

# **Digital Imaging and Communications in Medicine (DICOM)**

## *Supplement 146*

### *Ophthalmic Visual Field (OPV) Static Perimetry Measurements Storage SOP Class*

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## **Scope and Field of Application**

- 5 This Supplement to the DICOM Standard introduces a new IOD and SOP Class for visual field device measurements. The new IOD will be used with several types of ophthalmic devices that test visual fields.

Visual field devices currently do not have a specific data representation in the DICOM standard. These devices produce a set of numeric measurement values. IHE Eye Care Years 1-3 defined representation of the outputs of these types of devices using DICOM Encapsulated PDF. The new IOD defines the discrete data attributes measured by these types of devices.

- 10 This supplement specifically addresses static perimetry (i.e. perimetry using static target), and is not intended to support other types of perimetry (e.g. kinetic).

## Changes to NEMA Standards Publication PS 3.2-2009

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### Digital Imaging and Communications in Medicine (DICOM) Part 2: Conformance

Item: Add to table A.1-2 categorizing SOP Classes:

The SOP Classes are categorized as follows:

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Table A.1-2  
UID VALUES

UID Value	UID NAME	Category
...	...	...
<u>1.2.840.10008.5.1.4.1.1.80.1</u>	<u>Ophthalmic Visual Field Static Perimetry Measurements Storage</u>	<u>Transfer</u>
...	...	...

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**Changes to NEMA Standards Publication PS 3.3-2009**  
**Digital Imaging and Communications in Medicine (DICOM)**  
**Part 3: Information Object Definitions**

30 **Modify PS3.3 Table A.1-2 to add new IOD: Ophthalmic Visual Field Static Perimetry Object**

IODs Modules	...	<u>OPV</u>	...
Patient		<u>M</u>	
Clinical Trial Subject		<u>U</u>	
General Study		<u>M</u>	
Patient Study		<u>U</u>	
Clinical Trial Study		<u>U</u>	
General Series		<u>M</u>	
Clinical Trial Series		<u>U</u>	
<u>Visual Field Static Perimetry Measurements Series</u>		<u>M</u>	
General Equipment		<u>M</u>	
Enhanced General Equipment		<u>M</u>	
<u>Visual Field Static Perimetry Test Parameters</u>		<u>M</u>	
<u>Visual Field Static Perimetry Test Reliability</u>		<u>M</u>	
<u>Visual Field Static Perimetry Test Measurements</u>		<u>M</u>	
<u>Visual Field Static Perimetry Test Results</u>		<u>M</u>	
<u>Ophthalmic Patient Clinical Information and Test Lens Parameters</u>		<u>U</u>	
SOP Common		<u>M</u>	

**Modify PS3.3 Annex A to Include OPV IOD**

## A.XX Ophthalmic Visual Field Static Perimetry Measurements Information Object Definition

### A.XX.1 Ophthalmic Visual Field Static Perimetry Measurements IOD Description

40 The Ophthalmic Visual Field Static Perimetry Measurements IOD is used to encode results of static perimetry with visual field devices.

### A.XX.2 Ophthalmic Visual Field Static Perimetry Measurements IOD Entity-Relationship Model

45 The E-R Model in Section A.1.2 of this Part depicts those components of the DICOM Information Model that are referenced by the Ophthalmic Visual Field Static Perimetry Measurements IOD. Below the Series IE, only the Measurements IE is used.

### A.XX.3 Ophthalmic Visual Field Static Perimetry Measurements IOD Modules

50 Table A.XX.3-1 specifies the Modules of the Ophthalmic Visual Field Static Perimetry Measurements IOD.

**Table A.XX.3-1  
OPHTHALMIC VISUAL FIELD STATIC PERIMETRY MEASUREMENTS IOD MODULES**

IE	Module	Reference	Usage
Patient	Patient	C.7.1.1	M
	Clinical Trial Subject	C.7.1.3	U
Study	General Study	C.7.2.1	M
	Patient Study	C.7.2.2	U
	Clinical Trial Study	C.7.2.3	U
Series	General Series	C.7.3.1	M
	Clinical Trial Series	C.7.3.2	U
	Visual Field Static Perimetry Measurements Series	C.8. X.1	M
Equipment	General Equipment	C.7.5.1	M
	Enhanced General Equipment	C.7.5.2	M
Measurements	Visual Field Static Perimetry Test Parameters	C.8.X.2	M
	Visual Field Static Perimetry Test Reliability	C.8.X.3	M
	Visual Field Static Perimetry Test Measurements	C.8.X.4	M
	Visual Field Static Perimetry Test Results	C.8.X.5	M
	Ophthalmic Patient Clinical Information and Test Lens Parameters	C.8.X.6	U
	SOP Common	C.12.1	M

55 **Update PS3.3 Section 10 for generalized Macros**

### 10.x1 Data Set Identification Macro

Table 10-xx describes the attributes for the identification of an externally sourced data set.

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**Table 10-xx**  
**DATA SET IDENTIFICATION MACRO ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Data Set Name	(0024,0306)	1	The name assigned to the data set.
Data Set Version	(0024,0307)	1	The software version identifier assigned to the data set.
Data Set Source	(0024,0308)	1	Source of the data set e.g. the name of the manufacturer, researcher, university, etc.
Data Set Description	(0024,0309)	3	Description of the data set.

### 10.16 Algorithm Identification Macro

65 Table 10.19 describes the Attributes for encoding the algorithm used to create or derive a SOP Instance contents. An algorithm is described by the Algorithm Family, a specific Algorithm Name, and an Algorithm Version. A character string containing parameters that were used in the algorithm can be included.

**Table 10.19**  
**ALGORITHM IDENTIFICATION MACRO ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Algorithm Family Code Sequence	(0066,002F)	1	The family of algorithm(s) that best describes the software algorithm used. Only one item shall be permitted in the sequence.
>Include 'Code Sequence Macro Table 8.8-1'			Context ID may be defined in the macro invocation.
Algorithm Name Code Sequence	(0066,0030)	3	The code assigned by a manufacturer to a specific software algorithm. Only one item shall be permitted in the sequence.
>Include 'Code Sequence Macro Table 8.8-1'			No Baseline Context ID is defined.
Algorithm Name	(0066,0036)	1	The name assigned by a manufacturer to a specific software algorithm.
Algorithm Version	(0066,0031)	1	The software version identifier assigned by a manufacturer to a specific software algorithm.
Algorithm Parameters	(0066,0032)	3	The input parameters used by a manufacturer to configure the behavior of a specific software algorithm.
<u>Algorithm Source</u>	<u>(0024,0202)</u>	<u>3</u>	<u>Source of the algorithm, e.g., the name of the manufacturer, researcher, university, etc.</u>

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**Update PS3.3 Annex C - C.7.3.1 General Series Module to include Measurement Laterality**

**Table C.7-5a  
GENERAL SERIES MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
.....	.....	.....	.....
Laterality	(0020,0060)	2C	<p>Laterality of (paired) body part examined. Required if the body part examined is a paired structure and Image Laterality (0020,0062) or Frame Laterality (0020,9072) are not sent. Enumerated Values:</p> <p>R = right L = left</p> <p>Note: Some IODs support Image Laterality (0020,0062) at the Image level or Frame Laterality (0020,9072) at the Frame level in the Frame Anatomy functional group macro <u>or</u> <b><u>Measurement Laterality (0024,0113) at the Measurement level</u></b>, which can provide a more comprehensive mechanism for specifying the laterality of the body part(s) being examined.</p>

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**Update PS3.3 Annex C for Visual Field Measurements Modules**

**C.8.x Visual Field Static Perimetry Measurements Modules**

**C.8.X.1 Visual Field Static Perimetry Measurements Series Module**

Table C.8.X.1-1 specifies the Attributes that identify and describe general information about the Visual Field Static Perimetry Measurements Series.

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**Table C.8.X.1-1  
VISUAL FIELD STATIC PERIMETRY MEASUREMENTS SERIES MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	<p>Type of equipment that originally acquired the data used to create the measurements in this Series. Enumerated Values:</p> <p>OPV</p> <p>See section C.7.3.1.1.1 for further explanation.</p>

Referenced Performed Procedure Step Sequence	(0008,1111)	1C	Uniquely identifies the Performed Procedure Step SOP Instance to which the Series is related (e.g. a Modality or General-Purpose Performed Procedure Step SOP Instance). Only a single Item shall be permitted in this sequence. Required if the Modality Performed Procedure Step SOP Class, or General Purpose Performed Procedure Step SOP Class is supported.
>Include 'SOP Instance Reference Macro' Table 10-11			
Request Attributes Sequence	(0040,0275)	3	Sequence that contains attributes from the Imaging Service Request. The sequence may have one or more Items.
>Include 'Request Attributes Macro' Table 10-9			<p><i>In this Module Reason for Requested Procedure Code Sequence (0040,100A) has the Defined Context ID is 4236.</i></p> <p><i>Note: Reason for Requested Procedure Code Sequence (0040,100A) may be used to provide whether the test in the Series was taken for screening or diagnostic (quantitative) purposes.</i></p> <p><i>In this Module Scheduled Protocol Code Sequence (0040,0008) has the Defined Context IDs 4230 and 4231.</i></p> <p><i>Note: Scheduled Protocol Code Sequence (0040,0008) may be used to provide test pattern and test strategy.</i></p> <p><i>No Baseline Context IDs are defined for other Attributes.</i></p>
Include 'Performed Procedure Step Summary Macro' Table 10-16			<p><i>In this Module attribute Performed Protocol Code Sequence (0040,0260) is Type 1 and the Defined Context ID is 4230 and 4231.</i></p> <p><i>Note: Performed Protocol Code Sequence (0040,0260) is used to provide test pattern and test strategy.</i></p> <p><i>In this Module attribute Protocol Context Sequence (0040,0440) is Type 1 and the Defined Context ID is 4236.</i></p> <p><i>Note: Protocol Context Sequence (0040,0440) is used to provide whether the test in the Series were taken for screening or diagnostic purposes.</i></p> <p><i>No Baseline Context IDs are defined for other Attributes.</i></p>

### C.8.X.2 Visual Field Static Perimetry Test Parameters Module

- 85 Table C.8.X.2-1 defines the Attributes used to represent the parameters used during a patient's visual field test.

