



# Lighter 6

## **PROJECT EDITOR USER'S MANUAL**

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**Published 31 October 2012  
Printed in Donnas (AO), Italy.**

## REVISION INDEX

**REVISION INDEX**

Revision	Date	Number of added or edited pages
6.0.0	31/10/2012	Release

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# 1 WELCOME

## 1.1 About this Help System

This Help System is designed for developers who will be using Project Editor to write and manage programs so as to customize and automate laser engraving operations.

Project Editor is integrated into Laser Editor.

### 1.1.1 Using the Help System:

- To access the whole contents, choose **Help > Help** from the Project Editor's menu bar, or press **F1** in the main screen of the application.
- To use the context-sensitive Help: press **F1** (or the ? button in the title bar) to open dialog or window level Help.

### 1.1.2 Contents of the Help:

In particular, the Help is organized into the following main topics:

Chapter	Contents
<u>Getting started with Project Editor</u>	Presents an overview of the product in terms of scope and work environment.
<u>Managing Projects</u>	Describes how to create a project, how to add source or resource files, as well as to manage files.
<u>Opening, Saving, and Deleting Projects</u>	Describes how to open or save an existing project, either locally or to/from the laser device.
<u>Sending projects to marking</u>	Describes how to test and run a project, and how to send it to marking.
<u>Laser Engine Language Reference</u>	Describes all of the objects, types, functions, variables, classes, and constants that can be used to write your own programs.



## 2 GETTING STARTED WITH PROJECT EDITOR

This chapter is organized into the following sections:

<b>Topic</b>	<b>What you will learn</b>
<u>About Project Editor</u>	Scope and overview of Project Editor.
<u>Work environment overview</u>	Overview on how the work environment is organized.



## 2.1 About Project Editor

Project Editor is a programs editor integrated into Laser Editor. It has a friendly user interface, advanced debugging functions, and is provided with samples programs and reference material. Developers can use this tool to write and manage programs so as to interact with the laser system.

Such programs are then interpreted and executed via the Laser Engine. The programming language is an implementation of a subset of ECMAScript 4.0. ECMAScript, which is also called JavaScript or JScript by some vendors.

By creating your own programs with Project Editor you can:

- control the marking process
- fully customize your layout
- interact with users and with other programs or devices
- automate procedures and update the layout's contents at runtime

Project Editor is launched by choosing **File > Project Editor** from the Laser Editor's menu bar.



**Tip:**

Reference material on the programming language is provided into the Laser Engine Language Reference section of this Help System. To access it, choose menu **Help > Help** or press F1 at a window level.

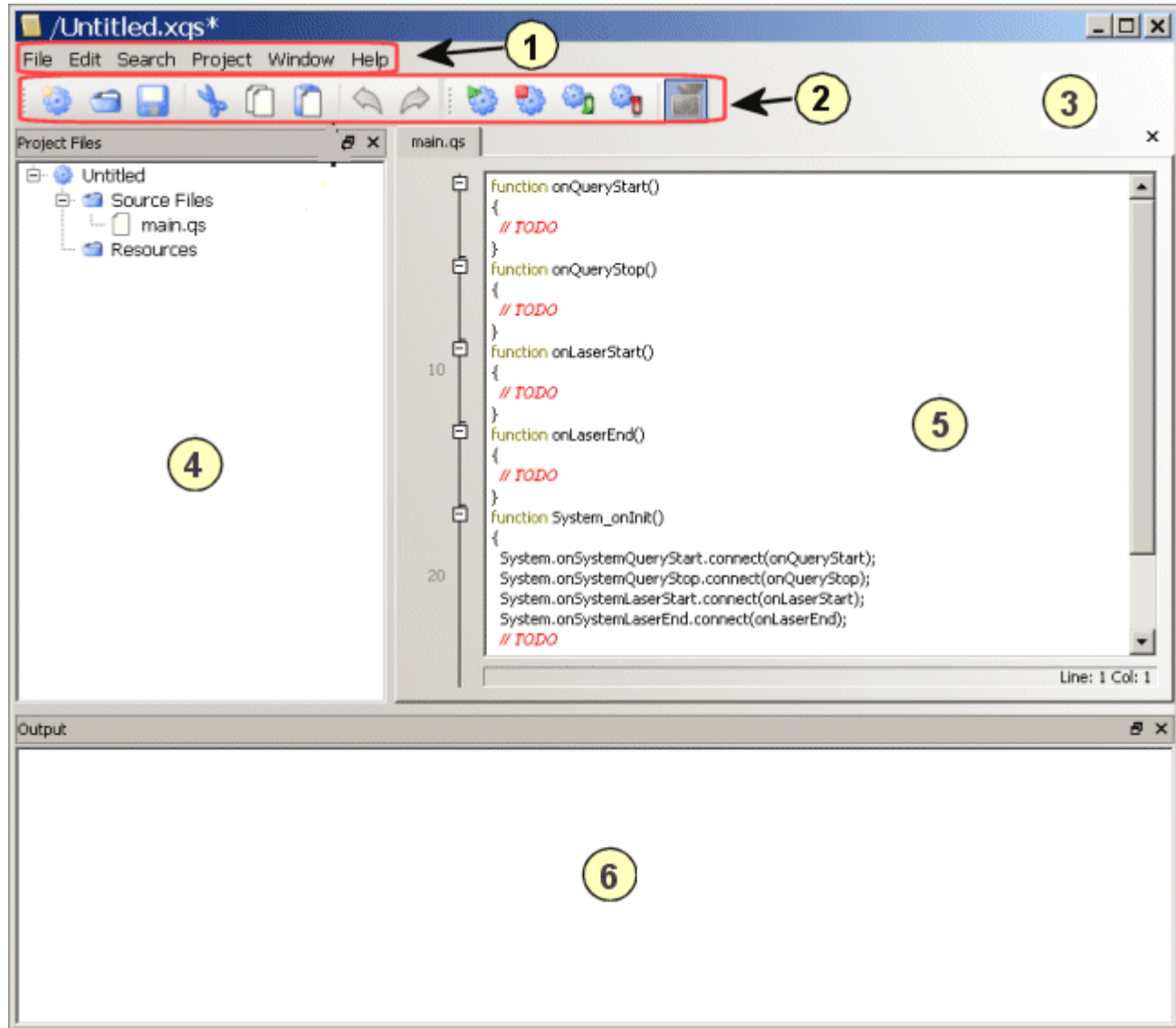
***Related topics:***

- Work environment overview
- Managing Projects

## 2.2 Work environment overview

This section provides an overview of the Project Editor work environment.

The picture below shows the main window of Project Editor when you access it:



**Tip:**

To hide/unhide a pane in the Project Editor window, either use the **Window** menu or right-click in a blank area next to the toolbar.

## CHAPTER 2

### 2.2.1 Work environment components:

Area	Description
1	<b>Menu bar</b> with all the Project Editor commands. All functions are described later.
2	<b>Toolbar</b> - It shows the tools that allow creating, managing and running the project. Point and hover a button to display a tooltip. All functions are described later.
3	Right-click this area to display a shortcut menu that allows you to hide/unhide the panes 5, 6, and 7.
4	<b>Project Files</b> pane - It lists the source files and resource files that compose the current project. Right-clicking an item (either the project folder, the source files folder, the resource files folder, or a file) will result in a shortcut menu being displayed on which you can choose options for files management. This window can float over the work area, or you can dock it at the left-side of the window by double-clicking its title bar. Furthermore, you can hide/display this window by right-clicking next to the toolbar and then selecting/deselecting the corresponding option.
5	<b>Program editor</b> area - This is the area where the source file is displayed. You can enter your code, edit it, copy, paste or search the code by using the menus or the toolbar. To customize how the editor looks, choose <b>Edit &gt; Configuration</b> and then enter the desired values.
6	<b>Output</b> area - When you run a project, it displays the relevant status or error messages. This window can float over the work area, or you can dock it at the bottom of the window by double-clicking its title bar. Furthermore, you can hide/display this window by right-clicking next to the toolbar and then selecting/deselecting the corresponding option.

## 3 MANAGING PROJECTS

This chapter is organized into the following sections:

- [Editor configuration](#)
- [Creating a project](#)
- [Adding files to the project](#)
- [Working with Source files](#)
- [About Formatters](#)

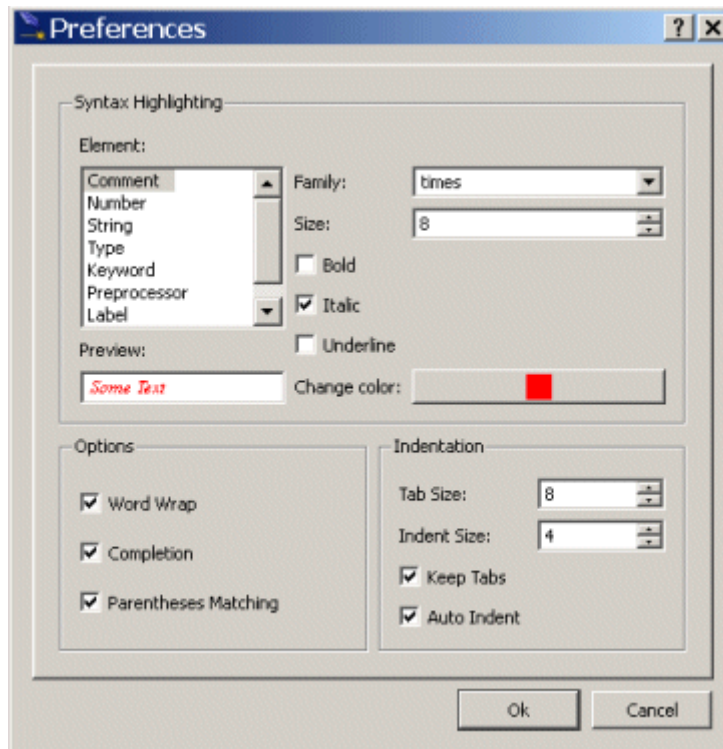
## CHAPTER 3

### 3.1 Editor configuration

You can customize Project Editor in terms of syntax formatting of the source files during editing.

#### To customize the editor:

1. From the Project Editor's menu bar, choose **Edit > Configuration**. The **Preferences** dialog box is displayed showing the current settings:



2. From the **Element** list, choose the item(s) you want to change the formatting for and enter the desired values.
3. When finished, click OK.

#### Related topics:

- [Creating a project](#)
- [Adding files to the project](#)

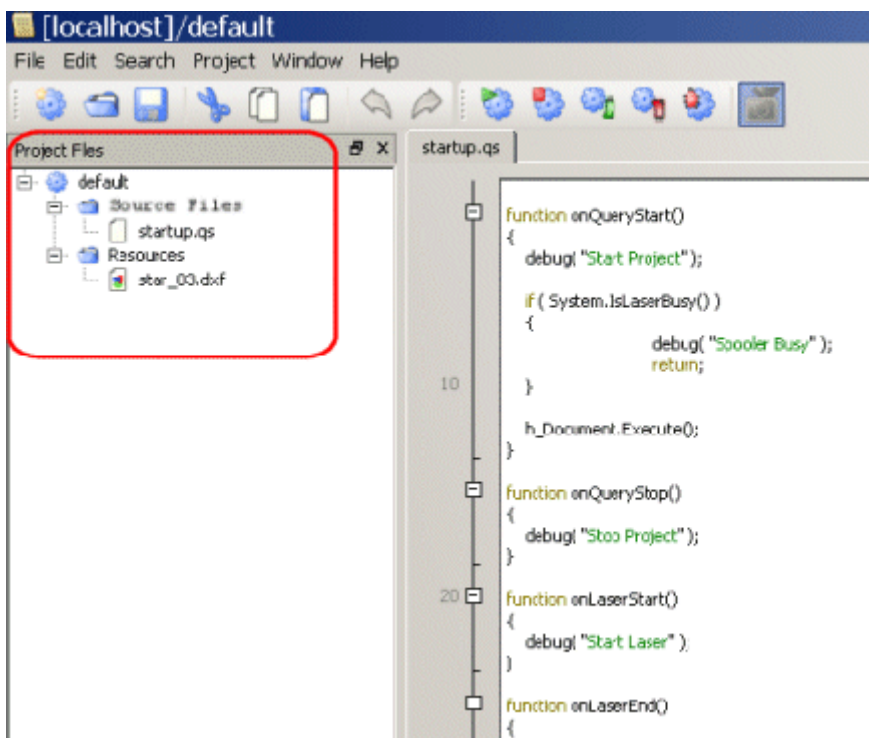
## 3.2 Creating a project

### About Projects

The Project is a program with a `.xqs` extension that works as a "container" for the files that are used to run the application. In particular a project is composed by **Source files**, that is, the files that contain the code, and **Resource files**, that is, any image file, database file, Word or Excel documents, and so forth that are required to run the program. (See [Adding files to the project](#)).

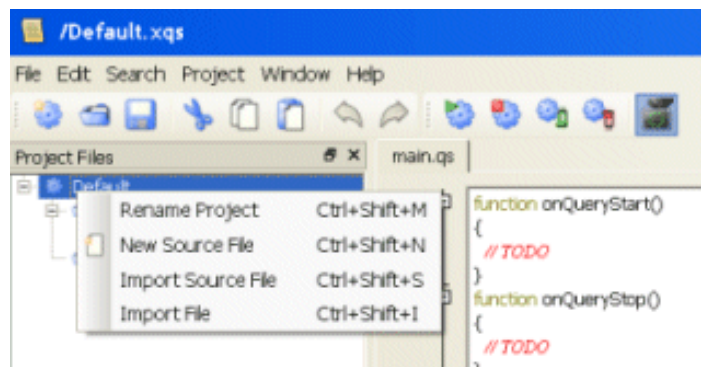
When you are working on a project, the **Project Files** pane lists all the files that compose the project. The pane is displayed by default on the left side of the window.

Figure Project Files pane



In particular, the Project Files pane allows you to:


- **Right-click** the Project folder to open a shortcut menu that shows a list of commands for project management (such as renaming or adding files):



## CHAPTER 3

- **Right-click** any document or project file to open a shortcut menu that shows a list of commands relevant to it.
- **Move** the pane to another location in the window by clicking the title bar. To restore the original position and dock the pane, double-click the title bar.
- **Hide/unhide** the pane by right-clicking in a blank area next to the toolbar, and then deselect/select the corresponding item.

### To create a new project:

1. Do one of the following:
  - Click the  **New Project** button on the toolbar.
  - From the menu bar, choose **File > New Project**.
2. A new default project is created, named `Untitled`, which contains a default source file named `main.qs`. You can use the default project as the basis for your application.
3. If you want, rename the project or the file as required: Right-click the name, choose **Rename file**, and then enter the new name.
4. Enter the code in the source file as required.
5. Add or import any **Source** or **Resource** files you need by doing one of the following:
  - Right-click the Project folder and choose the option you want.
  - Choose a command from the **File** menu.
6. Save your project as required. (See [Saving a project](#))

### To install a project deployed from somebody else:

According to the format the project comes to you (flat files or zipped archive), do the following steps from point "2" or "1" respectively:

1. Unzip the archive in a local directory.
2. [Follow the steps for opening a project.](#)
3. [Follow the steps for saving a project to the device.](#)



#### Tip:

Reference material for developers is provided into the [Laser Engine Language Reference](#) section of this Help system.

### Related topics:

- [Adding files to the project](#)
- [Importing source or resource files into a project](#)

### 3.3 Adding files to the project

Typically, you create (or open) a Project and then you add the files that are used to run the program. In particular:

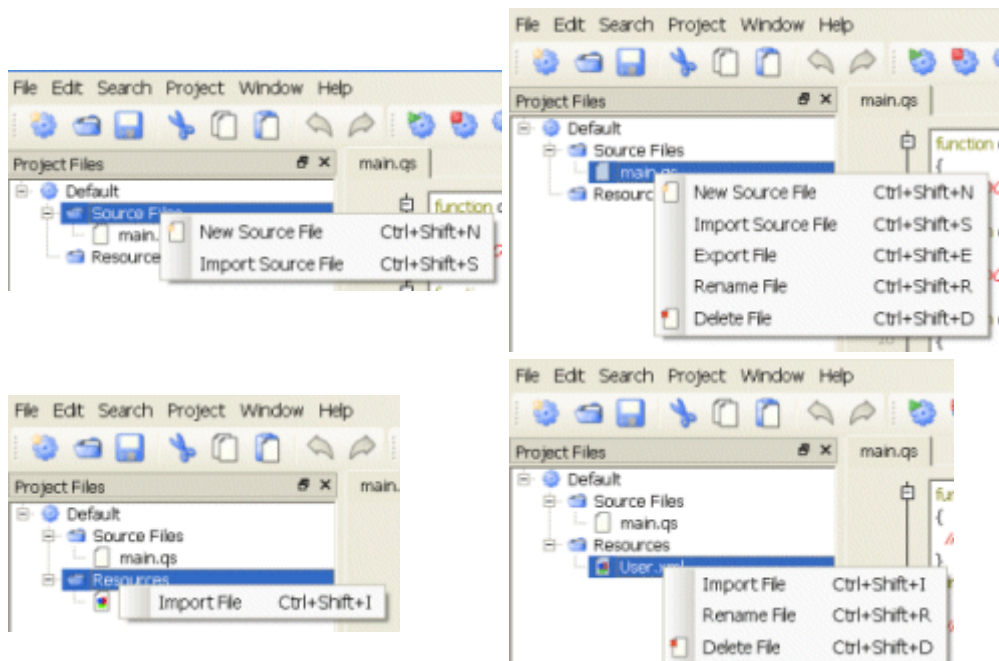
- **Source files**, that is, the files that contain the code. A source file has a .qs extension. You can directly enter the code into the program editor area of Project Editor, or you can import an existing file.
- **Resource files**, that is, any image file, icons, database file, Word or Excel documents, and so forth that are required by the program at runtime, as well as XML files that are used for marking on plastic cards. You can import any of these files into your project.

(For further information, see [Importing source or resource files into a project.](#))

Source and resource files that compose the project are listed into the **Project Files** pane, which is displayed by default on the left side of the window.

All the files that compose the project, are then synchronized when the project is executed, that is, they are copied to the device before being executed.

Files management commands are available by right-clicking the files folder or an individual file and then choosing an option from the shortcut menu. See pictures below:



**Related topics:**

- [Creating a new source file](#)
- [Importing source or resource files into a project](#)
- [Working with Source files](#)



## CHAPTER 3

### 3.3.1 Creating a new source file

#### To create a new file:

1. Create the project (See [Creating a project](#)) and then do one of the following:
  - o From the menu bar, choose **File > New source file**.
  - o In the **Project Files** pane, right-click the Source Files folder or an existing source file and then choose **New source file** from the shortcut menu.
2. In the **Input file name** window that is displayed, enter the name for the source file and click **OK**.

Note that the new file is added to the Project Files list. Furthermore, a new tab is opened in the program editor area allowing you to enter the code.



#### Tip:

Reference material for developers is provided into the [Laser Engine Language Reference](#) section of this Help system.

#### To print a source file:

1. Open the file to be printed. (If no file is opened, the command is disabled).
2. From the Project Editor menu bar, choose **File > Print** source file.
3. Choose the printer and click **OK**.

