



**Semantum**  
semantum.fi

# Drawing to Data

Changing the symbology in P&IDs when  
converting drawings to intelligent diagrams

THTH Spring webinar 2024

Gerardo.Santillan@semantum.fi

Marko.Luukkainen@semantum.fi

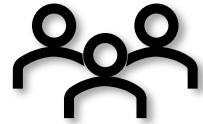


# S e m a n t u m



## Background

- Established in 2007
- Located in Espoo, Finland
- VTT Technical Research Centre of Finland background



## Expertise

- Highly skilled, multidisciplinary team of software developers, automation and system engineers, as well as modeling and simulation specialists
- A third of the company holds a PhD degree



## Focus areas

- Development and maintenance of system simulation tools for process industry such as Apros
- Industrial Simulation-Based Digital Twins
  - Cloud-based simulation turn-key solutions
- **Engineering automation solutions**
- Life Cycle Assessment solutions



## Trusted by:



# Model Broker

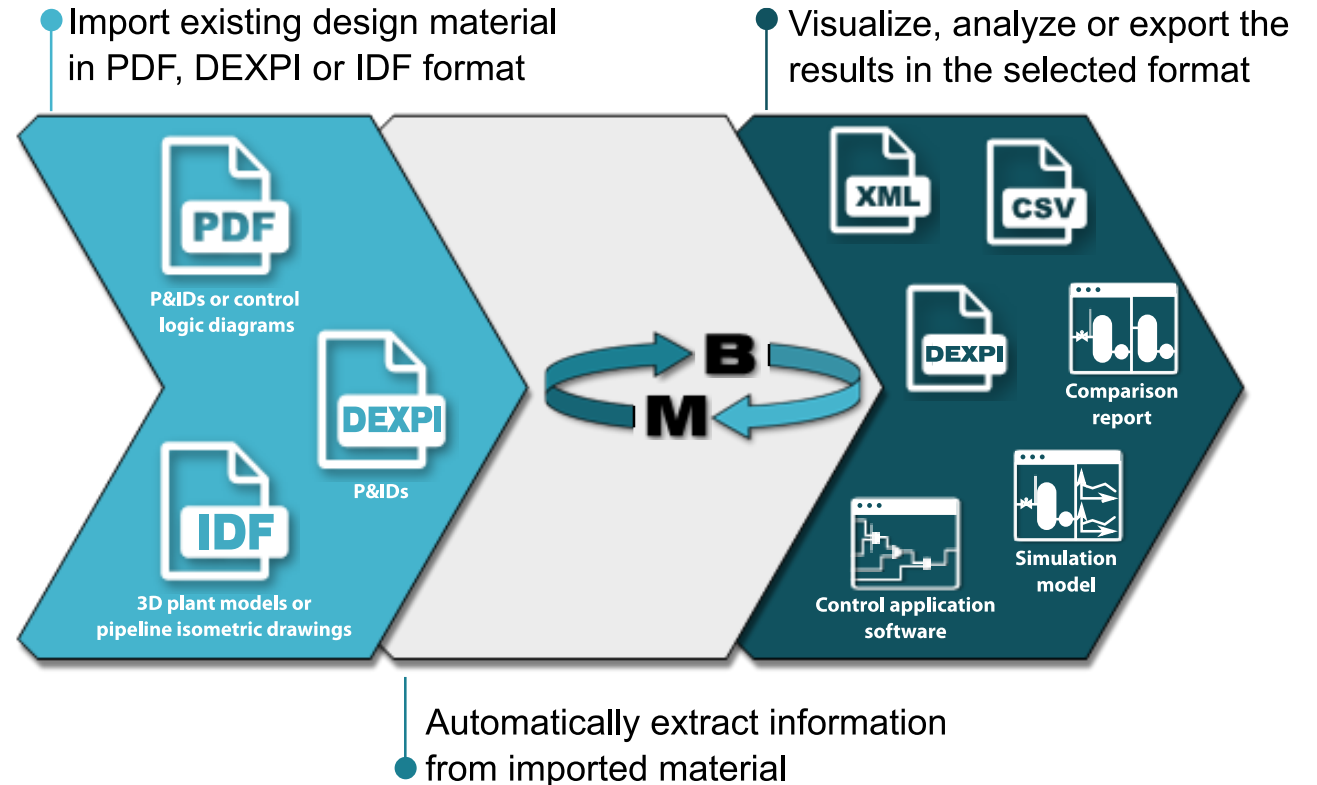
Engineering automation solutions

# Model Broker<sup>®</sup>

A software solution to **automatically extract information from second-hand plant design material**

