CYCLE	INTGR	PARTO	SNSET	ZXPLAN
CYLCTY	INTOF	PATERN	SNSLCT	
CYLNDR	INTOL	PAUSE	SNSMNT	
CYLRADSEGMNT	IPM	PCENT	SOUND	

Table 4 — Characterization file minor words

CMM	ENDSPT
FORMA	FORMB
FORMC	FORMD
FORME	FORMF
FORMG	FULL
NONE	NS

5.1.2.3 DMIS reserved words

DMIS reserved words consist of DMIS major words defined in (Table 1 — DMIS major words), DMIS minor words defined in (Table 3 — DMIS minor words) and intrinsic function names listed in (Table 5 — Intrinsic function words).

5.1.2.4 Label names

Labels consist of two components, a one to three character label type (for example F, TA, DAT...), followed immediately by a label name enclosed within parentheses. Labels are assigned in the inspection program to name features, tolerances, coordinate systems, sensors, output data formats, datums, macro routines, text strings, and program statements, etc; and each of these entities has a unique label type that is defined by DMIS. All label names, except for datum labels, are from one to sixty-four (64) characters where the only permissible characters are alphanumeric (A-Z, a-z, 0-9), dash '-', period '.', and underscore '_'. Datum label names are from one to two upper-case alpha characters for single datums, and two to four upper-case alpha characters with a dash '-' in between for compound datums. All label names are enclosed in parentheses. Label names (except for feature nominals) can be issued only once and cannot be redefined in a particular program; and labels with the same label name (within parentheses) but with a different label type are unique.

In addition to directly specifying label names, the indirect reference '@' operator is available. At most one level of indirect reference may be used. With the indirect reference method, the '@' character precedes the name of a CHAR variable that contains a label that is valid for the label type. If the character variable was declared as multi-dimensional, its name must be followed by an array index. The array index (base) begins at the number 1. Refer to example A.1.

Jumptargets are a special type of label that have an implied label type and are used for example in ERROR, JUMPTO or RESUME statements.

5.1.2.5 Text strings

Text strings are used extensively in DMIS. A text string is a grouping of printable ASCII characters, that is enclosed with apostrophes. All printable ASCII characters are allowed within a text string, but when an apostrophe is required it must be preceded by an additional apostrophe, for a total of two apostrophes. Spaces and tabs are considered printable characters. An empty string is specified by using only two apostrophes with no characters in between, that is ‘’. For example if an operator prompt requesting a Supplier's part number were "Enter the Supplier's part number". An appropriate statement would be:

```
TEXT/QUERY,(Sup_Part),20,PRNTCHAR,LEFT,'Enter the Supplier''s part number'
```


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CYLNDER-BOUND	Yes – Center Point	Yes – Axis	No
CYLRADSEGMNT	Yes – Center Point	Yes – Axis	No
EDGEPT	Yes	No	No
ELLIPS	Yes – Center Between Foci	Yes – from Focus1 to Focus2	No
ELONGCYL	No	No	Yes – Center Plane
GCURVE	No	No	No
GEOM	No	No	No
GSURF	No	No	No
LINE	No	Yes	No
OBJECT	No	No	No
PARPLN	No	No	Yes – Center Plane
PATERN	No	No	No
PLANE	No	No	Yes
POINT	Yes	No	No
RCTNGL	Yes – Center Point	No	No
REVSURF	No	Yes – Axis	No
SPHERE	Yes – Center Point	No	No
SPHRADSEGMNT	Yes – Center Point	No	No
SYMPLN	No	No	Yes – Center Plane
TORRADSEGMNT	Yes – Center Point	Yes	Yes
TORUS	Yes – Center Point	Yes	Yes
Reducible features are those features that can be unambiguously reduced.			
Derived Features are those features that can be derived from other feature's arguments.			

5.3.2.3 Feature reference

Features are referred to in two ways: as a feature nominal or as a feature actual.

5.3.2.3.1 Feature nominal

The feature nominal is the feature definition that comes from the CAD model or part drawing. It is the as-designed feature. The feature nominal definition is passed in the inspection program to the DME, and gives the nominal size, location, and orientation of the feature. A label name is assigned to the feature in the feature nominal definition. The label name is enclosed in parentheses and preceded by a label type "F", where the "F" indicates that this is the feature nominal definition.

