

**Custom Target Rules for
the OTOsuite PMM Module**
Reference Manual

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Technical support

Please contact your supplier.

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1 Purpose of custom target rules

In the OTOSuite PMM module, you can choose between several validated target rules to use for fitting verification (for example, DSL v4.2, DSL v5.0, NAL-NL1 and NAL-NL2).

In addition to the built-in target rules, you can now define your own prescriptive targets. These target calculations can be defined in a Microsoft Excel workbook. The calculations can be based on patient and measurement information which OTOSuite fills into the workbook automatically together with any additional customer information, such as custom RECD values, that the person responsible for the custom target sees fit to include.

The custom target workbooks only have to be edited by the person who develops the target calculation. Once the custom target workbook is ready for use, it only needs to be copied onto the computer of the daily users. The daily users don't have to open the workbook.

Purpose of this document

This document describes how to set up a custom target rule. The intended user of this document is the developer of a custom target rule. Once the target rule has been set up, it can be selected in OTOSuite and used like any other target rule.

2 Prerequisites

In order to develop a custom target rule, you must use Microsoft Excel 2003 or newer. Also, each OTOSuite user that will use the custom target rule must have Excel installed on their computer. (See also [Deployment to other computers](#) ► 6.)

3 Supported calculations

First you must decide which of the following calculations you want to support (at least one):

- Insertion gain (in real ear and coupler) – IG
- Aided gain (in real ear and coupler) – AG
- Aided response (in real ear and coupler) – AR
- Predicted real ear unaided gain - REUG
- Predicted real ear to coupler difference – RECD

Then you must define your algorithms for each of the supported targets and predicted values above.

The input parameters available can be found on the *Fitting Details* worksheet in the *Custom Target Rule* workbook and will reflect the settings available in the **Fitting Details** dialog in OTOSuite.

4 Using a custom target rule in OTOsuite

To enable the custom target rule in OTOsuite, you must create an Excel workbook from the template in the Support folder on your OTOsuite installation media (for example D:\Support\TargetRules\TargetRule.OTOTargetCalc.xlt, where D: is your DVD drive).

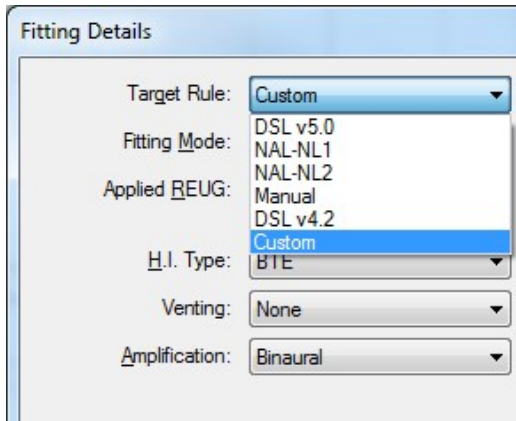
When you have setup the workbook and added the needed calculations you must save this file as an Excel workbook in the following folder: <INSTALLDIR>\CustomTargetRules\<filename>.OTOTargetCalc.xls. (E.g.: C:\Program Files\GN Otometrics\Otosuite\CustomTargetRules\MyTargetRule.OTOTargetCalc.xls)

If you want to create multiple target rules, you can create additional workbooks with different file names. (See [Creating multiple custom target rules](#) ► 12.)

Sample workbook

In the support folder of your installation media, you can also find a sample workbook that implements a basic "half gain" rule. Copy this file to the location above to see how it works. (D:\Support\TargetRules\Custom target rule sample.OTOTargetCalc.xls).

As soon as the workbook is saved in the correct folder, you can select the custom target rule from the **Fitting Details** dialog in OTOsuite.



4.1 Deployment to other computers

If you want to use the custom target rule on more computers, each computer must have a version of Microsoft Excel installed that supports the formulas used in your workbook. On each computer, the workbook must be copied to the correct folder, as described above.

5 Setting up the workbook

The *Custom Target Rule* workbook has several preconfigured worksheets available, which are described in the following. You can add more worksheets for detailed calculations. Comments in the cells give you guidance regarding the content and format of each cell.

Cells that must contain input for OTOSuite have a white or yellow background.

OTOSuite expects cells to retain their absolute positions on worksheets with the exact names as defined in the template. All empty cells can be used for any purpose and will be ignored by OTOSuite.



5.1 Target Rule Properties worksheet [data to OTOSuite]

This sheet is information to OTOSuite about the custom target rule and some of the values will be saved along with the target curve in OTOSuite. You must fill in all highlighted cells on this sheet.

