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PBA.pro Designer Getting Started

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1 The PBA.pro Designer Component

The Designer component supports creation of user defined dialogs, using a basic set of user interface elements as well as PBA.pro resource and Script component elements.

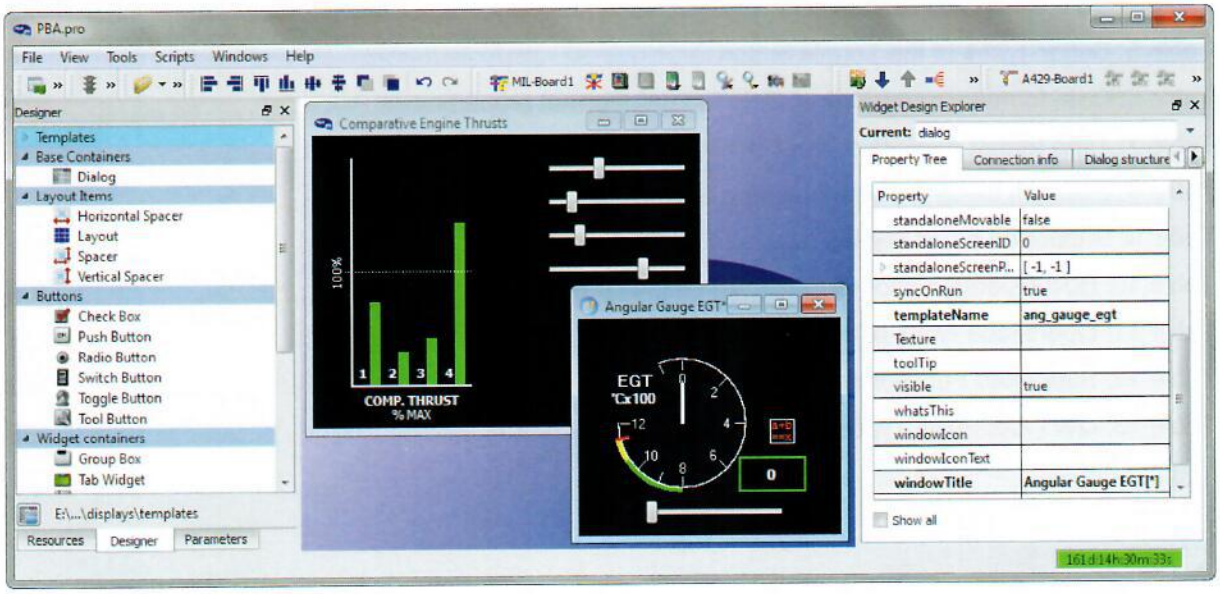


Figure 1: Designer general overview

1.1 General

1.1.1 Connection principles

The Designer functionality is based on a so called 'Signal – Slot' connection mechanism and on a 'Property' connection mechanism.

The "Signal - Slot" connection mechanism can be understood as a definition where a "Signal" (a kind of Event) of a PBA.pro object invokes a "Slot" (a kind of Function or Event Handler) of another or the same PBA.pro object. Note that the signals and slots mechanism is type safe: The signature of a signal must match the signature of the receiving slot. (In fact a slot may have a shorter signature than the signal it receives because it can ignore extra arguments.) Signals and slots are loosely coupled: A class which emits a signal neither knows nor cares which slots receive the signal. The signals and slots mechanism ensures that if a signal is connected to a slot, the slot will be called with the signal's parameters at the right time. Signals and slots can take any number of arguments of any type. As the mechanism is only activated if the signal is emitted, no polling on receiver side is needed.

> *Example: A Push Button on a Dialog sends a Signal ("Pressed") if it is pressed by the user. This Signal can be connected to the close slot of a dialog, the Button is placed on. Thus the dialog will be closed if the button is pressed.*

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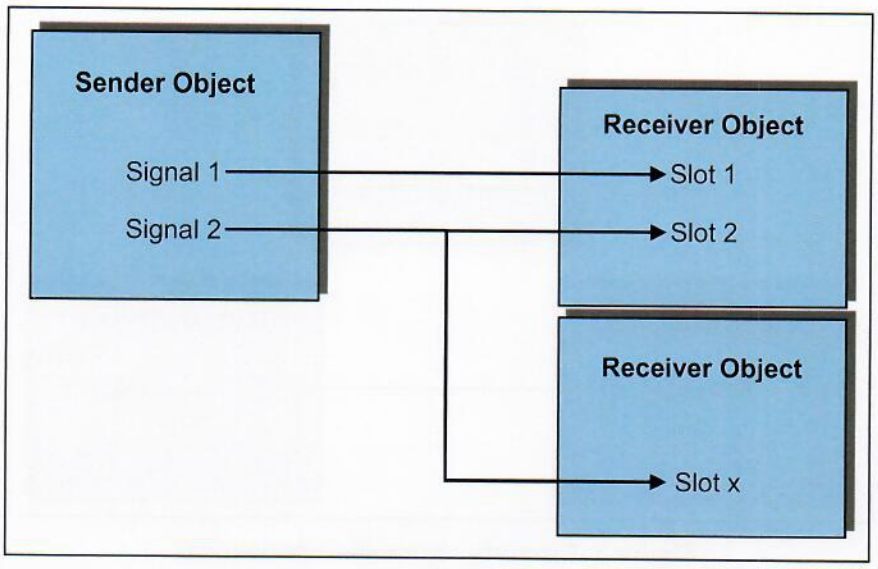


Figure 2: Signal-Slot connection principles

The "Property" connection mechanism is understood as a definition where a "Property" of a PBA.pro object is connected to a "Property" of another or the same PBA.pro object. Furthermore a trigger signal has to activate the synchronisation of the receiver property to the sender property.

Example: A Parameter has a "Property" ValueStr indicating the Engineering Unit String of some raw data. A Dialog hosts a LCD widget, which should be used for visualisation of this value. The LCD owns a "Property" named "value" for displaying a value.

The connection to be defined is between the "ValueStr" property of the Parameter and the "value" property of the LCD. The Trigger is the updated signal of the Parameter.

In comparison to "Signal-Slot" connections, which are already event driven, a "Property" connection requires to be triggered. As trigger any signal of any PBA.pro object e.g. a Timer widget for a cyclic synchronization of the properties or as in the sample the Parameter object itself (event driven synchronization of the properties) can trigger the synchronization.

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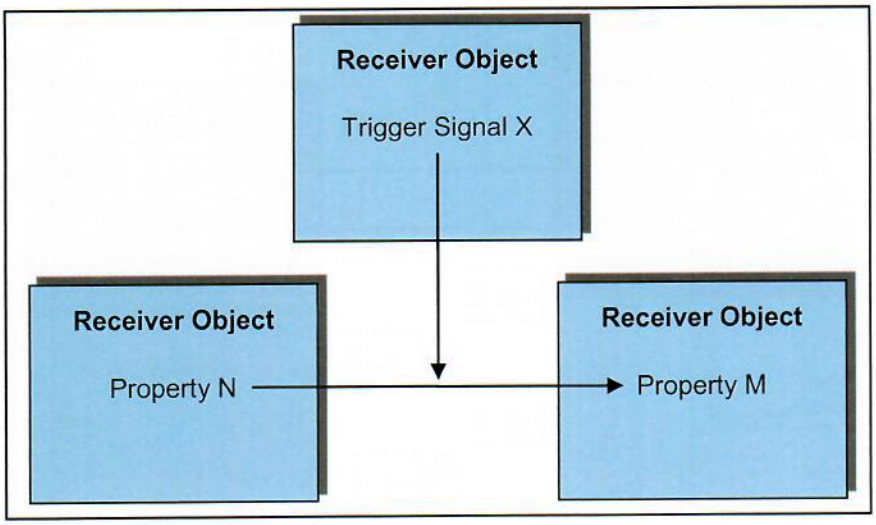


Figure 3: Property connection principles

The following figure shows the principle way, the Designer component works.

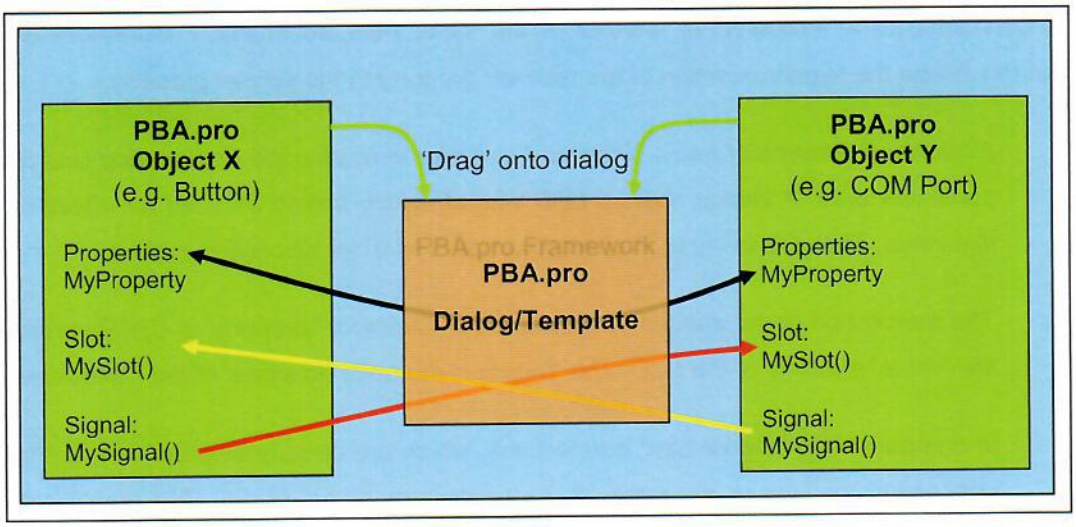


Figure 4: PBA.pro Designer concept

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1.1.2 Design

The Design of a Dialog always starts with a 'Base Container' of 'Dialog' Type, which represents an empty dialog box.

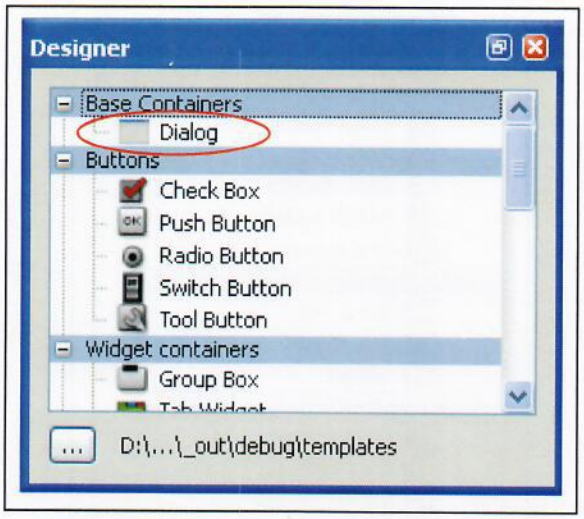


Figure 5: Dialog creation

After its creation a dialog can be populated with user interface controls, taken from the Designer's list of available widgets. On creation of a Dialog, the 'Widget Design Explorer' is automatically shown on the right hand side of the PBA.pro Main Window.

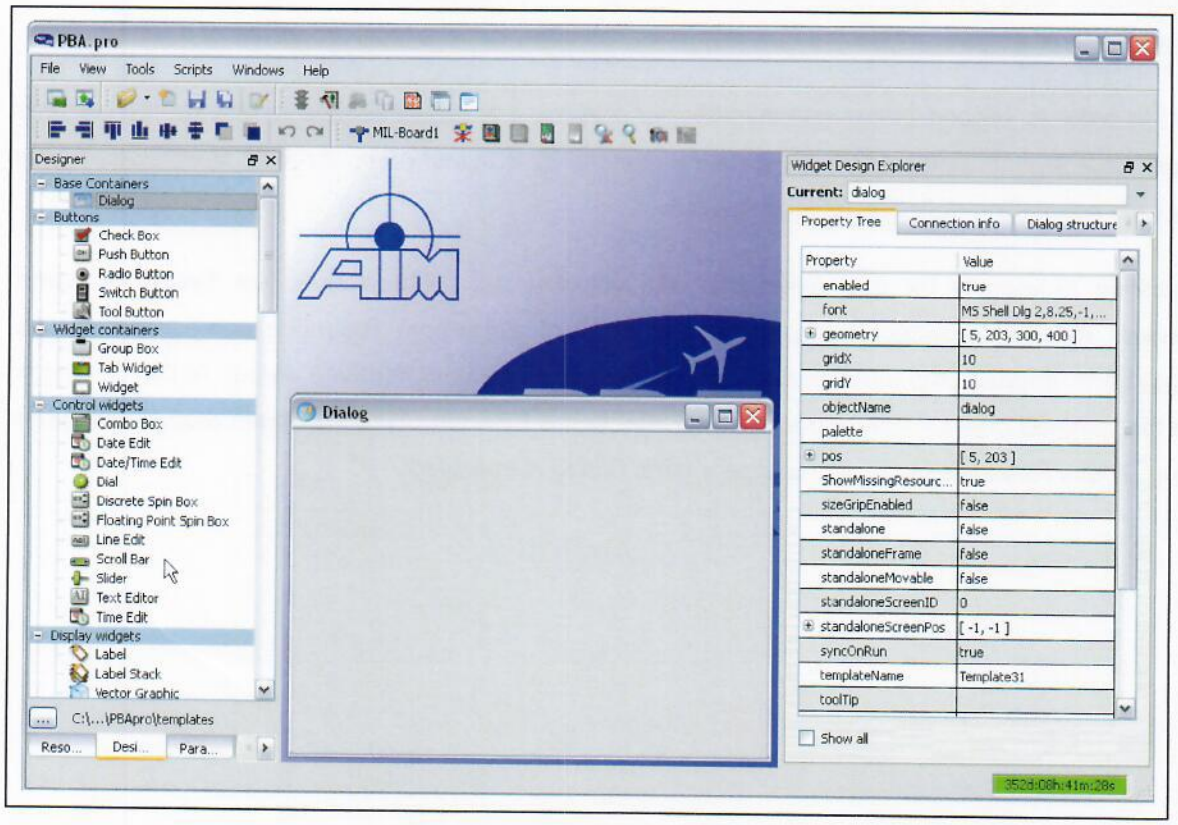


Figure 6: Basic Designer component windows

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The Designer offers per default a set of widgets to be used within Dialogs. A single widget can be moved per drag and drop onto the current Dialog. This list of widgets can be dynamically extended with new widgets without re-compilation of the PBA.pro.

