AUTODESK **UNIVERSITY** 2014

Instrumentation and Electrical Design in the Cloud

Andy Bonfield - SCADA Systems Ltd

PD6811 This class will explore the design process, the collaboration, and the data flows of a cloud-based instrumentation and electrical design project. The class will also review the advantages of cloud-based technology for this purpose, and we will provide hands-on interaction with a cloud project, so bring your Internet-ready laptop to the class. We will also briefly cover the design and data flows between a synchronized AutoCAD P&ID software project and a cloud instrumentation and electrical project, and we will review the integration with AutoCAD software products required at the client end of the cloud-based project. The class will also have an overall focus of creating, modifying, and generating instrumentation and electrical deliverables such as loop diagrams, junction-box wiring diagrams, hook-ups, datasheets, and reports

Learning Objectives

At the end of this class, you will be able to:

- Learn how to create an instrumentation and electrical database and design deliverables
- Understand the topology and benefits of a cloud-based I&E project
- Understand the integration of the cloud I&E project with AutoCAD software server and client products
- Collaborate with others in the production and modification of project data in the cloud

About the Speaker

SCADA Systems Ltd. have been Autodesk, Inc., network developers for almost 25 years, and for the last 10 years Andy Bonfield has been responsible for sales and marketing of the electrical and instrumentation design software, Elecdes Design Suite—particularly in the plant and process markets. He has been closely involved in the development of SCADA's database-driven instrument and control (I&C) design software and Instrument Manager, and his responsibilities include providing product training, customization, and implementation advice. Andy is based in SCADA Systems head office in Auckland, New Zealand, and this is his second visit to Autodesk University as a presenter.

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Introduction

I&E Database

For most plant projects, it is probable that over half of all assets, by number will be instruments and for each instrument there is a myriad of associated information. Specifications, materials, connections – this information is regularly updated, added to and modified not just at the design stage but also through the plant's lifecycle.

In other words, instrumentation and electrical projects are always data rich and whilst there is still a need to create drawings, a database is the best means of managing both assets and deliverables.

Instrument Manager offers a data-centric solution providing datasheets, reports and AutoCAD drawings for I&C projects and in the first part of this class, we will take a quick look at a sample project.

Working in the Cloud

In part 2, we will look at using cloud based technology for our I&E project. Cloud computing offers many advantages (and some pitfalls) for engineering projects including;

- Data accessibility
- Shared data storage
- Reduced overheads
- Real time collaboration

We will quickly review the considerations for using the cloud and take a hands-on look at accessing the project using mobile devices.

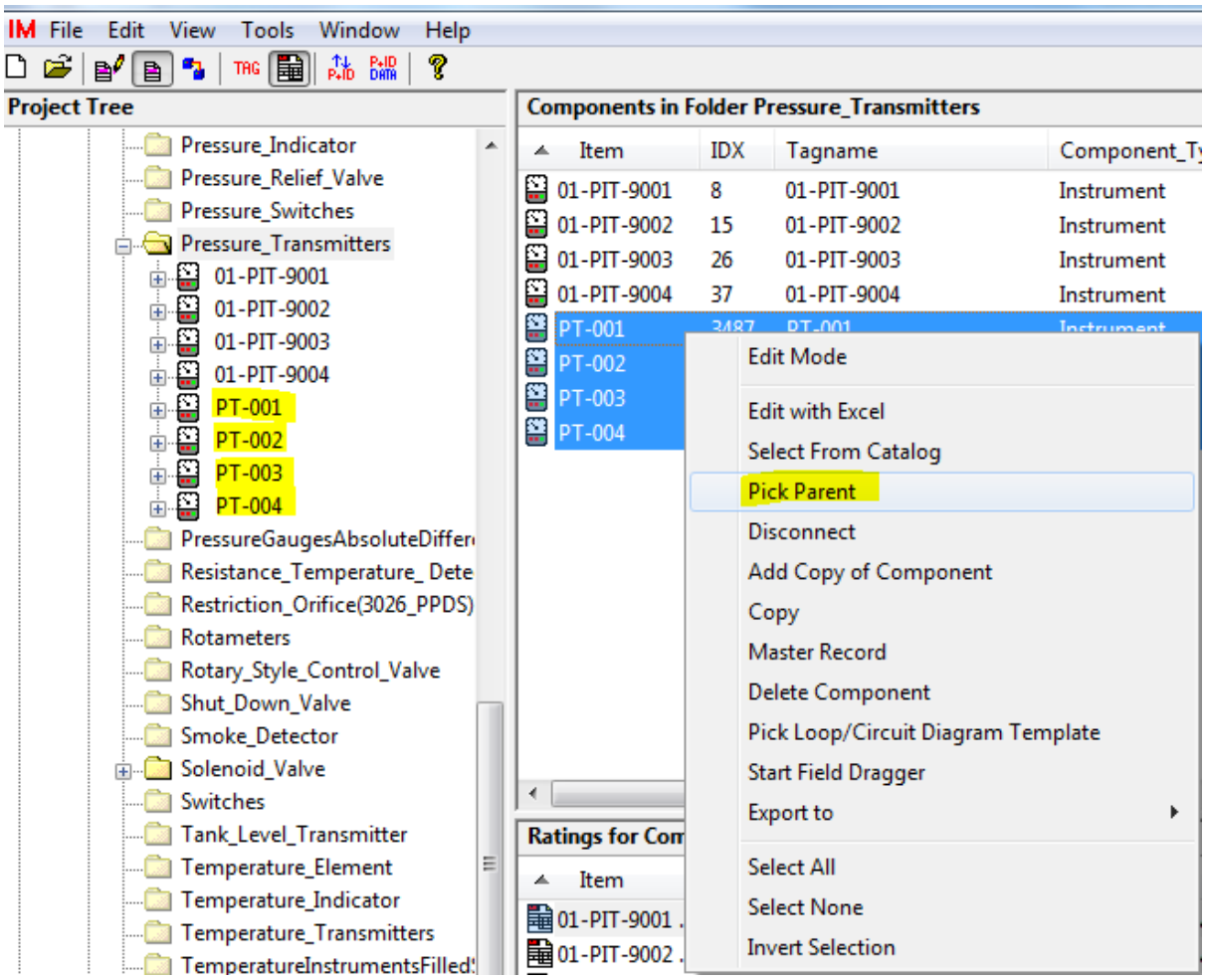
Learn how to create an instrumentation and electrical database and design deliverables

Database Overview

Projects created by Instrument Manager are primarily stored in database files. Each project has its own database which is typically a Microsoft SQL Server database.

