IAI
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GB

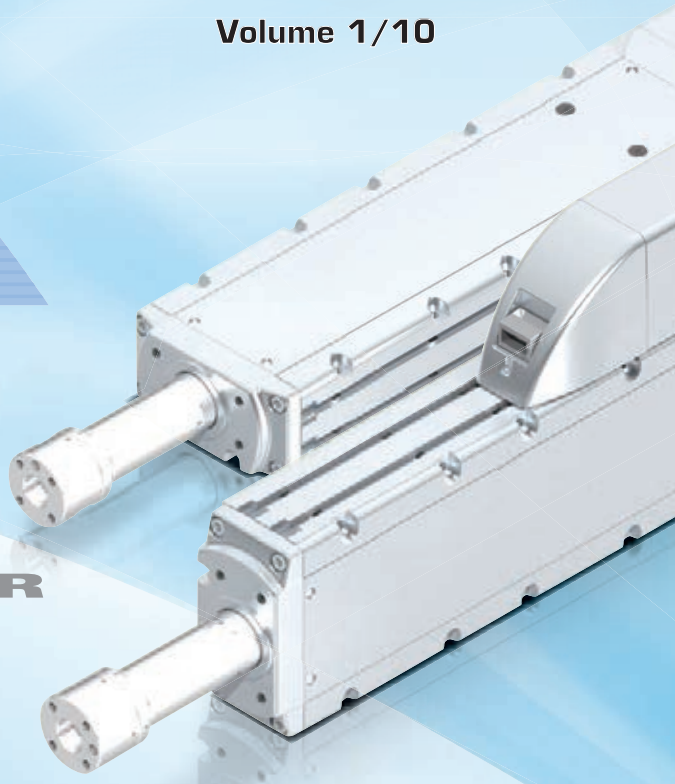
Easy Automation Concept

Lower costs with operation efficient RoboCylinder

Volume 1/10

Battery-less absolute encoder

No battery, no maintenance, no home return,
and absolutely no price increase.
There is no going back to incremental.



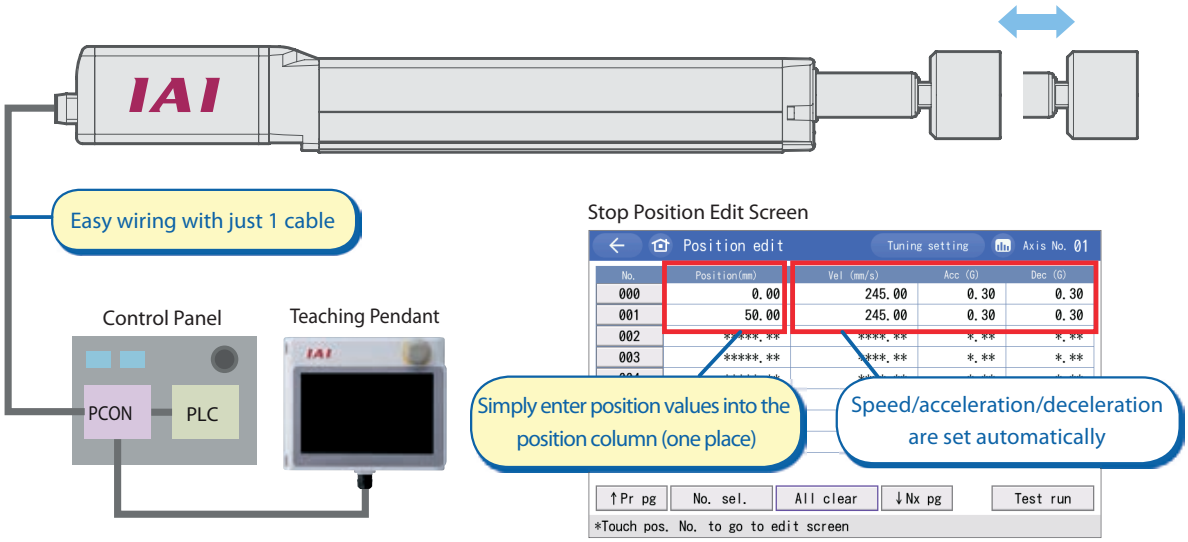
ROBO CYLINDER

green automation
IAI

Equipment configuration and adjustment becomes this easy with a RoboCylinder

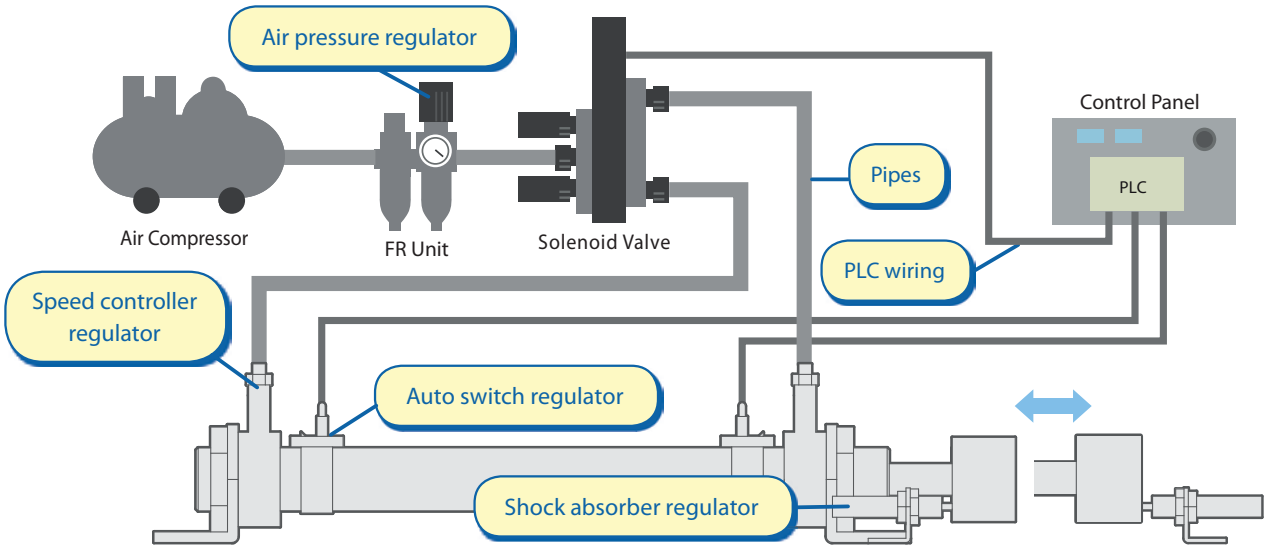
With a RoboCylinder

Only 1 cable is necessary to operate a RoboCylinder.
The stop position is easily set with the position edit screen.



