VCA – Vision Council of America

Rimless Frame Drill Mount Standard

Version 1.0

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Foreword

The Lens Processing Technology Division of the VCA developed Version 0.0 of the Rimless Drill Mount Standard for ophthalmic frames. It supersedes all prior versions. The version is identified within the protocol by the data field FDSV=0.0. This standard is an extract from the VCA Data Communication Standard (DCS) Version 3.04. Nothing in this standard shall conflict with the DCS.

Introduction

This standard is intended to enable frame manufacturers to prepare and disseminate the data needed to drill and process lenses for three-piece frames.

Today the VCA Data Communication Standard, DCS, provides a file format and communication protocol for the data needed by virtually all lens processing machines. Drill data needed for automated drilling of three-piece frames was added recently.

This standard is a subset of the DCS to be used in preparing frame data packets. It is simply the DCS stripped of reference to the communication protocol used to move data between machines and computers in the lab environment and also stripped of the vast number of data records needed for unrelated machines such as surface generators. The resulting data file is human-readable as are all DCS files.

The frame supplier is encouraged to build a collection of files for all of their products and distribute these files to customers or third parties. The files could be made available on the frame suppliers Web site. The files can also be distributed via email, on CDROM, or bundled into a database product. When drilling is done manually, these files can be used with programs that provide screen display or printed drill data.

1 Scope

This Standard establishes a file format and data requirements for the distribution of information needed to mount lenses in rimless and other frame styles. It is excerpted from the VCA Data Communication Standard (DCS). If the two standards conflict, the DCS take precedent.

2 Normative Reference

The VCA Data Communication Standard Version 3.04 is the normative reference for this standard.

3 Terms and definitions

For the purposes of this Standard, the terms and definitions given in the VCA Data Communication Standard Version 3.04 and in ISO 13666:1998 apply.

4 Requirements

4.1 Files

1. The file will contain printable ASCII characters, line terminators, and depending on the source platform, may contain an end-of-file marker. The line terminators and end-of-file characters may differ depending on the hardware and/or software platform on which the file is produced.
2. Lines in the file correspond to Records as defined in the VCA Data Communication Standard Version 3.04.
3. The file type is indicated by specifying a Request type of FRM. This appears as REQ=FRM in the first line of every file.
4. The LIB Record shall appear on the second line of every file. This record contains only the identifier “framefile” and the values of the following Records in the order shown: FMFR, FRAM, EYESIZ and BRGSIZ. This information aids in organizing a collection of frame files and identifies the frame sufficiently to locate the needed lens shape and drill data. “Framefile” is needed to differentiate this LIB Record from other types of LIB Records.
5. The remaining records in this file are selected from the lists in Tables 1 and 2. The records are listed in alphabetical order but, with certain exceptions, may appear in the file in any order. The exceptions are the REQ and LIB Records which must be the first and second Records in the file and Trace records shall be in the order TRCFMT, R, [A], [ZFMT], [Z], [ZA] where brackets [] indicate optional records. the TRCFMT Record which must appear immediately before the “R” Records. Table 1 lists the mandatory Records. Records in Table 2 are optional.
6. The only frame trace format allowed is format 1, ASCII, equiangular radii as defined in the DCS. Any number of data points may be used to define the shape except that the minimum number of points is 400.

7. Record length should not exceed 80 characters. Therefore, multiple trace Records will be needed for the 400 or more radii.
8. This file shall not include any other items that appear in DCS files. These include the Start, Stop, and CRC Position characters and the CRC, Status, JOB and DO Records.

4.2 Records

Table 1 lists all mandatory Records in the FRM file. Table 2 lists all optional Records in the file. Annex A is an informative excerpt from the DCS and includes information helpful in creating the file. If the two standards differ, the requirements specified by the DCS shall be used.

4.3 Drilling Records

The DRILL record introduced in version 3.03of the Data Communication Standard is deprecated in favor of the DRILLE record introduced in version 3.04. The DRILLE record supports feature location by two new reference schemes in addition to the Cartesian reference supported by the DRILL record.