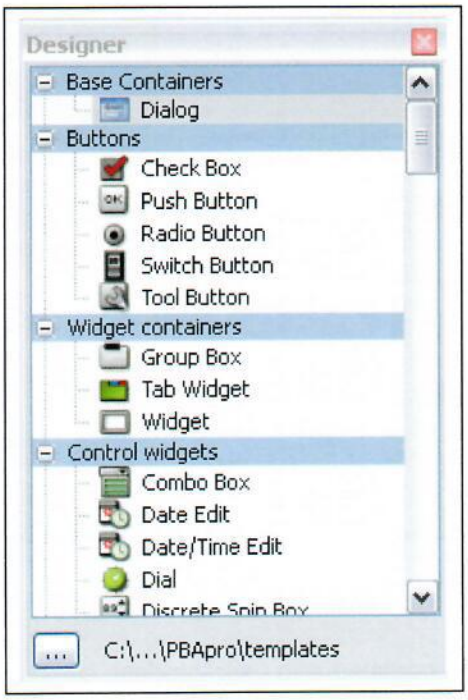


Figure 7: Designer component widget tree

Each widget, which has been placed on the Dialog, can be edited via the Property Tree Tab of the Widget Explorer window, where the Property Tree Tab offers access to all properties of a widget.

Note: In order to support better maintainability of a dialog it is recommended to change the widget's default 'objectName' property via the property explorer to a useful name for later identification. This eases the connection definition later on as well.

In addition to widgets for user interaction and visualisation, utility widgets like Timers or Script executers etc. are provided. Furthermore any node of a PBA.pro Resource component can be dragged and dropped onto a Dialog and can be connected to a user interface widget. At Dialog design time the dragged object's icon appears to indicate, that a PBA.pro object has been dropped onto the Dialog. These Resource icons will disappear if the Dialog is executed.

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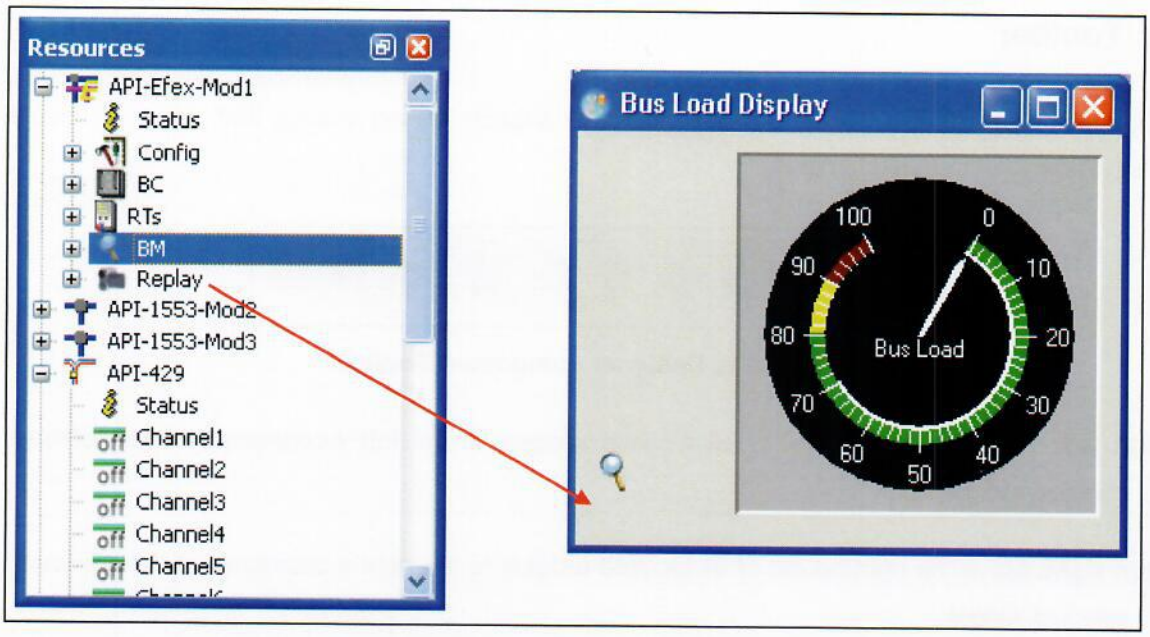


Figure 8: Example: Dragging the 1553 Resource Bus Monitor Object onto a Dialog

Note: All children of the dragged on resource are added as well and can be accessed via the "current" combo box of the widget design explorer. E.g. if the resource node of the 1553 card is dropped on the dialog, all its children are available as shown below.

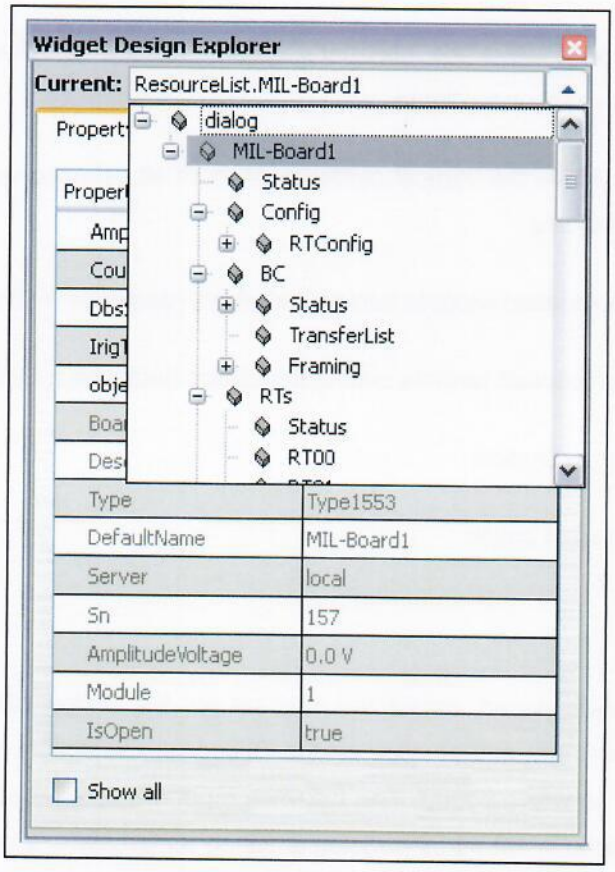


Figure 9: Overview of all available resource Objects

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1.1.3 Toolbar

The Designer also offers a set of tool buttons which support editing dialogs and arranging visual widgets (explanation from left to right):



Figure 10: The Designer component Toolbar

Align left: Move the left border of all focused widgets to the left x-coordinate of the leftmost selected widget

Align right: Move the right border of all focused widgets to the right x-coordinate of the rightmost selected widget

Align top: Move the top border of all focused widgets to the top y-coordinate of the topmost selected widget

Align bottom: Move the bottom border of all focused widgets to the bottom y-coordinate of the bottommost selected widget

Align to horizontal mid: Move the horizontal center position of all selected widgets to the calculated, common mid x-coordinate.

Align to vertical mid: Move the vertical center position of all selected widgets to the calculated, common mid y-coordinate.

Send to back: Send all focused widgets behind the others (decrease z-Order value)

Bring to front: Send all focused widgets behind the others (increase z-Order value)

Undo: Undo/ delete the last action

Redo: Redo/ restore the last action

1.1.4 Templates

Once all widgets have been placed, connected and set up, the Dialog can be saved as a Dialog Template. This is done via right mouse click on the Dialog and selection of the 'Save Template...' menu item of the context sensitive popup. The following input dialog will be used to set the template name. After a template name is set and the dialog is saved as template, a new node in the Designer tree will appear referencing the new saved template:

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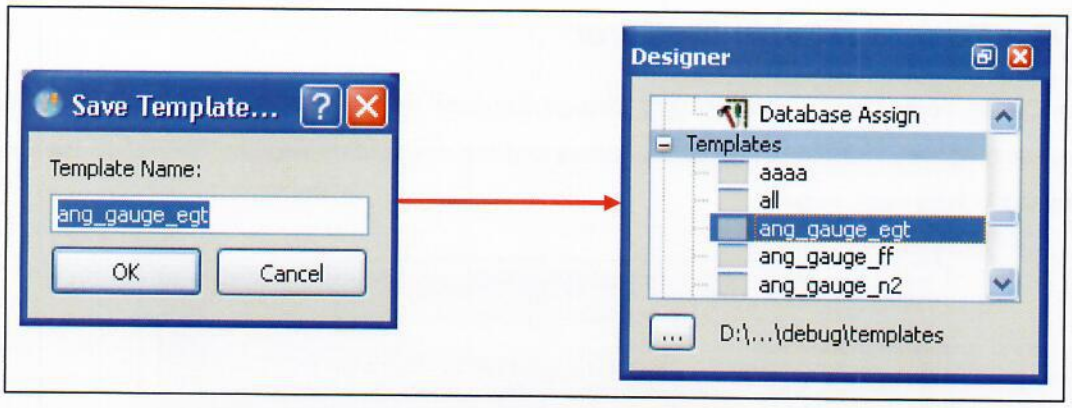


Figure 11: Saving a designed dialog as Template

Templates are available as child nodes of the designers 'Templates' node. While a double click on the corresponding template will invoke the dialog, dragging the Template from the Designer tree into the PBA.pro main window will put the dialog in edit mode again.

If the dialog is in edit mode, the preview option is provided via a right mouse click and is selecting the 'Preview...' menu item of the context sensitive menu. Selection of this menu entry will set the dialog into preview mode, which will establish all connections.

Per default the template directory is a subdirectory of the PBA.pro All Users Directory (called "templates"). The directory can be changed by either clicking on the tool button on the bottom of the designer window or via a right click on the Templates entry node and selection of the menu entry "Set template path..."

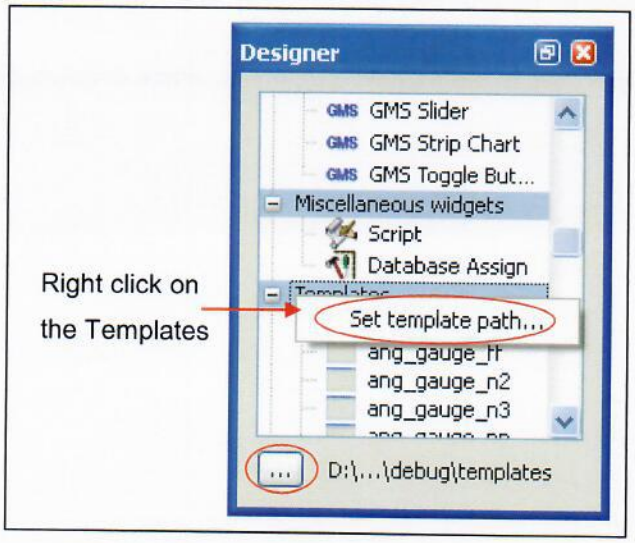


Figure 12: Setting the Template directory

Note: The widget-set directory can be set via right click on the widget-set node as well.

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1.2 The Widget Design Explorer

For the Dialog configuration, the *'Widget Design Explorer'* offers several functionalities to modify, configure and access information about the dialog and the dragged on widgets. Therefore the Explorer is organized in tabs resp. pages:

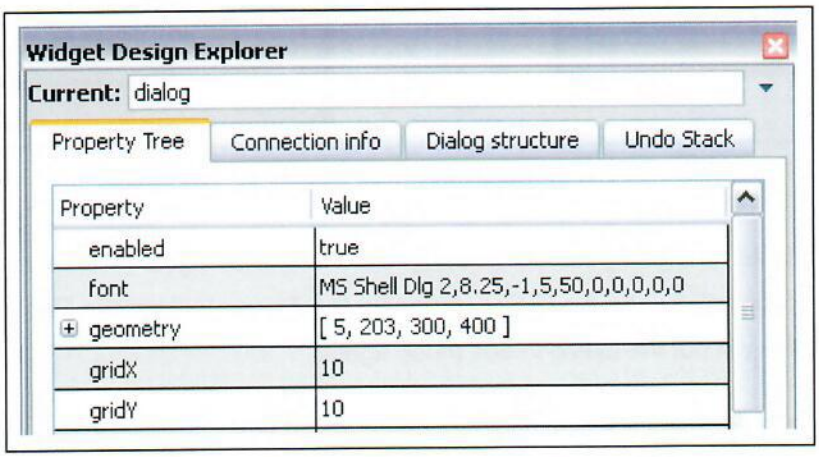


Figure 13: The Widget Design Explorer

1.2.1 Property Tree

Within this tab all properties and the corresponding values of the focused widget(s) are displayed in alphabetical order. Note that the top (in black font displayed) properties are writeable and the bottom (grey) properties are read only. These read only properties are appended to provide the drag and drop property connection functionality for read only properties as well.

This tree provides an easy access to the widgets' properties, where comfortable editors are offered for their modification.