**Table C.8.X.2-1**  
**VISUAL FIELD STATIC PERIMETRY TEST PARAMETERS MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Visual Field Horizontal Extent	(0024,0010)	1	The maximum horizontal angular subtend (diameter or width) of the tested visual field, in degrees.
Visual Field Vertical Extent	(0024,0011)	1	The maximum vertical angular subtend (diameter or height) of the tested visual field, in degrees.
Visual Field Shape	(0024,0012)	1	The shape of the visual field tested. Defined Terms: RECTANGLE CIRCLE ELLIPSE
Screening Test Mode Code Sequence	(0024,0016)	1C	Mode used to determine how the starting luminance values and expected thresholds are chosen. Required if Content Item Modifier Sequence (0040,0441) within Performed Protocol Code Sequence (0040,0260) contains an item with the value (R-42453, SRT, "Screening"). May be present otherwise. Only a single Item shall be permitted in this sequence.
>Include 'Code Sequence Macro' Table 8.8-1			Defined Context ID is 4232
Maximum Stimulus Luminance	(0024,0018)	1	Maximum luminance of stimulus, in candelas per square meter (cd/m <sup>2</sup> ).
Background Luminance	(0024,0020)	1	Background luminance of the device, in candelas per square meter (cd/m <sup>2</sup> ). Note: This value is easily convertible to apostilb, which is used only in perimetry and is not a standardized unit.
Stimulus Color Code Sequence	(0024,0021)	1	Color of light stimulus presented to the patient. Only a single Item shall be permitted in this sequence.
>Include 'Code Sequence Macro' Table 8.8-1			Defined Context ID is 4235
Background Illumination Color Code Sequence	(0024,0024)	1	Color of the background illumination of the visual field device. Only a single Item shall be permitted in this sequence.
>Include 'Code Sequence Macro' Table 8.8-1			Defined Context ID is 4235
Stimulus Area	(0024,0025)	1	Area of light stimulus presented to the patient, in degrees squared.
Stimulus Presentation Time	(0024,0028)	1	The duration of time that a light stimulus is presented to a patient per each individual test point, in milliseconds. Note: This time is the same for each stimulus presentation.

90 **C.8.X.3 Visual Field Static Perimetry Test Reliability Module**

Table C.8.X.3-1 defines the Attributes used to represent the test reliability parameters determined during a patient's visual field test.

**Table C.8.X.3-1  
VISUAL FIELD STATIC PERIMETRY TEST RELIABILITY MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Fixation Sequence	(0024,0032)	1	The patient's gaze stability information during the visual field test. Only a single Item shall be permitted in this sequence.
>Fixation Monitoring Code Sequence	(0024,0033)	1	The device strategy used to monitor the patient's fixation. One or more Items shall be included in this sequence.
>>Include 'Code Sequence Macro' Table 8.8-1 Defined Context ID is 4233			
>Fixation Checked Quantity	(0024,0035)	1C	The number of times that the patient's gaze fixation is checked. Required if Fixation Monitoring Code Sequence (0024,0033) contains an item with the value (111844, DCM, "Blind Spot Monitoring") or (111845, DCM, "Macular Fixation Testing"). May be present otherwise.
>Patient Not Properly Fixated Quantity	(0024,0036)	1C	The number of times the patient's gaze is not properly fixated. Required if Fixation Monitoring Code Sequence (0024,0033) contains an item with the value (111844, DCM, "Blind Spot Monitoring") or (111845, DCM, "Macular Fixation Testing"). May be present otherwise.
>Excessive Fixation Losses Data Flag	(0024,0039)	1	Whether the device was able to determine excessive fixation losses. Enumerated Values: YES NO
>Excessive Fixation Losses	(0024,0040)	1C	The number of fixation losses is outside of implementation-specific limits. Enumerated Values: YES NO Required if Excessive Fixation Losses Data Flag (0024,0039) is YES.
Visual Field Catch Trial Sequence	(0024,0034)	1	The reliability of the patient's responses to the visual field test. Only a single Item shall be permitted in this sequence.

>Catch Trials Data Flag	(0024,0055)	1	Whether catch trials data were performed. Enumerated Values: YES NO
>Negative Catch Trials Quantity	(0024,0048)	1C	Total number of times the patient's visual attention was tested using stimuli brighter than previously seen luminance (negative catch trials). Required if Catch Trials Data Flag (0024,0055) is YES.
>False Negatives Quantity	(0024,0050)	1C	Total number of stimuli that were not seen by the patient but were previously seen at a lower luminance earlier in the visual field test (false negatives). Required if Catch Trials Data Flag (0024,0055) is YES.
>False Negatives Estimate Flag	(0024,0045)	1	Whether the device was able to estimates false negatives. Enumerated Values: YES NO
>False Negatives Estimate	(0024,0046)	1C	Estimated percentage of all stimuli that were not seen by the patient but were previously seen at a lower luminance earlier in the visual field test (false negative responses), as percent. Required if False Negatives Estimate Flag (0024,0045) is YES.
>Excessive False Negatives Data Flag	(0024,0051)	1	Whether the device was able to determine excessive false negatives. Enumerated Values: YES NO
>Excessive False Negatives	(0024,0052)	1C	The false negative estimate is outside of implementation-specific limits. Enumerated Values: YES NO Required if Excessive False Negatives Data Flag (0024,0051) is YES.
>Positive Catch Trials Quantity	(0024,0056)	1C	The total number of times the device behaved as if it was going to present a visual stimulus but did not actually present the stimulus (positive catch trials). Required if Catch Trials Data Flag (0024,0055) is YES.
>False Positives Quantity	(0024,0060)	1C	The total number of patient responses that occurred at a time when no visual stimulus was present (false positive responses). Required if Catch Trials Data Flag (0024,0055) is YES.

>False Positives Estimate Flag	(0024,0053)	1	Whether the device was able to estimate false positives. Enumerated Values: YES NO
>False Positives Estimate	(0024,0054)	1C	Estimated percentage of all patient responses that occurred at a time when no visual stimulus was present (false positive responses), as percent. Required if False Positives Estimate Flag (0024,0053) is YES.
>Excessive False Positives Data Flag	(0024,0061)	1	Whether the device was able to determine excessive false positives. Enumerated Values: YES NO
>Excessive False Positives	(0024,0062)	1C	The false positive estimate is outside of implementation-specific limit. Enumerated Values: YES NO Required if Excessive False Positives Data Flag (0024,0061) is YES.
Stimuli Retesting Quantity	(0024,0042)	3	Total number of times in the course of a visual field exam that any location had to be retested at the same magnitude. Note: An example is that the patient received 20 stimuli and blinked twice, therefore need to present the stimuli two additional times in which case the value is 2.
Patient Reliability Indicator	(0024,0069)	3	Vendor implementation specific text to provide an analysis and/or summary of patient reliability indicator/indices.
Comments on Patient's Performance of Visual Field	(0024,0044)	3	Operator's (test administrator) subjective comment on patient's performance.
Visual Field Test Reliability Global Index Sequence	(0024,0317)	3	Information about various visual field indices related to test reliability. One or more items may be present.
>Include 'Ophthalmic Visual Field Global Index Macro' C.8.X.3-2			

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### C.8.X.3.1 Ophthalmic Visual Field Global Index Macro

Table C.8.X.3-2 describes the attributes for the Ophthalmic Visual Field Global Index Macro.

**Table C.8.X.3-2**  
**OPHTHALMIC VISUAL FIELD GLOBAL INDEX MACRO ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Data Observation Sequence	(0024,0325)	1	Information about various visual field global indexes. Only a single Item shall be permitted in this sequence.

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>Include 'Content Item Macro' Table 10-2			Value Type (0040,A040) shall be NUMERIC or CODE. Concept Name Code Sequence (0040,A043) shall use Context ID 4237. Concept Code Sequence (0040,A168) shall use Context ID 4234.
Index Normals Flag	(0024,0338)	1	Whether normative data exists for this index. Enumerated Values: YES NO
Index Probability Sequence	(0024,0344)	1C	Probability value and software algorithm used to provide the index. Required if Index Normals Flag (0024,0338) is YES. Only a single Item shall be permitted in this sequence.
>Index Probability	(0024,0341)	1	Probability for the index value within the normal population, in percent.
> Include Algorithm Identification Macro Table 10-19			

#### C.8.X.4 Visual Field Static Perimetry Test Measurements Module

105 Table C.8.X.4-1 defines the Attributes used to represent the test measurement values determined during a patient's visual field test.

**Table C.8.X.4-1**  
**VISUAL FIELD STATIC PERIMETRY TEST MEASUREMENTS MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Measurement Laterality	(0024,0113)	1	Laterality of body part (eye) examined. See section C.8.X.4.1.1 for further explanation. Enumerated Values: R = right L = left B = both left and right together  Note: This Attribute is mandatory, in order to ensure that measurements may be positioned correctly relative to one another for display.  Note: Laterality (0020,0060) is a Series level Attribute and must be the same for all Measurements in the Series, hence it must be absent if multiple instances from different eyes are encoded.
Presented Visual Stimuli Data Flag	(0024,0037)	1	Whether the device was able to determine presented visual stimuli. Enumerated Values: YES NO

Number of Visual Stimuli	(0024,0038)	1C	The total number of visual stimuli presented to the patient. This includes the number of stimuli repetitions. Required if Presented Visual Stimuli Data Flag (0024,0037) is YES.
Visual Field Test Duration	(0024,0088)	1	Total time the visual field machine was actively presenting visual stimuli to patient, in seconds.
Foveal Sensitivity Measured	(0024,0086)	1	Whether foveal sensitivity was measured. Enumerated Values: YES NO
Foveal Sensitivity	(0024,0087)	1C	Foveal Sensitivity is the reciprocal of foveal threshold (1/foveal threshold), in dB. Foveal Threshold is the minimum amount of luminance increment on a uniform background that can be detected by the patient at coordinates 0,0 (relative to the center of the patient's fixation). See section C.8.X.4.1.2 for further explanation. Required if the value for Foveal Sensitivity Measured (0024,0086) is YES.
Foveal Point Normative Data Flag	(0024,0117)	1	Existence of normative data base for the foveal point sensitivity. Enumerated Values: YES NO
Foveal Point Probability Value	(0024,0118)	1C	The percentile of the foveal point sensitivity within an age corrected normal visual field, in percent. Required if the value for Foveal Sensitivity Measured (0024,0086) is YES and Foveal Point Normative Data Flag (0024,0117) is YES.
Screening Baseline Measured	(0024,0120)	1	Whether visual field screening baseline was measured. Enumerated Values: YES NO
Screening Baseline Measured Sequence	(0024,0122)	1C	Information about the starting luminance screening values. Required if the value for Screening Baseline Measured (0024,0120) is YES. One or more items may be present.
>Screening Baseline Type	(0024,0124)	1	Method used to determine starting luminance screening values. Enumerated Values: CENTRAL PERIPHERAL
>Screening Baseline Value	(0024,0126)	1	Visual Field screening baseline value, in dB.

Blind Spot Localized	(0024,0106)	1	Whether the blind spot was measured. Enumerated Values: YES NO
Blind Spot X-Coordinate	(0024,0107)	1C	The horizontal coordinate of the patient's blind spot relative to the center of the patient's fixation, in degrees, such that toward the right is positive. Required if the value for Blind Spot Localized (0024,0106) is YES. See section C.8.X.4.1.3 for further explanation.
Blind Spot Y-Coordinate	(0024,0108)	1C	The vertical coordinate of the patient's blind spot relative to the center of the patient fixation, in degrees, such that up is positive. Required if the value for Blind Spot Localized (0024,0106) is YES. See section C.8.X.4.1.3 for further explanation.
Minimum Sensitivity Value	(0024,0105)	1	The minimum sensitivity value generated by the equipment used for this visual field test, in dB.
Test Point Normals Data Flag	(0024,0057)	1	Existence of normative data base for this set of test points. Enumerated Values: YES NO
Test Point Normals Sequence	(0024,0058)	1C	Normative data base used for this test sequence. Required if Test Point Normals Data Flag (0024,0057) is YES. Only a single Item shall be permitted in this sequence.
<i>&gt;Include 'Data Set Identification Macro' Table 10-xx</i>			
Age Corrected Sensitivity Deviation Algorithm Sequence	(0024,0065)	1C	Software algorithm used to provide the probability that the age corrected sensitivity deviation values at each test point belong to a normal visual field. Required if Test Point Normals Data Flag (0024,0057) is YES. Only a single Item shall be permitted in this sequence.
<i>&gt;Include 'Algorithm Identification Macro Table' 10-19</i>			
Generalized Defect Sensitivity Deviation Algorithm Sequence	(0024,0067)	1C	Software algorithm used to provide the probability that the sensitivity deviation values at each test point belong to a normal visual field. Required if Test Point Normals Data Flag (0024,0057) is YES. Only a single Item shall be permitted in this sequence.
<i>&gt; Include Algorithm Identification Macro Table 10-19</i>			
Visual Field Test Point Sequence	(0024,0089)	1	Information for each test point in the visual field. One or more items shall be present.

