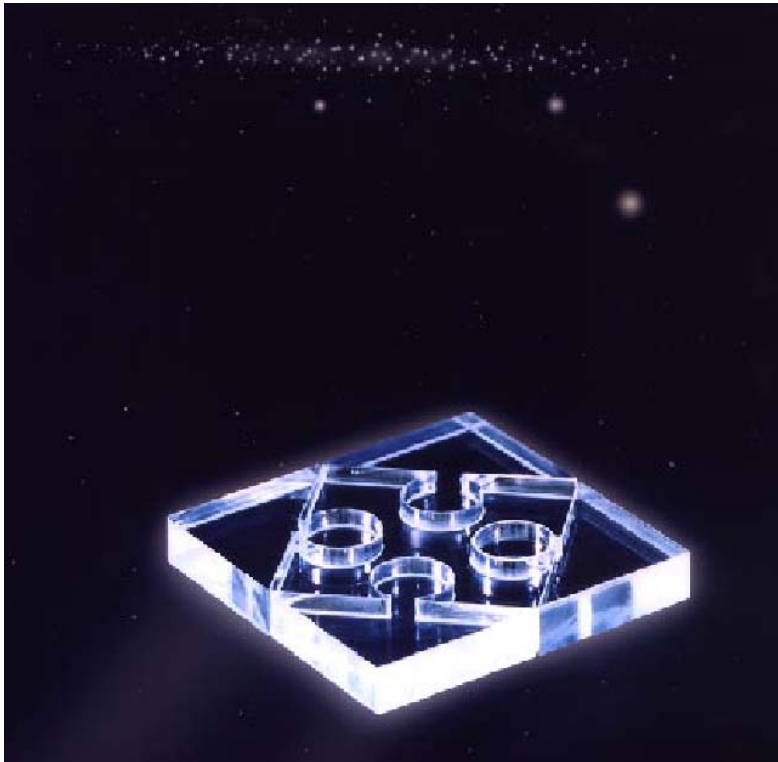

Axyz PAM

Process Automation Module

Software Reference Manual



Leica Geosystems AG

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1. Introduction

1.1 What is PAM?

PAM is a Process Automation Module integral to Axyz 1.4.2.

1.2 What is the purpose of PAM?

PAM is a Process Automation Module for programming sequences of commands and functions generally available in the Axyz software. This allows a customized sequence of operations to be executed as often as it is required. The main emphasis is on the **Automation** of Inspection and Analysis processes using any of the 3D optical instrument systems currently supported by Axyz and its associated systems control and administration, data management, data processing and analysis, and reporting.

Because PAM is such a powerful tool with much functionality and potential for refined programming, it can also be quite complex to use. However, processes for standard Axyz operations are a series of logical steps and are very simple to create.

PAM does not require Visual Basic programming of scripts but uses built in automation functionality. The CAD graphical view of data is currently not supported in this module.

1.3 Who is PAM for?

PAM is essentially for experienced Axyz users and it is assumed that they have a detailed knowledge of the sequences of steps and processes necessary to achieve a specified measurement and analysis task. A PAM programmer also needs to be able to anticipate the consequences of template loading and process actions and how results will be used or displayed.

Once the PAM process has been created and tested, any operator trained to use Axyz can use it. Depending on the level of programmed enhancement and the instrument system, the PAM process can provide Inspection and Analysis processes for operator interaction ranging from some user intervention by action prompts responses, data input, and options selection to no further action and complete automation.

1.4 What are Processes, Templates and Subroutines?

Operation sequences are created by using a **Process**, a **Template**, or a **Subroutine** file. These three sequences look very similar but have fundamental differences in their function and use. All three kinds use a grid that allows the user to specify a set of actions in a specified sequence of lines intended for later execution.

PAM is designed to execute **Processes**, which are sequences of user-defined actions. Actions may be manually entered into a **Process** or they may be loaded from **Templates**.

A **Template** contains user-defined actions just like a **Process**. Normally a **Template** defines a specific set of tasks that might be repeated over and over again within a single process using different imported elements each time.

A **Subroutine** is similar to a template in that it contains user-defined actions to complete a task that might have to be repeated many times in a process with different input information each time. A **Subroutine** defers input of element and result name information by allowing the user to declare 'parameters' that will be passed to it by branching to the Subroutine.

Only one of each sequence type can be open (or active) at the same time. An action is defined in a **Template**, **Process** or **Subroutine** line through a 'Define Action' dialog that displays a tree of actions from which to choose.

The Define Action dialogs for **Templates**, **Processes** and **Subroutines** are mostly identical with some exceptions. The actions 'Ask for Name', 'Create Name', and 'Import' are available in **Templates** only. 'Subroutine Parameter' applies only to **Subroutines**. Also, the 'Auto Process' and 'End Process' actions are not available in **Subroutines**. Action lines may be cut, copied and pasted, but only within the same type of sequence.

1.4.1 Properties and Differences

Process

- Only Process lines can be executed in PAM!
- A Process is a combined series of actions that have to be executed in sequence to automate the settings, displays, measurement and analysis functions commonly carried out one-by-one in Axyz.
- A Process is created by entering actions manually line by line or by loading from a Template. A Template cannot be loaded until a Process grid (new or existing) is open.
- During template loading, if the template includes an Import action, the action lines are repeated in the Process as many times as there are required elements in the Selected Data list of the Import data from Axyz DM or Excel dialog window.
- Associated with the Process is the Element List.

Template

- A Template is a set of actions that may be repeatedly loaded (appended) into a Process file. Several different templates can be loaded to create a Process. Many commonly used templates can be created and stored for convenience and for later repeated use.
- Templates cannot be executed in PAM independently.
- The Ask for Name action is unique to Templates. During template loading, if the open template contains Ask for Name actions of any kind, the user will be prompted to enter the Name which another action in the Template can refer to.
- The Create Name action is likewise unique to Templates. It is similar to Ask for Name except that it automatically creates a user-specified name for other Template actions to refer to when loading the template without prompting the user for one.
- The Import actions are also unique to Templates. During template loading, if the open template contains Import actions of any kind, the user will be prompted to provide the source (Axyz DM or Excel file) of those elements and these values will be stored in the Element List.
- Because of a Template's repetitive and future process execution characteristics, the point name of any measurement result can be generated during process execution by building the resulting point name from an existing name by either incrementing its numeric portion or by subtracting/adding alphanumeric prefixes.
- Templates are 'static'. Changing a Template will not update the process when this template was already loaded.

Subroutine

- A Subroutine is used to make the process code more compact and easier to modify. One single Subroutine can be used by several Process files; more than one Subroutine can be used in a Process file.
- A Subroutine is a set of PAM commands that are called as a group (action ‘Go To Subroutine’).
- Element names may be passed into the subroutine as parameters.
- The ‘Subroutine Parameter’ action is unique to Subroutines. By calling a Subroutine from a Process or Template file, the user has to declare parameters that will be passed to it.
- Subroutines are ‘dynamic’. They are loaded during the execution of the process when an action to call the subroutine is encountered. Subroutine lines are only loaded temporarily into the process and will be removed again when executed.
- The Auto Process and End Process actions are not available in Subroutines.

1.5 What is an Element List?

The ‘Element List’ is a grid that displays the elements imported or defined by the user. Elements consist of ID’s and values for points, shapes, coordinate systems or reference points. They are available for selection by various other actions.

Elements get into this list by any of the following means:

- Imported from Axyz DM or Excel during template loading,
- Imported using the Tools/Import Elements menu function,
- Imported during process execution with an Import Elements action,
- Created and stored by a previously executed process action,
- Manually created and stored using the Edit Element dialog.

The Element List window is attached to the process and is saved with it. This means that when the process is carried from one job/location to another, the intended nominal data remains intact with it and independent of Axyz DM or Excel spreadsheet databases.

Line	Element ID	Type Element	X	Y	Z	Std / Rot X	Std / Rot Y	Std / Rot Z	Size	Flag
1	DEFAULT/BASE	Coordinate System	0.000	0.000	0.000	Ang 0.0000	Ang 0.0000	Ang 0.0000	0.000	False
2	DEFAULT/circle1	Circle	1.387	-124.274	-99.151	Ang 216.9116	Ang 27.5028	Ang 359.7562	0.009	False
3	DEFAULT/line1	Line	1.386	-124.311	-99.190	Ang 319.7328	Ang 8.2712	Ang 0.0000		False
4	DEFAULT/1	Point	1.394	-124.278	-99.149					False
5	DEFAULT/2	Point	1.394	-124.277	-99.149					False
6	DEFAULT/3	Point	1.394	-124.277	-99.149					False
7	DEFAULT/4	Point	1.394	-124.276	-99.147					False
8	DEFAULT/5	Point	1.394	-124.276	-99.148					False
9	DEFAULT/6	Point	1.394	-124.275	-99.148					False
10	DEFAULT/7	Point	1.394	-124.276	-99.148					False
11	DEFAULT/8	Point	1.394	-124.278	-99.149					False

For more information about the ‘Element List, refer to [Chapter Tutorial - Element List](#).

1.6 What are differences between equivalent functions in PAM and Axyz?

Process actions are similar to those found in Axyz itself except that the dialog windows in PAM reflect the future execution characteristic of the Process. Where Axyz dialogs have Solve or Save buttons, the Process dialogs have OK and Set buttons.

The Axyz Help Files provide detailed explanations of the dialog boxes for functions common with PAM and those of PAM are therefore not duplicated in the same detail except where necessary.

To facilitate the automation of inspection and analysis processes PAM has the extra features of Displays, Branching, Importing and Positioning to specified points automatically for motorized instrument systems. This helps to automate the Build and Inspect functions and to carry out immediate on-site Analysis and Reporting.

1.7 What does it mean to store Pictures, Templates, and Subroutines in a Process and why do it?

As described above, Templates and Subroutines can be created for repeated use in Processes. Normally, a Template resides on the computer as a separate file with a *.tpl extension. Likewise, a Subroutine is a separate file with a *.sub extension. Furthermore, several actions in PAM allow the display of Pictures, which normally exist on the computer as separate graphics files with such extensions as *.bmp, *.ico, *.wmf, *.emf, *.jpg, or *.gif.

It is quite possible then for the computer to become laden with numerous accessory files that are associated with a single Process. If a supervisor wants to create a process and all its accessory files to give to an operator to run, he might have to supply the operator with a rather large collection of files besides just the Process (*.pro) file itself. It would be very easy to make mistakes and omit files doing things this way.

Therefore PAM allows the user to store Pictures, Templates, and Subroutines within the Process file itself so that everything associated with it can be totally self-contained. This makes the task of maintaining and transporting Processes between computers much less cumbersome.

2. Tutorial

This Tutorial is designed to help the user to understand and create Processes, Templates and Subroutines. Simple examples using LTM Measurement and Analysis functions will demonstrate how to create and modify Processes, Templates and Subroutines as well as how to use important features unique to PAM.

2.1 Start up of PAM

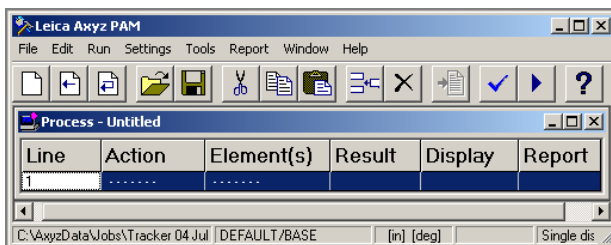
2.1.1 Requirements

Axyz CDM is running.

2.1.2 Open PAM

Press Icon:  in CDM or menu Tools/Process Automation


PAM opens by prompting for a Process name to optionally be opened. If so, it is opened and displayed. Otherwise, the following screen is shown and PAM is ready for entries into a new Process.



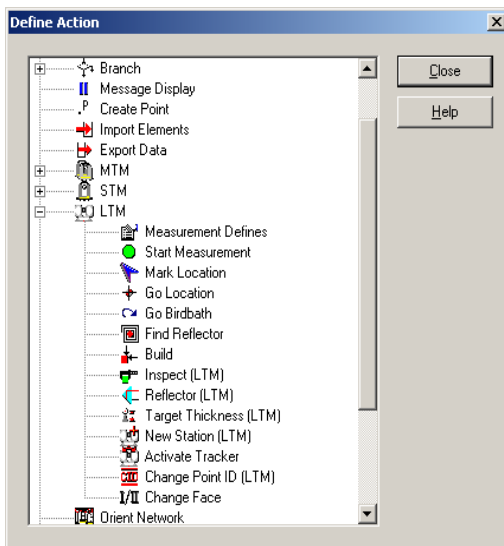
2.2 Creating a Process

For this Tutorial a simple Process will be created that:

1. Measures three points with LTM,
2. Applies analysis functions to fit a line to the points,
3. Calculates the deviation between the line and one of the measured points.

Create a new process by clicking:  or menu File/New Process (Ctrl+N).

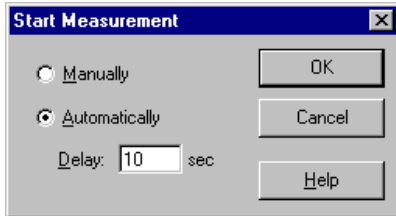
To enter an action line, click in any of the columns (except 'Line') in the next available blank process line. A tree of actions will be displayed from which to choose. The Action tree provides all the functions and capabilities found in Axyz CDM plus some extra features such as Displays and Branching. A click on the +, or double click on the headings reveals each list of actions.



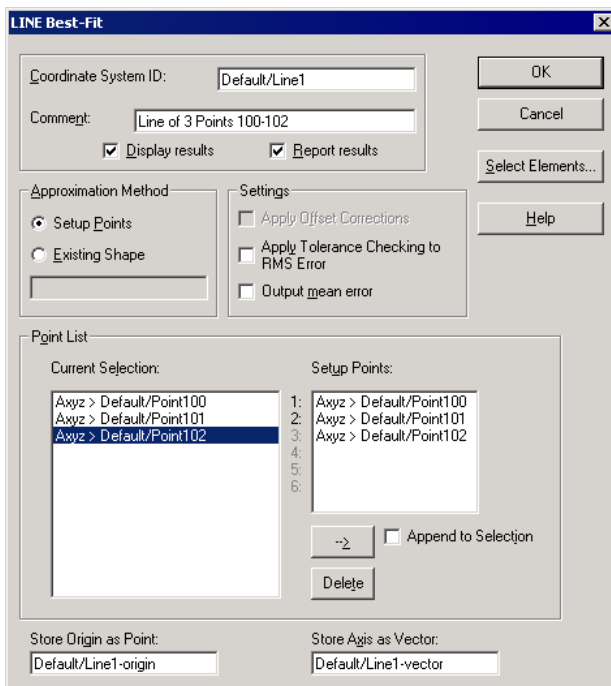
In the LTM action tree you will find the action 'Measurement Defines'. Once the standard Measurement Defines dialog window is completed, this function makes two entries in the Process: "Measurement Defines: Point" and "Start Measurement (manual)." In this example the Point ID is 'Point100'.

Line	Action	Element(s)	Result	Display	Report
1	Measurement Defines: Point	.....	Default/Point100	Point coordinates	Point data
2	Start Measurement (manual)	.....		
3	.....	.....	

The Start Measurement action must be repeated in lines 3 and 4 to measure two more points. Their point ID's will automatically be incremented, therefore 'Point101' and 'Point102' will be measured. Set the measurement to start automatically after a delay of 10 seconds.

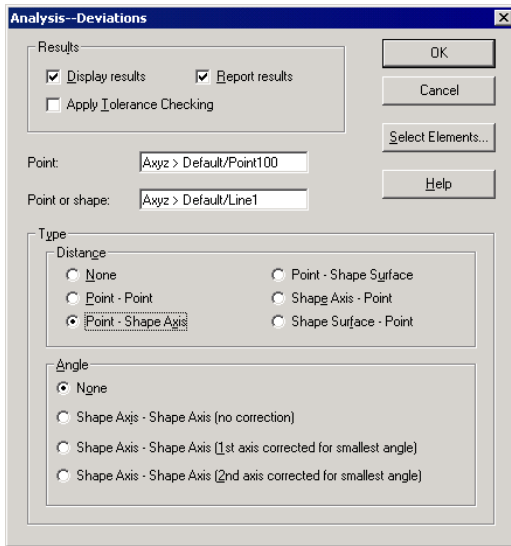


The next action is Line Best-Fit using the Points: 'Point100', 'Point101', and 'Point102'. The resulting Line will be 'Line1'.

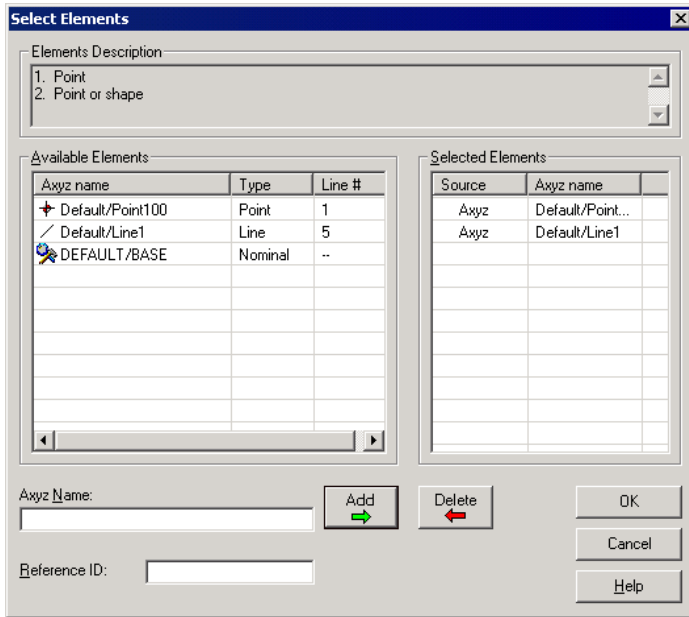


To select the elements you want to use for the Best-Fit Action, click on 'Select Elements'.

The final action for this process is Deviations, which can be found under the Analysis action tree.




To select the elements you want to compare, click on 'Select Elements'.