### 3.3.2 Importing source or resource files into a project

You can import both source and resource files. The files that you import are added to the corresponding folder into the **Project Files** pane.

All the files that compose the project, are then synchronized when the project is executed, that is, they are copied to the device before being executed. (See also [Running a project](#)).

#### To import a source file:

You can import an existing source file for further editing.

1. Do one of the following:
  - o From the menu bar, choose **File > Import source file**.
  - o In the **Project Files** pane, right-click the Source Files folder or an existing source file and then choose **Import source file** from the shortcut menu.
2. In the **Import file** window that is displayed, browse to locate the `.qs` file and click **Open**.

Note that the file is added under the **Source files** folder in the **Project Files** pane.

#### To import a resource file

You might import image files, icons, database file, Word or Excel documents, as well as XML files.

1. Do one of the following:
  - o From the menu bar, choose **File > Import file**.
  - o In the **Project Files** pane, right-click the Resource Files folder or an existing resource file and then choose **Import file** from the shortcut menu.
2. In the **Import file** window that is displayed, browse to locate the required file and then click **Open**.

Note that the file is added under the **Resource files** folder in the **Project Files** pane.

## 3.4 Working with Source files

You can easily manage or edit source files by using the menu bar, the toolbar, or by right-clicking the files into the Project Files pane.

### For further information:






- [Copying, cutting, and pasting text](#)
- [Searching or replacing text](#)
- [Renaming or deleting files](#)
- [Exporting source files](#)

## CHAPTER 3

### 3.4.1 Copying, cutting, and pasting text

When a source file is displayed in the program editor area, you can use the menu bar or the toolbar to perform common operations.

#### To copy, cut, and paste text:

1. Select the text in the source file (or choose **File > Select all** to select all the code).
  - To copy the text, use the **Edit > Copy** menu command, or click the  **Copy** button in the toolbar.
  - To cut the text, use the **Edit > Cut** menu command, or click the  **Cut** button in the toolbar.
  - To paste the text, use **Edit > Paste** menu command, or click the  **Paste** button in the toolbar.
2. Use the   **Undo/Redo** commands to reverse the changes.

### 3.4.2 Searching or replacing text

When a source file is displayed in the program editor area, you can use the search functions to locate or replace text.

#### To search the text:

1. From the **Search** menu, choose the appropriate command (**Find**, **Find Next**, or **Find Previous**).
2. In the window that is displayed, specify the search criteria and then click **Find**.

#### To search and replace the text:

1. From the **Search** menu, choose **Replace**.
2. In the window that is displayed, enter the text to be found and text for the replacement.
3. Specify the search criteria and then click **Replace** or **Replace all**.

#### To go to a specific line:

1. From the **Search** menu, choose **Go to line**.
2. In the window that is displayed, enter the number of the line you want to move to and then click **Go to**.

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### 3.4.3 Renaming or deleting files

You might rename or remove both source and resource files.

#### To rename a source or resource file:

1. In the Project Files list, right-click the file (not the folder) you want to rename.
2. From the shortcut menu, choose **Rename File**, enter a new name in the window that is displayed and then click **OK**.

#### To delete a source or resource file:

1. In the Project Files list, right-click the file (not the folder) you want to delete.
2. From the shortcut menu, choose **Delete File**.
3. Answer **Yes** in the window that is displayed.

### 3.4.4 Exporting source files

You might export source files so as to be used for other applications. When you export a file, a copy of it is saved as a .qs file in another location and the original is kept into your project.

#### To export a source file:

1. In the **Project Files** pane, right-click the source file (not the folder) you want to export and then choose **Export file** from the shortcut menu.
2. In the **Export file** window that is displayed, select the folder you want to save the .qs file in, and then click on **Save**.

## 3.5 About Formatters

Formatters are source files that are supplied with Project Editor. These files can be used as functions libraries.

Their purpose is to make it easier for developers to create custom applications. For example, as an integrator, you might need specific functions that these libraries provide.

Formatters have a `.qs` extension and are stored in the folder `...\Data\Formatters`.

### To prepare formatters:

1. From the Project Editor's menu bar, choose **File > Formatters**.
2. In the **Project Files** section, double click the formatter source file in order to access its code. Alternatively, right-click `Source Files` and then click `New Source File` for creating a new one.

### To use formatters:

1. In the layout, select one or more textual objects.
2. In the property section, set its `Custom Formatters` property to `True`.
3. Open the combo box named `Script` just below the preceding property and set it with the file name of the desired property.

## 4 OPENING, SAVING, AND DELETING PROJECTS

This chapter is organized into the following sections:

- [Opening a project](#)
- [Saving a project](#)
- [Managing files on the device](#)

## 4.1 Opening a project

You can open projects that you have previously saved for further editing, or for sending them to the engraver.

You can open a project that was saved locally, or a project that was saved to a device. (See [Opening a project from a device](#)).

### To open a project

1. Do one of the following:
  - From the Project Editor menu bar, choose **File > Open project**.
  - From the Project Editor standard toolbar, click the  **Open project** button.
2. In the **Choose a project to open** window that is displayed, browse to locate the `.xqs` project you want to open.
3. Click on **Open**. The selected project and the related files are listed in the Project Files pane, and the current source file appears in the programs editor area.



## CHAPTER 4


### 4.2 Saving a project

You can save a project either locally, or to a device so that it is then sent to the engraver through an automated procedure. Furthermore, you can save a project to a device as the default project (see [Saving a project as the default project](#)).

#### 4.2.1 Saving a project locally

The following procedure allows saving a project with a `.xqs` extension (Laser Project file) on your disk, for later use or editing.

##### To save the project:

1. To save a new, unnamed project:
  - Choose **File > Save Project** (or click the  button on the toolbar). The project is automatically saved into the default folder, which depends on your operating system. For example, if you are using Windows 7, the default folder is ...  
`C:\Users\UserName\AppData\<Application Name>\Data.`



##### Tip:

To locate the folder where projects are automatically saved in your system, do the following:

- Access the system configuration registry (**Start > Run**, and then digit **regedit**.)
- Navigate to `HKEY_LOCAL_MACHINE\Software\Laservall\DataDirectory` to see the folder's path.

2. To save a copy of an existing project:
  - Choose **File > Save Project as**.
  - In the **Save project as** window that is displayed, either go to the desired location or keep the default one.
  - In the **File name** box, type a new name for the project and click **Save**.

#### 4.2.2 Saving a project to the device

The following procedure allows saving a project to the device to which you are connected.

The projects are saved into the folder that is shared with the Laser Engine. They will be sent to the engraver in an automated way.

##### To save the project to a device:

1. To save a new, unnamed project:
  - From the Project Editor menu bar, choose **File > Save project to device**. The project is saved automatically to the current device.
2. To save a copy of an existing project with a specific name:
  - From the Project Editor menu bar, choose **File > Save project to device as**.
  - In the **Project name** window that is displayed, enter a new name for the project and click **OK**.

### 4.3 Managing files on the device

You can open, save, or delete projects to and from the device to which you are connected. Furthermore, you can save a project as the default.

In order to interact to a device you must be connected with it (see [Connecting to the device](#)).

#### 4.3.1 Opening a project from a device

You can open a project that has been previously saved to a device for edit or test operations, before sending it to the engraver.

**To open a project from a device:**

1. From the Project Editor menu bar, choose **File > Open project from device**.
2. In the window **Laser device projects list** window that is displayed, all projects that have been saved to the device are listed. Select from the list the project you want to open and click **OK**.

#### 4.3.2 Saving a project as the default project

When your project is ready, you can save it to the current device as the default. This way, this project will be automatically executed whenever the **Auto Mode** (default mode) is activated, that is, on any system boot.

**To save a project as the default:**

1. From the Project Editor menu bar, choose **File > Save device default project**.
2. In the window **Laser device projects list** window that is displayed, all projects that have been saved to the device are listed. Select from the list the project you want as the default and click **OK**.

#### 4.3.3 Deleting a project from the device

You can delete a project that has been saved to the device.

**To delete a project:**

1. From the Project Editor menu bar, choose **File > Delete project in device**.
2. In the window **Laser device projects list** window that is displayed, all projects that have been saved to the device are listed. Select from the list the project you want to delete and click **OK**.

## 5 SENDING PROJECTS TO MARKING

This chapter is organized into the following sections:

- [Connecting to the device](#)
- [Running a project](#)
- [Testing a project](#)

## 5.1 Connecting to the device

The laser device that you will use for marking your layouts can be either local, in the case of a stand-alone marking solution, or remote, in the case of a Supervisor unattended marking solution, typically on a production line.

In both cases, you can use the **File** menu to connect to the device.

### To connect to the device:

1. From Project Editor menu bar, choose **File > Connect to device**.
2. In the **Connect to device** device window that is displayed, choose the device you want to connect to.



**Note:**

If you have a Supervision installation of Laser Editor, all available devices are listed, both local and remote (if enabled), while, if you have a Stand-alone installation, only local devices are listed. In the case of a remote device, the **IP Address** is also displayed.

3. Click **OK**.

### Related topics:


- [Running a project](#)
- [Testing a project](#)

## CHAPTER 5

### 5.2 Running a project



When you are ready with your project (see [Creating a project](#)), you can run the program in two ways:

- **In Manual Mode** - By pressing **F5** (or clicking  **Run Project**).
- **In Auto Mode** - By saving the project to the device and executing it at the device level by activating the **Auto Mode**. (See [Saving a project](#)).

#### 5.2.1 Manual Mode vs. Auto Mode

In Auto Mode, programs are executed by the Laser Engine; this means that the currently selected default project is executed.

In order to test your projects you must switch to the Manual Mode. This way, the Laser Engine waits for commands rather than executing programs automatically.

#### To switch to the Manual Mode:

1. From the Project Editor menu bar, choose **File > Switch to Manual Mode**.
2. Select either the device or the simulator and then run the project.


#### 5.2.2 Executing the marking operation

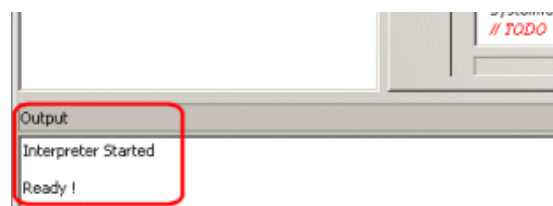



#### Attention:

When you execute a project (that is, when you press Run Project), all the source and resource files that compose it are copied to the device before being executed. Note that any file with the same name will be overwritten.

#### To send the project to the engraver:

1. Be sure that you are in Manual Mode.
2. Do one of the following:
  - Press **F5** or click on  **Run Project** on the toolbar.
  - Choose **Project > Run project** from the menu bar).
3. Note that in the **Output** pane of the Project Editor's window, the results of the operation are displayed. In the example here below the message says that the program has been loaded:



4. To stop the execution, click  **Stop Project**.

**To save a project to the device for next marking:**

From the Project Editor menu bar, do one of the following:

- To save the project, choose **File > Save Project to Device** or **Save Project to Device As**. The project will be sent to the engraver in an automated way. (For further information, see [Saving a project to the device](#)).
- To save the project as the default, choose **File > Save device default project**. (For further information, see [Saving a project as the default project](#)).

### 5.3 Testing a project



Project Editor can be used to test your projects by executing them on the connected device.



**Attention:**

The simulation can only be done in Manual Mode. In Auto Mode the feature is not available and the laser engraving is managed automatically through the Laser Engine (see [Manual Mode vs. Auto Mode](#)).

**To test your program:**

1. Be sure that you have activated the **Manual Mode**. To activate it, from the menu bar, choose **File > Switch to Manual Mode**.

**Note:** This is a toggle command: if the Manual Mode is activated, the command is To Auto Mode, and vice versa.

2. Press **F5** (or click  **Run Project**).
3. To stop the project, click  **Stop Project**.



**Note:**

When you press **Run Project**, a copy of the project that you are executing is automatically saved to the device.

## 6 LASER ENGINE LANGUAGE REFERENCE

### About this reference

This language reference describes the language features provided by **Laser Engine Program for Applications**.

Laser Engine is based on the ECMAScript scripting language, as defined in the *ECMAScript Language Specification*. Microsoft's JScript, and Netscape's JavaScript are also based on the ECMAScript standard.

### Audience

This reference is addressed to developers who will use Project Editor to write their own programs in order to automate marking operations, and to customize Laser Editor so as to suit their environment specific needs.

Readers are assumed to have a basic understanding of programming.

### Contents

This language reference is organized into the following sections:

Section	Contents
<u>Identifiers and reserved words</u>	What are identifiers and reserved keywords that you cannot use
<u>Commenting the code</u>	How to comment the code within your programs
<u>Declarations</u>	How to declare classes, functions, variables, and constants
<u>Control Statements</u>	A full description of the control statements and how to use them in a program.
<u>Classes and Methods (Member functions)</u>	What are classes and methods, and what are qualified names.
<u>Native and Built-in Objects</u>	A description of the native and built-in objects that are supplied with the Laser Engine <b>Program for Applications</b> .
<u>Arguments variable</u>	How to use the arguments variables within functions.
<u>Built-in Constants</u>	A full description of the constants that are provided, which are built into the Laser Engine Program.
<u>Built-in Functions</u>	A full description of the functions that are provided, which are built into the Laser Engine Program.
<u>Built-in Operators</u>	A full description of the operators that are provided, which are built into the Laser Engine Program.

## 6.1 Identifiers and reserved words

### 6.1.1 What are identifiers

Identifiers are the names for things that you get to make up.

Laser Engine Program for Application's identifiers match the regex pattern `[_A-Za-z][_A-Za-z0-9]*`.

The rules for the construction of identifiers are simple: you may use the 52 upper and lower case alphabetic characters, the 10 digits and finally the underscore '\_', which is considered to be an alphabetic character for this purpose. The only restriction is the usual one; identifiers must start with an alphabetic character.

Identifiers are used for variables, constants, class names, function names and labels.

#### See also:

- [Declaring Classes](#)
- [Declaring Variables](#)
- [Declaring Constants](#)
- [Declaring Functions](#)

### 6.1.2 Reserved words (Keywords)

Laser Engine Program reserves some words which are valid identifiers for its own use.



#### Important notice:

You cannot use any of these reserved words as identifiers for variables, functions, methods, or objects.

The following words are used as keywords in proposed extensions and are therefore reserved to allow for the possibility of future adoption of those extensions:

- abstract
- boolean
- byte
- char
- class
- const
- debugger
- double
- enum
- export
- extends
- final
- float
- goto
- implements
- import



## CHAPTER 6

- int
- interface
- long
- native
- package
- private
- protected
- public
- short
- static
- super
- synchronized
- throws
- transient
- volatile

**Related topics:**

- [Declarations](#)
- [Classes and Methods \(Member functions\)](#)
- [Native and Built-in Objects](#)
- [Built-in Constants](#)

## 6.2 Commenting the code

Laser Engine Program for Applications supports the same commenting syntax as C++.

One line comments may appear on a line of their own, or after the statements on a line. Multi-line comments may appear anywhere.

```
// A one line comment.

/*
  A multi-line
  comment.
*/
```

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### 6.3 Declarations

This section describes how to declare classes, functions, variables and constants. They are declared with `class`, `function`, `var` and `const` respectively.

In this section:

- [Declaring Functions](#)
- [Declaring Classes](#)
- [Declaring Variables](#)
- [Declaring Constants](#)

#### 6.3.1 Declaring Functions

A function definition consists of the function keyword, followed by:

- The name of the function.
- A list of arguments to the function, enclosed in parentheses and separated by commas.
- The Laser Engine Program statements that define the function, enclosed in curly braces, { }. The statements in a function can include calls to other functions defined in the current application.

For example, the following code defines a simple function named `square`:

```
function square(number) {
    return number * number;
}
```

#### 6.3.2 Declaring Classes

A class is not defined explicitly; there is no `class` keyword. Instead, you define a new class by defining a **constructor function** that will initialize new objects.

Functions that don't operate on the `this` object ("static" methods) are typically stored as properties of the constructor function, not as properties of the prototype object. The same applies to constants, such as enum values.

The following code defines a simple constructor function for a class called `Person`:

```
function Person(name)
{
    this.name = name;
}
```

When defining **subclasses**, there's a general pattern you can use. The following example shows how to create a subclass of `Person` called `Employee`:

**Example:**

```
function Employee(name, salary)
{
    Person.call(this, name); // call base constructor
    this.salary = salary;
}

// set the prototype to be an instance of the base class
Employee.prototype = new Person();

// initialize prototype
Employee.prototype.toString = function() { ... }
```

Again, you can use the `instanceof` to verify that the class relationship between `Employee` and `Person` has been correctly established:

```
var e = new Employee("Johnny Bravo", 5000000);
print(e instanceof Employee); // true
print(e instanceof Person); // true
print(e instanceof Object); // true
print(e instanceof Array); // false
```

### 6.3.3 Declaring Variables

Variables are declared using the `var` keyword:

```
var a; // undefined
var c = "foliage"; // the string "foliage"
x = 1; // global variable
```

If a variable is assigned to without being declared, it is automatically declared as a global variable.



**Tip:**

Using global variables can make your code difficult to debug and maintain and is not recommended.

Using the `var` keyword you can optionally initialize variables. If just the `variableName` is given, the variable is created, but it has no value, that is, its value is undefined:

```
var variableName;
var anotherVariableName = InitialValue;
```

If an `InitialValue` is given, the variable is created and assigned this `InitialValue`. Variables declared within functions are local to the function in which they are declared. Variables declared outside of functions and classes are global.

**Example:**

```
var i;
var count = 22;
var str = "string";
```

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### 6.3.4 Declaring Constants

Constants are declared using the `const` keyword:

**Syntax:**

```
const identifier = Value;
```

The `const` keyword is used to define constant values. The `identifier` is created as a constant with the given `Value`. The constant is global unless defined within the scope of a `class` or `function`.

Constants must be defined at the point of declaration, because they cannot be changed later.

Constants are public global if they are declared outside of any enclosing braces. When declared within the scope of some braces, that is, within an `if` statement, their scope is local to the enclosing block.

**Example:**

```
const PI2 = Math.PI * 2;  
const COPYRIGHT = "Copyright (c) 2001";
```

## 6.4 Control Statements

The flow--of--control in Laser Engine Program is controlled by control statements.

Statements consist of keywords used with the appropriate syntax. A single statement may span multiple lines. Multiple statements may occur on a single line if each statement is separated by a semicolon.

