Inextor product overview

Table of contents

Document Information Table	
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Introduction

Document INEX-POV-00001: Inextor Product Overview document, provides an overview of the functional capabilities of Inextor a product of the Inexto SA Suite range of serialization, validation and track and trace solutions. Information provided will guide the audience in the understanding and use of the product when implemented onsite to support client business / market needs.

Purpose

The purpose of INEX-POV-00001 is to provide a top level overview of the Inextor product and its use within client sites / market sectors to support client business needs.

Scope

The Scope of the document is limited to the use of Inextor a product of the Inexto SA Suite range of serialization, validation and track and trace solutions and outlines its function in supporting client business needs.

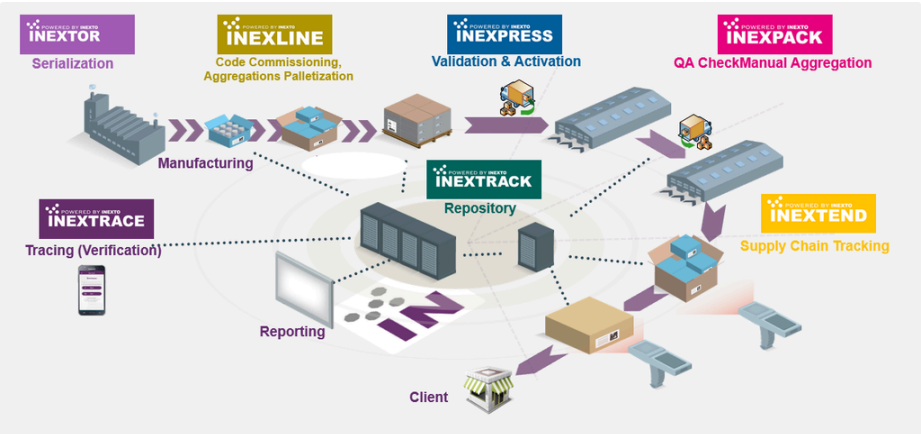
Inextor within the Inexto SA suite

Definition: Repository

In the context of the Inextor software, a repository is a central server in which data (especially codes) is stored and managed

This is the theoretical model. In the real world, some deviations from the theoretical model exist.

Example: the Vault and Gate also report data to Repositories (DLR, CRPT).



Document content

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Reference Documents

Document ID	Document Title	Revision
SOP 8.6	Technical Documentation Writing	v1.0
INEX-TMP-00003	Product overview template	v1.0

****END OF DOCUMENT****

Inextor: The Inextor system

- Inextor within the production process
- Data flow within Inextor and the Inexto suite
- Inextor functional coverage

Inextor within the production process

Inextor and the production process

The production workflow is divided into four key phases where each phase is supported by the Inextor product. The below information outlines each phase and the Inextor component used to support it

1. **Production Planning - Vault and Gate**
    - Prior to production commencing of an Item, a Production Order (PO) must be created. A Production Order references the item itself, the quantity produced, the dates of production, the production line setup, the market and other relevant information. The Production Order's composition is configured on the Gate.
    - If external codes are used an External Code Reference (ECR) is computed, in order to be able to optimize the use of codes.
    - From the creation of a PO a forecast is generated and sent to the Vault to requests codes (regulated market only) for the number of products to be produced within the PO.

2. **Serialization - Vault, Gate and Liz**
    - The Liz generates and prints a unique secured code on each product during production. The Liz sends production batch information to the Vault via the Gate. Together with this, the Liz's provide manufacturing information, including date, time and location of manufacture, volumes produced, brand information etc. This information is automatically uploaded to the Vault.
    - Inextor uses algorithms and processes, providing full control and protection over data. All information coming from the Liz is digitally signed by government trusted certificate in order to provide non-repudiation and ensure integrity of the data generated. Sensitive information is encrypted so only the Vault can read it.

3. **Aggregation - Vault**
    - During production the aggregation acquisition hardware verifies all codes and associates the Inextor codes of packaging units with their container packaging unit code. This information is later processed by the aggregation server located in the factory to extract only relevant information for the aggregation and sends it to the manufacturer Tracking and Tracing Repository (Vault).

4. **Reporting, validation and checking - Vault**
    - During distribution, the Tracking and Tracing kit capture the product movement within the supply chain and sends this information to the Tracking and Tracing event dispatcher that will ensure that only the relevant manufacturer Tracking and Tracing event repository will be notified and received the event information under its jurisdiction.
    - If a governmental Vault exists, the Government can access product information using the Vault system at any time for all products. Using the Tracking and Tracing portal, government has access to all Tracking and Tracing events stored in the manufacturers Tracking and Tracing event repositories.

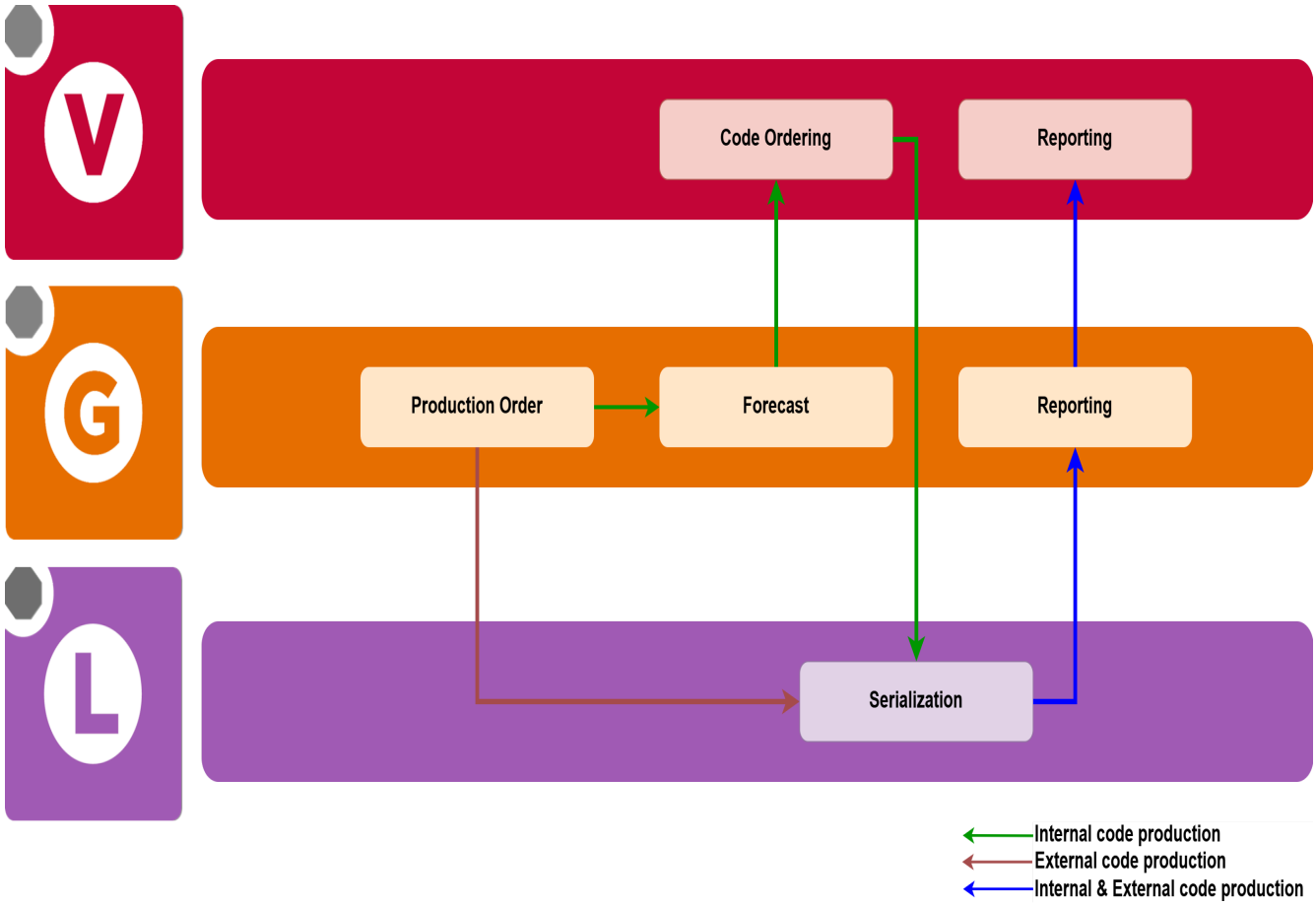


Figure 1: Inextor within the production process

Data flow within Inextor and the Inexto suite

Inextor within the Inexto Suite

Inextor is located at the beginning of the data flow process within the Inexto Suite. It is the primary product that requests/generates codes to begin the serialization process so that track and trace is possible with the remaining products of the Inexto suite.

The below image depicts the flow of data from corporates systems and governmental systems through the Inexto Suite starting with Inextor.

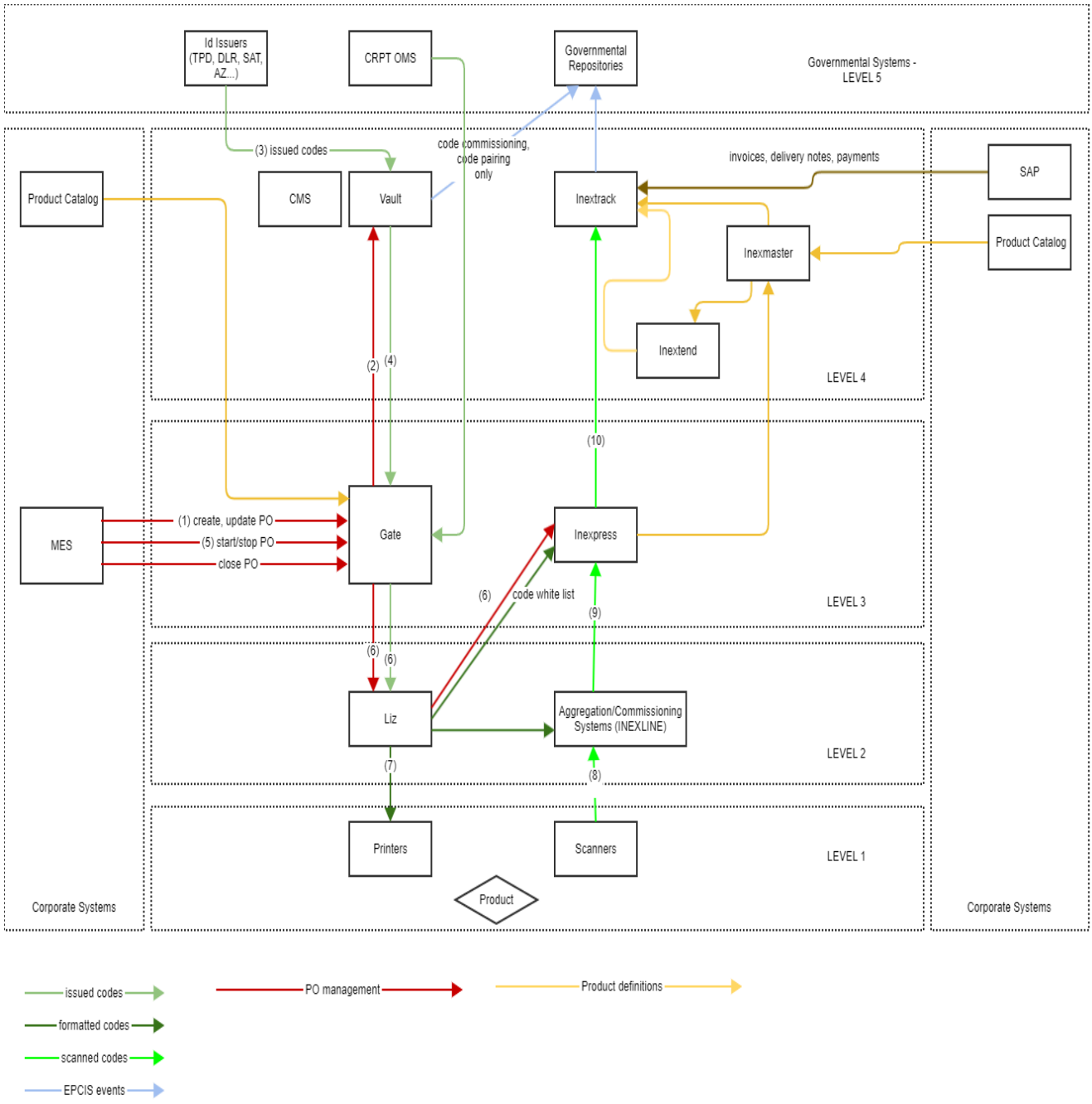
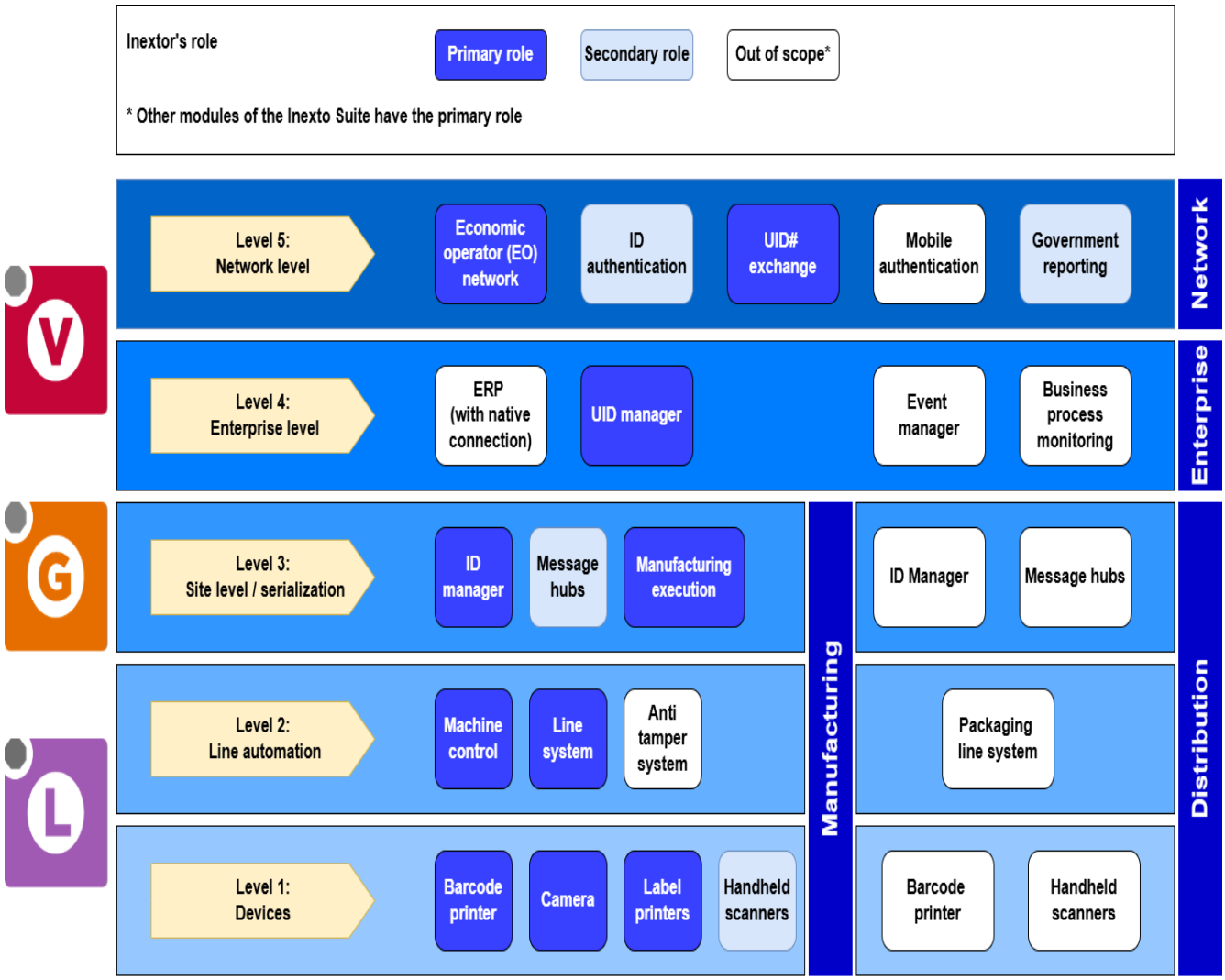


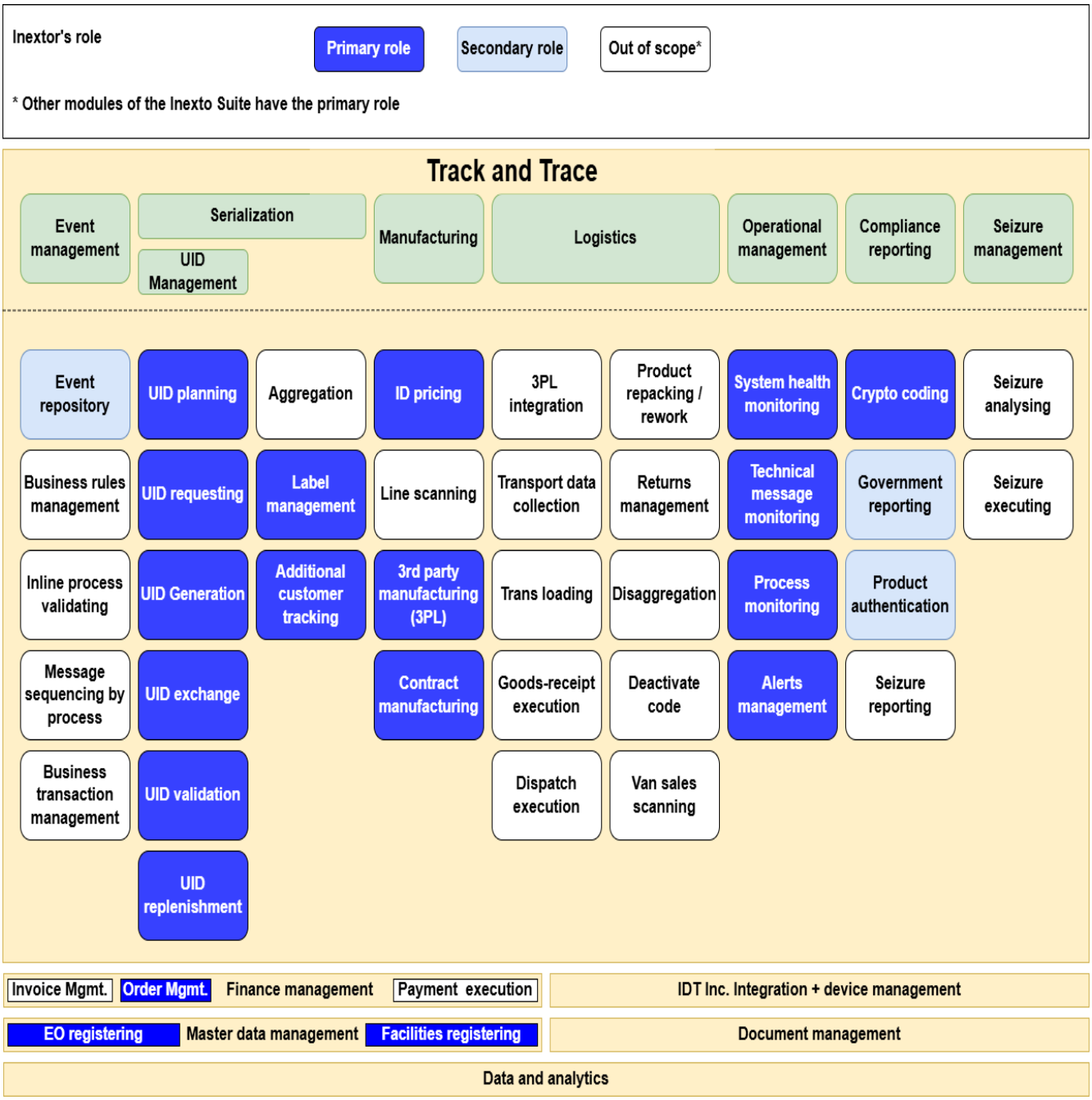
Figure 1: Data flow within the Inexto Suite

Inextor functional coverage

Coverage of the Inextor modules



Coverage in terms of business capabilities


Inextor's role
Primary role
Secondary role
Out of scope*
* Other modules of the Inexto Suite have the primary role
Track and Trace
Event management
Serialization
UID Management
Manufacturing
Logistics
Operational management
Compliance reporting
Seizure management
Event repository
UID planning
Aggregation
ID pricing
3PL integration
Product repacking / rework
System health monitoring
Crypto coding
Seizure analysing
Business rules management
UID requesting
Label management
Line scanning
Transport data collection
Returns management
Technical message monitoring
Government reporting
Seizure executing
Inline process validating
UID Generation
Additional customer tracking
3rd party manufacturing (3PL)
Trans loading
Disaggregation
Process monitoring
Product authentication
Message sequencing by process
UID exchange
Contract manufacturing
Goods-receipt execution
Deactivate code
Alerts management
Seizure reporting
Business transaction management
UID validation
Dispatch execution
Van sales scanning
UID replenishment
Invoice Mgmt.
Order Mgmt.
Finance management
Payment execution
IDT Inc. Integration + device management
EO registering
Master data management
Facilities registering
Document management
Data and analytics

Inextor: External and internal codes

Code classification and code states

Within the track and trace industry there are two types of codes used for the purposes oof serialization, validation and track and trace, these codes are classified as:

- Internal Codes
- External Codes

External codes have a validity period and must be used within this period otherwise they become invalid and cannot be used. The result of lost codes is a direct financial loss to the client as external codes need to be purchased from the ID issuer prior to use. It is therefore essential that the purchase of any external codes is linked to the production forecast to mitigate any potential financial loss to the client.

