# PLUS-E

Mold protection device PLUS-E PE-600

USHIO

PLUS-E provides every solution for customers by preventing the trouble of injection molds, and realize total-cost reduction plus high productivity in injection-molding production line.

# Mold protection device

## PLUS-E PE-600

## Uses digital color image processing technology

The PLUS-E tool monitoring device is a compact, lightweight all-in-one device that can effectively prevent tool breakage. The Model PE-600, which has undergone even further advancement, uses the industry's first digital color image processing technology, allowing it to support monitoring and to demonstrate its fullest capabilities in a wider variety of molding applications than ever before.
With a new design based on over 30 years of mold monitoring experience and know-how, the PLUS-E can reliably protect the valuable tools of its users.

### Even faster

The PLUS-E can digitally process and calculate high-definition images with full-color HD resolution (2 million pixels) at the outstanding speed of 0.012 seconds.
It is also compatible with high-cycle molding at 1 second or less, allowing it to support transitions to high-cycle operations.

### Even more accurate

Digital color image analysis technology utilizing RGB makes it possible to accurately identify resin colors that tend to blend in with tools when using monochrome monitoring. While minimizing the effects of ambient light and preventing "momentary stops", it can successfully achieve stable monitoring with a low chance of malfunction.

### Even easier to use

The main unit uses a large, 10.4-inch touch-panel monitor. This larger display can clearly represent recorded HD high-definition images in full color. The interface has also been redesigned to dramatically improve its ease of use when preparing monitoring areas in particular, for intuitive, quick, and highly-detailed area settings.
Support functions such as position correction and filtering to improve monitoring precision have been automated as well, to greatly reduce the time required for advance configuration.


10.4-inch large touch-panel display
Compatible with Digital HD Full Color (1920x1080)

* The screen shown is an inserted image.

# What's PLUS-E

## Benefits of installing tool monitoring devices

### Prevention of tool breakage

By monitoring molding processes with the PLUS-E, residue or ejector pin failures that can lead to tool breakage can be detected, and molding can be stopped or re-ejection can be conducted. This can prevent valuable tools from being damaged or broken.

- Lower tool repair costs
- Reduced delivery delays due to line shutdown

### Improved line cycles

The PLUS-E can monitor residue remaining after ejection of molded products. Under normal operating conditions it will perform functions such as skipping re-ejection procedures intended to prevent residue, which can contribute to improved molding cycles and production efficiency.
Also, its automatic recovery functions can reduce the work load of line managers and can effectively realize unmanned operation.

- Cycle improvements through reduced frequency of ejection
- Reduction of labor and realization of unmanned operation

### Prevention of release of NG products

The PLUS-E can detect short shots or burrs after molding, and if there are any abnormalities it will stop the molding machine.
Advance prevention of the inclusion of NG products with normal products and of their release will lead to greater trust from customers.
The device can also be re-deployed for application in external inspections.

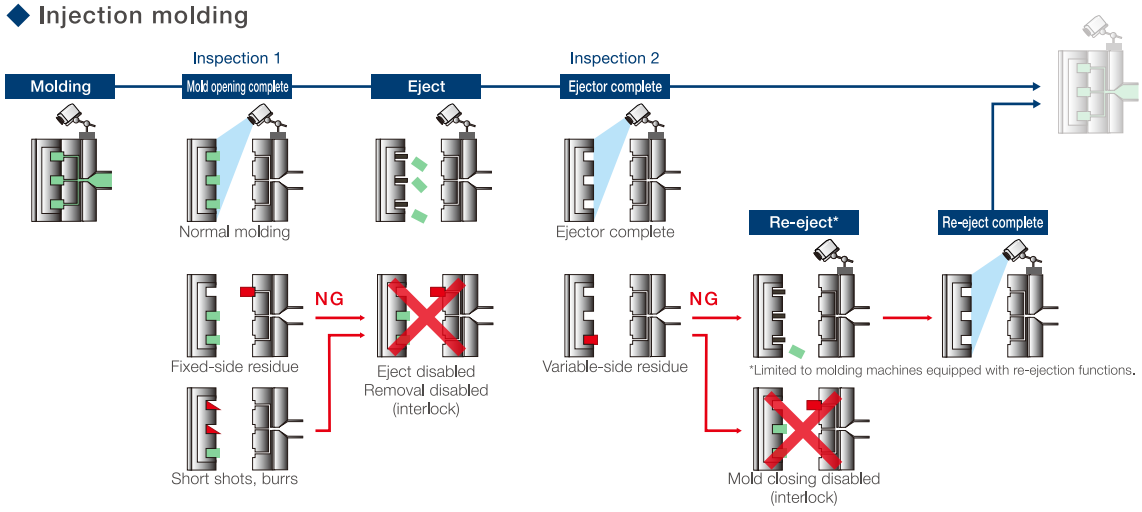
- Able to be applied as an external inspection device*
- Achieves stable quality, which will fulfill demands for reliability