The following table summarizes the Laser Engine Program Control statements. Click the statement's name for detailed information:

*Table 1 Statements list*

Statement	Description
<a href="#"><u>break</u></a>	Terminates the current loop, switch, or label statement and transfers program control to the statement following the terminated statement.
<a href="#"><u>const</u></a>	Declares a global constant and initializes it to a value.
<a href="#"><u>continue</u></a>	This keyword is used within the context of a <code>for</code> , <code>while</code> or <code>do loop</code> . Terminates execution of the statements in the current iteration of the current or labelled loop, and continues execution of the loop with the next iteration.
<a href="#"><u>for</u></a>	Creates a loop that consists of three optional expressions, enclosed in parentheses and separated by semicolons, followed by a statement executed in the loop.
<a href="#"><u>function</u></a>	Declares a function.
<a href="#"><u>if...else</u></a>	Executes a statement if a specified condition is true. If the condition is false, another statement can be executed.
<a href="#"><u>label</u></a>	Provides an identifier for a statement ( <code>continue</code> ) and refers to it elsewhere in a program.
<a href="#"><u>return</u></a>	Specifies the value to be returned by a function.
<a href="#"><u>switch</u></a>	Evaluates an expression, matching the expression's value to a case label, and executes statements associated with that case.
<a href="#"><u>throw</u></a>	Throws a user-defined exception.
<a href="#"><u>try...catch</u></a>	Marks a block of statements to try, and specifies a response, should an exception be thrown.
<a href="#"><u>var</u></a>	Declares a variable, optionally initializing it to a value.
<a href="#"><u>while</u></a>	Creates a loop that executes a specified statement as long as the test condition evaluates to true. The statement is executed after evaluating the condition.
<a href="#"><u>with</u></a>	Extends the scope chain for a statement.

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## CHAPTER 6

### 6.4.1 Break

#### Summary

Terminates the current loop, switch, or label statement and transfers program control to the statement following the terminated statement.

#### Syntax

```
break [label];
```

#### Parameters

Parameter	Description
label	Identifier associated with the label of the statement. If the statement is not a loop or switch, this is required.

#### Description

The `break` statement includes an optional label that allows the program to break out of a labeled statement. The `break` statement needs to be nested within this labelled statement. The labelled statement can be any block statement; it does not have to be preceded by a loop statement.

#### Examples

The following function has a `break` statement that terminates the while loop when `i` is 3, and then returns the value `3 * x`.

```
function testBreak(x) {
    var i = 0;
    while (i < 6) {
        if (i == 3) {
            break;
        }
        i += 1;
    }
    return i * x;
}
```

#### Related topics:

- [continue](#), [switch](#)

## 6.4.2 Const

### Summary

Declares a read-only, named constant.

### Syntax

```
const varname1 [= value1], varname2 [= value2], ..., varnameN [= valueN];
```

### Parameters

Parameter	Description
varnameN	Constant name. It can be any legal identifier.
valueN	Value of the constant. It can be any legal expression.

### Description

Creates a constant that can be global or local to the function in which it is declared. Constants follow the same scope rules as variables.

The value of a constant cannot change through re-assignment, and a constant cannot be re-declared. Because of this, although it is possible to declare a constant without initializing it, it would be useless to do so.

A constant cannot share its name with a function or a variable in the same scope.

### Examples

The following example produces the output "a is 7."

```
const a = 7;
print("a is " + a + ".");
```

### Related topics:

- [var](#)



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### 6.4.3 Continue

#### Summary

Terminates execution of the statements in the current iteration of the current or labelled loop, and continues execution of the loop with the next iteration.

#### Syntax

```
continue [label];
```

#### Parameters

Parameter	Description
label	Identifier associated with the label of the statement

#### Description

In contrast to the [break](#) statement, `continue` does not terminate the execution of the loop entirely; instead,

- In a [while](#) loop, it jumps back to the condition.
- In a [for](#) loop, it jumps to the update expression.

The `continue` statement can include an optional label that allows the program to jump to the next iteration of a labelled loop statement instead of the current loop. In this case, the `continue` statement needs to be nested within this labelled statement.

#### Examples

##### Using `continue` with `while`

The following example shows a [while](#) loop that has a `continue` statement that executes when the value of `i` is 3. Thus, `n` takes on the values 1, 3, 7, and 12.

```
i = 0;
n = 0;
while (i < 5) {
    i++;
    if (i == 3)
        continue;
    n += i;
}
```

##### Using `continue` with a label

In the following example, a statement labeled `checkiandj` contains a statement labeled `checkj`. If `continue` is encountered, the program continues at the top of the `checkj` statement. Each time `continue` is encountered, `checkj` reiterates until its condition returns false. When false is returned, the remainder of the `checkiandj` statement is completed.

If `continue` had a label of `checkiandj`, the program would continue at the top of the `checkiandj` statement.

```

checkiandj:
while (i < 4) {
    print(i );
    i += 1;

    checkj:
    while (j > 4) {
        print(j );
        j -= 1;
        if ((j % 2) == 0)
            continue checkj;
        print(j + " is odd.");
    }
    print("i = " + i);
    print("j = " + j);
}
    
```

### Related topics:

- [break, label](#)

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### 6.4.4 For

#### Summary

Creates a loop that consists of three optional expressions, enclosed in parentheses and separated by semicolons, followed by a statement executed in the loop.

#### Syntax

```
for ([initial-expression]; [condition]; [final-expression])
    statement
```

#### Parameters

Parameter	Description
initial-expression	An expression (including assignment expressions) or variable declaration. Typically used to initialize a counter variable. This expression may optionally declare new variables with the <code>var</code> keyword. These variables are not local to the loop, that is, they are in the same scope the <code>for</code> loop is in. The result of this expression is discarded.
condition	An expression to be evaluated before each loop iteration. If this expression evaluates to true, <code>statement</code> is executed. This conditional test is optional. If omitted, the condition always evaluates to true. If the expression evaluates to false, execution skips to the first expression following the <code>for</code> construct.
final-expression	An expression to be evaluated at the end of each loop iteration. This occurs before the next evaluation of <code>condition</code> . Generally used to update or increment the counter variable.
statement	A statement that is executed as long as the condition evaluates to true.

#### Examples

The following `for` statement starts by declaring the variable `i` and initializing it to 0. It checks that `i` is less than nine, performs the two succeeding statements, and increments `i` by 1 after each pass through the loop:

```
for (var i = 0; i < 9; i++) {
    n += i;
    myfunc(n);
}
```

## 6.4.5 Function

### Summary

Declares a function with the specified parameters.

### Syntax

```
function name([param] [, param] [..., param]) {
    statements
}
```

### Parameters

Parameter	Description
name	The function name.
param	The name of an argument to be passed to the function. A function can have up to 255 arguments.
statements	The statements which comprise the body of the function.

### Description

To return a value, the function must have a return statement that specifies the value to return.

A function created with the `function` statement is a `Function` object and has all the properties, methods, and behavior of `Function` objects.

A function can also be declared inside an expression. In this case the function is usually anonymous. See function operator for more information about the `function` (function expression).

Functions can be conditionally declared. That is, a function definition can be nested within an `if` statement. Technically, such declarations are not actually function declarations; they are function expressions.

### Examples

The following code declares a function that returns the total dollar amount of sales, when given the number of units sold of products `a`, `b`, and `c`.

```
function calc_sales(units_a, units_b, units_c) {
    return units_a*79 + units_b * 129 + units_c * 699;
}
```

### Related topics:

- [Built-in Functions](#)

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### 6.4.6 If...else

#### Summary

Executes a statement if a specified condition is true. If the condition is false, another statement can be executed.

#### Syntax

```
if (condition)
    statement1
[else
    statement2]
```

#### Parameters

Parameter	Description
condition	An expression that evaluates to true or false.
statement1	Statement that is executed if <code>condition</code> evaluates to true. Can be any statement, including further nested <code>if</code> statements.
statement2	Statement that is executed if <code>condition</code> evaluates to false and the <code>else</code> clause exists. Can be any statement, including block statements and further nested <code>if</code> statements.

#### Description

Multiple `if...else` statements can be nested to create an `else if` clause:

```
if (condition1)
    statement1
else if (condition2)
    statement2
else if (condition3)
    statement3
...
else
    statementN
```

To see how this works, this is how it would look like if the nesting were properly indented:

```
if (condition1)
    statement1
else
    if (condition2)
        statement2
    else
        if (condition3)
            ...
```

Do not confuse the primitive boolean values `true` and `false` with the true and false values of the `Boolean` object. Any value that is not `undefined`, `null`, `0`, `NaN`, or the empty string (`""`), and any object, including a `Boolean` object whose value is `false`, evaluates to `true` when passed to a conditional statement. For example:

```
var b = new Boolean(false);
if (b) // this condition evaluates to true
```

## Examples

### Using `if ... else`

```
if (cipher_char == from_char) {
    result = result + to_char;
    x++;
} else
    result = result + clear_char;
```

### Assignment within the conditional expression

It is advisable to not use simple assignments in a conditional expression, because the assignment can be confused with equality when glancing over the code. For example, do not use the following code:

```
if (x = y) {
    /* do the right thing */
}
```

If you need to use an assignment in a conditional expression, a common practice is to put additional parentheses around the assignment. For example:

```
if ((x = y)) {
    /* do the right thing */
}
```

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### 6.4.7 Label

#### Summary

Provides a statement with an identifier that you can refer to using a [break](#) or [continue](#) statement.

For example, you can use a label to identify a loop, and then use the [break](#) or [continue](#) statement to indicate whether a program should interrupt the loop or continue its execution.

#### Syntax

```
label :
    statement
```

#### Parameters

Parameter	Description
label	Any Laser Engine Program identifier that is not a reserved word.
statement	Statements. <code>break</code> can be used with any labeled statement, and <code>continue</code> can be used with looping labeled statements.

#### Examples

For an example of a label statement using `break`, see [break](#). For an example of a label statement using `continue`, see [continue](#).

### 6.4.8 Return

#### Summary

Specifies the value to be returned by a function.

#### Syntax

```
return [expression];
```

#### Parameters

Parameter	Description
expression	The expression to return. If omitted, <code>undefined</code> is returned instead.

#### Examples

The following function returns the square of its argument, `x`, where `x` is a number.

```
function square(x) {
    return x * x;
}
```

## 6.4.9 Switch

### Summary

Evaluates an expression, matching the expression's value to a case label, and executes statements associated with that case.

### Syntax

```
switch (expression) {
  case label1:
    statements1
    [break;]
  case label2:
    statements2
    [break;]
  ...
  case labelN:
    statementsN
    [break;]
  default:
    statements_def
    [break;]
}
```

### Parameters

Parameter	Description
expression	An expression matched against each label.
labelN	Identifier used to match against expression.
statementsN	Statements that are executed if expression matches the associated label.
statements_def	Statements that are executed if expression does not match any label.

### Description

If a match is found, the program executes the associated statements. If multiple cases match the provided value, the first case that matches is selected, even if the cases are not equal to each other.

The program first looks for a `case` clause with a label matching the value of `expression` and then transfers control to that clause, executing the associated statements. If no matching label is found, the program looks for the optional `default` clause, and if found, transfers control to that clause, executing the associated statements. If no `default` clause is found, the program continues execution at the statement following the end of `switch`. By convention, the `default` clause is the last clause, but it does not need to be so.

The optional `break` statement associated with each case label ensures that the program breaks out of `switch` once the matched statement is executed and continues execution at the statement following `switch`. If `break` is omitted, the program continues execution at the next statement in the `switch` statement.



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### Examples

In the following example, if expression evaluates to "Bananas", the program matches the value with case "Bananas" and executes the associated statement. When `break` is encountered, the program breaks out of `switch` and executes the statement following `switch`. If `break` were omitted, the statement for case "Cherries" would also be executed.

```
switch (expr) {
    case "Oranges":
        print("Oranges are $0.59 a pound.");
        break;
    case "Apples":
        print("Apples are $0.32 a pound.");
        break;
    case "Bananas":
        print("Bananas are $0.48 a pound.");
        break;
    case "Cherries":
        print("Cherries are $3.00 a pound.");
        break;
    case "Mangoes":
    case "Papayas":
        print("Mangoes and papayas are $2.79 a pound.");
        break;
    default:
        print("Sorry, we are out of " + expr + ".");
}
print("Is there anything else you'd like?");
```

### 6.4.10 Throw

#### Summary

Throws a user-defined exception.

#### Syntax

```
throw expression;
```

#### Parameters

Parameter	Description
expression	The expression to throw.

#### Description

Use the `throw` statement to throw an exception. When you throw an exception, `expression` specifies the value of the exception. Each of the following throws an exception:

```
throw "Error2"; // generates an exception with a string value
throw 42; // generates an exception with the value 42
throw true; // generates an exception with the value true
```

#### Examples

##### Throw an object

You can specify an object when you throw an exception. You can then reference the object's properties in the `catch` block. The following example creates an object `myUserException` of type `UserException` and uses it in a `throw` statement.

```
function UserException(message) {
    this.message = message;
    this.name = "UserException";
}
function getMonthName(mo) {
    mo = mo-1; // Adjust month number for array index (1=Jan,
    12=Dec)
    var months = new Array("Jan", "Feb", "Mar", "Apr", "May",
    "Jun", "Jul", "Aug", "Sep", "Oct", "Nov", "Dec");
    if (months[mo] != null) {
        return months[mo];
    } else {
        myUserException = new UserException("InvalidMonthNo");
        throw myUserException;
    }
}

try {
    // statements to try
    monthName = getMonthName(myMonth);
} catch (e) {
    monthName = "unknown";
    logMyErrors(e.message, e.name); // pass exception object to
err handler
}
```

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### Another example of throwing an object

The following example tests an input string for a U.S. zip code. If the zip code uses an invalid format, the `throw` statement throws an exception by creating an object of type `ZipCodeFormatException`.

```

/*
 * Creates a ZipCode object.
 *
 * Accepted formats for a zip code are:
 *   12345
 *   12345-6789
 *   123456789
 *   12345 6789
 *
 * If the argument passed to the ZipCode constructor does not
 * conform to one of these patterns, an exception is thrown.
 */

function ZipCode(zip) {
    zip = new String(zip);
    pattern = /[0-9]{5}([- ]?[0-9]{4})?/;
    if (pattern.test(zip)) {
        // zip code value will be the first match in the string
        this.value = zip.match(pattern)[0];
        this.valueOf = function() {
            return this.value
        };
        this.toString = function() {
            return String(this.value)
        };
    } else {
        throw new ZipCodeFormatException(zip);
    }
}

function ZipCodeFormatException(value) {
    this.value = value;
    this.message = "does not conform to the expected format for a
zip code";
    this.toString = function() {
        return this.value + this.message
    };
}

/*
 * This could be in a script that validates address data
 * for US addresses.
 */

var ZIPCODE_INVALID = -1;
var ZIPCODE_UNKNOWN_ERROR = -2;

function verifyZipCode(z) {
    try {
        z = new ZipCode(z);
    } catch (e) {
        if (e instanceof ZipCodeFormatException) {
            return ZIPCODE_INVALID;
        } else {

```

```

        return ZIPCODE_UNKNOWN_ERROR;
    }
}
return z;
}

a = verifyZipCode(95060);           // returns 95060
b = verifyZipCode(9560);           // returns -1
c = verifyZipCode("a");            // returns -1
d = verifyZipCode("95060");        // returns 95060
e = verifyZipCode("95060 1234");   // returns 95060 1234

```

#### 6.4.10.1.1 Rethrow an exception

You can use `throw` to rethrow an exception after you catch it. The following example catches an exception with a numeric value and rethrows it if the value is over 50. The rethrown exception propagates up to the enclosing function or to the top level so that the user sees it.

```

try {
    throw n; // throws an exception with a numeric value
} catch (e) {
    if (e <= 50) {
        // statements to handle exceptions 1-50
    } else {
        // cannot handle this exception, so rethrow
        throw e;
    }
}

```

## CHAPTER 6

### 6.4.11 Try...catch

#### Summary

Marks a block of statements to try, and specifies a response, should an exception be thrown.

#### Syntax

```
try {
    try_statements
}
[catch (exception_var_1 if condition_1) {
    catch_statements_1
}]
...
[catch (exception_var_2) {
    catch_statements_2
}]
[finally {
    finally_statements
}]
```

#### Parameters

Parameter	Description
try_statements	The statements to be executed.
catch_statements_1, catch_statements_2	Statements that are executed if an exception is thrown in the try block.
exception_var_1, exception_var_2	An identifier to hold an exception object for the associated catch clause.
condition_1	A conditional expression.
finally_statements	Statements that are executed after the try statement completes. These statements execute regardless of whether or not an exception was thrown or caught.

#### Description

The try statement consists of a try block, which contains one or more statements, and at least one catch clause or a finally clause, or both. That is, there are three forms of the try statement:

1. try...catch
2. try...finally
3. try...catch...finally

A catch clause contain statements that specify what to do if an exception is thrown in the try block. That is, you want the try block to succeed, and if it does not succeed, you want control to pass to the catch block. If any statement within the try block (or in a function called from within the try block) throws an exception, control immediately shifts to the catch clause. If no exception is thrown in the try block, the catch clause is skipped.

The finally clause executes after the try block and catch clause(s) execute but before the statements following the try statement. It always executes, regardless of whether or not an exception was thrown or caught.

You can nest one or more try statements. If an inner try statement does not have a catch clause, the enclosing try statement's catch clause is entered.

You also use the try statement to handle Java exceptions.

## Unconditional catch clause

When a single, unconditional `catch` clause is used, the `catch` block is entered when any exception is thrown. For example, when the exception occurs in the following code, control transfers to the `catch` clause.

```
try {
    throw "myException"; // generates an exception
}
catch (e) {
    // statements to handle any exceptions
    logMyErrors(e); // pass exception object to error handler
}
```

## The exception identifier

When an exception is thrown in the `try` block, `exception_var` (e.g. the `e` in `catch (e)`) holds the value specified by the `throw` statement. You can use this identifier to get information about the exception that was thrown.

This identifier is local to the `catch` clause. That is, it is created when the `catch` clause is entered, and after the `catch` clause finishes executing, the identifier is no longer available.

## The finally clause

The `finally` clause contains statements to execute after the `try` block and `catch` clause(s) execute but before the statements following the `try` statement. The `finally` clause executes regardless of whether or not an exception is thrown. If an exception is thrown, the statements in the `finally` clause execute even if no `catch` clause handles the exception.

You can use the `finally` clause to make your script fail gracefully when an exception occurs; for example, you may need to release a resource that your script has tied up. The following example opens a file and then executes statements that use the file (server-side Laser Engine Program allows you to access files). If an exception is thrown while the file is open, the `finally` clause closes the file before the script fails.

```
openMyFile()
try {
    // tie up a resource
    writeMyFile(theData);
}
finally {
    closeMyFile(); // always close the resource
}
```

## Examples:

See the examples for [throw](#)

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### 6.4.12 Var

#### Summary

Declares a variable, optionally initializing it to a value.

#### Syntax

```
var varname1 [= value1], varname2 [= value2], ..., varnameN [= valueN];
```

#### Parameters

Parameter	Description
varnameN	Variable name. It can be any legal identifier.
valueN	Initial value of the variable. It can be any legal expression.

#### Description

The scope of a variable is the current function or, for variables declared outside a function, the current application.

Using `var` outside a function is optional; assigning a value to an undeclared variable implicitly declares it as a global variable. However, it is recommended to always use `var`, and it is necessary within functions in the following situations:

- If a variable in a scope containing the function (including the global scope) has the same name.
- If recursive or multiple functions use variables with the same name and intend those variables to be local.

Failure to declare the variable in these cases will very likely lead to unexpected results.

#### Examples

The following example declares two variables, `num_hits` and `cust_no`, and initializes both to the value 0.

```
var num_hits = 0, cust_no = 0;
```

### 6.4.13 While

#### Summary

Creates a loop that executes a specified statement as long as the test condition evaluates to true. The condition is evaluated before executing the statement.