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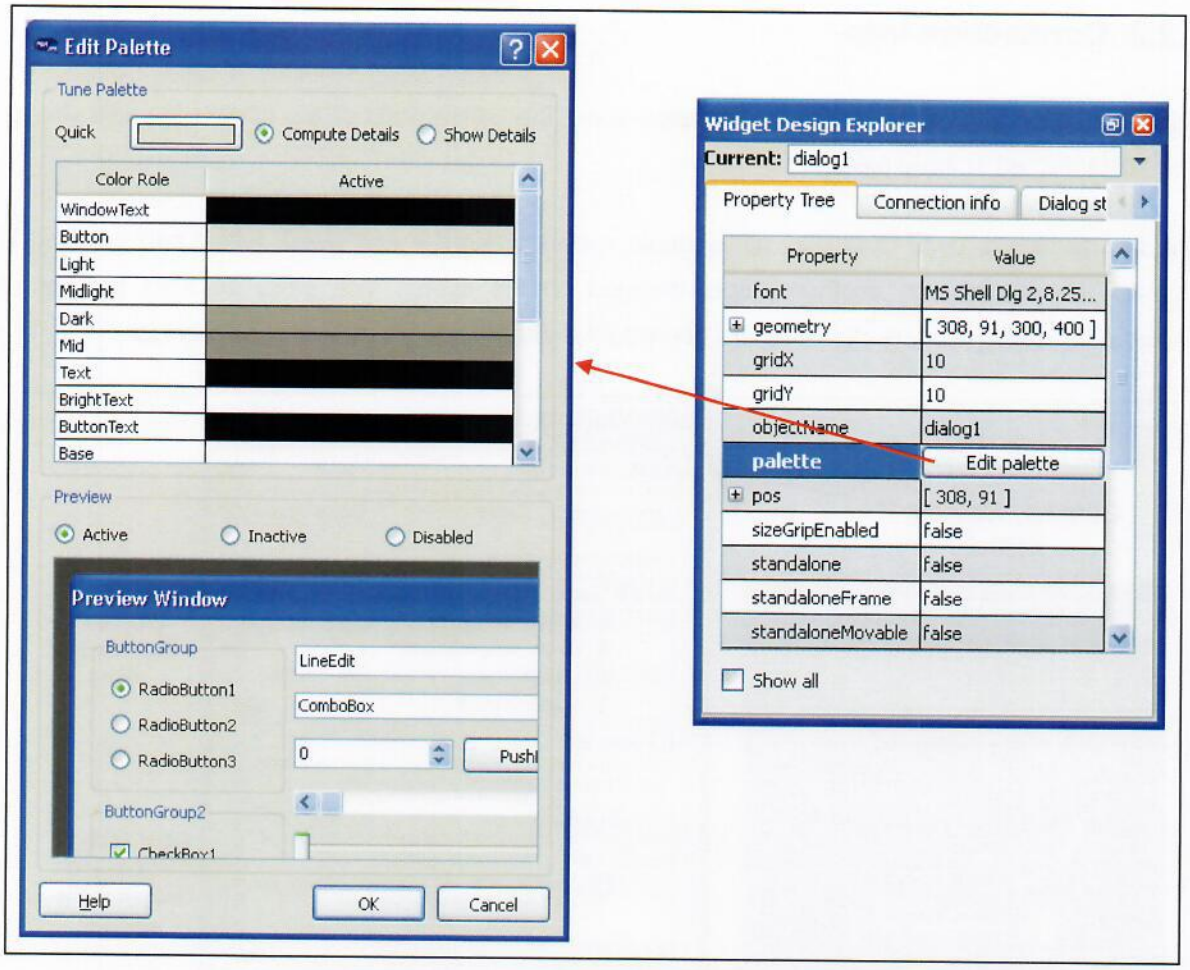


Figure 14: Editing the palette of a widget

If multiple widgets are selected on the dialog, the Property Tree displays all properties, the focused widgets have in common. This enables the user to change the property of all selected widgets at once.

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1.2.2 Connection Info

The Connection info page provides information about the connections of the current focused widget. The tab is divided in three parts.

The first section is used to display all available methods (signals and slots), which can be used to connect the widget with another widget dragged on the dialog. The other sections provide all information about the connections, where the widget is either used as sender or as receiver.

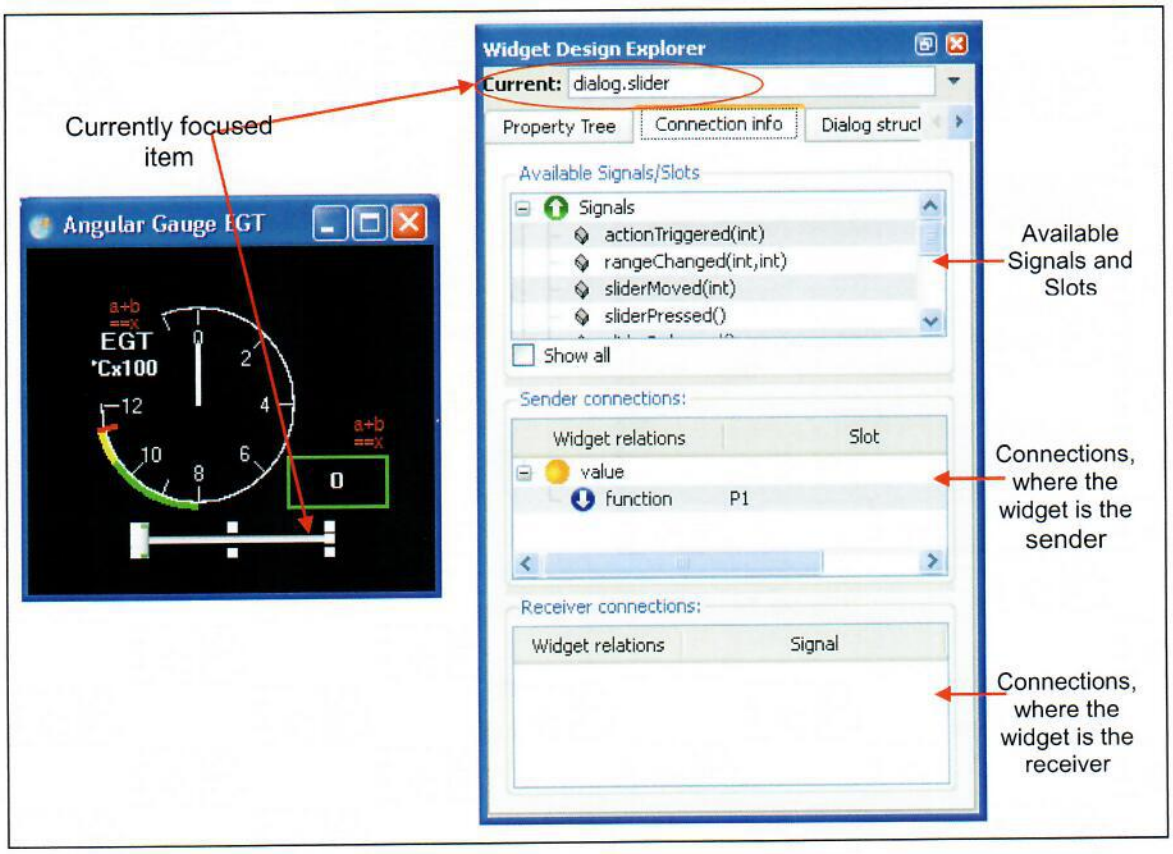


Figure 15: The connection information page

In addition to the provided information of the widgets' methods and connections, the 'Available Signals/ Slots' tree offers an easy and comfortable way to configure a connection for the widget (See Connection configuration section for further information about this feature).

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1.2.3 Dialog structure

The dialog structure page provides an overview of the dialog and all the dragged on widgets and resources. Therefore the widgets and resources are displayed in a hierarchical tree to show which widget resp. resource was dragged on which widget. Each item is displayed via two columns. The first column displays the object name of the widget/ resource, the second the corresponding class type.

In addition to the overview and class type information, the focused widgets and resources are marked bold. A widget or resource can be focussed via the dialog structure tree as well by double-click on the desired node. To select multiple widgets or resources hold SHIFT while clicking on the nodes.

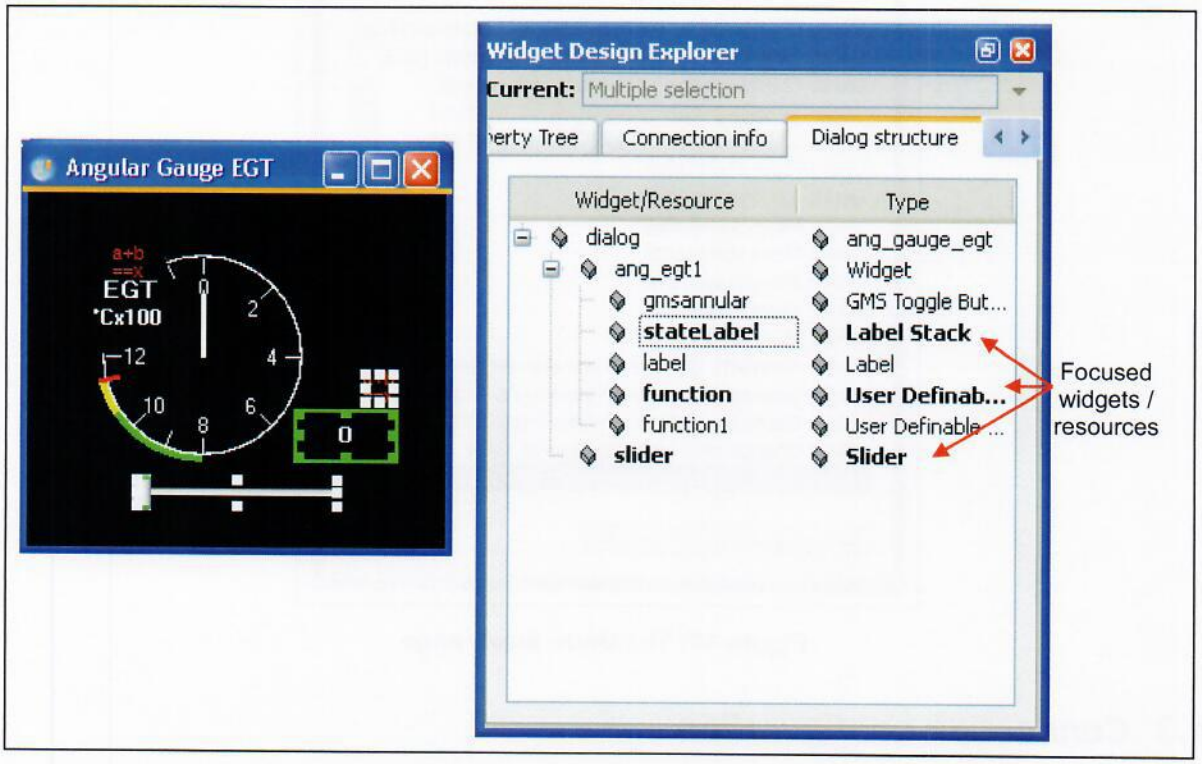


Figure 16: The Dialog Structure page

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1.2.4 Undo Stack

The modifications on the dialog are listed in the undo stack. This enables the user to go back to a certain modification stage by just clicking on the stack entry. All modifications which have been done after this entry will be set back to their former states. All stack entries after the selected entries will be overwritten if the user went back and does some new modifications.

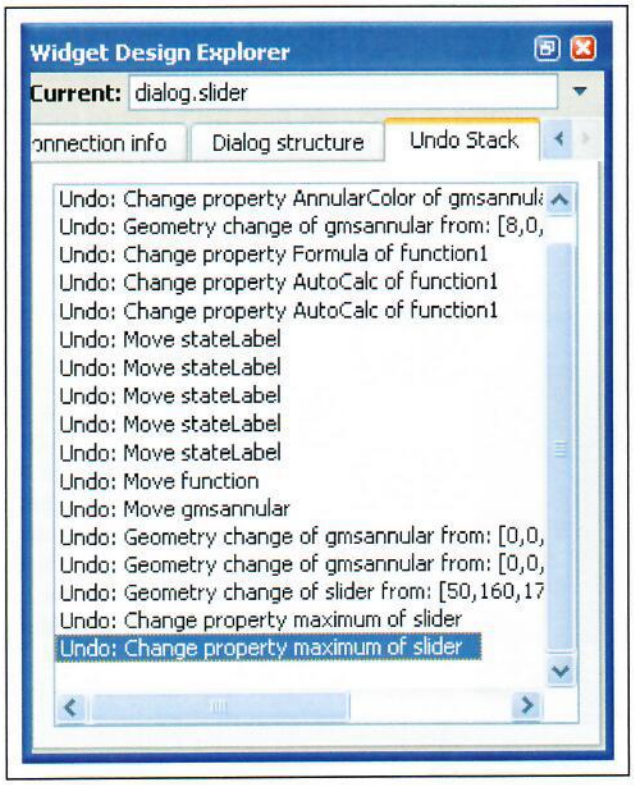


Figure 17: The Undo Stack page

1.3 Connection configuration

1.3.1 Interface connections

The interface connection configuration has been introduced in PBA.pro version V01.22 Build 72. Users running a previous version have to update the PBA.pro to use interface connections.

This feature provides the possibility to create automatic connections between widgets and/ or resources. Interfaces usually provide the main functionality and features of an item. Thus in most cases an interface can be used if connections are to be configured.

An interface is defined as a communication channel which can be one of the following Types:

Input

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Output

IO (Input and Output)

While an Input Interface can be used to set a value or call a slot of the item, an Output Interface is used to send some values or events to other items. Thus, if two items offer interfaces they can be connected to each other. Therefore the sender and receiver interfaces respectively one of their properties or one of their signal/ slot methods have to fit to each other.