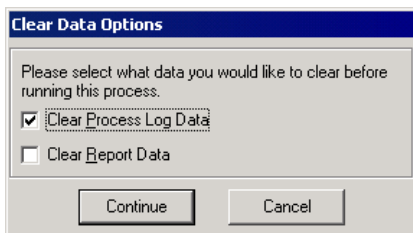
The resulting Process should now be saved (here as Example1.pro).

Line	Action	Element(s)	Result	Display	Report
1	Measurement Defines: Point	.....	Default/Point100	Point coordinates	Point data
2	Start Measurement (manual)	.....		
3	Start Measurement (delay 10 sec)	.....		
4	Start Measurement (delay 10 sec)	.....		
5	Shape Best Fit - Line	Axyz > Default/Point100 + 2	Default/Line1	Shape origin, RMS	Shape params, RMS, origin
6	Analysis Deviations	Axyz > Default/Point100 + 1		Deviations	Deviations
7	.....	.....	

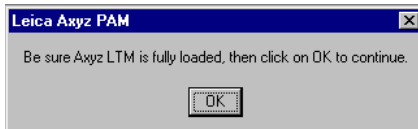
2.3 Running a process

Start the process by clicking the Icon:  or menu Run/Run All (F5). It is also possible to run only certain parts of a process using the commands 'Run Selected', 'Run Unmarked' or 'Run from Selected Line' in the 'Run' menu!

After starting a process, the following dialog appears. You can choose to clear all Process Log Data and all Report Data created with a previous process run. Detailed information about these two items will follow later on. Leave the default settings for now and click Continue.



If the Axyz module for your instrument is not yet running, a message such as the following appears while PAM automatically starts it. Change to the module and finish its startup procedure. Then go back to PAM and continue by clicking OK.



When a process line finishes executing, it is marked (yellow highlighted) as 'executed'. Skipped lines remain unmarked (not yellow highlighted).

Line	Action	Element(s)	Result	Display	Report
1	Measurement Defines: Point	.....	Default/Point100	Point coordinates	Point data
2	Start Measurement (manual)	.....		
3	Start Measurement (delay 10 sec)	.....		
4	Start Measurement (delay 10 sec)	.....		
5	Shape Best Fit - Line	Axyz > Default/Point100 + 2	Default/Line1	Shape origin, RMS	Shape params, RMS, origin
6	Analysis Deviations	Axyz > Default/Point100 + 1		Deviations	Deviations
7	.....	.....	

Notice that during execution various measurement prompts associated with each action are displayed. Various display feature enhancements will be demonstrated during the Process modification/editing examples later in this tutorial.

When the process is complete, have a look at the Data Log under Tools. This window provides a general summary of the process lines executed along with their execution status as well as various information about the action. A line highlighted green indicates an action that completed successfully, while a red-highlighted line means an error of some type occurred during the execution of that action.


Name	Type Data	Status	Action	X	Y	Z	i / Rot X	j / Rot Y	k / Rot Z	Reflector	RMS
Default/Point100	Measurement Defines Point	Good	LTM								
Default/Point100	Start Measurement	Skipped	LTM	0.000	0.000	0.000	0.000000	0.000000	0.000000		
Default/Point100	Start Measurement	Good	LTM	1.387	-124.320	-99.197	0.000000	0.000000	0.000000		
Default/Point101	Start Measurement	Good	LTM	1.386	-124.321	-99.198	0.000000	0.000000	0.000000		
Default/Line1	Line	Good	Shape Best Fit	1.387	-124.320	-99.197	-0.250173	-0.741296	-0.622811		0.000
Default/Point100-Default/Line1	Deviations	Good	Analysis	0.000	0.000	0.000	0.000000	0.000000	0.000000		

2.4 Create a Template

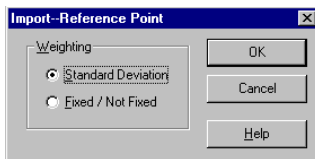
A Template is a set of actions that may be repeatedly loaded (appended) into a Process. Several different templates can be called to create a Process. Many commonly used templates can be created and stored for convenience and for later repeat use.

In this Tutorial a Template will be created to demonstrate some important features useful in creating Processes. This Template will be used to import nominal (reference) points, and to setup a Process that measures the same points with LTM and then do a transformation into the nominal coordinates. A New Template screen is opened from the New Template Toolbar button or from the File menu.

For defining actions the screen looks and functions exactly the same as that for a New Process. However, to avoid repetition, these will only be explained in detail where there are significant differences.

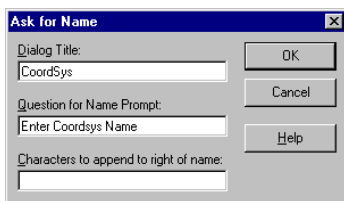
Create a new Template by clicking:  or menu File/New Template (CTRL+T).

To import Reference Points the 'Import Reference Point' action is used. At this moment you don't have to define which points to import. You only define how many points you want to import when loading the template into a process later.



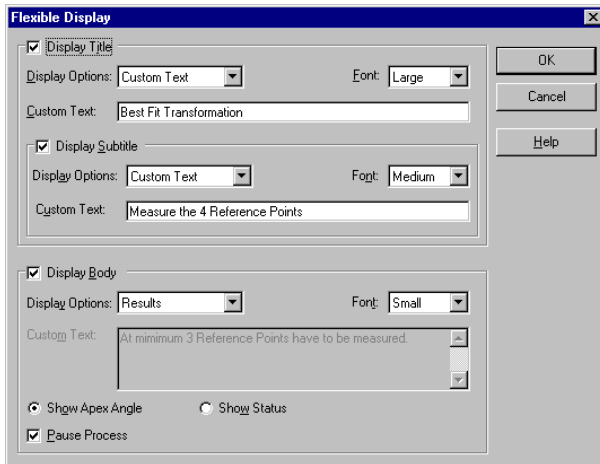
Insert the Import Reference Point action four times.

After the Import Action insert an Ask for Name action. (This is another action that is unique to Templates.)

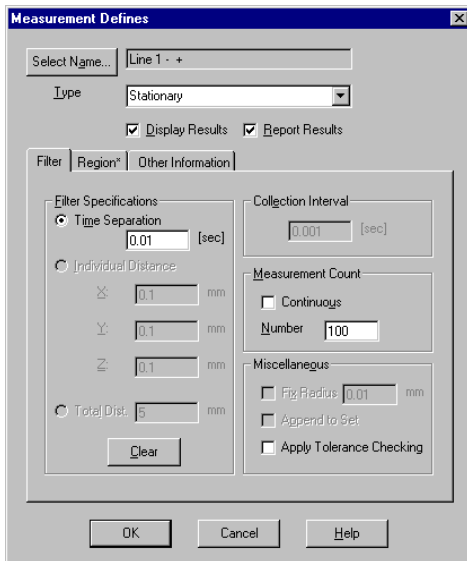


Enter the Dialog Title and the question for the Ask for Name action. Later, while loading this template into a process, you will refer to this action.

Insert a Flexible Display action into the template (Display/Flexible Display/Set Display).

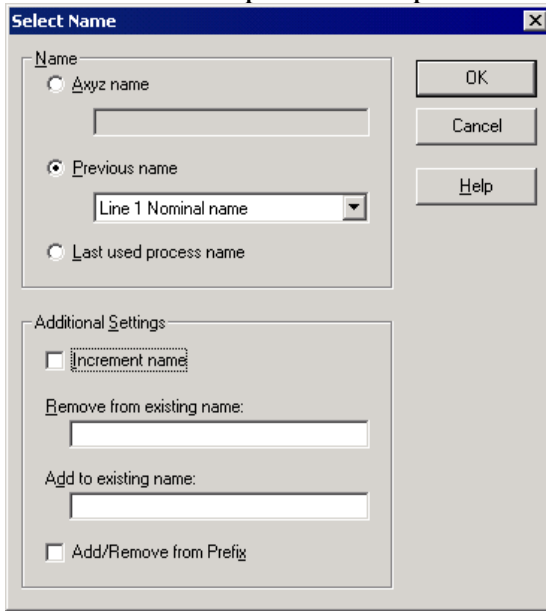


Then insert a Measurement Defines action.



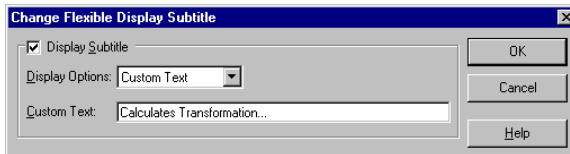
The resulting element ID must be entered differently when adding a Measurement Defines action to a template than when adding one to a process. Here you must click the ‘Select Name’ Button. There are three ways to enter the element ID in the Select Name dialog. In this example we refer to a previous template line. For the first Measurement Defines action, we refer to template Line 1, where we have an Import Reference Point action. Therefore, the first point we measure will have the same

name as the first point we import.

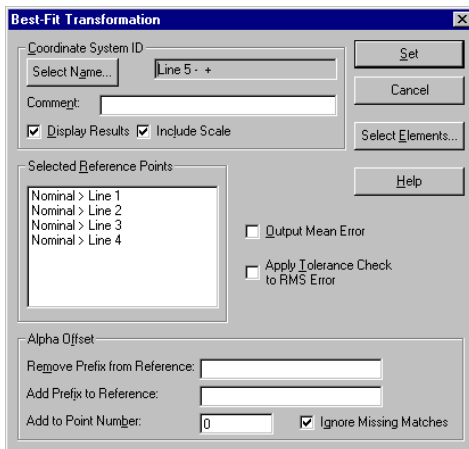


Do this also for the other three points.

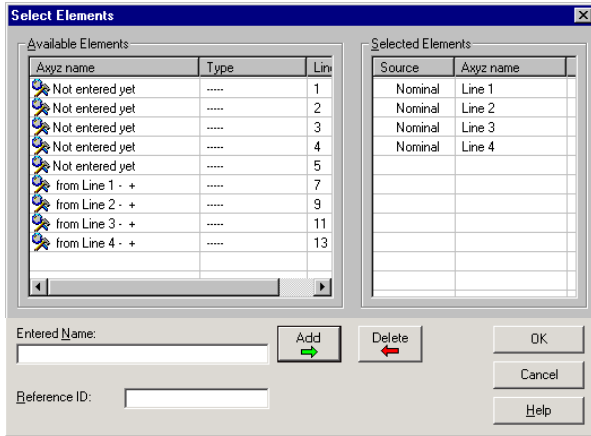
After the actions to measure the four points, change the Subtitle of the Flexible Display (Display/Flexible Display/Change Subtitle).



Insert a Transformation using the four imported points.



To select the points to use for the transformation, click the ‘Select Elements’ button.




Finally insert a Show Data Log action. This will automatically open the Data Log window.

Line	Action	Element(s)	Result	Display	Report
1	Reference point (Std Dev)	.....	Nominal name		
2	Reference point (Std Dev)	.....	Nominal name		
3	Reference point (Std Dev)	.....	Nominal name		
4	Reference point (Std Dev)	.....	Nominal name		
5	Ask for Name	.....	Nominal name		
6	Set Display	.....	None required		
7	Measurement Defines: Point	.....	Line 1 - +	Point coordinates	Point data
8	Start Measurement (manual)	.....	None required		
9	Measurement Defines: Point	.....	Line 2 - +	Point coordinates	Point data
10	Start Measurement (manual)	.....	None required		
11	Measurement Defines: Point	.....	Line 3 - +	Point coordinates	Point data
12	Start Measurement (manual)	.....	None required		
13	Measurement Defines: Point	.....	Line 4 - +	Point coordinates	Point data
14	Start Measurement (manual)	.....	None required		
15	Change Subtitle	.....	None required		
16	Transformation	Line 1 + 3	Line 5 - +		
17	Show Data Log	.....	None required		
18	.....	.....	

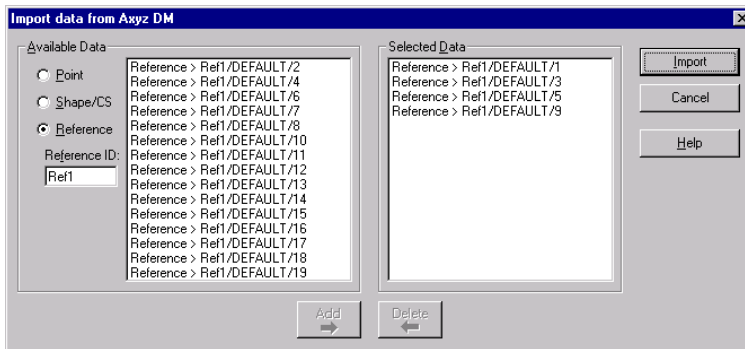
The completed Template is saved as Example2.tpl and can only be executed when loaded into a Process.

2.5 Load From Template

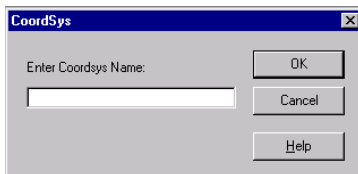
A Template cannot be loaded until a Process grid (new or existing) is open.

Start the Load from template by clicking the Icon:  or menu Tools/Load from Template (F3).

Template loading pauses to input the import element names. In this case the Reference radio button is marked and the Reference ID (Ref1) entered. All available reference points are listed in the left-hand window and can be selected and added in the order they are to be imported. Those in the right-hand window are the Selected Data imported to the Element List.



After the Import Reference Points PAM prompts to insert the name for the resulting Name of the Coordinate System created by the transformation.



The template-loaded Process is saved as Example2.pro and after running the process the following executed Process and Data Log are presented.

Line	Action	Element(s)	Result	Display	Report
1	Set Display	.....		
2	Measurement Defines: Point	.....	DEFAULT/1	Point coordinates	Point data
3	Start Measurement (manual)	.....		
4	Measurement Defines: Point	.....	DEFAULT/3	Point coordinates	Point data
5	Start Measurement (manual)	.....		
6	Measurement Defines: Point	.....	DEFAULT/5	Point coordinates	Point data
7	Start Measurement (manual)	.....		
8	Measurement Defines: Point	.....	DEFAULT/9	Point coordinates	Point data
9	Start Measurement (manual)	.....		
10	Change Subtitle	.....		
11	Transformation	Nominal > DEFAULT/1 + 3	Default/Tool		
12	Show Data Log	.....		
13	.....	.....	

Name	Type Data	Status	Action	X	Y	Z	i	j	k	Reflector
DEFAULT/1	Def Point	Good	Trk meas							
DEFAULT/1	Start meas	Good	Trk meas	-0.023	-0.062	25.312	0.000	0.000	0.000	
DEFAULT/3	Def Point	Good	Trk meas							
DEFAULT/3	Start meas	Good	Trk meas	319.996	-0.064	25.362	0.000	0.000	0.000	
DEFAULT/5	Def Point	Good	Trk meas							
DEFAULT/5	Start meas	Good	Trk meas	639.928	-0.038	25.364	0.000	0.000	0.000	
DEFAULT/9	Def Point	Good	Trk meas							
DEFAULT/9	Start meas	Good	Trk meas	640.030	440.061	25.376	0.000	0.000	0.000	
Default/Tool	Transformat	Good	Coord sys	964.054	2805.237	-567.649	0.145	0.212	316.541	
Default/Tool	Show Data	Good	Display							

Note


A green line in the Data Log means that the action line was executed successfully. A red line means that an error has occurred.

2.6 Create a Subroutine

Unique to the subroutine definition, the most important thing to plan is the parameters that must be passed.

Subroutine actions allow parameters to be referred to in place of any element or the result name only. Plan in advance the order in which they will be passed and be prepared to enter Subroutine Parameter actions to be referred to by other subroutine actions in the proper order.

In this Tutorial, a Template will be created which calls a Subroutine that measures as many points as desired then calculates a best fit plane with these points.

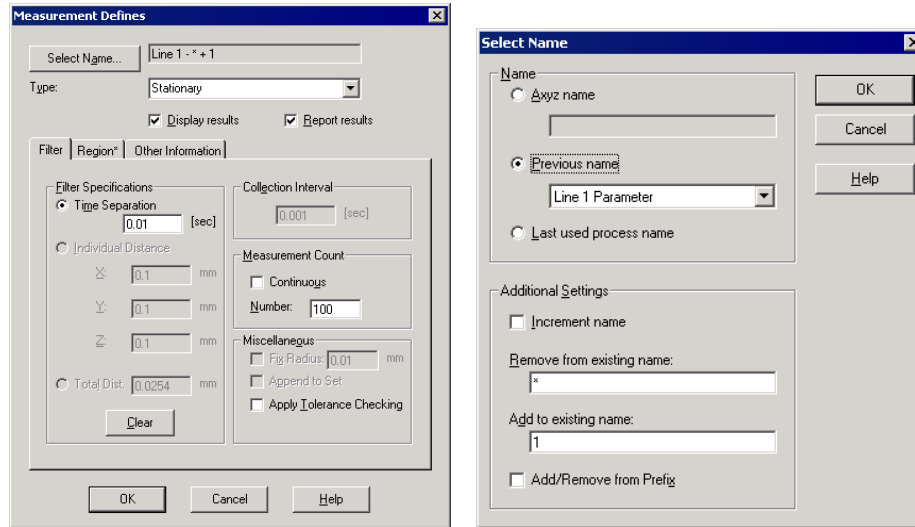
Create a new subroutine by clicking:  or menu File/New Subroutine (Ctrl+U).

Insert a 'Subroutine Parameter' action. This parameter will be used for the ID's of the points measured later in this subroutine.

Insert another Subroutine Parameter action. This parameter will be used for the ID of the best-fit plane calculated later in this subroutine.

The Subroutine Parameter action requires no operator input in order to be inserted into a subroutine. It is merely a placeholder in the subroutine that can be referred back to by subsequent subroutine actions. The order in which they appear in the subroutine will be matched exactly to the order of the parameters as they are passed by the calling process line during process execution.

Insert a Measurement Defines action.

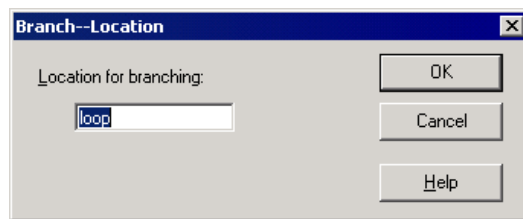


By clicking the ‘Select Name’ button, the name of the Line 1 parameter will be chosen, but a ‘*’ string will be removed and ‘1’ added to the existing PointID.

