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# SI700 automatic embedding for biometric cards

## General description

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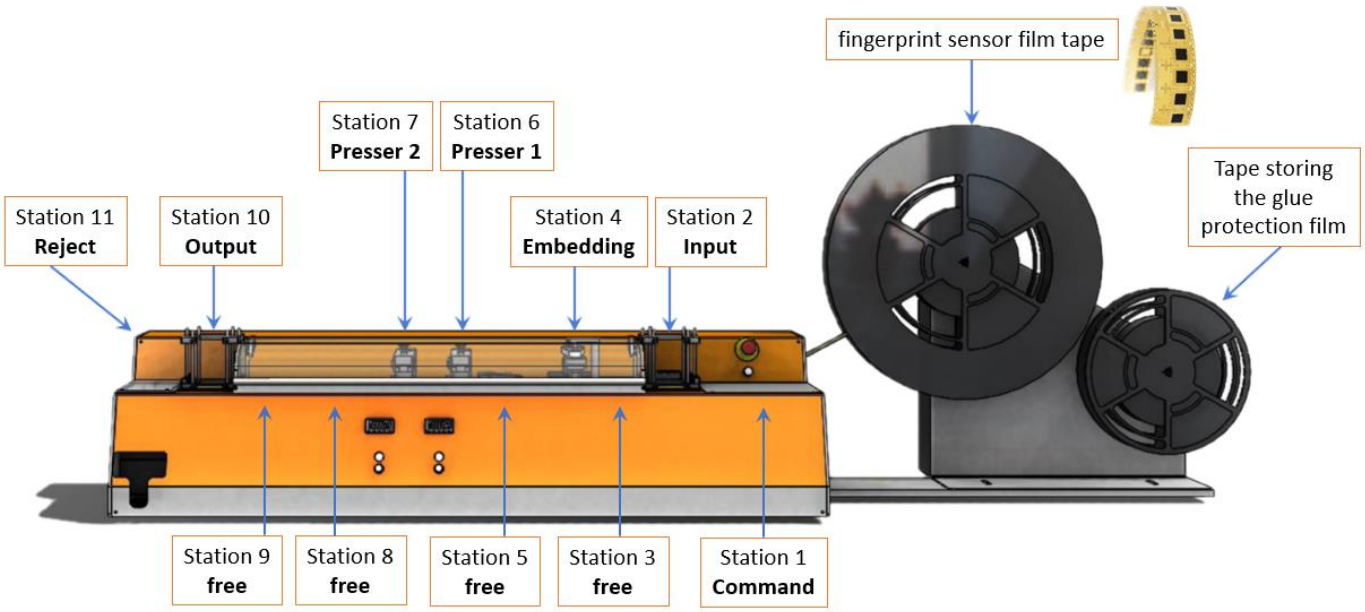
# I. Smart Inserter 700 (SI700) overview

The proposed SI700 for chip, contact plate and for fingerprint sensor embedding is a configuration optimized for embedding such objects, allowing keeping a good repeatability and accuracy during the production of cards. It also includes space areas allowing adding particular stations, such a vision inspection station and chip testing station, or additional hot presser heads.

The standard configuration includes the following stations, as illustrated below:

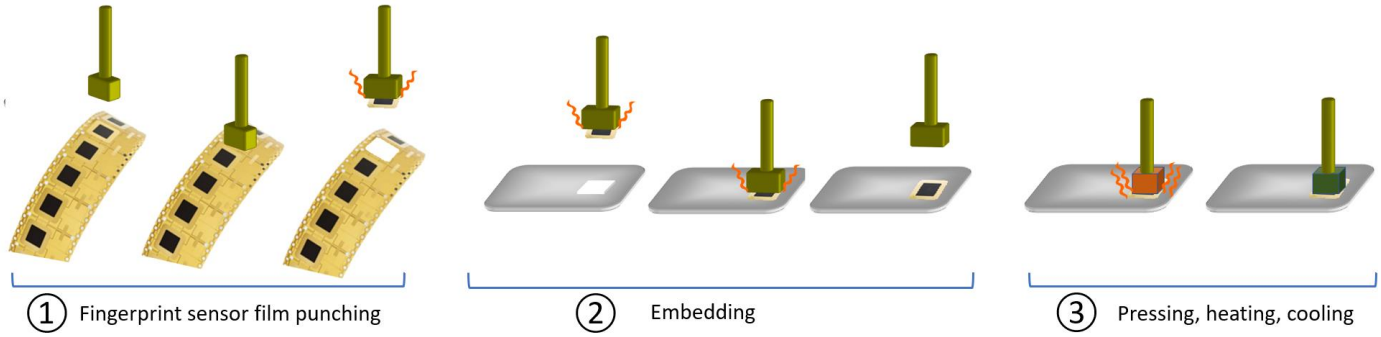
1. A command station, running under Windows 10 and including HMI (Human Machine Interface) software
2. A Card Input station, able to store 100 cards
3. A free station that can be used for vision inspection using a vision sensor
4. A fingerprint sensor embedding station
5. A free station that can be used for vision inspection, using a vision sensor
6. A first hot presser head station
7. A second hot presser head station
8. A free station that can be used to support an additional hot presser heads, or to support a test head to test the card
9. Another free station that can be used to support an additional hot presser heads, or to support a test head to test the card
10. An output station, able to store 100 cards
11. A card reject station




