Interfacing Laboratory Information Systems (LIMS) with Hamilton Robotics

The advances and cost reduction of biomolecular detection and analysis technologies in recent decades have led to an exponential growth of data generated. These developments increase the need for automation in sample processing and data management.

In order to maximize the automation capabilities of your laboratory, Hamilton provides various solutions in the software of our automated liquid handling workstations (VANTAGE Liquid Handling System™, STAR™, NIMBUS®) to generate detailed process reports or interface directly with an existing Laboratory Information Management Software (LIMS) through a network or database.

The type and amount of data generated or processed by the liquid handler will vary depending on each laboratory's requirements. Hamilton´s software can generate and read data from many different file formats and databases, accommodating practically any existing LIMS on the market today.

What is LIMS?

LIMS software (Laboratory Information Management System) is a tool that manages all the information generated or processed in a laboratory. Some benefits of using a LIMS are:

▶ Restricted access to data input or visualization

▶ Automatic validation of data input and output

▶ Automatic calculations and report generation, linking data from several devices in the lab

▶ Reproducibility and traceability of all data or changes done

▶ Centralized management and storage of data from different users, projects or devices

▶ Reduced human intervention of data transfer processes
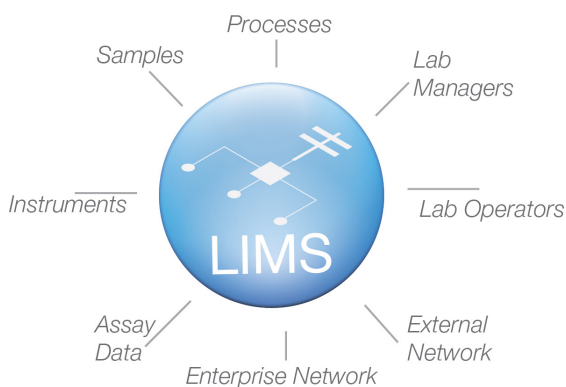
The LIMS is a networking tool and can interact with instruments and operators located in the same building or even in different cities.

HAMILTON

LIMS can send data to a Hamilton liquid handler

LIMS software can provide the Hamilton software information needed to process the next batch of samples loaded onto the liquid handler by the operator.

Assay instructions or worklist being sent
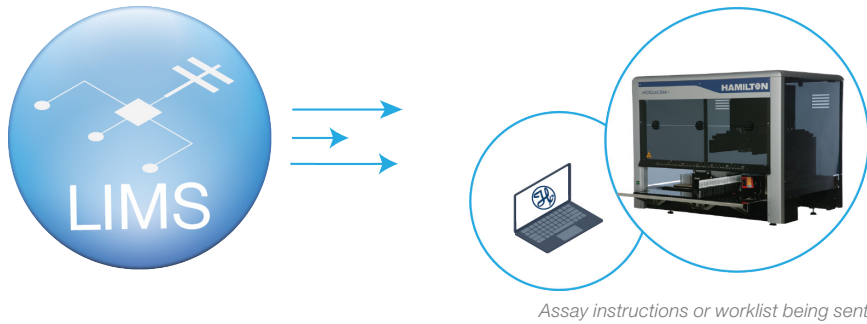
Worklist information can contain multiple types of data such as:

▶ **Assay lists**

▶ **Samples names or barcodes**

▶ **Volumes of samples and reagents**

▶ **Source and destination of samples and reagents**

▶ **Instructions for integrated 3rd party devices (e.g. reader program, incubation times, washer protocols, etc.)**

▶ **Process requests based on sample barcode or sample location**

Information is usually provided by the LIMS in one of three ways:
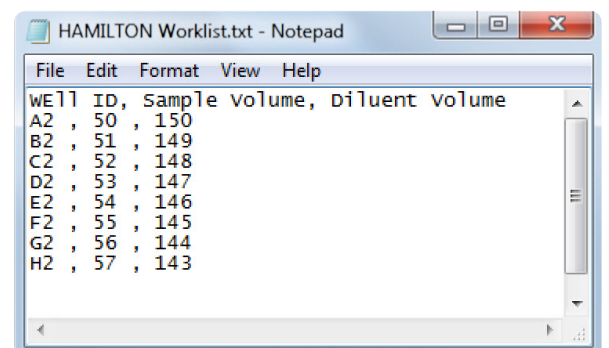
A) Worklist files

Worklist files are generated by the LIMS automatically or upon lab operators request. The files are stored in a folder accessible by the Hamilton software on the network or locally on the Hamilton liquid handler's computer.