Both external and internal codes can be assigned changeable statuses to inform the client the current status of the codes within the production process, the status is also required by Inextor so that the software is able to handle these codes properly. The changeable status values are listed in the below table:

For a detailed description of each code status, reference document CodeStatuses_VaultDb.

Code states have a hierarchy, and a new event will overwrite any 'lower' code state

State	Description
Generated	The code has been calculated on the Liz during a running production, upon request from a client system which is usually a printer driver. For an external code, a CodePairing entry is also recorded and indicates that the code has been consumed.
PushedToPrinter	The printer driver has pushed the code to a printer.
Printed	The code has been marked on the product.
Cleared	The code has been deleted from the printer buffer, without being printed.
Activated	The code has been successfully scanned and is recorded as 'activated' (synonym : 'commissioned').
Aggregated	The code has been successfully scanned by an aggregation system (e.g. Inexpress).
Waste	The code has been recorded as rejected as not fit-for-sale. It will be discarded.

Note: The code state is not displayed on any Inextor screen. This information is only stored in the database.

External codes from ID issuers

External code requests from the Liz

External codes are generated and provided by the ID issuer to Inextor through the Vault, unlike internal codes the Liz cannot generate these code formats and must request them from the Gate at time of production.

There are two scenarios that the Liz will request codes for:

1. For various regulation codes (e.g. TPD, DLR and SAT codes) with the exception of CRPT codes, the Liz requests codes from the Gate at the point of production preparation. The Liz receives the requested codes from the Gate and stores them temporarily in the buffer. The codes are stored in the buffer for approximately 20 minutes of production time to ensure that production is not held back by short breaks in communications or in Gate availability. This means that the Gate must procure the codes in advance of production, the means of which varies depending on the type of external code being used. The Liz requests more codes as production progresses so that the necessary volume of codes stored in buffer can support production requirements. When the Liz stops production, it frees all unused codes it had previously reserved.

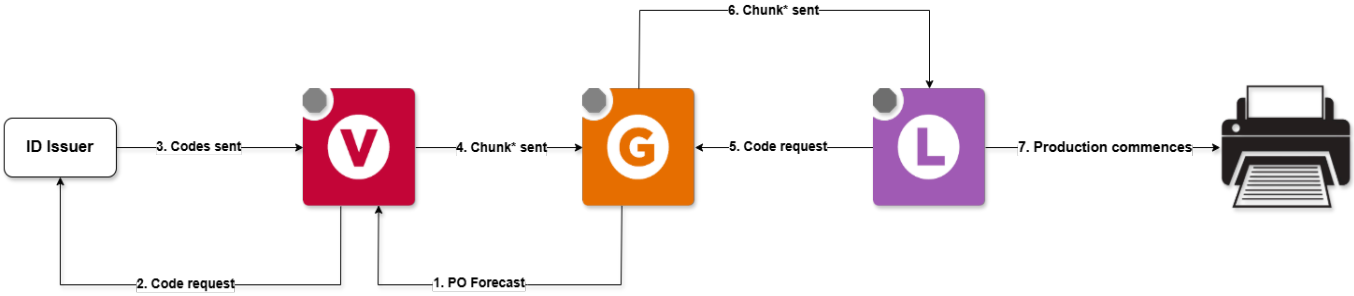


Figure 1: Code request process flow

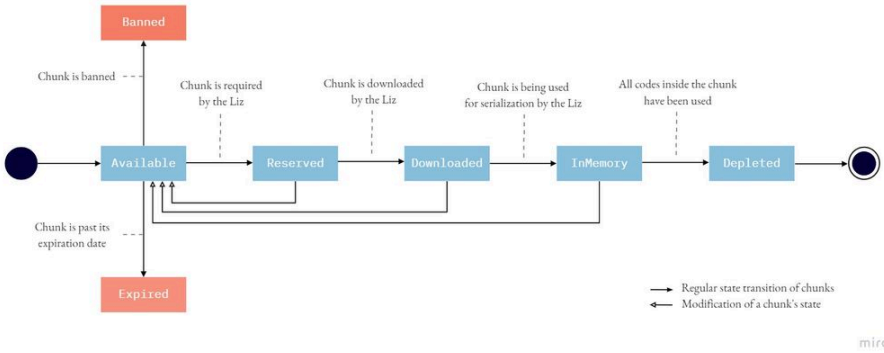
2. For CRPT codes, code requests are sent from the Liz to the Gate then to the CRPT Order Management System (OMS) rather than to the Vault, for further details on CRPT code requests reference document CRPT-Codes.

Chunk Status during production

ℹ ***Chunk**: A chunk is a range of 20'000 (or less) consecutive external codes. This number is configurable within Inextor.

When batches of codes are received from the code issuer, they are divided by Inextor into chunks, in order to be of a more manageable size. Each chunk is assigned a status.

- At creation time, the status is *Available*.
- When the Liz requests the chunk from the Gate, its status becomes *Reserved*.
- When the Liz prefetch a new chunk, its status changes to *Downloading*.
- When the Liz downloads the chunk, its status changes to *Downloaded*.
- When the Liz is actually using the chunk codes for serialization, its status becomes *InMemory*.
- When all the chunk codes have been used, the chunk status becomes *Depleted*.
- If a chunk with status *Available* goes past its expiration date (see below), its status becomes *Expired*. More precisely, this transition happens either when trying to reserve it or when the dedicated background job runs.
- If a chunk is banned (see below), its status becomes *Banned*.



ℹ A partially used chunk may have a status *Available*; however, the used codes in the chunk will be marked as such.

Banning Chunks

Users can ban chunks in order to prevent them from being used. In this case, the chunk status becomes *Banned*. Only chunks with an *Available* status can be banned.

Reasons for banning chunks are, but limited to:

- Invalid format codes - change of format to the code so that they canot be used.
- Temporary ban in order to have the time to examine codes - when there is an issue with the code that requires investigation, for example:
  - Problems with the code issuer
  - Code issuer configuration problem
  - Issue with the master data in the chunks...etc.

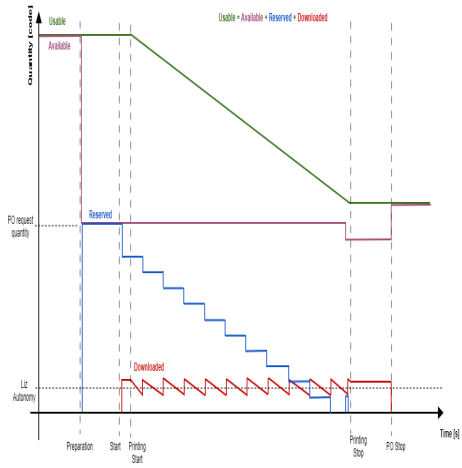
Users can unban chunks, which restores the chunk status to *Available*. This feature is restricted to super-users as unbanning invalid codes releases them back into production where they will be used, making possible the serialization of goods which could potentially be illegal to sell.

Expiration Dates

Code chunks come with expiration dates that Inextor calculates based on the type of external code utilized and the date of receipt. Each type of external code has a defined validity period. For further details, please refer to the specific external code information outlined in this section. Upon creation, each chunk is assigned an expiration date. Inextor regularly checks these chunks, updating their status to *Expired* once the expiration date is reached.

Code Consumption

Before preparation, there are more codes than are required for production. During preparation, the requested quantity of the Production Order (PO) is reserved. At production start, chunks are downloaded on the Liz to cover the prefetch quantity. During production, when the amount downloaded goes below the Liz Autonomy, reserved chunks are downloaded to cover the required autonomy quantity. If the production has achieved it's planned quantity, but continues (overproduction), the Liz downloads chunks from the available stock. This scenario pertains to the majority of external codes printed. The page on CRPT Codes outlines a unique scenario regarding the ordering of CRPT codes based on batch..



Section content

- External codes: Azerbaijan codes
- External codes: China codes
- External codes: Congo codes
- External codes: CRPT codes
- External codes: DLR codes
- External codes: Ecuador codes
- External codes: Prosefa codes
- External codes: SAT codes
- External Codes: Serbian codes
- External codes: Tajikistan Codes
- External Codes: TPD codes
- External codes: UK codes

External codes: Azerbaijan codes

The TNT system produces codes for Packs and Bundles. Only codes provided by TNT can be used in products for Azerbaijan.

The TNT system does not provide codes for Cases. INEXTOR-generated codes are used for Cases instead.

Concepts

Excise order: An excise order is registered by the distributor on the TNT system, specifying the number of base units (packs). This order, after it is confirmed, can be used as a pool of codes from which to draw to perform production. Codes inside an excise order are not restricted to a single machine, product or factory. An excise order can therefore be used for multiple production orders. See Batch and Production Document below.

Product category: Categorization of regulated products. There is a single category for "Tobacco Products". A product category is further split into product groups.

Product group: Subdivision of categories. Each product belongs to a specific group that belongs to a specific category.

Emission Type: Each code emitted by the TNT system is either Retail (i.e. for domestic production) or Imported (i.e. for foreign production, to be imported into Azerbaijan).

Department: Production sites, warehouses, etc. In the INEXTOR scope, each Gate (Factory) is represented by a department in the TNT system, and that department must also be registered as a Facility on the Vault.

Production Lines: Production lines inside a department. A Link Up or Machine in INEXTOR.

Products: All products must be registered in the TNT system. An aggregation hierarchy must be defined in each product, including packs, bundles and cases (but cases must be excluded from code generation).

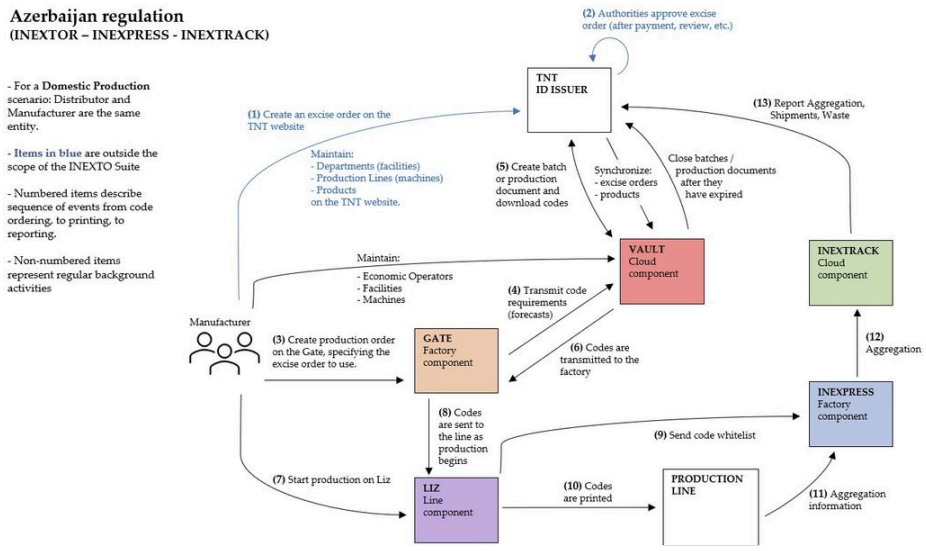
Batch: A batch is a quantity of pack codes (and corresponding bundle codes) that is withdrawn from the balance of an excise order for producing for a specific product, emission type and department.

Production Document: In the INEXTOR scope, a production document is used instead of a batch to generate bundle codes for pack rework. The codes are specific to a product, and an excise order is not required, as bundle codes are not charged.

Closing a batch or document: Closing a batch causes the number of codes inside the batch that have not yet been activated to be re-credited to the source excise order. It also makes it impossible to activate any more codes from that batch. A production document is not linked to an excise order, but must still be closed, and codes that were downloaded as part of the document can no longer be activated after closing the document.

Activation: Pack and bundle codes in the Azerbaijan regulation are implicitly activated the first time they are aggregated in pack-to-bundle aggregation.

System Overview



- Synchronizing excise orders and products is done at regular intervals.
- Closing batches and production documents is also done at regular intervals, finding the expired batches and closing them.
- Maintaining master data is a user's task.

Sample codes

Those codes comes from the QA environment.

Pack

- CHoDCTRrsTsfRP

- B7TD8Lk1boUOii
- lzuBhxMGfQv08k
- ttRnNexAp2rVWB
- ql4DxyMsky8mAY

Bundle

- d649ebbe6b77c3b9717b
- 465b6aa49ba4864f9e7f
- ba48060cd8cb796d754f
- 881dfd099923e9ab489c
- a06bdb521a235b00b66e

Code Pairing

Azerbaijan codes can be virtually paired to codes of other regulations (see page Multiple Regulation Production).

External codes: China codes

Concepts

Abbreviation	Name	Definition
IRPT	Industry Regulation Project Team	The Team in charge of the IRS system in China.
IRS	Industry Regulation System	The Track & Trace regulatory system from which to order code and report track & trace events.
STMA	State Tobacco Monopoly Administration 国家烟草专卖局	Government agency responsible for national tobacco monopoly regulation. It is the same institution as China Tobacco.
CT	China Tobacco 中国烟草	State owned tobacco manufacturer. It is the same institution as the STMA.
	Import agent	The company importing tobacco products in China. The import agent is the one responsible for ordering UIDs.
	Access system	The client system that request QR code segment to the IRS.
	QR code segment	Describe an order for UIDs. Name used in the STMA documentation.
	Print-shop	A printing company provinding the sheets of cardboard that are then folded into the packs and bundles.

Workflow

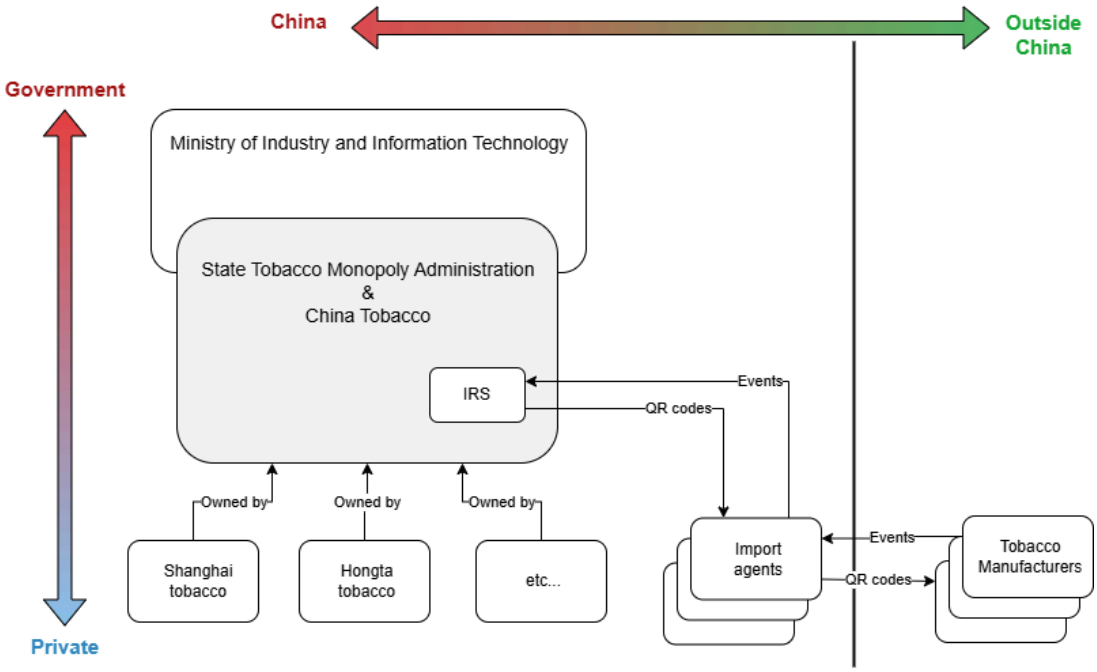


Figure 1: The structure of the Chinese tobacco market. Domestic manufacturers are all owned by the state.

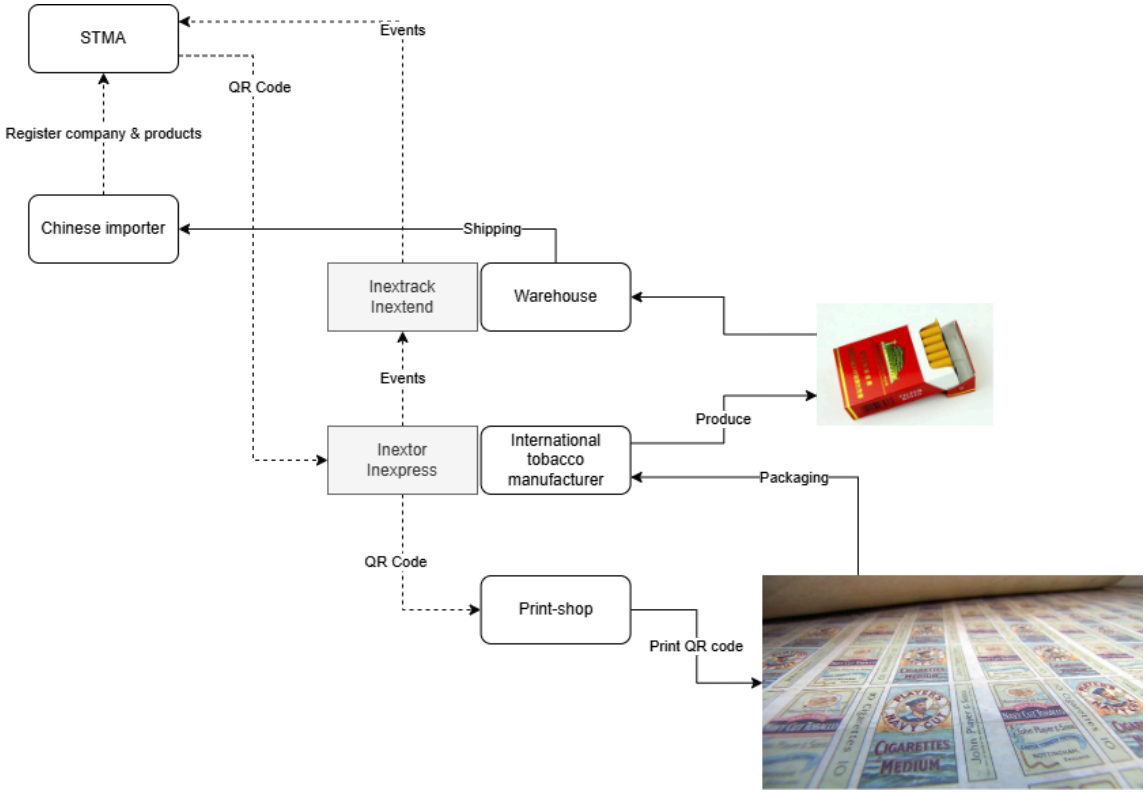


Figure 2: Simplified workflow of the data. One specificity is that some manufacturer sends the QR code for packs and bundles to the print-shop. The Chinese code is pre-printed before the production starts at the factory.

