New Value for Control Panels

OMRON

Control Panel Basics Volume 3

Terminals

UL
Certifi-
cations

Value+^plus

Electrical
control
CAD

Tempera-
ture
Controllers

realizing

Value $+^{plus}$
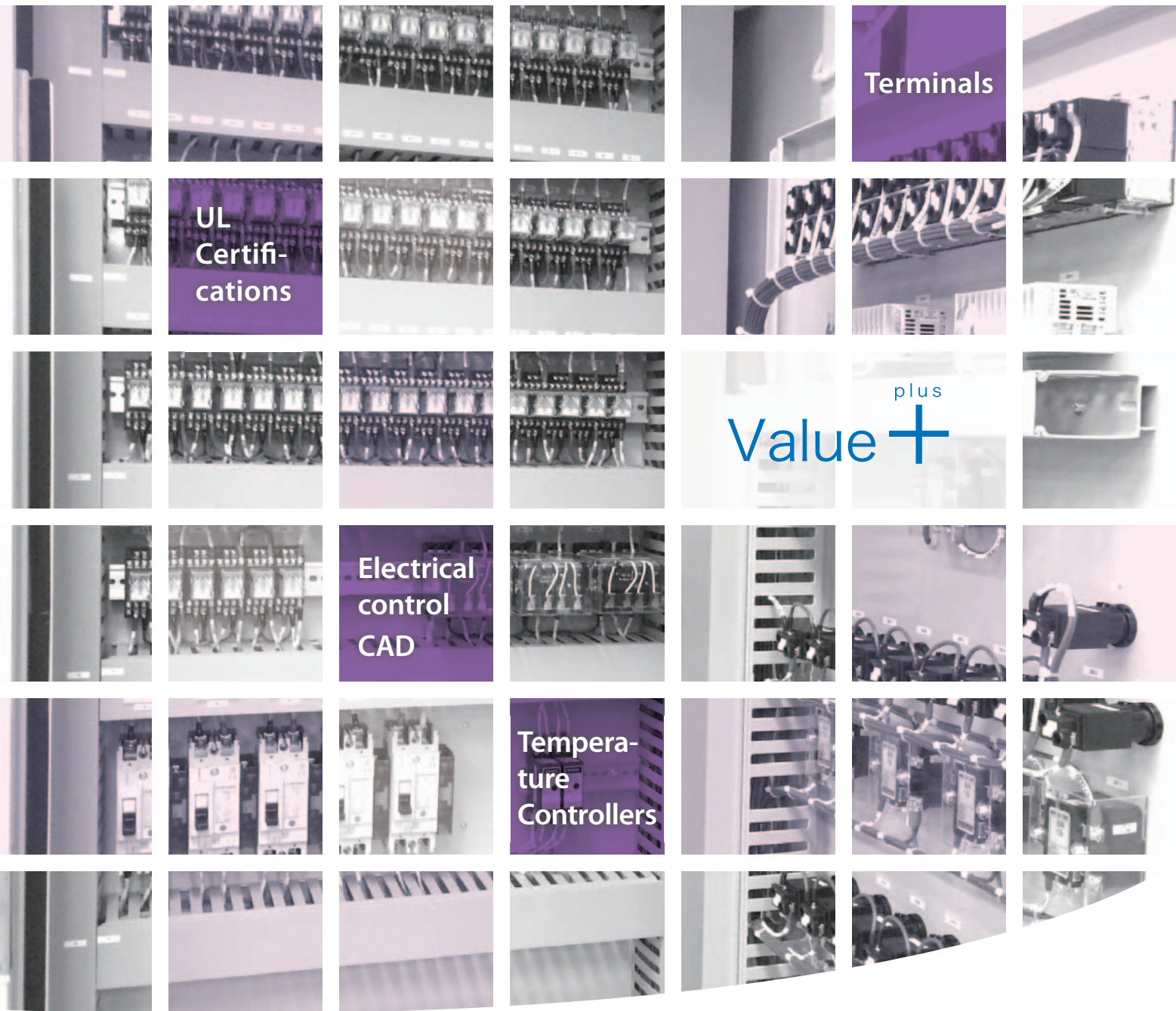
Basic Information on Control Panel Design

Changes in the market require handling a wide variety of control panel issues.
Control Panel Basics describes OMRON's wealth of know-how and information and provides easy-to-understand descriptions of the knowledge required to solve these issues through concrete examples.

