

The Innovator of Aluminum



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[Feature]

Electric control, made easy with **SiO!**

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**Murata Manufacturing
Co., Ltd.**

**Narita International
Airport Corporation**

Bringing control within reach

Yasuo Ishida, Director and President, SUS

In recent years, we at SUS have introduced the word “Karakuri Revolution” and made new proposals that bring the minimum necessary motorization to traditional un-powered karakuri mechanisms. The first step in this process was for us to develop motorized parts. We have released items such as “The Power Unit” with the idea of linking to aluminum pipe structural material GF which our customers have supported as parts for karakuri, and we continue to expand our lineup even now. To make these motorized parts easy to control, we attached a standardized controller that comes registered with multiple movement patterns, and which can be used just by plugging it in to a power source. However, as we have actually promoted practical use in combination with karakuri mechanisms, requests have come to us for control taken one step further, such as by linking this control with other mechanisms which require more than standard operations.

Originally, karakuri for kaizen were not created by experts on production facilities, but by people working in the manufacturing field who shared their wisdom with each other. This not only makes it possible to take advantage of the viewpoints of people actually doing work, but offers significance unlike large scale capital investment, as workers find motivation in using equipment they have made with their own hands to do work. We at SUS consider control devices that can be easily used without knowledge of electrical engineering to be

What is Karakuri?



“Karakuri”, a word coined in the 17th century of Japan, is a term used to describe mechanical devices. The most common example is the “Karakuri puppet”—a moving doll which utilizes the principles of gravity, movement, and levers to move. “Karakuri Kaizen”, a movement that is gaining ground in the Japanese automotive industry, aims to utilize the principles of karakuri to make improvements to the manufacturing workplace without the use of power. Real-life factory workers are working together to create “Karakuri” that improves production efficiency and creates worker-friendly stations at low costs.

Karakuri Kaizen is a registered trademark of the Japan Institute of Plant Maintenance (JIPM).

indispensable in carrying on these advantages through the “Karakuri Revolution”, so we have started developing controllers to follow up on electric parts. One of our accomplishments is the “SiO Controller”, which is featured in this special article.

SiO Controller is an item for realizing easy, low-cost, simple control that is necessary for motorizing karakuri. This concept differs greatly from conventional control equipment used for building large-scale automated equipment. We focused on creating specifications that enable use of SiO even without a specialized engineer on-site. We started development of this product in order to motorize karakuri, but its simplicity and the ability to use it in a number of ways with some adjustments means its applications are not limited to karakuri. We at SUS will continue to work towards the development of easy to

use, economical control devices that are more closely tied to the production field, and we hope to see our products used as a new means for executing kaizen.



[Feature] Electric control, made easy with **SiO!**

SiO



If you could do “electric control” without expert knowledge of programming and wiring, what kind of kaizen would you use it for?
This feature introduces the SUS input/output control mechanism “SiO Controller” which makes electric control easy for anyone.
Read on to find easy electric control made possible by SiO, including installation and programming processes.

SiO2



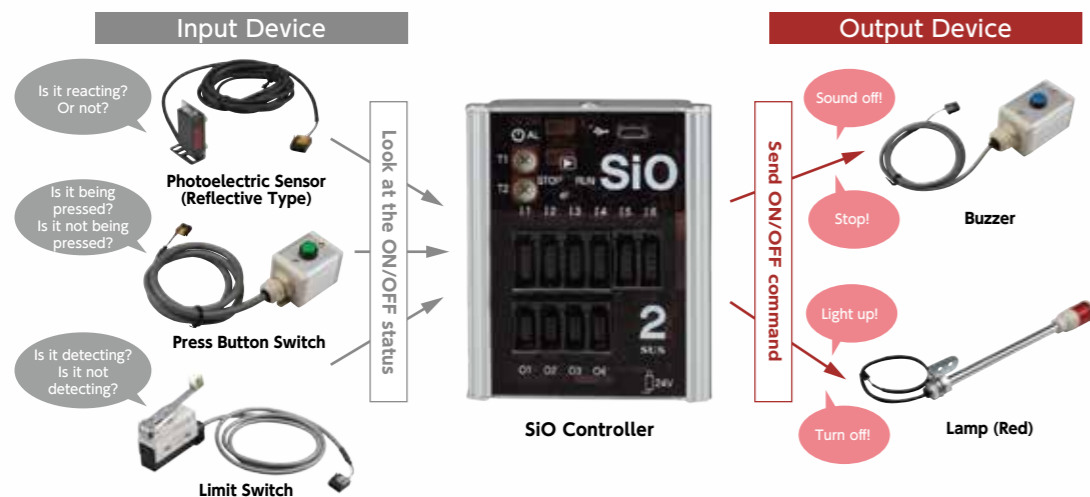


Simple but deep What is SiO (Simple Input Output) Controller?

SiO Controller is simple input/output control system launched by SUS in June 2016. Here we give an overview of the product in the format of a Q&A.

Q1 What can you do with SiO Controller?

A Look at the ON/OFF status of an input device to send ON/OFF commands to an output device.



Set the conditions to output to SiO Controller in advance. When the status matches these conditions, it sends a command to the output device.

- These are a few of the things it can do.
- Sound the buzzer as long as the press button switch is being pressed.
 - When the photoelectric sensor reacts 5 times, light up the lamp.
 - When the limit switch detects a workpiece, stop the buzzer... etc.



What's SiO?

Q3 What types of SiO Controllers are there?

A SUS offers two types you can choose from depending on their application.



SiO-C

8 Inputs/8 Outputs
Connector : Flat Cable

While still keeping a small size of just 60 mm × 73 mm × 22 mm, it is capable of connecting 8 inputs and 8 outputs. Our lineup includes 3 types with differing installation mechanisms (GF connector/DIN rail/fastening screws). SUS also offers an e-CON connector terminal block (SUC-162) as an option.



SiO2

6 Inputs/4 Outputs
Connector: e-CON

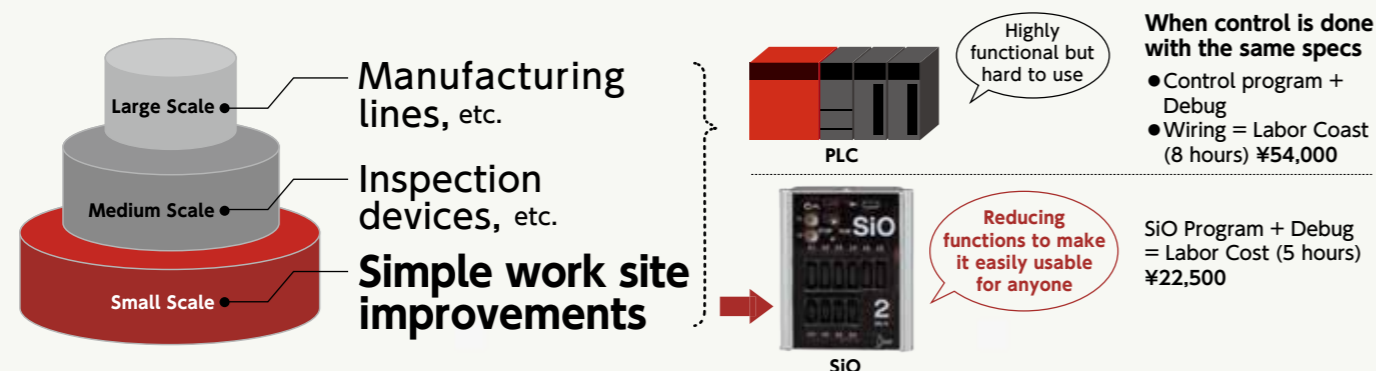
This model has the minimum number of inputs and outputs. An e-CON connector terminal block is built into the main unit, so devices can be connected easily just by plugging them in. Extruded aluminum is used for the housing. The same protrusions as aluminum pipe structural material GF are installed on the side, and in addition to enabling installation with standard GF connectors, there are also DIN rail parts on the back.



More new models are in development! Keep your eyes open for new models.

Q2 What kind of places and situations can it be used in?

A It is convenient for making simple work site improvements or automating karakuri, where PLC would be considered to be over-engineering.



When building the system that uses electric control in a factory, it used to be common to use a PLC (programmable logic controller) regardless of what needed to be achieved. By using an SiO Controller, it is possible to easily make small scale work-site improvements that don't quite call for PLC but would be convenient if they could be automated.

Q4 Do you need expert knowledge of electricity or controllers to introduce SiO?

A No special knowledge or experience is required. Even people making a program for the first time can use it easily.

Multiple Choice Simple Programming

You can use "SiO Programmer", the dedicated software for Windows computers, to set output conditions. Even first time users can easily make programs just by making the necessary choices. It also has a simulator function, so it is possible to check operations even without an SiO Controller.



Just plug in for easy connection

We use the industry standard e-CON connector[®], eliminating the need for difficult wiring work. SUS also offers optional input/output devices with an e-CON connector installed in advance. It makes easy connection possible, so necessary devices can just be plugged in.

[®]Options are necessary for SiO-C.





Easily retrofitted on existing equipment! Examples of simple kaizen using SiO

Here we use two examples to explain what small-scale, simple work-site improvements using SiO are like. Changing combinations of devices and programs will bring all new possibilities.



Example 1 Announce standard working time with a lamp!

Time Over Alarm

This example uses the timer function of SiO Controller to light up a lamp when a set time elapses after pressing the switch. By setting the timer with the standard work time of product assembly, it is possible to check whether work is completed by the target time with just a glance.

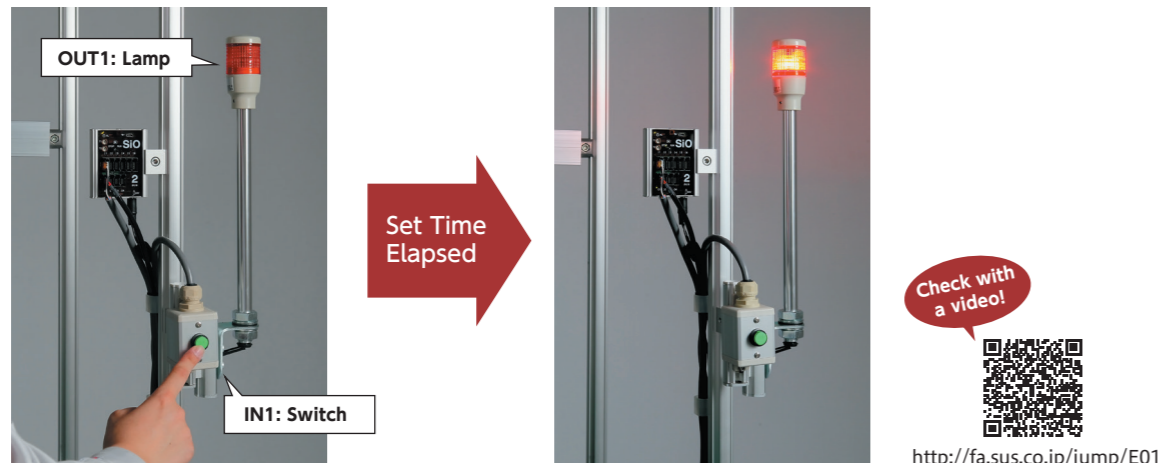
Example 2 Check whether a workpiece is stuck with sensors!

Chuter Anomaly Detection

A photoelectric sensor monitors whether workpieces are flowing at regular intervals on the chuter, and when there is an anomaly, it makes a warning by lighting up the lamp. The user can quickly find and deal with problems such as workpieces getting stuck, even from distant locations.



Operation Image



Press the switch at the start of assembly work, and the worker's movement starts counting time. When the set time has elapsed, it is announced by the lamp lighting up. When assembly is completed within the set time, pressing the switch again before the lamp is lit resets the timer, which starts counting again from 1.

