NI DIAdem™

Getting Started with DIAdem

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About This Manual

You can use this manual to familiarize yourself with DIAdem functions and how to use them. Each chapter describes a DIAdem panel.

This manual contains exercises for finding, analyzing, and presenting data, and for automating functions to process your data. The exercises do not take long, and they make it easier for you to get started with DIAdem. Each chapter concludes with a summary of the main points.

Related Documentation

For more information on DIAdem, refer to the following documentation:

- *NI DIAdem: Data Mining, Analysis, and Report Generation*

  This DIAdem manual explains the structure of DIAdem and how to use DIAdem to mine data, to run analyses, to create reports, and to combine all functions in a script.

- *NI DIAdem: Acquiring and Displaying Data*

  This DIAdem manual describes how to use DIAdem to acquire data, to control sequences, to operate plants, and to visualize processes.

- *You can open the DIAdem Help* in every dialog box with the **Help** button, on the toolbar with **Help»Contents**, or with <F1>.

  The DIAdem Help offers procedures and dialog box help for each panel, references for programmers.

1

Introduction to DIAdem

DIAdem is the interactive National Instruments software for finding and managing technical data, for mathematically and graphically-interactively analyzing data, and for presenting data in reports. In a standardized environment, DIAdem offers a unique combination of tools that are tailored to the requirements of technicians, engineers, and scientists. You can adjust all the tools to your tasks and automate them in scripts, which reduce evaluation time substantially.

The DataFinder enables you to find test data quickly and easily, and to identify corresponding data. The DataFinder does not need a database or any support by the IT department but can be used directly after the installation of DIAdem.-

Working with DIAdem

DIAdem groups related functions in panels. Use the panel bar that is on the left of the DIAdem screen to switch panels. Each panel provides all the tools for one of the following tasks:

- Use DIAdem NAVIGATOR to find, to load, and to manage data. Use the DataFinder to search for data on your computer and in the network, and to navigate through the found data files and databases. You load the data into the Data Portal so that all DIAdem panels can work with the data, which is organized in channels.

- Use DIAdem VIEW to view, to analyze, and to edit data as curves in axis systems. In channel tables you can edit and delete the data as values and enter new data. You synchronize videos or the map display of a test drive with data. You project data onto 3D models or map 3D data in two-dimensional contour areas.

- Use DIAdem ANALYSIS to analyze data mathematically. You can apply predefined standard mathematical functions, including basic mathematics, curve fitting, signal analysis, and statistics. The dialog boxes for these standard functions guide you through the calculation so you do not have to enter a formula. You select the input data and the settings. Use the DIAdem Calculator to define and calculate your own formulas.

- Use DIAdem REPORT to document data and present results. In 2D and 3D axis systems you display your data as curves, as bar diagrams, and as surfaces. In 2D and 3D tables you list channel contents. You can label your report with comments and text and illustrate the report with graphics and formulas.

- Use DIAdem SCRIPT to automate tasks in a script, which combines several work steps for recurring sequences such as standard calculations and serial evaluations. Scripts, which you can record interactively, use the functions of all DIAdem panels. You can add program structures and dialog boxes to scripts in the integrated script editor.

- With DIAdem DAC and DIAdem VISUAL you acquire data, control processes, and visualize data. In DIAdem DAC you create block diagrams to acquire measured values, and to process and to output the data online. In DIAdem VISUAL you design the visualization screen, display the acquired and calculated measurement values, and influence the measurement with input instruments.

When you select a panel, DIAdem changes the user interface for quick access to the functions you want. Each DIAdem panel has its own group bar to the right of the panel bar as shown in Figure 1-1. Open a group bar, click a function group, and select a function. The workspace also changes with the DIAdem panel and displays a folder hierarchy or a worksheet. The toolbars and the context menus contain frequently used functions, which DIAdem also adapts to the selected panel.

Figure 1-1. The Elements of the DIAdem User Interface
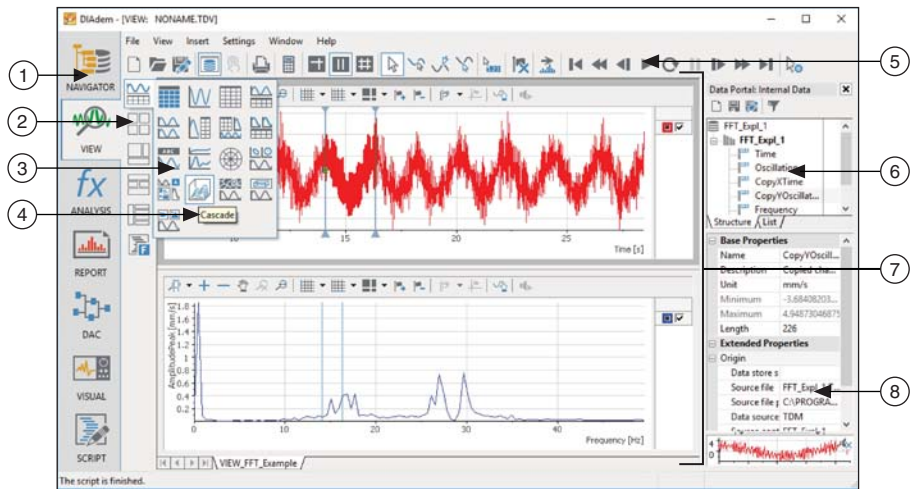
1	Panel bar	5	DIAdem VIEW toolbar
2	Group bar	6	Data Portal
3	Function group	7	DIAdem VIEW workspace
4	Tooltip of the selected function	8	Properties in the Data Portal

The Introduction Dialog Box

When you launch DIAdem, the DIAdem introduction screen appears. Open the website containing the DIAdem tutorials which help you get started in DIAdem and show you how you can work successfully with DIAdem. Open the manuals to get an overview of the functions in DIAdem and find out how to use these functions.

Open the examples gallery to load and execute examples in DIAdem and to use as templates for user-defined applications. The table of contents of the ExampleFinder contains procedures which are step-by-step instructions for the solution of certain tasks. Reproduce the steps of a procedure to learn how to solve the described task.

Note If the introduction screen does not appear when DIAdem launches, select **Help»Introduction** to open the introduction screen.

Figure 1-2. The DIAdem Introduction Screen

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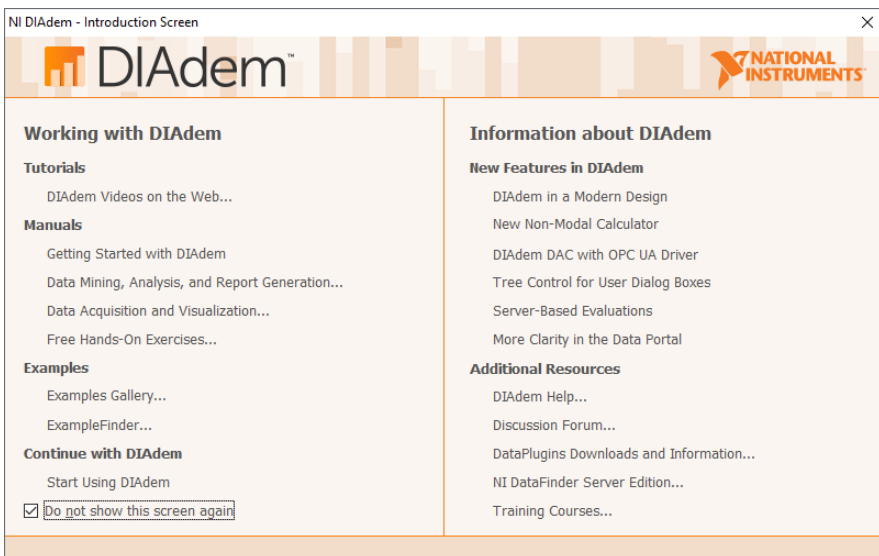
Finding Data

Use DIAdem NAVIGATOR to find, to load, and to manage data. Use the DataFinder to search for data on your computer and in the network, and to navigate through the found data files and databases. You load the data into the Data Portal so that all DIAdem panels can work with the data, which is organized in channels.

Mining Data

Use the **Quick Search** to search for a term if you do not know whether the property belongs to a file, a group, or a channel. Use the **Advanced Search** to combine several search conditions and to describe in detail the properties you want to find.

Executing a Quick Search

To find data with a **Quick Search**, complete the following steps.

1. Select **DIAdem NAVIGATOR**.
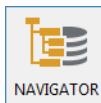
The file browser in the NAVIGATOR panel offers external data in a tree structure.

2. Enter the search term `Weather` in the search area to find all data sets containing the term `Weather`.

3. Click **Search**.

In the quick search DIAdem does not distinguish whether the data set contains the term as the name or the property of a file, of a channel group, or of a channel. DIAdem displays all files containing the term `Weather` or compounded terms, such as `Weather data` as **Search Results** as shown in Figure 2-1.

Figure 2-1. Search Results of the Quick Search
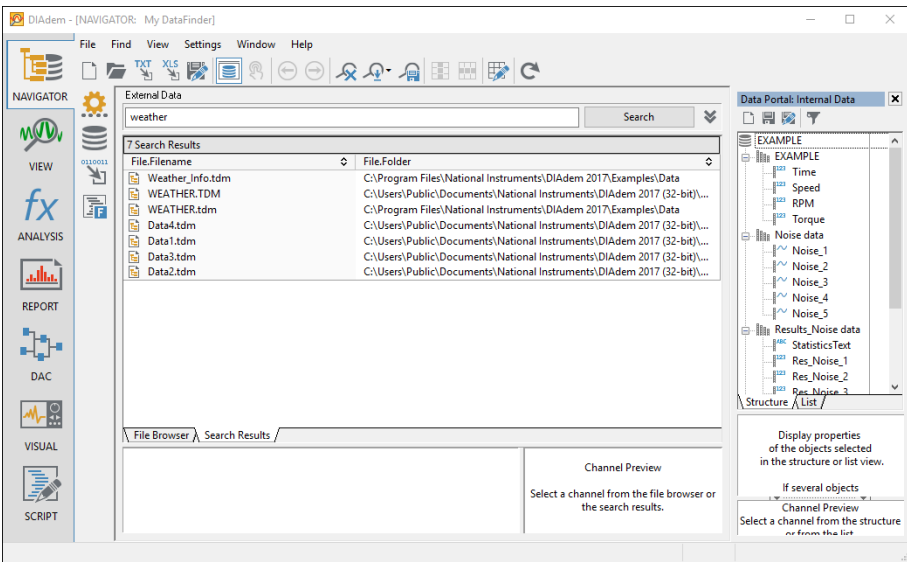
Executing an Advanced Search

Complete the following steps to limit the retrieved data with an **Advanced Search**.