Model Broker can be used to:

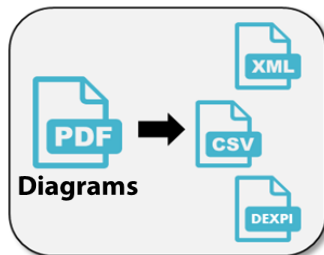
- Automatically find, analyze and extract information available in engineering material
- **Digitalize old engineering material into intelligent information models**
- **Compare, validate or find inconsistencies between process diagrams and 3D models**
- Automatically create engineering assets such as control application software or process simulation models



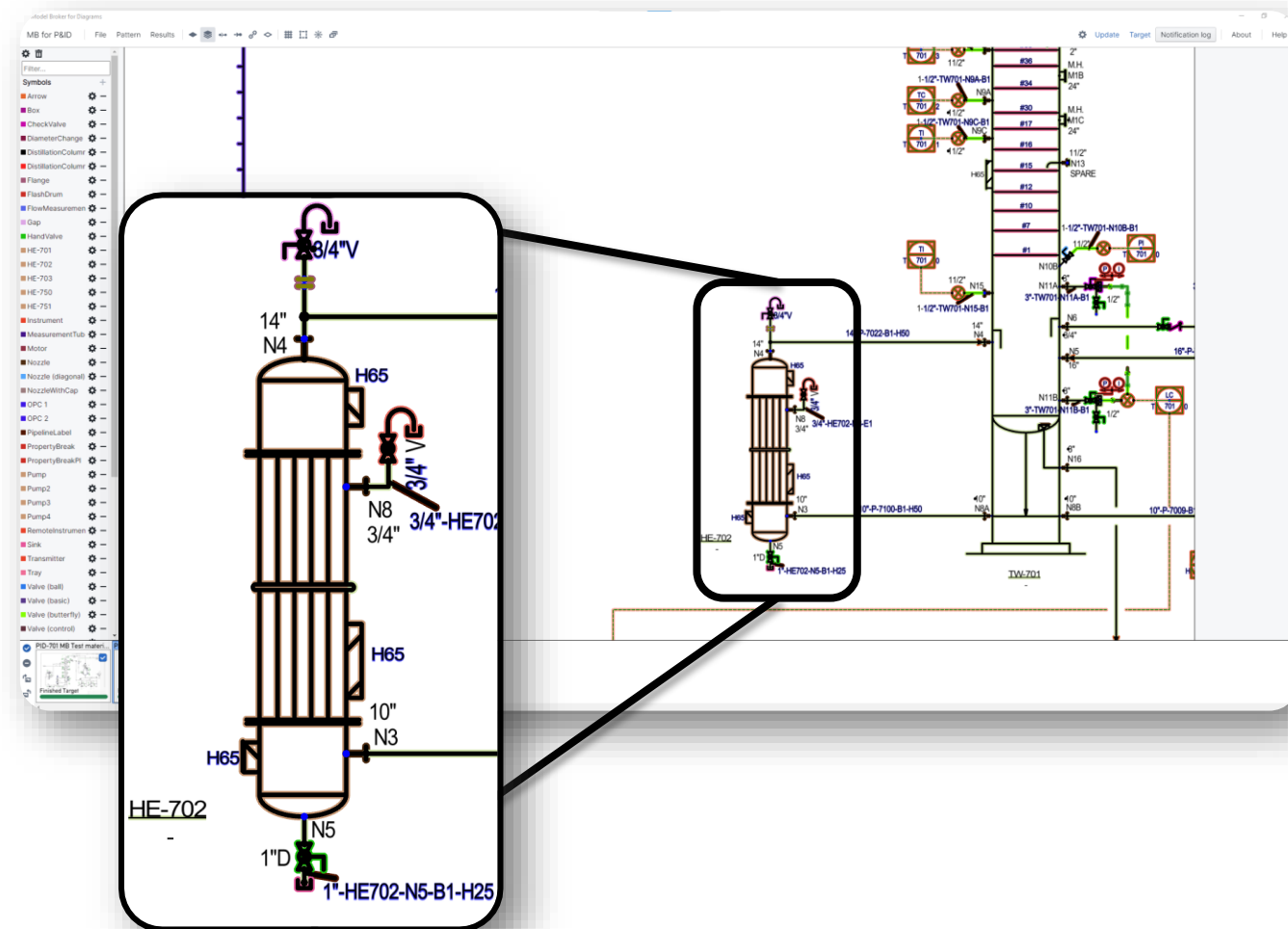
# Model Broker for Diagrams

Engineering automation solutions

# Model Broker for Diagrams



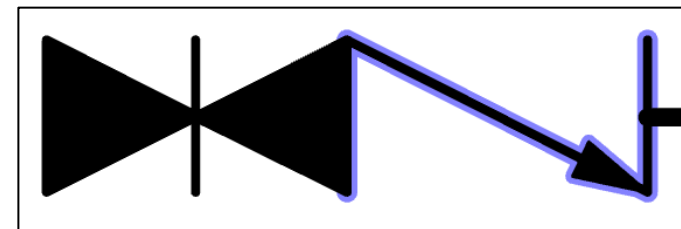
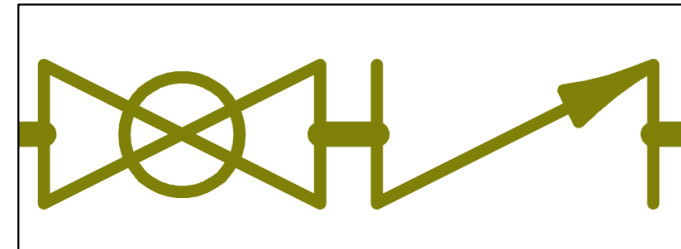
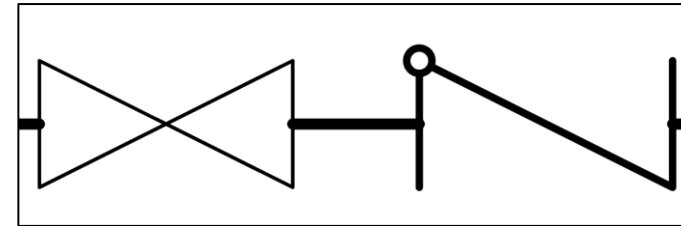
- **Recognize** symbols, connections and text from the diagrams
- **Transform** into CSV tables, PLC software or DEXPI files
- Model Broker for Diagrams can be used to:
  - Automatically find, analyze and extract information in P&IDs, electrical or any other engineering diagrams
