



## **Essential Metrics Project Manager (EPM)**

***ADA, Assembly, ASP, C#, C/C++, CSS,  
Fortran, IDL, HTML, Java, JavaScript, JSP,  
Perl, PHP, PL/SQL, Python, Ruby,  
ShellScript, Textfiles, VB6 / VB.NET /  
VBScript, VHDL, Windows Batch and XML***

**User Guide**

***1.19.3.0***

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## Document

### ***Purpose***

This document is a User Guide for the Essential Metrics PM command-line source code metrics tool.

### ***Readership***

This User Guide is intended for end-users, system administrators. Management and non-technical users should refer to our website – <http://www.powersoftware.com/epm/>

## Version History

1.00.011	20-Mar-2005	Corrected rounding issues and case-insensitivity with filenames.
1.00.012	25-Mar-2005	Corrected detection of changes from non-zero Difference in standard metric values to non-zero CHG_SLOC, ADD_SLOC, DEL_SLOC. To prevent loss of precision due to large Project E values, represent E in thousands (k).
1.00.013	27-Mar-2005	Added CSV reporting.
1.00.014	29-Mar-2005	Added XML reporting.  Please refer to the document definition – “epm.dtd” for interpreting the XML results.
1.00.015	4-May-2005	Added C/C++ Parsing
1.01.000	9-May-2005	Added Java Parsing
1.02.000	13-May-2005	Added VB6 and VB.NET Parsing
1.03.000	19-May-2005	Added PL/SQL Parsing
1.04.000	02-Aug-2005	Added ADA Parsing
1.05.000	15-Aug-2005	Added Perl Parsing
1.06.000	23-Aug-2005	Added XML Configuration
1.07.000	20-Dec-2005	<b>160</b> : Use Windows Services rather standalone mode for MySQL <b>164</b> : Added NFILE metric
1.08.000	28-Jan-2006	<b>168</b> : Added Metric Sets to the EPM XML Configuration file
1.08.002	14-Feb-2006	<b>187</b> : Various MySQL and EPM bugs quashed
1.09.000	21-Feb-2006	<b>188</b> : DSP Project file parsing added
1.09.003	18-Mar-2006	<b>212</b> : Employ the Diff specific to each Language to ensure correct Changed metrics
1.10.000	26-Mar-2006	<b>218</b> : Ignore Halstead metrics at the Project level <b>220</b> : Metrics for New files are all Zero <b>221</b> : CSV and XML Reports not obeying the specific metric visibility rules
1.10.001	10-Apr-2006	<b>230</b> : Ensure Ada parsing is case-insensitive
1.10.002	11-May-2006	<b>241</b> : Ensure EPM can be executed from any directory
1.10.003	02-Jun-2006	<b>244</b> : Resolved System Error 3 (MySQL service issues) <b>252</b> : Add Min/Max/Avg to Project window for Halstead metrics
1.10.004	06-Jun-2006	<b>255</b> : CSV Reporting correctly shows DEL_SLOC and DEL_FILE <b>257</b> : Metrics Sets work for XML and CSV Reports
1.11.000	18-Jul-2006	<b>272</b> : Added Changed Logical Lines of Code (CHG_LLOC, DEL_LLOC, ADD_LLOC)
1.12.000	27-Oct-2006	<b>117</b> : Added ASP Parsing
1.13.000	10-Nov-2006	<b>301</b> : Added PHP Parsing
1.14.000	10-Jul-2007	<b>314</b> : Added IDL Parsing
1.15.000	26-Jul-2007	<b>316</b> : Added VHDL Parsing
1.15.001	28-Jul-2007	<b>317</b> : Changed default VHDL extension to *.vhd
1.15.002	26-Oct-2007	<b>319</b> : Remove duplicate files in projects before analysing
1.15.003	01-Nov-2007	<b>321</b> : Ensure Logical Lines are calculated corrected in Ada, ASP & C/C++/Java.
1.15.004	28-Nov-2007	<b>323</b> : Resolved issues with missing PHP metrics.
1.16.000	11-Dec-2007	<b>325</b> : Added JSP and XML Parsing.
1.16.001	14-Dec-2007	
1.16.002	04-Jan-2008	<b>330</b> : Improved links in footer on HTML (h2) report.