1. Click the **Advanced Search** button to specify the search as shown in Figure 2-2.

2. Click **File** in the **Level** column in the first line and select `Group`.

   a. Click **<Enter a property>** in the **Property** column of the first line and select `Name`.

   b. Click the button with the three dots at the end of the first line. DIAdem lists the names of all the groups found.

   c. Select the group name `Weather` with a double-click.

📝 **Note**   If the list does not contain the term `Weather`, DIAdem was not able to index all example files. Select **Settings»My DataFinder»Configure»Indexer»Start Now** to start indexing.

Define another search condition in the second row to specify the search more accurately.

3. Click **File** in the **Level** column in the second line and select `Channel`.

   a. Click **<Enter a property>** in the **Property** column of the second line and select `Name`.

   b. Click the button with the three dots at the end of the second line. DIAdem lists the names of all the retrieved channels as shown in Figure 2-2.

   c. Select the channel name `Precipitation` with a double-click.

   Figure 2-2. Selection List with the Channel Names of the Indexed Data
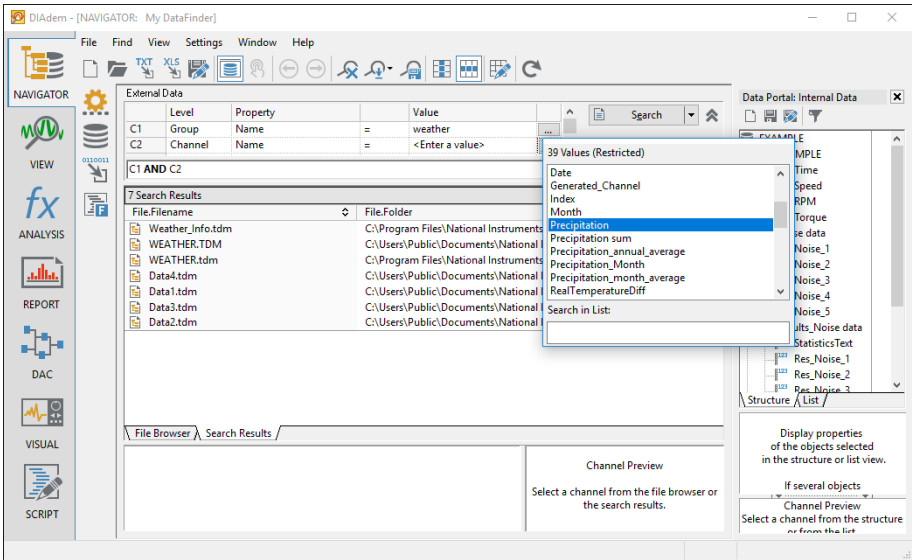
As you can see in the logical operations line below the search conditions, DIAdem connects several search conditions with the AND operator by default.

4. Replace the operator `AND` with `OR` so that the logical operations line contains the following operators:

   `C1 OR C2`

5. Click **Search**.

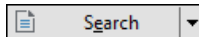DIAdem displays the **Search Results** as shown in Figure 2-3. Each of the found file contains either a group called `Weather` or a channel called `Precipitation`.

Figure 2-3. Search Results of the Advanced Search
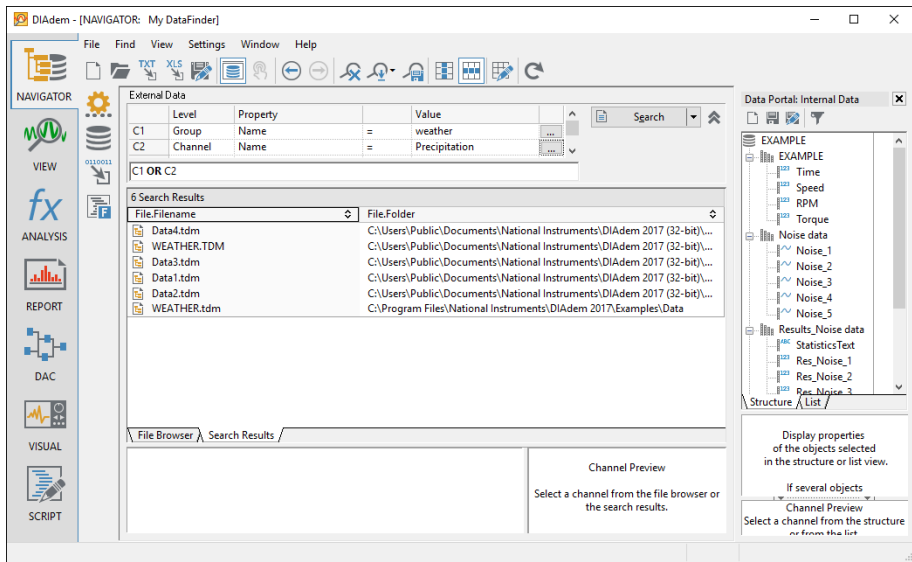
Browsing in Data Sets

Complete the following steps to open data files in the file browser in order to inspect search results.

1. Right-click the file `Data1.tdm` in the search results to open the context menu.

2. Select **Display in File Browser** from the context menu.

   DIAdem switches from the search results to the file browser and displays the file `Data1.tdm` in the tree view.

3. Click the plus sign before the file symbol and open the channel groups.

4. Click the plus sign before the file symbol of the `Weather` channel group and open the channels.

5. Click the `Precipitation` channel.

   DIAdem lists all the channel groups and channels that are contained in a file, in a tree structure. You can navigate down to channel level in the files that have the appropriate data formats. The **Properties** window below the **File Browser** displays further information on the selected file, channel group, or channel as shown in Figure 2-4. If you select a channel, the channel preview to the right of the properties display shows the channel data as a curve.

Figure 2-4. Browsing the Found Files in the File Browser
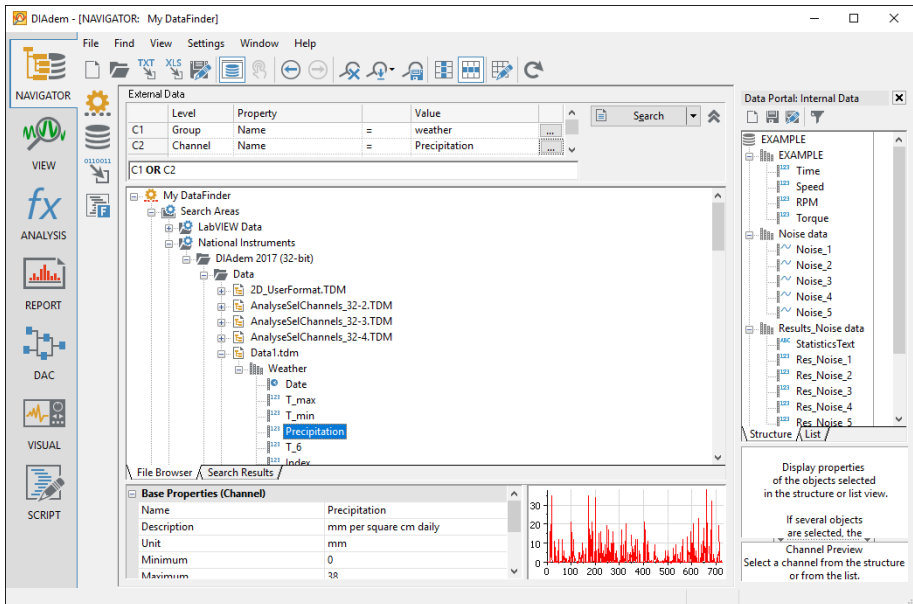
Loading and Managing Data

If you want to work with the data you found, you must load the data into the Data Portal. To load data and to remove unnecessary data, complete the following steps.

1. Click **Delete Internal Data** on the toolbar.
2. Select the channel group `Weather` in the file browser.

3. Drag and drop the selected channel group into the Data Portal.

    The Data Portal shows the new channel group `Weather` with all channels, as shown in Figure 2-5. If you select a channel, the channel preview of the Data Portal displays the channel data as a curve.

Figure 2-5. Loading Data from the File Browser to the Data Portal
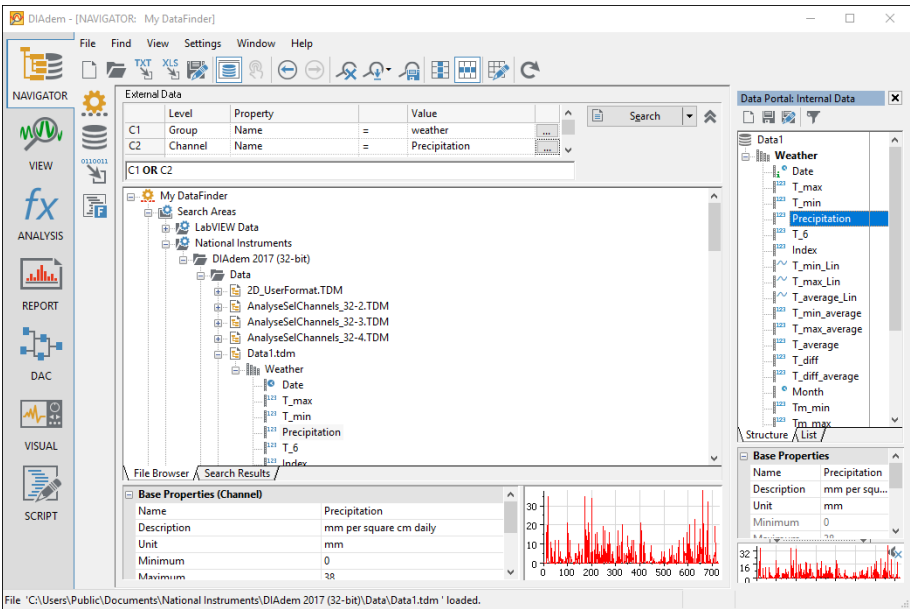
✎ **Note**   If you change data in the Data Portal, DIAdem does not automatically save these changes. The changes are executed only in the memory and not in the data file from which you loaded the data. This enables you to experiment with data without modifying the original data.

Saving Data

Click **Save** in the Data Portal to overwrite the file `Data1.tdm` with the current data of the Data Portal. Complete the following steps to save the data of the Data Portal at a different location under a different name.

4. Navigate to the DIAdem folder `Data` in the `National Instruments` folder.

5. Select the `Weather` channel group in the Data Portal.

6. Drag and drop `Weather` to the folder `Data`.

7. Enter the filename `Weather data` in the **Save As** dialog box.

8. Select the file type `National Instruments TDM Files (*.tdm)`.

9. Click **Save**.

Summary

The summary provides an overview of the topics discussed in this chapter. It also includes additional information.

DataFinder

In the search input area of the DataFinder, you enter search conditions to find your data. You can also drag and drop properties from the properties display of the Data Portal or of the file browser into the search input area. In the logical operations line, you connect the search conditions with AND and OR and use parentheses to specify queries more precisely. DIAdem lists the files found in the search areas on the **Search results** tab.

