# Line & Contrast Guiding Systems

Documentation

Line and contrast guiding aligns the web based on a printed line, pattern, or contrasting feature rather than the physical material edge. This is critical for printing, slitting, and die-cutting applications where the process must register to the image, regardless of how the material was wound or cut. Unlike conventional sensors, Roll-2-Roll® Sensors can be used for both edge guiding as well as line/contrast guiding withthout the need for specialized camera based systems. Additionally, the Roll-2-Roll® Sensors also have the advantage of wide sensor range that can track intermittent lines and variable patterns without the "tunnel vision" of traditional spot sensors.

## The Challenge: Why Edge Guiding Isn't Enough

The primary limitation of edge guiding in converting applications is that it assumes the physical edge of the material is perfectly aligned with the value-added features (like print or coating) on the web. In reality, this is rarely the case.

- **The Disconnect Between Edge and Image** In processes like printing and coating, the pattern applied to the web may not always be at a constant distance from the physical edge of the material on every roll. Upstream processes, such as slitting or winding, often introduce variations. If a web guide is set to track the physical edge, it will faithfully keep that edge straight. However, if the printed/coated image "wanders" relative to that edge, the web guide will essentially lock in the error, causing the print to drift laterally into the wrong position for downstream processes.
- **Inability to Correct Process Defects** Edge guiding ignores the actual content of the web. It blindly positions the material based on the physical border. Consequently, if the upstream printing process had slight lateral movement, or if the master roll was slit with slight "camber" (curvature), edge guiding cannot compensate for the position of the artwork. This leads to misalignment in critical finishing steps like die-cutting, coating, or slitting, where the tool must align with the print, not the material edge,.

## The Solution: Line and Contrast Guiding

Line and contrast guiding solve this problem by ignoring the physical edge of the material entirely and tracking the specific feature that matters to the process.

- **Feature-Based Registration** Instead of sensing the material's border, line guiding uses an optical sensor or camera to lock onto a printed line, a specific pattern, or a contrasting edge (such as a coating or UV feature). By tracking the feature itself, the system ensures that the downstream tool (e.g., a slitter blade or rotary die) stays perfectly registered to the image, regardless of how the physical web edge wanders or varies.
- **Independence from Edge Quality** Contrast guiding is the only method to achieve registration based on surface features. This approach makes the process immune to physical edge defects. Whether the web has "fuzzy" edges (common in nonwovens), serrated edges from poor slitting, or varying widths, the guide maintains alignment based on the stable printed or coated feature.

Summary of Advantages

| Feature | Edge Guiding | Line/Contrast Guiding |
|---|---|---|
| **Reference Point** | Physical material edge | Printed line, pattern, or coating edge |
| **Primary Risk** | **Print Misalignment:** If the print drifts relative to the edge, the process fails. | **None:** The process aligns directly to the print. |
| **Best Application** | General transport, rewinding, simple conveyance. | Printing, slitting, die-cutting, and coating registration. |
| **Edge Sensitivity** | High (affected by rough/fuzzy edges). | Zero (ignores physical edge defects). |

## Roll-2-Roll® Sensor Advantage

- **One sensor for line/contrast and Edge:** Since our sensor is camera based, the same sensor can be used for both line/contrast and edge guiding. The sensor installation might be different for either case but it is also possible to use the same sensor at the same location for both edge and line/contrast guiding for majority of cases.
- **Never Lose the Line:** Because our sensor sees a wide area (e.g., 48mm to 960mm), the line can wander significantly without leaving the sensor's view. If the line moves, we track it; we don't "hunt" for it.
- **Loss of Contrast Logic:** Our controllers feature intelligent logic for intermittent lines. If the line disappears (e.g., a die-cut gap), the system detects a "Loss of Contrast" condition and automatically locks the guide in position until the pattern returns.
- **Feature Agnostic:** We guide on printed lines, coating edges, negative space (white gaps), UV fluorescence, or even structural ridges on extruded plastics.

## Engineering Guide: Critical Installation Rules

Unlike edge guiding, line guiding requires specific mechanical setups to maintain optical focus. Follow these rules to prevent performance issues:

### The "Dead Bar" Requirement (Stabilizing the Web)

To prevent the sensor from losing focus during guide movement (pass line variation), you **must** stabilize the web plane at the sensor location,.

- **Install a Backup:** Place a **Dead Bar** (stationary) or **Idler Roller** immediately at the sensor location.
- **Mounting:** Mount the sensor to look directly at the web while it is wrapped over this stabilizer.
- **Wrap Angle Limits:**
  - **Dead Bar:** Maximum **5° wrap** (to minimize drag/steering influence).
  - **Idler Roller:** Maximum **15° wrap**.