Worker Movements

- 1 Press the switch
- 2 Perform assembly
- 3 Make a record when the lamp lights up midway

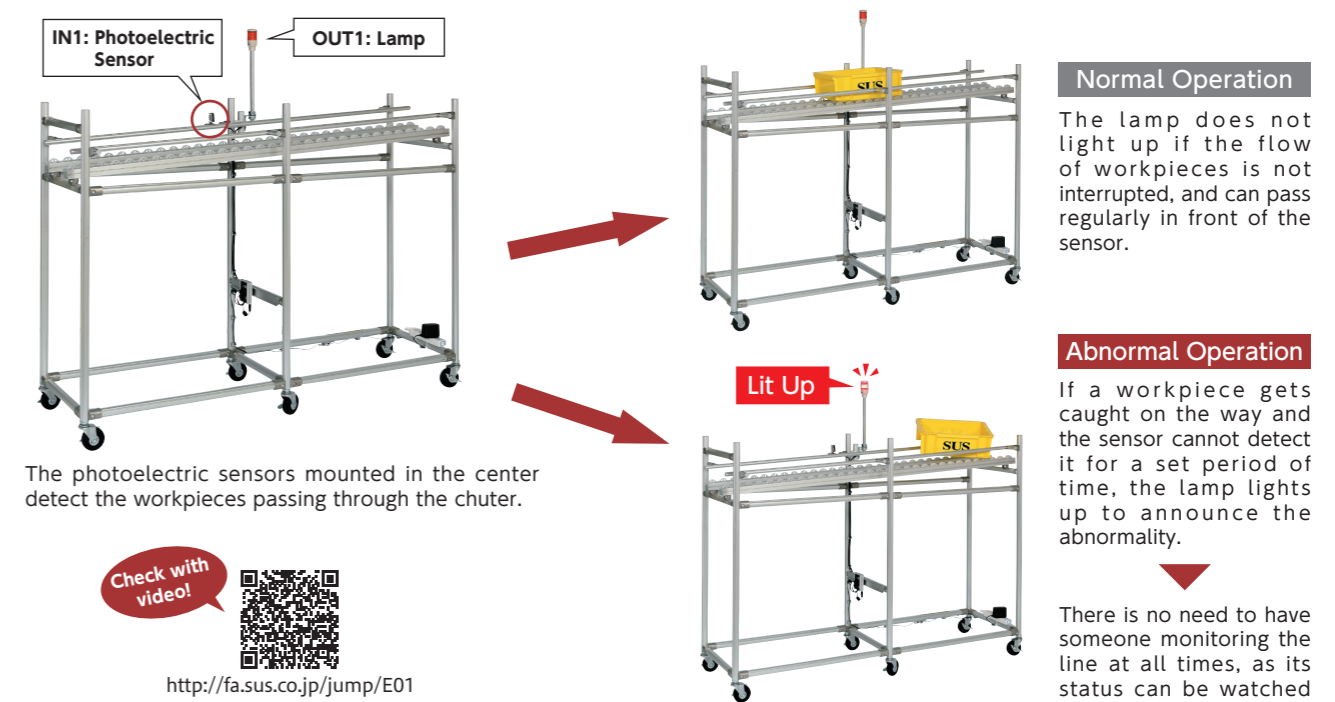
Since it is possible to know the number of times that assembly could not be done in standard time, it is possible to grasp each one's proficiency level.

Program Input

OUT	CONDITION1				CONDITION2			DURATION TIME(UNTIL)				OUTPUT TYPE				
	1	2	3	4	1	2	3	4	5	6						
(Example)	IN1	ON	AND	IN2	OFF	THEN	DELAY TIME	3.0	s later	IN3	ON	OR	DELAY TIME	5.0	sec	ON
OUT1 (Lamp)	IN1 (Switch)	OFF	-	-	-	DELAY TIME	5.0	sec	CONTINUES	IN1 (Switch)	ON	-	-	-	Lamp is	ON

When IN1 is OFF (switch not being pressed) for 5 seconds, the lamp will light up until IN1 turns ON (switch is being pressed). The timer can be set in 0.1 second increments from 0.0 seconds to 300 seconds.

Operation Image



The photoelectric sensors mounted in the center detect the workpieces passing through the chuter.

Normal Operation

The lamp does not light up if the flow of workpieces is not interrupted, and can pass regularly in front of the sensor.

Abnormal Operation

If a workpiece gets caught on the way and the sensor cannot detect it for a set period of time, the lamp lights up to announce the abnormality.

There is no need to have someone monitoring the line at all times, as its status can be watched from afar.

Program Input

OUT	CONDITION1				CONDITION2			DURATION TIME(UNTIL)				OUTPUT TYPE				
	1	2	3	4	1	2	3	4	5	6						
(Example)	IN1	ON	AND	IN2	OFF	THEN	DELAY TIME	3.0	s later	IN3	ON	OR	DELAY TIME	5.0	sec	ON
OUT1 (Lamp)	IN1 (Sensor)	OFF	-	-	-	DELAY TIME	10.0	sec	CONTINUES	IN1 (Sensor)	ON	-	-	-	Lamp is	ON

If IN1 is OFF (workpieces do not pass in front of the sensor) for 10 seconds, the lamp lights up until IN1 turns ON again (workpieces pass in front of and are detected by the sensor).

On the next page we introduce how to use SiO by following process of abnormality detection in Example 2.



From consideration to the start of operations

See real examples! Introduction to kaizen using SiO

From here we will introduce procedures for performing actual kaizen with SiO Controller. Take note of our points concerning utilization as well.

How to use SiO Controller

- 1 **Considering Movement** ... Imagine the system movement based on points you wish to improve
- 2 **Selecting Devices** ... Select and prepare necessary input/output devices and options.
- 3 **Installation and Wiring** ... Assembling the system, installing devices, and doing wiring.
- 4 **Programming** ... Create output conditions with the dedicated software "SiO Programmer".
- 5 **Writing** ... Connect a personal computer and SiO Controller with a cable and write the program.
- 6 **Executing** ... Turn ON the RUN switch of SiO Controller to activate the system.

1 Considering movement

When something goes wrong in the workplace, we first think about how we can implement kaizen. If something can be realized with simple electric motorization then SiO has a role to play. We consider necessary operations specifically to envision the device's movement.



Workpieces sometimes catch on the chuter causing it to stop

Kaizen Method 1

Preventing workpieces from getting stuck
 ⇒ Adjust the tilt of the chuter to the best angle.
 ⇒ Review workpiece materials including containers
 ⇒ Change to a roller conveyor that is compatible with the workpiece ... and so on.

Kaizen Method 2

Make workpieces easily found even if the device stops
 ⇒ Make a mechanism to notify people nearby when workpiece gets stuck

This could be achieved with simple electric motorization!



If the workpiece does not arrive at a certain point even after a set period of time, it turns on the alarm lamp that needs to be realized.

2 Selecting Devices

Once the operation that needs to be realized is decided upon, select a device. It is convenient to have accessories to bundle cables, in addition to input/output devices.



Output Device: Lamp (Red) (SUC-199)
Lights up to indicate the status.

AC Adapter (C1P-401P)
Supply 24 V DC to SiO2. There are also kit products with SiO2.

Input Device: Photoelectric Sensor Reflection Type (SUC-195)
Detects workpieces by reflection of light.

Installation Parts
Used for installing to GF.

Controller: SiO2
Capable of controlling up to 6 inputs and 4 outputs with just one device.

There is one input/output device for each set, so control is possible with a single SiO2. Various devices are mounted afterwards to the GF chuter of aluminum pipe structure material, so we also offer mounting parts specially designed for GF.

POINT Utilize convenient input/output devices

In addition to those used for detecting abnormalities, SUS offers many options, such as input/output devices and extension cables that can be used immediately after purchase, as SiO series options. Inquire with an SUS sales representative for details.



Photoelectric Sensor Transmission Type (SUC-196)



Proximity Sensor (SUC-194)



Limit Switch (SUC-193)

3 Installation and Wiring

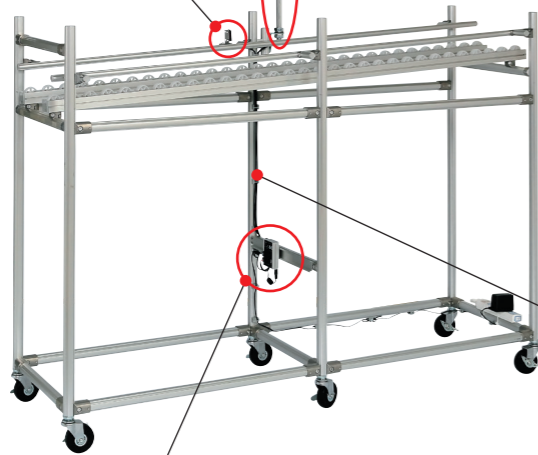
Mount the arranged items in the necessary places, and then wire them. In accordance with the image of the movement you need to realize, decide where to install each device while considering where to take the power supply and what length of cable is needed.

1 Installing various devices

Photoelectric Sensor (input device)



Attach a sensor for detecting workpieces to the guide of the chuter. By attaching the sensor to the green frame S SS slot (GFF-401) beforehand, it is possible to install with the standard connector and easily retrofit later.



Lamp (Output Device)



Install the lamp in a conspicuous position that is easily visible to surrounding workers as much as possible. When attaching to GF, it is convenient to attach to Green Frame L slot (GFF-004) first.

Bundling Cables



Leaving the cables from each device untouched may cause workpieces to get stuck or people to trip. These should all be handled properly, such as by fixing them to the system with a cable lock (GFE-010).

SiO2 (Controller)

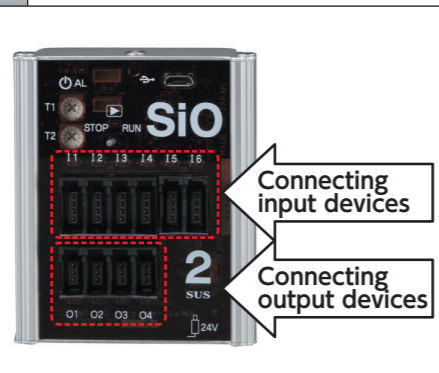


Decide the controller installation location by looking at the balance of input/output device positions and cable lengths. Here we have used the green frame DIN (GFF - 031), which is a combination of DIN rail and GF, at the feet of the chuter and installed SiO2.

2 Wiring



The e-CON connector is installed to the cable end of the lamp (SUC-199) and the photoelectric sensor reflection type (SUC-195) beforehand, so it is possible to complete the connection with SiO2 by just inserting it.



POINT

You can also use your existing devices

For those who wish to use their existing input/output devices, we also have an optional e-CON connector as a single item. By crimping the wiring of the input/output device, it is possible to use it with SiO2.



Input connector 4 pin (SUC - 212)

4 Programming

Conditions for controlling input/output devices with SiO Controller are created with "SiO Programmer", dedicated PC software for Windows*. Programming can be done by merely choosing the necessary items from the choices in order, so it is possible to learn it in a short time without expert knowledge.

*Check the details of the operating environment on our website etc.

What is SiO Programmer?
It is multiple-choice software developed exclusively for SiO Controller.

Tool Icon
You can compare data, monitor input/output, save files and so on.

OUT	CONDITION1	CONDITION2	DURATION TIME(DUTY)	OUTPUT TYPE
(Example) OUT1 (Lamp)	IN1 ON AND IN2 OFF	THEN DELAY TIME 0.0 1min	IN3 ON OR DELAY TIME 0.0 1sec	Lamp is ON
OUT2	IN1 ON	THEN DELAY TIME 0.0 1min	CONTINUOUS	OUT is ON
OUT3	IN1 ON	THEN DELAY TIME 0.0 1min	CONDITIONS OFF	OUT is ON
OUT4	IN1 ON	THEN DELAY TIME 0.0 1min	CONDITIONS OFF	OUT is ON
OUT5	IN1 ON	THEN DELAY TIME 0.0 1min	CONDITIONS OFF	OUT is ON
OUT6	IN1 ON	THEN DELAY TIME 0.0 1min	CONDITIONS OFF	OUT is ON
OUT7	IN1 ON	THEN DELAY TIME 0.0 1min	CONDITIONS OFF	OUT is ON
OUT8	IN1 ON	THEN DELAY TIME 0.0 1min	CONDITIONS OFF	OUT is ON

Program Editing
Set the conditions to turn the output ON/OFF.

Memo Input
This is the input/output memo column. The contents recorded are reflected in the program, input/output monitor, and simulator.

Read & Write Button
This communicates with SiO Controller to read and write the settings.

Other Settings
You can set various parameters.