DataFinder Server

DataFinder Servers index data files in the network and facilitate the simultaneous access of up to 25 DIAdem users to joint search areas . You can enable security settings and use archiving systems.

Search Areas

Search areas are folders of the file system, which the DataFinder indexes. Select **Settings» My DataFinder»Configure** to modify the search areas of the DataFinder.

File Browser

The **File Browser** displays the files of the search areas in a tree structure. Right-click the empty space of the file browser to open the context menu and hide or show the folders of the local file system in a separate tree.

Internal Data in the Data Portal

DIAdem manages internal data in the Data Portal, which is visible in all panels. In all DIAdem panels you work with the channels of the internal data and their descriptive information. DIAdem saves result data in the Data Portal. You can display and edit the channel contents in DIAdem VIEW.

> **Tip** If you select the symbols next to the channel names you can select several channels without using the <Shift> or <Ctrl> buttons. DIAdem displays a cursor with a plus sign.

Channel Groups

Channel groups contain channels and descriptive properties of the channel groups. Use different channel groups to organize your data. You can define a channel group as a default group, for example, to automatically group together all the calculation results from DIAdem ANALYSIS. DIAdem displays the group name of the default group in bold type.

Channels

Channels contain data series which you either measured, loaded from an external data set, or calculated with DIAdem. DIAdem distinguishes numeric channels, waveform channels, time channels, and text channels. Numeric channels contain numeric values, waveform channels contain numeric values and and the associated x-channel as a generation instruction, time channels contain time values, and text channels contain text.

Properties

Properties are information about the data, which DIAdem saves with the data series in a TDM file. The data set properties contain the name of the author and the storage date, the channel group properties contain the name of the measurement and comments, and the channel properties contain the data type and the channel unit. In addition to the standard properties, you can create your own custom properties for the data set, the channel group, and the channel. DIAdem displays the properties in the properties displays of the file browser and of the Data Portal.

Units Catalog

The channel unit is a special channel property because you can organize the channel units in the units catalog. Use the units catalog to assign a physical quantity and a unit to measurement values, for example, the quantity speed and the unit kilometers per hour. If you assign the unit mile per hour from the units catalog to the speed channel, DIAdem can convert the channel values.

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Viewing and Evaluating Data

Use DIAdem VIEW to view, to analyze, and to edit data as curves in axis systems. In channel tables you can edit and delete the data as values and enter new data. You synchronize videos or the map display of a test drive with data. You project the data onto 3D models or analyze the characteristic diagrams in contour areas.

Viewing Curves

To view the loaded data set in an axis system, complete the following steps.

Note If you did not do the exercise in the previous chapter, delete the current data in the Data Portal and load the data set `Data1.tdm` from the DIAdem folder `Data`. You find this folder in the DIAdem NAVIGATOR file browser in the search area **National Instruments**.

1. Select **DIAdem VIEW**.

2. Click **New Layout**.

3. Click **Regular Worksheet Partition** on the group bar and select **Two Areas**.

Note Each panel has its own group bar on the left hand side. When you click a button on the group bar, DIAdem opens the function group where you can select a function.

4. Select the time channel `Date` in the Data Portal.

5. Select the numeric channels `T_max` and `T_min` as well by clicking the symbols before the channel names. The cursor changes its color and displays a plus sign.

6. Drag and drop the three channels selected in the Data Portal into the upper worksheet area.

7. Select **2D Axis System** in the selection dialog box.

DIAdem displays the axis system, as shown in Figure 3-1.

Figure 3-1. Viewing Temperature Data as Curves
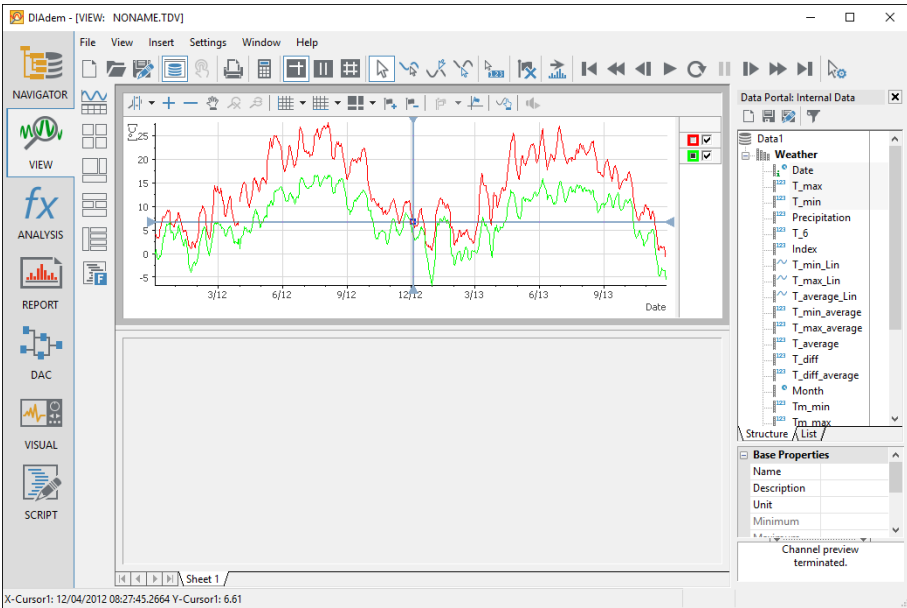
📓 **Note**   If you select several numeric channels in the Data Portal and drag them into an axis system, DIAdem assigns the channel selected first to the x-axis. If you select only one channel, DIAdem uses the index to display a numeric channel and uses the x-part to display a waveform channel.

Editing Curves

In DIAdem VIEW you can measure curves, and copy, delete, and interpolate curve sections. Use the curve cursor, the maximum values cursor, or the minimum values cursor on the DIAdem VIEW toolbar to measure a curve. To edit curve sections, use the flag functions on the axis system toolbar. The functions on the toolbar of the axis system influence the curves in the associated axis system, whereas the functions on the DIAdem VIEW toolbar influence all areas.

Measuring Curves

To follow the curve points with the curve cursor in an axis system, complete the following steps.

1. Click **Curve Cursor** on the tool bar.

2. Click the axis system and move the curve cursor along the curve.

    DIAdem displays the x-values and the y-values of the curve points in a tooltip next to the crosshair cursor that follows the cursor.

3. Click the red checkbox on the right side of the axis system to select the other curve as the leading curve.

📝 **Note** With the second checkbox next to the curve symbol you can hide and show the curve in the axis system.

DIAdem displays the coordinates of the new leading curve in the tooltip.

Copying Curve Sections

To select a curve section and to copy the data of the curve section into the Data Portal, complete the following steps.

1. Click **Band Cursor** on the tool bar.

2. Click the axis system at `12.12` and drag the band cursor to `3.13`.

    Click between the two lines to move the band cursor along the curves. Move the cursor lines to specify the width of the band cursor.

3. Click **Set Flags** on the axis system toolbar to select the curve points of the leading curve in the selected time slice.

📝 **Note** If you press <Shift> at the same time, DIAdem selects the points of all curves in this section.

4. Click **Flags: Copy Data Points** on the axis system toolbar to copy the data of the marked curve points to new channels.

    In the Data Portal, DIAdem creates a time channel and a numeric channel with the values of the copied curve section.

5. Drag and drop the new channels into the bottom workspace.

6. Select **2D Axis System**. DIAdem displays the copied curve section, as shown in Figure 3-2.

Figure 3-2. Selecting Curve Sections and Copying them into the Data Portal
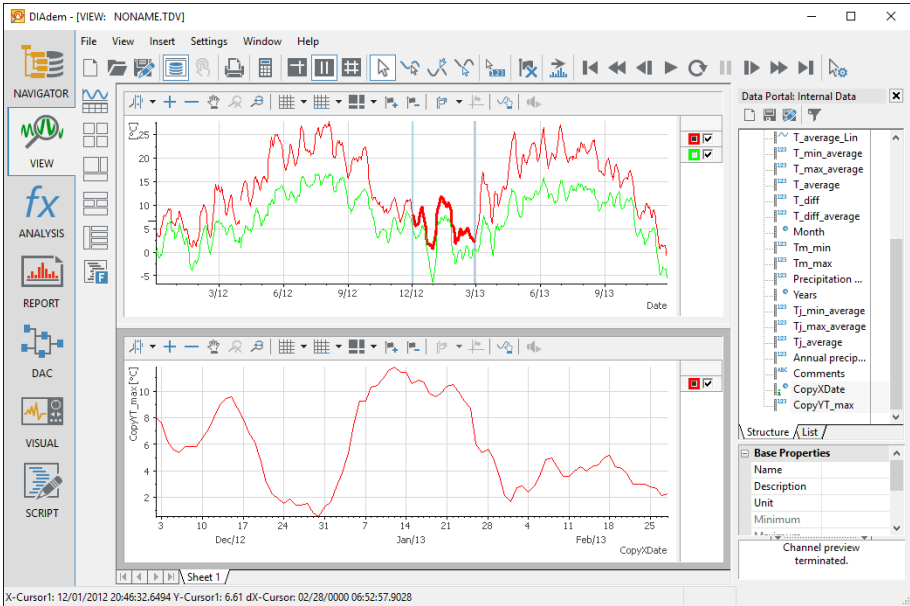
7. Click **Remove Flags from All Data** on the toolbar in DIAdem VIEW to disable the selection.

Editing Data in Channel Tables

In channel tables you can edit and delete data and add new data. You can enter or generate new data manually.

To edit values in a channel table and to generate new values, complete the following steps.

1. Click **Assigned Worksheet Partition** on the group bar and select **Channel Table**.

DIAdem creates a new worksheet with a channel table.

2. Select the channels Comments, CopyXDatum, and CopyYT_Max in the Data Portal and drag them into the channel table.

DIAdem displays the columns in the order in which you select the channels in the Data Portal.

3. Click the cell in the **CopyYT_max** column, row **10**.

4. Enter the value `1` and press <Enter>.

   DIAdem also displays the new value in the curve in the bottom axis system on the previous worksheet.

5. Right-click next to the channel table or into an empty column and select **Create New Channel** from the context menu.

   a. Enter the channel name `Generated_Channel`.

   b. Click **OK** to create the new channel in the channel table and in the Data Portal.

6. Right-click the first cell of the empty column **Generated_Channel** and select **Generate** from the context menu.

   a. Enter `0.5` as the step width and `100` as the number of values.

   b. Click **OK** to create the channel values.

   DIAdem displays the channel table, as shown in Figure 3-3.

Figure 3-3. Editing and Generating Data in Channel Tables

Click **Save Layout As** on the toolbar in DIAdem VIEW to save the layout with all worksheets as a template for similar data sets.

Summary

The summary provides an overview of the topics discussed in this chapter. It also includes additional information.

