

Splitting 2D Codes: A Smart Emerging Strategy for 2D Migration

Tuttlingen (Germany), Februar 11, 2026 – 2D codes are top of mind for virtually every company in the packaging industry – including LEIBINGER, a manufacturer of industrial marking systems. In the LEIBINGER 2D Codes article series, fresh angles and practical ideas can be explored, and this piece introduces an emerging concept designed to spark discussion and open exchange.

As manufacturers transition from 1D barcodes to GS1 2D codes, space on packaging and production line flexibility are becoming critical challenges. While the instinct is often to squeeze all data into a single complex code, a smarter, more innovative approach is emerging: splitting the code.

By dividing the data between a pre-printed fixed code and an in-line variable code, manufacturers can achieve the perfect balance of compliance, marketing reach, and production efficiency.



Image Caption: These examples, printed with original LEIBINGER CIJ coders, show how the splitting into two codes could look – one containing fixed data and the other containing variable data.

The Concept: Fixed vs. Variable

The strategy is simple but powerful. Instead of printing one massive 2D code containing every piece of data (GTIN, URL, Batch, Expiry, Weight, etc.) in real-time, you split the load:

1. **The Anchor (Pre-Printed):** A high-quality code containing all fixed data, such as the Global Trade Item Number (GTIN) and the GS1 Digital Link (URL). This is integrated into the packaging artwork. The associated syntax will be similar to the one below:

`https://id.yourbrand.com/01/<GTIN14>`

2. **The Variable (In-Line):** A smaller, dynamic code printed during production containing only the variable data, such as Best Before Date (17) and Batch/Lot Number (10). The associated syntax will be similar to the one below:

`(10)<LOT> (17)<YYMMDD>`

Modern vision systems and scanners are designed to read multiple codes within a defined field of view and seamlessly combine them into a single data set.

For this, multi-code settings are configured on the scanning systems; however, especially at the POS, whether and how both codes are actually captured in a single scan and processed correctly depends on the specific scanner model, configuration, and POS software, and should therefore be validated in the target setup.

In digital formats, the video "Splitting 2D Codes.mp4" can be inserted here to illustrate the concept for the reader.

Visualizing the Standard: The 100 mm diameter Association Zone

To ensure that scanners and smartphones recognize the two codes as "one product," they must be placed in close proximity. According to GS1 standards for associated marks, both symbols should fall within a specific field of view to be captured in a single scan. Below is the ideal implementation of this concept.

Example: The Hybrid "Association"

Pre-Printed QR Code + In-Line GS1 DataMatrix

This is the optimal setup for TCO (Total Cost of Ownership). The pre-printed QR code handles consumer engagement (web access), while the variable data is handled by a compact, ink-efficient GS1 DataMatrix. Such a combination is shown by Figure 1 A.

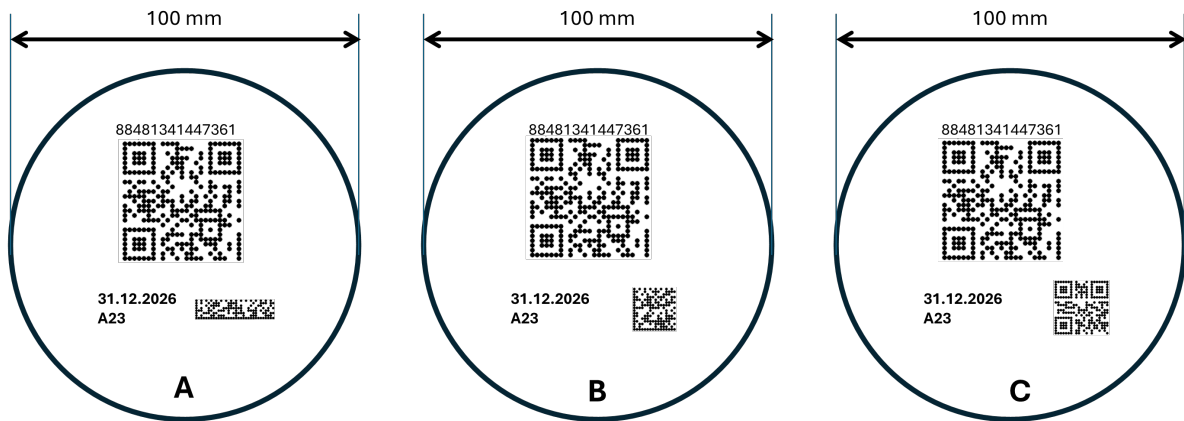


Image caption: Figure 1

Figure 1 shows 3 different executions where we can see the **inside of a Circle of 100 mm diameter:**

1. **Top/Center:** A standard **QR Code** (Pre-printed).
 - *Data Content:* <https://legr.ai/8848134144736> (GTIN + Link).
2. **Bottom/Center:** A **GS1 2D code** (Printed In-line).
 - *Data Content:* (10)A23 (17)261231 (Expiry: 31 Dec 2026, Batch: A23).

Figure 1 shows three examples of execution with different 2 codes configurations to code the same content:

- Figure 1 (A) shows a **rectangular data matrix 8x36= 312 cells** in total with **151 black cells**
- Figure 1 (B) shows a **square data matrix 16x16= 256 cells** in total with **133 black cells**
- Figure 1 (C) shows a **square QR code 21x21 = 441 cells** in total with **234 black cells**

All these three codes are readable by modern scanners and smart phones including the rectangular datamatrix format.

As a comparison, the fixed data included in **the top QR code is encoded in a 25x25 QR code**, which contains **625 cells in total**, of which **308 are black cells**.