>Visual Field Test Point X-Coordinate	(0024,0090)	1	The horizontal coordinate of a single test point relative to the center of the patient fixation, in degrees, such that toward the right is positive.
>Visual Field Test Point Y-Coordinate	(0024,0091)	1	The vertical coordinate of a single test point relative to the center of the patient fixation, in degrees, such that up is positive.
>Stimulus Results	(0024,0093)	1	Whether the patient saw a stimulus presented at a luminance other than maximum, a presentation at maximum luminance, or did not see any presented stimulus. Enumerated Values: SEEN = stimulus seen at a luminance value less than maximum NOT SEEN = stimulus not seen SEEN AT MAX = stimulus seen at the maximum luminance possible for the instrument Note: SEEN AT MAX is a value only relevant to Screening tests.
>Sensitivity Value	(0024,0094)	1C	If Stimulus Results (0024,0093) is SEEN then this value is the sensitivity, in dB. Required if Content Item Modifier Sequence (0040,0441) within Performed Protocol Code Sequence (0040,0260) contains an item with the value (R-408C3, SRT, "Diagnostic"). May be present otherwise. Note: If this is not present, refer to the attribute Minimum Sensitivity Value (0024,0105).
>Retest Stimulus Seen	(0024,0095)	3	Whether the retested stimulus presented was seen by the patient. Enumerated Values: YES NO
>Retest Sensitivity Value	(0024,0096)	3	If the Retest Stimulus Seen (0024,0095) is YES, then this value is the sensitivity, in dB. Note: If this is not present, refer to the attribute Minimum Sensitivity Value (0024,0105).
>Quantified Defect	(0024,0098)	3	Difference between the expected and the determined sensitivity, each in dB. Note: This field is only useful when the sensitivity is quantified. Some examples include Test Strategy Code Sequence (0024,0015) with items providing values such as Quantity-Defects, 2LT-Dynamic, 2LT-Normal.
>Visual Field Test Point Normals Sequence	(0024,0097)	1C	Information about normal values for each visual field test point. Required if Test Point Normals Data Flag (0024,0057) is YES. One or more items shall be present.
>>Age Corrected Sensitivity Deviation Value	(0024,0092)	1	Difference between the patient's local sensitivity and the age corrected normal sensitivity, in dB.

>>Age Corrected Sensitivity Deviation Probability Value	(0024,0100)	1	The percentile of the age corrected sensitivity deviation within the normal population of visual field, in percent.
>> Generalized Defect Corrected Sensitivity Deviation Flag	(0024,0102)	1	Whether generalized defect corrected data are available for this point. Enumerated Values: YES NO
>>Generalized Defect Corrected Sensitivity Deviation Value	(0024,0103)	1C	The age corrected sensitivity deviation after correction for the Generalized Defect, in dB. Generalized defect is proportional to the loss in sensitivity shared by all points in the visual field. Required if Generalized Defect Corrected Sensitivity Deviation Flag (0024,0102) is YES.
>>Generalized Defect Corrected Sensitivity Deviation Probability Value	(0024,0104)	1C	The percentile of the generalized defect corrected sensitivity deviation within the normal population of visual field, in percent. Required if Generalized Defect Corrected Sensitivity Deviation Flag (0024,0102) is YES.

#### **C.8.X.4.1 Visual Field Static Perimetry Test Measurement Attribute Descriptions**

##### **110 C.8.X.4.1.1 Measurement Laterality**

When B (both left and right together) eyes are provided for Measurement Laterality (0024,0113) it shall mean that both eyes are open during the test (binocular). It shall not be used to provide two monocular tests (i.e. one for the left eye and one for the right). Two monocular tests require two SOP Instances and two monocular tests with one binocular test require three SOP Instances.

##### **115 C.8.X.4.1.2 Foveal Sensitivity**

For Foveal Sensitivity (0024,0087), the terminology commonly used for perimetric measurements is employed, with reference to visual thresholds designated by a decibel (dB) scale. The decibel scale for conventional perimetry is based on the maximum stimulus luminance that can be superimposed on a uniform background, and it is given a value of 0 dB of sensitivity. Sensitivity is the inverse of threshold ( $\text{sensitivity} = 1/\text{threshold}$ ) and vice versa. In other disciplines, visual threshold is usually defined by the probability of seeing a difference in luminance, brightness, hue or saturation, or a difference in some other attribute exhibited by a given set of stimuli. As such, a threshold is usually described in terms of the minimum amount of luminance, contrast, hue or other attribute that can be minimally detected. However, many sources that refer to perimetry have described threshold in terms of decibel (dB) values rather than attributing the dB measures to sensitivity. It would be advisable to check each individual device to determine how dB is defined.

##### **C.8.X.4.1.3 Blind Spot X and Y Coordinates**

For Blind Spot X-Coordinate (0024,0107) and Blind Spot Y-Coordinate (0024,0108), the convention described below for the Cartesian coordinate system specifies that to the right is positive on the x axis and up is positive on the Y axis. Figure C.8.X.4.1-1 illustrates how visual fields are displayed in standard format with the temporal visual field from the right eye displayed to the right and the nasal visual field from the right eye to the left.

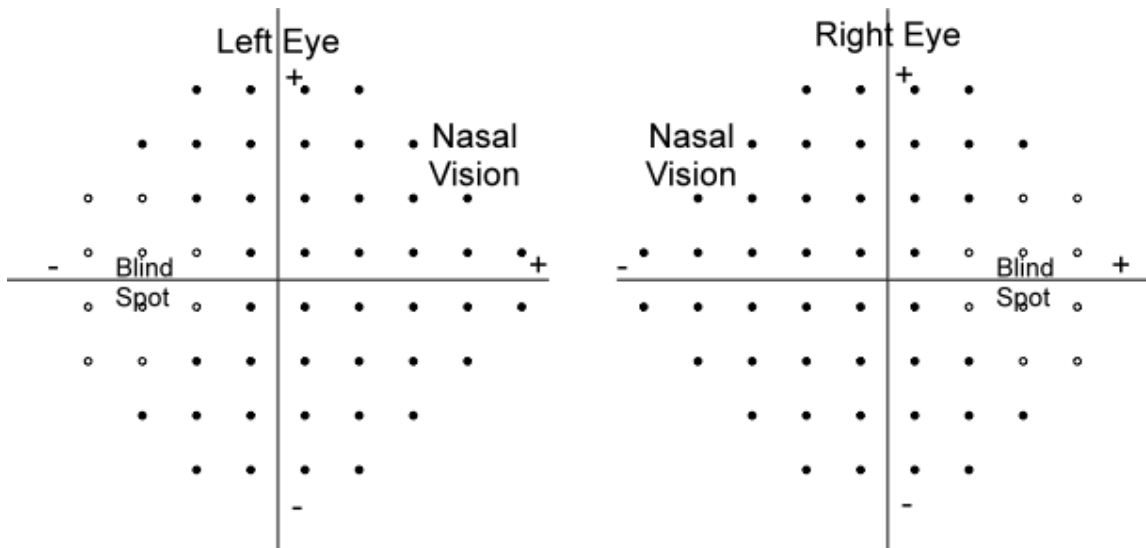


Figure C.8.X.4.1-1 Convention of coordinate system used in visual field representation.

#### C.8.X.5 Visual Field Static Perimetry Test Results Module

Table C.8.X.5-1 defines the Attributes used to interpret the test results of a patient's visual field test.

**Table C.8.X.5-1**  
**VISUAL FIELD STATIC PERIMETRY TEST RESULTS MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Visual Field Mean Sensitivity	(0024,0070)	1C	Average sensitivity of the test points of the visual field, in dB. Required if Content Item Modifier Sequence (0040,0441) within the Performed Protocol Code Sequence (0040,0260) contains an item with the value (R-408C3, SRT, "Diagnostic"). May be present otherwise.
Visual Field Test Normals Flag	(0024,0063)	1	Whether normals exist for this patient's results. Enumerated Values: YES NO
Results Normals Sequence	(0024,0064)	1C	Information that represents the statistically normal results for patients from a referenced data base. Required if Visual Field Test Normals Flag (0024,0063) is YES. Only a single Item shall be permitted in this sequence.
> Include 'Data Set Identification Macro' Table 10-xx			
>Global Deviation from Normal	(0024,0066)	1	Weighted average deviation from the age corrected normal field, in dB.

>Global Deviation Probability Normals Flag	(0024,0059)	1	Whether normals exist for the global deviation probability. Enumerated Values: YES NO
>Global Deviation Probability Sequence	(0024,0083)	1C	Probability value and software algorithm used to provide the normality for the global deviation. Only a single Item shall be permitted in this sequence. Required if Global Deviation Probability Normals Flag (0024,0059) is YES.
>>Global Deviation Probability	(0024,0071)	1	The percentile of the Global Deviation from Normal (0024,0066) value within the normal population, in percent.0024
>> Include 'Algorithm Identification Macro Table' 10-19			
>Localized Deviation from Normal	(0024,0068)	1	Weighted square root of loss variance, in dB.
>Local Deviation Probability Normals Flag	(0024,0072)	1	Whether normals exist for the local deviation probability. Enumerated Values: YES NO
>Localized Deviation Probability Sequence	(0024,0085)	1C	Probability value and software algorithm used to provide the normality for the local deviation. Only a single Item shall be permitted in this sequence. Required if Local Deviation Probability Normals Flag (0024,0072) is YES..
>>Localized Deviation Probability	(0024,0073)	1	The0024 percentile of the Localized Deviation from Normal (0024,0068) value within the normal population, in percent.0024
>> Include 'Algorithm Identification Macro' Table 10-19			
Short Term Fluctuation Calculated	(0024,0074)	1	Whether the short term fluctuation was calculated. Enumerated Values: YES NO
Short Term Fluctuation	(0024,0075)	1C	Average deviation of sensitivity for the repeated test locations, in dB. This is used to determine the consistency of the patient's responses. Required if Short Term Fluctuation Calculated (0024,0074) is YES.
Short Term Fluctuation Probability Calculated	(0024,0076)	1	Whether the short term fluctuation probability was calculated. Enumerated Values: YES NO

Short Term Fluctuation Probability	(0024,0077)	1C	The percentile of the Short Term Fluctuation (0024,0075) value within the normal population, in percent. Required if Short Term Fluctuation Probability Calculated (0024,0076) is YES.
Corrected Localized Deviation From Normal Calculated	(0024,0078)	1	Whether the corrected localized deviation from normal was calculated. Enumerated Values: YES NO
Corrected Localized Deviation From Normal	(0024,0079)	1C	Weighted square root of loss variance corrected for short term fluctuation, in dB. Required if Corrected Localized Deviation From Normal Calculated (0024,0078) is YES.
Corrected Localized Deviation From Normal Probability Calculated	(0024,0080)	1	Whether the corrected localized deviation from Normal probability was calculated. Enumerated Values: YES NO
Corrected Localized Deviation From Normal Probability	(0024,0081)	1C	The percentile of the Corrected Localized Deviation From Normal (0024,0079) value within the normal population, in percent. Required if Corrected Localized Deviation From Normal Probability Calculated (0024,0080) is YES.
Visual Field Global Results Index Sequence	(0024,0320)	3	Information about various visual field indexes related to test results. One or more items may be present.
>Include 'Ophthalmic Visual Field Global Index Macro' C.8.X.3-2			

145 **C.8.X.6 Ophthalmic Patient Clinical Information and Test Lens Parameters Module**

Table C.8.X.6-1 defines the Attributes used to represent a patient's clinical parameters during an ophthalmic test.

