Position where actuator slider comes to mechanical stop. Mechanical stopper. (Example: Urethane rubber)

Offline

A state in which the PC software is started without the RS232 cable connected to the controller.

Explanation of Terms

Offset

To shift from a position.

Online mode

The state in which the PC software is started with the RS232 cable connected to the controller.

Open collector output

A system with no overload resistance in the voltage output circuit, that outputs signals by sinking the load current. Since this circuit can turn the load current ON/OFF regardless of voltage potential to which the current is connected, it is useful for switching an external load and is widely used as a relay or ramp circuit or the like for switching external loads, etc.

Open loop system

A type of control system. This system only outputs commands and does not take feedback.

A typical example of this is the stepping motor. Since it does not compare each actual value against the commanded value, even if a loss of synchronization (i.e signal error) occurs, the controller would not be able to correct it.

Operation

Operation.

Overhang

The state in which the object that is mounted onto the actuator extends out to the front/rear, left/right, or above/below the axis of movement.

Overload check

A check for overload. (One of the protection functions)

Override

A setting for the percentage with respect to the running speed. (e.g. If VEL is set to 100mm/sec, an override setting of 30 will yield 30mm/sec)

Pitch error [pitch deviation or lead deviation]

Due to problems in the manufacturing, such as the heat treatment process used, the deviations of the ball screws, which are a key mechanical element of the actuator, are not always small when inspected closely. A JIS rating is used to indicate the qualitative accuracy of these items.

These items made for the market must meet tolerance values set as Class C10.

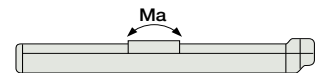
The accuracy required to meet the C10 standard is to be within a margin of error of $\pm 0.21\text{mm}$ for every 300mm of length. Generally the screw pitch error deviation accumulates in a plus or minus direction. One method of improving these items is to grind them in a finishing process.

[e.g.] When positioning 300mm from home:

The machine accepts a set position of 300 ± 0.21 . Supposing that the actual stop position is 300.21, if this position is repeatable and maintained at 300.21 ± 0.02 using a JIS6201-compliant method, then the repeatability standard for accuracy is met.

Pitching

Forward-backward motion along the axis of the slider's movement. (Direction of M_a)



PLC

Abbreviation for Programmable Logic Controller.

(Also referred to as sequencers or programmable controllers).

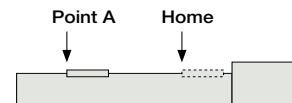
These are controllers that can be programmed to control production facilities and equipment.

Positioning band

The span within which a positioning operation is deemed as complete with respect to the target point. This is specified by a parameter. (PEND BAND)

Positioning repeatability

The variation in stop position accuracy for repeated positioning toward the same point.



Positioning settling time

The gap between the actual movement time and the ideal calculated value for movement. (Positioning operation time; processing time for internal controller operations.) The broader meaning includes the time for convergence of the mechanical swing.

Radial load

Load up to down in a direction 90° to horizontal slider.

Regenerative energy

Energy, generated by the motor's rotation. When the motor decelerates, this energy returns to the motor's driver (controller). This energy is called regenerative energy.

Regenerative resistance

The resistance that discharges the regenerative current. The regenerative resistance required for IAI's controllers is noted in the respective page of each controller.

Rolling

An angular movement around the axis of the slider's movement. (Mc direction)



SCARA

SCARA is an acronym for Selective Compliance Assembly Robot Arm, and refers to a robot that maintains compliance (tracking) in a specific direction (horizontal) only, and is highly rigid in the vertical direction.

Screw type

The types of screws for converting rotary motion of a motor to linear motion are summarized on the right.

IAI's single-axis robots and electric cylinders use rolled ball screws as a standard feature.

		Characteristics
Ball screw	Polished	Screws are polished for good precision, but expensive
	Rolled	Since the screws are rolled, they can be mass produced
Lead screw		Cheap, but poor precision and short life. Also not suitable for high-speed operation.

SEL language

The name of IAI's proprietary programming language, derived from an acronym for SHIMIZUKIDEN ECOLOGY LANGUAGE.

Semi-closed loop system

A system for controlling the position information or velocity information sent from the encoder with constant feedback to the controller.

Servo-free (servo OFF)

The state in which the motor power is OFF. The slider can be moved freely.

Servo-lock (servo ON)

The state in which, opposite to the above, the motor power is turned ON. The slider is continually held at a determined position.

Slider mounting weight [kg]

The maximum mounting weight of the slider when operating normally, without major distortion in the velocity waveform or current waveform, when operated at the specified acceleration/deceleration factor (factory settings).

Software limit

A limit in the software beyond which a given set stroke will not advance.

Stainless sheet

A dust-proof sheet used in ISD, DS, RC, etc. slider types.

Stepper motor (Pulse motor)

A motor that performs angular positioning in proportion to an input pulse signal by means of open loop control.

Thrust load

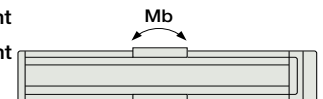
The load exerted in the axial direction.

Work rate

The ratio between the time during which the actuator is operating and the time during which it is stopped. This is also called duty.

Yawing

Motion at an angle in a left-right direction along slider movement axis. (Mb direction)



Along with pitching, laser angle measurement system is used for measurement, and the reading is the indication of maximum difference.

Z-phase

The phase (signal) that detects the incremental encoder reference point, used to detect the home position during homing operation.

Searching for the Z-phase signal for the reference during homing is called the "Z-phase search".