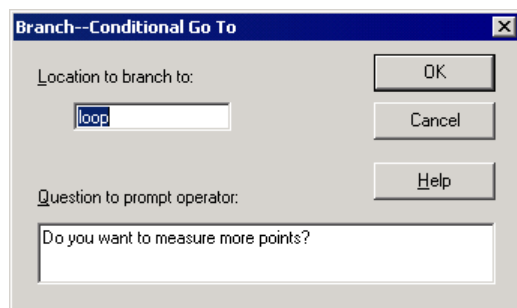
The character ‘*’ which will be appended on the right side of the PointID during the Ask for Name action in the template described later works as a wildcard (PointID_*).

The checkbox Add/Remove from Prefix allows you to choose whether to remove or add the characters from the left or right hand side.

Insert two Start Measurement manual actions.

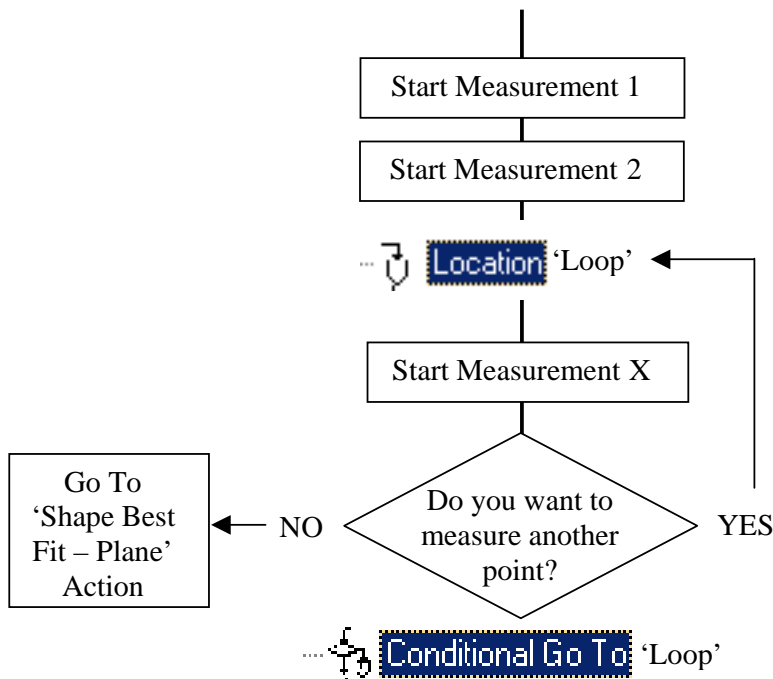


To ensure that as many points as desired can be measured, a ‘Branch Location’ action together with a ‘Conditional Go To’ action must be inserted into the subroutine.

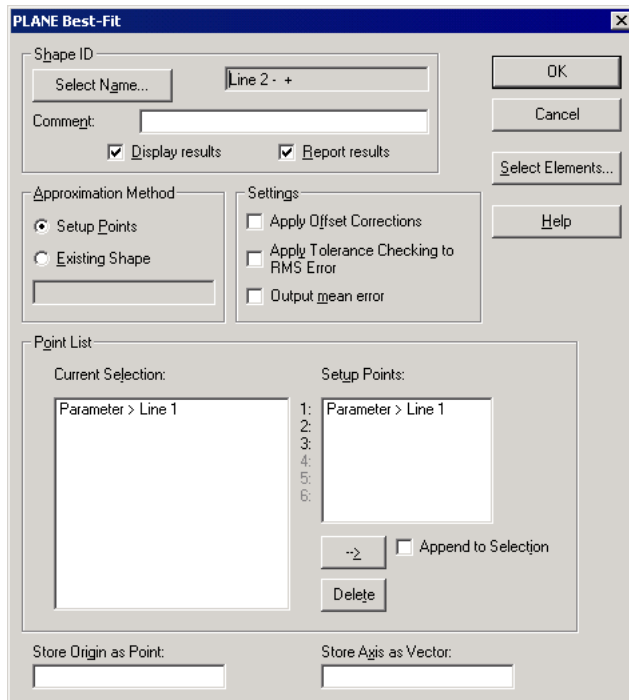


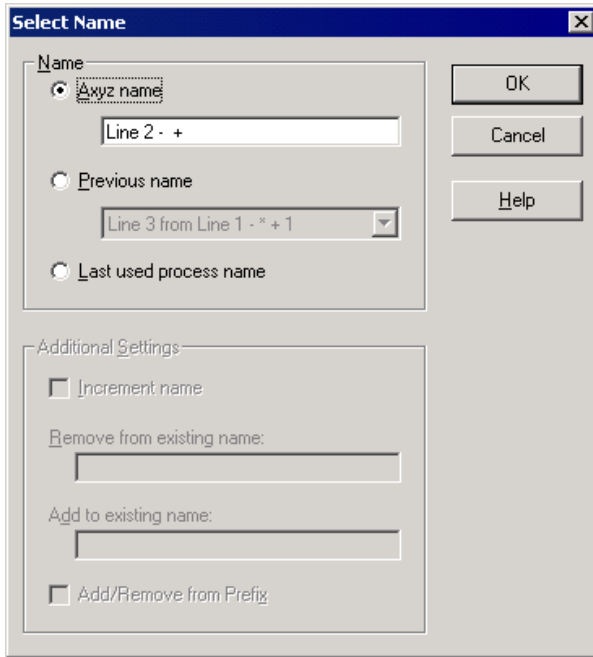
Since at least three setup points are needed to calculate the plane, do not forget to insert the third Start Measurement manual action in between.

The following diagram shows the function of the Conditional Go To and Branch Location actions used in the subroutine.

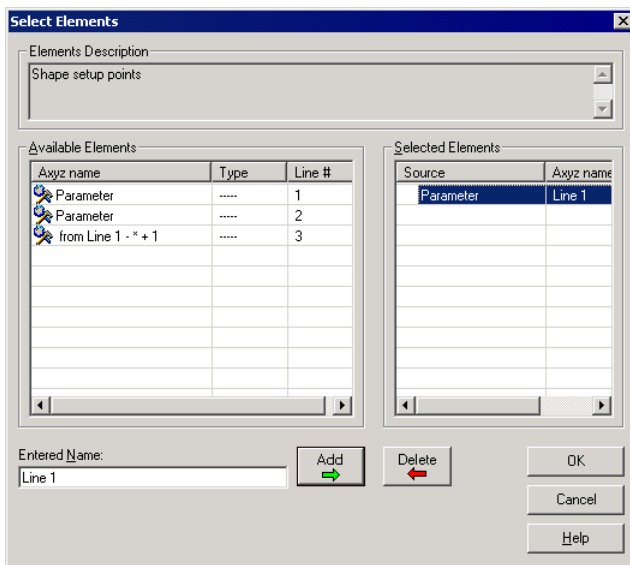


As the last step, insert a 'Plane Best-Fit' action.





As Shape ID, select the Line 2 value, which represents Subroutine Parameter #2.



The Shape setup Points will be defined through Subroutine Parameter #1.

Since during the Ask for Name Dialog in the template ‘_ *’ will be appended to the point name, this routine is able to find any of the measured points (refer also to next chapter).

The resulting Subroutine should now be saved (here as Example3.sub).

Line	Action	Element(s)	Result	Display	Report
1	Subroutine Parameter	.....	None required		
2	Subroutine Parameter	.....	None required		
3	Measurement Defines: Point	.....	Line 1 - * + 1	Point coordinates	Point data
4	Start Measurement (manual)	.....	None required		
5	Start Measurement (manual)	.....	None required		
6	loop:	.....	None required		
7	Start Measurement (manual)	.....	None required		
8	Conditional Go To loop	.....	None required		
9	Shape Best Fit - Plane	Line 1	Line 2 - +	Shape origin, RMS	Shape params, RMS, origin
10	.....	.....	

2.7 Go To Subroutine (Branching)

In this part a template file will be created which calls the programmed subroutine (example3.sub).

Open a new template file and enter the following lines:

Line	Action	Element(s)	Result	Display	Report
1	Ask for Name	.....	Nominal name		
2	Ask for Name	.....	Nominal name		
3	Job Information	.....	None required		
4	Go To Subroutine ..\Example3.sub	Line 1 + 1	None required		
5	.....	.....	

Choose the Ask for Name action for defining the PointID.

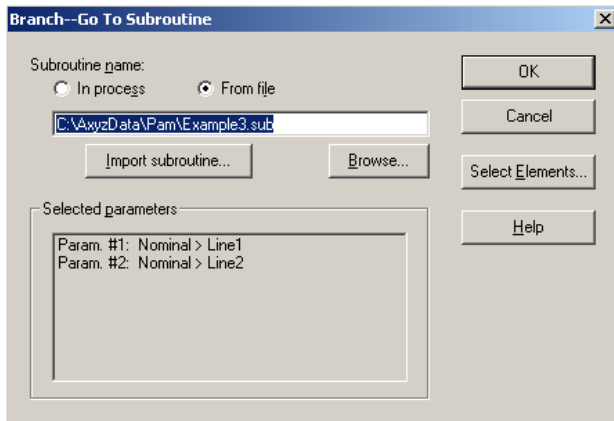
This action asks for a name to be defined. The ‘_*’ characters will be appended to the right of the name to ensure that all measured points (an unknown quantity) will be included in the Plane calculation.

Choose the Ask for Name action for defining the PlaneID.

Choose the Job Information action.

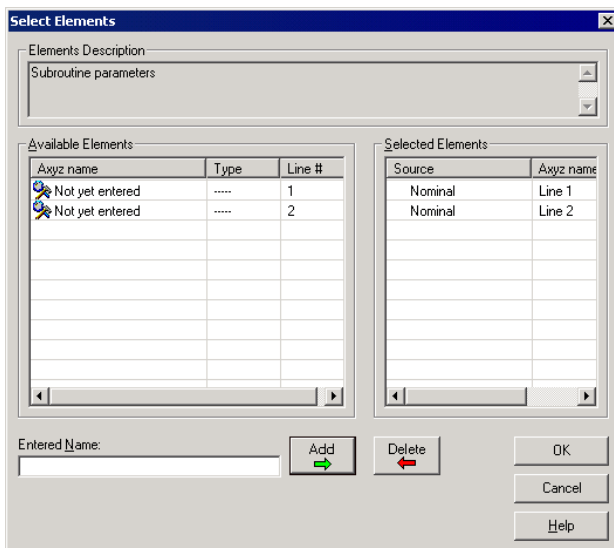
This action allows you to specify the Job Title and Job Description of the active Axyz jobfile. Check 'Show dialog at run time' to defer entering the title and description until the action is encountered at process execution time.

Choose the Branch/Go To Subroutine action.



Click on the 'From File' button then browse for the subroutine you want to call.

Note that the subroutine file must **not** be open to be able to call it.



By pressing the 'Select Elements' button, it is possible to specify the parameters that should be passed over to the subroutine. The parameters appear in the subroutine in the exact same order as entered here in the 'Select Elements' dialog.

After loading this template into a process, the process is ready to run.

Save the template as example3.tpl.

2.8 How to modify (edit) a process

2.8.1 Editing techniques

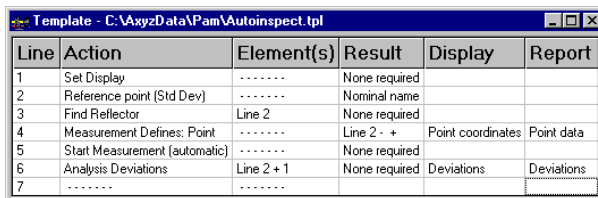
Other than repeatedly loading (appending) a template or templates into a process, the other ways of creating/building processes are mainly based on editing techniques such as Cut, Copy, Paste, Delete and Insert of lines. A combination of both methods allows the process to be completed by shifting lines or sequences of lines around and adding displays and other features to customize the task.

This part of the tutorial will use the editing techniques to add enhancements and to demonstrate important features.

2.8.2 Importing multiple reference data

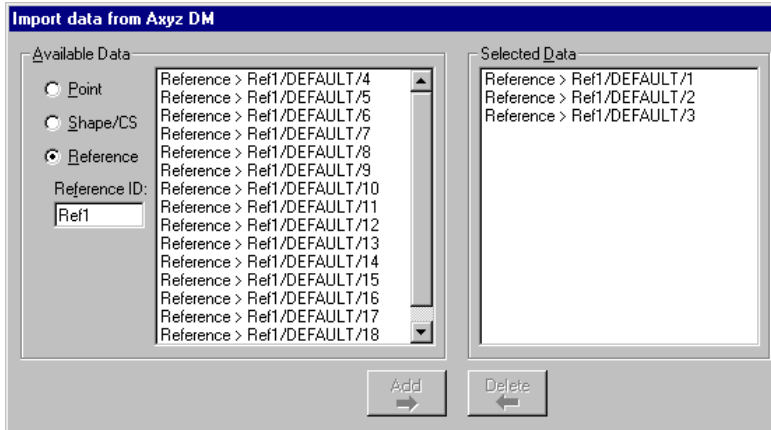
During template loading, if the template includes an Import action, the action lines are repeated in the process as many times as there are the required elements in the Selected Data list of the “Import data from Axyz DM” dialog window.

The following example shows an autoinspect for a single point.



Line	Action	Element(s)	Result	Display	Report
1	Set Display	.....	None required		
2	Reference point (Std Dev)	.....	Nominal name		
3	Find Reflector	Line 2	None required		
4	Measurement Defines: Point	.....	Line 2 - +	Point coordinates	Point data
5	Start Measurement (automatic)	.....	None required		
6	Analysis Deviations	Line 2 + 1	None required	Deviations	Deviations
7	.....	.....	

If you now select, for example, three points in the Import dialog, the whole template will be loaded for every single point.



Line	Action	Element(s)	Result	Display	Report
1	Set Display	.....		
2	Find Reflector	Nominal > DEFAULT/1			
3	Measurement Defines: Point	.....	DEFAULT/1	Point coordinates	Point data
4	Start Measurement (automatic)	.....		
5	Analysis Deviations	Nominal > DEFAULT/1 + 1		Deviations	Deviations
6	Set Display	.....		
7	Find Reflector	Nominal > DEFAULT/2			
8	Measurement Defines: Point	.....	DEFAULT/2	Point coordinates	Point data
9	Start Measurement (automatic)	.....		
10	Analysis Deviations	Nominal > DEFAULT/2 + 1		Deviations	Deviations
11	Set Display	.....		
12	Find Reflector	Nominal > DEFAULT/3			
13	Measurement Defines: Point	.....	DEFAULT/3	Point coordinates	Point data
14	Start Measurement (automatic)	.....		
15	Analysis Deviations	Nominal > DEFAULT/3 + 1		Deviations	Deviations
16	.....	.....	

2.9 Element List

The contents of the Element List can be viewed by opening it from Tools or by pressing Function Key F11. The Element List shown here is the result of the Import from Axyz DM during template loading to Example2.pro and before process execution. The Type Elements are Reference (Nominal) Points.

Line	Element ID	Type Element	X	Y	Z	Std / Rot X	Std / Rot Y	Std / Rot Z	Size	Flag
1	DEFAULT/BASE	Coordinate System	0.000	0.000	0.000	Ang 0.0000	Ang 0.0000	Ang 0.0000	0.000	False
2	DEFAULT/1	Reference Point	0.000	0.000	25.400	Stdev 0.001	Stdev 0.001	Stdev 0.001		False
3	DEFAULT/3	Reference Point	320.000	0.000	25.400	Stdev 0.001	Stdev 0.001	Stdev 0.001		False
4	DEFAULT/5	Reference Point	640.000	0.000	25.400	Stdev 0.001	Stdev 0.001	Stdev 0.001		False
5	DEFAULT/9	Reference Point	640.000	440.000	25.400	Stdev 0.001	Stdev 0.001	Stdev 0.001		False
6	Default/Tool	Ask for Name								False

Further elements can be imported manually in PAM using the Tools/Import Elements or during process execution using the Import Elements action. Elements can also be entered/edited manually in the Element List. When an empty or filled grid line is clicked, the Edit Element dialog is displayed and values can be input or edited for the element being defined. Any of the ten Element Types can be defined using the appropriate radio button.

The Element flag can be manually toggled when creating or editing Element List elements using the checkbox on the Edit Elements dialog. Elements entered into the Element List by any other means (importing using Tools/Import Elements or importing during a Load from Template) default this flag to False (unchecked).

Its state for each element appears as either the word “True” or “False” in the last column in the Element List dialog’s grid. In the Settings action tree, the Set Element Flag action allows you to specify an Element List item whose flag is to be set to either True or False during process execution. In the Branch action tree, the On Element Flag True action allows the user to specify a line label to branch to if a specified Element List item’s flag is True.

2.10 Displays

PAM has several Modes of Display. The modes are Large Display, Flexible Display, Message Display, Window Menu, Status Window, Status Bar, and Branching.

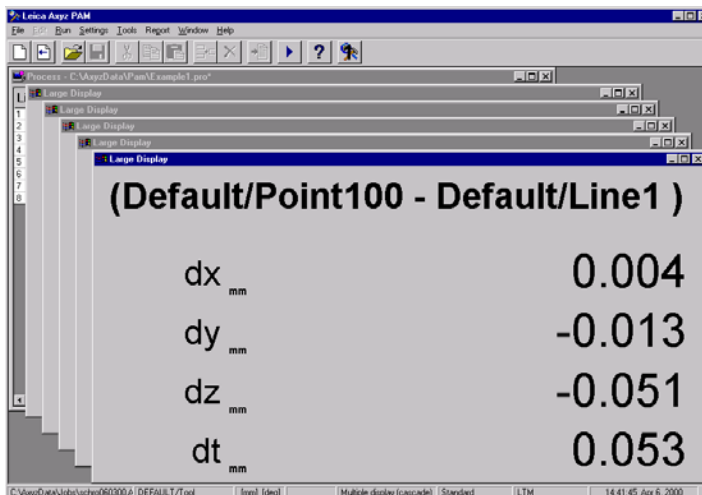
2.10.1 Large Display

A simple process without any provision for display uses Single Mode Large Display by default. When Example1.pro is executed, the results of each measurement, line best-fit and analysis deviation are briefly displayed. At the end of the process, only the results of the last action are displayed. In this case, it would be the results of the Analysis/Deviations action, provided the Display Results box was checked.

