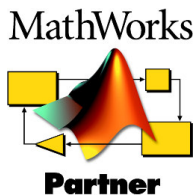


Embedding Documentation In Simulink® Models for Auto-Generating Reports and Specifications

Product Specification

(For MATLAB R14- R2009b - Report Generator V2 Components)

The screenshot shows a web browser window displaying a report titled "@Source Model Report - The Formative Years". The browser's address bar shows the URL "http://www.podiumtechnology.com/SourceModelReport/". The report content is organized into a "Table of Contents" on the left and a main section titled "1.2. Control System" on the right. The "Table of Contents" lists sections such as "1. Documentation Test Model", "2. Appendices", and "2.5. Variable Summary". The "List of Tables" includes "1-1. MDocTestSimple - Sig", "1-2. System Information St", "1-3. Unit Information", "1-4. Processor Information", "1-5. Application Information", "1-6. Maps - Signals Writer", "1-7. Maps - Configurable P", "1-8. Task Information", "1-9. Sub Section - Signals", and "1-10. Sub Section - Config". The main section "1.2. Control System" contains a diagram titled "Figure 1-11. Ctrl". The diagram is a Simulink block diagram showing a control loop. It includes blocks for "Control Task (Ctrl)", "Steady State Error", "Steady State Error 1", "Gain1", "Control Loop Excluded", and "Control Loop Excluded". The diagram is annotated with various parameters and signals, including "Task Information", "Section: All Control System", "Online Customization: Control System", "Signal: Error", "Signal: Error 1", "Signal: Error 2", "Signal: Error 3", "Signal: Error 4", "Signal: Error 5", "Signal: Error 6", "Signal: Error 7", "Signal: Error 8", "Signal: Error 9", "Signal: Error 10", "Signal: Error 11", "Signal: Error 12", "Signal: Error 13", "Signal: Error 14", "Signal: Error 15", "Signal: Error 16", "Signal: Error 17", "Signal: Error 18", "Signal: Error 19", "Signal: Error 20", "Signal: Error 21", "Signal: Error 22", "Signal: Error 23", "Signal: Error 24", "Signal: Error 25", "Signal: Error 26", "Signal: Error 27", "Signal: Error 28", "Signal: Error 29", "Signal: Error 30", "Signal: Error 31", "Signal: Error 32", "Signal: Error 33", "Signal: Error 34", "Signal: Error 35", "Signal: Error 36", "Signal: Error 37", "Signal: Error 38", "Signal: Error 39", "Signal: Error 40", "Signal: Error 41", "Signal: Error 42", "Signal: Error 43", "Signal: Error 44", "Signal: Error 45", "Signal: Error 46", "Signal: Error 47", "Signal: Error 48", "Signal: Error 49", "Signal: Error 50". The diagram is annotated with various parameters and signals, including "Task Information", "Section: All Control System", "Online Customization: Control System", "Signal: Error", "Signal: Error 1", "Signal: Error 2", "Signal: Error 3", "Signal: Error 4", "Signal: Error 5", "Signal: Error 6", "Signal: Error 7", "Signal: Error 8", "Signal: Error 9", "Signal: Error 10", "Signal: Error 11", "Signal: Error 12", "Signal: Error 13", "Signal: Error 14", "Signal: Error 15", "Signal: Error 16", "Signal: Error 17", "Signal: Error 18", "Signal: Error 19", "Signal: Error 20", "Signal: Error 21", "Signal: Error 22", "Signal: Error 23", "Signal: Error 24", "Signal: Error 25", "Signal: Error 26", "Signal: Error 27", "Signal: Error 28", "Signal: Error 29", "Signal: Error 30", "Signal: Error 31", "Signal: Error 32", "Signal: Error 33", "Signal: Error 34", "Signal: Error 35", "Signal: Error 36", "Signal: Error 37", "Signal: Error 38", "Signal: Error 39", "Signal: Error 40", "Signal: Error 41", "Signal: Error 42", "Signal: Error 43", "Signal: Error 44", "Signal: Error 45", "Signal: Error 46", "Signal: Error 47", "Signal: Error 48", "Signal: Error 49", "Signal: Error 50". The diagram is annotated with various parameters and signals, including "Task Information", "Section: All Control System", "Online Customization: Control System", "Signal: Error", "Signal: Error 1", "Signal: Error 2", "Signal: Error 3", "Signal: Error 4", "Signal: Error 5", "Signal: Error 6", "Signal: Error 7", "Signal: Error 8", "Signal: Error 9", "Signal: Error 10", "Signal: Error 11", "Signal: Error 12", "Signal: Error 13", "Signal: Error 14", "Signal: Error 15", "Signal: Error 16", "Signal: Error 17", "Signal: Error 18", "Signal: Error 19", "Signal: Error 20", "Signal: Error 21", "Signal: Error 22", "Signal: Error 23", "Signal: Error 24", "Signal: Error 25", "Signal: Error 26", "Signal: Error 27", "Signal: Error 28", "Signal: Error 29", "Signal: Error 30", "Signal: Error 31", "Signal: Error 32", "Signal: Error 33", "Signal: Error 34", "Signal: Error 35", "Signal: Error 36", "Signal: Error 37", "Signal: Error 38", "Signal: Error 39", "Signal: Error 40", "Signal: Error 41", "Signal: Error 42", "Signal: Error 43", "Signal: Error 44", "Signal: Error 45", "Signal: Error 46", "Signal: Error 47", "Signal: Error 48", "Signal: Error 49", "Signal: Error 50".