In volume 3, we provide know-how on Control Panel Design, from Information on UL Certifications, to Differences in Terminals, Display Visibility, and Temperature Controller Applications.

Control Panel Basics | Volume 3
CONTENTS

Types of UL Certification

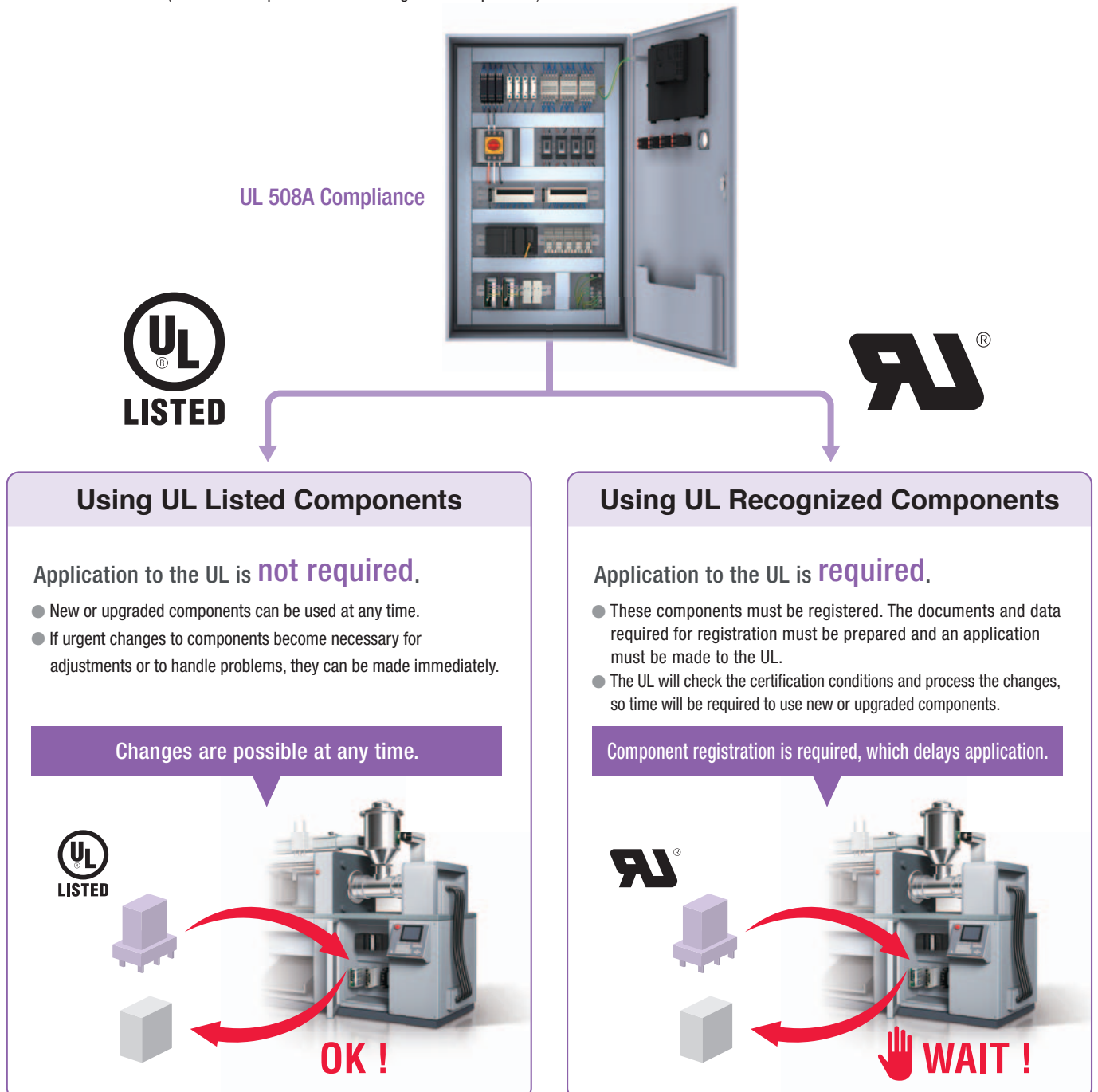## There are UL Listing and UL Component Recognition for UL certification.