The project database is the central storage of all of the data. All other files associated with an Instrument Manager project can be re-created from the data in the project database.

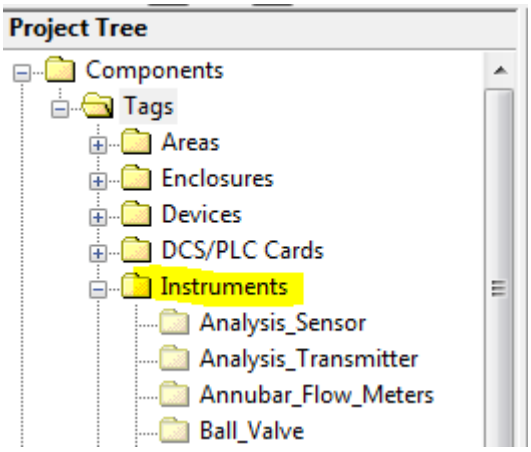
The project database contains tables. The tables contain records for component tags, component data, diagram data and project configuration data. The database is relational. There are many links between the records in different tables for component tags, component ratings and diagrams.



Components

Components are divided into categories, for example:

- Instruments,
- Enclosures,
- Devices,
- Cables



Data for components is stored in two types of tables: “tags” tables and “ratings” tables.

Tags Table

Each component has one tag record in a tags table. The tag record contains the naming of the component. It also contains all of the relational links to other components and to ratings or diagram records. A database can contain one tags table.

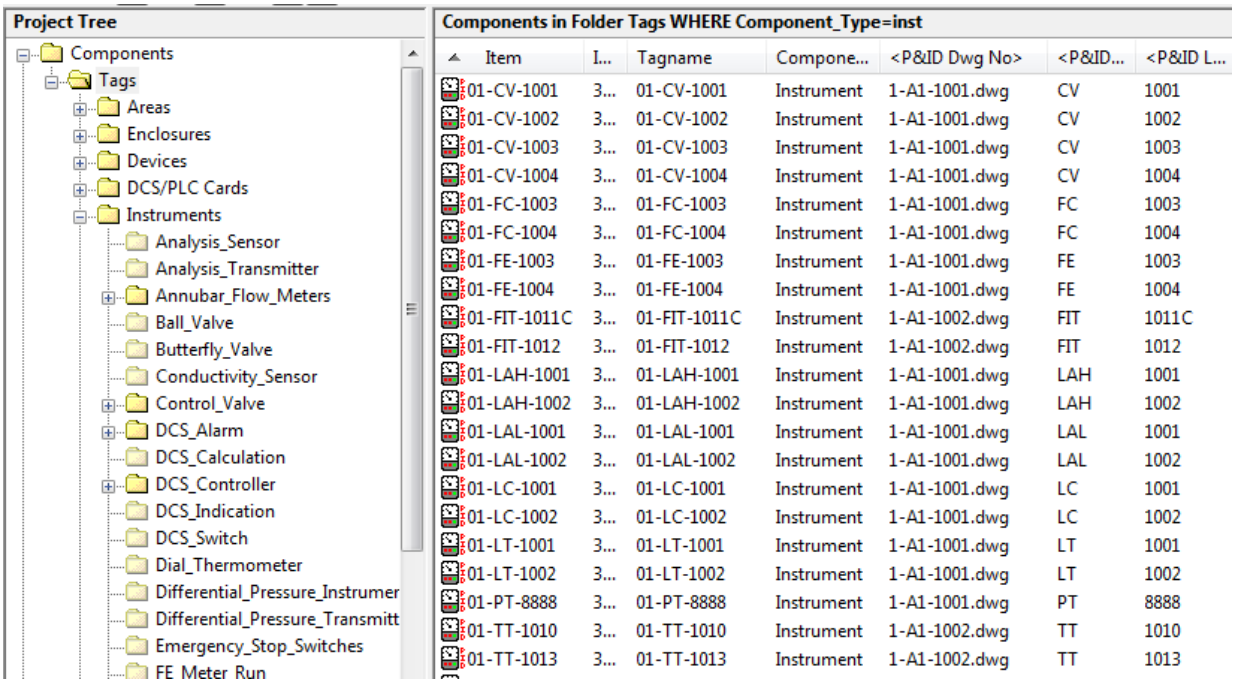
Ratings Tables

Each component can have one ratings record in a ratings table. The ratings record contains the specification of the component, which may be displayed on a datasheet or loop diagram.

Populating the Database

Component data is added in several ways;

- Synchronised Link to an AutoCAD P&ID database
- Imported from a file i.e. Excel, MS Access
- Added directly by editing a form or a table
- Copied from existing components.



Item	I...	Tagname	Compone...	<P&ID Dwg No>	<P&ID...	<P&ID L...
01-CV-1001	3...	01-CV-1001	Instrument	1-A1-1001.dwg	CV	1001
01-CV-1002	3...	01-CV-1002	Instrument	1-A1-1001.dwg	CV	1002
01-CV-1003	3...	01-CV-1003	Instrument	1-A1-1001.dwg	CV	1003
01-CV-1004	3...	01-CV-1004	Instrument	1-A1-1001.dwg	CV	1004
01-FC-1003	3...	01-FC-1003	Instrument	1-A1-1001.dwg	FC	1003
01-FC-1004	3...	01-FC-1004	Instrument	1-A1-1001.dwg	FC	1004
01-FE-1003	3...	01-FE-1003	Instrument	1-A1-1001.dwg	FE	1003
01-FE-1004	3...	01-FE-1004	Instrument	1-A1-1001.dwg	FE	1004
01-FIT-1011C	3...	01-FIT-1011C	Instrument	1-A1-1002.dwg	FIT	1011C
01-FIT-1012	3...	01-FIT-1012	Instrument	1-A1-1002.dwg	FIT	1012
01-LAH-1001	3...	01-LAH-1001	Instrument	1-A1-1001.dwg	LAH	1001
01-LAH-1002	3...	01-LAH-1002	Instrument	1-A1-1001.dwg	LAH	1002
01-LAL-1001	3...	01-LAL-1001	Instrument	1-A1-1001.dwg	LAL	1001
01-LAL-1002	3...	01-LAL-1002	Instrument	1-A1-1001.dwg	LAL	1002
01-LC-1001	3...	01-LC-1001	Instrument	1-A1-1001.dwg	LC	1001
01-LC-1002	3...	01-LC-1002	Instrument	1-A1-1001.dwg	LC	1002
01-LT-1001	3...	01-LT-1001	Instrument	1-A1-1001.dwg	LT	1001
01-LT-1002	3...	01-LT-1002	Instrument	1-A1-1001.dwg	LT	1002
01-PT-8888	3...	01-PT-8888	Instrument	1-A1-1001.dwg	PT	8888
01-TT-1010	3...	01-TT-1010	Instrument	1-A1-1002.dwg	TT	1010
01-TT-1013	3...	01-TT-1013	Instrument	1-A1-1002.dwg	TT	1013

