



Healthcare
User Group

Asset management using GS1 standards



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Disclaimer

GS1 UK has reviewed the contents of this document thoroughly. All statements, technical information, recommendations, schedules and costs (where specified) are believed to be reliable, but the accuracy and completeness thereof is not guaranteed or warranted unless otherwise stated.



About the healthcare user group (HUG)

The HUG is made up of invited senior representatives from healthcare trade associations, providers, suppliers, solution and service companies, and other related organisations. Its purpose is to promote the adoption of GS1 standards throughout UK health systems, its suppliers and partners, in line with necessary regulatory requirements.

The objectives of the group are to:

- Drive adoption of standards in health systems across the UK's four nations: England, Wales, Scotland and Northern Ireland
- Support implementation of standards to identify every person, product and place
- Create a sharing and learning environment
- Offer support and advice to regional groups implementing our standards
- Be responsive to the evolving healthcare environment
- Provide feedback and advice on GS1 UK's healthcare plans and activity
- Work with regulatory and other bodies, to support national and international standards activity
- Act as the UK point of contact for the GS1 Global Healthcare Group and to provide healthcare related feedback into the Global Standards Management Process (GSMP)



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1. Executive summary

The purpose of this document is to provide healthcare provider organisations (e.g. NHS trusts, Health Boards) across the UK and their solution partners with best practice guidance on asset management using GS1 standards. The assets in scope include any product that needs to be identified for tracking or tracing purposes. This includes hospital equipment (e.g. beds, X-ray machines), community equipment (e.g. walking aids), returnable equipment (e.g. gas cylinders) and accessories (e.g. mattresses).

Asset management using GS1 standards can deliver a broad range of benefits including improved asset utilisation, greater infection control, increased operational efficiencies, and reduced unwarranted clinical variation. The tracking of assets can be used for immediate need and maintenance, thereby improving overall patient safety.

Associating assets with GS1 standards will enable interoperability of asset information between systems, improve data capture efficiency and provide more comprehensive and accurate information about the management and use of assets. A recommended pre-requisite to implementing asset management are the three core enablers: person, product, place. These will allow assets to be cross referenced with people (staff/patients), product, and location information, so that healthcare provider organisations know who is using them, where, and who is managing the assets at a given time.

An asset management process using GS1 standards starts from purchasing the asset and preparing it for use, including associating it with a GS1 Identification Key and GS1 data carrier(s), (GS1) barcodes and/or passive radio-frequency identification (RFID) tags. Once the asset is ready for use, the asset is assigned to the user (e.g. patient) as needed. The asset will undergo maintenance when required and is eventually disposed of or replaced. The asset status and physical movement tracking information are recorded in the organisation's system(s). GS1 data carrier technologies can facilitate the automatic identification and data capture (AIDC) through scanning. The Electronic Product Code Information System (EPCIS) standard can standardise the sharing of asset status and physical movement tracking information.

The implementation of the asset management process using GS1 standards needs requirements and scope to be determined, GS1-compliant systems and data carrier technologies to be procured and deployed, and the process to go live with the initial set of assets. Following these stages, the process is rolled out to other assets and departments, and success metrics and learnings are reviewed.



2. Introduction

2.1 Foreword

GS1 is a not-for-profit, member-owned association, operating in more than 150 countries. The GS1 vision is to enable organisations to use the same language to identify people, products and places, capturing information at the point of interaction and sharing that data throughout a healthcare provider's systems and processes, from supplier to point of care/use.

GS1 defines standards for healthcare in collaboration with the global healthcare industry to enable traceability between and within organisations. This includes globally unique numbers, which are used in the identification of patients and caregivers, products, locations, and assets, anywhere within the global healthcare supply chain.

These standards enable, among other things, the accurate scanning of medicines at the pharmacy, the recording of medical instruments used in surgical procedures, and the location of equipment in a healthcare provider organisation to support patient safety.

GS1 understands the importance of having efficient and smooth-running supply chains for healthcare. Barcodes and identification technologies in hospitals play an important role in improving patient safety, by positively identifying patients, their interaction with caregivers, and the items used in their treatment.

Standards have been deployed successfully within healthcare around the globe to drive improvements in patient care and safety, while at the same time reducing costs through improved efficiencies.

The main benefit of adopting GS1 standards is improved patient safety. This is achieved through:

- Recording of information scanned at the point of use
- Improved traceability
- Enabling checks on usage
- Fewer Never Events and critical errors
- Reduced administration errors
- More efficient processes
- Better medicines management
- Simplification and enhanced accuracy of order processing and receipting

2.2 Purpose

The purpose of this document is to provide healthcare provider organisations (e.g. NHS trusts, Health Boards) across all the UK's four nations and their solution partners with best practice guidance on:

- The asset management process using GS1 standards
- The governance for GS1 Identification Keys for assets
- How GS1 standards can support the implementation of asset management

This document is produced and approved by the GS1 UK national healthcare user group and it contains the knowledge of experts who have been brought together to support the adoption of GS1 standards in healthcare.



2.3 Target audience

This document is a reference guide to implementing asset management processes using GS1 standards in healthcare provider organisations. It is intended for any organisation that wants to adopt GS1 standards to improve the tracking and traceability of assets and facilitate interoperability across different parties and systems.

It is important to recognise that the GS1 standards detailed in this document will enable traceability across the associated healthcare landscape. As such, any function involved in the procurement, storing, clinical use, and recall of products, can benefit from their accurate identification using GS1 standards.

This document is also intended for solution providers. In line with current drives to improve consistency, flexibility, and interoperability of technology across health and social care, all systems developed in house, commissioned, procured, or adopted, should be GS1 compliant (as applicable). The [GS1 UK Compliance Specification for the NHS](#) provides guidance for buyers and commissioners on what that means, and how to ensure the compliance of new systems.

New and existing systems will need to utilise the appropriate GS1 Identification Keys as either a primary or secondary identifier for the required data elements, based on the functionality and purpose of the system being considered.

If providers are unable to provide GS1-compliant systems in line with the recommendations in this document, then full interoperability and traceability will be unfeasible.

2.4 Scope

The following areas are **in scope** of this document:

- Assets that need to be identified for tracking or tracking purposes (see examples below)
- Information about managing and tracking the assets within a healthcare provider organisation

Examples of assets in scope	
Hospital equipment and accessories	
Clinical	Manual handling equipment
Beds and mattresses	Thermometers
Infusion devices (e.g. T34 ambulatory syringe pump/drivers)	Personal protective equipment (PPE) (e.g. filtering face piece 3 (FFP 3))
Anaesthetic equipment	
Bladder scanners	Bariatric equipment
Ventilators	Mobility aids (e.g. wheelchairs)
Cardiac equipment (e.g. monitors)	Non-clinical
Fridges	IT equipment
Imaging machines (e.g. fixed/mobile x-rays)	Catering equipment
Community equipment and accessories	
Respiratory aids (e.g. CPAP machines)	Infusion devices
Mobility aids (e.g. wheelchairs)	Fridges
Returnable equipment	
Gas cylinders	Mobility aids (e.g. wheelchairs)
Pallet bases, roll cages and plastic containers	Trolleys

The following assets are out of scope:

- Surgical instruments and containers. These are covered separately in the [surgical instrument traceability guidance](#) written by the HUG.
- Fixed assets that do not need to be identified for tracking or tracing purposes (e.g. buildings, engineering installations)
- Vehicles (e.g. ambulances)
- Paper medical records

2.5 Background

In UK healthcare, GS1 standards have been proven to improve patient safety and enhance clinical effectiveness by reducing unwarranted clinical variation and driving operational efficiencies irrespective of clinical settings^{1,2}. This is achieved by creating unique identifiers for every person, every product, and every place, allowing data to be captured consistently and accurately at the point of interaction and shared across supply chains up to the point of care.

The introduction of the [Medicines and Medical Devices Act \(MMDA\)](#) (February 2021) will further encourage the use of GS1 standards in healthcare. In particular, the [Medical Device Register \(MDR\)](#), in development by the Medicines and Healthcare products Regulatory Agency (MHRA), will ensure that eligible medical devices used in the UK are registered by the manufacturer, detailing key identifiable information in one central registry. Programmes are being developed across the UK's four nations to promote better use of technology for monitoring devices such as the Medical Devices Safety Programme (MDSP) led by Getting It Right First Time (GIRFT). In addition to unique identifiers for

¹ GS1 healthcare cases studies <https://healthcare.gs1uk.org/cases>

² Scan4Safety evidence report <https://healthcare.gs1uk.org/scan4safety>



medical devices, the [Assets in action: An Asset Management guide for non-technical managers](#) published by NHS England specifies the need for unique identifiers for assets.

GS1 UK has established multi-year partnership agreements with healthcare governing bodies across the UK to increase the adoption of GS1 standards across the various health systems. This approach supports the strategic aims for the UK's four nations, where the implementation of open data standards in healthcare will enable traceability and interoperability – allowing information to flow seamlessly between systems and organisations.

2.5.1 Why asset management is important

Asset management is important as it provides a systematic approach to ensuring that the quality of the services the assets are used for is maximised and the costs associated minimised. This enables user and staff needs to be met, achieving quality standards and delivering best value. This is highlighted in [Assets in action: An Asset Management guide for non-technical managers](#) by NHS England, first published in May 2003.

Achieving a desired state of asset management would contribute to the following benefits:

Improved patient safety and clinical outcomes	The asset, when assigned to a patient and correctly used, can improve the quality of care or service
	Better distribution of assets to areas of high demand
	More efficient updates/recalls of assets as requested by the manufacturer(s)
	Improved infection control management
	Clean and better maintained assets
Improved operational efficiencies	Efficient access to the asset in a serviceable condition
	Instant secure access to information about the asset (e.g. asset location)
	Efficient updates on asset information into systems
Reduced unwarranted clinical variation	Having a standard best practice approach can be replicated across all required departments and sites within a healthcare provider organisation

2.5.2 Why GS1 UK asset management guidance is needed

A formal request was made by the GS1 UK healthcare user group to create a best practice guide for asset management, utilising GS1 standards, that is applicable in clinical settings across the UK's four devolved nations. This guidance is needed to help address the universal challenges experienced within healthcare provider organisations in relation to asset management.