	A	B	C	D
1	This sheet contains information about the properties of target rule.			
2	All information in this sheet is information to the OTOSuite			
3				
4	Data format Version	1,00		
5				
6	Target Rule Name			
7	Target Rule version	1,00		
8	Supports signal spectrum			
9	Can Calculate REIG			
10	Can Calculate REAG			
11	Can Calculate REAR			
12	Can Predict REUG			
13	Can Predict RECD			
14	Provide Adult Eq. Audiogram			
15				
16				
17				
18				
19				
20				
21	Undefined Value	9999		
22				

The *Can Calculate...* and *Can Predict...* fields define which output values OTOSuite can read from the workbook.

Mouse over the label cells to read the detailed descriptions of each property, and click in the highlighted cells to see the valid input values.

The *Undefined Value* is your definition of values that are empty (not defined). Undefined values written by OTOSuite to the workbook will have this value. Values read by OTOSuite that have this value will be interpreted as undefined.

5.2 Fitting Details worksheet [data from OTOSuite]

The fitting details available in the workbook are all the properties you can set up from the **Fitting Details** dialog in OTOSuite after having selected the Custom target rule.

	A	B
1	This sheet contains information filled in by	
2	All information in this sheet is information	
3		
4		
5	Age in month's	<input type="text"/>
6	Client Type	<input type="text"/>
7	Gender	<input type="text"/>
8		
9	Fitting Mode	<input type="text"/>
10		
11	H.I.Type	<input type="text"/>
12	Venting	<input type="text"/>
13	Binaural Amplification	<input type="text"/>
14		
15	H.I. Program Type	<input type="text"/>
16	No of Channels	<input type="text"/>
17	Compression Type	<input type="text"/>
18		
19	Transducer	<input type="text"/>
20	Use Bone Conduction	<input type="text"/>
21		
22	Ear piece	<input type="text"/>
23	Coupler adapter	<input type="text"/>
24	REUG orientation	<input type="text"/>
25		

OTOSuite will fill in the cells with numbers. In your algorithms, you can interpret the numbers as described in the comments for each cell.

5.3 Audiogram worksheet [data from OTOSuite]

The *Audiogram* worksheet will contain all the audiogram data available from OTOSuite.

Each audiogram type consists of 24 values (linearly interpolated and extrapolated in the logarithmic frequency domain from the available audiogram points in OTOSuite) and 24 status points.

Each status point tells if the point is a true measured/entered point or interpolated/extrapolated and whether it is a No Response point.

OTOSuite will call the workbook for target calculations once for each ear but the workbook will always have audiogram data for both ears available.

	A	B	C	D	E	F	G	H	I
1	This sheet contains measured (or predicted) values filled in by the OTOSuite at runtime. Refer to the relevant								
2	All information in this sheet is information from the OTOSuite								
3	Note: Not all cells need to have a defined value. If the cell value is not defined this must be indicated by the								
4									
5									
6		125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz
7	Audiogram HTL Level								
8	Audiogram HTL status								
9	Audiogram UCL Level								
10	Audiogram UCL Status								
11	Audiogram BC Level								
12	Audiogram BC Status								
13	Audiogram HTL Level Opposite Ear								
14	Audiogram HTL status Opposite Ear								
15	Audiogram UCL Level Opposite Ear								
16	Audiogram UCL status Opposite Ear								
17	Audiogram BC Level Opposite Ear								
18	Audiogram BC status Opposite Ear								

Note • The audiogram will be an adult equivalent audiogram if the Provide Adult Eq. Audiogram property is set to true in the Target Rule Properties worksheet.

5.4 Loudness Scaling worksheet [data from OTOSuite]

The *Loudness Scaling* worksheet can contain data from multiple loudness scaling measurements. OTOSuite inserts data in the worksheet.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	
1	This sheet contains measured (or predicted) values filled in by OTOSuite at runtime. Refer to the relevant measurement values in the target rule calculation.																									
2	All information in this sheet is information from OTOSuite																									
3	Note: Not all cells need to have a defined value. If the cell value is not defined, this must be indicated with the value specified in the cell "Undefined Value" in the Target Rule Properties sheet.																									
4																										
5	Reference count																									
6	Offset between measurements																									
7																										
8																										
9	Measurement date time																									
10	UCL Offset																									
11	Aided Condition																									
12	Signal																									
13	Signal output																									
14	Transducer																									
15	Test options Method																									
16																										
17	Loudness scaling status																									
18		125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	750 Hz	800 Hz	1 kHz	1.25 kHz	1.5 kHz	1.6 kHz	2 kHz	2.5 kHz	3 kHz	3.15 kHz	4 kHz	5 kHz	6 kHz	6.3 kHz	8 kHz	10 kHz	
19	Uncomfortably Loud [50]																									
20	Very Loud [45]																									
21	Loud [40]																									
22	Loud [35]																									
23	Medium [30]																									
24	Medium [25]																									
25	Soft [20]																									
26	Soft [15]																									
27	Very Soft [10]																									
28	Very Soft [5]																									
29	Not Heard [0]																									
30																										
31	Opposite Ear																									
32		125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	750 Hz	800 Hz	1 kHz	1.25 kHz	1.5 kHz	1.6 kHz	2 kHz	2.5 kHz	3 kHz	3.15 kHz	4 kHz	5 kHz	6 kHz	6.3 kHz	8 kHz	10 kHz	
34	Uncomfortably Loud [50]																									
35	Very Loud [45]																									
36	Loud [40]																									
37	Loud [35]																									
38	Medium [30]																									
39	Medium [25]																									
40	Soft [20]																									
41	Soft [15]																									
42	Very Soft [10]																									
43	Very Soft [5]																									
44	Not Heard [0]																									