AutoCAD P&ID Synchronisation

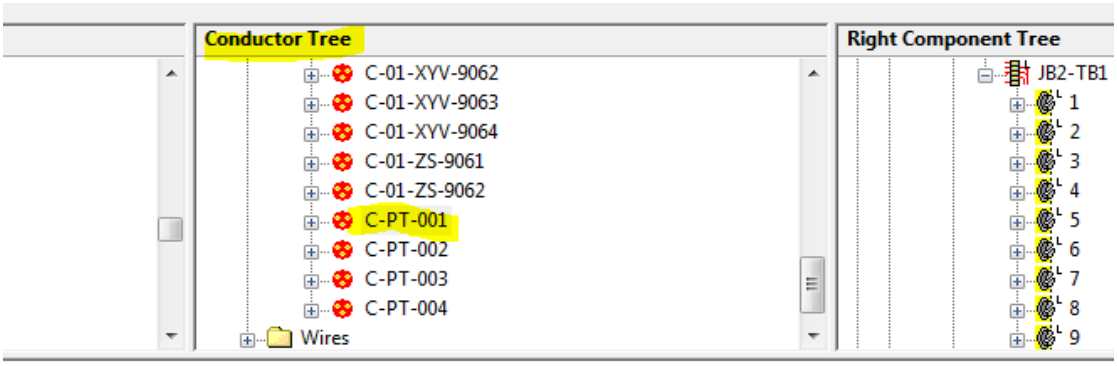
When an AutoCAD P&ID project is linked to an Instrument Manager project, any data that is modified in the P&ID project database will update automatically in the IM database. For live projects there are synchronisation and data fetching buttons that allow the synchronisation process to be temporarily paused.

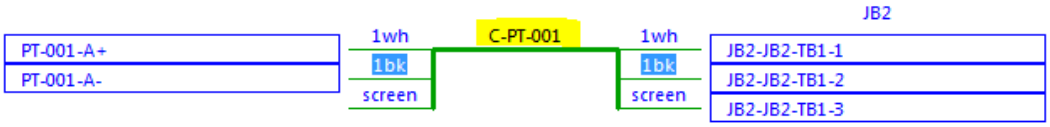
Linking Components

There are 3 main types of component linking;

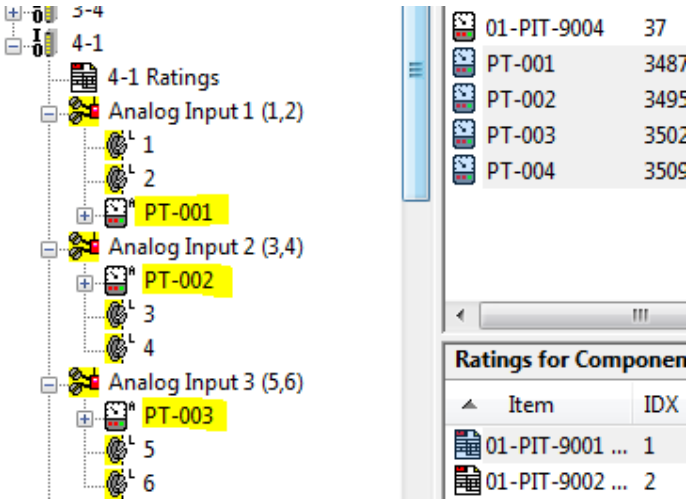
- Electrical Connections
- Parenting
- Associations

Connecting components electrically involves using the Connection View. This allows you to drag and drop cables and wires onto device terminals, terminal strips and I/O points. These electrical connections can be previewed prior to generating loop and wiring diagrams.

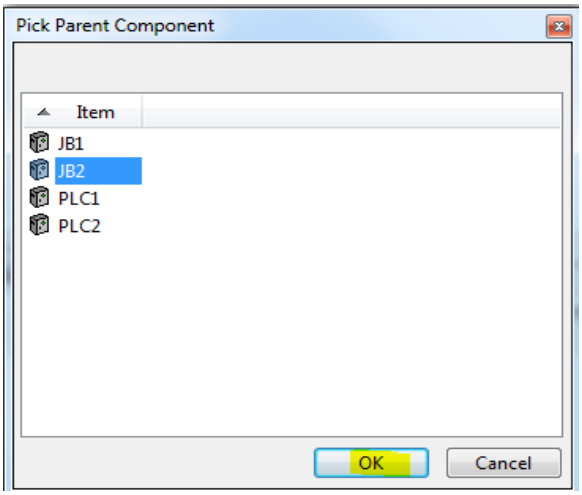




Linking components by association involves dragging and dropping components onto other components. With this method, you can for example associate instruments to I/O channels, Lines, Tanks etc.



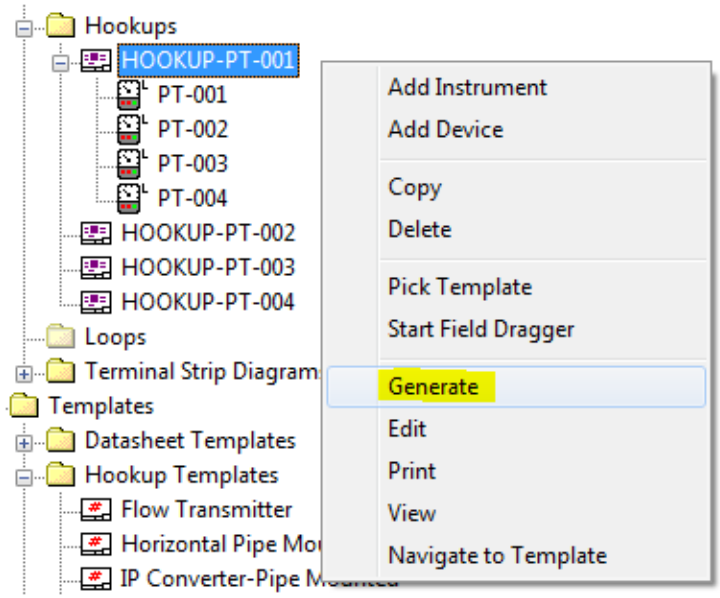
Parenting represents a component that is a container for a selected component or components. This may be a Terminal Strip in an Enclosure or an Enclosure which is contained in a Building (Area)