  - Digitize old engineering material into intelligent information models such as DEXPI
  - Compare and validate different design material
  - Automatically create lists of equipment or I/Os
- Support for vectorized PDFs, .dwg, .DXF
- **Raster image recognition possible**



# Symbology change

# Symbology change: Requirements

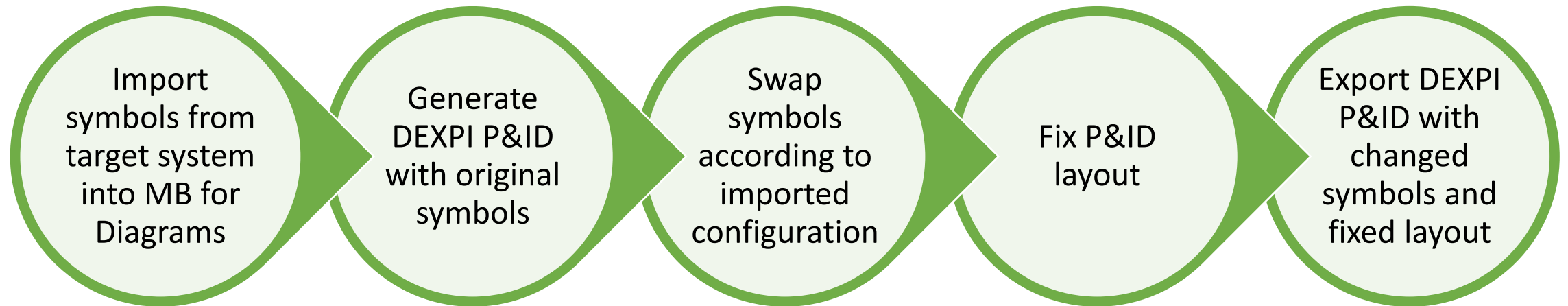
- **When old P&IDs (PDF, etc.) are converted to DEXPI there is often a need to change the symbols used.**
  - Old P&ID uses old (standard / software) symbols.
  - When a DEXPI P&ID is imported into a CAD system it use the original system's symbols.
- Company-wide custom symbol libraries are common
  - These need to be used when old P&IDs are imported into other CAD systems than those in which they were originally developed
- Challenges:
  - Replacement symbols are in different shape and in different size.
  - Connection terminals are in different locations.
  - We want to maintain clean connection lines.





