



## Level 4 - Measurements

### Level 4 measurements

The table below describes the recommended measurements in the CMM at level 4.

√	KPA	Description	References
	QPM	Measurements to determine the status of the activities for quantitative process management. (L4-15, M1)	
	SQM	Measurements used for software quality management based on the project's defined software process. (L4-20, C1, 2)	
	SQM	Software quality. (L4-26, A2, 1)	
	SQM	Software product quality. (L4-26, A2, 4)	
	SQM	Measurements used to quantify the characteristics of software product quality. (L4-27, A3, 2)	
	SQM	Quality of the project's software products. (L4-29, A4)	
	SQM	Quality of the software work products of each software life-cycle stage. (L4-29, A4, 4)	
	SQM	Measurements to determine the status of the software quality management activities. (L4-31, M1)	

## Level 4 - Work Products Managed and Controlled

### Level 4 work products managed and controlled

The table below lists the work products that are recommended to be managed and controlled in the CMM at level 4.

√	KPA	Work Products Managed and Controlled	References
	QPM	Project's quantitative process management plan. (L4-7, A1, 4)	
	QPM	Process performance baseline for the software project. (L4-12, A5, 9)	
	QPM	Process capability baseline for the organization's standard software process. (L4-14, A7, 5)	
	SQM	Software quality plan. (L4-25, A1, 10)	

## Level 4 - Reviews and Audits, Continued

### Level 4 reviews and audits, continued

The table below lists the recommended reviews and audits in the CMM at level 4, continued from the previous page.

√	KPA	Review or Audit	Review Participants	References
	SQM	<b>Senior management</b> reviews the software quality plans. (L4-25, A1, 9)	<b>Senior management</b>	
	SQM	The software tasks are planned and performed to address the project's software quality goals. At the beginning of a software task, <b>the team performing the task</b> : (L4-29, A4, 1)  <input type="checkbox"/> Reviews the quality goals for the software product. (L4-29, A4, 1.1)  <input type="checkbox"/> Reviews changes made to the process to meet the software quality goals. (L4-29, A4, 1.4)	<b>Team performing the software task</b>	
	SQM	The activities for software quality management are reviewed with <b>senior management</b> on a periodic basis. (L4-31, V1)	<b>Senior management</b>	
	SQM	The activities for software quality management are reviewed with the <b>project manager</b> on both a periodic and event-driven basis. (L4-31, V2)	<b>Project manager</b>	
	SQM	The <b>software quality assurance group</b> reviews and/or audits the activities and work products for software quality management and reports the results. (L4-32, V3)	<b>Software quality assurance group</b>	

## Level 4 - Reviews and Audits

### Level 4 reviews and audits

The table below lists the recommended reviews and audits in the CMM at level 4.

√	KPA	Review or Audit	Review Participants	References
	QPM	The project's quantitative process management plan undergoes peer review. (L4-7, A1, 2)	<b>Not specified in the CMM</b>	
	QPM	The project's quantitative process management plan is reviewed by the <b>group responsible for the organization's software process activities (e.g., the software engineering process group)</b> . (L4-7, A1, 3)	<b>Group responsible for the organization's software process activities (e.g., the software engineering process group)</b>	
	QPM	The results of the data analysis are reviewed with those affected by the data before they are reported to anyone else. (L4-12, A6, 1)	<b>Not specified in the CMM</b>	
	QPM	The activities for quantitative process management are reviewed with <b>senior management</b> on a periodic basis. (L4-15, V1)	<b>Senior management</b>	
	QPM	The software project's activities for quantitative process management are reviewed with the <b>project manager</b> on both a periodic and event-driven basis. (L4-16, V2)	<b>Project manager</b>	
	QPM	The <b>software quality assurance group</b> reviews and/or audits the activities and work products for quantitative process management and reports the results. (L4-16, V3)	<b>Software quality assurance group</b>	
	SQM	<b>Specialty engineers in areas such as safety and reliability</b> are available to help set the software quality goals and review progress towards the goals. (L4-21, Ab1, 1)	<b>Specialty engineers in areas such as safety and reliability</b>	
	SQM	The software quality plan undergoes peer review. (L4-24, A1, 7)	<b>Not specified in CMM</b>	
	SQM	The software quality plan is reviewed by <b>affected groups and individuals</b> . (L4-24, A1, 8)	<b>Affected groups and individuals</b>	

*Continued on next page*

## Level 4 - Tools

### Level 4 tools

The table below lists the tools recommended in the CMM for level 4.

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√	KPA	Tools	References
	QPM	Tools to support quantitative process management. (L4-5, Ab2, 3)	
	QPM	Organization's software process database. (L4-10, A4, 9)	
	SQM	Tools to support predicting, measuring, tracking, and analyzing software quality. (L4-21, Ab1, 2)	

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## Level 4 - Training

**Level 4 training** The table below lists the training recommended in the CMM at level 4.

√	KPA	Training	References
	QPM	The <b>individuals implementing or supporting quantitative process management</b> receive required training to perform these activities. (L4-6, Ab4)	
	QPM	The <b>members of the software engineering group and other software-related groups</b> receive orientation on the goals and value of quantitative process management. (L4-6, Ab5)	
	SQM	The <b>individuals implementing and supporting software quality management</b> receive required training to perform their activities. (L4-22, Ab2)	
	SQM	The <b>members of the software engineering group and other software-related groups</b> receive required training in software quality management. (L4-22, Ab3)	

## Level 4 - Procedures

### Level 4 procedures

The table below lists the activities that are recommended to be performed according to a documented procedure in the CMM at level 4. Refer to the Level 4 Procedure Checklists for additional information regarding the content of each documented procedure.

