# Data Model & ERD

## Purpose & Scope

This document defines the relational data model for the PineCone Pro Supplies ERP/IMS. It supports product information management, multi‑warehouse inventory control, order processing, purchasing, lot/serial tracking, shipping, returns and basic accounting integration. The aim is to create a normalized and scalable database that ensures data integrity, reduces redundancy and serves as the single source of truth for all departments.

## Design Principles

* **Identify entities and relationships:** The first step is to enumerate the main business objects (e.g., products, customers, orders, inventory) and how they interact.
* **Normalize the schema:** Entities are normalized to reduce redundancy and maintain data integrity. Reference tables (such as categories and tax rates) are separated from transactional tables.
* **Choose appropriate data types:** Fields use appropriate datatypes (e.g., integers for IDs, decimals for prices) to optimise storage and accuracy.
* **Define primary and foreign keys:** Each table has a surrogate primary key; relationships are enforced via foreign keys.
* **Represent cardinality:** One‑to‑many relationships (e.g., orders to order lines) and many‑to‑many relationships (e.g., products and warehouses) are modelled explicitly.
* **Support scalability:** The design accommodates multiple warehouses, thousands of SKUs and additional modules (e.g., forecasting) without major restructuring.

## Entities & Relationships Overview

Below is a high‑level summary of the core entities and their relationships. Details of each table follow in the Schema Catalog section.

* **Product** – Master record for each SKU; includes internal SKU code, barcodes, description, category, dimensional data and reorder quantities. Products participate in kits, orders, inventory and purchase orders.
* **Vendor** – Represents suppliers; includes name, address and contact details and is linked to purchase orders.
* **Customer** – Represents B2B/B2C customers; stores names and addresses and relates to orders.
* **PurchaseOrder** – Header for purchase transactions with vendors; has status, dates and is linked to multiple PurchaseOrderLine rows.
* **PurchaseOrderLine** – Line items of a purchase order; references a product, quantity and price.
* **InventoryLocation** – Warehouse or cross‑dock facility; includes location attributes and is linked to InventoryItem rows.
* **InventoryItem** – Junction entity connecting Product and InventoryLocation; stores quantity on hand, reserved quantity, reorder points and lot/serial references. This resolves the many‑to‑many relationship between products and warehouses.
* **Order** – Customer order; header with customer, order date, status, channel, payment and fraud flags.
* **OrderLine** – Line items for each order; references product, quantity, price and tax.
* **Shipment** – Physical shipment associated with an order; includes carrier, tracking number, origin warehouse and status.
* **RMA** – Return merchandise authorization; linked to an order or shipment; includes reason code and disposition (restock/refurbish/scrap).
* **Lot** – Represents lots/batches for regulated products; includes lot number, manufacture date, expiration date and links to inventory items.
* **Serial** – Unique serial numbers for high‑value items; includes warranty and service information.
* **TaxRate** – Stores jurisdictional tax rates by state, county and category; referenced by order lines for automated tax calculations.
* **AccountEntry** – Represents financial journal entries; integrates with accounting for debits and credits.
* **User / Role** – Entities for RBAC; map users to roles defined in the RBAC matrix (documented separately).

## ERD Diagram

Below is the conceptual ERD showing the core entities and their relationships.

A screenshot of a computer screen

AI-generated content may be incorrect.

ERP ERD

*Figure 1: Conceptual ERD for PineCone Pro ERP/IMS. Rectangles represent entities; connecting lines indicate one‑to‑many relationships. Many‑to‑many relationships (e.g., Product–Warehouse) are resolved by junction tables such as InventoryItem.*

## Field & Schema Catalog

The following tables describe the fields, primary/foreign keys and notes for each entity. Data types are indicative and can be adjusted to match the chosen database platform (Azure SQL, PostgreSQL, etc.). Dates and times should use timezone‑aware types where possible.

### Product

| Field | Type | Description | Key / Notes |
| --- | --- | --- | --- |
| ProductID | INT | Surrogate primary key | PK |
| SKU | VARCHAR(100) | Internal product code (SKU); unique | Unique |
| Barcode | VARCHAR(100) | Universal barcode/UPC |  |
| Name | VARCHAR(100) | Product name |  |
| Description | VARCHAR(2000) | Long description |  |
| CategoryID | INT | Foreign key to ProductCategory table | FK |
| PackedWeight | DECIMAL(10,2) | Weight incl. packaging |  |
| PackedHeight | DECIMAL(10,2) | Height incl. packaging |  |
| PackedWidth | DECIMAL(10,2) | Width incl. packaging |  |
| PackedDepth | DECIMAL(10,2) | Depth incl. packaging |  |
| Refrigerated | BOOLEAN | Requires refrigeration |  |
| HazardClass | VARCHAR(50) | Hazardous classification (e.g., ORM‑D, flammable) |  |
| BaseUnit | VARCHAR(20) | Base unit of measure (e.g., piece, gallon) |  |
| ConversionFactor | DECIMAL(10,4) | Factor for converting base unit to alternative units (for unit conversions) |  |
| ReorderQuantity | INT | Preferred reorder quantity |  |