Overview

Doc@Source extends the capabilities of the standard MATLAB and Simulink® Report Generators by adding several new report components and a block library.

The result is an ability to produce reports and documents that look better and are more readable to the target audience. Through the use of different report templates and tags with the embedded documentation, it is possible to produce different reports for several audiences from one model.

Doc@Source is therefore of benefit to anyone producing Simulink models to:

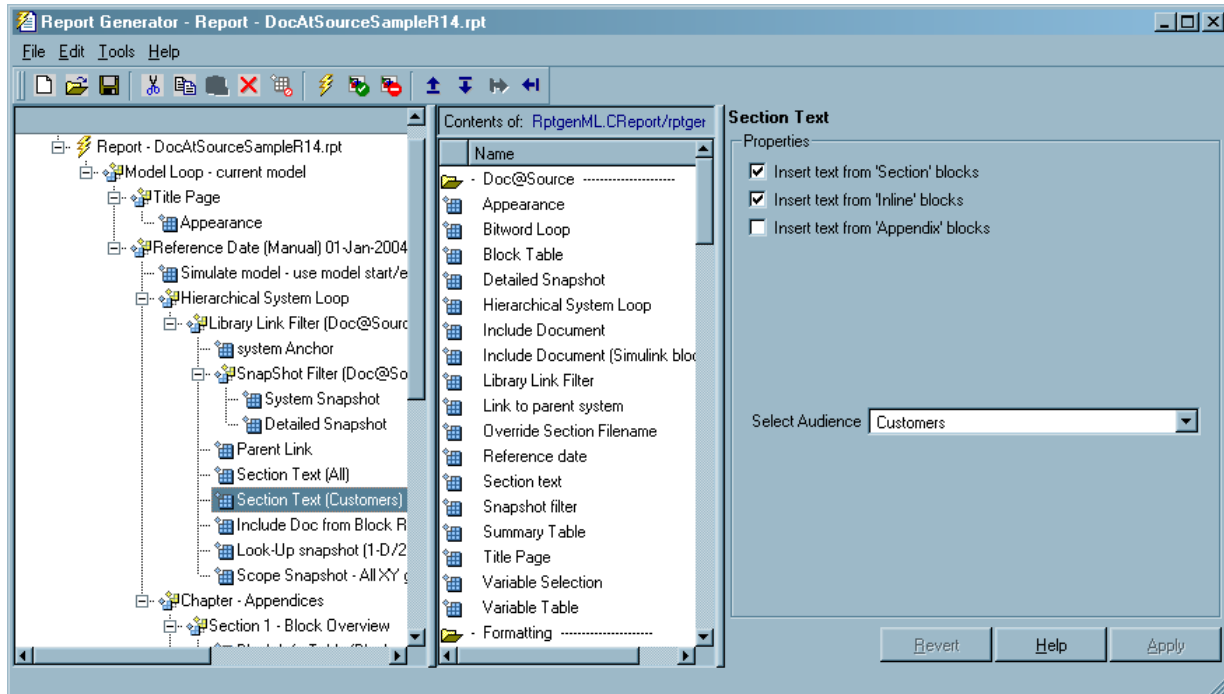
- Document models for their own memory aid.
- Augment models with explanatory text to aid the reading of the block diagrams.
- Encapsulate ALL the information required to make the Simulink model the complete specification of the system that it should be. This is ideal for passing a definitive executable specification to suppliers, customers or other in-house departments.

