



G+D  
Currency Technology

# SensorFusion® and SensorBrain®

Step into the future of precise and  
intelligent banknote processing



# Making sensors intelligent

As a thought leader, G+D is committed to developing sensor technology that meets the constantly growing requirements of cash processing operations – as it has done for more than 50 years

Sensors enable us to perceive the world by converting physical information into digital data. Since the early 1970s, G+D has been transforming banknotes' physical characteristics into digital information and as such paving the way towards precise and fully automated banknote processing.

## SETTING A NEW TECHNOLOGICAL BENCHMARK

As there is now more cash in circulation globally than ever before, technological developments remain crucial to meeting the constantly growing banknote processing requirements. As new advancements drive the complexity of banknote design and counterfeit efforts become more sophisticated, the technical expectations of automated cash handling systems are being raised. When addressing these developments, central banks, commercial banks, cash-in-transit companies, and printing works must balance the need for precise, future-proof cash processing systems with business pressures, such as cost effectiveness.

Sensor technology presents a powerful opportunity to address these issues. Representing the latest benchmark of technological achievement, G+D's sophisticated new SensorFusion algorithms and SensorBrain computing technology help to increase business effectiveness and optimize the cost-of-cash, while also opening the door to future possibilities.

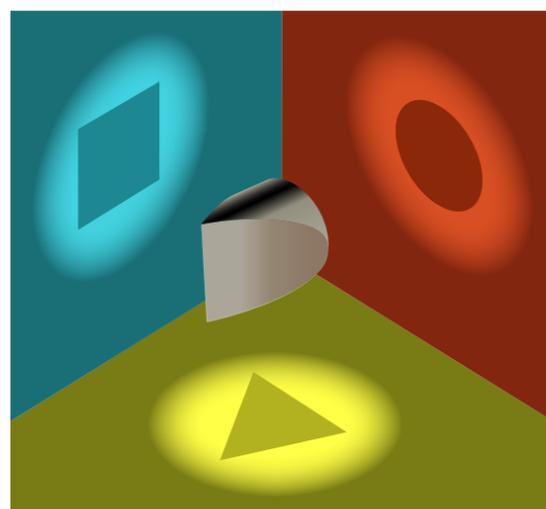
## G+D'S COMMITMENT TO ADVANCING SENSOR TECHNOLOGY

G+D is a world leader in the development of systems known for reliable detection of banknotes. The Nota-Scan models – Image, UV, Mag, and Profile – as well as NotaMaster Image are examples of G+D's sophisticated high-performance sensor systems. Moreover, G+D's BPS M and BPS X systems can detect more than 400 properties on each banknote, in all four physical orientations within a single run.

SensorBrain and SensorFusion continue G+D's tradition of technological leadership, by not only increasing the accuracy of banknote processing, but also taking a monumental step in scalable future-proof solutions and setting the benchmark for precision within the industry.

## MEETING NEW REQUIREMENTS FOR SENSOR DATA ANALYSIS

Best-in-class banknote processing requires greater computational power and more intelligent algorithms. Furthermore, as digitalization accelerates the speed of change, any new system must not only deliver unrivalled precision in fitness classification and counterfeit detection, but also keep up with continuous technological development.



Each of the shadows represents a true depiction. But only by combining all three will you perceive the full truth. The same applies to SensorFusion

“We developed SensorFusion and SensorBrain to meet our customers' expectations and needs, and to deliver higher business effectiveness to banknote processing. This has truly become the next step in sensor technology and it opens the door to a world of new possibilities.”

**Michael Khomut**, Manager Business Development, G+D Currency Technology



SensorFusion and SensorBrain will accelerate the precision of BPS M3, M5, M7, and BPS X9 machines

## G+D's new solution – SensorFusion and SensorBrain

Deep-learning algorithms, combined sensor analysis, and increased computational power drive precision in banknote processing

Traditionally, banknote processing machines treated sensor data singularly. When qualifying a feature, such as a watermark, each sensor measures the feature singularly and sequentially to make its determination. This separate treatment results in a limited view – a restriction rooted in confined computational power.

G+D's sophisticated new technology allows data from multiple sensors to be merged and evaluated simultaneously. This results in an unrivalled increase in the accuracy of banknote classification, further driving cost effectiveness and enabling unlimited future enhancements.