### ProductCategory

| Field | Type | Description | Key / Notes |
| --- | --- | --- | --- |
| CategoryID | INT | Primary key | PK |
| Name | VARCHAR(100) | Category name |  |
| ParentID | INT | Self‑reference for hierarchical categories | FK |

### Vendor

| Field | Type | Description | Key / Notes |
| --- | --- | --- | --- |
| VendorID | INT | Primary key | PK |
| Name | VARCHAR(100) | Legal name |  |
| Address | VARCHAR(200) | Mailing address |  |
| ContactName | VARCHAR(100) | Primary contact person |  |
| Email | VARCHAR(100) | Email address |  |
| Phone | VARCHAR(40) | Phone number |  |
| MinOrderQty | INT | Minimum order quantity for this vendor |  |
| LeadTimeDays | INT | Standard lead time (days) |  |
| Rating | DECIMAL(4,2) | Vendor performance score (0–5) |  |

### Customer

| Field | Type | Description | Key / Notes |
| --- | --- | --- | --- |
| CustomerID | INT | Primary key | PK |
| Name | VARCHAR(100) | Customer name |  |
| Address | VARCHAR(200) | Billing/shipping address |  |
| PhoneNumber | VARCHAR(40) | Contact phone |  |
| Email | VARCHAR(100) | Email address |  |
| Type | ENUM (B2C,B2B) | Customer type |  |
| AccountTerms | VARCHAR(50) | Payment terms (e.g., Net‑30) |  |

### PurchaseOrder

| Field | Type | Description | Key / Notes |
| --- | --- | --- | --- |
| PurchaseOrderID | INT | Primary key | PK |
| VendorID | INT | Supplier placing the order | FK |
| OrderDate | DATE | Date the PO was issued |  |
| Status | ENUM | Draft, Submitted, Approved, Received, Closed |  |
| ExpectedDate | DATE | Expected delivery date |  |
| TotalAmount | DECIMAL(12,2) | Total value |  |
| CreatedBy | INT | User who created the PO | FK |

### PurchaseOrderLine

| Field | Type | Description | Key / Notes |
| --- | --- | --- | --- |
| PurchaseOrderLineID | INT | Primary key | PK |
| PurchaseOrderID | INT | Associated purchase order | FK |
| ProductID | INT | Product ordered | FK |
| QuantityOrdered | INT | Number of units ordered |  |
| UnitPrice | DECIMAL(10,2) | Price per unit at order time |  |
| QuantityReceived | INT | Units received so far |  |
| Status | ENUM | Open, Partial, Completed |  |

### InventoryLocation

| Field | Type | Description | Key / Notes |
| --- | --- | --- | --- |
| LocationID | INT | Primary key | PK |
| Name | VARCHAR(100) | Name of warehouse or cross‑dock |  |
| Address | VARCHAR(200) | Physical address |  |
| IsRefrigerated | BOOLEAN | Facility has refrigeration |  |
| Type | ENUM | DC, CrossDock, 3PL |  |

### InventoryItem

| Field | Type | Description | Key / Notes |
| --- | --- | --- | --- |
| InventoryItemID | INT | Primary key | PK |
| LocationID | INT | Warehouse where the stock is held | FK |
| ProductID | INT | Associated product | FK |
| LotID | INT | Lot identifier (nullable) | FK |
| SerialID | INT | Serial number (nullable) | FK |
| QuantityOnHand | INT | Current stock quantity |  |
| QuantityReserved | INT | Quantity reserved for orders |  |
| MinimumStockLevel | INT | Min stock level for this location |  |
| MaximumStockLevel | INT | Max stock level |  |
| ReorderPoint | INT | Level at which reorder is triggered |  |
| CostPerUnit | DECIMAL(10,2) | Average cost per unit |  |
| LastUpdated | DATETIME | Timestamp of last inventory update |  |

### Lot

| Field | Type | Description | Key / Notes |
| --- | --- | --- | --- |
| LotID | INT | Primary key | PK |
| ProductID | INT | Product associated with the lot | FK |
| LotNumber | VARCHAR(50) | Lot/batch number |  |
| ManufactureDate | DATE | Date of manufacture |  |
| ExpirationDate | DATE | Expiry date |  |
| SupplierID | INT | Vendor that supplied the lot | FK |