Output Files

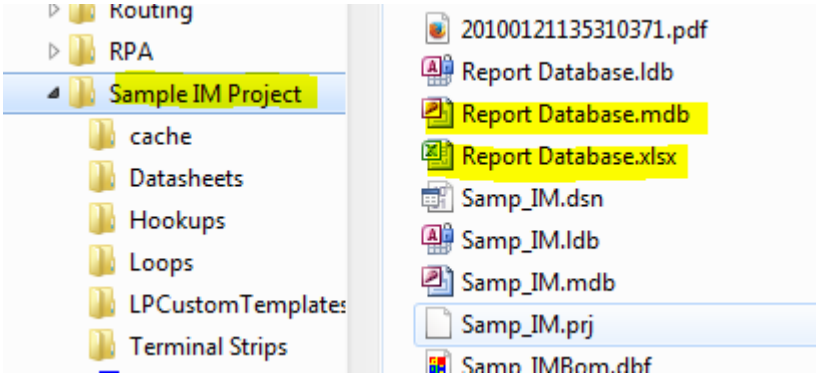
Instrument Manager can produce datasheets, hook-up diagrams, instrument loop diagrams, motor control schemes, terminal strip diagrams, wiring diagrams and reports. Each diagram has a record in an output diagram table. There are multiple diagram tables, one for each type of diagram. The record for each diagram contains data to be placed on the diagram that is not specific to any particular component on the diagram, for example the title block information.

The diagrams are produced as either Microsoft Excel spreadsheets or AutoCAD drawings, depending on the diagram type. These files are produced by populating diagram templates with data from the project database.



Once you have generated the file, you can use the “View” menu item to examine the output document.

Reports are configurable and are produced in either Microsoft Access or Microsoft Excel format.



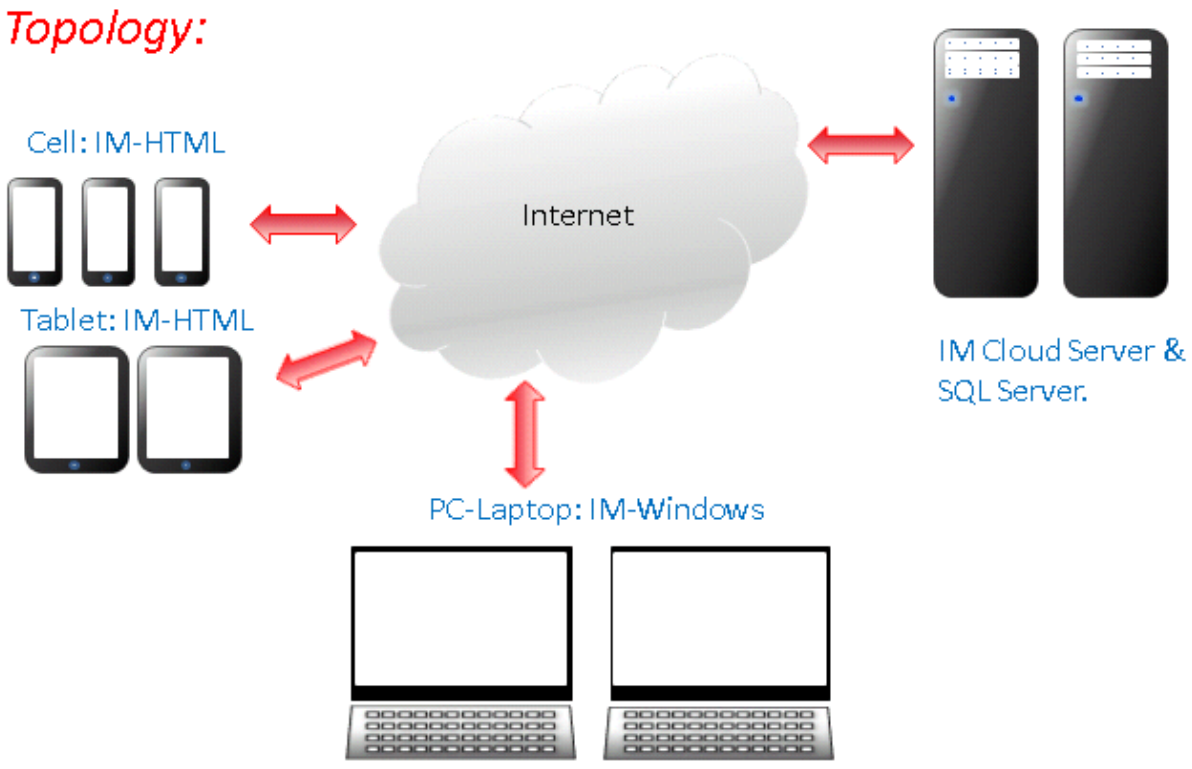
Once you have generated the report's database / Excel files you can view these by double clicking in Windows Explorer. You will need MS Office on your PC to view these files.

Understand the topology and benefits of a cloud-based I&E project

System Topology

The standard Instrument Manager **database topology** in your design office is a client-server configuration with the project database stored on a SQL Server located on a LAN or WAN. The Instrument Manager client application is Windows based and is typically installed on local PCs or workstations. Output files such as loop diagrams and data sheets are created on the LAN or WAN file servers with the Instrument Manager client application.

The Instrument Manager "Cloud" **database topology** uses a ***Web server*** for the database rather than a LAN or WAN based server. IM cloud users can therefore access their project from anywhere in the world. Instrument Manager "Cloud" provides a wide range of client device options.



IM Client Options

Instrument Manager “Cloud” offers the added functionality of an HTML based interface to the existing IM client application provided. Power users and designers should use IM client and conversely mobile, site and construction personnel will find the HTML based interface flexible and convenient.

Instrument Manager Client - Windows

PC/Windows Only
Mobile or Desktop
Web or LAN Server
P&ID LAN Server Live Link
Full Editing Functionality
Full CAD integration.
Local Documents and Drawings.

Design Phase +

Instrument Manager Client - HTML

Any PC, Laptop, Phone, Tablet.
All OS’s.
Mobile or Desktop
Web Server
Limited Editing Functionality
Web format Documents and Drawings.