*Inspection may not be possible depending on the shape or size of molded products.

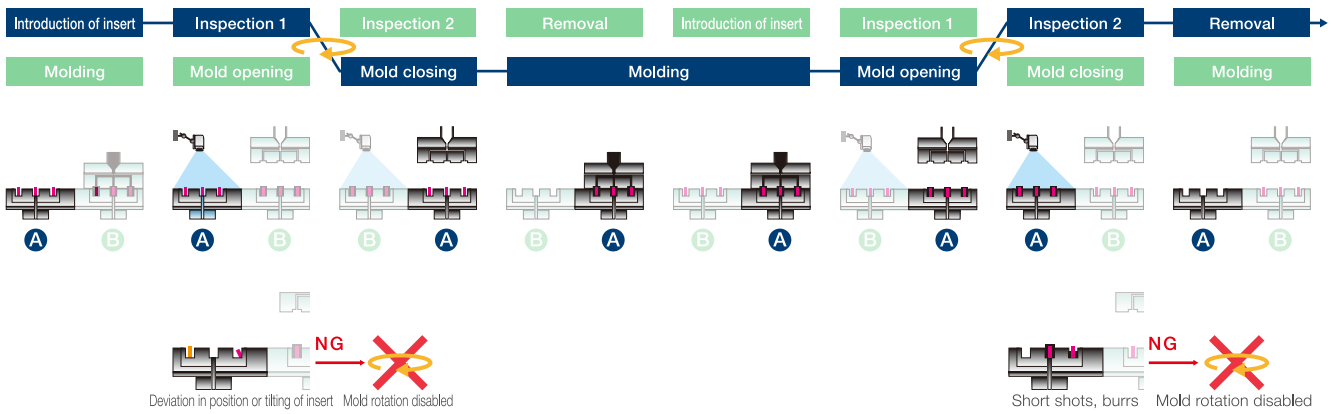
## Monitoring flow on molding lines

The PLUS-E can compare the differences in brightness of all pixels in reference images obtained beforehand during normal molding with those in monitoring images obtained during each molding procedure, to make decisions on their acceptability. Even more stable monitoring can be achieved by considering the impact of factors such as ambient light occurring in production line installation environments and determining allowable error ranges.

### Injection molding




### Vertical insert molding

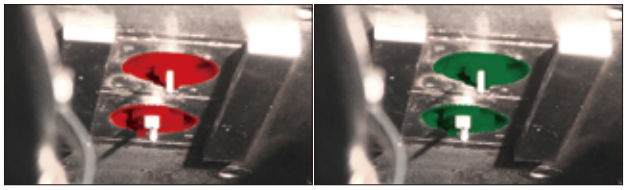



# Accurate Color identification to protect tools.

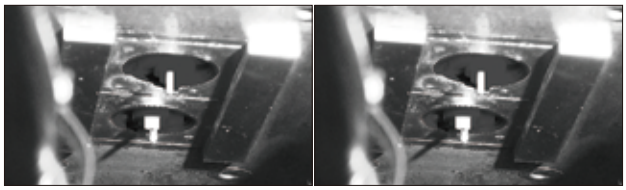
## Differences between color and monochrome monitoring

In conventional, general tool monitoring, monochrome images captured by cameras are compared with each other, and the "brightness" values of each pixel (dot) forming those images are analyzed to determine whether they are the same as or different from each other. Color monitoring with the PE-600, however, allows these judgments to be made based on whether the colors of pixels are identical or not, by analyzing the R (red), G (green), and B (blue) values of each individual pixel.