The data rows (row 9 through 44 in the preceding screen shot) will be repeated for each loudness scaling measurement with different measurement settings. If there are multiple measurements with the same measurement settings, only the latest measurement is included.

Use the *Reference Count* and *Offset between measurements* values to iterate through all available measurements and find the type of measurement that suits your needs.

5.5 Applied Values worksheet [data from OTOSuite]

The *Applied Values* worksheet contains information on the applied REUG and RECD as selected in the **Fitting Details** dialog. (These values can be measured or predicted by any target rule with that capability.)

The overall RMS level and the spectrum of the presented signal (the absolute SPL values measured at the reference microphone) are also available.

The spectrum for broadband signals is the Long Term Average Speech Spectrum (LTASS) for the presented signal. The overall RMS level for broadband is also calculated using the LTASS curve, and is displayed in the *Signal Level* field.

The spectrum for Tone Sweep is a peak spectrum. During a measurement, the tones are presented one by one and the level in the spectrum is the level at which the tones are presented. The overall RMS level will correspond to the level for each tone.

	A	B	C	D	E	F	G	H	I	
2	All information in this sheet is information from the OTOSuite									
3	Note: Not all cells need to have a defined value. If the cell value is not defined this must be indicated									
4										
5	Signal Level									
6	Signal Type									
7										
8										
9										
10										
11										
12		125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	7
13	Signal Spectrum									
14	Applied REUG									
15	Applied RECD									
16										

5.6 Target Curve worksheet [data to OTOSuite]

The *Target Curve* worksheet is the place where OTOSuite reads the target curves from a single calculation.

You must fill in each cell of the supported targets with formulas or references to cells with formulas to provide the corresponding values. Set the *Can Calculate...* properties accordingly in the *Target Rule Properties* worksheet.

You do not need to calculate all values. The points that you do not want to calculate can contain the value for *UndefinedValue* that you have specified in the *Target Rule Properties* worksheet. OTOSuite will interpolate undefined points to fill an entire curve in 3rd octave resolution (21 points). Therefore, you might choose to only calculate points on audiometric frequencies.

	A	B	C	D	E	F	G	H	I	
1	The "Target Curve Result" on this sheet should contain the resulting target curve.									
2	The values are read by the OTOSuite and used as the target curve.									
3	Note: Not all cells need to have a defined value. If the cell value is not defined this must be indicated									
4										
5										
6		125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	7
7	REIG Target Curve Result									
8	REAG Target Curve Result									
9	REAR Target Curve Result									
10										

If you leave a cell empty, this point will not be extrapolated and will not be shown in OTOSuite. You can use this if you want a curve that does not cover the full frequency range.

5.7 Predicted Values worksheet [data to OTOSuite]

The *Predicted Values* worksheet can be used to predict average REUG and RECD values for OTOSuite. If you have set the *Can Predict REUG* and *Can Predict RECD* properties in the *Target Rule Properties* worksheet, you must provide predicted values, preferably age dependent. All target rules can then use the predicted values from this Custom Target rule.

	A	B	C	D	E	F	G	H	I	
1	If the target rule supports "Predicted REUG "(refer to the "Target Rules Properties" sheet), the "Pre									
2	If the target rule supports "Predicted RECD "(refer to the "Target Rules Properties" sheet), the "Pre									
3	Note: Not all cells needs to have a defined value. If the cell value is not defined this must be indic									
4	Do not use these values within this workbook. Use the values supplied by OTOsuite in the <i>Applied</i>									
5										
6		125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	7
7	Predicted REUG Result									
8	Predicted RECD Result									
9										

You do not need to calculate all values. The values that you do not want to calculate must contain the value for UndefinedValue that you specified in the *Target Rule Propererities* worksheet. Undefined values will be interpolated by OTOsuite.

