ENTER THE WIDE WORLD OF RFID.
A GUIDEBOOK FOR CONVERTERS.
The fact that RFID is continuously expanding into new markets means new business for printers and converters. Just think about the many opportunities this opens up for you.

RFID REQUIRES PRODUCTION MODIFICATIONS

RFID tags are electronic devices which need to be handled in the correct way. To become a reliable RFID label supplier, it is necessary to make some new investments and machine modifications to your existing label converting process. You also need to optimize your working environment and conditions to match RFID production needs. Emphasis is also placed on quality control and the replacement or marking of faulty labels. And, of course, you need to train your employees properly.

But what is RFID actually? What kind of process modifications do you need? We supply RFID tags and inlays, which have the right answers ready for you in this very brochure.
DELIBERY FORMATS:

- **Tag:** Die-cut web with adhesive, paper face
- **Wet inlay:** Die-cut web with adhesive, film face
- **Dry inlay:** Continuous web, no adhesive, film face

UHF and HF RFID inlays by SMARTRAC
RFID is a means of identifying objects via radio frequency transmission. The most common frequencies used are High (HF) and Ultra High (UHF). A typical RFID system comprises a tag, a reader and a host system. The host manages the information flow, sending and receiving information to and from the reader and the tag.

We manufacture inlays based on passive RFID technology. This means there is no internal power supply or battery. The power required to energize the inlay comes from the reader unit's antenna. The inlay's ability to utilize energy efficiently from the reader RF field is based on the well-known electrical resonance effect.

Compared to a bar code system, RFID technology offers substantial benefits. The most important benefit is that end users can track and trace items faster and more accurately without a line of sight.

HF AND UHF – MAKING THE RIGHT CHOICE
Depending on the country of use, HF (High Frequency) inlays work at 13.56 MHz and UHF (Ultra High Frequency) at 860–960 MHz. The HF operating range is usually less than 30 cm or 12” while UHF can operate at significantly longer distances. Besides the difference in the operating frequency or environment, the choice is also made based on the product types.

LABEL AND INLAY – WHAT’S THE DIFFERENCE?
An RFID label or tag is attached to the product. The functional portion of the RFID label is an inlay consisting of an antenna to which a chip is attached. Typically supplied on a carrier, it is called a dry inlay. If adhesive is added, it is called a wet inlay.

### HF AND UHF RFID FREQUENCIES:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>HF (High Frequency)</th>
<th>UHF (Ultra High Frequency)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency range</td>
<td>13.56 MHz</td>
<td>860–960 MHz</td>
</tr>
<tr>
<td>Standards</td>
<td>ISO15693, ISO18000-3, ISO14443 (A/B)</td>
<td>ISO18000-6C, EPC Class 1 Gen2</td>
</tr>
<tr>
<td>Read range</td>
<td>Up to 1 m</td>
<td>Up to 14 m</td>
</tr>
</tbody>
</table>
It pays
SMARTRAC is the leading developer, manufacturer, and supplier of RFID transponders and inlays for a broad range of applications in all current frequency standards. SMARTRAC was founded in 2000, went public in July 2006, and trades as a stock corporation under Dutch law with its registered headquarters in Amsterdam. The company currently employs approximately 3,500 employees and maintains a global research and development, production, and sales network.

INNOVATIVENESS IS AT YOUR FINGERTIPS
We can supply you with LF, HF and UHF inlays. You are welcome to benefit from extensive experience in numerous antenna designs and strong capabilities in RF engineering. Our expertise in materials science, labelling, laminates and adhesives is also at your disposal.

We have a proven track record in developing innovative solutions that enable large-scale applications.

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In order to avoid IC damage due to static electricity, and also contribute to the well-being of your employees, the following changes can be made to your working environment:

- Coat the floor with an antistatic layer, at least on the working platforms
- Check the air humidity 40-60% RH / 20–24°C
- If you do not have air conditioning in your production facility, isolate your RFID department and install up-to-date air conditioning in that area
- All employees should wear ESD (electrostatic discharge) clothing and shoes
- Every time someone touches a roll of inlays, he or she should be grounded
Some tips for handling inlay rolls

- Do not open the inlay roll package unnecessarily
- Open the package only in the RFID facility
- Do not touch the IC side of the inlay if you are not connected to the ground
- Try to use the whole roll in one pass
- If using the whole roll is not possible, put the roll back into the original package, seal it and take it back to storage
- Do not damage or drop the roll
- Always keep inlay reels on their side
- Do not lay rolls on top of inlays
- Inspect roll and document reel number and yield prior to converting
- Review inlay specification for delivery format
What converting methods can be used?

RFID inlays can be easily broken during the label converting process, so they must be handled with care. Metallic or conductive materials are not suitable for RFID labels as they may weaken RF performance.

Two different converting methods can be used. With ‘on-pitch’ converting, the dry inlay reel does not necessarily have to be die-cut. The continuous dry inlay web is first laminated together with the backing and face material. The RFID labels are then die-cut from the laminated web.