### ADVANCED ALGORITHMS

SensorFusion is G+D's suite of enhanced AI algorithms, which enables more precise analysis of banknotes. By utilizing AI-pow-

ered deep fusion technology, SensorFusion enables a combined analysis of sensor raw data, allowing banknote processing machines to provide sharper and more precise inspection of a banknote's properties. This increases the quality of cash in circulation,

optimizes reject rates, saves time during reconciliation, and reduces the overall cost of processing, leading to higher overall business effectiveness.

### HIGH-END COMPUTING SYSTEM

SensorBrain is an innovative technology that enhances the computing power of banknote processing systems. This enhancement enables complex and demanding algorithms to classify up to 44 banknotes per second, thereby offering two major advantages. Firstly, SensorBrain enables the use of SensorFusion technology, which precisely classifies and authenticates banknotes in real time. Secondly, by facilitating the integration of the latest state-of-the-art computing boards, SensorBrain can also keep pace with future developments in Deep Fusion algorithms.

MORE THAN  
**4GB/s**  
HIGH-SPEED  
PERFORMANCE

The speed at which  
SensorBrain precisely processes  
and analyzes sensor data

# Enhanced Regions of Interest form a basis for more precise classification

**SensorFusion and SensorBrain facilitate more precise banknote classification through higher-quality, unlimited Regions of Interest. This ensures that virtually nothing on a banknote goes undetected**

**R**egions of Interest (ROI) can be interpreted as pieces of information regarding a specific area on a banknote. When combined, they provide a more detailed picture of a banknote as digital data. In the past, such an approach was limited by computational power.

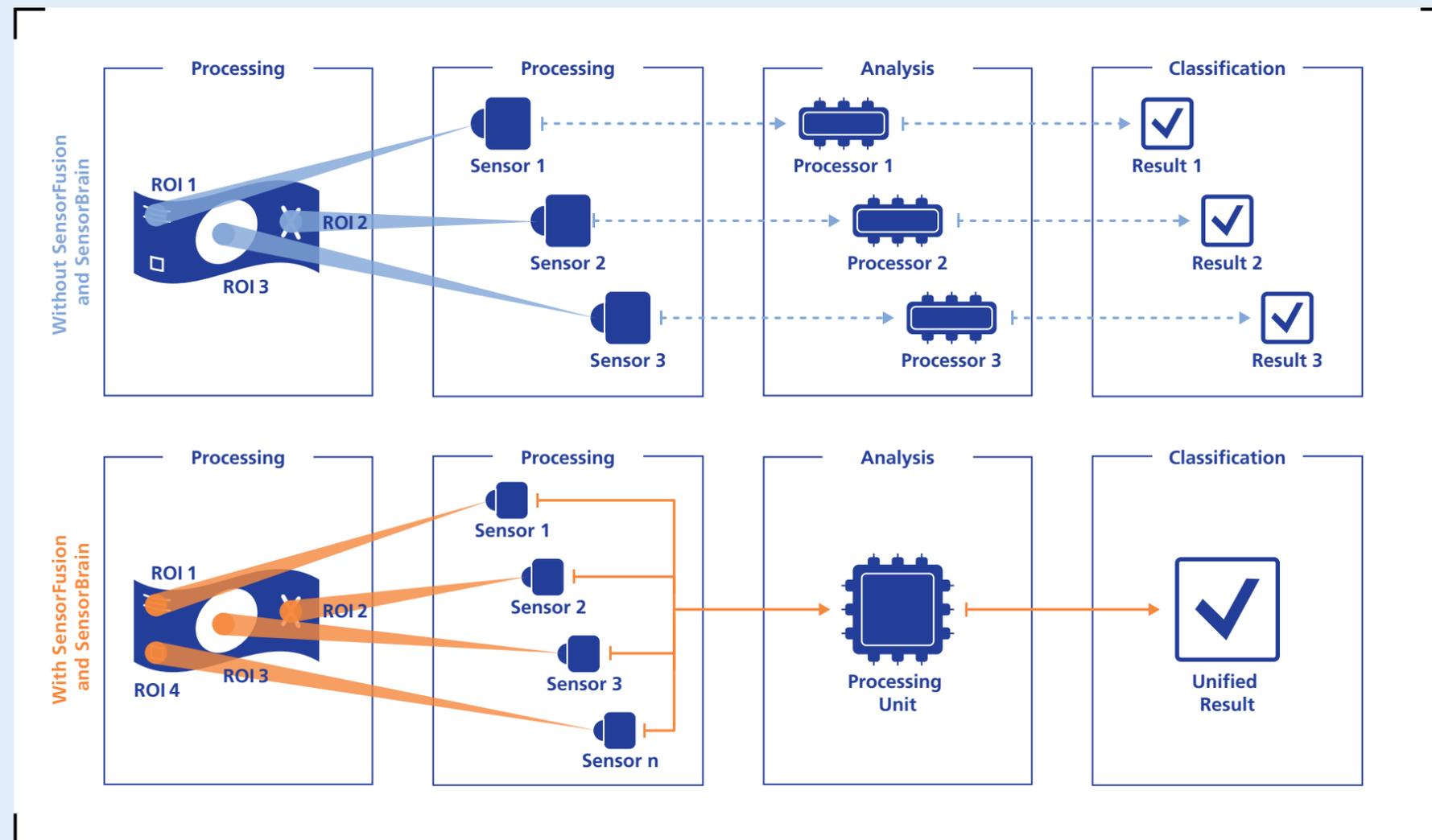
Today, SensorFusion and SensorBrain allow us to enter a new era of banknote classification – one in which we can evaluate each ROI sequentially and achieve a more amalgamated qualification of banknote properties due to sophisticated algorithms. Consequently, SensorFusion and SensorBrain represent a game-changing step in the future of banknote processing.