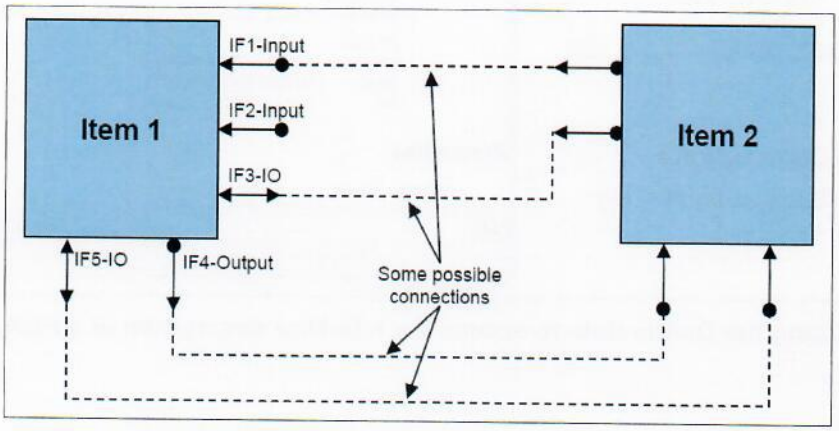


Figure 18: Interface connection scheme

For an overview of the interfaces a PBA.pro object provides, select the object and Press F1. This will open the online help of the selected object, where the Interface section lists all available interfaces. If a script component is available the online help of an object can be accessed via the script command line as well: To access the non visible Panel Manager place the command “tclqt_help PanelManager” resp. for python “pypro_help(“PanelManager”)” into the script command line and press Enter.

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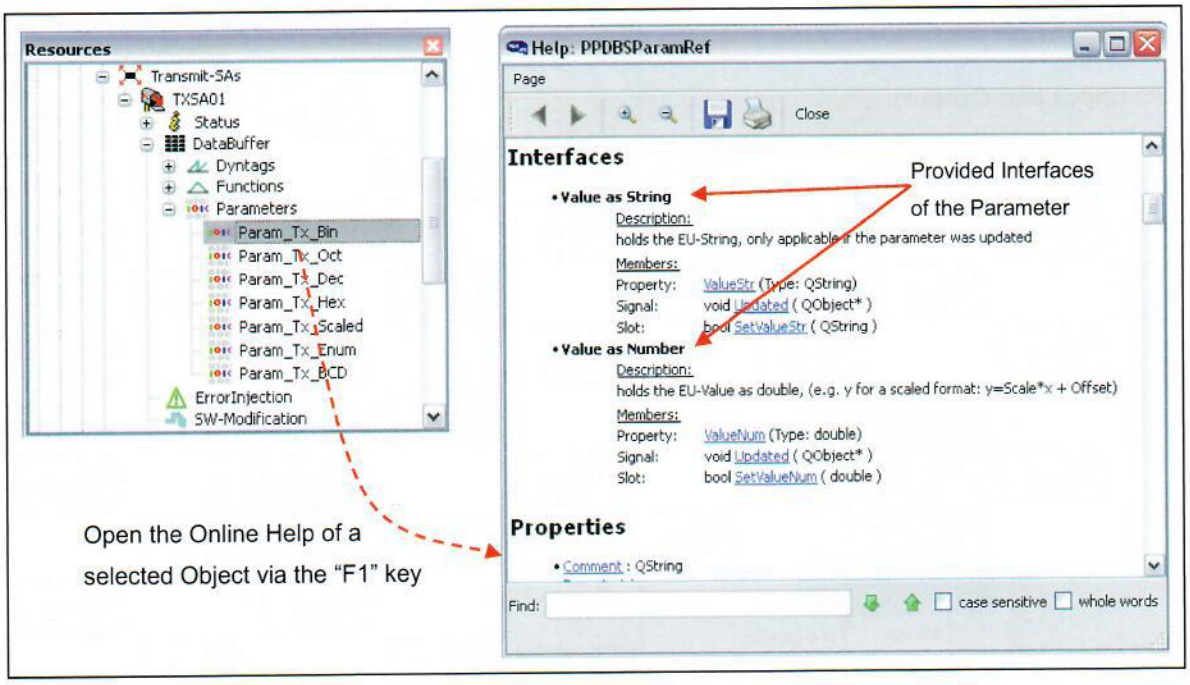


Figure 19: Using the Online Help to access the Interface description of a PBA.pro Object

1.3.1.1 Interface composition

Interfaces are just a set of properties, signals and slots which provide the same functionality and are grouped together to one abstract interface.

While input interfaces consist of slots and/ or writable properties, output interfaces will hold signals and readable properties. As one functionality or feature of the item is usually represented by one property and/ or one slot or signal, basic interfaces have the following structure:

Interface type	Amount of properties	Amount of slots	Amount of signals	Example
Simple_Input(1)	1	-	-	Currently not used
Simple_Input(2)	-	1	-	Run interface of the 1553 Bus Controller: • Slot: Run(bool)
Simple_Input(3) **most commonly used interface**	1	1	-	Text interface of Labels: • Property: text • Slot: setText(QString)
Extended_Input	N	N	-	Parameter1 interface of Functions: • Property: P1 • Slot1: SetP1(double) • Slot2: SetP1(int)
Simple_Output(1)	1	-	-	Currently not used

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Simple_Output(2)	-	-	1	Updated interface of Status objects: • Signal: Updated(QObject)
Simple_Output(3) **most commonly used interface**	1	-	1	Value interface of read-only Parameters: • Property: valueNum • Signal: Updated(QObject*)
Extended_Output	N	-	N	Result interface of Functions: • Property: Result • Slot1: Result(double) • Slot2: Result(int)

Table 1: Interface Types

1.3.1.2 Setting up Interface connections

Interface connections for resource items can be created by a simple drag and drop action holding the shift key pressed. The dragged resource has to be moved over the item the resource should be connected with (the current item on the template dialog is highlighted and a red square is painted around it).

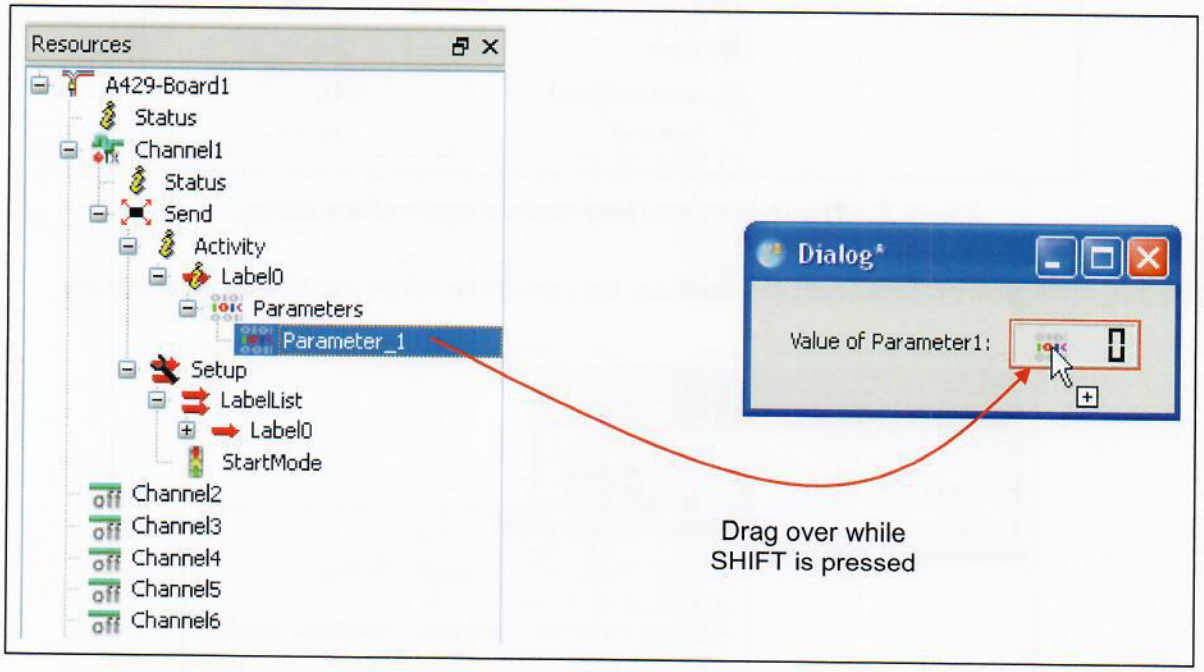


Figure 20: Setting up Interface connections

Interface connections can be set up between items which are already placed on the template dialog as well. If two items are selected on the template dialog the menu entry "Connect Interfaces…" - which is accessible on right click – will become enabled and can be selected to set up an interface connection between the two items.

Note: By default the first selected item will be the sender. Thus, the connections where the first item is the sender will be checked first. Online information about interfaces can be found in the PBA.pro Scripting Help which is accessible via button F1 or the corresponding Menu entry of the Help menu.

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If the resource object to connect to is of type Parameter, the connect widget will be initialized by the parameter definition as well. E.g. a Combo Box will hold all states of an enumerated Parameter if connected to via interface connection; the maximum and minimum value of a slider is calculated via the bit length and (if available) scaling of a parameter.

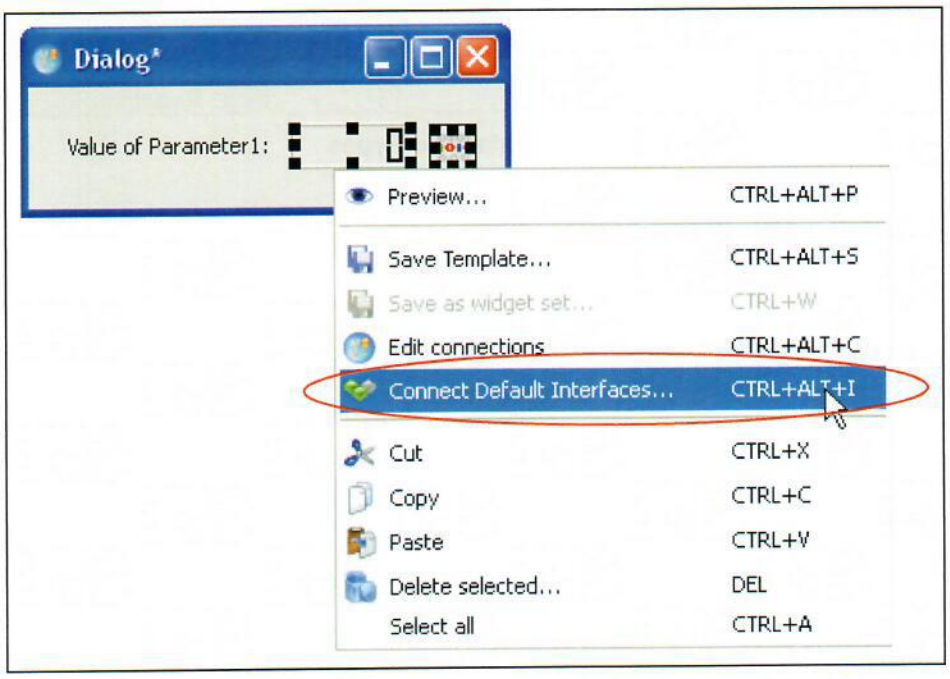


Figure 21: The Default interface context menu of the dialog

If the two items have only one matching interface, the connection will be established automatically.

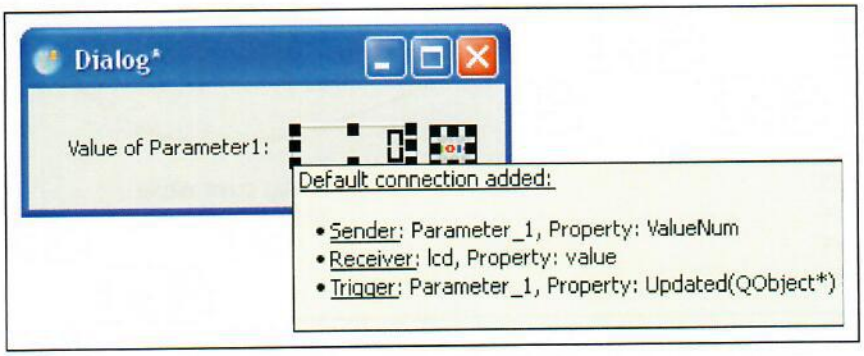


Figure 22: Default interface connection success notification

If more than one possible interface is found, the user has to select one of the possible interfaces from the popped up combo box.

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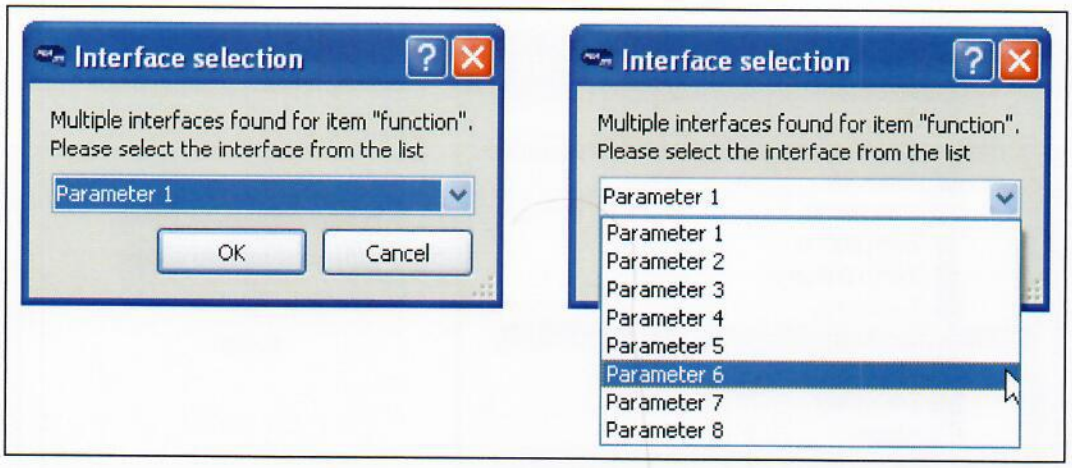


Figure 23: Interface selection dialog

1.3.2 Automatic widget and connection creation

Default interfaces, described in the section above, require that both objects are existent on set up. For example to connect a ValueStr property of a Parameter to the value Property of a LCD widget, the LCD needs to be placed on the Template first. Thus the user has to select the LCD widget from the designer tree and add it to the dialog first before the default interface connection with the Parameter Object can be set up.