Each feature to be produced on a lens is represented by a discrete DRILLE record. This means that packets containing any DRILLE records at all are likely to contain multiple DRILLE records.

The DRILLE record contains multiple fields that must always appear in the order shown below. The first four fields are required for all features. All or some of the remaining fields may be required to completely specify the feature. The record may simply end at the last required field. When required fields follow non-required fields, the intervening field separators must appear. When they do appear, the fields implicitly expressed thereby may contain nothing (this is an empty field expressed as two adjacent field separators). White space is allowed in records. Therefore it is permissible for spaces to appear in such empty fields.

4.3.1 DRILLE Record Examples

A minimal DRILLE Record: DRILLE = B ; C ; -17.0 ; 10.32

A more complex DRILLE record: DRILLE = B ; C ; -17.0 ; 10.32 ; -14.0 ; 10.32 ; ; 1 ; A ; -15.0 ; 5.0

4.3.2 Constituent fields of the DRILLE record

1. Eye Side

The first field in the DRILLE record shall contain one of the following characters: “R”, signifying that the record contains instructions for a feature to be applied to the right lens; “L”, signifying that the record contains instructions for a feature to be applied to the left lens, or “B” signifying that the record contains instructions for a feature to be applied to both lenses. In the case of a feature to be applied to both lenses, the data describes locations for a right lens, which shall be mirrored by the Device to apply the feature to the left lens. This field shall be populated in all DRILLE Records.

2. Feature location reference

The second field in the DRILLE record contains one of the characters listed below. In each case Cartesian coordinates are used with the x-axis passing through the box center of the frame trace and the y-coordinate is referenced to the x-axis. The origin of the x-axis and the sign convention for x-coordinates depends on the reference method selected and is described below. This field shall be populated in all DRILLE Records.

"**C**", Center Reference, indicates that the record contains x and y coordinates referenced to the origin of a Cartesian grid located at the box center of the frame trace;

"**EN**", Edge Reference Nasal Side, indicates that the feature is on the nasal side of the lens, the x-coordinate is referenced to the edge of the lens at the y-coordinate and the sign of the x-coordinate is positive when the feature is inside the lens;

"**ET**", Edge Reference Temple Side, indicates that the feature is on the temple side of the lens, the x-coordinate is referenced to the edge of the lens at the y-coordinate and the sign of the x-coordinate is positive when the feature is inside the lens;

"**BN**", Box Reference Nasal Side, indicates that the feature is on the nasal side of the lens, the x-coordinate is referenced to the edge of a box circumscribing the shape and the sign of the x-coordinate is positive when the feature is inside the lens;

"**BT**", Box Reference Temple Side, indicates that the feature is on the temple side of the lens, the x-coordinate is referenced to the edge of a box circumscribing the shape and the sign of the x-coordinate is positive when the feature is inside the lens.

3. Start Coordinate, x-axis

The third and fourth fields are the "starting" x and y coordinates respectively. This is the location of the center of the hole. When making a slot, this is the location where machining begins (see Figure 1 below). In the case of a slot the ending position is described in the sixth and seventh fields, End Coordinates. If Feature Type 2 is specified in the tenth field of this Record, the start coordinates specify the upper "outside" corner of a rectangular region (see field 9 below). This field shall be populated in all DRILLE Records.

4. Start Coordinate, y-axis

The fourth field is the y-coordinate of the starting location. See "Start Coordinates" above. This field shall be populated in all DRILLE Records.

5. Diameter

The fifth field is the diameter of the hole (or, in the case of a slot, the width of the slot). When this field is empty or absent, the hole shall be drilled to a default diameter determined at the Device which may be the diameter of the drilling tool.

6. End Coordinate, x-axis

The sixth and seventh fields are the "ending" x and y coordinates of a slot or rectangular feature. This field may be empty or absent in which case a round hole is drilled. If Feature Type 2 is specified in the ninth field, end coordinates must appear in fields 6 and 7 to specify the lower "inside" corner of the rectangular region (see field 9 below).

7. End Coordinate, y-axis

The seventh field is the y-coordinate of the end location. See "End Coordinate, x-axis" above.