A feature nominal definition for a circle called CIRCLE_1 might be as follows:

```
F(CIRCLE_1)=FEAT/CIRCLE,INNER,CART,10,10,5,0,0,1,8
```

Feature nominal coordinates shall retain their original values during any subsequent coordinate system transformations, with nominal values unchanged throughout the execution of the system. Therefore, a nominal definition is not directly associated with or expressed in any coordinate system; however, the nominal definition

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shall be utilized as a location relative to the origin of the current coordinate system at the time it is applied. Conversely, feature actual coordinates always reference the same absolute location within 3D space, but are transformed (when used) into the current coordinate system.

5.3.2.3.2 Feature actual

A feature actual FA(label) is created by measuring or constructing a feature, or defining an FA(label). The feature actual definition gives the measured size, location, and orientation of the feature. The actual definition is output by the DME into the output file, preceded by a label type FA(label) to indicate a feature actual (see 5.1.9, Data output). The label name of the actual is the same as the label name of the corresponding nominal.

For example, CIRCLE_1 might be output as:

```
FA(CIRCLE_1)=FEAT/CIRCLE,INNER,CART,9.89,9.93,5,0,0,1,7.97
```

Here, we see that the actual center location deviated from the nominal definition in paragraph 5.3.2.3.1 by 0.11 in the X direction and by 0.07 in the Y direction, and the actual diameter deviated by 0.03.

5.3.2.4 Measured feature

DMEs collect point data and use these data to construct features. A circle, for example, may be measured by calculating the best-fit circle through five measured points. The points themselves are not features, but are only used to compute the circle. When data are used in this manner, the circle is referred to as a measured feature.

As shown in paragraph 5.3.2.3.1 and 5.3.2.3.2, feature orientation consists of an x,y,z point and an i,j,k unit vector. The use of the vector is described in the individual statement definition in section 6. Unless otherwise indicated, all normal vectors point away from the part surface.

5.3.2.5 Constructed feature

The DMIS vocabulary provides for the construction of features using other features. When a DME is instructed to construct a feature from other features, at least one of the features used in the construction must be a feature type FA(label). The circle on which the holes in a bolt hole pattern lie, for example, can be constructed by measuring the bolt holes and then calculating the best-fit circle through their centers. In this case, the circle is called a constructed feature. The difference between a constructed feature and a measured feature is that the constructed feature is computed from other features, whereas the measured feature is computed from measured point data. Point data are usually lost after the feature actual definition is computed.

In the example of the bolt hole pattern, the DME can be instructed to compute the circle through the center-point of all measured holes, or it can be instructed to compute the center-point through one measured hole and the nominals of the other holes. It is not valid, however, to instruct the DME to compute the circle through only the nominals of the holes. In this case, the circle definition could have been computed without using any measurement results and therefore can be done without the DME. Since a construction must use at least one feature actual, a previously constructed feature, or a defined FA(label), the result of a construction is a feature actual.

Construction statements cause the DME to construct a feature from previously defined features and at least one previously measured feature. The result of the construction process is a feature actual. The feature nominal must be defined prior to the construction of the feature actual. There are several formats for this statement, and there are no defaults. The specification for each format is given in the Statement Reference section (section 6.14 to section 6.28).

5.3.2.6 Feature data access

If a feature has been measured with point buffering enabled with the PTBUFF/ON statement, then its corresponding individual point nominal and measured data can be referenced by the following syntax:

```
F(label)[n]
FA(label)[n]
F(label)[n,m]
```


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6.17 CONST (input format 4)

Function: Causes the DME to construct a point, given the label names of other features to use in the construction.

Input Formats:

can be: **CONST/POINT,F(label1),var_1**

Output Formats:

can be: **CONST/POINT,F(label1),var_1**

Where:

var_1 can be: **MIDPT,FA(label2),var_2**
or: **PIERCE,FA(label2),var_2**
or: **VERTEX,FA(label2)**
or: **PROJPT,FA(label2) var_3**
or: **MOVEPT,FA(label2),var_4**
or: **CURVE,FA(label2),var_2**
or: **EXTREM,var_5,FA(label2),var_6**
or: **COG,FA(label3) var_7**

var_2 can be: **FA(label4)**
or: **F(label5)**

var_3 can b e: **,FA(label4)**
or: **,F(label5)**
or: **does not exist**

var_4 can be: **dx,dy,dz**
or: **F(label5),dist**
or: **FA(label4),dist**

var_5 can be: **MIN**
or: **MAX**

var_6 can be: **XDIR**
or: **YDIR**
or: **ZDIR**
or: **VEC,i,j,k**
or: **F(label5)**
or: **FA(label4)**
or: **RADIAL**

var_7 can be: **,FA(label3) var_8**
or: **,F(label6) var_8**

var_8 can be: **var_7**
or: **does not exist**

COG signifies that the feature to be constructed is to be the center of gravity (geometric center) from the previously defined point reducible features.