Another approach is to create the widget, to which the resource object should be connected to, on demand. Therefore drag the object (e.g. the Parameter) over the dialog or widget and hold SHIFT. If the object is dropped on a standard widget, the default interface connection as described in the previous section "1.3.1.2 Setting up Interface connections" can be set up. If the object is dropped on a widget container, placed on the dialog or on the dialog itself the user can add a widget to the dialog before the default interface procedure is executed.

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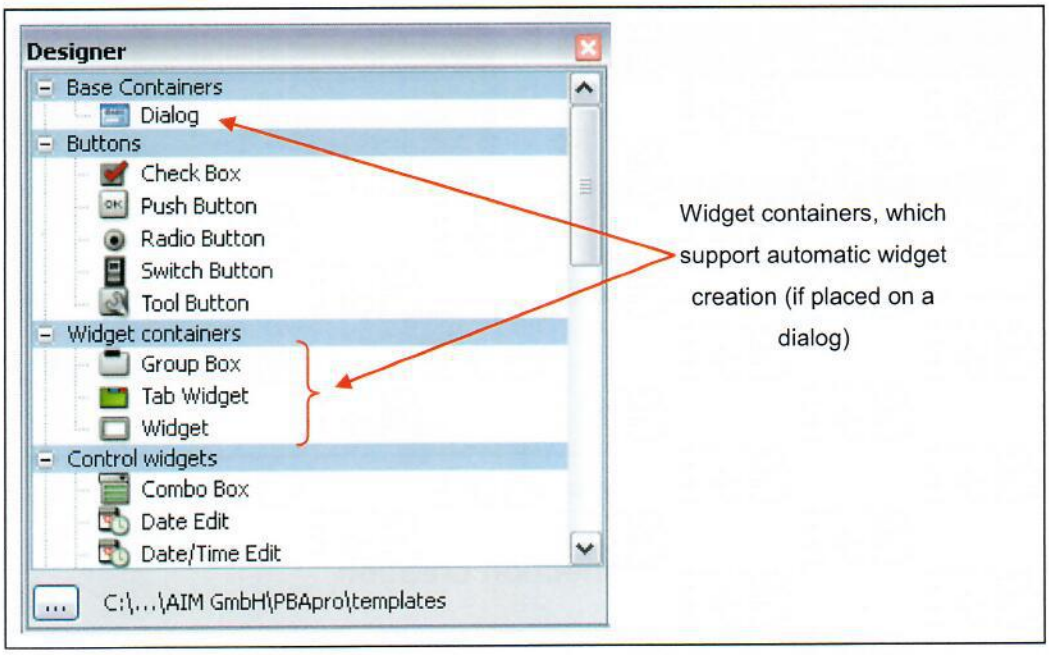
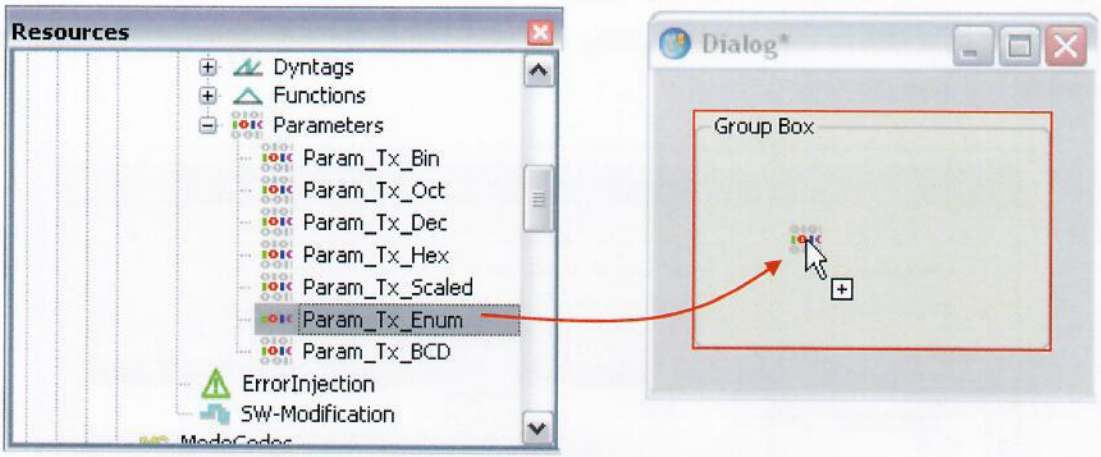


Figure 24: Widget containers of the designer component

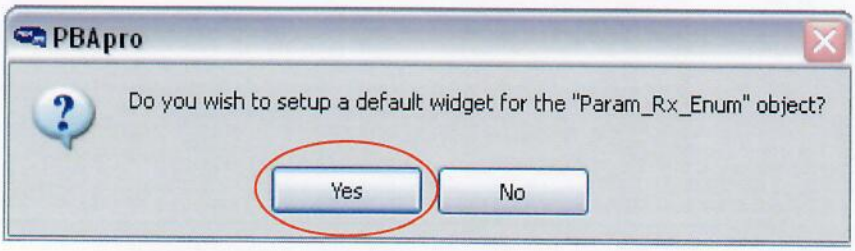
Therefore a message box will ask the user whether a default widget should be created or not. To create a default widget, press the “Yes” button and select one of the provided widgets of the widget tree. If a widget is selected and the dialog is closed via the “Ok” button, the widget is placed on the dialog. This will lead to the default interface connection procedure of the previous section “1.3.1.2 Setting up Interface connections”, where the user can set up a default interface between the object and the added widget.

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1. Hold SHIFT while dragging a resource object over a widget container e.g. a Group Box (the container will be highlighted and a red square is painted around it).



2. Drop the Object and select "Yes" on the message box to add a default widget.



3. Select a widget from the tree and click on the Ok button to add the widget on the dialog and to proceed with the default interface connection routine as described in the previous chapter. (This procedure will connect a default interface of the dropped resource object with a default interface of the selected widget.)

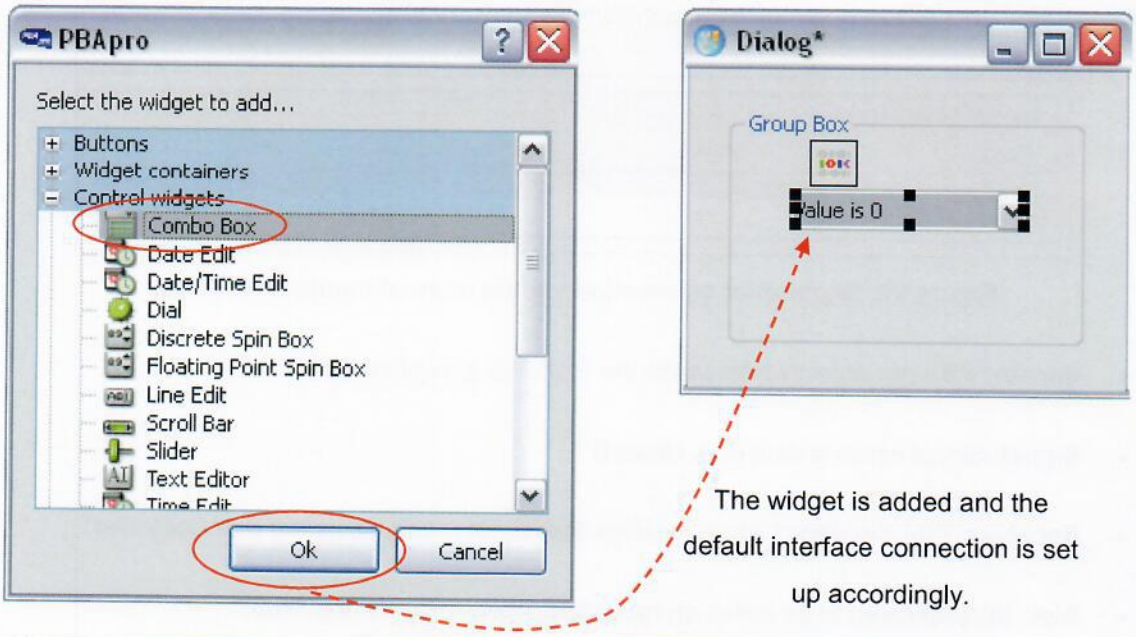


Figure 25: Automatic widget creation on dropping an object on a dialog

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1.3.3 The manual connection dialog

For manual definition of 'Signal – Slot' and 'Property' connections, the 'Edit Connections' Editor can be invoked via a right mouse click onto the dialog and selection of the 'Edit Connections' menu item of the context sensitive menu item.

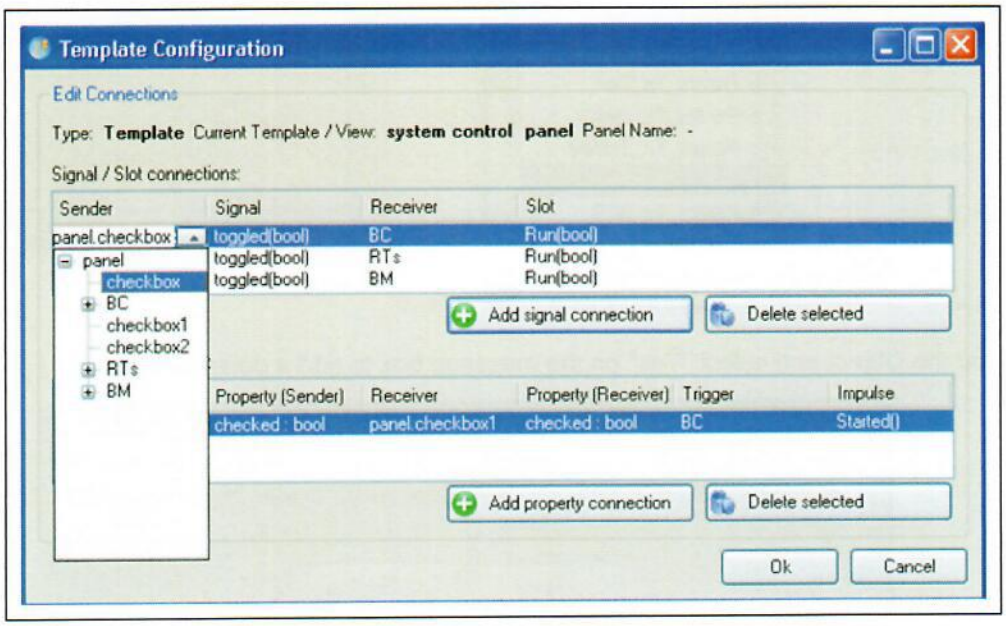


Figure 26: The manual connection dialog

The 'Template Configuration' Dialog supports definition of the two connection types, which are available via two different sets of edit controls.

A '***Signal-Slot'*** connection is set up via four parameters:

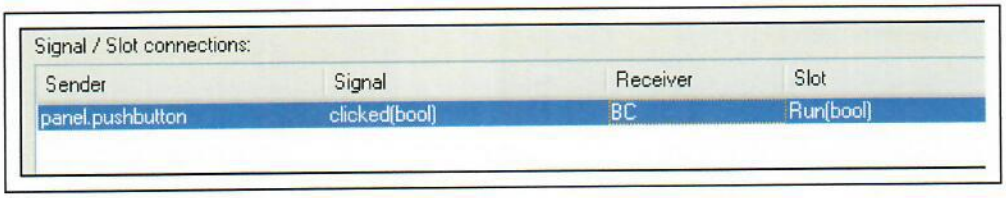


Figure 27: Signal-Slot connection via the manual connection editor

- **Sender**: PBA.pro object which sends the Signal (e.g. pushbutton)
- **Signal**: Signal which is sent (e.g. clicked)
- **Receiver:** PBA.pro object which receives the Signal (1553 Resource Bus Controller)
- **Slot**: Slot(Function) to be called on reception of given Signal (e.g. Run)

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A ***'Property'*** connection is set up via six parameters:

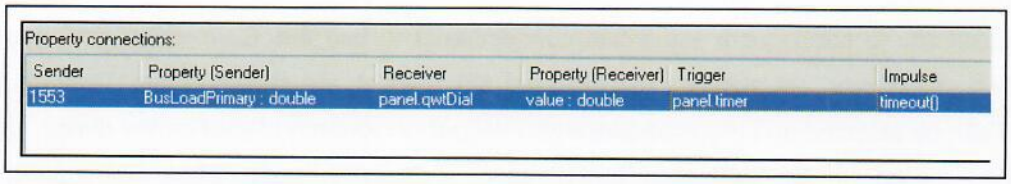


Figure 28: Property connection via the manual connection editor

- **Sender**: PBA.pro object which holds the source property (e.g. 1553 Bus Monitor object)
- **Property (Sender)**: Property of PBA.pro source object to be used (e.g. BusLoadPrimary)
- **Receiver**: PBA.pro object which holds the destination property (e.g. dial widget)
- **Property (Receiver)**: Property of PBA.pro destination object to be used (e.g. value)
- **Trigger**: PBA.pro object which triggers the property synchronization (e.g. a timer widget)
- **Impulse**: Event (Signal or Function) of PBA.pro Trigger Object (e.g. timeout)