Common worklist file formats used:

The created worklist file can be saved as a record of the parameters of a run for tracking and validation purposes.

	A	B	C
1	**Plate Name**	**Well**	**Barcode**
2	Hamilton Plate 01	A1	Sample001
3	Hamilton Plate 01	B1	Sample002
4	Hamilton Plate 01	C1	Sample003
5	Hamilton Plate 01	D1	Sample004
6	Hamilton Plate 01	E1	Sample005
7	Hamilton Plate 01	F1	Sample006
8	Hamilton Plate 01	G1	Sample007
9	Hamilton Plate 01	H1	Sample008
10	Hamilton Plate 01	A2	Sample009

Example of Excel worklist

Example of CSV woklist

B) Direct database access

When database access is granted by the LIMS to retrieve information, the Hamilton software can access information directly from the LIMS database without the need for an intermediate worklist file generation.

The flexibility of the functions incorporated in the Hamilton software ensures access to the most commonly used database systems such as:


Optionally, the Hamilton software can generate a worklist file from the information retrieved from the database as a record of the parameters of a run for tracking and validation purposes.

C) Web services

A web service is a communication protocol over a network that allows direct interaction between two computers. This is commonly used when connecting to any website, where a request is sent from a computer to a web server for viewing a particular web page.

The Hamilton software can request a worklist from the LIMS server by using different web service protocols such as HTTP or SOAP.
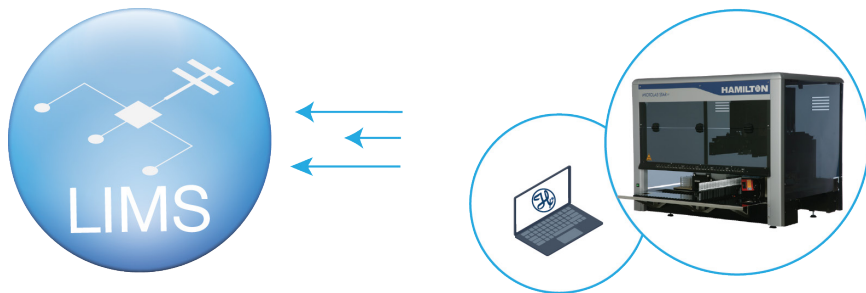

LIMS can get data from the Hamilton software

Sample tracking

Once a sample enters the Hamilton liquid handler, the software follows each sample from the start to the end of the run. The Hamilton software automatically records every stage of the sample during the process to an internal SQL database file. Information captured in this tracking process includes:

- ▶ **Volumes transferred of samples and reagents**
- ▶ **Samples location**
- ▶ **Samples and racks identification/barcode**
- ▶ **Action time and Lab Operator logged in**
- ▶ **Errors occurred (hardware, user intervention, barcode reading errors)**
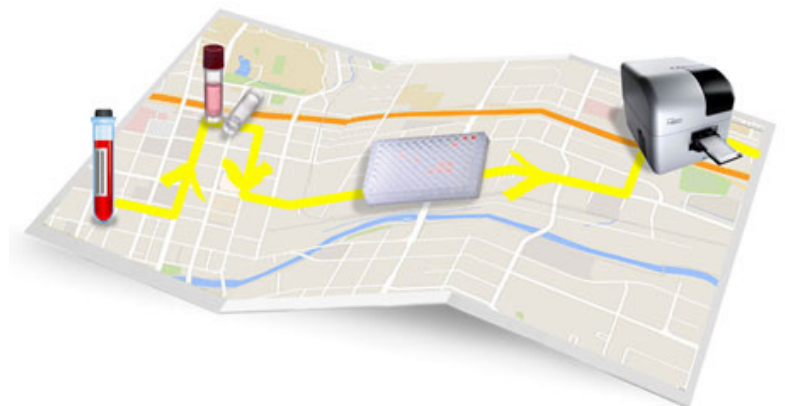
Reporting sample and run information

The Hamilton software can report process information of specified samples on demand at any time during the run.