8. Depth

The eighth field is the depth in millimeters of the feature. When absent or empty, the feature is drilled through the entire thickness of the lens. A negative Depth value indicates that the feature is on the back side of the lens.

9. Feature type

The ninth field in the DRILLE record contains the “Feature Type”, either 1 or 2, which differentiates the use of the start and end coordinate fields in the record. In all cases, the coordinates are referenced as described in the Feature Location Reference section. If this field is empty or absent, feature type 1 is implied.

Feature type 1 specifies a hole or a slot. In this case the start coordinates in fields 3 and 4 specify the location of the hole or the starting location of the slot. The end coordinates in fields 6 and 7 specify the ending location of the slot.

Feature type 2 specifies a rectangular region to be milled out of the lens. The start coordinates specify the upper outside corner of the region, and the end coordinates specify the lower inside corner of the region. “Outside” refers to the side of the milled region furthest from the center of the lens; “inside” refers to the side of the region closest to the center of the lens.

10. Angle Mode

The tenth field specifies the angle at which the feature is to be drilled relative to the surface of the lens. See Figures 1, 2, and 3 below. The Angle Mode field may contain one of the following characters: “B”, signifying that the feature is drilled normal to the lens back surface at the feature location; “F”, signifying that the feature is drilled normal to the lens front surface at the feature location; or “A”, signifying that the feature is drilled at the angles specified in the eleventh and twelfth fields. If this field is absent or empty and the feature is not part of a group with an explicitly specified Angle Mode, Angle Mode “F” is assumed. If the Angle Mode is not specified and the feature is included in a group, refer to the “Angle Mode for Feature Groups” section below.

10.1 Angle Mode for Feature Groups

Features that appear on the same side of the lens, either nasal or temple side, are implicitly grouped and shall be drilled at the same angle. The Angle Mode for the group can be specified by assigning an Angle Mode to one, but not more than one, feature in the group. The Angle Mode can include specified Lateral and Vertical Angles. Those features in the group that have no angle specification shall parallel the feature that has them. If no feature in the group has the Angle Mode specified, the feature in the group that appears first in the file is drilled normal to the front surface and the remaining features in the group are drilled parallel to this first hole. The presumption of grouping can be defeated by specifying the Angle Mode for each feature separately.

11. Lateral Angle

The eleventh field specifies the lateral angle, relative to the Drill Reference Axis, at which the feature is drilled. The Drill Reference Axis is the normal to the lens front surface at the lens box center. If the Angle Mode specified in the tenth field is “A”, this field shall not be absent or empty. The lateral angle is specified in degrees and indicates an angular deviation from the Drill Reference Axis. A positive number signifies a deviation towards the nasal on a right lens, and towards the temporal on a left lens. See Figure 2.

12. Vertical Angle

The twelfth field specifies the vertical angle, relative to the Drill Reference Axis, at which the feature is drilled. The Drill Reference Axis is the normal to the lens front surface at the lens box center. If the Angle Mode specified in the tenth field is “A”, this field shall not be absent or empty. The vertical angle is specified in degrees and indicates an angular deviation from the Drill Reference Axis. A positive number signifies a deviation towards the top of the lens. See Figure 3.