With an air cylinder

Several components are required for air cylinder configuration. This includes electrical wiring for speed controller regulators, auto switch regulators, shock absorber regulators, air pressure regulators, solenoid valves, and auto switches.

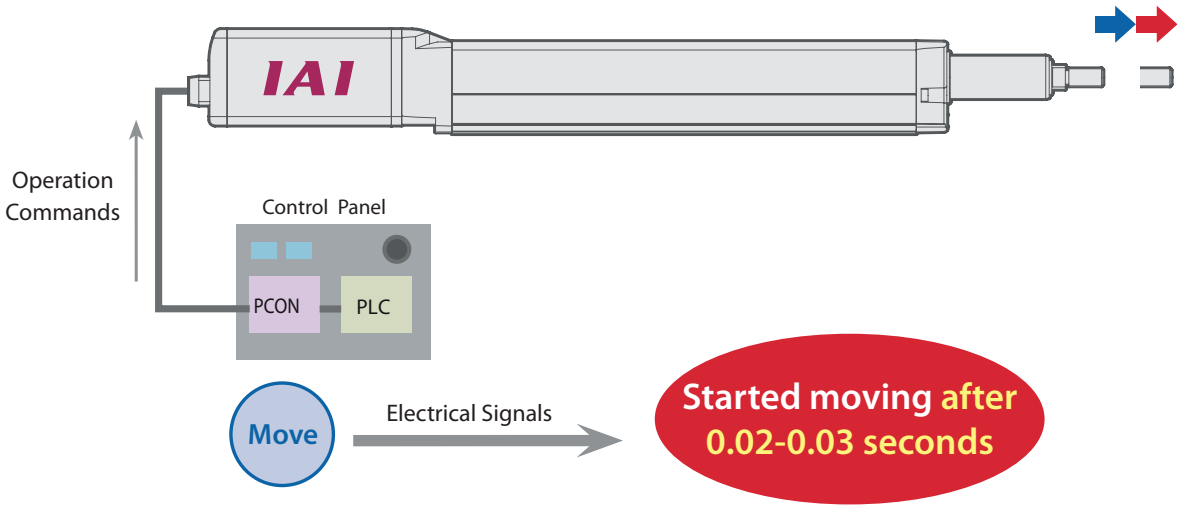


The time it takes for a RoboCylinder to start moving after an operation command is short.

A RoboCylinder moves in about 1/10 of the time it takes for an air cylinder to start moving.

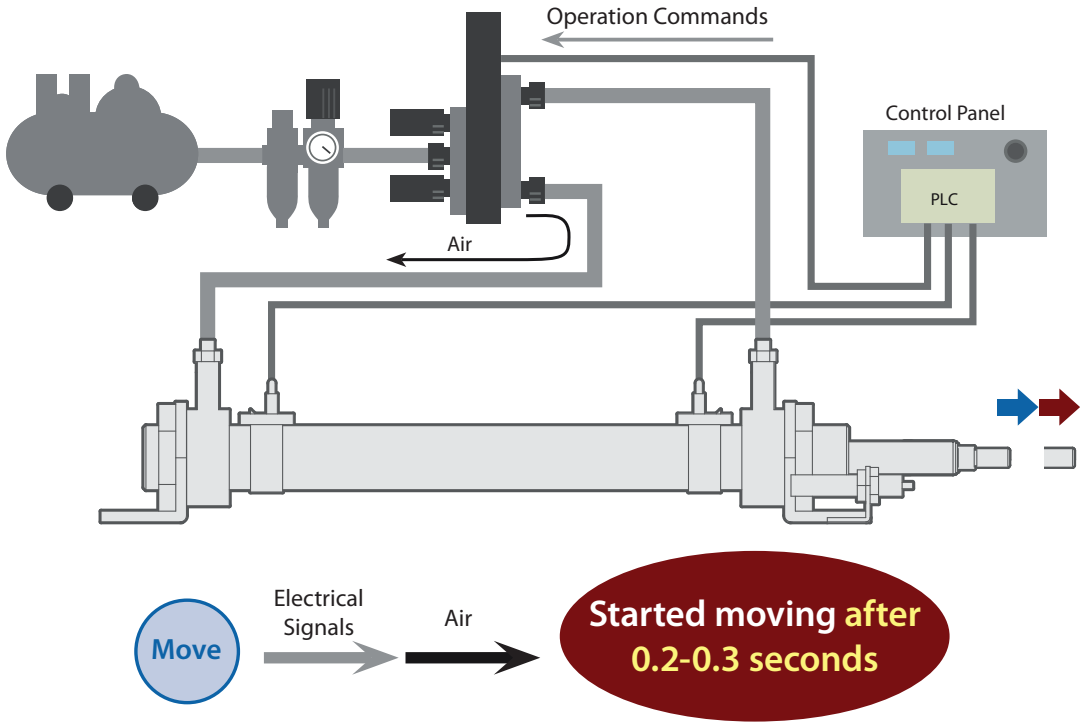
With a RoboCylinder

It takes 0.02-0.03 seconds for the rod to actually start moving after the start of operation commands.