# Symbology change in Model Broker for Diagrams

## Basic workflow:



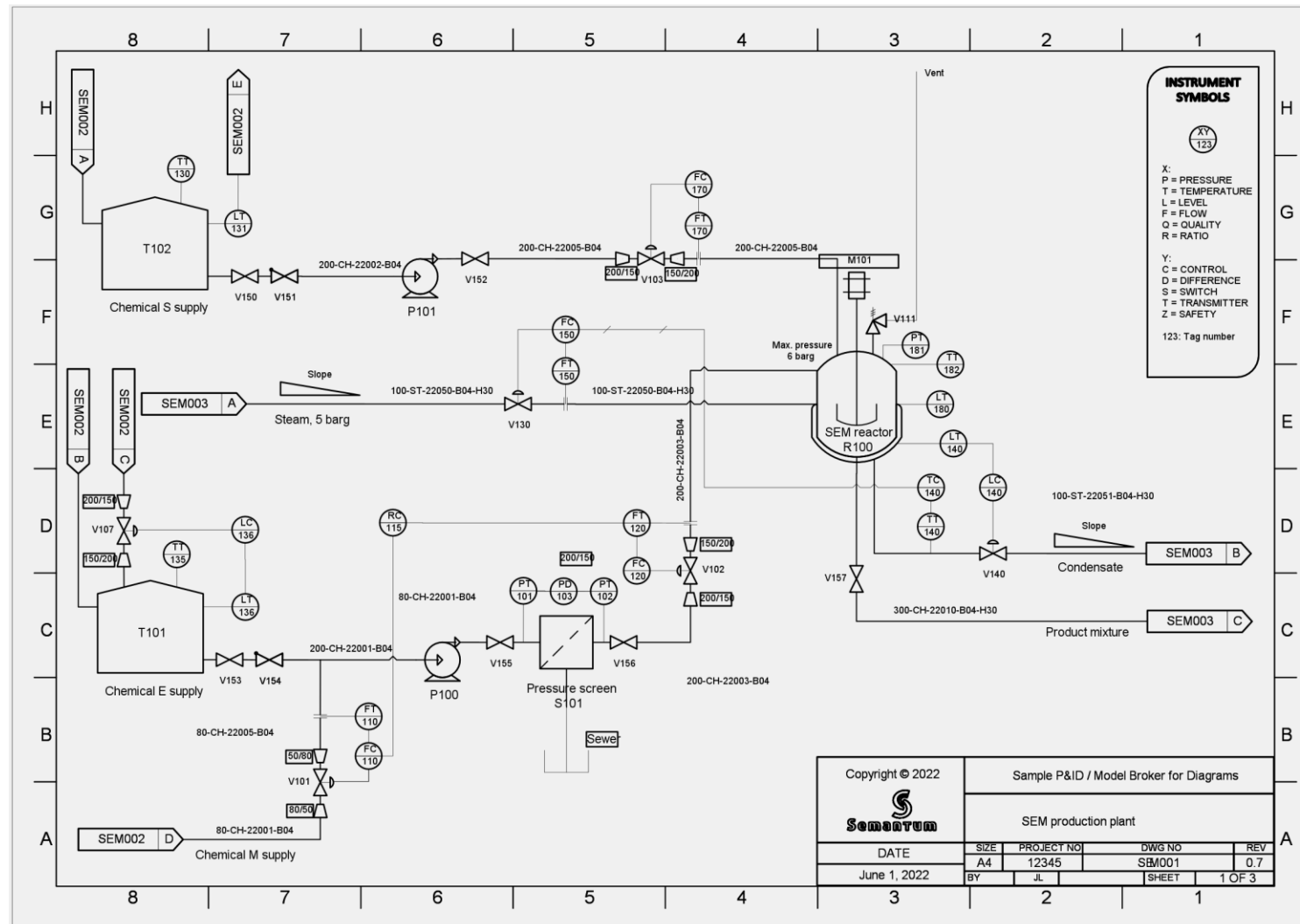
# Current implementation

- AutoCAD Plant3D P&ID configuration export
  - MB for Diagrams configuration with ACAD symbols.
  - ACAD DEXPI plug-in mapping file.
  - By default, creates DEXPI custom classes.
    - Can be overridden with a configuration file, which is similar to ACAD DEXPI mapping file.
- Notes:
  - AutoCAD DEXPI import does not support referring to project symbols. Instead, it creates all symbols based on DEXPI graphics.
  - DEXPI itself does not support concept of ignoring symbols defined in the file.
  - We need a custom attribute to skip symbol import (and use project symbol).
- Modified HMI layout logic processes
  - Symbol / Symbol
  - Symbol / Line
  - Line / Line overlaps
  - Grid snapping
- Does not process
  - Terminal directions
  - Labels
  - Other annotations
    - Flow arrows
    - Etc.
  - Page boundaries.