Layouts

A layout can contain several worksheets. DIAdem saves layouts separately from the channels. You can reuse the layout as a template for data sets with a similar structure.

Areas

Partition worksheets into areas to insert axis systems, channel tables, videos, 3D models, contours, maps, dialog boxes, text, and images. You can move the separating bars to resize any area in a worksheet. Use the **Assigned Worksheet Partitions** function group to add new worksheets with predefined areas to a layout.

Axis Systems

DIAdem VIEW provides 2D axis systems, polar axis systems, Bode axis systems, orbit axis systems, and shaft centerline axis systems which all display data as curves. In 2D axis systems you can display data as spikes or stair curves and add constants. To insert data into an axis system, drag and drop channels from the Data Portal into an axis system. Use the band cursor and the frame cursor to zoom curve sections. You open the legend on the right side of an axis system.

Graphics Cursor

DIAdem VIEW offers various graphics cursors for evaluating curves in axis systems. The free cursor moves freely in the axis system and the curve cursor follows the curve from curve point to curve point. Other graphics cursors determine the maximum values and the minimum values of a curve. If an axis system contains several curves, the graphics cursor follows the leading curve that you specify with the checkboxes in the legend. DIAdem synchronizes all the cursors of a worksheet with each other and with videos and 3D models.

Flags

Use the band cursor and the frame cursor to mark curve sections with flags, to delete, to copy, or to recalculate the marked curve points.

Channel Tables

In channel tables you view the individual values of all channel types, edit the values and add new values or channels. In the display properties of a channel table, you can specify whether a channel table only displays the channels that were dragged and dropped into the table or whether the channel table automatically displays all channels of a group or of the Data Portal.

Videos

In video areas you show videos. If you display the associated measured values as curves in an axis system, you can move a graphics cursor along the curves to display the video frame associated with each measurement value. Double-click an empty video area to insert a video.

3D Models

In model areas you project the measured or simulated data as a color shading or as a deformation onto a model of the test object. For example, you display temperatures as color shading on a climate dummy, and you display strain on bridge elements as deformation. To do so, you insert the 3D model of the test object and connect each data channel with the respective model point. For model points with no sensor, DIAdem interpolates the values from the data of neighboring model points.

Contours

In contour areas you display 3D data two-dimensionally by displaying the third dimension of the data as a color value and with isolines. You can use a contour display, for example, to display and to analyze characteristic diagrams. If you move the graphics cursor over a contour, DIAdem displays the associated isolines dynamically. You can save the data of every associated isoline and also the x-parallel and y-parallel intersection in the Data Portal.

Cascades

The cascade display type displays, for example, vibration data as a waterfall by displaying the vibration amplitude over the frequency in cascading, consecutive tracks. You can zoom into interesting areas and move over them with different measurement cursors. You can also show dynamic and static order lines, which help evaluate the rpm-related vibrations.

Maps

In map areas you display geographic data in map sections. For example, you can follow the route of a test drive when you move the graphics cursor in an axis system along the data, such as consumption, RPM, and torque, collected during the test drive. To do so, enter the recorded longitude and latitude and, for example, the time channel for synchronization.

Dialog Boxes

In dialog boxes you enter values, check settings, or start functions to change the displays in other areas of the layout during the analysis. You can include every user dialog box to which you added the control `VIEWConnector` in the dialog editor of DIAdem SCRIPT.

4

Analyzing Data with Mathematical Functions

Use DIAdem ANALYSIS to analyze data mathematically. You can apply predefined standard mathematical functions, including basic mathematics, curve fitting, signal analysis, and statistics. The dialog boxes for these standard functions guide you through the calculation, so you do not have to enter a formula. You select the input data and the settings. Use the DIAdem Calculator to define and calculate your own formulas.

Using Mathematical Standard Functions

DIAdem has extensive libraries with standard mathematical functions in several function groups in DIAdem ANALYSIS. The results of the calculations are displayed in new channels in the Data Portal.

📝 **Note** If you did not do the exercise in the previous chapter, delete the current data in the Data Portal and load the data set `Data2.tdm` from the DIAdem folder `Data`. This folder is in the search area **National Instruments** in the file browser of DIAdem NAVIGATOR.

To create a new group for the calculation results, complete the following steps.

1. Select **DIAdem ANALYSIS**.

fx
ANALYSIS

2. Right-click in the Data Portal and select **New»Group** from the context menu.
3. Enter `Results` as the **Name**. Enable the checkbox **Set default group**.
4. Click **OK**.

    DIAdem displays the name of the default group in bold type in the Data Portal.

Calculating the Sum of Channel Values

To total the precipitation for the year 2012, complete the following steps.

1. Click **Statistics** on the group bar and select **Descriptive Statistics**.
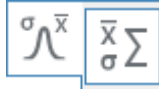
2. Click the three dots next to **Channels** in the dialog box area **Channel-oriented evaluation**.

3. Select [1]/Precipitation sum.

   This denotes the Precipitation sum channel in the first channel group.

4. Click **OK**.

5. Disable **Calculate over all rows** and enter from **row** 2-13.

> **Tip**   To check which rows contain the precipitation for the year 2012, switch to DIAdem VIEW and load the channels Month and Precipitation into a channel table. The Month channel contains the time values for the monthly precipitation totals.

6. Enable **Sums»Measured values** on the **Characteristic Values 1** tab.

> **Note**   Click **All Off** on the **Characteristic Values2** tab **if you already selected characteristic values.**

DIAdem displays the **Descriptive Statistics** dialog box, as shown in Figure 4-1. The dialog box displays the channel preview of the precipitation sum in the top right-hand corner and displays the result data below the channel preview.

Figure 4-1. Precipitation Summation in Sections
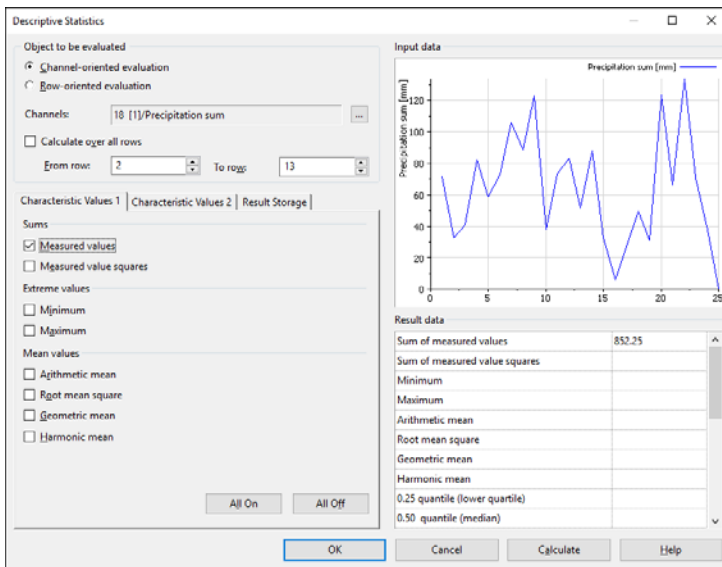
7.   Click **OK** to calculate the sum and to close the dialog box.

     DIAdem saves the result in the custom properties of the `Precipitation sum` channel.

> 📝 **Note** If you want to execute further calculations with this standard function, click **Calculate**. The dialog box remains open for further entries.

8.   Click `[1]/Precipitation sum` in the Data Portal and open the property `Result»Statistics»Sums»Sum`.

9.   Right-click `Sum` and select **Rename**. Enter `Result~Precipitation_2012` as the property name and press <Enter>.

Averaging Channels

To calculate the average monthly temperatures, complete the following steps.
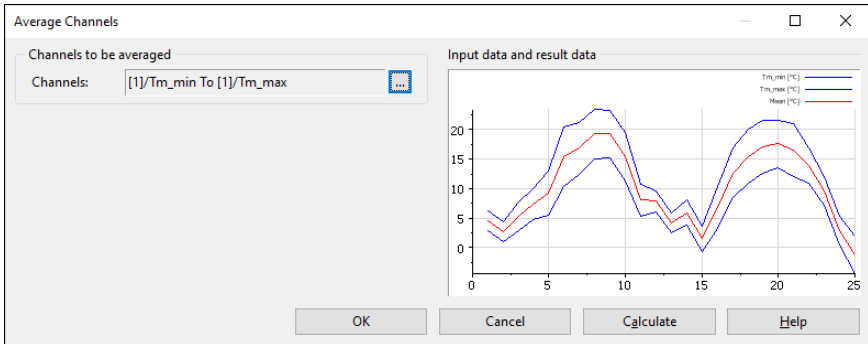
1.   Click **Channel Functions** on the group bar and select **Average Channels**.

2.   Click the three dots next to **Channels** in the dialog box area **Channels to be averaged**.

3.   Select `[1]/Tm_min`. Press <Ctrl> and select `[1]/Tm_max`.

4.   Click **OK**.

DIAdem displays the dialog box similar to Figure 4-2.

Figure 4-2. Averaging Minimum and Maximum Temperatures

5. Click **OK**.
6. Right-click `Results/Mean` in the Data Portal and select **Rename**. Enter `Temperatures` as the channel name and press <Enter>.

Calculating with the Units Catalog

The DIAdem units catalog organizes physical quantities and the associated units. Use the units catalog to convert channels into other units.

To convert the calculated average monthly temperatures from degrees Celsius to degrees Fahrenheit, complete the following steps.

1. Click **Channel Functions** on the group bar and select **Convert Channel Unit**.

2. The **Channel** entry field in the dialog box area **Channels to be calculated** contains the channel `[2]/Temperatures`.

    If there is a different channel in this area, select `Results/Temperatures` in the Data Portal and drag and drop the selected channel into the entry field.

3. Select **Unit»To** [°F] Degree Fahrenheit, as shown in Figure 4-3.

Figure 4-3. Converting Channel Units with the Units Catalog

4. Click **OK**.

5. Right-click Results/UnitConverted in the Data Portal and select **Rename**. Enter Temperatures_F as the channel name and press <Enter>.

Note You can also convert channel data into a different unit in the Data Portal. To do so, click the unit entry field in the properties display and click the button with the three dots to open the **Symbol Input Help** dialog box.

DIAdem ANALYSIS displays a record of the calculations, as shown in Figure 4-4, and the Data Portal displays new channels with the calculation results.

Note Click **Export ANALYSIS Log** on the toolbar to save the calculation log as an HTML file.