Main functions of SiO Programmer

- 1 **Program Editing**..... This function edits programs that write to SiO Controller. Edited data can be saved and printed.
- 2 **Input/Output Monitor**..... By connecting SiO Controller and a personal computer, you can monitor the status of the input/output device.
- 3 **Program Reading/Writing** Read the program registered in SiO Controller and write a new program to SiO Controller.
- 4 **Simulation**..... Program operation can be checked on a PC without connecting to SiO Controller.

POINT

Try using SiO programmer for free!

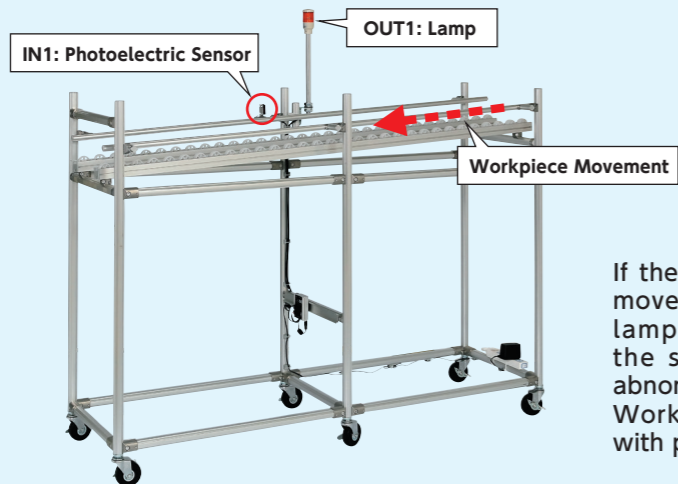
To use SiO Programmer, download software from SUS's website to install it on your computer and use it. It is free for download, so you can try program creation, simulation even before purchasing SiO Controller.

For first-time users, we also sell convenient kits with software CD, USB cable, AC adapter set.

SiO2 starter kit (SIO-K09)

HOW TO USE SiO

The operation to be realized
Abnormality Detection



If the workpiece does not move for 10 seconds, the lamp lights up to notify the surroundings of this abnormality. Workpieces are detected with photoelectric sensors.

① Memo Input : Enter English notes so that the operation is easy to imagine

② Setting CONDITION1/CONDITION2 : Set the condition to light the lamp

Select "OUTPUT" (OUT 1: Lamp) for which you want to set the condition and enter "CONDITION1". This time we want to turn on the lamp when the "CONDITION1" are met for a certain period of time (work did not flow for 10 seconds), so we select "CONTINUOUS" in the "CONDITION2" menu and enter 10 seconds.

POINT There are more useful functions!

In addition to the "Timer Function" used for abnormality detection, SiO Programmer also has a "Counter Function" that enables settings such as "Turn on the lamp after 10 workpieces pass". Try different combinations for a variety of settings.

HOW TO USE SiO

③ Setting the DURATION TIME(UNTIL): Set the condition to turn off the lamp

In case of abnormality detection, workpieces not flowing is considered to be an abnormality and workpieces flowing is considered normal, so sensors are selected as DURATION TIME.

Settings are made so that workpieces flow and "OUT1 (lamp) turns OFF when IN1 (sensor) turns ON."

④ Setting the OUTPUT TYPE : Set how to turn on the lamp

Easy to adjust the flashing interval by just entering numbers

The flashing interval when "ONOFF ALT" is selected can be changed with "PARAMETER". Specify ON time and OFF time between 0.2 seconds and 100 seconds, respectively.

[Completed Program]

In abnormality detection, the only output device to be used is the lamp, so the program is completed with this. If you use more than 2 output devices, repeat the same operation.

POINT Understand the content of the program in sentences

Place the cursor on the output button and the setting contents in the program are displayed in sentences. Use this as a reference when creating programs.

5 Simulation : Test the program on a PC

Input/Output Display Screen

It is possible to check the status of input/output, the elapsed seconds of the timer, etc.

INPUT BOX

Equivalent to the controller RUN switch

Click on the simulator icon in the upper right corner of the SiO Programmer screen to display the "I/O DISPLAY SCREEN" and "INPUT BOX". Click the "RUN" button in "INPUT BOX" to start the simulation. The simulator can be executed without connecting SiO Controller.

CHECK 1 Whether the lamp lights up when the workpieces do not flow for 10 seconds

1) Click the RUN switch → the CONDITION2 items starts counting the elapsed seconds

RUN shows ON status in green, OFF status in gray

Clicking the RUN switch automatically starts counting

2) After 10 seconds, the lamp turns ON and it stops counting

After 10 seconds, check that the lamp is lit

After 10 seconds, the count is reset

CHECK 2 After the lamp is lit, the next workpiece flows in and the lamp is turned off.

In state 2) of CHECK 1, turn ON the sensor → Check that the lamp goes out

Click the sensor button to turn it ON

Check that the lamp turns OFF

CHECK 3 Do not turn on the lamp when workpieces flow within 10 seconds

1) Turn ON the sensor before 10 seconds have passed → Check that the count is reset

Click the sensor button to turn it ON

Check that the count is reset to 0

2) Make sure that the sensor is turned OFF → The count is resumed

Click the sensor button again to turn it to the OFF status

Resume counting from 1 when the sensor turns OFF

Movement on the simulator was checked.

5 Writing

Connect SiO Controller and the PC on which SiO Programmer is installed with the USB cable and register the created program in the controller.

1 Writing data on the controller

USB Connector

RUN Switch

USB cable (SUC-121)

Insert the cable into the USB connector of the controller and connect it to the PC. When writing, keep the controller's RUN switch to STOP.

2 Check input/output status on the monitor screen

Input/output status of various devices connected to the controller is checked. With the controller connected to the computer, click on the input/output monitor icon in the upper right of the screen to start the monitor screen and monitor the input/output status.

Monitor Screen

SiO-Monitor

Check the status of the controller's RUN switch

Check the status of the input device

Check the status of the output device and internal output status

CHECK 1 Checking sensor response

INPUT CHECK

Sensor IN2 IN3 IN4 IN5 IN6 IN7 IN8

Check whether the photoelectric sensor can detect the workpieces correctly. Here we confirm that the "Sensor" part of the input check turns red (ON) when the hand is held over the photoelectric sensor, and turns gray (OFF) in the absence of anything.



CHECK 2 Check Lamp Operation

OUTPUT CHECK (Double Click to output forcibly)

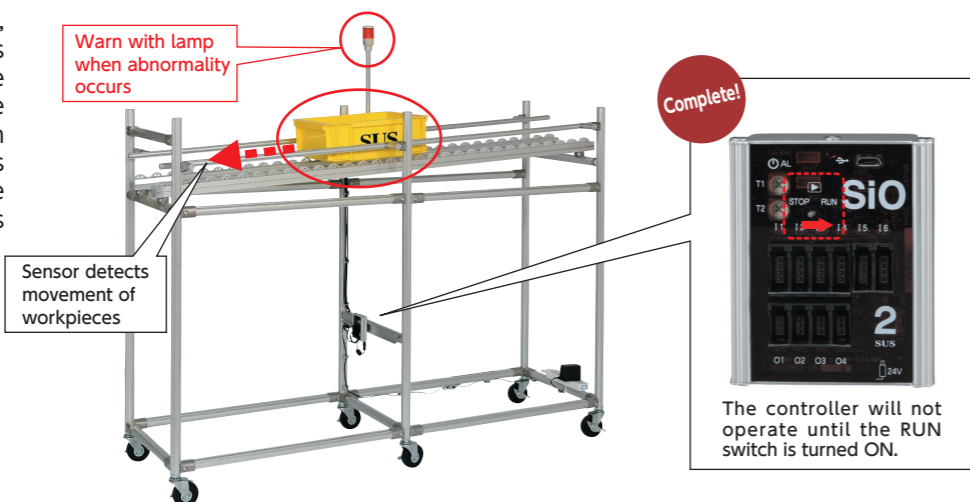
Lamp OUT2 OUT3 OUT4 OUT5 OUT6 OUT7 OUT8

Double-click the "Lamp" button on the screen to turn the button green, forcing it into the output state.



6 Executing

When checking input/output is completed, turn ON the controller's RUN switch and operate the system. Please check the status on the monitor screen as necessary. It will be complete if it works as planned.



Extra Feature

Making additions and changes is easy

Example 1

If you wish to announce an abnormality not only with the lamp but also with sound because the work site is large



Add a buzzer to output device 2 (OUT2). Turn on the buzzer in conjunction with the lighting of the lamp to broadly announce occurrence of abnormalities.

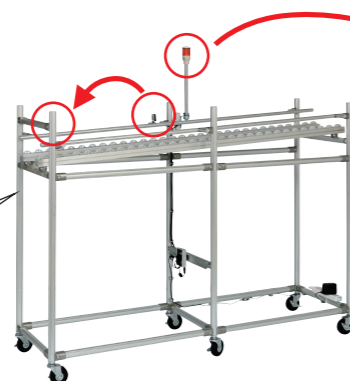
Program Input

OUT	CONDITION1				THEN	DELAY TIME	3.0 s later	CONDITION2				OR	DELAY TIME	5.0 sec	OUTPUT TYPE
	1	2	3	4				1	2	3	4				
(Example)	IN1	ON	AND	IN2	OFF			IN3	ON					ON	
OUT1 (Lamp)	INI (Sensor)	OFF	-	-	-	DELAY TIME	10.0 sec	CONTINUES	INI (Sensor)	ON	-	-	-	Lamp is ON	
OUT2 (Buzzer)	INI (Sensor)	OFF	-	-	-	DELAY TIME	10.0 sec	CONTINUES	INI (Sensor)	ON	-	-	-	Buzzer is ON	

Added the output condition of OUT2 so that the buzzer sounds under the same conditions as the lamp. By changing the number of seconds of "CONDITION2", you can also shift the timing at which the lamp and buzzer turn ON.

Example 2

If you wish to announce that workpieces have arrived so that people do not have to stay in the inspection process



Move the sensor (IN1) that detects workpieces from the middle of the shooter to the end (the arrival position of workpieces)

The lamp (OUT1) is installed in a position where the worker in charge can see it easily.

Program Input

OUT	CONDITION1				THEN	DELAY TIME	0.0 sec	CONTINUES	DELAY TIME	60.0 sec	OUTPUT TYPE
	1	2	3	4							
(Example)	IN1	ON									ON
OUT1 (Lamp)	INI (Sensor)	ON	-	-		DELAY TIME	0.0 sec	CONTINUES	DELAY TIME	60.0 sec	Lamp is ON

When IN1 is ON (workpieces arrive at the end of the shooter), the lamp will light up for 60 seconds.