2.5.3 Asset management – Current challenges and desired state

This subsection outlines the universal challenges experienced in relation to asset management and the ideal state (desired state) that they are striving to achieve.

Areas	Current challenges	Desired state
<p>Assets</p>	<p>Unable to locate assets that:</p> <ul style="list-style-type: none"> • Need to be assigned to a patient immediately • Are due for planned maintenance or decommission • Require decontamination/cleaning and other servicing • Require updates/recalls as requested by the manufacturer(s) <p>A lot of time spent on locating assets that are:</p> <ul style="list-style-type: none"> • Already in use due to their high demand • In limited supply • Stolen or damaged • Used without authorisation 	<p>Instant access to correct assets in clean and serviceable conditions and in the correct location when required due to:</p> <ul style="list-style-type: none"> • The speed of locating assets • Fast and regular maintenance of assets <p>Correctly used assets</p> <p>Maximum utilisation of clean, serviceable and available assets across sites and in the community. Redistribution of assets which are underutilised, or not used at all, to areas which have a demand for these items.</p> <p>Minimum purchases of new assets contributing to overall cost savings and carbon neutrality</p>
<p>Information about the assets</p>	<p>Insufficient asset management and tracking information available to:</p> <ul style="list-style-type: none"> • Locate assets for tracking and tracing purposes (e.g. infection control) • Forecast planned cleaning, maintenance and decommission • Inform business cases for change • Too many items listed as lost or status unconfirmed in the asset database • Asset information stored in local databases in various departments which can cause cross-departmental bottlenecks and delays • Paper documents and rekeying information in an attempt to keep asset databases up to date • Lack of transparency of the equipment library based on assumptions and not factual data 	<p>Instant secure access to timely, accurate and reliable information to:</p> <ul style="list-style-type: none"> • Track asset and physical movement information • Quickly locate assets affected by safety notices in order to quickly quarantine/recall affected assets or perform remedial work • Track asset performance in line with the healthcare provider organisation's asset management plan and policies • Understand total cost of ownership of assets and any impact on clinical outcome • Inform policy and decision making • Minimise opportunities for assets to be stolen, damaged and used without authorisation • Be informed of planned maintenance requirements and decommission based on requirements <p>Instant secure access to management reporting data about assets</p> <p>Minimum time taken to update asset databases and keeping them up to date</p>

3. Overview

3.1 GS1 standards for assets and how they can improve asset management

GS1 standards are divided into three groups:

- **Identify** – GS1 standards for identification, known as **GS1 Identification Keys**,
- **Capture** – GS1 standards for data capture, known as **GS1 data carriers**, and
- **Share** – **GS1 standards for data exchange**. This guide will mainly focus on GS1-compliant systems used to share the GS1 Identification Keys and associated data.

This subsection describes each group of GS1 standards and how they can improve asset management.



GS1 Identification Keys

These are identifiers that are globally recognised and can be used to uniquely identify assets. The GS1 Identification Keys covered in this guide are:

- **Serialised Global Trade Item Number (SGTIN)**
- **Global Individual Asset Identifier (GIAI)**
- **Global Returnable Asset Identifier (GRAI)**

A **Global Company Prefix (GCP)** is a component of a GS1 Identification Key and provides a 'base' for GS1 Identification Keys to be created.

See "7.1 Appendix: GS1 Identification Keys to support asset management" on page 35 for further information about the above GS1 Identification Keys.

Table continued on next page



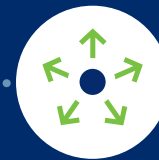
GS1 data carriers

These are GS1-compliant barcodes or EPC/RFID tags attached to assets. They carry the GS1 Identification Keys and associated information for tracking and tracing purposes. When the data carriers are read by a scanner or reader, the information about the assets is automatically captured into a system. This process is known as automatic identification and data capture (AIDC). The GS1 data carriers covered in this guide are:

- **GS1 DataMatrix 2D barcode**
- **GS1-128 linear barcode**
- **Passive radio frequency identification (RFID)**

See "7.3 Appendix: Data carrier technologies" on page 38 for further information about the above GS1 data carriers.

Table continued on next page



GS1 standards for data exchange

These are standards for sharing GS1 Identification Keys and associated information electronically. The GS1 for data exchange covered in this guide is **Electronic Product Code Information Services (EPCIS)**. See "7.4 Appendix: GS1 data exchange standard to support asset management" on page 41 for further information about the EPCIS standard.

GS1-compliant systems

These are systems that can receive, hold and transmit GS1 Identification Keys and associated information and/or generate GS1 data carriers.

See "5.1 GS1-compliant systems" on page 25 for further information about the GS1-compliant systems.

Table continued on next page



Benefits	Benefits	Benefits
<ul style="list-style-type: none"> • Provide assets with a unique identifier • Improve interoperability and communication between systems within hospital departments as well as operational locations across the healthcare system • Provide a more comprehensive view of all the assets held/available at the organisation for better procurement and management policies and decisions 	<ul style="list-style-type: none"> • Improve scannability of assets • Improve data capture efficiency and frequency - reducing time spent on updating databases and preventing delays • Improve data accuracy due to fewer manual transcription errors • Regularly updated information in systems can lead to reductions in time spent looking for assets, in particular for nursing staff • Better visibility of assets which have been used on individual patients 	<ul style="list-style-type: none"> • Improve interoperability, communication accuracy and efficiency, both between systems within the hospital departments as well as wider operational locations across the healthcare system • Reduce paper and manual processes • Improve the ability to allocate equipment maintenance and repair costs to departments • Have better access to equipment requirements which can improve equipment maintenance • More comprehensive and accurate information about the use of assets leading to better procurement and management policies, and improved decision making

3.2 The three core enablers and why they are needed for asset management

A recommended prerequisite to implementing asset management using GS1 standards is the implementation of what are known as the three core enablers: **person, product, place**. This will allow assets to be cross-referenced with person (staff/patients), product, and location information, so that organisations know where assets are and who is managing or using them at a given time. This subsection describes each core enabler and explains why it is needed for asset management.

Core enabler	Why is it needed for asset management?
<p>Person</p> <p>Patients and staff registered at the organisation are associated with a GS1 Identification Key called a Global Service Reference Numbers (GSRN). These keys are then encoded into appropriate GS1 data carriers for each individual.</p> <p>Table continued on next page</p>	<ul style="list-style-type: none"> • Enables identification of people to be associated with assets in a standardised format • Scanning a barcode on a wristband of a patient, to which the asset is assigned, enables accurate and real-time capture of information and minimises the clinical risk of capturing information from the wrong patient record • Seeing which asset has been used on individual patients helps improve patient safety (e.g. improved recall, infection control) <p>Table continued on next page</p>



Product

Associating product information with GS1 Identification Keys called **Global Trade Item Numbers (GTINs)** within the healthcare provider organisation's product database system (e.g. catalogue management system).

- The GTIN and serial number (collectively known as SGTIN), as well as any associated product information (e.g. lot number, expiry date) from the product database system, can be used in systems that support asset management (see "5.1 GS1-compliant system" on page 25) reducing the need to manually re-enter this information

Place

Associating parties and locations in the healthcare provider organisation and supplier organisations with GS1 Identification Keys called **Global Location Numbers (GLNs)**. For physical locations, these GLNs can also be encoded in GS1 data carriers, e.g., a barcoded label, where useful.

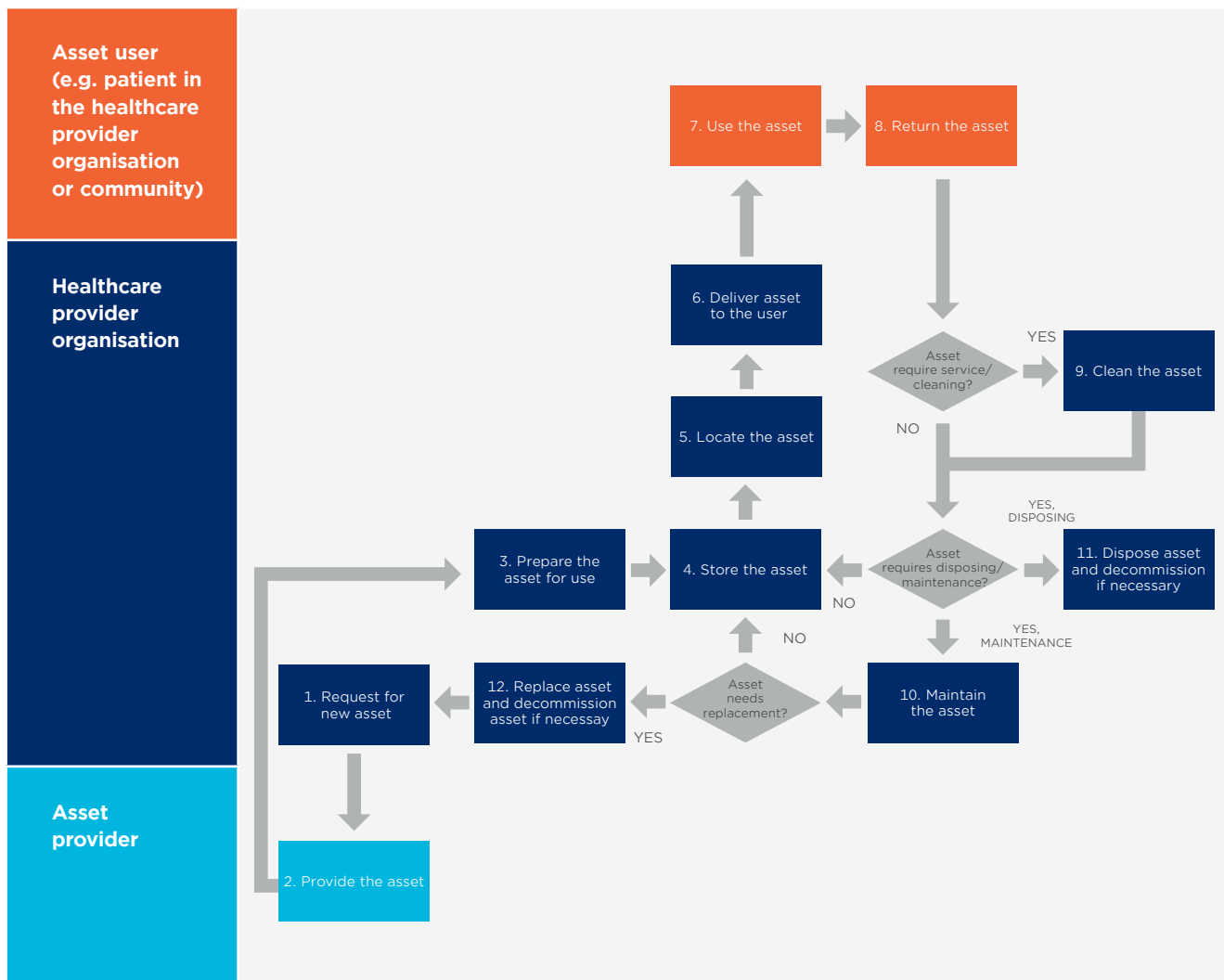
- Enables identification of places to be associated with assets in a standardised format
- Visibility of asset location information in systems can lead to reductions in time, especially nurses' time, spent looking for assets
- Enables applications, including those of external contractors, to use the barcodes and RFID tag data directly within their systems. For example, delivery services or other outsourced services are able to use the location barcode to confirm the correct delivery location record where the delivery was actually made or where the pick-up occurred.