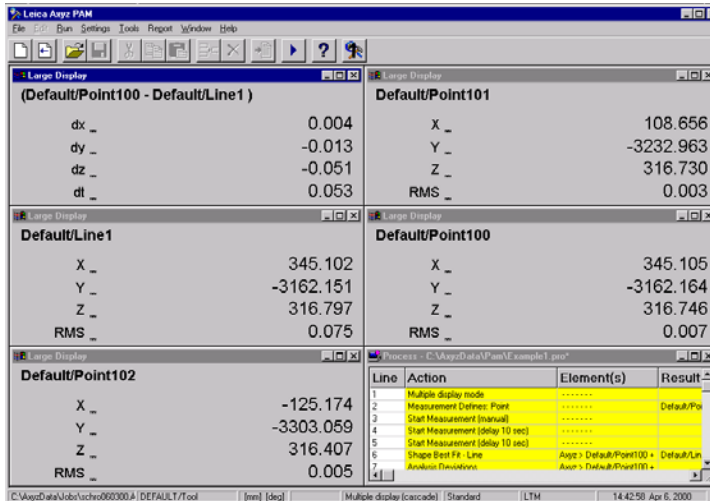
The process action Large Display settings can be Single or Multiple, and the latter can be Cascade, Tiled Horizontally or Tiled Vertically. The effects can be simply demonstrated by inserting a Multiple Mode Large Display in the Example1.pro process.

Line	Action	Element(s)	Result	Display	Report
1	Multiple display mode	.....		
2	Measurement Defines: Point (IFM)	.....	Default/Point100	Point coordinates	Point data
3	Start Measurement (manual)	.....		
4	Start Measurement (delay 10 sec)	.....		
5	Start Measurement (delay 10 sec)	.....		
6	Shape Best Fit - Line	Axyz > Default/Point100 + 2	Default/Line1	Shape origin	Shape params, RMS
7	Analysis Deviations	Axyz > Default/Point100 + 1		Deviations	Deviations
8	.....	.....	

The Cascade mode is the default and process execution displays and retains all Large Display windows with the following at termination.



To retain a view of all Large Display windows simultaneously instead of them overlapping, the Multiple Display Tiled Horizontally and Vertically provide the following:



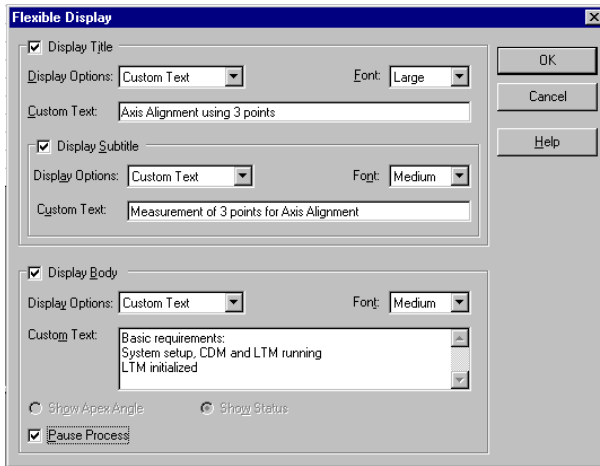
2.10.2 Flexible Display

The Flexible Display is the most useful display mode because it can be used to display action names, execution status, titles, messages and prompts, explanations and instructions, comments and custom text, result names and results all within the one window during execution. The Results Display replicates Large Display while still showing the Title and Subtitle and any prompt buttons such as Measure and Continue.

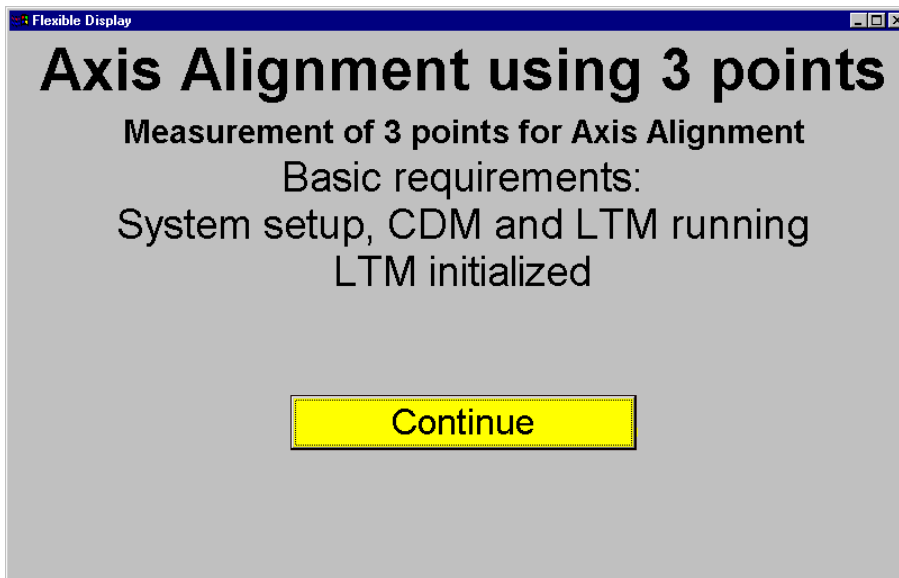
A good example of its use is the Axis Alignment using three points in Axis Alignment 3Pt.pro. Below are some samples of the process dialog boxes and the associated displays that are self-explanatory.

Line	Action	Element(s)	Result	Display	Report
1	Set Display	.....		
2	Set Display	.....		
3	Set Display	.....		
4	Measurement Defines: Point (IFM)	.....	Default/PointC	Point coordinates	Point data
5	Start Measurement (manual)	.....		
6	Message Display	.....		
7	Measurement Defines: Point (IFM)	.....	Default/PointA	Point coordinates	Point data
8	Start Measurement (manual)	.....		
9	Message Display	.....		
10	Measurement Defines: Point (IFM)	.....	Default/PointD	Point coordinates	Point data
11	Start Measurement (manual)	.....		
12	Axis Alignment	Axyz > Default/PointC + 2	Default/AxisAlignment3Pt		
13	.....	.....	

Flexible Display of line 1 during programming time.



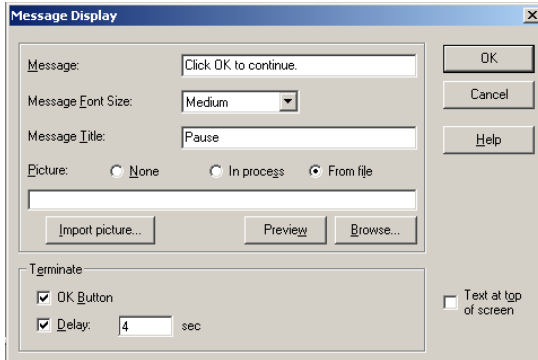
Flexible Display of line 1 during runtime.



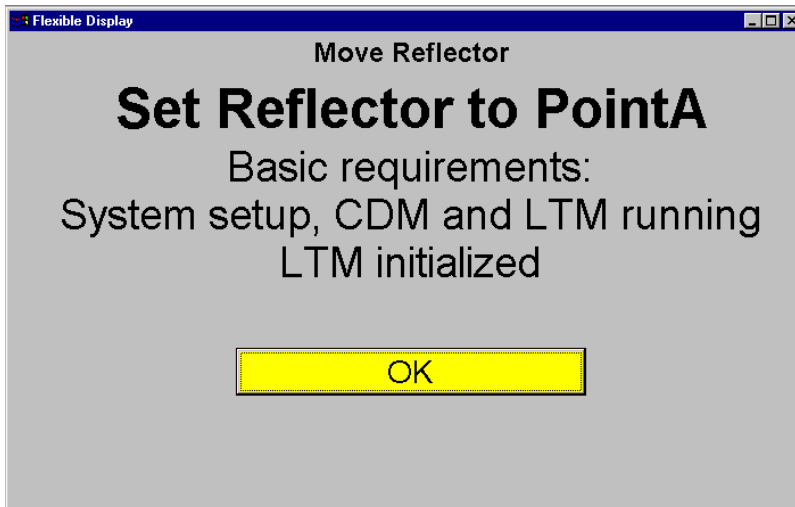
2.10.3 Message Display

This action allows process execution to be paused and display a message. This feature transmits messages/instructions to the operator to carry out measurement operations or allows him to scroll around among displayed dialogs and review data before continuing with the execution of a process. An example from the same process is illustrated below.

Message Display during programming time.

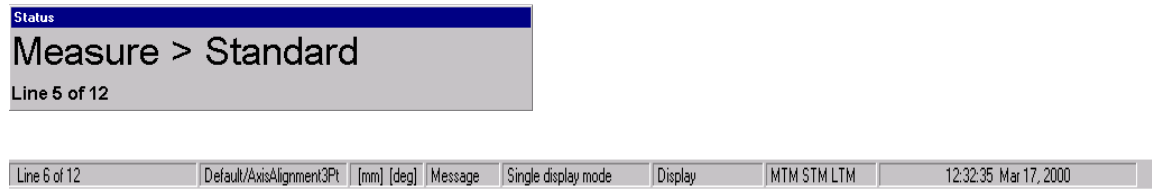


Message Display during runtime.



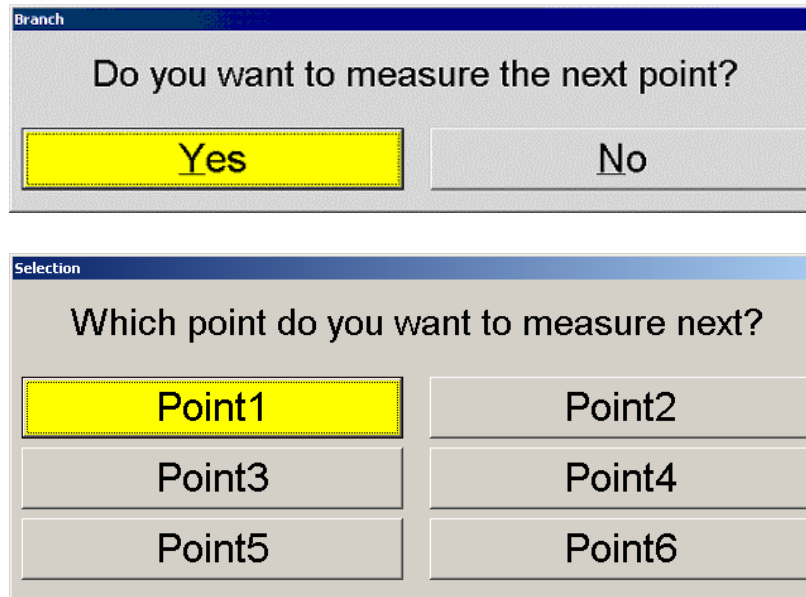
2.10.4 Status Bar

The **Status Window** and the **Status Bar** provide status information about the process line number being executed under the condition headings: Updating Views, Executing Solutions, and Reading Data. The Status Window essentially replicates an enlargement of what is already one of the conditions displayed on the Status Bar at the bottom of the screen. The Status Window is only visible during runtime and if Show Process Status is activated under Tools.

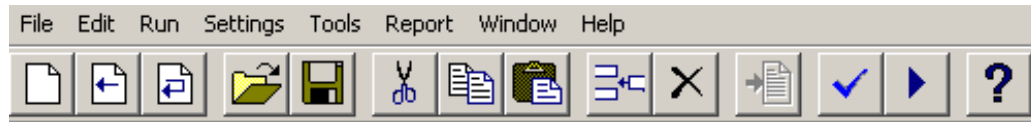


2.10.5 Branching

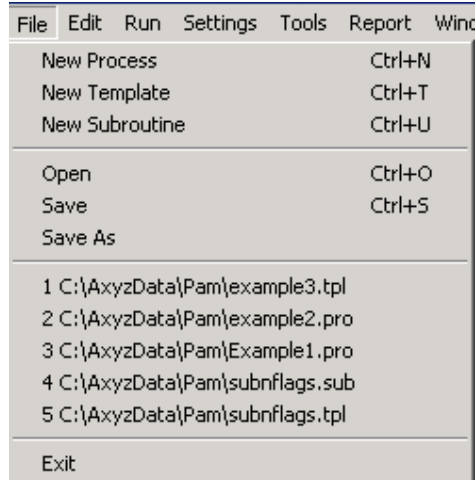
Another display is that associated with **Branching** which provides for Conditional Go To and Selection Displays using Messages and Prompt Buttons.



3. Menus in PAM



3.1 Menu File



3.1.1 New Process

Shortcut: Ctrl+N Symbol: 

This selection creates a new process grid that allows the user to specify a set of actions that define a process.

3.1.2 New Template

Shortcut: Ctrl+T Symbol: 

This selection creates a new template grid that allows the user to specify a set of actions that may be repeatedly loaded into a process.

3.1.3 New Subroutine

Shortcut: Ctrl+U Symbol: 

This selection creates a new subroutine grid that allows the user to specify a set of actions that may be repeatedly called by a process.

3.1.4 Open

Shortcut: Ctrl+O Symbol: 

This selection displays the Open dialog box that allows the user to select an existing process, template or subroutine to open.

3.1.5 Save

Shortcut: Ctrl+S

Symbol: 

This selection saves the currently open process, template or subroutine with the same name.

3.1.6 Save As

This selection displays the Save As dialog box that allows the user to specify the name to associate with the process, template or subroutine being saved.

3.1.7 Recent opened file list

This selection displays a list of the most recently opened process, template and subroutines files in PAM. It allows a quicker way to open recently used files.

3.1.8 Exit

This selection quits the PAM application.

3.2 Menu Edit

Edit	Run	Settings	Tools	Re
Cut			Ctrl+X	
Copy			Ctrl+C	
Paste			Ctrl+V	
Insert Line			Shift+Ins	
Delete Lines			Del	
Delete All Lines			Shift+Del	
Mark Lines				
Unmark Lines				
Select All Lines			Ctrl+A	

3.2.1 Cut

Shortcut: Ctrl+X

Symbol: 

This command removes selected process, template or subroutine lines. It places them on the clipboard so that they can be pasted elsewhere in the process, template or subroutine, if desired.

3.2.2 Copy

Shortcut: Ctrl+C

Symbol: 

This command places the marked process, template or subroutine lines on the clipboard so that they can be pasted elsewhere in the process, template or subroutine, if desired. However, it does not remove the original lines.

3.2.3 Paste

Shortcut: Ctrl+V

Symbol: 

This command pastes lines from the clipboard above the current selected process, template or subroutine line or lines.

3.2.4 Insert Line

Shortcut: Shift+Ins

Symbol: 

This command inserts a blank line above the selected line in the active process, template or subroutine grid.

3.2.5 Delete Lines

Shortcut: Del

Symbol: 

This command removes the selected line(s) from the active process, template or subroutine grid.

3.2.6 Delete All Lines

Shortcut: Shift+Del

This command removes all lines from the active process, template or subroutine grid.

3.2.7 Mark Lines

This command takes line(s) that have been selected by the cursor in an active process grid and marks (yellow highlights) them as executed.

3.2.8 Unmark Lines

This command takes line(s) that have been selected by the cursor in an active process grid and removes any marks (yellow highlights) to change any lines with “executed” status to “not executed” status. It does not delete lines.

3.2.9 Select All Lines

This command highlights all lines in the currently active process grid, if any, so that you can perform any other action, such as Delete or Unmark, on them.

3.3 Menu Run

Run	Settings	Tools	Report
Run All			F5
Run Selected			F6
Run Unmarked			F7
Run from Selected Line			F8

3.3.1 Run All

Shortcut: F5

Symbol: 

This command executes all actions in the open process grid.

3.3.2 Run Selected

Shortcut: F6

This command executes the actions in the active process grid whose line(s) have been selected by the cursor.

3.3.3 Run Unmarked

Shortcut: F7

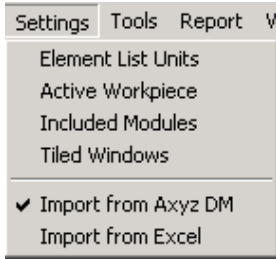
This command executes the actions in the open process grid whose line(s) have not been marked as executed.

3.3.4 Run from Selected Line

Shortcut: F8

This command executes the actions in the open process grid beginning at the line you have selected.

3.4 Menu Settings



3.4.1 Element List Units

Displays the Element List Units dialog. Use this command to select a predefined unit to associate with inputs for nominal or other entered values of elements in the Element List.

Length: feet, inches, meters, microns, millimeters, yards

Angle: degrees, gons, radians

Displayed digits: 0-6

3.4.2 Active Workpiece

Specify the name of the workpiece to be used throughout PAM when you enter an ID without a workpiece name.

3.4.3 Included Modules

Check any and all modules to which you have access (MTM, STM, LTM). You will only be able to define process, template or subroutine actions that are applicable for the modules you have specified.

3.4.4 Tiled Windows

Select which windows (Process, Data Log, Elements) will be displayed in PAM during either the Tile Horizontal or Tile Vertical mode.

3.4.5 Import from Axyz DM/ Import from Excel

When loading a template into a process, check whether you wish to import elements from the Axyz Data Manager or from a Microsoft Excel spreadsheet.

3.5 Menu Tools

Tools	Report	Window	Help
Data Log			F9
Show Process Status			
Element List			F11
Import Elements			F2
Mirror an Axis			
Load From Template			F3
Import Picture			
Export Picture			
Delete Picture			
Import Subroutine			
Export Subroutine			
Delete Subroutine			
Import Template			
Export Template			
Delete Template			
Check Process			F12
Set Password			
Compress Process			
Load External References			
Toolbar Shortcuts			▶
Objectbar Shortcuts			▶

3.5.1 Data Log

Shortcut: F9

This selection displays a data log grid that contains results from executing process actions.

3.5.2 Show Process Status

This feature turns On or Off the display of a Status Window during process execution. If checked, the window that is displayed while a process is running shows various status information about the process action line that is being executed.