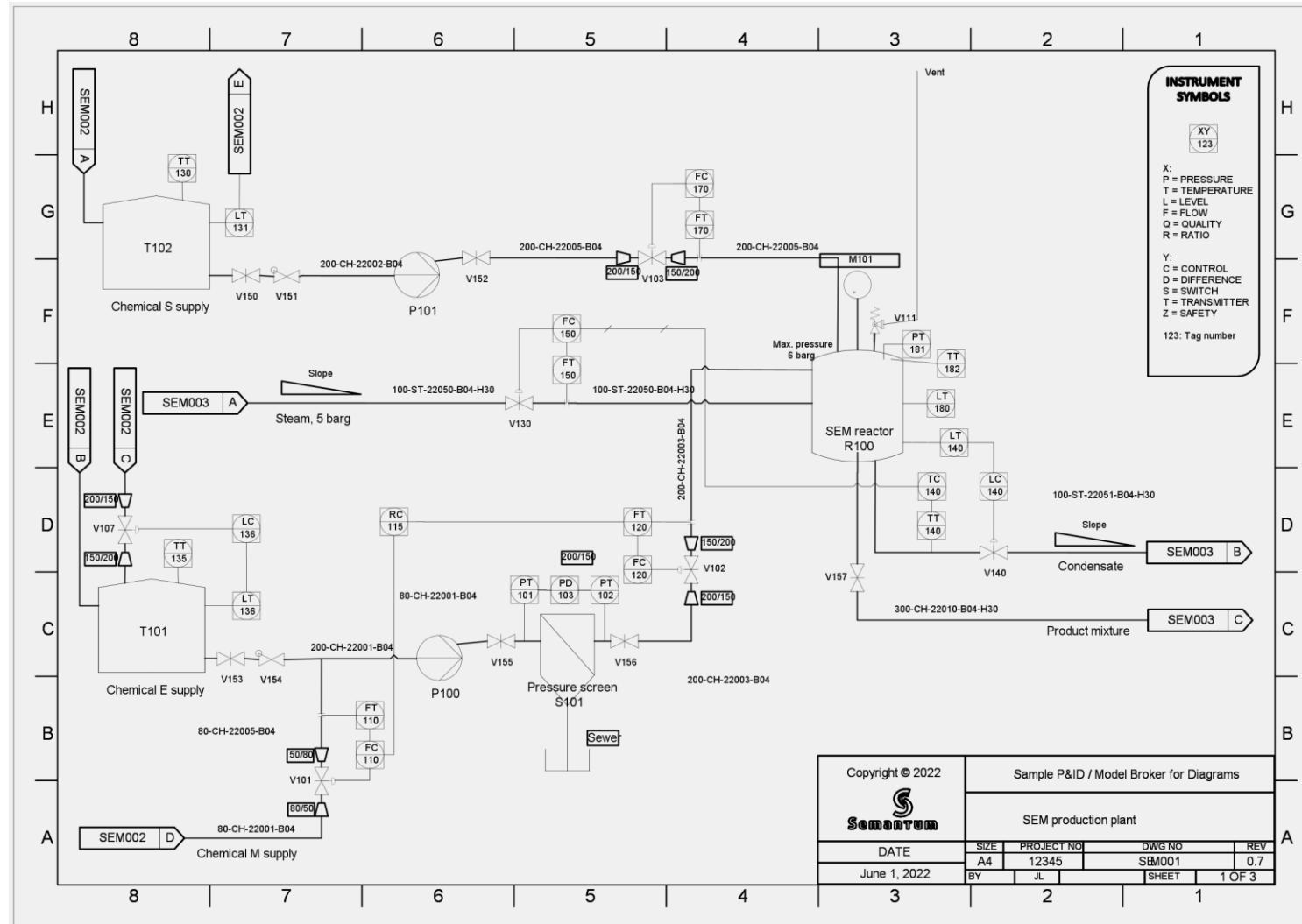
# Demo

# Example case

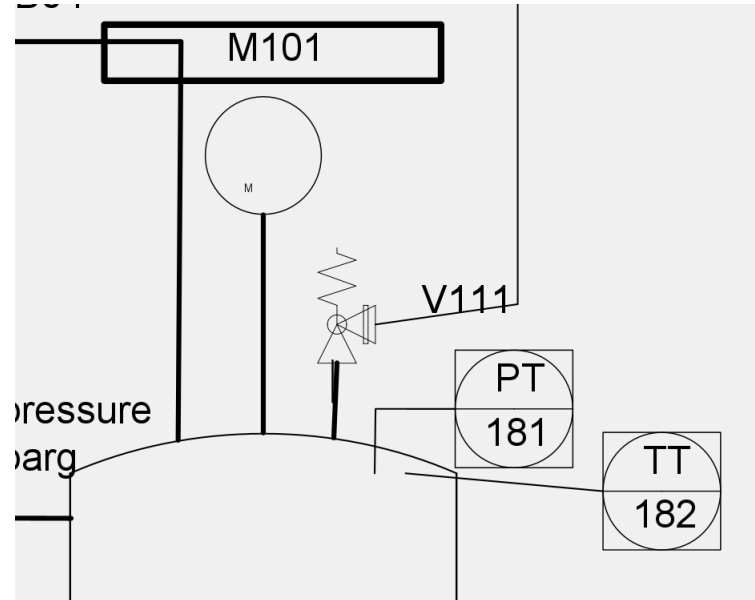
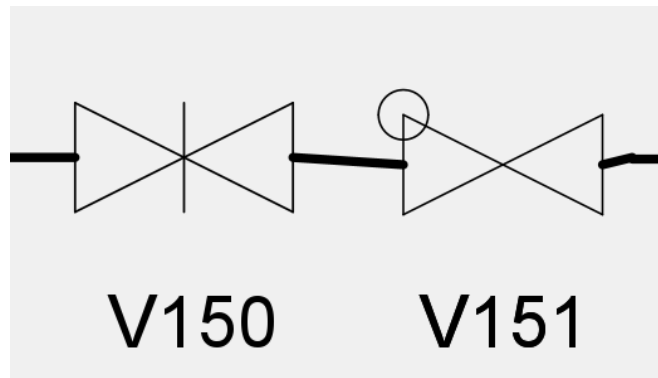
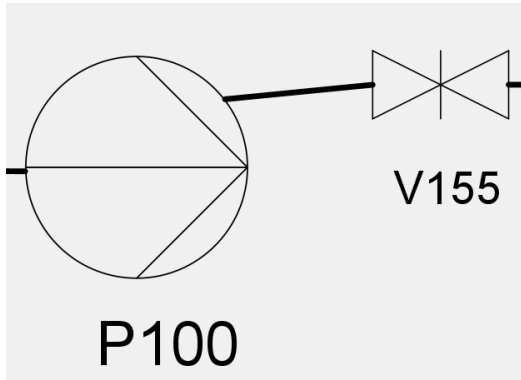
## Digitized P&ID (DEXPI)