This information can be transferred to the LIMS software in three different ways:

A) Report file

The Hamilton software can generate a file in a folder accessible by the LIMS in the network or locally on the Hamilton liquid handler's computer. Typically, LIMS continuously watch a specified folder, automatically retrieving and processing any new report files created in the specified location.   Similar to worklists, this report file can be generated in various formats such as:

The flexibility of the software on all Hamilton liquid handling workstations allows full customization of the reports generated in order to fit the LIMS requirements:

	A	B	C	D	E	F	G	H
1	Destination Plate	Destination Well	Process Summary	Volume	Source Tube	Source Tube Barcode	Action Date Time	User Name
2	XXUDW1	A1	Correct pipetting	200	1	234762398	9/2/2014 10:44	Jim
3	XXUDW1	B1	Correct pipetting	200	2	775837463	9/3/2014 10:44	Jim
4	XXUDW1	C1	Correct pipetting	200	3	909338272	9/4/2014 10:44	Jim
5	XXUDW1	D1	Correct pipetting	200	4	753679230	9/5/2014 10:44	Jim
6	XXUDW1	E1	Barcode reading error	200	5	753679231	9/6/2014 10:44	Jim
7	XXUDW1	F1	Correct pipetting	200	6	753679232	9/7/2014 10:44	Jim
8	XXUDW1	G1	Correct pipetting	200	7	753679233	9/8/2014 10:44	Jim
9	XXUDW1	H1	Correct pipetting	200	8	753679234	9/9/2014 10:44	Jim
10	XXUDW1	A2	Correct pipetting	200	9	753679235	9/10/2014 10:44	Jim
11	XXUDW1	B2	Not enough liquid	155	10	753679236	9/11/2014 10:44	Jim
12	XXUDW1	C2	Correct pipetting	200	11	753679237	9/12/2014 10:44	Jim

Example of Excel report file
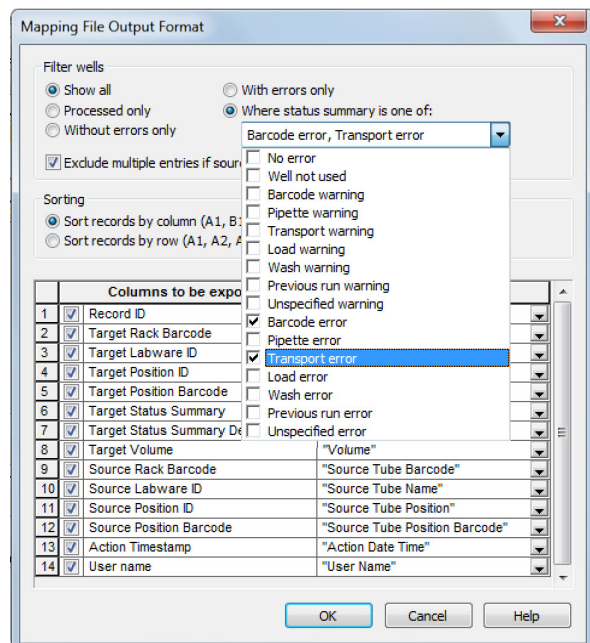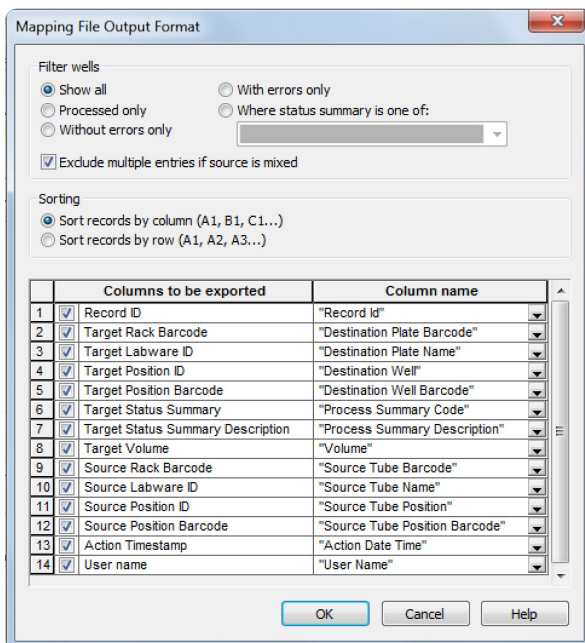
VENUS software mapping report options