4. Asset management process

This section describes the process for the management and tracking of an individual asset.

4.1 Process overview

An asset management process using GS1 standards starts from purchasing the asset and preparing it for use. This preparation includes associating it with a GS1 Identification Key and GS1 data carrier(s) (GS1 barcodes and/or passive RFID tags). Once the asset is ready, it is assigned to the user (e.g. patient) as needed. The asset will undergo maintenance when required and is eventually disposed of or replaced. The asset status and physical movement tracking information are recorded in the organisation's system(s). GS1 data carrier technologies can facilitate the AIDC through scanning. The EPCIS standard can standardise the sharing of asset status and physical movement tracking information.



4.2 Process activities

The table below describes the asset management process activities. For each activity, it details:

- the relevant GS1 Identification Key(s) that are encoded within the data carriers for AIDC,
- the associated data which are retrieved using the GS1 Identification Key(s) within the GS1-compliant system(s)
- the applicable GS1 data carriers options that are required for the Key(s), and
- the relevant GS1-compliant system(s) that are updated using the relevant GS1 standards for data exchange



Activity	Person, product, place, asset or other relevant items	GS1 Identification Keys	Associated data	GS1 data carriers	GS1 standards for data exchange
1) Request for the new asset The process starts when the healthcare provider organisation makes a request to commission a new asset or replace an existing asset from the asset provider. This request can be made from the organisation's catalogue management system. Asset providers should identify themselves using their own unique identifier (their legal entity GLN), which is recorded in the GS1 UK LocationManager. This will enable the healthcare provider organisation to use this identifier in their internal systems and in their electronic orders, without having to maintain complex internal cross reference tables.	Healthcare provider organisation that purchased the asset	Legal entity GLN	Organisation name	N/A	Updated in the product database system. Healthcare provider organisation and asset provider location information are sourced from GS1 UK LocationManager.
	Asset that is being commissioned	GTIN	Product name	N/A	
	Asset provider	Legal entity GLN	Provider name	N/A	



<p>2) Deliver the new asset</p> <p>The asset provider delivers the new asset to the healthcare provider organisation. This process involves scanning the asset and the physical delivery location when it is delivered.</p>	<p>Ship-from/deliver-from location of commissioned asset</p>	Physical location GLN	Physical location name	GS1-128, GS1 DataMatrix	<p>Updated in the product database system.</p> <p>Healthcare provider organisation location information is sourced from GS1 UK LocationManager.</p>
	<p>Commissioned asset</p>	GTIN	Asset name, serial number, lot number, expiry date	GS1-128, GS1 DataMatrix	
	<p>Packaging of the commissioned asset</p>	GTIN	Packaging details	ITF-14, GS1-128, GS1 DataMatrix	
	<p>Ship-to/deliver-to location of commissioned asset</p>	Physical location GLN	Physical location name	GS1-128, GS1 DataMatrix	
	<p>Ship-from/deliver-from organisation, department/function</p>	Legal entity GLN/ function GTIN	Organisation /department /function name	N/A	
	<p>Ship-to/deliver-to organisation/department/function</p>	Legal entity GLN/ function GTIN	Organisation /department /function name	N/A	
<p>3) Prepare the asset for use</p>					
<p>3a) Register the new asset</p> <p>Preparation of the new asset starts when registration details of the new asset are entered in the database system that supports asset management. Details include the manufacturer's GTIN and, where provided, other production information such as the serial number, batch number and expiry date. Additional information such as the name of the department responsible for the asset, may be entered at this stage.</p>	<p>Asset</p>	GTIN	Asset name, serial number, lot number, expiry date	GS1-128 or GS1 DataMatrix	<p>Updated in database system(s) that support asset management and tracking.</p> <p>Master staff information is sourced from the person database system.</p> <p>Master location information is sourced from the location database system.</p>
	<p>Department responsible for the asset</p>	Function GLN	Department name	N/A	
	<p>Staff testing the asset</p>	Staff GSRN	First name, surname	GS1 DataMatrix and passive RFID	



<p>3b) Identify asset with GS1 Identification Key</p> <p>The asset is uniquely identified with a GS1 Identification Key. GS1 UK recommends identifying the asset with the GIAI or GRAI, or continue using the manufacturer's SGTIN depending on the scenario. Section 7.1 on page 35 provides a guide on which GS1 Identification Key to use. The identifier might have already been pre-generated in Step 2 or 3a. The GS1 Identification Key for the asset is updated in the database systems that support asset management and tracking.</p>	<p>Asset</p>	<p>SGTIN, GIAI or GRAI</p>	<p>Asset name, serial number, lot number, expiry date</p>	<p>GS1-128 or GS1 DataMatrix</p>	<p>Updated in database system(s) that support asset management and tracking.</p>
<p>3c) Test the asset</p> <p>The asset carries out the necessary tests to determine whether it is fit for utilisation.</p>	<p>Staff testing the asset</p>	<p>Staff GSRN</p>	<p>First name, surname</p>	<p>GS1 DataMatrix and passive RFID</p>	<p>Updated in database system(s) that support asset management and tracking. Event data, such as the status and location of the asset, is updated using the EPCIS standard. Master staff information is sourced from the person database system.</p>
	<p>Asset</p>	<p>SGTIN, GIAI or GRAI</p>	<p>Asset name, serial number, lot number, expiry date</p>	<p>GS1-128, GS1 DataMatrix and/or passive RFID</p>	



<p>3d) Attach GS1 data carrier(s) to the asset</p> <p>The GS1 Identification Key and associated information are encoded to the GS1 data carrier and attached to the asset.</p> <p>For GS1 data carriers on labels, the layout of labels needs to be agreed and verified prior to attaching the data carrier to the asset. Label suppliers can provide labels with GS1 data carriers pre-encoded with sequential GS1 Identification Keys. These labels can be attached to new assets as part of the commissioning process (Activity 1).</p> <p>Note: Care should be taken to ensure that any asset labels meet the requirements of infection control.</p>	<p>Asset</p>	<p>SGTIN, GIAI or GRAI</p>	<p>Asset name, serial number, lot number, expiry date</p>	<p>GS1-128, GS1 DataMatrix and/or passive RFID</p>	<p>Updated in database system(s) that support asset management and tracking.</p>
<p>3e) Training on the asset (if required)</p> <p>Training on using, servicing/cleaning and/or maintaining the asset occurs at this stage. Supporting documentation (e.g. maintenance requirements) is required.</p>	<p>Staff providing the training</p>	<p>Staff GSRN</p>	<p>First name, surname</p>	<p>GS1 DataMatrix and passive RFID</p>	<p>Updated in database system(s) that support asset management and tracking. Event data, such as the status and location of the asset, is updated through the EPCIS standard.</p> <p>Master staff information is sourced from the person database system.</p>
	<p>Staff receiving the training</p>	<p>Staff GSRN</p>	<p>First name, surname</p>	<p>GS1 DataMatrix and passive RFID</p>	
	<p>Asset</p>	<p>SGTIN, GIAI or GRAI</p>	<p>Asset name, serial number, lot number, expiry date</p>	<p>GS1-128, GS1 DataMatrix and/or passive RFID</p>	



<p>3f) Carry out further testing/compliance checks (if required)</p> <p>Healthcare provider organisation staff undergo further testing/compliance checks if required. These steps can be updated in the database system that supports asset management and tracking.</p>	Staff testing the asset	Staff GSRN	First name, surname	GS1 DataMatrix and passive RFID	<p>Updated in database system(s) that support asset management and tracking. Event data, such as the status and location of the asset, is updated through the EPCIS standard.</p> <p>Master staff information is sourced from the person database system.</p>
	Asset	SGTIN, GIAI or GRAI	Asset name, serial number, lot number, expiry date	GS1-128, GS1 DataMatrix and/or passive RFID	
<p>4) Store the asset</p> <p>After the necessary preparations, the asset is now ready to be used and stored in an equipment library or secure departmental storage location between uses. The booking of the asset in and out of storage, along with the physical location of the asset storage, can be scanned and updated in the database system that supports asset management and tracking.</p> <p>A record is needed for any assets that have been removed or returned to the store and any staff who entered or left the library. This should be sufficient to follow up on any items that have been removed without providing the required information. It should be noted that in the absence of an equipment library it is difficult and expensive to get the accurate equipment utilisation figures that are required for more effective equipment management. Even where a library is in use, utilisation information is only related to the time that an asset has been booked out. This might not correlate closely to the time the asset was actually being used.</p>	Asset storage location	Physical GLN (and optional extension component)	Physical location name	GS1-128, GS1 DataMatrix N/A in passive RFID technology as location defaulted in passive RFID reader	<p>Updated in database system(s) that support asset management and tracking. Event data, such as the status and location of the asset, is updated using the EPCIS standard.</p> <p>Master staff information is sourced from the person database system.</p>
	Equipment library staff	Staff GSRN	First name, surname	GS1 DataMatrix and passive RFID	
	Portering/medical engineering staff	Staff GSRN	First name, surname	GS1 DataMatrix and passive RFID	
	Asset	SGTIN, GIAI or GRAI	Asset name, serial number, lot number, expiry date	N/A	