### Serial

| Field | Type | Description | Key / Notes |
| --- | --- | --- | --- |
| SerialID | INT | Primary key | PK |
| ProductID | INT | Product associated | FK |
| SerialNumber | VARCHAR(100) | Unique serial | Unique |
| WarrantyEnd | DATE | Warranty expiry date |  |
| CustomerID | INT | Owner/customer (nullable) | FK |

### Order

| Field | Type | Description | Key / Notes |
| --- | --- | --- | --- |
| OrderID | INT | Primary key | PK |
| CustomerID | INT | Ordering customer | FK |
| OrderDate | DATE | When the order was placed |  |
| Status | ENUM | Pending, Confirmed, Packed, Shipped, Cancelled |  |
| Channel | ENUM | Web, B2B Portal, POS, Amazon |  |
| PaymentStatus | ENUM | Unpaid, Paid, Refunded |  |
| FraudStatus | ENUM | Pending, Approved, Flagged |  |
| TotalAmount | DECIMAL(12,2) | Total before tax |  |
| TaxAmount | DECIMAL(12,2) | Computed tax |  |
| ShippingAmount | DECIMAL(12,2) | Shipping cost |  |
| CreatedBy | INT | User who created the order | FK |

### OrderLine

| Field | Type | Description | Key / Notes |
| --- | --- | --- | --- |
| OrderLineID | INT | Primary key | PK |
| OrderID | INT | Associated order | FK |
| ProductID | INT | Product ordered | FK |
| Quantity | INT | Units ordered |  |
| UnitPrice | DECIMAL(10,2) | Price per unit at order time |  |
| TaxRateID | INT | Tax jurisdiction | FK |
| LineTotal | DECIMAL(12,2) | Quantity × UnitPrice |  |

### Shipment

| Field | Type | Description | Key / Notes |
| --- | --- | --- | --- |
| ShipmentID | INT | Primary key | PK |
| OrderID | INT | Associated order | FK |
| LocationID | INT | Warehouse origin | FK |
| ShipmentDate | DATE | Date shipped |  |
| Carrier | VARCHAR(100) | Shipping carrier |  |
| TrackingNumber | VARCHAR(100) | Tracking number |  |
| HazMatDocs | VARCHAR(200) | Reference to hazmat documentation when required |  |
| Status | ENUM | Pending, InTransit, Delivered, Lost |  |

### RMA (Return)

| Field | Type | Description | Key / Notes |
| --- | --- | --- | --- |
| RMAID | INT | Primary key | PK |
| OrderID | INT | Original order | FK |
| ShipmentID | INT | Associated shipment (if applicable) | FK |
| CustomerID | INT | Customer returning item | FK |
| CreatedDate | DATE | RMA creation date |  |
| ReasonCode | ENUM | Reason for return (Damaged, WrongItem, Warranty, Other) |  |
| Disposition | ENUM | Restock, Refurbish, Scrap |  |
| Status | ENUM | Open, Processing, Closed |  |

### TaxRate

| Field | Type | Description | Key / Notes |
| --- | --- | --- | --- |
| TaxRateID | INT | Primary key | PK |
| State | VARCHAR(50) | State/Province |  |
| County | VARCHAR(50) | County/locality |  |
| Category | VARCHAR(50) | Tax category (e.g., general, food) |  |
| Rate | DECIMAL(6,4) | Tax percentage |  |
| EffectiveDate | DATE | Effective date |  |

### AccountEntry

| Field | Type | Description | Key / Notes |
| --- | --- | --- | --- |
| EntryID | INT | Primary key | PK |
| Date | DATE | Entry date |  |
| AccountNumber | VARCHAR(20) | GL account |  |
| Debit | DECIMAL(12,2) | Debit amount |  |
| Credit | DECIMAL(12,2) | Credit amount |  |
| ReferenceType | ENUM | Order, PurchaseOrder, Inventory, Manual |  |
| ReferenceID | INT | ID of the source record |  |
| Description | VARCHAR(200) | Narrative description |  |

### User & Role (simplified)

| Field | Type | Description | Key / Notes |
| --- | --- | --- | --- |
| UserID | INT | Primary key | PK |
| Username | VARCHAR(50) | Login name | Unique |
| PasswordHash | VARCHAR(200) | Password hash |  |
| Email | VARCHAR(100) | Email |  |
| RoleID | INT | Assigned role | FK |

| Field | Type | Description | Key / Notes |
| --- | --- | --- | --- |
| RoleID | INT | Primary key | PK |
| Name | VARCHAR(50) | Role name (e.g., Warehouse Associate, Purchasing Lead) | Unique |
| Description | VARCHAR(200) | Role description |  |

This completes the Data Model and ERD specification. The design follows good database practices—normalized schemas, clear primary and foreign keys, and support for domain‑driven modularity—while aligning with the functional requirements of PineCone Pro’s ERP/IMS.