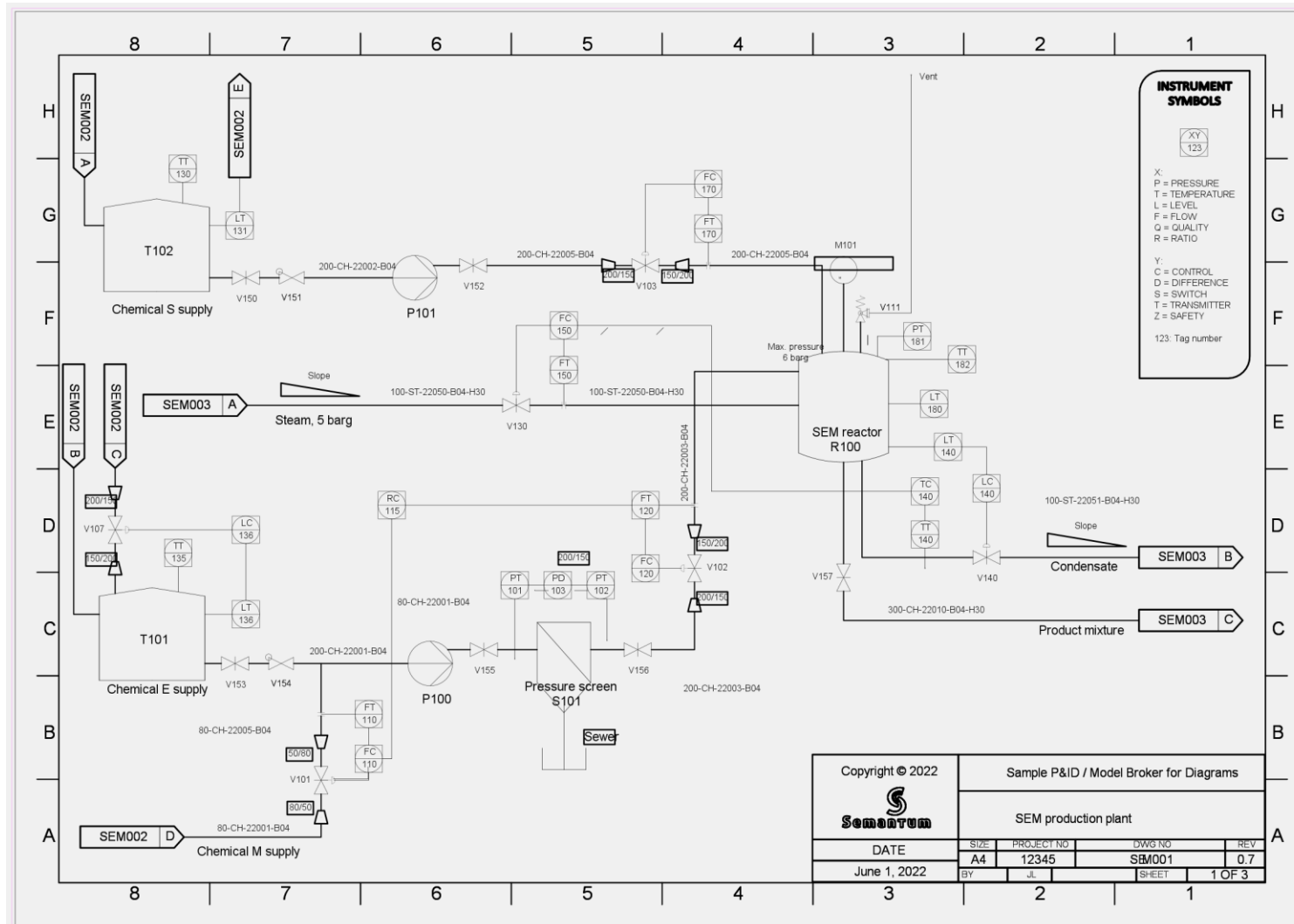
# Plain symbol replace



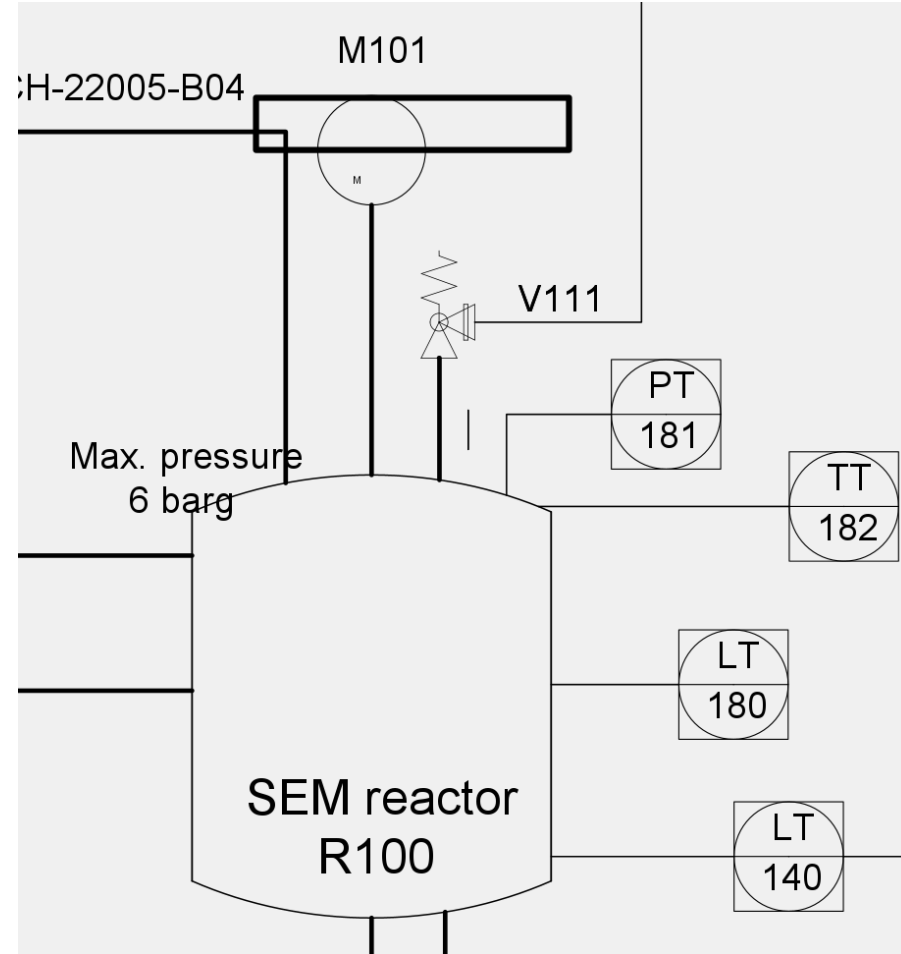