Note • The predicted RECD is only RECD for verification. The RECD for assessment will be predicted by DSL5 in all cases when using the Custom Target rule.

5.8 Calc1 worksheet

In the *Calc1* and *Calc2* worksheets you can place any intermediate calculations of your choice.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	Place intermediate calculations here															
2																
3	Fitting Mode = RealEar															
4																
5	REIG Target Curve Result															
6	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	750 Hz	800 Hz	1 kHz	1.25 kHz	1.5 kHz	1.6 kHz	2 kHz	2.5 kHz
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8																
9																
10																
11	This half gain rule calculates the insertion gain as the hearing loss for each frequency divided by 2.															

You can use any formula available in the version of Excel you want to use for your calculations.

Refer to the Custom target rule sample.OTOTargetCalc.xls for specific examples of calculations and references. (See [Using a custom target rule in OTOsuite](#) ► 5.)

6 Creating multiple custom target rules

You can set up more than one custom target rule. You use a different Excel file for each target rule. The *Target Rule Name* is included in the list of target rules in the **Fitting Details** dialog in OTOsuite.

If more than one workbook contains the same name in the *Target Rule Name* field, then the rule with the highest *Target Rule Version* will be used.

7 Workflow in OTOsuite

When you have selected the name of your custom target rule in the **Target Rule** field and you make a measurement or change the fitting details or the audiogram, then OTOsuite will call the workbook a number of times for each target needed (REIG, REAG, REAR, Predicted REUG or Predicted RECD), and for one ear at a time.

On each call, the data, fitting details and measurement settings (e.g. Signal Level and Used REUG) will be copied to the workbook according to the desired target.

Below is a description of a typical workflow to illustrate how OTOsuite applies the custom target rule.

1. Create or load an audiogram.
2. Open PMM in OTOsuite and open the **Fitting Details** dialog from the **Measurement** menu or with F10.
3. In the **Target Rule** field, select the name of the custom target rule (only visible if there is a valid Excel workbook in the right location).
4. Select the **Applied REUG** and **Applied RECD** (for verification). The selected REUG/RECD will be supplied to the workbook upon calculation. This means that you can choose to let DSL or NAL provide the predicted REUG and RECD for your workbook. If your workbook supports Predicted REUG and/or Predicted RECD, then **Predicted (Custom)** will be the default choice. This means that your workbook will get its own predicted values from OTOsuite. (OTOsuite will retrieve the values from the *Predicted Values* worksheet and then feed the values to the *Applied Values* worksheet.)

Note • *This is the way to use your own data. Do not reference your own predicted values directly in the workbook.*

5. When you start a measurement from the control panel, the target curve will be calculated. This is done in the following sequence:
 - A. OTOsuite writes current audiogram data, fitting details and measurement settings to the workbook. The measurement settings include the signal type and signal level that have been set up for the measurement button you pressed.
 - B. OTOsuite makes the workbook calculate all cells in all worksheets.
 - C. OTOsuite reads the target curves provided by the workbook (according to the CanPredictREIG, CanPredictREAG, CanPredictREAR properties on the *Target Rule Properties* worksheet)
 - D. OTOsuite calculates the remaining target curves not provided by the workbook (e.g. $REIG = REAG - REUG$, $REAG = REIG + REUG$ and $REAR = REAG + \text{signal spectrum}$)

When you mouse over a measurement button, or if you have selected the Preview Target Curves overlay, the steps above will also be executed.

6. The HL/SPL conversion in OTOsuite will use the Applied REUG and Applied RECD selected in the Fitting Details. This means that whatever target rule you have selected, the workbook can be asked to supply Predicted REUG, but not the predicted RECD for Assessment because this value is not supported by custom target rules in OTOsuite (the workbook can only supply RECD for verification).

8 Debugging your custom target rule

If you have created a custom target rule that does not behave as expected, you can use the **Save target rule state** button in the **Fitting Details** dialog to take a snapshot of the MyTargetRule.OTOTargetCalc.xls file.

The snapshot will be saved in the root folder of your C-drive. In the snapshot, you can see all values that OTOSuite made available for the latest calculation of the custom target curves.

Calculating results

The Custom Target Rule workbook is set up for manual calculation. When OTOSuite sends data to the workbook, OTOSuite controls when calculations are triggered. This avoids redundant calculations and ensures the best performance.

If you would like to see the result of changes that you make in the workbook during debugging, you must activate the "Calculate Now" function manually. Do not change the calculation options for the workbook.