Construction
Commissioning
Testing
Maintenance
Life Cycle

Benefits

Why bother with the cloud?

Front End Design

The cloud offers global access to data and also mobile access to data. During the design phase of your project, most design will be done in the design office as opposed to being on site. In most cases, an Instrument Manager Client application works best for high pressure design work.

IM PC client connects to a web based server and enables multiple users in different locations to collaborate on the same project. In a perfect world, the design deliverables are designed remotely and issued to site for construction.

The cloud offers the ability for the front end design team to work together when not in the same location, without significant travel/relocation costs.

The design office can upscale and downscale without significant IT cost.IT cost should reduce when only paying for the software as it is required.

The cloud base supplier also supplies the infrastructure, much of the deployment and the updates. This eliminates infrastructure cost and mobilises your personnel.

Construction, Commissioning, Testing, Maintenance

In the construction phase, specifications are constantly amended, connections changed, drawings re-issued and much of this modification requirement comes from on-site during construction, commissioning and testing.

By having all project data and outputs available instantly via the cloud, engineers can check and revise data and, in some cases, drawings from their mobile devices. Handwritten notes and drawing mark-ups can be replaced by directly modifying project data or by sending project design requests via the cloud database.

Further down the track, maintenance engineers can access instrument data directly on site.

Instrument Manager Cloud can redefine the workflow of your design phase, your construction phase and the plant lifecycle.

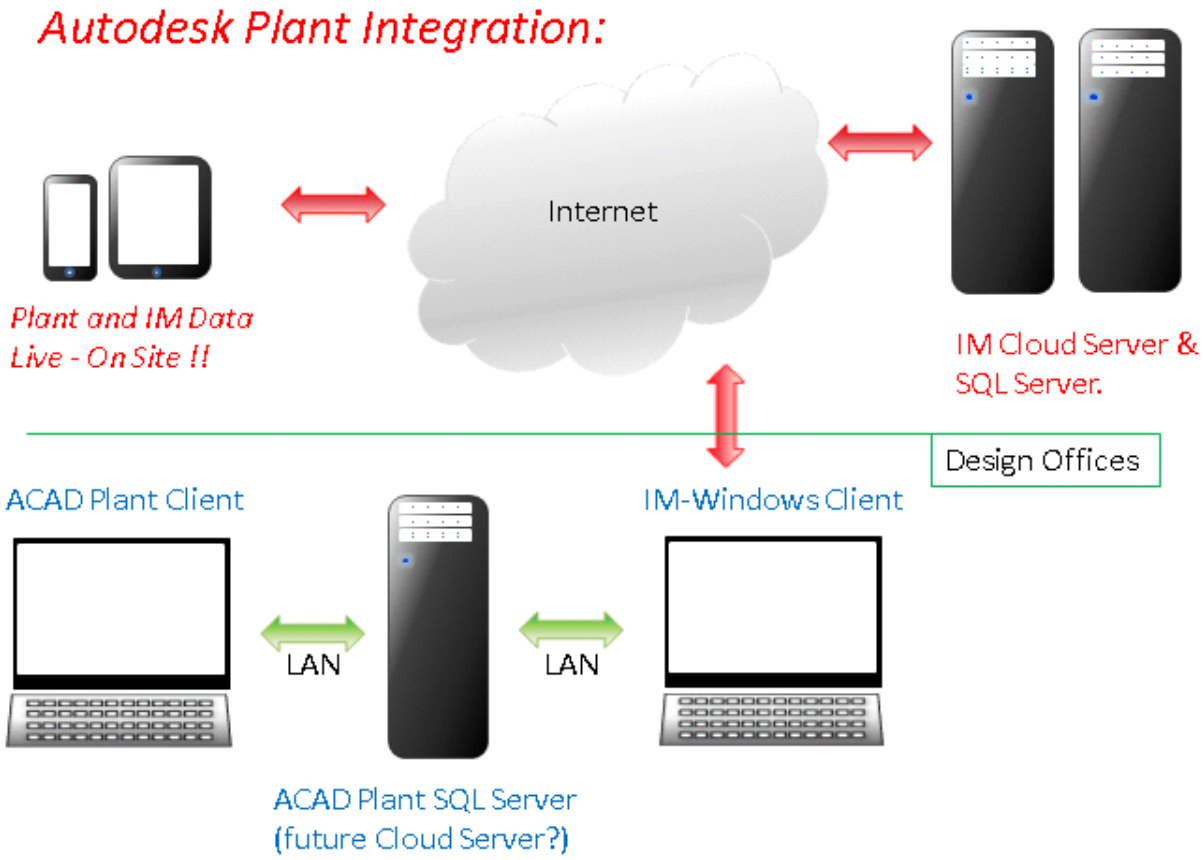
Understand the integration of the cloud I&E project with AutoCAD software server and client products

Autodesk Plant Integration

In a standard design office topology, your AutoCAD P&ID database is contained in a LAN based SQL Server and accessed across a local area network. Instrument Manager “Standard” is configured the same way and a synchronised link is established connecting the two databases.

The AutoCAD P&ID database currently needs to be located on a LAN or WAN server and can be synchronised with any Instrument Manager database, ***WEB or LAN***, as long as there exists an installation of the IM client on the LAN or WAN that contains AutoCAD P&ID.

We anticipate AutoCAD P&ID and plant database will transition to the cloud in the near future.



Interactive: Collaborate with others in the production and modification of project data in the "Instrumentation Cloud".

This final section of the class gives you the chance to explore a project in the cloud for yourself using your mobile device i.e. laptop, tablet, phone and the Instrument Manager Cloud browser based client.