With an air cylinder

It takes 0.2-0.3 seconds for the rod to actually start moving after the start of operation commands.



Application Example 1

Equipment for fastening bottle caps

1 Equipment Overview

Explanation of use

This is equipment for press-fitting plastic caps for bottles.

Process

Process 1 **Liquid filling**
Plastic bottles are filled with liquid.

Process 2 **Cap setting**
Caps are set on top of the bottles.

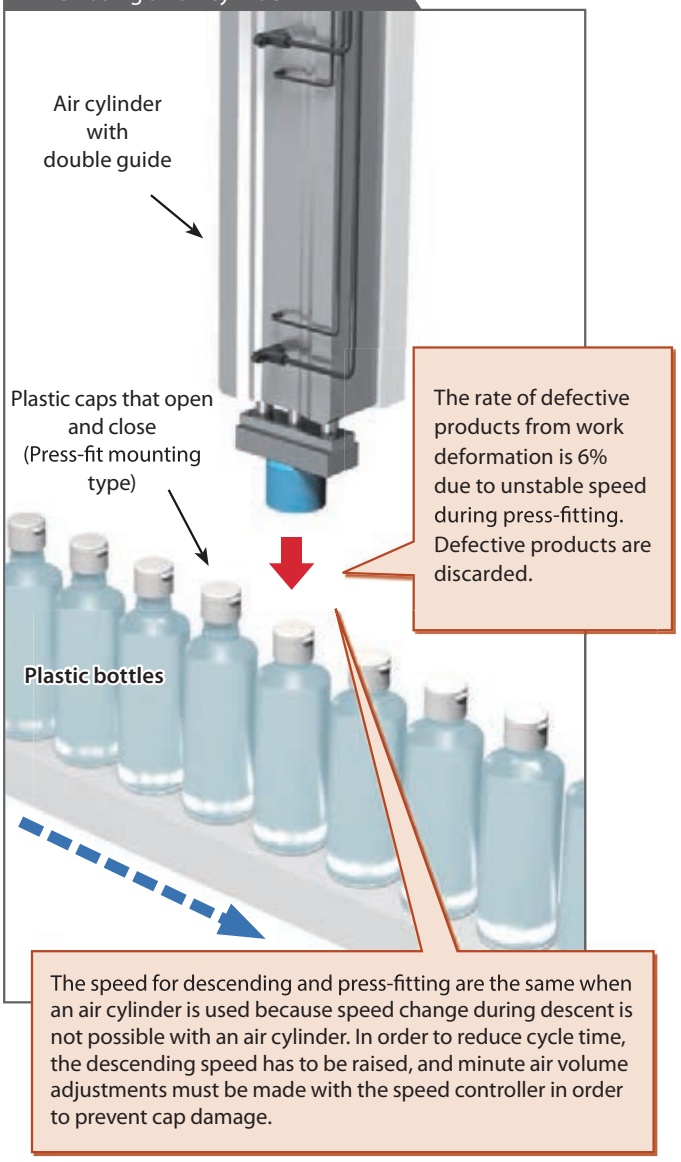
Improvement tasks

Process 3 **Cap press-fitting**
Caps are press-fit onto the bottles.

Process 4 **Inspection**
Press-fit states of the caps are inspected.

Bottle Cap Press-fit Process

When using an air cylinder



Improvement tasks

- Reduce cycle time
- Reduce the amount of adjustment work
- Reduce the rate of defective products

Improved process with a RoboCylinder → **Lower costs**

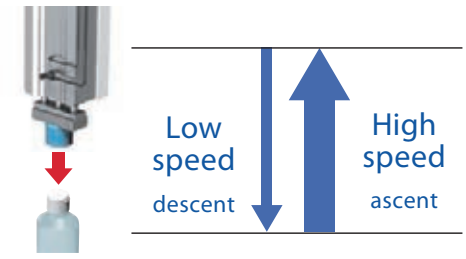
2 How to Lower Costs with a RoboCylinder

The improvement tasks were completed by switching the air cylinder used in the cap press-fitting equipment to a RoboCylinder.

Point 1 Cycle time reduction accomplished

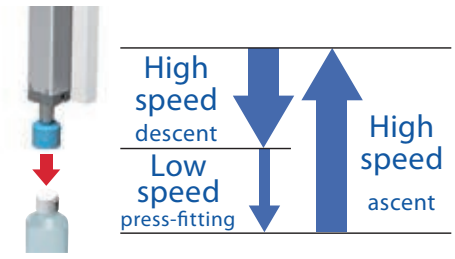
Air cylinder 3.4 seconds

- Speed change during descent is not possible.
- To limit the impact when contacting the cap, high speed movement is not possible.



RoboCylinder 3.0 seconds

- It is possible to set the speed, acceleration, and deceleration.
- With the push-motion function, high speed descent and low speed press-fitting operations are performed.



Point 2 Defective rate improved significantly

Air cylinder 6%

- Fluctuations in the air pressure cause defective products to be made. (Minute speed adjustments must be made when defects occur.)

RoboCylinder 0%

- Uses the push-motion function.
- The push force can be set at a desired level.

Improved process with the 7 functions of the RoboCylinder

- With the RoboCylinder, the speed, acceleration, and deceleration can be set for each position. A stable movement is possible by setting the best speed, acceleration, and deceleration.
- The push-motion function can be used by simply setting the push force and push width (push movement range) in the position data.

Please visit here for "The 7 benefits of the RoboCylinder"

http://www.intelligentactuator.com/7

Point 3 Equipment simplified

Air cylinder

Cylinder with guide

- An air cylinder with a double guide is used in order to prevent the rod from wavering.