UL certification is required for control panels used in the USA.
Here we describe the difference between certification as a UL listed component (listing) and certification for a UL recognized component (R/C).

Actions Required for New or Revised Components Used in Control Panels for the USA

Industrial control panels used in the USA are required to comply with UL508A.
Of the components used in control panels that comply with UL 508A, there are differences in the requirements depending
on the UL certification (UL listed components or UL recognized components).

UL 508A Compliance

Using UL Listed Components

Application to the UL is not required.

● New or upgraded components can be used at any time.
● If urgent changes to components become necessary for
  adjustments or to handle problems, they can be made immediately.

Changes are possible at any time.

OK !

Using UL Recognized Components

Application to the UL is required.

● These components must be registered. The documents and data
  required for registration must be prepared and an application
  must be made to the UL.
● The UL will check the certification conditions and process the changes,
  so time will be required to use new or upgraded components.

Component registration is required, which delays application.

WAIT !

There are also differences based on whether the component is directly connected to devices or equipement outside of the control panel.

Example in Final Installation Site of Control Panel

Using UL Listed Components

Wiring is allowed.

Device/ Equipment

Using UL Recognized Components

Wiring is not allowed.

Device/ Equipment
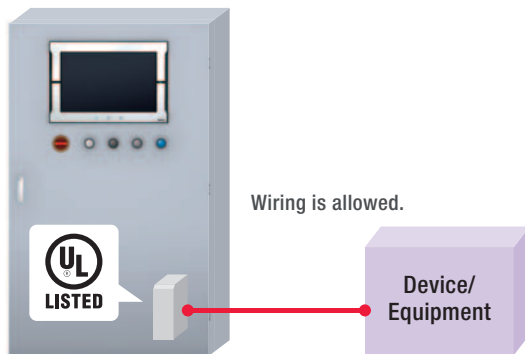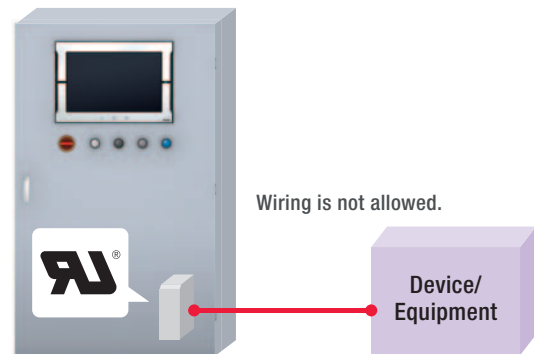
Note: There are some exceptions.

Point !   For People Who Want to Know More

UL Listing

● In general, this certification applies to end products that are operated by general users, such as machine tools, robots, and other equipment that are directly controlled by an operator.

● Because it is assumed that the equipment will be used by an operator or a general user, there are many restrictions and evaluation tests for designs and configuration components.

UL Component Recognition

● This certification applies to components that are built into end products that do not function by themselves or have limited functionality (molded products, wires, PWB, and general-purpose Automation Systems).

● Components for which UL Listing is not required fall under UL Component Recognition.

Recommended UL Listed Components

Reliable and Easy Operation- Worldwide Power Supply Resistant in tough environments Easy and fast installation The most compact class on the market

Switch Mode Power Supplies (15-W, 30-W, 60-W, 120-W, 240-W, and 480-W models)

S8VK-G

Search for "OMRON S8VK-G" for details.

Worldwide 3-phase Power Supply Resistant in tough environments Easy and fast installation The most compact class on the market

Switch Mode Power Supplies (120-W, 240-W, 480-W, and 960-W models)

S8VK-T

Search for "OMRON S8VK-T" for details.

Contribute to build high reliable systems Compact and Cost-effective solution for Back-up applications Easy setup for system reliability requirement

Redundancy Units

S8VK-R

Search for "OMRON S8VK-R" for details.