**Table C.8.X.6-1**  
**OPHTHALMIC PATIENT CLINICAL and TEST LENS PARAMETERS MODULE ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Ophthalmic Patient Clinical Information Left Eye Sequence	(0024,0114)	1C	Information used to represent a patient's clinical parameters during an ophthalmic test. Only a single Item shall be permitted in this sequence. Required if Measurement Laterality (0024,0113) is L or B.
>Include 'Ophthalmic Patient Clinical Information and Test Lens Parameters Macro' Table C.8.X.6-2			

Ophthalmic Patient Clinical Information Right Eye Sequence	(0024,0115)	1C	Information used to represent a patient's clinical parameters during an ophthalmic test. Only a single Item shall be permitted in this sequence. Required if Measurement Laterality (0024,0113) is R or B.
>Include 'Ophthalmic Patient Clinical Information and Test Lens Parameters Macro' Table C.8.X.6-2			

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### C.8.X.6.1 Ophthalmic Patient Clinical Information and Test Lens Parameters Macro

Table C.8.X.6-2 describes the attributes for the Ophthalmic Patient Clinical and Test Lens Parameters Macro.

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**Table C.8.X.6-2**  
**OPHTHALMIC PATIENT CLINICAL INFORMATION AND TEST LENS PARAMETERS MACRO**  
**ATTRIBUTES**

Attribute Name	Tag	Type	Attribute Description
Refractive Parameters Used on Patient Sequence	(0024,0112)	2	Refractive parameters used when performing visual field test. Zero or one Item shall be permitted.
>Sphere Lens Power	(0022,0007)	1	Sphere value in diopters.
>Cylinder Lens Power	(0022,0008)	1	Cylinder value in diopters.
>Cylinder Axis	(0022,0009)	1	Axis value in degrees.
Pupil Size	(0046,0044)	2	The horizontal diameter measurement of the pupil, in mm.
Pupil Dilated	(0022,000D)	2	The patient's pupils were pharmacologically dilated for this acquisition. Enumerated Values: YES NO If this tag is empty, no information is available.
Intra Ocular Pressure	(0022,000B)	3	Value of intraocular pressure in mmHg.
Visual Acuity Measurement Sequence	(0024,0110)	3	Measurements of a patient's visual acuity.
>Include 'Visual Acuity Measurement Macro' Table C.8.25.12-2			

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**Changes to NEMA Standards Publication PS 3.4-2009**  
**Digital Imaging and Communications in Medicine (DICOM)**  
**Part 4: Service Class Specifications**

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Add to PS3.4 Annex B.5.

**B.5 Standard SOP Classes**

Table B.5-1  
STANDARD SOP CLASSES

SOP Class Name	SOP Class UID	IOD (See PS 3.3)
...		
<u>Ophthalmic Visual Field Static Perimetry Measurements Storage</u>	<u>1.2.840.10008.5.1.4.1.1.80.1</u>	<u>Ophthalmic Visual Field Static Perimetry Measurements</u>

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Add to PS3.4 Annex I.4.

**I.4 Media Standard Storage SOP Classes**

Table I.4-1  
Media Storage Standard SOP Classes

SOP Class Name	SOP Class UID	IOD (See PS 3.3)
...		
<u>Ophthalmic Visual Field Static Perimetry Measurements Storage</u>	<u>1.2.840.10008.5.1.4.1.1.80.1</u>	<u>Ophthalmic Visual Field Static Perimetry Measurements</u>

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## Changes to NEMA Standards Publication PS 3.6-2009

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### Digital Imaging and Communications in Medicine (DICOM)

#### Part 6: Data Dictionary

Add to PS3.6 Annex A

UID Value	UID NAME	UID TYPE	Part
...			
<u>1.2.840.10008.5.1.4.1.1.80.1</u>	<u>Ophthalmic Visual Field Static Perimetry Measurements Storage</u>	<u>SOP Class</u>	<u>PS 3.4</u>

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Add the following data elements to PS 3.6:

Tag	Name	Keyword	VR	VM
(0024,0010)	Visual Field Horizontal Extent	VisualFieldHorizontalExtent	FL	1
(0024,0011)	Visual Field Vertical Extent	VisualFieldVerticalExtent	FL	1
(0024,0012)	Visual Field Shape	VisualFieldShape	CS	1
(0024,0016)	Screening Test Mode Code Sequence	ScreeningTestModeCodeSequence	SQ	1
(0024,0018)	Maximum Stimulus Luminance	MaximumStimulusLuminance	FL	1
(0024,0020)	Background Luminance	BackgroundLuminance	FL	1
(0024,0021)	Stimulus Color Code Sequence	StimulusColorCodeSequence	SQ	1
(0024,0024)	Background Illumination Color Code Sequence	BackgroundIlluminationColorCodeSequence	SQ	1
(0024,0025)	Stimulus Area	StimulusArea	FL	1
(0024,0028)	Stimulus Presentation Time	StimulusPresentationTime	FL	1
(0024,0032)	Fixation Sequence	FixationSequence	SQ	1
(0024,0033)	Fixation Monitoring Code Sequence	FixationMonitoringCodeSequence	SQ	1
(0024,0034)	Visual Field Catch Trial Sequence	VisualFieldCatchTrialSequence	SQ	1
(0024,0035)	Fixation Checked Quantity	FixationCheckedQuantity	US	1
(0024,0036)	Patient Not Properly Fixated Quantity	PatientNotProperlyFixatedQuantity	US	1
(0024,0037)	Presented Visual Stimuli Data Flag	PresentedVisualStimuliDataFlag	CS	1

(0024,0038)	Number of Visual Stimuli	NumberOfVisualStimuli	US	1
(0024,0039)	Excessive Fixation Losses Data Flag	ExcessiveFixationLossesDataFlag	CS	1
(0024,0040)	Excessive Fixation Losses	ExcessiveFixationLosses	CS	1
(0024,0042)	Stimuli Retesting Quantity	StimuliRetestingQuantity	US	1
(0024,0044)	Comments on Patient's Performance of Visual Field	CommentsOnPatientPerformanceOfVisualField	LT	1
(0024,0045)	False Negatives Estimate Flag	FalseNegativesEstimateFlag	CS	1
(0024,0046)	False Negatives Estimate	FalseNegativesEstimate	FL	1
(0024,0048)	Negative Catch Trials Quantity	NegativeCatchTrialsQuantity	US	1
(0024,0050)	False Negatives Quantity	FalseNegativesQuantity	US	1
(0024,0051)	Excessive False Negatives Data Flag	ExcessiveFalseNegativesDataFlag	CS	1
(0024,0052)	Excessive False Negatives	ExcessiveFalseNegatives	CS	1
(0024,0053)	False Positives Estimate Flag	FalsePositivesEstimateFlag	CS	1
(0024,0054)	False Positives Estimate	FalsePositivesEstimate	FL	1
(0024,0055)	Catch Trials Data Flag	CatchTrialsDataFlag	CS	1
(0024,0056)	Positive Catch Trials Quantity	PositiveCatchTrialsQuantity	US	1
(0024,0057)	Test Point Normals Data Flag	TestPointNormalsDataFlag	CS	1
(0024,0058)	Test Point Normals Sequence	TestPointNormalsSequence	SQ	1
(0024,0059)	Global Deviation Probability Normals Flag	GlobalDeviationProbabilityNormalsFlag	CS	1
(0024,0060)	False Positives Quantity	FalsePositivesQuantity	US	1
(0024,0061)	Excessive False Positives Data Flag	ExcessiveFalsePositivesDataFlag	CS	1
(0024,0062)	Excessive False Positives	ExcessiveFalsePositives	CS	1
(0024,0063)	Visual Field Test Normals Flag	VisualFieldTestNormalsFlag	CS	1
(0024,0064)	Results Normals Sequence	ResultsNormalsSequence	SQ	1
(0024,0065)	Age Corrected Sensitivity Deviation Algorithm Sequence	AgeCorrectedSensitivityDeviationAlgorithmSequence	SQ	1
(0024,0066)	Global Deviation From Normal	GlobalDeviationFromNormal	FL	1
(0024,0067)	Generalized Defect Sensitivity Deviation Algorithm Sequence	GeneralizedDefectSensitivityDeviationAlgorithmSequence	SQ	1
(0024,0068)	Localized Deviation from Normal	LocalizedDeviationfromNormal	FL	1
(0024,0069)	Patient Reliability Indicator	PatientReliabilityIndicator	LO	1
(0024,0070)	Visual Field Mean Sensitivity	VisualFieldMeanSensitivity	FL	1