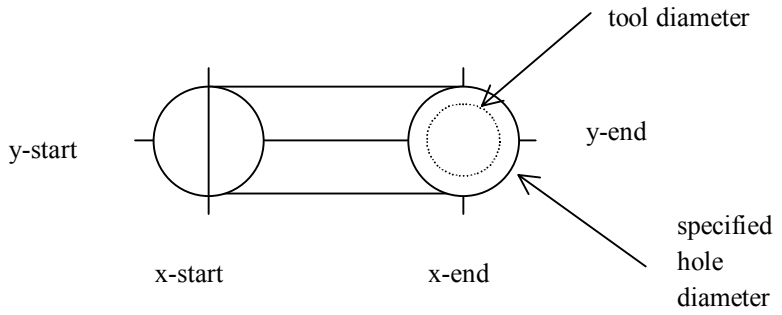

Figure 1 – Drill Information

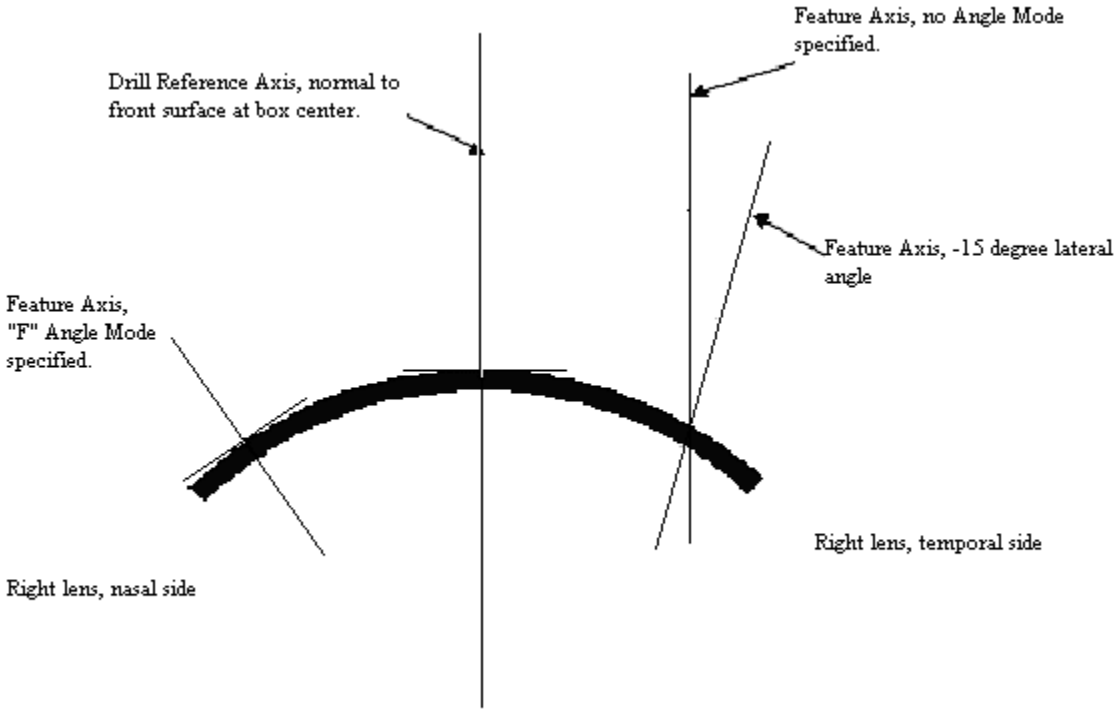

Figure 2 – Lateral Drill angle

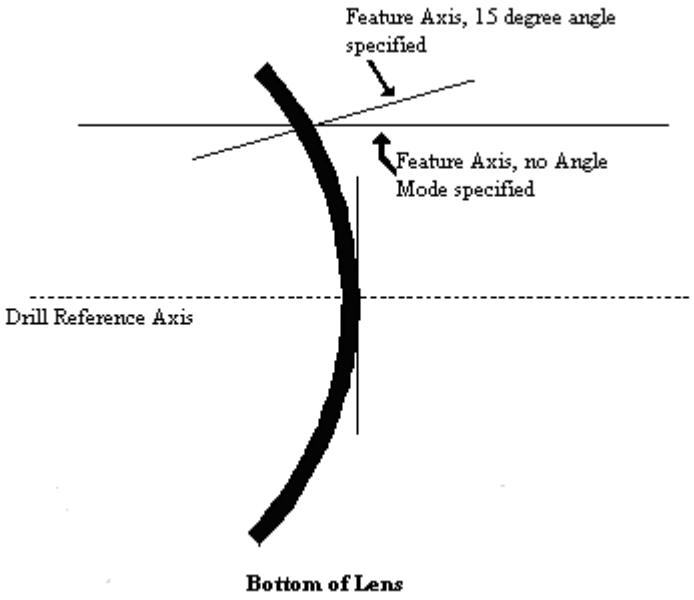

Figure 3 – Vertical Drill angle

Table 1 – Mandatory Records

Record name	Description
LIB	Library identification
FMFR	Manufacturer of frame (This is the name of the frame supplier, not the factory that produced the frame. The same name should be used for all frames from one supplier.)
FRAM	Name of frame
EYESIZ	Nominal eye size of frame
BRGSIZ	Bridge size of frame
FUPC	Frame UPC number
DRILLE	Drill data
TRCFMT	Trace format
R	Trace data radius values