Control Panel Efficiency Starts with the Terminals

Change from Tightening Screws to Inserting Wires
You Can Increase Production Efficiency by Rethinking Wiring Work

Wiring Work

Wiring work is essential to manufacturing control panels, and it accounts for the majority of the lead time for control panel manufacturing.
Therefore, if you can make wiring work easier and faster, you can dramatically shorten the manufacturing lead time for control panels.
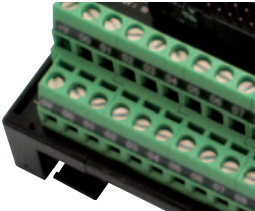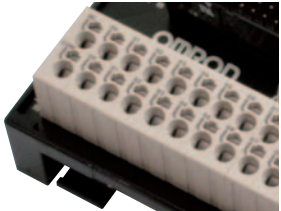
Current Issues

Normally when people hear about wire connection methods, many of them tend to think about securing wires by tightening screws.
And in reality, many of the control devices used in control panels use screw terminals, and such devices have become common.
Also, screw terminals have a long track record, are the method most recognized by customers, and are therefore considered reliable.
However, screw terminals require that you loosen the screw, attach the wire (crimp terminal), and then tighten the screw, which is a lot of work.

New Screwless Connections

Screwless connections, which have recently become common in Europe, eliminate the need to tighten screws to dramatically reduce the work required for wiring and they are gradually becoming popular in control panels around the world.
The work of loosening and tightening screws has been replaced by merely inserting wires to complete wiring work, greatly reducing work time.
First you need to learn about screwless connections and then experience how efficient this method is.

Terminal Connection Methods

Type	Screws		Screwless	
	Phillips screws	Slotted screws	Clamps	Push-in
Securing method	Screws		Springs	
Terminals				
Crimp terminals	Forked terminal Round terminal	Round pin terminal Square pin terminal	Ferrules Note: Bare wires are also possible.	
Recommended products	Common Sockets PYF (Socket for MY) Connector-Terminal Block Conversion Units XW2R Series	Connector-Terminal Block Conversion Units XW2R Series	Screwless Clamp Terminal Sockets PYF□□S and P2RF-□□-S (Sockets for MY and G2R)	Connector-Terminal Block Conversion Units XW2R Series I/O Relays G2RV/G3RV

Push-in Terminals

Push-in terminals are one type of screwless terminal. Wiring is completed simply by inserting a wire with a crimped ferrule.
The strength of a spring presses the ferrule against the terminal wall to connect the wire.

Mechanism
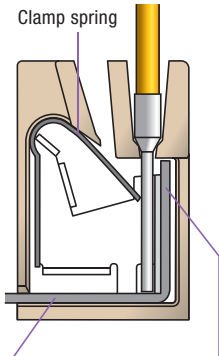
Clamp spring

Conductive fitting

The pressure of the clamp spring holds the ferrule securely.

No Retightening Work

Note: Test conditions: IEC 60947-7-1

Differences in Wiring Work

		Wiring			
		(1) Loosen the screw.	(2) Remove the screw.	(3) Attach the terminal.	(4) Tighten the screw.
Screw terminals	Round terminals	27 s *			
	Forked terminals	7 s *	Not necessary		
Push-in terminals	Ferrules				Insert.
		2 s *			
		Not necessary	Not necessary	Not necessary	

* Based on OMRON demonstration test results.

Display Innovations for On-panel Devices

Increase Visibility by Using White Characters on Black Backgrounds

Control panels always include control amounts (e.g., temperatures or pressures).
The control amounts are important parameters that affect workpiece quality, and displays of the control amounts are generally provided on the fronts of control panels.
Although touch panels are becoming popular display methods for high-end models, the cost involved results in many control panels using controllers with displays.

Control panels are installed in various lighting environments, from well-lit to dimly-lit locations. You need on-panel devices with good visibility.
The visibility of displays increases with the difference in the brightness of the colors used, so displays with a large difference in color brightness are easily recognized from a distance or in bright or dark locations.
If the background is black, white offers the largest difference in brightness, but the chromatic color yellow draws attention better.