## SENSORFUSION

SensorFusion enables processing machines to become more exact in the classification of banknotes based on fitness and authenticity. By running a combined analysis of the raw data from each ROI, it achieves a more complete picture, improving the margin



More sophisticated sensor data processing improves analysis and facilitates a more holistic view of the entire banknote.



of uncertainty and optimizing the sorting threshold. Consequently, larger ROIs lead to a more enhanced and sharper classification of banknotes, facilitating increased scalability and paving the way for future enhancements.

## SENSORBRAIN COMPUTING SYSTEM

SensorBrain answers the need for a level of computational and processing power necessary to sharpen the ROI and enable increased precision in banknote analysis. By utilizing the latest multi-core processing technology, it greatly increases the volume of data that can be processed simultaneously, thereby helping to enlarge and sharpen the ROI.

## TOWARDS THE WHOLE BANKNOTE AS A REGION OF INTEREST

In combination, the greater analysis and computational power afforded by the SensorBrain system means that ROIs can move beyond their traditional size and sharpness. These increased capabilities essentially remove limits, enabling a move from analyzing small, separate Regions of Interest on the banknote to treating the whole banknote as one large ROI. Once this is realized, no element of a banknote goes unnoticed and each feature can be analyzed in its entirety, leading to significantly higher accuracy of classification and authentication.

# Improved decision-making

Optimized qualification of banknotes drives a myriad of benefits, ranging from improved efficiency to sustainability

As a thought leader, G+D focuses not only on providing more accurate fitness recognition and authentication but also opening the door to new possibilities for businesses and the entire industry.

**TECHNICAL BENEFITS\* INCLUDE:**

- ▶ More accurate classification of banknotes in terms of fitness (fit/unfit) and authenticity
- ▶ Optimized precision spectrum, providing a better foundation for informed decision-making
- ▶ Reduced reject rate
- ▶ Improved sustainability due to optimized shredding rates
- ▶ New possibilities in polymer banknote fitness classification, through the fusion of multiple sensors' data
- ▶ Future-proof, scalable, and modular concept

**BUSINESS BENEFITS\* INCLUDE:**

- ▶ Optimized business effectiveness and cost-of-cash
- ▶ Lowered reconciliation efforts, due to optimized reject rates
- ▶ Optimized shred rate, leading to improved sustainability
- ▶ Increased scalability and future business robustness