(0024,0071)	Global Deviation Probability	GlobalDeviationProbability	FL	1
(0024,0072)	Local Deviation Probability Normals Flag	LocalDeviationProbabilityNormals Flag	CS	1
(0024,0073)	Localized Deviation Probability	LocalizedDeviationProbability	FL	1
(0024,0074)	Short Term Fluctuation Calculated	ShortTermFluctuationCalculated	CS	1
(0024,0075)	Short Term Fluctuation	ShortTermFluctuation	FL	1
(0024,0076)	Short Term Fluctuation Probability Calculated	ShortTermFluctuationProbabilityCalculated	CS	1
(0024,0077)	Short Term Fluctuation Probability	ShortTermFluctuationProbability	FL	1
(0024,0078)	Corrected Localized Deviation From Normal Calculated	CorrectedLocalizedDeviationFromNormalCalculated	CS	1
(0024,0079)	Corrected Localized Deviation From Normal	CorrectedLocalizedDeviationFromNormal	FL	1
(0024,0080)	Corrected Localized Deviation From Normal Probability Calculated	CorrectedLocalizedDeviationFromNormalProbabilityCalculated	CS	1
(0024,0081)	Corrected Localized Deviation From Normal Probability	CorrectedLocalizedDeviationFromNormalProbability	FL	1
(0024,0083)	Global Deviation Probability Sequence	GlobalDeviationProbabilitySequence	SQ	1
(0024,0085)	Localized Deviation Probability Sequence	LocalizedDeviationProbabilitySequence	SQ	1
(0024,0086)	Foveal Sensitivity Measured	FovealSensitivityMeasured	CS	1
(0024,0087)	Foveal Sensitivity	FovealSensitivity	FL	1
(0024,0088)	Visual Field Test Duration	VisualFieldTestDuration	FL	1
(0024,0089)	Visual Field Test Point Sequence	VisualFieldTestPointSequence	SQ	1
(0024,0090)	Visual Field Test Point X-Coordinate	VisualFieldTestPointXCoordinate	FL	1
(0024,0091)	Visual Field Test Point Y-Coordinate	VisualFieldTestPointYCoordinate	FL	1
(0024,0092)	Age Corrected Sensitivity Deviation Value	AgeCorrectedSensitivityDeviationValue	FL	1
(0024,0093)	Stimulus Results	StimulusResults	CS	1
(0024,0094)	Sensitivity Value	SensitivityValue	FL	1
(0024,0095)	Retest Stimulus Seen	RetestStimulusSeen	CS	1
(0024,0096)	Retest Sensitivity Value	RetestSensitivityValue	FL	1
(0024,0097)	Visual Field Test Point Normals Sequence	VisualFieldTestPointNormalsSequence	SQ	1
(0024,0098)	Quantified Defect	QuantifiedDefect	FL	1

(0024,0102)	Generalized Defect Corrected Sensitivity Deviation Flag	GeneralizedDefectCorrectedSensitivityDeviationFlag	CS	1
(0024,0103)	Generalized Defect Corrected Sensitivity Deviation Value	GeneralizedDefectCorrectedSensitivityDeviationValue	FL	1
(0024,0104)	Generalized Defect Corrected Sensitivity Deviation Probability Value	GeneralizedDefectCorrectedSensitivityDeviationProbabilityValue	FL	1
(0024,0105)	Minimum Sensitivity Value	MinimumSensitivityValue	FL	1
(0024,0106)	Blind Spot Localized	BlindSpotLocalized	CS	1
(0024,0107)	Blind Spot X-Coordinate	BlindSpotXCoordinate	FL	1
(0024,0108)	Blind Spot Y-Coordinate	BlindSpotYCoordinate	FL	1
(0024,0110)	Visual Acuity Measurement Sequence	VisualAcuityMeasurementSequence	SQ	1
(0024,0112)	Refractive Parameters Used on Patient Sequence	RefractiveParametersUsedOnPatientSequence	SQ	1
(0024,0113)	Measurement Laterality	MeasurementLaterality	CS	1
(0024,0114)	Ophthalmic Patient Clinical Information Left Eye Sequence	OphthalmicPatientClinicalInformationLeftEyeSequence	SQ	1
(0024,0115)	Ophthalmic Patient Clinical Information Right Eye Sequence	OphthalmicPatientClinicalInformationRightEyeSequence	SQ	1
(0024,0117)	Foveal Point Normative Data Flag	FovealPointNormativeDataFlag	CS	1
(0024,0118)	Foveal Point Probability Value	FovealPointProbabilityValue	FL	1
(0024,0120)	Screening Baseline Measured	ScreeningBaselineMeasured	CS	1
(0024,0122)	Screening Baseline Measured Sequence	ScreeningBaselineMeasuredSequence	SQ	1
(0024,0124)	Screening Baseline Type	ScreeningBaselineType	CS	1
(0024,0126)	Screening Baseline Value	ScreeningBaselineValue	FL	1
(0024,0202)	Algorithm Source	AlgorithmSource	LO	1
(0024,0306)	Data Set Name	DataSetName	LO	1
(0024,0307)	Data Set Version	DataSetVersion	LO	1
(0024,0308)	Data Set Source	DataSetSource	LO	1
(0024,0309)	Data Set Description	DataSetDescription	LO	1
(0024,0317)	Visual Field Test Reliability Global Index Sequence	VisualFieldTestReliabilityGlobalIndexSequence	SQ	1
(0024,0320)	Visual Field Global Results Index Sequence	VisualFieldGlobalResultsIndexSequence	SQ	1
(0024,0325)	Data Observation Sequence	DataObservationSequence	SQ	1

(0024,0338)	Index Normals Flag	IndexNormalsFlag	CS	1
(0024,0341)	Index Probability	IndexProbability	FL	1
(0024,0344)	Index Probability Sequence	IndexProbabilitySequence	SQ	1

Add new rows to PS 3.6 Annex A Table A-3

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**Table A-3**  
**CONTEXT GROUP UID VALUES**

Context UID	Context Identifier	Context Group Name
...		
1.2.840.10008.6.1.909	4230	Visual Field Static Perimetry Test Patterns
1.2.840.10008.6.1.910	4231	Visual Field Static Perimetry Test Strategies
1.2.840.10008.6.1.911	4232	Visual Field Static Perimetry Screening Test Modes
1.2.840.10008.6.1.912	4233	Visual Field Static Perimetry Fixation Strategy
1.2.840.10008.6.1.913	4234	Visual Field Static Perimetry Test Analysis Results
1.2.840.10008.6.1.914	4235	Visual Field Illumination Color
1.2.840.10008.6.1.915	4236	Visual Field Procedure Modifier
1.2.840.10008.6.1.916	4237	Visual Field Global Index Name

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**Changes to NEMA Standards Publication PS 3.16-2009**  
**Digital Imaging and Communications in Medicine (DICOM)**  
**Part 16: Content Mapping Resource**

Add the following definitions to Part 16 Annex B DCMR Context Groups (Normative)

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**CID 4230      Visual Field Static Perimetry Test Patterns**

**Context ID 4230**

**Visual Field Static Perimetry Test Patterns**

**Type: Extensible**

**Version: 20100827**

<b>Coding Scheme Designator (0008,0102)</b>	<b>Code Value (0008,0100)</b>	<b>Code Meaning (0008,0104)</b>
DCM	111800	Visual Field 24-2 Test Pattern
DCM	111801	Visual Field 10-2 Test Pattern
DCM	111802	Visual Field 30-2 Test Pattern
DCM	111803	Visual Field 60-4 Test Pattern
DCM	111804	Visual Field Macula Test Pattern
DCM	111805	Visual Field Central 40 Point Test Pattern
DCM	111806	Visual Field Central 76 Point Test Pattern
DCM	111807	Visual Field Peripheral 60 Point Test Pattern
DCM	111808	Visual Field Full Field 81 Point Test Pattern
DCM	111809	Visual Field Full Field 120 Point Test Pattern
DCM	111810	Visual Field G Test Pattern
DCM	111811	Visual Field M Test Pattern
DCM	111812	Visual Field 07 Test Pattern
DCM	111813	Visual Field LVC Test Pattern
DCM	111814	Visual Field Central Test Pattern

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**CID 4231      Visual Field Static Perimetry Test Strategies**

**Context ID 4231**

**Visual Field Static Perimetry Test Strategies**

**Type: Extensible**

**Version: 20100827**

<b>Coding Scheme Designator (0008,0102)</b>	<b>Code Value (0008,0100)</b>	<b>Code Meaning (0008,0104)</b>
DCM	111815	Visual Field SITA-Standard Test Strategy
DCM	111816	Visual Field SITA-SWAP Test Strategy
DCM	111817	Visual Field SITA-Fast Test Strategy

DCM	111818	Visual Field Full Threshold Test Strategy
DCM	111819	Visual Field FastPac Test Strategy
DCM	111820	Visual Field Full From Prior Test Strategy
DCM	111821	Visual Field Optima Test Strategy
DCM	111822	Visual Field Two-Zone Test Strategy
DCM	111823	Visual Field Three-Zone Test Strategy
DCM	111824	Visual Field Quantify-Defects Test Strategy
DCM	111825	Visual Field TOP Test Strategy
DCM	111826	Visual Field Dynamic Test Strategy
DCM	111827	Visual Field Normal Test Strategy
DCM	111828	Visual Field 1-LT Test Strategy
DCM	111829	Visual Field 2-LT Test Strategy
DCM	111830	Visual Field LVS Test Strategy
DCM	111831	Visual Field GATE Test Strategy
DCM	111832	Visual Field GATEi Test Strategy
DCM	111833	Visual Field 2LT-Dynamic Test Strategy
DCM	111834	Visual Field 2LT-Normal Test Strategy
DCM	111835	Visual Field Fast Threshold Test Strategy
DCM	111836	Visual Field CLIP Test Strategy
DCM	111837	Visual Field CLASS Strategy

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**CID 4232 Visual Field Static Perimetry Screening Test Modes**

**Context ID 4232**

**Visual Field Static Perimetry Screening Test Modes**

**Type: Extensible**

**Version: 20100827**

<b>Coding Scheme Designator (0008,0102)</b>	<b>Code Value (0008,0100)</b>	<b>Code Meaning (0008,0104)</b>
DCM	111838	Age corrected
DCM	111839	Threshold related
DCM	111840	Single luminance
DCM	111841	Foveal sensitivity related
DCM	111842	Related to non macular sensitivity
DCM	121410	User chosen value

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**CID 4233 Visual Field Static Perimetry Fixation Strategy**

**Context ID 4233**

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**Visual Field Static Perimetry Fixation Strategy**

**Type: Extensible**

**Version: 20100827**

<b>Coding Scheme Designator (0008,0102)</b>	<b>Code Value (0008,0100)</b>	<b>Code Meaning (0008,0104)</b>
DCM	111843	Automated Optical
DCM	111844	Blind Spot Monitoring
DCM	111845	Macular Fixation Testing
DCM	111846	Observation by Examiner
SRT	R-40775	None

**CID 4234 Visual Field Static Perimetry Test Analysis Results**

**Context ID 4234**

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**Visual Field Static Perimetry Test Analysis Results**

**Type: Extensible**

**Version: 20100827**

<b>Coding Scheme Designator (0008,0102)</b>	<b>Code Value (0008,0100)</b>	<b>Code Meaning (0008,0104)</b>
DCM	111847	Outside normal limits
DCM	111848	Borderline
DCM	111849	Abnormally high sensitivity
DCM	111850	General reduction in sensitivity
DCM	111851	Borderline and general reduction in sensitivity
SRT	M-00101	Within normal limits

**CID 4235 Visual Field Illumination Color**

**Context ID 4235**

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**Visual Field Illumination Color**

**Type: Extensible**

**Version: 20100827**

<b>Coding Scheme Designator (0008,0102)</b>	<b>Code Value (0008,0100)</b>	<b>Code Meaning (0008,0104)</b>
SRT	G-A11D	Yellow
SRT	G-A12B	White
SRT	G-A11A	Red
SRT	G-A12F	Blue
SRT	G-A11E	Green

**CID 4236 Visual Field Procedure Modifier**

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**Context ID 4236  
Visual Field Procedure Modifier**

**Type: Extensible**

**Version: 20100827**

<b>Coding Scheme Designator (0008,0102)</b>	<b>Code Value (0008,0100)</b>	<b>Code Meaning (0008,0104)</b>
SRT	R-42453	Screening
SRT	R-408C3	Diagnostic

**CID 4237 Visual Field Global Index Name**

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**Context ID 4237  
Visual Field Global Index Name**

**Type: Extensible**

**Version: 20100827**

<b>Coding Scheme Designator (0008,0102)</b>	<b>Code Value (0008,0100)</b>	<b>Code Meaning (0008,0104)</b>
DCM	111852	Visual Field Index
DCM	111853	Visual Field Loss Due to Diffuse Defect
DCM	111854	Visual Field Loss Due to Local Defect
DCM	111855	Glaucoma Hemifield Test Analysis
DCM	111856	Optical Fixation Measurements

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**Add the following definitions to Part 16 Annex D DICOM Controlled Terminology Definitions (Normative)**

**Annex D DICOM Controlled Terminology Definitions (Normative)**

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<b>Code Value</b>	<b>Code Meaning</b>	<b>Definition</b>	<b>Notes</b>
----	----	----	
111800	Visual Field 24-2 Test Pattern	Test pattern, nominally covering an area within 24° of fixation. Consists of 54 test points a minimum of 3° from each meridian and placed 6° apart. The “-2” distinguishes this from another 24° pattern (no longer supported).	