#### Syntax

```
while (condition)
    statement
```

#### Parameters

Parameter	Description
condition	An expression evaluated before each pass through the loop. If this condition evaluates to true, statement is executed. When condition evaluates to false, execution continues with the statement after the <code>while</code> loop.
statement	A statement that is executed as long as the condition evaluates to true.

#### Examples

The following `while` loop iterates as long as `n` is less than three.

```
n = 0;
x = 0;
while (n < 3) {
    n++;
    x += n;
}
```

Each iteration, the loop increments `n` and adds it to `x`. Therefore, `x` and `n` take on the following values:

- After the first pass: `n = 1` and `x = 1`
- After the second pass: `n = 2` and `x = 3`
- After the third pass: `n = 3` and `x = 6`

After completing the third pass, the condition `n < 3` is no longer true, so the loop terminates.



## CHAPTER 6

### 6.4.14 With

#### Summary

Extends the scope chain for a statement.

#### Syntax

```
with (object)
    statement
```

#### Parameters

Parameter	Description
object	Adds the given object to the scope chain used when evaluating the statement. The parentheses around object are required.
statement	Any statement.

#### Description

Laser Engine Program looks up an unqualified name by searching a scope chain associated with the execution context of the script or function containing that unqualified name. The 'with' statement adds the given object to the head of this scope chain during the evaluation of its statement body. If an unqualified name used in the body matches a property in the scope chain, then the name is bound to the property and the object containing the property. Otherwise a 'ReferenceError' is thrown.

#### Performance Pro & Con

- **Pro:** 'with' can help reduce file size by reducing the need to repeat a lengthy object reference without performance penalty. The scope chain change required by 'with' is not computationally expensive. Use of 'with' will relieve the interpreter of parsing repeated object references. Note, however, that in many cases this benefit can be achieved by using a temporary variable to store a reference to the desired object.
- **Con:** 'with' forces the specified object to be searched first for all unqualified name lookups. Therefore all identifiers that match formal function argument and declared local variable names will be found more slowly in a 'with' block. Where performance is important, 'with' would likely only be used to encompass code blocks that do not use function argument and declared local variable identifiers.

#### Ambiguity Con

- **Con:** 'with' makes it hard for a human reader or Laser Engine Program compiler to decide whether an unqualified name will be found along the scope chain, and if so, in which object. So given this example:

```
function f(x, o) {
    with (o)
        print(x);
}
```

only when `f` is called is `x` either found or not, and if found, either in `o` or (if no such property exists) in `f`'s activation object, where `x` names the first formal argument. If you forget to define `x` in the object you pass as the second argument, or if there's some similar bug or confusion, you won't get an error -- just unexpected results.

## Examples

The following `with` statement specifies that the `Math` object is the default object. The statements following the `with` statement refer to the `PI` property and the `cos` and `sin` methods, without specifying an object. Laser Engine Program assumes the `Math` object for these references.

```
var a, x, y;
var r = 10;
with (Math) {
    a = PI * r * r;
    x = r * cos(PI);
    y = r * sin(PI / 2);
}
```

## 6.5 Classes and Methods (Member functions)

Laser Engine Program is a fully object oriented language.

A class's constructor is the function which has the same (case-sensitive) name as the class itself. The constructor should not contain an explicit return statement; it will return an object of its type automatically. Laser Engine Program does not have a destructor function (a function that is called when the class is destroyed), for a class.

The class's member variables are declared with `var` (see [Declaring Variables](#)), and its member functions (methods) with function (see [Declaring Functions](#)).

The object instance itself is referred to using the [this operator](#). Inside a member function of a class, member variables and member functions can be accessed with an explicit `this` (e.g. `this.x = posX;`). This is not required, but can sometimes help to increase visibility.

Laser Engine Program supports single inheritance, and if a class inherits from another class, the constructor of the superclass constructor can be called with `super()`.

### For further information:

- [Qualified Names](#)
- [Class Properties](#)
- [Declaring Classes](#)

### 6.5.1 Qualified Names

When you declare an object of a particular type, the object itself becomes, in effect, a namespace. For example, in Laser Engine Program there is a function called `Math.sin()`. If you want to have a *sin()* function in your own class that would not be a problem, because objects of your class would call the function using the `object.function()` syntax. The period is used to distinguish the namespace a particular identifier belongs to.

For example, in a Laser Engine Program GUI application, every application object belongs to the `Application` object. This can lead to some rather lengthy code, for example `Application.Dialog.ListBox.count`. Such long names can often be shortened, for example, within a signal handler, e.g. `this.ListBox.count`.

In practice, Laser Engine Program is intelligent enough to work out the fully qualified name, so the code you would actually write is simply `ListBox.count`. The only time that you need to qualify your names is when an unqualified name is ambiguous.

### 6.5.2 Class Properties

A property is an undeclared variable that can be written to and accessed if the class supports properties. The classes supporting properties are the application objects and the classes provided by the object and wrapper factories.

```
var obj = new Object
    object.myProperty = 100;
```

The class `Object` does not define the variable `myProperty`, but since the class supports properties, we can define the variable with that name on the fly and use it later. Properties are associated with the object they are assigned to, so even though the object `obj` in the example above gets the property `myProperty`, it does not mean that other objects of type `Object` will have the `myProperty` property, unless explicitly stated.

## 6.6 Native and Built-in Objects

Reference documentation for native and built-in objects is organized as follows:

Objects	Description
<b><u>Native Objects</u></b>	This set of objects is supplied by the Laser Engine Program implementation. Some native objects are built-in, while other may be constructed during the course of execution of a Laser Engine Program.
<b><u>Graphical User Interface Objects</u></b>	This set of objects allows defining the graphical interface of the application (dialogs, checkbox, buttons, and so forth).
<b><u>Base System Objects</u></b>	This set of objects allows defining the system interface, as well as accessing directories and files, or interacting with external programs.
<b><u>Laser Graphical Objects</u></b>	This set of objects allows managing the documents and all of the graphic objects they may contain (arrays, codes, strings, and so forth).
<b><u>Laser System Objects</u></b>	This set of objects allows managing the low-level laser system, that is, axis movement and I/O modules.

### Related topics:

- [Built-in Constants](#)
- [Built-in Functions](#)
- [Control Statements](#)

### 6.6.1 Native Objects

Native objects are supplied by the Laser Engine Program implementation. Some native objects are built-in; others may be constructed during the course of execution of a Laser Engine Program.

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### In this section the following objects are described:

- [Math](#)
- [Array](#)
- [Boolean](#)
- [Date](#)
- [Number](#)
- [RegExp](#)
- [String](#)

## CHAPTER 6

### 6.6.1.1 Math

The built-in `Math` object provides a variety of functions, including all the common mathematical functions. [More...](#)

#### Math Functions

Number	<code>Math::abs ( Number number );</code>
Number	<code>Math::acos ( Number number );</code>
Number	<code>Math::asin ( Number number );</code>
Number	<code>Math::atan ( Number number );</code>
Number	<code>Math::atan2 ( Number yCoord, Number xCoord );</code>
Number	<code>Math::ceil ( Number number );</code>
Number	<code>Math::cos ( Number number );</code>
Number	<code>Math::exp ( Number number );</code>
Number	<code>Math::floor ( Number number );</code>
Number	<code>Math::log ( Number number );</code>
Number	<code>Math::max ( Number number1, Number number2 );</code>
Number	<code>Math::min ( Number number1, Number number2 );</code>
Number	<code>Math::pow ( Number number, Number power);</code>
Number	<code>Math::random ( );</code>
Number	<code>Math::round ( Number number );</code>
Number	<code>Math::sin ( Number number );</code>
Number	<code>Math::sqrt ( Number number );</code>
Number	<code>Math::tan ( Number number );</code>

#### Math Properties

Number	<code>E</code>
Number	<code>LN2</code>
Number	<code>LN10</code>
Number	<code>LOG2E</code>
Number	<code>LOG10E</code>
Number	<code>PI</code>
Number	<code>SQRT1_2</code>
Number	<code>SQRT2</code>

#### Detailed description

The built-in `Math` object provides a variety of functions, including all the common mathematical functions.

The `Math` object always exists in a Laser Engine program. Use the `Math` object to access mathematical constants and functions, for example.

```
var x, angle, y;
with ( Math ) {
x = PI * 2;
angle = 1.3;
y = x * sin( angle );
}
```

## Math functions documentation

### **Math::abs ( Number *number* );**

Returns the absolute value of the given number.

The equivalent of:

$$x = x < 0 ? -x : x;$$

```
var x = -99;
var y = 99;
with ( Math ) {
  x = abs( x );
  y = abs( y );
}
if ( x == y )
    print( "equal" );
```

### **Math::acos ( Number *number* );**

Returns the arccosine of the given number in radians between 0 and `Math.PI`. If the number is out of range, returns `NaN`.

### **Math::asin ( Number *number* );**

Returns the arcsine of the given number in radians between `-Math.PI/2` and `Math.PI/2`. If the number is out of range, returns `NaN`.

### **Math::atan ( Number *number* );**

Returns the arctangent of the given number in radians between `-Math.PI/2` and `Math.PI/2`. If the number is out of range, returns `NaN`.

### **Math::atan2 ( Number *yCoord*, Number *xCoord* );**

Returns the counter-clockwise angle in radians between the positive x-axis and the point at (`xCoord`, `yCoord`). The value returned is always between `-Math.PI` and `Math.PI`.

The following shows an example:

```
function polar( x, y )
{
    return Math.atan2( y, x );
}
```

### **Math::ceil ( Number *number* );**

If the number is an integer, it returns the number. If the number is a floating point value, it returns the smallest integer greater than the number.

The following shows an example:

```
var x = 913.41;
x = Math.ceil( x ); // x == 914
var y = -33.97;
y = Math.ceil( y ); // y == -33
```

### **Math::cos ( Number *number* );**

Returns the cosine of the given number. The value will be in the range `-1..1`.

### **Math::exp ( Number *number* );**

Returns `Math.E` raised to the power of the given number.

### **Math::floor ( Number *number* );**

If the number is an integer, it returns the number. If the number is a floating point value, it

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returns the greatest integer less than the number.

### **Math::log ( Number *number* );**

If the number is  $> 0$ , it returns the natural logarithm of the given number. If the number is 0, it returns Infinity. If the number is  $< 0$ , it returns NaN.

### **Math::max ( Number *number1*, Number *number2* );**

Returns the largest of *number1* and *number2*.

### **Math::min ( Number *number1*, Number *number2* );**

Returns the smallest of *number1* and *number2*.

### **Math::pow ( Number *number*, Number *power*);**

Returns the value of the *number* raised to the *power*.

### **Math::random ( );**

Returns a pseudo-random floating point number between 0 and 1. Pseudo random numbers are not truly random, but may be adequate for some applications, for example, games and simple simulations.

### **Math::round ( Number *number* );**

Returns the number rounded to the nearest integer. If the fractional part of the number is  $\geq 0.5$ , the number is rounded up; otherwise it is rounded down.

### **Math::sin ( Number *number* );**

Returns the sine of the given number. The value will be in the range  $-1 . . 1$ .

### **Math::sqrt ( Number *number* );**

If the number is  $\geq 0$ , it returns the square root. If the number is  $< 0$ , it returns NaN.

### **Math::tan ( Number *number* );**

Returns the tangent of the given number.

## Math properties documentation

All the `Math` properties are read-only constants.

### **E**

Eulers constant. The base for natural logarithms.

### **LN2**

Natural logarithm of 2.

### **LN10**

Natural logarithm of 10.

### **LOG2E**

Base 2 logarithm of E.

### **LOG10E**

Base 10 logarithm of E.

### **PI**

Ratio of the circumference of a circle to its diameter.

### **SQRT1\_2**

Square root of 1/2; equivalently, 1 over the square root of 2.

### **SQRT2**

Square root of 2.



## CHAPTER 6

### 6.6.1.2 Array

An Array is a datatype which contains a named list of items. [More...](#)

#### Array functions

Array	<a href="#">Array::concat ( Array a1, Array a2 ... aN );</a>
String	<a href="#">Array::join ( String optSeparator );</a>
Object	<a href="#">Array::pop ();</a>
Number	<a href="#">Array::push ( item1, optItem2, ... optItemN );</a>
void	<a href="#">Array::reverse ();</a>
Object	<a href="#">Array::shift ();</a>
Array	<a href="#">Array::slice ( Number startIndex, Number optEndIndex );</a>
Number	<a href="#">Array::sort ( Function optComparisonFunction );</a>
Array	<a href="#">Array::splice ( Number startIndex, Number replacementCount, optItem1, ... optItemN );</a>
String	<a href="#">Array::toString ();</a>
Number	<a href="#">Array::unshift ( String expression, optExpression1, ... optExpressionN );</a>

#### Array properties

Number	<a href="#">length</a>
--------	------------------------

#### Detailed description

An Array is a datatype which contains a named list of items. The items can be any Laser Engine object. Multi-dimensional arrays are achieved by setting array items to be arrays themselves. Arrays can be extended dynamically simply by creating items at non-existent index positions.

- Items can also be added using `push()`, `unshift()` and `splice()`.
- Arrays can be concatenated together using `concat()`.
- Items can be extracted using `pop()`, `shift()` and `slice()`.
- Items can be deleted using `splice()`.
- Arrays can be turned into strings using `join()` or `Array::toString()`.
- Use `reverse()` to reverse the items in an array, and `sort()` to sort the items. The `sort()` function can be passed a comparison function for customized sort orders.

In general, operations that copy array items perform a deep copy on items that are `Number` or `String` objects, and a shallow copy on other objects.

#### Array constructor documentation

Arrays can be constructed from array literals or using the [new operator](#):

```
var mammals = [ "human", "dolphin", "elephant", "monkey" ];
var plants = new Array( "flower", "tree", "shrub" );
var things = [];
for ( i = 0; i < mammals.length; i++ ) {
    things[i] = new Array( 2 );
    things[i][0] = mammals[i];
    things[i][1] = plants[i];
}
```

Arrays can be initialized with a size, but with all items undefined:

```
var a = new Array( 10 ); // 10 items
```

## Array access

Array items are accessed via their names. Names can be either integers or strings.

```
var m2 = mammals[2];
mammals[2] = "gorilla";
var thing = things[2][1]
```

The first statement retrieves the value of the third item of the `mammals` array and assigns it to `m2`, which now contains "monkey". The second statement replaces the third item of the `mammals` array with the value "gorilla". The third statement retrieves the second item of the third item's array from the `things` array and assigns it to `thing`, which now contains "shrub".

As stated above, it is also possible to access the arrays using strings. These act as normal properties, and can be accessed either using the square bracket operator (`[]`) or by directly dereferencing the array object and specifying the property name (`.name`). These two accessor types can be mixed freely as seen below with the `address` and `phoneNumber` properties:

```
var names = [];
names["first"] = "John";
names["last"] = "Doe";
var firstName = names["first"];
var lastName = names["last"];

names["address"] = "Somewhere street 2";
names.phoneNumber = "+0123456789";
var address = names.address;
var phoneNumber = names["phoneNumber"];
```

## Array functions documentation

### **Array::concat ( Array *a1*, Array *a2* ... *aN* );**

Concatenates the array with one or more other arrays in the given order, and returns a single array.

#### **Parameter:**

*a1* ... *aN* - Arrays and/or values to concatenate to the resulting array.

```
var x = new Array( "a", "b", "c" );
var y = x.concat( [ "d", "e" ], [ 90, 100 ] );
// y == [ "a", "b", "c", "d", "e", 90, 100 ]
```

### **Array::join ( String *optSeparator* );**

Joins all the items of an array together, separated by commas, or by the specified `optSeparator`.

```
var x = new Array( "a", "b", "c" );
var y = x.join();           // y == "a,b,c"
var z = x.join( " * " );   // y == "a * b * c"
```

### **Array::pop ( );**

Pops (that is, removes) the top-most (right-most) item off the array and returns it.

```
var x = new Array( "a", "b", "c" );
var y = x.pop(); // y == "c"  x == [ "a", "b" ]
```

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### **Array::push ( *item1*, *optItem2*, ... *optItemN* );**

Pushes (that is, inserts) the given items onto the top (right) end of the array. The function returns the new length of the array.

**Parameter:**

*item1* ... *optItemN* - The items to add to the array.

```
var x = new Array( "a", "b", "c" );
x.push( 121 ); // x == [ "a", "b", "c", 121 ]
```

### **Array::reverse ( );**

Reverses the items in the array.

```
var x = new Array( "a", "b", "c", "d" );
x.reverse(); // x == [ "d", "c", "b", "a" ]
```

### **Array::shift ( );**

Shifts (that is, removes) the bottom-most (left-most) item off the array and returns it.

```
var x = new Array( "a", "b", "c" );
var y = x.shift(); // y == "a" x == [ "b", "c" ]
```

### **Array::slice ( Number *startIndex*, Number *optEndIndex* );**

Extracts a slice of the array from the item with the given starting index to the item before the item with the given ending index, *optEndIndex*.

**Parameters:**

*startIndex* - Zero-based index at which to begin extraction.

*optEndIndex* - Zero-based index at which to end extraction. `slice` extracts up to but not including end.

If no ending index is given, all items from the starting index onward are sliced.

```
var x = new Array( "a", "b", "c", "d" );
var y = x.slice( 1, 3 ); // y == [ "b", "c" ]
var z = x.slice( 2 ); // z == [ "c", "d" ]
```

### **Array::sort ( Function *optComparisonFunction* );**

Sorts the items in the array using string comparison.

**Parameter:**

*optComparisonFunction* - Specifies a function that defines the sort order. If omitted, the array is sorted lexicographically (in dictionary order) according to the string conversion of each element.

For customized sorting, pass the `sort()` function a comparison function, *optComparisonFunction*, that has the following signature and behavior:

```
var x = new Array( "d", "x", "a", "c" );
x.sort(); // x == [ "a", "c", "d", "x" ]
function comparisonFunction( a, b ) // signature
```

The function above must return an integer as follows:

- -1 if  $a < b$
- 0 if  $a == b$
- 1 if  $a > b$

The following is an example:

```
function numerically( a, b ) { return a < b ? -1 : a > b ? 1 : 0; }
var x = new Array( 8, 90, 1, 4, 843, 221 );
x.sort( numerically ); // x == [ 1, 4, 8, 90, 221, 843 ]
```

### **Array::splice ( Number *startIndex*, Number *replacementCount*, *optItem1*, ... *optItemN* );**

Splices items into the array and out of the array.

#### **Parameters**

*startIndex* - The index at which to start changing the array.

*replacementCount* - The number of items that are to be replaced.

*optItem1* ... *optItemN* - The items to be inserted.

Make the second argument 0 if you are simply inserting items. If you are simply deleting items, the second argument must be > 0 (that is, the number of items to delete), and there must be no new items given.

```
var x = new Array( "a", "b", "c", "d" );

// 2nd argument 0, plus new items ==> insertion
x.splice( 1, 0, "X", "Y" );
// x == [ "a", "X", "Y", "b", "c", "d" ]

// 2nd argument > 0, and no items ==> deletion
x.splice( 2, 1 );
// x == [ "a", "X", "b", "c", "d" ]

// 2nd argument > 0, plus new items ==> replacement
x.splice( 3, 2, "Z" );
// x == [ "a", "X", "b", "Z" ]
```

### **Array::toString ( );**

Joins all the items of an array together, separated by commas.