- Air pipes x2
- Sensor wires x2
- Sensor position adjustment
- Air quantity adjustment by speed controller

RoboCylinder

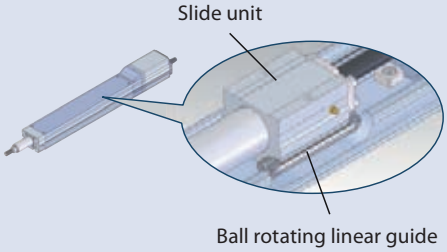
External guide not necessary
Radial cylinder

- External guide not necessary due to the adoption of the radial cylinder

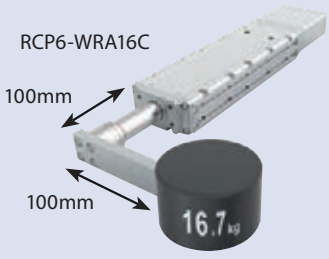
- Guide built-in
- 1 cable (Control panel ↔ actuator)
- Value setting by dedicated adjustment tools

What is a radial cylinder? Applicable models: RCP6(S)-RRA/WRA, RCP5/RCP4-RA

~A rod type that doesn't need a guide!? A radial cylinder is…~



- A ball rotating linear guide mechanism is built into the actuator.
- It can handle radial loads on the rod.
- It is also possible to handle loads that are offset from the center of the rod.
- The maximum stroke is 800mm.



3 Cost Cutting Effect

(1) Conditions

Needed Production Quantity	**10000 bottles/ day**
Number of Workers	**1 person**
Labor Cost	**€ 18 * /hour ÷ 4 equipment = € 4.50 * /equipment** 1 worker was in charge of 4 equipment
Annual Operation Days	**250 days**
Work Cost	**8 cents* (bottle, cap)**

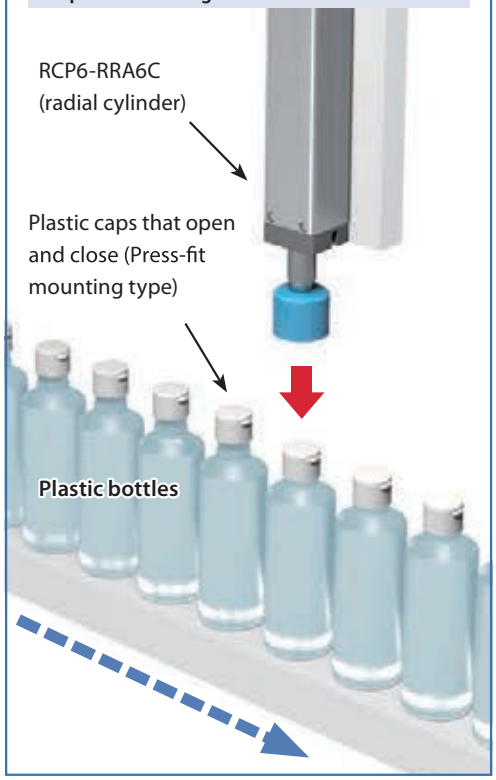
(2) Comparison of air cylinder and RoboCylinder

Item	Equipment using air cylinder	Equipment using RoboCylinder
Cycle Time	**3.4 seconds**	**3.0 seconds**
Equipment Operation Time	**9.5 hours /day** (Normal operation time: 10000 bottles x 3.4 sec. = 34000 sec.)	**8.3 hours /day** (Normal operation time: 10000 bottles x 3.0 sec. = 30000 sec.)
Labor Cost	**€ 10687.50 * /year** 9.5 hours x € 4.50 * /hour = € 42.75 * /day € 42.75 * x 250 days = € 10687.50 * / year	**€ 9337.50 * /year** 8.3 hours × € 4.50 * /hour = € 37.35 * /day € 37.35 * × 250 days = € 9337.50 * /year
Discarding of Defects	**€ 12000.00 * /year** (600 bottles x 250 days x € 0.08 * = € 12000.00 *)	**€ 0 * /year**

RoboCylinder adopted

Please visit here for the video.

http://www.intelligentactuator.com/eac-v01



(3) Cost Cutting Effect

	Air cylinder		RoboCylinder		
Labor cost	€ 10687.50 *	-	€ 9337.50 *	=	€ 1350.00 *
Discarding of defects	€ 12000.00 *	-	€ 0.00 *	=	€ 12000.00 *
			Difference	=	€ 13350.00 *

Result

An annual cost reduction of

labor cost + discarding of defects = € 13350.00 *

has been realized by switching to a RoboCylinder.

*Exchange Rate: 1 € = 100 Japanese Yen

Application Example 2

Equipment for polishing iron pipe interiors

1 Equipment Overview

Explanation of use

This is equipment for polishing the interiors of iron pipes with a brush.

Process

Process 1 **Pipe cutting**
Long iron pipes are cut to appropriate lengths

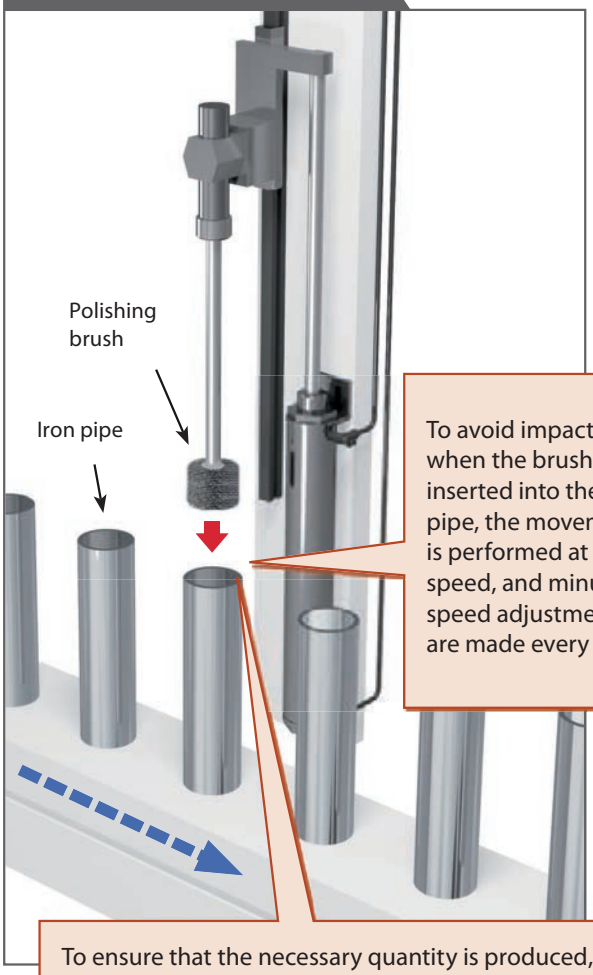
Process 2 **Cut surface deburring**
The cut surfaces are deburred.