External codes: Congo codes

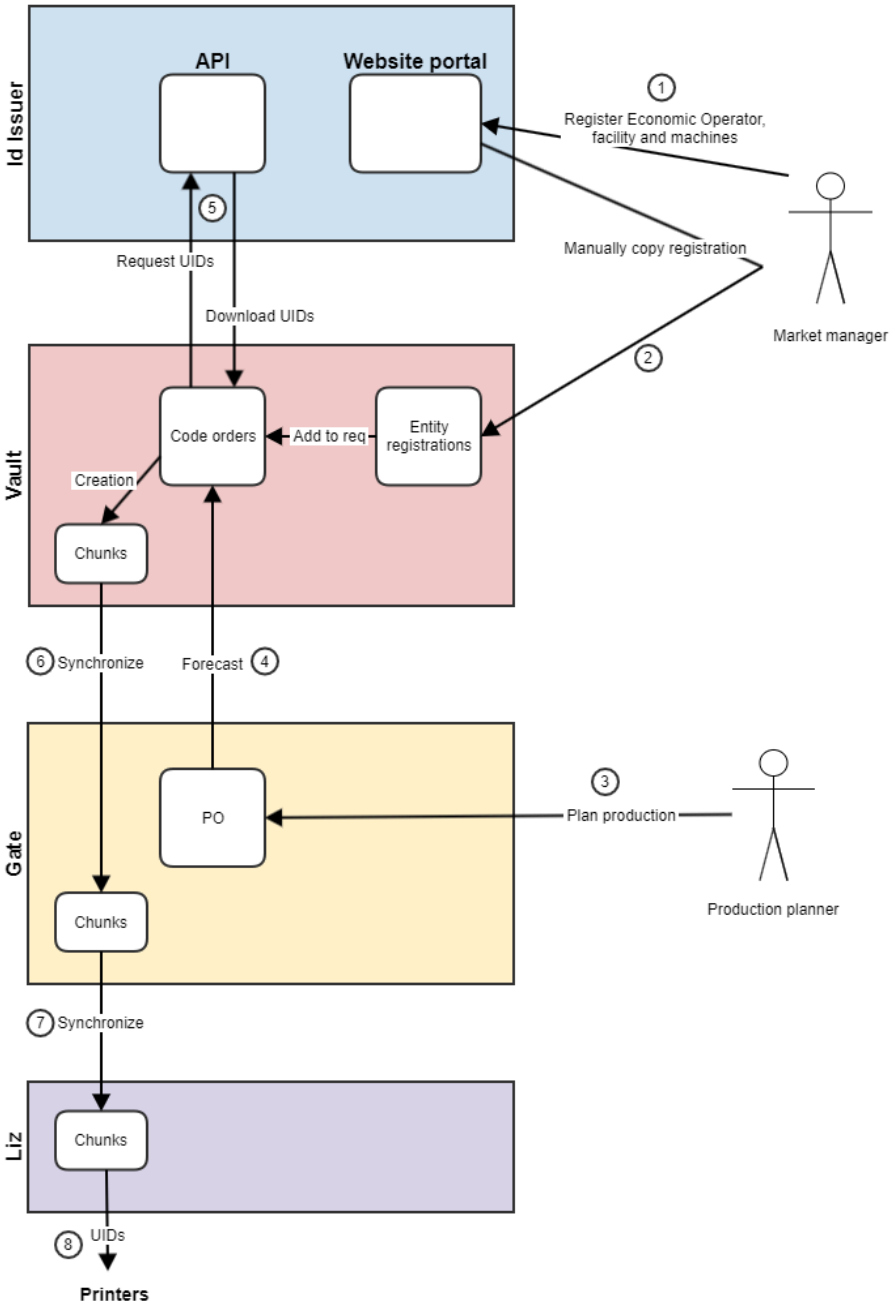
Concepts

Id Issuer	The entity mandated by the government to emit the UIDs. For Congo, it's the AGENCE CONGOLAISE DE NORMALISATION ET DE LA QUALITE (ACONOQ). The technical provider of the Id Issuer solution is Dentsu International. The Id Issuer offers a website and an API. The Vault use the API to order UIDs.
Code order	A request for UIDs. It is created on the Vault and sends a request to the Id Issuer API. The code order is completed when the UIDs are downloaded by the Vault. The Congo code orders are found on the Vault with the other FCTC code orders (TPD, UK, WLN, etc...)
Production Order (PO)	Describes a production. The PO is created in the Gate. A custom Congo tab exists to easily see and edit the Congo attributes. If the Gate detects that the stock of compatible UIDs is not enough for the production, it will send a forecast message to the Vault to request more UIDs.
Forecast	A message from the Gate to the Vault requesting UIDs. Congo has its own type of forecast.
Chunk	A package containing a group of UIDs. The chunks containing Congo UIDs indicates that the external code type is CONGO.

Workflow

1	The economic operator, facilities and machines must be registered on the website of the Id Issuer. This operation is manual, but must only be done once per entities.
2	Once an entity has been registered, the registration must be manually copied in the Vault. The most important data to copy are the EOID, EO Code, FID and MID generated by the Id Issuer. See: Vault FCTC Regulations: Economic Operators Vault FCTC Regulations: Facilities Vault FCTC Regulations: Machines
3	When a production is planned, the user must create a production order on the Gate. This can be done from the UI or from the API. The start date, the requested quantity, the linkup and the Congo specific attributes must be specified. Gate PO Tab: Gate: Congo The PO must be created in advance to leave enough time for the system to order UIDs. It takes 2 days for the Id Issuer to provide the UIDs. In a hurry, the setting immediate delivery can be used. The Id Issuer will deliver the UIDs as soon as possible, but the code order cannot be canceled. The setting can be set in the Congo tab or with the attribute "CG_ImmediateDelivery" = "True".
4	Gate will analyze the POs and the available Congo UIDs. If it detects that more UIDs are needed, it will send a forecast message to the Vault.

5	The Vault will convert the forecast into one or more code orders. The code orders will automatically request UIDs to the Id Issuer's API.
6	Once the UIDs are downloaded from the Id Issuer, they are stored into one or more chunks. The chunks are then automatically synchronized to the Gate.
7	When the production is started, the Gate sends a number of chunks to the Liz.
8	The Liz extract the UIDs from the chunks and push to the printers the data.



External codes: CRPT codes

This page contains an introduction to the system overview and the code ordering process in CRPT-regulated markets.

System Overview

The following diagram shows a basic overview of the manufacturing systems used from requesting codes to reporting code usage data.

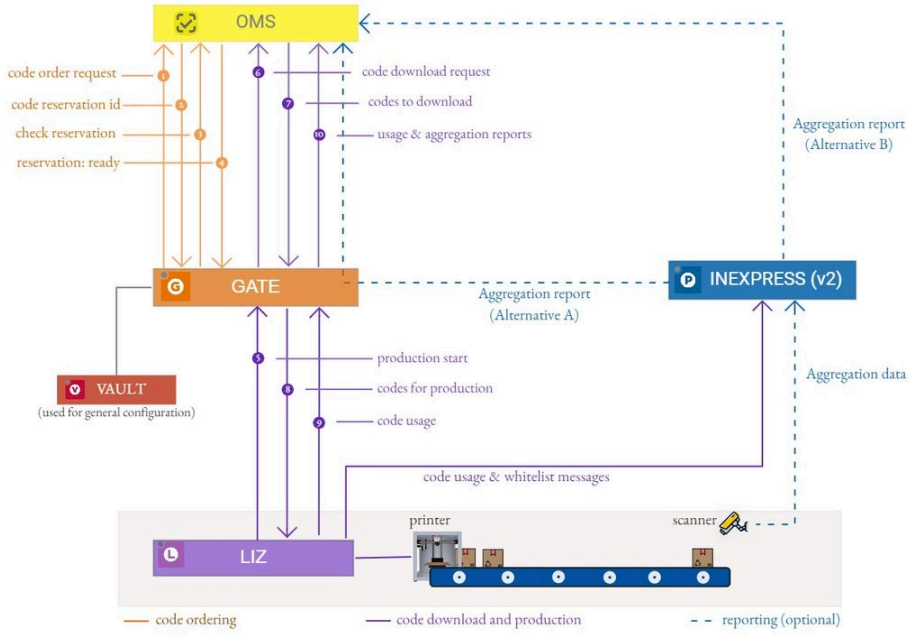


Figure 1: System overview of software systems used in production

Description of data flow in Figure 1 (without Inexpress v2)

1. A code order request is sent from the factory to OMS (CRPT) using the Gate.
   a. In this scenario, the Gate will upload codes to be signed by CRPT
2. The code order request is saved by the OMS, and a response (with Reservation Id) is returned.
3. Using the Reservation Id, the Gate will continue to request the status of the code order.
4. If the code order is accepted by the OMS, the Reservation Id will return a status of Ready
   a. A status of Ready indicates the OMS has accepted (signed) the codes
   b. At this stage, the manufacturer can start production
5. Production is started on the Liz
6. A request to the OMS is sent from the Gate to download the signed codes
7. Codes are downloaded from the OMS to the Gate
8. The Gate will forwards chunks of codes to the Liz for production
   a. At this stage, the Liz will forward the codes to printers and store the usage status (e.g., printed)
9. Code usage status is sent to the Gate by the Liz
10. The Gate sends a report to the OMS about the code usage and aggregation information.

Reporting and Alternatives

The reporting mechanism of the Inextor Suit can vary depending on the requirements of the manufacturer.

For the reporting section, the following alternatives exist:

1. Scanner → Inextor (Gate) → OMS
2. Scanner → Inexpress → Inextor (Gate) → OMS
3. Scanner → Inexpress (v2) → OMS
4. Scanner → Third-party → OMS

In the following diagram, the lines represent the alternative ways a code consumption report is sent from an Acquisition System (scanner) to the OMS.

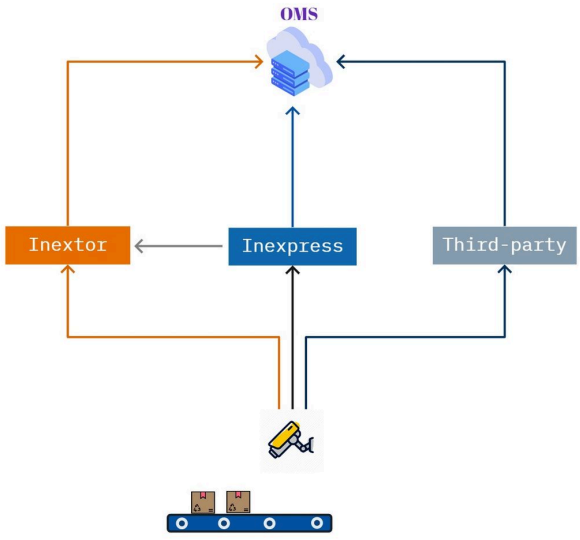


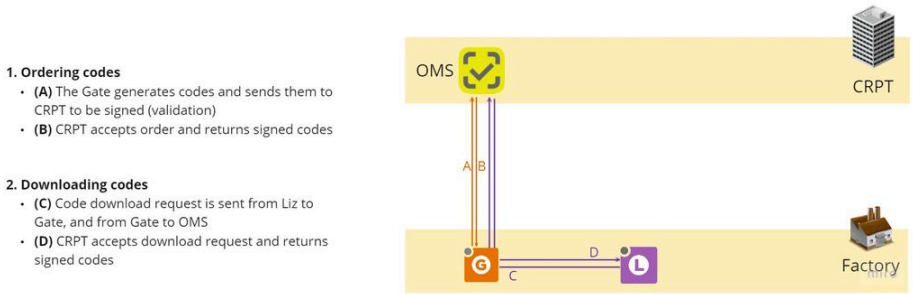
Figure 2: variations of the reporting system

CRPT Codes

The CRPT codes are hybrid codes: They are internal codes generated by INEXTOR and then sent to the government repository (OMS), which signs them by adding a signature string at the end of the code (meant to prevent tampering). CRPT codes are thus generated, sent to the OMS, signed by the OMS and finally imported into the Gate (which sends them on to the Liz) on the fly during production. There is no buffering. For a precise description of CRPT codes, see Codes and code ordering flow: CRPT codes (OMS).

More precisely, there is first a reservation for the codes sent to the OMS by the Gate, then the OMS confirms the codes are ready. When production starts (from the Liz), the Liz fetches the codes on the OMS through the Gate. Report on usage and aggregation is mandatory, and therefore the use of INEXPRESS is required.

The workflow is the following:



CRPT codes lose their validity after 20 days.

The comprehensive description of the CRPT code implementation can be found on the CRPT-Codes-OMS page. The complete operational guide can be found in the CRPT Regulated Markets Operational Guide.

CRPT Orders

Normally, CRPT Orders follow the same rules as other orders, i.e., "Orders based on PO" (see Codes: External Codes).

However, some customers are not ordering the complete amount of CRPT codes for a production before starting it. Instead, the Gate places orders on the fly, while the production is running. This mode is called "Orders based on Batch".

When the "Orders based on Batch" is used, the production is started without codes. The creation of the Batch will trigger a first set of OMS orders, usually one of 90'000 pack codes and one of 30'000 bundle codes. Once the number of codes Reserved, Downloaded and in Memory goes under the prefetch quantity, a new OMS order is generated. By default, the Liz has a prefetch duration of 20 minutes and a TI max of 1000 codes/min, thus, the prefetch quantity is 20'000 codes.

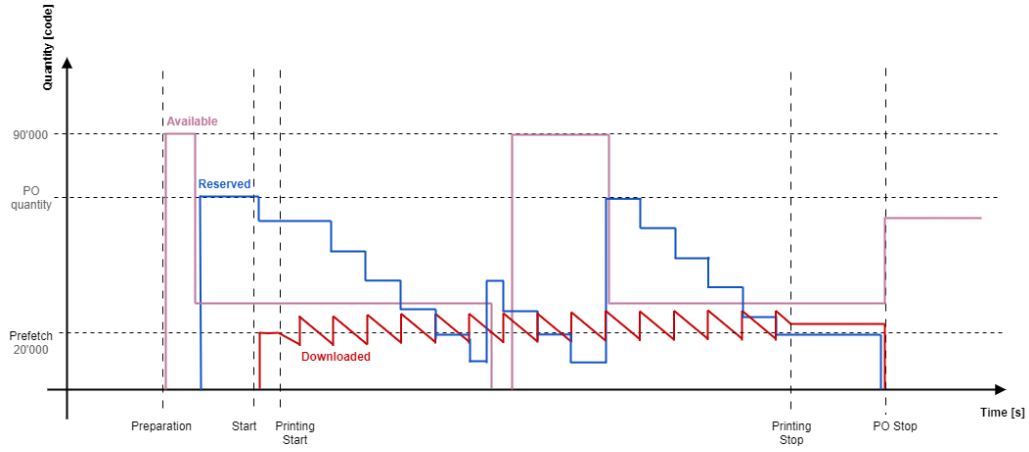
External Code Reference (ECR)

The External Code Reference for CRPT packs and budles is composed of the following properties:

ECR Name	Structure	ECR Sample
RussiaExternalCodeReference_Packs	{GTIN}_{MRP}_{OMS_SCHEME}	00000046223715_012500_DefaultV2.0_Packs
RussiaExternalCodeReference_Bundles	{GTIN}_{MRP}_{OMS_SCHEME}	04600439938842_125000_DefaultV2.0_Bundles

Note: Markets that do not require the MRP code (e.g., Khazakistan) use the **{GTIN}_{OMS_SCHEME}** ECR structure for packs and bundes (without the MRP code)

Code Quantity Presentation



External codes: DLR codes

The DLR codes must be imported manually: the user in charge goes to the DLR website, orders the codes, gets a file and imports it into the Gate (which then sends them automatically to the Vault).

⚠ The difficulty to automate is that the products registered in the DLR system are usually not matching the products registered in the Manufacturer ERP.

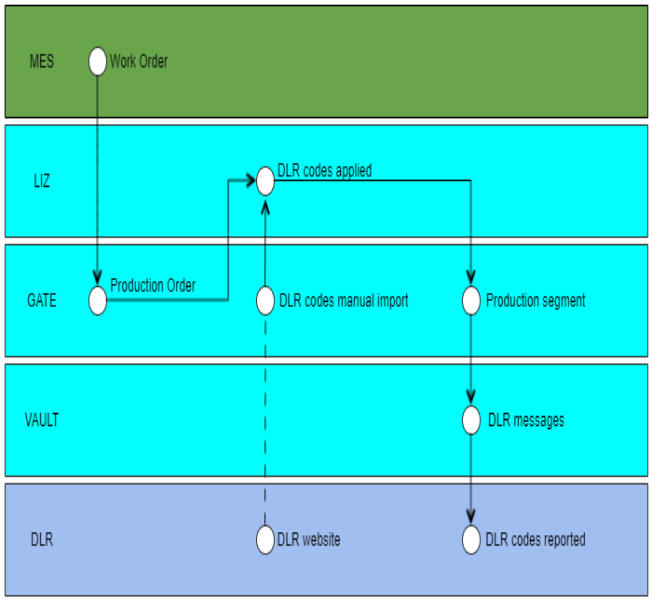
Consequently, an informed person from the Market Entity needs to pick the right product on the DLR web site combobox.

It is not unusual that the code file generated by the DLR web site will not match the products defined on the Gate, so the file header must be edited manually before import.

⛔ DLR codes lose their validity after 12 months.

In the DLR regulated markets, the ECR (see definition in Forecasts) comprises the country, the product reference and the production line machine reference, so any PO which matches that information can use the codes.

The workflow is the following (where MES is the manufacturer's Management Execution System):



The comprehensive description of the DLR code implementation can be found in the DLR Regulated Markets Operational Guide.

DLR codes are often used for code pairing (see page Concepts and Workflow Printing: Multiple Regulation Production).

External codes: Ecuador codes

Two cases arise:

1. Cigarettes: The Gate orders codes from the ID Issuer (in this particular case, the Worldline company). The code structure is described in the document below.
2. Industrial beer and alcoholic beverages: INEXTOR acts as ID issuer and generates SUPI12 codes (see Internal codes generated by Inextor)

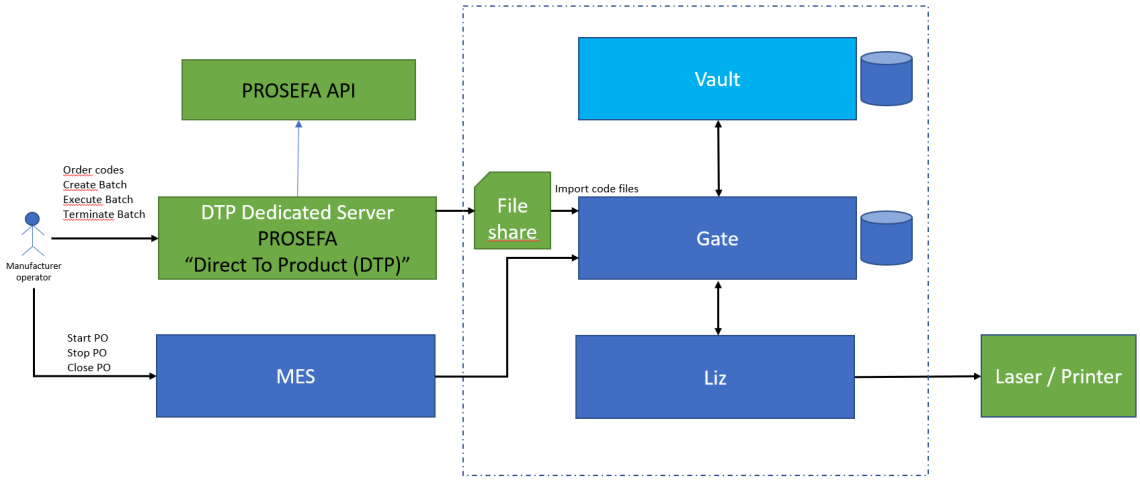
The Gate is also responsible for validating the necessary Ecuadorian production data supplied by the customer and putting it into the production order properties, in order to pass them to INEXPRESS for further processing.