111801	Visual Field 10-2 Test Pattern	Test pattern, nominally covering an area within 10° of fixation. Consists of 68 test points a minimum of 1° from each meridian and placed 2° apart. The “-2” in this case indicates its point layout to be similar to the 30-2 and 24-2.	
111802	Visual Field 30-2 Test Pattern	Test pattern consisting of test point locations within 30° of fixation. Consists of 76 test points a minimum of 3° from each meridian and placed 6° apart. The “-2” distinguishes this from another 30° pattern (no longer supported).	
111803	Visual Field 60-4 Test Pattern	Test pattern consisting of 60 test point locations between 30° and 60° of fixation a minimum of 6° from each meridian and placed 12° apart. The “-4” distinguishes this from a similar 60° pattern having 4 additional points.	
111804	Visual Field Macula Test Pattern	Test pattern consisting of 16 test point locations within 10° of fixation a minimum of 1° from each meridian and placed 2° apart.	
111805	Visual Field Central 40 Point Test Pattern	Test pattern consisting of 40 test point locations within 30° of fixation that spread out radially from fixation.	
111806	Visual Field Central 76 Point Test Pattern	Test pattern consisting of 76 test point locations within 30° of fixation a minimum of 3° from each meridian and placed 6° apart.	
111807	Visual Field Peripheral 60 Point Test Pattern	Test pattern consisting of 60 test point locations between 30° and 60° of fixation a minimum of 6° from each meridian and placed 12° apart.	
111808	Visual Field Full Field 81 Point Test Pattern	Test pattern consisting of 81 test point locations within 60° of fixation that spread out radially from fixation.	
111809	Visual Field Full Field 120 Point Test Pattern	Test pattern consisting of 120 test point locations within 60° of fixation that spread out radially from fixation, concentrated in the nasal hemisphere.	
111810	Visual Field G Test Pattern	Test pattern for Glaucoma and general visual field assessment with 59 test locations of which 16 test locations are in the macular area (up to 10° eccentricity) and where the density of test location is reduced with eccentricity. The test can be extended with the inclusion of 14 test locations between 30° and 60° eccentricity, 6 of which are located at the nasal step.	

111811	Visual Field M Test Pattern	Test pattern for the macular area. Orthogonal test pattern with 0.7° spacing within the central 4° of eccentricity and reduced density of test locations between 4 and 10,5° of eccentricity. 81 test locations over all. The test can be extended to include the test locations of the Visual Field G Test Pattern between 10,5° and 60°.	
111812	Visual Field 07 Test Pattern	Full field test pattern with 48 test locations from 0-30° and 82 test locations from 30-70°. Reduced test point density with increased eccentricity. Can be combined with screening and threshold strategies.	
111813	Visual Field LVC Test Pattern	Low Vision Central. Orthogonal off-center test pattern with 6° spacing. 75 test locations within the central 30°. Corresponds with the 32/30-2 excluding the 2 locations at the blind spot, including a macular test location. The LVC is linked with a staircase threshold strategy starting at 0 dB intensity and applies stimulus area V.	
111814	Visual Field Central Test Pattern	General test corresponding to the 30-2 but excluding the 2 test locations in the blind spot area, hence with 74 instead of 76 test locations.	
111815	Visual Field SITA-Standard Test Strategy	Swedish Interactive Thresholding Algorithm (SITA). Strategy gains testing efficiency through use of visual field and information theory models. In: Bengtsson B, Olsson J, Heijl A, Rootzen H. A new generation of algorithms for computerized threshold perimetry, SITA. Acta Ophthalmologica Scandinavica, 1997, 75: 368-375.	
111816	Visual Field SITA-SWAP Test Strategy	Adaptation of SITA testing methods to Blue-Yellow testing.	
111817	Visual Field SITA-Fast Test Strategy	Similar to SITA-Standard but with less strict criteria for closing test points. Intended for patients who must be tested in the shortest possible time. In: Bengtsson B, Heijl A. SITA Fast, a new rapid perimetric threshold test. Description of methods and evaluation in patients with manifest and suspect glaucoma. Acta Ophthalmologica Scandinavica, 1998, 76: 431-437.	

111818	Visual Field Full Threshold Test Strategy	Threshold test algorithm that determines a patient's sensitivity at each test point in the threshold test pattern by adjusting intensity by 4 dB steps until the patient changes their response, and then adjusts the intensity in the opposite direction by 2 dB steps until the patient changes their response again. The last stimulus seen by the patient is recognized as the threshold for that point. The starting values are determined by first thresholding a "primary" point in each quadrant then using the results of each primary point to determine the starting values for neighboring points.	
111819	Visual Field FastPac Test Strategy	Similar to the Full Threshold algorithm except that it steps by 3 dB and only crosses the threshold only once. In: Flanagan JG, Wild JM, Trope GE. Evaluation of FASTPAC, a new strategy for threshold estimation with the Humphrey Field Analyzer, in a glaucomatous population. Ophthalmology, 1993, 100: 949-954.	
111820	Visual Field Full From Prior Test Strategy	Identical to Full Threshold except that starting values are determined by the results of a previous test performed using the same test pattern and the Full Threshold test strategy.	
111821	Visual Field Optima Test Strategy	Similar to FastPac except that the steps are pseudo-dynamic (differ based on the intensity of the last presentation).	
111822	Visual Field Two-Zone Test Strategy	Suprathreshold testing strategy, in which each point is initially tested using stimulus that is 6 dB brighter than the expected hill of vision. If the patient does not respond, the stimulus is presented a second time at the same brightness. If the patient sees either presentation, the point is marked as "seen"; otherwise it is marked as "not seen".	
111823	Visual Field Three-Zone Test Strategy	An extension of the two-zone strategy in which test points where the second stimulus is not seen are presented with a third stimulus at maximum brightness.	
111824	Visual Field Quantify-Defects Test Strategy	An extension of the two-zone strategy, in which test points where the second stimulus is not seen receive threshold testing to quantify the depth of any detected scotomas.	

111825	Visual Field TOP Test Strategy	Tendency Oriented Perimetry. Fast thresholding algorithm. Test strategy makes use of the interaction between neighboring test locations to reduce the test time compared to normal full threshold strategy by 60-80%.  In: Morales J, Weitzman ML, Gonzalez de la Rosa M. Comparison between Tendency-Oriented Perimetry (TOP) and octopus threshold perimetry. Ophthalmology, 2000, 107: 134-142.	
111826	Visual Field Dynamic Test Strategy	Dynamic strategy is a fast thresholding strategy reducing test duration by adapting the dB step sizes according to the frequency-of-seeing curve of the threshold. Reduction of test time compared to normal full threshold strategy 30-50%.	
111827	Visual Field Normal Test Strategy	Traditional full threshold staircase strategy. Initial intensities are presented, based on anchor point sensitivities in each quadrant and based on already known neighboring sensitivities. In a first run, thresholds are changed in 4dB steps until the first response reversal. Then the threshold is changed in 2 dB steps until the second response reversal. The threshold is calculated as the average between the last seen and last not-seen stimulus, supposed to correspond with the 50% point in the frequency-of-seeing curve.	
111828	Visual Field 1-LT Test Strategy	One level screening test: Each test location is tested with a single intensity. The result is shown as seen or not-seen. The intensity can either be a 0 dB stimulus or a predefined intensity.	
111829	Visual Field 2-LT Test Strategy	Two level screening test: Each test location is initially tested 6 dB brighter than the age corrected normal value.	
111830	Visual Field LVS Test Strategy	Low Vision Strategy is a full threshold normal strategy with the exception that it starts at 0 dB intensity and applies stimulus area V.	

111831	Visual Field GATE Test Strategy	German Adaptive Threshold Estimation is a fast strategy based on a modified 4-2 staircase algorithm, using prior visual fields to calculate the starting intensity. In: Chieffer U, Pascual JP, Edmunds B, Feudner E, Hoffmann EM, Johnson CA, Lagreze WA, Pfeiffer N, Sample PA, Staubach F, Weleber RG, Vonthein R, Krapp E, Paetzold J. Comparison of the new perimetric GATE strategy with conventional full-threshold and SITA standard strategies. Investigative Ophthalmology and Visual Science, 2009, 51: 488-494.	
111832	Visual Field GATEi Test Strategy	Similar to GATE. The i stands for initial. If there was no prior visual field test to calculate the starting values, an anchor point method is used to define the local start values.	
111833	Visual Field 2LT-Dynamic Test Strategy	A test started as two level screening test. In the course of the test, the threshold of relative defects and/or normal test locations has been quantified using the dynamic threshold strategy.	
111834	Visual Field 2LT-Normal Test Strategy	A test started as two level screening test. In the course of the test, the threshold of relative defects and/or normal test locations has been quantified using the normal full threshold strategy.	
111835	Visual Field Fast Threshold Test Strategy	Takes neighbourhood test point results into account and offers stimuli with an adapted value to save time.	
111836	Visual Field CLIP Test Strategy	Continuous Luminance Incremental Perimetry which measures at first the individual reaction time of the patient and threshold values in every quadrant. The starting value for the main test is slightly below in individual threshold.	
111837	Visual Field CLASS Strategy	A supra threshold screening strategy. The starting stimuli intensities depend on the classification of the patient's visual field by measuring the central (fovea) or peripheral (15° meridian) threshold. The result of each dot slightly underestimates the sensitivity value (within 5 dB).	
111838	Age corrected	Mode for determining the starting luminance for screening test points – the starting luminance is chosen based on the age of the patient.	
111839	Threshold related	Mode for determining the starting luminance for screening test points – the starting luminance is chosen based on the results of thresholding a set of "primary" test points (one in each quadrant).	