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1.3.4 Drag & drop connection configuration via the Connection Info page

Another possibility to configure a signal-slot connection is to use the 'Connection Info' page of the 'Widget Design Explorer'. All methods (Signals and Slots) which are shown in the 'Available Signals/ Slots' tree can be selected and dragged over every widget or resource placed on the dialog. Using this drag & drop mechanism of connection configuration, a dedicate configuration dialog pops up and displays all possible methods of the dragged over widget, which can be connected to the dragged method:

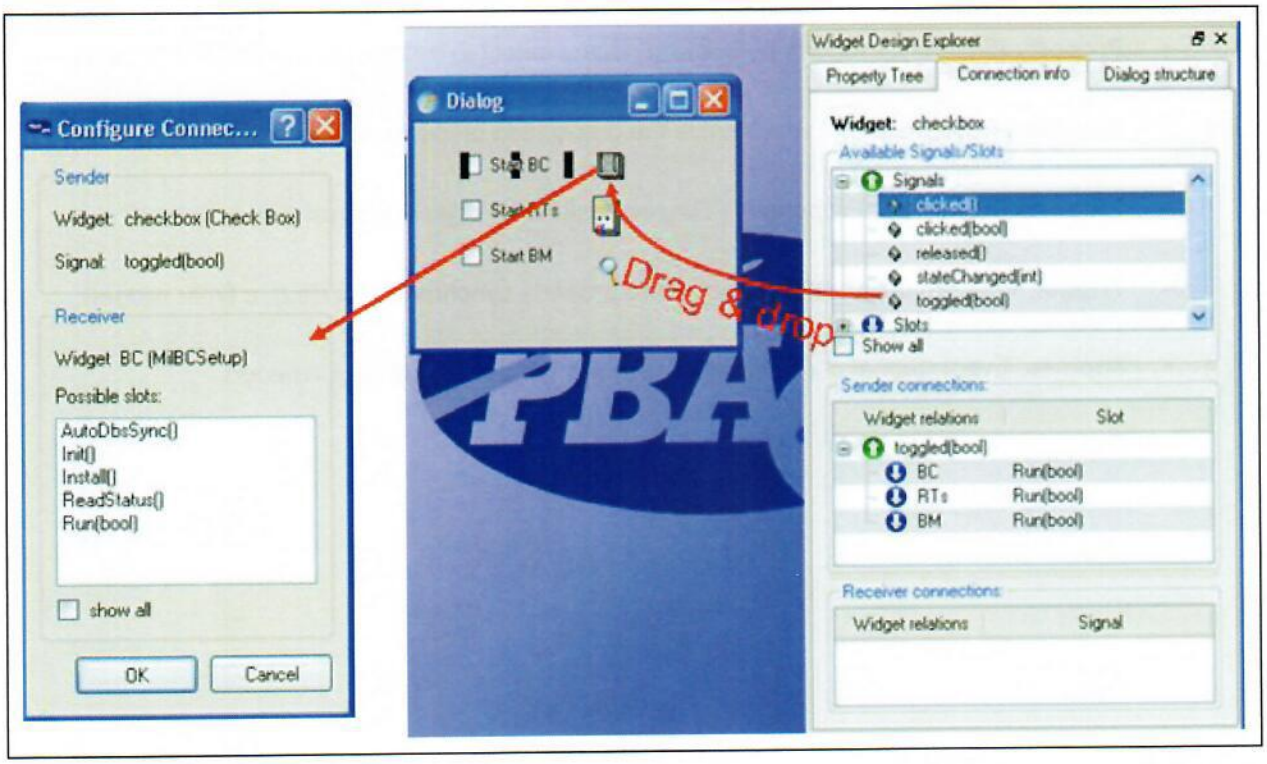


Figure 29: Drag and drop connection configuration

1.3.5 Drag & drop property connections

To configure a property connection use any 'Property Tree' of the PBA.pro. The selected property can be dragged over every widget or resource placed on the dialog in the same way as a signal or slot, explained in the previous section. After the drag & drop, the 'Property connection Dialog' will pop up. Comparable to the signal/ slot connection the matching receiver properties are displayed within the receivers property list. To configure a connection the receiver property as well as the trigger object and its trigger signal (impulse) has to be specified. To specify the trigger object a hierarchical tree will be shown in the corresponding trigger region, where the list below lists the possible impulses of the selected trigger.

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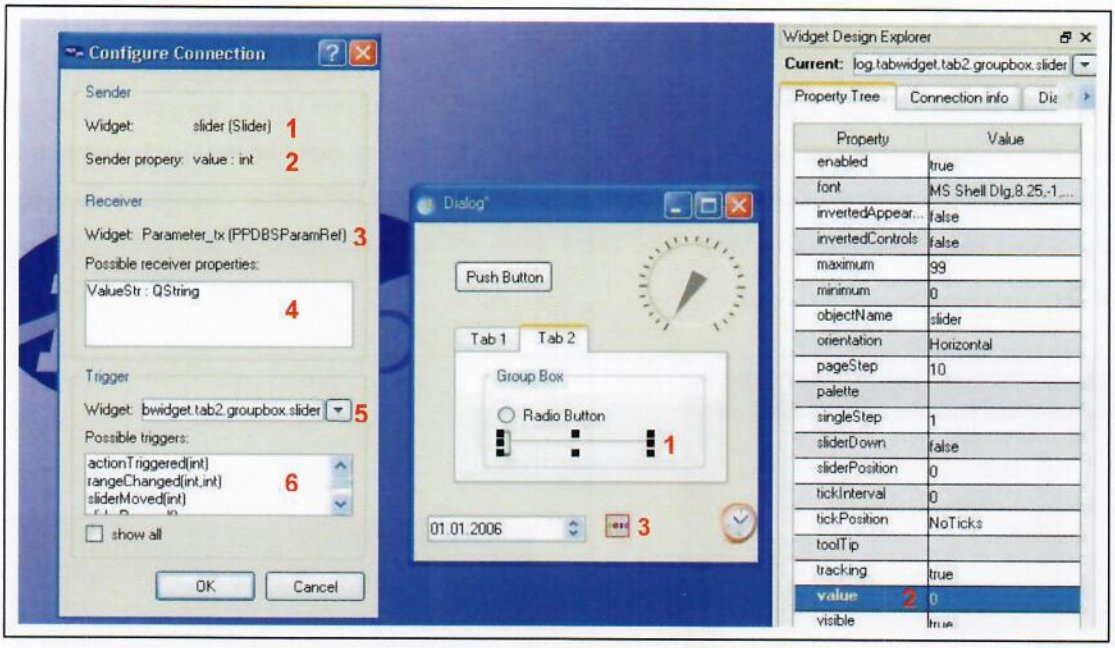


Figure 30: Drag & drop property connection configuration

- Screenshot explanation:

  1: Sender widget

  2: Sender property

  3: Receiver widget

  4: Possible receiver properties

  5: Trigger widget

  6: Impulse which synchronizes the two properties

Note: As already mentioned property connections can be created from every property tree of any PBA.pro item (Property trees are usually accessible on double click on the corresponding item in the resource tree or via an entry in its context menu). If the dragged property resp. the resource is not added to the template dialog yet, the user will be asked if he wants to add the resource to the template dialog. Only added resources can be used for connection configuration.

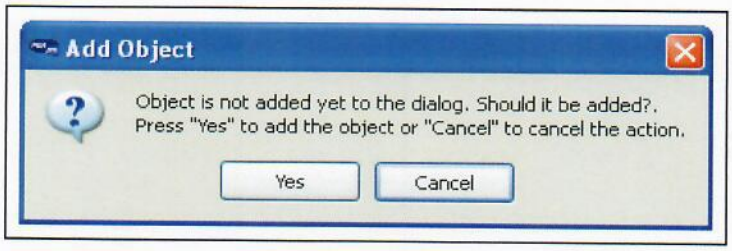


Figure 31: Object not added yet notification

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1.4 Embedding Object/ Class Views

As described above, dialogs are created on adding the provided widgets of the designer widget gallery via drag and drop to the dialog. In addition to this, so called object or class views can be embedded to a designer dialog as well. An object resp. class view is a dialog which will be opened on double click on any object within the resource tree. The class view will be embedded to the Workspace of the PBA.pro.

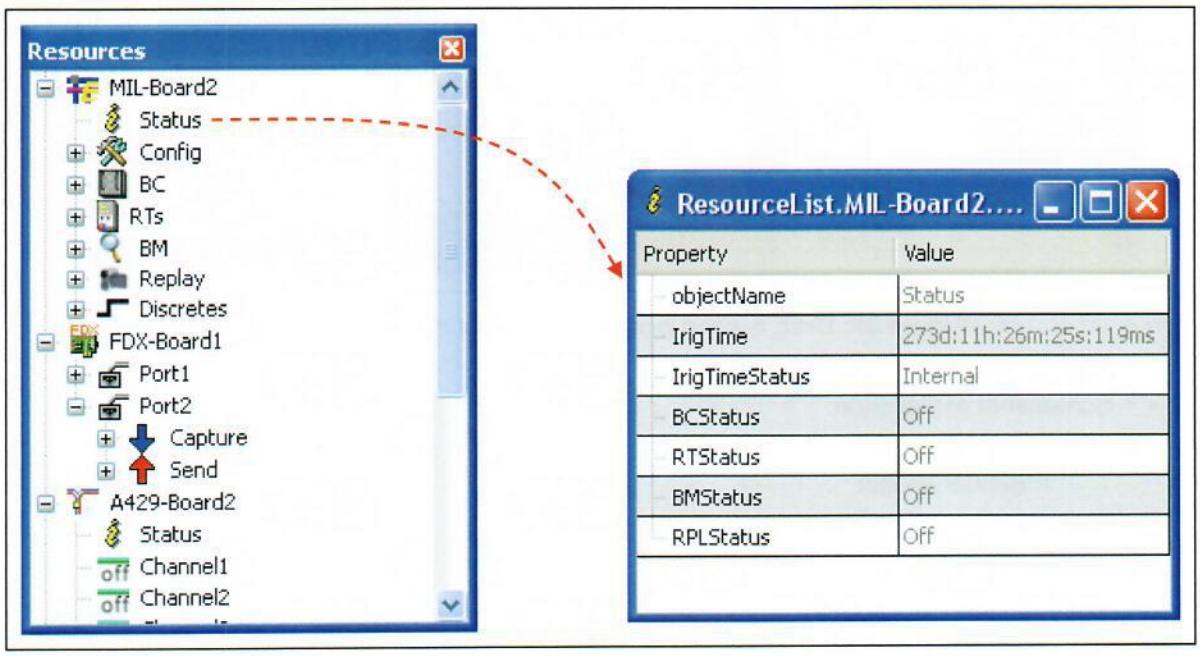


Figure 32: Opening a object view

To embed such a view to a designer dialog, right click on an already dropped base container and select the "Embed Views" context menu entry. Note that this entry will only be enabled if there is any class view on the Workspace available. If the Embed Views entry has been selected, the background of the Workspace will turn to grey to indicate that the views can be embedded to the dialog.

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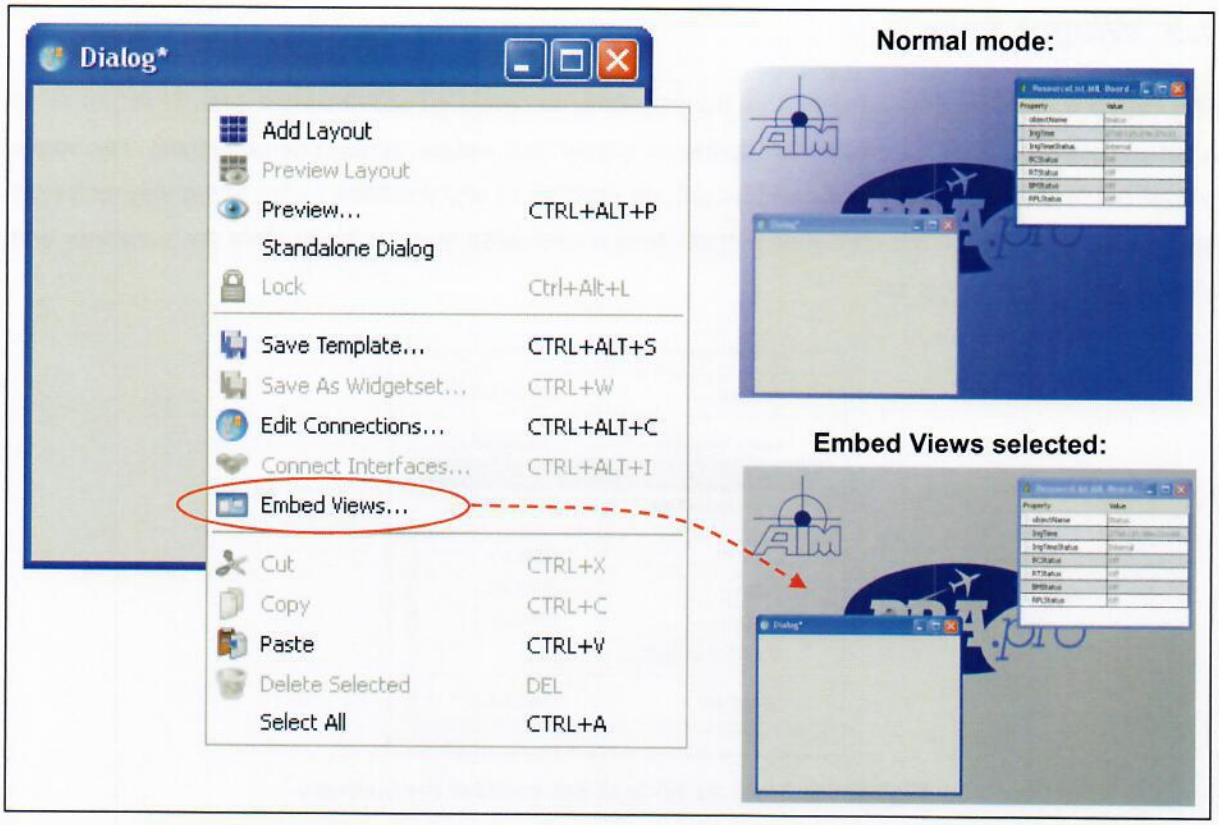


Figure 33: Switching to "Embed Views" mode

If the mode has been switched to “Embed Views”, the class views can be added to the dialog via drag and drop (from inside the view to embed) as any other widget. The Embed Views mode can be deactivated via the context menu again. Note that the mode will be deactivated as well if no class views are on the workspace anymore.