Figure 4-4. Record of the Calculations with Standard Functions
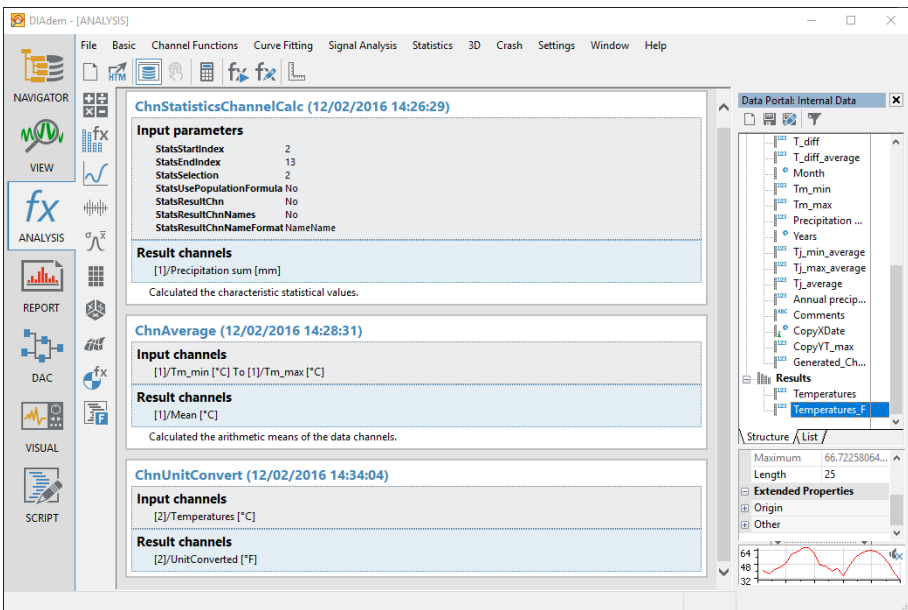
Refer to Figure 5-3 in the next chapter to view the curves of the average temperatures and the annual precipitation.

Calculating Formulas with the Calculator

Use the DIAdem Calculator to calculate your own mathematical formulas. In the Calculator you calculate with channels, variables, and values you enter. DIAdem stores the results in channels or variables.

Complete the following steps to calculate the difference between the monthly maximum temperatures and the average temperatures.

1. Click **Calculator** on the toolbar.
2. Enter the following formula in the Calculator entry field.

```
Ch("Results/TmMax_Diff")=Ch("[1]/Tm_max")-Ch("[2]/Temperatures")
```

Tip   Instead of typing in the entire formula, copy this line and paste it in the calculator.

Figure 4-5. Calculating Formulas with the Calculator

3. Click <Enter> and close the dialog box with the red window button.
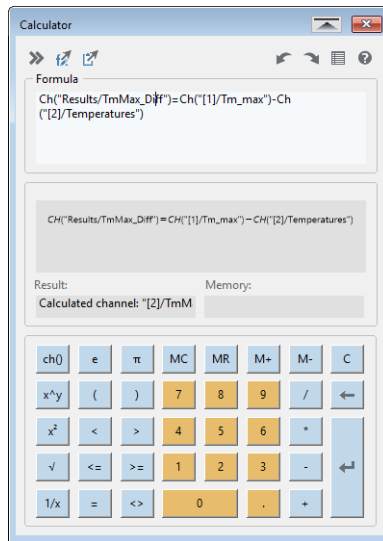
   DIAdem adds the new channel `TmMax_Diff` to the `Results` channel group in the Data Portal.

Summary

The summary provides an overview of the topics discussed in this chapter. It also includes additional information.

Mathematical Functions

DIAdem ANALYSIS offers a variety of standard functions for analyzing your data. You assign input channels to standard functions, set parameters, and execute the calculation. Click **OK** to execute a calculation once and to close the dialog box. Click **Calculate** to execute several calculations with the same standard function.

Result Channels

DIAdem ANALYSIS saves calculation results in new channels. This enables you to calculate new data without overwriting the existing channels. In most dialog boxes of the standard functions, you can select **Store result in original channel** to overwrite the existing channels.

Custom Properties

Some standard functions, such as descriptive statistics or approximation store the calculated characteristic values as custom properties in the result or input channels.

Default Group

DIAdem stores the result channels of a calculation in the default group in the Data Portal. In the context menu you can define a different group as the default group. DIAdem displays the group name of the default group in bold type.

Calculator

Use the Calculator to specify your own formulas for analyzing data. The Calculator has functions that range from simple arithmetic functions to advanced scientific and engineering functions. Use the Calculator to calculate channels, variables, and single values. DIAdem stores the results in channels or variables.

Units

If you assign units from the units catalog to the original channels, DIAdem automatically determines the unit of the result channels. Based on the physical quantities and units of the original channels, the division of distance by time results in a speed with the unit kilometers per hour, for example. Use **Settings»Options»Units** to add user-defined units and to define unit sets with preferred units.

Calculation Manager

To execute recurring analysis sequences with a mouse-click you can define simple as well as complex calculations in the calculation manager. An analysis sequence can contain user-specific formulas and default functions and can combine calculations when one calculation step accesses the result from a different calculation step.

5

Creating Reports

Use DIAdem REPORT to document data and present results. In 2D and 3D axis systems, you display your data as curves, as bar diagrams, and as surfaces. In 2D and 3D tables you list channel contents. Add comments and text to your report and illustrate it with graphics and formulas. You use the Chart Wizard to create and to modify 2D axis systems and polar axis systems.

Creating Axis Systems

To create a new layout with the Chart Wizard, complete the following steps.

Note If you did not do the exercise in the previous chapter, delete the current data in the Data Portal and load the data set `Data3.tdm` from the DIAdem folder `Data`. This folder is in the search area **National Instruments** in the file browser of DIAdem NAVIGATOR.

1. Select **DIAdem REPORT**.
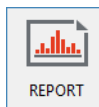
2. Click **New Layout**.
3. Select the channel `Weather/Month` and then the channels `Weather/Precipitation sum` and `Results/Temperatures` in the Data Portal.
4. Right-click a selected channel and select **Chart Wizard** from the context menu.

    DIAdem opens the Chart Wizard and creates a new worksheet with an axis system. In the axis system, DIAdem displays the channels that are selected in the Data Portal as curves, as shown in Figure 5-1. DIAdem assigns the first selected channel to the x-axis.

    In Step 1 you select the diagram type. In Step 2 you add or delete curves. In Step 3 you specify the diagram display on several tabs. The preview, as shown in Figure 5-1, directly displays how the diagram changes.

5. Select the diagram type **Line** and then the subtype **Lines with Several Y-Axes**.

Figure 5-1. The Chart Wizard Displays the Preview in the Worksheet
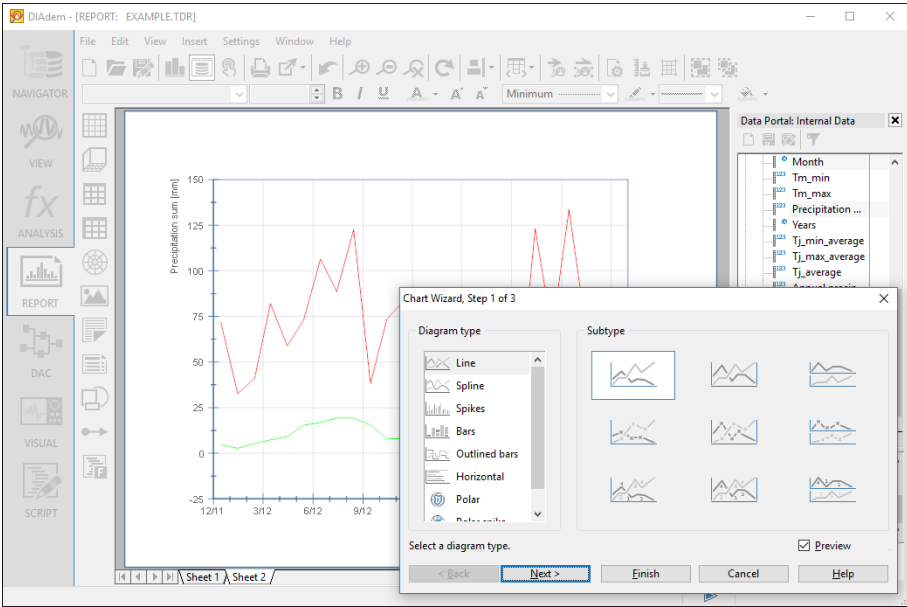
6. Click **Next** twice to open Step 3 of 3.

7. Select the **X-Axis** tab.

8. Enable **Manual from** for the value range and enter `01/01/2012` as the start and `12/31/2012` as the end.

9. Click **Finish** to create the axis system.

   In the axis system, DIAdem displays the monthly precipitation and the monthly average temperatures over the date.

> **Tip** You can open the Chart Wizard at several points in DIAdem. If you want to display curves with various x-channels, open the Chart Wizard on the toolbar. If you want to integrate axis systems into the current worksheet, open the Chart Wizard from the **2D Axis Systems** function group or the **Polar Axis Systems** function group. If you want to edit an axis system, open the Chart Wizard from the context menu of the axis system.

Editing Axis Systems

You can move and resize axis systems or parts of an axis system. To make it easier for you to see which objects you can select, DIAdem displays an object in a blue frame as soon as the mouse cursor idles on the object. Double-click the object to open its settings.

Complete the following steps to display the precipitations as bars.

1. Double-click the red curve of the precipitation sum to open the associated curve parameter.

2. Select Bars as the **Display type** and click **OK**.

   DIAdem displays the worksheet, as shown in Figure 5-2.

Figure 5-2. DIAdem Displays the Precipitation as Bars
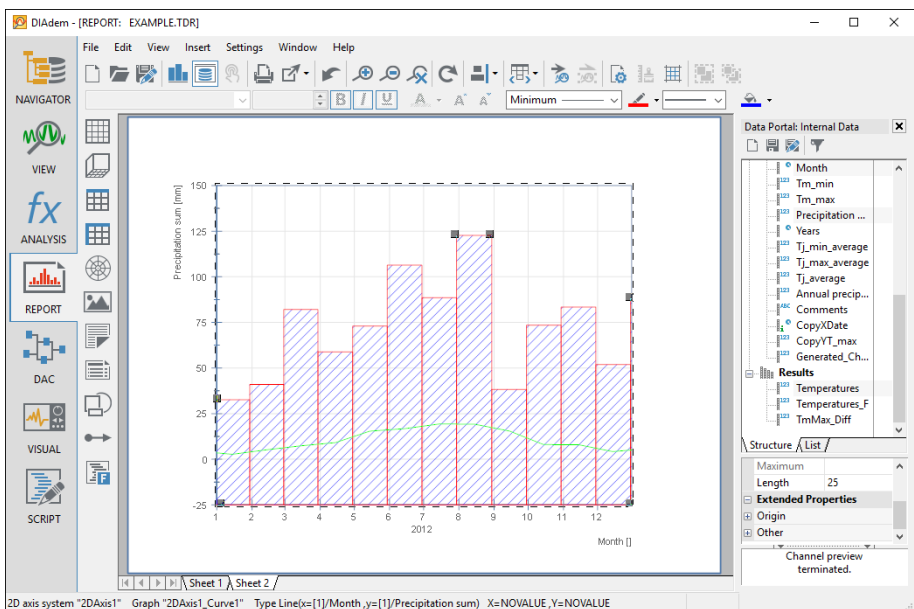
3. Select the axis system by clicking a free space in the axis system.