<p>5) Locate the asset</p> <p>When the asset is required for use, the asset needs to be located. The staff uses the database system that supports asset management and tracking to locate the asset.</p> <p>This step may also be relevant for assets that need to be returned for planned maintenance, recalled, disposed of or decommissioned.</p>	<p>Staff locating the asset</p>	Staff GSRN	First name, surname	N/A	<p>Updated in database system(s) that support asset management and tracking. Event data, such as the status and location of the asset, is updated using the EPCIS standard.</p> <p>Master staff information is sourced from the person database system.</p> <p>Master location information is sourced from the location database system.</p>
	<p>Asset location</p>	Physical location GLN (and optional extension component)	Physical location name	N/A	
	<p>Asset</p>	SGTIN, GIAI or GRAI	Asset name, serial number, lot number, expiry date	GS1-128, GS1 DataMatrix and/or passive RFID	
<p>6) Assign the asset to the user</p> <p>The asset is assigned to user (e.g. patient). Asset user training may be required prior to this step. The GS1 Identification Key of the asset, the patient to which it has been assigned (e.g. GSRN), and the physical location to which it has been delivered can be scanned at this stage and updated on the system that supports asset management and tracking.</p> <p>*describes a data item/attribute that is also expected be encoded within the GS1 data carrier</p>	<p>Ship-from/deliver-from location of asset</p>	Physical location GLN (and optional extension component)	Physical location name, address	GS1-128, GS1 DataMatrix	<p>Updated in database system(s) that support asset management and tracking. Event data, such as the status and location of the asset, is updated using the EPCIS standard.</p> <p>Master patient and staff information is sourced from the person database systems.</p> <p>Master location information is sourced from the location database system.</p>
	<p>Ship-to/deliver-to location of asset</p>	Physical location GLN (and optional extension component)	Physical location name, address	GS1-128, GS1 DataMatrix	
	<p>Person delivering the asset</p>	Staff GSRN	First name, surname	GS1 DataMatrix and/or passive RFID	
	<p>Patient using the asset</p>	Patient GSRN	First name*, surname*, date of birth* , other relevant patient identifiers* (e.g. patient hospital number)	GS1 DataMatrix	
	<p>Asset</p>	SGTIN, GIAI or GRAI	Asset name, serial number, lot number, expiry date	GS1-128, GS1 DataMatrix and/or passive RFID	



<p>7) Use the asset</p> <p>The asset is being used at this stage by the assigned patient. The location and the patient is scanned (e.g. via the patient's GS1 compliant wristband), and tracked by readers which update the database system that supports asset management and tracking.</p> <p>*describes a data item/attribute that is also expected be encoded within the GS1 data carrier</p>	<p>Patient to which the asset is assigned</p>	Patient GSRN	First name*, surname*, date of birth*, other relevant patient identifiers* (e.g. patient hospital number)	GS1 DataMatrix	<p>Updated in database system(s) that support asset management and tracking using the EPCIS standard.</p> <p>Master patient information is sourced from the person database system.</p>
	<p>Tracking location</p>	Physical GLN (and optional location extension component)	Physical location name, address	<p>GS1-128, GS1 DataMatrix</p> <p>N/A in passive RFID technology as location defaulted in passive RFID reader</p>	<p>Master location information is sourced the location database system.</p>
<p>8) Return the asset</p> <p>The asset is returned to the owner at the end of the planned usage period or returned earlier than planned if faulty or if there is user non-compliance.</p>	<p>Ship-from/deliver-from location of asset</p>	Physical GLN (and optional location extension component)	Physical location name, address	<p>GS1-128, GS1 DataMatrix</p> <p>N/A in passive RFID technology as location defaulted in passive RFID reader</p>	<p>Updated in database system(s) that support asset management and tracking using the EPCIS standard.</p> <p>Master patient and staff information are sourced from the person database system.</p>
	<p>Ship-to/deliver-to location of asset</p>	Physical GLN (and optional location extension component)	Physical location name, address	<p>GS1-128, GS1 DataMatrix</p> <p>N/A in passive RFID technology as location defaulted in passive RFID reader</p>	<p>Master location information is sourced from the location database system.</p>
	<p>Staff owning the asset</p>	Staff GSRN	First name, surname	GS1 DataMatrix and passive RFID	
	<p>Service location</p>	Physical GLN (and optional location extension component)	Physical location name	<p>GS1-128, GS1 DataMatrix</p> <p>N/A in passive RFID technology as location defaulted in passive RFID reader</p>	



<p>9) Clean the asset</p> <p>The asset may need to be serviced or cleaned/ decontaminated between use, during utilisation, at regular intervals on site, or at an external facility.</p>	<p>Ship-to/ deliver-to location of asset</p>	<p>Physical GLN (and optional location extension component)</p>	<p>Physical location name, address</p>	<p>GS1-128, GS1 DataMatrix</p> <p>N/A in passive RFID technology as location defaulted in passive RFID reader</p>	<p>Updated in database system(s) that support asset management and tracking using the EPCIS standard.</p> <p>Master staff information is sourced from the person database system.</p> <p>Master location information is sourced from the location database system.</p>
	<p>Staff providing the service</p>	<p>Staff GSRN</p>	<p>First name, surname</p>	<p>GS1 DataMatrix and/or passive RFID</p>	
	<p>Asset</p>	<p>SGTIN, GIAI or GRAI</p>	<p>Asset name, serial number, lot number, expiry date</p>	<p>GS1-128, GS1 DataMatrix and/or passive RFID</p>	
	<p>Ship-from/ deliver-from location of asset</p>	<p>Physical GLN (and optional location extension component)</p>	<p>Physical location name, address</p>	<p>GS1-128, GS1 DataMatrix</p> <p>N/A in passive RFID technology as location defaulted in passive RFID reader</p>	



<p>10) Maintain the asset</p> <p>The asset undergoes planned maintenance or service. The asset management system indicates when the equipment is due for planned maintenance. Unplanned maintenance can also occur if the asset is deemed faulty. The maintenance can be done in situ (at the current location of the asset), at a repair facility at the healthcare provider organisation, or at an external location. As the asset moves through the maintenance processes, the asset and its physical location can be scanned and recorded on the healthcare provider organisation's asset system, along with the maintenance status. Maintenance needs to be aligned with the maintenance requirements.</p>	<p>Ship-to/deliver-to location of asset</p>	Physical GLN (and optional location extension component)	Physical location name, address	GS1-128, GS1 DataMatrix N/A in passive RFID technology as location defaulted in passive RFID reader	<p>Updated in database system(s) that support asset management and tracking using the EPCIS standard.</p> <p>Master staff information is sourced from the person database system.</p> <p>Master location information is sourced from the location database system.</p>
	<p>Staff providing asset maintenance</p>	Staff GSRN	First name, surname	GS1 DataMatrix and/or passive RFID	
	<p>Asset</p>	SGTIN, GIAI or GRAI	Asset name, serial number, lot number, expiry date	GS1-128, GS1 DataMatrix and/or passive RFID	
	<p>Ship-from/deliver-from location of commissioned asset</p>	Physical GLN (and optional location extension component)	Physical location name, address	GS1-128, GS1 DataMatrix N/A in passive RFID technology as location defaulted in passive RFID reader	
<p>11) Dispose of the asset, and decommission if necessary</p> <p>The asset management system indicates any assets whose contract is finishing, needs to be recalled, or is deemed unusable. These assets can then be collected, prepared for return as required by the contract, their GS1 Identification Key of the asset and physical location scanned, and the asset database updated.</p> <p>The asset that has been agreed for end-of-life disposal can be scanned and the relevant record updated to show it is available for pick up. When the asset finally leaves the healthcare</p>	<p>Ship-to/deliver-to location of commissioned asset</p>	Physical GLN (and optional location extension component)	Physical location name, address	GS1-128, GS1 DataMatrix N/A in passive RFID technology as location defaulted in passive RFID reader	<p>Updated in database system(s) that support asset management and tracking using the EPCIS standard.</p> <p>Location information is sourced from the location database system.</p>
	<p>Asset</p>	SGTIN, GIAI or GRAI	Asset name, serial number, lot number, expiry date	GS1-128, GS1 DataMatrix and/or passive RFID	



<p>provider organisation is no longer responsible.</p> <p>In addition, if the asset had been capitalised, it may be necessary to update a separate financial asset registry.</p>	<p>Ship-from/ deliver- from location of the decommissioned asset</p>	<p>Physical GLN (and optional location extension component)</p>	<p>Physical location name, address</p>	<p>GS1- 128, GS1 DataMatrix</p> <p>N/A in passive RFID technology as location defaulted in passive RFID reader</p>	
<p>12) Replace the asset, and decommission if necessary</p> <p>If the asset needs replacing, this should be updated on the asset management system and the asset management process followed from Step 1.</p>	<p>Ship-to/ deliver-to location the decommissioned asset</p>	<p>Physical GLN (and optional location extension component)</p>	<p>Physical location name, address</p>	<p>GS1- 128, GS1 DataMatrix</p> <p>N/A in passive RFID technology as location defaulted in passive RFID reader</p>	<p>Updated in database system(s) that support asset management and tracking using the EPCIS standard.</p> <p>Master location information is sourced from the location database system.</p>
	<p>Asset</p>	<p>SGTIN, GIAI or GRAI</p>	<p>Asset name, serial number, lot number, expiry date</p>	<p>GS1- 128, GS1 DataMatrix and/or passive RFID</p>	
	<p>Ship-from/ deliver- from location of the decommissioned asset</p>	<p>Physical GLN (and optional location extension component)</p>	<p>Physical location name, address</p>	<p>GS1- 128, GS1 DataMatrix</p> <p>N/A in passive RFID technology as location defaulted in passive RFID reader</p>	

5. Technology and governance supporting the process

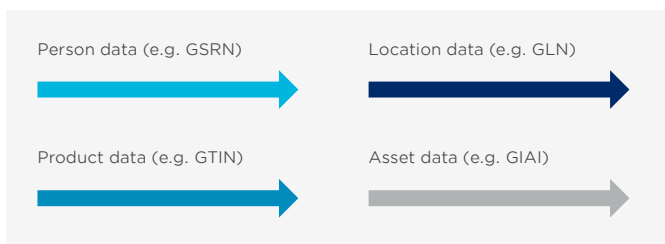
This section describes the technology and governance necessary to support the asset management process described in [section 4 on page 14](#). This helps healthcare provider organisations select the appropriate systems, as detailed in [section 6 on page 33](#).