Molding image captured with color monitoring



Molding image captured with monochrome monitorin



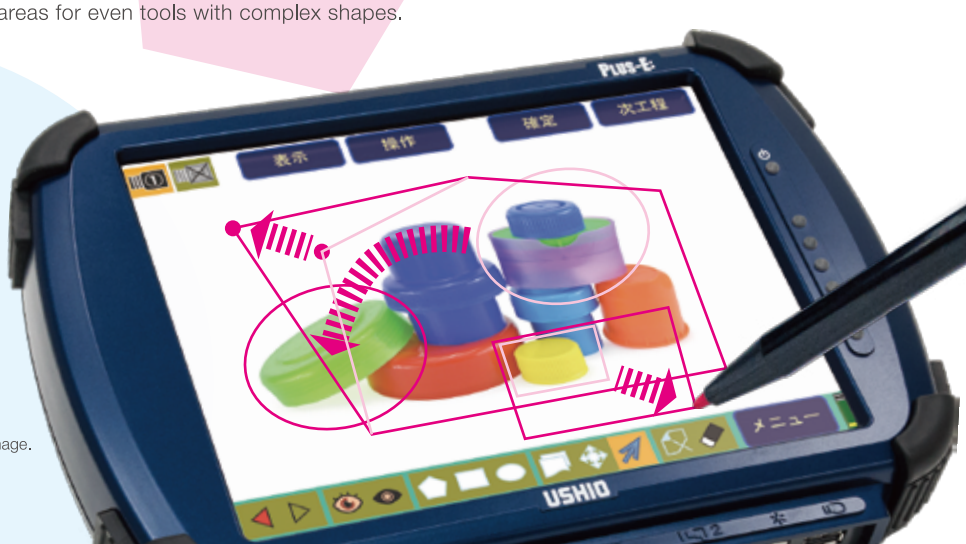
Shown to the right are images of tools after molded products have been completed. To the human eye, it is clear that the molded products have differing colors of red and green, but with monochrome monitoring there are occasions where they cannot be distinguished from each other. This is because the colors in the two examples have the same brightness.
Also, there are often cases encountered like those shown in the lower image where the difference in brightness between the molded product and the tool is very small, making it impossible to accurately identify the entire molded product that must be monitored.
The PE-600 uses color image processing to properly determine differences in color and shape, for more accurate monitoring.

# Intuitively-operated user interface

## Free setting of multiple monitoring areas including round and rectangular shapes

Setting monitoring areas to exclude areas that do not require monitoring is an important part of preventing malfunctions caused by factors such as ambient light, as well as achieving quick and accurate monitoring.
The PE-600 supports the creation of round monitoring areas in addition to conventional polyhedral and rectangular shapes, with intuitive touch pen control that allows area movement and size adjustment, as well as point movement.
This can greatly shorten the time required to set areas for even tools with complex shapes.

Furthermore, the control screen is equipped with icons clearly arranged so that anyone can easily access required functions.




* The screen shown is an inserted image.

# Features

## Basic functions

### Image recording function

If an error is detected, the monitoring images for a period of roughly 5 seconds before and after the error will be recorded, and can be stored if desired. This allows the causes of abnormalities to be investigated quickly, aiding in prompt line restarts.

### Output NG product function

If a molding defect is detected, signals are also sent to traverses and other surrounding equipment, to prevent NG products from being included with normal products.

### Alarm function


When molding operations are stopped due to detection of an error, an alarm is also sounded to notify the line manager.

### lamp variations

With a varied lineup of lamp options, particularly LED lamps, dimming control can be performed from the PLUS-E main unit. Optimal brightness levels can be set easily using functions such as reducing overexposure in video images to match the work environment.