4. To reduce the width of the axis system, move the small square in the middle of the right edge of the selected axis system to the left.

Graphics and Lines

Illustrate reports with graphics and company logos. Use lines and rectangles to partition the worksheet or to highlight a text field.

To add a graphic to your worksheet, complete the following steps.

1. Click **Graphics** on the group bar and select **Load Graphic**.

2. Select `Weather.jpg` in the DIAdem `Documents` folder and click **Open**.
3. Click and drag the graphic to the right edge of the workspace.
4. Resize the graphic by dragging the small squares at the corners of the graphic.

To prepare a description field on the right of the worksheet, complete the following steps.

1. Click **Lines and Arrows** and select **Continuous Vertical Line**.

    DIAdem inserts a vertical line on the right edge.
2. Move this line slightly to the left to widen the description field.

Using Text and Variables as Labels

Add text and variables to a report to explain the contents and highlight specific items. All texts can include formula expressions and DIAdem variables, which DIAdem updates along with the rest of the report. Double @ characters indicate to DIAdem which parts of the text to evaluate dynamically.

To add a text to your report, complete the following steps.

1. Click **Text** on the group bar and select **Text**. The cursor changes to a text cursor.

2. Click the text field in the worksheet and enter `Weather Report`.

3. Press <Enter> and type `@@CurrDate@@` into the second line.

4. Click outside the text to conclude the entry.

5. Click the text. To resize the text, drag the small squares at the corners of the text with the mouse.

Adding and Formatting Channel Properties

Click the button with the three dots next to the entry field to open the text entry help and use the available variables and expressions to edit the text. You can easily drag and drop channel properties from the Data Portal into the worksheet.

To add a channel property to your report and to edit the channel property, complete the following steps.

1. Click `[1]/Precipitation sum` in the Data Portal and open the property `Result»Precipitation_2012`.

2. Drag this custom property into the text field.

3. Double-click the inserted text. The text editor displays the following text:

   Result~Precipitation_2012:
   @@Str(Data.GetChannel("[1]/Precipitation
   sum).Properties("Result~Precipitation_2012").Value,
   "AutoAdj")@@

   a. Replace the first term `Result~Precipitation_2012` with the description `Annual precipitation`.

   b. Press <Enter> to position the value below the text.

   c. Enter `mm` at the end of the text.

4. Click the **Position** tab and select `Centered` as the **Relative position**.

5. Click **OK**.

6. Select both texts and the graphic.

7. Click **Alignment** on the toolbar and select **Vertical**.

    DIAdem displays the worksheet, as shown in Figure 5-3.

Figure 5-3. Using Text and Variables as Labels
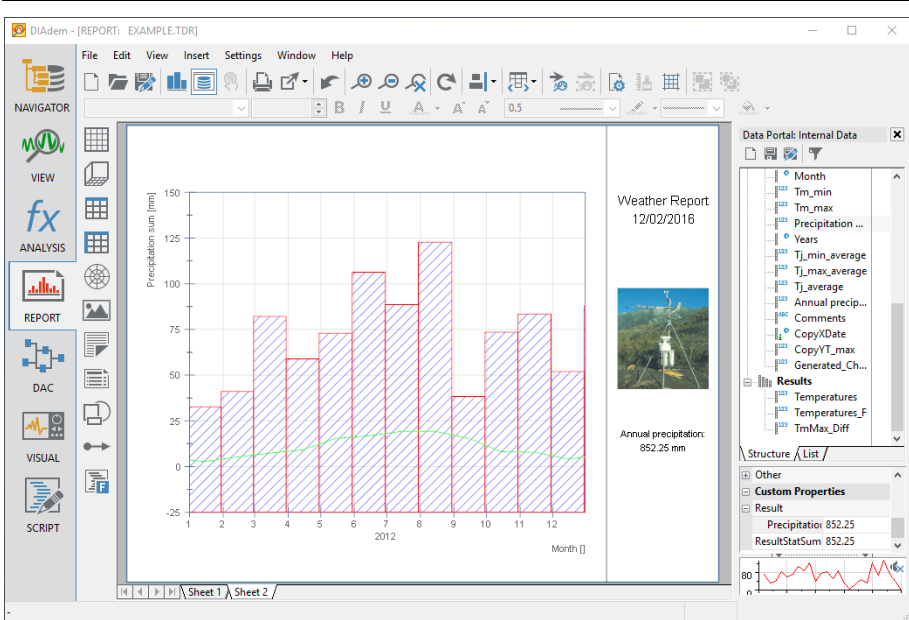
Click **Save Layout As** in order to save the layout as a template for similar data sets.

Summary

The summary provides an overview of the topics discussed in this chapter. It also includes additional information.

Layouts

A layout can contain several worksheets. DIAdem saves layouts separately from the channels. You can reuse layouts as templates for data sets with a similar structure.

Worksheets

Worksheets contain axis systems, tables, text, formulas, and graphics. To add data to the worksheet, drag and drop channels from the Data Portal into axis systems and tables. In addition to selecting data channels from the Data Portal, you also can add data channels by double-clicking an axis system or a table.

Select **Settings»Layout Setup»Worksheet Parameters** to change the page format of a worksheet so that, for example, the table of contents is in portrait format, whereas the diagrams remain in the landscape format.

Export your report as a PDF-, XPS-, and HTML-file or export individual pages as a graphic in various formats, for example, PNG, JPG, GIF, TIF, and EMF. Under **Settings»Layout Setup» Layout Parameters** you can add custom properties to a report, for example, the name of a test sequence, in order to search for this property with the DataFinder.

Master Layout
Use a master layout to create a uniform appearance for reports. The master layout remains unchanged in the background of all worksheets and consists of a landscape master and a portrait master. To create a master layout, select **File»Master Layout»New**.

Chart Wizard
You can use the Chart Wizard to create and to modify 2D axis systems and polar axis systems. The preview function displays each changed setting in the worksheet.

Axis Systems
Use axis systems to display channels as curves, as bars, and as surfaces. You double-click an axis system to edit the displayed curves, to add new curves, and to delete existing curves. To zoom curve sections, change the scaling of the x-axis and the y-axis with the mouse wheel as soon as you position the cursor over the respective axis.

Tables
Use tables to list the contents of numeric channels and also text channels. Double-click a table to edit the columns, to add new columns, and to delete columns.

Text
Use text to label worksheets. Use **Add Curve Coordinate** in the context menu of a curve to add comments to values. Text also can include variable information, such as filenames or the current date. For DIAdem, the @@ characters indicate a variable expression. Click **Refresh** on the DIAdem REPORT toolbar to display the current variable contents.

Formulas
Use formulas to display calculation instructions in graphics. DIAdem uses the Mathematical Markup Language (MathML) formula syntax for text editing.

Graphics
Use graphics and logos to illustrate worksheets. DIAdem supports numerous different graphic formats including PNG, BMP, JPG, TIF, and WMF.

6

Automating Sequences

Use DIAdem SCRIPT to automate tasks in a script, which combines several work steps for recurring sequences, such as standard calculations and serial evaluations. Scripts, which you can record interactively, use the functions of all DIAdem panels. You can add program structures and dialog boxes to scripts in the integrated script editor.

Creating Scripts

The recording mode is the easiest way to create scripts. If you enable the recording mode, DIAdem creates a new script in the script editor and records your actions in this script. To create a new script in the recording mode, complete the following steps.
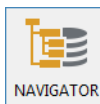
1. Select **DIAdem SCRIPT**.

2. Click **Enable Recording Mode** on the toolbar to start recording the script.

   a. Enter DIAdem user as the **Author** and Manual example as **Comment** in the dialog box that opens.

   DIAdem writes this information directly into the script code to help you identify the script in the future.
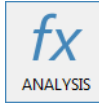
   b. Click **OK**.

3. Select **DIAdem NAVIGATOR**.

4. Click **Delete Internal Data** to delete the data in the Data Portal.

   DIAdem displays a message box asking whether the changed data should be saved.

5. Enter `Weather` in the search area of the quick search and click **Search**.

6. Drag and drop the `Data1.tdm` file into the Data Portal.

7. Select **DIAdem ANALYSIS**.

8. Click **Channel Functions** on the group bar and select **Average Channels**.

    a. Click the three dots next to **Channels** in the dialog box area **Channels to be averaged**.

    b. In the selection dialog box that opens, select the channels `[1]/Tm_min` and `[1]/Tm_max` and click **OK**.

    c. Click **OK** to calculate the mean values and to close the dialog box.
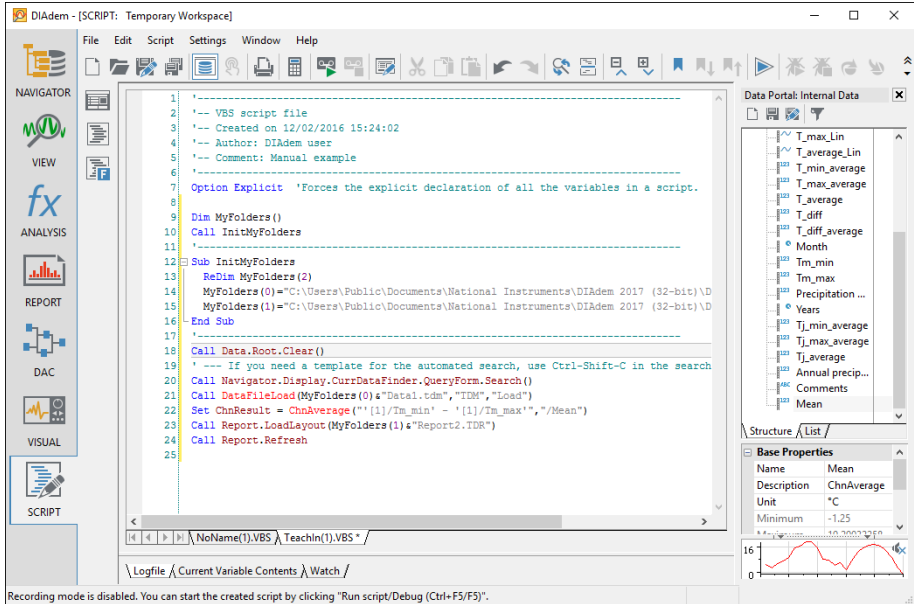
9. Select **DIAdem REPORT**.
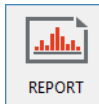
10. Click **Load Layout**.

    a. Select the layout `Report2.tdr` and click **Load**.

    DIAdem refreshes the display and shows the loaded data set.