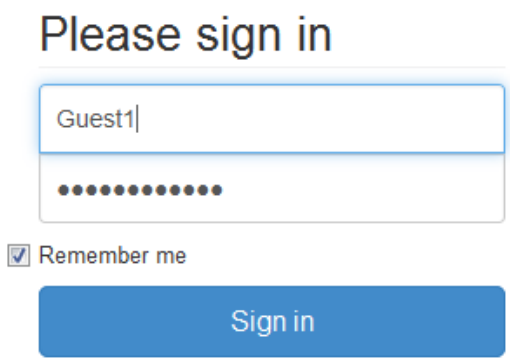
1) Web Browser

Use the link below to open the IM web browser;

http://cloud.elecdes.com

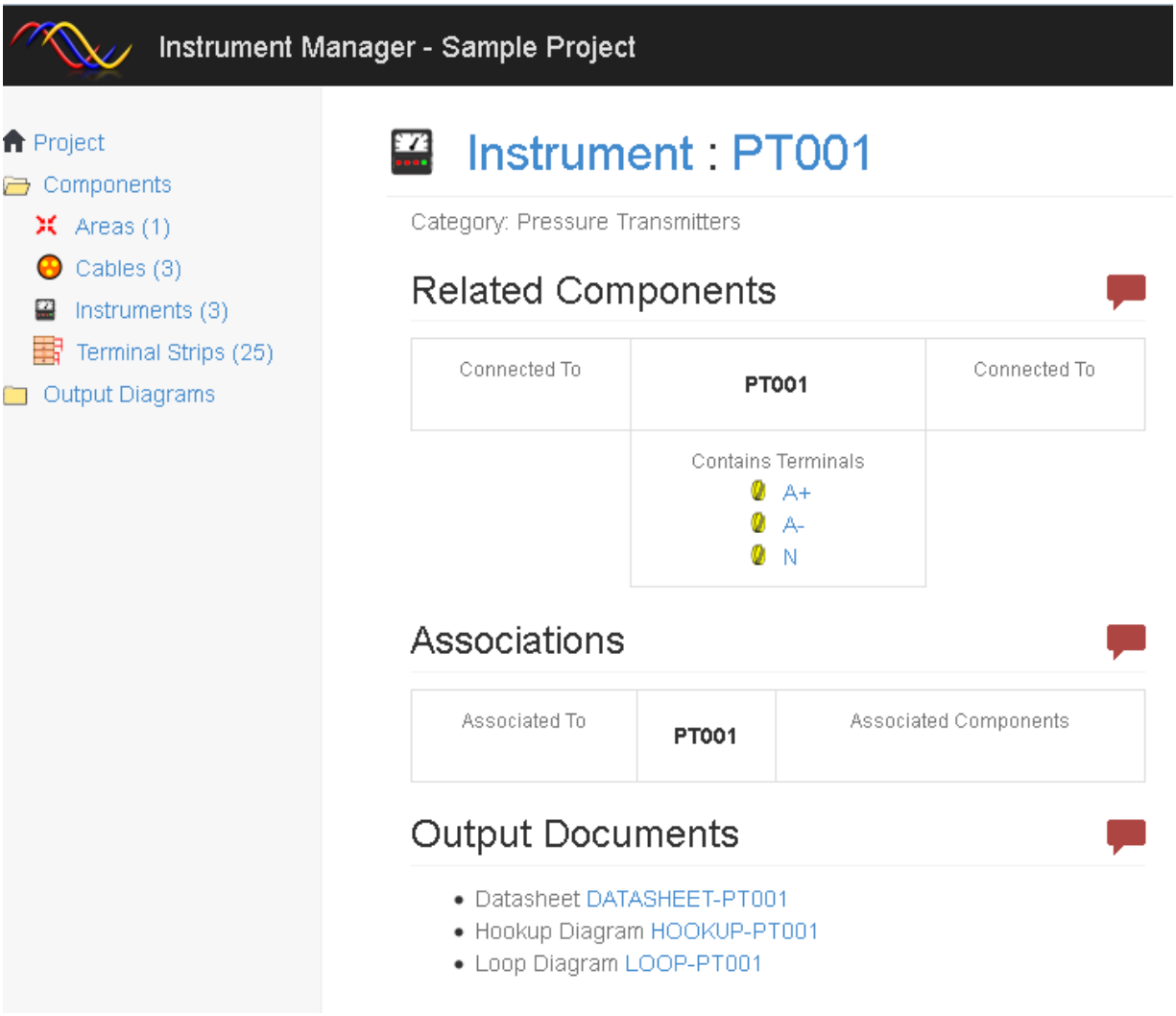
2) Sign in

To sign in, use the login and password provided in the class



3) Select a project

Example: AU_2014 project



4) Navigation

The project interface has a slightly different layout to the IM Windows client application.

A Component tree is still accessible on the left hand side of your screen, Navigation is intuitive and clicking on a component will bring up various information i.e. Ratings, Connections, Associations, and Output Documents.

Tip The visible page layout may vary depending on your mobile device. If all columns are not displayed, scroll up or down to view the different sections

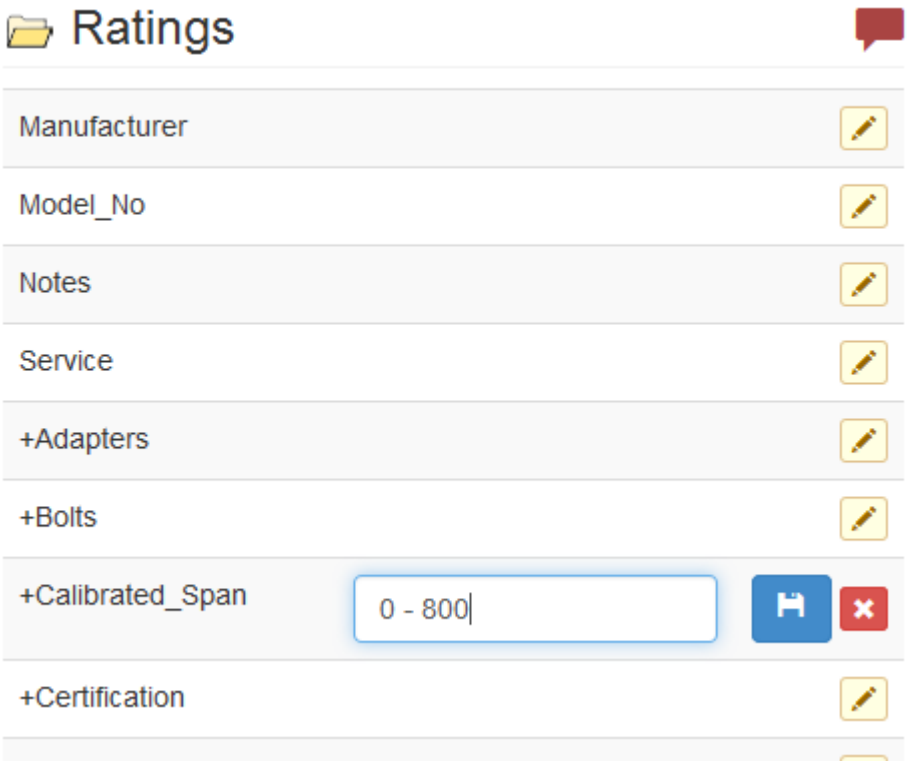
Phone users: The navigation "Tree" menu may not fit on your phone and may hide itself, select the 3 bars icon on the top of the right side of your screen to pop up the menu.