Above configuration can be adapted to also support chip or contact plate embedding. Such adaptations can be offered as an option, and will consist in supplying an additional punching tool, an additional pick-up tool, and additional hot presser heads designed for the chip or the contact plate.

The global process can be illustrated as follows. It consists in 3 steps:

- Punching the sensor film to remove a sensor from the film, and pre-heat it to allow staying in the cavity once it is embedded, before moving to the presser heads.
  Note: when the sensor is from IDEX, then it is picked-up from the tape but not punched. See further information below in chapter 2, section “embedding”.
- Insert the sensor into the card cavity.
- Press, heat and cool the sensor during a certain time to complete the gluing process and to connect the sensor with the card inlay.




The sensor film should be preliminary laminated with an adhesive, which typically is conductive (ACF).

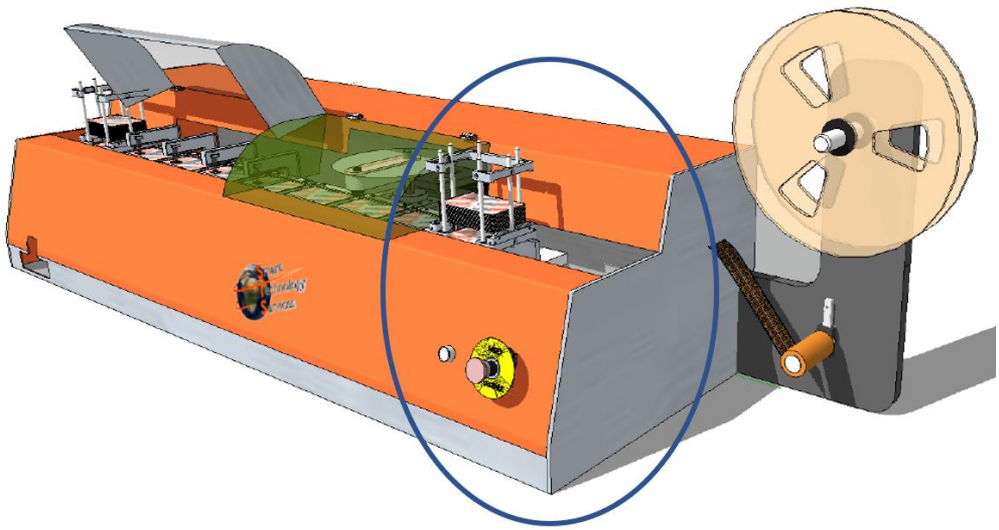
A standard laminator for chip modules films can be used to laminate the fingerprint sensor film, providing it includes the corresponding glue punching tool and presser heads.

Cards should also be milled with a cavity designed as per the sensor specification.

Smart Technology Services can provide a laminator solution, as well as a system to mill cards in any area of the card, which is mandatory for biometric cards.

## II. SI700 description for the proposed configuration

### *Command and input stations*



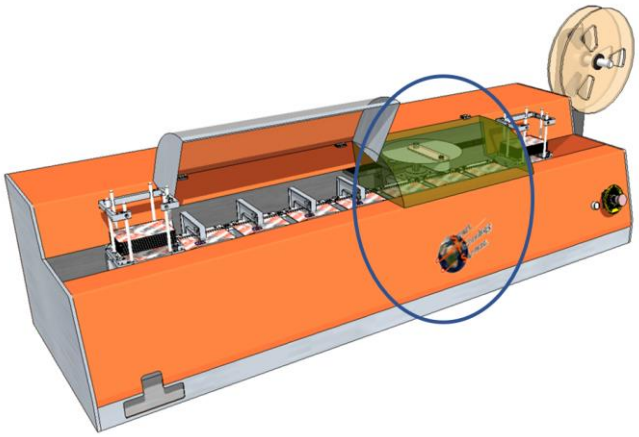
**Command station**

- PC controller Operating system: Windows 10
- Power supply: 200 to 240V, or 110V, 50 or 60 Hz
- Compressed Air Supply : 6 bars, 8 L/mn
- Global operating environment of the machine: 10°C to 35°C
- Humidity: 85% maximum, non-condensing
  Above limits only apply to the equipment, and not to the glue material used on the chip or sensor film