11. Select **DIAdem SCRIPT**.

12. Click **Disable Recording Mode**.

DIAdem displays the recorded script in the script editor as shown in Figure 6-1.

Figure 6-1. Recording Actions in the Script Editor

After the commenting header, DIAdem declares the `MyFolders` path variable and assigns to this variable the paths to the data folder and to the document folder. If you want the script to load the data file or the layout file from another folder, just change the paths at this point in the script.

Editing Scripts

In the recording mode you have recorded the search for weather data, loaded a data set, and created a report. Expand the recorded script to evaluate further weather data.

To select data interactively complete the following steps.

1. Replace the script line for loading the data file `Data1.tdm`

    ```
    Call DataFileLoad(MyFolders(0)&"Data1.tdm","TDM","Load")
    ```

    with the following script lines:

    ```
    Call WndShow("NAVIGATOR","OPEN")
    Call InteractionOn("Load Data4.tdm")
    ```

    The first script line opens the NAVIGATOR panel and the second line stops the script so that you can load data interactively.

2. Enter the hide Data Portal instruction behind the last script line and CodeCompletion to do so.

   a. Enter `Portal`.

      When you type a dot behind the `Portal` object, DIAdem offers a selection of available methods and properties for this object, as shown in Figure 6-2.

Figure 6-2. CodeCompletion and SmartInfo Make Editing Objects Easier
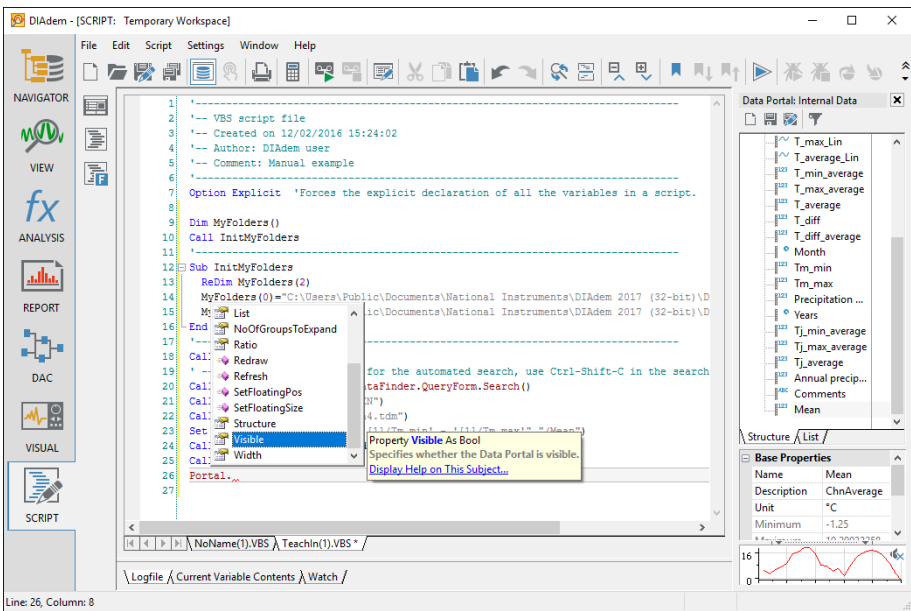
   b. Double-click `Visible` to insert this property into the script.

   c. Complete the script line as follows:

```
Portal.Visible = False
```

DIAdem displays the respective SmartInfo for every element in the selection list. Click **Display Help on this Subject** to open the help page on this object.

Testing Scripts

To test the modified script, complete the following steps.

1. Click **Run Script**.

   The script opens the NAVIGATOR panel and displays in the **Search Results** all the data files that contain the term `Weather`.

2. Click the `Data4.tdm` file and drag and drop the file into the Data Portal.

3. Click **Load Data4.tdm** in the dialog box to end the interaction.

The script opens the REPORT panel. DIAdem refreshes the date shown in the heading and hides the Data Portal, as shown in Figure 6-3.

Figure 6-3. Report Created with the Script
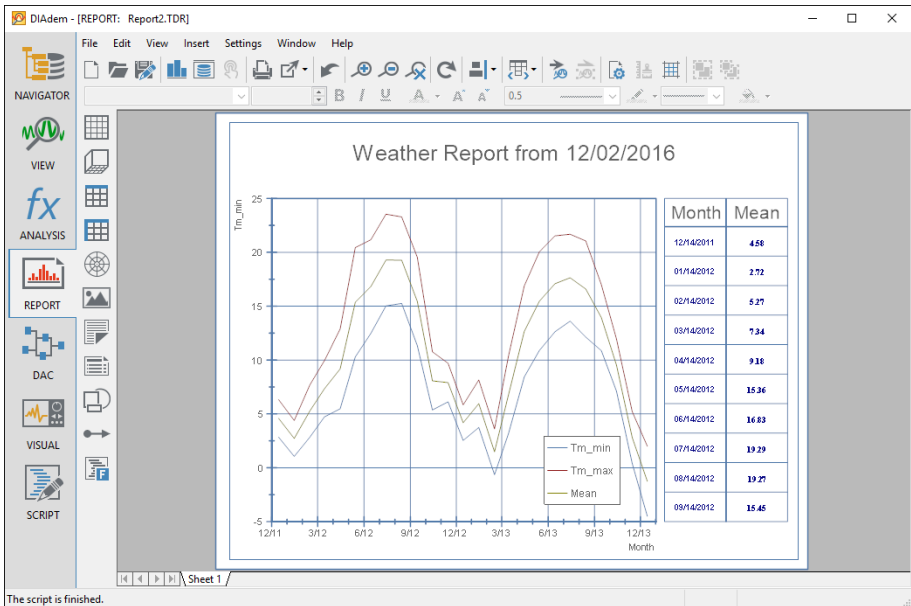
4. Click **Data Portal** to show the Data Portal again.

Select **DIAdem SCRIPT** and click **Save File As** to save the file.

Summary

The summary provides an overview of the topics discussed in this chapter. It also includes additional information.

Scripts

Scripts allow you to execute a series of commands for finding data, loading data, analyzing data, and creating reports. In scripts you can use the VBS functionality and DIAdem functions. You can integrate the standard dialog boxes in scripts or you can create your own dialog boxes.

Recording Scripts

In the recording mode DIAdem records the command for every action that you execute interactively, in a script.

<Ctrl-Shift-C>

In the recording mode, DIAdem does not usually record the value assignment for object properties and variables. Press <Ctrl-Shift-C> to record, for example, the values of properties and variables in a dialog box in DIAdem REPORT. If DIAdem is not in the recording mode, you also copy the value assignment with <Ctrl-Shift-C> but in this case to the Windows clipboard. Then you insert these assignments in a script and change the required properties and variables.

Script Editor

The script editor displays the program code of scripts. While you record actions in the recording mode, DIAdem records the commands directly in the script editor. Use functions such as go to line, bookmarks, restoring, and find and replace, to make script editing easier.

If you click a command, a property, a method, or a variable, the SmartInfo displays the parameters of the command, the property, the method, or the value range of the variable. For further information click **Display Help on this Topic**.

CodeCompletion

If you enter the name of an object and complete the entry with a dot, the script editor offers the subobjects, events, properties, and methods that are available for this object. Add your selection to the object in the script with a double-click.

When you enter the first characters of a command, for example, and press <Ctrl-Spacebar>, the script editor automatically completes the command. If several commands start with these characters, the script editor offers a selection list of all the possible objects, commands, and procedures.

Interaction Mode

When you use the interaction mode, you can stop your script and work interactively with DIAdem. Use the `InterActionOn` command to enable the interaction mode in scripts. Use the **End Interaction** button on the toolbar of every panel or in a message box to end the interaction.

User Commands

To add commands to DIAdem, you can define user commands in a script. For example, you use user commands to run calculations in the calculator, to format axis systems in DIAdem REPORT, or to extend the range of functions in scripts.

User Dialog Boxes

Create user dialog boxes in the dialog editor in DIAdem SCRIPT to enter values, to request settings, or to start functions. Use events to connect elements from user dialog boxes and specify how the script proceeds depending on the previously specified settings.

7

Data Acquisition and Visualization

With DIAdem DAC and DIAdem VISUAL you acquire data, control processes, and visualize data. In DIAdem DAC you create block diagrams to acquire measurement values and to process and output the measurement values during the measurement. In DIAdem VISUAL you design the visualization to display the acquired and calculated measurement values and to influence the measurement with input instruments.

Acquiring Measurement Data

In DIAdem DAC you select functions blocks from the various function groups and connect them with signal buses, to create block diagrams. The measurement data is transferred from data sources to processing blocks, display instruments, and output blocks.

To create a block diagram with a simulated signal source, complete the following steps:

📝 **Note** You can replace the simulated signal with measured data.

1. Select **DIAdem DAC**.
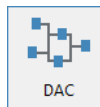
2. Click **New Block Diagram**.
3. Click **Simulation Inputs** on the group bar and select the **Function Generator**.

4. Click **Display Instruments** on the group bar and select **Numeric Display**.

   DIAdem inserts every new block in the top left corner of the workspace in DIAdem DAC.

5. Move the **Digit1** block to the right side of the **Generator1** block.

6. Click the output on the right side of **Generator1**. Click and hold the mouse button and drag the green bus to the input on the left side of the **Digit1** block. As soon as **OK** appears on the cursor, you can release the mouse button.

   The data source and the display instrument are now linked with a green data bus similar to Figure 7-1.

Figure 7-1. Block Diagram with Function Generator and Digits Display
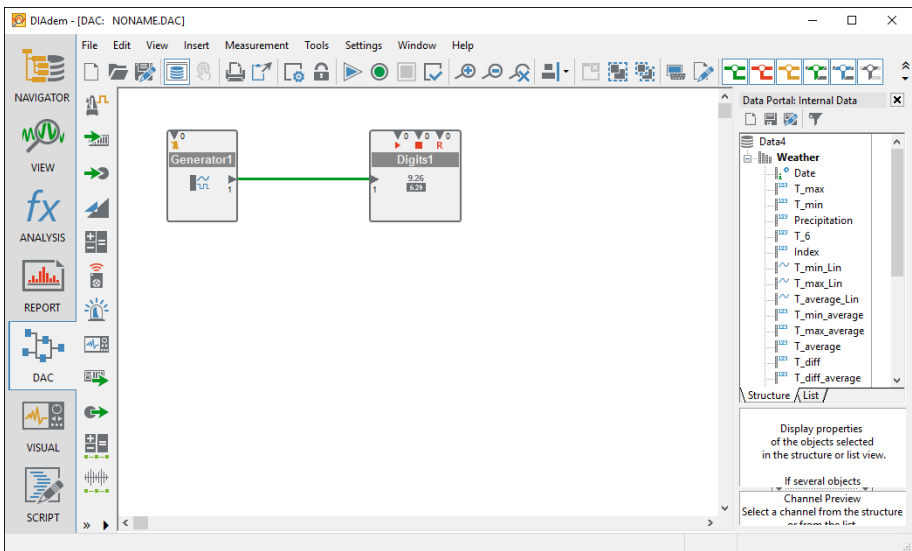
7. Click **Start Display** on the toolbar.