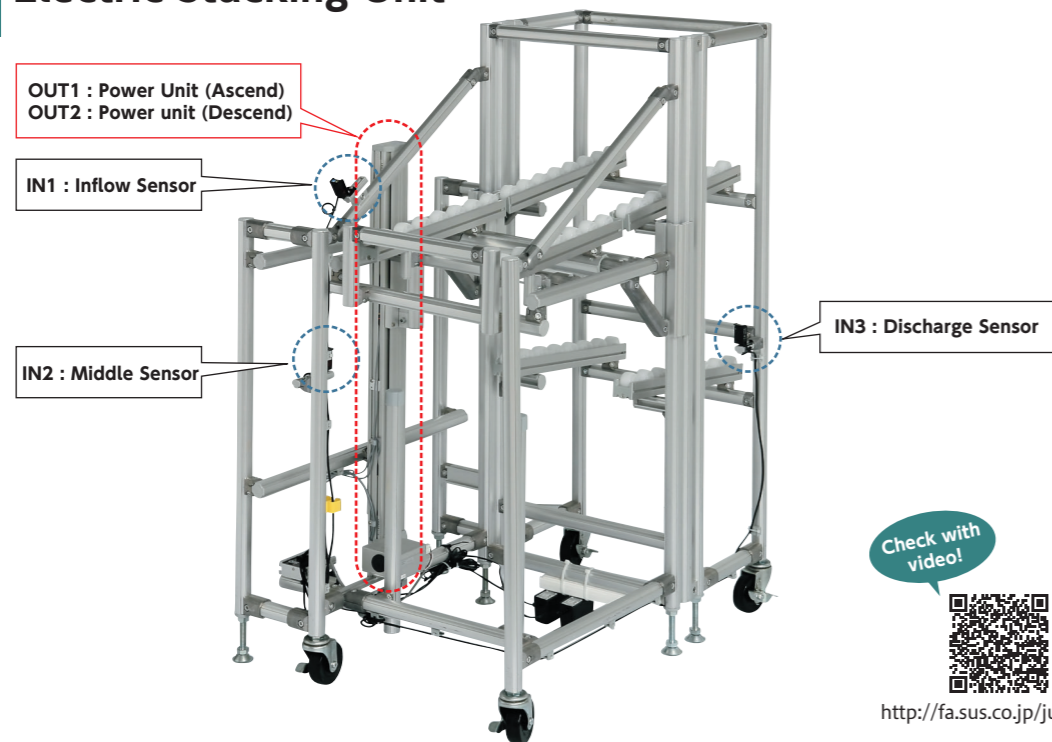


Introducing Examples of Kaizen [Applications Feature]

Potential for electric karakuri using SiO

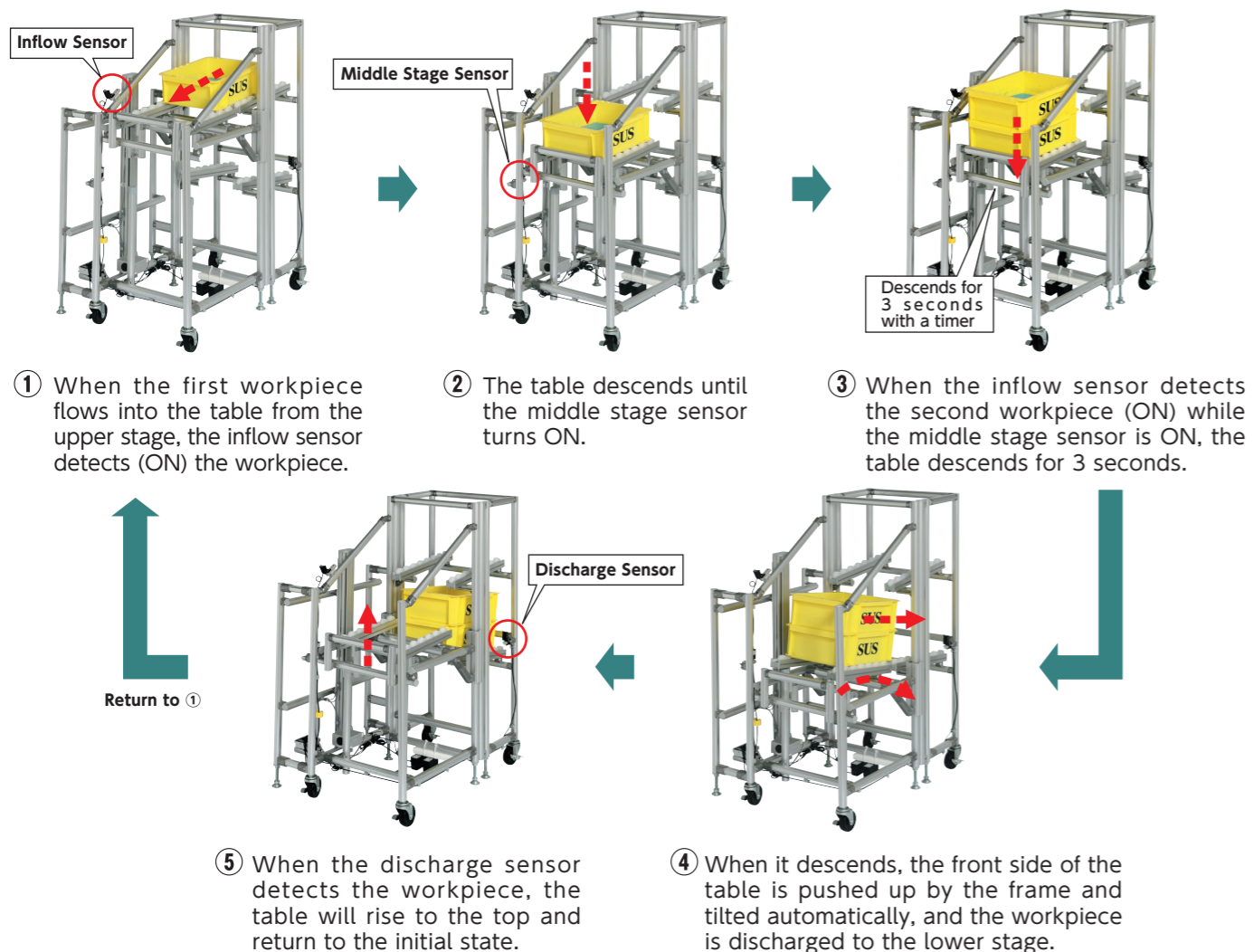
Combining various electric parts with SiO makes it easy to interlock with sensors and create the movement that could not be achieved with only standard controllers.

Examples Electric Stacking Unit



This unit stacks the workpieces supplied to the table from the upper stage of the chuter in 2 levels, and then discharges them to the lower stage. Using the power unit slider type power, you can raise and lower the table without using human hands, and can stack the flowing workpieces automatically. Because the position of the table is determined by the sensor, it is possible to support workpieces of different weights with one unit.

Operation Image



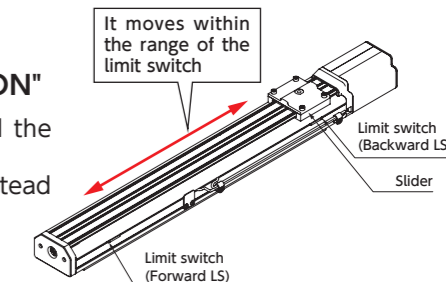
Program Input

OUT	CONDITION1				CONDITION2	DURATION TIME(UNTIL)				OUTPUT TYPE				
	1	2	3	4		1	2	3	4					
(Example)	IN1	ON	AND	IN2	OFF	THEN	DELAY TIME	3.0 s later	IN3	ON	OR	DELAY TIME	5.0 sec	ON
OUT1 (forward)	IN3 (Discharge)	ON	-	-	-	THEN	DELAY TIME	0.5 s later	IN1 (Inflow)	ON	-	-	-	forward is ON
OUT2 (backward)	FLAG1 (backward1)	ON	OR	FLAG2 (backward2)	ON	THEN	DELAY TIME	0.0 s later	CONDITION1	OFF	-	-	-	backward is ON
FLAG1 (backward1)	IN1 (Inflow)	ON	AND	IN2 (Middle)	OFF	DELAY TIME	0.5 sec	CONTINUES	IN2 (Middle)	ON	-	-	-	backward1 is ON
FLAG2 (backward2)	IN1 (Inflow)	ON	AND	IN2 (Middle)	ON	DELAY TIME	0.5 sec	CONTINUES	DELAY TIME	3.0 sec	-	-	-	backward2 is ON

In the "Electric Stacking Unit", forward and backward movements of the power unit are regarded as different outputs and assigned to outputs 1 and 2, respectively. In addition, we use "internal output (FLAG)" to classify cases according to the position of the table, for lowering the table.

Condition for OUT1 to turn ON (table rises) or OFF (stops rising)

- ON condition** "IN3 (discharge sensor) turns ON"
 - OFF condition** "IN1 (Inflow Sensor) turns ON" ⇒ "Forward LS* ON"
- After checking with the discharge sensor that the workpiece entered the lower stage, raise the table to the top. Even if the empty table rises, the inflow sensor does not turn ON, but instead stops when "Forward LS" that detects the limit of advancement turns ON.



*The range of movement of the power unit slider type is determined by the position of the limit switch (Forward LS/Backward LS) attached to the main unit. Even though the "Continue to move forward" and "Continue to move backward" commands are issued from SiO Controller, the slider automatically stops as it reaches its limit.

Condition for OUT2 to turn ON (Table descends) or OFF (Stops descending)

- ON condition** "IN1 (Inflow Sensor) ON" and "IN 2 (middle sensor) OFF"
 - OFF condition** "IN 2 (Middle Stage Sensor) turns ON"
- Once checked with the inflow sensor that the workpiece has flowed into the table at the top position, lower the table to the middle stage sensor position.
- ON condition** "IN1 (inflow sensor) ON" and "IN2 (middle sensor) ON"
 - OFF condition** 3 seconds passed
- When checking with the inflow sensor that the workpiece in the second stage has flowed into the table at the middle position, lower the table to the position where the workpiece is discharged.

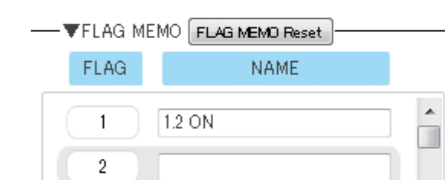
POINT Utilization of virtual output (FLAG) for setting 2 or more conditions

SiO Programmer can only input up to 2 conditions for 1 output device. Use internal output (FLAG) when you want to make slightly more complicated settings, such as using three or more conditions.

When lighting the lamp with 3 sensors turned on

OUT	CONDITION1				CONDITION2	DURATION TIME(UNTIL)								
	1	2	3	4		1	2	3	4					
(Example)	IN1	ON	AND	IN2	OFF	THEN	DELAY TIME	3.0 s later	IN3	ON	OR	DELAY TIME	5.0 sec	ON
OUT1 (Lamp)	FLAG1 (1,2 ON)	ON	AND	IN3 (Sensor3)	ON	THEN	DELAY TIME	0.0 s later	CONDITION1	OFF	-	-	-	ON
FLAG1 (1,2 ON)	IN1 (Sensor1)	ON	AND	IN2 (Sensor2)	ON	THEN	DELAY TIME	0.0 s later	CONDITION1	OFF	-	-	-	ON

When sensors 1 and 2 are turned ON, turn FLAG1 ON, and when sensor 3 is turned ON, the lamp is set to light up. Since FLAG1 is an output for recording the state "Sensors 1 and 2 ON" inside the controller, the state of the output device does not change even if it is turned ON. If you want to check whether FLAG is being output correctly, use the simulation screen and monitor screen. As with typical input/output, English memos can be attached to internal output.



Opportunities grow for motorized karakuri! Connect power units to SiO

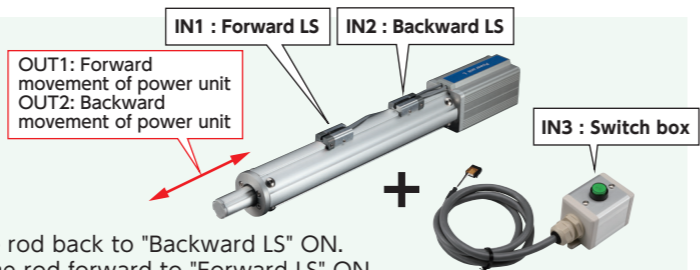
Here we introduce procedures to move electric parts using SiO Controller, with the subject of the power unit. Connection can be done easily with an optional cable.

Items used for connecting power units and SiO Controller



The operation to be realized
Driving power unit with one point switch

When using the standard controller of the power unit, operations requiring 2 switch boxes are realized with 1 switch box.



Operation Procedure When "Forward LS" is ON, "Switch" ON turns the rod back to "Backward LS" ON.
When "Backward LS" is ON, "Switch" ON turns the rod forward to "Forward LS" ON.

How to connect cables

- Connect the "Power Unit Input Cable" to the "LS Signal External Output Terminal" in the controller of the power unit and insert the other end into the input terminal of SiO Controller. Forward/Backward LS is IN1/IN2.
- Connect one end of the power unit input cable to the switch connector of the controller and the other end into the output terminal of SiO Controller. The Forward/Backward command is OUT1/OUT2.
- Connect the e-CON connector of the switch box to I3 and connect the motor cable of the power unit to the standard controller.
- Connect the power supply AC adapter to the power unit and SiO Controller, respectively. When using electric parts, it is necessary to secure a power supply separate from SiO controller.

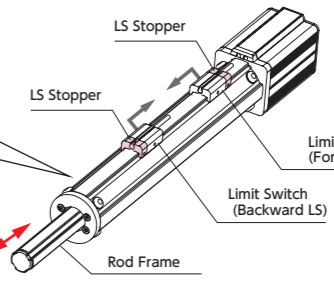
Easy installation/Electric power assistance of speed start Review of the features of the power unit

9 operation patterns are set in the power unit beforehand, and it is possible to operate immediately by simply connecting the power supply and turning on the switch.