**Input station**

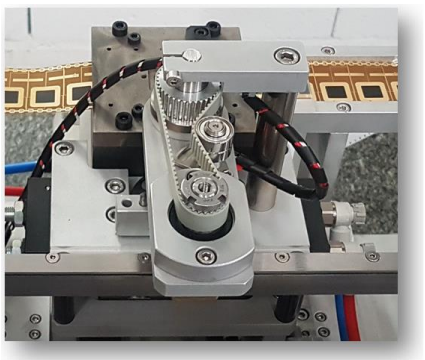
- Hopper capacity: 100 cards
- Car feeding: Automatic, with empty hopper detection
- Card types supported : ISO/IEC 7810 ID-1 Size; 30 mil (+/- 10%)
- Card material supported : PVC, composite, polycarbonate, ABS, PET and PETG

## *Embedding station*



The embedding station is able to embed chips or contact plates in ISO position on the card, as well as fingerprint sensors in any area of card, except below 2 mm from the card edges. The embedding station is not able to embed both a chip and a sensor at the same time. It can embed either the chip/contact plate or the sensor by installing the punching tool (also called “cutting tool”) corresponding to the exact design of the chip or the sensor. The hot presser heads at the presser head station (described below) also needs to correspond to the exact design of the chip or the sensor.

The embedding station uses a pick & place system allowing punching all chips from the film or all sensors from the film and embed them into each card. This solution brings the following advantages:



- A good accuracy and repeatability in card production. The pick & place solution is based on systems already used on big embedding machines. It demonstrated a high stability and low reject rates during mass productions with several such systems in the world.
- The same embedding station can be used to embed chips/contact plates or fingerprint sensors (but not both at the same time). A quick replacement of the cutting tool and presser heads is just needed to configure the embedding from chips/contact Plates to sensors, or vice-versa.
- The punching tool or pick-up tool will pre-heat the chip/contact plate or the sensor to allow it staying in the cavity once it is embedded, and before moving the card to the hot presser heads station. This allows avoiding the sensor or chip/contact plate to move in the cavity or jump during the card movement.

## Embedding FPC or IDEX sensors

The embedding station is configured differently depending sensors are FPC (like the fpc1321) or IDEX (like the Kepler sensor). Both are supplied in a 35 mm tape, but with the following differences:

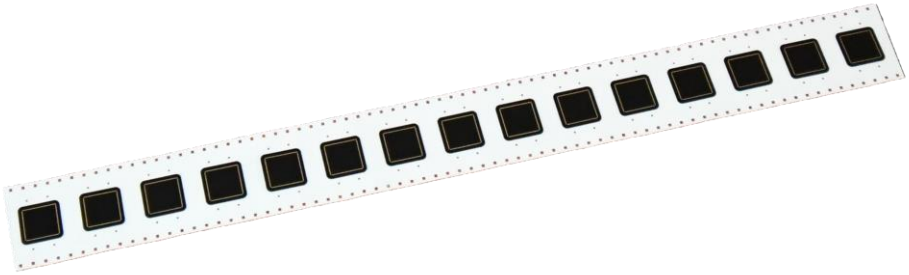
***FPC***

FPC sensors are supplied by Linxens, and are integrated into a 35 mm film like standard contact chips. Therefore the pick&place system needs to punch the sensor from the film to remove it, exactly like a embedding machine such as the MPR5800 for instance. The 35 mm film needs to be first laminated with glue, using a laminator.

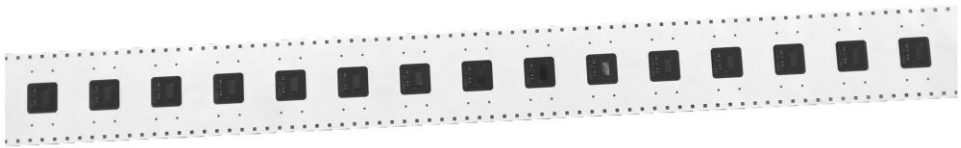
The embedding station can detect sensors that have been identified as bad on the sensor film to avoid embedding them, with the use of an optical sensor.