3.5.3 Element List

Shortcut: F11

This selection shows a grid that displays the elements imported or defined by the user. The user can enter element values for points, shapes, coordinate systems or reference points. When the user clicks on an empty or filled grid line, the Edit Element dialog is displayed. The user may edit or input values for the element being defined. When the user presses OK, the element is added to the grid display.

3.5.4 Import Elements

Shortcut: F2

This command allows you to import elements into the Element List without having to use Import actions in a template and then loading them into a process.

3.5.5 Mirror an Axis

Check the axis you wish to mirror. The coordinate values for the selected axis of all elements in the Element List will be multiplied by -1.

Furthermore, the corresponding i,j,k value for the selected axis for all shapes with vectors in the Element List will also be multiplied by -1.

If the Element List contains coordinate systems (besides the BASE) and/or shapes with rotation angles instead of vectors, you will be warned that mirroring of rotation angles is not possible. You can then choose to mirror everything in the Element List except those rotation angles or abort the mirroring task.

3.5.6 Load from Template

Shortcut: F3 Symbol: 

This command allows you to load a template into a process. Both a template and a process dialog must be opened for this command to work.

3.5.7 Import Picture

This command allows you to store a picture found in a graphics file (with extension *.bmp, *.ico, *.wmf, *.emf, *.jpg, or *.gif) directly into the open process. Such a picture would then be available for display in any PAM action that displays pictures. Specify the picture file to import by either typing in the full file name or by clicking on Browse and selecting the file. Click Preview to see the selected picture to be sure it is the one you want to import. Specify the Picture name under which to store it in the process. Click Import to actually import the picture from the file into the process.

3.5.8 Export Picture

This command allows you to extract a picture already stored in the open process and store it as a graphics file (with extension .jpg). Select the Picture name to export by either typing it in or selecting it from the list of available pictures in the process. Click Preview to see the selected picture displayed to be sure it is the one you want to store. Choose the name of the file to store the picture as by either typing in the full name or by clicking on Browse and selecting its name and location. Click Export to actually export the picture to the file.

3.5.9 Delete Picture

This command allows you to remove a picture already stored in the open process. Select the Picture name to remove by either typing it in or selecting it from the list of available pictures in the process. Click on Preview to see the selected picture displayed to be sure it is the one you want to remove. Click Delete to remove the picture from the process.

3.5.10 Import Subroutine

This command allows you to store a subroutine found in a subroutine file (with extension *.sub) directly into the open process. Such a subroutine would then be available for calling in PAM's Go To Subroutine action. Specify the subroutine file to import by either typing in the full file name or by clicking on Browse and selecting the file. Specify the Subroutine name under which to store it in the process. Click Import to actually import the subroutine from the file into the process.

3.5.11 Export Subroutine

This command allows you to extract a subroutine already stored in the open process and store it as a subroutine file (with extension .sub). Select the Subroutine name to export by either typing it in or selecting it from the list of available subroutines in the process. Choose the name of the file to store the subroutine as by either typing in the full name or by clicking on Browse and selecting its name and location. Click Export to actually export the subroutine to the file.

3.5.12 Delete Subroutine

This command allows you to remove a subroutine already stored in the open process. Select the Subroutine name to remove by either typing it in or selecting it from the list of available subroutines in the process. Click Delete to remove the subroutine from the process.

3.5.13 Import Template

This command allows you to store a template found in a template file (with extension *.tpl) directly into the open process. Such a template would then be available for loading in PAM's Import Elements action. Specify the template file to import by either typing in the full file name or by clicking on Browse and selecting the file. Specify the Template name under which to store it in the process. Click Import to actually import the template from the file into the process.

3.5.14 Export Template

This command allows you to extract a template already stored in the open process and store it as a template file (with extension .tpl). Select

the Template name to export by either typing it in or selecting it from the list of available templates in the process. Choose the name of the file to store the template as by either typing in the full name or by clicking on Browse and selecting its name and location. Click Export to actually export the template to the file.

3.5.15 Delete Template

This command allows you to remove a template already stored in the open process. Select the Template name to remove by either typing it in or selecting it from the list of available templates in the process. Click Delete to remove the template from the process.

3.5.16 Check Process

Shortcut: F12

Symbol: 

This feature allows you to verify that there are no errors in actions listed in a process or any subroutine that it calls. Specifically, PAM checks for the following error conditions:

- No Start Measurement action may appear before a Measurement Defines action.
- All locations referred to by any kind of Branch action must be present.

Additionally, subroutines must exist in the process or as a separate .SUB file and the number of parameters in the call to it (Branch/Go To Subroutine action) must match the number the subroutine itself expects to be passed.

3.5.17 Set Password

This feature allows you to set a password to prevent editing of the open process by unauthorized users. You will be prompted to enter the desired password, following by entering it again for verification. Passwords are case-sensitive. They may be up to 20 characters in length, and may be any printable character of your choosing.

If a password-protected process is reopened, this menu option changes to "Enter Password." Until this option is selected so that the password can be entered, the process will be executable but not editable.

3.5.18 Compress Process

This feature allows you to compress the open process into a small file. As process files are used they grow larger—even if information once created in them is deleted. This feature removes unused portions of the

process file and makes it smaller.

3.5.19 Load External References

This feature allows you to change all actions in the currently active process (and any unique subroutines it may call) that refer to external files so that they point to those files imported into the process instead. It also loads such files into the process automatically.

The following process actions are affected:

- Display Picture (picture)
- Go To Subroutine (subroutine)
- Import Elements (template)
- Message Display (picture)

After scanning, and if any external references were found, a dialog is brought up with a grid that displays the following information about each applicable action:

- Subroutine (name of subroutine the action is found in, if it is not the actual open process itself)
- Line (process line number of the action)
- Action (the name of the action)
- External File Reference (the name of the external file referred to)

A grid column labeled "Use?" is provided for each applicable action to select whether to include it in the Load or not. Click on Use All to set all grid lines to "Yes" at the same time. Or click on Use None to change all lines to "No." Otherwise, select actions individually by clicking on the appropriate grid line to toggle them between "Yes" and "No."

It is assumed that you wish to load these external files into the process using the base part of their name. You may select another name to import the external file (template, subroutine, or picture) as. Click on the import name column for the grid line you wish to change. The available files already loaded in the process are listed for you or you can type in a new name.

If an external file referred to does not exist, the text for that action line is grayed out and cannot be included in the load.

Click Load to load the external files into the process and to change all the selected references to them to be "in-process" instead. Action lines that were successfully modified are shown against a green background.

3.5.20 Toolbar Shortcuts

This command allows you to add or remove a toolbar button to serve as a shortcut when accessing existing processes and templates. Up to 5 shortcut buttons may be added. You have three options:

Add current process/template

Remove current process/template

Remove all shortcuts

3.5.21 Objectbar shortcuts

This command allows you to add buttons to or remove buttons from an external toolbar, or objectbar. You may label a button with any 3-char text that will remind you what the button does. You assign an existing template to the button. When the object bar is visible, clicking on a button will open the attached template, load it into a process, and run it automatically.

You have three options:

Add current process/template

Create a button on the objectbar that is attached to the currently open, previously saved, template and label the button as well.

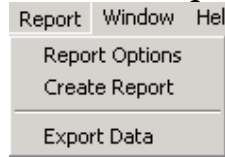
Remove process/template

Specify a button to remove from the objectbar.

Show objectbar

Toggle the objectbar visible or invisible.

3.6 Menu Report



3.6.1 Report Options

This dialog allows you to clear the information from the report database and select whether to write new elements over those already in the database with the same name or to append them to the report database.

Select "Overwrite Report Data" to overwrite elements in the report database with the same name as a new item encountered. Select "Append Report Data" to write an additional element in the report database when an existing name is encountered.

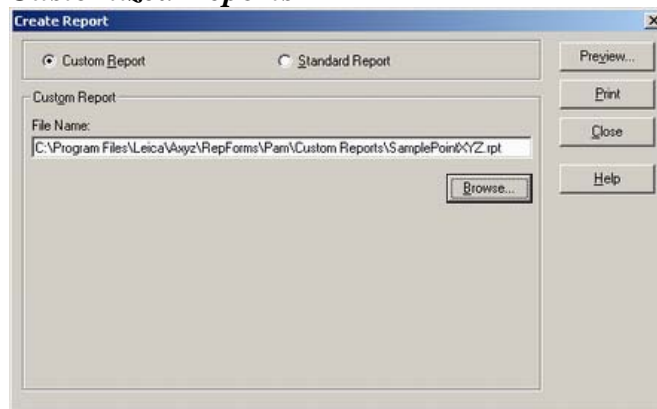
Click on Clear All Report Data to remove all information from the report database.

3.6.2 Create Report

This command generates reports from data collected and stored in the program during the execution of a process.

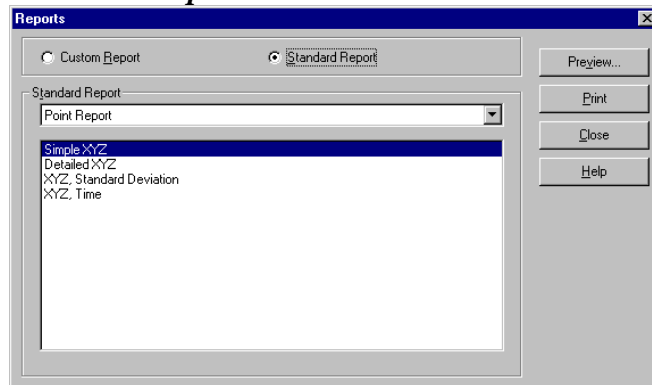
The Reports are mainly split in two groups: Standard Reports and Customized Reports.

Customized Reports



Select the Report you're interested in and click Print to directly print or press Preview to see the layout of the report on the screen.

Standard Reports

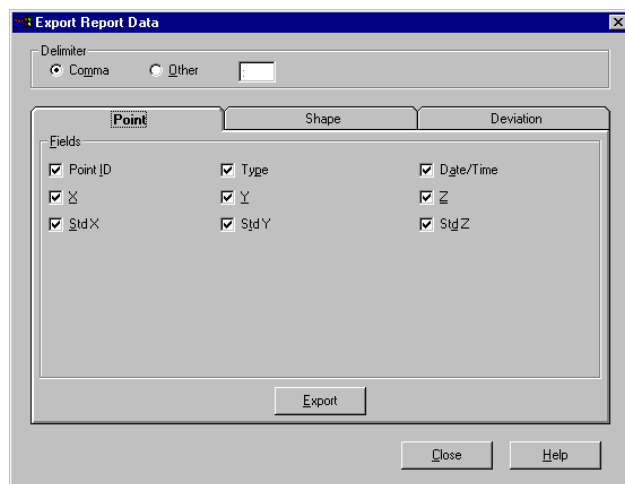


Select in the Standard Report dropdown list the information you want to print (Point, Shape or Compare) as well as the report type. Afterwards click Print to directly print or press Preview to see the layout of the report on the screen.

3.6.3 Export Data

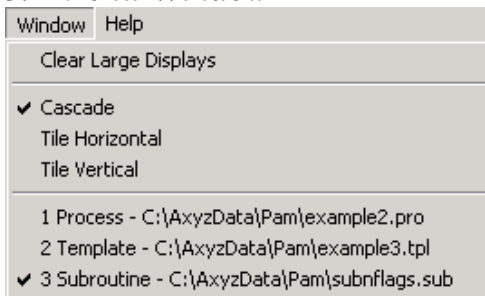
Select report data to export to an ASCII file.

There are three different types of information you can export: Points, Shapes and Deviations.



Define the Delimiter between the fields. Then select the type of data you want to export (Point, Shape and Deviation) and the fields you want to export. You can only export fields from the active tab.

3.7 Menu Window



3.7.1 Clear Large Displays

This feature removes all visible Large Displays from view. It is the same as the action of the same name, which can be added to a process.

3.7.2 Cascade

Arrange any and all open windows, including Template, Process, Subroutine, Element List, Data Log or Large Display windows in overlapping "cascade" fashion.

3.7.3 Tile Horizontal

Arrange any and all open windows, including Template, Process, Subroutine, Element List, Data Log or Large Display windows in horizontal fashion with no overlapping of tiles.

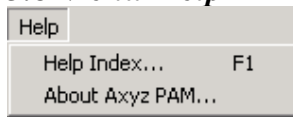
3.7.4 Tile Vertical

Arrange any and all open windows, including Template, Process, Subroutine, Element List, Data Log or Large Display windows in vertical fashion with no overlapping of tiles.

3.7.5 Open Window List

Choose to show the desired Window as the active one on screen.

3.8 Menu Help



3.8.1 Help Index

Shortcut: F1 Symbol: 

The Help Contents give explanations about each item in the Tool Bar Menus. The Index and Find buttons in the Contents window provide detailed information about specific action definitions. The other help functions are standard to Windows Help.

3.8.2 About Axyz PAM

Brings up the About dialog box which displays version information about the product.

4. Actions

4.1 General

The following information is applicable to several or all actions.

Select Stations/Use all Stations

Click Select Stations to bring up a dialog that allows you to choose which stations you wish the action to run on. This button is only active if you have unchecked the "Use all stations" check box. If Use all stations is checked the action will run on all stations that will be active when this action is processed.

Point ID/Select Name

If defining a process action, type in the workpiece/pointID. Spaces are not allowed.

If defining a template or subroutine action, click on "Select Name" to bring up the Select Name dialog for building the resulting point identifier. The Select Name dialog appends the active workpiece ID to entered names not containing one already.

Select Elements

Click to select the elements you want to use in this action. If the action requires more than one element, you may select all elements at the same time.

Display Results

If this box is checked, various action results are shown in the Display window. If this box is not checked, no results are shown. If no display is specified and the box is checked, the results will be displayed on the Large Display.

Report Results

If this box is checked, various action results are flagged for report generation. If this box is not checked, the results are not flagged and the data is not available for reports.

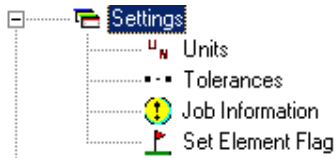
4.2 Auto Process



This action tells PAM to automatically run the process as soon as it is loaded. You must specify whether to (1) clear the Data Log and (2) clear Report Data prior to automatically executing the process.

If present, it should be the first action in a process. This action is not available for use in subroutines.

4.3 Settings



4.3.1 Units

This action allows you to specify the active length and angle units (as well as how many characters to the right of the decimal point should be displayed) when numerical data is shown or reported throughout the program. Any units selections made are temporarily activated in Axyz as well.

4.3.2 Tolerances

This action allows you to specify various tolerance values to be checked against during analysis of measured data as well as view the preset tolerance color codes for making the analyzed data easier to interpret.

You may specify the following tolerance values:

- Parallelism and Intersection tolerances for use in analyses,
- Individual X,Y,Z and i,j,k tolerances as well as totals in all three,
- RMS tolerance for use in shape-fit comparisons,
- Maximum deviation, Total RMS, and Point Error Distance tolerances for use in analyzing measured coordinates.

4.3.3 Job Information

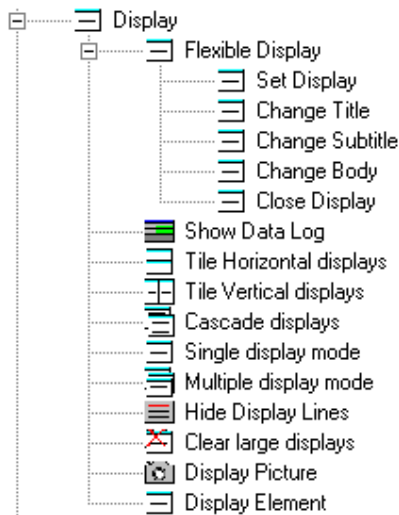
This action allows you to specify the Job Title and Job Description for the active jobfile. The Job ID of the active jobfile is displayed for reference but cannot be set.

When defining the action, you may check 'Show dialog at run time' to defer entering the title and description until the action is encountered at process execution time.

4.3.4 Set Element Flag

This action allows you set the element flag of a specified element in the Element List.

4.4 Display



If none of the following Displays are selected, PAM minimizes during runtime and interacts with the user using message boxes.

4.4.1 Flexible Display

Set Display

This action customizes a display that will be shown during the execution of a process. The flexible display potentially has three main sections: a title area, a subtitle area, and a main body area. A process status line may also be configured.

Display Title

Check this box to display something in the title area. Pick the type of text to be shown (from: Custom Text, Result Name, Action Name, Execution Status, and Comment/Description). If Custom Text is selected, type in the text to be shown. Select Small, Medium, or Large font size for the text. (Default: Medium)

Display Subtitle

Check this box to display something in the subtitle area. The Display Title box must also be checked for a subtitle to be displayed. Pick the type of text to be shown. If Custom Text is selected, type in the text to be shown. Select the font size. (Default: Large)

Display Body

Check this box to display something in the main body area. Pick the type of text to be shown. If Custom Text is selected, type in the text to be shown and select the font size. (Default: Large) If Results is selected, choose whether to show action status or apex angle. If Picture is selected, choose the picture file to be displayed in the main body area. Check the Pause Process box to pause process execution after the line is done in order to have time to view results on the flexible display.

Change Title

Use this action to change the information displayed in the Flexible Display's title area as defined by a previous Flexible Display or Change Title action.

Change Subtitle

Use this action to change the information displayed in the Flexible Display's title area as defined by a previous Flexible Display or Change Subtitle action.

Change Body

Use this action to change the information displayed in the Flexible Display's title area as defined by a previous Flexible Display or Change Body action.

Close Display

Use this action to close the Flexible Display. Close Display to switch from PAM-Display-based to Measurement-Module-Display-based Environment.

4.4.2 Show Data Log

Use this action to open the Data Log window, where you can see the results of the executed process actions. It's helpful to use this action at the end of a process, especially when debugging a process.

4.4.3 Tile Horizontal displays

Arrange any and all open windows, including **Template**, **Process**, **Subroutine**, **Element List**, **Data Log** or **Large Display** windows in horizontal fashion with no overlapping of tiles.