As with all reports produced with the MATLAB/Simulink Report Generator, the report output can be in a variety of formats such as HTML or RTF (MS-Word).

Podium Technology have worked closely with the developers of The MathWorks V2 Report Generator, during their development phase, in order to offer **Doc@Source** with components that really matter.

Report Generator Components

Version 2 Report Generator offers a new user interface through the Report Generator Explorer:



Doc@Source is fully integrated with scheme, allowing its components to be mixed and matched with those from The MathWorks

The Report Generator components that are included with **Doc@Source** are:

- **Hierarchical Model Loop:** Loops the model reflecting the model structure, rather than just a flat system list provided by the standard component from The MathWorks.
- **Document Include:** Two components are provided to enable external documents to be referenced from the generated document. One enables the document to be entered in explorer properties; the other will use a block placed in the Simulink model to get the document name.
- **Scalar Vector Graphic Snapshot (Simulink and Stateflow):** Produces an SVG snapshot of a system, chart or state. When viewed in a browser, the diagram maintains its hyperlink capabilities as well as being capable of zooming in/out and panning. This is particularly useful for large systems and charts that cannot show all their detail in a single screen.
- **Detailed Snapshot:** When generating an HTML report with bit-map system views, large systems can be *grainy* due to the compression. In this situation a link can be put below the snapshot to a high-definition PDF document that has not lost any of the original detail.

- **Title Page:** Enables the information for the report title page to be taken from a block in the Simulink model, this removes the need to keep a separate template for each model.
- **Appearance:** Enables style sheets to be selected and the information to put in headers, footers and company logos.
- **Section Text:** Formatted text can be saved with and edited from the model through one of the blocks in the block library (see below). As well as the formatted text, these blocks can be a tag for the next section (e.g. 2, 2.1.2 etc.) and have an *audience* attribute so that the text can be selectively included.
- **Library Filter:** When looping through the model, it is possible to specify a list of libraries that should not be looped into (typically you would loop into strategy libraries but not component libraries).
- **Reference Date:** This enables a *last release date* to be established, either determined from the template, model or MATLAB script. The section text and any other blocks can use this date to determine whether they have changed since the last release. The section text will be highlighted to indicate that it has changed since the reference date.
- **Parent Link:** When navigating the (HTML) document, the *Parent Link* enables the model to be navigated up as well as down.
- **Snapshot Filter:** This component can be used to select systems that should not have a picture in the document - established by a *No Snapshot* block being in the system.
- **Block Table:** Produces a summary table of all blocks, detailing all the parameter objects used and any signal objects feeding it or being written by it:

Full Block Path	Inputs	Outputs	Parameters	Modified	Parent Link
DocAtSourceTest/In1		Signal In			DocAtSourceTest
DocAtSourceTest/HTML Documentation				30-Aug-2004 17:02:03	DocAtSourceTest
DocAtSourceTest/Output/In1		Signal Out			Output
DocAtSourceTest/Output/HTML Documentation				22-Jan-2004 16:48:59	Output
DocAtSourceTest/Output/Output Signal	Signal Out				Output
DocAtSourceTest/Processing/Extra Depth/Gain			Gain Description		Extra Depth
DocAtSourceTest/Processing/Extra Depth/Sum	Map Interp Out; Table Lookup Out	Sumation Out			Extra Depth
DocAtSourceTest/Processing/Extra Depth/myMap Lookup		Map Interp Out	2D Map Description; X Axis Description; Y Axis Description		Extra Depth
DocAtSourceTest/Processing/Extra Depth/myTable Look-Up		Table Lookup Out	1D Map Description; X Axis Description		Extra Depth
DocAtSourceTest/Processing/Extra Depth/Out1	Sumation Out				Extra Depth
DocAtSourceTest/Processing/HTML Documentation				22-Jan-2004 16:48:28	Processing
DocAtSourceTest/Test Signals	Signal In				DocAtSourceTest
DocAtSourceTest/Test Signals/HTML Documentation				22-Jan-2004 16:47:20	Test Signals

- **Summary Table:** Produces a table that summarises the properties of a particular block type:

Table 2.2. DocAtSourceTest - Doc Include Summary

Block Name	Modified	File to include	Link Text
Include Doc		PT-Example.pdf	Link To Another Document
Include Other Doc		PT-Example.pdf	Link To Another Document

- **Variable Table:** Produces a table of various variable (combination of signal and parameter) properties. The table can summarise a number of variables in one table or produce one table per variable:

Table 2.3. DocAtSourceTest/Output/HTML Documentation - Variable Properties

Name	Description	Min/Max	Model Units
Gain Description	Gain Description	[-100 100]	mm/s
2D Map Description	2D Map Description	[-200 200]	s
1D Map Description	1D Map Description	[-Inf Inf]	%
X Axis Description	X Axis Description	[-20 20]	mm
Y Axis Description	Y Axis Description	[-10 10]	mm

Table 2.4. Gain Description - Variable Properties

Property	Value
Name	Gain Description
Description	Gain Description
Value (Display)	2.5
Dimensions	[1 1]
Class	Simulink.Parameter
Value (Model)	2.5
Minimum	-100
Maximum	100

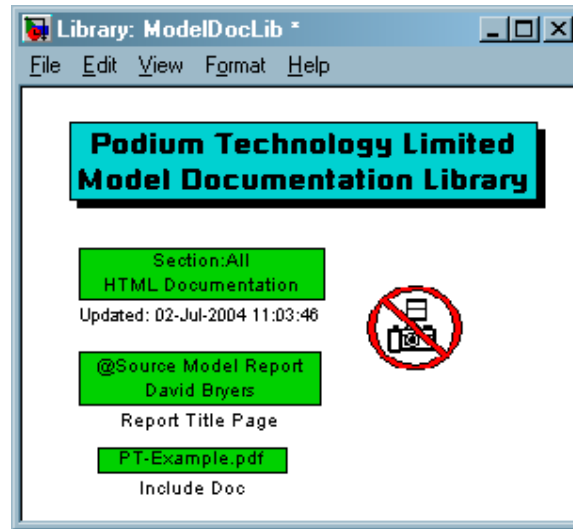
- **Variable Selection:** In order to tabulate the right variables, this component allows you to select them based on some core properties (parameter, signal, scalar, vector etc.)
- **Bitword Loop:** So that bits of a bitword can be brought together, this component collates them in bit order and passes them on to the variable table component:

Table 2.47. CarStatus - Variable Properties

Member	Bit N°	N° Bits	Description	Additional Info	Enum Values
All			Car Status	CarStatus <i>additional information.</i> This bitword has: <ul style="list-style-type: none">• Lots of lovely bits• All with colourful additional info	N/A
ChasStat	01	4	Chassis Status	Chassis summary status of ALL chassis control systems.	0:Good, 1:Not Good, 2:Bad, 3:Very Bad
EngStat	05	4	Engine Status	Engine summary status of ALL engine control systems.	0:Good, 1:Not Good, 2:Bad, 3:Very Bad

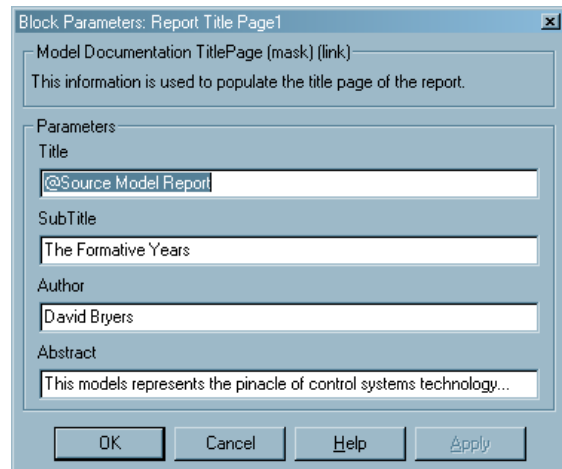
- **Section/File Name Override:** In the situation where the contents of a section have to go in a specific file (e.g. because they are being referenced by an external programme), this component allows this to occur.

Block Library

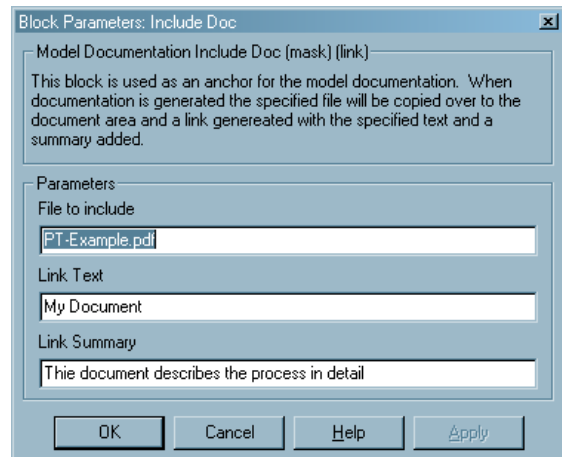


Doc@Source provides four blocks in its block library:

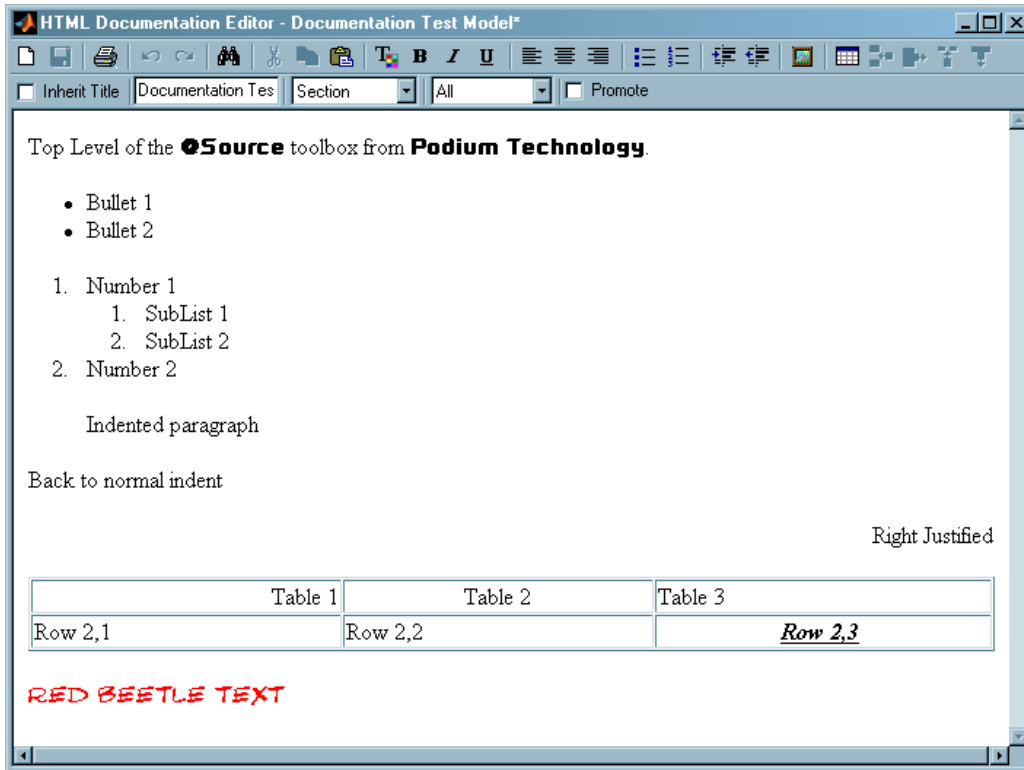
- **Section Text:** This block holds formatted text, double clicking on the block opens up an HTML editor (see below).
- **Report Title Page:** This block can be placed in the model to define details for the title page. This further enables one template to be used with many models.