***IDEX***

IDEX sensors are supplied by Zwipe, and are stored on a paper-line that looks like a 35 mm film. Each sensor stored in each pocket is already laminated with ACF glue so that the paper-line by itself is not laminated. As the sensor is not integrated in the paper-line (like fpc on a 35 mm film), it does not need to be punched. However the pick&place needs to be adapted to properly pick-up each sensor from the paper-line.



*Paper-liner with IDEX sensors - front*



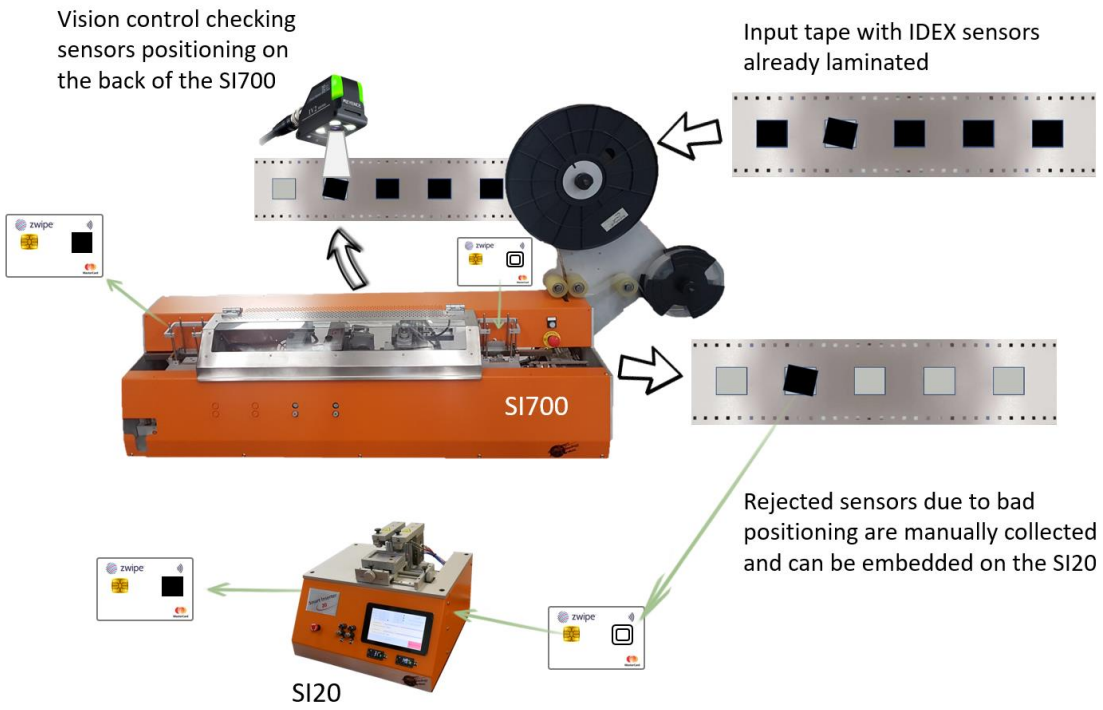
*Paper-liner with IDEX sensors - back*

Following additional elements are added on the SI700 when using IDEX:

- A Keyence vision control device and lighting allowing checking the sensor positioning accuracy against some tolerances. These tolerances are values that will be entered into the PC monitor of the SI700.
  - If the measured accuracy is good: the sensor will be picked up to be inserted into the card cavity.
  - If not: the sensor will stay on the reel and can be manually collected later to be embedded using a SI20.


- An adapted clamping system allowing properly indexing the reel before sensor pick-up and allowing pushing the IDEX sensor to facilitate its removal from the film.
- An adapted pick & place station, including its arm and belt to fit with the IDEX sensor.
- 2 presser heads adapted for IDEX sensor.

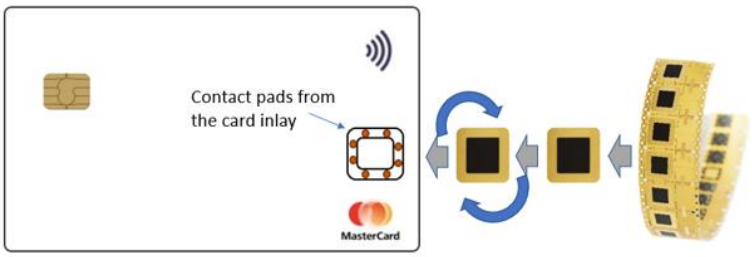
When using IDEX sensors, the general process flow of the SI700 can be illustrated as below.