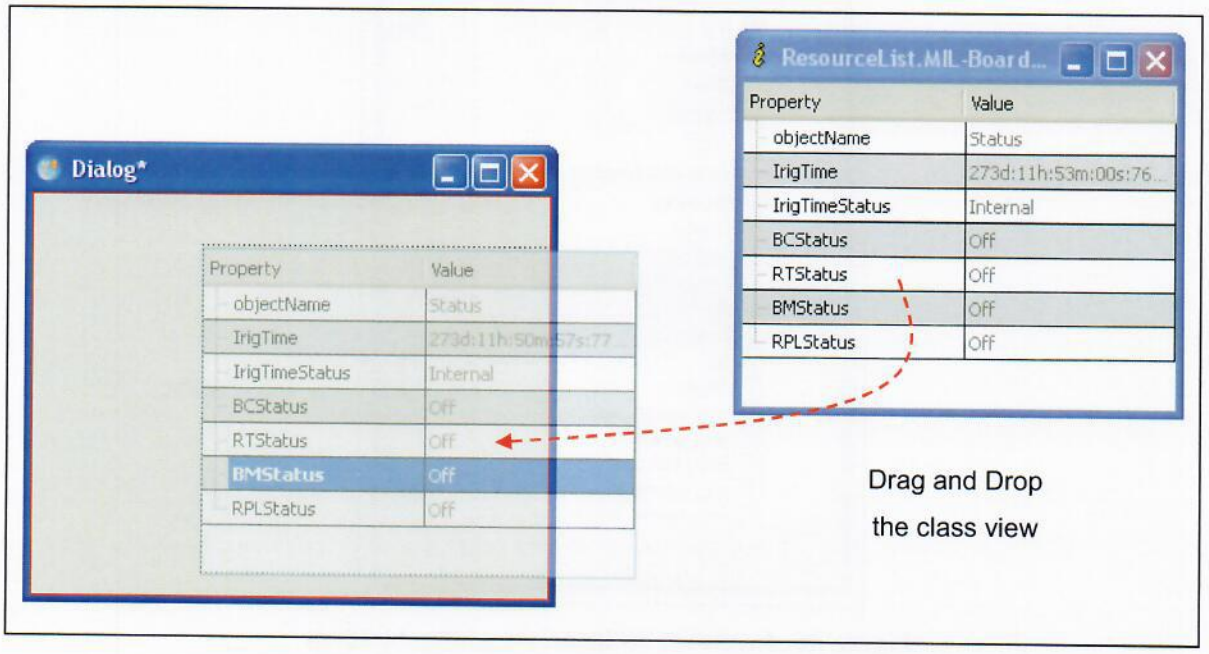


Figure 34: Adding a class view to a designer dialog

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1.5 Widget Sets

The PBA.pro designer component offers the possibility to create so called widget sets. A widget set is a set of widgets placed on a common container widget (tab widget, group box or widget). The whole widget set resp. the widgets of the widget set are configured and modified in the same way as single widgets. A right click on the container widget offers a dedicated menu entry to store the container and all widgets on it as widget set.

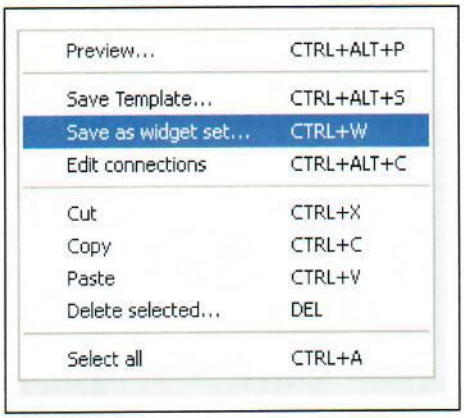


Figure 35: Save as Widget Set context menu entry

An input dialog pops up, where the name of the widget set is to be set. If ok is pressed, the widget set is saved and will appear in the designer widget tree below the "Widget Sets" node. Widget sets can be used as every other widget in the designer tree, and added to resp. dropped onto a template dialog via drag and drop.



Figure 36: Available Widget Sets of the designer

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1.6 Automatic Layouts

Without using Layouts the size and position of all widgets placed on a template will be fixed. To resize and re-arrange the widgets according to the template size, layouts can be used.

A layout is a non visual object which belongs to exactly one widget. All widgets placed on this widget can be organized and arranged using this layout. The concept of layouts allows to arrange widgets in a grid. The size and position of the widget is not fixed anymore but set dynamically to a proportional size by the layout. This ensures that widgets are displayed correctly if a dialog or the parent widget is resized.

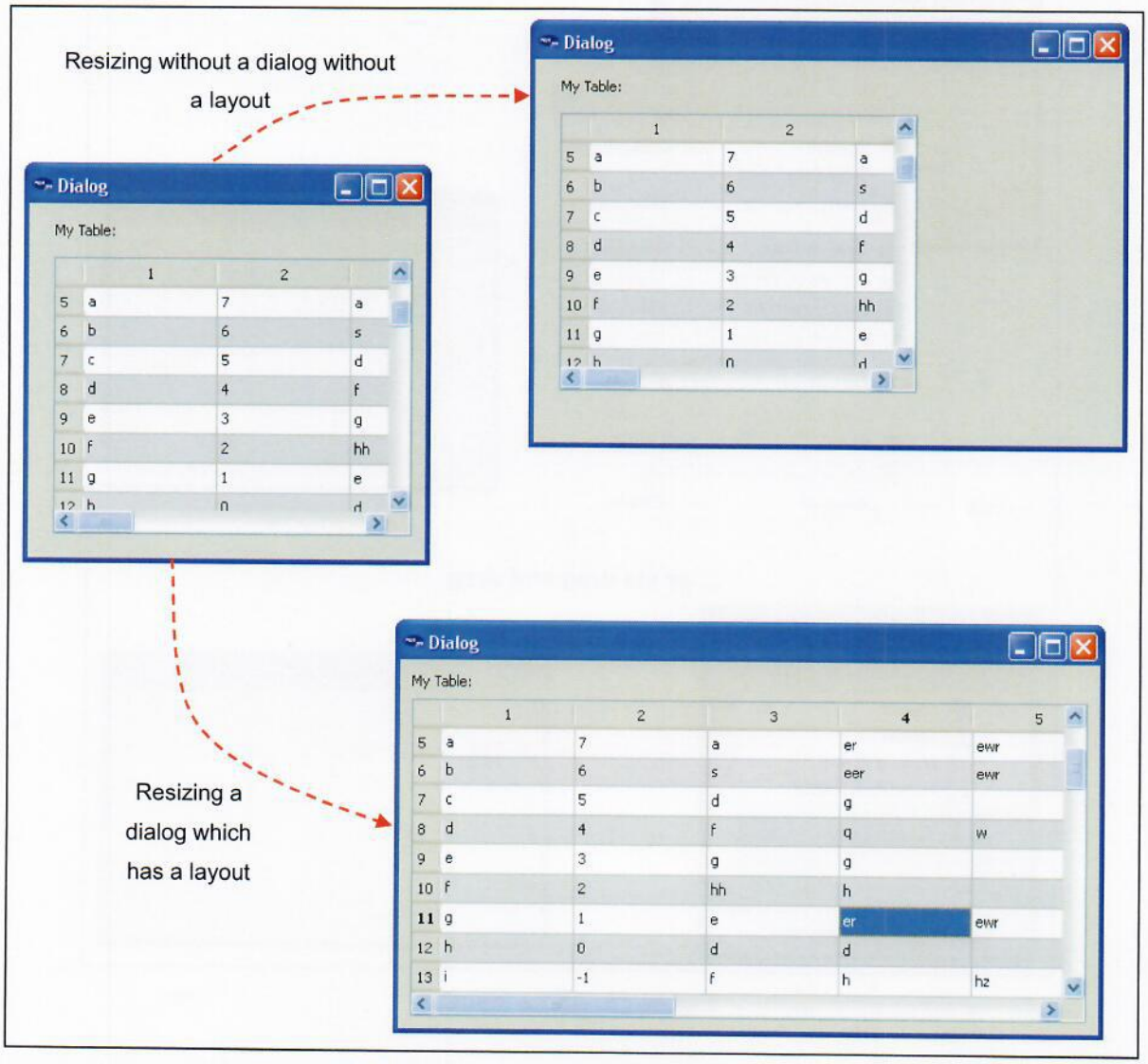


Figure 37: Resizing a dialog with and without a layout

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1.6.1 Layout creation and configuration

Layouts can be added to all container widgets (except the table widget) as well as to the base dialog itself. To add a layout to a widget right click on the widget in design mode and select the "Add Layout" entry of the context menu. By default a red square will be painted on the widget to display the layout border. Alternatively the layout can be added via drag and drop from the standard designer tree as well.

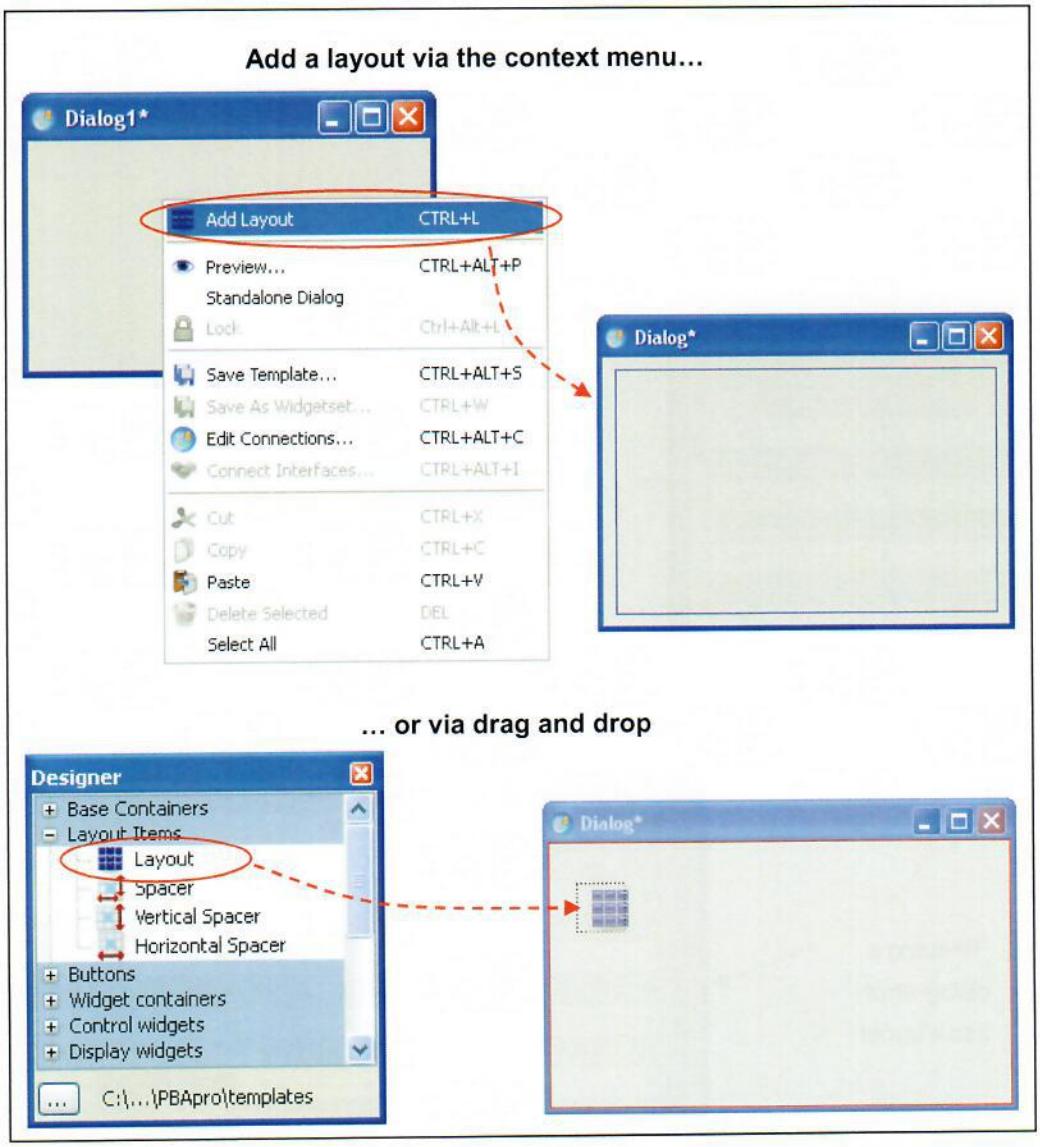


Figure 38: Add a layout

If the layout is added, the context menu will provide two further entries to configure and to delete layout. If the "Configure Layout" entry is selected a layout property editor will be opened, where the setup of the layout can be configured. Note that this editor is opened automatically, if the layout is added via drag and drop. This editor offers access to configure the following properties:

- **Margin:** The margin of the layout itself

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- **Spacing:** The space between the cells of a layout grid. Note that the spacing will only be used if there are some widget dropped onto the layout

- **sizeConstraint:** the resize mode of the layout (usually there is no need to change this property)

Value	Description
SetDefaultConstraint	The main widget's minimum size is set to minimumSize(), unless the widget already has a minimum size.
SetFixedSize	The main widget's size is set to sizeHint(); it cannot be resized at all.
SetMinimumSize	The main widget's minimum size is set to minimumSize(); it cannot be smaller.
SetMaximumSize	The main widget's maximum size is set to maximumSize(); it cannot be larger.
SetMinAndMaxSize	The main widget's minimum size is set to minimumSize() and its maximum size is set to maximumSize().
SetNoConstraint	The widget is not constrained.