With ‘off-pitch’ converting, the wet inlays are often already die-cut. The individual inlays are then dispensed to the release liner to match with the final product pitch. Next, the face material is laminated onto the top of the inlays, and afterwards the RFID labels are die-cut. Another off-pitch method of converting dispenses the inlays to be laminated in die-cut labels.
To meet the needs of RFID inlay inserting, it is necessary to modify your standard label converting process. The changes needed in the printing machines with on-line inserting units, slitting machines, sheet cutters and label dispensers include the following:

- Avoid hard nips. Coat all rubber rollers with soft, antistatic or conductive rubber (50 +/- 5 Shore A)
- All hard-nip rollers touching the IC in the inlay must be grooved to prevent the IC from breaking due to high pressure
- Use conductive grease in the bearings
- Use ESD prevention devices such as carbon fiber brushes and ionized air blowers
- The machines must be well grounded
- Never use corona on labelstock with inlays
- The diameter of all steel and rubber rolls should be a minimum of 50 mm to eliminate IC breakage due to overly sharp bending
- Measure ESD in process
- ESD level must be less than 2 kV

For more information, see our product specifications.
How to imprint and encode RFID labels?

When imprinting variable information printing (VIP) RFID labels, use:

- An inkjet in the printing press or during dispensing
- Some modified direct thermal (DT) or thermal transfer printers (TTR)
- Dye diffusion thermal transfer (D2T2)

**Note**

- Do not use a laser due to high corona and sharp bending around small-diameter rollers unless the laser has been designed for RFID printing
- Do not use a VIP printer with high nip pressure if rollers are not grooved

Encoding an IC can be carried out during the imprinting process or in a separate unit.

**Testing**

It is recommended to have two inline testing points: one before and another after processing. The yield loss of the process can be calculated at these points. Yield loss can be caused by, for example, ESD or mechanical stress.

The functionality of the tag can be tested either with a commercial reader-based system or specially designed testing equipment. The reader system has to be designed in such a way that only the desired inlay is read, and only one inlay at a time. Failed tags can be replaced or just marked, depending on customer needs.
How to handle and pack RFID products?

PLEASE NOTE THE FOLLOWING INSTRUCTIONS:

Handling
- Handle the product with care
- Finish and pack the product directly after inserting
- When stored, hang the reel from the core or place it on a pallet with a soft underlay
- Do not stack pallets
- Always keep inlay reels on their side
- Do not roll mother rolls or ready coils on the floor, carry them or use a trolley
- Do not wind reels too tight
- Keep the working environment tidy and clean
- Do not stack too many RFID products on top of each other

Packaging
- Use a strong package that protects the product well
- Lock coils with a center shaft or chucks to prevent them from gliding in the box during transport
- Packaging material must not create static electricity load when handled
The most significant advantage that RFID has over bar codes is that it does not have to be seen to be read. This makes it easier to track and update data as the product moves through the supply chain to the end-use application, and even beyond. Radio waves can pass through most non-metallic materials so RFID tags can be embedded in packaging or encased in protective plastic. This makes them more durable and able to withstand harsh weather conditions.

Since RFID is a read/write technology, data can be programmed also after the tag’s attachment to the product. This provides higher flexibility for tracking and data updating as the product goes through the supply chain.

**What’s the difference between RFID and bar codes?**

Radio Frequency Identification (RFID) is a generic term for technologies that use radio waves to automatically identify objects. Information is encoded onto a tiny microchip within a thin RFID tag. Signals are received and transmitted through an antenna.
The amount of RFID applications is virtually limitless. The most common uses today are in supply chain management to improve the efficiency of inventory tracking and management. The apparel industry uses RFID to manage worldwide supply chains from manufacturers through distributors to retailers.

The pharmaceutical industry uses RFID to improve security by preventing theft and counterfeiting. Payment systems using RFID help ticketing and transportation services run smoothly, while retailers use it for eliminating out-of-stocks and for product promotions.

How is RFID being used today?

A glossary of RFID terms

- D2T2: Dye Diffusion Thermal Transfer
- DT: Direct Thermal Printer
- EPC: Electronic Product Code
- ESD: Electrostatic Discharge
- HF: High Frequency
- IC: Integrated Circuit
- NFC: Near Field Communication
- RF: Radio Frequency
- RFID: Radio Frequency Identification
- TTR: Thermal Transfer Printer
- UHF: Ultra High Frequency
- VIP: Variable Information Printing

What are the proven benefits of RFID technology?

RFID offers numerous benefits: it reduces administrative errors, labour costs and theft. Industries using RFID are able to track work-in-process and achieve just-in-time manufacturing. RFID improves the accuracy in shipping goods by sea, land or air and in maintaining overall inventory levels. In hazardous areas or risky environments, it is invaluable in boosting worker safety.