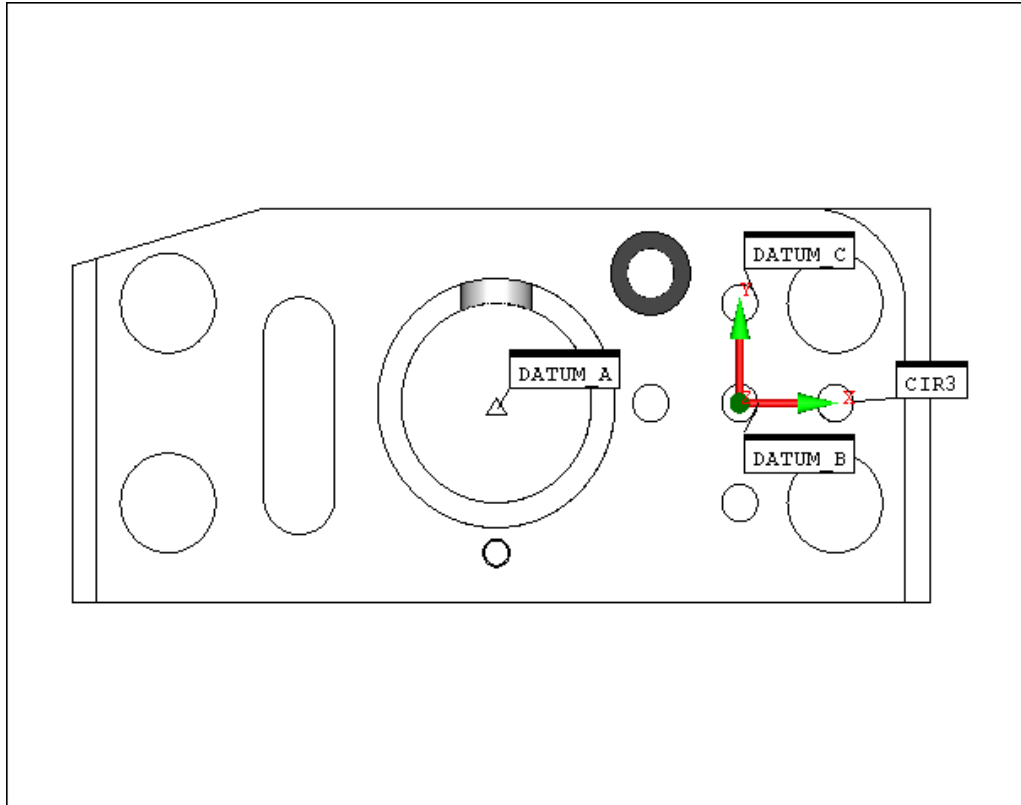


True Position – PC-DMIS 4.1

(Legacy Dimension Mode)

The *Use Datums* option in the True Position window allows the analysis to be performed in three ways. 1) From the active Alignment. 2) From a mathematical *Virtual Hard Gage* simulation (Fit to Datums: ON). 3) From a *Datum Reference Frame* simulation (Fit to Datums: OFF). All examples reference the illustration below (Features, Datums and Alignment).



Option #1: Use Datums: OFF

Application: Use this method when there are no modifier(s) (MMC or LMC) on the Datum(s) and when checking the Position of one or multiple features (single feature or a pattern) from a *Datum Reference Frame*. Bonus tolerance is only available on the feature(s).

Results: The True Position of the selected feature(s) is evaluated in the active alignment. Therefore, the active alignment must be set up to reflect the specified Datum Reference Frame before creating the True Position dimension(s).

Example of True Position "Use Datums" Off:

.375±.005ϕ ϕ.010Ⓜ A B C

<input type="checkbox"/>	IN	LOC2 - CIR3						
AX	MEAS	NOMINAL	+TOL	-TOL	BONUS	DEV	OUTTOL	
X	1.0030	1.0000	0	0	0	0.0030	0	
Y	0.0030	0.0000	0	0	0	0.0030	0	
DF	0.3760	0.3750	0.0050	0.0050	0.0060	0.0010	0.0000	<input type="checkbox"/>
TP	0	MMC	0.0100	0	0.0060	0.0085	0.0000	<input checked="" type="checkbox"/>

Option #2: Use Datums: ON and Fit to Datums: ON

Application: Use this method when there are modifier(s) (MMC or LMC) on the Datum(s) and when checking the True Position of a single feature (multiple features are not supported in legacy dimension mode). Note: True Position of multiple features and MMC/LMC on the Datum feature(s) is supported when “Use Legacy” is not selected and the new True Position Feature Control Frame dimension command is used.

