

## LPL: Product Description

LPL is a full-fledged **mathematical modeling system** with a point-and-click user interface and a powerful **modeling language**. The language is a structured mathematical and logical modeling and programming language with an extended index mechanism, which allows one to build, maintain, modify, and document large linear, non-linear, and other mathematical (optimization) models. A language interpreter translates the model automatically into a solver acceptable form; reads data directly from database, calls a solver and can write the results directly back to the database or generate complex solution report files. LPL can communicate with many commercial and free solvers.

### The full system contains:

- **A declarative mathematical language:** LPL can be used to formulate concisely complete mathematical linear, non-linear and logical models of large size. The data can be stored in the model itself or outside in databases or text files. The interface to various commercial solvers is integrated and easy configurable. Real-live linear models with 1'000'000 constraints and more have been processed and solved using LPL in a commercial context.
- **An algorithmic programming language:** LPL is a complete programming language which allows one to write algorithms to pre- or post-process the data or to loop through many optimizations (while adding constraints dynamically, for example). It has all necessary control structures of another programming language. The language further permits to break down a complex model into logical modules (itself models or model-parts). The modules can be themselves entire optimization models which can be processed individually or communicate their results.
- **An optimization tool:** LPL is designed to communicate with various commercial and free mathematical linear, mixed-integer, and non-linear mathematical packages to solve large optimization problems (Gurobi, CPLEX, Xpress, LocalSolver, MOPS, GLPK, Ip\_solve, XA, Mosek, Knitro, Conopt, Loqo, and many others). LPL comes with an own LP-solver for solving small models, as well as with a heuristic Tabu-search solver to solve certain simple scheduling problems.
- **Automatic model type recognition:** From the model formulation, LPL deduces automatically if the model is linear, convex quadratic, non-linear, or some other types and can choose the solver on this basis. This can be overridden by the user, of course.
- **A data modeling tool:** LPL can be used to generate a database from scratch. From an LPL modeling specification one can generate automatically a SQL-script, which generates a complete database optionally loaded with data. LPL can read/write from/to various database systems (mySQL, InterBase, SyBase, Oracle, DB2, MS Access, and Excel).

- **A data manipulation tool:** Like a data manipulation language (DML) in database, LPL can manipulate (join, select, project, etc.) large multi-dimensional data (datacubes) in a sparse way. The data are read from or written to databases or text files in various ways. Tools exist for generate various pivot tables from a multi-dimensional data cube in order to change the view on the fly in the modeling environment.
- **A modeling environment:** LPL comes with a powerful model browser. It allows the user to view and traverse the model in different ways and to find and modify all elements on a single mouse click. A model editor, a table browser with pivot-table functionality, a graphical modeling- and instance viewer, a drawing tool to generates various output and result graphs, this all is integrates in an easy to understand user interface.
- **A documentation tool:** From a LPL model specification enriched with inline model documentation text, one can generate automatically a LaTeX-file or a PDF-file to produce a printable or publishable model documentation report (this requires a free LaTeX-documentation system to be installed).
- **A reporting tool:** The LPL model system communicates with the commercial reporting system, called [FastReport](#), an advanced and well known reporting system. Reporting templates are generated automatically from easy-to-design output instructions within LPL. These templates can be modified by an integrated template point-and-click designer. The reports can be generated automatically as PDF-, DOCX-, ODF-, XLSX-, HTML-, TXT, or JPG-file.
- **A library in other applications:** The complete functionality of LPL comes as a dynamic link library and all its functions can be integrated (and hidden from the end user) in another “end-user” application, written, for example, in a Python, Visual Basic, C++, Java, Delphi and others.
- **An Internet solving tool:** LPL is a client- and a server-application. Installing an LPL-client on a machine and a LPL-server on another, the two can communicate through the Internet: The client can send the model to the server machine where the model can be manipulated, calculated or solved by a LPL-server in the same way as on the local machine. It is completely transparent to the user (true ASP: application service providing). On the server machine, one only needs to install Tomcat engine (a free Java-based distributed software) and an LPL-server. On the client-side the user only needs to set a single parameter!

## LPL: One Single Product – Different Packages

The *complete* software comes in one single version that *can be downloaded free of charge* from [matmod.ch](http://matmod.ch). This package is called the **Free Package** with a limited functionality (see below). It is free and everybody can use it without restriction. The license text written in the file *license-free.txt* applies.

The user can obtain an **Academic Package** – limited to one month – by downloading a license key at [matmod.ch](http://matmod.ch), which can be renewed at any time. At any time the user can upgrade to the other packages that contain additional and increasing functionality: the **Professional Package**, and the **Enterprise Package**. The Academic, Professional and the Enterprise Package are subjected to the license text written in file *license.txt*.