Movement which is not in the pattern is conveniently produced by the combination with SiO!

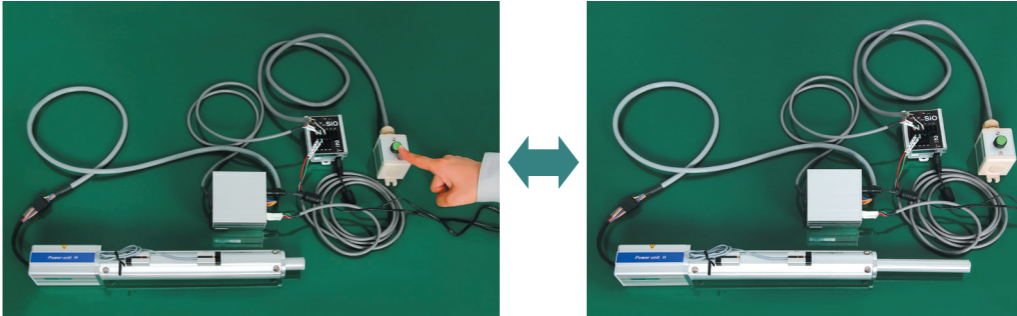
We use an aluminum pipe structural material GF-G (43 mm type) frame for the body. Installation is made easy with standard connectors.

The rod moves back and forth, assisting movements such as "push", "lower" and "lift".



To adjust the operating range of the rod, simply loosen the screw of the limit switch and slide it.

Operation Image



Check with video!



<http://fa.sus.co.jp/jump/E01>

Pressing the switch moves the rod forward to its maximum position. Push the switch again with the rod fully extended, and it retreats to the initial position and stops.

Program Input

OUT	CONDITION1				CONDITION2		DURATION TIME(UNTIL)				OUTPUT TYPE				
	1	2	3	4	1	2	1	2	3	4					
(Example) OUT1 (forward)	IN1 (Switch)	ON	AND	IN2 (F-LS)	ON	THEN	DELAY TIME	0.0 s later	IN3 (F-LS)	ON	-	-	-	forward is	ON
OUT2 (backward)	IN3 (Switch)	ON	AND	IN1 (F-LS)	ON	THEN	DELAY TIME	0.0 s later	IN2 (B-LS)	ON	-	-	-	backward is	ON

In the power unit, different forward and backward movements are considered to be different outputs, and forward LS and backward LS are considered to be different inputs. This is also the case when using electric stopper.

Condition for OUT1 to turn ON (rod forward), OFF (stop) Condition for OUT2 ON (Rod goes backward), OFF (stop)

ON condition "IN2 (Forward LS) is ON" and "IN3 (Switch) is ON"
OFF condition "IN1 (Forward LS) turns ON"
→ Turn on the switch when the rod is retracted to the shortest position to make the rod extend to the longest position then stop.

ON condition "IN1 (Forward LS) is ON" and "IN3 (Switch) is ON"
OFF condition "IN2 (Backward LS) turns ON"
→ Turn on the switch when the rod is extended to the longest position, to make the rod retract and stop at its shortest position.

New Product Introduction

Convenient in combination with SiO "Power BOX PS 6-100"

SUS has released a power supply box which is convenient for power supply when using multiple AC adapters such as motorized karakuri! Use it together with motorized parts and SiO Controller.

- Feature 1 Output current is 4A**
It can output up to 4A total with 6 circuits in one power supply box. Even when using multiple motorized parts at once, it is possible to realize clean power wiring.
- Feature 2 Emergency stop circuit is standard equipped for safety**
Of the 6 ports, 4 have specifications that can shut off the power by emergency stop. Combined with the optional emergency stop switch box, it is possible to easily construct the emergency stop mechanism required for the motorized karakuri device.
- Feature 3 Easy installation on GF frames**
The same protrusions as the GF frame are on the bottom of the box, and it can easily be installed with standard connectors. It is also highly compatible with electric motorized karakuri.





- 32** | **Honda Motor Co., Ltd.**
Saitama Factory, Yorii Plant > 25 > 30 *Bring the joy of building to the factory!
Going back to the start of manufacturing by
focusing on the challenge of "karakuri"*
- 33** | **Murata Manufacturing Co., Ltd.**
Yokaichi Plant > 31 > 36 *A factory that continues to evolve by
actively scrapping and building
Pursuit of safety like nowhere else*
- 34** | **Narita International Airport**
Corporation > 37 > 42 *Create an airport that is pleasing both
for workers and passengers by giving
shape to their latent needs*

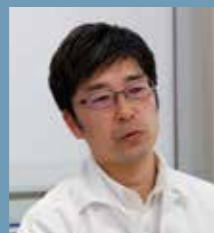
Honda Motor Co., Ltd.
Saitama Factory, Yorii Plant

Bring the joy of building to the factory! Going back to the start of manufacturing by focusing on the challenge of “karakuri”

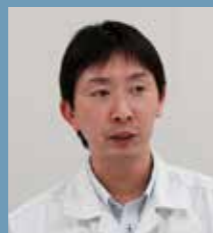
The Saitama Factory, Yorii Plant is the newest factory of Honda Motor Co., Ltd. (hereafter “Honda”) in Japan. In this factory, which is equipped with the latest equipment using Honda’s revolutionary technology, work is gaining speed on “karakuri” (originally-devised tools) which could be seen as the exact opposite. In this article, we cover examples of karakuri that are active in the factory, as well as thoughts on the monozukuri (manufacturing with a sense of craftsmanship) behind it.



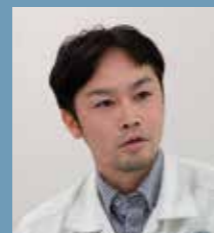
Yorii Automobile Plant
 Assembly Frame
 Department
 Manager
 Mr. Takanori Onoe



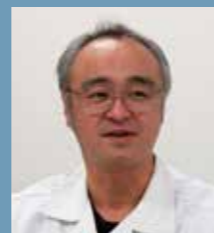
Yorii Automobile Plant
 Assembly Frame
 Department
 Staff Engineer
 Mr. Kenichi Kase



Yorii Automobile Plant
 Assembly Frame
 Department
 Staff Engineer
 Mr. Takeharu Iwata



Yorii Automobile Plant
 Assembly Frame
 Department
 Engineering Coordinator
 Mr. Takuya Maenishihara



Yorii Automobile Plant
 Assembly Frame
 Department
 Mr. Mitsuo Onda

COMPANY DATA

Honda Motor Co., Ltd. Saitama Factory, Yorii Plant

2354 Ohaza-tomita Yorii-machi Ohsato-gun Saitama-ken. 369-1216 Japan
<http://www.honda.co.jp/>



Demonstration machines we presented at the Karakuri Kaizen® Innovation Exhibition are arranged in a corner of the plant so that they can be visited at any time. This place was also used for in-house presentation including practice.

Overcoming weaknesses found by exchange with other companies
 Promoting the cultivation of human resources through monozukuri

It seems that Honda is starting to put emphasis on karakuri now.

Last autumn, the Yorii Plant was the first Honda plant to appear at the Karakuri Kaizen® Innovation Exhibition. The opportunities to work on karakuri have only grown since then, but we started full-scale production at the Yorii Plant after deciding to appear at last year’s exhibition. The Karakuri Kaizen® Innovation Exhibition is an event that started in 1993 and has a well-known history, but there are many people in the company who do not even know it exists, and efforts have just begun.

In our Suzuka and Kumamoto factories, although they did not participate in the exhibition, they started introducing karakuri even before the Yorii Plant, and we frequently shared information on the first challenge.

Why do “karakuri” now?

The Yorii Plant is Honda’s newest domestic factory,

which started operation in July 2013, and produces four models of compact cars, such as the Fit and the VezeL. We have many state-of-the-art robots and automatic machines in the plant, and we are proud of the high level of production technology. However, as we have been interacting with various manufacturers for about 2 years now, we have come to realize that the actual efforts at the Yorii Plant are lacking compared to other companies in terms of kaizen (the process of constant improvement) activities, which are the essence of the manufacturing workplace. We felt a sense of crisis about our ideals for monozukuri at the work site fading away as we go continued our pursuit of improved efficiency. Therefore, we will introduce kaizen activities that employ karakuri that are operating at other companies in order to communicate to the younger generation the joy of building things, the feeling of accomplishment and skills related to kaizen.

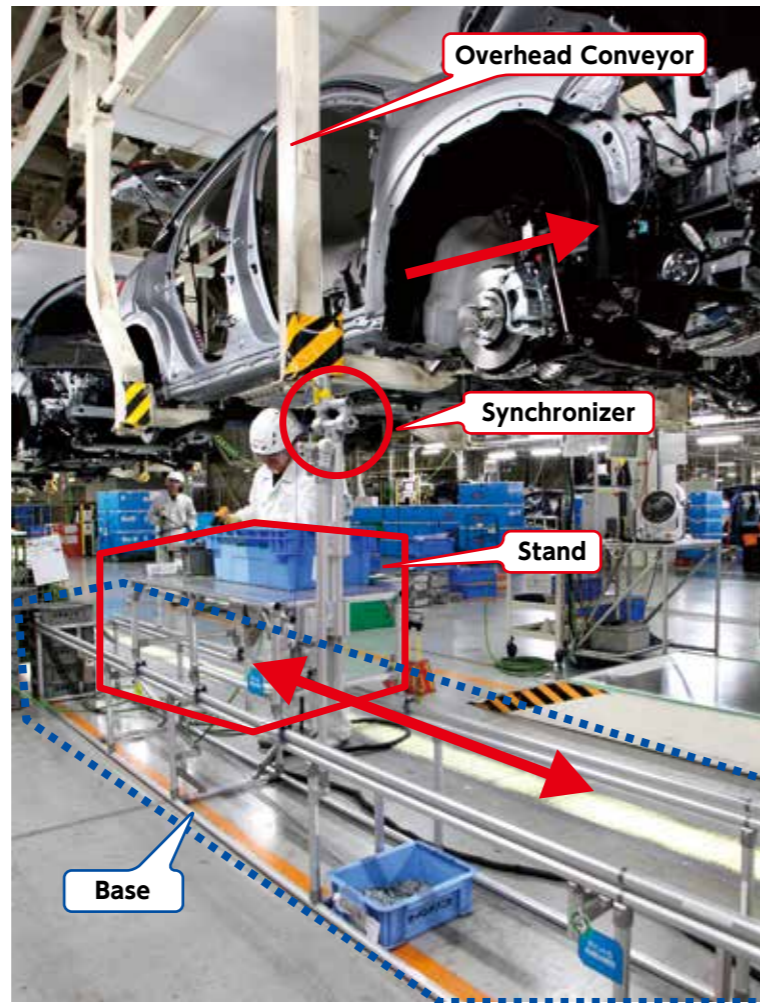
It is our goal to solve problems in the workplace and improve efficiency, of course but our primary goal is to lead human resource development and revitalize the workplace. Among such activities, we feel that aluminum pipe structural material GF, which is easy to assemble and can freely give shape to workers’ ideas, is a very attractive component. The karakuri synchronous cart, our first karakuri, was also made of GF.

1 Special Award Winner at the Karakuri Kaizen® Innovation Exhibition!

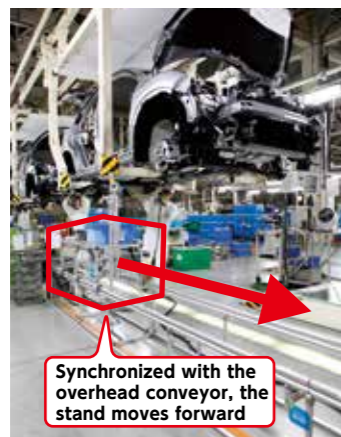
"Karakuri Synchronous Cart" that reduces time spent walking

The "Karakuri Synchronous Cart", which consists of a stand to place parts on and a base which serves as a rail, was exhibited by the Yorii Plant last year. By hooking the "synchronizer" attached to the stand to the overhead conveyor, the movements of the stand and the vehicle are synchronized, making parts easy to reach. After moving a certain distance, the synchronizer automatically falls down, the synchronization is released, and the stand returns to the original position. The collapsed synchronizer is pushed up while the stand is returning, making synchronization possible again.