If we intend to include **both variable and fixed data in a single QR code**, we would need a **33×33 QR code with 1,089 cells**, of which approximately **600 would be black** cells.

We can therefore conclude that using a dedicated code to represent the variable data requires **20% to 40% fewer resources** compared to embedding both variable and non-variable data into one full QR code.

This represents a significant cost-saving opportunity and broadens the range of technologies available for encoding variable data directly on the production line.

Why this combination works

- **Compliance:** By keeping both codes within the 100 mm zone, you ensure that handheld scanners and fixed industrial readers can capture both data strings simultaneously. Mode 3 should be capable of delivering all barcodes using GS1 syntaxes. With appropriate tuning of the ERP/host retail systems, the received data sets can be properly used.
- **Efficiency:** The DataMatrix takes up significantly less space than a second QR code, allowing it to fit easily into the "white space" next to the pre-printed artwork without cluttering the design. DataMatrix requires also less ink to be printed as the number of associated cells is significantly lower than the number of cells needed for an equivalent QR code.

Technical Advantages

Optimized Printing

By offloading the complex, fixed data (like long URLs) to the pre-printing stage, the coding system on the production line only needs to print a small string of characters (Date/Batch). This simplifies the print job, allowing for faster processing and higher throughput. In term of speed difference, the change is simply impressive using CIJ technology, **Configuration A could be printed 3 times faster than configuration C**. The difference becomes much higher if we intended to print one single QR code including all the information mentioned above.

Improved Readability

Smaller individual codes are easier to print with high precision than one large, dense code. Splitting the data reduces the risk of "dot placement errors" that can make a large 2D code unreadable, lowering rejection rates.

Space Efficiency

Packaging real estate is valuable. By using the "split" method, you can fit the variable code into small open spaces on the label, provided it stays within the association zone of the fixed code.

Process and Organizational Benefits

Reduced Line Downtime

Complexity is the enemy of uptime. Printing less data in real-time means the printer operates with greater margin for error and speed.

Simplified Artwork Management

Marketing teams can finalize the fixed QR code (linking to the brand website) early in the design phase. The production team does not need to alter the artwork. When batch logic or date formats change, those are handled entirely by the printer settings.

Lower TCO

Choosing a **GS1 DataMatrix** for the variable split significantly lowers TCO. It minimizes ink consumption per product compared to a similar QR code, while maintaining full supply chain compliance.

Systemic Considerations

Scanner Compatibility

Modern GS1-compliant scanners and vision systems utilize "Image Association." They capture the designated area, recognize multiple codes, and merge the data (GTIN + Batch + Date) into a single event automatically.

Future-Proofing

This approach supports GS1 Digital Link and serialization efforts without requiring a complete packaging redesign every time a regulatory requirement shifts.

Already applied in the market

The smart concept described in the article is already being implemented in the market by early adopters of GS1 standards and 2D-code-based traceability systems. As illustrated in Figure 2, a cheese package commercialized in the French retail chain *Grand Frais* integrates two identification carriers: a pre-printed QR code applied during the packaging production process (top) and a variable, inline-printed QR code generated during the final packing stage (bottom).



Image Caption: Practical implementation on a French cheese package: two codes jointly carry the data (Figure 2)

The LEIBINGER Perspective: Precision Meets Efficiency

Implementing a split-code strategy requires a variable coding solution that is as reliable as the pre-printed packaging. This is where the **LEIBINGER IQJET** excels.

Why IQJET is the ideal partner for Split Coding:

1. **Best-in-Class TCO:** The IQJET is designed for "Plug & Print" efficiency. When combined with the ink-saving nature of the GS1 DataMatrix, it offers one of the lowest operating costs in the market.
2. **Automatic Nozzle Sealing Technology:** The variable code (Batch/Date) is critical for compliance; if the printer fails, the product cannot ship. LEIBINGER's unique automatic nozzle sealing system prevents ink from drying out during production breaks. This ensures that the first code printed after a stop is just as sharp as the last, with zero cleaning required.
3. **High-Speed Precision:** Whether you choose DataMatrix or QR for your variable segment, LEIBINGER printers deliver high-contrast, precise placement even at maximum line speeds, ensuring the code is always readable within the 100 mm zone.

Conclusion

Splitting GS1 2D codes into fixed and variable parts is not just a workaround for limited space. It is a strategic advantage. It allows manufacturers to



leverage the marketing power of pre-printed QR codes while maintaining the industrial efficiency of in-line DataMatrix printing.

With this approach, you gain compliance, speed, and scalability. And with technology like the **LEIBINGER IQJET**, implementing this smart strategy is easier and more reliable than ever.

Are you ready to optimize your GS1 migration strategy? All previously published articles in the series are available on leibinger-group.com.

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About Paul Leibinger GmbH & Co. KG (LEIBINGER)

LEIBINGER is a global specialist in coding & marking systems with its headquarters in Tuttlingen (Baden-Württemberg), Germany. This third-generation family-run company founded in 1948 employs a payroll staff of around 350 employees. Its primary focus is on the development and production of industrial inkjet printers and inks for use in the marking and coding of products. The solutions created by LEIBINGER are defined by their high quality standards and their innovative technologies. As the inventor of a ground-breaking nozzle sealing technology that makes ink-based marking and coding systems significantly less susceptible to contamination, now with tens of thousands of installations worldwide, LEIBINGER is able to assure higher productivity in the production of food and industrially manufactured products. Through its subsidiaries in the USA and China and its global network of around 150 distribution partners, LEIBINGER is able to maintain a close relationship with its customers right around the world.