1.16.003	24-Apr-2008	<b>359</b> : LLOC whitespace causing erroneous Diff values <b>355</b> : LLOC mismatch – C++-Style comments within C-style comments <b>356</b> : DEL_LLOC not being output to CSV file
1.16.004	26-Apr-2008	<b>360</b> : Build issues caused by compilation under VS2008 (upgraded from VC++6).
1.16.005	30-May-2008	<b>366</b> : Ensure EPM has the current MySQL 5.0+ drivers.
1.17.000	18-Apr-2009	<b>10400</b> : Added JavaScript Language (JT) <b>10401</b> : Added HTML Language (HT) <b>10402</b> : Added Assembler Language (AY) <b>10403</b> : Added Python Language (PY) <b>10415</b> : Perl parser optimisation <b>10416</b> : C# parser optimisation <b>10418</b> : XML parser optimisation <b>10420</b> : Ada parser optimisation <b>10421</b> : ASP parser optimisation <b>10422</b> : C/C++ parser optimisation <b>10424</b> : Java parser optimisation <b>10426</b> : PHP parser optimisation <b>10428</b> : VB parser optimisation <b>10430</b> : Add Churn metrics (CRN_SLOC, CRN_LLOC & CRN_FILE)
1.17.1.0	30-Apr-2009	<b>10436</b> : Allow setting of language for empty file extension using space (" ")
1.17.2.0	05-May-2009	<b>10441</b> : Ensure free text within HTML is counted as SLOC.
1.17.3.0	12-May-2009	<b>10450</b> : Ensure commas in filenames do not disrupt CSV reports.
1.18.0.0	27-Jul-2009	<b>10454</b> : Add Text files (TX) Language to EPM <b>10453</b> : Add Shell Script (SH) Language to EPM <b>10457</b> : Investigate Intel Issue: EPM crash parsing 'MKL sources' <b>10451</b> : Add Fortran (FT) Language to EPM
1.19.0.0	22-Aug-2009	<b>10450</b> : Added CSS Stylesheet (SS) Language to EPM <b>10452</b> : Added Ruby (RB) Language to EPM <b>10455</b> : Added Windows Batch File (WB) Language to EPM <b>10456</b> : Corrected issue with Halstead Bug Prediction (B) rounding to 0 or 1.
1.19.2.0	15-Sep-2009	<b>10479</b> : Add PLOC (Preprocessor LOC) for Preprocessor Directives to C/C++ and Assembly <b>10483</b> : Add logging to EPM <b>10488</b> : File extensions that do not exist in EPM.XML are excluded
1.19.3.0	27-Oct-2009	<b>10499</b> : Ensure integrity of build (following missing files in 1.19.2.0).

## EPM Filelists

Essential Project Manager accepts "Project files". A Project file is required to describe the project's key attributes: its name, a snapshot date, as well as the files to be parsed within the project.

The Standard EPM Project contains the name of each file to be parsed within the project file itself. It is also possible to create an EPM Project that references an external project file (currently Microsoft DSP files are supported) to minimise the amount of additional configuration required to integrate EPM into the build process.

### **Standard EPM Project file**

A Standard EPM Project file is structured as follows:

Line 1:       **Project Name**  
Line 2:       **Project Snapshot date** (a text representation of the date snapshot taken)  
Line 3:       **Base directory** (useful for cropping long paths and essential for PM comparisons)  
Line 4-end:   full path and filename of each file

You can create a filelist using a DOS Batch file similar to the following:

```
@echo off

set FILELIST=filelist.txt
set PATH=c:\tmp\c#code\mono\mono-1.0.5

echo Mono Version 1.0.5 > %FILELIST%
echo 03-Feb-2005 >> %FILELIST%
echo %PATH% >> %FILELIST%

dir %PATH%\*.cs /s /b >> %FILELIST%
```

### **EPM Project file referencing Microsoft DSP**

To reference your Microsoft DSP project file within an EPM Project, structure your file as follows:

Line 1:       **Project Name**  
Line 2:       **Project Snapshot date** (a text representation of the date snapshot taken)  
Line 3:       @DSP=<your DSP file>

For example:

```
My New Project
21/02/2006
@DSP=c:\Dev\Project1\Project1.dsp
```

Note that there is no "Base Directory" specified. This is because EPM intelligently derives the base directory by extracting the most common part of the path from the absolute pathname of every file referenced in the DSP file. This enables EPM to compare different versions of a Microsoft VS project without requiring a configuration headache.