Improvement tasks

Process 3 **Pipe polishing**
The interiors of the pipes are polished.

Process 4 **Inspection**
The conditions of the cut surfaces and the interiors of the iron pipes are inspected.

How the pipe polishing process is done when using an air cylinder



To avoid impact when the brush is inserted into the iron pipe, the movement is performed at low speed, and minute speed adjustments are made every day.

To ensure that the necessary quantity is produced, the polishing cannot be done more than once. As a result, 10% of the products are defective due to uneven polishing, and they have to be polished again.

Improvement tasks

- Reduce the amount of adjustment work
- Reduce cycle time
- Reduce the rate of defective products
- Improve product quality

Improved process with a RoboCylinder → **Lower costs**

2 How to lower costs with a RoboCylinder

The improvement tasks were completed by switching the air cylinder used in the pipe polishing equipment to a RoboCylinder.

Point 1 Defective rate improved significantly

Air cylinder 10%

- Polishing defects occur due to speed instability caused by changes in frictional resistance during polishing.

RoboCylinder 0%

- Uneven polishing does not occur because the speed is uniform.
- Product quality improved by polishing twice.

Point 2 Daily adjustments are unnecessary

Air cylinder about 10 times/day

- The speed has to be adjusted for each lot since the load during polishing changes due to unevenness in the interior of the pipe.

RoboCylinder 0 times/day

- Daily adjustments are unnecessary because operation is performed at a set speed, acceleration, and deceleration.

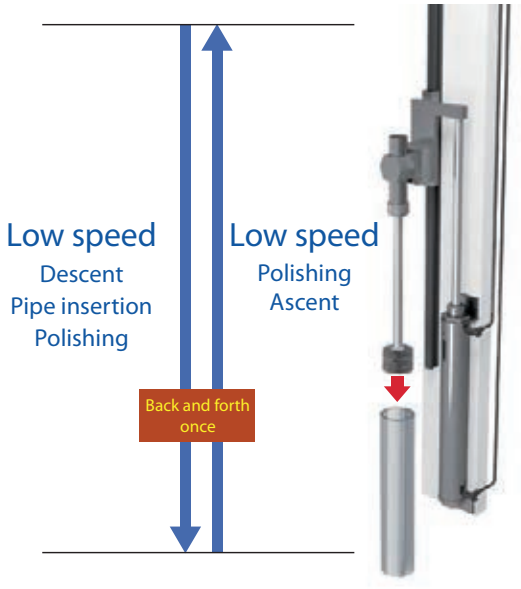
Point 3 Cycle time reduction accomplished

Air cylinder

Number of times polished:
Back and forth once

Cycle time: 15 seconds

• To avoid impact when inserting the brush into the iron pipe, while also improving product quality, descent and polishing speed are fixed at low speeds.



• To ensure that the necessary quantity is produced and to ensure product quality, the ascent and descent during polishing are performed at low speeds, and cannot be performed more than once.

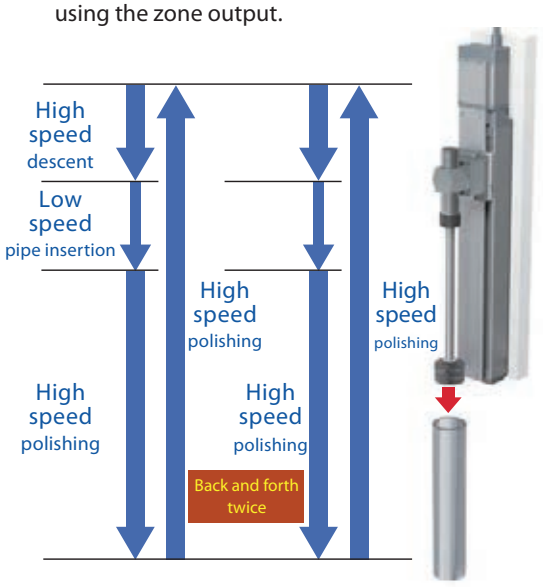
RoboCylinder

Number of times polished:
Back and forth twice

Cycle time: 12 seconds
(6 seconds/cycle x back and forth twice)

3 seconds faster even after going back and forth twice!

• The speed, acceleration, and deceleration can be set for each position. Also, the low speed range can be set easily without a sensor by using the zone output.



• It became possible to polish twice because cycle time was reduced.

Even at high speed, going back and forth twice has
improved product quality.

Improved process with the 7 functions of the RoboCylinder

• Since the RoboCylinder can switch speed and acceleration/deceleration rates instantly, it can freely perform speed changes like fast→slow→fast.

• The low speed range can be set using zone output. Zone output does not require an external sensor, so it can be set easily without sensor deviations happening.