This reduces the number of trips made between a vehicle and the workbench, and saves time that was previously spent walking.



▼ Karakuri synchronous cart movement



Synchronized with the overhead conveyor, the stand moves forward



Realization of making parts easy to reach without pushing the cart



② Wire is pulled and synchronizer collapses

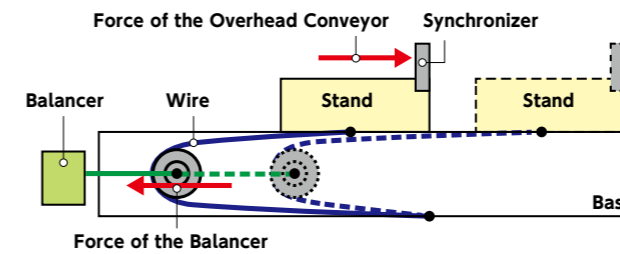
③ Go back

① The release bar of the stand hits the release stopper of the base

Utilizing the force of the overhead conveyor, the base that advanced with the vehicle is released from synchronization when it reaches the end of the base, and returns to its original position by the force of the balancer.

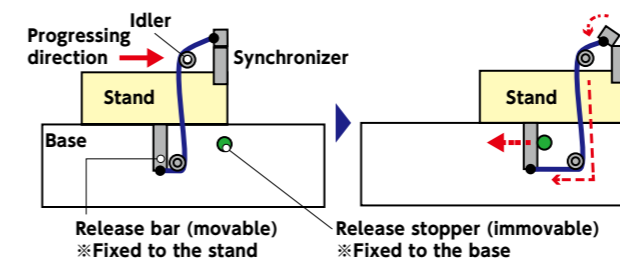
▼ Operation Mechanism

① Reciprocating motion of the stand



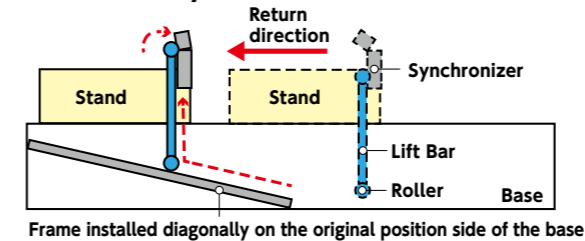
The stand is propelled forward by the force of the overhead conveyor, and pushed backward by the force of the balancer. Our problem was that there is only 3 meters of stroke with just the balancer, which does not do the necessary work, but we solved the problem by extending this to 6 meters with a running block.

② Automatic synchronization release



When the stand moves a certain distance, the release bar fixed to the stand hits the release stopper fixed near the end of the base, and the force is transmitted to the synchronizer via the idler and the wire. Synchronization is canceled when the synchronizer collapses and disengages from the overhead conveyor.

③ Automatic synchronization



Near the synchronizer, a lift bar is installed for raising the collapsed synchronizer. The roller rolls on the diagonal frame attached to the original position side of the base, so that the lifting bar is pushed up, returning the synchronizer to its initial state.

▼ Effect of introduction

	Before kaizen	After kaizen
Number of reciprocations of vehicle and workbench	3 times	Once
Walking distance	18.1m	8.4m
Walking time	11 seconds	5.1 seconds

※ per vehicle

Presented karakuri at the exhibition for the first time
Shared awareness, accelerated kaizen

What brought you to adopt SUS products?

The Saitama Factory to which the Yorii Plant belongs also has the Ogawa Plant and Sayama Automobile Plant, and had a track record of using SUS products. Based on past experiences, as a result of consideration from several manufacturers when setting up Yorii, it was decided to introduce 400 GF workbenches. One reason is its clean appearance. Since 8,000 visitors come to the Yorii Plant annually, we were conscious of how the factory looked. We also liked that they could be reused instead of just becoming industrial waste. One of the reasons for spreading to the workplace as part of karakuri is the exhibition held by the SUS in the factory around the summer of 2015. It was a time when we began exploring ideas to utilize karakuri and we asked them to introduce examples produced by GF. Even before that, professional staff knew about SUS products, but when they actually witnessed it moving, everyone at the workplace was impressed by the fact that they could do something like this if they have a vision.

How did you start working on karakuri?

The first department to make karakuri at the Yorii Plant was the "Yorii Assembly Frame Department", which is responsible for the process of assembling automobiles. First, the main members visited various factories at other companies, and started from learning examples as well as the culture and attitude of kaizen. At other companies, even a single workbench contained a lot of improvements and ideas of workers, and we were shocked to discover viewpoints we had never seen before. There were also many examples using GF. After that, we started on actual production based on what we had learned. First we sketched on paper and made a prediction that it will "move like this", but when we made it, it did not move that way at all. Because we did not know the strength, there was not enough reinforcement at the beginning, and it broke down often. However, we quickly improved, and we felt it was a valuable experience that allowed us to experience the real pleasure of monozukuri.

How are the usability and reputation of GF?

We think that GF is a useful senes. Moreover, because it is easy to handle, it also has the merit that even if trouble occurs at the workplace, it can be maintained by the operator. The reputation of the completed karakuri is excellent.



What is decorated on the bulletin board is a monozukuri map that shows areas which have benefited from kaizen in the factory. There are color-coded magnets on the floor plan of the factory, such as "Synchronous Cart", "Karakuri", and "Chuter". The number is gradually increasing.

Since we handle a lot of heavy items as an automobile plant, each line worker raises the question of how durable it is against heavy objects. We think that the range that can be used widens to a large extent if it can answer that. Additionally, it was very convenient that it came not only as the single product GF

but also as a set with the free 3D drawing software UnitDesign. Currently we have about 5 members who can use UnitDesign, but we plan to train more.

Please tell us what the challenge of Karakuri Kaizen® Innovation Exhibition brought you?

In the beginning, we did not know what kind of event it was, but the factory boosted everything along, and we were motivated to finish. About two weeks before the exhibition, a preliminary presentation was also carried



This group picture was taken at a presentation held at the company in advance of the Karakuri Kaizen® Innovation Exhibition. Everyone involved, from the factory chief down to young employees, came together in solidarity.

out with the sponsorship of the factory chief at the time. Along with practicing for the main presentation, the aim was to share the effort with many members, so it was filmed and broadcast within Honda. Also, at the exhibition venue, there was the problem of how to reproduce the atmosphere used at the workplace in order to convey the effect of the karakuri in an clear manner. Therefore, we built a mechanism to explain the movement of conveyors with GF. This was produced not by the main members but by younger workers, so many employees cooperated as we approached the exhibition.

On that day, we were overwhelmed by the many people who devised other companies' improvements, and started to feel uneasy, thinking "Is our idea too simple?" However, after the opening, many visitors came to our booth and listened closely to us, so we had a great time despite the difficulties.

The core members of the exhibition came to be widely recognized as "the karakuri crew" within the company, and have received many requests. Although it is not easy to come up with good idea, they are working hard together to come up with new solutions.

What kinds of activities are currently going on?

The other day, eight people including members who participated in the Karakuri Kaizen® Innovation Exhibition, launched a "kaizen support" team. They are support staff who work between specialized areas like production technology and the worksite, Although kaizen activities were carried out every day in the company, there was a problem. It was rather largely dependent on the discretion of the individual, and was not incorporated into a system. Regarding kaizen, there were few opportunities to show off or to receive evaluation even if we achieved results. Therefore, we are trying to rebuild a system that enables us to share technologies and continuously improve, including organization creation.

One such measure is the "Monozukuri Room" which started operation in April. In addition to being able to stock materials to create equipment for kaizen, we hope to make it a place to enjoy fun ideas. For that reason, in addition to exhibiting the basic mechanisms of the karakuri made with GF and trees, "Kaizen Support" staff will be stationed and consultation will be accepted. Basically, you cannot communicate while concentrating on production. Gathering in the Monozukuri Room and working on ideas with senior and junior employees will also lead to revitalizing the

workplace. Although it is still just an ideal, we want to gradually give shape to it.

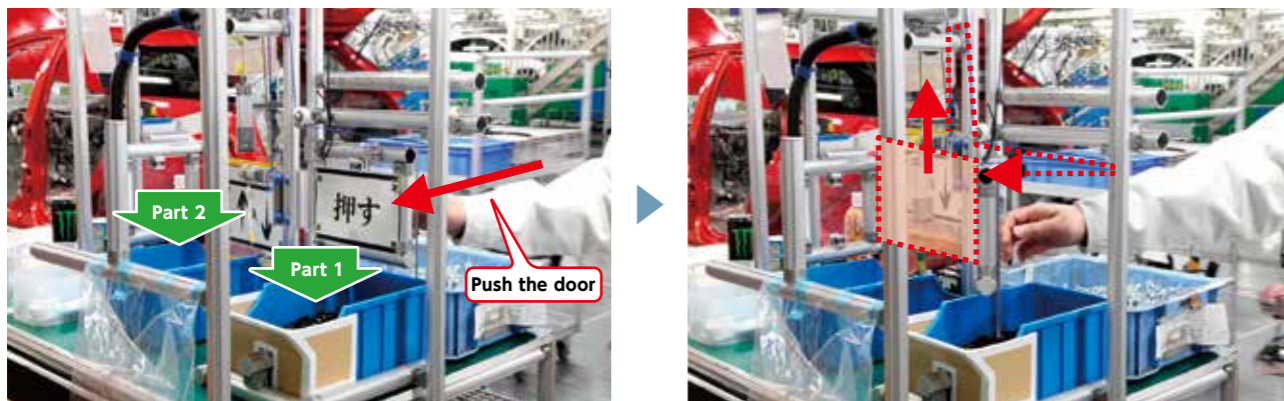
Please tell me again about your motivation moving forward.

In the Showa period (until the late 1980s), there was a corporate culture where kaizen could be learned naturally in casual exchange at the manufacturing site. However, as companies grow bigger and expand to the world, efficiency is emphasized, and we feel that such fundamentals have faded away. Initiatives for karakuri should return to the origin of the manufacturing industry. We have been rallying people to the cry of "Let's do what's obvious, and do it right," and slowly that circle has grown. Honda's corporate philosophy shows the "three joys" that we pursue. These are "the joy of buying" for customers, "the joy of selling" for sales staff, and "the joy of making". We would like to continue activities in the future with the aim of creating an environment where members working at the manufacturing site can feel "the joy of making".



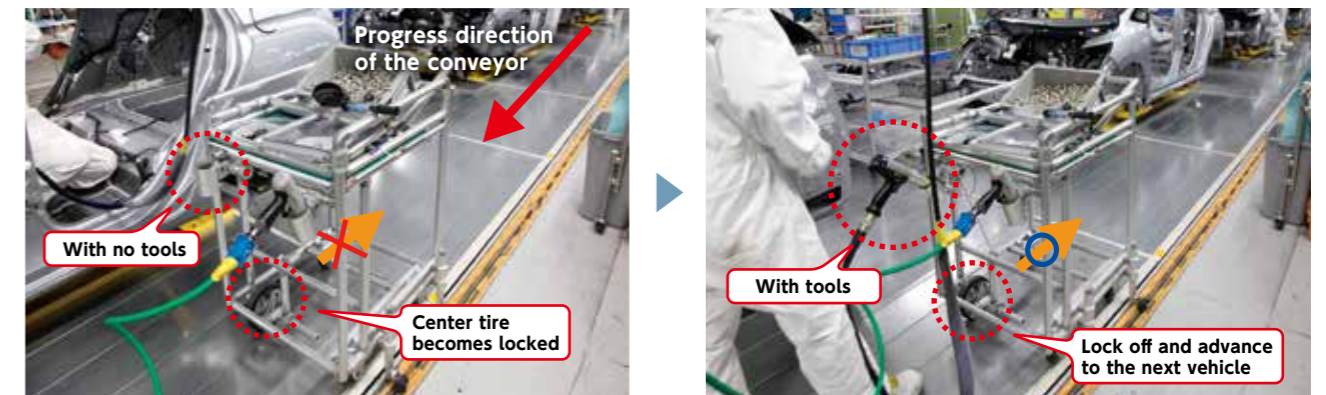
The "Monozukuri Room". Although it has just been installed, there are still few users, but they hope to develop monozukuri from here.