Output reports can also incorporate data from 3rd party devices (incubation time and temperatures, OD results from microplate readers, etc.):

	A	B	C	D	E
1	Batch ID	Plate Barcode	Plate Well	Sample Barcode	OD
2	95384	Hamilton Plate 01	A1	87235761	0.124
3	95384	Hamilton Plate 01	B1	87235762	0.251
4	95384	Hamilton Plate 01	C1	87235763	0.611
5	95384	Hamilton Plate 01	D1	87235764	0.714
6	95384	Hamilton Plate 01	E1	87235765	0.723
7	95384	Hamilton Plate 01	F1	87235766	0.746
8	95384	Hamilton Plate 01	G1	87235767	0.835
9	95384	Hamilton Plate 01	H1	87235768	0.001
10	95384	Hamilton Plate 01	A2	87235769	0.059

Example of an output file with data from a microplate reader

Additionally, custom formatting and printable reports including plate layouts can be created for easy sample identification and result review by the lab operator:

MY LABORATORY NAME

Plate ID	----------
User	HamiltonCo
Date	2011-09-02 10:33:59

	1	2	3	4	5	6	7	8	9	10	11	12
A	59744	59746_14318	60233_14713	60250_14721	----------	----------	----------	----------	----------	----------	----------	----------
B	60749_14133	59747_14319	60235_14714	60252_14722	----------	----------	----------	----------	----------	----------	----------	----------
C	60742_1413410	59748_14320	60238_14715	60254_14723	----------	----------	----------	----------	----------	----------	----------	----------
D	60751_14135	59749_14321	60240_14716	60257_14724	----------	----------	----------	----------	----------	----------	----------	----------
E	60774_14136	60225_14709	60241_14717	60259_14725	----------	----------	----------	----------	----------	----------	----------	----------
F	60867_14137	60227_14710	60245_14718	60262_14726	----------	----------	----------	----------	----------	----------	----------	----------
G	60875_14138	60229_14711	60247_14719	55349_2254	----------	----------	----------	----------	----------	----------	----------	----------
H	60880_14139	60231_14712	60249_14720	----------	----------	----------	----------	----------	----------	----------	----------	----------

B) Direct database access

When database access is granted by the LIMS, the Hamilton software can post the run information directly into the LIMS database without the need for an intermediate report file generation.