4.4.4 Tile Vertical displays

Arrange any and all open windows, including **Template, Process, Subroutine, Element List, Data Log** or **Large Display** windows in vertical fashion with no overlapping of tiles.

Note

Four or more open windows will be automatically tiled using an easily readable combination of both horizontal and vertical positioning.

It is also possible, under menu Settings/Tiled Windows, to define which windows are included in Tiled mode: Process, Data Log, Element List.

4.4.5 Cascade displays

Arrange any and all open windows, including **Template, Process, Subroutine, Element List, Data Log** or **Large Display** windows in overlapping "cascade" fashion.

4.4.6 Single display mode

Only one Large Display is visible at any time. This function doesn't work with Flexible Display.

4.4.7 Multiple display mode

For every new result a new large display will be created. This function also doesn't work with Flexible Display.

4.4.8 Hide Display Lines

This action allows you to hide various lines from being displayed in the Large Display. Normally, actions that display results in the Large Display show X,Y,Z values and possibly a fourth line (deviations, RMS, etc.). Check which lines are to be hidden and their values not displayed. All actions that display results in the Large Display will use these settings until they are changed.

4.4.9 Clear large displays

Clears all large displays. It doesn't matter whether the process is in single or multiple display mode.

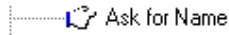
4.4.10 Display Picture

This action allows you to specify a picture to be displayed in a Large Display at process execution time. The picture may come from a graphics file (with extension *.bmp, *.ico, *.wmf, *.emf, *.jpg, or *.gif) or from a picture already stored in the process itself. Click on Import Picture to load a picture from a graphics file into the process.

4.4.11 Display Element

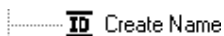
This action allows you to specify an element whose coordinates are to be displayed in a Large Display at process execution time. Click on Select Element to specify the point from the Axyz jobfile or element list to display.

4.5 Ask for Name (unique in templates)



This action allows you to defer specifying a result name or element list identifier until the time a template is loaded into a process. This action behaves much like entering an Element List name because you may refer back to the line of this action in subsequent template line actions.

4.6 Create Name (unique in templates)

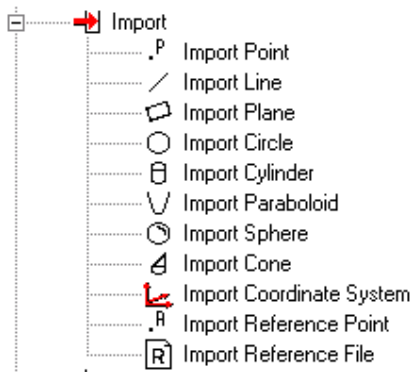


This action, available only when defining a template, allows you to create an element name that can be referred to in subsequent template lines. When loaded into a process, the name entered in this action behaves like the result name entered in any other applicable PAM action.

Choose Select Name to create the name. It is created like any other result name for a template action. You may refer this name to previous template lines, especially Import Element lines.

When loaded into a process, this action will not appear. Create Name is not available in a process nor when defining a subroutine.

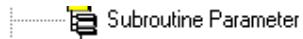
4.7 Import (unique in templates)



-P Import Point
-/ Import Line
-□ Import Plane
-○ Import Circle
-□ Import Cylinder
-∨ Import Paraboloid
-○ Import Sphere
-△ Import Cone
-⌂ Import Coordinate System
-R Import Reference Point
-R Import Reference File

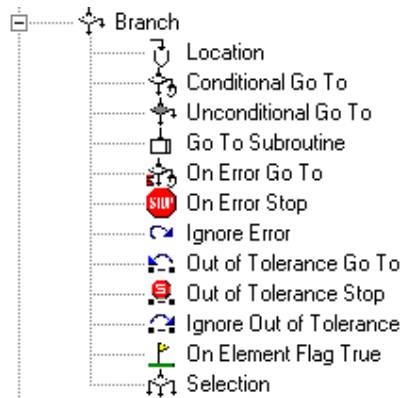
These actions allow you to import certain points, lines, planes etc. when loading a template into a process file.

4.8 Subroutine Parameter (unique in subroutines)



This command line is used to provide a line address for a parameter that is passed into a subroutine. This line is referenced in the subroutine where an element name is required. If more than one parameter is passed into a subroutine, then more than one subroutine parameter line will be required to use the passed parameter(s).

4.9 Branch



Branching allows the user to control the flow of process line execution based on one of several conditions. Typically, you will specify a process line by name to branch to. You may also name a process line with a label so that it may be branched to. Branch location labels are case-sensitive.

4.9.1 Location

This action allows you to name a process line with a label that you can jump to from some other Branch action.

4.9.2 Conditional Go To

Specify a process location to branch to and a question to be asked of the user at process execution time that provides a choice as to whether to actually perform the branch or continue with the next process line. Use this feature to possibly review results from a set of process lines and decide whether to go back and redo the lines or just go on.

4.9.3 Unconditional Go to

Specify a process location to branch to automatically. However, be careful with this feature. It could very likely result in an endless loop.

4.9.4 Go To Subroutine

Refer to or branch to a subroutine file. The code will be temporarily appended to the end of the PAM process. When the process flow exits the subroutine, the subroutine code lines are erased from the process. The element names that are passed into the subroutine are selected with this command (Parameters).

4.9.5 On Error Go To

The *On Error Go To* feature specifies a location to branch to upon an error occurring. (This action has to be executed before the error happens.)

4.9.6 On Error Stop

The *On Error Stop* feature stops process execution on an error condition. (This action has to be executed before the error happens.)

4.9.7 Ignore Error

The *Ignore Error* deactivates any error branches.

4.9.8 Out of Tolerance Go To

The *Out of Tolerance Go To* feature specifies a location to branch to upon an ‘out of tolerance’ occurring. (This action has to be executed before the ‘out of tolerance’ happens).

4.9.9 Out of Tolerance Stop

The *Out of Tolerance Stop* feature stops process execution on an ‘out of tolerance’ condition. (This action has to be executed before the ‘out of tolerance’ happens.)

4.9.10 Ignore Out of Tolerance

The *Ignore Out of Tolerance* deactivates any ‘out of tolerance’ branches.

4.9.11 On Element Flag True

The *On Element Flag True* action allows specifying a line label to branch to if a specified element list item’s flag is true.

4.9.12 Selection

This feature allows you to specify a process location to jump to during the execution of the process based on a button you click on in a selection dialog. Up to six locations are possible.

Selection dialog title

Enter the title that will appear in the selection dialog during the process execution.

Go to Location

Enter the process line label that will be jumped to when the selection button is pressed. Branch labels are case-sensitive.

Caption of the button

Enter the text for the caption of the button.

4.10 Message Display

Message Display

This action allows you to pause the program and display a message. Enter the contents of the message that will be displayed as well as the size of the font to use (small, medium, or large) and the text that will appear in the title bar of the message window.

Terminate

Select either one or both of two different ways to Terminate (close the message window) and continue with the process: by having an OK button to click on, or by specifying how long (Delay) you want the message window to be displayed before it is automatically cleared. You may declare both methods of termination. In that case, the message window is cleared when time runs out OR you click on OK, whichever comes first.

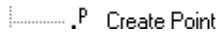
Picture

Specify a picture (graphics file with extension *.bmp, *.ico, *.wmf, *.emf, *.jpg, or *.gif) to be displayed in the dialog that appears for the action at process execution time. The picture will be displayed in the dialog above the message text and buttons. The picture also shows up in the body area if Flexible Display is active.

Text at Top of screen

When this box is checked, the Message Display dialog appears at the top of the screen, when not using flexible display.

4.11 Create Point



This action allows you to specify a point to be added to the Axyz database. Select the name of the point as well as its coordinates in the current coordinate system and units. You may also enter a point description.

4.12 Import Elements



This action allows you to import elements from an ASCII file into the Element List during the execution of a process by loading a template containing various Import actions.

Enter the name of the template to be loaded during process execution that contains various Import actions. The template may come from a template file (with extension *.tpl) or from a template already stored in the process itself. Click on Import Template to import a template from a template file directly into the process.

Enter the name of the ASCII text file containing the data to be imported into the Element List by the Import actions in the template specified above. Specify the character that delimits the various values in each line of the text file.

If the text file contains both the Workpiece and Identifier for each element, select Read workpiece and ID from ASCII file. If only the ID is present, select Read ID only from ASCII file, then enter a workpiece to go with the ID. If neither is present, select Increment from starting ID, then specify both a starting Workpiece and ID. If you omit a Workpiece name where required, the active Workpiece will be used.

Check "Overwrite existing elements" to cause elements whose IDs already exist in the element list to be overwritten automatically without having to stop and be asked.

4.13 Export Data



This action allows you to select elements from the Element List or from Axyz to output to either an Excel file or an ASCII file or both. You may also choose what kinds of data get output.

Export File

You may select to output element data to an Excel spreadsheet file or an ASCII text file or both. You must choose several options for each type of file to output that govern how output is done.

Excel Output

Check Output to Excel file to send element data to an Excel spreadsheet. Enter the name of the file to output to, or click Browse to select the file. You may choose to either include the entire history of measurements to individual points on separate spreadsheet tabs (One point per tab), or you may choose for each tab to represent a pass through the measurements of all points (Measurement cycle), or you may choose to output elements that are points, shapes, reference points, or sets to individual tabs (Unique element types). You may choose to Append data to existing spreadsheet rows in the selected file, or Overwrite existing data if any, with new data. Click on Include column headers to include header information in the cells of Row 1 of your spreadsheets identifying the contents of the column.

ASCII Output

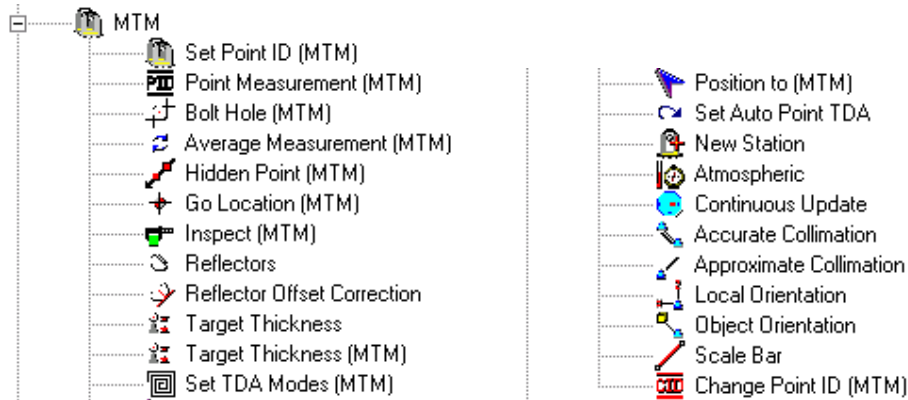
Check Output to ASCII file to send element data to an ASCII text file. Enter the name of the file to output to, or click Browse to select the file. You may choose the character to separate individual fields of data in each text row. The options are Comma, Space, or Semicolon. You may choose to Append data to existing text rows in the selected file, or Overwrite existing rows, if any, with new data. Click on Include column headers to include header information in Row 1 of your spreadsheets identifying the contents of the row fields. Check Add double quotes to text fields to put double quotes characters before and after the text in all fields in a row that are alphanumeric. This includes ID's and comments, but not numeric data such as coordinates, angles, etc.

Output Options

Four types of elements can be output: points, shapes, reference points, and sets. For each type of element, you can click on the checkbox to include or not include that type of element in the output. For each type chosen to be output, check which individual fields you want to include in the output.

Check Select Elements to choose which Element List and/or Axyz elements you wish to output.

4.14 MTM



4.14.1 Set Point ID (MTM)

Specify a point identifier or message to send to theodolite stations.

4.14.2 Point Measurement (MTM)

(See Set Point Parameter.)

4.14.3 Bolt Hole (MTM)

(See Set Point Parameter.)

4.14.4 Average Measurement (MTM)

(See Set Point Parameter.)

Set Point Parameter

Specify parameters that will control point measurements, bolt hole measurements, and average measurements in MTM.

Measure from Station

Check this box if you want to start the measurement from the theodolites. If you want to start the measurement from the computer, uncheck this box.

4.14.5 Hidden Point (MTM)

Specify parameters that will control hidden point measurements in MTM.

4.14.6 Go Location (MTM)

Calls the Go Location dialog of MTM.

4.14.7 Inspect (MTM)

Create multiple actions in a process or template that implement an inspect task in MTM. Specify the points to drive to and measure here and the actions necessary to do so are created automatically. You may also specify which stations are to be used in the inspection (the active ones or any you choose), as well as whether to measure from the stations or let the computer do it and whether to read angles only or distance as well (for Total Stations). Motorized theodolites are required to use this feature.

4.14.8 Reflectors

Calls the Reflectors dialog of MTM.

4.14.9 Reflector Offset Correction

Calls the Reflector Offset Correction dialog of MTM.

4.14.10 Target Thickness

Calls the Target Thickness dialog of MTM. (The necessary data have to be entered during process run time.)

4.14.11 Target Thickness (MTM)

This action allows you to specify whether target thickness should be applied to measured points, including how much and in what direction.

4.14.12 Set TDA Modes (MTM)

This action sets the ATR mode for the selected TDA theodolite stations. You may choose particular station numbers specifically or choose to use all active MTM stations.

4.14.13 Position to (MTM)

This action will move the motorized instrument to point at the specified entered coordinates or to the coordinates of the point selected in the Select Element dialog. You may choose whether this action is to happen to one or more particular, specified station or to all active stations at the time of the action.

4.14.14 Set Auto Point TDA

This action sets parameters in MTM/STM that control how it reacts when the beam in a TDA instrument is broken during measurement. The Lock enabled mode has to have been set for the particular station by a previous Set TDA Modes action.

4.14.15 New Station

Calls the Station Setup dialog of MTM.

4.14.16 Atmospheric

Calls the Atmospheric Correction dialog of MTM.

4.14.17 Continuous Update

Specify parameters for continuous update from theodolites in MTM.

Continuous Update

Check this box to turn on the Continuous Update feature in MTM.

Update interval

The update interval is the number of seconds between updating of the coordinates in the MTM views that are in continuous update mode.

4.14.18 Accurate Collimation

Calls the Accurate Collimation Measurement dialog of MTM.

4.14.19 Approximate Collimation

Calls the Approximate Collimation Measurement dialog of MTM.

4.14.20 Local Orientation

Calls the Local Orientation Measurements dialog of MTM.

4.14.21 Object Orientation

Calls the Object Orientation Measurements dialog of MTM.

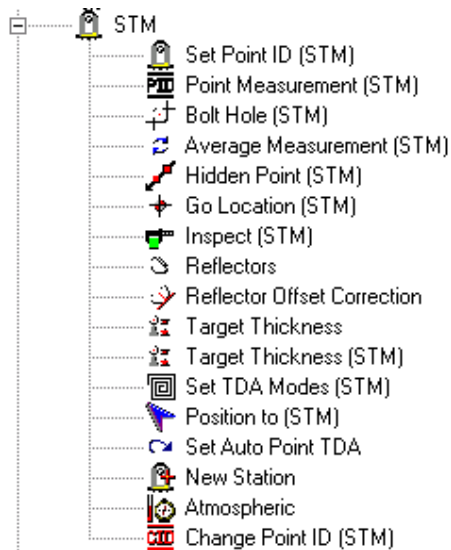
4.14.22 Scale Bar

Calls the Scale Bar Measurements dialog of MTM.

4.14.23 Change Point ID (MTM)

Calls a dialog that prompts you for an ID at process run time. It will be set on all connected stations.

4.15 STM



4.15.1 Set Point ID (STM)

Specify a Point ID or message to send to the theodolite station.

4.15.2 Point Measurement (STM)

(See Set Point Parameter and Set TDA Modes.)

4.15.3 Bolt Hole (STM)

(See Set Point Parameter.)

4.15.4 Average Measurement (STM)

(See Set Point Parameter.)

Set Point Parameter

Specify parameters that will control point measurements, bolt hole measurements, and average measurements in STM.

4.15.5 Hidden Point (STM)

Specify parameters that will control hidden point measurements in STM.

4.15.6 Go Location (STM)

Calls the Go Location dialog of STM.

4.15.7 Inspect (STM)

Create multiple actions in a process or template that implement an inspect task in STM. Specify the points to drive to and measure here and the actions necessary to do so are created automatically. You may also specify whether to measure from the active station or let the computer do it. Motorized theodolites are required to use this feature.

4.15.8 Reflectors

Calls the Reflectors dialog of STM.

4.15.9 Reflector Offset Correction

Calls the Reflector Offset Correction dialog of STM.

4.15.10 Target Thickness

Calls the Target Thickness Dialog of STM. (The necessary data have to be entered during running time of the process.)

4.15.11 Target Thickness (STM)

This action allows you to specify whether target thickness should be applied to measured points, including how much and in what direction.

4.15.12 Set TDA Modes (STM)

This action sets the ATR mode for the selected TDA theodolite station. You may choose a particular station number specifically or choose to use the active STM station. Automatic Target Recognition is turned off entirely during measurements if the Disabled radio button is selected.

ATR only is turned on during measurement if ATR enabled is selected. If Measure from station is disabled in the Point Measurement dialog, the instrument measures automatically. A TDA theodolite can then automatically find a target and measure the point.

If Lock enabled is selected, the TDA instrument will remain locked on the target (for tracking purposes) once you have measured a point.

4.15.13 Position to (STM)

This action will move the motorized instrument at the specified entered coordinates or to the coordinates of the point selected in the Select element dialog.

4.15.14 Set Auto Point TDA

This action sets parameters in STM that control how it reacts when the beam in a TDA instrument is broken during measurement. The Lock enabled mode has to have been set for the particular station by a previous Set TDA Modes action.

4.15.15 New Station

Calls the Station Setup dialog of STM.

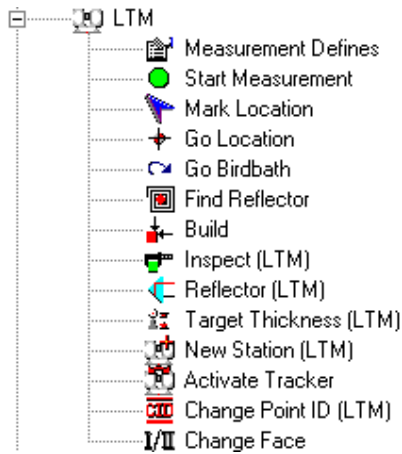
4.15.16 Atmospheric

Calls the Atmospheric Correction dialog of STM.