File	Modified
Worldine Technical Proposal-T&T EC.pdf	Oct 10, 2022 by Nathalie Chiva

External codes: Prosefa codes

The INEXTOR Gate imports automatically the files of codes exported from PROSEFA.

PROSEFA batches and Production Orders transmitted to the Gate are mapped one-to-one, using the same identifier (order number). This allows INEXTOR to match the imported codes with the production order that can use them.



The «INEXTOR Shared Folders»

External codes: SAT codes

Data flow

The SAT codes are ordered by the Vault. The only information given out at order time is the manufacturer's identity, the factory (Gate) and the quantity of codes. This means that codes can be ordered without considering which product will be produced, only total factory production quantity is necessary.

Once codes are received by the Vault, they are sent to the Gate. The Gate uses them for production and then sends them back, together with the production's precise information (product, quantity, factory line/Liz), to the Vault.

The Vault then builds a report with all the relevant info and sends it to the SAT. The codes are then considered as legal.

The comprehensive description of the SAT code implementation can be found in the Mexican Regulated Market Operational Guide.

SAT codes lose their validity after 120 days.

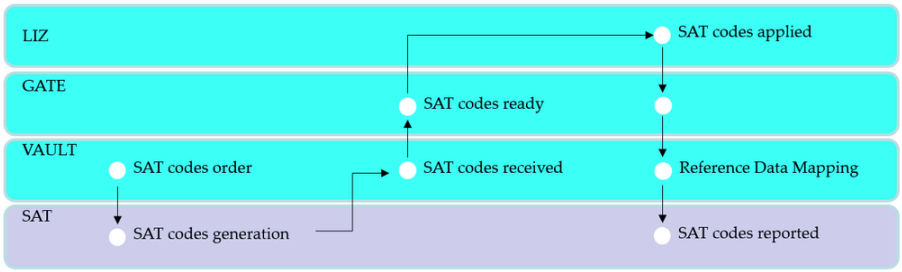


Figure 1: Workflow

Connection to SAT

Direct VPN

The recommended connection infrastructure is to have a VPN between Inexto's Azure cloud and Alestra's network.

For a brand-new setup, SAT require an Expressroute VPN. For existing setup, site-to-site policy-based VPN can be used.

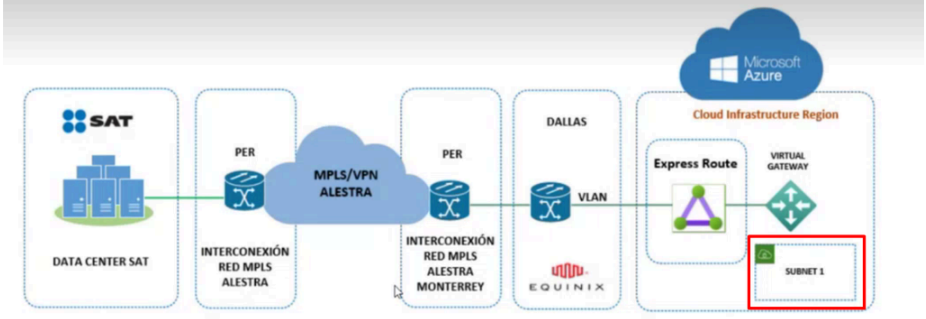


Figure 2: The latest connection requirement provided by SAT.

SAT Proxy

If the customer has already a VPN configured between their network and Alestra, we can use the existing infrastructure. To do this, we need to deploy in the customer's infrastructure the SAT Proxy. It will act as a bridge between the Vault and the customer's network.

For more details, see Installing the SAT Proxy

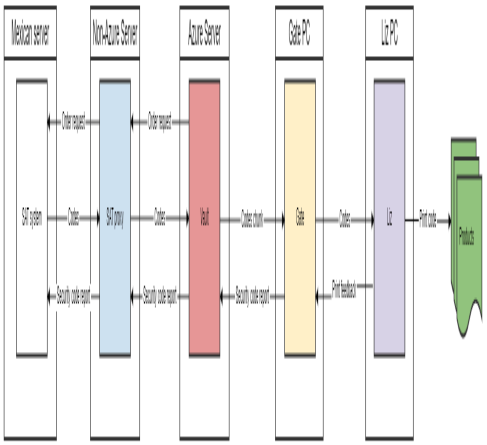


Figure 3: Simplified view of the data flow with the SAT Proxy.

Annex

WSDL provided by SAT: https://apagaf.siat.sat.gob.mx/ws/tabacos-PacContribuyente/PacContribuyente?WSDL

External Codes: Serbian codes

The Serbian market uses external codes for **Packs**.

Automatic code ordering is not currently supported. The codes must be uploaded on the Gate.

Characteristics of Codes Used in the Serbian Market

The codes utilized in the Tajikistan market follow these characteristics:

Codes for Packs

- Non-GS1 compliant, generated by the ID Issuer
- Machine readable format: `{ID Issuer code: MF - 2 characters}` `{Serial number - 13 characters}` `{Product code - up to 4 characters}` `{Timestamp: YYMMDDhh - 8 characters}`
- Human readable format: `{ID Issuer code: MF - 2 characters}` `{Serial number- 13 characters}`
- Data carriers allowed are dotcode and data matrix

Code for Bundles

- Standard GS1-SGTIN, not generated by the ID Issuer
- Machine readable format: `01 {GTIN14}` `21 {Serial number - 13 characters} <GS>` `240 {up to 30 characters}`
- Human readable format: `(01) {GTIN14}` `(21) {Serial number - 13 characters}` `(240) {up to 30 characters}`
- Data carrier allowed is data matrix

Cases

- Standard GS1-SGTIN, not generated by the ID Issuer
- Machine readable format: `01 {GTIN14}` `21 {Serial number - 13 characters} <GS>` `240 {up to 30 characters}`
- Human readable format: `(01) {GTIN14}` `(21) {Serial number - 13 characters}` `(240) {up to 30 characters}`
- 240 is optional
- Data carrier allowed is data matrix

Pallets

- Standard GS1-SSCC, not generated by the ID Issuer
- Machine readable format: `00 {18 characters}`
- Human readable format: `(00) {18 characters}`
- optional application identifiers are allowed
- Data carriers allowed are data matrix and linear barcode

External codes: Tajikistan Codes

The market in Tajikistan uses external codes for Packs and Bundles.

Currently, the ID Issuer does not offer support for code ordering through web services. Therefore, the codes must be uploaded to the Gate.

Characteristics of Codes Used in the Tajikistan Market

The codes utilized in the Tajikistan market follow these characteristics:

Codes for Packs

- Format: `{GTIN14 - 14 characters}` `{Serial number - 16 characters)`
- Example: `04870249811639aAVXGQk25bd57ddf`
- Pack codes do not adhere to GS1 standards.

Code for Bundles

- Format: `01 {GTIN14}` `21 {Serial number - 8 characters}` `<GS> 93 {Signature - 8 characters)`
- Example: `010487024981164621pAbpHOM2934d04a32d`
- Codes for bundles are standardized under GS1.

External Codes: TPD codes

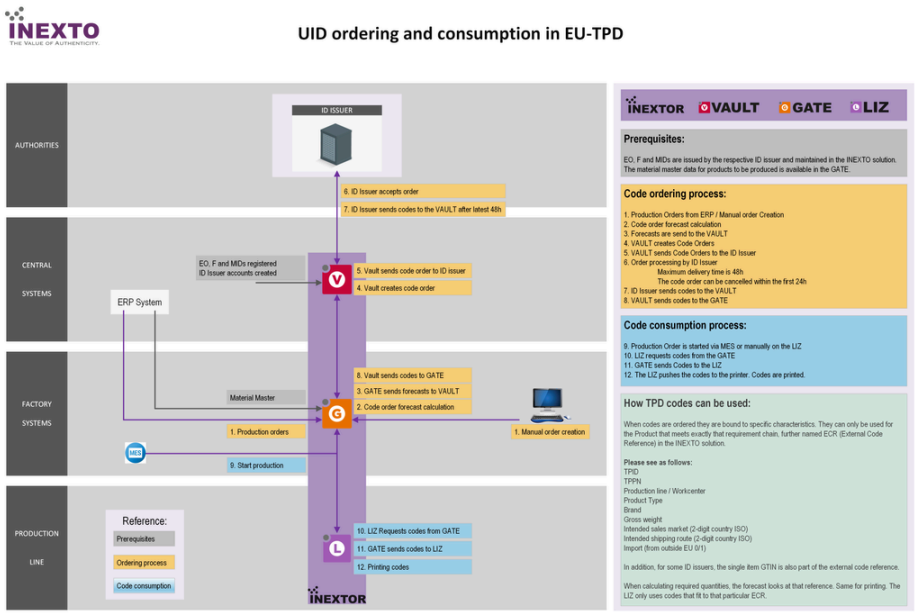
Definition: ID Issuer

Inside European Union, an ID issuer is the issuer for all codes destined to the country and/or produced in the country.

Each country of the EU chooses one (and only one) ID issuer. Each ID issuer is provided by a supplier. Each manufacturer also chooses a Primary, which is a third-party repository, and a single Secondary repository exists for all of the EU. There is no interaction of the INEXTOR software with the Secondary.

An ID issuer can, by law, take up to two working days to generate codes after being queried, which means that manufacturers must plan ahead.

TPD codes lose their validity after 6 months.



In order to plan production, the manufacturer creates a Production Order in the Gate. The Gate then checks if it has chunks of codes available to cover the production order, totally or partially: Inside the Gate is a component called a Forecast Driver which tries to match the available codes to the Production Order by looking at the ECR (sublist of the Production Order's attributes, see ECRs). The Forecast Driver then sends forecasts to the Vault for the Production Order if there are not enough available codes matching that Production Order. For a more complete explanation, see Forecasts.

For the TPD regulated Production Orders, the ECR comprises approximately 15 elements.

The Vault receives the forecasts and tries to order the codes as late as possible, given the production start date (which is defined in the forecast) and a customer-defined parameter which indicates the number of days to schedule in advance for the ID issuer involved. The number of codes the Vault specifies in the order is defined by the forecast, by the maximum number of codes the ID issuer accepts in a single order (defined per ID issuer), by the minimum number of codes the ID issuer accepts in a single order (defined per ID issuer) and by the number of which it must be a multiple of (defined per ID issuer). This means that sometimes the Vault has to order too many codes (if the minimum number is not reached or if the number is not the required multiple) or to split the order into several (if the maximum number is exceeded).

Example

For ID issuer XZY, the maximum number is 100'000, the minimum number is 20'000 and the number must be a multiple of 5000.

- If the number of codes specified in the forecast is 155'000, the Vault will issue 2 orders: One for 100'000 and one for 55'000 (total: 155'000).
- If the number of codes specified in the forecast is 15'000, the Vault will issue 1 order for 20'000 (total: 20'000).
- If the number of codes specified in the forecast is 133'000, the Vault will issue 2 orders: One for 100'000 and one for 35'000 (total: 135'000).
- If the number of codes specified in the forecast is 103'000, the Vault will issue 2 orders: One for 100'000 and one for 20'000 (total: 120'000).

Each ID issuer has its own interface for ordering codes, so the Vault has one plugin per supplier in order to be able to issue the orders.

The Vault regularly polls the ID issuer for availability of ordered codes and sends them to the Gate when they arrive. If the primary code checks takes place (i.e., if that functionality is enabled for the ID Issuer), the codes won't be released to the Gate until they have been whitelisted (i.e., checked and found valid).

All the codes which are ordered from an ID issuer are sent by the latter to the Primary. If, at control time, the codes are not in the Primary, they will not be recognized as legal, and so the Vault checks for the existence of the codes on the Primary before sending them to the Gate.

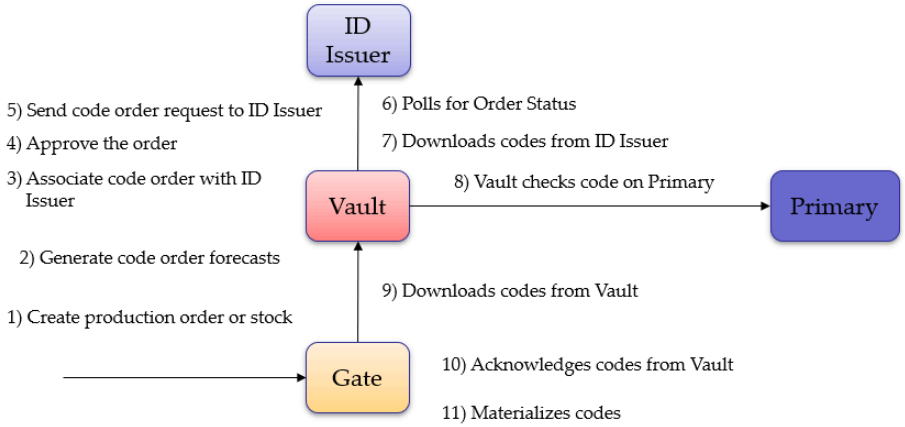
For each ID issuer, a code check strategy is defined: check nothing, check all codes, check every Nth code, or check 1st and last codes of received order.

If code checks fail, codes are put aside and checked regularly after that. When the forecast's start date is reached and the codes still do not check out, the codes are blacklisted. The not yet accepted codes are then regularly checked and emails are sent to the manufacturer regularly to remind them of the existence of the blacklisted codes or to inform them that they are not blacklisted anymore.

If only part of the forecast's codes checks out and another part does not, there is what is called a salvage operation which ensures the 'good' codes can still be used.

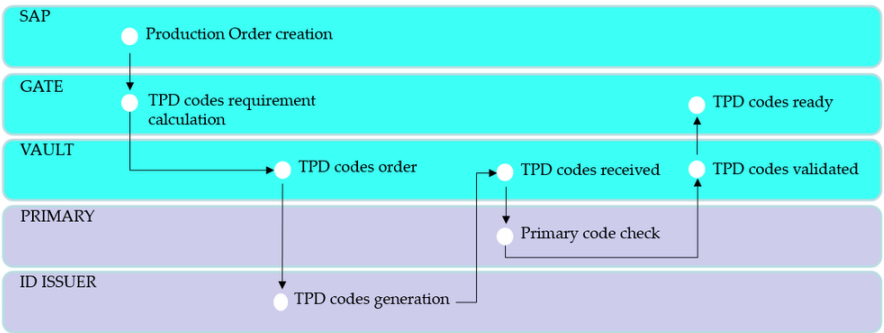
For more details, see page Codes Check on Primary.

The process of code ordering is the following:



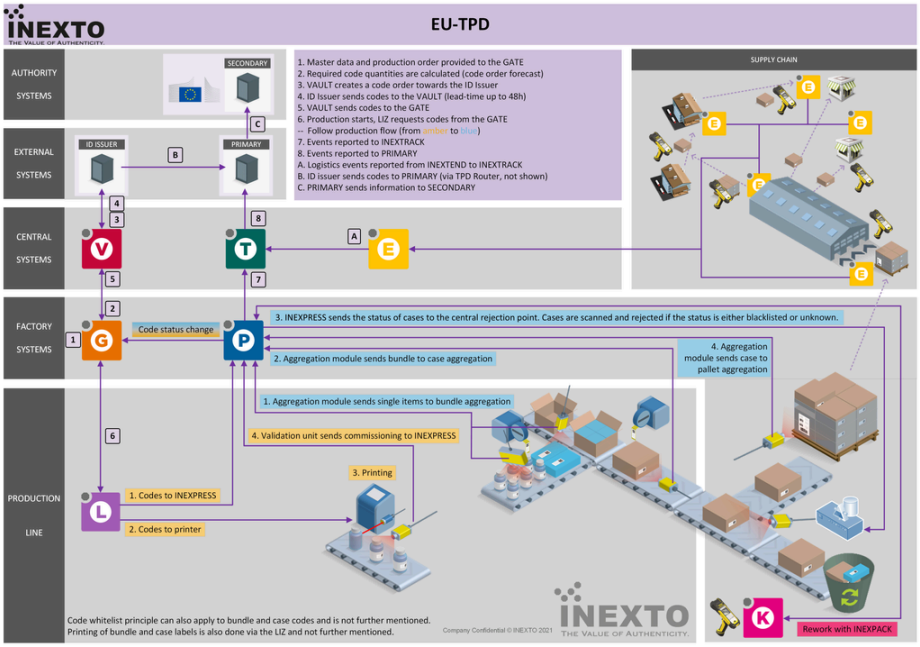
1. User or Web service creates or modify production orders & stocks.
2. Gate sends order forecasts to Vault based on production orders, stocks & its available codes.
3. Vault associates order with the appropriate ID Issuer depending on order forecast information.
4. If enabled on Vault, a manual approval can be necessary before the order is sent to the ID Issuer (disabled by default).
5. When reaching time limit, Vault automatically sends order to ID Issuer.
6. Vault regularly requests ID Issuer for order status (approved, rejected).
7. Once approved, Vault downloads codes from ID Issuer, order is completed
8. If enabled, codes are checked against the Primary
9. Gate downloads codes from Vault, the order is ready to be executed.
10. Gate acknowledges the reception of codes.
11. Gate materializes the codes (in order to speed up codes check).

The workflow is the following one (where SAP can be replaced by any manufacturer's Management Information System):



Most ID issuer support automated code ordering, but in some cases, the manufacturer must manually download a file containing the codes on the ID issuer's site. The codes must then be imported into the INEXTOR software.

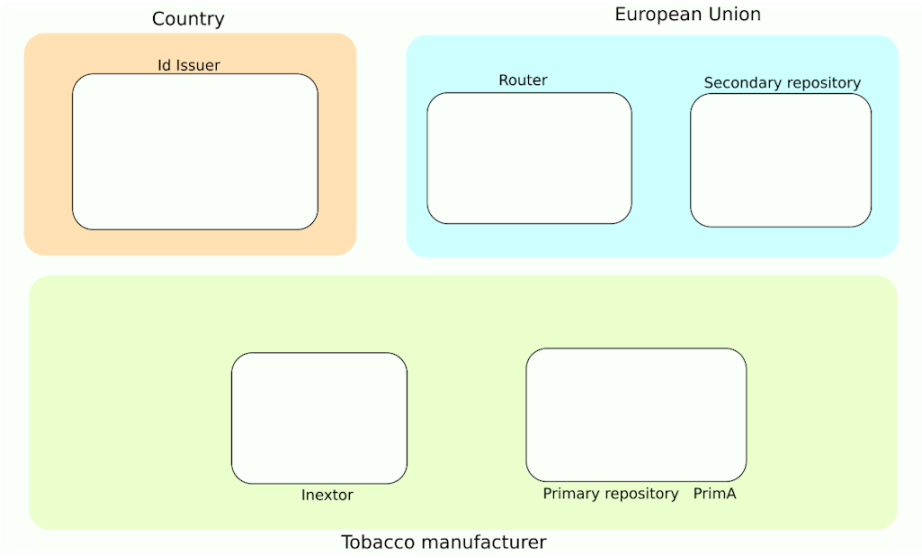
The end-to-end process is the following:



The comprehensive description of the TPD code implementation can be found on the Code Ordering Process page.

Routing

The relationship between the TPD router, primary and secondary repository, is not directly impacting INEXTOR, but it's interesting to understand how it works.



The above animation shows a simplified view of the process to download codes, with an emphasis on the role of the router and two repositories.

1. Registration
    a. Manufacturer register its company, factories and machines to the Id Issuer.
    b. Id Issuer generates corresponding EOID, FID, MID.
    c. Id Issuer sends the new IDs to EU Router and secondary.

2. Copy of IDs
    a. Manufacturer manually adds the new IDs in the Vault.
    b. Manufacturer adds the new IDs in the Primary repository.
    c. Primary repository tells the EU Router that data with EOID/FID must be routed to this Primary.
3. Unique Identifiers (UIs) ordering
    a. Vault sends a UIs request with the EOID/FID/MID.
    b. Id Issuer generates the UIs and sends a copy to the EU Router.
    c. Vault download the UIs.
    d. Router sends a copy of the UIs to the Secondary and manufacturer's Primary. It's using the info provided in 2.c to know which Primary should receive the UIs.
4. Primary check
    a. Vault ask the Primary if it has also received the UIs. If yes, it will push the codes to the factory (Gate).