CURVE signifies that the feature to be constructed is a point at the intersection of two previously defined features. The features involved in the construction must contain both location and orientation data.

dist is the incremental distance along the feature axis.

dx,dy,dz are the incremental distances in Cartesian coordinates.

EXTREM signifies that the feature to be constructed is the measurement point for the previously defined feature that is the most extreme in the direction specified in var_5.

F(label1) is the label name of the previously defined feature nominal to be constructed.

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F(label5)	is the label name of a previously defined feature to be used for the construction.
F(label6)	is the label name of a previously defined point reducible feature used for the construction.
FA(label2) **FA(label4)**	are the label names of previously defined, measured or constructed features to be used for the construction.
FA(label3)	is the label name of a previously defined, measured or constructed point reducible feature to be used for the construction.
i,j,k	is the unit vector along which the most extreme point will be found.
MAX	signifies that the extreme point will be calculated along the direction specified in var_6.
MIDPT	signifies that the feature to be constructed is to be the midpoint of the two previously defined features that follow.
MIN	signifies that the extreme point will be calculated against the direction specified in var_6.
MOVEPT	signifies that the feature to be constructed is to be offset from a previously measured point by the specified incremental distances or along the specified feature axis by the specified distance.
PIERCE	signifies that the feature to be constructed is a point at the intersection of the line reducible feature represented by FA(label2) with the surface of F(label5) or FA(label4). In the case of multiple solutions for the constructed pierced point feature, the one that is nearest the nominal definition will be utilized.
POINT	signifies that a point is to be constructed.
PROJPT	signifies that the feature to be constructed is to be the projection of the previously defined feature onto a specified plane or line reducible feature or, if var_3 does not exist, onto the working plane.
RADIAL	signifies that the extreme point will be calculated along a direction pointing away from the center and perpendicular to the surface of the measured feature FA(label2) at the measured point.
VEC	signifies that the direction for the extreme evaluation will be specified as a unit vector.
VERTEX	signifies that the feature to be constructed is the vertex of the previously defined cone that follows.
XDIR **YDIR** **ZDIR**	signifies that the most extreme point will be calculated along the specified direction.

When VERTEX is specified, FA(label2) is a cone. Refer to (Figure B.14 — Constructed point).

When PROJPT is specified, FA(label2) is a point reducible feature. Refer to (Figure B.13 — Constructed projected point).

When MOVEPT is specified, FA(label2) is a point reducible feature. Refer to (Table 7 — Reducible features).

When CURVE is specified, FA(label2) and FA(label4) or F(label5) are two features that contain position and orientation data. Both must be point reducible features, the first of which is measured. The features are treated as planes which when intersected, form a line representing the curve line. The point on the line is controlled by projecting the nominal point from the feature declaration (FEAT/POINT) onto the curve line. Refer to (Figure B.32 — Construction of a point on a curve) and (Figure B.33 — Construction of a point on a curve).

Since all constructed features have a feature nominal definition, for example, F(label1) specified in the program, there should be no ambiguities in the construction. When more than one result is possible from a given construction, the desired result is that which most closely agrees with the feature nominal definition.

When MIDPT is specified, the FA(label2) and FA(label4) or F(label5) are two point reducible features, the first of which is measured. Refer to (Figure B.12 — Constructed mid-point).

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The RADIAL parameter can be used with arc, circle, cylinder, ellipse, cone and sphere features.

According to paragraph 5.3.2.6, if a feature has been measured with point buffering enabled, with a PTBUFF/ON statement, then its individual point data can be referenced by appending the [n] option to F(label) or FA(label), where n is the point index from the feature's programmed PTMEAS statements. Using this subscripted label option is equivalent to using an F(label) or FA(label) of a feature type POINT and can only be used when a feature type POINT is appropriate. In the case of CONST/POINT, use of the subscripted label option is only appropriate when used with the MIDPT, PROJPT, or MOVEPT minor words.