Objective is to pick-up each sensor from the tape and insert it into each card cavity in a similar way as the FPC sensors.

### The SI700 can embed the sensor with various orientations, with FPC or IDEX

Depending on the card design, the SI700 can adapt the fingerprint sensor orientation on the card during embedding. Once the sensor is punched and removed from the sensor film, the pick&place system can turn the sensor orientation to 90°, 180°, 270° when needed so that the sensor contact pads can properly connect with the right contacts on the card inlay.




*The SI700 makes sure the sensor contacts will connect to the right card contacts.*

The whole SI700 configured for embedding can run up to 700 cards/hour.

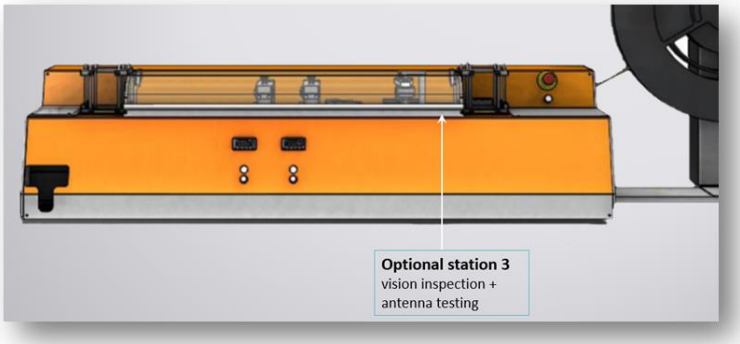
### Engineering mode

The SI700 is also flexible enough to allow embedding chips/contact plates or sensors 1 by 1 with different embedding parameters, for engineering purposes. This allows tuning a process and checking the card immediately once it is produced, before launching the production of a larger batch of cards.

This engineering mode is useful to support trials, pilots and other experiments.

## Optional Vision Inspection <u>before</u> embedding

This corresponds to the optional “station 3” as indicated in above page 2.





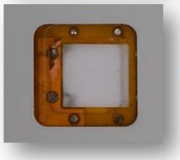
Using a Keyence vision sensor, the station allows checking:

- The presence of a cavity at the right position on the card
- That all electrical contacts appear in good conditions

The card is automatically rejected in case of default detected.

Vision inspection is commonly used on embedding systems for dual interface cards to check that the 2 antenna contacts are clean and have not been damaged during milling.

OK



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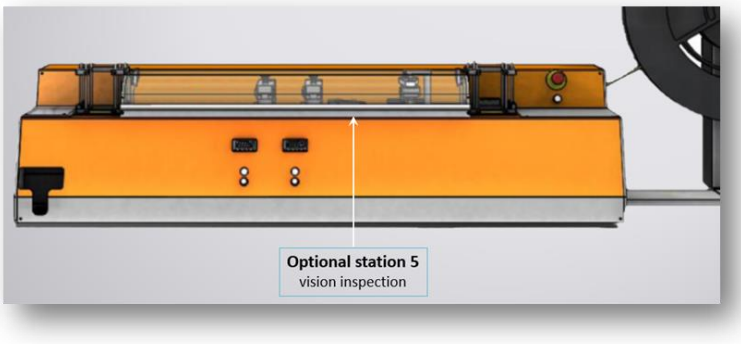
## Optional Vision Inspection <u>after</u> embedding

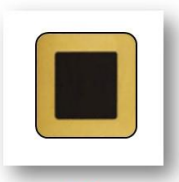
This corresponds to the optional “station 5” as indicated in above page 2.





Using a Keyence vision sensor, the station allows checking

- The presence of a fingerprint sensor or contact plate at the right position on the card
- That the fingerprint sensor or contact plate is correctly inserted in the card cavity and does not show any space or slippage



OK

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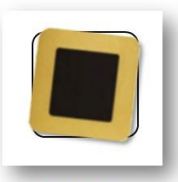
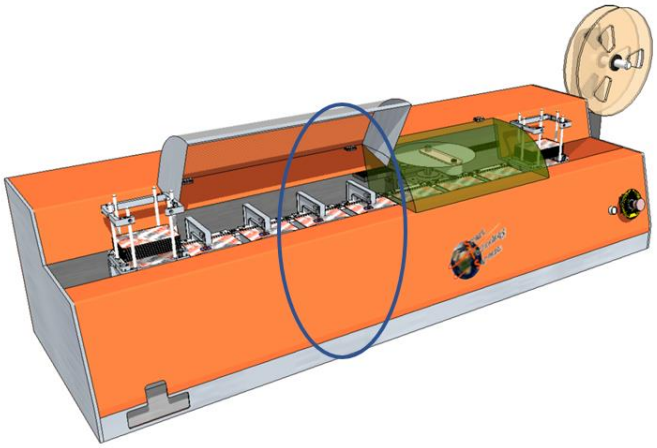


Not OK

The card is automatically rejected in case of default detected.