5.1 GS1-compliant systems

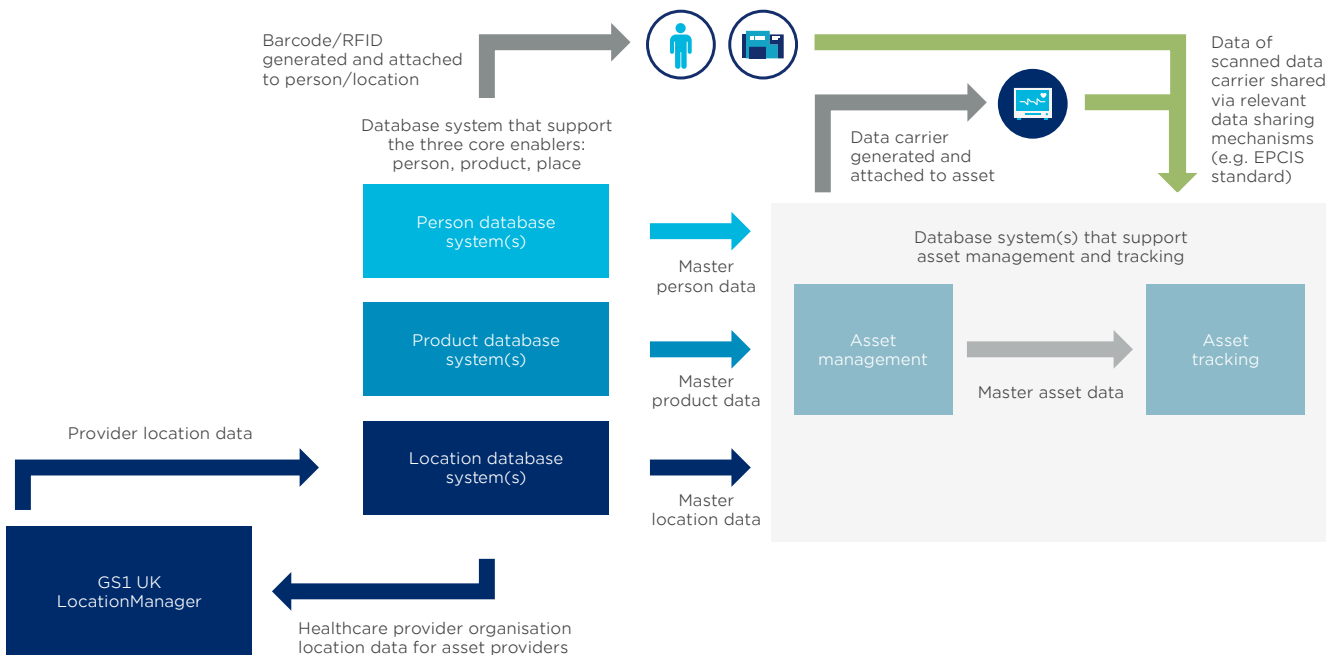
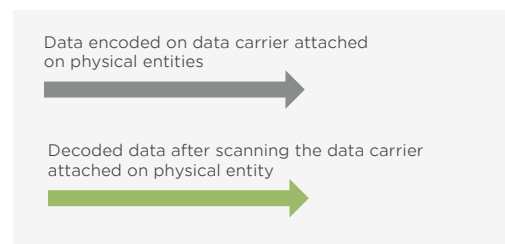
5.1.1 Overview of GS1-compliant systems

The diagram below illustrates the GS1-compliant systems and, flow of master data, and the scanned data of physical entities (e.g. person, location, asset) between systems.

Master data flows



Data carried on physical entities



5.1.2 GS1-compliant systems

This subsection details the database systems that support the asset management process. This includes the GS1 Identification Keys and associated data that the systems should be supporting. [See section 7.1 on page 35](#) Appendix: GS1 Identification Keys to support asset management for the description and format of the GS1 Identification Keys.

Database systems	Person, product, place, asset or other relevant items	GS1 Identification Keys <small>See section 7.1 on page 35 for further information</small>	Associated data
<p>Database system(s) that support asset management and tracking</p> <p>These systems are used to support the management and tracking of assets owned by the healthcare provider organisation. The registration of assets is typically managed in a system called an asset register or asset database. The tracking of asset locations are typically in Real-Time Locating Systems (RTLSSs), however some systems on the market can support both functions.</p> <p>Asset management features</p> <ul style="list-style-type: none"> • Supports the registration process for assets • Supports the allocation of GIAI/GRAI for assets • Receives, holds and transmits relevant identification keys for assets (GIAI, GRAI and/or SGTIN) and other master information about assets (e.g. asset owner, storage location) owned by the healthcare provider organisation • Supports the generation of GS1-compliant data carriers for assets • Tracks asset status information (e.g. testing, training, maintenance of assets) • Sends master asset information to system(s) that support asset tracking • Optional: Can support the EPCIS standard for tracking events through barcode and/or RFID scanning <p>Asset tracking features</p> <ul style="list-style-type: none"> • Sources master asset information from system(s) that support asset management • Tracks real-time tracking location information of assets with date/time stamps • Optional: Can support the EPCIS standard for tracking events through barcode and/or RFID scanning 	Asset	SGTIN, GIAI or GRAI	Asset name, serial number, batch number, asset status (e.g. commissioned), GIAI/GRAI status info (e.g. status, allocation date, deactivation date)
	Department responsible for the asset	Function GLN	Department name
	Staff providing the activity/event/service/status	Staff GSRN	First name, surname, activity performed (e.g. cleaning)
	Staff who is a recipient of the activity/event/service	Staff GSRN	Staff first name, surname, activity received (e.g. being trained)
	Patient using the asset	Patient GSRN	First name, surname, date of birth, other relevant patient identifier(s) (e.g. patient hospital number)
	Asset tracking location	Physical location GLN	Physical location name
	Ship/deliver from location of asset	Physical location GLN	Physical location name
	Ship/deliver to location of asset	Physical location GLN	Physical location name
	Ship/deliver from department/function	Legal entity GLN, function GLN	Organisation/ Department/function name
	Ship/deliver to department/function	Legal entity GLN, function GLN	Organisation/ Department/function name
Activity/event/service status information	N/A	Activity/Event/Status name (e.g. in testing, training, cleaning, in use, in maintenance)	



Database systems that support the three core enablers: person, product, place

<p>Person database system(s)</p> <p>This system is used to support the creation and maintenance of master person information for the healthcare provider organisation. Patient demographic information is typically managed in the Patient Administration System (PAS) or Electronic Patient Record (EPR). Both can support other functionalities such as clinical documentation and the management of test results. Staff information is typically managed in an Electronic Staff Record (ESR) system. Master patient information is typically synchronised with a national database which holds source of truth master person information (e.g. Personal Demographics Service (PDS) for NHS England patients).</p> <p>Patient information management features</p> <ul style="list-style-type: none"> • Holds the GSRN and associated master information of the healthcare provider organisation's registered patients • Supports the generation of GS1-compliant data carriers on patient wristbands, which includes the encoded patient GSRN • Sends master patient information to systems that support asset management <p>Staff information management features</p> <ul style="list-style-type: none"> • Holds GSRN and associated master information of healthcare provider organisation staff • Sends staff information to the database systems that support asset management and tracking • Supports the generation of GS1-compliant data carriers used on staff badges, which includes the encoded staff GSRN 	<p>Patient</p>	<p>Patient GSRN</p>	<p>First name, surname, date of birth, other relevant patient identifiers (e.g. NHS number)</p>
	<p>Staff</p>	<p>Staff GSRN</p>	<p>First name, surname</p>
<p>Product database system(s)</p> <p>This system is used to support the creation and maintenance of product information for the healthcare provider organisation. This information is typically managed in a catalogue management system. In the asset management process, the product database system is used to request/commission new assets as part of the purchase-to-pay process.</p> <p>Features</p> <ul style="list-style-type: none"> • Supports the purchase-to-pay process • Holds GTINs and other master product information regarding the asset that is being commissioned 	<p>Commissioned asset</p>	<p>GTIN</p>	<p>Asset name, serial number, batch number, asset status (e.g. commissioned)</p>
	<p>External Supplier of the commissioned asset (asset provider)</p>	<p>Legal entity GLN</p>	<p>External supplier name</p>
	<p>Healthcare provider organisation of the commissioned asset</p>	<p>Legal entity GLN</p>	<p>Organisation name</p>