All packages are basically limited in time, which means that the user can use the software for a limited amount of time, after that time (the due time) the package falls back to be **Free** with the limited functionality as describe below. At any time, the time limit can be extended be buying the software for an additional amount of time. The different packages and the various time-limitation only differ in the license key, the software always is the same. The license key typically is stored in a small file (*lpl.lic*). Buying an upgrade or extend the due time then only means to buy, download and install a new license key – by replacing the previous one. To upgrade see our [MatMod Shop](http://MatMod Shop) or send an email to: [info at matmod.ch](mailto:info@matmod.ch).

By default, the software comes as a **Free Package**, that disallows the use of some advanced functions in the modeling software. Besides of these advanced functions, the Free Package is fully functional and can be used to solve and run models.

The advanced features that are *not* available in the Free Package are as follows :

- **Output-files:** Generating various advanced output-files, such as INT-file, EQU-file (equation listing), TEX-file (automatic model documentation), BUG-file (debugging output files), SPS-file (snapshots), SQL-file (generated database script files), report files.
- **Search Functionality:** Extended search functionality in *lplw.exe*.

- **List / Files View:** Listing all entities in alphabetical order and all files in drop-down lists in order to be selected and browsed.
- **DB-Connectivity:** Reading from and writing to databases, generating database scripts in order to create databases on the fly.
- **Internet Solver:** There exists “out there” in the Internet a solver to which each LPL client program can communicate. By setting a parameter only within the software, the model can be processed (solved or manipulated) by that “general” solver.
- **Link to commercial solvers:** The ability to communicate with commercial solvers such as Gurobi, CPLEX, Xpress, MOPS, XA, MOSEK, and others.
- **Console lplc:** lplc.exe is a program that allows running a model from the console and it can, therefore, be integrated into complex batch processes for multiple model processing.
- **Encrypt Model:** The model source code can be encrypted in order to hide the logic from other users or developers.
- **Instance View:** Showing the model structure as a graphical view in order to browse it more conveniently. There is a generic view and a full instance view.
- **Reporting:** Capability to use the FastReport@ Reporting system and the ability to generate report templates on the fly and reports in the form of PDF-, HTML-, RTF- or text-files.
- **Dll Library:** The whole LPL software functionality can be accessed through a full-fetched dynamic linked library that can be integrated into any other application.
- **Lpl-Server:** Capability to use the LPL-Server program, installation of server as well as additional workshop to maintain the server are provided as well when buying this package.

Besides of these advanced functions, each package contains all functions. Table 1 gives an overview of the functionality of each package.

The **Free Package** is free of charge. It contains the whole functionality besides the mentioned advanced features listed above. The Free Package is great for a first test, for learning modeling and for developing and running all kind of models. The **Academic Package** – also free of charge for one month – allows one to create and solve model using commercial solvers, and to link to databases and do real modeling in a teaching environment. The **Professional Package** is for the professional model builder and contains all kind of model debugging tools. The **Enterprise Package** is for modeling tool and application developers. They can use the complete package as an additional module in their own modeling environment. Finally, the **Server Package** can be used to provide modeling services over the Internet *on you own site*.

Model \ Package Functionality	Free Package	Academic Package	Professional Package	Enterprise Package	Server Package
Output-files	--	yes	yes	yes	yes
Search Functionality	--	yes	yes	yes	yes
List / Files View	--	yes	yes	yes	yes
DB-Connectivity	--	yes	yes	yes	yes
Link to Commercial Solvers	--	yes	yes	yes	yes
Internet Solver	--	<50 vars>	yes	yes	yes
Console Iplic	--	--	yes	yes	yes
Encrypt Model	--	--	yes	yes	yes
Instance View	--	--	yes	yes	yes
Reporting	--	--	yes	yes	yes
DII Library	--	--	--	yes	yes
LPL-Server	--	--	--	--	yes
Everything else ... Unlimited model-size	yes	yes	yes	yes	yes

**Table 1: The various Packages**

- The LPL software is constantly updated and its functionality is extended on a regular base. Updating the software is free of charge: it only consists in downloading the newest version from the MatMod Site. Hence, the user can fully benefit from the developments of LPL free of charge at any time.

Upgrading (passing from one package to another) is also very easy: It only consists of buying the license of another Package.

All packages – as mentioned above already – are available as time-limited versions. “Time-limited” means that during a certain time (typically for 1 year) the software runs and then expires.

The software is protected by Swiss law and the user must read and understand the license before using the software (see file: [license-free.txt](#) (for the Free Package) and [license.txt](#) (for the other packages)).

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**Please note also that**

We offer model building and consulting and implement complete projects ready to be used. We organize client specific workshops on mathematical modeling or LPL tutorials. Contact us at [Email MatMod](#).

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