- **Include Doc:** This block enables other documents to be linked in with the automatically generated document. External documents are copied to the report directory to ensure that everything is encapsulated in one place.
- **No Snapshot:** Certain systems may not need their 'picture' in the final document, placing this block in a system ensures it is not.



The core of the documentation tool hinges around the *Section Text* block. This block contains a number of properties that are defined in the HTML editor that opens up when the block is clicked on:



The properties that can be defined in the above window are:

- Location: Where the text should be inserted in the document, this can either be:
 - Section: A new section is made (e.g. section 1.2.5) and the text is placed at the beginning of the section.
 - Inline: The section is placed in the document without adding any new sections.
 - Appendix: The text is saved for insertion in the appendices.
- Audience: Which audiences should see the text. The user can create their own audiences; these may be *All*, *Developer*, *Customer* or *Application Engineer*, for example. Typically a different report template would be generated for each audience in order to present the information that is of interest to them.
- Section Title: Where a new section is being tagged, the section title text can be defined.
- Section Text: This is formatted text to be inserted into the generated document.

Examples of Document Output

Some examples of how the report layout can be presented are shown here. All the attributes of font, justification, colours etc. can be defined through your own style sheets, for which examples are provided. The full document can be seen on our web site at:

<http://www.podiumtechnology.co.uk/DocWeb/index.html>

Below is an example of the title page; the information for the title, sub-title and abstract come from a block in the model, the other information (company related) is defined in the report template. The example shows the report in HTML format and is in a *four-frame* window (no frames and two frames are alternatives). The contents are kept in the left frame for rapid navigation.

@Source Model Report
The Formative Years

@Source Model Report
The Formative Years

05-Jul-2004

Podium Technology

David Bryers

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This models represents the pinnacle of control systems technology...

Proprietary and Confidential

[Next](#)
Documentation Test Model

The content of this document is proprietary and confidential.

Podium Technology

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The screenshot below has the following notable features:

- The system snapshot has hyperlinked areas, therefore clicking on a block will take you to tables giving information for that block, clicking on sub systems will navigate you to that system.
- The *Parent* link navigates back up the model.
- The *Detailed Snapshot* links to a PDF version of the system to combat any loss of detail in the bitmap image.
- The text comes from the green *Section Text* blocks, the background is yellow to highlight that this text has been modified since the last reference date. A section *1.2 Control System* has been created because the block is tagged as a section node.

1.2. Control System

Figure 1-11. Ctrl

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- Ctrl - Configurable F
- Task Information
- System Information §
- Unit Information
- Processor Informatio
- Application Informati
- Task Information
- Event Summary
- Message Process S
- Initialisafion Functio

Detailed Snapshot

Parent: MDocTestSimple/AUTO/Rate Tasks

This subsystem shows how a control system may be put together, it demonstrates the use of:

- Configurable constants
- Configurable vector scaled as an enumerated type
- Configurable gain

The content of this document is proprietary and confidential.