5) Data Editing

There are 2 options set up for modifying data; editing ratings directly OR sending project design request “issues” to your project designers. To modify data directly the system administrator in a real project must grant the appropriate database permissions.

Editing Ratings

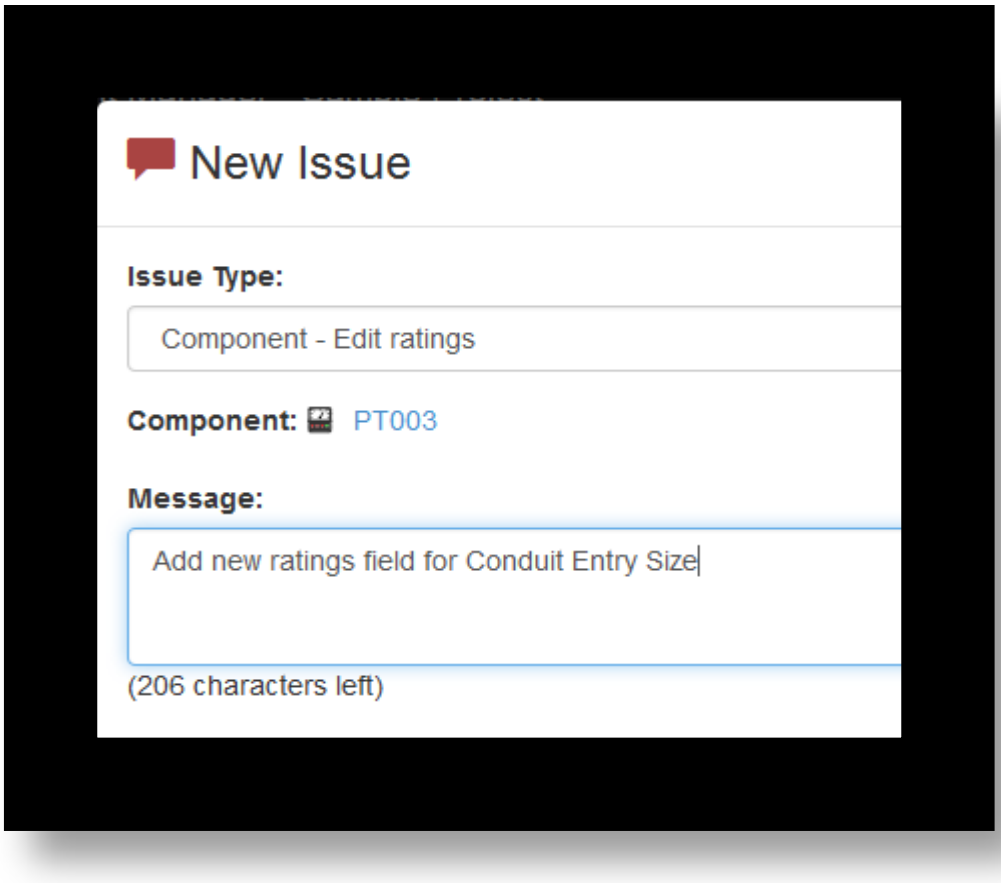
If you are on site, you may wish to modify component data, perhaps change specifications for an instrument for example. To do this, select an instrument i.e. PT003, go to the ratings section of the details page for that instrument and select an attribute and change data directly. Use the “pencil” icon to start the edit and the blue “save” button so save the edit. The save will update the database.



Raise Issues

Rather than editing data directly from on site, you can send project design request “issues” to your project designers from a form within the **Instrument Manager Cloud browser based client**.

The issue form can be opened by clicking on this this “New Issue” icon 



The new issue is written directly to the database and can be viewed from the web browser. The designer in the design office will be alerted by an signal that indicates that the mobile team has issues to resolve.