Example of custom report layout

The flexibility of the functions incorporated in the Hamilton software ensures access to the most commonly used database systems:
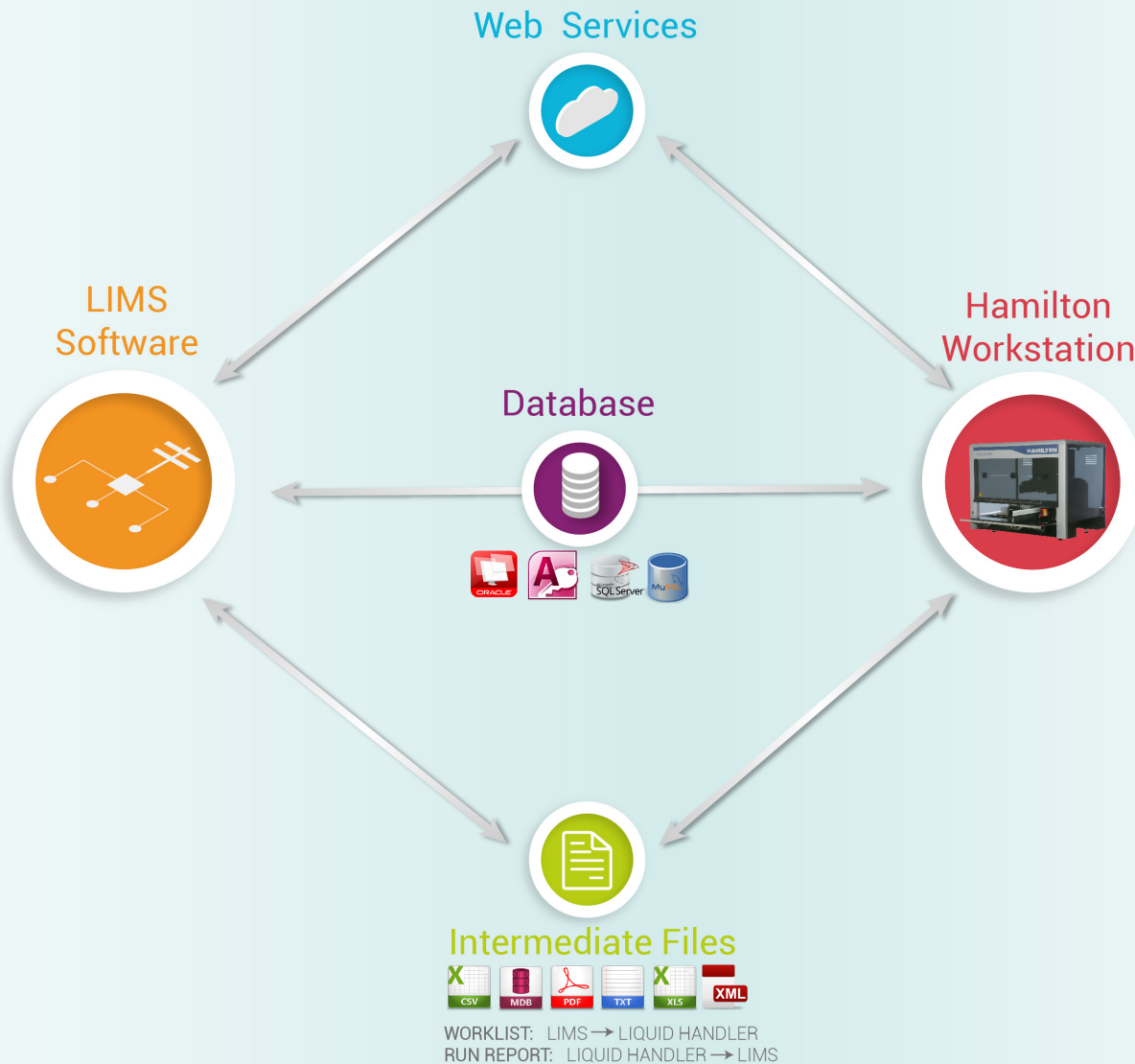

Optionally, the Hamilton software can generate a report file from the sample tracking and run information as a record for tracking and validation purposes.

C) Web services

A web service is a communication protocol over a network that allows direct interaction between two computers. This is commonly used when connecting to any website, where a request is sent from a computer to a web server for viewing a particular web page.

The Hamilton software can send a run report or process status to the LIMS server by using different web service protocols such as HTTP or SOAP.

Web Services

LIMS Software

Hamilton Workstation

Database

Intermediate Files

WORKLIST: LIMS → LIQUID HANDLER
RUN REPORT: LIQUID HANDLER → LIMS

HAMILTON

Web: www.hamiltonrobotics.com
USA: 800-648-5950
Email: marketingrequest@hamiltonrobotics.com

United States
Tel: +1-775-858-3000
United Kingdom & Ireland
Tel: +44 (0)121-717-0199
Brazil
Tel: +55 (11) 9677-4093

China
Tel: +86-21-6164-6567
France
Tel: +33 (01) 69751616
Italy
Tel: +39-39-689-33-93

Denmark, Norway, Sweden, Finland
Tel: +45-70-26-4499
Germany, Switzerland, Austria, Benelux
Tel: +49 (089) 552649-0

To find a subsidiary or distributor in your area, please visit hamiltoncompany.com/contact-us/distributors