Table 2 – Optional Records

Record Name	Description
MAXFRT	Maximum (steepest) lens front curve allowed
MINFRT	Minimum (flattest) lens front curve allowed
MAXBACK	Maximum (steepest) lens back curve allowed
MINBACK	Minimum (flattest) lens back curve allowed
FETHK	Lens thickness min and max at drill hole
FINST	Special processing instructions
ZFMT	Format for trace Z-axis data
FCRV	Frame curve
DBL	Distance between lenses (mm)
FTYP	Frame type: 1=plastic, 2=metal, 3=rimless
FMAT	Frame material (e.g., titanium)
FDSV	Frame Data Standard version number
HBOX	Horizontal boxed lens size of frame (mm)
PANTO	Pantascopic angle (degrees)
TPSIZ	Side or temple length of frame (mm)
TPTYP	Side or temple type of frame such as cable or straight

Annex A – informative

Records

Device records

Table A.1 lists all device Records that may be used in the FRM file. The column labeled “Data type” indicates the characteristics of the data associated with each Record label.

The semi-colon field separator character in the Data type column indicates that values may be provided for both right and left eyes. The lack of a field separator (semi-colon) indicates that only one value is expected, i.e., the record is not chiral. Data for either eye may be empty, but the field separator shall be present. If the data is for the right eye only it shall appear to the left of the semi-colon. A single value, whether or not followed by a semi-colon, applies to both eyes. A leading semi-colon followed by a value applies to the left eye only. For example, if only one circumference is supplied, it is assumed to apply to both right and left eyes.

Numeric fields may or may not contain a decimal point. If a decimal point is present, hosts and devices should be able to correctly parse any degree of precision, including zero. Numeric format should be flexible, but reasonable.

Integer fields shall not contain decimal points.

The ± symbol indicates that a number may be positive or negative. The absence of the symbol indicates that a value is expected to be positive.

Square brackets [] around any element other than the semi-colon indicate that the enclosed item is optional.

The letter M indicates a mandatory Record. All other Records are optional.

The units of measure used in Table 1 are millimeters, diopters and degrees.

Frame sizing

HBOX, VBOX and CIRC records, if included, shall reflect the dimensions of the shape sent in R records and shall be for the right eye only.

Tracing records

Trace data begins with a TRCFMT record that specifies the format in which the tracing is to be expressed, the number of points to be transmitted, whether the radii are equiangular, the orientation of the tracing and an indication of what was traced. For frame files described in this standard, only one trace format is allowed as described in Table 1.

The radius data are contained in “R” records. These shall appear immediately after the TRCFMT record. All of the R records for a tracing appear together. The radius data in an R record is expressed in hundredths of a millimeter with an implied decimal point and shall be in the range 0-35999 (24.79mm is expressed as R=2479). An R record may

contain multiple radius values. In this case, the values are separated by a field separator (semi-colon). Data should be limited to 80-characters per line; therefore multiple "R" records are required for a single radius data set. Lines should be separated by a Carriage Return and/or Line Feed (<CR/LF>).

Frame tracing coordinates

Trace data shall be centered geometrically about the box center of the right eye of the frame. Eye orientation, right or left, should be viewed as a refractionist views a spectacle wearer; right-eye oriented data therefore start at the nasal side while left-eye data start at the temporal. Decentered trace data is not permitted.

The DCS allows a variety of ways to express the shape data, but in the interest of consistency and simplification, all shapes used in frame files will be represented by equally spaced radii expressed in absolute ASCII format for the right eye and based on a frame trace. The minimum number of radii is 400. Only the right eye shape data is provided, the left eye is assumed to be symmetrical.