### Terminal Guide Considerations

- **Unwind Stand:** The sensor must be **fixed to the machine frame** (floor). You must use a *shifting idler* that moves with the stand to keep the web plane constant relative to the fixed sensor.
- **Rewind Stand:** The sensor must be **attached to the moving rewind carriage** (chasing the web). A fixed idler must be placed immediately upstream to stabilize the web for the sensor,.

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## Pros & Cons of Line Guiding

| Feature | Pros | Cons |
|---|---|---|
| **Alignment** | **Highest:** Aligns process to the value-added print/feature. | Requires high-contrast features to function reliably. |
| **Stability** | **Loss of Contrast logic** prevents crashing during print gaps. | More complex setup than edge guiding (requires "teaching" the contrast). |
| **Cost** | Prevents expensive waste in downstream converting. | Sensors are typically more expensive than simple edge sensors. However, the Roll-2-Roll® Sensor is the same for edge and line/contrast. |

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## System Configurations (Select Your Kit)

Standard Line Guide Kit

*Best for: Slitting, Printing, and Converting lines.*

- **Sensor:** Roll-2-Roll® Sensors (Wide sensing range ensures line is never lost).
- **Light Source:** White LED (Standard) or UV (for special coatings/invisible contrasts) or IR (for both edge and line/contrast with high contrast difference).
- **Controller:** Roll-2-Roll® Controllers with "Teach" function for contrast recognition.
- **Actuator:** Roll-2-Roll® Actuator based on thrust requirement

### Retrofit option

- **Compatibility:** Replaces many legacy line-guide sensors, including some Fife and AccuWeb models. Adapter kits are available for some models; contact us for compatibility.
- **Benefit:** Upgrade from narrow-view sensors to wide-area track-and-trace. Eliminate the need for motorized sensor positioners in many cases.

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## ROI & Results

- **Protect Value-Added Material.** Line guiding is typically used late in the production process (after printing/coating), where the material is most valuable.
- **Eliminate Re-work:** Ensure die cuts align perfectly with print.
- **Reduce Setup Time:** Wide sensors mean operators don't have to manually "find the line" with a micrometer during changeovers.
- **Material Savings:** Run closer to the print edge, reducing trim waste width.

## Technical Specifications

### Sensor Specifications for Line/Contrast Guiding

| Specification | ODC Family | 1DC Series |
|---|---|---|
| **Sensing Range Options** | 48 to 960 mm | 96 to 960 mm |
| **Hardware Resolution** | 0.0635 mm (0.0025 in) | 0.0635 mm (0.0025 in) |
| **Repeatability** | ±0.127 mm (±0.005 in) | ±0.127 mm (±0.005 in) |
| **Minimum Line Width** | 2 mm (0.08 in) | 2 mm (0.08 in) |
| **Response Time** | 20 ms standard | 20 ms standard |
| **Light Source Options** | Infrared, White Light, UV | Infrared, White Light, UV |
| **Controller Required** | Yes (SCU5 or SCU6x) | No (built-in) |

### Light Source Selection Guide

| Light Source | Wavelength | Best For |
|---|---|---|
| **Infrared (IR)** | 880 nm | High-contrast printed lines, most edge and line guiding applications |
| **White Light** | Warm white | Visible color contrasts, low-contrast patterns, label printing |
| **Ultraviolet (UV)** | 385 nm | UV-fluorescent inks, security printing, invisible registration marks |

**Key Insight:** For most high-contrast applications, the same infrared sensor that performs edge guiding also handles line and contrast guiding—no separate sensors required.

## The Roll-2-Roll Technologies Difference: Why Our Approach is Simpler

Traditional line/contrast sensors require:

- **Separate sensors** for edge versus line guiding
- **Motorized positioning** to physically move the sensor to find the line
- **Expensive camera systems** for pattern recognition
- **Constant adjustment** when switching between materials

Roll-2-Roll® Sensors deliver a fundamentally different approach:

| Traditional Approach | Roll-2-Roll Technologies Approach |
|---|---|
| Separate edge sensor + line sensor | **One sensor** handles edge, line, AND contrast guiding |
| Motorized sensor head to find line | **Wide sensing range (48–960 mm)** sees the entire area—no movement needed |
| Camera system for pattern detection | **Fiber-optic spatial filtering** detects patterns at sensor simplicity |
| Recalibration per material type | **Material-agnostic**—works on foils, films, paper without adjustment |
| Sensor "crashes" when line disappears | **Loss of Contrast Logic** holds position until feature returns |

**Result:** Significantly lower system cost, faster changeovers, and crash-free operation.