This function is used when the array is used in the context of a string concatenation or is used as a text value, e.g. for printing. Use `join` if you want to use your own separator.

#### **See also:**

[Array::join \( String \*optSeparator\* \);](#)

```
var x = new Array( "a", "b", "c" );
var y = x.toString(); // y == "a,b,c"
var z = x.join();     // y == "a,b,c"
```

### **Array::unshift ( String *expression*, *optExpression1*, ... *optExpressionN* );**

Unshifts (that is, inserts) the given items at the bottom (left) end of the array and returns the new length of the array.

#### **Parameter:**

*expression* ... *optExpressionN* - The items to add to the array.

```
var x = new Array( "a", "b", "c" );
x.unshift( 121 ); // x == [ 121, "a", "b", "c" ]
```

## **Property documentation**

### **length**

Holds the number of items in the array. Items with string keys are excluded from the length property.

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### 6.6.1.3 Boolean

Laser Engine Program provides a `Boolean` data type. [More...](#)

#### Boolean functions

String	<code>Boolean::toString ()</code> ;
Boolean	<code>Boolean::valueOf ()</code> ;

#### Detailed description

Laser Engine Program provides a `Boolean` data type. In general, creating objects of this type is not recommended since the behavior will probably not be what you would expect.

Instead, use the boolean constants `true` and `false` as required. Any expression can be evaluated in a boolean context, for example, in an `if` statement.

If the expression's value is `0`, `null`, `false`, `NaN`, `undefined` or the empty string `"`, the expression is `false`; otherwise the expression is `true`.

#### Boolean functions documentation

##### `Boolean::toString ()`;

Returns a string representing the specified `Boolean` object.

Laser Engine Program calls the `toString` method automatically when a `Boolean` is to be represented as a text value or when a `Boolean` is referred to in a string concatenation. For `Boolean` objects and values, the built-in `toString` method returns the string `"true"` or `"false"` depending on the value of the boolean object.

In the following code, `flag.toString` returns `"true"`.

```
var flag = new Boolean(true)
var myVar=flag.toString()
```

##### `Boolean::valueOf ()`;

Returns the primitive value of a `Boolean` object or literal `Boolean` as a `Boolean` data type.

```
x = new Boolean();
myVar = x.valueOf()           //assigns false to myVar
```

### 6.6.1.4 Date

Instances of the `Date` class are used to store and manipulate dates and times. [More...](#)

#### Static date functions

Number	<code>Date::parse ( String dateString );</code>
Number	<code>Date::UTC (year, month[, date[, hrs[, min[, sec[, ms]]]]) )</code>

#### Date functions

Number	<code>Date::getDate ( );</code>
Number	<code>Date::getDay ( );</code>
Number	<code>Date::getFullYear ( );</code>
Number	<code>Date::getHours ( );</code>
Number	<code>Date::getMilliseconds ( );</code>
Number	<code>Date::getMinutes ( );</code>
Number	<code>Date::getMonth ( );</code>
Number	<code>Date::getSeconds ( );</code>
Number	<code>Date::getTime ( );</code>
Number	<code>Date::getTimezoneOffset ( );</code>
void	<code>Date::setDate ( Number dayOfMonth );</code>
void	<code>Date::setFullYear ( yearValue[, monthValue[, dayValue]] );</code>
void	<code>Date::setHours ( Number hour );</code>
void	<code>Date::setMilliseconds ( Number milliseconds );</code>
void	<code>Date::setMinutes ( Number minutes );</code>
void	<code>Date::setMonth ( Number month );</code>
void	<code>Date::setSeconds ( );</code>
void	<code>Date::setTime ( Number milliseconds );</code>
String	<code>Date::toString ( );</code>
String	<code>Date::toDateString ( );</code>
String	<code>Date::toTimeString ( );</code>
String	<code>Date::toLocaleString ( );</code>
String	<code>Date::toLocaleDateString ( );</code>
String	<code>Date::toLocaleTimeString ( );</code>
Number	<code>Date::valueOf ( );</code>
Number	<code>Date::getUTCDate ( );</code>
Number	<b><code>Date::getUTCDay ( );</code></b>
Number	<code>Date::getUTCFullYear ( );</code>
Number	<code>Date::getUTCHours ( );</code>
Number	<code>Date::getUTCMilliseconds ( );</code>
Number	<code>Date::getUTCMinutes ( );</code>
Number	<code>Date::getUTCMonth ( );</code>
Number	<code>Date::getUTCSeconds ( );</code>
void	<code>Date::setUTCDate ( dayvalue );</code>
void	<code>Date::setUTCFullYear ( yearValue[, monthValue[, dayValue]] );</code>
void	<code>Date::setUTCHours ( hoursValue[, minutesValue[, secondsValue[, msValue]] ] );</code>
void	<code>Date::setUTCMilliseconds ( millisecondsValue );</code>
void	<code>Date::setUTCMinutes ( minutesValue[, secondsValue[, msValue]] );</code>
void	<code>Date::setUTCMonth ( monthValue[, dayValue] );</code>
void	<code>Date::setUTCSeconds ( secondsValue[, msValue] );</code>
String	<b><code>Date::toUTCString ( );</code></b>

## CHAPTER 6

### Detailed description

Instances of the `Date` class are used to store and manipulate dates and times.

A variety of get functions are provided to obtain the date, time or relevant parts (see [Date functions](#)). A complementary variety of set functions are also provided (such as, for example, `setDate` or `setYear`).

The functions operate using local time. Conversion between `Date` objects to and from strings are provided by `parse()` and `Date::toString()`.

Elapsed time (in milliseconds) can be obtained by creating two dates, casting them to `Number` and subtracting one value from the other.

```
var date1 = new Date();
// time flies..
var date2 = new Date();
var timedifference = date2.getTime() - date1.getTime();
```

### Date constructor documentation

Dates can be constructed with no arguments, in which case the value is the date and time at the moment of construction using local time. A single integer argument is taken as the number of milliseconds since midnight on the 1st January 1970.

```
Date()
Date( milliseconds )
Date( year, month, day, optHour, optMinutes, optSeconds,
optMilliseconds )

var today = new Date();
var d = new Date( 1234567 );
var date = new Date( 1994, 4, 21 );
var moment = new Date( 1968, 5, 11, 23, 55, 30 );
```

### Static Date functions documentation

#### **Date::parse ( String *dateString* );**

This is a static function that parses a string, `dateString`, which represents a particular date and time. It returns the number of milliseconds since midnight on the 1st January 1970. The string must be in the ISO 8601 extended format:

YYYY-MM-DD or with time YYYY-MM-DDTHH:MM:SS.

```
var d = new Date( Date.parse( "1976-01-25T22:30:00" ) );
d = Date.parse( "1976-01-25T22:30:00" );
```

#### **Date::UTC (year, month[, date[, hrs[, min[, sec[, ms]]]])**

Accepts the same parameters as the longest form of the constructor, and returns the number of milliseconds in a `Date` object since January 1, 1970, 00:00:00, universal time.

##### Parameters

*year* - A year after 1900.

*month* - An integer between 0 and 11 representing the month.

*date* - An integer between 1 and 31 representing the day of the month.

*hrs* - An integer between 0 and 23 representing the hours.

*min* - An integer between 0 and 59 representing the minutes.

*sec* - An integer between 0 and 59 representing the seconds.

*ms* - An integer between 0 and 999 representing the milliseconds.

You should specify a full year for the year; for example, 1998. If a year between 0 and 99 is specified, the method converts the year to a year in the 20th century (1900 + year); for example, if you specify 95, the year 1995 is used.

The UTC method differs from the `Date` constructor in two ways.

- `Date.UTC` uses universal time instead of the local time.
- `Date.UTC` returns a time value as a number instead of creating a `Date` object.

If a parameter you specify is outside of the expected range, the UTC method updates the other parameters to allow for your number. For example, if you use 15 for month, the year will be incremented by 1 (year + 1), and 3 will be used for the month.

Because UTC is a static method of `Date`, you always use it as `Date.UTC()`, rather than as a method of a `Date` object you created.

The following statement creates a `Date` object using GMT instead of local time:

```
gmtDate = new Date(Date.UTC(96, 11, 1, 0, 0, 0));
```

## Date functions documentation

### **Date::getDate ( );**

Returns the day of the month using local time. The value is always in the range 1..31.

```
var d = new Date( 1975, 12, 25 );
var x = d.getDate(); // x == 25
```

### **Date::getDay ( );**

Returns the day of the week using local time. The value is always in the range 1..7, with the week considered to begin on Monday.

```
var d = new Date( 1975, 12, 25, 22, 30, 15 );
var x = d.getDay(); // x == 4
```

The following shows an example:

```
var IndexToDay = [ "Mon", "Tue", "Wed", "Thu", "Fri", "Sat",
"Sun" ];
var d = new Date( 1975, 12, 28 );
System.println( IndexToDay[ d.getDay() - 1 ] ); // Prints "Sun"
```

### **Date::getFullYear ( );**

Returns the year of the specified date according to local time.

The value returned by `getFullYear` is an absolute number. For dates between the years 1000 and 9999, `getFullYear` returns a four-digit number, for example, 1995. Use this function to make sure a year is compliant with years after 2000.

The following example assigns the four-digit value of the current year to the variable `yr`.

```
var today = new Date();
var yr = today.getFullYear();
```

### **Date::getHours ( );**

Returns the hour using local time. The value is always in the range 0..23.

```
var d = new Date( 1975, 12, 25, 22 );
var x = d.getHours(); // x == 22
```



## CHAPTER 6

### **Date::getMilliseconds ( );**

Returns the milliseconds component of the date using local time. The value is always in the range 0 . . 999. In the example, x is 0, because no milliseconds were specified, and the default for unspecified components of the time is 0.

```
var d = new Date( 1975, 12, 25, 22 );
var x = d.getMilliseconds(); // x == 0
```

### **Date::getMinutes ( );**

Returns the minutes component of the date using local time. The value is always in the range 0 . . 59.

```
var d = new Date( 1975, 12, 25, 22, 30 );
var x = d.getMinutes(); // x == 30
```

### **Date::getMonth ( );**

Returns the month component of the date using local time. The value is always in the range 1 . . 12.

```
var d = new Date( 1975, 12, 25, 22, 30 );
var x = d.getMonth(); // x == 12
```

The following shows an example:

```
var IndexToMonth = [ "Jan", "Feb", "Mar", "Apr", "May", "Jun",
                    "Jul",
                    "Aug", "Sep", "Oct", "Nov",
                    "Dec" ];
var d = new Date( 1975, 12, 25 );
System.println( IndexToMonth[ d.getMonth() - 1 ] ); // Prints
"Dec"
```

### **Date::getSeconds ( );**

Returns the seconds component of the date using local time. The value is always in the range 0 . . 59. In the example x is 0 because no seconds were specified, and the default for unspecified components of the time is 0.

```
var d = new Date( 1975, 12, 25, 22, 30 );
var x = d.getSeconds(); // x == 0
```

### **Date::getTime ( );**

Returns the number of milliseconds since midnight on the 1st January 1970 using local time.

```
var d = new Date( 1975, 12, 25, 22, 30 );
var x = d.getTime(); // x == 1.91457e+11
```

### **Date::getTimezoneOffset ( );**

Returns the time-zone offset in minutes for the current locale.

The time-zone offset is the minutes in difference, the Greenwich Mean Time (GMT) is relative to your local time. For example, if your time zone is GMT+10, -600 will be returned. Daylight savings time prevents this value from being a constant.

```
x = new Date()
currentTimezoneOffsetInHours = x.getTimezoneOffset()/60
```

### **Date::setDate ( Number *dayOfTheMonth* );**

Sets the day of the month to the specified *dayOfTheMonth* in local time.

```
var d = new Date( 1975, 12, 25, 22, 30 );
d.setDate( 30 ); // d == 1975-12-30T22:30:00
```

### **Date::setFullYear ( *yearValue* [, *monthValue* [, *dayValue*] ] );**

Sets the full year for a specified date according to local time.

#### **Parameters**

*yearValue* - An integer specifying the numeric value of the year, for example, 1995

*monthValue* - An integer between 0 and 11 representing the months January through December

*dayValue* - An integer between 1 and 31 representing the day of the month. If you specify the *dayValue* parameter, you must also specify the *monthValue*

If you do not specify the *monthValue* and *dayValue* parameters, the values returned from the *getMonth* and *getDate* methods are used.

```
theBigDay = new Date();
theBigDay.setFullYear(1997);
```

**Date::setHours ( Number *hour* );**

Sets the hour to the specified hour, which must be in the range 0 . . 23, in local time.

The minutes, seconds and milliseconds past the hour (*optMinutes*, *optSeconds* and *optMilliseconds*) can also be specified.

```
var d = new Date( 1975, 12, 25, 22, 30 );
d.setHours( 10 ); // d == 1980-12-30T10:30:00
```

**Date::setMilliseconds ( Number *milliseconds* );**

Sets the milliseconds component of the date to the specified value in local time.

```
var d = new Date( 1975, 12, 25, 22, 30 );
d.setMilliseconds( 998 ); // d == 1980-12-30T10:30:00:998
```

**Date::setMinutes ( Number *minutes* );**

Sets the minutes to the specified minutes, which must be in the range 0 . . 59, in local time.

The seconds and milliseconds past the minute (*optSeconds* and *optMilliseconds*) can also be specified.

```
var d = new Date( 1975, 12, 25, 22, 30 );
d.setMinutes( 15 ); // d == 1980-12-30T10:15:00
```

**Date::setMonth ( Number *month* );**

Sets the month to the specified month, which must be in the range 0 . . 11, in local time.

```
var d = new Date( 1975, 12, 25, 22, 30 );
d.setMonth(0); // d == 1980-01-11T22:30:00
```

**Date::setSeconds ( );**

Sets the seconds to the specified seconds, which must be in the range 0 . . 59, in local time.

```
var d = new Date( 1975, 12, 25, 22, 30 );
d.setSeconds( 25 ); // d == 1980-12-30T22:30:25
```

**Date::setTime ( Number *milliseconds* );**

Sets the date and time to the local date and time given in terms of milliseconds since midnight on the 1st January 1970.

```
var d = new Date( 1975, 12, 25, 22, 30 );
var duplicate = new Date();
duplicate.setTime( d.getTime() );
```

**Date::toString ( );**

Converts the date into a string on the ISO 8601 extended format: YYYY-MM-DDTHH:MM:SS.

```
var d = new Date( 1975, 12, 25, 22, 30 );
var s = d.toString(); // s == "1975-12-25T22:30:00"
```

**Date::toDateString ( );**

Returns the date portion of a *Date* object in human readable form.

```
var d = new Date(1993, 6, 28, 14, 39, 7);
println(d.toString()); // prints Wed Jul 28 1993 14:39:07 GMT-
0600 (PDT)
println(d.toDateString()); // prints Wed Jul 28 1993
```

**Date::toTimeString ( );**

Returns the time portion of a *Date* object in human readable form.

## CHAPTER 6

```
var d = new Date(1993, 6, 28, 14, 39, 7);
println(d.toString()); // prints Wed Jul 28 1993 14:39:07 GMT-
0600 (PDT)
println(d.toTimeString()); // prints 14:39:07 GMT-0600 (PDT)
```

### **Date::toLocaleString ( );**

Converts a date to a string, using the operating system's locale's conventions.

The `toLocaleString` method converts the date to a string using the formatting convention of the operating system where the script is running. If the operating system is not year-2000 compliant and does not use the full year for years before 1900 or over 2000, `toLocaleString` returns a string that is not year-2000 compliant. `toLocaleString` behaves similarly to `toString` when converting a year that the operating system does not properly format.

Methods such as `getHours`, `getMinutes`, and `getSeconds` give more portable results than `toLocaleString`.

In the following example, `today` is a `Date` object:

```
today = new Date(95,11,18,17,28,35); //months are represented by
0 to 11
today.toLocaleString();
```

In this example, `toLocaleString` returns a string value that is similar to the following form. The exact format depends on the platform.

```
12/18/95 17:28:35
```

### **Date::toLocaleDateString ( );**

Converts a date to a string, returning the date portion using the operating system's locale's conventions.

The `toLocaleDateString` method converts the date to a string using the formatting convention of the operating system where the script is running. If the operating system is not year-2000 compliant and does not use the full year for years before 1900 or over 2000, `toLocaleDateString` returns a string that is not year-2000 compliant. `toLocaleString` behaves similarly to `toString` when converting a year that the operating system does not properly format.

Methods such as `getHours`, `getMinutes`, and `getSeconds` give more portable results than `toLocaleDateString`.

```
today = new Date(95,11,18,17,28,35) //months are represented by
0 to 11
today.toLocaleDateString();
```

### **Date::toLocaleTimeString ( );**

Converts a date to a string, returning the date portion using the current locale's conventions.

**See also:**

[Date::toString \( \);](#)

The `toLocaleTimeString` method converts the date to a string using the formatting convention of the operating system where the script is running. If the operating system is not year-2000 compliant and does not use the full year for years before 1900 or over 2000, `toLocaleDateString` returns a string that is not year-2000 compliant. `toLocaleString` behaves similarly to `toString` when converting a year that the operating system does not properly format.

Methods such as `getHours`, `getMinutes`, and `getSeconds` give more portable results than `toLocaleDateString`. Use `toLocaleTimeString` when the intent is to display to the user a string formatted using the regional format chosen by the user. Be aware that this method, due to its nature, behaves differently depending on the operating system and on the user's settings.

```
today = new Date(95,11,18,17,28,35) //months are represented by
0 to 11
today.toLocaleTimeString()
```

```
today.toLocaleDateString()
```

**Date::valueOf ( );**

Returns the primitive value of a `Date` object as a number data type, the number of milliseconds since midnight 01 January, 1970 UTC.

This method is functionally equivalent to the `getTime` method. This method is usually called internally by Laser Engine Program and not explicitly in code.

**See also:**

[Date::getTime \( \);](#)

```
x = new Date(56, 6, 17);
myVar = x.valueOf(); //assigns -424713600000 to myVar
```

**Date::getUTCDate ( );**

Returns the day (date) of the month in the specified date according to universal time. The value returned by `getUTCDate` is an integer between 1 and 31.

The following example assigns the day portion of the current date to the variable `d`.

```
var d;
Today = new Date();
d = Today.getUTCDate();
```

**Date::getUTCDay ( );**

Returns the day of the week in the specified date according to universal time. The value returned by `getUTCDay` is an integer corresponding to the day of the week: 0 for Sunday, 1 for Monday, 2 for Tuesday, and so on.

The following example assigns the weekday portion of the current date to the variable `weekday`.

```
var weekday;
Today = new Date();
weekday = Today.getUTCDay();
```

**Date::getUTCFullYear ( );**

Returns the year in the specified date according to universal time. The value returned by `getUTCFullYear` is an absolute number that is compliant with year-2000, for example, 1995.

The following example assigns the four-digit value of the current year to the variable `yr`.

```
var yr;
Today = new Date();
yr = Today.getUTCFullYear();
```

**Date::getUTCHours ( );**

Returns the hours in the specified date according to universal time. The value returned by `getUTCHours` is an integer between 0 and 23.