External codes: UK codes

The code ordering process as well as production configuration (which content to use) are impacted by the UK regulation.

The differences depends on the scenario of production which relies on 2 main parameters:

- The market of production
- The market of destination of the product

The values of these 2 parameters determine which regulation applies between UK and EU and how code ordering and serialization are impacted.

The main impact is when both regulation UK and EU apply:

- Codes must be ordered both from an EU ID Issuer and the UK ID Issuer (except for Northern Ireland, which requires only codes from the UK ID Issuer).
- EU codes are printed on Packs
- UK codes are paired with EU codes and the pairing information needs to be reported to UK authorities (Dentsu Gateway system).
  INEXTOR does not report the code pairing directly to UK authorities but, depending on the code pairing solution chosen by each manufacturer, INEXTOR can be involved in building this information.

When only UK regulation applies:

- Codes must be ordered from the UK ID Issuer only.
- UK codes are printed on Packs.

The following table summarizes the different scenarios.

Production Market	Destination Market	UK codes	EU codes
UK	UK (without Northern Ireland)	✅	❌
UK	EU	✅	✅
UK	Northern Ireland	✅	❌
UK	Rest of World	✅	❌
EU	UK (without Northern Ireland)	✅	✅
EU	Northern Ireland	❌	✅
EU	Rest of World	❌	✅
Rest of World	UK	✅	❌

Internal codes generated by Inextor

Secure Unique Product Identifier (SUPI) Codes

Internal codes generated by Inextor are called SUPI (Secure Unique Product Identifier) codes, for a detailed description of these codes reference documents Code Generation and Encryption and Secure Digital Codes.

These SUPI codes are generated by combining three data sets:

1. A Liz ID (which is unique inside a Vault),
2. A time stamp which changes every minute (YYMMDDHHmm)
3. A time index which distinguishes product items within the same minute.

This string is then encrypted (with an encryption key which is generated at installation of the Liz).

Figure1: Example of a SUPI12 code

Internal code structure variation

Other internal codes generated by Inextor can follow different formats through scripted contents (see Concepts and Workflow Printing: Templates and Layouts). These codes can be unique or not, for example:

1. Shift codes - codes which identify the team working at the time the item was produced.
2. Serial Shipping Container Codes (SSCCs) - 18-digit numbers used to identify logistics units.
3. Any other codes required by the manufacturer or the local authorities.

Code generation

All the internal codes are generated by the Liz during production, at the time of printing, the Liz also reports to the Gate which in turn reports to the Vault. It sends an update of the production status which contains the last time stamp (databaseId) of the generated codes. There is no requirement for the Liz to send actual SUPI code properties, as Inextor is able to regenerate them or verify them from the three data sets that compose a SUPI code (Liz ID, time stamp, time index).

The Liz also sends a whitelist report to Inexpress, reference document Aggregation for details.

Code generation and encryption

Codes are unique

The generation algorithm ensures that the same Inextor serial code cannot be marked twice on different product items.

Codes are protected using a cryptographic algorithm impossible to forge

The 12-digit Inextor serial codes are generated using "double key algorithm" cryptographic technologies, which ensure that unauthorized codes cannot be generated without detection. Without the proper master key and volatile key, valid serial codes cannot be generated. The master key and volatile key are shared between the Serializer (Liz) and the Central System (Vault).Reconstructing secret keys by analyzing a substantial number of authentic codes is virtually impossible. TThis stands in contrast to holograms and security inks typically used in paper-based solutions, which can often be replicated quickly and inexpensively.

Code contains intrinsic information that identifies the origin of the product

Intrinsic information can be obtained from the code itself without additional data storage as opposed to linked information which is stored in a data storage. The intrinsic information contains a unique product identifier created from the serializer (Liz) identifier and date/time. This identifier is combined with a digital signature created from the secret keys (master key and volatile key) for integrity.

Code information is protected by encryption

The intrinsic information within the code is protected using two distinct encryption keys. It is cryptographically impossible to retrieve the encoded information without the encryption keys.

Intrinsic information is used for code validation

The Serializer (Liz) keeps track of the unique product identifiers generated and the subsequent events happening on the production (validation, rejection or aggregation). To be considered as valid, the codes must meet the below conditions:

- Its unique identifier must be registered by the Serializer (Liz) with a valid status,
- Any linked information registered during production must match the actual product,
- The digital signature must be verified from the secret keys stored in the central system (Vault).

Data exchanges between systems are secured

For maximum security, key data exchanges between systems are secured using a Public Key Infrastructure (PKI), whose root certificate is held by the government at the central system (Vault). Only registered manufacturers providing valid authentic certificates are allowed to connect to the central system (Vault). Inextor serial codes are thus secure against confidentiality and integrity attacks.

The government is in full control of the system

Only the government, who controls the central system (Vault), can issue genuine keys (signed using its certificate) and can read the information reported into the system by manufacturers. Therefore, manufacturers cannot mark codes without proper authorization from the government. The government can deny at anytime the manufacturers ability to generate genuine Inextor codes. A comprehensive access control system ensures that confidentiality of the data is preserved. Manufacturers will only be

able to see their own information. The government can at anytime review the effective list of codes marked on the products, and compute the manufactured quantities.

Codes are not stored anywhere in the factory

Codes are never stored during the generation and marking process. The data is generated in real-time and promptly transmitted to the coding equipment. This dramatically increases the security of the system as valid codes cannot be seen and therefore cannot be hacked or extracted from the system. Also, this increases performance, reduces bandwidth consumption, and improves system robustness by limiting the system dependencies. Not storing or transmitting the codes themselves is a key strength of the system. Inextor requires that only the unique product identifiers are stored and transmitted. This ensures that manufacturers have no access to a comprehensive list of the codes and therefore cannot steal or duplicate them.

Codes can still be applied on products even if network infrastructure fails

The Serializer (Liz) will continue to transmit Inextor codes even if the network infrastructure is under attack or fails (i.e. due to a local power outage). The Serializer (Liz) can keep transmitting codes for several days while being disconnected from the network. Of course, the serial codes will not be fully authorized before the Serializer (Liz) finally restores its connection to the Central System (Vault) and reports the unique product identifiers of the codes and the subsequent events.

Secure digital codes

Codes are secured

Each code is generated in real-time by an algorithm designed to guarantee uniqueness, authorization for product application, and security in its seemingly random structure. These codes appear completely random, exhibiting no correlation between consecutive products. Each code is marked as follows::

Figure 1: Example of a SUPI code (Inextor code)

Licensing scheme

All actors (economic operators), products and manufacturers must be registered and authorized by the government to be able to use the system or any of its components. All manufacturers receive a digital certificate which authorizes their use of the system.

Line authorization

Each Serializer (Liz) module installed on an individual production line must have been granted prior authorization to manufacture, in the form of a master key containing generation parameters and authorization policies. This authorization certificate is issued by the Central system (Vault).

Production authorization

During production, the Serializer (Liz) continuously verifies the authorization granted to the manufacturer and the specific machine for the given production run, and generates a unique volatile key that is only used for a given production run. This key is securely stored and transmitted to the government, guaranteeing that only government-authorized systems are able to use it. Both the government's master key and the volatile production key are required by the production algorithm to generate a valid and secure authorization code.

Production information

The Serializer (Liz) securely reports all production information to the government online enabling tax verification and volume monitoring.

Verification

The government owns the master key and securely receives the volatile key. Therefore only the government can decrypt the information uploaded during production by authorized manufacturers to validate manufactured products and similarly, only governments can see all detailed information on manufactured product , manufacturer, production machine, and manufacturing date.

Reporting

The government can also verify tax information, and monitor production volumes using the information reported by the Serializers (Liz).

Codes and code ordering flow

Code format

Codes are presented in two distinct formats.:

- Human-readable form (HRC): The code consists of a combination of numbers and letters that is easily interpretable by humans. This code is generated by the software or provided by the regulatory authority, often accompanied by a timestamp and additional information requested by the customer.
- Machine-readable form (MRC): TThis is the barcode. In the Track & Trace industry, the most commonly utilized two-dimensional barcodes are DotCodes (DC) and DataMatrix (DM). These barcodes contain codes generated by the software or received from regulatory authorities, along with a timestamp and additional information requested by customers. This code will be scanned by cameras on the production line and will also be employed for various Tracking & Tracing events throughout the product lifecycle.

Sometimes, other information (e.g. price) is printed together with the human-readable and machine-readable codes.

Code format examples

The below table illustrates the two code formats defined above.

Image	Description
	DotCode (DC) printed on an Item and in pre-print format.

	• ataMatrix (DM) printed on an Item and in pre-print format.

Section content

The following content defines per regulated / unregulated market the code ordering flow.

- Codes and code ordering flow: Code states
- Codes and code ordering flow: Code workflow
- Codes and code ordering flow: Azerbaijan codes
- Codes and code ordering flow: China codes
- Codes and Code Ordering Flow: Congo Codes
- Codes and code ordering flow: CRPT codes (OMS)
- Codes and Code Ordering Flow: DLR Codes
- Codes and Code Ordering Flow: Inextor codes
- Codes and Code Ordering Flow: Ecuador Codes
- Codes and Code Ordering Flow: Mexican Codes (SAT)
- Codes and Code Ordering Flow: Prosefa Codes
- Codes and Code Ordering Flow: TPD Codes
- Codes and code ordering flow: UK codes

Codes and code ordering flow: Code states

Codes can be considered from several points of view.

Track and Trace

This concerns only the Track & Trace business.

A code is marked as *Invalid* if the Track & Trace system has no information on it or its existence.

Otherwise, the system provides this information when queried, and the questioner must interpret the information as he or she sees fit.

Brand Integrity

This concerns the fight against counterfeiting.

To some extent, the code can substitute for the presence of copy-protection features. In that scenario, the security is based on the difficulty for counterfeiters to obtain a large number of genuine codes. Brand owners will build the list of codes spotted on several product items (*Blacklist*) and the list of codes already verified (*Verification History*).

By combining these two lists, the system provides a good statistical feedback and detects most counterfeited products.

Codes and code ordering flow: Code workflow

During Manufacturing

After Ship Out (Logistics)

Codes and code ordering flow: Azerbaijan codes

Introduction

Tobacco products sold in Azerbaijan must carry serialization codes that have been obtained from the "Track and Trace" system (TNT) of Azerbaijan.

Aggregation and shipping must be reported to the TNT system, up to the master case level (mandatory) or higher (optional).

ID Issuer

The TNT system offers the following services, via a web portal as well as an API that can be used for automation:

- Register entities involved in the production and supply of tobacco products: fiscal entities, departments (including factories), production lines.
- Register regulated products
- Create excise orders for product codes, which need to be paid for and approved by authorities
- Generate codes that must be printed on regulated products (from a specific excise order)
- Register aggregation, shipping and waste of regulated products

Coding

The TNT system provides codes for Packs and Bundles.

Codes for Master Case can be generated by the ID Issuer, but must still abide by the code format specified in the regulation.

Each level needs to have both a machine readable and a human readable code printed.

The machine readable code contains the same information as the human readable, as shown in bold face below.

The human readable can also contain optional elements which are shown greyed out below.

Packs

(250) f8f5d2ece9addW
(01) 04023500715224
(21) 457f8f5d2ece9addW111

- AI250: unique serial number, provided by TNT
- AI01: optional, provided by manufacturer. It must match the GTIN registered on the TNT system for this product.
- AI21: optional, provided by manufacturer. To use optional AIs, it is necessary that the code format is configured appropriately on the product on the TNT system, otherwise the code will not be recognized when reporting events.

Bundles

(243)12345678901234
(01) 04023500715224
(21) 457f8f5d2ece9addW111
(240) 14194765
(10) 243G1555

- AI243: provided by TNT
- AI01: provided by manufacturer. Must be registered on the TNT system.
- AI21: unique serial number, provided by TNT.
- AI240, AI10: optional, provided by manufacturer. To use optional AIs, it is necessary that the code format is configured appropriately on the product on the TNT system, otherwise the code will not be recognized when reporting events.

Cases

(01) 04023500715224
(21) 457f8f5d2ece9addW111
(240) 14194765
(10) 243G1555
(17) 20.12.2021
(91) 3455665

- AI01: provided by manufacturer. Must be registered on the TNT system.
- AI21: unique serial, provided by manufacturer
- AI240, AI10, AI17, AI91: optional, provided by manufacturer. To use optional AIs, it is necessary that the code format is configured appropriately on the product on the TNT system, otherwise the code will not be recognized when reporting events.

Codes and code ordering flow: China codes

Introduction

Foreign tobacco manufacturers, that want to sell products on the Chinese market, must follow the Chinese regulation. It requires to print unique QR codes on the packaging levels: **pack**, **bundle** and **case**. Currently, the products regulated are **cigarettes** and **cigars**. **Taxed** and **duty-free** products must both follow the regulation.

During manufacturing and logistic, events must be sent to the Chinese authorities.

Organizations

The QR code are provided by the State Tobacco Monopoly Administration (STMA). The technical implementation is done by Tencent.

Since it's imported production, the tobacco manufacturer must work with an importer registered in China. It is the importer who will be the legal representative. Therefore, the importer must create an account in the STMA system and register the products. STMA will provide identifier for the different entities, importer, manufacturer, products. STMA will also provide credentials to access their system.

Coding

The unique identifiers (UID) must be printed as QR code. The regulation doesn't require printing a human-readable version.

The UID is a web URL. It starts by "https://". It is composed of various parts referencing master data. For instance, it contains the importer code, the brand code, the product type, etc ...

Pack and bundle

The UIDs for pack and bundles are received exactly as they should be printed.

The UID is made of 59 alphanumeric+symbols characters.

Sample

- https://y2wm.cn/99.1000.1/AC1006498001VI6WHW2T6O2US73TPANTK

Case

The case UID must be created during production. STMA will only provide the serial number. The rest of the UID is composed of various master data (see figure 1).

	Identification Prefix (26)				Cigarette Main Data Encoding				Shipping Case Identification Code (70)								
					Object Encoding		Basic Information Encoding		Business Serial Number (61)								
									Associated Attribute Code								
	Network Service Address	Forward Slash	Identification resolution prefix	Forward Slash	Cigarette Classification	Package Type	Business Type	SKU Code	Organization Code	Product Barcode	Production Type	Production Time	Production Line	Printer	Production Shift	Self Defined Info	Unique Serial Number
Start-End	1-15	16	17-25	26	27-28	29	30	31-35	36-43	44-56	57	58-71	72-73	74-75	76	77-78	79-96
Length	15	1	9	1	2	1	1	5	8	13	1	14	2	2	1	2	18
Example	HTTPS://Y2WM.CN	/	99.1000.1	/	AC	3	2	**12345**	88888888	690102812345**6**	9	20230906112220	01	01	A	XX	.....

Example : HTTPS://Y2WM.CN/99.1000.1/AC+1+2+12345+88888888+6901028123456+6+20230906112220+01+01+A+XX+QR Code Serial Number

Remark:	
Character 1-15	No modification: Network Service Address in 15 Characters
Character 16	No modification: Forward Slash
Character 17-25	No modification: Identification resolution prefix in 9 Characters
Character 26	No modification: Forward Slash
Character 27-28	No modification: Cigarette Classification in 2 Characters
Character 29	No modification: Package Type **(2-Shipping Case)**
Character 30	No modification: Business Type
Character 31-35	SKU code generated according to product specification files by China Tobacco in 5 Characters
Character 36-43	Organization code assigned by China Tobacco in 8 Characters
Character 44-56	Product Barcode in 13 Characters
Character 57	No modification: Production Type (6-Foreign Brands Produced Oversea)
Character 58-71	Production Time (Year/Month/Day/Hour/Mins/Second-20230906132030) in 14 Characters
Character 72-73	Production Line in 2 Characters
Character 74-75	Printer Equipment Number self-defined by manufacturer in 2 Characters
Character 76	Production Shift self-defined by manufacturer
Character 77-78	Information self-defined by manufacturer in 2 Characters
Character 79-96	QR Code Serial Number in 18 Characters

The serial number is made of 18 alphanumeric+symbols characters.

The complete UID is made of 96 alphanumeric+symbols characters.

Sample

- HTTPS://Y2WM.CN/99.1000.1/AC3212345ABCD123485258229799736202408200801000101A0116WZSW7BRRYIU4O57T

Codes and Code Ordering Flow: Congo Codes

Introduction

To sell tobacco product on the territory of the Republic of the Congo, unique identifiers (UID) must be printed on the packaging. The smallest packaging level must have a UID provided by the government. The other aggregation packaging must have a UID, but it doesn't need to be one provided by the government.

The technical provider of the solution is Dentsu, thus you will see similarities with the European Tobacco Product Directive (EU TPD). Dentsu has put in place an Id Issuer, where the entities can be registered and UIDs can be ordered. The Id Issuer has both a website and a web API.

- QA: https://idissuer.cg-pre.dentsutracking.com/
- Production: https://idissuer.cg.dentsutracking.com/

Coding

Smallest packaging level

The smallest packaging level is the one that doesn't contain another packaging inside. It's usually: packs, pouch, tin, etc...

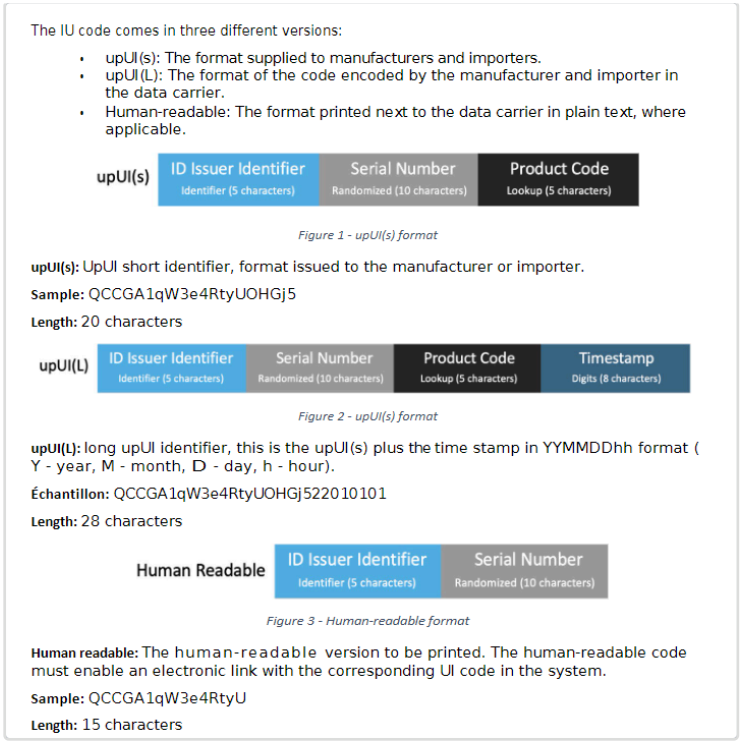
The UID provided by the government can have up to 4 parts:

- **Id Issuer identifier:** A code that identify the Id Issuer
- **Serial number:** The unique identifier of the package. Two packages of the same product must have different serial number.
- **Product code:** The unique identifier of the product. All the packages produced during a production, usually, have the same product code.
- **Timestamp:** The date-time at which the UID has been printed. Precision is to the hour.

When receiving the UIDs from the Id Issuer, it is composed of the Id Issuer identifier, serial number and product code.

During production, the governmental UIDs must be printed in a human-readable (HR) format and a machine-readable (MR) format.

- **HR:** {IDIssuerCode}{SerialNumber}
- **MR datamatrix:** 5R{IDIssuerCode}:{SerialNumber}{ProductCode}{Date:yyMMddHH}
- **MR dotecode:** [FNC1]5R{IDIssuerCode}:{SerialNumber}{ProductCode}{Date:yyMMddHH}



Various formats of the QCCGA UID.

UIDs are valid for 6 months after they have been generated by the Id Issuer.

Aggregation packaging

For the aggregation packaging, the Inextor SUPI code can be printed.

Codes and code ordering flow: CRPT codes (OMS)

Introduction to tobacco regulation in Russia

In December 2017, the Russian Government introduced a law requiring that all tobacco products produced and sold in Russia must carry a unique serialization code.

These unique codes allow the Russian Government control over any goods sold on the Russian market by monitoring their movement in the supply chain.