Tracing data angular orientation

Trace data shall be expressed so that the first radius is at zero degrees (3 o'clock on standard polar scale) and shall proceed anti-clockwise.

Table A.1 – informative

Record details

Description	Record name	Data type
Bridge size of frame (mm)	BRGSIZ	integer
Distance between lenses (mm)	DBL	numeric
Nominal lens size of frame (mm)	EYESIZ	integer
Maximum (steepest) lens back curve allowed (diopters)	MAXBACK	±numeric
Minimum (flattest) lens back curve allowed (diopters)	MINBACK	±numeric
Color name of frame	FCOL	text
Frame curve (diopters)	FCRV	±numeric[;]
Frame Data Standard version number	FDSV	numeric
Frame: lens thickness min and max at drill hole (mm)	FETHK	numeric; numeric
Maximum (steepest) lens front curve allowed (diopters)	MAXFRT	±numeric

Minimum (flattest) lens front curve allowed (diopters)	MINFRT	±numeric
Frame: special processing instructions	FINST	text
Frame material (e.g., titanium)	FMAT	text
Manufacturer of frame	FMFR	text
Name of frame	FRAM	text
Frame type	FTYP	integer
0– Undefined		
1 – Plastic		
2 – Metal		
3 – Rimless		
4..127 – reserved		
Frame UPC number	FUPC	integer
Horizontal boxed lens size of frame (mm)	HBOX	numeric [;]
Library identification	LIB	text; integer
The LIB Record for frame files has the form: LIB = framefile;FMFR;FRAM;EYESIZ;BRGSIZ		
Pantascopic angle (degrees)	PANTO	integer;
Side or temple length of frame (mm)	TPSIZ	integer
Side or temple type of frame such as cable or straight	TPTYP	text
Vertical boxed lens size (mm)	VBOX	numeric[;]
Side-to-side tilt of frame as traced (degrees)	ZTILT	numeric[;]
Drill data	DRILLE	
This record has the form DRILLE = R|L|B; C|EN|ET|BN|BT; x-start; y-start; [diameter]; [x-end]; [y-end]; [depth]; [1|2]; [B|F|A]; [lateral angle]; [vertical angle] See section 4.3 above for detailed descriptions of the fields		literal; literal; ±numeric; ±numeric; [±numeric]; [±numeric]; [±numeric]; [±numeric]; [literal]; [literal]; [±numeric]; [±numeric]
Z dimension format for trace data. Identical to TRCFMT.	ZFMT	

Trace format	TRCFMT	
This record has the form: TRCFMT=Format;N;E;R;F/D<CR/LF>		
Format is always 1 for ASCII		integer
Number of points, minimum is 400		integer
Angle increment - always E for equal		literal
Which eye was traced - R or L for right or left		literal
What was traced - F for frame, D for demo lens, P for pattern		literal
Trace data radius values (hundredths of mm)	R	integer

Annex B – Informative

Example File

REQ=FRM
LIB=framefile;Kenwood;Diane;56;16
FMFR=Kenwood
FRAM=Diane
EYESIZ=56
BRGSIZ=16
FUPC=123456789123