## Hot presser head station

Hot presser heads are needed after embedding to properly complete the gluing process for the chip or the sensor, and to allow also properly contacting the chip or the sensor with the contact pads from the flexible PCB inside the card.

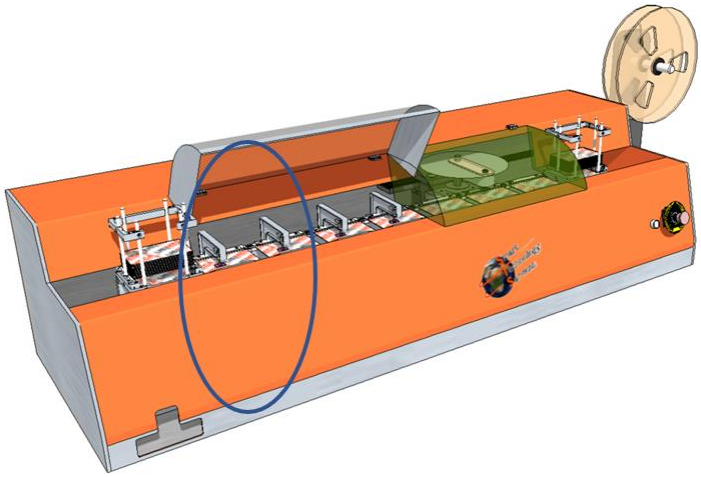


- The station includes 2 heads. For each head; the pressure force, pressure time and temperature can be adjusted.
- Each presser head on the hot presser head station will be able to reach 250°C.
- Each presser head will be able to press several times and at different temperatures, for a constant pressure. For small productions where the machine throughput is not critical, this will avoid using additional hot presser heads if pressing more than 2 times is needed.

  For instance, head#1 could press first at 160°C during 2 sec and then at 160°C again – or at another temperature – during 3 sec. The second head could press 3 times …

  This will affect the machine throughput. For large productions, using additional hot presser heads will help keeping higher throughputs.

## Free stations after the presser heads




This corresponds to the optional “stations 8 and 9” as indicated in above page 2

Free space is available after the 2 presser head stations to allow installing either:

- 1 or 2 additional presser head stations, in the case the process required using more than 2 hot presser heads.
  or
- A chip testing station, as described below.

**Optional chip testing station**

Using a Smartware Ultrasmart Nano Box with contact and contactless Interfaces, the electrical test station allows testing the card through an ATR (Answer to Reset) test using a contact head, or through an ATS (Answer to Select) test using a contactless head. When using the contact heads, the test is conducted only through the contact plate (not through the fingerprint sensor).

The station includes the Ultrasmart Nano box and corresponding dual interface head (contact & contactless) and cabling.

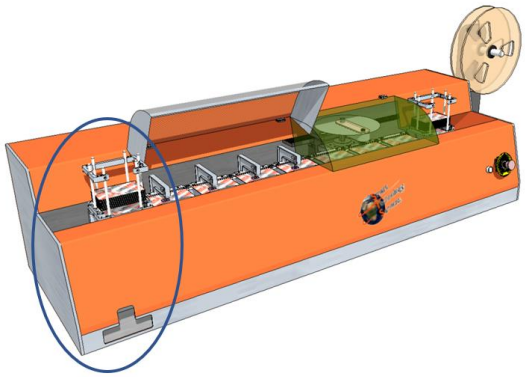
The card is automatically rejected in case it does not properly respond to the ATR or ATS test.

The electrical test station is located just after an ambiant air blowing station allowing cooling the fingerprint sensor after the hot presser heads, to avoid testing the card whilst the sensor is still hot. The position of the air blowing device can be adjusted depending on the position of the fingerprint sensor.

When using Zwipe Pay One (ZPO) product, the IDEX sensor connection and functionality can also be tested running a BIST (Built In Self Test).

## Output and Reject stations

Output station capacity: 100 cards
Reject station capacity: 50 cards



## System dimensions