Results: A “Virtual Hard Gage” simulation is performed mathematically by *Translating and Rotating* based on the amount of bonus tolerance from the Datum(s). This results in the measured values for the feature changing by the amount of “Datum Shift” which simulates the jiggling of the gage. In many cases the measured values may be the same as the nominal values when there is sufficient bonus from the datum features. When the feature is out of tolerance, no fitting occurs and the measured values and deviations reflect the actual location of the feature such that process adjustments can be made or an Engineering analysis of the nonconformance can be performed.

Note: The results are representing “Pass/Fail” analysis just as a functional gage does therefore it is not possible to monitor for process variation or perform statistical studies.

Bonus Column: The bonus column in the report shows the calculated amount of bonus of the feature (DF) and the calculated amount of bonus of each datum feature of size (D1 primary, D2 secondary, D3 tertiary). The total bonus value is determined based on the following conditions:

Condition #1A: In-Tolerance



When sufficient bonus tolerance from the datum(s) allow datum shift such that there is no deviation from the nominal values without utilizing up to 100% of the allowable bonus from the datum(s), the total bonus amount is the sum of the bonus from the feature and the unused amount of bonus from the datum(s).

Example of Condition #1A In-Tolerance: $.375 \pm .005 \varnothing$ $\varnothing .010 \text{ (M)} \text{ A (M) C (M)}$

The measured values changed based on the allowable datum shift derived from the bonus of datums D2 and D3 (simulates a functional gage). In this case the measured values check nominal resulting in zero deviation, and the total bonus is the sum of the bonus from the feature (.006) and the unused bonus from the datums (.002) for a total of .008 bonus tolerance.

2 DOF from bonus on D2 (.008 bonus): translation in X and Y axis


1 DOF from bonus on D3 (.008 bonus): rotation about Z axis

\varnothing	IN	LOC1 - CIR3						
AX	MEAS	NOMINAL	+TOL	-TOL	BONUS	DEV	OUTTOL	
X	1.0000	1.0000	0	0	0	0.0000	0	
Y	0.0000	0.0000	0	0	0	0.0000	0	
DF	0.3760	0.3750	0.0050	0.0050	0.0060	0.0010	0.0000 	
D1	0	0	0	0	0	PLANE		
D2	0.3780	0.3750	0.0050	0.0050	0.0080	CIRCLE		
D3	0.3780	0.3750	0.0050	0.0050	0.0080	CIRCLE		
TP	0	MMC	0.0100	0	0.0080	0.0000	0.0000 	


Condition #1B: In-Tolerance

When 100% of the bonus from the datum(s) is used then the total bonus amount is only the bonus from the feature. Typically this case would show some amount of deviation from the nominal values.

Example of Condition #1B In-Tolerance:

.375±.005ϕ 


The tolerance for D2 and D3 were changed to illustrate using 100% of the bonus from the datums where there is deviation from nominal yet still an In-Tolerance condition.

	IN	LOC4 - CIR3					
AX	MEAS	NOMINAL	+TOL	-TOL	BONUS	DEV	OUTTOL
X	1.0015	1.0000	0	0	0	0.0015	0
Y	0.0000	0.0000	0	0	0	0.0000	0
DF	0.3760	0.3750	0.0050	0.0050	0.0060	0.0010	0.0000
D1	0	0	0	0	0	PLANE	
D2	0.3780	0.3750	0.0030	0.0000	0.0030	CIRCLE	
D3	0.3780	0.3750	0.0030	0.0000	0.0030	CIRCLE	
TP	0	MMC	0.0100	0	0.0060	0.0030	0.0000


Condition #2: Out of Tolerance

When there is insufficient bonus from the datum(s) to allow datum shift such that the feature is *In-Tolerance*, no fitting is performed, the measured values are not altered and the total bonus is only the bonus from the feature.

Example of Condition #2 Out of Tolerance:

.375+.001/- .000 ϕ 

Note: The tolerance for the DF, D2, D3 and the TP were changed to illustrate the out of tolerance condition.