2 "Ninja House" active in prevention of parts being left unattached



This is a new karakuri made after the exhibition. Two doors are installed in front of the two types of parts placed on the workbench. The door on the back will not open, unless the door in the front is pressed, preventing unattached parts from being left unattached.

3 Quality improvement with careless mistake prevention! "Simple Shugoshin (Guardian)"



This hand-cart that does not advance after completing work unless the tool is put on it is a simplified version of the karakuri called "Shugoshin (Guardian)" which was shown at the exhibition. Furthermore, like the ninja house, a mechanism to prevent parts from being left uninstalled is incorporated in the upper part of the hand-cart. Production was handled by the line workers themselves.

Product Profile New and advanced. New Fit launched June 29th.

Supporting safe and comfortable driving with eight advanced functions. >>>



- 1. To avoid collisions
Collision Mitigation Brake System(CMBS)
- 2. To avoid sudden acceleration
Unintended Start Prevention Function(USPF)
- 3. To stay aware of pedestrians
Pedestrian Accident Reduced Steering(PARS)
- 4. To avoid road departure
Road Departure Mitigation System(RDMS)
- 5. To keep from getting too close
Adaptive Cruise Control (ACC)
- 6. To avoid wobbling
Lane Keeping Assist System(LKAS)
- 7. To stay aware of starting traffic
Leading Car Start Alerts (LCSA)
- 8. To make sure you don't miss anything
Road Sign Recognition Function(RSRF)

A factory that continues to evolve by actively scrapping and building Pursuit of safety like nowhere else

Yokaichi Plant supports factories both in Japan and overseas as a core base for supplying raw materials and elements of Murata Manufacturing, a major electronic component manufacturer. I asked employees of the Ceramics Production Department 1, Manufacturing Division 2 which is responsible for the manufacture of ceramic elements, about the kaizen activities of the factory and equipment they particularly give attention to.



Ceramics Production Department 1
 General Manager
 Mr. Toshiyuki Ishibe



Ceramics Production Department 1
 Manufacturing Division 2
 Senior Manager
 Mr. Kazuhiko Utsumi



Ceramics Production Department 1
 Manufacturing Division 2
 Manager
 Mr. Satoshi Kitagishi



Ceramics Production Department 1
 Manufacturing Division 2
 Mr. Hirotaka Okamoto

COMPANY DATA

Murata Manufacturing Co., Ltd. Yokaichi Plant

4-1, Higashiokino 4-chome, Higashiomi-shi, Shiga-ken. 527-8558 Japan
<http://www.murata.com/en-jp>



GF cart (left) and SF cart (right) actually used in the process. The GF cart in the photo is a partially modified version of the equipment which was requested to SUS to assembly for the first time, with a load capacity of 320kg.

Product adoption started from Sing

Design and assembly services that saved the company from its plight

What role does the Yokaichi Plant play in Murata Manufacturing, which has sales, development, and production bases throughout the world?

Our company, an electronic parts manufacturer, has 105 sites in Japan and overseas, and our products are used in various products such as mobile phones, personal computers, home appliances, and automobiles. Murata's motto is "New electronic devices begin with new electronic components; new electronic components begin with new materials." so we put a strong emphasis on materials. The Yokaichi Plant manufactures ceramic materials as raw materials and ceramic elements which are sintered raw materials and supplies them to domestic and overseas processing plants. It is located right in the center of our group companies which are dispersed throughout the country, and it is in a convenient area just a few hours by car to a processing factory with a high supply ratio. In addition to playing a role as a core supply base for raw materials and elements, it is also a factory that makes finished products such as noise removal filters and temperature sensors.

The Yokaichi Plant was opened in 1962, is that right?

It is a historical establishment among the Murata Group, and about 50 years have passed since its opening. Along with the expansion of the electronics market, we have gradually expanded its functions. However, since the factory's neighborhood is a residential area, we cannot expand the premises to expand the facilities. Therefore, at the Yokaichi Plant, we promote a process of scrap-and-build to rebuild aging buildings as necessary. When transferring a process that had been done in an old building to a new building, we are concentrating so that production can be made more efficiently, instead of just relocating or transferring as it is. When doing so, it is impossible to make the most of the limited space on ready-made work desks and shelves of fixed sizes. Yet, if we use aluminum frames that can be customized in length, we can realize the equipment for each site, so we have used it as material for kaizen.

Please tell me more about the circumstances of SUS product adoption in the Manufacturing Division 2.

We knew that members of other departments were reading "Sing" in the Yokaichi Plant and thought that we wanted to read it as well, so we started to

request the information. At that time we were using a square frame from another company, so we did not plan to adopt SUS products. As a matter of fact, it was our stance that it was good enough to read the pages of magazines, but the sales representative of SUS came visiting with Sing and a catalog in hand. There is a specialized organization "Kaizen Group" in charge of kaizen in the Manufacturing Division 2 to which we belong. Although we called ourselves a group, only Okamoto was affiliated with it at that time, and he was doing everything from design to picking up necessary materials, ordering, and assembling on his own. That's why, when a sales representative from SUS learned of Okamoto's incredible schedule, he made us a proposal saying, "If you can draw a sketch, then we can do the design", so we started requesting SF carts. The square frame is a familiar shape as it was used conventionally, and it is compatible with conventional products. In this way, adoption of SUS products has started.

Currently, I hear that the adoption of aluminum pipe structural material GF is also increasing.

Originally, we were using only SF, but now GF is becoming mainstream. We discovered GF in the venue of the SUS seminar held in December 2014. We liked the appeal of it being lightweight but having rigidity, and first decided to make one shelf. When assembling for the first time, we had a hard time with measurements and learning how to use the connector, but we were able to assemble it safely with support from the salesperson, so we realized the convenience of GF. The shelf was remodeled afterwards, but even now it is used in the workplace. The adoption of SUS products including GF further advanced afterwards when the Kaizen Group had a big project and was busy. Despite having been busy with the production of working desks, 70 more carts were needed. We decided that the task was beyond our capacity, decided to ask a partner

company to do assembly, but we could not find a company that would meet the desired price. Then they told me "SUS offers assembling too", which led to placing a mass order. Since the work to be loaded on the cart can reach up to several hundred kilograms, we originally planned to order a more robust SF cart. However, we decided to use it as the main trolley because it was found that the strength of GF carts was greater than expected, in addition to being much lighter and offering cost benefits. After introduction, it was easy to grasp the handle because of its round shape, and it was very lightweight and easy to handle even for women, so it has become popular on the work site.

and replacing seals. Products we have designed and produced in the company must not injure our workers. Since the Yokaichi Plant handles especially heavy objects within the Murata Group, we work on production with safety as the most important concern in all our products, not only equipment. We think that it is important for employees who work in the factory to come to work healthy, and for us to make sure they go home healthy after a day's work.

Please tell me about efforts to conduct kaizen on processes in the workplace, including Kaizen Group activities.

The Kaizen Group was launched in Manufacturing Division 2 as an organization responsible mainly for kaizen. Traditionally, workbenches and carts were made by workers and members who were good at equipment production, but in order to ensure safety, we decided to form a group of members with professional skills. The job is mainly to improve the efficiency of the workplace related to process consolidation. Apart from the Kaizen Group that exists only in Manufacturing Division 2, Murata Manufacturing as a whole, there is also an in-house qualification called "Kaizen Professional" which qualifies the skills of and selects employees with practical kaizen achievements. This system began in order to share the achievements of each factory throughout the company and enhance synergistic effects. We hold study sessions as part of "Kaizen Professional Activities" that nurture members who are good at kaizen. Kaizen Professionals are learning the skills necessary for reviewing the site from all aspects of safety, quality and efficiency, such as expert knowledge such as work design and points

**Thorough pursuit of safety!
 Equipment designed with the user first in mind**

When producing equipment, please tell us points you are improving or focusing on.

We are dedicated to making equipment that is safer than anywhere else. For example, carefully calculating strength in detail such as load capacity, always attaching end covers, and if it is a cart, a structure that does not overturn. We also manufacture the size accurately so as not to remove 1 mm from the specified dimensions. When installing shelves and other fixtures, we always implement earthquake resistance measures, and all improvements are introduced only after thorough review and safety confirmation by the Kaizen Group. Furthermore, we regularly inspect carts in use

About MURATA Cheerleaders' technologies

This robot was developed to introduce the company's superior products and high technical capabilities in an easy-to-understand manner. It maintains an exquisite balance with a gyro sensor measuring the tilt of its body, so it always appears to be on the verge of collapsing but never does. It also learns its position in relation to its surroundings with an ultrasonic microphone and infrared sensor in real time, realizing strong team work so that it always looks like it will collide but never does. In addition, it is equipped with many products of the company which are used in various situations such as communication modules, capacitors, inductors, etc.



Examples of use that demonstrate the Kaizen Group's skill ①

SF dangerous goods repository 18 L can turn table

Conventionally, it was necessary to lift and tilt when transferring contents, which was a heavy burden on workers. In order to fix this, we created a dedicated storage area.



When using it, first pull it forward. Then stop it with a stopper, and fix it at that position.



Rotate the frame on the fixed base to the right.



As you rotate 90 degrees, you can pour as it is because the spout is in front. Then just return it with the same process and you are done.

of view for improving occupancy rates. Okamoto is concurrently in charge of a kaizen group and serves as a kaizen professional for the Manufacturing Division 2. Inside each process there are also small group activities that are mainly conducted by workers, so if we want to improve efficiency, we make use of the skills of expert kaizen professionals and realize quality improvement in the workplace.

At the end of April this year, you held the first karakuri technology exchange event gathering kaizen professionals from across Japan, didn't you?

It was held at the Okayama Murata Manufacturing Co., Ltd., the most advanced factory in Murata Manufacturing, where the concept of Karakuri has not penetrated far yet.* Many Karakuri units and parts using SUS products were exhibited and it was a good opportunity to be inspired by how to use the parts. Among the exhibits, a lot of interest was given to a cart equipped with a mechanism that lifts items with just a light force. However, as we reported, we are dedicated to safety more than anything at the time of equipment production, so we introduce devices to the process having first confirmed that they are safe and unchanged no matter how many times we use them. Karakuri seems to have a slight artistic aspect as well. It is difficult to support with technical data, and there is still unease because there are many parts related in a complex way. For that reason, we hope that we will enrich the technical data that is increasingly posted in catalogs so that we can calculate all the numerical values even when we use them in various ways for various movements.

※In Vol. 34 of Sing (Japanese version only), we will discuss kaizen cases and karakuri of the Okayama Murata Manufacturing.

From our dedication to safety, all carts are fitted with stoppers to prevent movement, including ready-made products.



The Kaizen Group's workplace, where they have designed and assembled many pieces of high-quality equipment. On the wall, a certificate awarded by the director of the plant acknowledges this achievement.

Please tell us what you would like to change in the future, or want to put your strength in the future.

Since we introduced equipment after repeatedly examining the specifications many times, and we are continually refining them day by day to meet the needs of workers, we believe that our workplaces have improved relatively at the present moment. However, as the distance traveled shrinks, the lead time will be shorter and the utilization rate will be improved, so we will continue to consolidate our working space in the future. In that case, it is meaningless if workability gets worse. The most important thing is the equipment made with the user in mind. As one way to create a site that is really convenient for workers and improves work efficiency, we will positively consider karakuri kaizen in the future.

Currently, there are more and more departments adopting equipment that uses SUS products in the Yokaichi Plant. For that reason, many questions are being posed by various departments to the kaizen group which has long been handling aluminum frames, such as how to assemble them. The guidance given will be further developed by members who return to their department, but since the types of parts are diverse and there are many

employees, we cannot cover them with the kaizen group alone. In order to raise the skills of the whole company, we would like to have an assembling workshop organized by SUS held. In addition, the karakuri technology exchange events where kaizen pros gather will continue, and the day that it will

be held at the Yokaichi Plant is not so far off. Going forward, we aim to create a better workplace from various aspects such as process consolidation through aggressive scrap and build, realization of new kaizen ideas born by deepening knowledge of SUS products, and unchanging pursuit of safety.

Examples of use that demonstrate the Kaizen Group's skill ②

Material storage shelf and partition realized by collaboration between GF and AZ

Since it is difficult to adjust hanging sliding doors with an opening of 1 meter or more, it is a project with few deliveries in SUS. However, with the reliable adjustment technology of the kaizen group, the hanging sliding door which opens and closes smoothly was completed despite having an opening of 2 meters.