111840	Single luminance	Mode for determining the starting luminance for screening test points – in this case, all starting luminance is set to the same value.	
111841	Foveal sensitivity related	Mode for determining the starting luminance for screening test points – the starting luminance is chosen based on the result of the foveal threshold value.	
111842	Related to non macular sensitivity	Mode for determining the starting luminance for screening test points – the starting luminance is chosen based on the result of four threshold values measured near the 15° meridian (one in each quadrant).	
111843	Automated Optical	Real time evaluation of the camera image to recognize blinks and fixation losses with influence on the test procedure. Blinks that interfere with stimuli presentation cause the automated repetition of such stimulus presentations. Fixation losses can be used to delay the stimulus presentation until correct fixation is regained.	
111844	Blind Spot Monitoring	A method of monitoring the patient's fixation by periodically presenting stimulus in a location on the background surface that corresponds to the patient's blind spot.	
111845	Macular Fixation Testing	A method of monitoring the patient's fixation by presenting the stimulus to the patient's macula.	
111846	Observation by Examiner	A method of monitoring the patient's fixation by observation from the examiner of the patient.	
111847	Outside normal limits	Analysis Results are outside normal limits.	
111848	Borderline	Analysis Results are borderline.	
111849	Abnormally high sensitivity	Analysis Results identify abnormally high sensitivity	
111850	General reduction in sensitivity	Analysis Results identify general reduction in sensitivity.	
111851	Borderline and general reduction in sensitivity	Analysis Results identify Borderline and general reduction in sensitivity.	
111852	Visual Field Index	Index of a patient's remaining visual field normalized for both age and generalized defect.	
111853	Visual Field Loss Due to Diffuse Defect	Estimate of the portion of a patient's visual field loss that is diffuse (i.e. spread evenly across all portions of the visual field).	
111854	Visual Field Loss Due to Local Defect	Estimate of the portion of a patient's visual field loss that is local (i.e. not spread evenly across all portions of the visual field).	

111855	Glaucoma Hemifield Test Analysis	An analysis of asymmetry between zones of the superior and inferior visual field. It is designed to be specific for defects due to glaucoma.	
111856	Optical Fixation Measurements	The data output of an optical fixation monitoring process, consisting of a list of positive and negative numbers indicating the quality of patient fixation over the course of a visual field test. The value 0 represents the initial fixation. Negative numbers indicate a measuring error (i.e. the patient blinked). Positive numbers quantify the degree of eccentricity from initial fixation.	

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**Changes to NEMA Standards Publication PS 3.17-2009**  
**Digital Imaging and Communications in Medicine (DICOM)**  
**Part 17: Explanatory Information**

**Add to PS3.17 Annex U**

265

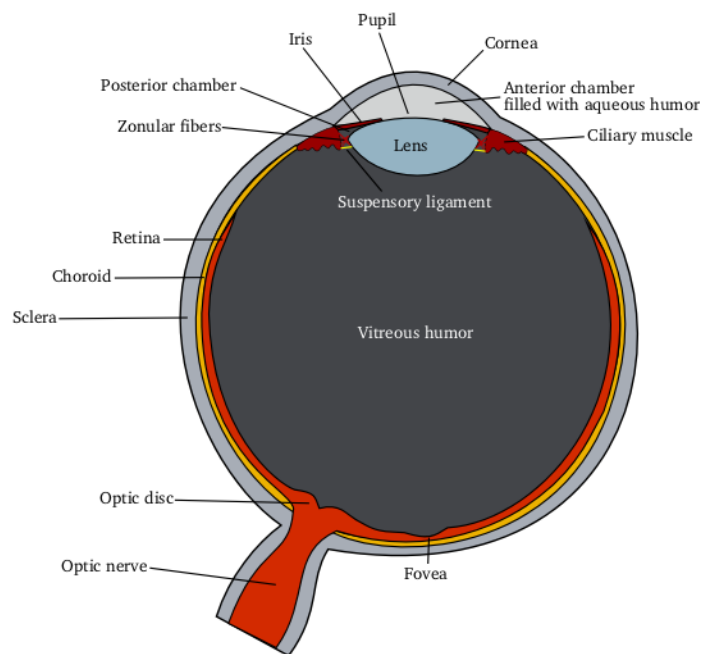
**Annex U Visual Field Static Perimetry Use Cases (Informative)**

**U.1 Introduction**

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Automated visual fields are the most commonly used method to assess the function of the visual system. This is accomplished by sequentially presenting visual stimuli to the patient and then requiring the patient press a button if he/she perceives a stimulus. The stimuli are presented at a variety of points within the area expected to be visible to the patient and each of those points is tested with multiple stimuli of varying intensity. The result of this is a spatial map indicating how well the patient can see throughout his/her visual field.

**U.2 Use Cases**



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**Figure U.2-1 Schematic Representation of the Human Eye**

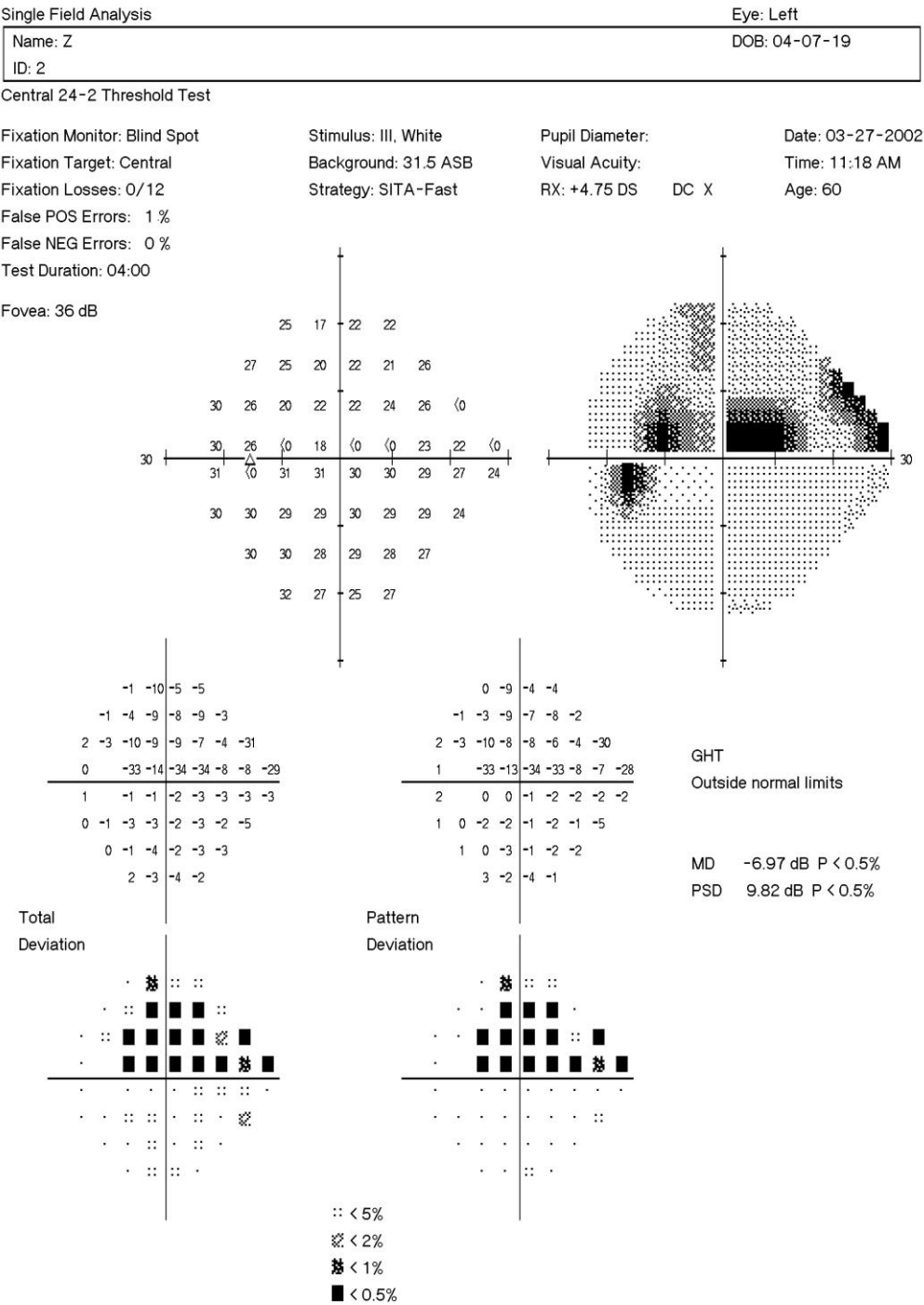


Figure U.2-2 Sample Report from an Automated Visual Field Machine

280 U.2.1 Evaluation for Glaucoma

The diagnosis and management of Glaucoma, a disease of the optic nerve, is the primary use of visual field testing. In this regard, automated visual fields are used to assess quantitatively the function of the optic nerve with the intent of detecting defects caused by glaucoma.

The first step in analyzing a visual field report is to confirm that it came from the correct patient. Demographic information including the patient's name, gender, date of birth, and perhaps medical record number are therefore essential data to collect. The patient's age is also important in the analysis of the visual field (see below) as optic nerve function changes with age. Finally, it is important to document the patient's refractive error as this needs to be corrected properly for the test to be valid.

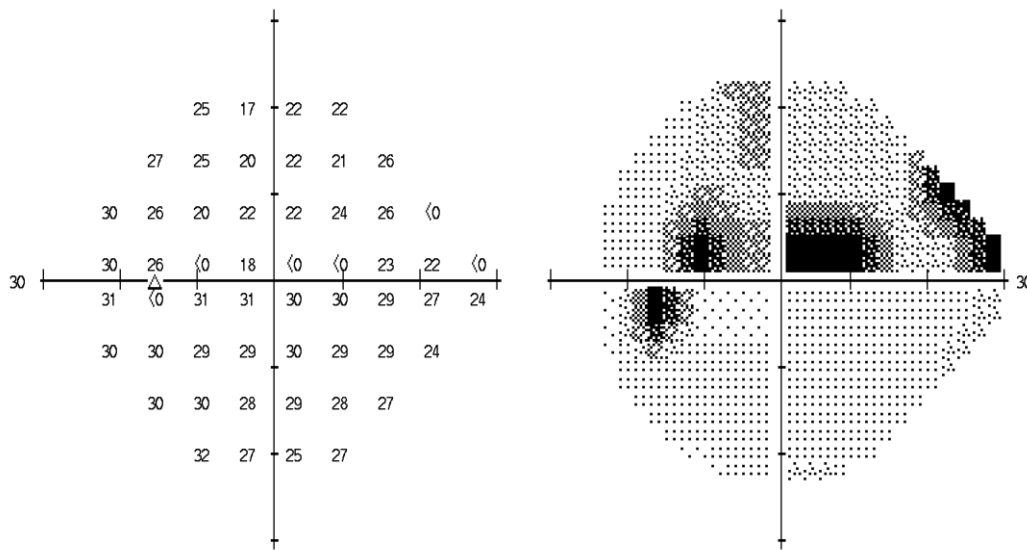
Second, the clinician needs to assess the reliability of the test. This can be determined in a number of ways. One of these is by monitoring patient fixation during the test. To be meaningful, a visual field test assumes that the subject was looking at a fixed point throughout the test and was responding to stimuli in the periphery. Currently available techniques for monitoring this fixation include blind spot mapping, pupil tracking, and observation by the technician conducting the test. Blind spot mapping starts by identifying the small region of the visual field corresponding to the optic nerve head. Since the patient cannot detect stimuli in this area, any positive response to a stimulus placed there later in the test indicates that the patient has lost fixation and the blind spot has "moved". Both pupil tracking and direct observation by the technician are now easily carried out using a camera focused on the patient's eye.