For constructed features of type POINT, the following should be used to define the ijk component of the resulting point feature:

- When MIDPT is specified , the resulting ijk for the mid point is the same as the feature nominal ijk definition.
- When VERTEX is specified, the resulting ijk for the vertex is the same as the cone's ijk direction.
- When PROJPT is specified, the resulting ijk for the projection is in the direction from the resulting projected feature to the feature that was being projected. In the case where the resulting feature is already on the line or plane feature being projected to, the resulting ijk should be the same as the nominal ijk for the constructed feature.
- When MOVEPT is specified , the resulting ijk for the point is the same as the feature nominal ijk definition.
- When CURVE is specified, the resulting ijk for the point is the same as the feature nominal ijk definition.
- When EXTREM is specified, the resulting ijk for the extreme point is the same as the direction specified in var_6 .
- When COG is specified, the resulting ijk for the center of gravity point is the same as its nominal definition.
- When PIERCE is specified, the resulting ijk for the pierce point is the direction of the surface normal at that point.

The CONST (input format 4) statement is passed to the output file when executed.

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6.73 FEAT/CIRCLE

Function: Defines a nominal circle or constructs an actual circle, and assigns to it a label name.

Input Formats:

can be: **F(label)=FEAT/CIRCLE,var_1,var_2,i,j,k,diam**

or: **FA(label)=FEAT/CIRCLE,var_1,var_2,i,j,k,diam**

Output Formats:

can be: **F(label)=FEAT/CIRCLE,var_1,var_2,i,j,k,diam**

or: **FA(label)=FEAT/CIRCLE,var_1,var_2,i,j,k,diam**

or:
```
F(label)=FEAT/CIRCLE,RAWDAT
/rx1,ry1,rz1
/rx2,ry2,rz2
/...
ENDAT
```

or: **F(label)[n]=FEAT/CIRCLE,PTDATA,var_3 var_4**

or: **FA(label)[n]=FEAT/CIRCLE,PTDATA,var_5,prbdiam var_6**

Where:

var_1 can be: **INNER**
or: **OUTER**

var_2 can be: **CART,x,y,z**
or: **POL,r,a,h**

var_3 can be: **CART,xp,yp,zp**
or: **POL,rp,ap,hp**

var_4 can be: **,in,jn,kn**
or: **does not exist**

var_5 can be: **var_3**
or: **RAWDAT,rx1,ry1,rz1**

var_6 can be: **,ip,jp,kp**
or: **does not exist**

CART signifies that Cartesian coordinates are to follow.

CIRCLE signifies that the feature is a circle.

diam is a positive real number representing the diameter of the circle.

ENDAT signifies the end of raw data.

i,j,k is the direction vector of the plane in which the circle lies.

in,jn,kn is the nominal approach direction specified in the PTMEAS statement in programmed mode. Refer to section 5.3.2.6.

INNER signifies that the inside of the circle is to be measured (that is, a hole).

ip,jp,kp is the probe compensation direction of the specified point. Refer to section 5.3.2.6.

label is an alphanumeric label name assigned to the feature.

n is a positive integer that is the index value of a specific individual point.

OUTER signifies that outside of the circle is to be measured (that is, a boss).

POL signifies that polar coordinates are to follow.

prbdiam is a positive real number representing the actual probe diameter used to measure the specified points.

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PTDATA	signifies output of individual point data (from the PTMEAS statements (if any) specified in the feature measurement).
r,a,h	are the polar coordinates of the center-point of the circle.
RAWDAT	signifies that the uncompensated, Cartesian coordinates of the measured point(s) (raw data) are to follow.
rp,ap,hp	are the polar coordinates of the specified point.
rx1,ry1,rz1 **rx2,ry2,rz2** **...**	are the Cartesian coordinates of raw data points.
x,y,z	are the Cartesian coordinates of the center-point of the circle.
xp,yp,zp	are the Cartesian coordinates of the specified point.

The location(s) and direction(s) are given relative to the current coordinate system.

For RAWDAT output, each data point is preceded with a slash and followed with a carriage return and line feed. The feature definition is terminated with the ENDAT statement. The data points are output in relation to the current coordinate system in effect when the feature was measured.

The FEAT/CIRCLE statement is passed to the output file by execution of the OUTPUT statement.

Note: The RAWDAT output format is used when the DME does not recognize the feature type and is given a measurement sequence to follow.

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