   DIAdem opens the DIAdem VISUAL panel and displays the simulated sine values in a Digits display.

8. Click **Stop Measurement**.

Saving Measurement Data

Until now you have displayed the signal values, but the values are not yet saved. To document processes and to check results, DIAdem must save measurement values.
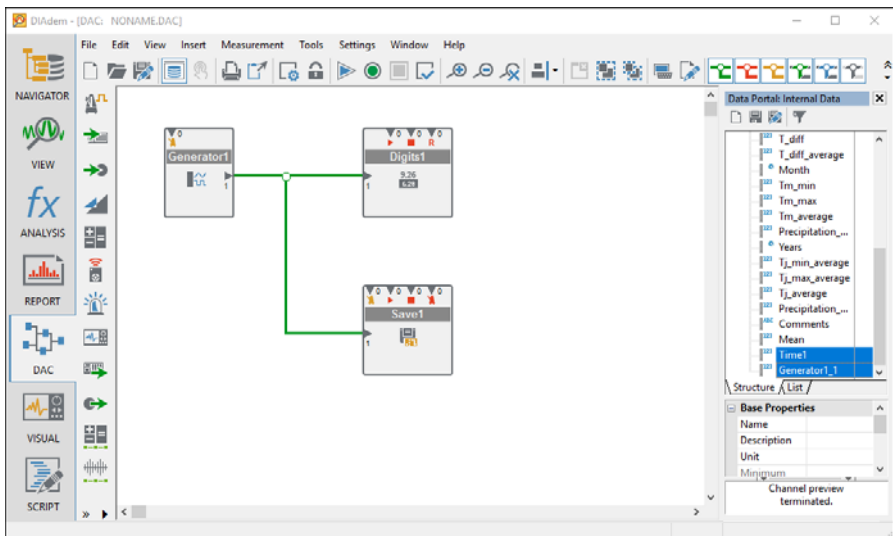
To save the measurement data, complete the following steps.

1. Select **DIAdem DAC**.

2. Click **System** on the group bar and select **Save Data with Trigger**.

3. Position the **Save1** block below the digital display.

4. Click the green data bus and drag the bus to the data input of the Save block as shown in Figure 7-2.

5. Double-click the **Save1** block.

   a. Select **Parameters**.

   b. Enter `1000 Values` for **Cycle»Save**

   c. Click **OK**.

6. Click **Start Measurement**.

   DIAdem stops the measurement as soon as 1,000 values are saved.

7. Switch to **DIAdem DAC**.

   The new channels `Time1` and `Generator1_1` are now visible in the default group of the Data Portal.

Figure 7-2. Extended Block Diagram with Data Storage

Monitoring Measurement Signals

In control blocks you define conditions for monitoring and controlling measurements.

To save measurement values in relation to a condition, complete the following steps.

1. Click **Simulation Inputs** on the group bar and select **Slider Control**.


2. Position the **Slider1** block below the function generator.
3. Click **Control** on the group bar and select **Window**.

4. Position the **Window1** block next to the slider control.
5. Drag a green bus from the output on the Slider control to the input on the Window condition.
6. Double-click the **Window1** block.

    a. Enter the lower limit –5 and the upper limit 5 in the signal list, as shown in Figure 7-3.

    b. Select `Window exit` as the **Window Type**.

**Figure 7-3.** Setting the Window Condition
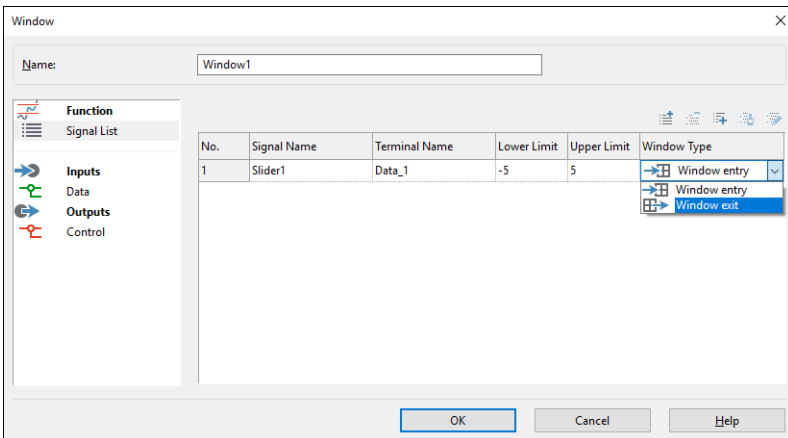
    c. Click **OK**.

7. Click the bus between the blocks **Slider1** and **Window1** and drag a new bus onto the green bus between the blocks **Generator1** and **Digit1**.

   The 2 at the input of the numeric display indicates that two signals now reach the block on this data bus.

8. Drag a bus from the output at the bottom of the **Window1** block to the input with the red triangle at the top of the **Save1** block, as shown in Figure 7-4.

   This creates a red control bus that DIAdem uses to trigger data storage. Always connect control buses at the top or at the bottom of a block.

Figure 7-4. Extended Block Diagram with Slider Control and Window Condition
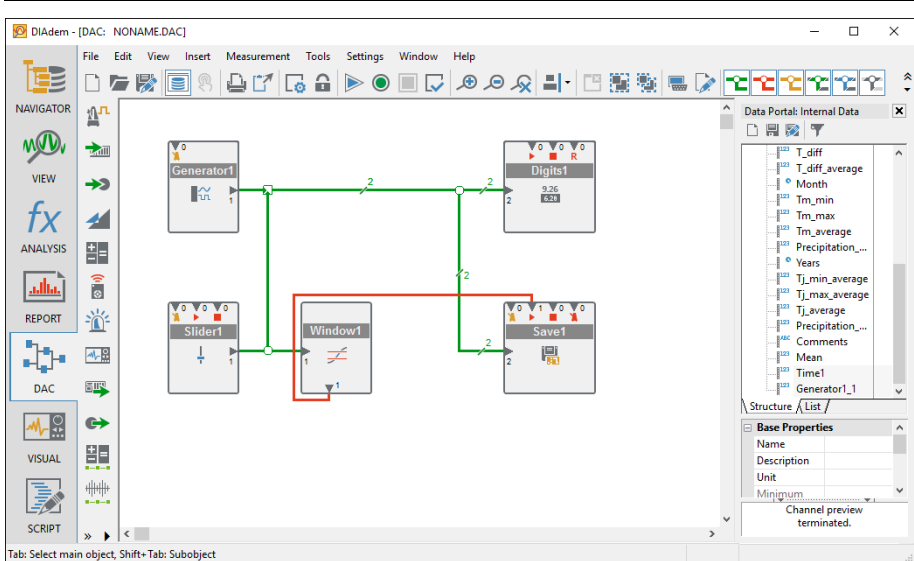
Visualizing Measurements

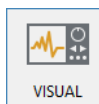You can arrange the input instruments and display instruments, which are integrated in the block diagram, in DIAdem VISUAL and you can configure each instrument individually.

To design the visualization complete the following steps.

1. Switch to **DIAdem VISUAL**.

The instruments Slider Control and Digit Display are positioned on top of each other at the top left of the display area of DIAdem VISUAL.

2. Position the two instruments next to each other.

3. Select both instruments.

    a. Click **Alignment** and select **Horizontal**.

    b. Click in the workspace to deselect it.

4. Click **Start Measurement**.

5. Drag the slider control up and down.

    As soon as you leave the specified window range of –5 to +5, DIAdem starts saving the measurement values. Figure 7-5 shows the visualization.

Figure 7-5. Visualization with Input Instruments and Display Instruments
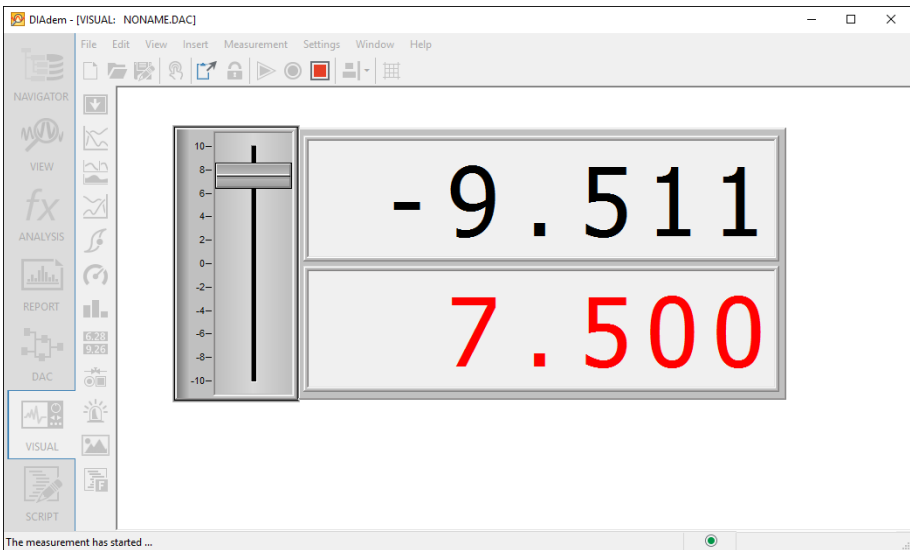
6. Click **Stop Measurement** or wait until DIAdem has acquired the specified 1,000 values and created new channels in the Data Portal.

Click **Save Block Diagram As** to save the block diagram.

Summary

The summary provides an overview of the topics discussed in this chapter. It also includes additional information.

DIAdem DAC

You use DIAdem DAC to describe measurement and control tasks in a block diagram. Select function blocks from the various function groups and connect the function blocks with the mouse. When you start a measurement, DIAdem opens the VISUAL panels and runs the visualization.

Data Acquisition

The blocks of the **Inputs** function group represent data sources in DIAdem DAC, such as A/D convertors, front-end devices, and other external measurement devices. You register the corresponding drivers in DIAdem DAC and configure the signal inputs and signal outputs. Additional data sources can be input instruments, data files, and calculation results.

Signal Buses

Signal buses connect the function blocks and transport signals. Connect signal buses to the signal inputs and to the signal outputs on a function block. You can connect these buses with other blocks an also with other buses. To delete a bus, select the bus and press <Del>. DIAdem distinguishes between system buses, control buses, data buses, alarm buses, and text buses.

DIAdem VISUAL

Select instruments such as gauges, digits, bar display, recorders, or wipers to display the measurement values from the DIAdem VISUAL library. You use input instruments such as switches, dials, or slider controls, to trigger events and control functions during a measurement. When you design a visualization, you can align and configure instruments as you like.

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