√	KPA	Documented Procedures	References
	QPM	The software project's plan for quantitative process management is developed according to a documented procedure. (L4-6, A1)	
	QPM	The measurement data used to control the project's defined software process quantitatively are collected according to a documented procedure. (L4-9, A4)	
	QPM	The project's defined software process is analyzed and brought under quantitative control according to a documented procedure. (L4-10, A5)	
	QPM	The process capability baseline for the organization's standard software process is established and maintained according to a documented procedure. (L4-13, A7)	
	SQM	The project's software quality plan is developed and maintained according to a documented procedure. (L4-23, A1)	

## Level 4 - Process Descriptions

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### **QPM process description**

Quantitative Process Management involves establishing goals for the performance of the project's defined software process, which is described in the Integrated Software Management key process area, taking measurements of the process performance, analyzing these measurements, and making adjustments to maintain process performance within acceptable limits. When the process performance is stabilized within acceptable limits, the project's defined software process, the associated measurements, and the acceptable limits for the measurements are established as a baseline and used to control process performance quantitatively.

The organization collects process performance data from the software projects and uses these data to characterize the process capability (i.e., the process performance a new project can expect to attain) of the organization's standard software process, which is described in the Organization Process Definition key process area. Process capability describes the range of expected results from following a software process (i.e., the most likely outcomes that are expected from the next software project the organization undertakes). These process capability data are, in turn, used by the software projects to establish and revise their process performance goals and to analyze the performance of the projects' defined software processes. (L4-1)

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### **SQM process description**

Software Quality Management involves defining quality goals for the software products, establishing plans to achieve these goals, and monitoring and adjusting the software plans, software work products, activities, and quality goals to satisfy the needs and desires of the customer and end user for high quality products.

The practices of Software Quality Management build on the practices of the Integrated Software Management and Software Product Engineering key process areas, which establish and implement the project's defined software process, and the Quantitative Process Management key process area, which establishes a quantitative understanding of the ability of the project's defined software process to achieve the desired results.

Quantitative goals are established for the software products based on the needs of the organization, the customer, and the end users. So that these goals may be achieved, the organization establishes strategies and plans, and the project specifically adjusts its defined software process, to accomplish the quality goals. (L4-19)

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## Level 4 - Standards

### Level 4 standards

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The CMM recommends the contents of the following work products at level 4:

√	KPA	Standards at Level 4	References
	QPM	Projects' quantitative process management plan. (L4-7, A2)	
	SQM	Project's software quality plan. (L4-25, A2)	

### Reference

Refer to the Level 4 Standards Checklists for additional information regarding the content of each standard.

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## Level 4 - Policies

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**Level 4 policies** The following table lists the recommended policies in the CMM at level 4.

√	KPA	Description	References
	QPM	Written organizational policy for measuring and quantitatively controlling the performance of the project's defined software process. (L4-2, C1)	
	QPM	Written policy for analyzing the process capability of the organization's standard software process. (L4-3, C2)	
	SQM	Written organizational policy for managing software quality. (L4-20, C1)	

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## Level 4 - KPA Goals

### Level 4 KPA goals

The following table lists the goals that are described in the CMM for each key process area at level 4.

√	KPA	CMM Goals at Level 4	References
	QPM	The quantitative process management activities are planned. (L4-2, G1)	
	QPM	The process performance of the project's defined software process is controlled quantitatively. (L4-2, G2)	
	QPM	The process capability of the organization's standard software process is known in quantitative terms. (L4-2, G3)	
	SQM	The project's software quality management activities are planned. (L4-20, G1)	
	SQM	Measurable goals for software product quality and their priorities are defined. (L4-20, G2)	
	SQM	Actual progress toward achieving the quality goals for the software products is quantified and managed. (L4-20, G3)	

## Level 4 - KPA Purposes

### Level 4 KPA purposes

The following table describes the purpose of each key process area in the CMM at level 4.

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√	KPA	Purpose of KPAs at Level 4
	QPM	The purpose of Quantitative Process Management is to control the process performance of the software project quantitatively. Software process performance represents the actual results achieved from following a software process. (L4-1)
	SQM	The purpose of Software Quality Management is to develop a quantitative understanding of the quality of the project's software products and achieve specific quality goals. (L4-19)

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# Level 4 Summary

## Overview

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**Section purpose** The purpose of this section is to provide checklists that provide a summary of the managed level (level 4). This section contains three perspectives of a CMM level.

- *Key process area (KPA) specific information:*
  - KPA purpose
  - KPA goals
- *Operational framework information (from a maturity level viewpoint):*
  - Policies
  - Standards
  - Process descriptions
  - Procedures
  - Training
  - Tools
- *Other key process information (from a maturity level viewpoint):*
  - Reviews and audits
  - Work products managed and controlled
  - Measurements

**Section overview**

This section contains the following topics.

Topic	Page
Level 4 - KPA Purposes	L4-Summary-2
Level 4 - KPA Goals	L4-Summary-3
Level 4 - Policies	L4-Summary-4
Level 4 - Standards	L4-Summary-5
Level 4 - Process Descriptions	L4-Summary-6
Level 4 - Procedures	L4-Summary-7
Level 4 - Training	L4-Summary-8
Level 4 - Tools	L4-Summary-9
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