Multi-point positioning | Speed, Acceleration/ Deceleration setting function | Zone Output

Please visit here for "The 7 benefits of the RoboCylinder"
http://www.intelligentactuator.com/7

3 Cost Cutting Effect

(1) Conditions

Needed Production Quantity	**2400 pipes/ day**
Number of Workers	**1 person**
Labor Cost	**18 € * /hour ÷ 5 machines = € 3.60 * /machine** 1 worker was in charge of 5 machines
Annual Operation Days	**250 days**

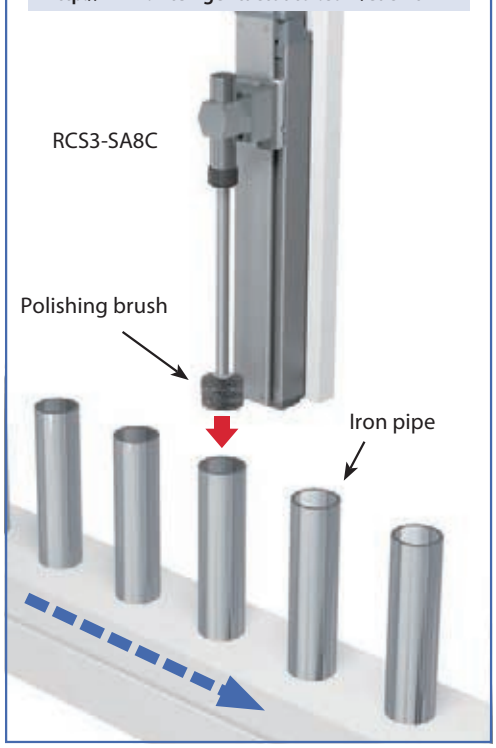
(2) Comparison of air cylinder and RoboCylinder

Item	Equipment using air cylinder	Equipment using RoboCylinder
Equipment Adoption Cost	**€ 10000.00 ***	**€ 11000.00 ***
Cycle Time	**15 seconds** (back and forth once)	**12 seconds** (back and forth twice)
Equipment operation time	**11 hours/day** Normal operation time: 2400 pipes x 15 sec. = 36000 sec. + Redo polishing time: 240 pipes x 15 sec. = 3600 sec.	**8 hours/day** Normal operation time: 2400 pipes x 12 sec. = 28800 sec. + Redo polishing time: 0 pipes x 12 sec. = 0 sec.
Labor Cost	**€ 9900.00 */year** 11 hours x € 3.60 */hour = € 39.60 */day € 39.60 * x 250 days = € 9900.00 */year	**€ 7200.00 */year** 8 hours x € 3.60 */hour = € 28.80 */day € 28.80 * x 250 days = € 7200.00 */year

RoboCylinder adopted

Please visit here for the video.

http://www.intelligentactuator.com/eac-v01



(3) Cost cutting effect

	Air cylinder		RoboCylinder		
Equipment operation time	11 hours	-	8 hours	=	3 hours reduction
Labor cost (annual)	€ 9900.00 *	-	€ 7200.00 *	=	€ 2700.00 *

Result

An annual cost reduction of

labor cost (annual) = € 2700.00 *

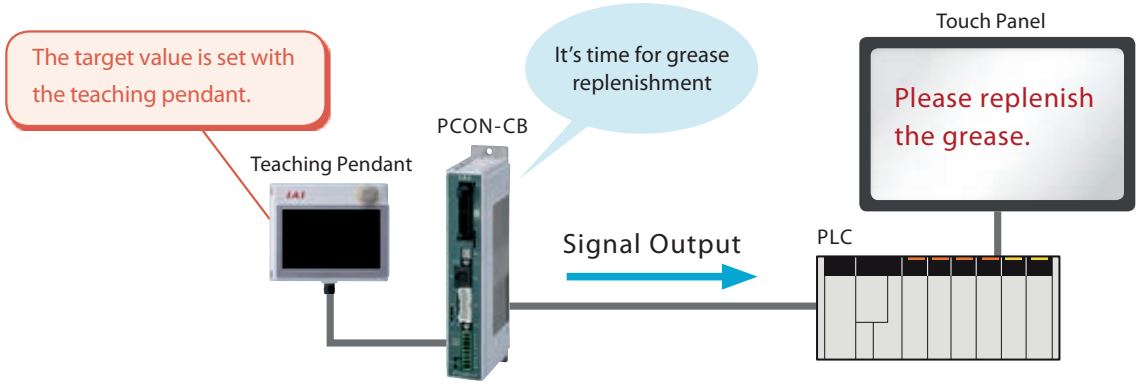
has been realized by switching to a RoboCylinder.

*Exchange Rate: 1 € = 100 Japanese Yen

Maintenance Inspection

Notifies you of inspection and replacement times

Notification of grease replenishment and inspection times can be made by setting the travel distance and number of movements.

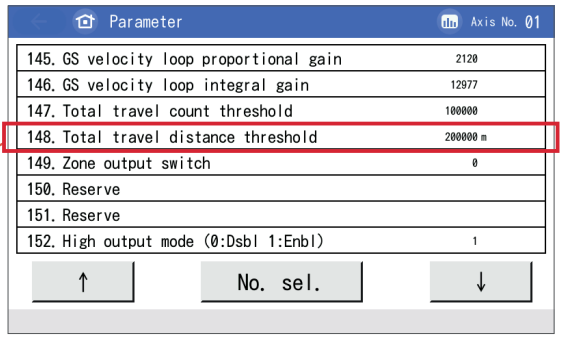


The following settings are made with a teaching pendant in order to use this function.

■ Target value for total distance traveled

Sums up the movement amount of the movement command positions, and creates a message alarm when the set value is exceeded.

Teaching Pendant Setting Screen

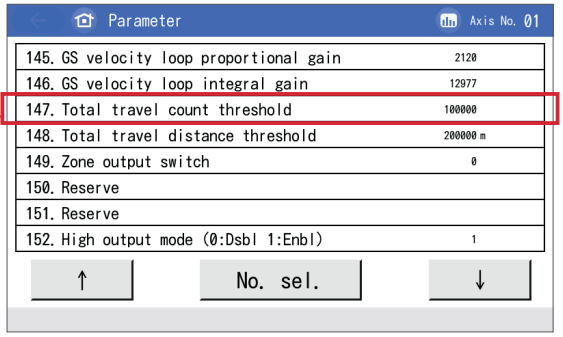


The target value for the total distance traveled is set here.