Podium Technology

Developing Report Generator Objects for 3rd Party Tools

Doc@Source has been designed specifically to integrate with your own or third party Simulink library. The interface is achieved through an interface classes, a parent/super-classes are provided for the interface to inherit some or all of its functionality. In fact, the minimum required to integrate libraries with Doc@Source is an XML file that informs Doc@Source that the library exists and to use the parent class as the interface.

The basic functionality in the parent classes allow you to:

- Use the summary table to summarise blocks of the same (mask) type.
- Tabulate core properties of parameter objects (i.e. those provided in the Simulink.Parameter object)
- Tabulate core properties of signal objects (i.e. those provided in the Simulink.Signal object)
- Tabulate a block summary detail input signals, output signals and parameters.

You would need to write your own interface class when:

- You want to tabulate derived data from blocks.
- Display properties from your own Simulink.Parameter/Signal objects.
- Provide your own methods for deriving the input signals, output signals and block parameters.

An interface class has been used to interface @Source (also from Podium Technology). An example of a property table with the additional properties provided by the AtSource.Signal object are provided below (showing 16 of the available 40 properties):

Property	Value
Name[Member]	Map3D_Modeln
Description	3D Map Input Mode
Data Type	uint32
Quantity	UserType
Units	
Model Units	
Gain	1
Offset	0
Menu Group	\Mapsn
Init String	1
Value	Map1
Enum Values	1:Map1, 2:Map2
Memory Location	Configurables
Dimensions	1 1
Used By Blocks	MDocTestSimple/AUTQ/Rate_Tasks/Maps/Map3D_Modeln
Used In Systems	MDocTestSimple/AUTQ/Rate_Tasks/Maps

An example of an @Source message send block being summarised:

Message Command	Help Text	Identifier	Number of Parameters to receive	Parameter Data Type	Response Format String
Dump	Dump application information	99	10	ptfloat	DumpResp %.0f\n\r
Plump	Plump application information	100	2	ptfloat	DumpResp %.0f\n\r

An example report can be seen at: <http://www.podiumtechnology.co.uk/AsDocWeb/index.html>.

Documentation and examples are provided to make the implementation of these classes as simple as possible.

Can Doc@Source be configured to my specific needs?

Podium Technology has a policy of continually improving its products, should your requirement fall in the bracket of a *general enhancement*, the changes are usually covered under the maintenance agreement and are free of charge.

Should you require some features specific to your needs, **Podium Technology** can quote for this work and deliver, if necessary, a customer specific version of **Doc@Source**.

System Requirements:

Doc@Source has been tested with MATLAB[®] R14 onwards; MATLAB Report Generator and Simulink Report Generator are required.

Podium Technology is part of The MathWorks Connections Program to ensure that **Doc@Source** is available when new releases are made by The MathWorks.

Related Products:

Podium Technology produces **@Source** from which **Doc@Source** was derived. **@Source** is the ideal tool for generating a hardware target independent model that can be applied to standard or customer target hardware platforms. Signal and parameter properties are stored in the model so that application tool files can be produced in any format (e.g. ASAM-MCD2) and documentation to be produced with the MATLAB/Simulink Report Generator. See our web site or contact us for further information.

Design Service:

Podium Technology can has experience in a wide range of areas, with particular focus on the MATLAB/Simulink, control and embedded arenas:

- ❑ Rapid generation of Real-Time Workshop targets for customer hardware platforms using **@Source**.
- ❑ Hardware specific block sets for Simulink and Real-Time Workshop.
- ❑ Developing control systems in 'C' or Simulink.
- ❑ MATLAB/Simulink Report Generator component generation.
- ❑ Porting legacy models to **@Source**.

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