Timeline

The diagram below illustrates the timeline from the legislation to the adoption of the regulation.

With the introduction of this new law, all manufacturers producing tobacco products for Russia were now required to change their workflow as follows:

1. The manufacturer must generate a unique product code for serialization
2. The generated codes must be uploaded to the Russian ID Issuer for validation
   - The ID Issuer validates codes by adding an extra 4-characters known as check digits
3. The manufacturer downloads the validated codes for application on their product

The ID Issuer authorized to validate the manufacturer's code is referred to as The Center for Research in Perspective Technologies (CRPT).

About CRPT

Introduction and Purposes

CRPT is a private-public joint program of several shareholders approved by the Russian government to create a unified national track & trace digital system.

The CRPT, which is similar to its EU counterpart EMVO, is also the operator of the Chestny ZNAK (fair label) the national digital track and trace system.

Currently, almost a dozen product categories are already covered by the system, including drugs, medicine, fur coats, milk, tobacco products, clothes, footwear, perfumes, bicycles, wheelchairs, digital cameras, and tires (see complete catalog).

By 2024, the system is expected to be applied for all commodities.

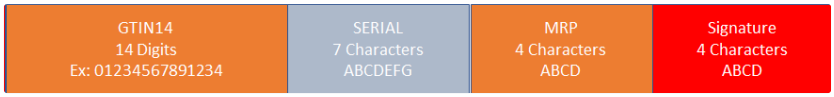
For the CRPT-regulated market (Russia, Kazakhstan, etc. - probably the whole Commonwealth of Independent States (CIS) in the future), codes must be generated at the factory and then sent to the OMS (Order Management System), which is an intermediary (middleware) between the manufacturer and the ID Issuer (CRPT, i.e., Center for Research in Perspective Technologies). The OMS signs the codes (by adding some information to them) and returns them to the manufacturer's repository. They can then be used.

CRPT codes lose their validity after 20 days: They cannot be printed on products manufactured after that time (if they are, the product will be considered illegal).

The official Russian Track and Trace directive can be found on the site of Chestny Znak. The CRPT organization and aim can be found on the CRPT site.

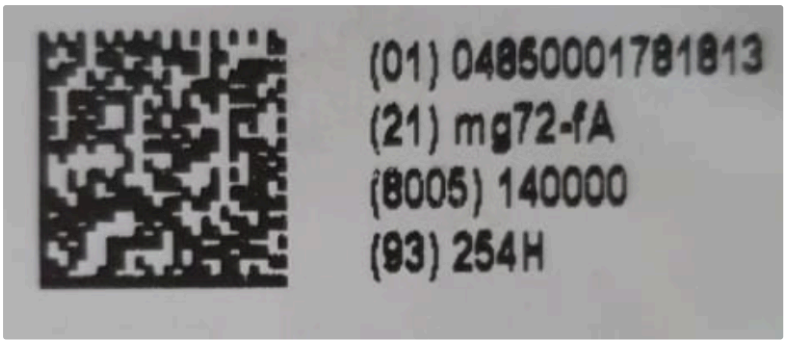
Codes for packs

The following structure present the content of the Machine-Readable code for the Packs



Codes for bundles

For the bundles, here is the structure, used by some tobacco manufacturers (JTI-PMI-BAT)



Any element after AI 93 is considered as optional for the bundles and can be added by the tobacco manufacturers

The elements in Orange are master data that must be provided by tobacco manufacturers as part of the attributes of production order or manufactured products.

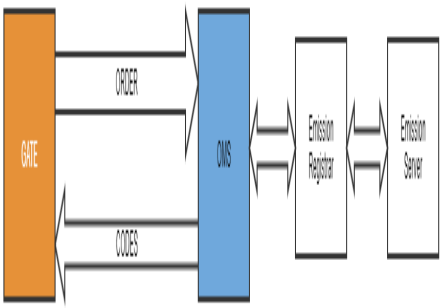
The elements in Gray are the serial number generated by the software.

The elements in Red are generated by the authorities.

So the software has to generate an internal code and send it to the OMS. The OMS then sends it back with an added signature. The MRP (Maximum Retail Price) must be added in between. There are 2 scenarios, depending on the OMS version used:

Information Flow

The flow of the information is as described in the following diagram.



OMS version 1:

The MRP must be added after receiving the signed code, between the internal code and the signature.

Example:

- Internal code sent to the OMS: 00000000001234Ym74k2D
- With the OMS signature: 00000000001234Ym74k2D5462
- The MRP is 125
- Final version, with the MRP added: 00000000001234Ym74k2D1255462

OMS version 2:

The MRP can be added to the internal code, and the concatenation sent to the OMS, which will add the signature before sending it back.

Example:

- Internal code with MRP (=125), sent to the OMS: 00000000001234Ym74k2D125
- With the OMS signature, final version: 00000000001234Ym74k2D1255462

Codes and Code Ordering Flow: DLR Codes

For some markets, codes are mandatorily emitted by De La Rue (DLR).

The list of these markets is the following:

- United Arab Emirates
- Kingdom of Saudi Arabia
- Kingdom of Bahrain
- Sultanate of Oman
- State of Qatar

The tobacco goods must comply with 2 obligations:

- Bear a DLR physical tax stamp
- Be printed with a DLR electronic code.

As a first step, the manufacturer must order the appropriate category of physical paper stamps, that he will stick on the tobacco packs. This stamp order grants to the manufacturer an ***Entitlement*** for electronic codes.

As a second step, the manufacturer will scan a datamatrix located on the boxes of paper stamps. To do that, they use a dedicated PC located in the factory, which is equipped with a scanner. The scanning will allow ordering the same quantity of electronic codes against these paper stamps. The user will fill a form on the dedicated PC and select the GTIN14 in a combobox that lists the registered products. The codes are downloaded as a file, and imported into the manufacturing system.

Because of this manual process related to physical stamps, the electronic code ordering and downloading to the factory is not automatable.

The code-stamp correspondence is not one-on-one: To a batch of codes corresponds a batch of stamps, and any one of these stamps can be attached to a package bearing any one of these codes. However, these stamps cannot be used with another batch.

DLR codes lose their validity after 12 months: They cannot be printed on products manufactured after that time (if they are, the product will be considered illegal).

The relevant documents are attached to this page:

- United Arab Emirates Cabinet Decision No. (42) of 2018 'On Marking Tobacco and Tobacco Products'
- United Arab Emirates Federal Tax Authority Decision No. (3) of 2018 'On Implementing the Marking Tobacco and Tobacco Products Scheme'
- De La Rue 'DTS Interface for Manufacturers and Supply Chain Agents UAE' documentation

Code structure

Tobacco

Based on document Manufacturers Interface v1.1.pdf , the code will have the following format:
CC AAAAAAAAAAA PPPP (YYMMDDHH): 17 characters (25 with date)

Where:

- **CC** = 2 digit ISO country code of installation, e.g. AE for UAE.
- **AAAAAAAAAAA** = 11 character alphanumeric serial number with security element. 1Bn (1,000,000M) unique values, likelihood of guessing > 1 in 32k. Security algorithm can be switched out.
- **PPPP** = 4 character identifier for Site, Product, Machine, Intended Retail market (country), and Intended Shipment Route (for EU only) – Generated by DTS System. Approximately 1M unique values.
- (YYMMDDHH) = Date Time ADDED BY MANUFACTURER (not generated by DTS System).

Beverage

In a foreseeable future, and only for the state of Oman, a new legislation for beverages will take effect.

The code will have the following format:
CC BBBBBBBB SSS PP (YYMMDDHH): 15 characters (23 with date)

Where:

- **CC** = 2 digit ISO country code of installation, e.g. OM for Oman.
- **BBBBBBBB** = 8 character alphanumeric serial number
- **SSS** = 3 character security code
- **PP** = 2 character product type
- (YYMMDDHH) = Date Time ADDED BY MANUFACTURER (not generated by DTS System).

File	Modified
Cabinet-Decision-No-42-of-2018-on-Marking-Tobacco-and-Tobacco-products EN.PDF	Jul 15, 2020 by Former user

File	Modified
FTA-Decision-No-(3)-of-2018-on-Implementing-the-Marking-Tobacco-and-Tobacco-Products-Scheme EN.PDF	Jul 15, 2020 by Former user
Manufacturers Interface v1.1.pdf	Jul 15, 2020 by Former user
DLR - UAE- Manufacturers Interface v1.1.pdf	Oct 06, 2023 by Yannick Gauthier

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Codes and Code Ordering Flow: Inextor codes

For all markets which are, as of now, unregulated, there must exist a mechanism in the software used by the manufacturer which generates unique and secure codes, since the traceability needs, though not mandated by state, still exist.

In that case, the only repository is the manufacturer's. Codes can be directly generated by the production line at the factory, and sent to that repository.

Codes and Code Ordering Flow: Ecuador Codes

For the Ecuador market, a special regulation applies to the manufacturers of alcoholic beverages, industrial beer and cigarettes.

The manufacturers must pay the *Impuesto a los Consumos Especiales* (ICE), i.e. Special Consumption Tax, to the *Servicio de Rentas Internas* (State Internal Revenue Service). They must apply CFS (codes called *Componentes Físicos de Seguridad*, Physical Security Components) to the manufactured goods in order to provide traceability and to prove payment. They can choose the ID Issuer as they wish, with the constraint that this ID issuer must not be a related party to the manufacturer. The higher levels of containers (e.g. cigarette bundles) must also be marked and aggregation must be performed. No product subject to control will continue to the next marketing chain without having the CFS marked and activated, as well as having been reported to the Tax Administration.

The ID issuer must provide identification, marking, tracking and tax traceability services to manufacturers and importers of goods taxed with ICE, and must generate information on goods, either domestically produced or imported. They must also guarantee a certain level of security in the components that make up the solution. They must transmit the relevant information to the Tax Administration in compliance with a given format and in a timely manner.

The interconnection mechanisms used between the supplier, the taxpayers and the Tax Administration must guarantee that the information complies with certain parameters of confidentiality, security, integrity and availability. CFS must be unique, traceable, and if not activated, must be reported as such to the Tax Administration.

A mobile application for reading and providing information on codes must be provided.

When planning to commercialize a new type of product, manufacturers must request an ICE-SKU code from the Tax Administration. The CFS delivered by the supplier is associated with the corresponding ICE-SKU product code. Goods that do not have the ICE-SKU product code generated will not be marked.

ICE-SKU codes consist of the following fields, separated by a hyphen between fields (total of 40 characters with codes and hyphens):

Description	Length	Type	Remark
Tax code	4 char.	Numeric	Codification of product according to product type, given by the State.
Category	3 char.	Numeric	Category of product, given by the manufacturer.
Brand	6 char.	Numeric	Given by the manufacturer
Presentation	3 char.	Numeric	Code corresponding to the type of packaging (e.g. 'Pack of 20 cigarettes').
Capacity	6 char.	Numeric	Product quantity (e.g. '1'). 000000 for cigarettes.
Unit of measure	2 char.	Numeric	
Country	3 char.	Numeric	
Alcohol content	6 char.	Numeric	000000 for cigarettes.

All elements must be completed with zeros to the left if they do not reach the specified length. All codes refer to a specific catalog table of correspondence provided by the manufacturer (see chapter 13 of the attached document).

When generating CFS, during code activation, additional information must be generated and transmitted to the Tax Administration (see chapter 8 of the attached document for more details). Equipment used by the supplier must allow to read and activate the CFS (automatic activation). The information of the activated CFS is then transmitted to the supplier's database. This activation consists in reading the unique CFS code and registering it with *activated* status in the supplier's system. In automatic production lines, the CFS is activated directly during the manufacturing process in the production plants.

File	Modified
Ficha técnica de proveedores de identficación marcación y trazabilidad fiscal.pdf	Oct 10, 2022 by Nathalie Chiva
Ficha técnica de proveedores de identficación marcación y trazabilidad fiscal en-US.pdf	Oct 10, 2022 by Nathalie Chiva
image2022-11-9_15-21-8.png	Nov 09, 2022 by Yannick Gauthier

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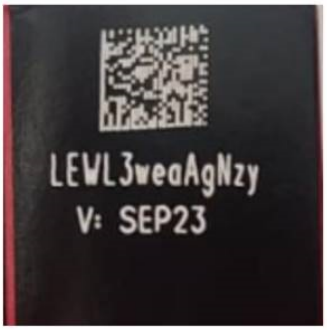
Today, the manufacturer prints the following information:

1. In the Datamatrix code (MR) we are printing the full code <ID-Issuer ID><Serialization part><Product description><Date&Time>
2. In the human readable part (as per Law) we are printing only <ID-Issuer ID><Serialization part> as short code


LEWL3weaAgNzy
V: SEP23

Codes and Code Ordering Flow: Mexican Codes (SAT)

For the Mexico market, the manufacturer must order codes from the *Servicio de Administración Tributaria* (SAT), use them and then report use to the SAT service (which is an official Mexican state service). This regulation impacts production very little, since codes can be ordered without specifying for which product and on which line of production they will be used.

The SAT provides a web-service that allows to download codes and send back reports.

The SAT codes can be downloaded by specifying the Company and Factory. Since there is no other info, this means that the code can be printed on any product. It's only after printing that the information of the Product and Line must be reported back to the SAT service. Without this report, the printed codes will be invalid (which means that the manufactured products they are printed on will be considered illegal).

The code is a 12 characters alphanumeric combination.

SAT codes lose their validity after 120 days: They cannot be printed on products manufactured after that time (if they are, the product will be considered illegal).

The relevant documents (the SAT's 'Fiscal Miscellaneous Resolution for 2015' and the 'Anexo 26-BIS de la Resolución Miscelánea Fiscal para 2015') are attached to this page. Information about the tobacco products regulation can be found on page 412 of the Fiscal Miscellaneous Resolution.
The validity period is referred in the screenshot "SatExpiration120Days.png". Translation:

Deadline for using security codes

5.2.33. For the purposes of article 19, section XXII of the IEPS Law, the security codes provided by the SAT, which have not been used within one hundred and twenty calendar days, from the date on which they were authorized, will be without effect.

Once the period referred to in the previous paragraph has ended, the SAT will invalidate the security codes and they cannot be used. LIEPS 19, FMR 2023 5.2.2

File	Modified
RMF2015_compila2aresolucion.pdf	Jul 29, 2020 by Former user
Anexo 26 BIS.docx	Sep 24, 2020 by Former user
SatExpiration120Days.png	Jun 02, 2023 by Ken Larpin

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Codes and Code Ordering Flow: Prosefa Codes

The Prosefa Platform consists of an integrated system to support both physical stamping and Direct Product Marking of products in Angola that must hold a secure fiscal stamp, such as tobacco and its substitutes, wines and spirits, beers and sugary drinks to be consumed in the domestic market, whether produced in Angola or imported. The sealing of these products consists of the affixing of physical seals or direct marking on the packages, which include an exclusive and Unique Identifier (UID) for each individual product package, which allows the individual tracking of each product unit placed on the market.
Each stamp with a Unique Identifier is declared on the Prosefa Platform as associated with a specific product by the economic operator who affixes it. The agencies responsible for inspecting seals, economic agents and any citizen can trace the origin of a product to which they have access, validating its legitimacy by reading the Unique Identifier attached to it, by consulting the Identification and Tracking System of the Prosefa Platform.
Many of the products covered by Prosefa may be sealed in their production lines using the Direct Marking of the packages, after being filled. Direct Marking to Product is accomplished by engraving a Unique Traceability Identifier (UID), Direct To Print (DTP) on bottles, cans or other legally acceptable containers. With this option, no physical tax seal label will be applied to the product. This option is suitable for high-speed production lines where the placement of physical seals may be inappropriate.

All Prosefa documentation can be found in AN - Documentation.

Codes and Code Ordering Flow: TPD Codes

The Tobacco Products Directive (TPD) gives a set of rules mandatory for all tobacco products manufactured or sold in the EU.

Codes must be bought and printed on tobacco items. These codes are used for all TPD regulated markets. The composition of these codes depends on each ID issuer. For a detailed description of these codes per ID Issuer, see ID Issuers Integration. For codes formats, see INEXPRESS Tobacco Tpd Code Formats.

There are two main entities involved: The manufacturer and the State Authority.

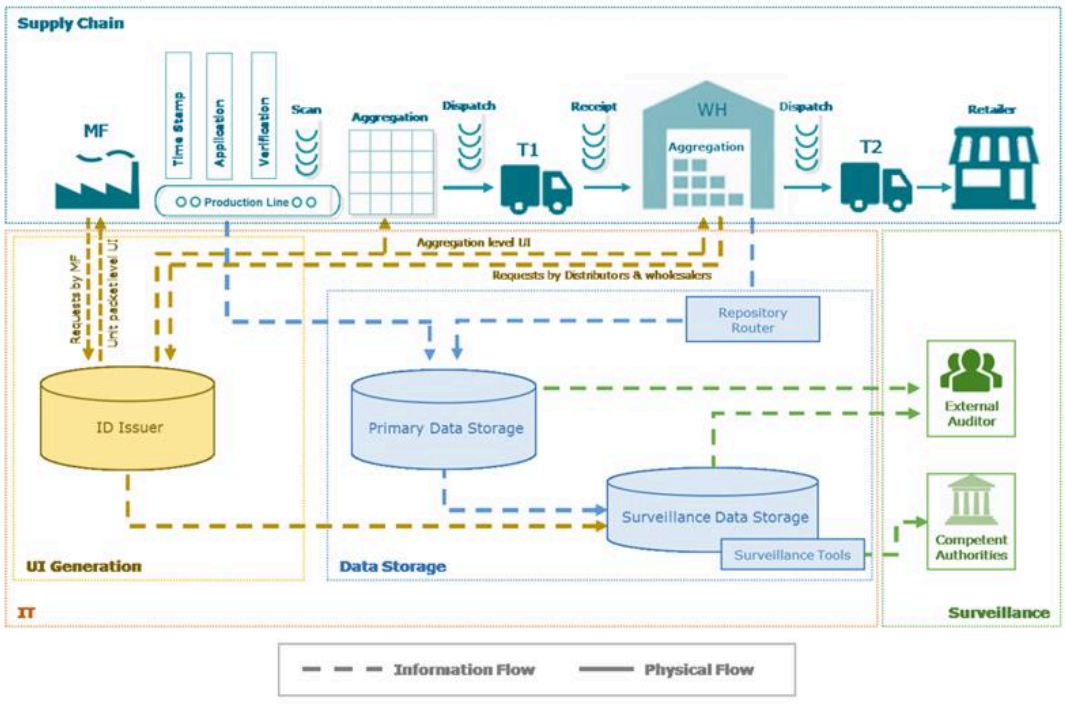
The state requires the manufacturer to mark its production with a certain type of codes which must be ordered from specific code issuers named ID issuers. The choice of the ID issuer is determined by specific rules (market for which the production is intended, manufacturing country, etc.).

There are three types of repositories for codes and code information:

1. The manufacturer's private repository.
2. The Primary, which is a third-party repository, chosen by the manufacturer from a list of state-approved Primaries, used to deposit codes as a stage between the manufacturer's repository and the Secondary. Some validation checks on the codes are performed in the Primary.
3. The Secondary, which is a sole repository, owned by the EU, for all codes from all manufacturers in the EU. Some validation checks on the codes are performed in the Secondary, outside the scope of this documentation.

Manufacturers order codes from an ID Issuer, via a production order sent to the manufacturer's repository from the factory. This ID Issuer then sends codes to both the manufacturer's repository which ordered them and to the Primary. The Primary sends these codes to the Secondary. When manufactured products enter the geographical area of one of the EU countries, customs request checks from the Secondary and will not let the merchandise enter the area if these checks return invalid results.

The following diagram illustrates the process (diagram taken from the site Public Health | (europa.eu), file https://ec.europa.eu/health/sites/health/files/tobacco/docs/2018_technicalspecifications_analysis_en.pdf).



TPD codes lose their validity after 6 months: They cannot be printed on products manufactured after that time (if they are, the product will be considered illegal).

The official TPD directive can be found on the site of the European Commission. Dentsu's Secondary repository specifications can be found on Dentsu's site.

Codes and code ordering flow: UK codes

Until end of 2020, United Kingdom was under the EU regulation defined by the Tobacco Product Directive (TPD).