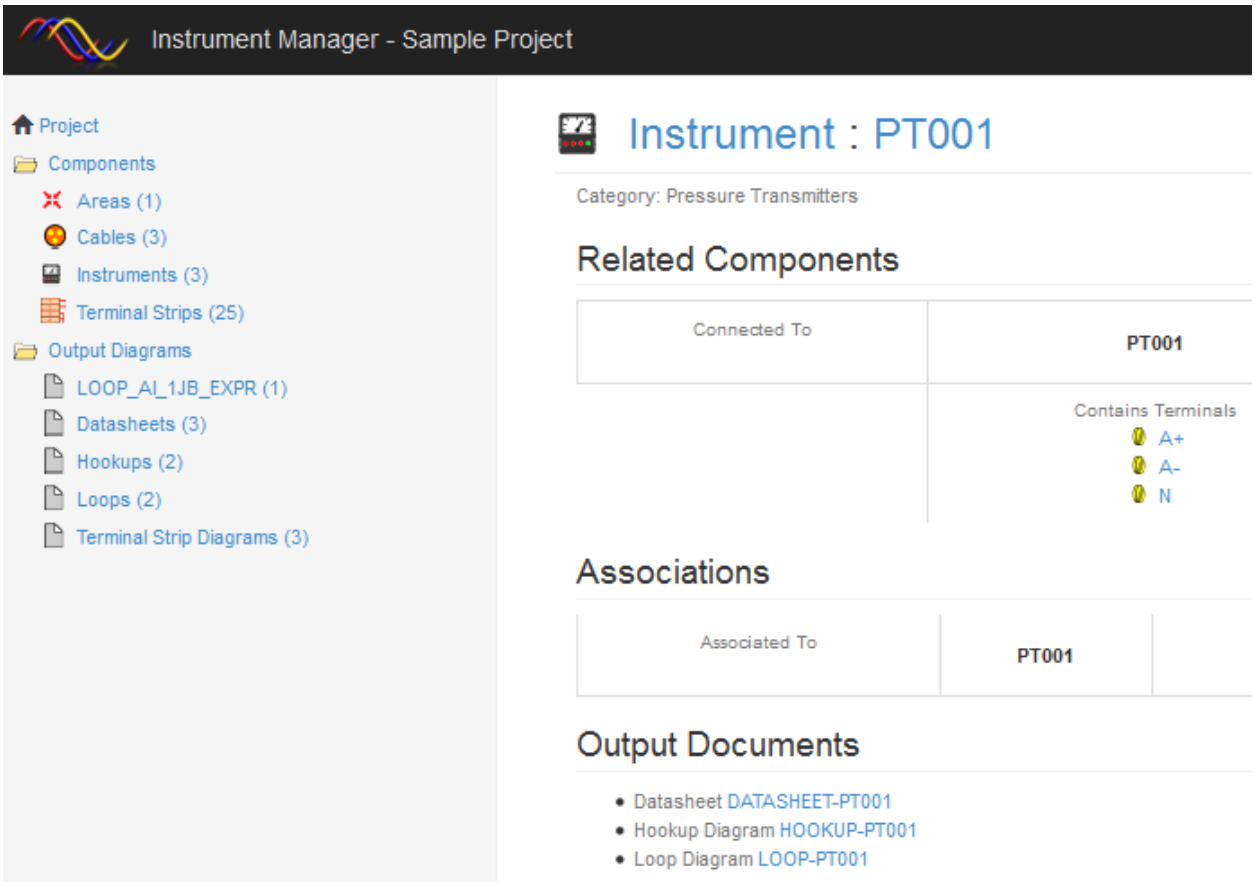
Raised Issues

Issue Type	Raised By	Message	Status
Edit ratings	andy@elecdes.com	Add new ratings field for Conduit Entry Size	New

Once the issue has been resolved, the designer can change the item status.

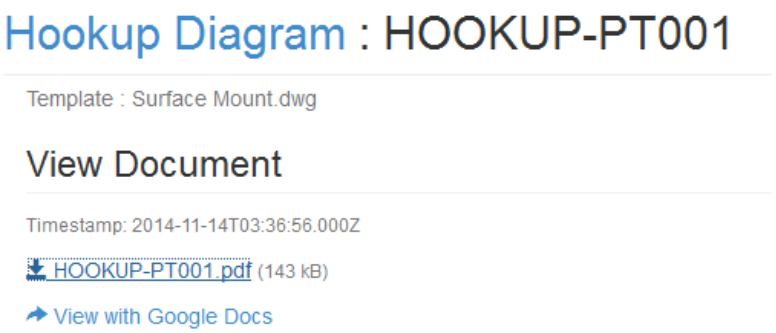
6) Viewing project output documents and drawings

You can navigate directly to output documents from components or from the project tree.



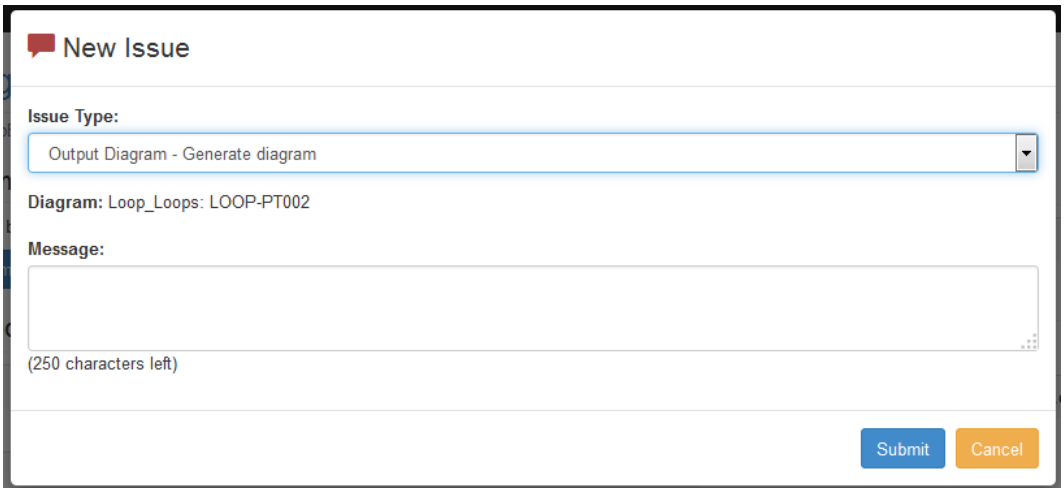
Output diagram generation requires initiation from a windows IM client. In most cases a DWG and a PDF file are generated simultaneously. The pdf files are those accessible for viewing through the web browser. For datasheets, xlsx and pdf files are generated simultaneously.

Click on the link to view the document or diagram.



7) Output Documents – Generate

If a diagram has not already been generated, a new drawing can be generated using the New Issue form.

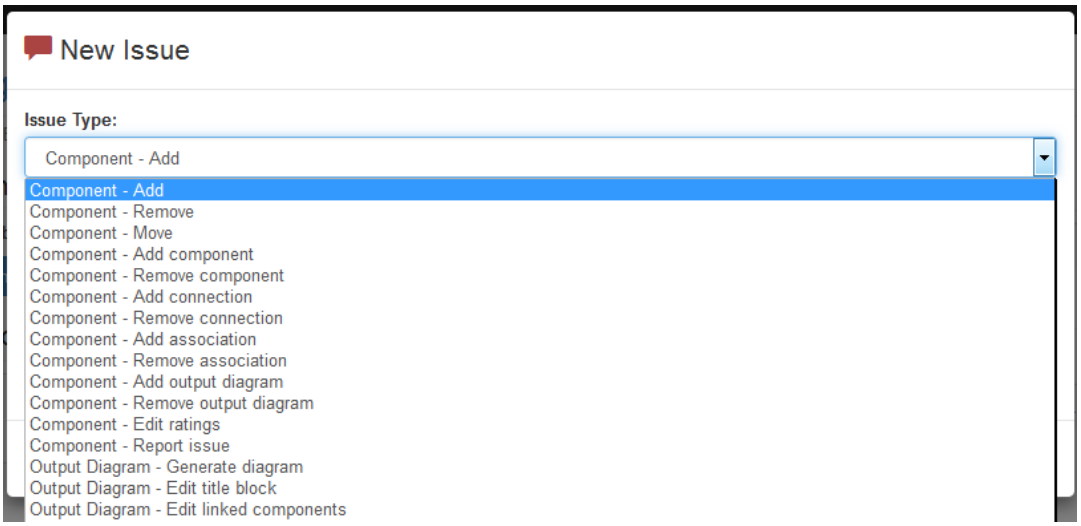


The generation, where interactive drawing is not required, is automated. Shortly your diagram will be available in the database. Interactive generation requires the designer to resolve the requested generation issue. We envisage web based DWG interactive editing and generation will be available through AutoCAD 360 soon.

Add an optional message to the designer by clicking on the message box.

Click the “Submit” button when your issue is read to send to the designer.

Note that there are various options available in a drop down box for easy selection of common issues.



Conclusion: This concludes the interactive section of the class.