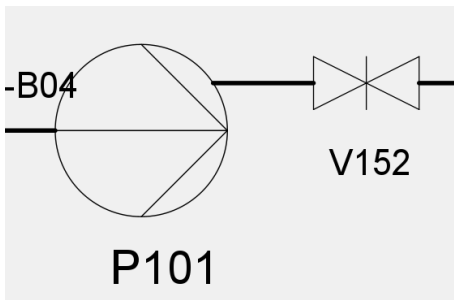
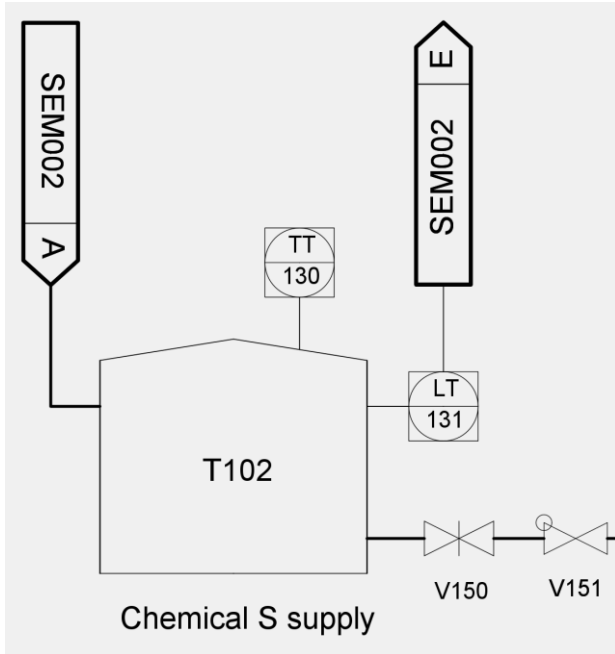
# Issues with plain replace