## Installing MySQL (optional)

If you wish to use an existing MySQL server in the organisation, you can do so using the `-s` (and `-u/-p` if required) parameter.

Otherwise, a local MySQL database will be started implicitly as Essential Metrics runs.

### ***Installing Essential Project Manager on Microsoft Windows Vista***

Vista's User Account Control prevents EPM from installing and starting the MySQL service. A simple solution to this problem is to install MySQL separately, and reference accordingly within the command-line of EPM.

Please follow the instructions in the **KEPM\_Vista\_MySQL** User Guide – which accompanies the EPM installation.

Now follow the instructions in the previous section of this document to connect to your separate MySQL installation.

## Running Essential Metrics PM

### *Installing a License*

You must obtain either a time-locked (for testing) or node-locked/floating (following purchase) license from Power Software. The recommended way to install the license is to place it where you installed Essential Metrics (e.g. C:\Program Files\Power Software\Essential Metrics C# PM) and then simply to call 'epm' at the command line. This will prompt for you to Browse to the license.dat file.

### *Command Line options*

Usage: epm options name

#### **Options**

-s	MySQL server	Name of the MySQL server to store data
-u	MySQL user	User to connect to MySQL server ( <b>must accompany -p</b> )
-p	MySQL pass	Password to connect to MySQL server ( <b>must accompany -u</b> )
-fX	filelist	Obtain files from the given file list (f1=new, f2=old)
-m	metrics_set	Name of the Metrics Set (defined in epm.xml) to apply to reports.
-c	csv_file	Create a CSV report.
-h2	html_dir	Create multiple page HTML report.
-x	xml_file	Create an XML report.
-l	log_file	Log output of the session to a logfile.
-?		Show this help screen.

**Name** A name to give the project.

You can either operate as a two-stage process:

1. Generate metrics
2. Output reports

Or perform both tasks together. You must specify one or other or both, you cannot omit both the filelist and reporting options – Essential Metrics would have nothing to do.

## ***Combined PM Generation and Report***

```
epm -f1 C:\tmp\c#code\mono\mn_new.txt  
    -f2 C:\tmp\c#code\mono\mn_old.txt -h2 html -s knox mono1
```

Explanation:

-f1 is the first project filelist, considered to be the new project  
-f2 is the old project filelist, or baseline, against which the comparison will be performed  
-h2 specifies an HTML report to the '**html**' directory (if this does not exist, you will be prompted for creation)  
-s specifies '**knox**' as the MySQL server  
mono1 is the MySQL database that will be created to store the results.

**WARNING: the database will be dropped and recreated each time -fX options are passed to Essential Metrics – ensure you do not use the name of an existing database if using a separate MySQL Server.**

## ***Two-stage Single Project Generation and Report***

```
epm -f1 C:\tmp\c#code\mono\mn_new.txt -s knox mono2  
epm -h2 html -s knox mono2
```

If you wish to copy the 'style.css' file included with the build to any HTML report directories you create, you will see the output is formatted colourfully. You may also amend the style.css to match any corporate/departmental standards before publishing to an intranet.

## FAQ

### *How does EPM know which parser to use?*

EPM is supplied with a default XML Configuration file that instructs the tool to apply different languages parsers to the files based on the following file extensions:

Language	Extensions	Parser Code
ADA	.a .ada .adb .ads	AD
ASP	.asp .aspx	AS
Assembly	.asm	AY
C++	.cpp .c .hpp .h	CP
C#	.cs	CS
CSS	.css	SS
Fortran	.f .f90	FT
IDL	.idl	ID
HTML	.htm .html .htm	HT
Java	.java	JV
JavaScript	.js	JT
JSP	.jsp	JS
PHP	.php	PH
Perl	.pl	PL
PL/SQL	.sql .ora	S1
Python	.py	PY
Ruby	.rb	RB
Shell Script	.ash .bash .bsh .csh .sh .tcsh .tsh .zsh	SH
Textfile	.cvs .install .readme .tsv .txt	TX
VB.NET	.vb	VB
VB6	.frm .bas .cls	VB
VBScript	.vbs	VB
VHDL	.vhd	VH
Windows Batch	.bat .cmd	WB
XML	.xml .xsd .xsl .xslt .wsml	XM

**All other files are treated as C/C++ files.**

**You cannot simply add a language of your own.** EPM only understands the **Parser Codes** listed above. Should you need a new language not listed here, please contact us to discuss.