Visibility of Various Colors on Black
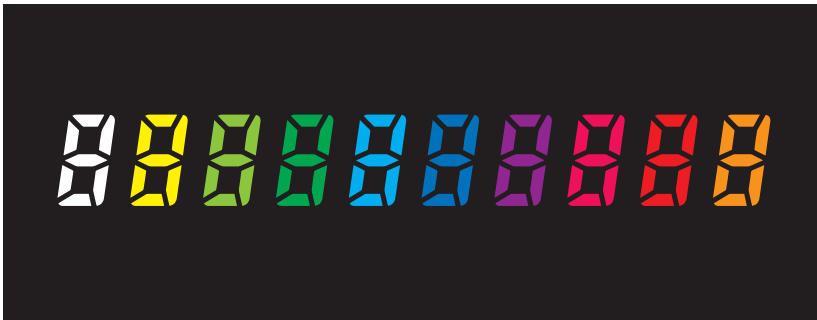
Example: White characters on a black background are used in many types of locations.

Creating Panels with a Good Sense of Design and Good Visibility

By incorporating large display devices with white or yellow characters on a black background into panels, not only is visibility improved, but also panels with a high sense of design are made possible.
Also, control panels are not always viewed from directly in front of them, so viewing angles are also important.
Consider the visibility from an angle when you select components.

The display remains easy to read even from wide viewing angles.

Recommended Controllers with Displays

- Large, white PV displays that are easy to read and provide better visibility.
- Easy to use from model selection to setup and operation.
- A complete range of I/O capacities, functions, and performance.
- Handles more applications.

Digital Temperature Contollers
E5□C Series

Search for "OMRON E5_C" for details.

Control Panel Column

A knowledge of Temperature Controller functions will increase design possibility.

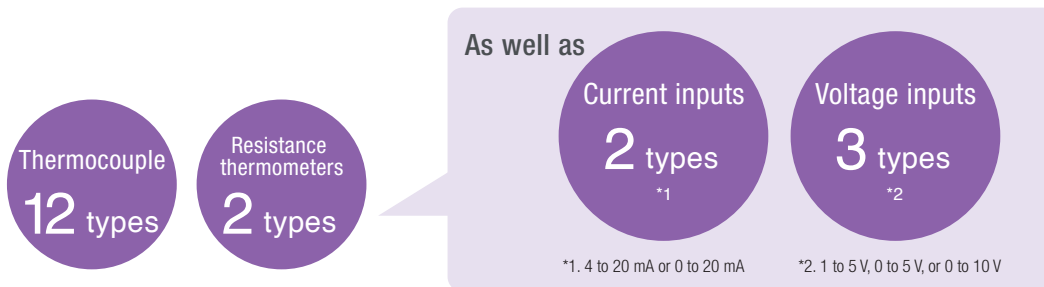Temperature Controllers are mainly used for heating control of heaters.
The target temperature is set, the manipulated variable is calculated from the difference between the target temperature and the process temperature, and then the manipulated variable is output to turn the heater ON and OFF to control the temperature.
However, Temperature Controllers can be used to control more than just temperatures.

Non-temperature Control Applications

Applications for Flow Rate Control and Pressure Control

You can switch a Temperature Controller from a temperature sensor input to a current or voltage input.

As well as

Thermocouple
12 types

Resistance thermometers
2 types

Current inputs
2 types
*1

Voltage inputs
3 types
*2

*1. 4 to 20 mA or 0 to 20 mA   *2. 1 to 5 V, 0 to 5 V, or 0 to 10 V

Applications as Simple Display Devices and Alarms

For example, if a request is made for the installation of a display device after the panel has been completed or if monitoring is required without any control functions, a Temperature Controller can be used as a display device or an alarm.

Display device

Alarm

Applications for Control and Signal Conversion

Some Temperature Controllers have a transfer output for 4 to 20 mA or 1 to 5 V.
For example, you could convert a 1 to 5-V analog input to a 4 to 20-mA output to serve as a signal converter for another device.

Pressure Sensor

1 to 5 V

4 to 20 mA

Temperature Controller
with Transfer Output

Recorder

OMRON

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