The following example assigns the hours portion of the current time to the variable `hrs`.

## CHAPTER 6

```
var hrs;
```

```
Today = new Date();
hrs = Today.getUTCHours();
```

### **Date::getUTCMilliseconds ( );**

Returns the milliseconds in the specified date according to universal time. The value returned by `getUTCMilliseconds` is an integer between 0 and 999.

The following example assigns the milliseconds portion of the current time to the variable `ms`.

```
var ms;
Today = new Date();
ms = Today.getUTCMilliseconds();
```

### **Date::getUTCMinutes ( );**

Returns the minutes in the specified date according to universal time. The value returned by `getUTCMinutes` is an integer between 0 and 59.

The following example assigns the minutes portion of the current time to the variable `min`.

```
var min;
Today = new Date();
min = Today.getUTCMinutes();
```

### **Date::getUTCMonth ( );**

Returns the month of the specified date according to universal time. The value returned by `getUTCMonth` is an integer between 0 and 11 corresponding to the month. 0 for January, 1 for February, 2 for March, and so on.

The following example assigns the month portion of the current date to the variable `mon`.

```
var mon;
Today = new Date();
mon = Today.getUTCMonth();
```

### **Date::getUTCSeconds ( );**

Returns the seconds in the specified date according to universal time. The value returned by `getUTCSeconds` is an integer between 0 and 59.

The following example assigns the seconds portion of the current time to the variable `sec`.

```
var sec;
Today = new Date();
sec = Today.getUTCSeconds();
```

### **Date::setUTCDate ( *dayvalue* );**

Sets the day of the month for a specified date according to universal time.

#### **Parameter**

*dayvalue* - An integer from 1 to 31, representing the day of the month.

If a parameter you specify is outside of the expected range, `setUTCDate` attempts to update the date information in the `Date` object accordingly. For example, if you use 40 for `dayValue`, and the month stored in the `Date` object is June, the day will be changed to 10 and the month will be incremented to July

```
theBigDay = new Date();
theBigDay.setUTCDate(20);
```

**Date::setUTCFullYear ( *yearValue*[, *monthValue*[, *dayValue*]] );**

Sets the full year for a specified date according to universal time.

**Parameters**

*yearValue* - An integer specifying the numeric value of the year, for example, 1995.

*monthValue* - An integer between 0 and 11 representing the months January through December.

*dayValue* - An integer from 1 to 31, representing the day of the month. If you specify the *dayValue* parameter, you must also specify the *monthValue*.

If you do not specify the *monthValue* and *dayValue* parameters, the values returned from the `getMonth` and `getDate` methods are used. If a parameter you specify is outside of the expected range, `setUTCFullYear` attempts to update the other parameters and the date information in the `Date` object accordingly. For example, if you specify 15 for *monthValue*, the year is incremented by 1 (`year + 1`), and 3 is used for the month.

```
theBigDay = new Date();
theBigDay.setUTCFullYear(1997);
```

**Date::setUTCHours ( *hoursValue*[, *minutesValue*[, *secondsValue*[, *msValue*]]] );**

Sets the hour for a specified date according to universal time.

**Parameters**

*hoursValue* - An integer between 0 and 23, representing the hour.

*minutesValue* - An integer between 0 and 59, representing the minutes.

*secondsValue* - An integer between 0 and 59, representing the seconds. If you specify the *secondsValue* parameter, you must also specify the *minutesValue*.

*msValue* - A number between 0 and 999, representing the milliseconds. If you specify the *msValue* parameter, you must also specify the *minutesValue* and *secondsValue*.

If you do not specify the *minutesValue*, *secondsValue*, and *msValue* parameters, the values returned from the `getMinutes`, `getSeconds`, and `getMilliseconds` methods are used. If a parameter you specify is outside of the expected range, `setUTCHours` attempts to update the other parameters and the date information in the `Date` object accordingly. For example, if you use 100 for *secondsValue*, the minutes will be incremented by 1 (`min + 1`), and 40 will be used for seconds.

```
theBigDay = new Date();
theBigDay.setUTCHours(8);
```

**Date::setUTCMilliseconds ( *millisecondsValue* );**

Sets the milliseconds for a specified date according to universal time.

**Parameter**

*millisecondsValue* - A number between 0 and 999, representing the milliseconds.

If a parameter you specify is outside of the expected range, `setUTCMilliseconds` attempts to update the other parameters and the date information in the `Date` object accordingly. For example, if you use 1100 for *millisecondsValue*, the seconds stored in the `Date` object will be incremented by 1, and 100 will be used for milliseconds.

```
theBigDay = new Date();
theBigDay.setUTCMilliseconds(500);
```

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**Date::setUTCMinutes ( *minutesValue*[, *secondsValue*[, *msValue*]] );**

Sets the minutes for a specified date according to universal time.

**Parameters**

*minutesValue* - An integer between 0 and 59, representing the minutes.

*secondsValue* - An integer between 0 and 59, representing the seconds. If you specify the *secondsValue* parameter, you must also specify the *minutesValue*.

*msValue* - A number between 0 and 999, representing the milliseconds. If you specify the *msValue* parameter, you must also specify the *minutesValue* and *secondsValue*.

If you do not specify the *secondsValue* and *msValue* parameters, the values returned from the *getSeconds* and *getMilliseconds* methods are used. If a parameter you specify is outside of the expected range, *setUTCMinutes* attempts to update the other parameters and the date information in the *Date* object accordingly. For example, if you use 100 for *secondsValue*, the minutes (*minutesValue*) will be incremented by 1 (*minutesValue* + 1), and 40 will be used for seconds.

```
theBigDay = new Date();
theBigDay.setUTCMinutes(43);
```

**Date::setUTCMonth ( *monthValue*[, *dayValue*] );**

Sets the month for a specified date according to universal time.

**Parameters**

*monthValue* - An integer between 0 and 11 representing the months January through December.

*dayValue* - An integer from 1 to 31, representing the day of the month.

If you do not specify the *dayValue* parameter, the value returned from the *getUTCDate* method is used. If a parameter you specify is outside of the expected range, *setUTCMonth* attempts to update the date information in the *Date* object accordingly. For example, if you use 15 for *monthValue*, the year will be incremented by 1 (*year* + 1), and 3 will be used for month.

```
theBigDay = new Date();
theBigDay.setUTCMonth(11);
```

**Date::setUTCSeconds ( *secondsValue*[, *msValue*] );**

Sets the seconds for a specified date according to universal time.

**Parameters**

*secondsValue* - An integer between 0 and 59, representing the seconds.

*msValue* - A number between 0 and 999, representing the milliseconds.

If you do not specify the *msValue* parameter, the value returned from the *getUTCMilliseconds* method is used. If a parameter you specify is outside of the expected range, *setUTCSeconds* attempts to update the date information in the *Date* object accordingly. For example, if you use 100 for *secondsValue*, the minutes stored in the *Date* object will be incremented by 1, and 40 will be used for seconds.

```
theBigDay = new Date();
theBigDay.setUTCSeconds(20);
```

**Date::toUTCString ( );**

Converts a date to a string, using the universal time convention.

The value returned by *toUTCString* is a readable string formatted according to UTC convention. The format of the return value may vary according to the platform.

```
var today = new Date();
var UTCstring = today.toUTCString();
// Mon, 03 Jul 2006 21:44:38 GMT
```

### 6.6.1.5 Number

A `Number` is a datatype that represents a number. In most situations, programmers will use numeric literals like 3.142 directly in code. [More...](#)

#### Number functions

String	<code>Number::toString ( [radix] );</code>
String	<code>Number::toExponential ( [fractionDigits] );</code>
String	<code>Number::toFixed ( [Digits] );</code>
String	<code>Number::toLocaleString ( );</code>
String	<code>Number::toPrecision ( [ precision ] );</code>
Number	<code>Number::valueOf ( );</code>

#### Number properties

Number	<code>MAX_VALUE</code>
Number	<code>MIN_VALUE</code>
Number	<code>NaN</code>
Number	<code>NEGATIVE_INFINITY</code>
Number	<code>POSITIVE_INFINITY</code>

#### Detailed description

A `Number` is a datatype that represents a number. In most situations, programmers will use numeric literals like 3.142 directly in code.

The `Number` datatype is useful for obtaining system limits, e.g. `MIN_VALUE` and `MAX_VALUE`, and for performing number to string conversions with `toString()`

#### Number constructor documentation

Numbers are not normally constructed, but instead created by simple assignment, such as, for example:

```
var x = 3.142;
```

#### Number function documentation

##### **Number::toString ( [radix] );**

Returns the number as a string value.

**Parameter:**

*radix* - An integer between 2 and 36 specifying the base to use for representing numeric values.

The `toString` method parses its first argument, and attempts to return a string representation in the specified `radix` (base). For radices above 10, the letters of the alphabet indicate numerals greater than 9. For example, for hexadecimal numbers (base 16), A through F are used.

If `toString` is given a radix not between 2 and 36, an exception is thrown. If the radix is not specified, Laser Engine Program assumes the preferred radix is 10.



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```
var count = 10;
print(count.toString()); // displays "10"
print((17).toString()); // displays "17"
```

```
var x = 7;
print(x.toString(2)); // displays "111"
```

### **Number::toExponential ( [*fractionDigits*] );**

Returns a string representing the Number object in exponential notation

**Parameter:**

*fractionDigits* - An integer specifying the number of digits after the decimal point. Defaults to as many digits as necessary to specify the number.

**See also:**

[Number::toFixed \( \[\*Digits\*\] \);](#)

This method returns a string representing a Number object in exponential notation with one digit before the decimal point, rounded to *fractionDigits* digits after the decimal point. If the *fractionDigits* argument is omitted, the number of digits after the decimal point defaults to the number of digits necessary to represent the value uniquely.

If you use the `toExponential` method for a numeric literal and the numeric literal has no exponent and no decimal point, leave a space before the dot that precedes the method call to prevent the dot from being interpreted as a decimal point.

If a number has more digits that requested by the *fractionDigits* parameter, the number is rounded to the nearest number represented by *fractionDigits* digits. See the discussion of rounding in the description of the `toFixed` method, which also applies to `toExponential`.

```
var num=77.1234;
print("num.toExponential() is " + num.toExponential()); //
displays 7.71234e+1
print("num.toExponential(4) is " + num.toExponential(4)); //
displays 7.7123e+1
print("num.toExponential(2) is " + num.toExponential(2)); //
displays 7.71e+1
print("77.1234.toExponential() is " + 77.1234.toExponential());
//displays 7.71234e+1
print("77 .toExponential() is " + 77 .toExponential()); //
displays 7.7e+1
var x = 7;
```

### **Number::toFixed ( [*Digits*] );**

Formats a number using fixed-point notation.

**Parameter:**

*Digits* - The number of digits to appear after the decimal point; this may be a value between 0 and 20, inclusive, and implementations may optionally support a larger range of values. If this argument is omitted, it is treated as 0.

This method returns a string representation of number that does not use exponential notation and has exactly *digits* digits after the decimal place. The number is rounded if necessary, and the fractional part is padded with zeros if necessary so that it has the specified length. If number is greater than  $1e+21$ , this method simply calls `Number.toString()` and returns a string in exponential notation.

toFixed throws the following

- `RangeError` - If `digits` is too small or too large. Values between 0 and 20, inclusive, will not cause a `RangeError`. Implementations are allowed to support larger and smaller values as well.
- `TypeError` - If this method is invoked on an object that is not a `Number`.

```
var n = 12345.6789;
n.toFixed(); // Returns 12346: note rounding, no
fractional part
n.toFixed(1); // Returns 12345.7: note rounding
n.toFixed(6); // Returns 12345.678900: note added
zeros
(1.23e+20).toFixed(2); // Returns 123000000000000000000.00
(1.23e-10).toFixed(2) // Returns 0.00
```

### Number::toLocaleString ( );

Returns a human readable string representing the number using the locale of the environment.

### Number::toPrecision ( [precision] );

Returns a string representing the `Number` object to the specified precision.

**Parameter:**

*precision* - An integer specifying the number of significant digits.

**See also:**

[Number::toFixed \( \[Digits\] \);](#), [Number::toString \( \[radix\] \);](#)

This method returns a string representing a `Number` object in fixed-point or exponential notation rounded to precision significant digits. See the discussion of rounding in the description of the `toFixed` method, which also applies to `toPrecision`.

If the `precision` argument is omitted, behaves as `toString`. If it is a non-integer value, it is rounded to the nearest integer. After rounding, if that value is not between 1 and 100 (inclusive), a `RangeError` is thrown.

```
var num = 5.123456;
print("num.toPrecision() is " + num.toPrecision()); //displays
5.123456
print("num.toPrecision(4) is " + num.toPrecision(4)); //displays
5.123
print("num.toPrecision(2) is " + num.toPrecision(2)); //displays
5.1
print("num.toPrecision(1) is " + num.toPrecision(1)); //displays
5
```

### Number::valueOf ( );

Returns the primitive value of a `Number` object as a number data type.

```
var x = new Number();
print(x.valueOf()); // prints "0"
```

## Number properties documentation

### MAX\_VALUE

Returns the maximum value for floating point values.

### MIN\_VALUE

Returns the minimum value for floating point values.

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### NaN

A value representing Not-A-Number. NaN is always unequal to any other number, including NaN itself; you cannot check for the not-a-number value by comparing to `Number.NaN`. Use the [isNaN\(\)](#) function instead.

### NEGATIVE\_INFINITY

A value representing the negative Infinity value. Several Laser Engine Program methods (such as the `Number` constructor, `parseFloat`, and `parseInt`) return NaN if the value specified in the parameter is significantly lower than `Number.MIN_VALUE`.

In the following example, the variable `smallNumber` is assigned a value that is smaller than the minimum value. When the `if` statement executes, `smallNumber` has the value `"-Infinity"`, so `smallNumber` is set to a more manageable value before continuing:

```
var smallNumber = (-Number.MAX_VALUE) * 2
if (smallNumber == Number.NEGATIVE_INFINITY) {
    smallNumber = returnFinite();
}
```

### POSITIVE\_INFINITY

A value representing the negative Infinity value. Several Laser Engine Program methods (such as the `Number` constructor, `parseFloat`, and `parseInt`) return NaN if the value specified in the parameter is significantly lower than `Number.MIN_VALUE`.

In the following example, the variable `smallNumber` is assigned a value that is smaller than the minimum value. When the `if` statement executes, `smallNumber` has the value `"-Infinity"`, so `smallNumber` is set to a more manageable value before continuing:

```
var smallNumber = (-Number.MAX_VALUE) * 2
if (smallNumber == Number.NEGATIVE_INFINITY) {
    smallNumber = returnFinite();
}
```

A numeric variable can hold a non-numeric value, in which case [isNaN\(\)](#) returns `true`. The result of an arithmetic expression may exceed the maximum or minimum representable values in which case the value of the expression will be [Infinity](#), and [isFinite\(\)](#) will return `false`.

### 6.6.1.6 RegExp

Creates a regular expression object for matching text according to a pattern. [More...](#)

#### RegExp Functions

The global RegExp object has no methods of its own, however, it does inherit some methods through the prototype chain.

Array	<a href="#">RegExp::exec(String str);</a>
Boolean	<a href="#">RegExp.test([String str])</a>
String	<a href="#">RegExp::toString();</a>
String	<a href="#">RegExp::valueOf();</a>

#### RegExp Properties

(*ptFunction)	<a href="#">constructor</a>
Boolean	<a href="#">global</a>
Boolean	<a href="#">ignoreCase</a>
Number	<a href="#">lastIndex</a>
Boolean	<a href="#">multiline</a>
String	<a href="#">source</a>

#### Detailed description

Creates a regular expression object for matching text according to a pattern.

```
var regex = new RegExp("pattern" [, "flags"]);
var literal = /pattern/flags;
```

When using the constructor function, the normal string escape rules (preceding special characters with \ when included in a string) are necessary. For example, the following are equivalent:

```
var re = new RegExp("\\w+");
var re = /\w+/;
```

Notice that the parameters to the literal format do not use quotation marks to indicate strings, while the parameters to the constructor function do use quotation marks. So the following expressions create the same regular expression:

```
/ab+c/i;
new RegExp("ab+c", "i");
```

#### Special characters in regular expressions

Character	Meaning
\	For characters that are usually treated literally, indicates that the next character is special and not to be interpreted literally. For example, /b/ matches the character 'b'. By placing a backslash in front of b, that is by using /\b/, the character becomes special to mean match a word boundary. <i>or</i> For characters that are usually treated specially, indicates that the next character is not special and should be interpreted literally. For example, * is a special character that means 0 or more occurrences of the preceding character should be matched; for example, /a*/ means match 0 or more "a"s. To match * literally, precede it with a backslash; for example, /a*/ matches 'a*'.  
^	Matches beginning of input. If the multiline flag is set to true, also matches immediately after a line break character.

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	For example, <code>/^A/</code> does not match the 'A' in "an A", but does match the first 'A' in "An A."
\$	Matches end of input. If the multiline flag is set to true, also matches immediately before a line break character. For example, <code>/t\$/</code> does not match the 't' in "eater", but does match it in "eat".
*	Matches the preceding item 0 or more times. For example, <code>/bo*/</code> matches 'boooo' in "A ghost boooooed" and 'b' in "A bird warbled", but nothing in "A goat grunted".
+	Matches the preceding item 1 or more times. Equivalent to <code>{1,}</code> . For example, <code>/a+/</code> matches the 'a' in "candy" and all the a's in "caaaaaaandy".
?	Matches the preceding item 0 or 1 time. For example, <code>/e?le?/</code> matches the 'el' in "angel" and the 'le' in "angle." If used immediately after any of the quantifiers <code>*</code> , <code>+</code> , <code>?</code> , or <code>{}</code> , makes the quantifier non-greedy (matching the minimum number of times), as opposed to the default, which is greedy (matching the maximum number of times). Also used in lookahead assertions, described under <code>(?=)</code> , <code>(?!)</code> , and <code>(?:)</code> in this table.
.	(The decimal point) matches any single character except the new line characters: <code>\n</code> <code>\r</code> <code>\u2028</code> or <code>\u2029</code> . ( <code>[\s\S]</code> can be used to match any character including new lines.) For example, <code>/n/</code> matches 'an' and 'on' in "nay, an apple is on the tree", but not 'nay'.
(x)	Matches <code>x</code> and remembers the match. These are called capturing parentheses. For example, <code>/(foo)/</code> matches and remembers 'foo' in "foo bar." The matched substring can be recalled from the resulting array's elements <code>[1]</code> , ..., <code>[n]</code> or from the predefined <code>RegExp</code> object's properties <code>\$1</code> , ..., <code>\$9</code> .
(?:x)	Matches <code>x</code> but does not remember the match. These are called non-capturing parentheses. The matched substring can not be recalled from the resulting array's elements <code>[1]</code> , ..., <code>[n]</code> or from the predefined <code>RegExp</code> object's properties <code>\$1</code> , ..., <code>\$9</code> .
x(?:y)	Matches <code>x</code> only if <code>x</code> is followed by <code>y</code> . For example, <code>/Jack(?:Sprat)/</code> matches 'Jack' only if it is followed by 'Sprat'. <code>/Jack(?:Sprat Frost)/</code> matches 'Jack' only if it is followed by 'Sprat' or 'Frost'. However, neither 'Sprat' nor 'Frost' is part of the match results.
x(?:!y)	Matches <code>x</code> only if <code>x</code> is not followed by <code>y</code> . For example, <code>/\d+(?!\.)</code> matches a number only if it is not followed by a decimal point. <code>/\d+(?!\.)/.exec("3.141")</code> matches 141 but not 3.141.
x y	Matches either <code>x</code> or <code>y</code> . For example, <code>/green red/</code> matches 'green' in "green apple" and 'red' in "red apple."
{n}	Where <code>n</code> is a positive integer. Matches exactly <code>n</code> occurrences of the preceding item. For example, <code>/a{2}/</code> doesn't match the 'a' in "candy," but it matches all of the a's in "caandy," and the first two a's in "caaandy."
{n,}	Where <code>n</code> is a positive integer. Matches at least <code>n</code> occurrences of the preceding item. For example, <code>/a{2,}</code> doesn't match the 'a' in "candy", but matches all of the a's in "caandy" and in "caaaaaaandy."
{n,m}	Where <code>n</code> and <code>m</code> are positive integers. Matches at least <code>n</code> and at most <code>m</code> occurrences of the preceding item. For example, <code>/a{1,3}/</code> matches nothing in "cndy", the 'a' in "candy," the first two a's in "caandy," and the first three a's in "caaaaaaandy". Notice that when matching "caaaaaaandy", the match is "aaa", even though the original string had more a's in it.
[xyz]	A character set. Matches any one of the enclosed characters. You can specify a range of characters by using a hyphen. For example, <code>[abcd]</code> is the same as <code>[a-d]</code> . They match the 'b' in "brisket" and the 'c' in "ache".
[^xyz]	A negated or complemented character set. That is, it matches anything that is not enclosed in the brackets. You can specify a range of characters by using a hyphen. For example, <code>[^abc]</code> is the same as <code>[^a-c]</code> . They initially match 'r' in "brisket" and 'h' in

	"chop."
<code>[\b]</code>	Matches a backspace. (Not to be confused with <code>\b</code> .)
<code>\b</code>	Matches a word boundary, such as a space. (Not to be confused with <code>[\b]</code> .) For example, <code>/\bn\b/</code> matches the 'no' in "noonday"; <code>/\wy\b/</code> matches the 'ly' in "possibly yesterday."
<code>\B</code>	Matches a non-word boundary. For example, <code>/\w\Bn/</code> matches 'on' in "noonday", and <code>/y\B\b/</code> matches 'ye' in "possibly yesterday."
<code>\cX</code>	Where <code>x</code> is a letter from A - Z. Matches a control character in a string. For example, <code>/\cM/</code> matches control-M in a string.
<code>\d</code>	Matches a digit character in the basic Latin alphabet. Equivalent to <code>[0-9]</code> . For example, <code>/\d/</code> or <code>/[0-9]/</code> matches '2' in "B2 is the suite number."
<code>\D</code>	Matches any non-digit character in the basic Latin alphabet. Equivalent to <code>[^0-9]</code> . For example, <code>/\D/</code> or <code>/[^0-9]/</code> matches 'B' in "B2 is the suite number."
<code>\f</code>	Matches a form-feed.
<code>\n</code>	Matches a linefeed.
<code>\r</code>	Matches a carriage return.
<code>\s</code>	Matches a single white space character, including space, tab, form feed, line feed and other unicode spaces. <sup>1</sup> For example, <code>/\s\w*/</code> matches ' bar' in "foo bar."
<code>\S</code>	Matches a single character other than white space. <sup>2</sup> For example, <code>/\S\w*/</code> matches 'foo' in "foo bar."
<code>\t</code>	Matches a tab.
<code>\v</code>	Matches a vertical tab.
<code>\w</code>	Matches any alphanumeric character from the basic Latin alphabet, including the underscore. Equivalent to <code>[A-Za-z0-9_]</code> . For example, <code>/\w/</code> matches 'a' in "apple," '5' in "\$5.28," and '3' in "3D."
<code>\W</code>	Matches any character that is not a word character from the basic Latin alphabet. Equivalent to <code>[^A-Za-z0-9_]</code> . For example, <code>/\W/</code> or <code>/[^\$A-Za-z0-9_]/</code> matches '%' in "50%."
<code>\n</code>	Where <code>n</code> is a positive integer. A back reference to the last substring matching the <code>n</code> parenthetical in the regular expression (counting left parentheses). For example, <code>/apple(,)\sorange\1/</code> matches 'apple, orange,' in "apple, orange, cherry, peach."
<code>\0</code>	Matches a NUL character. Do not follow this with another digit.
<code>\xhh</code>	Matches the character with the code <code>hh</code> (two hexadecimal digits.)
<code>\uhhhh</code>	Matches the character with the Unicode value <code>hhhh</code> (four hexadecimal digits).

<sup>1</sup>equivalent\_s - Equivalent to: `[\t\n\v\f\r\u00a0\u2000\u2001\u2002\u2003\u2004\u2005\u2006\u2007\u2008\u2009\u200a\u200b\u2028\u2029\u3000]`

<sup>2</sup>equivalent\_S - Equivalent to: `[^\t\n\v\f\r\u00a0\u2000\u2001\u2002\u2003\u2004\u2005\u2006\u2007\u2008\u2009\u200a\u200b\u2028\u2029\u3000]`

The literal notation provides compilation of the regular expression when the expression is evaluated. Use literal notation when the regular expression will remain constant. For example, if you use literal notation to construct a regular expression used in a loop, the regular expression won't be recompiled on each iteration.

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The constructor of the regular expression object, for example, `new RegExp("ab+c")`, provides runtime compilation of the regular expression. Use the constructor function when you know the regular expression pattern will be changing, or you don't know the pattern and are getting it from another source, such as user input.

### RegExp functions documentation

#### RegExp::exec(String *str*);

Executes a search for a match in a specified string. Returns a result array, or `null`.

##### Parameter:

*str* - The string against which to match the regular expression.

As shown in the syntax description, a regular expression's `exec` method can be called either directly, (with `regexp.exec(str)`) or indirectly (with `regexp(str)`). If you are executing a match simply to find true or false, use the `test` method or the `String` `search` method.

If the match succeeds, the `exec` method returns an array and updates properties of the regular expression object. If the match fails, the `exec` method returns `null`.

Consider the following example:

```
// Match one d followed by one or more b's followed by one d
// Remember matched b's and the following d
// Ignore case
var myRe = /d(b+)(d)/ig;
var myArray = myRe.exec("cdbBdbsbz");
```

The following table shows the results for this script:

Object	Property/Index	Description	Example
MyArray		The content of <code>myArray</code> .	[ "dbBd", "bB", "d" ]
	<code>index</code>	The 0-based index of the match in the string.	1
	<code>input</code>	The original string.	cdbBdbsbz
	<code>[0]</code>	The last matched characters.	dbBd
	<code>[1], ...[n]</code>	The parenthesized substring matches, if any. The number of possible parenthesized substrings is unlimited.	[1] = bB [2] = d

MyRe	lastIndex	The index at which to start the next match.	5
	IgnoreCase	Indicates if the "i" flag was used to ignore case.	true
	global	Indicates if the "g" flag was used for a global match.	true
	multiline	Indicates if the "m" flag was used to search in strings across multiple line.	false
	source	The text of the pattern.	d(b+)(d)

If your regular expression uses the "g" flag, you can use the `exec` method multiple times to find successive matches in the same string. When you do so, the search starts at the substring of `str` specified by the regular expression's `lastIndex` property. For example, assume you have this script:

```
var myRe = /ab*/g;
var str = "abbccdefabh";
var myArray;
while ((myArray = myRe.exec(str)) != null)
{
    var msg = "Found " + myArray[0] + ". ";
    msg += "Next match starts at " + myRe.lastIndex;
    print(msg);
}
```

This script displays the following text:

```
Found abb. Next match starts at 3
Found ab. Next match starts at 9
```

**Example: Using `exec` to execute a match against the input**

In the following example, the function executes a match against the input. It then cycles through the array to see if other names match the user's name.

This script assumes that first names of registered party attendees are preloaded into the array `A`, perhaps by gathering them from a party database.

```
var A = ["Frank", "Emily", "Jane", "Harry", "Nick", "Beth",
"Rick", "Terrence", "Carol", "Ann", "Terry", "Frank",
"Alice", "Rick", "Bill", "Tom", "Fiona", "Jane", "William",
"Joan", "Beth"];

function lookup(input)
{
    var firstName = /\w+/i.exec(input);
    if (!firstName)
    {
        print(input + " isn't a name!");
        return;
    }

    var count = 0;
    for (var i = 0; i < A.length; i++)
    {
        if (firstName[0].toLowerCase() == A[i].toLowerCase())
            count++;
    }
    var midstring = count == 1 ? " other has " : " others have ";
    print("Thanks, " + count + midstring + "the same name!")
}
```



## CHAPTER 6

### RegExp.test([String str])

Executes the search for a match between a regular expression and a specified string. Returns true or false.

**Parameter:**

*str* - The string against which to match the regular expression.

When you want to know whether a pattern is found in a string use the `test` method (similar to the `String.search` method); for more information (but slower execution) use the `exec` method (similar to the `String.match` method).

The following example prints a message which depends on the success of the test:

```
function testinput(re, str){
    if (re.test(str))
        midstring = " contains ";
    else
        midstring = " does not contain ";
    print (str + midstring + re.source);
}
```

### RegExp::toString();

Returns a string representing the specified object.

The following example displays the string value of a `RegExp` object:

```
myExp = new RegExp("a+b+c");
alert(myExp.toString()); // displays "/a+b+c/"
```

### RegExp::valueOf()

Returns a string representing the source code of the function.

## RegExp properties documentation

Note that several of the `RegExp` properties have both long and short (Perl-like) names. Both names always refer to the same value. Perl is the programming language from which Laser Engine Program modeled its regular expressions.

### constructor

Specifies the function that creates an object's prototype.

Returns a reference to the `RegExp` function that created the instance's prototype. Note that the value of this property is a reference to the function itself, not a string containing the function's name.

### global

Whether to test the regular expression against all possible matches in a string, or only against the first. `global` is a property of an individual regular expression object.

The value of `global` is true if the "g" flag was used; otherwise, false. The "g" flag indicates that the regular expression should be tested against all possible matches in a string.

You cannot change this property directly.

### ignoreCase

Whether to ignore case while attempting a match in a string. `ignoreCase` is a property of an individual regular expression object.

The value of `ignoreCase` is true if the "i" flag was used; otherwise, false. The "i" flag indicates that case should be ignored while attempting a match in a string.

You cannot change this property directly.

### lastIndex

A read/write integer property that specifies the index at which to start the next match. `lastIndex` is a property of an individual regular expression object.

This property is set only if the regular expression used the "g" flag to indicate a global search.

The following rules apply:

- If `lastIndex` is greater than the length of the string, `regexp.test` and `regexp.exec` fail, and `lastIndex` is set to 0.
- If `lastIndex` is equal to the length of the string and if the regular expression matches the empty string, then the regular expression matches input starting at `lastIndex`.
- If `lastIndex` is equal to the length of the string and if the regular expression does not match the empty string, then the regular expression mismatches input, and `lastIndex` is reset to 0.
- Otherwise, `lastIndex` is set to the next position following the most recent match.

For example, consider the following sequence of statements:

`re = /(hi)?/g` - Matches the empty string.

`re("hi")` - Returns ["hi", "hi"] with `lastIndex` equal to 2.

`re("hi")` - Returns [], an empty array whose zeroth element is the match string. In this case, the empty string because `lastIndex` was 2 (and still is 2) and "hi" has length 2.

### multiline

Reflects whether or not to search in strings across multiple lines. `multiline` is a property of an individual regular expression object.

The value of `multiline` is true if the "m" flag was used; otherwise, false. The "m" flag indicates that a multiline input string should be treated as multiple lines. For example, if "m" is used, "^" and "\$" change from matching at only the start or end of the entire string to the start or end of any line within the string.

You cannot change this property directly.

### source

A read-only property that contains the text of the pattern, excluding the forward slashes. `source` is a property of an individual regular expression object.

You cannot change this property directly.

## CHAPTER 6

### 6.6.1.7 String

A `String` is a sequence of zero or more Unicode characters. [More...](#)

#### Static String functions

String     `String::fromCharCode ( Number code1, Number code2,... );`

#### String functions

String     `String::charAt ( Number pos );`

Number     `String::charCodeAt ( Number pos );`

String     `String::concat ( string2, string3[, ..., stringN] );`

Number     `String::indexOf( String or RegExp pattern, Number pos );`

Number     `String::lastIndexOf ( String or RegExp pattern, Number pos );`

String     `String::match ( RegExp pattern );`

String     `String::replace ( RegExp pattern, String newValue );`

Number     `String::search ( RegExp pattern );`

String     `String::slice ( beginslice[, endSlice]);`

String     `String::split ([separator][, limit]);`

String     `String::substring ( Number startIndex, Number endIndex );`

String     `String::toLowerCase ( );`

String     `String::toString ( );`

String     `String::toUpperCase ( );`

#### String Properties

Number     `length`

#### Detailed description

A `String` is a sequence of zero or more Unicode characters. Laser Engine's `String` class uses the `QString` class's functions and syntax.

Strings can be created and concatenated as follows.

```
var text = "this is a";
var another = new String( "text" );
var concat = text + " " + another; // concat == "this is a
text"
```

#### Static String function documentation

##### **String::fromCharCode ( Number code1, Number code2,... );**

Returns a string made up of the characters with code `code1`, `code2`, etc., according to their Unicode character codes.

```
var s = String.fromCharCode( 65, 66, 67, 68 );
println( s ); // prints "ABCD"
```

#### String functions documentation

##### **String::charAt ( Number pos );**

Returns the character in the string at position `pos`. If the position is out of bounds, `undefined` is returned.

##### **Parameter:**

*Pos* - An integer between 0 and 1 less than the length of the string.

The following example displays characters at different locations in the string "Brave new world":

```
var anyString="Brave new world"

print("The character at index 0 is '" + anyString.charAt(0) +
"'")
print("The character at index 1 is '" + anyString.charAt(1) +
"'")
```

These lines display the following:

```
The character at index 0 is 'B'
The character at index 1 is 'r'
```

**String::charCodeAt ( Number pos );**

Returns the character code of the character at position `pos` in the string. If the position is out of bounds, `undefined` is returned.

**Parameter:**

*Pos* - An integer greater than 0 and less than the length of the string; if unspecified, defaults to 0.

The following example returns 65, the Unicode value for A:

```
"ABC".charCodeAt(0) // returns 65
```

**String::concat ( string2, string3[, ..., stringN] );**

Combines the text from one or more strings and returns a new string. Changes to the text in one string do not affect the other string.

**Parameter:**

*string2 ... stringN* - Strings to concatenate to this string.

```
s1="Oh "
s2="what a beautiful "
s3="mornin'."
s4=s1.concat(s2,s3) // returns "Oh what a beautiful mornin'."
```

**String::indexOf( String or RegExp pattern, Number pos );**

Returns the index of `pattern` in the string, starting at position `pos`. If no position is specified, the function starts at the beginning of the string. If the pattern is not found in the string, `-1` is returned.

**Parameters:**

*pattern* - A string representing the value to search for.

*pos* - The location within the calling string to start the search from. It can be any integer between 0 and the length of the string. The default value is 0.

The following example uses `indexOf` to locate a value in the string "Brave new world":

```
var anyString="Brave new world"
print("<The index of the first w from the beginning is " +
anyString.indexOf("w")) // Displays 8
```

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### **String::lastIndexOf ( String or RegExp *pattern*, Number *pos* );**

Returns the last index of *pattern* in the string, starting at position *pos* and searching backwards from there. If no position is specified, the function starts at the end of the string. If the pattern is not found in the string, -1 is returned.

#### **Parameters:**

*pattern* - A string representing the value to search for.

*pos* - The location within the calling string to start the search from, indexed from left to right. It can be any integer between 0 and the length of the string. The default value is the length of the string.

The following example uses `lastIndexOf` to locate a value in the string "Brave new world":

```
var anyString="Brave new world"
print("<The index of the first w from the end is " +
anyString.lastIndexOf("w")           // Displays 6
```

### **String::match ( RegExp *pattern* );**

Returns the matched *pattern* if this string matches the pattern defined by *regexp*. If the string doesn't match or *regexp* is not a valid regular expression, `undefined` is returned.

### **String::replace ( RegExp *pattern*, String *newValue* );**

Replaces the first occurrence of *pattern* in the string with *newValue* if the pattern is found in the string. A modified copy of string is returned.

If *pattern* is a regular expression with global set, all occurrences of *pattern* in the string will be replaced.

### **String::search ( RegExp *pattern* );**

Executes the search for a match between a regular expression and this `String` object. If successful, `search` returns the index of *pattern* inside the string.

The following example prints a message which depends on the success of the test:

```
function testinput(re, str){
  if (string.search(re) != -1)
    midstring = " contains ";
  else
    midstring = " does not contain ";
  print (str + midstring + re.source);
}
```

### **String::slice ( *beginSlice*[, *endSlice*]);**

Extracts a section of a string and returns a new string. Changes to the text in one string do not affect the other string.

#### **Parameters:**

*beginSlice* - The zero-based index at which to begin extraction.

*endSlice* - The zero-based index at which to end extraction. If omitted, `slice` extracts to the end of the string.

The following example uses `slice` to create a new string:

```
var str1 = "The morning is upon us.";
var str2 = str1.slice(3, -2);
print(str2);
```

This writes:

```
morning is upon u
```

### **String::split ([separator][, limit]);**

Splits a `String` object into an array of strings by separating the string into substrings.

#### **Parameters:**

*separator* - Specifies the character to use for separating the string. The separator is treated as a string or a regular expression (see [RegExp](#)). If separator is omitted, the array returned contains one element consisting of the entire string.

*limit* - Integer specifying a limit on the number of splits to be found.

The `split` method returns the new array. When found, `separator` is removed from the string and the substrings are returned in an array. If separator is omitted, the array contains one element consisting of the entire string.

If `separator` is a regular expression that contains capturing parentheses, then each time `separator` is matched the results (including any undefined results) of the capturing parentheses are spliced into the output array. However, not all browsers support this capability.



#### **Note:**

When the string is empty, `split` returns an array containing one empty string, rather than an empty array.

The following example defines a function that splits a string into an array of strings using the specified separator. After splitting the string, the function displays messages indicating the original string (before the split), the separator used, the number of elements in the array, and the individual array elements.