■ Target value for total number of movements

Counts the number of movement commands, and creates a message alarm when the set value is exceeded.

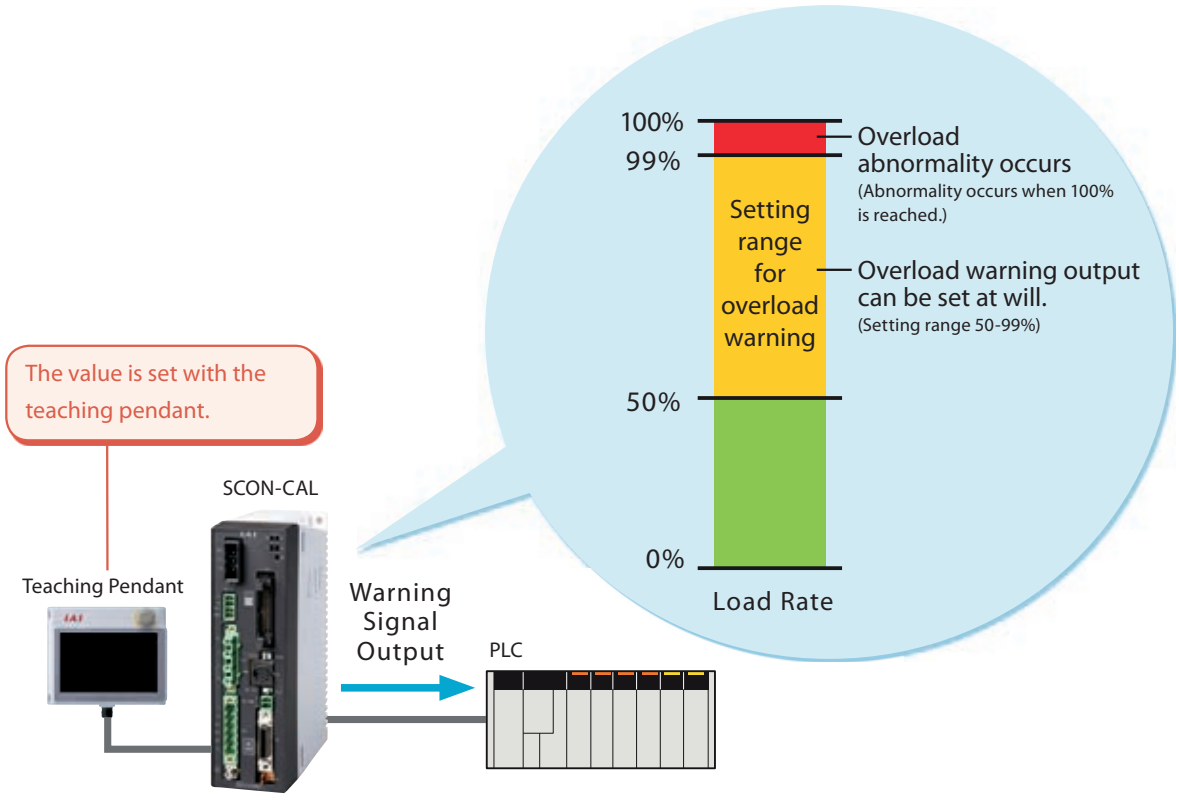
Teaching Pendant Setting Screen



The target value for the total number of movements is set here.

Predictive Maintenance Functions

<Predictive Maintenance Functions> Warns about load conditions

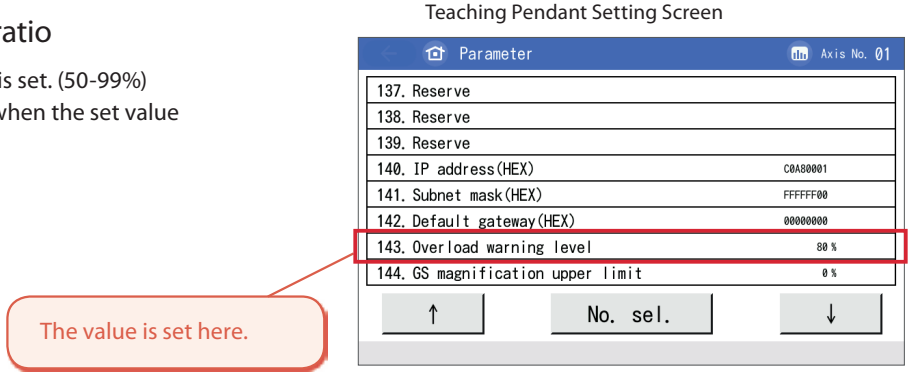


The following settings are made with a teaching pendant in order to use this function.

■ Overload load level ratio

The value of the load rate is set. (50-99%)
Creates a message alarm when the set value is exceeded.