<ul style="list-style-type: none"> Sends master product information to systems that support asset management 	Ship-from/deliver-from location of the commissioned asset	Physical location GLN	Physical location name
	Ship-to/deliver-to location of the commissioned asset	Physical location GLN	Physical location name
	Ship-from/deliver-from department/function	Legal entity GLN, function GLN	Organisation/Department/function name
	Ship-to/deliver-to department/function	Legal entity GLN, function GLN	Organisation/Department/function name
<p>Location database system(s)</p> <p>This system is used to support the creation and maintenance of location information used for healthcare provider organisation's internal processes. This system is usually known as the space management system or the estate management system and is typically hosted by the healthcare provider organisation within the estates department.</p> <p>Features</p> <ul style="list-style-type: none"> Stores healthcare provider organisation's GLNs, associated data, and linkages between different location types if necessary (e.g. physical locations with function locations) Supports the allocation of GLNs for the healthcare provider organisation Stores status of allocated and unallocated GLNs Displays how many GLNs have been allocated and how many there are left Supports the generation of GS1-compliant data carriers attached to physical locations. This includes the encoded GLN. Sends up-to-date location information to GS1 UK LocationManager to support the purchase-to-pay process. This can currently be done either via the manual entry of individual GLNs directly into the registry, a manual bulk upload of multiple GLNs via CSV file, or an API. 	Physical location within the healthcare provider organisation	Physical location GLN	Physical location name, GLN status info (e.g. GLN status, allocation date, GLN deactivation date)
	Organisation/Department/function within the healthcare provider organisation	Legal entity GLN, function GLN	Department/function name, GLN status info (e.g. GLN status, allocation date, GLN deactivation date)



<p>GS1 UK LocationManager</p> <p>The GS1 UK hosted national GLN registry which supports the purchase-to-pay process. This ensures that products can be tracked from the point of manufacture, directly to the location of use. See GS1 UK LocationManager for further details.</p> <p>Features</p> <ul style="list-style-type: none"> • Stores a subset of allocated GLNs and the names that are needed by third parties (e.g. asset manufacturers and distributors) • Central access to up-to-date GLNs enables products to be tracked and traced seamlessly through the entire supply chain and patient care pathway • Takes information from the location database systems. This can currently be done either by manual entry of individual GLNs directly into the registry, a manual bulk upload of multiple GLNs via CSV file, or an API. GLNs used to identify locations in healthcare provider internal processes (e.g. bed spaces) will not be stored in this system. 	<p>Healthcare provider organisation</p>	<p>Legal entity GLN</p>	<p>Organisation name</p>
	<p>External supplier of the commissioned asset</p>	<p>Legal entity GLN</p>	<p>Organisation name</p>
	<p>Ship-from/deliver-from location of the external supplier of the commissioned asset</p>	<p>Physical location GLN</p>	<p>Physical location name, address</p>
	<p>Ship-to/deliver-to location of the healthcare provider organisation of the commissioned asset</p>	<p>Physical location GLN</p>	<p>Physical location name, address</p>
	<p>Ship-from/deliver- from location of the healthcare provider organisation of the decommissioned asset</p>	<p>Physical location GLN</p>	<p>Physical location name, address</p>
	<p>Ship-to/deliver-to location of the external supplier of the decommissioned asset</p>	<p>Physical location GLN</p>	<p>Physical location name, address</p>
	<p>Location of transfer point</p>	<p>Physical location GLN</p>	<p>Physical location name, address</p>



5.2 Data carrier technologies

This document covers the following data carrier technologies that can be used to carry GS1 Identification Keys and associated data which are attached to the asset:

GS1 data carrier technologies	Non-GS1 data carrier technologies
<ul style="list-style-type: none">• GS1-128 linear barcode• GS1 DataMatrix 2D barcode• Passive radio-frequency identification (RFID)	<ul style="list-style-type: none">• Active radio-frequency identification (RFID)• Bluetooth Low Energy (BLE)• Near-Field Communication (NFC)

This subsection provides an overview of these technologies. [See section 7.2 Appendix: Data carrier technologies on page 38](#) for further information. Depending on the asset and scenario, more than one data carrier may be attached to the asset. One asset may have two different GS1 data carriers (e.g. GS1 DataMatrix barcode and a GS1-128 barcode), whilst another asset may have a GS1 data carrier and a non-GS1 data carrier (e.g. an infusion pump tracked by BLE whilst the GIAI in a GS1 DataMatrix could be scanned at the point of care). An asset needs have at least a GS1 data carrier attached to it to be GS1 compliant.



		GS1 data carriers technologies			Non-GS1 data carrier technologies*		
		Barcode		Passive RFID	Active RFID	BLE	NFC
		GS1-128	GS1 DataMatrix				
Data carrier	Storage capacity	Up to 48 characters	Up to 2335 alpha-numeric characters depending on barcode size	Up to 96-bits for 96-bit RFID tags ³	Two kilobytes	Depends on deployment requirements	Depends on deployment requirements
	Label reuse	Reprint label	Reprint label ⁴	Some labels can be reused	Some labels can be reused	Tags can be reused	Tags can be reused
Reader	Auto/manual scanning	Manual	Manual	Auto - by readers and antenna	Auto	Auto and manual	Auto and manual
	In or out of line of sight	Scan in line of sight	Scan in line of sight	RFID technology pick up the data	RFID technology pick up the data	Bluetooth technology pick up the data	Scan in line of sight
	Scanning range	Narrow	Broad	Narrow	Broad	Narrow	Very narrow
	Many/single items scanned at once	Single (typically)	Single (typically)	Many	Many	Many	Single

*Information on non-GS1 data carrier technologies have been validated by The Barcode Warehouse.

3 96-bit RFID tags are commonly used RFID tags for assets

4 Asset labels containing unique identifiers on reusable medical devices can be rescanned repeatedly



5.3 Governance

It is integral that the governance on GCP management is in place to ensure that GS1 Identification Keys generated from the GCP are unique. Allocation of GS1 Identification Keys (e.g. GIAI, GRAIs) based on the healthcare provider organisation's GCPs should be done at the healthcare provider organisation level and the sites will inherit the GS1 Identification Keys. This should be stated in the Healthcare provider organisation's asset management standard operating procedures (SOPs).

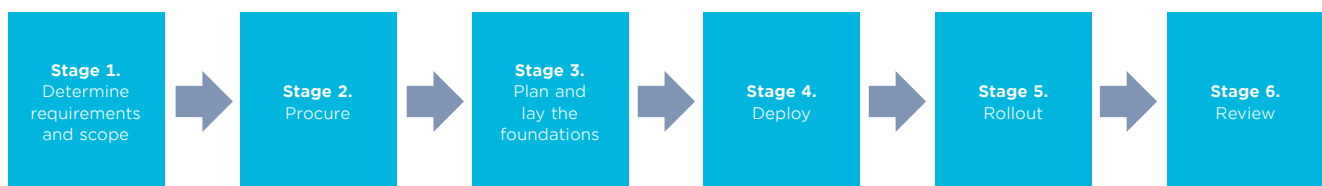
An SOP on the management of GS1 Identification Keys for assets needs to be created and should include the following:

- Specified GS1 Identification Key(s) used to identify assets at the healthcare provider organisation, and the GCP from which they are generated
- Describes the format of the GS1 Identification Key defined by the healthcare provider organisation in compliance with GS1 standards and supported by systems
- Describes the steps taken for effective GS1 Identification Key management to ensure The Keys are not duplicated. Steps include:
 - Generating the GS1 Identification Key in the correct format,
 - Allocating the GS1 Identification Key to the asset, and
 - Storing the GS1 Identification Key in the agreed GS1-compliant system
- Specifies the department/staff who are responsible for the above steps

6. Implementation

This section describes the implementation stages that take place to establish an effective asset management process using GS1 standards, as described in [section 4 on page 15](#). Case studies of successful asset management implementations can be found [here](#).

Below outlines the implementation stages and provides a description of each stage.




<p>Stage 1. Determine requirements and scope</p>	<ul style="list-style-type: none"> • Ensure clear requirements are scoped, with formal agreements signed off at senior level (ideally executive board) showing what the project will deliver • Budget and resources secured and agreed for the procurement of the agreed scope
<p>Stage 2. Procure</p>	<ul style="list-style-type: none"> • The first stage is to decide on the systems (e.g. database systems used to support asset management and tracking) data carrier technologies (e.g. GS1 passive RFIDs) and procure them. The systems and data carrier technologies are detailed in section 5.1.2 GS1-compliant systems on page 26 and section 5.1.2 GS1-compliant systems" on page 26.
<p>Stage 3. Plan and lay the foundation</p>	<ul style="list-style-type: none"> • Following the procure stage, an implementation and rollout plan needs to take place. Implementing the GS1 core enablers (person, product, place) is crucial at this stage. See section 7.4 on page 41 Appendix: Implementation steps of three GS1 Core Enablers for further information. Any label with a GS1 data carrier that has been deployed for the GS1 core enablers needs to be verified for GS1 compliance⁵. • This stage also involves an audit of all the assets in the healthcare provider organisation, and their owners • The audit will allow the healthcare provider organisation to determine how many GS1 Identification Keys need to be allocated for identifying assets and for identifying priority areas/assets for initial deployment • The GS1 Identification Keys are allocated to the initial set of assets • Asset management SOP is defined at this stage (see section 5.3 Governance on page 32 Governance for further information on SOPs)



<p>Stage 4. Deploy</p>	<ul style="list-style-type: none">• This stage focuses around working with the solution partners to deploy the GS1-compliant systems, data carrier technologies, and data sharing standards for asset management. GS1 UK offers data carrier validation and verification services for GS1 data carriers to ensure optimal quality and compliance with GS1 standards.• The initial set of assets are associated with GS1 Identification Keys and attached with GS1 data carriers following steps 3c and 3d in Section 4.2 on page 15 Asset Management Process• At go-live, the asset management process (activities 4-12 of Section 4.2 on page 15 Asset Management Process) is in operation for the initial set of assets. For new assets in the priority areas, the end-to-end asset management process (activities 1-12 of Section 4 Asset Management Process) can also be in operation at this stage. Asset management SOP is followed at go-live.
<p>Stage 5. Rollout</p>	<ul style="list-style-type: none">• This stage focuses on identifying the remainder of the assets with GS1 Identification Keys and attaching them with GS1 data carrier labels following steps 3c and 3d in Section 4.2 on page 15, Asset Management Process. Asset management process (activities 4-12 of Section 4.2 on page 15, Asset Management Process) is rolled out for all the assets.• Other areas/departments also rolls out the end-to-end asset management process for new assets (activities 1-12 of Section 4.2 on page 15, Asset Management Process). Asset management SOP continues to be followed during the roll out stage.
<p>Stage 6. Review</p>	<ul style="list-style-type: none">• Review the metrics which have been achieved against those benchmarked as success factors from the commencement of the project• Review and detail lessons learned• Produce final end of project report• Advise the senior stakeholders (ideally executive board) that the project is complete and what the business-as-usual model is to be.