If you need to modify this configuration, you may edit the EPM.XML configuration file supplied with the tool, **but please take a backup before you start** and if you experience any errors and you report these, please **include your EPM.XML file** and state what you were trying to achieve.

The default file looks like:

<pre>&lt;?xml version="1.0" encoding="UTF-8"?&gt; &lt;epm&gt;   &lt;lang name="C++" parser="CP"&gt;     &lt;filetype name="Source"&gt;       &lt;ext name="Class" value="cpp" /&gt;       &lt;ext name="C File" value="c" /&gt;     &lt;/filetype&gt;     &lt;filetype name="Header"&gt;       &lt;ext name="C++ Header" value="hpp" /&gt;       &lt;ext name="C Header" value="h" /&gt;     &lt;/filetype&gt;   &lt;/lang&gt;   &lt;lang name="C#" parser="CS"&gt;     &lt;filetype name="Source"&gt;       &lt;ext name="Class" value="cs" /&gt;     &lt;/filetype&gt;   &lt;/lang&gt;   ... &lt;/epm&gt;</pre>	<p>This extract from the file shows the definitions for two Languages: C++ and C#.</p> <p>Within each lang entity there are filetype entities. <b>The C++</b> Language has two filetypes: <b>Source</b> and <b>Header</b>. Each filetype then has one or more ext entities representing the file extensions that comprise the filetype.</p> <p><b>C#</b> only has one filetype – <b>Source</b> – and a single extension – <b>cs</b>.</p> <p><i>Extensions are the characters after the last period (.) in the filename.</i></p>
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To add new `filetype` or `ext` entities, simply edit the file using a text editor, copy/paste an existing block and modify the name and value attributes accordingly.

The values in the **name** attributes are free-text. In a future version of EPM it will be possible to report on these values, including viewing files/metrics grouped by the same filetype (e.g. Source) across several languages.

If you have files that have no extension, you may use a value of " " (single space). This means that **all** files with no extension will be parsed using the language parser you have selected.

```
<ext name="MyFileType" value=" " />
```

The **parser** attribute of the **lang** entity must be one of the Parser Codes listed in the first table.

## How can I limit the metrics that are output by the reports?

You can limit the metrics that are output to the EPM reports by creating "Metric Sets" in the epm.xml Configuration file.

A Metric Set is a grouping of Metrics identified by a name. You can then pass that *name* into EPM via the "-m *name*" option (see **Command Line options**). An example follows:

<pre>&lt;?xml version="1.0" encoding="UTF-8"?&gt; &lt;epm&gt;   &lt;lang name="C#" parser="CS"&gt;     &lt;filetype name="Source"&gt;       &lt;ext name="Class" value="cs" /&gt;     &lt;/filetype&gt;   &lt;/lang&gt;   &lt;sets&gt;     &lt;set name="Core Metrics"&gt;       &lt;met id="100" upper="10000" /&gt;       &lt;met id="101" /&gt;       &lt;met id="102" /&gt;       &lt;met id="109" upper="10000" /&gt;       &lt;met id="110" lower="0" upper="100" /&gt;       &lt;met id="111" lower="100" upper="1000000" /&gt;       &lt;met id="112" upper="10" /&gt;       &lt;met id="116" /&gt;       &lt;met id="118" /&gt;       &lt;met id="119" /&gt;       &lt;met id="121" /&gt;       &lt;met id="122" /&gt;     &lt;/set&gt;     &lt;set name="Code Lines"&gt;       &lt;met id="100" /&gt;       &lt;met id="101" /&gt;       &lt;met id="119" /&gt;       &lt;met id="120" /&gt;       &lt;met id="121" /&gt;     &lt;/set&gt;   &lt;/sets&gt; &lt;/epm&gt;</pre>	<p>After the "lang" entities, you would create a <b>&lt;sets&gt;</b> entity.</p> <p>Within this, you can create one or more <b>&lt;set&gt;</b> entities.</p> <p>The example opposite has two Metric Sets defined: "Core Metrics" and "Code Lines". Be sure to give the set a name, so that you can refer to it when you call EPM.</p>
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Within each set, you list the Metrics (by ID – see

**What do the Metric IDs and Codes mean?)** and you can optionally put lower and upper limits on these metrics. Future EPM functionality will allow "Violating Metrics" reports to be produced showing those files whose metrics are above/below the limits specified.