Following the Brexit, United Kingdom put in place its own regulation for Tobacco products in 2 phases:

- Phase 1: starting from January 1st 2021, a transitory regulation went live. This first version was based on the existing TPD regulation to minimize the impact of the change for the manufacturers.
- Phase 2: the final UK regulation was effective after June 30, 2022. It does not rely on the existing TPD regulation anymore.

What remains from TPD regulation

During Phase 1, De La Rue was the ID Issuer for the UK regulation.
The code ordering API exposed by this ID Issuer was exactly the same under the UK regulation as the TPD regulation (same properties, same validation rules).
De La Rue kept in its master data all registrations of EOIDs, FIDs and MIDs performed until end of 2020.
These registrations could still be used by factories located in EU, UK or Rest Of the World (ROW) to order codes from the UK ID Issuer.

In Phase 2, Dentsu Tracking is the ID Issuer for the UK regulation, and offers a new code ordering API. All registered EOIDs, FIDs and MIDs are kept, and new registrations must be done with Dentsu.

Northern Ireland is a special case: Northern Ireland is considered part of UK and EU in the same instance, so in this scenario UK codes for Northern Ireland are considered as EU codes and no pairing is needed In order to be able to manage this exception, Northern Ireland was given an ISO code of XI.

All other UK territories are treated like UK mainland.

The complete UK regulation can be found on page https://www.gov.uk/guidance/put-unique-identifiers-uids-on-your-tobacco-products.

Inextor: Production requirements

- Manufactured product, production orders, and ECR's
- Forecast
- Manufacturing market constraint

Manufactured product, production orders, and ECR's

Table of contents

Manufactured product

A manufactured product also referred to as product, is an item produced by the manufacturer, which has a name, a description, an intended market, and other definable attributes (e.g. layouts, GTIN, price, all of which can be captured in the code printing process.

Within Inextor, the manufactured product is defined on the Gate, and when sent to the Vault, must be matched and synchronized with an SKU (Stock Keeping Unit) code.

The SKU is the Vault counterpart of the product; it was originally intended to give the possibility of having different names on the Gate and on the Vault for the same item, the Product was supposed to reflect the factory's definition, and the SKU was supposed to reflect the manufacturer's or the government's (in case of a governmental Vault) definition. Despite the initial potential of this opportunity, it remains untapped, resulting in a current disconnect between Product and SKU that lacks utility. Nevertheless, the concept has been put into practice, necessitating the definition and alignment of both structures. Consequently, the terms are utilized variably, depending on the relevant entity—either Vault or Liz/Gate.

Production Orders (PO)

A Production Order (PO) defines all the characteristics that need to be known before starting production:

- The material to be produced
- the Factory (Gate) where production has to be done
- The production line where production has to be done (which includes the printer(s) used) (this is needed only if the market regulation requires for codes to be associated with a machine)
- The planned date and time of production
- The quantity of goods required
- The attributes relevant to the regulation(s) which governs the production.

When defining a PO, the mandatory characteristics are product, plus production line for production with external codes (regulated markets), plus start date for TPD regulated markets. Depending on the regulation, other attributes can be optional or mandatory, and some are user-defined. The data within the PO is used to order external codes from the ID issuer for regulated markets so that production can be started from the Liz.

A Production Order inherits the characteristics of the product, the Liz and the Gate it references. The product itself inherits the characteristics of the market it references, and of the Manufacturing Market Constraint (see Manufacturing Market Constraint **) it references.

Users can configure a PO by creating or editing the characteristics (except the inherited ones). For instance, if, for a certain kind of product, price was not printed but the manufacturer decides to print it from a certain date, they can create a new characteristic "Price" for all or some of their PO's. Creating a new PO can be accomplished in two ways: either by starting from scratch or by cloning an existing Production Order.

> PO's can have an end date, but it is informative only. In order for the software to consider a Production Order as unusable, it has to be closed (or deleted, which is a form of archiving).

Management of Production Orders within Inextor is described in detail in section Gate Production: Production Orders

Known Synonyms:

- Work Orders or Orders (in Inexpress)

External Code Reference (ECR)

How can the software minimize code costs, reduce codes waste and maximize code availability?

- By finding the highest common factor allowing several PO's to use the same codes.

An ECR (External Code Reference) is a sub-list of the PO's attributes and allows a set of codes to be used on any PO which has the same ECR. It works as a highest common factor allowing two PO's to use the same codes. The composition of this sub-list depends on the regulation which rules that particular production. An ECR presents as the canonical concatenation of attributes which will restrict the conditions under which the codes can be legally applied onto a product.

> ECRs are used only for regulated markets with external codes. In all other markets, there is no code ordering since there are only internal codes generated by the software.

ECR usage

ECRs are used for:

- Identifying available chunks of codes: In regulated markets, code orders are divided into chunks (continuous sets of codes) in order to make the size of code sets more manageable. ECR is useful for identification of available chunks for one or several PO's, in order to determine the available quantity of codes that covers these PO's.
- Generating forecasts for the uncovered parts of the Production Order (see Forecasts)
- External codes reservation during printing: In regulated markets, the Liz sends to the Gate a request for external codes using the ECR associated with the order to be produced.
- Identifying chunks for one or several Production Orders for reporting purpose (e.g. identifying expiring chunks that could be used by planned orders).

ECR Example

Here is an example of ECR for a given production:

00000040329116-MP14-Pack-DE-False-FR-1-00003-18-93285-Titi Filter-28.1-00000040329116

- Pos.01 - Product code
- Pos.02 - Production line
- Pos.03 - Unit Type
- Pos.04 - Intended Route
- Pos.05 - Importation to EU ("False" if factory is located in EU)
- Pos.06 - Intended Market
- Pos.07 - Type of Tobacco product
- Pos.08 - Tobacco Product Identifier
- Pos.09 - Brand Name

- Pos.10 - Weight
- Pos.11 - GTIN14

Any codes ordered for another production which has the same information as shown here can be used, even if other attributes are not the same.

Forecast

Table of contents

Business Summary

Codes are expensive. As the exact amount of manufacturing waste is difficult to predict accurately, some code over-ordering is necessary to be on the safe side and ensure the Production Order can be completed. While there are often leftover codes from previous productions, it would be unwise to order additional codes and allow the older ones to go to waste. As incidents happen, production orders must sometimes be rescheduled or reassigned to different manufacturing lines. A flexible system that automatically reallocates codes between production orders is crucial. This ensures not only efficiency but also strict compliance with regulations.

Code Consumption Forecasts

Code consumption forecasts allow Inextor to limit excessive code ordering, optimize code usage, and reduce the costs. in the current version of Inextor, forecasts (forecast driver) are mainly used for TPD regulated markets. In almost all other regulated markets, code orders are managed manually. In non regulated markets, there is no code ordering since there are only internal codes generated by the software.

Definition: Forecast

A forecast is a way to automate and optimize the ordering of codes from the Gate. It consists of what the Gate needs in terms of codes in order to complete a production. There is no way to create, modify or delete a forecast, it is entirely automated.

Forecast Driver

The Gate maintains a list of available codes. Inside the Gate is a component called a Forecast Driver which tries to match the available codes to the Production Order (see examples below) by looking at the ECR (see ECRs): If two Production Orders have the same ECR, the codes that have been ordered for one of them can be used by the other and vice versa. The Forecast Driver then sends forecasts to the Vault for the Production Order if there are not enough available codes matching that Production Order. The Forecast Driver on the Gate uses the following parameters to calculate the forecasts:

- Productions Orders (grouped by ECR):
  - Requested Quantity
  - Produced Quantity
  - State: must not be closed or deleted to be taken into account

- External Code Chunks (available quantity).

When do forecasts run?

- Forecasts normally run periodically in the background. They can also be run at a specified time once a day, or be run manually.
- The frequency at which they run is configurable.
- Forecasts only run on Production Orders (and thus on ECRs) that have been modified since the last run. In this case, the forecasts are generated taking into account all open Production Orders with the same ECR as the modified ones.
- Even if the values of the Production Order have not changed, saving that Production Order means it will be taken into account by the next forecast run.

The user can activate an option which displays the forecast info (i.e., what codes will be ordered) whenever a Production Order is created or modified. **At any other time, there is no direct way to visualize this info**.

> ⚠ **Important:** This information is valid at the exact moment it is displayed. Any change in production will change the forecast information.

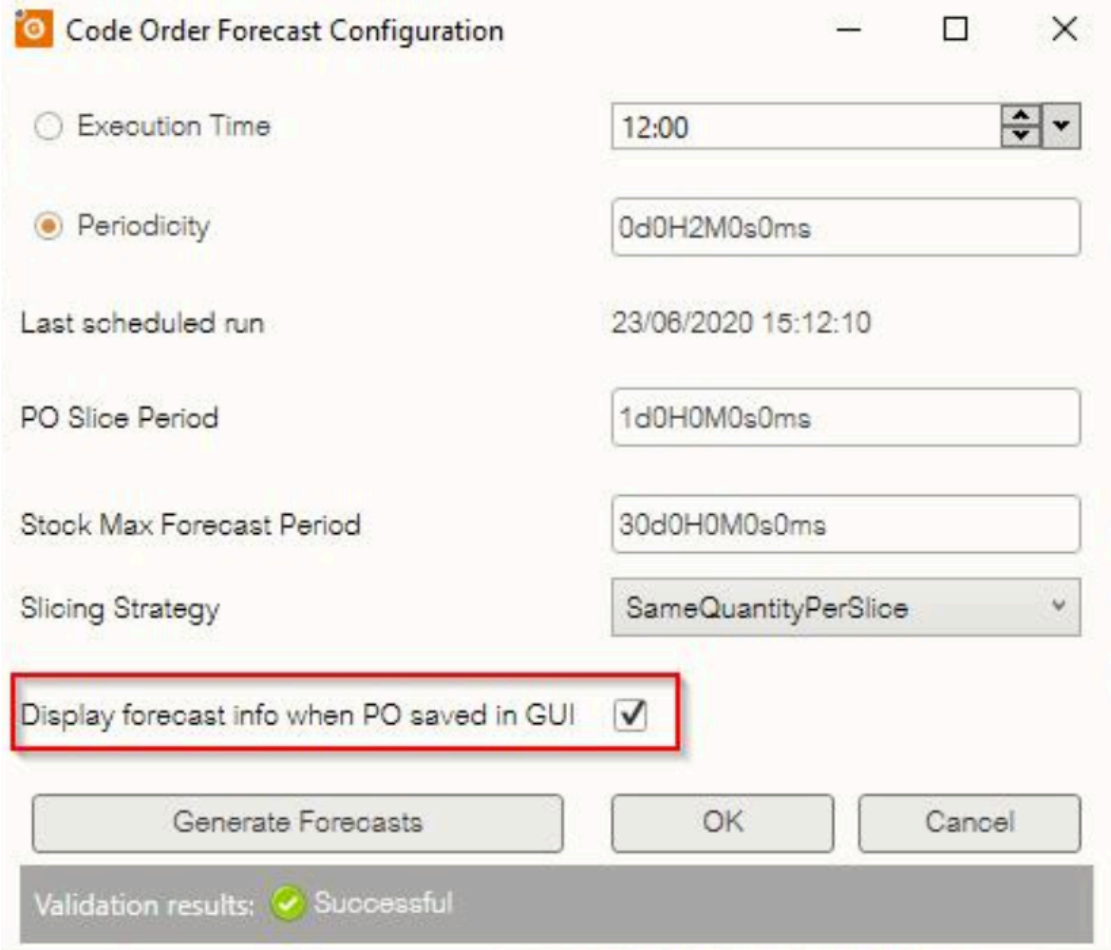


figure 1: Code Order Forecast Configuration UI

For the forecasts to be accurate, the Production Orders which are no longer used must be closed. If a Production Order is not closed and has not been completely filled, the forecast driver will take into account this Production Order and will order enough codes to complete it, even if the end date of this order has been reached and even if there is no production planned for it. This can result in the ordering of too many codes.

Examples

Case 1: for a particular ECR, there is only one valid production order

When, for a particular ECR, there is only one valid Production Order, the forecast logic is to order:
ForecastQuantity = RequestedQuantity - ProducedQuantity - AvailableQuantity.

If it is a negative number, it will be 0.

Examples:

1. The operator creates Production Order A. It has a requested quantity of 10000, the produced quantity is 0, the available quantity is 0. The forecast quantity will be 10000 - 0 - 0 = 10000.
2. The operator opens existing Production Order B, edits its description and saves it. Forecasts will run on this PO (since it has been modified). The requested quantity is 10000, the produced quantity is 2000, the available quantity is 1000. The forecast quantity will be 10000 - 2000 - 1000 = 7000.
3. As in the previous case, operator edits Production Order C in order to change its description (or some attributes that does not change the ECR). The forecasts will then run on this PO (since it has been modified). Production Order C has requested a quantity of 10000, the produced quantity is 11000, the available quantity is 0. The forecast quantity will be 10000 - 11000 - 0 = -1000, so since it's a negative number, it will be 0. The customer would have to set a requested quantity greater that what he produced (in our example at least 11000) in order to trigger an order.

Case 2: multiple production orders share the same ECR

When multiple Production Orders share the same ECR, the forecasts are calculated by taking Production Orders one by one, ordered by start date (take first Production Order that should be produced first), and using the same equation as in case 1 for each Production Order successively.

Example 1:

May 2020, ECR XYZ with 3 Production Orders, the available quantity is 10000:

- Production Order 1, start date May 5 2020, the requested Quantity is 5000, the produced quantity is 1000
- Production Order 2, start date May 6 2020, the requested quantity is 6000, the produced quantity is 7000
- Production Order 3, start date May 7 2020, the requested quantity is 7000, the produced quantity is 0

Calculation of forecasts if the operator edits one of these 3 Production Orders (without changing the ECR):

- Production Order 1: Needed quantity = 5000 - 1000 = 4000. This will be taken from the available quantity of 10000. Forecast: 0. Remaining available quantity: 6000.
- Production Order 2: Needed quantity = 6000 - 7000 = -1000 → 0. Forecast: 0. Remaining available quantity: 6000.
- Production Order 3: Needed quantity = 7000 - 0 = 7000. Taking 6000 from remaining available quantity. Missing: 1000. Forecast: 1000.

Thus, there will be a forecast of 1000 codes for ECR XYZ, with a forecast quantity of 0 for Production Order 1, a forecast quantity of 0 for Production Order 2, and a forecast quantity of 1000 for Production Order 3.

Important: This order of 1000 codes would have been avoided if one of the following actions had been taken:

1. Close Production Order 2 before it overproduced. If it had produced 6000 instead of 7000 codes, there would have been enough codes to cover the needs of the two other Production Orders
2. Or lower the requested quantity of the other Production Orders. For example, if the requested quantity of Production Order 3 was set to 6000 instead of 7000, there would be enough codes available and the final forecast quantity would be 0

However, once ordered, the 1000 codes will be available for all Production Orders with the same ECR XYZ.

Example 2:

Three Production Orders with ECR ABC, the available quantity is 0:

- Production Order 1, the requested Quantity is 5000, the produced quantity is 5000
- Production Order 2, the requested quantity is 6000, the produced quantity is 7000
- Production Order 3, the requested quantity is 7000, the produced quantity is 6000

We see here that the total requested quantity of all these 3 Production Orders was 18000. In total, 18000 codes were produced. However, Production Order 2 overproduced by 1000 codes. Production Order 3 produced 1000 codes less than its requested quantity.

If the production is considered as over (there is no intention to manufacture this product), these 3 Production Orders should all be closed (Production Order 3 should be closed first).

If it is not the case and an operator edits one of these Production Orders, the forecast calculation will run, and the Gate will order 1000 codes. This is caused by the fact that Production Order 2 overproduced by 1000 codes, and the Gate considers that Production Order 3 will need 1000 codes to finish producing its requested quantity of 7000 codes. Again, to avoid this order of 1000 codes, all Production Orders should be closed, or the quantity of Production Order 3 should be lowered.

Example 3:

May 2020, ECR DEF with 3 Production Orders. Production Order 1 has 5000 codes available before producing, and the remaining quantity from other closed Production Orders which had the same ECR is also 3000 codes. So before Production Order 1 starts producing, there is a total of 8000 codes available:

- Production Order 1, start date May 5 2020, the requested Quantity is 5000, the produced quantity is 7000
- Production Order 2, start date June 20 2020, the requested quantity is 6000, the produced quantity is 0 (future planned production)
- Production Order 3, start date July 15 2020, the requested quantity is 7000, the produced quantity is 0 (future planned production)

Calculation of forecasts if for example Production Order 3 is modified:

- Production Order 1: Needed quantity = 5000 - 7000 = -2000 → 0. Forecast: 0. Remaining available quantity: 1000 (8000 codes were available before Production Order 1 started production).
- Production Order 2: Needed quantity = 6000 - 0 = 6000. 1000 codes taken from remaining quantity. Forecast: 5000. Remaining available quantity: 0.
- Production Order 3: Needed quantity = 7000 - 0 = 7000. Forecast: 7000.

Following the forecasts calculation, the Vault creates two orders:

- 5000 codes planned for June 20 2020
- 7000 codes planned for July 15 2020

For the code orders planned in the future, the Vault will not order with the ID Issuer until some time before the start date. Thus, if one of these codes orders is not needed anymore, it should be blocked on the Vault, and the corresponding Production Order on the Gate should be closed. Then, a new forecast will arrive and will delete the code order on the Vault corresponding to the closed Production Order on the Gate.

In our example, if Production Order 2 is closed, the remaining quantity of 1000 codes is allocated for Production Order 3, and a new forecast of 6000 codes for July 15 2020 is generated.

On the Vault, the two previous code orders are updated/deleted and replaced by a single code order:

- 6000 codes planned for July 15 2020

Manufacturing market constraint

How does the software know Vault roles and attributes?

- By defining a rule: The Manufacturing Market Constraint (MMC), which defines which Vault does what, and where messages and Forecasts must be sent.

The Gate supports multiple connections to Inextor Vaults reference section The Vault for details. If only one Vault is connected to the Gate, that Vault will be defined as both primary and secondary. If two or more Vaults are connected to a Gate, one Vault must be defined as primary and the other(s) as secondary. Forecasts (reference section forecast, for details) will be sent to the primary Vault. When creating a dynamic Content (reference section Concepts and Workflow Printing: Templates and Layouts, for details), the type of Vault (primary or secondary) to which the internal codes generated by the software will be sent from the Gate must be defined.

The Manufacturing Market Constraint (MMC) is a rule created on the Gate. It is defined for one or more markets (usually only one), and will define how many Vaults are involved and their roles (primary, secondary or both (reference section The Vault for details).

Examples

Example 1

Product XYZ is marketed in Germany, subject to TPD regulation. There is only one INEXTOR Vault. The Manufacturing Market Constraint for product XYZ, market Germany, will define the Vault as both primary and secondary.

Example 2

Product ZYX is marketed in Switzerland, subject to Swiss regulation, where the governmental Vault is supplied by Inexto. The manufacturer's Vault is managed by Inexto, the governmental Vault is managed by a third party. There are therefore 2 Inextor Vaults, one private (the manufacturer's), and one governmental. The Manufacturing Market Constraint for product ZYX, market Switzerland, will define the manufacturer's Vault as primary and the governmental Vault as secondary.

Inextor: Serialization

Serialization is the assigning and application of a unique code to each produced unit of each product. This allows linkage to detailed information about the product: Factory where it was produced, production line, time stamp, etc.

Codes

Code composition is governed by detailed prescriptions.

For more information on codes, see page Codes and code ordering flow .

For detailed information about the GS1 (Global Standards 1), see the GS1 association site.

For detailed information about the GTIN (Global Trade Item Number) standard, including its predecessors EAN (European Article Number) and UPC (Universal Product Code), see the GTIN site.

For detailed information about the SSCC (Standard Shipping Container Codes), see the relevant page on the GS1 site.

For detailed information about Data Matrix codes (graphical), see the relevant Wikipedia page.

For detailed information about Barcodes and in particular Dot codes, see the relevant Wikipedia page.

For detailed information about the American National Standards Institute (ANSI) and the International Organization for Standardization (ISO), see the ISO association site.

⚠ To encode GS1 strings, you can use EPC Encoder/Decoder | GS1

Printing

The actual printing of the code is done with dedicated specialized printers.