Hanging sliding doors with an opening of 2 m supported by upper and lower frames.

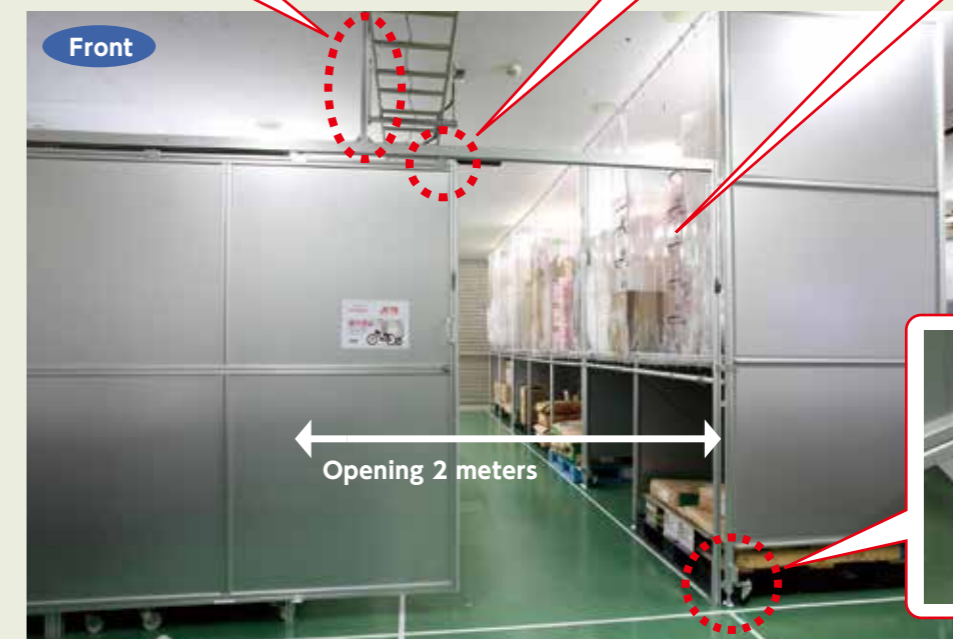


Adjusted by grinding down a part of the pulley unit kit installed inside.



Inside

The inside of the partition is used as a shelf for material storage.



Front

Opening 2 meters

Anchors are driven as earthquake resistance measures. It is also possible to remove it when moving storage shelves and partitions.



Left Side



Right Side

GF

In order to carry in and out material from the back shutter, casters were attached to all the foot suspensions, making it movable.

In order to secure a passage for visitors, we produced the partition, which was previously made from plastic corrugated cardboard, with GF and AZ using aluminum composite board. Because it is lightweight, looks good, and has a sense of unity, it is highly appreciated by other departments and people in other processes.

Create an airport that is pleasing both for workers and passengers by giving shape to their latent needs

Narita International Airport has as many as 39 million passengers annually as the number one gateway to Japan's skies, with more than 600 aircrafts on average arriving and departing per day. And gradually from last year, adoption of SUS products has begun in that airport. We listened to their environmental kaizen tailored to their needs, which are being promoted while taking advantage of the high versatility unique to aluminum frames.

※In the text, when referring to Narita International Airport Corporation, we use "NAA", and when referring to the airport itself we use "Narita Airport".



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The packing table of Terminal 1. The table is designed to fit the place it is installed.

We want to solve passenger's problems!
 Challenging newly started equipment

I was surprised to hear that you are using SUS aluminum frames at Narita Airport. What made you choose SUS?

Actually, we first knew SUS products not by the aluminum frame, but by smoking booths. When considering how to practice kaizen in the smoking areas installed at Narita airport, it happened that the smoking booth of SUS really caught our eye. We liked the stylish look, and we wanted to hear the details, so we visited a showroom in Nihonbashi Kodenmachi, Chuo-ku, Tokyo. For the first time, we learned that SUS is a company that makes various proposals using aluminum. We were also very interested in the karakuri lined up in the showroom. We naturally decided to consult with them about packing tables, which were the first items delivered, as to whether it could be used to solve some problems we had at the airport at the time. The packing table is a work bench for organizing and repacking luggage. Due to strict restrictions on imported goods and checked baggage items in the aircraft in recent years, we have seen customers

open, organize, and repack overweight suitcases on the floor of the departure lobby of the airport. Doing this on the floor is not only a burden on that customer, but also hinders the flow line for other passengers, so we thought "we have to do something about this!"

Please tell me about the flow to delivery.

At the beginning, we handed out photographs of examples used at overseas airports to convey the image. NAA requests how they want the size and materials, and the detailed design and production are left to SUS. First of all, we had them make a half size prototype based on this request, and while discussing this with people involved, we approached the finished product. It is good that it was easier to give a concrete opinion because images can be shared if there is an actual product. We were particular about not only ease of use, but safety as well. Since people of a wide age range from many countries come to Narita Airport, we took care to avoid injury in case of emergency, such as attaching R shapes at the corners. A total of 10 packing tables were installed and used in the first and second terminals of Narita Airport at the end of May 2016. A weighing scale was also installed next to the table, so customers can check the weight of luggage themselves, then reorganize



Packing area set in the departure lobby of Terminal 2. The framework of the table was made of SF, and stainless steel was used for the top plate. A weighing scale that fits the design of the table is lined up in the back.

and repack their luggage before heading to boarding. Because this facility was not available in the past, we renamed the installation place as the "Packing Area" and posted signs. This effort has attracted attention inside the company, such as being featured in the "Green Port Report", NAA's publicity magazine which provides information on Narita Airport, as well as aviation, travel and the transportation industry.

Under what kind of circumstances is equipment such as packing tables selected and introduced?

New development, updates, and repairs, and kaizen or improvements to large facilities such as buildings are advanced in a long-term plan. In the background, there are judgments that consider future demand prospects, trends in the airline industry, the service life of the facility, etc., and we respond with a special organization called the Facility Maintenance Department. Yet, equipment such as packing tables is often introduced because of opinions from users. Users of airports can be roughly divided into two categories in the form of "general passengers" who

are aboard an aircraft and "people of airline staff", but various requests come from each of them from day to day. We regularly hold meetings with the airline companies, and with the aim to create a comfortable airport, we are engaged in various discussions not limited to just equipment. In fact, we were considering selection of packing tables before consulting with SUS, and because we wanted to make them easy to use and safer for customers, we were planning to have them custom made. However, normally when we introduce new equipment, we do it not with the idea of "making", but "buying" ready-made items that match



A prototype of the weighing scale delivered just before the interview. It is based on a ready-made scale that was originally in use.

the conditions, so we did not know who to ask. Although we tried talking to a small factory, our cost and safety needs were not met, so we made no progress. Then, we happened to learn about SUS by chance, and we decided to ask them, but at the beginning we only half believed that they could deliver what we wanted. However, as prototypes were finished that fit what we actually talked about, our trust increased gradually and we felt that we could trust them more, until they finally produced something that satisfied our demands. SUS has various materials such as aluminum structural material SF and aluminum pipe structural material GF, and they have the technology to engineer and design necessary equipment by combining these. We also think it's great that they have the ability to draw out the customer's request. We felt like they were able to quickly make a

Realize the core needs of the airport with the power of aluminum

Besides the packing table, it seems that you have consulted regarding equipment that you never have used before.

The second is a special cart that stores and transports tape stanchion. A tape stanchion is a pole that separates a row of people, etc. At Narita airport, it is mainly used around check-in counters where boarding procedures are carried out. When they are not being used, they are put together on the back of the counter, and how to arrange and store these tape stanchions was a challenge. Furthermore, since each one is heavy and bulky, not only do they take a lot of time and effort to carry, but there is also the problem that if you drag them, they will scratch the floor. There are cases in foreign airports of using specialized carts to carry tape stanchions, so we had an image of what kind of thing we would like to make, but what we did not understand is how to give it shape. Because the packing tables which we were working at the same time had already earned a good reputation, we also decided to consult with SUS on these carts. When we informed the salesperson of the request, it

proposal that suited our demands by finding out what our problem is and engineering and producing the final equipment completely in house.



A GF cart for three-seat bench which is used in airport lobbies frequently. Although it is still a prototype, it is easy for one person to carry a bench weighing dozens of kilograms, which reduces loads such as when changing or cleaning seat surfaces, or changing layouts.

was answered that flexible proposal using aluminum frame was possible, and it was surprising that the original cart was actually finished reasonably and more quickly than we imagined. As for carts for tape stations, as well as packing tables, we got prototypes first, the intent of this was reflected properly, and the examination after that went smoothly.

How was the completed cart for the tape stanchions?

The cart is mainly used by female staff of airline companies. So, when we showed it to the airline company at the prototype stage to get their opinion, we were impressed that it was very well received and we even got smiles. We are very pleased with the carts now in service. What we, NAA requested was that it be as easy to use as possible for people who are not very strong, to give the cart a small turning radius, and furthermore to finish it compactly while increasing the number of tape stanchions that can be stored in one unit. Since there are two types of tape stanchions used at Narita airport, one which can be stacked and one which cannot be stacked, we asked for proposal for two types of carts with different shapes. We were impressed that they not only included ideas such as ease of use when pushing



A GF cart that is used in the departure lobby (South Wing) of the Terminal 1. It can hold up to 20 stacking style tape stanchions that can store the base part in layers.

the cart but also ideas that we did not notice, such as ease of use when loading tape stanchions and securing safety. We felt like SUS carefully considered everything after listening to our requests, including what our troubles were and what we wanted. As a result, they made a cart that was easy for Japanese people use, quite different from the foreign carts we had referenced at first.

Furthermore, not only were we able to introduce what we really wanted, but by using the SUS aluminum frames and the proposal that combines them, we found that we can realize the needs we had given up on relatively easily, and this awareness also was very fruitful. Today, a positive atmosphere is being created in which we actively tackle tasks that we did not know how to do in the past.



Since the stacking style tape stanchions are slightly inclined by stacking them, a frame for supporting the column is attached, so that it does not collapse even if it shakes.

What do you think about aluminum as a material and SUS products?

There is a rule that the equipment in an airport must be incombustible. Aluminum is a metal, so it can be said that it is a very suitable material in that respect. Also, especially for carts, the light weight was a major benefit.

SUS is a company that has developed products according to the needs of the factory, so it is good to have a wealth of materials such as aluminum frames and parts. We got the impression that items that can satisfy our request are available in a standard product line. After the packing table and the tape stanchion cart, we are also asking of a rail for the wheelchair space, and we think that such flexible support is unique to SUS.

What kind of kaizen can be done in the future?

Airport facilities and services evolve with the times, and we think that this will continue in the future. If the major parts such as facilities like buildings and the whole airport system change, the necessary facilities will also change and we will receive a variety of opinions from our users, so our kaizen will never be over.

What we are thinking now is organizing around check-in counters. Currently various guidance items and fixtures are lined up around the counter, which leaves the impression that there is no sense of unity. From now on, we are going to discuss things

to make this as neat as possible. Although it is still under consideration, we may also consult with SUS following this.

Actually, the other day, when we were giving tours to representatives from another airport, the cart for the tape stanchions caught their eye and they started talking about it, saying they wanted something like that. Since there are many common issues among airports, the equipment we ordered SUS is also appealing to other companies in the same industry. What we were not expecting was that we received an opinion from a prefectural governor who saw the packing table in NAA's publicity magazine and remarked "This is nice." We felt that there are still a lot of users that cannot imagine how to solve their problems despite being in trouble, and latent needs that users themselves have not noticed. We think that we can dig into these needs and give shape to them.



We intend to keep working actively in the future to improve the degree of satisfaction so that customers coming to the airport can use it without stress, and to create an environment where staff of airline companies can work just a bit more efficiently and effortlessly.



By partitioning the garage with a GF fence, it became possible to keep clean the rental wheelchairs which were prone to getting cluttered.



The fence for the wheelchair space uses a hinge connector at the corner, and its specifications enable it to open and expand the space.

For tape stanchions that cannot be stacked, we produced carts with height differences on the table on which the bases of the tape stanchions are placed. By staggering, we can store 10 in 1.