Fixation Monitor: Blind Spot  
Fixation Target: Central  
Fixation Losses: 0/12  
False POS Errors: 1 %  
False NEG Errors: 0 %  
Test Duration: 04:00

#### **Figure U.2-3 Information Related to Test Reliability**

Another means of assessing the reliability of the test is to count both false positive and false negative responses. False positives occur when the subject presses the button either in response to no stimulus or in response to a stimulus with intensity significantly below one they had not detected previously. False negatives are recorded when the patient fails to respond to stimulus significantly more intense than one they had previously seen. Taken together, fixation losses, false positives, and false negatives provide an indication of the quality of the test.

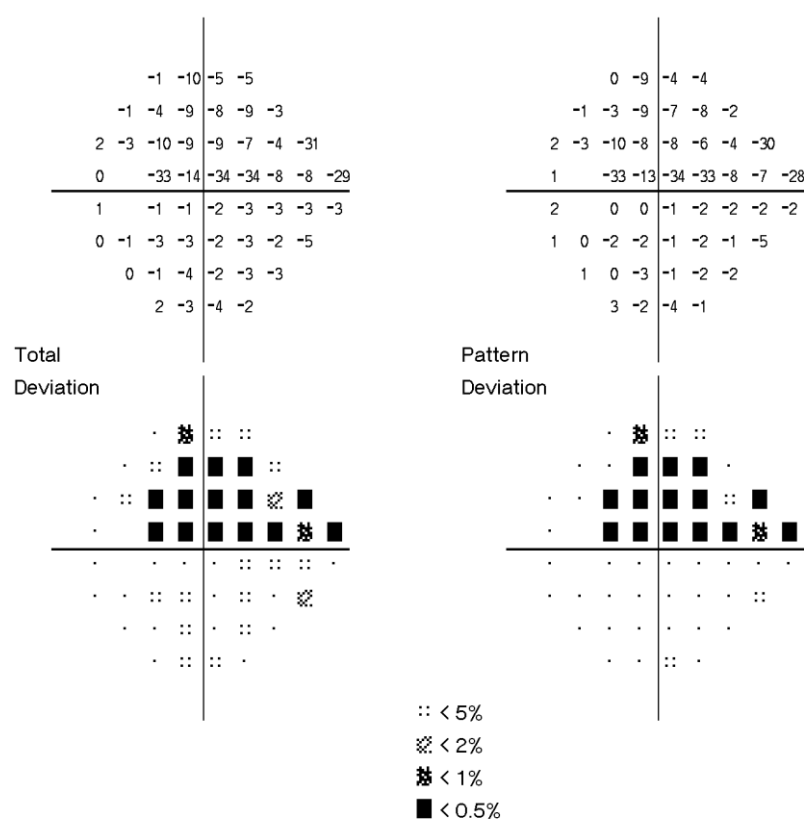
The next phase of visual field interpretation is to assess for the presence of disease. The first aspect of the visual field data used here are the raw sensitivity values. These are usually expressed as a function of the amount of attenuation that could be applied to the maximum possible stimulus such that the patient could still see it when displayed. Since a value is available at each point tested in the visual field, these values can be represented either as raw values or as a graphical map.



**Figure U.2-4 Sample Output from an Automated VF Machine Including Raw Sensitivity Values (Left, Larger Numbers are Better) and an Interpolated Gray-Scale Image**

320 Because the raw intensity values can be affected by a number of factors including age and other non-optic nerve problems including refractive error or any opacity along the visual axis (cornea, lens, vitreous), it is helpful to also evaluate some corrected values. One set of corrected intensity values is usually some indication of the difference of each tested point from its expected value based on patient age. Another set of corrected intensity values, referred to as "Pattern deviation or "Corrected comparison" are normalized for age and also have a value subtracted from the deviation at each test point, which is estimated to be due to diffuse visual field loss. This latter set is useful for focal rather than diffuse defects in visual function. In the case of glaucoma and most other optic nerve disease, clinicians are more interested in focal defects so this second set of normalized data is useful.

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**Figure U.2-5 Examples of Age Corrected Deviation from Normative Values (upper left) and Mean Defect Corrected Deviation from Normative Data (upper right)**

For all normalized visual field sensitivity data, it is useful to know how a particular value compares to a group of normal patients. Vendors of automated visual field machines therefore go to great lengths to collect data on such “normal” subjects to allow subsequent analysis. Furthermore, the various sets of values mentioned above can be summarized further using calculations like a mean and standard deviation. These values give some idea about the average amount of field loss (mean) and the focality of that loss (standard deviation).

A final step in the clinical assessment of a visual field test is to review any disease-specific tests that are performed on the data. One such test is the Glaucoma Hemifield Test which has been designed to identify field loss consistent with glaucoma. These tests are frequently vendor-specific.

### U.2.2 Neurological Disease

In addition to primary diseases of the optic nerve, like glaucoma, visual fields are useful for assessing damage to the visual pathway occurring between the optic chiasm and occipital cortex. There is the same need for demographic information, for assessment of reliability, and for the various raw and normalized sensitivity values. At this time, there are no well-established automated tests for the presence of neurological defects.

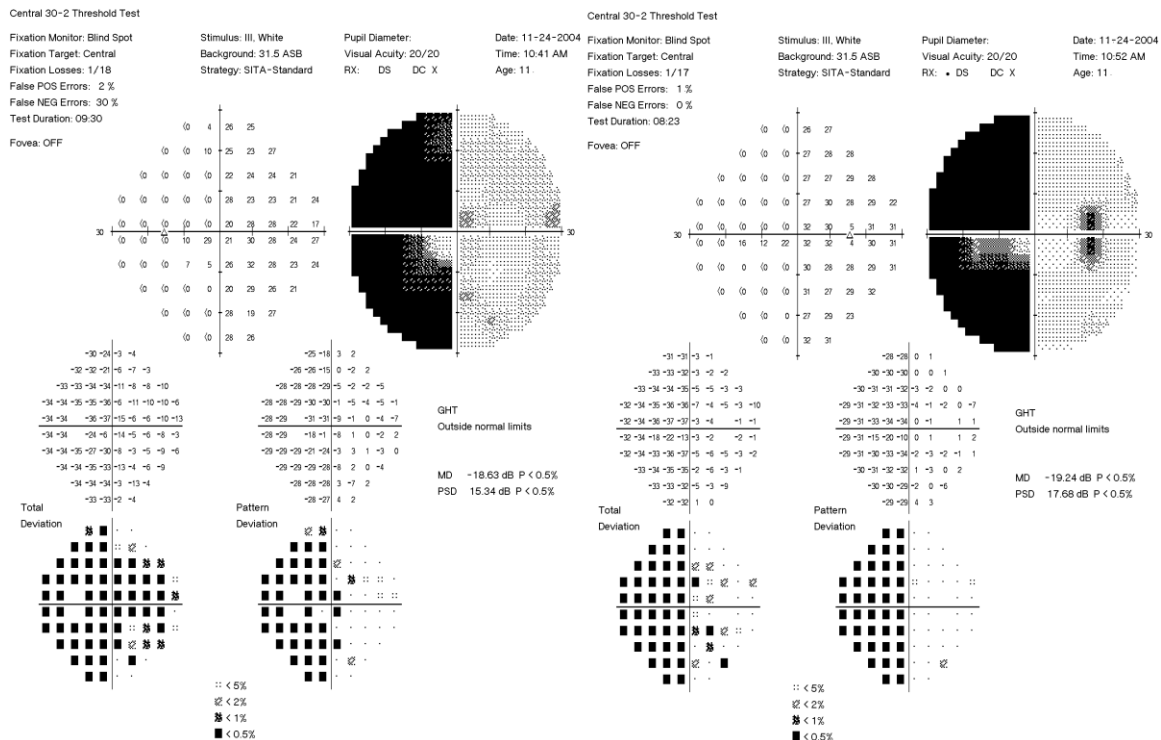
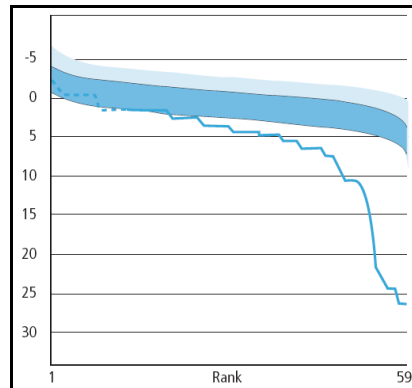


Figure U.2-6 Example of Visual Field Loss Due to Damage to the Occipital Cortex Because of a Stroke

## U.2.3 Diffuse and Local Defect

### U.2.3.1 Diffuse Defect

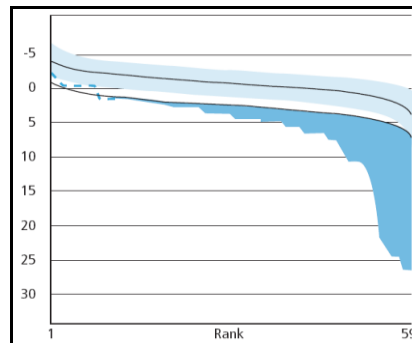
The Diffuse Defect is an estimate of the portion of a patient's visual field loss that is diffuse, or spread evenly across all portions of the visual field, in dB. In this graphical display, deviation from the average normal value for each test point is ranked on the x axis from 1 to 59, with 59 being the test point that has the greatest deviation from normal. Deviations from normal at each test point are represented on the y axis, in dB. The patient's actual test point deviations are represented by the thin blue line. Age corrected normal values are represented by the light blue band. The patient's deviation from normal at the test point ranked 25% among his or her own deviations is then estimated to be his or her diffuse visual field loss, represented by the dark blue band. This provides a graphical estimate of the remaining visual field loss for this patient, which is then presumed to consist of local visual field defects, which are more significant in management of glaucoma than diffuse defects.



**Figure U.2-7 Example of Diffuse Defect**

#### 375 **U.2.4.2 Local Defect**

The Local Defect is an estimate of the portion of a patient's visual field loss that is local, or not spread evenly across all portions of the visual field. The x and y axis in this graphical display have the same meaning as in the diffuse defect. In this graphical display the top line/blue band represent age corrected normal values. This line is shifted downward by the amount estimated to be due to diffuse visual field loss for this patient, according to the calculation in Figure U.2-7 (Diffuse Defect). The difference between the patient's test value at each point in the ranking on the horizontal axis and the point on the lower curve at the 50% point is represented by the dark blue section of the graph. This accentuates the degree of local visual field defect, which is more significant in management of glaucoma than diffuse defects. The Local Defect is an index that highly correlates with square root of the loss variance (sLV) but is less susceptible to false positives. In addition to the usage in white/white perimetry it is especially helpful as early identifier for abnormal results in perimetry methods with higher inter subject variability such as blue/yellow (SWAP) or flicker perimetry. An example of Local Defect is shown in Figure U.2-8 and is expressed in dark blue in dB and is normalized to be comparable between different test patterns.



**Figure U.2-8 Example of Local Defect**