```
function splitString(stringToSplit,separator)
{
    var arrayOfStrings = stringToSplit.split(separator);
    print('The original string is: ' + stringToSplit + '');
    print('The separator is: ' + separator + '');
    print("The array has " + arrayOfStrings.length + " elements:
");
        for (var i=0; i < arrayOfStrings.length; i++)
            print(arrayOfStrings[i] + " / ");
}

var tempestString = "Oh brave new world that has such people in
it.";
var monthString = "Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov,
Dec";

var space = " ";
var comma = ",";

splitString(tempestString, space);
splitString(tempestString);
splitString(monthString, comma);
```

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This example produces the following output:

```
The original string is: "Oh brave new world that has such people
in it."
```

```
The separator is: " "
```

```
The array has 10 elements: Oh / brave / new / world / that / has
/ such / people / in / it. /
```

```
The original string is: "Oh brave new world that has such people
in it."
```

```
The separator is: "undefined"
```

```
The array has 1 elements: Oh brave new world that has such
people in it. /
```

```
The original string is: "Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep,
Oct, Nov, Dec"
```

```
The separator is: ", "
```

```
The array has 12 elements: Jan / Feb / Mar / Apr / May / Jun /
Jul / Aug / Sep / Oct / Nov / Dec /
```

### **String::substring ( Number *startIndex*, Number *endIndex* );**

Returns a copy of this string which is the substring starting at *startIndex* and ending at *endIndex*.

#### **Parameters:**

*startIndex* - An integer between 0 and one less than the length of the string.

*endIndex* - An integer between 0 and the length of the string.

The following example uses `substring` to display characters from the string "Laser Editor".

```
// assumes a print function is defined
var anyString = "Laser Editor";
```

```
// Displays "Light"
print(anyString.substring(0,5));
```

### **String::toLowerCase ( );**

Returns the value of the string converted to lowercase. `toLowerCase` does not affect the value of the string itself.

### **String::toString ( );**

Returns a string representing the specified object.

The following example displays the string value of a `String` object:

```
x = new String("Hello world");
alert(x.toString()) // Displays "Hello world"
```

### **String::toUpperCase ( );**

Returns the value of the string converted to uppercase. `toUpperCase` does not affect the value of the string itself.

## **String property documentation**

### **length**

A value that specifies the length of the string.

## 6.6.2 Arguments variable

The `arguments` object is a local variable available within all functions.

You can refer to a function's arguments within the function by using the `arguments` object. This object contains an entry for each argument passed to the function, the first entry's index starting at 0. For example, if a function is passed three arguments, you can refer to the argument as follows:

```
arguments[0]
arguments[1]
arguments[2]
```

The `arguments` object is not an array. It is similar to an array, but does not have any array properties except `length`.

You can use the `arguments` object if you call a function with more arguments than it is formally declared to accept. This technique is useful for functions that can be passed a variable number of arguments. You can use `arguments.length` to determine the number of arguments passed to the function, and then process each argument by using the `arguments` object.

### Description

It is an Array of the arguments that were passed to the function. It only exists within the context of a function.

### Example:

```
function sum()
{
    total = 0;
    for ( i = 0; i < arguments.length; i++ ) {
        total += arguments[ i ];
    }
    return total;
}
```



## CHAPTER 6

### 6.6.3 Built-in Constants

Laser Engine Program provides a number of convenient built-in constants.

For further information:

- [Infinity](#)
- [NaN](#)
- [undefined](#)

#### 6.6.3.1 Infinity

This is the value of any division by zero.

##### Syntax

```
var i = 1/0;
```

In Laser Engine Program, division by zero does not raise an exception; instead it assigns the `Infinity` value as the result of the expression. Use [isFinite\(\)](#) to test whether a value is finite or not.

#### 6.6.3.2 NaN

NaN means "Not-a-Number", and is used to signify that a value is not a legal number. Use [isNaN\(\)](#) function to test a value to see if it is NaN.

#### 6.6.3.3 undefined

This is the value of a variable that has never been declared, or that has been declared, but has not been assigned a value.

##### Example:

```
var i;
// ...
if ( i == undefined ) {
    i = 77;
}
```

In this example, if execution reaches the `if` statement, and `i` has not been assigned a value, it will be assigned the value 77.

## 6.6.4 Built-in Functions

Laser Engine Program provides the following built-in functions.

<a href="#">connect()</a>	<a href="#">isNaN()</a>
<a href="#">disconnect()</a>	<a href="#">isFinite()</a>
<a href="#">print()</a>	<a href="#">parseFloat()</a>
<a href="#">eval()</a>	<a href="#">parseInt()</a>

### See also:

- [Declaring Functions](#)

### 6.6.4.1 connect()

#### Syntax:

```
connect(function)
```

This function is used to create signals and slots connections between objects.

It has two forms, with or without arguments, as it is shown in the following examples:

#### Example without arguments:

```
function myInterestingScriptFunction() { ... }
...
myQObject.somethingChanged.connect(myInterestingScriptFunction);
```

#### Example with arguments:

```
function myInterstingScriptFunction2(arg1,arg2) { ... }
...
myQObject["somethingChanged2(arg1,arg2)"]
.connect(myInterestingScriptFunction2);
```

Note that the function is resolved when the connection is made, not when the signal is emitted.

- Back to the full list of [Built-in Functions](#)

### 6.6.4.2 disconnect()

To disconnect from a signal, you invoke the signal's `disconnect()` function, passing the function to disconnect as argument:

```
myQObject.somethingChanged.disconnect(myInterestingFunction);
```

- Back to the full list of [Built-in Functions](#)

### 6.6.4.3 print()

#### Syntax:

```
print( expression )
```

Prints the expression (applying `toString()` if necessary) to the output (`stderr`), followed by a newline.

- Back to the full list of [Built-in Functions](#)

## CHAPTER 6

### 6.6.4.4 eval()

#### Syntax:

```
eval( string )
    var x = 57;
    var y = eval( "40 + x" ); // y == 97
```

This function parses and executes the contents of the `string`, taking the text to be valid Laser Engine Program.

- Back to the full list of [Built-in Functions](#)

### 6.6.4.5 isFinite()

#### Syntax:

```
isFinite( expression )
```

Returns `true` if the expression's value is a number that is within range; otherwise returns `false`.

- Back to the full list of [Built-in Functions](#)

### 6.6.4.6 isNaN()

#### Syntax:

```
isNaN( expression )
```

Returns `true` if the expression's value is not a number; otherwise returns `false`.

#### Example:

```
var x = parseFloat( "3.142" );
var y = parseFloat( "haystack" );
if ( isNaN( x ) ) debug( "x is not a number" );
if ( isNaN( y ) ) debug( "y is not a number" );
// Prints: "y is not a number"
```

- Back to the full list of [Built-in Functions](#)

### 6.6.4.7 parseFloat()

#### Syntax:

```
parseFloat( string )
```

Parses the `string` and returns the floating point number that the string represents or `NaN` if the parse fails. Leading and trailing whitespace are ignored. If the string contains a number followed by non-numeric characters, the value of the number is returned and the trailing characters ignored.

- See also [parseInt\(\)](#).
- Back to the full list of [Built-in Functions](#)

### 6.6.4.8 parseInt()

#### Syntax:

```
parseInt( string, optBase )
```

Parses the `string` and returns the integer that the string represents in the given base `optBase`, or `NaN` if the parse fails. If the base isn't specified, the base is determined as follows:

- base 16 (hexadecimal) if the first non-whitespace characters are "0x" or "0X"
- base 8 (octal) if the first non-whitespace character is "0"
- base 10 otherwise

Leading and trailing whitespace are ignored. If the string contains a number followed by non-numeric characters, the value of the number is returned and the trailing characters ignored.

#### Example:

```
var i = parseInt( "24" );           // i == 24
var h = parseInt( "0xFF" );       // h == 255
var x = parseInt( " 459xyz " );   // x == 459
```

- See also [parseFloat\(\)](#).

## 6.6.5 Built-in Operators

Laser Engine Program provides a set of built-in operators, which are divided into the following types:

- [Assignment Operators](#)
- [Arithmetic Operators](#)
- [String Operators](#)
- [Logical Operators](#)
- [Comparison Operators](#)
- [Bit-wise operators](#)
- [Special Operators](#)

### 6.6.5.1 Assignment Operators

These operators are used to assign the value of expressions to variables:

<a href="#">= operator</a>	<a href="#">&amp;= operator</a>
<a href="#">+= operator</a>	<a href="#">^= operator</a>
<a href="#">-= operator</a>	<a href="#"> = operator</a>
<a href="#">*= operator</a>	<a href="#">&lt;&lt;= operator</a>
<a href="#">/= operator</a>	<a href="#">&gt;&gt;= operator</a>
<a href="#">%= operator</a>	<a href="#">&gt;&gt;&gt;= operator</a>

#### = operator

```
var variable = expression;
```

The assignment operator is used to assign the value of an expression to the variable.

It is an error to attempt to assign to a [constant](#).

#### += operator

```
variable += expression;
```

This operator adds the value of the expression to the variable. It is the same as:

```
variable = variable + expression;
```

but is shorter to write, and less error-prone.

See also [String Operators](#) (+= string)

#### -= operator

```
variable -= expression;
```

This operator subtracts the value of the expression from the variable.

#### \*= operator

```
variable *= expression;
```

This operator multiplies the value of the expression by the value of the variable.

**/= operator**

```
variable /= expression;
```

This operator divides the value of the `variable` by the value of the `expression`.

**%= operator**

```
variable %= expression;
```

This operator divides the `variable` by the `expression`, and assigns the remainder of the division (which may be 0), to the `variable`.

**&= operator**

```
variable &= expression;
```

This operator performs a bit-wise AND on the value of the `expression` and the value of the `variable`, and assigns the result to the `variable`.

**^= operator**

```
variable ^= expression;
```

This operator performs a bit-wise OR on the value of the `expression` and the value of the `variable`, and assigns the result to the `variable`.

**|= operator**

```
variable |= expression;
```

This operator performs a bit-wise OR on the value of the `expression` and the value of the `variable`, and assigns the result to the `variable`.

**<<= operator**

```
variable <<= expression;
```

This operator performs a bit-wise left shift on the `variable` by an `expression` number of bits. Zeros are shifted in from the right.

**>>= operator**

```
variable >>= expression;
```

This operator performs a bit-wise (sign-preserving) right shift on the `variable` by an `expression` number of bits.

**>>>= operator**

```
variable >>>= expression;
```

This operator performs a bit-wise (zero-padding) right shift on the `variable` by an `expression` number of bits.

## CHAPTER 6

### 6.6.5.2 Arithmetic Operators

These operators are used to perform arithmetic computations on their operands.

<u>+ operator</u>	<u>* operator</u>
<u>++ operator</u>	<u>/ operator</u>
<u>- operator</u>	<u>% operator</u>
<u>-- operator</u>	

#### + operator

```
operand1 + operand2
```

This operator returns the result of adding the two operands (`operand1` and `operand2`).

See also [String Operators \(+ string\)](#)

#### ++ operator

```
++operand; // pre-increment
operand++; // post-increment
```

The pre-increment version of this operator increments the `operand`, and returns the value of the (now incremented) `operand`.

The post-incremented version of this operator returns the value of the `operand`, and **then** increments the `operand`.

#### - operator

```
var result = operand1 - operand2; // subtraction
operand = -operand; // unary negation
```

The subtraction version of this operator returns the result of subtracting its second operand (`operand2`) from its first operand (`operand1`).

The unary negation version of this operator returns the result of negating (changing the sign) of its `operand`.

#### -- operator

```
--operand; // pre-decrement
operand--; // post-decrement
```

The pre-decrement version of this operator decrements the `operand`, and returns the value of the (now decremented) `operand`.

The post-decremented version of this operator returns the value of the `operand`, and **then** decrements the `operand`.

#### \* operator

```
operand1 * operand2
```

This operator returns the result of multiplying the two operands (`operand1` and `operand2`).

### / operator

operand1 / operand2

This operator returns the result of dividing the first operand (`operand1`) by the second operand (`operand2`).

Note that division by zero is **not** an error. The result of division by zero is `Infinity`. (See [Infinity](#)).

### % operator

operand1 % operand2

This operator returns the integer remainder (which may be 0) from the division of `operand1` by `operand2`.

## 6.6.5.3 String Operators

These operators provide string functions using operators. Many other string functions are available. (See also [String](#) built-in type).

The String operators are described in the table below:

Operator	Syntax	Description
<code>+ string</code>	<code>str1 + str2</code>	This operator returns a string that is the concatenation of its operands, ( <code>str1</code> and <code>str2</code> ). See also <a href="#">Arithmetic Operators</a> (+ operator).
<code>+= string</code>	<code>str1 += str2</code>	This operator appends its second operand ( <code>str2</code> ) onto the end of the first operand ( <code>str1</code> ). See also <a href="#">Assignment Operators</a> (+= operator).

## 6.6.5.4 Logical Operators

These operators are used to evaluate whether their operands are `true` or `false` in terms of the operator (for unary operators) and in terms of each other (for binary operators).

The binary operators use short-circuit logic, i.e. they do not evaluate their second operand if the logical value of the expression can be determined by evaluating the first operand alone.

The Logical operators are described in the table below:

Operator	Syntax	Description
<code>&amp;&amp;</code>	<code>operand1 &amp;&amp; operand2</code>	This operator returns an object whose value is <code>true</code> if both its operands are <code>true</code> ; otherwise it returns an object whose value is <code>false</code> . Specifically, if the value of <code>operand1</code> is <code>false</code> , the operator returns <code>operand1</code> as its result. If <code>operand1</code> is <code>true</code> , the operator returns <code>operand2</code> .
<code>  </code>	<code>operand1    operand2</code>	This operator returns an object whose value is <code>true</code> if either of its operands are <code>true</code> ; otherwise it returns an object whose value is <code>false</code> . Specifically, if the value of <code>operand1</code> is <code>true</code> , the operator returns <code>operand1</code> as its result. If <code>operand1</code> is <code>false</code> , the operator returns <code>operand2</code> .
<code>!</code>	<code>! operand</code>	If the operand's value is <code>true</code> , this operator returns <code>false</code> ; otherwise it returns <code>true</code> .



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### 6.6.5.5 Comparison Operators

Comparison operators are used to compare objects and their values.

The following table summarizes comparison operators:

Operator	Syntax	Description
==	operand1 == operand2	Returns <code>true</code> if the operands are equal; otherwise returns <code>false</code> .
!=	operand1 != operand2	Returns <code>true</code> if the operands are not equal; otherwise returns <code>false</code> .
= = =	operand1 === operand2	Returns <code>true</code> if the operands are equal <i>and</i> of the same type; otherwise returns <code>false</code> .
!==	operand1 !== operand2	Returns <code>true</code> if the operands are not equal <i>or</i> if the operands are of different types; otherwise returns <code>false</code> .
>	operand1 > operand2	Returns <b>true</b> if <b>operand1</b> is greater than <b>operand2</b> ; otherwise returns <b>false</b> .
>=	operand1 >= operand2	Returns <b>true</b> if <b>operand1</b> is greater than or equal to <b>operand2</b> ; otherwise returns <b>false</b> .
<	operand1 < operand2	Returns <b>true</b> if <b>operand1</b> is less than <b>operand2</b> ; otherwise returns <b>false</b> .
<=	operand1 <= operand2	Returns <b>true</b> if <b>operand1</b> is less than or equal to <b>operand2</b> ; otherwise returns <b>false</b> .

### 6.6.5.6 Bit-wise operators

These operators perform their operations on binary representations, but they return standard Laser Engine Program numerical values.

The following table summarizes bit-wise operators:

Operator	Syntax	Description
&	operand1 & operand2	Returns the result of a bit-wise AND on the operands (operand1 and operand2).
^	operand1 ^ operand2	Returns the result of a bit-wise XOR on the operands (operand1 and operand2).
	operand1   operand2	Returns the result of a bit-wise OR on the operands (operand1 and operand2).
~	~ operand	Returns the bit-wise NOT of the operand.
<<	operand1 << operand2	Returns the result of a bit-wise left shift of operand1 by the number of bits specified by operand2. Zeros are shifted in from the right.
>>	operand1 >> operand2	Returns the result of a bit-wise (sign propagating) right shift of operand1 by the number of bits specified by operand2.
>>>	operand1 >>> operand2	Returns the result of a bit-wise (zero filling) right shift of operand1 by the number of bits specified by operand2. Zeros are shifted in from the left.

### 6.6.5.7 Special Operators

The following special operators are available:

<a href="#"><u>?: operator</u></a>	<a href="#"><u>instanceof operator</u></a>
<a href="#"><u>, operator</u></a>	<a href="#"><u>new operator</u></a>
<a href="#"><u>function operator</u></a>	<a href="#"><u>this operator</u></a>
<a href="#"><u>in operator</u></a>	<a href="#"><u>typeof operator</u></a>

#### ?: operator

```
expression ? resultIfTrue : resultIfFalse
```

This operator evaluates its first operand, the `expression`. If the `expression` is `true`, the value of the second operand (`resultIfTrue`) is returned; otherwise the value of the third operand (`resultIfFalse`) is returned.

#### , operator

```
expression1, expression2
```

This operator evaluates its first and second operand (`expression1` and `expression2`), and returns the value of the second operand (`expression2`).

The comma operator can be subtle, and is best reserved only for use in argument lists.

#### function operator

```
var variable = function( optArguments ) { Statements }
```

This operator is used to create anonymous functions. Once assigned, the `variable` is used like any other function name, e.g. `variable(1, 2, 3)`. Specify the argument names (in `optArguments`) if named arguments are required. If no `optArguments` are specified, arguments may still be passed and will be available using the arguments list. (See [Arguments variable](#)).

The Laser Engine Program function operator supports closures, for example:

```
function make_counter( initialValue )
{
    var current = initialValue;
    return function( increment ) { current += increment;
return current; }
}
// ...
var counterA = make_counter( 3 ); // Start at 3.
var counterB = make_counter( 12 ); // Start at 12.
debug( counterA( 2 ) ); // Adds 2, so prints 5
debug( counterB( 2 ) ); // Adds 2, so prints 14
debug( counterA( 7 ) ); // Adds 7, so prints 12
debug( counterB( 30 ) ); // Adds 30, so prints 44
```

Note that for each call to `make_counter()`, the anonymous function that is returned has its own copy of `current` (initialized to the `initialValue`), which is incremented independently of any other anonymous function's `current`. It is this capturing of context that makes the function that is returned a closure.

See also [Declaring Functions](#).

## CHAPTER 6

### in operator

property in Object

Returns true if the given Object has the given property; otherwise returns false.

### instanceof operator

object instanceof type

Returns true if the given object is an instance of the given type, (or of one of its base classes); otherwise returns false.

### new operator

```
var instance = new Type( optArguments );
```

This function calls the constructor for the given Type, passing it the optional arguments (optArguments) if any, and returns an instance of the given Type. The Type may be one of the built-in types, one of the library types, or a user-defined type.

#### Example:

```
var circle = new Circle( x, y );
var file = new File();
```

### this operator

this.property

The this operator may only be used within a function that is defined within a class or form, i.e. a member function. Within the scope of the function this is a reference to the particular instance (object) of the class's type. (See also [Declaring Functions](#) and [Declaring Classes](#)).

To illustrate the concept of binding, refer to the following example.

#### Example:

```
function Car(brand) {
    this.brand = brand;
}

Car.prototype.getBrand = function() {
    return this.brand;
}

var foo = new Car("toyota");
print(foo.getBrand());
```

As expected, this outputs "toyota".

### typeof operator

typeof item

This operator returns a type of the object as a string.

#### Example:

```
var f = new Function("arguments[0]*2"); // "object"
var str = "text"; // "string"
var pi = Math.PI; // "number"
```

Functions and built-in objects have a typeof of "function".



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