## Functions to enhance monitoring precision

### Free setting of up to 20 areas

Up to 20 areas, including polygonal areas with up to 16 sides as well as round areas, can be set intuitively using a touch panel. With an expanded range of selectable shapes allowing only the areas that require monitoring to be defined accurately, highly reliable monitoring can be performed.

### Compatible with 2-camera monitoring

2 cameras can be used with one unit, allowing support for even more detailed mold monitoring. This can also be applied to monitoring of large tools.

### One-cycle reference image capture


Monitoring reference images are captured for only one cycle, allowing them to be taken easily and quickly.

### Masking function (non-monitored areas)

Areas that do not require monitoring (non-monitored areas) can be set and masked to reduce the size of monitoring areas as much as possible, which can contribute to preventing momentary stops and achieving stable monitoring.

## User support functions

### Adjustment support


The unit is equipped with support functions necessary for stable monitoring such as position correction functions that can permit deviations in mold opening positions, with the additional capability for these functions to be automated.

### Testing functions

After reference images have been captured, testing functions can display the results of monitoring at desired sensitivities as a real-time graphic display. This can shorten the time required for fine adjustments.

## Global standards

### Multi-language support

Standard support for Chinese, English, and Korean is provided, which can be expanded to support other languages as well.

### Global directives and certifications

Oriented toward overseas sales, the unit is compliant with directives and certifications including CE, RoHS*, FCC (CLASS-A), and KC, allowing it to be operated anywhere in the world.

*RoHS is only applicable to Europe.

## Specifications

| Prduct No. | PLUS-E PE-600 |
|---|---|
| Resolution | 1920 x 1080 pixels |
| Comparison processing time | 0.012 seconds |
| Display | 10.4 inch SVGA color LCDs touch panel |
| Synchronic input / output signal | No voltage contact signal |
| Rejection circuit | Standard |
| 2 cameras monitoring function | Standard |
| Input power | DC24V |
| Power consumption | 24W |
| Ambient temperature | 0 ～ 45°C |
| Ambient humidity | Relative humidity 85% max. (without condensation) |
| External dimensions | W298 x H210 x D49 mm (excluding projection portion) |
| Weight | 1.4kg |

## Device configuration

| Standard set | Options |
|---|---|
| Main unit | Various Lens |
| CMOS camera | Various filter |
| I/O unit | LED lighting set with dimmer function |
| Camera cable | Infrared LED lighting set |
| Camera stand | LED lighting set |
| Camera mounting shaft | USB memory |
| Interface cable | Camera stand (L) |
| I/O cable set | |
| Stylus pen (with mounting code) | |


Main unit (PLUS-E PE-600)


Lens (wide / zoom)


CMOS camera


lighting fixture
(lamp is excluded )

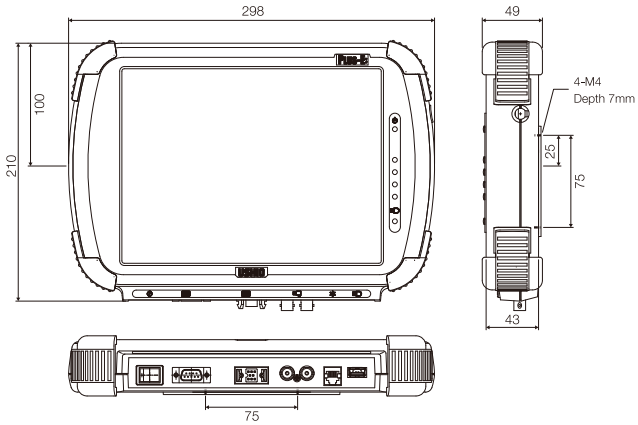

LED lamp


Halogen lamp


IR lamp


I/O unit

## Dimensions (mm)





Connecting example for standard set

### Safety precautions

Before operating or carrying out any work involving this equipment, be sure to read the instruction manual to understand the product description, its operation, and safety requirements.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