7. Appendix

7.1 Appendix: GS1 Identification Keys to support asset management

GS1 Identification Key	Format	Further guidance to meet GS1 and NHS requirements
<p>GS1 Identification Keys for the core enablers: person, product, place</p>		
<p>GSRN for the person</p> <p>The GSRN can be used to identify a relationship between a person and an organisation that is offering a service. GSRN is often used to identify two types of relationships:</p> <ul style="list-style-type: none"> The relationship between the organisation offering the service and the actual recipient of the service The relationship between the organisation offering the service and the actual provider of the service <p>From the NHS perspective, the GSRN is used to identify:</p> <ul style="list-style-type: none"> The NHS patient. This GSRN is known as the patient GSRN The staff providing services in the NHS. This GSRN is known as the staff GSRN 	<p>As the name suggests, GSRN is numeric. It is an 18-digit number which starts with the GCP, followed by the service reference, and ends with the check digit. The definition of the service reference is at the discretion of the GS1 Member. For example, NHS Digital released a national information standard for AIDC for Patient Identification which utilises the patient NHS number as the service reference for patient GSRNs in NHS England. See DCB1077: AIDC for Patient Identification standard for further information.</p> 	<p>Sections 2 and 4 of the GS1 General Specifications</p>
<p>GTIN for the product</p> <p>The GTIN can be used to identify any item (product or service) that may be priced, or ordered, or invoiced at any point in any supply chain.</p> <p>Continued on the next page.</p>	<p>As the name suggests, GTIN is numeric. There are four formats. The 13-digit GTIN (GTIN-13) and the 14-digit GTIN (GTIN-14) are the commonly utilised formats in the healthcare sector. The GTIN-13 starts with the GCP followed by the item reference and ends with the check digit. For each GTIN-13, an additional range of 14-digit numbers can be created which are the GTIN-14s typically used to identify packaging for that product. GTIN-14 starts with the indicator digit followed by the GTIN-13's GCP, item reference and ends with the check digit. The indicator digit for each GTIN-14 can range from 1 to 8. All GTIN-14s beginning with the indicator digit, 9, are reserved for variable measure items.</p> <p>Continued on the next page.</p>	<p>Sections 2 and 4 of the GS1 General Specifications</p> <p>GS1 Healthcare Implementation Guideline</p>

A GTIN itself does not provide unique identification of each unit of a product because it does not uniquely identify each instance of a physical object. The serialised GTIN, SGTIN, is an extension to the GTIN which allows different units of the same product line to be individually identified. The brand owner and the manufacturer are responsible for ensuring the uniqueness of serial numbers for a GTIN.

SGTIN can also provide unique identification for the healthcare provider's asset depending on the scenario. Section 7.2 on page 38 for further information



Serial number

The serial number field is alphanumeric and cannot exceed 20 characters. Although the serial number reference can be in alphanumeric format and can start with leading zeros, the 96-bits encoding for passive RFID data carriers (the most commonly used GS1 data carrier for asset) requires the serial number to be numeric. A zero as the first digit cannot be used and the decimal value must be less than 38. See EPC Tag Data Standard for further information.

GLN for the place

The GLN can be used to identify locations for a broad range of use cases including identifying delivery points, the final destination of an asset, where assets are stored, where they are sent from, and where they are delivered to.

There are four types of GLNs: Legal entity GLN, physical location GLN, function GLN and digital location GLN. The most commonly used GLNs are as follows:

- **Legal entity GLN:** This can be used to identify any business, government body, department, charity, individual or institution that has standing in the eyes of the law and capacity to enter into agreements or contracts. Examples can be St John's Hospital, NHS Scotland, and/or a Health Board.
- **Physical location GLN:** This can be used to identify a site (an area, a structure or group of structures), or an area within a site where something was, is or will be located. Examples include hospital ward, bed location and a corridor.
- **Function GLN:** This can be used to identify an organisational subdivision or department based on the specific tasks being performed, as defined by the organisation. An example of a function is the St Johns Hospital - critical care unit.

There is the option to use the **GLN Extension Component** to identify internal physical sublocations such as bed locations.

As the name suggests, GLN is numeric and is 13 characters long. It starts with the GCP, followed by the location reference and ends with the check digit.



The Extension Component can hold up to 20 characters and is alphanumeric. Using the Extension Component with the same GLN (GLN + GLN Extension Component) substantially increases the number of locations that can be identified. The definition of the GLN Extension Component is at the discretion of the healthcare provider organisation.

Sections 2 and 4 of the [GS1 General Specifications](#)



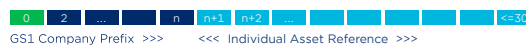
GS1 Identification Keys for assets

See [Section 7.1 on page 35](#) to determine which GS1 Identification Key to use depending on the given scenario

GIAI

The GIAI can be used to identify an individual asset such as computers, vehicles, surgical instruments and pumps.

The GIAI can be up to 30 characters long. It starts with the GCP in numeric format followed by the individual asset reference in alphanumeric format. The individual asset reference is used to identify the individual asset. The definition of the individual asset reference is at the discretion of the asset owner or manager at the hospital site.



Although the individual asset reference can be in alphanumeric format and can start with leading zeros, the 96-bits encoding for passive RFID data carriers (the most commonly used GS1 data carrier for asset) requires the individual asset reference to be numeric and a zero cannot be used as the first digit. See [EPC Tag Data Standard](#) for further information.

Sections 2 and 4 of the [GS1 General Specifications](#)

[GS1 Healthcare Implementation Guideline](#)

GRAI

The GRAI can be used to identify returnable items such as pallet bases, roll cages, plastic containers or gas cylinders which are used in the movement of goods. The goods themselves are identified by a GTIN or a Serial Shipping Container Code (SSCC).

The GRAI can be up to 30 characters long. It starts with a filler digit, 0, followed by the GCP and asset type in numeric format, and ends with the check digit. The GRAI can also include an alphanumeric serial component, which identifies the individual asset within a given asset type. The definition of the Serial Number is at the discretion of the asset owner or manager at the hospital site.



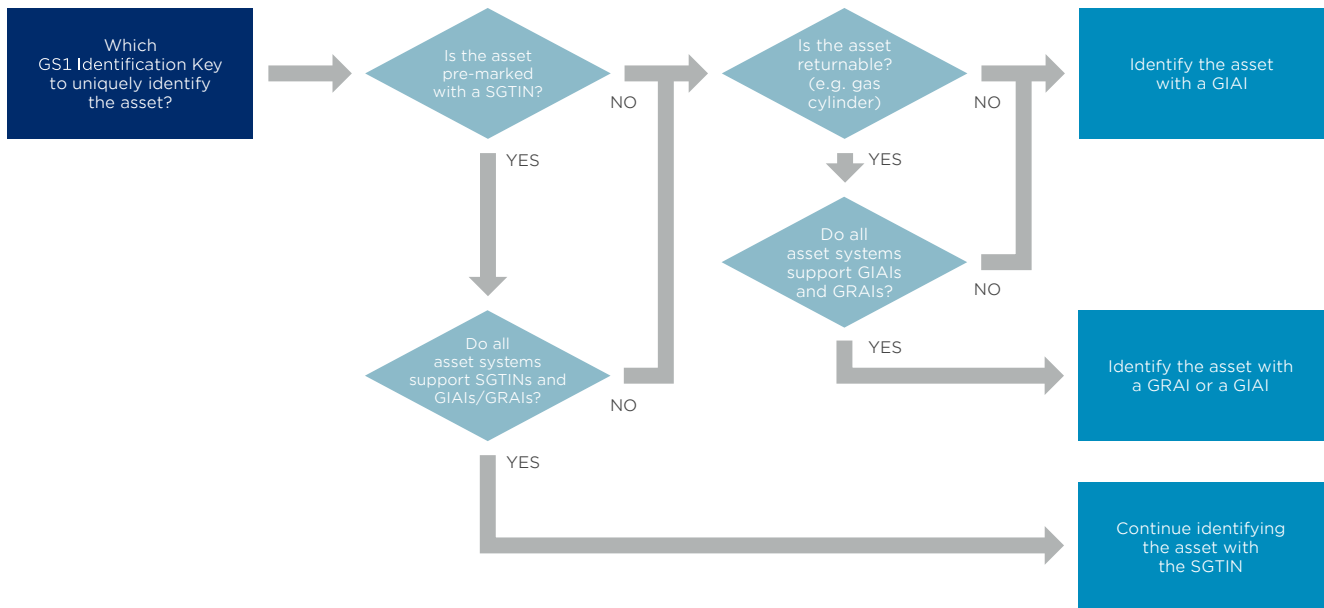
Although the serial component reference can be in alphanumeric format and can start with leading zeros, the 96-bits encoding for passive RFID data carriers (the most commonly used GS1 data carrier for assets) requires the returnable asset reference to be numeric and a zero as the first digit cannot be used. See [EPC Tag Data Standard](#) for further information.

Sections 2 and 4 of the [GS1 General Specifications](#)

[GS1 Healthcare Implementation Guideline](#)

7.2 Appendix: Determining which GS1 Identification Key to use for assets

The diagram below is an illustrative guide that helps healthcare provider organisations determine which GS1 Identification Key will be used to associate with the asset.