# Layout fixing



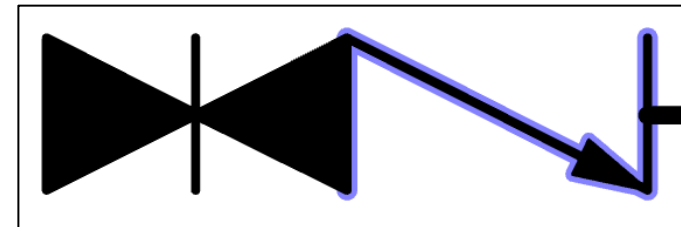
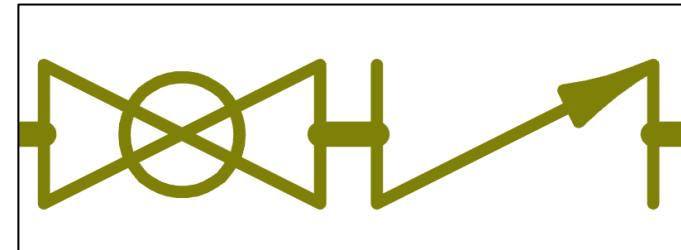
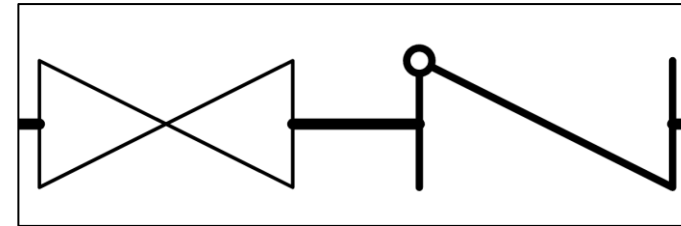
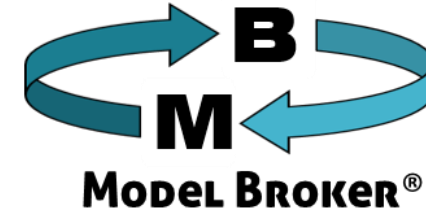
# Highlights





# Conclusions

- Symbol change can be achieved when
  - DEXPI is used as the format for P&ID exchange
  - Target symbol library is available
- Automatic layout options are critical to achieve good results
- We can apply this approach to other DEXPI files
  - Not only to those that were created with Model Broker
- We have tested with AutoCAD Plant 3D
  - Possible to apply to other CAD systems
- These functions will be further developed in the fPVN Arrowhead project



# Thank you!

[contact@semantum.fi](mailto:contact@semantum.fi)  
[www.model-broker.com](http://www.model-broker.com)  
[www.semantum.fi](http://www.semantum.fi)