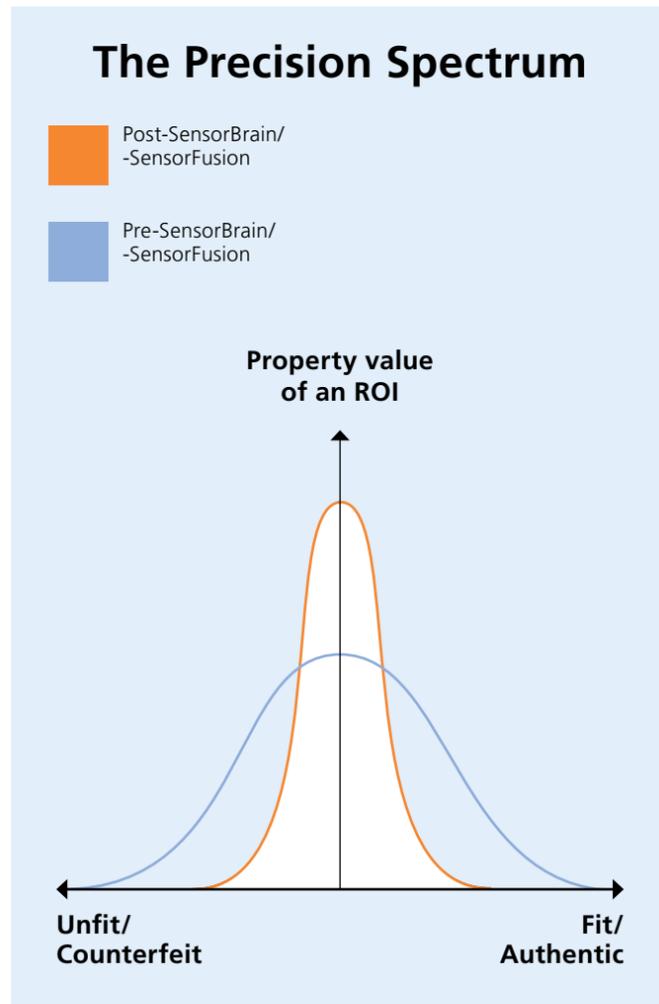
\*Benefits and their impact may vary, depending on currency, denomination, and various factors, including banknote quality, substrate, and equipped sensor systems.

**IMPROVING THE PRECISION SPECTRUM**

Traditional banknote processing is limited by singular sensor data evaluation. In contrast, SensorFusion runs a combined analysis of multiple sensors and can make more nuanced allowances for false fit, false unfit, and false rejects. As a result, the precision spectrum is broadened, improving the overall accuracy of banknote classification and empowering more informed decision-making.

**REDUCING THE COST-OF-CASH**

As central banks and cash centers well know, shredding unfit banknotes requires time and money. Therefore, a reduction in shred makes a significant contribution to



the cost effectiveness of banknote processing. Even a small reduction in shred, when considering a machine like the BPS M7, which processes up to 120,000 banknotes per hour, can result in significant savings across an entire year. Reduced shred also lowers waste, as fewer banknotes need to be destroyed. This enhances the sustainability of cash handling and allows banknotes to remain in the cash cycle for longer, driving further cost reductions.



Ensure that your operations enter the future by upgrading your machines with this revolutionary new technology

**INTERESTED?**

Contact one of our experts to learn more about how SensorFusion and SensorBrain can optimize your banknote processing operations today!

## Striving for new solutions

In combination with G+D's state-of-the-art solutions and position as a thought leader in the industry, SensorFusion and SensorBrain will ensure you go beyond your operational targets

In developing SensorFusion and SensorBrain, G+D demonstrates its commitment to driving the evolution of banknote processing technology into the future. Capabilities that further improve banknote detection are in development, as is a more efficient adaptation process and unlimited raw data processing. Representing the next stage in sensor technology, SensorFusion and SensorBrain can drive your operations to the technological forefront and unlock future possibilities.

**WHAT YOU CAN EXPECT:**

- ▶ New installations: All new BPS M3, M5, M7, and X9 machines include the advanced SensorBrain technology and enable the use of SensorFusion
- ▶ Retrofitting: installed M5, M7, and X9 machines can be retrofitted with SensorBrain and, subsequently, the SensorFusion algorithm
- ▶ Combination: SensorBrain can be used in conjunction with other G+D tech-

nologies. For example, in an industry first, when used with NotaScan UV2, it provides high-resolution pictures, enabling the detection of UV fibers

- ▶ Future readiness: take advantage of these scalable solutions and ensure long-term sustainability for your business

**“With SensorBrain and SensorFusion, G+D has further established its position as a pioneer of industry innovation – setting new benchmarks for cutting-edge solutions that anticipate our customers’ expectations and needs.”**

**Dieter Stein**, Director Product  
Management BPS Sensor Systems at G+D

## **About G+D Currency Technology**

G+D Currency Technology is a technology leader in Advanced Currency Management for an efficient and secure currency cycle. The digital and physical solutions, products, and services provided by G+D Currency Technology have been safeguarding confidence in values worldwide for over 160 years.

Customers around the world include central and commercial banks, printworks, cash-in-transit companies, and casinos. G+D Currency Technology is part of Giesecke+Devrient (G+D), a global security technology group headquartered in Munich, Germany.

For more information, please visit  
[www.gi-de.com/ct](http://www.gi-de.com/ct)

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