7.3 Appendix: Data carrier technologies


There are several options for different data carrier technologies to be implemented. In regards to assets, the appropriate data carrier depends on asset type, composition, packaging, size, the materials it was constructed with, and the environment in which it is stored and used. The tables below outline GS1-compliant data carriers as well as other available technologies.

7.3.1 Appendix: GS1 data carrier technologies

Data carrier	Reader characteristics	Further guidance to meet GS1 and NHS requirements
<p>GS1-128 linear barcode</p>  <ul style="list-style-type: none"> • 48 Alphanumeric capacity • Supports any GS1 Identification Key • Supports data associated with GS1 Identification Keys 	<ul style="list-style-type: none"> • Information encoded within a GS1-128 barcode can be read by any barcode reader, ranging from light beams to optical devices (e.g. camera scanner in a smartphone) • Readers will scan the barcode manually • The scanning needs to be done in line of sight • Single barcodes can be scanned at once 	<p>Sections 3, 5 and 7 of the GS1 General Specifications</p> <p>GS1 Healthcare Implementation Guideline</p> <p>GS1 Human Readable Interpretation (HRI) Implementation Guideline</p>
<p>GS1 DataMatrix 2D barcode</p>  <ul style="list-style-type: none"> • Can carry more data than a GS1-128 barcode, larger sizes carry more data • Can be encoded with built in error correction, so symbol can still be read if damaged. 	<ul style="list-style-type: none"> • Information encoded within a GS1 DataMatrix barcode can be read by an optical device (e.g. camera scanner in a smartphone) • Readers will scan the barcode manually • The scanning needs to be done in line of sight • Single barcodes can be scanned at once 	<p>Sections 3, 5 and 7 of the GS1 General Specifications</p> <p>GS1 Healthcare Implementation Guideline</p> <p>GS1 Human Readable Interpretation (HRI) Implementation Guideline</p> <p>GS1 DataMatrix Guideline</p>
<p>Passive RFID</p>  <ul style="list-style-type: none"> • Not battery powered • Little/no intelligence • Can be embedded in a normal label or in a protective plastic casing if they are subject to heavy treatment 	<ul style="list-style-type: none"> • Information encoded within a passive RFID tag can be read by a reader by a radio wave • Fixed readers: <ul style="list-style-type: none"> • Typically located in corridors and entrances and exits • If fixed readers are in a room, then its contents can be monitored continuously, and warnings generated of any equipment entering or leaving the room • Mobile readers: <ul style="list-style-type: none"> • Can be based on a trolley that is moved around a hospital going through each room on a weekly or monthly basis • Can be as a handheld wand which can be used to scan items within a room, cupboard, or patient bedside. The handheld wand can beep when it finds specific tags and beeps louder as it gets closer to a tag. 	<p>Sections 3, 5 and 7 of the GS1 General Specifications</p> <p>GS1 Healthcare Implementation Guideline</p> <p>EPC Tag Data Standard</p>

	<ul style="list-style-type: none"> • Can show the location of assets on maps and floor plans • Communicate with the asset system via Wi-Fi or on returning to a docking station 	
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7.3.2 Appendix: Non-GS1 data carrier technologies⁶

Data carrier	Reader characteristics
<p>Active RFID</p>  <ul style="list-style-type: none"> • Typically battery assisted • Little/no intelligence • They typically are encased in a protective plastic casing in a wide variety of formats • The tags can be attached to assets with glue, a lanyard or screws 	<ul style="list-style-type: none"> • Mobile phone or a handheld device, enabling tags to be read each time a porter visits a location during their normal course of duty • This can provide real time location info in the most frequented locations. For locations that are not visited frequently, it may be necessary to request porters to visit the location in order to generate asset location information. • Fixed readers <ul style="list-style-type: none"> • For more autonomous data capture, the ability to cover larger areas and transition point capability. Possible directionality awareness is specific readers. • Mobile readers <ul style="list-style-type: none"> • Active RFID can be read from a distance of many metres • Movement history between departments is available, especially useful for infection control
<p>BLE</p> <ul style="list-style-type: none"> • Always battery assisted • Little/no intelligence • They typically are encased in a protective plastic casing in a wide variety of formats • The tags can attached to assets with glue, a lanyard or screws 	<ul style="list-style-type: none"> • Mobile phone or a handheld device, enabling tags to be read each time a porter visits a location during their normal course of duty • This can provide location information up to 10 times per day in the most frequented locations. For locations that are not visited frequently, it may be necessary to request porters to visit the location to get asset location information. • More accurate location of a tag when communicating with a beacon



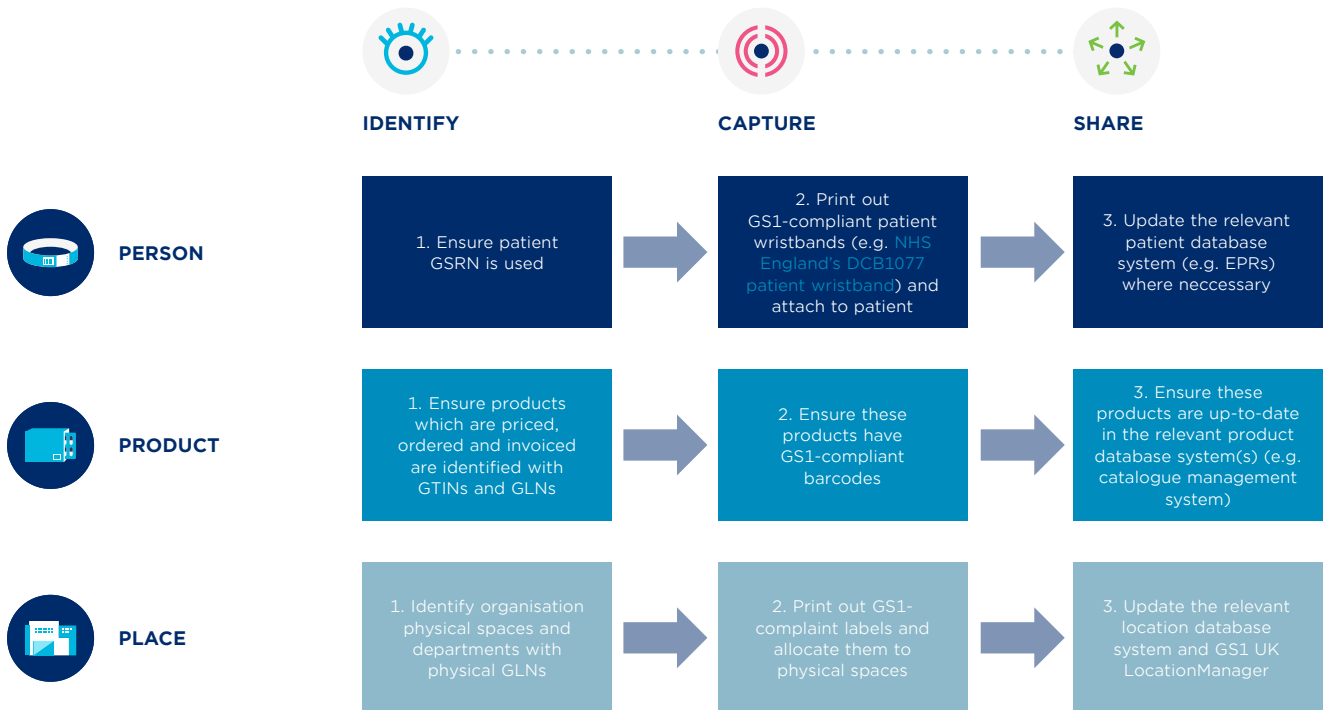
NFC	
<ul style="list-style-type: none">• Not battery powered• No intelligence• Both printed or hard tags• Very low reader range	<ul style="list-style-type: none">• Mobile phone or a handheld device, enabling tags to be read each time a porter visits a location during their normal course of duty• This can provide location information up to 10 times per day in the most frequented locations. For locations that are not visited frequently, it may be necessary to request porters to visit the location to get asset location information.

7.4 Appendix: GS1 data exchange standard to support asset management

EPCIS	Further guidance to meet GS1 requirements
<ul style="list-style-type: none">• Can be used for capturing, communicating, storing and accessing barcode or RFID scanned data, also known as event data• Enables healthcare provider organisations to build an organisation-wide scanning system that can cover all internal processes independently of existing hospital applications• Complements other data exchange standards used for sharing data within the healthcare provider organisation, such as Health Level 7 (HL7)• Existing systems can be integrated as required, using the standard EPCIS application interfaces, or through existing interoperability engines• Includes inbuilt extensibility mechanisms which render it inherently futureproof	<p>EPC Information Services (EPCIS)</p>

7.5 Appendix: Implementation steps of the three core enablers

The flowcharts below illustrate the steps needed to implement the three core enablers.



7.6 Appendix: Acronyms and abbreviations

1D	One-dimensional
2D	Two-dimensional
AIDC	Automatic identification and data capture
API	Application programming interface
BLE	Bluetooth Low Energy
CPAP	Continuous positive airway pressure
CSV	Comma-Separated Values
EPC	Electronic Product Code
EPCIS	Electronic Product Code Information Services
EPR	Electronic patient record
ESR	Electronic staff record
FFP3	Filtering face piece 3
GCP	Global Company Prefix
GIAI	Global Individual Asset Identifier
GIRFT	Getting It Right First Time
GLN	Global Location Number
GRAI	Global Returnable Asset Identifier
GTIN	Global Trade Item Number



HL7	Health Level 7
IT	Information technology
MDR	Medical Device Register
MDSP	Medical Devices Safety Programme
MHRA	Medicines and Healthcare products Regulatory Agency
NFC	Near-field communication
NHS	National Health Service
PAS	Patient administration system
PDS	Personal Demographics Service
PPE	Personal protective equipment
RFID	Radio-frequency identification
RTLS	Real-Time Locating System
SGTIN	Serialised Global Trade Item Number
SOP	Standard operating procedure
SSCC	Serial Shipping Container Code

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