Table 2: Layout sizeConstraint description

- **Rows:** The amount of rows of the cell grid (Note that layouts can not shrink! Thus, the rows of a layout can not be set to a smaller value as the property already is set to)

- **Columns:** The amount of columns of the cell grid (Note that layouts can not shrink! Thus, the columns of a layout can not be set to a smaller value as the property already is set to)

- **PaintGrid:** Indicates whether the layout grid should be displayed on the container or not

- **GridPen:** The pen or style, which is used to paint the layout grid if the PaintGrid option is set to true. Note that the grid is only painted in design mode

- **DefaultSize:** The default size, empty cells should be expanded to. This is just to be able to drop new widget into the layout. Note that the size of empty cells will be set to 0 if the dialog is executed. Thus, the appearance during the design and execution of the dialog may be different. To check the final appearance of the layout visually during design, set the height and width of the DefaultSize property to 0

- **DefaultVerticalSizePolicy** and **DefaultHorizontalSizePolicy:** Indicates how empty cells should be resized during design

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Value	Description
Fixed	The widget sizeHint is the only acceptable alternative, so the widget can never grow or shrink (for example the vertical direction of a push button).
Minimum	The sizeHint is minimal, and sufficient. The widget can be expanded, but there is no advantage to it being larger. It cannot be smaller than the size provided by sizeHint (the default for the empty layout cells)
Maximum	The sizeHint is a maximum; The widget can be shrunk any mount without detriment if other widgets need the space (for example a separator line). It cannot be larger than the size provided by sizeHint.
Preferred	The sizeHint is best, but the widget can be shrunk and still be useful. The widget can be expanded, but there is no advantage to it being larger than sizeHint.
MinimumExpanding	The sizeHint is minimal, and sufficient; the widget can make use of extra space, so it should get as much space as possible (for example the horizontal direction of a horizontal slider).
Expanding	The sizeHint is a sensible size, but the widget can be shrunk and still be useful. The widget can make use of extra space, so it should get as much space as possible (for example the table widget).
Ignored	The sizeHint is ignored. The widget will get as much space as possible.

Table 3: Layout size Policy for empty cells

To add a widget on a layout just drag the widget over the grid. The cell respectively area, where the widget will be dropped into will be highlighted red. Widgets can be added to a layout by either creating a new widget via drag and drop from the designer widget tree or via drag and drop of existing widgets already placed on the dialog. To move a Widget from one cell to another use the standard drag and drop operation and drop the widget on the desired highlighted cell.

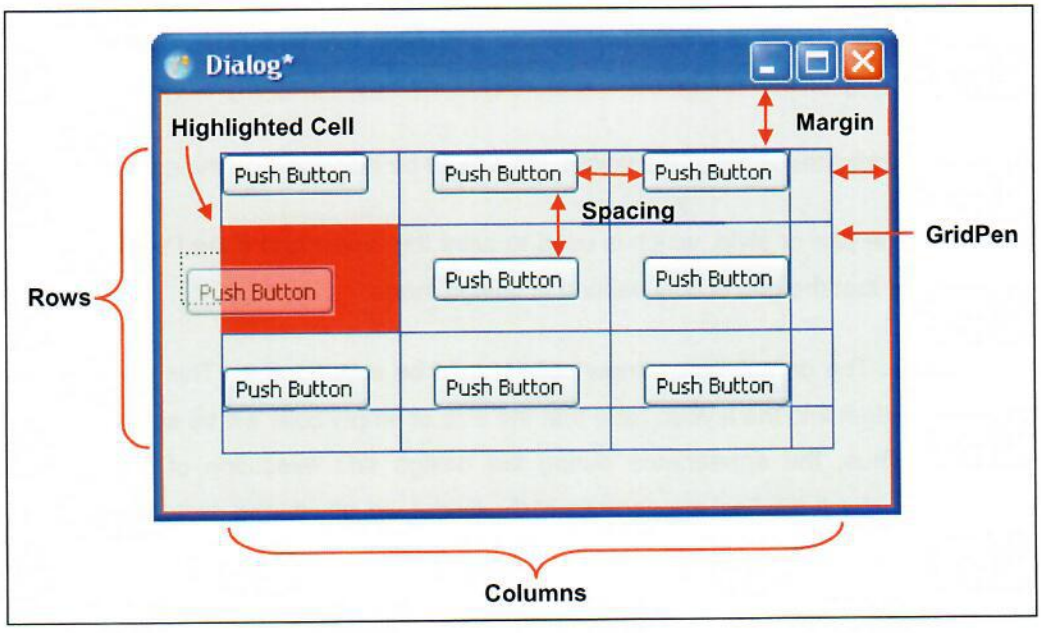


Figure 39: Layout configuration

Note that if a layout is added to a template or container widget, which already has some widgets added, the widgets are inserted to the layout automatically. The cell and the spacing of the widgets within the grid depends on the position, they are placed on the container or template before adding the layout:

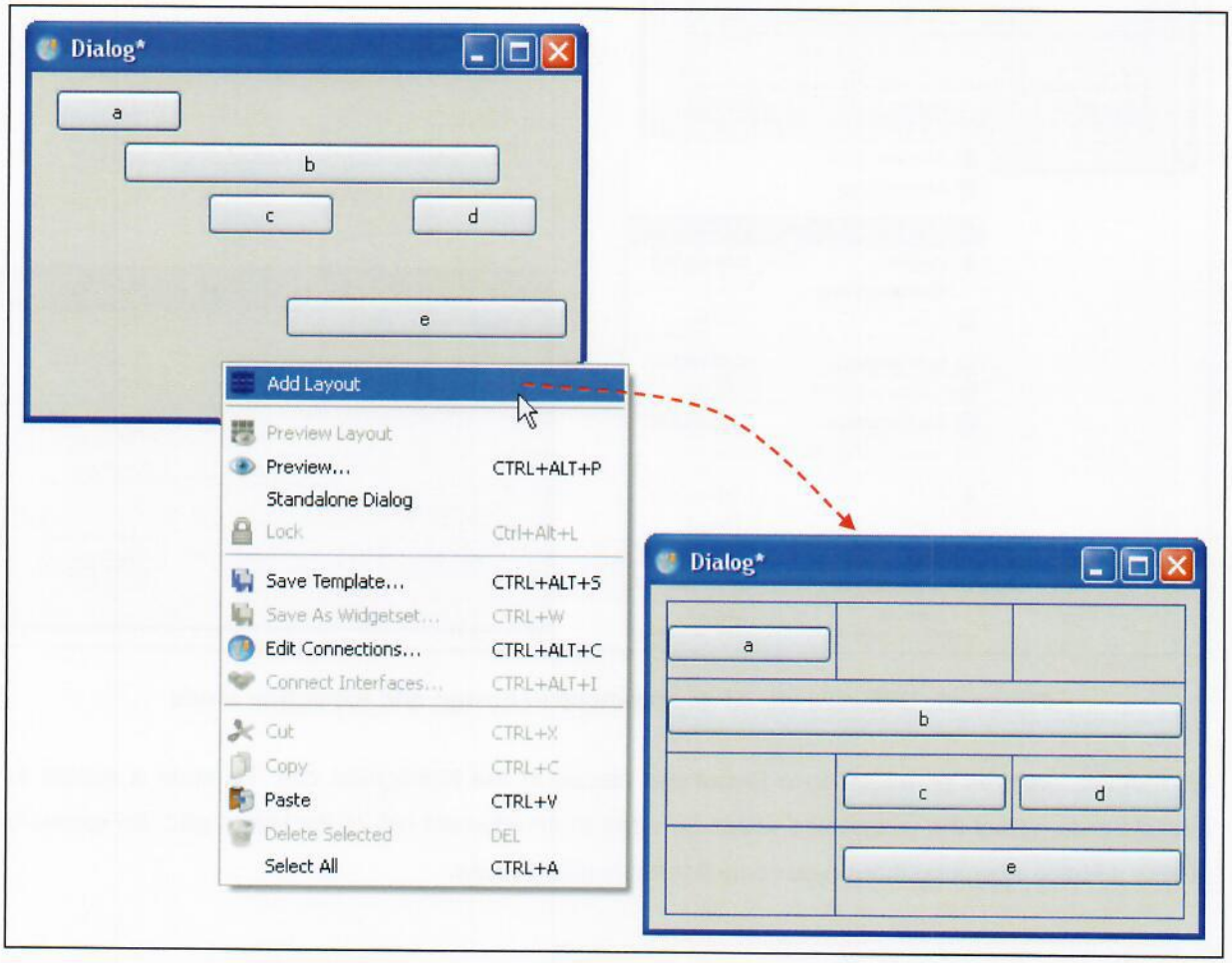


Figure 40: Automatic Layout of already added widgets

Due to the grid settings, the visual appearance of the design mode and the later execution mode might be slightly different as empty cells might need some space in design mode. To check the real appearance, right click on the template and select the “Preview layout” option.

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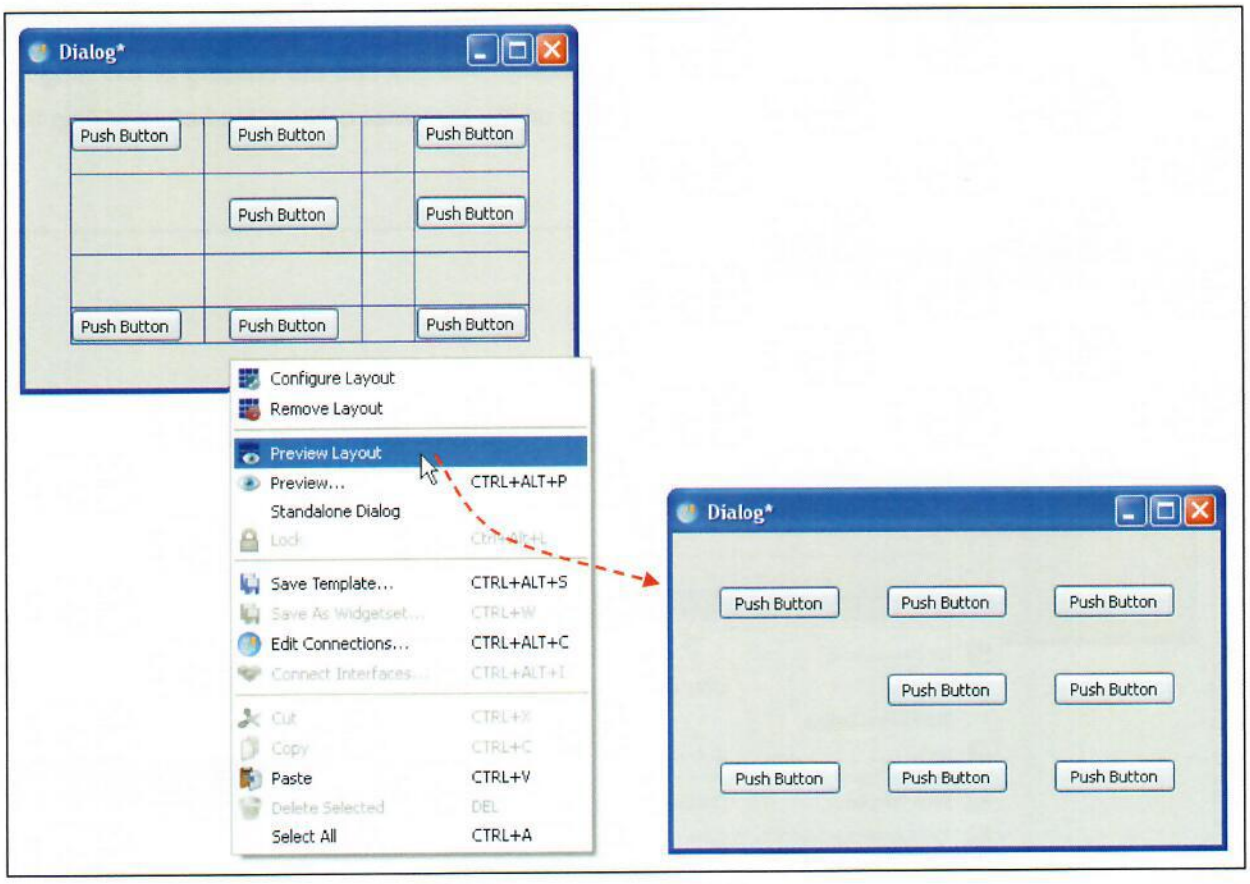


Figure 41: Different visual appearances in design and execution mode

All widgets, dropped or added to a layout are placed in the highlighted cell. To span a widget to multiple cells, select the widget and resize an edge to an adjacent cell of the layout grid. An example of how a button spanning three cells is configured is given below.

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