It is possible for a manufacturer to use a serialization station, which includes all the components needed for printing and checking: Printers, cameras, software, reject station, quality grading apparatus (see the GS1 site page on grades).

They can alternately choose to assemble their own system with separate components.

Verification

Once the codes have been printed onto the produced items, it is essential to verify the accuracy of the printing. Manufacturers typically install cameras along the production line for this verification process, which also serves aggregation purposes. Verification can range from simple checks ensuring that the code has been printed without any blank spaces to more advanced methods, such as using dedicated software linked to the camera to read the code and validate it against the repository data.

Inextor: Printing

- Templates and layouts
- Multiple regulation production

Templates and layouts

Table of contents

How can we tell the printer what to print?

- By defining a set of concepts for that purpose.

Inextor printing terminology defined

The below table lists the common terminology associated to the printing aspect of the Inextor solution.

Term	Description
Layout	A layout defines a reference of the type of product that will be printed. It can define what data will be consumed during its production, whether actually printed or transmitted to other track & trace systems. The layout can also impose data to be printed (Required Content, see below). Layouts are defined per product and per hierarchy level (package, bundle, etc.). Several products can have the same layout. Layouts are not device-dependent. **Example:** Layout 1 requires price, TPD code and time stamp to be printed. Layout 2 requires only TPD code. Layout 3 does not require any information.
Injection Point	Injection points are set areas on the label where production data will be printed. **Example:** In Figure 1: Templates and Injection Points below, the data holders include text boxes (i.e., Text 1 and Text 2), a barcode, and a bitmap.
Template	A template can be seen as the representation of a label and is printer-specific. Each printer model has its language. Most printers offer a graphical design application which makes designing a template easier (otherwise, the template must be specified using a programming language accepted by the printer). A template is materialized as a template file plus a list of injection points (see definition above). The template can contain variables which will be instantiated at production time (e.g. code printed, time of printing, etc.). Each template is defined for a specific device (printer). The repository for templates is located on the Gate.

Content	A Content consists of one piece of information that will be used during a production (e.g. code, batch number, expiry date, GTIN...). A Content can be variable within a Production Order (e.g. code, time stamp) or constant within the Production Order (e.g. price, factory identifier, production identifier). An injection point can only be informed with one Content. There are several types of contents: • Static: value generated once at the beginning of the production (e.g. Production Order property like price) • Dynamic: value can change once per printed item (e.g. TPD code, SUPI, CRPT code, date & time, shift-codes, etc.) • Formatted contents: Concatenation of several contents into one string (e.g. code + time stamp) • Scripted contents: Defined by a .net program applied to simple contents (e.g. splitting a code, or applying a condition on it) Management of contents is done in the Gate. A detailed description of Contents can be found in Contents. **Content: required or not required** If a content is required in a layout, then any implementation of this layout (see below) will have to use this content, thus guaranteeing that the value of this content will be printed. A non required content will be generated by the Liz during production. It can therefore be used by other contents like scripted or internal ones, even if it is not printed.
Layout Implementation	A layout implementation consists of: • The layout • The device configuration (which defines what driver will be used and its default parameters) • The template (which has the injection points) • The contents It is thus an implementation of a Layout for a given printer (using a particular template). Therefore, you can have one Layout implemented for multiple printers. Note that you cannot have multiple implementations for the same printer **and** the same Layout using different templates. This mechanism allows reusing templates for several products. Example: In order to print the machine-readable code, the human-readable code, the timestamp and the string of characters 'RRR3-4' on product XYZ with printer ABC, a layout implementation is defined. For explanations about using the layout implementation, see Printing: Layout Implementations.
Commissioned As	"Commissioned as" is a contents tag in the layout. It can take the following values: • MR code: Machine readable code (code level 0) • HR code: Human readable code (code level 1)

	• Paired code (code level 2, used for double regulation DLR/TPD where the DLR code is only commissioned while the TPD code is both printed and commissioned) • Doubled code (code level 3, used for double regulation CRPT/TPD where both codes are printed and commissioned) • Utility code: machine-readable code used temporarily as a replacement of another machine-readable code placed in another position which is not readable due to manufacturing process (see Inexpress - Codes)

Template and injection point relationship

The following diagram shows the relationship between template and injection points.

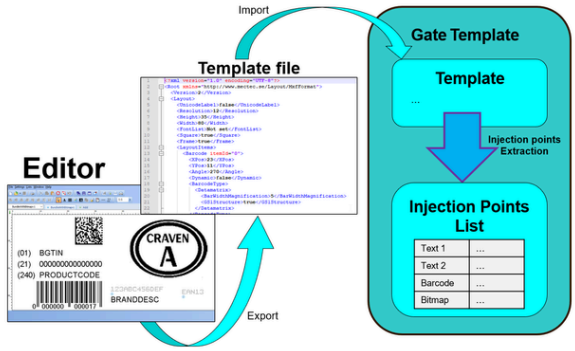


Figure 1: Templates and Injection Points

Template, layout and content relationship

The following diagram shows the relationship between template, layout implementation and contents.

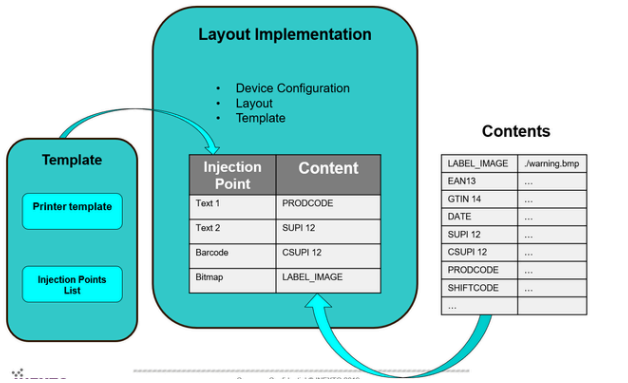


Figure 2: Templates, layout implementation and contents

Data flow from the Gate to the Liz

Figure 3: Data from the Gate to the Liz shows how the Gate pushes information to the Liz, the Liz then uses the Batch Recipe in order to generate the codes:

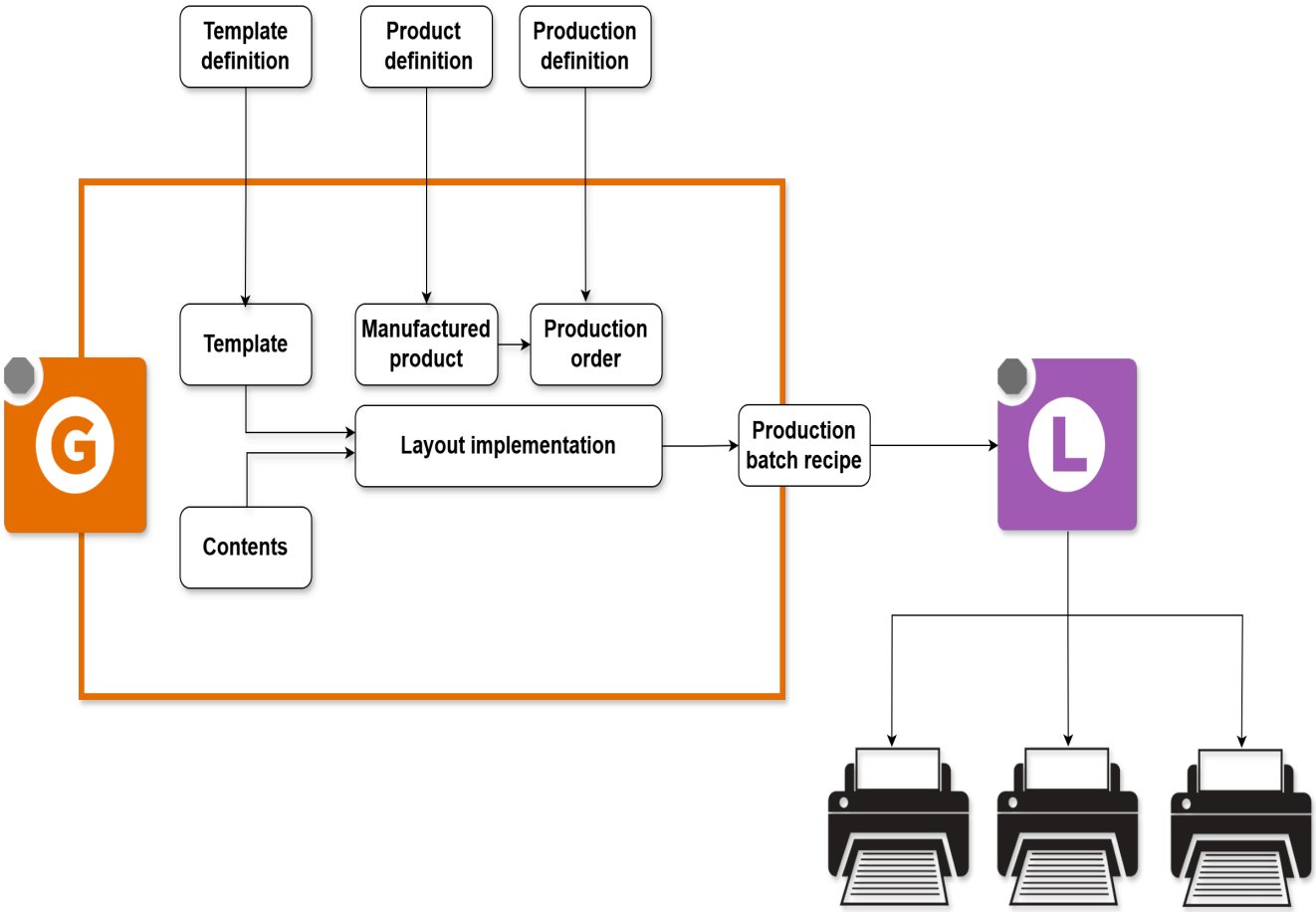


Figure 3: Data from the Gate to the Liz

The workflow then goes as follows:

- The Liz will first get the master data corresponding to the order it is about to produce from the Gate (product, template,...) according to the printers that are enabled on the line. It will build and validate the production characteristics based on this master data and the capability of the line. Each printer has its own settings (e.g. throughput, number of input codes it can buffer, darkness, capacity of multi-printing on several packs at a time, etc.). There can be several printers (one per unit type: packs, bundles, etc., and sometimes several per unit type), all controlled by the Liz.
- If the production involves external codes, the Liz asks the Gate for the external codes. The Liz also generates internal codes (SUPIs), one for each produced item, and sends updates of production which contains the last databaseId indicating the last minute of the production. The Gate and Vault are able to verify codes or rebuild them based on this information (this is done after the production is effectively started).
- Production starts from the Liz. When the Production Order starts on the production line, the Liz sends the template (which is constant throughout the Production Order) to the printer and uses the layout implementation to generate the contents (amongst which the codes).
- In a second phase, the Liz will also send the generated codes in to fill the printer's buffer with codes (or other variable data). The Liz regularly polls the printer in order to know if it needs more codes.
- The printer prints on items by combining the template with the contents.
- Periodically, the Liz sends information to the Gate which in turn sends it to the Vault:
  - Production update to the Gate (see second point above)
  - When printing external codes, it sends code pairing ranges associating a range of code to a range of SUPIs, thus allowing external code verification.
  - When printing external codes, it sends and update of the chunk status and of the number of codes used in the chunk.
  - Code statuses, in order to indicate if a code has been generated, sent to printer, printed, or cleared.

Before production's start, the Gate itself tries to detect if the contents are compatible with the intended market referenced in the PO. However, detection is not perfect, because this is sometimes very difficult to check (especially with scripted contents).

Inexpress

If the Inexpress driver is activated, the Liz sends all the printed codes to Inexpress (in order for Inexpress to be able to verify commissioning and aggregation, see Aggregation). In order to know which codes to transmit and how to do it, the Liz will refer to the Layout used for this production. The contents defined in it can be tagged to be forwarded to Inexpress. This tag used to be called "Code Level", and is now, for clarity, called "Commissioned as".

All tagged codes are sent to Inexpress.

Multiple regulation production

Code pairings

A Code Pairing is a match between 2 types of codes. Known combinations are:

- TPD/DLR
- TPD/CRPT
- Any regulation/SUPI (internal)

Code pairings are always sent to the Vault. In the case of a regulated market production, there is always a pairing of internal code/external code.

Production in EU for a DLR market

Both the TPD codes and the DLR codes must be ordered and used however, only the TPD code is printed (the DLR code is consumed). More precisely, the DLR code is tagged in the layout contents and thus not printed but used (see Templates and layouts), and the TPD code is printed and also used in the layout implementation. Due to code pairing, the DLR codes, even if not printed, will be recognized as part of the production when verified.

Production in EU for a CRPT market

Both the TPD codes and the CRPT codes must be ordered, used and printed. This creates a challenge regarding the available space on the packaging for printing both codes. Consequently, major manufacturers with factories in multiple countries tend to steer clear of this situation. However, some small manufacturers cannot avoid it, so they have to increase the printing area size, which slows production down.

Production in EU for UK market or Production in UK for EU market

Both the TPD codes and the UK codes must be ordered and used. However, only the TPD code is printed (the UK code is consumed).More precisely, the UK code is tagged in the layout contents and thus not printed but used (see Templates and layouts), and the TPD code is printed and also used in the layout implementation. Due to code pairing, the UK codes, even if not printed, will be recognized as part of the production when verified.

Exception: If the destination market is Northern Ireland, only UK codes are ordered and printed, there is no TPD codes and therefore no external pairing.

Others

At the present time, no other double regulation production is known.In the event that a situation arises, the Inextor software does not require modification; it simply needs to be configured appropriately.

Example of multiple regulation consumption

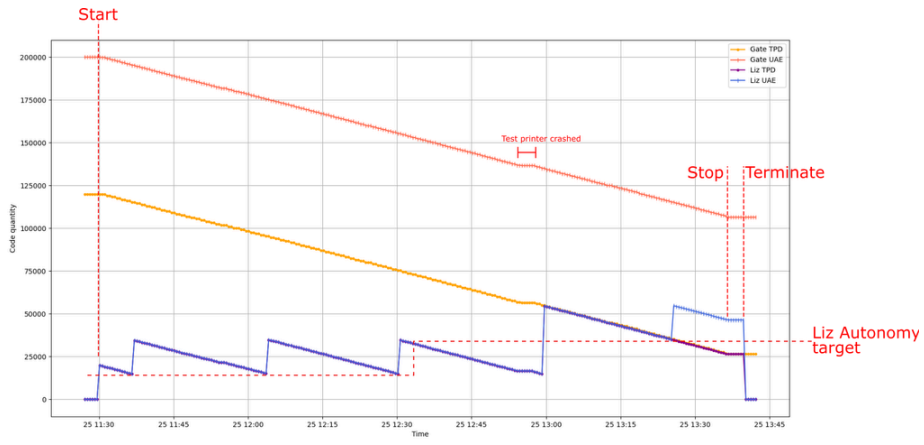


Figure 1: Multiple regulation consumption example

Example with real values:

TPD and UAE (DLR) codes are consumed. At the start, there are more UAE codes than TPD. In the middle of the production, we increase the Liz Autonomy target. The change takes effect on the Liz after one complete cycle. Following this, the Liz retains a greater number of codes in its memory. As the end approaches, the Gate lacks sufficient TPD codes, this is the reason why the TPD quantities for both the Gate and Liz are aligned.

Inextor: Aggregation

Aggregation is the action of linking child units to a parent unit, by establishing a hierarchical relationship between them. In the Inexto world, this means a sequence of bundling, as described in this diagram:

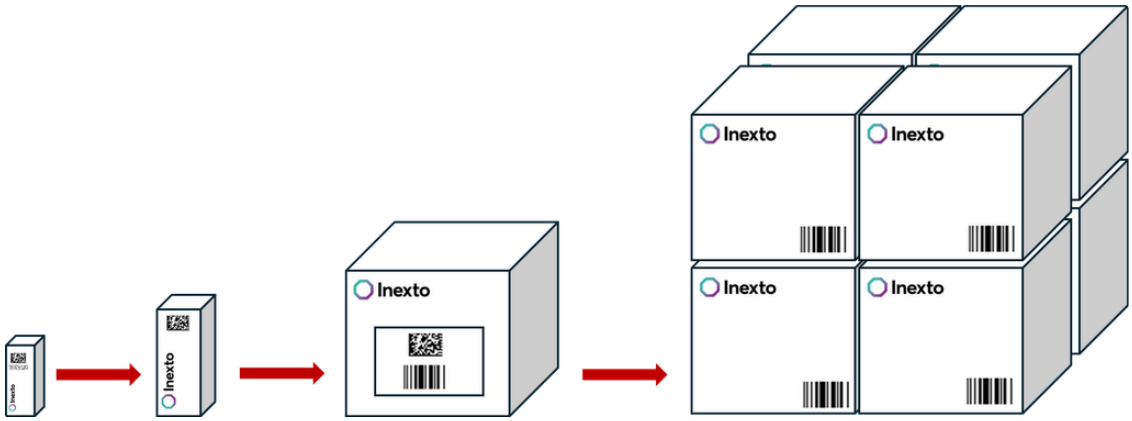


Figure 1: Aggregation configuration

Item	Bundle	Master Case	Pallet
Packaging that contains the manufactured product.	Packaging used to contain a configuration of multiple items.	Master case containing a configuration of multiple bundles	Palettized configuration of the master case

Inextor can print codes on units of any unit type. Inexpress (which is the aggregation validation component of the Inexto Suite) gets aggregation messages (i.e., messages indicating which child units have been aggregated into which parent unit) from the production line. There is an interface between Inextor and Inexpress which allows Inexpress to send aggregation messages to Inextor, so that Inextor can update the code status (see Inextor: External and Internal Codes) to "Aggregated".

Any other aggregation management task lies outside the scope of Inextor and therefore of this document.

inextor Navigation Map**

- Complete Lifecycle
  - Install Central System
  - Onboard MAN/GOV
  - Install Factory System
  - Install Line System
  - Perform Product Integration
  - Prepare Product Printing
  - Plan Production Order
  - Execute Production
  - Verify Codes

Complete Lifecycle

What do you want to do? Choose among the following lifecycle steps, and click on the step which interests you:

Install Central System

To install the Central System (Vault), first perform a general installation, then, according to the regulations you need to follow, perform one or more specific installations.

Onboard MAN/GOV

To onboard a Manufacturer or a Government, first follow the mandatory steps, then, if you need to follow the TPD regulation, register EOID/FID.

Install Factory System

To install the Factory System (Gate), first perform a general installation, then, according to the regulations you need to follow, perform one or more specific installations.

Install Line System

To install the Line System (Liz), first perform a general installation, then, according to the regulations you need to follow, perform one or more specific installations.

Perform Product Integration

Background

Products need to be defined in the INEXTOR Gate before some production orders can be created and started.

Product records do not necessarily need to contain all the attributes that are required for production (for ordering codes, and printing, for each regulation). But, if they don't, the missing attributes will need to be specified when the Production Order is created.

When a ERP or MES system exists at the manufacturer, it is common to define the products with minimal information, and supply the bulk of the attributes directly in each Production Order.

On the other hand, when no ERP or MES system exists, it makes sense to maintain all attributes in the Product, so that the manual PO creation on the Gate is a lightweight operation.

So, depending on existing IT systems, where the manufacturer intends to keep his Reference Data (Single Source of Truth), and the processes that he wants to follow, different technical solutions can be designed.

Technical solutions for importing product data

Manufacturers can choose between different approaches:

- Manually create and update the product data using the Gate Administration GUI. This approach is viable for a small number of products, and is the only choice if the information does not exist in any electronic reference data system (if the information is on paper only).
- Manually import existing Excel files containing the product data.
- Setup automated Production Integration on the Gate.

When they decide to setup Product Integration, manufactures can choose 2 alternatives:

- Develop some software client to push the product data using the Gate web-service **ExternalServiceDriver**.
- Develop some SQL views to extract the product data from an existing database.

Refer to Gate Integration Developers: Data sources and flows.

Prepare Product Printing

In order to be able to print, you must prepare templates and layouts. According to the regulations you need to follow, specific layouts may be needed.

Plan Production Order

Before producing, you must prepare production.

Execute Production

Verify Codes