### **What does line\_type in CSV reports mean?**

Line Type	Description	Meaning
<b>C</b>	Changed	The File/Project has Changed. This line gives details of the New File/Project and the original metrics can be found on a corresponding Old ( <b>O</b> ) line.
<b>O</b>	Old	Where a File/Project has Changed, the Old line will also be output to the CSV file.
<b>X</b>	Diff	Where a File/Project has Changed, the Diff line will also be output to the CSV file, showing the difference between Changed ( <b>C</b> ) and Old ( <b>O</b> ) lines.
<b>U</b>	Unchanged	The File/Project has not changed.
<b>N</b>	New	The File is New, it has been added to the Project.

Deleted files are not shown in CSV reports.

### **Why do I get ‘You do not have a valid license’?**

If you have not requested a license from [laurence.arthur@powersoftware.com](mailto:laurence.arthur@powersoftware.com), please do so. Once you have received this file (supplied as an attachment called 'license.dat'), please detach this to the folder in which you installed EPM, by default:

```
C:\Program Files\Power Software\Essential Metrics PM
```

If there is an existing license.dat, overwrite it. Then try re-executing EPM.exe. If you continue to experience problems, send an email [support@powersoftware.com](mailto:support@powersoftware.com) with the License [Code] value you see on starting up EPM.

### **What does the error stating the MySQL cannot start mean?**

If you are relying on EPM to start a MySQL database for you, please ensure that you wait a few seconds between running successive EPM sessions. MySQL takes a moment or so to start and stop the service at the beginning and end of an EPM session.

## What do the Metric IDs and Codes mean?

We use a unique numeric code for each metric, as well as an alpha code which is more descriptive.

For efficiency reasons, these numeric codes may change between releases, when a new metric is inserted into the list. We upgrading, be sure to check your Metric Sets and any other interfaces that rely upon the Metric ID.

ID	Code	Description	Project	File
100	LOC	Lines of Code	✓	✓
101	SLOC	Source Lines of Code	✓	✓
102	SLOC_NAT	Source Native Lines of Code	✓	✓
103	SLOC_TAG	Source Tag Lines of Code	✓	✓
104	SLOC_HTM	Source HTML Lines of Code	✓	✓
105	SLOC_SCR	Source Script Lines of Code	✓	✓
106	PLOC	Preprocessor Directive Lines of Code	✓	✓
107	LLOC	Logical Lines of Code (semi-colon count – formerly NSC)	✓	✓
108	N1	Total No. of Operators		✓
109	N2	Total No. of Operands		✓
110	n1	No. of unique or distinct Operators		✓
111	n2	No. of unique or distinct Operands		✓
112	N	Halstead program Length (calculated as N1 + N2)		✓
113	n	Halstead program Vocabulary (calculated as n1 + n2)		✓
114	V	Halstead Volume (calculated as V = Nlog2n)		✓
115	D	Halstead program Difficulty		✓
116	E	Halstead program Effort (calculated as D * V)		✓
117	B	Halstead Bug Prediction		✓
118	J_COM	Java-style Comment Lines	✓	✓
119	C_COM	C-style Comment Lines	✓	✓
120	EOL_COM	To End of Line Comment Lines	✓	✓
121	COM_LOC	Total Comment Lines	✓	✓
122	BYTES	File size in bytes	✓	✓
123	NFILE	Number of Files	✓	
124	CHG_SLOC	Changed Source Lines of Code	✓	✓
125	DEL_SLOC	Deleted Source Lines of Code	✓	✓
126	ADD_SLOC	Added Source Lines of Code	✓	✓
127	CRN_SLOC	Churn Source Lines of Code (CHG_SLOC + DEL_SLOC + ADD_SLOC)	✓	✓
128	CHG_LLOC	Changed Logical Lines of Code	✓	✓
129	DEL_LLOC	Deleted Logical Lines of Code	✓	✓
130	ADD_LLOC	Added Logical Lines of Code	✓	✓
131	CRN_LLOC	Churn Logical Lines of Code (CHG_LLOC + DEL_LLOC + ADD_LLOC)	✓	✓
132	CHG_FILE	Changed Files	✓	
133	DEL_FILE	Deleted Files	✓	
134	ADD_FILE	Added Files	✓	
135	CRN_FILE	Churn Files (CHG_FILE + DEL_FILE + ADD_FILE)	✓	