Teaching Pendant Setting Screen

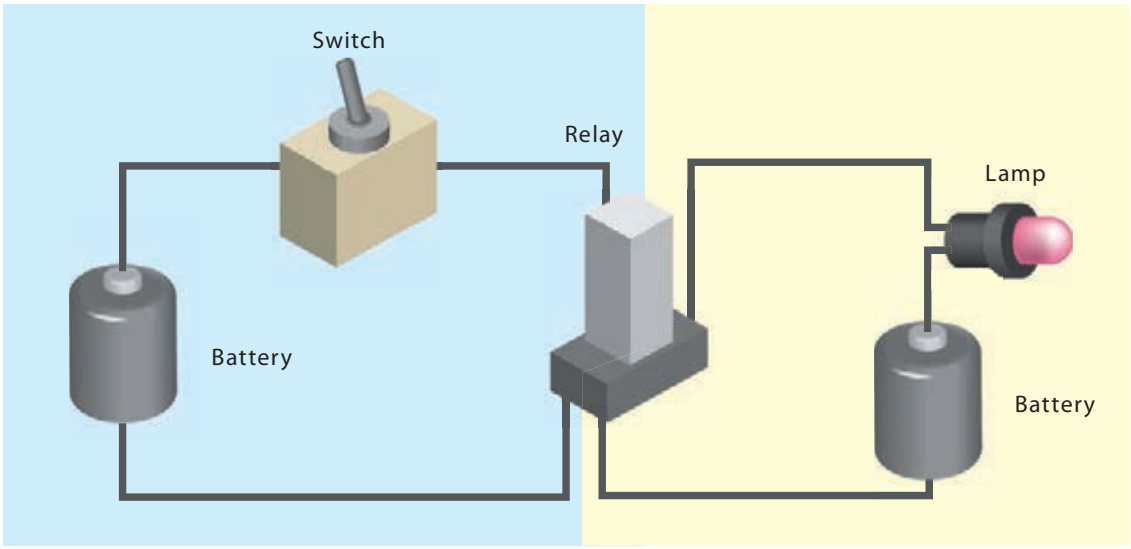


1 What is sequence control?

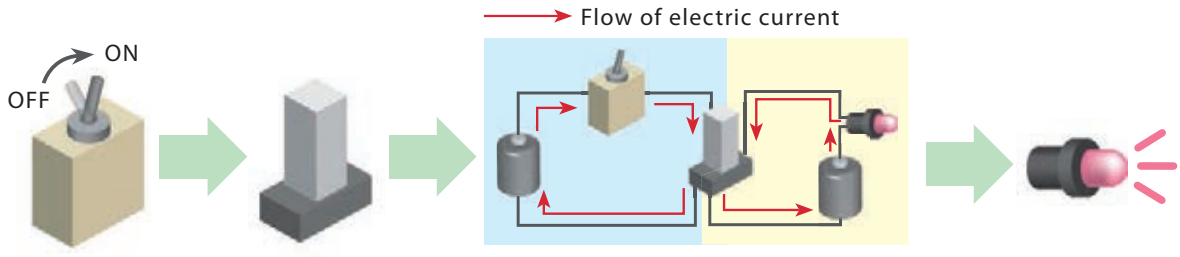
A control that is performed according to a predetermined order is called sequence control.
A circuit that lights a lamp with a switch is a sequence control.

Example control of lighting a lamp

< Wiring Example >



When the switch is turned ON



The switch is turned ON.

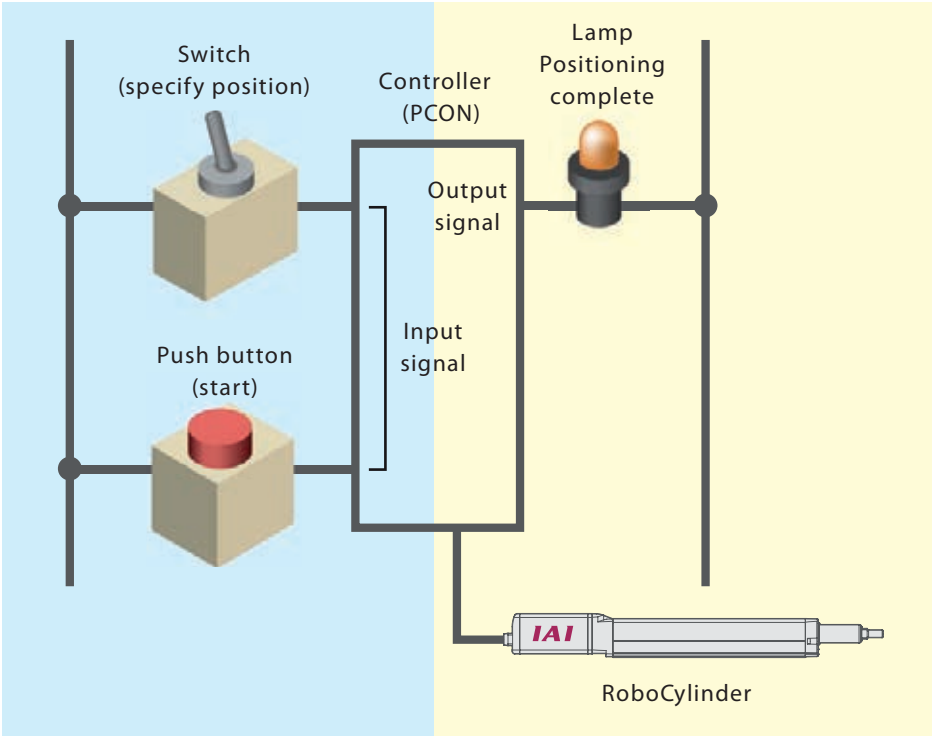
The relay turns ON.

Electricity flows.

The lamp lights up.

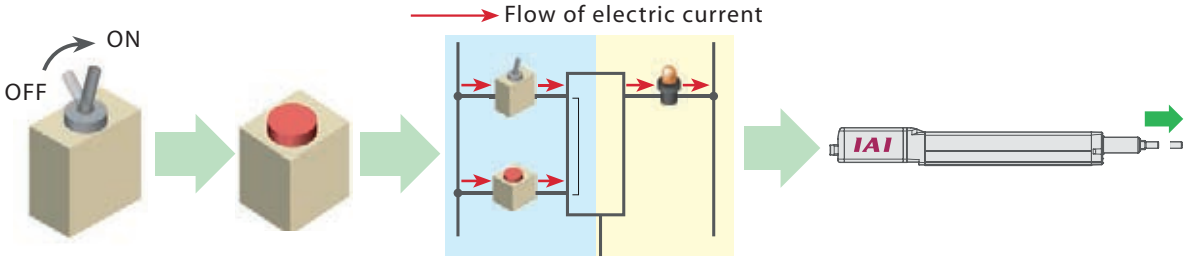
Example control of a RoboCylinder

< Wiring diagram >



Operation Method

① Performs positioning to the specified position when the switch is turned on and the push button is pushed.



② The lamp lights up when positioning is complete.

The lamp lights up.

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