4.15.17 Change Point ID (STM)

Calls a dialog that prompts you for an ID at process run time. It will be set on any connected station.

4.16 LTM



4.16.1 Measurement Defines

This dialog allows you to define all the tracker measurement actions. If you enter a Measurement Defines dialog, PAM automatically inserts also a Start Measurement action.

4.16.2 Start Measurement

This action is automatically generated every time a Measurement Defines action is created in a process, template or subroutine. Or it can be created separately. During process execution, it actually executes a tracker measurement using the parameters set up by the most recently executed Measurement Defines action.

You may specify that the measurement be started "Manually", which means you will be prompted to click a button or press a key to start the measurement, or "Automatically." If the Delay value specified is 0 seconds, the measurement begins immediately upon LTM becoming ready. If the Delay value is greater than 0 seconds, PAM waits that number of seconds to automatically begin the measurement.

4.16.3 Mark Location

This Action sends the laser beam to the point you selected in the 'Specify One Element' dialog. If you have an ADM, you can catch the beam and place the reflector in a stable position. The tracker will automatically set the distance as soon as the reflector is on a stable position.

4.16.4 Go Location

Enter a point in the 'Specify One Element' dialog, where the tracker must drive to. The distance will be set by the entered parameters. This is the same functionality as in LTM.

4.16.5 Go Birdbath

Sends the tracker back to the Birdbath.

4.16.6 Find Reflector

This action allows you to specify a point to drive the tracker to. You give the search diameter for PAM to use to look for a reflector at the location. The ADM is used to find the point. Click on "Select Element" to specify the point (from Axyz or the Element List) to drive the tracker to.

You may select from three methods of handling an error condition—that is, no reflector is found at the location specified:

- *Manually find point on error*—PAM automatically calls LTM's Find Reflector dialog to allow you to use the camera to find the point.
- *Receive notification of error*—PAM gives you three choices of how to proceed: Stop the process, retry the measurement, or continue with the process. If you continue with the process and an On Error Goto location has previously been specified, PAM will branch to that location.
- *Branch automatically on error*—PAM will automatically branch to any location specified in a previously executed On Error Goto action. If no such action has been executed, PAM automatically continues with the process at the next action.

4.16.7 Build

This action sets the system in Continuous Try mode and displays the difference between the location of the reflector and the reference point to build. When all coordinates are sufficiently close to zero, click on the Start Measurement button to measure the point.

4.16.8 Inspect (LTM)

This action actually generates four (4) separate actions for each of the reference points you select as elements. These actions, which allow you to perform an inspection using a tracker, are:

- Find Reflector
- Measurement Defines
- Start Measurement
- Deviations

4.16.9 Reflector (LTM)

This action allows you to specify the reflector that is being used to measure as well as whether its radius should be removed from measured coordinates and in what direction.

4.16.10 Target Thickness (LTM)

This action allows you to specify whether target thickness should be applied to measured points, including how much and in what direction.

4.16.11 New Station (LTM)

Calls the Station Setup dialog of LTM.

4.16.12 Activate Tracker

Select the tracker number to activate.

4.16.13 Change Point ID (LTM)

Calls a dialog that prompts you for an ID at process run time.

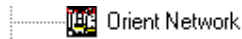
4.16.14 Change Face

This action causes the tracker to change faces immediately and reacquire the reflector.

4.16.15 Orient to Gravity

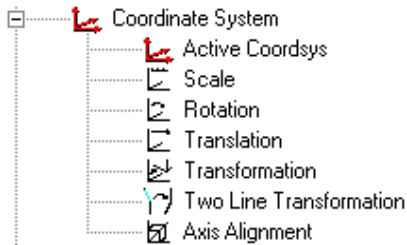
This action brings up the normal LTM dialogs that prompt you through the steps to orient the tracker to gravity using a Nivel 20.

4.17 Orient Network



Calls the Orient Network Dialog.

4.18 Coordinate System



4.18.1 Active Coordsys

Select in the 'Specify One Element' dialog the coordinate system you want to activate.

4.18.2 Scale

This action allows you to create a new coordinate system by scaling a specified coordinate system. There are 3 ways to specify the scale factor: (1) manually enter a scale factor to be used, (2) use the distance between two known points to generate the scale factor, or (3) use the coefficient of thermal expansion of the material being measured.

4.18.3 Rotation

This action allows you to create a new coordinate system by rotating one or more of the coordinate axes as they are currently oriented into a specified coordinate system.

4.18.4 Translation

This action allows you to create a new coordinate system by translating the origin of a specified coordinate system by a specified amount or to a known point's location.

4.18.5 Transformation

This action allows you to create a new coordinate system by performing a best-fit, least squares solution that transforms coordinates in the base coordinate system to the new one using blueprint, or reference coordinates.

Output Mean Error

If the box is checked, the Variance Factor (Mean Error) is used as the quality figure for the best-fit result. If the box is unchecked, uniform weighting is applied to each point and an RMS (Root Mean Square) value is used as the quality figure for the best-fit result.

Apply Tolerance Check to RMS error

If this box is checked, the RMS error for the calculated transformation will be compared to the maximum shape fit tolerance set in the Settings/Tolerance action. The Large Display window will show a color code indicating how far out of tolerance the RMS error is and generate an error if it exceeds the maximum.

Show Dialog at run-time

If this box is checked, PAM will show the standard CDM Transformation dialog at process run time to allow the user to repeatedly solve the transformation, perhaps with various points selected or deselected from inclusion.

Alpha Offset

In order to calculate a bestfit transformation; object points must be matched up with reference points. The matching is done via identifiers. It is not necessary for corresponding reference and object point IDs to be identical but it must be possible to modify one by a standard procedure in order to create the other. This is done with the alpha prefix offset.

Add to Point Number

Enter a value to add to the point numbers of reference IDs. To match them as they are, enter 0.

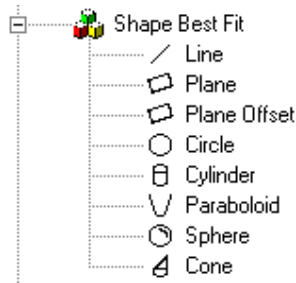
4.18.6 Two Line Transformation

This action allows you to create a new transformation that will keep the same geometry for a part that has been moved from its original position. Two lines are required which were measured in the original position and the same two lines measured in the moved position of a part.

4.18.7 Axis Alignment

This action allows you to create a new coordinate system by aligning the three coordinate axes according to existing measurements. It translates the origin of the base coordinate system to a known point and rotates the three axes through known points and/or with respect to gravity.

4.19 Shape Best-fit



These actions allow you to fit measured data to various shapes, including lines, planes, plane offsets, circles, cylinders, paraboloids, spheres, and cones.

4.19.1 General

Coordinate System ID

Enter the Axyz name for the resulting shape element. If the solution is successful, the new shape element will be stored in the database under the result name.

Settings:

Apply Tolerance Checking to RMS error

If this box is checked, the RMS error for the calculated shape will be compared to the maximum shape fit tolerance set in the Settings/Tolerance action. The Large Display window will show a color code indicating how far out of tolerance the RMS error is and generate an error if it exceeds the maximum.

Output mean error

If the box is checked, the Variance Factor (Mean Error) is used as the quality figure for the shapefit result. If the box is unchecked, uniform weighting is applied to each point and an RMS (Root Mean Square) value is used as the quality figure for the shapefit result.

4.19.2 Plane Offset

This action allows you to create a plane which is offset a specified amount in the direction of a specified point from a plane.

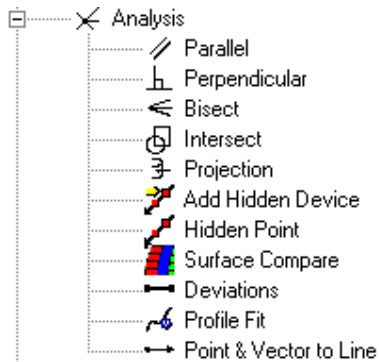
Point in offset direction

Displays the ID of a point on the side of the measured points in the direction of the reflector offset. Typically, this is a point on the surface being measured.

Output mean error

If the box is checked, the Variance Factor (Mean Error) is used as the quality figure for the plane fit result. If the box is unchecked, uniform weighting is applied to each point and an RMS (Root Mean Square) value is used as the quality figure for the plane fit result.

4.20 Analysis



4.20.1 Parallel

This action allows you to create a line through a specified point that is parallel to another line or a plane.

4.20.2 Perpendicular

This action allows you to create a perpendicular line from a point or shape axis to another shape axis or surface.

4.20.3 Bisect

This action allows you to create an element that bisects two other elements.

4.20.4 Intersect

This action allows you to create an element that is the intersection of two other elements.

4.20.5 Projection

This action allows you to project a point or a shape origin point onto a shape.

4.20.6 Add Hidden Device

This action allows you to add a 2-point linear hidden device to the active Axyz jobfile. You must specify the device ID number and the distance from the two points to the device tip. If the device number already exists, its configuration will be updated. If not, it will be created.

4.20.7 Hidden Point

This action allows you to calculate a hidden point using already measured Axyz points and store it using any desired name. In addition to the name

you wish to give the hidden point, you must specify the 2-point, linear hidden device number to use as well as the names of the points used when measuring the device.

4.20.8 Surface Compare

This action allows you to compare points to free-form (irregularly-shaped) surfaces.

Tolerance Checking

If the “Apply Tolerance Checking” box is checked, comparisons will be checked against the various tolerances set by the Settings/Tolerances action.

Search Radius

The Search Radius is how far about each point on the surface to look for nearby points for calculating the surface.

Result Order

Choose whether the comparison result order is Nominal - Surface Point or Surface Point - Nominal.

Offset

Check whether to remove reflector offset when calculating surface coordinates. If so, enter the amount, in the current length units, of the offset to remove from the measured coordinates to get points on the actual surface.

Comparison Elements

Click on Select Elements to select the three elements needed for surface comparison:

- A point on the airside of the surface for determining the direction to apply the reflector offset
- The ID of the point to compare to the surface.
- Surface points (may be in a data set). (Minimum of 20 surface points required.)

4.20.9 Deviations

This action allows you to calculate deviations between various points and shapes (elements).

Apply Tolerance Checking

If this box is checked, deviations calculated will be checked against the various tolerances set by the Settings/Tolerances action.

Type/Distance

To calculate a linear distance deviation between the two selected points or shapes, select from one of the options. Be sure the selected elements are entered in the correct type order.

None

Do not calculate a distance deviation at all.

Point - Point

Calculate the distance between two points.

Point - Shape Axis

Calculate the distance between a point and the closest point on a shape axis.

Point - Shape Surface

Calculate the distance between a point and the closest point on a shape surface.

Shape Axis - Point

Calculate the distance between a shape axis and a point.

Shape Surface - Point

Calculate a distance between a shape surface and a point.

Type/Angle

To calculate an angular deviation between the two selected shapes, select from one of the options. Be sure the selected elements are either shapes or both coordinate systems.

None

Do not calculate an angular deviation at all.

Shape Axis - Shape Axis (no correction)

Calculate the angle between two shape axes. The direction of neither axis' vector is flipped.

Shape Axis - Shape Axis (1st axis corrected for smallest angle)

Calculate the angle between two shape axes. The direction of the first axis is flipped, if necessary, so that the smallest possible angle is produced.

Shape Axis - Shape Axis (2nd axis corrected for smallest angle)

Calculate the angle between two shape axes. The direction of the second axis is flipped, if necessary, so that the smallest possible angle is produced.

4.20.10 Profile Fit

The Profile Fit action analyzes measurements of profile templates on checking fixtures. Profile templates are sheet metal parts with one edge cut to conform to the profile of the part to be checked. It is assumed that measurements of the profile template edge have taken place already by the time this action is encountered in a process.

The analysis of the profile template measurements consists generally of showing deviations of the measured points from expected values. To calculate the coordinates of the points measured on the profile template for comparison it will be necessary to specify several parameters.

Required input

The following items must be specified for the Profile Fit action.

Measurement set

The identifier you specify must be that of a continuous measurement set that will already exist in the Axyz jobfile by the time this action is encountered in a process. Measurements are taken of a reflector sitting in a holder whose pin is being moved along the bottom edge of the profile template (with the part to be checked removed). They must be taken using Total Distance as the criteria for measurement filtering. (The filter distance should be greater than the "noise" of the system.) They should be taken from one end of the profile to the other in one continuous direction. Do not retrace measurements by moving the reflector back and forth over the edge. Pass over the edge one time only, however, it does not matter which direction you measure as long as you maintain that direction. If there is not much curvature to the line, measure a few points up one side of the profile template.

Nominal line

The identifier you specify must actually be that of a line that will already exist in the Axyz jobfile or Elements list by the time this action is encountered in a process. The line will pass through a nominal point and have a probe direction vector towards the profile template edge. The nominal point should be chosen so that the closest point measured on the profile template edge to it is positioned such that about half the points that will be used in the solution are on either side of it.

Plane offset

This is the thickness of the reflector minus that amount of the reflector offset value corresponding to the part of the reflector that is seated in the holder.

Radial offset

This is the thickness of the pin of the reflector holder that is being used to guide the holder along the edge of the profile template.

Polynomial degree

This value determines how many turns can be in the resulting line calculated through the profile template measurements. The minimum is 1 for a straight line. The maximum is one fewer than the number of fit points. A practical polynomial degree will be 5 to 10 with the number of fit points ranging from 2 to 5 times greater.

Number of fit points

This is the number of points measured along the profile template edge that will actually be used in the system. It is usually not practical to use them all since there could be thousands in the set. The number should be small enough so that there are enough points on each side of the nominal point to allow the closest point to be in the center of the fit points subset. The number should be large enough to cover enough of the curve with extra points to smooth out the small deviations.

Solution

The first step in the solution is to fit all of the points measured on the profile edge to a plane. (The reflector offset and plane offset are taken out of the measured points in order to find a plane that is essentially on the profile template.)

The closest point in the measurement set to the nominal point is then determined. The fit points to use in the solution calculation are then chosen from the measurement set points so that half are on each side of this point. The fit points and the nominal point with its direction vector are then transformed into the coordinate system of the plane of the profile template.

A polynomial line is fit through the fit points. Then a normal line is calculated from the nominal point to the polynomial line. The radial offset correction is made along the normal line in the direction indicated by the vector associated with the nominal point.

The solution is an offset point along with the nominal point and deviations, which are stored into the report database (if you have selected "Report results") which can then be viewed using a normal deviation report. If you have selected "Display results" the deviations of the solution points are shown.

4.20.11 Point & Vector to Line

This action allows you to create a line whose origin is a specified point and direction is that of a shape's vector.

Click on Select Elements to enter the Origin Point and the Shape as vector.

If defining this action as part of a process, enter the ID to store the line as in the database. If defining this action as part of a template or subroutine, click on Select Name to choose the ID to store the line as.

If the "Display results" box is checked the line data are shown in the Large Display window. If the box is not selected, no data are shown. If the "Report results" box is checked the coordinates of the line data are flagged to be included in generated reports. If the box is not selected, this line will not be included in reports.

4.21 Reports



4.21.1 Report

Calls the 'Report' action.

Report Type

Select whether to show a 'Standard Report' or to browse a 'Custom Report'.

Output Report

Select whether to preview the report on the screen and/or Print the report on the selected printer.

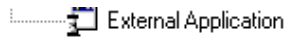
Additional Report Parameters

Optionally select elements to output to the report as well as the coordinate system for reporting coordinates.

4.21.2 Clear Report

The 'Clear Report' action clears all data in the process database where PAM stores report information.

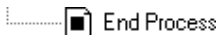
4.22 External Application



This action runs the specified external application program. You may choose whether to continue with the PAM process while the external application is running or for PAM to pause and wait until the external application is closed (default).

You may also select a list of elements. At process execution time, these element names will be written to a text file, called ExtAppElements.txt, located in the PAM accessory files folder. (The name of the active Axyz jobfile will be written to the first line of this file followed by the element names.) External applications called by this action that know of the existence of this file can open it and use the element names in any way desired.

4.23 End Process



This action affects the behavior of PAM when a process is complete. You may choose to either (1) load another process or (2) end PAM completely.

If present, it should be the last line in a process. It will perform the specified behavior regardless of whether there are additional lines in the process. If not present, PAM ends the process normally, leaving the process lines displayed in the grid.

If you choose to load another process, you may also specify which process to load. If you enter a process name, that process will automatically be loaded next. If you enter no process name, you will be prompted at run-time for the name of the process to load.

This action is not available for use in subroutines.

5. Samples

5.1 LTM

5.1.1 Plane

Overview

Load this template into a process to measure a plane with a minimum of three stationary points.

Line	Action	Element(s)	Result	Display	Report
1	Ask for Name	.....	Nominal name		
2	Measurement Defines: Point (IFM)	.....	Line 1 - "*" + 1	Point coordinates	Point data
3	Start Measurement (manual)	.....	None required		
4	Start Measurement (manual)	.....	None required		
5	add:	.....	None required		
6	Start Measurement (manual)	.....	None required		
7	Conditional Go To add	.....	None required		
8	Shape Best Fit - Plane	Line 1	Line 1 - "*" +	Shape origin	Shape params, RMS
9	Show Data Log	.....	None required		
10	.....	.....	

Description

- Line1: The “Ask for Name” during load will be used by Line 2 (as Point ID) and Line 10 (as Plane ID).
- Line2: Defines the measurement mode (stationary) and sets the Point ID (*Plane Name_1*).
- Line3: Measures a point manually with the point ID defined in Line 2.
- Line5: Measures a point manually with the increased Point ID of Line 3.
- Line5: “add:” is a location for the “loop” with which you can measure a flexible number of points.
- Line6: Same as Line 4.
- Line7: The “Conditional Go To *add*” asks if you want to measure additional points. If “yes”, the program jumps to Line 6; otherwise it goes on with Line 10.
- Line8: Calculates the shape with the name you define with the “Ask for Name” action. All points with a name starting with “Plane ID_” will be used for the calculation.
- Line9: Calls the Data Log, where you can see if the process ran properly (all lines green).