TRCFMT=1,400,E,R,F
R=2592;2607;2622;2638;2653;2670;2687;2705;2721;2738;2754;2773;2789;2809;2826
R=2846;2865;2887;2910;2930:2951;2972;2993;3017;3038;3063;3087;3111;3133;3154
R=3173;3192;3206;3227;3240;3253;3262;3270;3275;3274;3273;3270;3265;3260;3250
R=3236;3224;3206;3188;3168;3148;3124;3106;3080;3057;3031;3009;2984;2957;2933
R=2902;2876;2855;2833;2808;2786;2768;2748;2726;2706;2688;2670;2653;2637;2620
R=2606;2593;2581;2569;2558;2544;2533;2523;2513;2504;2496;2487;2480;2472;2465
R=2459;2453;2447;2440;2434;2428;2424;2421;2418;2416;2414;2414;2413;2414;2414
R=2414;2414;2417;2420;2422;2425;2429;2434;2439;2445;2452;2460;2469;2473;2483
R=2490;2500;2508;2517;2528;2539;2551;2563;2576;2590;2603;2616;2629;2644;2656
R=2670;2685;2701;2716;2731;2746;2758;2772;2785;2798;2810;2822;2834;2844;2852
R=2863;2874;2878;2884;2893;2898;2902;2906;2910;2913;2914;2915;2915;2914;2915
R=2913;2910;2909;2907;2905;2902;2900;2898;2895;2894;2893;2890;2887;2885;2887
R=2889;2886;2883;2881;2878;2875;2873;2870;2868;2864;2861;2857;2853;2850;2846
R=2843;2840;2838;2836;2835;2833;2832;2831;2830;2830;2830;2832;2833;2835;2837
R=2841;2844;2848;2852;2857;2861;2866;2872;2878;2884;2890;2896;2903;2911;2918
R=2924;2929;2936;2943;2948;2954;2959;2964;2968;2972;2973;2975;2977;2979;2981
R=2982;2980;2979;2975;2971;2966;2961;2956;2951;2945;2937;2926;2916;2904;2892
R=2880;2867;2855;2844;2830;2817;2802;2789;2780;2767;2749;2735;2721;2707;2693
R=2679;2665;2653;2639;2629;2618;2604;2590;2576;2563;2551;2539;2529;2514;2503
R=2491;2482;2474;2462;2451;2442;2430;2422;2412;2404;2397;2389;2382;2375;2368
R=2362;2359;2350;2342;2338;2332;2324;2319;2314;2310;2304;2296;2295;2289;2284
R=2280;2277;2273;2274;2269;2265;2262;2259;2256;2253;2252;2252;2249;2247;2245
R=2244;2244;2243;2243;2243;2245;2246;2247;2247;2248;2249;2251;2252;2254;2255
R=2257;2257;2261;2263;2263;2267;2271;2275;2278;2280;2282;2284;2286;2290;2293
R=2296;2297;2299;2304;2308;2311;2316;2320;2324;2328;2333;2338;2342;2347;2351
R=2356;2361;2366;2372;2377;2384;2389;2397;2405;2413;2422;2430;2440;2450;2462
R=2471;2482;2491;2503;2515;2527;2540;2552;2565;2579

DRILLE=B;C;-21.00;16.00;1.50
DRILLE=B;C;-17.50;16.00;1.50
DRILLE=B;C;22.00;11.50;1.50
DRILLE=B;C;25.00;11.50;1.50

How to Read the Example

This file contains only the mandatory Records. Use the key below to read the file:

The first part describes the frame and the file.

REQ=FRM - indicates this information is for a frame, this exact first line appears in every file

LIB=framefile;Kenwood;Diane;56;16 - summarizes the essential information needed to identify the frame and place the data in a library, this part always begins with the word “framefile,” followed by the manufacturer’s name, frame name, eye size, and then bridge size.
FMFR=Kenwood - manufacturer name
FRAM=Diane - frame name
EYESIZ=56 - eye size
BRGSIZ=16 - bridge size

The second part of this file is the frame trace data.

TRCFMT=1;400;E;R;F means that this is absolute ASCII data with 400 radii Equally spaced representing the Right eye of the Frame.
R=2592;2607;2622… are the 400 radii describing the frame shape.

The last part of this file lists the drill data for the four holes needed for this example frame. Other frames may require additional data that is discussed briefly at the end of this document. Here is how to read the first DRILLE Record:

DRILLE=B;C;-21.00;16.00;1.50 – is the first DRILLE Record which has five fields. From left to right these fields are:

1. (**B**) - the eye side the drill data applies to; usually this will be B, meaning both eyes
2. (**C**) - indicates that center-referenced coordinates are used
3. (-**21.00) -** the starting x-coordinate referenced to box center
4. (**16.00**) - the starting y-coordinate referenced to box center
5. (**1.50**) - the diameter of the hole

The shape and drill data for this example