	IN	LOC3 - CIR3					
AX	MEAS	NOMINAL	+TOL	-TOL	BONUS	DEV	OUTTOL
X	1.0030	1.0000	0	0	0	0.0030	0
Y	0.0030	0.0000	0	0	0	0.0030	0
DF	0.3760	0.3750	0.0010	0.0000	0.0010	0.0010	0.0000
D1	0	0	0	0	0	PLANE	
D2	0.3780	0.3750	0.0030	0.0000	0.0030	CIRCLE	
D3	0.3780	0.3750	0.0030	0.0000	0.0030	CIRCLE	
TP	0	MMC	0.0010	0	0.0010	0.0085	0.0065

Option #3: Use Datums: ON and Fit to Datums: OFF (4.1 enhancement)

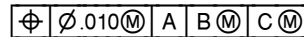
Application: Use this method when there are modifier(s) (MMC or LMC) on the Datum(s) and you do not want the measured data fitted (no Datum Shift). This option was added based on customer request to provide the ability to incorporate bonus from a Datum and still monitor for process variation (the measured values are not altered because no “Datum Shift” is applied).
 Note: This method is not compliant with Y14.5M 1994.

Results: A “Datum Reference Frame” simulation is performed mathematically by *Translating and Rotating* based on the *Degree’s of Freedom* constrained by the selected Datum(s). The X, Y or Z measured values and deviations are from the active Alignment and are not altered based on the bonus from the Datum features (no Datum Shift).

Bonus Column: The bonus column in the report shows the calculated amount of bonus of the feature (DF) and the calculated amount of bonus of each datum feature of size (D1 primary, D2 secondary, D3 tertiary). The total bonus value is the sum of the bonus from the feature and the Datum with the smallest amount of bonus amongst the selected datums.

Example of Condition #1 In-Tolerance:

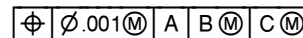
.375±.005∅



⊕	IN	LOC7 - CIR3					
	MEAS	NOMINAL	+TOL	-TOL	BONUS	DEV	OUTTOL
X	1.0030	1.0000	0	0	0	0.0030	0
Y	0.0030	0.0000	0	0	0	0.0030	0
DF	0.3760	0.3750	0.0050	0.0050	0.0060	0.0010	0.0000
D1	0	0	0	0	0	PLANE	
D2	0.3780	0.3750	0.0030	0.0030	0.0060	CIRCLE	
D3	0.3780	0.3750	0.0050	0.0050	0.0080	CIRCLE	
TP	0	MMC	0.0100	0	0.0120	0.0085	0.0000

Example of Condition #2 Out of Tolerance:

.375+.001/-.000 ∅



Note: The tolerance for the DF, D2, D3 and TP were changed to illustrate the out of tolerance condition.

⊕	IN	LOC5 - CIR3					
	MEAS	NOMINAL	+TOL	-TOL	BONUS	DEV	OUTTOL
X	1.0030	1.0000	0	0	0	0.0030	0
Y	0.0030	0.0000	0	0	0	0.0030	0
DF	0.3760	0.3750	0.0010	0.0000	0.0010	0.0010	0.0000
D1	0	0	0	0	0	PLANE	
D2	0.3780	0.3750	0.0030	0.0000	0.0030	CIRCLE	
D3	0.3780	0.3750	0.0050	0.0050	0.0080	CIRCLE	
TP	0	MMC	0.0010	0	0.0040	0.0085	0.0035

General Rules for True Position Dimensions when Use Datums is On:

- 1) It is important to select all the Datums specified in the feature control frame such that the proper fitting is performed. The features selected for D1, D2 and D3 represent the Primary, Secondary and Tertiary Datums and are used to constrain up to “*Six Degrees of Freedom*” (3 degrees of *Translation* and 3 degrees of *Rotation*).
- 2) All *Measured Feature* commands (datums and feature) must contain the correct nominal values (X,Y,Z,I,J,K) in the THEO field (fitting references the *measured feature* commands to calculate datum constraints and the dimensional results).
- 3) The *Measured Feature* command and the associated *True Position Dimension* command must come from the same alignment (ensures the nominal values are correct and the same as what is called out as basic dimensions on the drawing). This is critical when programming without CAD as it will require editing *measured feature* commands (guess mode) to provide the correct nominal values (used for fitting).
- 4) The *Ignore CAD to Part* option in the Setup Options/General Dialog window (F5) must not be selected.

Note: It is recommended to use the new *True Position Feature Control Frame* method of dimensioning when there are modifier(s) (MMC or LMC) on the Datum(s) (4.1 enhancement). The *Legacy True Position* command with *Use Datums* ON is available for program migration and no longer needed for new programs created in 4.1.