Additional Information

You could remove line 4 and 5, but you would no longer be sure that the user measured the minimum amount of points.

5.1.2 Move Station

Overview

Load this template into a process anytime you need to move the tracker to a new station during a process.

Line	Action	Element(s)	Result	Display	Report
1	Ask for Name	.....	Nominal name		
2	Set Display	.....	None required		
3	Measurement Defines: Point	.....	Line 1 - +	Point coordinates	Point data
4	Start Measurement (manual)	.....	None required		
5	Start Measurement (manual)	.....	None required		
6	Start Measurement (manual)	.....	None required		
7	add1:	.....	None required		
8	Start Measurement (manual)	.....	None required		
9	Conditional Go To add1	.....	None required		
10	Change Subtitle	.....	None required		
11	New Station (LTM)	.....	None required		
12	Change Subtitle	.....	None required		
13	Measurement Defines: Point	.....	Line 1 - +	Point coordinates	Point data
14	Start Measurement (manual)	.....	None required		
15	Start Measurement (manual)	.....	None required		
16	Start Measurement (manual)	.....	None required		
17	add2:	.....	None required		
18	Start Measurement (manual)	.....	None required		
19	Conditional Go To add2	.....	None required		
20	Change Subtitle	.....	None required		
21	Orient Network	.....	None required		
22	Message Display	.....	None required		
23	.....	.....	

Description

- Line1: “Ask for Name” will be used to define the ID of the first orientation point (common point).
- Line2: Setup Flexible Display.
- Line3: Defines the measurement mode and sets the point ID defined with the “Ask for Name” action.
- Line4-6: Starts the measurement with the mode selected in Line 3.
- Line7: Location where the program jumps to with the Conditional Go To in Line 9.
- Line8: Starts the four point measurements.
- Line9: “Conditional Go To” is used to ask the user if he wants to measure additional points. If “yes” the program jumps to line 7, otherwise it goes on.
- Line10: Changes the Display Subtitle.
- Line11: Calls the LTM Station Editor dialog, where you can add a new station.
- Line12: Changes the Display Subtitle.
- Line13: Defines the Measurement mode and resets the Point ID to the name defined with the “Ask for Name” action.
- Line14-16: Starts the measurement with the mode selected in Line 13.
- Line17: Location where the program jumps to with the “Conditional Go To” in Line 19.
- Line18: Starts the four point measurements.

- Line19: “Conditional Go To” is used to ask the user if we want to measure additional points. If “yes” the program jumps to line 17, otherwise it goes on.
- Line20: Changes the Subtitle.
- Line21: Calls the Orient Network dialog of CDM/LTM.
- Line22: Message that process has finished.

5.1.3 LockCheck

Overview

Load this template into a process to ensure the tracker is locked on to a reflector without having to change to LTM to lock the reflector on.

Line	Action	Element(s)	Result	Display	Report
1	On Error Go To BB	-----	None required		
2	Conditional Go To End	-----	None required		
3	Unconditional Go To skip	-----	None required		
4	BB:	-----	None required		
5	Message Display	-----	None required		
6	skip:	-----	None required		
7	Message Display	-----	None required		
8	Go Birdbath	-----	None required		
9	End:	-----	None required		
10	-----	-----			

Description

- Line1: “On Error Go To” starts an error check. When an error occurs from this point of the process on, the program will jump to the line you define (BB:).
- Line2: “Conditional Go To *end*” asks if the reflector is locked on. If “yes” it jumps to the end of the process, otherwise it goes on.
- Line3: If you said “no” in Line 2, the “Unconditional Go To” sends you to Line 6.
- Line4: This is the location to which PAM branches if an error occurs.
- Line5: This messages informs you that you forgot to place the reflector in the Birdbath or that the wrong reflector is selected.
- Line6: Location for Unconditional Go To in Line 3.
- Line7: This message instructs you to place the reflector in the Birdbath.
- Line8: Sends the tracker to the Birdbath. If an error occurs (that is, there is no reflector or the wrong reflector in the Birdbath) the program branches to Line 4.

5.1.4 Measure Check

Overview

Load this template, which calls a subroutine, into a process to import points, inspect them and create a Deviation Report.

Line	Action	Element(s)	Result	Display	Report
1	Import Point	.....	Nominal name		
2	Go To Subroutine ...\Measurecheck.sub	Line 1	None required		
3	.....	.....	

Line	Action	Element(s)	Result	Display	Report
1	Subroutine Parameter	.....	None required		
2	On Error Go To ErrorHandler	.....	None required		
3	On Element Flag True Go To al_measured	Line 1	None required		
4	Find Reflector	Line 1	None required		
5	Measurement Defines: Point	.....	Line 1 - + Meas	Point coordinates	Point data
6	Start Measurement (automatic)	.....	None required		
7	Set Element Flag True	Line 1	None required		
8	Analysis Deviations	Line 1 + 1	None required	Deviations	Deviations
9	Report	.....	None required		
10	Unconditional Go To end	.....	None required		
11	al_measured:	.....	None required		
12	Message Display	.....	None required		
13	Unconditional Go To end	.....	None required		
14	ErrorHandler:	.....	None required		
15	Message Display	.....	None required		
16	end:	.....	None required		
17	.....	.....	

Description

Template

- Line1: Import nominal points for inspecting.
- Line2: Calls subroutine .../Measurecheck.sub, and passes as the name of the imported point as a parameter to the subroutine.

Subroutine

- Line1: Represents the passed Parameter #1 value.
- Line2: Set up to branch to “ErrorHandler” (Line 14) when an error occurs.
- Line3: Set up to skip to “al_measured” (Line 11) if the Element Flag of the imported point is already set (True).
- Line4-6: Calls the “Find Reflector” action and measures the point automatically.
- Line7: Sets the Element Flag of the point passed in as Parameter #1 to True.
- Line8: Calls the “Analysis/Deviation” action.
- Line9: Calls the “Report” action.
- Line10: Forces the process to jump unconditionally to Line 16.

- Line11: Location where the process jumps to when the Element Flag of the point specified in Line 3 is already True.
- Line12: Message for Line 11 branch.
- Line13: Forces the process to jump unconditionally to Line 16.
- Line14: Location where the process jumps on any error in Line 2.
- Line15: Message for Line 14 branch.
- Line16: Location where the process jumps to from Line 10 and Line 13.

5.2 STM

5.2.1 Circle

Overview

Load this template into a process to measure a circle with an undefined number of points.

Line	Action	Element(s)	Result	Display	Report
1	Ask for Name	.....	Nominal name		
2	Point Measurement (STM)	.....	Line 1 - * + 1	Point coordinates	Point data
3	Point Measurement (STM)	.....	Increment Line 2	Point coordinates	Point data
4	Point Measurement (STM)	.....	Increment Line 3	Point coordinates	Point data
5	Conditional Go To add	.....	None required		
6	Unconditional Go To skip	.....	None required		
7	add.	.....	None required		
8	Set Point ID (STM)	.....	Increment Line 4		
9	Message Display	.....	None required		
10	skip:	.....	None required		
11	Shape Best Fit - Circle	Line 1	Line 1 - * +	Shape origin	Shape params, RMS
12	Show Data Log	.....	None required		
13	.....	.....	

Description

Line1: “Ask for Name” action that will ask for the circle name and append “_*”, e.g. “*ShapeID_**”, where “*” is used as wildcard.

Line2-4: “Point Measurement” actions for the minimum number of points.

Line5: “Conditional Go To” for additional points.

Line6: “Unconditional Go To” to skip the additional points.

Line7: Location to jump to from Line 5.

Line8: Set Point ID for the first additional point.

Line9: Message Display instructing you to measure the additional points.

Line10: Location to jump to from Line 6.

Line11: Circle Best-Fit calculation using all measured points.

Line12: Calls Data Log dialog to check if circle calculation was successful.

5.2.2 Additional Constant

Overview

Load this template into a process for defining the Additional Constant. You can use the results you get here for the AddConst.xls you find in the TPS5000 folder on the Axyz CD (TPS500\CCR Distance Field Check\AddConst.xls).

Line	Action	Element(s)	Result	Display	Report
1	Set Display	.....	None required		
2	Units: Len=millimeter(2) Ang=degree(4)	.....	None required		
3	Reflectors	.....	None required		
4	Set TDA Modes (STM) (Disabled)	.....	None required		
5	Atmospheric	.....	None required		
6	Message Display	.....	None required		
7	Point Measurement (STM)	.....	Station1/Point1	Point coordinates	Point data
8	Point Measurement (STM)	.....	Station1/Point2	Point coordinates	Point data
9	Message Display	.....	None required		
10	Message Display	.....	None required		
11	Point Measurement (STM)	.....	Station2/Point1	Point coordinates	Point data
12	Point Measurement (STM)	.....	Station2/Point2	Point coordinates	Point data
13	Change Body	.....	None required		
14	Message Display	.....	None required		
15	.....	.....	

Description

Line1: Setup of Flexible Display.

Line2: Sets the Units you need for the AddConst.xls.

Line3: Calls the reflector dialog of STM/MTM where you have to select CCR1.5 (STM).

Line4: Disables the ATR-mode.

Line5: Calls the dialog where you can enter the Atmospheric Data (Temperature and Pressure).

Line6: Message Display that instructs you where to place your theodolite.

Line7: Measures the first point.

Line8: Measures the second point.

Line9: Message Display that instructs you where to move your theodolite.

Line10: Message Display that instructs you to level the instrument.

Line11: Measures the first point.

Line12: Measures the second point.

Line13: Changes the Display Body and tells you what to do with the measurements you have taken.

Line14: Message Display that informs you the process has finished.

Additional Information

As is, this template is ideal for users who know how a CCR-Calibration works. Less experienced users may need to add additional information with Message Displays and Flexible Displays.

5.2.3 Move Station

Overview

Load this template into a process anytime you need to move a theodolite to a new station during a process.

Line	Action	Element(s)	Result	Display	Report
1	Ask for Name	.....	Nominal name		
2	Message Display	.....	None required		
3	Point Measurement (STM)	.....	Line 1 - +	Point coordinates	Point data
4	Point Measurement (STM)	.....	Increment Line 3	Point coordinates	Point data
5	Point Measurement (STM)	.....	Increment Line 4	Point coordinates	Point data
6	Set Point ID (STM)	.....	Increment Line 5		
7	Message Display	.....	None required		
8	Message Display	.....	None required		
9	Message Display	.....	None required		
10	New Station	.....	None required		
11	Message Display	.....	None required		
12	Point Measurement (STM)	.....	Line 1 - +	Point coordinates	Point data
13	Point Measurement (STM)	.....	Increment Line 12	Point coordinates	Point data
14	Point Measurement (STM)	.....	Increment Line 13	Point coordinates	Point data
15	Set Point ID (STM)	.....	Increment Line 14		
16	Message Display	.....	None required		
17	Orient Network	.....	None required		
18	Message Display	.....	None required		
19	.....	.....	

Description

- Line 1: “Ask for Name” will be used to define the ID of the first orientation point (common point).
- Line 2: Message Display tells you to measure common points for move station function.
- Line 3: Measures point using name provided in the “Ask for Name” function.
- Line 4: Measures point using incremented name from Line 3.
- Line 5: Measures point using incremented name from Line 4.
- Line 6: Sets point ID using incremented name from Line 5.
- Line 7: Message Display that tells you to measure additional points.
- Line 8: Message Display that tells you to move the theodolite to a new position.
- Line 9: Message Display that tells you to level the Total Station.
- Line 10: Opens the Station Editor dialog of STM.
- Line 11: Message Display that tells you to measure common points in new position.
- Line 12: Measures point using name provided in the “Ask for Name” function.
- Line 13: Measures point using incremented name from Line 12.
- Line 14: Measures point using incremented name from Line 13.
- Line 15: Sets point ID using incremented name from Line 14.
- Line 16: Message Display that tells you to measure the additional points from station 2.
- Line 17: Starts the Orient Network function.
- Line 18: Message Display that informs you the process has finished.

5.2.4 Autoinspect

Overview

Load this template into a process to perform a kind of Autoinspect. It will automatically measure reference points. However, there will be no deviations saved with the point measurement as happens in the STM Autoinspect feature.

Line	Action	Element(s)	Result	Display	Report
1	Tolerances	.....	None required		
2	Set Display	.....	None required		
3	Reference point (Std Dev)	.....	Nominal name		
4	Position to (STM)	Line 3	None required		
5	Set TDA Modes (STM) (ATR enabled)	.....	None required		
6	Point Measurement (STM)	.....	Line 3 · +	Point coordinates	Point data
7	Analysis/Deviations	Line 3 + 1	None required	Deviations	Deviations
8	Set TDA Modes (STM) (Disabled)	.....	None required		
9	.....	.....	

- Line 1: Sets the tolerance used for the coloring of the coordinates. This tolerance setting can also be done only once afterwards when creating a process.
- Line 2: Sets a Flexible Display.
- Line 3: Import function for the reference point.
- Line 4: Sends the Total Station to the coordinates of the imported point.
- Line 5: Activates ATR-mode.
- Line 6: Starts point measurement automatically, because ATR is active and Measure from Station is deactivated.
- Line 7: Analysis/Deviations action that calculates the deviation between reference and measured point.
- Line 8: Deactivates ATR-mode.

5.3 MTM

5.3.1 Orientation

Overview

Load this Orientation template into a process when you can select between Accurate and Approximate Orientation and measure as many points and scalebars as you want.

Line	Action	Element(s)	Result	Display	Report
1	Ask for Name	.....	Nominal name		
2	Set Display	.....	None required		
3	Collimation:	.....	None required		
4	Selection	.....	None required		
5	Approximate:	.....	None required		
6	Approximate Collimation	.....	None required		
7	Unconditional Go To Points	.....	None required		
8	Accurate:	.....	None required		
9	Accurate Collimation	.....	None required		
10	Points:	.....	None required		
11	Set Point ID (MTM)	.....	Line 1 - +		
12	Message Display	.....	None required		
13	SB:	.....	None required		
14	Scale Bar	.....	None required		
15	Conditional Go To SB	.....	None required		
16	Orient Network	.....	None required		
17	Conditional Go To Remeasure	.....	None required		
18	Unconditional Go To End	.....	None required		
19	Remeasure:	.....	None required		
20	Selection	.....	None required		
21	End:	.....	None required		
22	.....	.....	

Description

Line1: “Ask for Name” of the first common point.

Line2: Setup of Flexible Display.

Line3: Location where you jump to if you have to remeasure the Collimation.

Line4: “Selection” action, for choosing Accurate or Approximate Collimation.

Line5: Location where you jump to if you select Approximate in Line 4.

Line6: Calls the Approximate Collimation dialog.

Line7: “Unconditional Go To” to skip lines 8 and 9.

Line8: Location where you jump to if you select Accurate in Line 4.

Line9: Calls the Accurate Collimation dialog.

Line10: Location where you jump to if you have to remeasure points.

Line11: Sets the point ID for the first common point.

Line12: Message Displays that instructs you to measure as many points as you want.

Line13: Location where you jump to if you have to measure or remeasure additional scalebars.

Line14: Calls the ScaleBar dialog.

Line15: “Conditional Go To” for measuring additional scalebars.

- Line16: Calls and starts the Orient Network function of CDM, STM/MTM.
- Line17: “Conditional Go To *Remeasure*” sends you to Line 20 if “yes”, otherwise it goes on with Line 18.
- Line18: “Unconditional Go To *end*” sends you to the end of the template.
- Line19: Location where you jump to if you said “yes” in Line 17.
- Line20: “Selection” action allowing you to select where you want to jump to (above Collimation Measurement, above Point Measurement or above Scalebar Measurement).
- Line21: Location where you jump to from Line 19.

5.3.2 Transformation

Overview

Load this Transformation template into a process to perform a transformation in MTM with four points.

Line	Action	Element(s)	Result	Display	Report
1	Ask for Name	.....	Nominal name		
2	Reference point (Std Dev)	.....	Nominal name		
3	Reference point (Std Dev)	.....	Nominal name		
4	Reference point (Std Dev)	.....	Nominal name		
5	Reference point (Std Dev)	.....	Nominal name		
6	Setup Display	.....	None required		
7	Point Measurement (MTM)	.....	Line 2 - +	Point coordinates	Point data
8	Point Measurement (MTM)	.....	Line 3 - +	Point coordinates	Point data
9	Point Measurement (MTM)	.....	Line 4 - +	Point coordinates	Point data
10	Point Measurement (MTM)	.....	Line 5 - +	Point coordinates	Point data
11	Change Display Subtitle	.....	None required		
12	Transformation	Line 2 + 3	Line 1 - +		
13	Message Display	.....	None required		
14	Show Data Log	.....	None required		
15	.....	.....	

Description

Line 1: “Ask for Name” of the resulting coordinate system.

Line 2-5: Import of reference points.

Line 6: Setup of Flexible Display.

Line 7-10: Point measurement of the reference points.

Line 11: Change the Subtitle to show the user that the transformation starts.

Line 12: Transformation using the name provided in the “Ask for Name” action selecting the four imported points.

Line 13: Message Display that tells you the Transformation has finished.

Line 14: Calls the Data Log dialog.

6. Structures

6.1 Structures in Programming Languages and in PAM

Loop in PL	Loop in PAM
IF yes THEN ... ELSE ...	CONDITIONAL GO TO if UNCONDITIONAL GO TO else if: ... UNCONDITIONAL GO TO end else: ... end:
DO ... UNTIL yes	do: ... CONDITIONAL GO TO end UNCONDITIONAL GO TO do end:
DO ... WHILE yes	do: ... CONDITIONAL GO TO do
WHILE yes ... DO	start: CONDITIONAL GO TO do UNCONDITIONAL GO TO end do: ... UNCONDITIONAL GO TO start end:
UNTIL yes ... DO	start: CONDITONAL GO TO end ... UNCONDITIONAL GO TO start end:
Switch CASE 1 ... BREAK CASE 2 ... BREAK	SELECTION 1,2,3 ... 1: ... UNCONDITIONAL GO TO Endselection 2: ... Endselection: