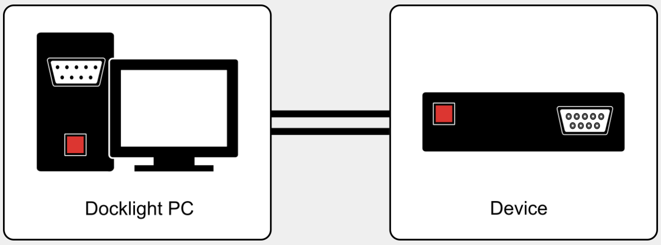
Docklight Scripting V2.4 User Manual 02/2023



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Introduction

2 Introduction

2.1 Docklight - Overview

Docklight is a testing, analysis, and simulation tool for serial communication protocols (RS232, RS485/422 and others). It allows you to monitor communications between two serial devices or to test the serial communication of a single device. Docklight is easy to use and works on almost any standard PC running *Windows 11*, *Windows 10, Windows 8,* or *Windows 7*.

Docklight's key functions include

- **simulating serial protocols** - Docklight can send out user-defined sequences according to the protocol used and it can react to incoming sequences. This makes it possible to simulate the behavior of a serial communication device, which is particularly useful for generating test conditions that are hard to reproduce with the original device (e.g. problem conditions).
- **logging RS232 data** - All serial communication data can be logged using two different file formats. Use plain text format for fast logging and storing huge amounts of data. An HTML file format, with styled text, lets you easily distinguish between incoming and outgoing data or additional information. Docklight can also log any binary data stream including ASCII 0 <NUL> bytes and other control characters.
- **detecting specific data sequences** - In many test cases, you will need to check for a specific sequence within the RS232 data that indicates a problem condition. Docklight manages a list of such data sequences for you and can perform user-defined actions after detecting a sequence, e.g. taking a snapshot of all communication data before and after the error message was received.
- **responding to incoming data** - Docklight lets you specify user-defined answers to the different communication sequences received. This allows you to build a basic simulator for your serial device within a few minutes. It can also help you to trace a certain error by sending out a diagnostics command after receiving the error message.

Docklight will work with the COM communication ports provided by your operating system. Physically, these ports will be RS232 SUB D9 interfaces in many cases. However, it is also possible to use Docklight for other communication standards such as RS485 and RS422, which have a different electrical design to RS232 but follow the RS232 communication mechanism.

Docklight has also been successfully tested with many popular USB-to-Serial converters, Bluetooth serial ports, GPS receivers, virtual null modems, Arduino, MicroPython/pyboard or other Embedded/UART boards that add a COM port in Windows.

For RS232 full-duplex monitoring applications, we recommend our Docklight Tap USB accessory or our Docklight Monitoring Cable.

This manual only refers to RS232 serial connections in detail, since this is the basis for other serial connections mentioned above.

TIP: For getting started, have a look at the Docklight sample projects, which demonstrate some of the basic Docklight functions.

2.2 Docklight Scripting - Overview

Docklight Scripting is an extended edition of Docklight RS232 Terminal / RS232 Monitor. It features an easy-to-use scripting language, plus a built-in editor to create and run automated test jobs. A Docklight script allows you to execute all basic Docklight operations (sending predefined data sequences, detecting specific sequences within the incoming data stream, ...) and embed them in your own test code.

Docklight Scripting is network-enabled. Instead of using a serial COM port, Docklight Scripting can establish TCP connections (TCP client mode), accept a TCP connection on a local port (TCP server mode), or act as a UDP peer. It also supports USB HID connections and Named Pipes.

Docklight Scripting gives you both flexibility and simplicity. Within minutes you can build your own automated testing tools and create:

- **time-controlled test jobs** (e.g. sending a diagnostics command every 5 minutes and reporting an error, if the device response is not OK)
- **repeated test cycles** (e.g. endurance testing for a motion control / drive system)
- **automatic device configuration scripts** (e.g. resetting a RS232 device to factory defaults before delivery)
- **fault analysis tools for service and maintenance tasks** (e.g. running a set of diagnostics commands and performing automatic fault analysis)
- **protocol testers with automatic checksum calculations** (e.g. CRC - Cyclic Redundancy Codes)
- **Docklight startup scripts** (e.g. automatically starting a COM port logging task at PC startup)

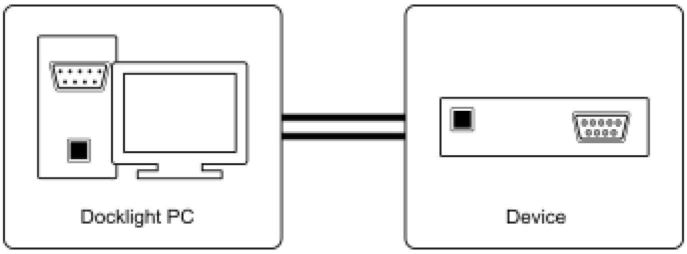
Docklight Scripting uses the VBScript engine, allowing you to write your tests in a simple, well-known scripting language. Docklight's basic functions and features are made available through a small and convenient set of Docklight script commands.

TIP: For getting started, have a look at the Docklight modem testing script, which demonstrates the usage of Docklight script commands for an automated modem test. A simple demonstration for the TCP/IP capabilities can be found in the TCP client/server sample.

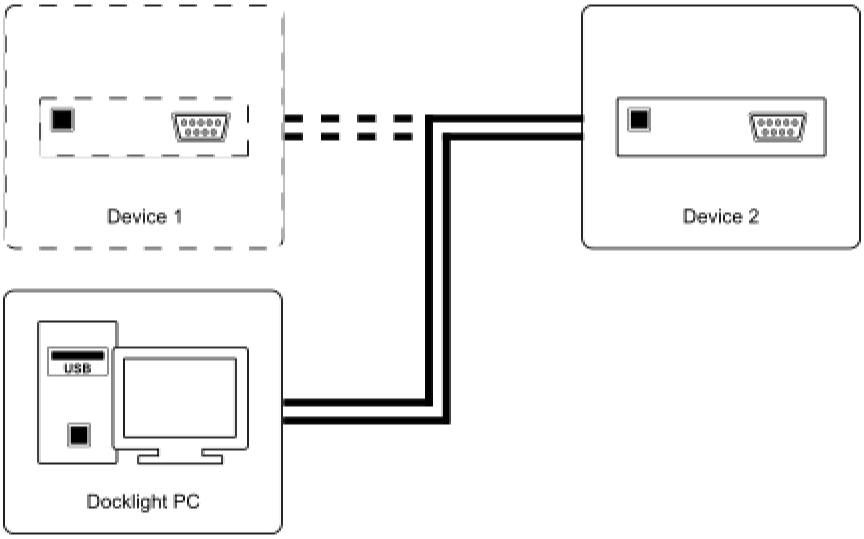
2.3 Typical Applications

Docklight is the ideal tool to support your development and testing process for serial communication devices. Docklight may be used to

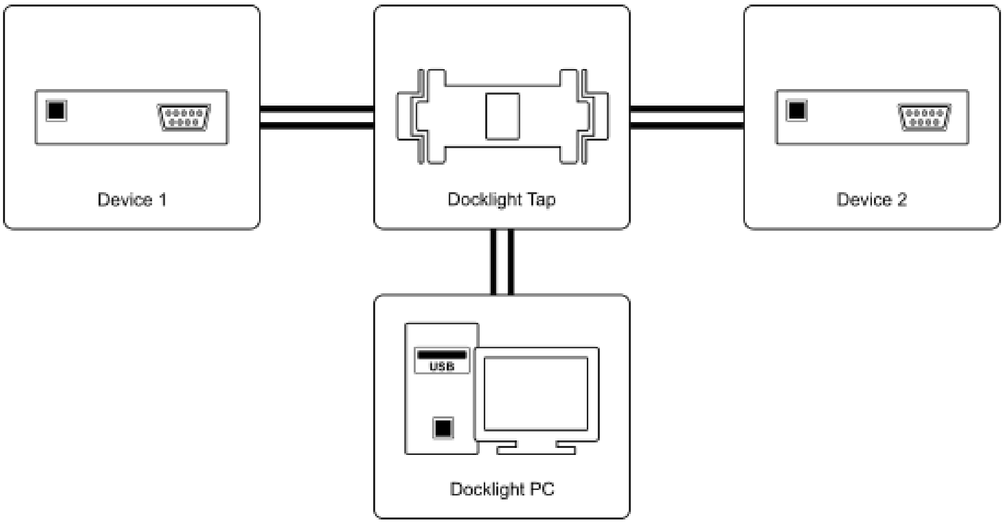
- Test the functionality or the protocol implementation of a serial device.
  You may define control sequences recognized by your device, send them, log and analyze the responses and test the device reaction.



- Simulate a serial device.
  Although rare, the possibility of a hardware fault must be considered in most systems. Imagine you have a device that sends an error message in the case of a hardware fault. A second device should receive this error message and perform some kind of reaction. Using Docklight you can easily simulate the error message to be sent and test the second device's reaction.



- Monitor the communication between two devices.
  Insert Docklight into the communication link between two serial devices. Monitor and log the serial communication in both directions. Detect faulty communication sequences or special error conditions within the monitored communication. Take a snapshot of the communication when such an error condition has occurred.



2.4 System Requirements

Operating system
- *Windows 11, Windows 10, Windows 10 x64, Windows 8, Windows 8 x64, Windows 7, Windows 7 x64.*

Additional requirements
- For RS232 testing or simulation: Minimum one COM port available. Two COM ports for monitoring communication between two serial devices.
- For low-latency monitoring using Docklight Tap, Docklight Tap Pro or Docklight Tap 485: One USB port.
- For Docklight Scripting TCP or UDP applications: Network with IPv4 addressing.

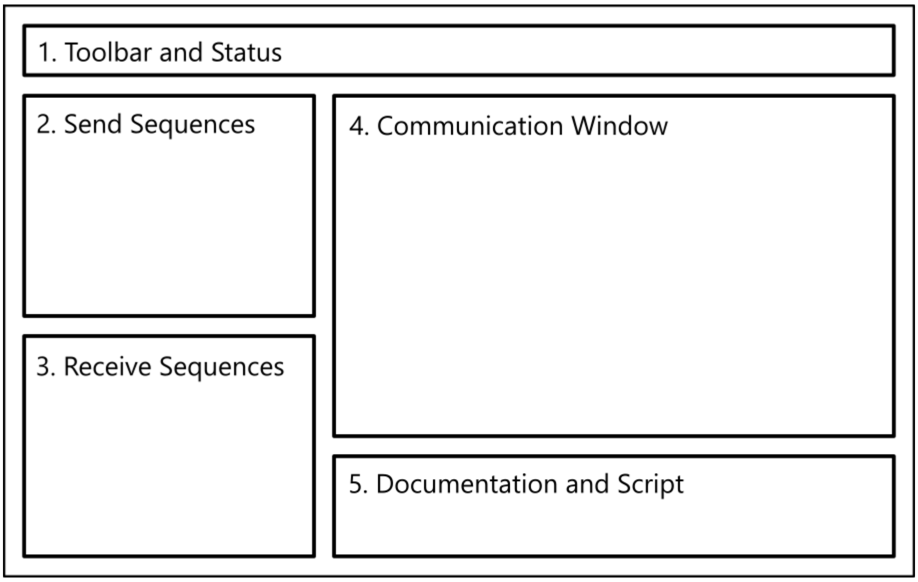
Additional cables or software drivers may be required for connecting the equipment to be tested. See the sections on Docklight Tap, Docklight Monitoring Cable RS232 SUB D9, Standard RS232 Cables and virtual null modem drivers.

User Interface

3 User Interface

3.1 Main Window (Scripting)

The main window of Docklight Scripting is divided into five sections:



1. Toolbar and Status
You can select all main Docklight functions from the Toolbar. The status line below shows additional information about the communication status and the current settings.

2. Send Sequences
Define, edit and manage your Send Sequences here. Use the arrow symbol or the Space key to send out the selected sequence. Double click on the blank field at the end of a list to create a new sequence. A context menu (right mouse button) is available to cut, copy or paste entire Send Sequences to/from the Clipboard. See Editing and Managing Sequences and Dialog: Edit Send Sequence for more information.

3. Receive Sequences
Define, edit and manage your Receive Sequences here. Double click on the blank field at the end of a list to create a new sequence. The Receive Sequence list supports the same reordering and clipboard operations as the Send Sequence list. You can also copy a Send Sequence to the clipboard and paste it into the Receive Sequence list. See Editing and Managing Sequences and Dialog: Edit Receive Sequence for more information.

You can reorder the sequence lists using drag&drop: First, allow reordering the list by clicking on the small lock icon in the top left corner. When unlocked, the list can be changed by dragging a sequence to a new position with the left mouse button pressed.

By clicking the **|<** mark you can minimize the Send/Receive Sequences area.

4. Communication Window
Displays the outgoing and incoming communication of the serial data connection. Various display options are available for the communication data, including ASCII / HEX / Decimal / Binary display, time stamps, and highlighting (see Options). If serial communication is stopped, all data from the communications window may be copied to the clipboard or printed. You may also search for specific sequences using the Find

Sequence function. See How Serial Data is Processed and Displayed for more information.

5.
5a. Project and Sequence Documentation
Type in additional comments concerning your project, or a specific Send Sequence / Receive Sequence. Docklight presents sequence-specific documentation when you choose a Send Sequence or Receive Sequence from the list (2. and 3.). Docklight switches to the main project documentation when you click on the empty bottom line of the sequence list, or when you click inside the Communication Window (4.).

To avoid accidental editing, the Documentation Area is locked by default and you need to enable editing by clicking on the small lock icon above it. When unlocked, you can edit/copy/paste/delete its contents freely.

5b. Script
Edit your Docklight script code here. A context menu (right mouse button) is available to cut, copy, paste, delete, or find/replace code. For advanced editing features, support for external editors is available. For more information about creating Docklight scripts, see the Docklight Scripting Reference.

By clicking the **v** mark on the right side you can minimize the documentation/script area.

3.2 Clipboard - Cut, Copy & Paste

Docklight supports Cut/Copy/Paste operations. Clipboard operations are available in the

- Main Window - Send Sequences
- Main Window - Receive Sequences
- Main Window - Communication
- Main Window - Documentation
- Main Window - Script Editor (Docklight Scripting only)
- Dialog: Edit Send Sequence
- Dialog: Edit Receive Sequence
- Dialog: Find Sequence
- Dialog: Send Sequence Parameter
- Documentation Area
- Keyboard Console

You can cut a serial data sequence from the communication window and create a new Send or Receive Sequence by pasting it into the appropriate list. Or edit a Send Sequence, copy a part of this sequence to the clipboard and create a new Receive Sequence from it by pasting it into the Receive Sequence window.

TIP: Use the **right mouse button** context menu for Cut/Copy/Paste operations or the related Keyboard Hotkey.

3.3 Documentation Area

Docklight offers documentation areas in the lower right part of the main window and in the Edit Send Sequence or Edit Receive Sequence dialogs.

You can use these areas to write down additional notes concerning your Docklight application. E.g., how to use the Send / Receive Sequences and sequence parameters, or notes on additional test equipment, etc.

The documentation contents are stored and loaded along with all other Docklight project settings (see saving and loading your project data, scripts, and options).

TIP: The documentation areas are simple text boxes without formatting menus or tools. For formatted documentation including pictures and tables, you can prepare your documentation in *Windows WordPad* or *Microsoft Word* and use copy&paste to add it to the Docklight documentation area.

Features and Functions

4 Features and Functions

4.1 How Serial Data Is Processed and Displayed

Docklight handles all serial data in an 8 bit-oriented way. Every sequence of serial data consists of one or more 8 bit characters. Docklight allows you to

- display the serial data in either ASCII, HEX, Decimal or Binary format
- copy serial data to the clipboard and paste it into a standard text file or a formatted *Microsoft® Word* document, or create a Send / Receive Sequence using the data.
- print out serial data, user comments and other information

Docklight's communication window shows the current communication on the selected serial port(s). Docklight distinguishes between two communication channels (channel 1 and channel 2), which represent the incoming and outgoing data in Send/Receive Mode or the two communication channels being observed in Monitoring Mode. Channel 1 and channel 2 data are displayed using different colors or fonts, and the communication data may be printed or stored as a log file in plain text or HTML format.

Besides the serial data, Docklight inserts date/time stamps into the communication display. By default, a date/time stamp is inserted every time the data flow direction switches between channel 1 and channel 2, or before a new Send Sequence is transmitted. There are several options available for inserting additional time stamps. This is especially useful when monitoring a half-duplex line with only one communication channel. See Options --> Date/Time Stamps

Docklight is able to process serial data streams containing any ASCII code 0 - 255 decimal. Since there are non-printing control characters (ASCII code < 32) and different encodings for ASCII code > 127, not all of these characters can be displayed in the ASCII text window. Nonetheless, all characters will be processed properly by Docklight and can be displayed in HEX, Decimal or Binary format. Docklight will process the serial data on any language version of the *Windows* operating system in the same way, although the ASCII display might be different. For control characters (ASCII code < 32), an additional display option is available to display their text equivalent in the communication window. See Options dialog and Appendix, ASCII Character Set Tables.

Docklight allows you to suppress all original serial data, if you are running a test where you do not need to see the actual data, but only the additional evaluations generated using Receive Sequences. See the Project Settings for Communication Filter.

4.2 Editing and Managing Sequences

A Docklight project mainly consists of user-defined sequences. These may be either Send Sequences, which may be transmitted by Docklight itself, or Receive Sequences, which are used to detect a special message within the incoming serial data.

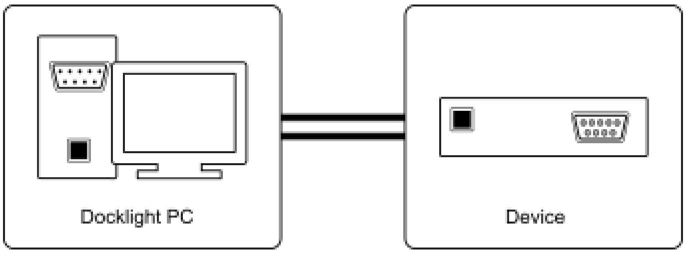
Sequences are defined using the Edit Send Sequence or Edit Receive Sequence dialog window. This dialog window is opened
1. by choosing **Edit** from the context menu available using the **right mouse button**.
2. by double-clicking on an existing sequence or pressing **Ctrl + E** with the Send Sequence or Receive Sequence list selected.
3. when creating a new sequence by double-clicking on the blank field at the end of a list (or pressing **Ctrl + E**).
4. when pasting a new sequence into the sequence list.

Docklight supports the use of wildcards (e.g. wildcard "?" as a placeholder for one arbitrary character) within Receive Sequences and Send Sequences. See the sections sending commands with parameters and checking for sequences with random characters for details and examples.

Working with Docklight

5 Working with Docklight

5.1 Testing a Serial Device or a Protocol Implementation



Preconditions

- You need the specification of the protocol to test, e.g. in written form.
- The serial device to test should be connected to one of the PC's COM ports. See section Standard RS232 Cables for details on how to connect two serial devices.
- The serial device must be ready to operate.

Performing the test

A) Creating a new project
Create a new Docklight project by selecting the menu **File >** **New Project**

B) Setting the Communication Options
1. Choose the menu **Tools >** **Project Settings...**
2. Choose communication mode **Send/Receive**
3. At **Send/Receive on comm. channel**, set the COM Port where your serial device is connected.
4. Set the baud rate and all other **COM Port Settings** required.
5. Confirm the settings and close the dialog by clicking the **OK** button.

C) Defining the Send Sequences to be used
You will probably test your serial device by sending specific sequences, according to the protocol used by the device, and observe the device's reaction. Perform the following steps to create your list of sequences:

1. Double click on the last line of the Send Sequences table. The Edit Send Sequence dialog is displayed (see also Editing and Managing Sequences).
2. Enter a **Name** for the sequence. The sequence name should be unique for every Send Sequence defined.
3. Enter the **Sequence** itself. You may enter the sequence either in ASCII, HEX, Decimal or Binary format. Switching between the different formats is possible at any time using the **Edit Mode** radio buttons.
4. After clicking the **OK** button the new sequence will be added to the Send Sequence lists.

Repeat steps 1 - 4 to define the other Send Sequences needed to perform your test.

D) Defining the Receive Sequences used
If you want Docklight to react when receiving specific sequences, you have to define a list of Receive Sequences.

1. Double click on the last line of the Receive Sequences table. The dialog Edit Receive Sequence is displayed. The dialog consist of three parts: **Name** field, **Sequence** field, and **Action** field.
2. Edit the **Name** and **Sequence** fields.
3. Specify an Action to perform after the sequence has been received by Docklight. There are four types of actions available:
   Answer - After receiving the sequence, transmit one of the Send Sequences.
   Comment - After receiving the sequence, insert a user-defined comment into the communication window (and log file, if available).
   Trigger - This is an advanced feature described in Catching a specific sequence...
   Stop - After receiving the sequence, Docklight stops communications.
4. Click the **OK** button to add the new sequence to the list.

Repeat steps 1 - 4 to define the other Receive Sequences you need to perform your test.

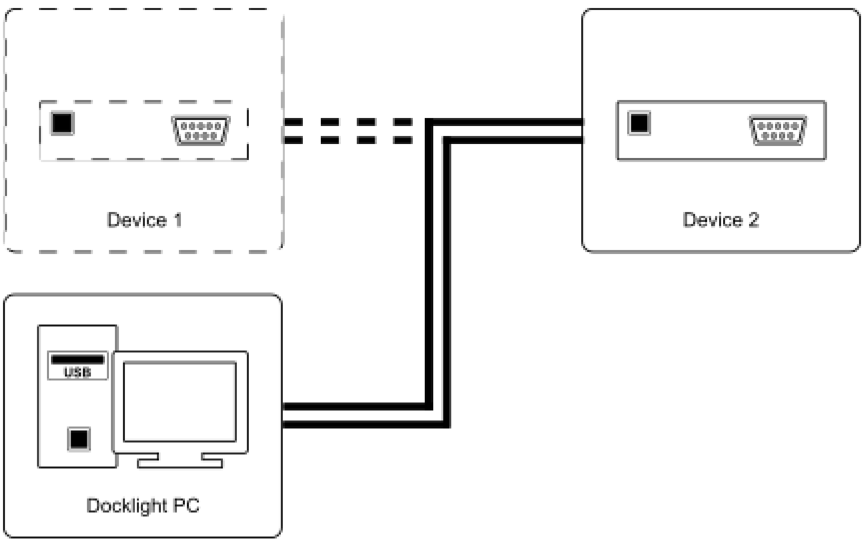
E) Storing the project
Before running the actual test, it is recommended that the communication settings and sequences defined be stored. This is done using the menu **File >** **Save Project**.

F) Running the test
Start Docklight by choosing **Run >** **Start Communication**.

Docklight will open a serial connection according to the parameters specified. It will then display all incoming and outgoing communication in the communication window. Use the ----> **Send** button to send one of the defined sequences to the serial device. The on-screen display of all data transfer allows you to check the device's behavior. All protocol information can be logged in a text file for further analysis. Please see section Logging and analyzing a test.

TIP: Using the Documentation Area , you can easily take additional notes, or copy & paste parts of the communication log for further documentation.

5.2 Simulating a Serial Device



Preconditions

- You need the specification of the behavior of the serial device you want to simulate, e.g. what kind of information is sent back after receiving a certain command.
- A second device is connected to a PC COM port, which will communicate with your simulator.

This second device and its behavior is the actual object of interest. An example could be a device that periodically checks the status of an UPS (Uninterruptible Power Supply) using a serial communication protocol. You could use Docklight to simulate basic UPS behavior and certain UPS problem cases. This is very useful when testing the other device, because it can be quite difficult to reproduce an alarm condition (like a bad battery) at the real UPS.

NOTE: The second device may also be a second software application. It is possible to run both Docklight and the software application on the same PC. Simply use a different COM port for each of the two applications and connect the two COM ports using a RS232 null modem cable. You can also use a virtual null modem for this purpose.

Performing the test

A) Creating a new project
Create a new Docklight project by selecting the menu **File > New Project**

B) Setting the Communication Options
1. Choose the menu **Tools > Project Settings...**
2. Choose communication mode **Send/Receive**
3. At **Send/Receive on comm. channel**, set the COM Port where your serial device is connected.
4. Set the baud rate and all other **COM Port Settings** required.
5. Confirm the settings and close the dialog by clicking the **OK** button.

C) Defining the Send Sequences used
Define all the responses of your simulator. Think of responses when the simulated device is in normal conditions, as well as responses when in fault condition. In the UPS example mentioned above, a battery failure would be such a problem case that is hard to reproduce with the original equipment. To test how other equipment reacts to a battery failure, define the appropriate response sequence your UPS would send in this case.

NOTE: See Testing a serial device... to learn how to define Send Sequences.

D) Defining the Receive Sequences used
In most cases, your simulated device will not send unrequested data, but will be polled from the other device. The other device will use a set of predefined command sequences to request different types of information. Define the command sequences that must be interpreted by your simulator here.

For every command sequence defined, specify **Answer** as an action. Choose one of the sequences defined in C). If you want to use two or more alternative response sequences, make several copies of the same Receive Sequence, give them a different name (e.g. "status cmd - answer ok", "status cmd - answer battery failure", "status cmd - answer mains failure") and assign different Send Sequences as an action. In the example, you would have three elements in the Receive Sequences list that would respond to the same command with three different answers. During the test you may decide which answer should be sent by checking or unchecking the list elements using the **Active** column.

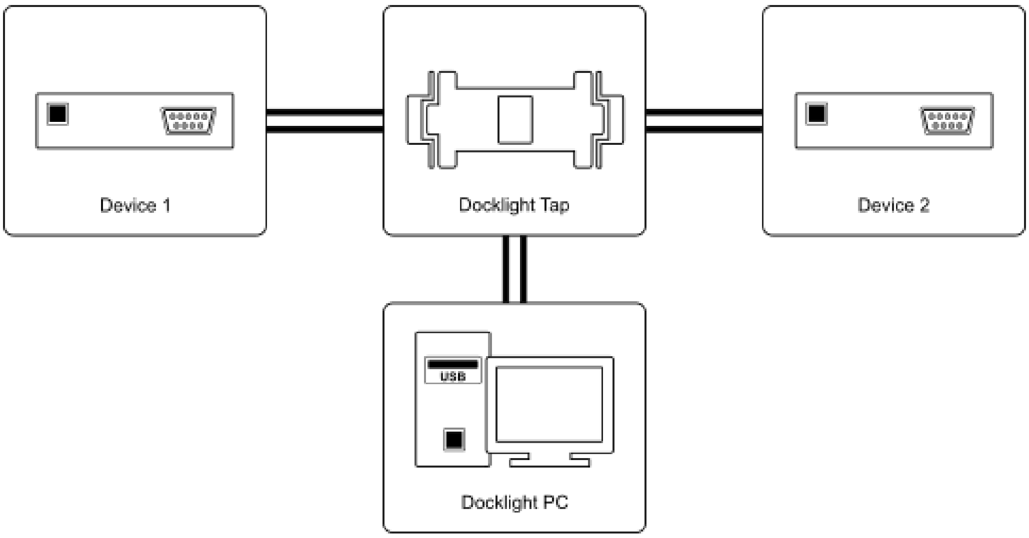
E) Storing the project
Before running the actual test, it is recommended that the communication settings and sequences defined be stored. This is done using the menu **File >** **Save Project**.

F) Running the test
Start Docklight by choosing **Run >** **Start Communication**.

Docklight will now respond to all commands received from the connected serial device. The on-screen data transfer display allows you to monitor the communications flow. All protocol information can be logged to a text file for further analysis. See section Logging and analyzing a test.

TIP: Using the Documentation Area, you can easily take additional notes, or copy & paste parts of the communication log for further documentation.

5.3 Monitoring Serial Communications Between Two Devices



Preconditions

- A Docklight Monitoring Cable, Docklight Tap, or Docklight Tap Pro/485 is required to tap the RS232 TX signals of both serial devices and feed them into Docklight, while not interfering with the communications between the devices.
- For a Docklight Monitoring Cable setup, two COM ports must be available on your PC for monitoring. Each port will receive the data from one of the serial devices being monitored.
- Device 1 and Device 2 must be ready to operate.

Performing the test

A) Creating a new project
Create a new Docklight project by selecting the menu **File >** **New Project**

B) Setting the Communication Options

1. Choose the menu **Tools >** **Project Settings...**

2. Choose communication mode **Monitoring**

Alternative I - Using Docklight Monitoring Cable:

3. At **Receive Channel 1**, set the COM Port where the monitoring signal from serial device 1 is received. At **Receive Channel 2**, set the COM port for the second device.

   NOTE: In Docklight Monitoring Mode, all received data from one COM port is re-sent on the TX channel of the opposite COM port ("Data Forwarding"). This does not have any effect on Docklight Monitoring Cable setups, since the TX signal is not connected. But it can be useful for special applications where you need to route the serial data traffic through Docklight using standard RS232 cabling. If you require a pure passive monitoring behavior where no TX data appears, you can disable the "Data Forwarding" using the menu **Tools >** Expert Options...

Alternative II - Using Docklight Tap

3. At **Receive Channel 1**, open the dropdown list, scroll down to the **-- USB Taps --** section and choose the first Tap port, e.g. **TAP0**. At **Receive Channel 2**, the second tap port (e.g. **TAP1**) is selected automatically.

Alternative III - Using Docklight Tap Pro / Docklight Tap 485:

3. At **Receive Channel 1**, open the dropdown list, scroll down to the **-- USB Taps --** section and choose the first VTP Tap port, e.g. **VTP0**. At **Receive Channel 2**, the second VTP tap port (e.g. **VTP1**) is selected automatically.

4. Set the baud rate and all other communication parameters for the protocol being used.

   NOTE: Make sure your PC's serial interfaces port works properly at the baud rate and for the communication settings used by Device 1 and Device 2. If Device 1 and 2 use a high-speed data transfer protocol, the PC's serial interfaces and the Docklight software itself might be too slow to receive all data properly.

5. Confirm the settings and close the dialog by clicking the **OK** button.

C) Defining the Receive Sequences used
Define Receive Sequences, which should be marked in the test protocol or trigger an action within Docklight. Docklight checks for Receive Sequence on both monitoring channels, i.e. it does not matter whether the sequences come from serial device 1 or serial device 2.

NOTE: Since a special monitoring cable is used for this test, all communication between serial device 1 and serial device 2 will remain unbiased and no additional delays will be introduced by Docklight itself. This is particularly important when using Docklight for tracking down timing problems. This means, however, that there is no way to influence the serial communication between the two devices. While communication mode **Monitoring** is selected, it is not possible to use Send Sequences.

D) Storing the project
Before running the actual test, it is recommended to store the communication settings and sequences defined. This is done using the menu **File > Save Project**.

E) Running the test
Start Docklight by choosing **Run > Start Communication**, then activate the serial devices 1 and 2 and perform a test run. Docklight will display all communication between serial device 1 and serial device 2. Docklight uses different colors and font

types to make it easy to distinguish between data transmitted by device 1 or device 2. The colors and font types can be chosen in the Display tab of the **Tools > Options...** dialog.

TIP: The Snapshot Function allows you to locate a rare sequence or error condition in a communication protocol with a large amount of data.

TIP: See the sections How to Increase the Processing Speed... and How to Obtain Best Timing Accuracy to learn how to adjust Docklight for applications with high amounts of data, or increased timing accuracy requirements.

5.4 Catching a Specific Sequence and Taking a Snapshot of the Communication

When monitoring serial communications between two devices, you might want to test for a rare error and the interesting parts would be just the serial communication before and after this event. You could look for this situation by logging the test and searching the log files for the characteristic error sequence. This could mean storing and analyzing several MB of data when you are actually just looking for a few bytes though, if they appeared at all. As an alternative, you can use the Snapshot feature as described below.

Preconditions

- Docklight is ready to run a test as described in the previous use cases, e.g. monitoring serial communications between two devices.

Taking a snapshot

A) Defining a trigger for the snapshot

1. Define the sequence that appears in your error situation as a Receive Sequence.
2. Check the **Trigger** tab in the "action" part of the Receive Sequence dialog: The trigger option must be enabled if this is the sequence that you want to track down.

NOTE: Do not forget to disable the trigger option for all other Receive Sequences that should be ignored in your test so that they do not trigger the snapshot.

B) Creating a snapshot

Click on the **Snapshot** button of the toolbar. Docklight will start communications, but will not display anything in the communication window. If the trigger sequence is detected, Docklight will display communication data before and after the trigger event. Further data is processed, until the trigger sequence is located roughly in the middle of the communication window. Docklight will then stop communication and position the cursor at the trigger sequence.

5.5 Logging and Analyzing a Test

Preconditions

- Docklight is ready to run a test as described in the previous use cases, e.g. Testing a serial device or a protocol implementation

Logging the test

Click on the **Start Logging** button on the main toolbar.

A dialog window will open for choosing log file settings.

For each representation (ASCII, HEX, ...), a separate log file may be created. Choose at least one representation. Log files will have a ".txt", ".htm" or ".rtf" file extension, depending on your file format choice. Docklight also adds the representation type to the file name to distinguish the different log files. E.g. if the user specifies "Test1" as the base log file name, the plain text ASCII file will be named "Test1_asc.txt", whereas an RTF HEX log file will be named "Test1_hex.rtf".

Confirm your log file settings and start logging by clicking the **OK** button.

To stop logging and close the log file(s), click the **Stop Logging** button on the main toolbar. Unless the log file(s) have been closed, it is not possible to view their entire contents.

TIP: If you have additional requirements for your log file format, e.g starting a new file every hour, you can use a Docklight script and the StartLogging method for this purpose. See also the **LogFileNamesTimestamp.zip** sample script (folder **Extra\LogFileNamesTimestamp** in your Script Samples directory).

5.6 Checking for Sequences With Random Characters (Receive Sequence Wildcards)

Many serial devices support a set of commands to transmit measurement data and other related information. In common text-based protocols the response from the serial device consists of a fixed part (e.g. "temperature="), and a variable part, which is the actual value (e.g "65F"). To detect all these responses correctly in the serial data stream, you can define Receive Sequences containing wildcards.

Take, for example, the following situation: A serial device measures the temperature and periodically sends the actual reading. Docklight shows the following output:

```
07/30/2012 10:20:08.022 [RX] - temperature=82F<CR>
07/30/2012 10:22:10.558 [RX] - temperature=85F<CR>
07/30/2012 10:24:12.087 [RX] - temperature=93F<CR>
07/30/2012 10:26:14.891 [RX] - temperature=102F<CR>
```

...

Defining an individual Receive Sequence for every temperature value possible would not be a practical option. Instead you would define one Receive Sequence using wildcards. For example:

t | e | m | p | e | r | a | t | u | r | e | = | ? | # | # | F | r

("r" is the terminating <CR> Carriage Return character)

This ReceiveSequence would trigger on any of the temperature strings listed above. It allows a 1-3 digit value for the temperature (i.e. from "0" to "999"). The following step-by-step example describes how to define the above sequence. See also the additional remarks at the end of this section for some extra information on '#' wildcards.

NOTE: See Calculating and Validating Checksums on how to receive and validate checksum data, e.g. CRCs. There are no wildcards required for checksum areas. Instead, use some default character values, e.g. "00 00" in HEX representation.

Preconditions

- Docklight is ready to run a test as described in the previous use cases, e.g. testing a serial device or a protocol implementation.
- The serial device (the temperature device in our example) is operating.

Using Receive Sequences with wildcards

A) Preparing the project
Create a new Docklight project and set up all communication parameters.

B) Defining the Receive Sequences used
1. Create a new Receive Sequence. Enter a **Name** for the sequence.
2. Enter the fixed part of your expected answer in the **Sequence** section. For our example you would enter the following sequence in ASCII mode:
   t | e | m | p | e | r | a | t | u | r | e | =
3. Open the popup / context menu using the **right mouse button**, and choose **Wildcard '?' (matches one character)** to insert the first wildcard at the cursor position. Add two '#' wildcards using the popup menu **Wildcard '#' (matches zero or one character)**. The sequence now looks like this:
   t | e | m | p | e | r | a | t | u | r | e | = | ? | # | #
4. Enter the fixed tail of our temperature string, which is a letter 'F' and the terminating <CR> character. You can use the default control character shortcut **Ctrl+Enter** to enter the <CR> / ASCII code 13. The sequence is now:
   t | e | m | p | e | r | a | t | u | r | e | = | ? | # | # | F | r
5. Specify an **Action** to perform after a temperature reading has been detected.
6. Click **OK** to add the new sequence to the Receive Sequence list.

NOTE: To distinguish the wildcards '?' and '#' from the regular question mark or number sign characters (decimal code 63 / 35), the wildcards are shown on a different background color within the sequence editor.

C) Running the test
Start Docklight by choosing **Run > Start Communication**.

Docklight will now detect any temperature reading and perform the specified action.

NOTE: The DL_OnReceive() event procedure allows further evaluation and processing of the actual measurement data received.

Additional notes on '#' wildcards

1. '#' wildcards at the end of a Receive Sequence have no effect. The Receive Sequence "HelloWorld###" will behave like a Receive Sequence "HelloWorld".

2. A "match inside a match" is not returned: If a Receive Sequence "Hello#######World" is defined, and the incoming data is "Hello1Hello2World", the Receive Sequence detected is "Hello1Hello2World", not "Hello2World".

Receive Sequence comment macros

Macro keywords can be used in the Edit Receive Sequence **> 3 - Action > Comment** text box, to create Docklight comment texts with dynamic data, e.g. the actual data received.

Macro	Is Replaced By
%_S	BELL signal. Produce a 'beep sound', depending on your *Windows* sound scheme.
%_L	Line break
%_T	Time stamp for the data received
%_C	Docklight channel no. / data direction (1 or 2) for the data received
%_X	The channel name or channel alias that corresponds to the data direction %_C. E.g. "RX", "TX" or "COM5".
%_I	Receive Sequence List Index, see the Dialog: Edit Receive Sequence
%_N	Receive Sequence Name
%_A	The actual data that triggered this Receive Sequence. Use ASCII representation
%_H	Same as %_A, but in HEX representation
%_D	Same as %_A, but in Decimal representation
%_B	Same as %_A, but in Binary representation
%_A(1,4)	Extended syntax: Insert only the first 4 characters of this Receive Sequence (start with Character No. 1, sequence length = 4).
%_H(3,-1)	Extended Syntax: Insert everything from the third character until the end of the sequence (length = -1). Use HEX representation.

Example:
For a Receive Sequence as described above (t | e | m | p | e | r | a | t | u | r | e | = | ? | # | # | F | r), you could define the following comment text:

New Temp = %_L %_A(13, -3) °F

Docklight output could then look like this:

```
10/30/2012 10:20:08.022 [RX] - temperature=82F<CR>
 New Temp =
 82 °F
10/30/2012 10:22:10.558 [RX] - temperature=85F<CR>
 New Temp =
 85 °F
10/30/2012 10:24:12.087 [RX] - temperature=93F<CR>
 New Temp =
 93 °F
```

5.7 Saving and Loading Your Project Data, Script, and Options

You can specify Docklight Scripting's behavior via three different types of user configuration data:

- Project Data
- Scripts
- Program Options

Saving and Loading Project Data

The project data includes:
- Send Sequences
- Receive Sequences
- Additional Project Settings: communication mode, COM ports used, COM port settings (baud rate, parity, ...)
- Documentation contents

The project is saved in a Docklight project file (**.ptp** file) using the menu **File > Save Project** or **File > Save Project As...**

It is generally recommended to save your project before starting a test run.

NOTE: Saving your project only stores the project's sequences, settings, and Documentation Area data. If you want to save a log of the communication during a test run, see section logging and analyzing a test.

Loading a project is done using the **File > Open Project...** menu.

Saving and Loading Scripts

Docklight script code for automated testing tasks is saved in a separate file (**.pts** file). Use the menu **Scripting > Save Script** or **Scripting > Save Script As...**

Saving and Loading Program Options

Docklight Options (text formatting, control-character behaviors, a.s.o) can be modified by using the Docklight Options dialog (menu **Tools > Options...**).

TIP: When running your script, you may want to use a specific set of Options to ensure that Docklight creates the communication and log output in a well-defined format. Use the SaveProgramOptions and LoadProgramOptions methods to create an options file and load the options at the start of your script.

Using Project and Script Pairs: _auto.pts

In most Docklight Scripting applications, a Docklight script (**.pts** file) requires an accompanying project (**.ptp** file). You can use the following naming scheme to enable automatic loading and script start:

myproject**.ptp**
myproject**_auto.pts**

If the two files are located in the same folder, Docklight Scripting will perform the following additional operations:

- If **myproject.ptp** is opened (either double-click in Windows Explorer, or using menu **File > Open Project...**), Docklight Scripting also opens **myproject_auto.pts** alongside, if not already open.
- If **myproject_auto.pts** is opened, Docklight Scripting also opens **myproject.ptp** alongside, if not already open.
- If **Start communication** is executed, the communication port is opened and the script is started.

NOTE: If **myproject.ptp** is opened in Docklight (non-scripting), a warning appears that this seems to be a project with script support and its use is limited in Docklight (non-scripting).

NOTE: The OpenProject and StartCommunication script methods are not affected by the **_auto.pts** behavior.

Working with Docklight (Advanced)

6 Working with Docklight (Advanced)

6.1 Sending Commands With Parameters (Send Sequence Wildcards)

When testing a serial device, the device will most likely support a number of commands that include a parameter.

Example: A digital camera supports a command to set the exposure time. For setting the exposure time to 25 milliseconds, you need to send the following sequence:
e | x | p | | 0 | 2 | 5 | r   ("r" is a terminating <CR> Carriage Return character)

To avoid defining a new Send Sequence for every exposure time you want to try, you can use a Send Sequence with wildcards instead:
e | x | p | | ? | ? | ? | r

The following step-by-step example describes how to define an exposure time command with a parameter and use a different exposure value each time the sequence is sent.

Preconditions

- Docklight is ready to run a test as described in testing a serial device or a protocol implementation.

Performing the test using commands with parameters

A) Preparing the project
Create a new Docklight project and set up all communication parameters.

B) Defining the commands used
1. Create a new Send Sequence. Enter a **Name** for the sequence.
2. Enter the fixed part of your command in the **Sequence** section. For our example you would enter the following sequence in ASCII mode:
   e | x | p | |
3. Now open the context menu using the **right mouse button**, and choose **Wildcard '?' (matches one character) F7** to insert one wildcard at the cursor position. In our example we would have to repeat this until there are three '?' wildcards for our three-digit exposure time. The sequence now looks like this:
   e | x | p | | ? | ? | ?
4. Now add the terminating <CR> character, using the default control character shortcut **Ctrl+Enter.** The example sequence now is
   e | x | p | | ? | ? | ? | r
5. Click **OK** to add the new sequence to the Send Sequence list.

Repeat steps 1 - 5 to define other commands needed to perform your test.

NOTE: To distinguish a '?' wildcard from a question mark ASCII character (decimal code 63), the wildcard is shown on a different background color within the sequence editor.

C) Sending a command to the serial device
1. Use the  **Send** button to open the serial communication port and send one command to the serial device.

2. The communication pauses and the Send Sequence Parameter dialog pops up, allowing you to enter the parameter value. In our example, an exposure time, e.g. "025".
3. Confirm by pressing **Enter**. The sequence is now sent to the serial device.

It is possible to define commands with several parameters, using several wildcard areas within one sequence. The Send Sequence Parameter dialog will then appear several times before sending out a sequence.

NOTE: If you are using **Wildcard '?'**, you must provide exactly one character for each '?' when sending the sequence. For variable-length parameters use **Wildcard '#' (matches zero or one character) F8**.

NOTE: You cannot use a Send Sequence with wildcards as an automatic answer for a Receive Sequence (see Action).

NOTE: If your Send Sequence requires a checksum, you can define it as described in Calculating and Validating Checksums. The checksum is calculated after the wildcard/parameter area has been filled with the actual data, then the resulting sequence data is handed over to the send queue.

6.2 How to Increase the Processing Speed and Avoid "Input Buffer Overflow" Messages

When monitoring serial communications between two devices, Docklight cannot control the amount of incoming data. Since Docklight applies a number of formatting and conversion rules on the serial data, only a limited number of bytes per seconds can be processed. There are numerous factors that determine the processing speed, e.g. the PC and COM devices used, the Display Settings, and the Receive Sequence Actions defined. It is therefore not possible to specify any typical data rates.

The most time-consuming task for Docklight is the colors&font formatting applied by default (see the Docklight Display Options). If Docklight cannot keep up with formatting the incoming data, it will automatically switch to the simpler Plain Text Mode.

If this is still not fast enough to handle the incoming data, Docklight will add the following message in the Communication Window output and log files.

```
DOCKLIGHT reports: Input buffer overflow on COM1
```

TIP: Search for this message using the **Find Sequence in Communication Window...** (Ctrl + F) function.

If you are experiencing the above behavior, Docklight offers you several ways to increase the data throughput.

1. Simplify the display output:
   - Deactivate all unneeded Display Modes in the **Options...** dialog
   - Use Plain Text Mode right from the start (see the automatic switch behavior described above).
   - If you are using ASCII mode, disable the Control Characters Description option

2. Log the communication data to a plain text file instead of using the communication window(s):
   - Use the "plain text" Log File Format
   - Create only a log file for the Representation (ASCII / HEX / Decimal / Binary) you actually need

- Disable the communication windows while logging, using the High Speed Logging option

3. Use the Communication Filter from the **Project Settings...** dialog, and disable the original serial data for one or both communication directions. This is especially useful if you actually know what you are looking for and can define one or several Receive Sequences for this pieces of data. These Receive Sequences can print a comment each time the sequence appears in the data stream so you still know what has happened, even if the original serial data is not displayed by Docklight.

6.3 How to Obtain Best Timing Accuracy

Many RS232 monitoring applications – including Docklight – can only provide limited accuracy when it comes to time tagging the serial data. As a result, data from the two different communication directions can be displayed in chronologically incorrect order, or several telegrams from one communication direction can appear as one chunk of data.

This behavior is not caused by poor programming, but is rather characteristic for a PC/Windows system, and the various hardware and software layers involved. Unspecified delays and timing inaccuracies can be introduced by:
- The COM device's chipset, e.g. the internal FIFO (First-In-First-Out) data buffer.
- The USB bus transfer (for USB to Serial converters).
- The serial device driver for Windows.
- The task/process scheduling in a multitasking operating system like Windows.
- The accuracy of the date/time provider.

Docklight comes with a very accurate date/time provider with milliseconds granularity, but it still needs to accept the restrictions from the hardware and software environment around it.

Here is what you can do to minimize additional delays and inaccuracies and achieve a typical time tagging accuracy of 5 milliseconds or better:

1. Get our Docklight Tap for lowest USB-related latency times. Or use on-board RS232 ports, if still available on your PC.

2. Choose External / High Priority Process Mode in the **Tools > Expert Options...** dialog.

3. When monitoring high amounts of data, use the recommendations from the previous section How to Increase the Processing Speed... to avoid input buffer overflows and that the computer become irresponsive because of high CPU usage.

NOTE: The **Expert Options...** recommended above will change the overall system balance and must be used with care. Best results can be achieved only when Docklight is **Run as administrator**. Please make sure you understood the remarks and warning in the documentation.

4. As an alternative to the above 1.-3.: Use our Docklight Tap Pro or Docklight Tap 485 accessories which use their own Embedded time provider and eliminate PC-based inaccuracies altogether.

6.4 Calculating and Validating Checksums

Many communication protocols include additional checksum fields to ensure data integrity and detect transmission errors. A common algorithm is the CRC (Cyclic

Redundancy Code), which is used in different variations for different protocols. The following step-by-step example describes how to set up on-the-fly checksum calculation for a Send Sequence, and how to enable automatic validation of a checksum area within a Receive Sequence.

TIP: For a working example to address a Modbus slave device, see the tutorial Modbus RTU With CRC checksum.

TIP: See also the DL.CalcChecksum method on how to calculate checksums using script code as an alternative.

Preconditions

You know the checksum specification for the protocol messages:
- Which area of the sequence data is guarded by a checksum?
- Where is the checksum located? (Usually at the end of the sequence.)
- What checksum algorithm should be used? (Most likely one of the standard CRC types, or a simple MOD256 sum.)

Using Send Sequences with automatic checksum calculation

A) Defining a Send Sequence that includes a checksum

1. Create a new Send Sequence. Enter a **Name** for the sequence.

2. Enter the Sequence part of your message in the **Sequence** section. For example, here we use a very simple HEX message as our sequence:
   01 | 02 | 03 | 04 | **??**

   Use the context menu via **right mouse button** or **F7** to create the **??** wildcard.

   NOTE: See also the Send Sequence Parameter section for more information on wildcards and parameters.

3. Now add one additional 00 value as a placeholder for the checksum.
   01 | 02 | 03 | 04 | ?? | **00**

   NOTE: In a Send Sequence, you can use any character code from 00-FF as a placeholder at the positions where the calculated checksum should be inserted later. This is different from the way it works in a Receive Sequence, where you use ?? wildcards. See the Receive Sequence example below.

4. Go to the **Additional Settings | Checksum** tab and define the checksum. For example, here we chose to use **MOD256** from the dropdown list.

   NOTE: The text field for Checksum allows comments. Everything behind a **#** character is just a comment. You can add your own comments to describe what this checksum is about.

5. Click **OK** to add the new sequence to the Send Sequence list.

B) Performing the test

6. Use the  **Send** button to send one of the predefined commands. Enter a parameter value, e.g. 05.

Before sending the data, Docklight calculates the actual MOD256 checksum. The result goes to the specified checksum position. For MOD256 this is the last character position by default, which means that the 00 placeholder is overwritten with the checksum result.

If we use 05 as a parameter when sending the sequence, the data sent by Docklight will look like this:

```
18.06.2015 11:07:23.251 [TX] - 01 02 03 04 05 0F
```

The placeholder has been replaced by the sum over the message bytes:
1 + 2 + 3 + 4 + 5 = 15 or Hex 0F.

Using Receive Sequences with automatic checksum validation

A) Defining a Receive Sequence with checksum

1. Create a new Receive Sequence. Enter a **Name** for the sequence.

2. Enter the **Sequence** data, including a wildcard area for both a random payload byte, plus a wildcard for the checksum. We use the same telegram as in the above Send Sequence example:
01 | 02 | 03 | 04 | ?? | **00**.

3. Go to the **Action | Comment** tab and enter the following text: **Correct checksum**

4. Go to the **Checksum** tab and pick **MOD256** in the left dropdown list.

5. Keep the **Detect Checksum OK** option. It means that the Receive Sequence is only triggered if the MOD256 checksum byte in the received data is correct.

5. Click **OK** to confirm the changes

B) Running the test

6. Start communications and send some data telegrams to your Docklight application / COM port.

The Communication Window output could look like this:

```
15.02.2016 17:43:28.072 [RX] - 01 02 03 04 05 0F  Correct
checksum

15.02.2016 17:43:31.870 [RX] - 01 02 03 04 0F 19  Correct
checksum

15.02.2016 17:43:35.833 [RX] - 01 02 03 04 10 1A  Correct
checksum
```

NOTE: This example showed how to define a Receive Sequence that is triggered by data telegrams with correct checksum only. It is also possible to do the opposite: detecting a checksum error. Go to the **Checksum** tab and change the option **Detect Checksum OK** to **Checksum Wrong**.

6.5 Controlling and Monitoring RS232 Handshake Signals

The Docklight project settings for Flow Control support offer a Manual Mode that allows you to set or reset the RTS and DTR signals manually by clicking on the corresponding indicator. The following section describes how to use the **Function Character '!' (F11**

key) to change the RTS and DTR signals temporarily within a Send Sequence, or detect changes for the CTS, DSR, DCD or RI lines using a Receive Sequence.

Preconditions

- Docklight is ready to run a test as described in testing a serial device or a protocol implementation.
- Flow Control Support is set to "Manual" in the project settings.
- The Docklight project already contains one or several Send Sequences, but there is an additional requirement for changing RTS / DTR signals while sending.

Implementing RTS/DTR signal changes

For our example we assume that we are using a RS485 converter which requires RS485 Transceiver Control, but uses the DTR signal instead of RTS for switching between "transmit" and "receive" mode. We further assume there is already a "Test" Send Sequence which looks like this in ASCII mode:
T | e | s | t

A) Modifying the existing Send Sequence

1. Open the Edit Send Sequence dialog.
2. Switch the **Edit Mode** to **Decimal**. Our "Test" example looks like this in decimal mode:
   084 | 101 | 115 | 116
3. Insert an RTS/DTR function character at the beginning: Press **F11**, or open the context menu using the **right mouse button** and choose **Function character '!' (RTS and DTR signals)** . The example sequence now reads:
   ! | 084 | 101 | 115 | 116
4. Add the new RTS/DTR state as a decimal parameter value (see below). In our example we need the DTR signal set to high. We choose "002" as the parameter value, so the sequence is now:
   ! | 002 | 084 | 101 | 115 | 116
5. Add a RTS/DTR function character at the end of the sequence, and use "000" as parameter value to reset the DTR signal low. The sequence data is now:
   ! | 002 | 084 | 101 | 115 | 116 | ! | 000
6. Click **OK** to confirm the changes

NOTE: To distinguish a '!' RTS/DTR function character from a exclamation mark ASCII character (decimal code 33), the RTS/DTR function character is shown on a different background color by the sequence editor.

NOTE: The character after a RTS/DTR function character is used to set the RTS / DTR signals and is not sent to the serial device (see parameter values below).

B) Sending the data with additional DTR control

1. Send the test sequence using the  **Send** button.

Docklight will now set the DTR signal to high, send the ASCII sequence "Test" and then reset DTR.

NOTE: The RTS/DTR indicators will indicate any changes of the RTS or DTR state. However, in the above example the DTR is set and reset very quickly, so the DTR indicator will probably not give any visual feedback. If you want to actually "see" the DTR behavior, try introducing a small inter-character delay.

Function character '!' (F11) - setting RTS and DTR

Character Value (Decimal Mode)	RTS	DTR
000	Low	Low
001	High	Low
002	Low	High
003	High	High

Temporary parity changes / 9 bit applications

Some protocols and applications require a 9th data bit, e.g. for device addressing on a bus. The only way to talk to such devices using a standard UART with maximum 8 data bits is to use serial settings that include a parity bit and change this parity bit temporarily within a Send Sequence. The function character '!' supports additional parameter values for this purpose:

Character Value (Decimal Mode)	Parity
016	No parity
032	Odd parity
048	Even parity
064	Mark. Set parity bit to logic '1'
080	Space. Set parity bit to logic '0'

The new parity settings are applied starting with the next regular character, both on the TX and the RX side. The parity is switched back to the original Communication Settings after the Send Sequence has been completely transmitted.

NOTE: The most useful parameters for this function character are the "Mark" and "Space" settings, because they allow you to set the parity bit to a defined value that effectively serves as a 9th data bit.

NOTE: It is recommended to set the Parity Error Character to "(ignore)", so you can evaluate incoming data in both cases, 9th bit = high and 9th bit = low.

TIP: See also the **SwitchParityDemo.ptp** sample project (folder **Extras\ParitySwitch_9BitProtocols** in your \Samples directory).

Function character '!' (F11) - detecting handshake signal changes (CTS, DSR, DCD or RI)

Docklight Scripting detects changes of the handshake signals CTS, DSR, DCD or RI, but in normal operation these changes are not visible in the Docklight Communication Window (similar to a Break State).

Using the function character '!' you can make these changes visible, and/or define an action after detecting such changes. The function character '!' supports the following parameter values for this purpose:

Character Value (Decimal Mode)	Handshake Signal
001	CTS = High
002	DSR = High
004	DCD = High

008	RI (Ring Indicator) = High

NOTE: See also DL.GetHandshakeSignals() for the extended set of signal states supported in Tap Pro / Tap RS485 applications.

Example Receive Sequence definitions in Decimal Edit Mode:

Receive Sequence (Decimal Mode)	Description
! | 001	triggers when CTS=high, all other signals low
! | 006	triggers when CTS=low, DSR=high, DCD=high, RI=low
! | ???	triggers on any change of the status lines

For the following example we assume that Docklight is ready to run a test as described in testing a serial device or a protocol implementation and Flow Control Support is set to "Manual" in the project settings.

A) Create a new Receive Sequence for detecting handshake signal changes.

1. Open the Edit Receive Sequence dialog.
2. Switch the **Edit Mode** to **Decimal**.
3. Insert a 'signals' function character at the beginning: Press **F11**, or open the context menu using the **right mouse button** and choose **Function character '!' (CTS/DSR/DCD/RI changes)** .
4. Add the handshake state as a decimal parameter value (see above). In our example we want to detect when CTS is high, while all other signals are low. This means we need to enter "001" as the parameter value, so the sequence is now:
   ! | 001
5. Specifiy a **Comment** for this sequence, e.g. "[CTS = high, DSR/DCD/RI = low]"
6. Click **OK** to confirm the new sequence

B) Start the test and confirm that Docklight now detects when the CTS line changes from low to high.

NOTE: This example only works if CTS is the only handshake line with "high" level. For a more flexible approach, you can define the character after the '!' function character as a wildcard, and use the DL_OnReceive() event procedure to evaluate the state of the handshake lines.

Function character '^' (F12) - bitwise comparisons

The Function Character '^' can be added by pressing **F12** in the Edit Receive Sequence dialog. After the '^' character, two additional character values specify which bits to check (*mask*) and which values to expect for these bits (*value*).

Receive Sequence (HEX Mode)	Description
^ | *mask* | *value*	Is a match for the next character received, when the following is true: ((*nextCharacterReceived* XOR *value*) AND *mask*) = 0 In other words - the '^' character picks only the bits marked in *mask* and compares them with the corresponding bits in *value*. See below for examples.
^ | 0F | 05	Is a match, when for the next character the following is true:

	Bit 0 = 1 Bit 1 = 0 Bit 2 = 1 Bit 3 = 0 Bit 4-7 = (don't care)
! | ^ | 04 | 04	This Receive Sequence triggers when the new handshake signal state says DCD = High. All other handshake signals can have any state. NOTE: This Receive Sequence will trigger for any change of any handshake signal, in case DCD still remains High.

TIP: This extension is also demonstrated in the Docklight Scripting example project **Docklight_TapPro_Demo.ptp** (see the folder **Extras\TapPro** in your \Samples directory)

6.6 Creating and Detecting Inter-Character Delays

Some applications, especially microcontroller applications without a dedicated serial data buffer, require an extra delay between individual characters to avoid buffer overflows and allow the microcontroller to execute other code.

In Docklight you can implement inter-character delays by inserting one or several **Function Characters '&' (F9 key)** in your Send Sequence data, followed by a character specifying the desired delay time from 0.01 seconds to 2.55 seconds.

You can also use the '&' delay character inside a Receive Sequence to specify a minimum silent time where no further characters should be received. This is useful for detecting pauses in the data stream that indicate the beginning/end of a telegram, especially for protocols where there is no dedicated start or end character.

Preconditions

- Docklight is ready to run a test as described in testing a serial device or a protocol implementation.
- The Docklight project already contains one or several Send Sequences, but an additional delay at certain character positions is required.

Sending Data With Inter-Character Delays

As an example, we use a microcontroller application which understands a "get" command. In ASCII Mode, the Send Sequence would be:
g | e | t | r   ("r" is a terminating <CR> Carriage Return character)

The following steps describe how to add an additional delay of 20 milliseconds between each character and avoid buffer overflows on the microcontroller side.

A) Modifying the existing Send Sequence

1. Open the Edit Send Sequence dialog.
2. Switch **Edit Mode** to **Decimal**. Our "get" example looks like this in decimal mode:
   103 | 101 | 116 | 013
3. Insert a delay function character between the first and the second character: Press **F9**, or open the context menu using the **right mouse button**, and choose **Function character '&' (delay...** . The example sequence now reads:
   103 | & | 101 | 116 | 013

4. Add the delay time: In this example a decimal value of 002 (20 milliseconds) after the "&" function character is added. The sequence is now:
   103 | & | 002 | 101 | 116 | 013
5. Insert a delay between all other inter-character positions: the delay character and delay time can be copied using **Ctrl+C**, and pasted in the desired positions using **Ctrl+V**. Our example sequence finally reads:
   103 | & | 002 | 101 | & | 002 | 116 | & | 002 | 013
   Or back in ASCII Mode:
   g | & | □ | e | & | □ | t | & | □ | r
6. Click **OK** to confirm the changes

NOTE: To distinguish a '&' delay character from a regular ampersand ASCII character (decimal code 38), the delay function character is shown on a different background color by the sequence editor.

NOTE: The character after a delay function character is interpreted as the delay time and is not sent to the serial device.

B) Sending the command to the microcontroller application

1. Send the modified Send Sequences using the  **Send** button.

Docklight will send out the same data as before, but leave additional timing gaps as specified by the delay characters. The communication display will show the same communication data as without the delays.

NOTE: Docklight's accuracy for delay timing is limited because it has no control over the UART's internal TX FIFO buffer. The specified delay times for the '&' delay function character are minimum values. Measured delay values are significantly higher, because Docklight always waits a minimum time to ensure the UART TX FIFO buffer is empty. Also, the display format and the additional performance settings affects the timing. If you have more specific requirements on Send Sequence timing and need to control the Docklight "wait time" as well as your UART FIFO settings, please contact our e-mail support.

TIP: If you require the same delay between each character of the transmitted data, have a look at the **SendByteTiming.pts** sample script (see the folder **Extras\SendByteTiming** in your Script Samples directory). This script will automatically slice your Send Sequences into individual characters and send the data "byte-by-byte", using a predefined inter-character delay.

Pause detection using a Receive Sequence

Docklight already offers the Pause detection... display option to insert additional time stamps or line breaks after communication pauses.

If you require not only visual formatting, but need to define actions after a minimum pause, or simply make sure the Receive Sequence detection algorithm starts anew after a pause, you can add the delay function character to your Receive Sequence definition.

In most applications the best place for the delay function character will be at the beginning of the Receive Sequence, before the actual receive data characters. You can also create a Receive Sequence that contains a delay/pause definition only, and no actual serial data. This can be very useful for implementing timing constraints, e.g. resetting the telegram detection after a pause occurred.

TIP: See the **LineParser.ptp / LineParser.pts** project and script file (folder **Extras\LineParser** in your Script Samples directory) for a sample application.

6.7 Setting and Detecting a "Break" State

Some serial application protocols (e.g. LIN) make use of the so-called Break state for synchronization purposes. Docklight Scripting supports sending a "break" within a Send Sequence and detecting a "break" state using a Receive Sequence definition. "break" signals are added to your sequence definition by inserting a **Function Character '%' (F10 key)**. A Docklight "break" signal has a minimum length of 15 * <nominal bit length>.

Preconditions

- Docklight is ready to run a test as described in testing a serial device or a protocol implementation.
- The Docklight project already contains one or several Send Sequences, but signalling or detecting a "break" state is also required.

Sending a "Break" state

We assume there is already a "Test" Send Sequence which looks like this in ASCII mode:
T | e | s | t

1. Open the Edit Send Sequence dialog.
2. Insert a "Break" function character at the beginning: Press **F10**, or open the context menu using the **right mouse button**, and choose **Function character '%' (break signal)** . The example sequence now reads:
   % | T | e | s | t
3. Click **OK** to confirm the changes
4. Send the test sequence using the 

Send button.

The TX line will go to Space (logical 0) for at least 15 bit durations, then the "Test" ASCII sequence will be transmitted. The "break" character does not appear in the communication window display.

Detecting a "Break" state

Received "break" signals are not displayed in the communication window, because they are not part of the actual data sequence. Nonetheless, it is possible to define a Receive Sequence including a "break" function character.

1. Create a new Receive Sequence. Enter a **Name** for the sequence.
2. Add a **Function character '%' (break signal)** for the **Sequence** data.
3. Enter a Receive Sequence **Action**, for example printing the comment "BREAK detected"
4. Click **OK** to confirm the changes
5. Start communications.

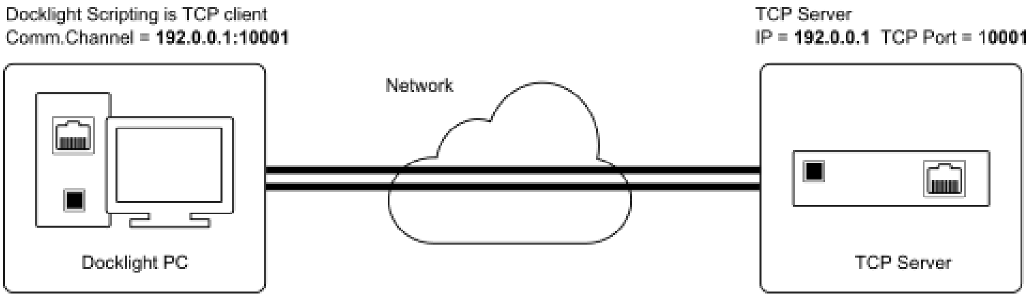
Docklight will now add `BREAK detected` to the communication window display each time a break signal is detected.

NOTE: After detecting a break signal, an additional <NUL> character (decimal code 0) may appear in the received data stream. This behavior cannot be controlled by

Docklight, it depends on how the serial UART of your PC's COM port interpretes the break state.

NOTE: If you need to implement a Receive Sequence that checks for a break signal followed by additional data, keep in mind that Docklight cannot tell the exact position of the break signal within the data stream. The break signal will sometimes show up earlier in the data stream, but never later than the actual position. To define a Receive Sequence that safely triggers on break + specific data, you can use the following workaround: Insert some '#' (zero or one character) wildcards between the break character and the additional data. The resulting Receive Sequence could look like this:
% | # | # | # | # | # | # | # | # | T | e | s | t

6.8 Testing a TCP Server Device (Scripting)



Preconditions

- The IP address of the device is known, and the device is accessible via the network from the computer running Docklight Scripting - i.e. a 'ping' to the device's IP address works.
- You know which TCP port you can connect to your device on.
- You know the protocol specification for the device, e.g. Modbus TCP, and the set of commands the device understands.

Testing TCP Server protocol functions

A) Setting the Communication Options

1. Choose the menu **Tools >** **Project Settings...**
2. Choose communication mode **Send/Receive**
3. At **Send/Receive on comm. channel**, enter the IP address and TCP port number for connecting to the device, e.g. 192.0.0.1:10001.
4. Confirm the settings and close the dialog by clicking the **OK** button.

TIP: If you want to connect to a server that runs on the same computer as Docklight, you can use the keyword **LOCALHOST** instead of the actual IP address of your computer (e.g. LOCALHOST:10001 for connecting to a server on port 10001 on the same computer). Using the loopback address 127.0.0.1 will have the same effect.

B) Defining the Send Sequences and Receive Sequences used:
Define all of the commands and responses required for your test, as described in Testing a Serial Device or a Protocol Implementation.

C) Running the test
Establish a connection by choosing Run **>** Start Communication.

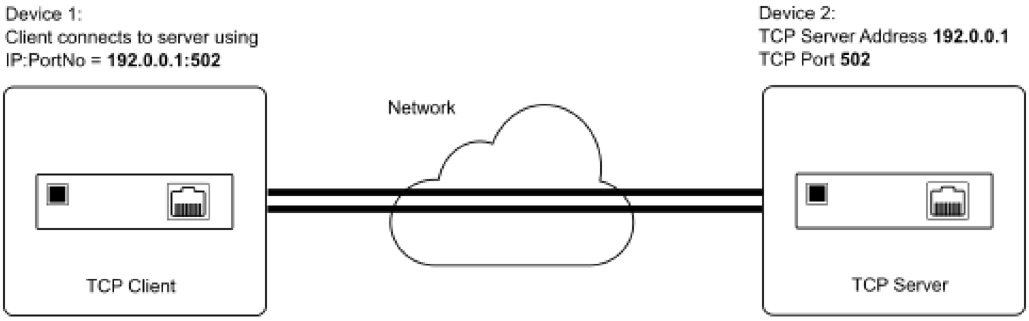
Docklight Scripting now tries to connect to the TCP server device. After the connection is established, you can send one of your predefined Send Sequences using the Send button. Until the TCP server accepts the connection request, you will not see any TX (transmission) data appearing in the Communication Window.

NOTE: If the server closes the TCP session before you choose Run **>** Stop Communication in Docklight, you will receive the error message "TCP/IP connection closed by the remote computer", and the communication will be stopped.

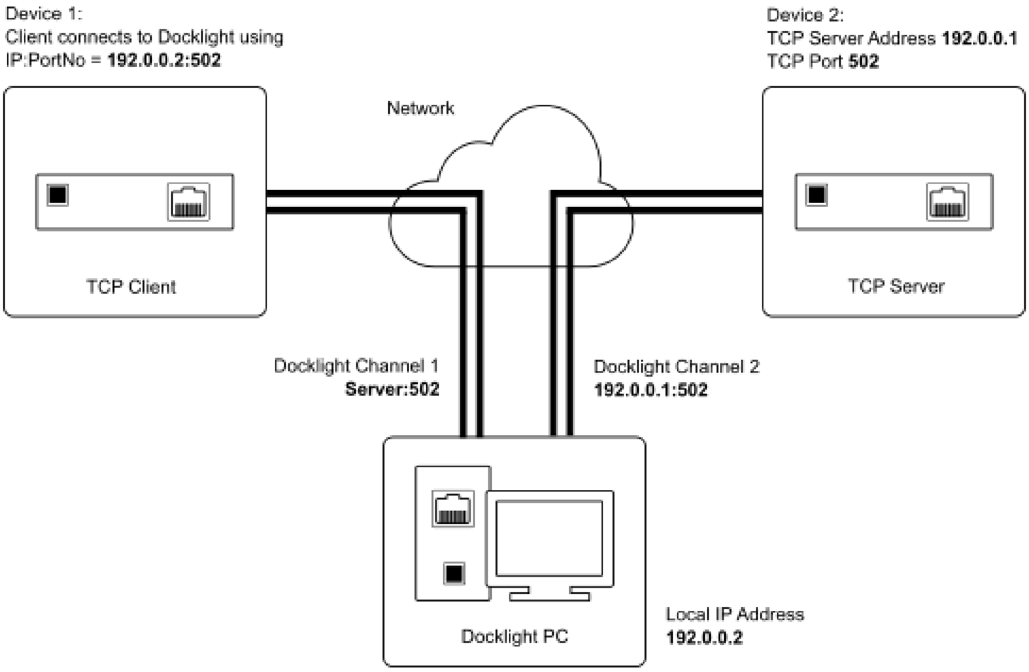
NOTE: If you receive the error "IP Address / TCP port in use" when starting communications, check if another server or even another Docklight Scripting instance is blocking the port. Also try closing and restarting Docklight Scripting - sometimes the TCP driver layer used by Docklight Scripting does not release a TCP port until the application using it is closed.

NOTE: Even if there is no other server or client blocking a port, it may take up to 4 minutes until a port is actually released and available again. This is a restriction in the TCP driver layer used in Docklight Scripting, and unfortunately Docklight Scripting cannot control this.

6.9 Monitoring a Client/Server TCP Connection (Scripting)



Docklight Scripting allows you to monitor and debug a TCP-based application with the same ease as when using RS232 ports and cables. Instead of using a Docklight Monitoring Cable between the two devices being tested, you can run Docklight Scripting within the network and simply have the client (Device 1) connect to Docklight Scripting instead of the network-enabled product (Device 2).



Preconditions

- Device 1, Device 2 and the PC with Docklight are connected in a common network (LAN).
- All IP addresses and the TCP port number are known.
- Device 1 is currently configured to connect to Device 2, and communications between the two devices is working.

Route and debug TCP traffic

A) Route the traffic through Docklight Scripting
In Device 1, change the communication parameters: Device 1 must connect to the Docklight PC (in our example IP 192.0.0.2).

B) Setup Docklight Scripting for operating as a bridge for the communication between Device 1 and Device 2

1. Choose the menu **Tools >** **Project Settings...**
2. Choose communication mode **Monitoring (Receive only)**
3. For **Receive Channel 1**, type the keyword **SERVER** and the TCP port to listen on (e.g. SERVER:502).
4. For **Receive Channel 2**, type the **IP address** and **TCP Port number** for connecting to Device 2 (e.g. 192.0.0.1:502).
5. Confirm the settings and close the dialog by clicking the **OK** button.

C) Running the test

Start Docklight Scripting using **Run >** **Start Communication**. Let Device 1 connect and perform a test run. Docklight Scripting will act as a bridge between the devices and show you all the TCP data transferred between the devices in the communication window.

NOTE: Docklight Scripting does not allow multiple connections on a SERVER port. Only one connection at a time may be used. This is similar to the default operation of many Serial Device Servers.

TIP: An example that can be tried on any computer with a web browser and Internet access is the **TCP_Monitoring_HTTP.ptp** project which can be found in the **\Network** folder of the \ScriptSamples directory.

Examples and Tutorials

7 Examples and Tutorials

This chapter describes two sample projects that demonstrate some of Docklight's basic functions. The corresponding Docklight project files (**.ptp** files) can be found in the **\Samples** folder within the Docklight installation directory (e.g. **C:\Program Files\FuH\Docklight V2.3\Samples**).

TIP: The **\Samples** folder can also be reached via the Docklight Welcome screen (menu **Help > Welcome Screen and Examples...**).

NOTE: If you are logged on with a restricted user account, you will not have permission to make any changes in the program files directory. In this case, saving a project file or any other data into the **\Samples** folder will produce an error.

NOTE: For additional sample projects and Application Notes, see also our online resources at https://docklight.de/examples/.

7.1 Testing a Modem - Sample Project: ModemDiagnostics.ptp

The Docklight project **ModemDiagnostics.ptp** can be used to perform a modem check. A set of modem diagnostic commands are defined in the Send Sequences list.

This is a simple example for Testing a serial device or a protocol implementation. The sample project uses the communication settings listed below. This should work for most standard modems.

Communication Mode	Send/Receive
COM Port Settings	9600 Baud, No parity, 8 Data Bits, 1 Stop Bit

Getting started

- Use the *Windows* **Device Manager** to find out which **COM Port** is a modem device. This demo project may be used with any AT-compatible modem available on your PC, e.g. a built-in notebook modem, or a GSM or Bluetooth modem driver than can be accessed through a virtual COM port.

TIP: For a simple test without specialized hardware, add your mobile phone as **Bluetooth Device** on your *Windows* PC. Then find your phone in the *Windows* **Devices and Printers** list. Right-click on it, choose **Properties** and go to the **Hardware** tab. In the **Device Functions** list it should mention the modem related COM Ports.

- Go to the **Project Settings...** dialog and make sure you have selected the same COM Port for **Send/Receive on comm. channel**.
- Press the **Start Communication** button in the toolbar.
- Try sending any of the predefined modem commands by pressing the -----> **Send** button

You should now receive a response from your modem, e.g. "OK" if your command was accepted, a model identification number, etc. The response will vary with the modem model.

After sending several sequences, the Docklight communication window could look like this:

```
07.02.2013 18:17:54.083 [TX] - ATQ0V1E0<CR><LF>
```

```
07.02.2013 18:17:54.107 [RX] - ATQ0V1E0<CR><LF>
<CR><LF>
OK<CR><LF>

07.02.2013 18:18:00.511 [TX] - ATI2<CR><LF>

07.02.2013 18:18:00.747 [RX] - <CR><LF>
V 11.10<CR><LF>
13-05-11<CR><LF>
RM-721<CR><LF>
(c) Nokia            <CR><LF>
<CR><LF>
OK<CR><LF>

07.02.2013 18:18:01.393 [TX] - ATI3<CR><LF>

07.02.2013 18:18:01.421 [RX] - <CR><LF>
Nokia C2-01<CR><LF>
<CR><LF>
OK<CR><LF>
...
```

Further Information

The Send Sequences list includes the following standard AT modem commands:

Send Sequence	Description / Modem Response
ATQ0V1E0	Initializes the query.
AT+GMM	Model identification (ITU V.250 recommendation is not supported by all modems).
AT+FCLASS=?	Fax classes supported by the modem, if any.
AT#CLS=?	Shows whether the modem supports the Rockwell voice command set.
ATI<n>	Displays manufacturer's information for <n> = 1 through 7. This provides information such as the port speed, the result of a checksum test, and the model information. Check the manufacturer's documentation for the expected results.

The \Samples folder also contains a log file **ModemDiagnostics_Logfile_asc.txt**. It shows a test run where the above Send Sequences were sent to a real modem.

7.2 Reacting to a Receive Sequence - Sample Project: PingPong.ptp

The Docklight project **PingPong.ptp** is a simple example for how to define and use Receive Sequences.

Getting started

- Go to the **Project Settings...** dialog and choose a COM port.
- Apply a simple loopback to this COM port: Connect Pin 2 (RX) with Pin 3 (TX). See RS232 SUB D9 Pinout.
- Now press the **Send** button for either of the two Send Sequences. Communication is started and the Send Sequence is transmitted. It will of course be instantly received on the COM port's RX line.

Docklight will detect the incoming data as being one of the defined Receive Sequences. It will then perform the action predefined for this event, which is sending out another sequence. As a result, Docklight will send out alternating Send Sequences - "Ping" and "Pong".

- Use the **Stop communication** button to end the demo.

The Docklight communication display should look similar to this:

```
3/8/2009 16:25:44.201 [TX] - ----o Ping
3/8/2009 16:25:44.216 [RX] - ----o Ping "Ping" received
3/8/2009 16:25:44.218 [TX] - o---- Pong
3/8/2009 16:25:44.233 [RX] - o---- Pong "Pong" received
3/8/2009 16:25:44.236 [TX] - ----o Ping
3/8/2009 16:25:44.251 [RX] - ----o Ping "Ping" received
3/8/2009 16:25:44.254 [TX] - o---- Pong
3/8/2009 16:25:44.268 [RX] - o---- Pong "Pong" received
3/8/2009 16:25:44.271 [TX] - ----o Ping
3/8/2009 16:25:44.286 [RX] - ----o Ping "Ping" received
3/8/2009 16:25:44.289 [TX] - o---- Pong
3/8/2009 16:25:44.303 [RX] - o---- Pong "Pong" received
3/8/2009 16:25:44.307 [TX] - ----o Ping
3/8/2009 16:25:44.322 [RX] - ----o Ping "Ping" received
3/8/2009 16:25:44.324 [TX] - o---- Pong
```
...

See also the corresponding log files in the \Samples folder (**PingPong_Logfile_asc.htm** and **PingPong_Logfile_hex.htm**).

Further Information

This demo project can also be run in three alternative configurations:

1. Run two Docklight applications on the same PC using different COM ports. The two COM ports are connected using a simple null modem cable.
2. Instead of two RS232 COM ports and a null modem cable you can use a virtual null modem.
3. Use two PCs and run Docklight on each PC. Connect the two PCs using a simple null modem cable.

TIP: For Docklight Scripting there is also a related example project that uses a UDP loopback connection, and does not require any serial data ports. See the **PingPong_UDP_Loopback.ptp** project in the **\Network** folder of the \ScriptSamples directory.

7.3 Modbus RTU With CRC checksum - Sample Project: ModbusRtuCrc.ptp

The Docklight project file **ModbusRtuCrc.ptp** demonstrates how to automatically calculate the CRC value required to send a valid Modbus RTU frame.

The project file uses the communication settings listed below, according to the Modbus implementation class "Basic".

Communication Mode	Send/Receive
Send/Receive on comm. channel	COM1
COM Port Settings	19200 Baud, Even parity, 8 Data Bits, 1 Stop Bit

Getting started

- Open the project file **ModbusRtuCrc.ptp** (menu Open Project ...). The file is located in the \Samples folder.
- Connect the PC's COM port to your Modbus network. Open the **Project Settings...** dialog and make sure you have selected the correct COM Port for **Send/Receive on comm. channel**.
- Click the -----> **Send** button in the **Read Input Register Slave=?..** line of the Send Sequence list
- Enter a slave number in the **Send Sequence Parameter** dialog, e.g. "01" for addressing slave no. 1.

After sending "Read Input Register" commands to slaves 1 - 4, the communication window could look like this:

```
23.09.2019 07:04:56.170 [TX] - 01 04 00 03 00 01 C1 CA
23.09.2019 07:04:56.282 [RX] - 01 04 02 FF FF B8 80
Detected Modbus Frame = 01 04 02 FF FF B8 80
SlaveID=01
FunctionCode=04
Addr/Data=02 FF FF
CRC=B8 80

 Input Register Answer: Slave=001 ValueHex=FFFF

23.09.2019 07:05:21.761 [TX] - 02 04 00 03 00 01 C1 F9
23.09.2019 07:05:21.873 [RX] - 02 04 02 7F 58 DC FA
Detected Modbus Frame = 02 04 02 7F 58 DC FA
SlaveID=02
FunctionCode=04
Addr/Data=02 7F 58
CRC=DC FA

 Input Register Answer: Slave=002 ValueHex=7F58

23.09.2019 07:05:35.713 [TX] - 03 04 00 03 00 01 C0 28
23.09.2019 07:05:35.824 [RX] - 03 04 02 01 0A 41 67
Detected Modbus Frame = 03 04 02 01 0A 41 67
SlaveID=03
FunctionCode=04
Addr/Data=02 01 0A
CRC=41 67

 Input Register Answer: Slave=003 ValueHex=010A

23.09.2019 07:05:51.677 [TX] - 04 04 00 03 00 01 C1 9F
23.09.2019 07:05:51.789 [RX] - 04 04 02 40 00 44 F0
Detected Modbus Frame = 04 04 02 40 00 44 F0
SlaveID=04
FunctionCode=04
```

```
Addr/Data=02 40 00
CRC=44 F0

 Input Register Answer: Slave=004 ValueHex=4000
```

The [RX] channel shows the responses from the Modbus slaves:
slave 1 responded value "-1",
slave 2 responded "32600",
slave 3 responded "266" and
slave 4 responded "16384".

NOTE: If you are using the Docklight Modbus example on a RS485 bus and do not see a device answer, check if your RS485 hardware interface automatically switches between transmit and receive mode, or you need to use the RS485 Transceiver Control option.

Further Information

- The CRC calculation is made according to the specifications for Modbus serial line transmission (RTU mode). Docklight's checksum function supports a "CRC-MODBUS" model for this purpose. See Calculating and Validating Checksums for more general information on implementing checksum calculations.
- If you do not have any Modbus slave devices available, you can use a software simulator. See the www.plcsimulator.org/ as originally mentioned on www.modbus.org, "Modbus Technical Resources", "Modbus Serial RTU Simulator". This simulator was used to produce the sample data shown above.

Examples and Tutorials (Scripting)

8 Examples and Tutorials (Scripting)

This chapter describes sample scripts that demonstrate some of the possibilities when using Docklight Scripting. The corresponding Docklight script files (**.pts** files) and other related files can be found in the folder **\ScriptSamples** within the Docklight Scripting installation directory (e.g. **C:\Program Files\FuH\Docklight Scripting V2.3\ScriptSamples**).

TIP: The **\ScriptSamples** folder can also be reached via the Docklight Scripting Welcome screen (menu **Help > Welcome Screen and Examples...**).

NOTE: If you are working with a user account which has restricted system access, you might not have permission to save into the program files directory. In this case, saving a project file or any other data into the **\ScriptSamples** folder will produce an error.

NOTE: For additional sample scripts, projects and Application Notes, see our online resources at https://docklight.de/examples/.

8.1 Automated Modem Testing - Sample Script: ModemScript.pts

The Docklight script **ModemScript.pts** and the accompanying project file **ModemATCommands.ptp** demonstrate how to use a Docklight script for an automated test or configuration task with user interaction.

The project file uses the communication settings listed below. This should work for most standard modems.

Communication Mode	Send/Receive
Send/Receive on comm. channel	COM3
COM Port Settings	9600 Baud, No parity, 8 Data Bits, 1 Stop Bit

Getting started

- Connect the modem to an available COM port, e.g. COM1, and switch it on. The demo may also run on a notebook with a built-in modem. In many cases you will find your notebook's built-in modem on COM3, so you can try and run the sample script without modifying the project settings.
- Go to the **Project Settings...** dialog and make sure you have selected the same COM Port for **Send/Receive on comm. channel**.
- Press the **Run Script** button in the toolbar.
- Type in the AT command range to be tested, or simply accept the default value by pressing **Enter**.

The script now establishes a connection with the modem and runs through the AT command set. After successfully completing the test run, the Docklight communication window could look like this:

```
 Waiting for modem ...

3/8/2009 16:23:08.870 [TX] - ATQ0V1E0<CR><LF>

3/8/2009 16:23:08.873 [RX] - ATQ0V1E0<CR>
<CR><LF>
OK<CR><LF>
```

```
 Checking AT command set...

3/8/2009 16:23:08.888 [TX] - ATI0<CR><LF>

3/8/2009 16:23:08.891 [RX] - <CR><LF>
Agere SoftModem Version 2.1.46<CR><LF>
<CR><LF>
OK<CR><LF>

3/8/2009 16:23:09.091 [TX] - ATI1<CR><LF>

3/8/2009 16:23:09.101 [RX] - <CR><LF>
OK<CR><LF>

3/8/2009 16:23:09.293 [TX] - ATI2<CR><LF>

3/8/2009 16:23:09.294 [RX] - <CR><LF>
OK<CR><LF>

3/8/2009 16:23:09.496 [TX] - ATI3<CR><LF>

3/8/2009 16:23:09.498 [RX] - <CR><LF>
Agere SoftModem Version 2.1.46<CR><LF>
<CR><LF>
OK<CR><LF>

3/8/2009 16:23:09.700 [TX] - ATI4<CR><LF>

3/8/2009 16:23:09.702 [RX] - <CR><LF>
Built on 07/22/2004 14:50:10<CR><LF>
<CR><LF>
OK<CR><LF>

3/8/2009 16:23:09.901 [TX] - ATI5<CR><LF>

3/8/2009 16:23:09.912 [RX] - <CR><LF>
2.1.46, AMR Intel MB, AC97 ID:SIL REV:0x27, 06<CR><LF>
<CR><LF>
OK<CR><LF>

3/8/2009 16:23:10.104 [TX] - ATI6<CR><LF>

3/8/2009 16:23:10.110 [RX] - <CR><LF>
OK<CR><LF>

3/8/2009 16:23:10.308 [TX] - ATI7<CR><LF>

3/8/2009 16:23:10.315 [RX] - <CR><LF>
AMR Intel MB<CR><LF>
<CR><LF>
OK<CR><LF>

3/8/2009 16:23:10.510 [TX] - ATI8<CR><LF>

3/8/2009 16:23:10.513 [RX] - <CR><LF>
AC97 ID:SIL REV:0x27<CR><LF>
<CR><LF>
```



```
OK<CR><LF>

3/8/2009 16:23:10.713 [TX] - ATI9<CR><LF>

3/8/2009 16:23:10.723 [RX] - <CR><LF>
Germany<CR><LF>
<CR><LF>
OK<CR><LF>

3/8/2009 16:23:10.916 [TX] - ATI10<CR><LF>

3/8/2009 16:23:10.921 [RX] - <CR><LF>
OK<CR><LF>

3/8/2009 16:23:11.119 [TX] - ATI11<CR><LF>

3/8/2009 16:23:11.120 [RX] - Description
  Status<CR><LF>
---------------                    ------------<CR><LF>
Last Connection                    Unknown<CR><LF>
Initial Transmit Carrier Rate      0<CR><LF>
Initial Receive  Carrier Rate      0<CR><LF>
Final   Transmit Carrier Rate      9600<CR><LF>
Final   Receive  Carrier Rate      9600<CR><LF>
Protocol Negotiation Result        NONE<CR><LF>
Data Compression Result            NONE<CR><LF>
Estimated Signal/Noise Ratio   (dB) 00<CR><LF>
Receive  Signal Power Level  (-dBm) 00<CR><LF>
Transmit Signal Power Level  (-dBm) 10<CR><LF>
Round Trip Delay             (msec) 1000<CR><LF>
Near Echo Level              (-dBm) 00<CR><LF>
Far  Echo Level              (-dBm) 00<CR><LF>
Transmit Frame Count               0<CR><LF>
Transmit Frame Error Count         0<CR><LF>
Receive  Frame Count               0<CR><LF>
Receive  Frame Error Count         0<CR><LF>
Retrain by Local  Modem            0<CR><LF>
Retrain by Remote Modem            0<CR><LF>
Rate Renegotiation by Local  Modem 0<CR><LF>
Rate Renegotiation by Remote Modem 0<CR><LF>
Call Termination Cause             0<CR><LF>
Robbed-Bit Signaling               0<CR><LF>
Digital Loss                   (dB) 00<CR><LF>
Remote Server ID                   NA<CR><LF>
<CR><LF>
OK<CR><LF>

3/8/2009 16:23:11.441 [TX] - ATI12<CR><LF>

3/8/2009 16:23:11.443 [RX] - <CR><LF>
OK<CR><LF>

3/8/2009 16:23:11.643 [TX] - ATI13<CR><LF>

3/8/2009 16:23:11.654 [RX] - <CR><LF>
ERROR<CR><LF>

3/8/2009 16:23:11.846 [TX] - ATI14<CR><LF>
```

```
3/8/2009 16:23:11.852 [RX] - <CR><LF>
ERROR<CR><LF>

 Results:
 Found 13 valid AT commands.
 2 AT command(s) did not work.
```

8.2 Startup From Command Line - Sample Script: LogStartupScript.pts

The Docklight script **LogStartupScript.pts**, the related project file **LogStartupSettings.ptp**, and the batch file **LogStartup.bat** demonstrate how to start Docklight from the command line, create a log file according to predefined settings and start communications automatically.

The project file uses the communication settings listed below.

Communication Mode	Monitoring (receive only)
Receive channel 1	COM1
Receive channel 2	COM3
COM Port Settings	9600 Baud, No parity, 8 Data Bits, 1 Stop Bit

Getting started

- Start the batch file **LogStartup.bat** from a command line or go to the \ScriptSamples directory and run **LogStartup.bat** by double-clicking the file.

Docklight Scripting is started, an ASCII log file **C:\DocklightScripting_Logfile_asc.txt** is created and communication is started immediately.

Use **Shift+F6** to stop the script's execution and close the communication ports and log file.

NOTE: This sample requires a software license for the Docklight standard version, since it makes use of the Docklight Logging function. A Docklight Scripting license is not required when running the sample.

Further Information

The batch file, **LogStartup.bat**, contains the following line:

```
..\Docklight_Scripting.exe -r LogStartupScript.pts
```

This will start Docklight Scripting, open the script file **LogStartupScript.pts** and run it immediately (**-r** option). The script **LogStartupScript.pts** contains the following commands:

```
' LogStartupScript.pts
' Start up logging and communication
DL.OpenProject "LogStartupSettings"
' Create (or append to) a ASCII log file
DL.StartLogging "C:\DocklightScripting_Logfile", True, "A"
DL.StartCommunication
' Keep communication & logging alive until user stops
Do
```

```
    DL.Pause 1 ' (the pause reduces CPU load while idle)
Loop
```

The communication settings used in **LogStartupSettings.ptp** are just an example. If you require different settings, you need to open the project file, modify the project settings and save the changes. It is recommended that all related files (**LogStartupScript.pts**, **LogStartupSettings.ptp** and **LogStartup.bat**) be copied to a different location before making any changes. You need to provide the complete actual path to the **Docklight_Scripting.exe** application within the **.bat** file in this case.

8.3 Manipulating a RS232 Data Stream - Sample Script: CharacterManipulation.pts

The Docklight script **CharacterManipulation.pts** demonstrates how to manipulate a RS232 data stream using the DL_OnReceive() event procedure. All data received on the RX line is sent out again on the TX line, but with some of the characters replaced.

Getting started

- Open the project file **CharacterManipulationPrj.ptp** (using the **Open Project ...** menu) and the script file **CharacterManipulation.pts** (using the **Open Script ...** menu). The files are located in the \ScriptSamples folder.
- Go to the **Project Settings...** dialog and choose a COM port.
- Press the **Run Script** button in the toolbar.
- Start a second instance of Docklight and open the project file **CharacterManipulationTest.ptp**.
- Choose a different COM port for this second Docklight instance (or even use another computer).
- Connect the two COM ports using a simple null modem cable. Or use a virtual null modem instead.
- Use the -----> **Send** button on the second instance of Docklight to send the test sentence.

The communication display of the second instance of Docklight should look similar to this:

```
2/21/2009 11:56:57.343 [TX] - This is a test for the character
manipulation sample script
2/21/2009 11:56:57.502 [RX] - Dhis is a desd for dhe characder
manibuladion samble scribd
```

Each "T" is replaced by a "D", and each "P" is replaced by a "B". (Visitors to the Nuremberg area, where our company is located, might notice that dialect speakers here do something similar...)

Further Information

- The sample uses the **DL_OnReceive()** event procedure to perform additional operations each time a new character is received. See Evaluating Receive Sequence Data for more details.
- The performance of a character-by-character processor in Docklight Scripting is quite limited. You can easily overload it by sending a constant flow of data. Docklight will display a comment in the communication window in this case, e.g. `DOCKLIGHT reports: Input buffer overflow on COM1`
- For performance reasons, all TX and RX data display is disabled in **CharacterManipulationPrj.ptp**

- If you are thinking of writing a manipulator for your own protocol, consider a packet-based approach, where one Receive Sequence can detect a whole packet or command from your protocol. This will allow higher data rates than the character-based approach presented here.

8.4 TCP/IP Communications - Sample Projects PingPong_TCP_Server/Client.ptp

The project files **PingPong_TCP_Server.ptp** and **PingPong_TCP_Client.ptp** in the \ScriptSamples**\Network** folder demonstrate how to use Docklight Scripting as a TCP server or TCP client and exchange data.

The samples show how a server and a client can be run on the same computer using the **LOCALHOST** network name, which always refers to the computer Docklight is running on.

Getting started

- Open the project **PingPong_TCP_Server.ptp** in Docklight Scripting
- Press the **Start Communication** button in the toolbar.
- If you are using a Personal Firewall on your PC, it will probably notify you that Docklight Scripting wants to act as a server. Confirm and allow, if required.
- Start a second instance of Docklight Scripting and open the **PingPong_TCP_Client.ptp** project
- In this 'client' instance , press the ----> **Send** button for the "Ping" sequence.
- If you are using a Personal Firewall on your PC, allow Docklight Scripting to connect to the Internet.

The 'client' Docklight now connects to the 'server' Docklight, and data is exchanged as if the two Docklight instances were connected by a serial null-modem cable.

The communication window on the client side now displays the following messages:

```
3/9/2009 17:29:24.192 [TX] - ----o Ping
3/9/2009 17:29:24.218 [RX] - o---- Pong "Pong" received
3/9/2009 17:29:24.221 [TX] - ----o Ping
3/9/2009 17:29:24.249 [RX] - o---- Pong "Pong" received
3/9/2009 17:29:24.254 [TX] - ----o Ping
3/9/2009 17:29:24.281 [RX] - o---- Pong "Pong" received
3/9/2009 17:29:24.283 [TX] - ----o Ping
3/9/2009 17:29:24.312 [RX] - o---- Pong "Pong" received
...
```

On the server side, you will see something like this:

```
3/9/2009 17:29:24.203 [RX] - ----o Ping "Ping" received
3/9/2009 17:29:24.206 [TX] - o---- Pong
3/9/2009 17:29:24.235 [RX] - ----o Ping "Ping" received
3/9/2009 17:29:24.238 [TX] - o---- Pong
3/9/2009 17:29:24.266 [RX] - ----o Ping "Ping" received
3/9/2009 17:29:24.268 [TX] - o---- Pong
3/9/2009 17:29:24.298 [RX] - ----o Ping "Ping" received
3/9/2009 17:29:24.301 [TX] - o---- Pong
...
```

Reference

9 Reference

9.1 Menu and Toolbar (Scripting)

NOTE: Hotkeys are available for common menu and toolbar functions.

File Menu

New Project
Close the current Docklight project and create a new one.

Open Project ...
Close the current Docklight project and open another project.

Import Sequence List ...
Import all Send Sequences and Receive Sequences from a second Docklight project.

Save Project / Save Project As ...
Save the current Docklight project.

Print Project ...
Print the project data, i.e. the list of defined Send Sequences and Receive Sequences. The sequences are printed in the same representation (ASCII, HEX, Decimal or Binary) that is used in the Docklight main window. The representation may be chosen using the Options dialog window.

Print Communication ...
Print the contents of the communication window. The communication data is printed in the same representation that is currently visible in the communication window.

Exit
Quit Docklight.

Edit Menu

Edit Send Sequence List ...
Edit the Send Sequences list, i.e. add new sequences or delete existing ones.

Edit Receive Sequence List ...
Edit the Receive Sequences list, i.e. add new sequences or delete existing ones.

Swap Send and Receive Sequence Lists
Convert all Send Sequences into Receive Sequences and vice versa.

Find Sequence in Communication Window...
Find a specific sequence within the data displayed in the communication window. See the Find Sequence function.

Clear Communication Window
Delete the contents of the communications window. This applies to all four representations (ASCII, HEX, Decimal, Binary) of the communication window.

Run Menu

Start communication
Open the communication ports and enable serial data transfer.

Stop communication
Stop serial data transfer and close the communication ports.

Tools Menu

Start Communication Logging ...
Create new log file(s) and start logging the incoming/outgoing serial data. See logging and analyzing a test.

Stop Communication Logging
Stop logging and close the currently open log file(s).

Start Snapshot Mode
Wait for a trigger sequence and take a snapshot. See Catching a specific sequence...

Stop Snapshot Mode
Abort a snapshot and reenable the communication window display.

Keyboard Console On
Enable the keyboard console to send keyboard input directly.

Keyboard Console Off
Disable the keyboard console.

Minimize/Restore Documentation and Script
Minimize the Documentation and Script area, or bring it back to regular size.

Minimize/Restore Sequence Lists
Minimize the Send/Receive Sequence lists, or bring them back to regular size.

Project Settings...
Select the current project settings (COM ports, baud rate, ...).

Options...
Select general program options (e.g. display mode, date / time stamp).

Expert Options...
Select expert program options intended for advanced users and specific applications (e.g. high monitoring accuracy).

Scripting Menu

Run / Continue Script
Execute the code in the script editor.

Stop Script
Stop a running script.

Break Script
Interrupts a running script.

New Script
Close the current Docklight script and create a new one.

Open Script ...
Close the current Docklight script and open another script.

Save Script / Save Script As ...
Save the current Docklight script.

Customize / External Editor...
Use an external editor instead of Docklight's built-in editor.

9.2 Dialog: Edit Send Sequence

This dialog is used to define new Send Sequences and edit existing ones (See also Editing and Managing Sequences).

Index
The index of the sequence displayed below. The first sequence has index 0 (zero).

1 - Name
Unique name for this sequence (e.g. "Set modem speaker volume"). This name is for referencing the sequence. It is not the data that will be sent out through the serial port. See "2 - Sequence" below.

2 - Sequence
The character sequence that will be transmitted through the serial port.

TIP: For transmitting larger blocks of data that exceed the maximum sequence size, use the DL.UploadFile script command.

TIP: Special Function Characters are available for creating inter-character delays, set handshake signals and parity bits, or setting a break state.

3 - Additional Settings
- **Repeat** - Check the "Send periodically..." option to define a sequence that is sent periodically. A time interval between 0.01 seconds and 9999 seconds can be specified.

NOTE: The *Windows* reference time used for this purpose has only limited precision. Time intervals < 0.03 seconds will usually not be accurate.

- **Checksum** - Perform automatic calculation of any type of checksum, including any type of CRC standard such as Modbus, CCITT, CRC32.

TIP: See Calculating and Validating Checksums for a general overview, and Checksum Specification for the text format used to define a checksum.

Wildcards
Wildcards can be used to introduce parameters into a Send Sequence that you wish to insert manually each time the sequence is sent. See section Sending commands with parameters for details and examples.

Control Character Shortcuts
Using keyboard shortcuts is a great help when editing a sequence that contains both printing characters (letters A-z, digits 0-9, ...) and non-printing control characters (ASCII code 0 to 31). Predefined shortcuts are:
Ctrl+Enter for carriage return / <CR> / decimal code 13
Ctrl+Shift+Enter for line feed / <LF> / decimal code 10

Use Options... --> Control Character Shortcuts to define other shortcuts you find useful.

Sequence Documentation

Add some documentation about this sequence here. This documentation is also shown in the main window when selecting the sequence in the Send Sequences list.

9.3 Dialog: Edit Receive Sequence

This dialog is used to define new Receive Sequences and edit existing ones (See also Editing and Managing Sequences).

Index
The index of the sequence displayed below. The first sequence has index 0 (zero).

1 - Name
Unique name for this sequence (e.g. "Ping received"). This name is for referencing the sequence. It is not the sequence received through the serial port. See "2 - Sequence" below.

2 - Sequence
The character sequence which should be detected by Docklight within the incoming serial data.

TIP: Special Function Characters are available for detecting inter-character delays, evaluating handshake signal changes or detecting a break state.

3 - Action
The action(s) performed when Docklight detects the sequence defined above.

You may choose from the following actions:
- **Answer** - After receiving the sequence, transmit one of the Send Sequences. Only Send Sequences that do not contain wildcards can be used as an automatic answer.
- **Comment** - After receiving the sequence, insert a user-defined comment into the communication window (and log file, if available). Various comment macros are available for creating dynamic comment texts.
- **Trigger** - Trigger a snapshot when the sequence is detected. This is an advanced feature described in the section Catching a specific sequence...
- **Stop** - Stop communications and end the test run.
- **Checksum** - Perform automatic validation of a checksum, including any type of CRC standard such as Modbus, CCITT, CRC32.
  Set the Checksum Specification, as well as what should be done with the result:
  Detect Checksum OK - the received data must have the same checksum than the calculated value from Docklight.
  Checksum Wrong - the opposite. A mismatching checksum constitutes a "sequence match".
  Both OK/Wrong - the sequence is always detected. The checksum area will contain all ASCII "1" (HEX 31) for a matching checksum, or ASCII "0" (HEX 30) for a wrong checksum.

TIP: See Calculating and Validating Checksums for a general overview, and Checksum Specification for the text format used to define a checksum.

Wildcards
Wildcards can be used to test for sequences that have a variable part with changing values (e.g. measurement or status values). See section Checking for sequences with random characters for details and examples.

Control Character Shortcuts
Using keyboard shortcuts is a great help when editing a sequence that contains both printing characters (letters A-z, digits 0-9, ...) and non-printing control characters (ASCII code 0 to 31). Predefined shortcuts are:

Ctrl+Enter for carriage return / <CR> / decimal code 13
Ctrl+Shift+Enter for line feed / <LF> / decimal code 10

Use Options... --> Control Character Shortcuts to define other shortcuts you find useful.

Sequence Documentation
Add some documentation about this sequence here. This documentation is also shown in the main window when selecting the sequence in the Send Sequences list.

9.4 Dialog: Start Logging / Create Log File(s)

Menu **Tools > Start Communication Logging ...**

Log file format
The available log formats are plain text (.txt), HTML for web browsers (.htm), or RTF Rich Text Format for *Microsoft* Word or Wordpad (.rtf).

- **Plain text file (.txt)** is a good choice if you expect your log files to become very large.

TIP: The *Windows* built-in Notepad editor can be very slow in opening and editing larger files. We recommend the popular Open Source editor Notepad++ as available at http://notepad-plus.sourceforge.net - it is a much faster and more powerful alternative.

NOTE: there is no size limit for Docklight log files besides the limits on your Windows PC. We have successfully tested Docklight in long-term monitoring / high volume applications and created log files with several GB size without any stability issues.

- **HTML files (.htm)** are more comfortable to analyze, because they include all the visual formatting of the Docklight communication windows (colors, bold characters, italic characters). However, the disk size for such a file will be larger than for a plain text format, and large HTML files will slow down common web browsers.

  TIP: If you have specific requirements on the output format, you can customize the HTML output.

- **RTF Rich Text Format (.rtf)** is a good choice for both small and large log files with formatted text - both *Microsoft* Word and Wordpad can navigate through larger files fast and without appearing unresponsive.

NOTE: Due to the specifics of the RTF document format, Docklight cannot efficiently append new data to an existing log file, but needs to create a temporary copy of the existing log first, which can cause additional delays. It is also not supported to append new logging data with different colors & font settings than at the start of the file.

Log file directory and base name
Choose the directory and base file name for the log file(s) here. The actual file path used for the individual log file representations are displayed in the text boxes within the "Log file representation" frame.

Overwrite / append mode
Choose "append new data" if you do not want Docklight to overwrite existing log file(s). Docklight will then insert a "start logging / stop logging" message when opening / closing the log files. This is so that when in 'append mode' it is still possible to see when an individual log file session started or ended.

Representation

A separate log file may be created for each data representation (ASCII, HEX, ...). Choose at least one representation. The log files will have a ".txt" or ".htm" file extension. Docklight additionally adds the representation type to the file name to distinguish the different log files. E.g. if the user specifies "Test1" as the base log file name, the plain text ASCII log file will be named "Test1_asc.txt", whereas the plain text HEX log file will be named "Test1_hex.txt".

Disable communication window while logging
If you are monitoring a high-speed communication link or if you are running Docklight on a slow computer, Docklight may not be able to process all the transmitted data or may even freeze (no response to any user input).
Using this option to disable the communication window output while logging the data to a file. Docklight will run much faster, since the continuous display formatting and update requires considerable CPU time.

NOTE: For more information on high-speed applications, see also the section How to Increase the Processing Speed...

9.5 Dialog: Customize HTML Output

(via menu **Tools >** **Start Communication Logging ...** , then choose **HTML file for web browsers (.htm)** and click **Customize HTML output**)

This dialog allows you to change the appearance of the HTML log files, by modifying the HTML template code that Docklight uses when generating the HTML log file data.

You need some basic understanding of HTML documents and CSS style attributes. We recommend www.htmldog.com (English) or www.selfhtml.org (German) for a quick overview on these topics.

HTML Header Template
The HTML document header. Here you can change the font applied to the log file data, using the following CSS style attributes:

CSS Style Attribute	Description and Example

font-family	Defines one or several fonts (or: font categories) that the HTML browser should use to print a text. If the browser does not support the first font, it will try the second one, a.s.o. The last font usually defines a generic font category that every browser supports. Examples:
	`font-family:'Courier New', Courier, monospace`
	`font-family:'Times New Roman', Times, serif`
	`font-family:arial, helvetica, sans-serif`

font-size	Specifies the font size. Both, absolute and relative sizes are possible. Examples for absolute font sizes:
	`font-size:12pt`
	`font-size:xx-small`
	`font-size:x-small`
	`font-size:small`
	`font-size:medium`
	`font-size:large`
	`font-size:x-large`
	`font-size:xx-large`
	Examples for relative font sizes (relative to the parent HTML element)
	`font-size:smaller`
	`font-size:larger`

	`font-size:90%`

NOTE: Use the semicolon (";") as a separator between two different CSS style attributes, e.g.
`font-family:sans-serif; font-size:small`

NOTE: Docklight will insert additional <u> (underline), <i> (italic) and <b> (bold) HTML tags, if such formatting options are activated in the Display Settings. You do not have to use the **font-style** or **font-weight** attribute to create these effects.

HTML Footer Template
Adds additional footer text and closes the HTML document.

Data Element Template
For every new piece of log file information (channel 1 data, channel 2 data, or a comment text), a new <span> tag with different text color is added to the HTML log file.

The template code for the header, footer and data parts contains Docklight-specific wildcards which must not be deleted:

Wildcard	Description
%BACKCOLOR%	The background color, as selected in the Display Settings
%HEADERMSG%	Header text at the start of the log file
%FOOTERMSG%	Footer text at the end of the log file
%DATA%	a chunk of the log file data: channel 1 data, channel 2 data, or a comment text
%TEXTCOLOR%	The text color to apply for %DATA%, as selected in the Display Settings

When generating a log file, Docklight replaces the wildcards with the current display settings and the actual communication data.

9.6 Dialog: Find Sequence

Menu **Edit > Find Sequence in Communication Window...**

The **Find Sequence** function searches the contents of the communication window. The search is performed in the communication window tab that is currently selected (ASCII, HEX, Decimal or Binary). You may, however, define your search string in any other representation.

Searching the communication windows is only possible if the communication is stopped.

You can search for anything that is already defined as a Send Sequence or a Receive Sequence, or you may define a custom search sequence.

NOTE: If you are looking for a sequence within the ASCII communication window, please remember the following limitations:
- The **Find Sequence** function is not able to locate sequences containing non-printing control characters (ASCII decimal code < 32) or other special characters (decimal code > 127). This is due to the nature of the ASCII display. Search using the HEX or Decimal communication window tab instead.
- In ASCII mode, the **Find Sequence** function will treat date/time stamps and any other comments in the same way as regular communication data. In HEX / Decimal /

Binary mode, all additional information is ignored as long as it does not look like a character byte value.

9.7 Dialog: Send Sequence Parameter

Type in one or several value(s) for a Send Sequence with wildcards here. As with the Edit Send/Receive Sequence dialog, you may use control character shortcuts or clipboard functions.

Parameter No.
A Send Sequence can contain any number of wildcards. Each set of consecutive wildcards is considered a separate parameter. The value for each parameter is entered separately.

Minimum Characters Required
For each '?' wildcard exactly one character is required. Therefore, the minimum number of characters required is equal to the number of '?' wildcards within one parameter.

NOTE: While the Send Sequence Parameter dialog is shown, all serial communication is paused. Docklight does not receive any data and does not send any (periodical) Send Sequences.

9.8 Dialog: Project Settings - Communication

Menu **Tools >** **Project Settings... | Communication**

Communication Mode

Send/Receive
Docklight acts both as transmitter and receiver of serial data. This mode is used when Testing the functionality or the protocol implementation of a serial device or simulating a serial device.
Naming conventions: The received data (RX) will be displayed and processed as "Channel 1", the transmitted data (TX) will be displayed as "Channel 2".

Monitoring
Docklight receives serial data on two different communication channels. This mode is used, for example, when Monitoring the communication between two devices.
Naming conventions: The serial data from device 1 is "Channel 1", the data from device 2 is "Channel 2".

Communication Channels - Serial COM ports, Docklight TAP/VTP, network TCP/UDP, HID, Named Pipes
In Docklight Scripting, a communication channel can be configured as

- Serial COM port (RS232, RS422 or RS485),
- TAP port for Docklight Tap monitoring
- VTP port for Docklight Tap Pro or Tap 485 monitoring
- Network communication socket for TCP or UDP
- HID connections for USB or Bluetooth devices
- Named Pipes client

The following settings can be used:

Setting / Examples	Description
COM*xxx*	The channel is connected to a serial COM port.

COM1 COM256	Use the dropdown list to see all COM ports available on your PC from the *Windows* operating system.
TAP*x* TAP0 TAP1	The channel is connected to one of the Docklight Tap monitoring data directions. The TAP connections are only available if Communication Mode is set to 'Monitoring', the Docklight Tap is plugged in and the Docklight Tap USB device drivers are installed properly.
VTPx VTP0 VTP1	The channel is connected to one of the Tap Pro / Tap 485 monitoring data directions, similar to the Docklight Tap application using TAPx settings.
RemoteHost:*RemotePort* 192.168.1.100:10001 NIC.COM:80 LOCALHOST:504	The channel acts a TCP client. When starting communications, it connects to the host and TCP port specified. For *RemoteHost* you can enter • an IP4 address, e.g. 192.168.1.100 • a host name, e.g. NIC.COM (for accessing a server on the Internet) or the *Windows* NetBIOS name for another computer on your local network. • the LOCALHOST keyword which always points to the computer Docklight is running on. This is equivalent to using the loopback IP address 127.0.0.1.
SERVER:*LocalPort* SERVER:10001 SERVER:80 SERVER:504	The channel acts as a TCP server. When communication is started, Docklight accepts one connection from a TCP client. When a client is connected, further connection attempts are rejected.
PROXY:*LocalPort* PROXY:10001	Same as SERVER, but in Monitoring Mode it will control the second channel according to the connection accepted by the server. If the second channel forcefully closes a connection, the PROXY server drops the accepted connection, too.
UDP:*RemoteHost*:*Port* UDP:10.0.0.1:8001 UDP:LOCALHOST:10001	The channel acts as a UDP peer. Transmit data is sent to the destination *RemoteHost*:*Port*, and Docklight listens to UDP data on the local UDP port number *Port.* When using a channel setting like UDP:LOCALHOST:10001 you effectively create a loopback, similar to a serial port loopback, where and all outgoing data is immediately received.
UDP:*RemoteHost* :*RemotePort*: *LocalPort* UDP:10.0.0.1:8001:8002	The channel acts as a UDP peer, but using different port numbers for outgoing and incoming data. Data is transmitted to *RemotePort,* and Docklight listens on the *LocalPort*.
UDP:*LocalPort* UDP:10001	The channel acts as a UDP server. Docklight listens for UDP data on *LocalPort*. Send data is transmitted to the source IP and port number of the last UDP packet received.
PIPE:*myNamedPipe* PIPEREAD:*myNamedPipe* PIPEWRITE:*myNamedPipe*	Client connection to a Named Pipe with read/write access Client connection with read access only Write access only
USBHID:*vendorId* :*productId* USBHID:4D8:F708	USB HID input / output report Docklight opens a connection to the specified USB HID device (or a Bluetooth HID device) and allows sending and receiving HID input and output report data.

(or use USB Device Path) USBHID:\\?\hid#vid_04d8&pid_...	The Docklight communication display is report-based: Each input report generates a new Docklight time stamp and prints the original HID report data, including the input report ID as the first byte, if > 0.
USBHID:*vendorId*:*productId*:P USBHID:4D8:F708:P	USB HID access, protocol based. Only the actual payload data is displayed, without the leading Input Report ID byte and/or trailing zero bytes. Time stamps are generated according to the usual time stamp rules, not before every report.
USBHID:*vendorId*:*productId*:I USBHID:4D8:F708:I	USB HID access, but with variable output report ID as part of your Send Sequence data. In this mode, all Send Sequence definitions require an extra byte at the start of the sequence, which sets the actual Output Report ID to use.
USBHID:*vendorId*:*productId*:*[P],outputID,outputPayloadSize* USBHID:4D8:F708:,1,63 USBHID:4D8:F708:P,2	USB HID extended syntax: *outputID*: if specified, use this Output Report ID, instead of the default zero *outputPayloadSize*: if specified, override the report length and ignore the value Windows reports via HID_CAPS.OutputReportByteLength
PIPE:*myNamedPipe* PIPEREAD:*myNamedPipe* PIPEWRITE:*myNamedPipe*	Client connection to a Named Pipe with read/write access Client connection with read access only Write access only

Monitoring Mode - Channel Combinations And Their Applications
In Monitoring Mode, two communication channels are available, which can be set up individually. This allows Docklight Scripting to be used in a large number of different applications and test environments. Below is a list of typical channel combinations:

Communication Channel Settings	**Example Settings**	**Application**
Ch1: COM Port Ch2: COM Port	COM1 COM2	Monitoring Serial Communications Between Two Devices using a Docklight Monitoring Cable
Ch1: Docklight Tap Ch2: Docklight Tap	TAP0 TAP1	Monitoring Serial Communications Between Two Devices using a Docklight Tap
Ch1: Tap Pro or 485 Ch2: Tap Pro or 485	VTP0 VTP1	Monitoring Serial Communications Between Two Devices using a Docklight Tap Pro or Docklight Tap 485
Ch1: COM Port Ch2: TCP Server	COM1 SERVER:10001	Emulating a Serial Device Server. A client can connect to the Docklight server on port 10001 and talk to the serial device connected on COM1.
Ch1: TCP Client Ch2: TCP Server	10.0.0.1:502 SERVER:502	Monitoring a Client/Server TCP Connection where Docklight acts as a gateway between the two sides.
Ch1: UDP Peer Ch2: UDP Peer	UDP:10.0.0.1:8001 UDP:10.0.0.2:8002	Monitoring and forwarding a UDP transmission, similar to the TCP example above. Note that for each channel you need to specify a different UDP port, because each channel needs to listen on its own separate port number.

COM Port Settings (COM, TAP and VTP channels only)

Baud Rate
Choose a standard baud rate from the dropdown list, or use a non-standard baud rate by typing any integer number between 110 and 9999999.

NOTE: Non-standard baud rates may not work correctly on all COM ports, dependent on the capabilities of your COM port's hardware UART chip. You will receive no warning, if any non-standard rate cannot be applied.

NOTE: Although Docklight's Project Settings allow you to specify baud rates up to 9 MBaud, this does not mean Docklight is able to handle this level of throughput continuously. The average data throughput depends very much on your PC's performance and the Docklight display settings. See also How to Increase the Processing Speed.

NOTE: There are many COM ports drivers and applications that do not use actual RS232/422 or 485 transmission, and do not require any of the RS232 communication parameters. In some cases such COM port drivers even return an error when trying to set the RS232 parameters, so Docklight would fail to open the COM channel. Use the Baud Rate setting **None** for these applications.

Data Bits and Stop Bits
Specify the number of data bits and stop bits here. As with the baud rate, some of the available settings may not be supported by the COM port device(s) on your PC.

Tap 485 Sign. Level.
The Docklight Tap Pro / Tap 485 support additional voltage levels, besides the standard RS232 voltages:

- **RS485/422** - the differential voltage levels for RS485 and RS422 bus applications.
- **Inverted** - Inverted RS232/TTL mode, where the mark state (or logical 1) is the positive voltage, and the space state (logical 0) is the negative voltage or zero volts.

Parity
All common parity check options are available here. (The settings 'Mark' and 'Space' will probably not be used in practical applications. 'Mark' specifies that the parity bit always is 1, 'Space' that the parity bit is always 0, regardless of the character transmitted.)

Parity Error Character
This is the character that replaces an invalid character in the data stream whenever a parity error occurs. You should specify an ASCII character (printing or non-printing) that does not usually appear within your serial data stream. Characters may be defined by entering the character itself or entering its decimal ASCII code (please enter at least two digits).

NOTE: Choose "(ignore)" for the Parity Error Character if you need to transmit/receive the parity bit but Docklight should preserve all incoming characters, even when the parity bit is wrong. This is useful for applications where a 9th bit is used for addressing purposes and not for error checking.

Using Baud Rate Scan - VTP channels only

Docklight Tap Pro / Tap 485 devices offer a baud rate scan / autodetect mode. To activate baud rate scan, choose **None** from the **Baud Rate** setting and close the Project Settings dialog. Now start the communication using menu **Run > Start communication (F5)**. The Docklight Tap Pro / Tap 485 now scans the communication independently in both directions. If serial data could be detected in either data direction, the most probable settings are displayed as comments in the Communication Window. They are also are noted in the communications status bar under the main toolbar.

NOTE: The accuracy of this autodetection feature depends on the actual data stream present during the scan. A continuous stream of highly random data leads to high detection accuracy, while small transfers of individual bytes or repeating patterns may lead to wrong baud rates, data bit or parity guesses.

9.9 Dialog: Project Settings - Flow Control

Menu **Tools > Project Settings... | Flow Control**

Used to specify additional hardware or software flow control settings for serial communications in Docklight Send/Receive Mode.

Flow Control Support

Off
No hardware or software flow control mechanism is used. RTS and DTR are enabled when the COM port is opened.

Manual
Use this mode to control the RTS and DTR signals manually and display the current state of the CTS, DSR, DCD and RI lines. If flow control is set to "Manual", an additional status element is displayed in the Docklight main window. You may toggle the RTS and DTR lines by double clicking on the corresponding indicator.

NOTE: Flow control signals are not treated as communication data and will not be displayed in the communication window or logged to a file.

Hardware Handshaking, Software Handshaking
Support for RTS/CTS hardware flow control and XON/XOFF software flow control. These are expert settings rarely required for recent communication applications.

RS485 Transceiver Control
Some RS232-to-RS485 converters require manual RTS control, i.e. the RS232 device (PC) tells the converter when it should enable its RS485 driver for transmission. If you choose "RS485 Transceiver Control", the COM port sets RTS to High before transmitting the first character of a Send Sequence, and resets it to Low after the last character has been transmitted.

NOTE: Many USB-to-Serial converters or virtual COM port drivers do not implement the *Windows* RTS_CONTROL_TOGGLE mode properly. If you experience problems with RS485 Transceiver Control, try using a PC with an on-board COM interface or a standard PCI COM card.

9.10 Dialog: Project Settings - Communication Filter

Menu **Tools > Project Settings... | Communication Filter**

Contents Filter
Use this option if you do not need to see the original communication data on the serial line and only require the additional comments inserted by a Receive Sequence. This is useful for applications with high data throughput, where most of the data is irrelevant for testing and you only need to watch for very specific events. These events (and related display output) can be defined using Receive Sequences.

Channel Alias
This allows you to re-label the two Docklight data directions according to your specific use case. E.g. [Docklight] / [Device] instead of [TX] / [RX]. Or [Master] / [Slave] instead of [TAP0] / [TAP1].

9.11 Dialog: Options

Menu **Tools > Options...**

Display

Formatted Text Output (Rich Text Format)
used for setting the appearance of the Docklight communication window. The two different serial data streams, "Channel 1" and "Channel 2", may be displayed using different colors and styles. The standard setting uses different colors for the two channels, but using different font styles (e.g. Italics for "Channel 2") is also possible. You may also choose the overall font size here.

NOTE: If you change the font size, the communication window contents will be deleted. For all other changes, Docklight will try to preserve the display contents.

Plain Text Output (faster display, but no colors & fonts)
The formatted text output is similar to a word processor and consumes a considerable amount of CPU time. It also requires frequent memory allocation and deallocation which might decrease your PC performance. So if you are monitoring a high-speed communication link, but still want to keep an eye on the serial data transferred, try using the "Plain Text Output" format.

Control Characters (ASCII 0 - 31)
For communication data containing both printing ASCII text as well as non-printing control characters, it is sometimes helpful to see the names of the occurring control characters in the ASCII mode display window. Docklight provides an optional display settings to allow this. You can also suppress the control characters (except CR and LF) for cases when this would clutter your display.

Display Modes

Communication Window Modes
By default, Docklight will display four representations of the serial data streams: ASCII, HEX, Decimal and Binary. You may deactivate some of these modes to increase Docklight's overall performance. For example, the Binary representation of the data is rarely required. Disabling Binary mode for the communication window will considerably increase processing speed. Even when turned off for the communication window, logging in all formats is still possible.

See also the **Plain Text Output** option above.

Date/Time Stamps

Adding a Date/Time Stamp
Docklight adds a date/time stamp to all data that is transmitted or received. You may choose to insert this date/time stamp into the communication window and the log file whenever the data flow direction changes between Channel 1 and Channel 2.

For applications where the data flow direction does not change very often, you may want to have additional date/time stamps at regular time intervals. For this, activate the **Clock - additional date/time stamp...** option then and choose a time interval.

On a half duplex line (e.g. 2 wire RS485), changes in data direction are difficult to detect. Still, in most applications there will be a pause on the communication bus before a new device starts sending. Use the **Pause detection...** option to introduce additional time stamps and make the pauses visible in your communication log.

Date/Time Format
Docklight offers time stamps with a resolution of up to 1/1000 seconds (1 millisecond). For compatibility to earlier Docklight versions (V1.8 and smaller), 1/100 seconds is available, too.

NOTE: The resulting time tagging accuracy can be considerably different, e.g. 10-20 milliseconds only. The actual accuracy depends on your serial communications equipment, your PC configuration, the Docklight Display Settings (see above) and the Docklight Expert Options. See the section How to Obtain Best Timing Accuracy for details.

Control Characters Shortcuts

Here you can define your own keyboard shortcuts for ASCII Control Characters (ASCII code < 32), or for any character code > 126. Keyboard shortcuts can be used within the following Docklight dialogs and functions

- Dialog: Edit Send Sequence
- Dialog: Edit Receive Sequence
- Dialog: Find Sequence
- Dialog: Send Sequence Parameter
- Keyboard Console

For each character from decimal code 0 to 31 and from 127 to 255, you can define a keyboard combination to insert this character into a sequence (**Shortcut**). You may also define a letter which is used to display this control character when editing a sequence in ASCII mode (**Editor**).

Double click to change the value of a **Shortcut** or **Editor** field.

Predefined shortcuts are:
Ctrl+Enter for carriage return / <CR> / decimal code 13
Ctrl+Shift+Enter for line feed / <LF> / decimal code 10

9.12 Dialog: Expert Options

Menu **Tools > Expert Options...**

Expert Options are additional settings for specialized applications with additional requirements (e.g. high time tagging accuracy).

Performance

Communication Driver Mode

Use **External / High Priority Process** mode to work around a common problem for any Windows user mode application: unspecified delays and timing inaccuracies can be introduced by the Windows task/process scheduling, especially if you are running other applications besides Docklight.

External / High Priority Process mode is recommended for high accuracy / low latency monitoring using the Docklight Tap.

NOTE: For even higher and guaranteed time tagging accuracy, use the Docklight Tap Pro / Tap 485 accessories. Their accuracy does not depend on Windows and driver latencies, and High Priority Process mode is not required for Tap Pro and Tap 485 applications.

In **External / High Priority Process** mode, the data collection in Docklight becomes a separate Windows process with "Realtime" priority class. It will be executed with higher priority than any other user application or additional application software such as Internet Security / Antivirus. For best results Docklight needs to be **Run as administrator**. Otherwise the data collection process will run with the maximum priority permitted by the OS, but not "Realtime class".

External / High Priority Process mode must be used with care, especially when you intend to monitor a high-speed data connection with large amounts of data. The PC might become unresponsive to user input. To resolve such a situation, simply "pull the plug": First disconnect the data connections or the monitoring cable to bring down the CPU load and restore the responsiveness. Then choose **Stop communication** in Docklight.

NOTE: See the section How to Obtain Best Timing Accuracy for some background information on timing accuracy.

Docklight Monitoring Mode

When Monitoring Serial Communications Between Two Devices, all received data from one COM port is re-sent on the TX channel of the opposite COM port by default ("Data Forwarding"). This is intended for special applications that require routing the serial data traffic through Docklight using standard RS232 cabling.

Use the **No Data Forwarding** Expert Option for applications with two serial COM ports where you need to avoid that any TX data is sent. This can be used to improve performance when using a Docklight Monitoring Cable, or to work around problems caused with unstable serial device drivers.

For Docklight Tap applications (e.g. using Communication Channel TAP0 / TAP1), the 'Data Forwarding' setting has no effect. The Docklight Tap is accessed in read-only mode always, and no data is forwarded.

Devices

Windows COM Devices

Use **Disable I/O error detection** when receiving repeated error messages like this:

```
DOCKLIGHT reports: General I/O error on COM1
```

NOTE: Docklight uses Windows Serial Communications in "overlapped I/O" mode for best efficiency and timing accuracy, and it continuously evaluates errors from the related Win32 API calls. In rare situations like COM devices using faulty or outdated COM device drivers, such errors can appear even in standard read/write operation. In this case, you can use this option to revert to the behavior of Docklight V2.2 and earlier versions: simply ignoring such errors.

Tap Pro / Tap 485

The firmware update functions for our Docklight Tap Pro / Docklight Tap 485 hardware accessories are only required in rare situations. E.g. if you are using an older device (< year 2017) which does not support the baud rate scan feature yet.

9.13 Keyboard Console

The Keyboard Console tool allows you to send keyboard input directly to the serial port. It can be activated using the menu **Tools >** **Keyboard Console On**. The keyboard console is only available for communication mode Send/Receive.

After activating the keyboard console, click in the communication window and type some characters.

Docklight will transmit the characters directly through the selected serial port. The communication window will display the characters the same way it does a Send Sequence.

NOTE: The Keyboard Console tool supports pasting and transmitting a character sequence from the clipboard, using **Ctrl + V**. This is similar to pasting clipboard data inside the Edit Send Sequence Dialog. Clipboard contents that exceeds the maximum sequence size of 1024 characters gets truncated.

NOTE: The keyboard console is not a full-featured terminal and does not support specific terminal standards, such as VT 100. The **Enter** key is transmitted as **<CR>** (ASCII 13) plus **<LF>** (ASCII 10). The **ESC** key sends **<ESC>** (ASCII 27). Use control character shortcuts to send other ASCII control characters.

NOTE: The keyboard console does not support inserting ASCII characters by pressing/holding ALT and using the numeric keypad. Please use the Edit Send Sequences dialog in HEX or Decimal representation to create any ASCII character code > 127.

9.14 Checksum Specification

Checksum specifications are used in Edit Send Sequence and Edit Receive Sequence dialogs and in the Docklight Scripting method CalcChecksum. See Calculating and Validating Checksums for a general overview.

Supported Checksum Specifications / *checksumSpec* Argument

checksumSpec	Checksum algorithm applied
MOD256	Simple 8 bit checksum: Sum on all bytes, modulo 256.
XOR	8 bit checksum: XOR on all bytes.
CRC-7	7 bit width CRC. Used for example in MMC/SD card applications. An alternative *checksumSpec* text for the same checksum type would be: CRC:7,09,00,00,No,No See the "CRC:*width*, *polynomial...*" syntax described in the last row.
CRC-8	8 bit width CRC, e.g. for ATM Head Error Correction. Same as: CRC:8,07,00,00,No,No
CRC-DOW	8 bit width CRC known as DOW CRC or CCITT-8 CRC. Can be found in Dallas iButton(TM) applications. Same as: CRC:8,31,00,00,Yes,Yes
MOD65536	Simple 16 bit checksum: Sum on all bytes, modulo 65536.

CRC-CCITT	16 bit width CRC as designated by CCITT. Same as: CRC:16,1021,FFFF,0000,No,No
CRC-XMODEM	16 bit width CRC similar to CRC-CCITT, but the initial value is zero. Same as: CRC:16,1021,0000,0000,No,No
CRC-16	16 bit width CRC as used in IBM Bisynch, ARC. Same as: CRC:16,8005,0000,0000,Yes,Yes
CRC-MODBUS	16 bit width CRC as used in Modbus. Similar to CRC-16, but with a different init value. Same as: CRC:16,8005,FFFF,0000,Yes,Yes
CRC-32	32 bit CRC as used in PKZip, AUTODIN II, Ethernet, FDDI. Same as: CRC:32,04C11DB7,FFFFFFFF,FFFFFFFF,Yes,Yes
-MOD256 *or* LRC	Similar to MOD256, but returns the negative 8 bit result, so the sum of all bytes including the checksum is zero. This is equivalent to what is known as LRC (Longitudinal redundancy check) used e.g. in POS applications.
LRC-ASCII	Like -MOD256 / LRC, but it expects the source data to be HEX numbers as readable ASCII text. See the MODBUS ASCII example below.
CRC:*width*, *polynomial*, *init*, *finalXOR*, *reflectedInput*, *reflectedOutput*	Generic CRC calculator, where all CRC parameters can be set individually: *width* : The CRC width from 1..32. *polynomial* : HEX value. The truncated CRC polynomial. *init* : HEX value. The initial remainder to start off the calculation. *finalXor* : HEX value. Apply an XOR operation on the resulting remainder before returning it to the user. *reflectedInput* : Yes = Reflect the data bytes (MSB becomes LSB), before feeding them into the algorithm. *reflectedOutput* : Yes = Reflect the result after completing the algorithm. This takes places before the final XOR operation.

Remarks

Each of the predefined CRC algorithms (CRC-8, CRC-CCITT, ...) can be replaced by a specification string for the generic CRC computation (CRC:8,07,00...) as described above. We have carefully tested and cross-checked our implementations against common literature and resources as listed in the CRC Glossary.

Unfortunately there are a lot of CRC variations and algorithms around, and choosing (not to mention: understanding) the right CRC flavor can be a rather difficult job. A good way to make sure your CRC calculation makes sense is to run it over an ASCII test string of "123456789". This is the most commonly used testing string, and many specifications will refer to this string and provide you the correct checksum the CRC should return when applied on this string.

Checksums in Edit Send Sequence / Edit Receive Sequence

In the **Checksum** tab, choose one of the predefined definition strings from the drop-down list, or type in your own definition in the following format:

[(*startPos*, *len*)] ***checksumSpec*** [A *or* L] [@ *targetPos*] [# *optional user comment*]

with anything inside [ ] being an optional part.

Part	**Description**

checksumSpec	Required. String that specifies the checksum algorithm and its parameters, according to the checksumSpec Format table above.
(*startPos*, *len*) e.g. (1, 4)	Optional. Start and length of the character area that is used to calculate the checksum. By default everything before the checksum result is used.
A	Optional. If used, the resulting checksum value is converted into a HEX number as readable ASCII text. See the MODBUS ASCII example below.
L	Optional. Little Endian - the resulting checksum value is stored with the least significant byte (LSB) first. Default is Big Endian / MSB first.
@ *targetPos* e.g. @ -4	Optional. Specifies the first character position for storing the resulting checksum value. By default Docklight writes the checksum result to the last sequence data positions, unless you have specified "A" for ASCII result. In this case, the results is stored one character before the end, so there is still space for a "end of line" character, typically a CR as in Modbus ASCII.
# *comment*	You can type in a comment about this checksum specification

Remarks

startPos, *len* and *targetPos* support negative values, too, as a way to specify positions relative to the end of the sequence and not relative to the start of the sequence.
Examples:
startPos is -4 : start calculating at the 4th character from the end.
len is -1 : use everything until the end of the sequence.
targetPos is -1 : first (and only) byte of the result is stored at the last sequence character position.
targetPos is -2 : result is stored starting at the 2nd character from the end.
targetPos is -3 : result is stored starting at the 3rd character from the end.

Examples

Checksum Specification	Send Sequence Example	Actual TX Data	Remarks
`# (off, no checksum)`	01 | 02 | 03 | 04 | 05 | 00	`01 02 03 04 05 00`	after a **#** you can type in any comment to describe your checksum
`MOD256 # simple one byte sum on all but the last character`	01 | 02 | 03 | 04 | 05 | **00**	`01 02 03 04 05 0F`	As a checksum placeholder, an extra **00** was added, but you can use any value from **00-FF**.
`CRC-MODBUS L # Modbus RTU checksum. Lower Byte first ('Little Endian')`	01 | 06 | 01 | 02 | 00 | 07 | **FF** | **FF**	`01 06 01 02 00 07 68 34`	**CRC-MODBUS** is a 16 bit checksum which is placed at the last two character positions in the sequence data by default.
`(2, -5) LRC-ASCII A @ -4 # MODBUS ASCII checksum is LRC over readable HEX data, excluding start`	: | 1 | 1 | 0 | 3 | 0 | 0 | 6 | b | 0 | 0 | 0 | 3 | **X** | **X** | r | n	`:1103006b00037E<CR><LF>`	**LRC-ASCII** treats the sequence data as a readable HEX string, where each data byte is represented by two characters. Using the **A** option produces a readable 2-

':' and end 'CR/LF'			letter checksum text, instead of a one character result. The **@ -4** places the result at the 4th character position from the right (leaving the trailing CR / LF intact).
CRC:8,07,00,00,No,Yes # CRC with custom, non-standard spec	01 | 02 | 03 | 04 | 05 | **00**	01 02 03 04 05 **3D**	Rare or custom CRCs flavors can be calculated by Docklight, but you need to know the required CRC calculation parameters. For more details see the resources listed in the CRC Glossary.

Reference (Scripting)

10 Reference (Scripting)

10.1 VBScript Basics

If you already know *Visual Basic*® or *Visual Basic*® for Applications (VBA), VBScript will be very familiar. Have a look at the definitions and examples listed below. For getting started, try some of the following examples by copying & pasting the code into the script editor window and running the script. Docklight Scripting also comes with a number of sample scripts for you to try out.

This chapter introduces some basic VBScript functions and features. For a complete reference, please see the original documentation from *Microsoft*® at the following locations:
- Visual Basic Scripting Edition (or go to www.microsoft.com and search for "VBScript")
- VBScript User's Guide
- VBScript Language Reference.

TIP: Use the ScriptEngine function to find out which version of VBScript is installed on your computer.

NOTE: Docklight Scripting executes the VBScript code in "safe mode" (safe subset) and disallows potentially harmful actions. For example, creating a "FileSystemObject" (file I/O) is one of the actions disallowed in the VBScript safe subset. The Docklight script will abort with an error message. Please contact our e-mail support if you have special requirements and need to use "unsafe" VBScript statements. By popular request, file I/O is now easily possible using Docklight's FileInput / FileOutput objects.

Docklight-Specific Features

- Docklight Script Commands - The DL Object
- Docklight OnSend / OnReceive event procedures
- Docklight FileInput / FileOutput Object for Reading and Writing Files

VBScript Basic Features by Categories

- Control Structures (Decision Structures, Loop Structures)
- Variables, Arrays, Constants and Data Types
- Operators
- Date/Time Functions
- Miscellaneous

VBScript Basic Features in Alphabetical Order

- Date Function
- Day Function
- Do Until ...Loop
- Do...Loop While
- For...Next
- Hour Function
- If...Then
- If...Then...Else
- InputBox Function

- LBound Function
- Minute Function
- Month Function
- Now Function
- ScriptEngine Function
- Second Function
- Select Case
- Time Function
- Timer Function
- UBound Function
- While...Wend
- Year Function

10.1.1 Copyright Notice

10.1.2 Control Structures

VBScript control structures allow you to control the flow of your script's execution. To learn more about specific control structures, see the following topics:

- Decision Structures   An introduction to decision structures used for branching.
- Loop Structures   An introduction to loop structures used to repeat processes.

10.1.2.1 Decision Structures

- **If...Then**

  Use an If...Then structure to execute one or more statements conditionally. You can use either a single-line syntax or a multiple-line *block* syntax:

  If *condition* **Then** *statement*

  If *condition* **Then**
  statements
  End If

  The condition is usually a comparison. If condition is True, VBScript executes all the statements following the Then keyword. You can use either single-line or multiple-line syntax to execute just one statement conditionally (these two examples are equivalent):

```
If anyDate < Now Then anyDate = Now

If anyDate < Now Then
   anyDate = Now
End If
```

Notice that the single-line form of If...Then does not use an End If statement. If you want to execute more than one line of code when condition is True, you must use the multiple-line block If...Then...End If syntax.

- **If...Then...Else**

Use an If...Then...Else block to define several blocks of statements, one of which will execute:

```
If condition1 Then
[statementblock-1]
[ElseIf condition2 Then
[statementblock-2]] ...
[Else
[statementblock-n]]
End If
```

- **Select Case**

VBScript provides the Select Case structure as an alternative to If...Then...Else for selectively executing one block of statements from among multiple blocks of statements. A Select Case statement provides capability similar to the If...Then...Else statement, but it makes code more readable when there are several choices.

```
' Example
Select Case Weekday(now)
   Case 2
      DL.AddComment "Monday"
   Case 3
      DL.AddComment "Tuesday"
      Case 4
      DL.AddComment "Wednesday"
   Case 5
      DL.AddComment "Thursday"
   Case 6
      DL.AddComment "Friday"
   Case Else
      DL.AddComment "Weekend!"
End Select
```

10.1.2.2 Loop Structures

- **Do Until ...Loop**

```
'Example
Do Until DefResp = vbNo
   MyNum = Int (6 * Rnd + 1)    ' Generate a random integer
  between 1 and 6.
   DefResp = MsgBox (MyNum & " Do you want another number?",
  vbYesNo)
Loop
```

- **Do...Loop While**

```
'Example
```

```
Do
   MyNum = Int (6 * Rnd + 1)    ' Generate a random integer
  between 1 and 6.
   DefResp = MsgBox (MyNum & " Do you want another number?",
  vbYesNo)
Loop While DefResp = vbYes
```

- **While...Wend**

```
'Example
Dim Counter
Counter = 0   ' Initialize variable.
While Counter < 20   ' Test value of Counter.
   Counter = Counter + 1   ' Increment Counter.
   DL.AddComment Counter
Wend   ' End While loop when Counter > 19
```

- **For...Next**

```
'Example
For I = 1 To 5
      For J = 1 To 4
            For K = 1 To 3
               DL.AddComment I & " " & J & " " & K
            Next
      Next
Next
```

10.1.3 Variables, Arrays, Constants and Data Types

You often need to store values temporarily when performing calculations with VBScript. For example, you might want to calculate several values, compare them, and perform different operations on them, depending on the result of the comparison.

- **Variables**

  Variable names follow the standard rules for naming anything in VBScript. A variable name:
  - Must begin with an alphabetic character.
  - Cannot contain an embedded period.
  - Must not exceed 255 characters.
  - Must be unique in the scope in which it is declared.

```
' Examples
ApplesSold = 10 ' The value 10 is passed to the variable.
ApplesSold = ApplesSold + 1 ' The variable is incremented.
```

- **Arrays**
  Arrays allow you to refer to a series of variables by the same name and to use a number (an index) to tell them apart. This helps you create smaller and simpler code in many situations, because you can set up loops that deal efficiently with any number of cases by using the index number.

```
' Example
Dim A(10)
```

```
A(0) = 256
A(1) = 324
A(2) = 100
' ...
A(10) = 55
```

LBound Function
Returns the smallest available subscript for the indicated dimension of an array.

Syntax

LBound (*arrayname* **[,***dimension* **])**

Part	Description
arrayname	Name of the array variable; follows standard variable naming conventions.
dimension	Optional. Whole number indicating which dimension's lower bound is returned. Use 1 for the first dimension, 2 for the second, and so on. If *dimension* is omitted, 1 is assumed.

UBound Function
Returns the largest available subscript for the indicated dimension of an array.

Syntax

UBound (*arrayname* **[,***dimension* **])**

Part	Description
arrayname	Name of the array variable; follows standard variable naming conventions.
dimension	Optional. Whole number indicating which dimension's lower bound is returned. Use 1 for the first dimension, 2 for the second, and so on. If *dimension* is omitted, 1 is assumed.

```
' Example
Dim A(100,3,4)
UBound(A,1) ' returns 100
UBound(A,2) ' returns 3
UBound(A,3) ' returns 4
```

- **Constants**

A Const statement can represent a mathematical or date/time quantity:

```
' Example
Const conPi = 3.14159265358979
```

- **Data Types**

VBScript has only one data type called a Variant. A Variant is a special kind of data type that can contain different kinds of information, depending on how it is used. Because Variant is the only data type in VBScript, it is also the data type returned by all functions in VBScript.

Variant Subtypes
Beyond the simple numeric or string classifications, a Variant can make further distinctions about the specific nature of numeric information. For example, you can have numeric information that represents a date or a time. When used with other date or time data, the result is always expressed as a date or a time. You can also have a rich variety of numeric information ranging in size from Boolean values to huge floating-point numbers. These different categories of information that can be contained in a Variant are called subtypes. Most of the time, you can just put the kind of data you want in a Variant, and the Variant behaves in a way that is most appropriate for the data it contains.

The following table shows subtypes of data that a Variant can contain.

Subtype	Description
Empty	Variant is uninitialized. Value is 0 for numeric variables or a zero-length string ("") for string variables.
Null	Variant intentionally contains no valid data.
Boolean	Contains either True or False.
Byte	Contains integer in the range 0 to 255.
Integer	Contains integer in the range -32,768 to 32,767.
Currency	-922,337,203,685,477.5808 to 922,337,203,685,477.5807.
Long	Contains integer in the range -2,147,483,648 to 2,147,483,647.
Single	Contains a single-precision, floating-point number in the range -3.402823E38 to -1.401298E-45 for negative values; 1.401298E-45 to 3.402823E38 for positive values.
Double	Contains a double-precision, floating-point number in the range -1.79769313486232E308 to -4.94065645841247E-324 for negative values; 4.94065645841247E-324 to 1.79769313486232E308 for positive values.
Date (Time)	Contains a number that represents a date between January 1, 100 to December 31, 9999.
String	Contains a variable-length string that can be up to approximately 2 billion characters in length.
Object	Contains an object.
Error	Contains an error number.

10.1.4 Operators

- **Arithmetic**

Description	**Symbol**
Exponentiation	^
Unary negation	-
Multiplication	*
Division	/
Integer division	\

Modulus arithmetic	Mod
Addition	+
Subtraction	-
String concatenation	&

- **Comparison**

Description	Symbol
Equality	=
Inequality	<>
Less than	<
Greater than	>
Less than or equal to	<=
Greater than or equal to	>=
Object equivalence	Is

- **Logical**

Description	Symbol
Logical negation	Not
Logical conjunction	And
Logical disjunction	Or
Logical exclusive	Xor
Logical equivalence	Eqv
Logical implication	Imp

10.1.5 Date/Time Functions

- **Date Function**

```
'Example Date Function
DL.ClearCommWindows
DL.AddComment Date     ' prints the current system date.
```

- **Time Function**

```
'Example Time Function
DL.ClearCommWindows
DL.AddComment Time    ' prints the current system time.
```

- **Timer Function**

```
'Example Timer Function
'The Timer function returns the number of seconds that have
  elapsed
'since 12:00 AM (midnight).
StartTime = Timer
For i = 1 To 1000
Next
DL.AddComment "Duration [milliseconds] = " & (Timer -
  StartTime) * 1000
```

- **Now Function**

```
'Example Now Function
Dim MyVar
MyVar = Now ' MyVar contains the current date and time.
```

- **Day Function**

```
'Example Day Function
DL.AddComment Day(Now)
```

- **Month Function**

```
'Example Month Function
DL.AddComment Month(Now)
```

- **Year Function**

```
'Example Year Function
Dim MyDate
MyDate = #December 7, 1968#    ' Assign a date.
DL.AddComment Year(MyDate)
```

- **Hour Function**

```
'Example Hour Function
DL.AddComment Hour(Now)
```

- **Minute Function**

```
'Example Minute Function
DL.AddComment Minute(Now)
```

- **Second Function**

```
'Example Second Function
DL.AddComment Second(Now)
```

10.1.6 Miscellaneous

- **InputBox Function**

Displays a prompt in a dialog box, waits for the user to input text or click a button, and returns the contents of the text box.

TIP: Use the Docklight-specific DL.InputBox2 method for a dialog box that always appears on the same screen as the Docklight Scripting main window. Or see the DL.GetKeyState function on how to wait and react to keyboard or mouse input.

Syntax

result **= InputBox (***prompt***[,** *title***][,** *default***][,** *xpos***][,** *ypos***][,** *helpfile***,** *context***])**

Part	Description
prompt	Required. String expression displayed as the message in the dialog box. The maximum length of prompt is approximately 1024 characters, depending on the width of the characters used. If prompt consists of more than one line, you can separate the lines using a carriage return character (**Chr(**13**)**), a linefeed character (**Chr(**10**)**), or carriage return plus linefeed character combination (**Chr(**13**) & Chr(**10**)**) between each line.
title	Optional. String expression displayed in the title bar of the dialog box. If you omit title, the application name is placed in the title bar.
default	Optional. String expression displayed in the text box as the default response if no other input is provided. If you omit default, the text box is displayed empty.
xpos	Optional. Numeric expression that specifies, in twips, the horizontal distance of the left edge of the dialog box from the left edge of the screen. If xpos is omitted, the dialog box is horizontally centered.
ypos	Optional. Numeric expression that specifies, in twips, the vertical distance of the upper edge of the dialog box from the top of the screen. If ypos is omitted, the dialog box is vertically positioned approximately one-third of the way down the screen.
helpfile	Optional. String expression that identifies the Help file to use to provide context-sensitive Help for the dialog box. If *helpfile* is provided, *context* must also be provided.
context	Optional. Numeric expression that identifies the Help context number assigned by the Help author to the appropriate Help topic. If context is provided, helpfile must also be provided.

```
'Example InputBox Function
Dim MyInput
MyInput = InputBox("Please enter text", "My Title", "Example
  Text")
DL.AddComment MyInput     ' Add the current input as comment
```

- **MsgBox Function**

Displays a message box, waits for the user to click a button, and returns a value that indicates which button the user clicked.

TIP: Use the Docklight-specific DL.MsgBox2 method for a message box that always appears on the same screen as the Docklight Scripting main window. Or see the DL.SetUserOutput function on how to create an additional user output area and display extra user information.

Syntax

result **= MsgBox (***prompt***[,** *buttons***][,** *title***][,** *xpos***][,** *ypos***][,** *helpfile***,** *context***])**

Part	Description
prompt	Required. Same as InputBox Function above.
buttons	Optional, common values are a combination (sum) of the below constants: Constant / Value / Description vbOKOnly / 0 / OK button only (default) vbOKCancel / 1 / OK and Cancel buttons vbAbortRetryIgnore / 2 / Abort, Retry, and Ignore buttons vbYesNoCancel / 3 / Yes, No, and Cancel buttons vbYesNo / 4 / Yes and No buttons vbRetryCancel / 5 / Retry and Cancel buttons vbCritical / 16 / Critical message vbQuestion / 32 / Warning query vbExclamation / 48 / Warning message vbInformation / 64 / Information message vbDefaultButton1 / 0 / First button is default (default) vbDefaultButton2 / 256 / Second button is default vbDefaultButton3 / 512 / Third button is default TIP: For a full list of all constants available, see the Microsoft VBA documentation for MsgBox.
title	Optional. Same as InputBox Function above.
xpos, ypos, helpfile, context	Optional. Same as InputBox Function above.
result	Returns the user action: Constant / Value / Description vbOK / 1 / OK button pressed vbCancel / 2 / Cancel button pressed vbAbort / 3 / Abort button pressed vbRetry / 4 / Retry button pressed vbIgnore / 5 / Ignore button pressed vbYes / 6 / Yes button pressed vbNo / 7 / No button pressed

```
'Example MsgBox Function
result = MsgBox("Run this test?", 3, "My Title")
If result = 6 Then
    DL.AddComment "Yes button pressed"
ElseIf result = 7 Then
    DL.AddComment "No button pressed"
Else
    DL.AddComment "Canceled"
End If
```

- **ScriptEngine Function**

Returns a string representing the scripting language in use.

Use the following script example to get the complete description of script language and version number.

```
'Example using the ScriptEngine Function
DL.AddComment GetScriptEngineInfo

Function GetScriptEngineInfo
    Dim s
    s = "" ' Build string with necessary info.
    s = ScriptEngine & " Version "
    s = s & ScriptEngineMajorVersion & "."
    s = s & ScriptEngineMinorVersion & "."
    s = s & ScriptEngineBuildVersion
    GetScriptEngineInfo = s ' Return the results.
End Function
```

10.2 Docklight Script Commands - The DL Object

The global **DL** object is used to access Docklight-specific functions from a VBScript program.

DL Methods

DL.AddComment
DL.ClearCommWindows
DL.GetReceiveCounter
DL.GetDocklightTimeStamp
DL.OpenProject
DL.Pause
DL.Quit
DL.ResetReceiveCounter
DL.SendSequence
DL.StartCommunication
DL.StopCommunication
DL.StartLogging
DL.StopLogging
DL.WaitForSequence

DL Methods (Advanced)

DL.CalcChecksum
DL.ConvertSequenceData
DL.GetChannelSettings
DL.GetChannelStatus
DL.GetCommWindowData
DL.GetEnvironment
DL.GetHandshakeSignals
DL.GetKeyState
DL.GetReceiveComments
DL.InputBox2
DL.LoadProgramOptions
DL.PlaybackLogFile
DL.SaveProgramOptions
DL.SetChannelSettings
DL.SetContentsFilter
DL.SetHandshakeSignals
DL.SetUserOutput
DL.SetWindowOutput

DL.ShellRun
DL.UploadFile

DL Properties
DL.NoOfSendSequences
DL.NoOfReceiveSequences

Additional Docklight Scripting Features
OnSend / OnReceive Event Procedures
FileInput / FileOutput Objects for Reading and Writing Files
Side Channels - Using Multiple Data Connections

10.2.1 Methods

10.2.1.1 AddComment

Adds a user-defined text to the communication data window and log file.

Return Value

Void

Syntax

DL.AddComment [*comment***] [,** *timeStampAfterComment***] [,** *lineBreakAndPadding***]**

The **AddComment** method syntax has these parts:

Part	Description
comment	Optional. String containing the comment to add to the communication window(s) or log file(s). If *comment* is left out, **AddComment** will produce a line break only.
timeStampAfterComment	Optional Boolean value. False (Default) = No additional time stamp. True = Add a time stamp after the comment. The time stamp is added when processing the next serial data character, not immediately after printing the comment. This is similar to how the "Additional time stamp..." option in the Receive Sequence dialog works.
lineBreakAndPadding	Optional Boolean value. True (Default) = Additional space characters are added before and after the text, to separate it from the communication data. A line break is added after the comment. False = No additional spaces or line break. This is especially useful in combination with the Communication Filter option, when you want to create the actual screen output entirely with the **AddComment** method.

Remarks

AddComment supports the Receive Sequence comment macros **%_S** (bell, "beep signal") , **%_L** (line break) and **%_T** (Timestamp) for convenience. See comment macros for details.

You cannot use ASCII control characters like decimal code 08 (Backspace) to emulate terminal functions / display formatting. The only exception is decimal code 07 (Bell), which can be use to produce a 'beep signal', depending on your *Windows* sound scheme.

Example

```
' Example AddComment

DL.ClearCommWindows
DL.AddComment "Hello World!"
' Additional line break
DL.AddComment
' Use the '&' operator to concatenate strings and other
variables
r1 = 10
r2 = 20
DL.AddComment "Result 1 = " & r1 & "    Result 2 = " & r2
' The VBScript constant vbCrLf can be used for an
' additional line break, too
DL.AddComment
DL.AddComment "Result 1 = " & r1 & vbCrLf
DL.AddComment "Result 2 = " & r2

' Disabling the line break and padding characters gives you
' better control over the actual output
DL.AddComment vbCrLf + "Here's some bit of info", False, False
DL.AddComment "rmation. " + vbCrLf, False, False

' A "beep" signal for user notification
DL.AddComment Chr(7)
```

10.2.1.2 ClearCommWindows

Deletes the contents of the communications window. This applies to all four representations (ASCII, HEX, Decimal, Binary) of the communication window.

Return Value

Void

Syntax

DL.ClearCommWindows

Example

```
' Example ClearCommWindows

' fresh start
DL.ClearCommWindows
DL.AddComment "Test run started!"
```

10.2.1.3 GetReceiveCounter

Returns the current hit counter value for the specified Receive Sequence. The counter is incremented each time the Receive Sequence is detected within the incoming data stream. It can be reset using the ResetReceiveCounter command. The OpenProject and StartCommunication commands also reset the hit counter to zero.

Return Value

Long

Syntax

result **= DL.GetReceiveCounter(** *nameOrIndex* **)**

The **GetReceiveCounter** method syntax has these parts:

Part	Description
nameOrIndex	Required. String containing the Name or Sequence Index of a Receive Sequence.

Remarks

See also WaitForSequence

Example

See WaitForSequence

10.2.1.4 GetDocklightTimeStamp

Returns the current Docklight date/time stamp, according to the following settings:

1. The Docklight date/time stamp format chosen in the Options dialog:
   - Time stamp
   - Date stamp
   - Use time stamps with 1/100 seconds precision

2. The Windows setting for **Region and Language > Formats > Short date** and **Long time**

The **GetDocklightTimeStamp** function is especially useful for printing additional time information using the AddComment method.

Return Value

String

Syntax 1

result **= DL.GetDocklightTimeStamp()**

Remarks (Syntax 1)

GetDocklightTimeStamp adds a trailing space to the date/time string. This is for historical reasons and compatibility. See Syntax 2 for a trimmed version. See also the AddComment method.

Example 1

```
' Example GetDocklightTimeStamp

DL.ClearCommWindows
DL.StartCommunication
DL.AddComment "Communication started at " &
DL.GetDocklightTimeStamp()
DL.AddComment "Waiting for data..."
```

```
' Endless loop to prevent the script from terminating
immediately
Do
    DL.Pause 1 ' (the pause reduces CPU load while idle)
Loop
```

Syntax 2

result **= DL.GetDocklightTimeStamp([** *myDateTime* **] [,** *milliseconds* **] [,** *trimmed* **])**

Part	Description
myDateTime	Optional. a VBScript Date (Time) variable which provides the date/time information in resolution "1 second". 0 (default) = Use Docklight's own time base.
milliseconds	Optional integer value with corresponding milliseconds from 0..999. -1 (default) = Use Docklight's own time base. -2 = Do NOT add the milliseconds part.
trimmed	Optional. True = Remove the trailing space (see Syntax 1). False (Default) = use the original format for compatibility.

Remarks (Syntax 2)

The extended syntax is typically used for formatting Receive Sequence timing information obtained within a Sub DL_OnReceive() event procedure. See the Example 2.

The argument *milliseconds* = -2 is useful when creating an export file for software like Excel that expects a standard Windows time format without milliseconds.

10.2.1.5 OpenProject

Opens an existing Docklight project file (.ptp file).

Return Value

Void

Syntax

DL.OpenProject *filePathName*

The **OpenProject** method syntax has these parts:

Part	Description
filePathName	Required. String containing the file path (directory and file name) of the Docklight project file (.ptp file) to open. The file extension .ptp can be omitted. If no directory is specified, Docklight uses the current working directory.

Remarks

If *filePathName* is not a valid Docklight project file or does not exist, Docklight reports an error and the script execution is stopped.

If *filePathName* is an empty string, a file dialog will be displayed to choose a project file.

All Receive Sequence counters are reset when (re)opening a Docklight project, see the ResetReceiveCounter function.

Example

```
' Example OpenProject

' Load a Docklight project file
DL.OpenProject "D:\My Docklight Files\Test.ptp"

' Load the file 'Test.ptp' from the current working directory
DL.OpenProject "Test"
```

10.2.1.6 Pause

Pauses the script's execution for a specified number of milliseconds.

Return Value

Void

Syntax

DL.Pause *milliseconds*

The **Pause** method syntax has these parts:

Part	Description
milliseconds	Required. Long value for the delay in milliseconds. Minimum value is 0 (**Pause** returns immediately). Maximum value is 86000000 (23.88 hours).

Remarks

Docklight in general and the **Pause** function do not provide a very exact timing with milliseconds precision, so the actual delay may vary from the *milliseconds* value.

During a **Pause**, no DL_OnReceive() procedure calls can be processed. If you need to process **DL_OnReceive()** events while waiting, see the **pauseWithEvents()** code described at Example 2.

Example

```
' Example Pause

' Send a test command
DL.SendSequence "Test1"
' 5 seconds delay
DL.Pause 5000
' Send another command
DL.SendSequence "Test2"

' Typical main loop for processing data
Do
   DL.Pause 1 ' reduce CPU load
   countSomeThings = DL.GetReceiveCounter(1)
   ' ... do more things ...
Loop
```

10.2.1.7 Quit

Stops the Docklight script immediately.

Return Value

Void

Syntax

DL.Quit

Remarks

If communication has been started using a script command (see StartCommunication) , the communication is stopped, too. If a log file has been opened using StartLogging, the file is closed. Files opened using FileInput or FileOutput are closed as well.

Using VBScript's built-in "Stop" statement, or other VBScript debugging features that alter the program flow, is not possible in Docklight Scripting. Always use the **DL.Quit** statement to terminate script execution.

10.2.1.8 ResetReceiveCounter

Resets one or all Receive Sequence hit counter(s). Also resets the search algorithm which checks the character stream for a matching Receive Sequence (see example code below).

Return Value

Void

Syntax

DL.ResetReceiveCounter [*nameOrIndex***]**

The **ResetReceiveCounter** method syntax has these parts:

Part	Description
nameOrIndex	Optional. String containing the Name or Sequence Index of a Receive Sequence. If specified, only the corresponding counter is reset. If *nameOrIndex* is omitted, all counters are reset.

Remarks

See also GetReceiveCounter and WaitForSequence

Example

See WaitForSequence for a basic example.

A second application is demonstrated below - resetting the receive sequence detection each time a new Send Sequence is transmitted. This is especially useful when Docklight is testing a serial device, and the sequence detection should not get confused by incomplete or faulty packets received earlier. See also DL_OnSend().

```
' Example ResetReceiveCounter
' Reset sequence detection each time a new sequence is sent
```

```
' Endless loop to prevent the script from terminating
immediately
Do
    DL.Pause 1 ' (the pause reduces CPU load while idle)
Loop

Sub DL_OnSend()
    DL.ResetReceiveCounter
End Sub
```

10.2.1.9 SendSequence

Sends a Send Sequence or a custom data sequence. Starts the communication, if not already running (see StartCommunication).

Return Value

Void

Syntax 1

DL.SendSequence *nameOrIndex* **[,** *parameters***] [,** *representation***]**

Sends out the Send Sequence that matches *nameOrIndex*. The **SendSequence** method syntax 1 has these parts:

Part	Description
nameOrIndex	Required. String containing the Name of the Send Sequence. The first Send Sequence from the list with a name that matches *nameOrIndex* is used. As an alternative, you may pass an integer value specifying the Sequence Index. Valid Sequence Index range is from 0 to (NoOfSendSequences - 1).
parameters	Optional. String containing one or several parameter value(s) for a Send Sequence with wildcards. Parameters are passed in ASCII representation by default. The space character is used to separate several different parameters for different wildcard areas. To pass parameters in HEX, Decimal or Binary representation, use the optional *representation* argument described below. In HEX, Decimal or Binary representation, the comma (",") is used as a separator between several different parameters.
representation	Optional. String value to define the format for *parameters* list "A" = ASCII (default), "H" = Hex, "D" = Decimal or "B" = Binary.

Remarks (Syntax 1)

If the wrong number of parameters is provided by the *parameters* argument, or the parameter length does not match the corresponding wildcards region, Docklight will not raise an error, but apply the following rules:

- If too few parameters are provided, or the parameter string is too short, all remaining wildcards are filled up with a blank character. If you are using *representation* = "A" (ASCII) , the wildcards are filled with space characters (ASCII code 32). For all other formats, the wildcards will be filled with ASCII code 0.
- If too many parameters are provided, or the parameter string is too long, the parameter(s) will be truncated or ignored.

Syntax 2

DL.SendSequence "", *customSequence* **[,** *representation* **]**

Sends out a custom data sequence. The **SendSequence** method syntax 2 has these parts:

Part	Description
customSequence	Required. String containing the sequence to send. The sequence is passed in ASCII representation by default. For HEX, Decimal or Binary sequence data, use the optional *representation* argument described below.
representation	Optional. String value to define the format for *customSequence*. "A" = ASCII (default), "H" = HEX, "D" = Decimal or "B" = Binary.

Example

```
' Example SendSequence

' Predefined Send Sequences
' (0) Test: Test
' (1) One:  One<#><#><#><CR><LF>
' (2) Two:  One<?><?><?>Two<#><#><#>

DL.StartCommunication
DL.ClearCommWindows
' Send sequence without parameter
DL.SendSequence "Test"
' Send sequence with one parameter
DL.SendSequence "One", "100"
' Send sequence with two parameters
DL.SendSequence "Two", "100 20"
' Pass two parameters in HEX representation, including spaces
and control characters
DL.SendSequence "Two", "20 31 20, 30 0D 0A", "H"
' Send custom sequence data, not using a predefined Send
Sequence
DL.SendSequence "", "Custom Data"

' And now using a loop and the loop variable
' for the Send Sequence parameter values
For i = 1 To 10
      parString = i & " " & i+1  ' use a space to separate
parameters
      DL.SendSequence "Two", parString
Next

DL.StopCommunication
```

After running the script, the Docklight communication window could look like this:

```
08/05/2008 13:50:35.622 [TX] - Test
08/05/2008 13:50:35.631 [TX] - One100<CR><LF>

08/05/2008 13:50:35.665 [TX] - One100Two20
08/05/2008 13:50:35.682 [TX] - One 1 Two0<CR><LF>
```



```
08/05/2008 13:50:35.699 [TX] - Custom Data
08/05/2008 13:50:35.713 [TX] - One1  Two2
08/05/2008 13:50:35.745 [TX] - One2  Two3
08/05/2008 13:50:35.771 [TX] - One3  Two4
08/05/2008 13:50:35.807 [TX] - One4  Two5
08/05/2008 13:50:35.846 [TX] - One5  Two6
08/05/2008 13:50:35.878 [TX] - One6  Two7
08/05/2008 13:50:35.907 [TX] - One7  Two8
08/05/2008 13:50:35.922 [TX] - One8  Two9
08/05/2008 13:50:35.955 [TX] - One9  Two10
08/05/2008 13:50:35.987 [TX] - One10 Two11
```

10.2.1.10 StartCommunication

Opens the communication port(s) and enables the data transfer. This corresponds to the Docklight menu **Run > Start communication**

Return Value

Void

Syntax

DL.StartCommunication

Remarks

The methods SendSequence, WaitForSequence and UploadFile will automatically open the communication port(s), if they have not been opened before by using the **StartCommunication** method.

See also StopCommunication.

10.2.1.11 StopCommunication

Stops the data transfer and closes the communication port(s). This corresponds to the Docklight menu **Run > Stop communication.**

Return Value

Void

Syntax

DL.StopCommunication

Remarks

See the StartCommunication method for more information.

10.2.1.12 StartLogging

Creates new log file(s) and starts logging the incoming/outgoing serial data. This corresponds to the Docklight menu **Start Communication Logging ...**

Return Value

Void

Syntax

DL.StartLogging *baseFilePath* **[,** *appendData***] [,** *representations***] [,** *format***] [,** *highspeed***] [,** *noHeaders***]**

The **StartLogging** method syntax has these parts:

Part	Description
baseFilePath	Required. String containing the directory and base file name for the log file(s).
appendData	Optional Boolean value. True (Default) = Append the new data to existing log file(s). False = Overwrite existing log file(s). Previously saved logging data will be lost.
representations	Optional String to choose the log file representations. "A" (ASCII), "H" (HEX), "D" (Decimal) and/or "B" (Binary). Default value is "AHDB" (create all four representations ASCII, HEX, Decimal, Binary).
format	Optional Integer value. 0 (Default) = create plain text files (.txt) 1 = create HTML files for web browsers (.htm) 2 = create RTF Rich Text Format files (.rtf) NOTE: For compatibility to V2.2. and earlier, it is also possible to use: False = plain text (.txt) True = HTML (.htm)
highspeed	Optional Boolean value. False (Default) = not used True = Disable communication window while logging (e.g. for monitoring high-speed communications on a slow PC).
noHeaders	Optional Boolean value. False (Default) = create a standard header "Docklight Log File started..." after opening the file. Create a footer "Docklight Log File stopped" when closing the file. True = Do not create any additional header or footer information.

Remarks

See also logging and analyzing a test and the Create Log Files(s) Dialog for more information on the **StartLogging** functionality and arguments described above.

If *baseFilePath* is an empty string, a file dialog will be displayed to choose the log file path and base file name.

If **StartLogging** is called while another log file is still open from a previous **StartLogging** call, the file is closed and the new file is created / opened. This allows changing the log file name without losing any data.

The *noHeaders* flag is particularly useful when you are creating log data without time stamps. You can then easily compare the result to previous test runs using an file compare tool.

Example

```
' Example StartLogging

DL.ClearCommWindows
DL.StartLogging "C:\DocklightLogging"
```

```
' - opens four log files:
'  'C:\DocklightLogging_asc.txt'
'  'C:\DocklightLogging_hex.txt'
'  'C:\DocklightLogging_dec.txt'
'  'C:\DocklightLogging_bin.txt'
' Wait for 5 seconds
DL.Pause 5000
' Close the four log files
DL.StopLogging
```

Example 2

This is a more advanced example which demonstrates how to include a date/time stamp in the log file name and start a new log file every hour

```
' Example 'One Log File per Hour'

' This is the base path and location where the log file(s) will
be stored
Const BASE_FILE_PATH = "logfile_"
' Create ASCII and HEX log files
Const LOG_REPRESENTATIONS = "AH"

currentLogFileName = ""
DL.StartCommunication
Do
    newLogFileName = getFileName()
    ' Time for starting a new file?
    If newLogFileName <> currentLogFileName Then
        DL.StartLogging newLogFileName, True,
LOG_REPRESENTATIONS
     currentLogFileName  = newLogFileName
    End If
    DL.Pause 1 ' reduce CPU load
Loop

Function getFileName()
    dt = Now
    ' Compose a file name.
    ' The Right() functions ensure that all months, days,
    ' hours are printed with two decimals
    getFileName = BASE_FILE_PATH & Year(dt) & "_" & Right("0" &
Month(dt), 2) & "_" & Right("0" & Day(dt), 2) & "_" & Right("0"
& Hour(dt), 2) & "H"
End Function
```

10.2.1.13 StopLogging

Stops the logging and closes the log file(s) currently open. This corresponds to the Docklight menu **Stop Communication Logging**.

Return Value

Void

Syntax

DL.StopLogging

Remarks

See the StartLogging method for more information on log files.

10.2.1.14 WaitForSequence

Waits for one or several occurrences of a Receive Sequence and returns the corresponding counter value (see GetReceiveCounter). Starts the communication, if not already running (see StartCommunication).

Return Value

Long

Syntax

result **= DL.WaitForSequence(** *nameOrIndex* **[,** *maxCounter***] [,** *timeout***])**

The **WaitForSequence** method syntax has these parts:

Part	Description
nameOrIndex	Required. String containing the Name of the Receive Sequence to count. The first Receive Sequence from the list with a name that matches *nameOrIndex* is used. As an alternative, you may pass an integer value specifying the Sequence Index. Valid Sequence Index range is from 0 to (NoOfReceiveSequences - 1).
maxCounter	Optional. Long number containing the counter limit until the function returns. Default value is 1 (one): **WaitForSequence** returns after detecting the first occurrence of the receive sequence. Return value is 1 in this case. If *maxCounter* is -1, **WaitForSequence** does not use a counter limit. It will only return after a timeout (see below). Use *maxCounter* = -1 to count all occurrences of a Receive Sequence within a limited period of time.
timeout	Optional. Long number specifying an additional timeout in milliseconds. Default value is -1 (no timeout). Maximum value is 86000000 (23.88 hours).

Remarks

The **WaitForSequence** method checks the number of "hits" for this Receive Sequence since the communication has been started (see StartCommunication) or the counter has been reset (see ResetReceiveCounter). **WaitForSequence** waits until the number of "hits" specified by the *maxCounter* have been detected.

One basic application for **WaitForSequence** is waiting for a specific answer after sending out a test command to your serial device. To make sure that you do not miss a very quick response from your device, use the following command order:
1. Reset the counter(s) first using ResetReceiveCounter.
2. Send your test command using SendSequence
3. Now use **WaitForSequence** to wait for the expected answer

It is very important that you use **ResetReceiveCounter** before **SendSequence.** **ResetReceiveCounter** will not only set the detection counter to zero, but also reset the character matching process, so any characters that have been previously received are not considered when looking for a sequence match. See also the remarks on wildcard search for additional information on how Docklight handles Receive Sequence pattern matching.

During a **WaitForSequence**, no DL_OnReceive() procedure calls can be processed. If you need to process **DL_OnReceive()** events while waiting, see the **pauseWithEvents()** code described at OnReceive Example 2.

If you need to wait for *any* of the Receive Sequences to trigger, the DL_OnReceive() procedure provides the solution. See the OnReceive Example 3.

Example

```
' Example WaitForSequence

' Count the number of occurrences of
' the first Receive Sequence within a 10 seconds
' interval.
' Requires at least one Receive Sequence definition

DL.StartCommunication
DL.ClearCommWindows
result = DL.WaitForSequence(0 , -1, 10000)
DL.AddComment vbCrLf & vbCrLf & "Receive Sequence #0, hit count
= " & result
' alternative way to read the counter afterwards
DL.AddComment "Receive Sequence #0, hit count = " &
DL.GetReceiveCounter(0)

' Send the first Send Sequence and wait for a device response
(no timeout)
DL.AddComment vbCrLf & vbCrLf & "Sending data and waiting for
Receive Sequence #0"
DL.ResetReceiveCounter
DL.SendSequence 0
DL.WaitForSequence 0
```

10.2.2 Methods (Advanced)

10.2.2.1 CalcChecksum

Returns a checksum or CRC value for a given sequence, or a part of a sequence.

The **CalcChecksum** method is an advanced Docklight Scripting feature and requires some knowledge about checksums in serial application protocols, and how Docklight deals with send/receive data in general.

TIP: We recommend the section Calculating and Validating Checksums for introduction. If the CRC-specific terms and parameters seem confusing to you, see the CRC Glossary for some background information.

Return Value

String

Syntax

result **= DL.CalcChecksum(** *checksumSpec*, *dataStr*, **[**, *representation*] **[**, *startPos*] **[**, *endPos*] **[**, *bigEndian* **])**

The **CalcChecksum** method syntax has these parts:

Part	Description

checksumSpec	Required. String that specifies the checksum algorithm and its parameters. **CalcChecksum** supports predefined names for common checksum algorithms, or you can pass a generic CRC specification for calculating more exotic CRCs. Predefined names are: "MOD256", "XOR", "CRC-8", "CRC-CCITT", "CRC-16", "CRC-MODBUS" and "CRC-32" See checksumSpec Format for the full format specification.
dataStr	Required. String value that contains the input Sequence for the checksum calculation, as for example returned by the OnSend_GetData() function.
representation	Optional. String value to define the format of the *dataStr* Sequence: "H" = Hex (default), "A" = ASCII , "D" = Decimal or "B" = Binary.
startPos	Optional Integer value. Specifies the character position where the calculation should start. Default value is 1 (beginning of the *dataStr* Sequence). *startPos* also accepts negative values, e.g. -1 for "last character", -2 for "2nd character from the end", -3 for "3rd character from the end".
endPos	Optional Integer value. Specifies the last character that should be included in the calculation. Default value is the size of the dataStr Sequence. *endPos* also accepts negative values, see *startPos* above.
bigEndian	Optional. Boolean value to define the byte order for *result* . True (default): Use big-endian byte order (first character is most significant) False: use little-endian byte order (first character is least significant)

Remarks

The return value is a string with the CRC/checksum in the Docklight HEX sequence format, e.g. "CB F4 39 26". The number of HEX bytes returned depends on the width of the checksum algorithm. See the example script and communications window output below.

With the help of **CalcChecksum** you can generate specific checksums for Send Sequences on the fly, or use advanced checksum validations for received data. See the Sub DL_OnSend() Event Procedure for details.

Standard checksums can already be processed without script code using the **Checksum** part of the Edit Send Sequence / Edit Receive Sequence dialogs. See also the related Modbus protocol example example.

Example

```
' Example CalcChecksum

DL.ClearCommWindows

DL.AddComment
DL.AddComment "Simple checksum (Mod 256) for '123456789'"
DL.AddComment "CalcChecksum = " & DL.CalcChecksum("MOD256",
"123456789", "A")

DL.AddComment
DL.AddComment "8 bit CRC (CRC DOW) for '123456789'"
DL.AddComment "CalcChecksum = " & DL.CalcChecksum("CRC-DOW",
"123456789", "A")
```

```
DL.AddComment
DL.AddComment "16 bit CRC (CRC-16) for '123456789'"
DL.AddComment "CalcChecksum = " & DL.CalcChecksum("CRC-16",
"123456789", "A")

DL.AddComment
DL.AddComment "16 bit CRC (CRC-Modbus) for '123456789' in
'LittleEndian' - lower byte first"
DL.AddComment "CalcChecksum = " & DL.CalcChecksum("CRC-Modbus",
"123456789", "A", , ,False)

DL.AddComment
DL.AddComment "16 bit CRC (CRC-CCITT) for '123456789'"
DL.AddComment "CalcChecksum = " & DL.CalcChecksum("CRC-CCITT",
"123456789", "A")
DL.AddComment "Now do the same thing, but specify all CRC
details yourself..."
DL.AddComment "CalcChecksum = " &
DL.CalcChecksum("CRC:16,1021,FFFF,0000,No,No", "123456789",
"A")

DL.AddComment
DL.AddComment "32 bit CRC (CRC-32) for '123456789'"
DL.AddComment "CalcChecksum = " & DL.CalcChecksum("CRC-32",
"123456789", "A")

DL.AddComment
DL.AddComment "A 32 bit CRC (CRC-32) on the first 5 bytes of
HEX sequence 01 02 03 04 05 FF FF FF FF, result is Little
Endian / lowest byte first"
DL.AddComment "CalcChecksum = " & DL.CalcChecksum("CRC-32", "01
02 03 04 05", "H", 1, 5, False)
```

The above script code produces the following output in the Docklight communication window:

```
 Simple checksum (Mod 256) for '123456789'
 CalcChecksum = DD

 8 bit CRC (CRC DOW) for '123456789'
 CalcChecksum = A1

 16 bit CRC (CRC-16) for '123456789'
 CalcChecksum = BB 3D

 16 bit CRC (CRC-Modbus) for '123456789' in 'LittleEndian' -
lower byte first
 CalcChecksum = 37 4B

 16 bit CRC (CRC-CCITT) for '123456789'
 CalcChecksum = 29 B1
 Now do the same thing, but specify all CRC details yourself...
 CalcChecksum = 29 B1

 32 bit CRC (CRC-32) for '123456789'
 CalcChecksum = CB F4 39 26
```



```
 A 32 bit CRC (CRC-32) on the first 5 bytes of HEX sequence 01
02 03 04 05 FF FF FF FF, result is Little Endian / lowest byte
first
 CalcChecksum = F4 99 0B 47
```

10.2.2.2 ConvertSequenceData

Converts Sequence data to/from a float number, an integer number, or other common types of data in technical applications.

Return Value

String

Syntax

result **= DL.ConvertSequenceData(** *conversionType*, *source*, **[**, *representation*] **[**, *bigEndian* **])**

The **ConvertSequenceData** method syntax has these parts:

Part	Description
conversionType	Required. String that specifies the conversion type and direction. See below for the list of conversions and examples.
source	Required. Input data string for the conversion. This can be a Docklight Sequence, e.g. "4B 06 9E 3F", or a string with the application value, e.g. "1.234567". See below for details.
representation	Optional. Format of the sequence string (either *source* or *result*, depending on *conversionType*): "H" = Hex (default), "D" = Decimal or "B" = Binary.
bigEndian	Optional. Boolean value to define the byte order for integer or float conversions. True (default): Use big-endian byte order (first character is most significant) False: use little-endian byte order (first character is least significant)

The *conversionType* argument supports the following values and types of conversions:

Value	Description
"toSingle"	Convert *source* to a single precision float number. *source*: IEEE single precision (32 bit) sequence *result*: string with floating point number in non-localized format, uses period (".") as the decimal separator. Example: `DL.ConvertSequenceData("toSingle", "3F 9E 06 4B")` returns: `1.234567`
"fromSingle"	Convert *source* to a IEEE single precision (32 bit) sequence *source*: string with floating point number. Both period (".") and comma (",") are accepted as decimal separator. *result*: 32 bit sequence data Example: `DL.ConvertSequenceData("fromSingle", "1.234567")` returns: `3F 9E 06 4B`
"toDouble"	Convert *source* to a double precision float number. *source*: IEEE double precision (64 bit) sequence *result*: string with floating point number in non-localized format (see above) Example:

	`DL.ConvertSequenceData("toDouble", "103 154 149 160 081 161 036 075", "D", False)` returns: `9.87987987987E+53`
"fromDouble"	Convert to a IEEE double precision (64 bit) sequence *source*: string with floating point number. Both period (".") and comma (",") are accepted as decimal separator. *result*: 64 bit sequence data Example: `DL.ConvertSequenceData("fromDouble", "9.87987987987E+53", "D", False)` returns: `103 154 149 160 081 161 036 075`
"fromText"	Converts a plain text into a Hex, Decimal or Binary sequence. E.g. `DL.AddComment DL.ConvertSequenceData("fromText", "Hello World")` returns: `48 65 6C 6C 6F 20 57 6F 72 6C 64` *bigEndian* = false: If this option is used for "fromText", the resulting sequence is without separator, e.g. `48656C6C6F20576F726C64`

"toInteger16"
"fromInteger16"
	Convert to/from a signed 16 bit integer value
	Examples:
	`DL.ConvertSequenceData("toInteger16", "80 00")`
	returns: `-32768`
	`DL.ConvertSequenceData("fromInteger16", "-1")`
	returns: `FF FF`

"toUnsigned16"
"fromUnsigned16"
	Same as "toInteger16" / "fromInteger16", but for unsigned 16 bit integer data
	Examples:
	`DL.ConvertSequenceData("toUnsigned16", "80 00")`
	returns: `32768`
	`DL.ConvertSequenceData("fromUnsigned16", "65535", "D")`
	returns: `255 255`

"toInteger32"
"fromInteger32"
	Convert to/from a signed 32 bit integer value
	Examples:
	`DL.ConvertSequenceData("toInteger32", "00 00 00 80", "H", False)`
	returns: `-2147483648`
	`DL.ConvertSequenceData("fromInteger32", "-2", "H", False)`
	returns: `FE FF FF FF`

"toUnsigned32"
"fromUnsigned32"
	Same as "toInteger32" / "fromInteger32", but for unsigned 32 bit integer data
	Examples:
	`DL.ConvertSequenceData("toUnsigned32", "FF 00 FF 00")`
	returns: `4278255360`
	`DL.ConvertSequenceData("fromUnsigned32", "21121977", "D")`
	returns: `001 066 075 185`

"toBool"	Returns "True" if the first *source* character is <> 0
	Example:
	`DL.ConvertSequenceData("toBool", "00")`
	returns: `False`
	`DL.ConvertSequenceData("toBool", "01 00")`
	returns: `True`

"toText"	Converts sequence data into a text string with printing characters only (see [ASCII Character Set](#)). ASCII code 0 - 31 and 127 - 255 are filtered out and do not appear in the result. *source*: sequence with the original data, including non-printing character codes *result*: the ASCII text using only ASCII code 32 - 126 Example: `DL.ConvertSequenceData("toText", "FF 48 65 6C 6C 6F 21 0D 00 00")` returns: `Hello!`

Remarks

Carefully check your protocol specification on the data format, including Endianness (little endian / big endian).

When using the result of a "toSingle" or "toDouble" conversion for further calculations, keep in mind that *result* can be a non-numeric strings like "NaN" (not a number) or "Inf" (Infinity).

Note that "toText" is not the same as reading out a data sequence in ASCII representation ("A"). Example:

```
DL.AddComment DL.OnSend_GetData("A")
DL.AddComment DL.ConvertSequenceData("toText",
DL.OnSend_GetData("H"))
```

could return the following:

```
□Hello!<CR><NUL><NUL>
Hello!
```

10.2.2.3 GetChannelSettings

Returns the current communication channel settings (COM port number or TCP address, serial port settings).

NOTE: **GetChannelSettings** is a companion to the [SetChannelSettings](#) method, and intended for advanced Docklight Scripting applications where control of the communication channel settings is required.

Return Value

String

Syntax

result **= DL.GetChannelSettings([***channelNo***])**

The **GetChannelSettings** method syntax has these parts:

Part	Description
channelNo	Optional. Integer that specifies the communication channel if [Communication Mode: Monitoring](#) is used. Default value is 1 (Channel 1).

Remarks

GetChannelSettings returns a string with the current serial or TCP settings for the specified communication channel.

If the channel is a serial port, the return value has the following format:
COM*xxx*: *BaudRate*, *Parity*, *DataBits*, *StopBits*, *FlowControl*, *ParityErrorChar*
e.g. "COM1:9600,NONE,8,1,OFF,63"

If the channel is a TCP client, the return value is the current IP address and TCP port number, e.g. "192.0.0.1:3001".

If the channel is a TCP server, the return value is the string "SERVER:" plus the TCP port number, e.g. "SERVER:3001"

See also the SetChannelSettings method for a detailed overview on the return value data format, and a more complex example on how to manipulate channel settings during script runtime.

Example

```
' Example GetChannelSettings

DL.AddComment "Comm. Channel 1 Settings = " &
DL.GetChannelSettings()
' The following command will only work,
' if Docklight Communication Mode is 'Monitoring (receive
only)'
DL.AddComment "Comm. Channel 2 Settings = " &
DL.GetChannelSettings(2)
```

The example could produce the following output in the Docklight Communication Window:

```
Comm. Channel 1 Settings = COM1:9600,NONE,8,1,OFF,63

Comm. Channel 2 Settings = SERVER:10001
```

10.2.2.4 GetChannelStatus

Returns the current communication channel status (closed, open, waiting for TCP connection, or error).

Return Value

Integer

Syntax

result **= DL.GetChannelStatus([***channelNo***])**

The **GetChannelStatus** method syntax has these parts:

Part	Description
channelNo	Optional. Integer that specifies the communication channel if Communication Mode: Monitoring or Side Channels are used. Default value is 1 (Channel 1).

Remarks

GetChannelStatus returns the following values:

result	Description
0	Channel is closed, communications is stopped (see also StopCommunication)
1	Channel is open and ready to transmit/receive data. TCP server or TCP client mode: Connection established.
2	TCP server or TCP client mode: Waiting for connection. COM port with RTS/CTS hardware flow control: Waiting for handshake signal.
3	Channel error, e.g. after a SetChannelSettings command that specified a non-existing COM port number.

See also SetChannelSettings and GetChannelSettings.

Example

```
' Example GetChannelStatus
' (requires Docklight in Send/Receive mode)

DL.ClearCommWindows

DL.AddComment "COM port access"
DL.SetChannelSettings "COM3:9600,NONE,8,1", 1
DL.AddComment "GetChannelStatus before StartCommunication = " &
DL.GetChannelStatus(1)
DL.StartCommunication
DL.AddComment "GetChannelStatus after StartCommunication = " &
DL.GetChannelStatus(1)
DL.StopCommunication

DL.AddComment
DL.AddComment "TCP client mode"
DL.AddComment "Connecting to docklight.de ..."
DL.SetChannelSettings "docklight.de:80", 1
DL.StartCommunication
' wait until connected
Do
    commStatus = DL.GetChannelStatus(1)
    DL.AddComment "GetChannelStatus = " & commStatus
    DL.Pause 10
Loop Until commStatus <> 2
If commStatus = 1 Then
    DL.AddComment "Connected."
Else
    DL.AddComment "Error!"
End If
DL.StopCommunication
```

After running the script on a computer with a built-in COM3 port (e.g. modem) and Internet connection, the communications window could look like this:

```
COM port access
GetChannelStatus before StartCommunication = 0
GetChannelStatus after StartCommunication = 1

TCP client mode
Connecting to docklight.de ...
```



```
GetChannelStatus = 2
GetChannelStatus = 2
GetChannelStatus = 2
GetChannelStatus = 2
GetChannelStatus = 1
Connected.
```

10.2.2.5 GetCommWindowData

Returns the accumulated contents of the communication windows buffer.

NOTE: This method is for special applications. For many standard uses cases, the OnSend / OnReceive event procedures, or the GetReceiveComments method will be the preferred solution.

Return Value

String

Syntax

result = **DL.GetCommWindowData([***representation***])**

The **GetCommWindowData** method syntax has these parts:

Part	Description
representation	Required. String value to define the window buffer format requested: "A" = ASCII (default), "H" = Hex, "D" = Decimal or "B" = Binary.

Remarks

Only a *representation* enabled in Docklight Options – Communication Window Modes can be used. By default, this is ASCII, HEX and Decimal. If required, load different options using LoadProgramOptions**.**

The maximum size of the **GetCommWindowData** buffer is 128000 characters. If more communication data is accumulating without calling **GetCommWindowData**, the oldest data gets deleted.

10.2.2.6 GetEnvironment

Returns the value of a *Windows* environment variable in the currently active user profile, or a value of one of the Docklight-specific environment variables described below.

Return Value

String

Syntax

result **= DL.GetEnvironment(** *name* **)**

The **GetEnvironment** method syntax has these parts:

Part	Description
name	Required. *name* can be: 1) The name of the *Windows* environment variable. (Not including the %-signs around it that are used in the *Windows* Command Shell **cmd.exe**).

	2) One of the Docklight-specific names listed below

Docklight Scripting Environment Variables

Name	Description
DOCKLIGHT_VERSION	Docklight Scripting application version
DOCKLIGHT_SCRIPTDIR	the folder the script runs in
DOCKLIGHT_DIALOGDIR	the folder used for the last script file dialog used
DOCKLIGHT_PORTLIST	list of COM ports available on this PC
DOCKLIGHT_SENDSEQ	list of all Send Sequence names in the current Docklight project (**.ptp** file)
DOCKLIGHT_RECEIVESEQ	list of all Receive Sequence names
DOCKLIGHT_SENDSEQDEF	list of all Send Sequences **Name** and **Sequence** in HEX format. **Name** and **Sequence** are returned in separated text lines
DOCKLIGHT_SENDSEQDEF: *SequenceName*	Lists the definition only for the sequence names that match *SequenceName*. *SequenceName* can contain wildcards, e.g. you can use: `DOCKLIGHT_SENDSEQDEF:Test*`
DOCKLIGHT_RECEIVESEQDEF	same as `DOCKLIGHT_SENDSEQDEF` but for Receive Sequences

Remarks

The list of environment variables used in the example below is just an example.

TIP: For a list of variables available on your current user profile, open a *Windows* Command Processor window (Windows Key + R, then type **cmd**), then type **SET** and press Enter.

NOTE: In Docklight Scripting V2.0 and earlier this method was called **GetEnvironmentVariable**. The old name is still supported for compatibility reasons. It was changed to avoid confusion with the Windows API function of the same name.

Example

```
' Example GetEnvironment

nameList =
"ALLUSERSPROFILE,APPDATA,COMPUTERNAME,HOMEDRIVE,HOMEPATH,LOCALA
PPDATA,LOGONSERVER,NUMBER_OF_PROCESSORS,OS,PROCESSOR_ARCHITECTU
RE,PROCESSOR_IDENTIFIER,PROCESSOR_LEVEL,PROCESSOR_REVISION,PUBL
IC,TEMP,TMP,USERDOMAIN,USERNAME,USERPROFILE"

DL.AddComment "Running Docklight Scripting " &
DL.GetEnvironment("DOCKLIGHT_VERSION")
nameArray = Split(nameList , ",")
For i = 0 To UBound(nameArray)
   name = nameArray(i)
   DL.AddComment name & " = " & DL.GetEnvironment(name)
Next
```

On a *Windows 10* notebook, the communications window output could look like this:

```
 Running Docklight Scripting Docklight Scripting V2.4.5
 ALLUSERSPROFILE = C:\ProgramData
 APPDATA = C:\Users\docklight\AppData\Roaming
 COMPUTERNAME = DOCK-OH
 HOMEDRIVE = C:
 HOMEPATH = \Users\docklight
 LOCALAPPDATA = C:\Users\docklight\AppData\Local
 LOGONSERVER = \\DOCK-OH
 NUMBER_OF_PROCESSORS = 4
 OS = Windows_NT
 PROCESSOR_ARCHITECTURE = x86
 PROCESSOR_IDENTIFIER = Intel64 Family 6 Model 78 Stepping 3,
GenuineIntel
 PROCESSOR_LEVEL = 6
 PROCESSOR_REVISION = 4e03
 PUBLIC = C:\Users\Public
 TEMP = C:\Users\docklight\AppData\Local\Temp
 TMP = C:\Users\docklight\AppData\Local\Temp
 USERDOMAIN = DOCK-OH
 USERNAME = docklight
 USERPROFILE = C:\Users\docklight
```

10.2.2.7 GetHandshakeSignals

Returns the current handshake signal states (CTS, DSR, DCD, RI) as an integer bit value, in the same way the Receive Sequence function character '!' works.

Return Value

Integer

Syntax

result **= DL.GetHandshakeSignals()**

Remarks

result is a bit value with the following components:

Bit No.	Decimal Value	Handshake Signal
0	001	CTS = High
1	002	DSR = High
2	004	DCD = High
3	008	RI (Ring Indicator) = High

In Tap Pro / Tap 485 applications, **GetHandshakeSignals** returns the following extended set of handshake signal states:

Bit No.	Decimal Value	Handshake Signal
0	001	CTS = High (DCE side / Docklight Receive Channel 2)
1	002	DSR = High (DCE side / Channel 2)
2	004	DCD = High (DCE side / Channel 2)
3	008	RI (Ring Indicator) = High (DCE side / Channel 2)
4	016	RTS = High (DTE side / Channel 1)
5	032	DTR = High (DTE side / Channel 1)

See also SetHandshakeSignals for controlling the state of the RTS and DTR lines.

Example

```
' Example GetHandshakeSignals
DL.StartCommunication
Do
    DL.AddComment DL.GetDocklightTimeStamp() & " -
GetHandshakeSignals() = " & DL.GetHandshakeSignals()
    DL.Pause 200
Loop
```

Example Communication Window output:

```
 6/23/2012 10:07:44.244  - GetHandshakeSignals() = 0
 6/23/2012 10:07:44.469  - GetHandshakeSignals() = 48
 6/23/2012 10:07:44.677  - GetHandshakeSignals() = 48
 6/23/2012 10:07:44.884  - GetHandshakeSignals() = 48
```

NOTE: It can take 5-10 milliseconds after **StartCommunication** until **GetHandshakeSignals** reports the correct signal state.

10.2.2.8 GetKeyState

Returns the state of a specific keyboard key, mouse button or similar input.

Syntax

result **= DL.GetKeyState(** *virtKey* **)**

The **GetKeyState** method syntax has these parts:

Part	Description
virtKey	Required integer value. An ASCII or virtual key code. If they requested key is a digit from 0-9, or a letter from A-Z, the corresponding ASCII code is used. For other keys and buttons, see the **Virtual-Key Codes** table available in the *Microsoft Windows* Docs.

Remarks

The **GetKeyState** argument and return value correspond to the *Windows* GetKeyState function from the **Winuser.h** library.

For virtual keys (e.g. F1-F12, multimedia keys, mouse buttons a.s.o), you can use the VBScript declarations in the **GetKeyState_ImportFile_VirtualKeys.pts** file from the ScriptSamples\Extras\GetKeyState_Example folder. We recommend copying the file to your own script folder and include it using the #include directive.

Example

```
' Example GetKeyState

' Two virtual key declarations, taken from
GetKeyState_ImportFile_VirtualKeys.pts
Const VK_F2      = &h71
Const VK_LBUTTON= &h01

Do
```

```
        DL.AddComment "Example for F2 function key:
DL.GetKeyState(VK_F2)=" & DL.GetKeyState(VK_F2)
        If keyDown(Asc("D")) Then
                DL.AddComment "D key is pressed"
        End If
        If keyDown(VK_F2) Then
                DL.AddComment "F2 key is pressed"
        End If
        If keyDown(VK_LBUTTON) Then
                DL.AddComment "Left mouse button is pressed"
        End If
        DL.Pause 500
Loop

Function keyDown(virtKey)
        keyDown = (DL.GetKeyState(virtKey) And 128) > 0
End Function
```

Example Communication Window output:

```
Example for F2 function key: DL.GetKeyState(VK_F2)=1
Example for F2 function key: DL.GetKeyState(VK_F2)=1
Example for F2 function key: DL.GetKeyState(VK_F2)=1
Left mouse button is pressed
Example for F2 function key: DL.GetKeyState(VK_F2)=1
Left mouse button is pressed
Example for F2 function key: DL.GetKeyState(VK_F2)=1
D key is pressed
Example for F2 function key: DL.GetKeyState(VK_F2)=1
Example for F2 function key: DL.GetKeyState(VK_F2)=-128
F2 key is pressed
Example for F2 function key: DL.GetKeyState(VK_F2)=0
Example for F2 function key: DL.GetKeyState(VK_F2)=0
Example for F2 function key: DL.GetKeyState(VK_F2)=0
```

10.2.2.9 GetReceiveComments

Returns a chronological list of all Receive Sequence comments issued, as an alternative to the Sub DL_OnReceive() processing.

Return Value

String

Syntax

result **= DL.GetReceiveComments()**

Remarks

result contains all Receive Sequence Comments in chronological order, separated by a line break, since the last call of **GetReceiveComments**. With the help of Receive Sequence comment macros you can implement a parser for all incoming Receive Sequence data, as an alternative to Sub DL_OnReceive().

NOTE: A maximum of 10000 Receive Sequence events are stored and returned by **GetReceiveComments**, which should be sufficient for all practical applications.

10.2.2.10 InputBox2

Alternative to the original VBScript InputBox method.

Displays a prompt in a dialog box, waits for the user to input text or click a button, and returns the contents of the text box. This dialog will always appear on the same screen as the Docklight Scripting main window. It does not support the (rarely useful) optional arguments *xpos*, *ypos*, *helpfile* and *context* of the VBScript InputBox method.

TIP: As an alternative, see also the DL.GetKeyState function on how to wait and react to keyboard or mouse input.

Return Value

String

Syntax

result **= DL.InputBox2 (***prompt***[,** *title***][,** *default***])**

Part	Description
prompt	Required. String expression displayed as the message in the dialog box. The maximum length of prompt is approximately 1024 characters, depending on the width of the characters used. If prompt consists of more than one line, you can separate the lines using a carriage return character (**Chr(**13**)**), a linefeed character (**Chr(**10**)**), or carriage return plus linefeed character combination (**Chr(**13**) & Chr(**10**)**) between each line.
title	Optional. String expression displayed in the title bar of the dialog box. If you omit title, the application name is placed in the title bar.
default	Optional. String expression displayed in the text box as the default response if no other input is provided. If you omit default, the text box is displayed empty.

```
'Example DL.InputBox2 Function
MyInput = DL.InputBox2("Please enter text", "My Title",
  "Example Text")
DL.AddComment MyInput     ' print the user input
```

10.2.2.11 MsgBox2

Alternative to the original VBScript MsgBox method.

Displays a message box, waits for the user to click a button, and returns a value that indicates which button the user clicked. This dialog will always appear on the same screen as the Docklight Scripting main window. It does not support the optional arguments *helpfile* and *context* of the VBScript MsgBox method.

TIP: As an alternative, see the DL.SetUserOutput function on how to create an additional user output area and show extra user information.

Return Value

Integer

Syntax

result **= DL.MsgBox2 (***prompt***[,** *buttons***][,** *title***])**

Part	Description
prompt	Required. String expression displayed as the message in the dialog box. The maximum length of prompt is approximately 1024 characters, depending on the width of the characters used. If prompt consists of more than one line, you can separate the lines using a carriage return character (**Chr(**13**)**), a linefeed character (**Chr(**10**)**), or carriage return plus linefeed character combination (**Chr(**13**) & Chr(**10**)**) between each line.
buttons	Optional, common values are a combination (sum) of the below constants: Constant / Value / Description vbOKOnly / 0 / OK button only (default) vbOKCancel / 1 / OK and Cancel buttons vbAbortRetryIgnore / 2 / Abort, Retry, and Ignore buttons vbYesNoCancel / 3 / Yes, No, and Cancel buttons vbYesNo / 4 / Yes and No buttons vbRetryCancel / 5 / Retry and Cancel buttons vbCritical / 16 / Critical message vbQuestion / 32 / Warning query vbExclamation / 48 / Warning message vbInformation / 64 / Information message vbDefaultButton1 / 0 / First button is default (default) vbDefaultButton2 / 256 / Second button is default vbDefaultButton3 / 512 / Third button is default TIP: For a full list of all constants available, see the Microsoft VBA documentation for MsgBox.
title	Optional. String expression displayed in the title bar of the dialog box. If you omit title, the application name is placed in the title bar.
result	Returns the user action: Constant / Value / Description vbOK / 1 / OK button pressed vbCancel / 2 / Cancel button pressed vbAbort / 3 / Abort button pressed vbRetry / 4 / Retry button pressed vbIgnore / 5 / Ignore button pressed vbYes / 6 / Yes button pressed vbNo / 7 / No button pressed

```
'Example MsgBox2 Function
result = DL.MsgBox2("Run this test?", 3, "My Title")
If result = 6 Then
      DL.AddComment "Yes button pressed"
ElseIf result = 7 Then
      DL.AddComment "No button pressed"
Else
      DL.AddComment "Canceled"
End If
```

10.2.2.12 LoadProgramOptions

Loads the Docklight program options from a file created using SaveProgramOptions.

Return Value

Void

Syntax

DL.LoadProgramOptions *filePathName*

The **LoadProgramOptions** method syntax has these parts:

Part	Description
filePathName	Required. String containing the file path (directory and file name) of the Docklight settings file to load. If no directory is specified, Docklight uses the current working directory. If *filePathName* is an empty string, a file dialog will be displayed to choose a file.

Remarks

See the SaveProgramOptions method for more information on saving and loading Docklight program options.

10.2.2.13 PlaybackLogFile

Opens an existing Docklight Log File (HEX, Decimal or Binary representation) and plays back (re-sends) the data from one communication direction of this log file.

Starts the communication, if not already running (see StartCommunication).

Return Value

Void

Syntax

DL.PlaybackLogFile *filePathName* **[,** *dataDirection***] [,** *timeInterval* **]**

The **PlaybackLogFile** method syntax has these parts:

Part	Description
filePathName	Required. String containing the file path (directory and file name) of the log file. If no directory is specified, Docklight uses the current working directory. If *filePathName* is an empty string, a file dialog will be displayed to choose a file.
dataDirection	Optional String value. Specifies which of the two communication channels recorded (TX or RX? COM1 or rather COM2?) should be played back. If *dataDirection* is an empty string, the first channel that appears in the log file is used.
timeInterval	Optional Integer value. Use a pause time in milliseconds between two messages instead of the original timing from the log file (see remarks below).

Remarks

Playback is only possible in Communication Mode Send/Receive and only for log files in HEX, Decimal or Binary representation. Both HTML (.htm) and plain text (.txt) files can be used for playback.

If *filePathName* does not exist, Docklight reports an error and the script execution is stopped.

The log file used must contain date/time stamps for the two communication directions.

filePathName needs to contain the original Docklight-style name extension to determine the type of log file, e.g. "log1_hex.txt", "log1_dec.txt" or "log1_bin.txt". If *filePathName* has a different format, a HEX log file is assumed.

PlaybackLogFile evaluates the date/time stamps from the log file and emulates the timing of the original communications logged. If you want to change this, e.g. to slow down things for debugging purposes, you can use the optional *timeInterval* argument.

Example

```
' Example PlaybackLogFile

' Playback the first data direction from a sample log file
DL.AddComment "Playback TX side"
DL.PlaybackLogFile "modbus_logfile_hex.txt"

' Same file, but now play the answers from the RX side
DL.AddComment
DL.AddComment
DL.AddComment "Playback RX side"
DL.PlaybackLogFile "modbus_logfile_hex.txt", "RX"

' Same file, but use a fixed time interval between the
individual sequences.
DL.AddComment
DL.AddComment
DL.AddComment "Playback TX with fixed 500 milliseconds
interval"
DL.PlaybackLogFile "modbus_logfile_hex.txt", "", 500
```

We assume that the log file modbus_logfile_hex.txt was created during a previous Modbus communication session and contains the following information:

```
8/29/2006 18:45:23.19 [TX] - 01 04 00 00 00 01 31 CA
8/29/2006 18:45:23.34 [RX] - 01 04 02 FF FF B8 80
8/29/2006 18:45:33.14 [TX] - 02 04 00 00 00 01 31 F9
8/29/2006 18:45:33.29 [RX] - 02 04 02 27 10 E7 0C
8/29/2006 18:45:43.23 [TX] - 03 04 00 00 00 01 30 28
8/29/2006 18:45:43.39 [RX] - 03 04 02 00 00 C0 F0
8/29/2006 18:45:58.72 [TX] - 04 04 00 00 00 01 31 9F
8/29/2006 18:45:58.87 [RX] - 04 04 02 04 00 77 F0
```

After running the example script, the communications window could look like this:

```
 Playback TX side

4/26/2009 13:29:15.841 [TX] - 01 04 00 00 00 01 31 CA
4/26/2009 13:29:25.788 [TX] - 02 04 00 00 00 01 31 F9
4/26/2009 13:29:35.879 [TX] - 03 04 00 00 00 01 30 28
4/26/2009 13:29:51.367 [TX] - 04 04 00 00 00 01 31 9F

 Playback RX side

4/26/2009 13:29:51.545 [TX] - 01 04 02 FF FF B8 80
4/26/2009 13:30:01.495 [TX] - 02 04 02 27 10 E7 0C
4/26/2009 13:30:11.596 [TX] - 03 04 02 00 00 C0 F0
4/26/2009 13:30:27.075 [TX] - 04 04 02 04 00 77 F0

 Playback TX with fixed 500 milliseconds interval
```

```
4/26/2009 13:30:27.095 [TX] - 01 04 00 00 00 01 31 CA
4/26/2009 13:30:27.595 [TX] - 02 04 00 00 00 01 31 F9
4/26/2009 13:30:28.096 [TX] - 03 04 00 00 00 01 30 28
4/26/2009 13:30:28.596 [TX] - 04 04 00 00 00 01 31 9F
```

10.2.2.14 SaveProgramOptions

Saves the current Docklight program options (everything that can be adjusted in the Options dialog) and the active communication window mode (ASCII, HEX, Decimal or Binary) to a file.

Return Value

Void

Syntax

DL.SaveProgramOptions *filePathName*

The **SaveProgramOptions** method syntax has these parts:

Part	Description
filePathName	Required. String containing the file path (directory and file name) of the Docklight settings file create. If no directory is specified, Docklight uses the current working directory. If *filePathName* is an empty string, a file dialog will be displayed to choose a file.

Remarks

A file created with **SaveProgramOptions** can be loaded using LoadProgramOptions. **SaveProgramOptions** creates XML files (.xml file extension).

SaveProgramOptions and **LoadProgramOptions** are very useful to ensure that Docklight uses specific display and time stamp settings for executing your Docklight script. This is great for automated testing tools that are intended for other users, who are not familiar with Docklight. You can prepare the appropriate display representation (e.g. HEX mode only) and make sure other users will receive the same display output as you did.

NOTE: Communication needs to be stopped (see StopCommunication) before using **SaveProgramOptions** or **LoadProgramOptions**.

Example

```
' Example SaveProgramOptions
DL.StopCommunication
DL.SaveProgramOptions "myFavoriteSettings"
DL.Quit
```

Now make some changes in the Docklight Options, or change the communication window, e.g. by selecting the Decimal tab. Then run the following script:

```
' Example LoadProgramOptions
DL.LoadProgramOptions "myFavoriteSettings"
```

Docklight will now revert to the display settings used before.

10.2.2.15 SetChannelSettings

Change the current communication channel settings: provide a new COM port number or TCP/IP address, or change the serial port settings (baud rate, parity settings, ...).

Serial port settings can be changed on-the-fly, while the communication channel is open. For other changes, e.g. the COM port number itself, StopCommunication must be called before using **SetChannelSettings**.

NOTE:

Return Value

Boolean

Syntax

result **= DL.SetChannelSettings(** *newSettings* **[,** *channelNo***] [,** *dontTest***])**

The **SetChannelSettings** method syntax has these parts:

Part	Description
newSettings	Required. String with the new communication channel and/or the serial settings. See below for detailed specification
channelNo	Optional. Integer value that specifies the communication channel if Communication Mode: Monitoring is used. Default value is 1 (Channel 1).
dontTest	Optional. Boolean value. If *dontTest* is set to True, **SetChannelSettings** does not open and close the communication channel for testing purposes. See the "Remarks" section below. Default value is False (channel is tested to determine return value).

The *newSettings* argument accepts the following values:

Value	Description
"COM*xxx*"	Select new serial communication port, e.g. "COM7"
"*RemoteHost*:*RemotePort*"	Make this channel a TCP client and connect to the specified IP address and TCP port number, e.g. "192.0.0.1:3001" (see Projects Settings)
"SERVER:*LocalPort*"	Make this channel a TCP server, accepting connections on the specified TCP port, e.g. "SERVER:3001" (see Projects Settings)
"UDP:*RemoteHost*:*Port*"	Makes this channel a UDP peer, transmitting data to *RemoteHost*:*Port* and listening to the local *Port* (see Projects Settings)
"USBHID:*vendorId*:*productId*"	USB HID input / output report access (see Projects Settings).
"PIPE:*myNamedPipe*"	Client connection to a Named Pipe with read/write access (see Projects Settings).
"COM*xxx*:*BaudRate*,*Parity*, *DataBits*,*StopBits*"	Select new serial port and serial communication settings *Parity* can be NONE, EVEN, ODD, MARK, SPACE. Example: "COM18:9600,EVEN,8,1"
"*BaudRat*,*Parity*,*DataBits*, *StopBits*"	Changing the serial settings without knowing/changing the current serial port. Example: "38400,NONE,8,1"
"*BaudRat*,*Parity*,*DataBits*, *StopBits*,*FlowControl* ,*ParityErrorChar*"	Extended syntax to additionally change the hardware flow control options:

	FlowControl can be OFF, RTSCTS, XONXOFF, RTSSEND *ParityErrorChar*: The decimal ASCII code for the Parity Error Character (see Projects Settings). Default value is 63. Example: "9600,NONE,8,2,RTSCTS,35"
">"	Find the next serial COM port available on this PC. If the currently selected port is COM1, **SetChannelSettings** will start searching at COM2.

Remarks

For most applications it is not necessary to use **SetChannelSettings** or its companion, GetChannelSettings. Communication parameters can be chosen in the Project Settings dialog, and stored in the Docklight project file (see Saving and Loading Your Project Data and the Open Project method).

The **SetChannelSettings** method is intended for advanced Docklight Scripting applications, where control of the communication channel settings during script runtime is required. It allows you to create scripts that access different COM ports (see example below), or walk through a list of IP addresses.

SetChannelSettings method will produce an error, if an illegal value is passed with *newSettings*.

If the *newSettings* argument is valid (and the *dontTest* flag is not set), the communication channel will be opened and closed again immediately for a test.

If *dontTest* is True, **SetChannelSettings** will not open/close the channel for testing, and return always True. This is useful in networking applications, where additional connect/disconnect attempts might confuse the other host/device. Problems have been experienced for example with Telnet server applications.

The return value of **SetChannelSettings** is True, if the channel could be successfully opened (or the new settings are ok and *dontTest* is true).
The return value is False, if the settings are invalid or an error occurred while trying to access the port (e.g. the COM port already in use, or the Firewall denied the TCP/IP access).

NOTE: Modifying the *FlowControl* parameter when Project Settings: Flow Control is other than "Off" can result in undefined behavior.

See also GetChannelSettings and GetChannelStatus.

Example

```
' Example SetChannelSettings / GetChannelSettings
' (requires Docklight in Send/Receive mode)

DL.ClearCommWindows

DL.AddComment "Searching for first COM port available on this
PC..."
portAvailable = DL.SetChannelSettings("COM1:9600,NONE,8,1")
While Not portAvailable
    oldPort = DL.GetChannelSettings()
    ' try next COM port
    portAvailable = DL.SetChannelSettings(">")
    newPort = DL.GetChannelSettings()
```

```
    ' tried out already all COM ports on this PC?
    If (oldPort = newPort) Then
        DL.AddComment "No COM port available"
        DL.Quit
    End If
Wend
DL.AddComment "Using COM port " & DL.GetChannelSettings()

' Try a few different baud rates
baudRatesStr = "9600,14400,57600,115200"
baudRatesArray = Split(baudRatesStr, ",")
For i = 0 To UBound(baudRatesArray)
    ' Tweak the serial port settings
    DL.SetChannelSettings(baudRatesArray(i) + ",NONE,8,1")
    DL.AddComment
    DL.AddComment
    DL.AddComment "Testing with settings " &
DL.GetChannelSettings()
    ' Send a modem test command and allow some waiting time for
the answer
    DL.StartCommunication
    DL.SendSequence "", "ATI3" + Chr(13) + Chr(10)
    DL.Pause 200
    DL.StopCommunication
Next
```

After running the script on a computer with a built-in modem on COM3, the Docklight communication window could look like this:

```
 Searching for first COM port available on this PC...
 Using COM port COM3:9600,NONE,8,1


 Testing with settings COM3:9600,NONE,8,1

28.01.2008 16:28:36.26 [TX] - ATI3<CR><LF>

28.01.2008 16:28:36.26 [RX] - ATI3<CR>
<CR><LF>
Agere SoftModem Version 2.1.46<CR><LF>
<CR><LF>
OK<CR><LF>


 Testing with settings COM3:14400,NONE,8,1

28.01.2008 16:28:37.46 [TX] - ATI3<CR><LF>

28.01.2008 16:28:37.46 [RX] - ATI3<CR>
<CR><LF>
Agere SoftModem Version 2.1.46<CR><LF>
<CR><LF>
OK<CR><LF>


 Testing with settings COM3:57600,NONE,8,1

28.01.2008 16:28:38.60 [TX] - ATI3<CR><LF>
```

```
28.01.2008 16:28:38.60 [RX] - ATI3<CR>
<CR><LF>
Agere SoftModem Version 2.1.46<CR><LF>
<CR><LF>
OK<CR><LF>


 Testing with settings COM3:115200,NONE,8,1

28.01.2008 16:28:39.73 [TX] - ATI3<CR><LF>

28.01.2008 16:28:39.73 [RX] - ATI3<CR>
<CR><LF>
Agere SoftModem Version 2.1.46<CR><LF>
<CR><LF>
OK<CR><LF>
```

10.2.2.16 SetContentsFilter

Use a different **Contents Filter** setting than the one defined in the Project Settings - Communication Filter dialog.

Return Value

Void

Syntax

DL.SetContentsFilter *newContentsFilter*

The **SetContentsFilter** method syntax has these parts:

Part	Description
newContentsFilter	Required. Integer value to select the new filter: 0 = Show all original communication data (channel 1 and channel 2) 1 = Show channel 1 or [TX] data only 2 = Show channel 2 or [RX] data only 3 = Hide all original serial data, show additional comments only

Remarks

After the script execution has ended, the **Contents Filter** is set to the original project setting defined in Project Settings - Communication Filter.

Example

```
' Requires the Docklight basic example project "PingPong" and a
loopback on the chosen
' communication channel
DL.OpenProject "PingPong"
DL.ClearCommWindows
DL.SendSequence "Ping"
DL.Pause 50
DL.AddComment vbCrLf + "SetContentsFilter(1) " :
DL.SetContentsFilter(1)
DL.Pause 50
```

```
DL.AddComment vbCrLf + "SetContentsFilter(2) " :
DL.SetContentsFilter(2)
DL.Pause 50
DL.AddComment vbCrLf + "SetContentsFilter(3) " :
DL.SetContentsFilter(3)
DL.Pause 50
```

After running the script, the Docklight communication window could look like this:

```
7/30/2012 17:42:31.322 [TX] - 2D 2D 2D 2D 6F 20 50 69 6E 67
7/30/2012 17:42:31.326 [RX] - 2D 2D 2D 2D 6F 20 50 69 6E 67
 "Ping" received
7/30/2012 17:42:31.350 [TX] - 6F 2D 2D 2D 2D 20 50 6F 6E 67
7/30/2012 17:42:31.352 [RX] - 6F 2D 2D 2D 2D 20 50 6F 6E 67
 "Pong" received
7/30/2012 17:42:31.499 [TX] - 2D 2D 2D 2D 6F 20 50 69 6E 67
SetContentsFilter(1)
 "Ping" received
7/30/2012 17:42:31.523 [TX] - 6F 2D 2D 2D 2D 20 50 6F 6E 67
 "Pong" received
7/30/2012 17:42:31.547 [TX] - 2D 2D 2D 2D 6F 20 50 69 6E 67
 "Ping" received
7/30/2012 17:42:31.572 [TX] - 6F 2D 2D 2D 2D 20 50 6F 6E 67
 "Pong" received
7/30/2012 17:42:31.594 [TX] - 2D 2D 2D 2D 6F 20 50 69 6E 67
 "Ping" received
7/30/2012 17:42:31.619 [TX] - 6F 2D 2D 2D 2D 20 50 6F 6E 67
SetContentsFilter(2)

7/30/2012 17:42:31.621 [RX] - 6F 2D 2D 2D 2D 20 50 6F 6E 67
 "Pong" received 2D 2D 2D 2D 6F 20 50 69 6E 67  "Ping" received
6F 2D 2D 2D 2D 20 50 6F 6E 67  "Pong" received 2D 2D 2D 2D 6F
20 50 69 6E 67  "Ping" received 6F 2D 2D 2D 2D 20 50 6F 6E 67
 "Pong" received
SetContentsFilter(3)
 "Ping" received  "Pong" received  "Ping" received  "Pong"
received  "Ping" received  "Pong" received
```

10.2.2.17 SetHandshakeSignals

Sets the RTS and DTR handshake signals. Only allowed when Flow Control: Manual is used.

Syntax

DL.SetHandshakeSignals *rts*, *dtr*

The **SetHandshakeSignals** method syntax has these parts:

Part	Description
rts	Required. Boolean value to set RTS = High (True) or RTS = Low (False)
dtr	Required. Boolean value to set DTR = High (True) or DTR = Low (False)

Remarks

See also the GetHandshakeSignals function for reading the current state of the handshake signals.

SetHandshakeSignals can be used before opening the communication channel to ensure a certain state of the RTS and DTR lines on initialization.

Example

```
' Example SetHandshakeSignals
DL.SetHandshakeSignals true, false
DL.StartCommunication
DL.Pause 1000
DL.SetHandshakeSignals false, true
DL.Pause 1000
```

10.2.2.18 SetUserOutput

Create an additional user output tab in the documentation/script area of the Docklight main window. Add plain text or formatted RTF output to provide visual user feedback and/or menu-style interaction (using GetKeyState).

Syntax

DL.SetUserOutput *text* **[,** *rtfFormat***] [,** *append***] [,** *readFromFile***]**

The **SetUserOutput** method syntax has these parts:

Part	Description
text	Required. Your output to show or add. If *text* is an empty string, the output tab is removed again from the Docklight main window .
rtfFormat	Optional Boolean value. False (Default) = *text* is plain text True = *text* is a valid RTF document, e.g. the contents of a RTF document file.
append	Optional Boolean value. True (Default) = add *text* to the already existing content. False = replace the existing output content with *text* .
readFromFile	Optional Boolean value. False (Default) = *text* contains the actual text or RTF document True = *text* is a file and its contents should be displayed. NOTE: if a file does not exist or cannot be loaded, **SetUserOutput** uses an empty string instead and does not indicate an error.

Remarks

SetUserOutput can help you to create a customized user output or offer menu-style user interactions. An example could be choosing from different predefined tests in an automated device testing rig.

See the **SetUserOutput_Example.pts** example script in the ScriptSamples\Extras\SetUserOutput_Example folder for the different possibilities of loading / adding formatted text.

Example

```
DL.SetUserOutput "" ' clear output
DL.Pause 1000
```

```
DL.SetUserOutput "A good old 'Hello World!'"
DL.Pause 5000
DL.SetUserOutput "... more text ..."
DL.Pause 5000

' You can create your RTF document bits with Windows Wordpad
and
' open the resulting .rtf file with Windows Notepad to see the
RTF code.
rtfExample =
"{\rtf1\ansi\ansicpg1252\deff0{\fonttbl{\f0\fnil\fcharset0
Harlow Solid Italic;}}{\colortbl ;\red75\green172\blue198;}
\cf1\f0\fs32 A Curly Hello!\par}"
DL.SetUserOutput "... something more colorful ..."
DL.SetUserOutput rtfExample, True

DL.Pause 5000
DL.SetUserOutput "The End. Removing output tab soon...", False,
 False
DL.Pause 5000
DL.SetUserOutput ""
```

Example 2 (read RTF file and display)

```
DL.SetUserOutput "C:\mytext.rtf", True, False, True
```

10.2.2.19 SetWindowLayout

Controls the Docklight main window appearance, similar to the menu **Tools > Minimize/Restore...** and the F12 Hot Keys.

Syntax

DL.SetWindowLayout [*layout* **]**

The **SetWindowLayout** method syntax has these parts:

Part	Description
layout	Optional String argument. A combination of the following letters: S - sequence area visible D - doc/script area visible Default value is "SD" - show both the sequence lists and the doc/script area.

Remarks

SetWindowLayout is useful when you have a ready-to-use script/project and the end user should not be distracted by details of your Docklight project and script definitions. By hiding some areas of the Docklight main window, you can put the focus on the Communication Window output, or a SetUserOutput display you created.

Example

```
' Example SetWindowLayout
' show communication window only. No doc/script area, no
Send/Receive Sequence area
```

```
DL.SetWindowLayout ""
DL.Pause 4000
' show communication window and Send/Receive sequence lists,
but no doc/script area
DL.SetWindowLayout "S"
DL.Pause 4000
' show everything (default, same as <layout> = "SD")
DL.SetWindowLayout
```

10.2.2.20 ShellRun

Starts an external application or executes a *Windows* Shell operation.

Return Value

Integer

Syntax 1

result **= DL.ShellRun(***operation*, *file* **[**, *parameters***] [**, *directory***] [**, *showCmd***])**

The **ShellRun** method syntax 1 has these parts:

Part	Description
operation	Required. String which specifies the type of action to be performed, corresponding to the *Windows* ShellExecute lpOperation parameter. Commonly used values are: "open"- opens a file or a folder "print"- prints a file "edit" - launches an editor and opens the file for editing See the *Windows* ShellExecute documentation for more values and documentation.
file	Required. String with the path to the file on which to execute *operation*.
parameters	Optional. String value. If *file* is an executable, command-line arguments can be passed here.
directory	Optional. String value. Defines the working directory for the action. If not used, the current Docklight working directory is used.
showCmd	Optional Integer value. Specifies the application appearance, corresponding to the *Windows* ShellExecute nShowCmd parameter. Default value is: 10 - SW_SHOWDEFAULT other common values are: 0 - SW_HIDE 1 - SW_SHOWNORMAL 2 - SW_SHOWMINIMIZED 3 - SW_SHOWMAXIMIZED

Remarks (Syntax 1)

result contains the return value of *Windows* ShellExecute.

result is **> 32** if successful.

See the example below for a definition of relevant error constants for *result*.

Syntax 2

result = **DL.ShellRun(**"wait<*timeout*>"**, [,** *file*] **[,** *parameters*] **[,** *directory*] **[,** *showCmd*]**)**

The **ShellRun** method syntax 1 has these parts:

Part	Description
"wait<*timeout*>"	Instead of operation as in Syntax 1, use: "wait" - start an external application and wait for it to quit or "wait<*timeout*>", e.g. "wait60000" - start an external application and wait for it to quit, or for the specified timeout in milliseconds to expire.
file *parameters* *directory* *showCmd*	same as in Syntax 1

Remarks (Syntax 2):

The "wait<*timeout*>*"* starts and monitor an external application via Windows ShellExecuteEx, similar to the "open" command of Syntax 1.

The return values in Syntax 2 are different from Syntax 1:

result	**Description**
0	successful
-1	error starting the application
-2	timeout

Example

```
' Example ShellRun
'
' Here is a list of error codes, according to the original C
header file shellapi.h from Windows Kit 8.1:
' regular WinExec() codes */
const SE_ERR_FNF = 2            ' file not found
const SE_ERR_PNF = 3            ' path not found
const SE_ERR_ACCESSDENIED = 5 ' access denied
const SE_ERR_OOM = 8            ' out of memory
const SE_ERR_DLLNOTFOUND = 32
' error values for ShellExecute() beyond the regular WinExec()
codes
const SE_ERR_SHARE = 26
const SE_ERR_ASSOCINCOMPLETE = 27
const SE_ERR_DDETIMEOUT = 28
const SE_ERR_DDEFAIL = 29
const SE_ERR_DDEBUSY = 30
const SE_ERR_NOASSOC = 31

' Example for Syntax 2
DL.AddComment "Open notepad and wait for application end. After
max 60 sec timeout close forcefully:"
DL.AddComment "DL.AddComment DL.ShellRun(" & Chr(34) &
"wait60000" & Chr(34) & ", " & Chr(34) & "notepad.exe" &
Chr(34) & ", " & Chr(34) & "test.txt" & Chr(34) & ")"
DL.AddComment "returns = " & DL.ShellRun("wait60000",
"notepad.exe", "test.txt")
```

```
DL.Pause 1000
' Examples for Syntax 1
DL.AddComment "Ask Windows to open the same file with the
default edit application for .txt files, continue immediately:"
DL.AddComment "DL.ShellRun(" & Chr(34) & "edit" & Chr(34) & ",
" & Chr(34) & "test.txt" & Chr(34) & ")"
DL.AddComment "returns = " & DL.ShellRun("edit", "test.txt")
DL.Pause 3000
DL.AddComment "Open the Docklight web site in the default
browser:"
DL.AddComment "DL.ShellRun(" & Chr(34) & "open" & Chr(34) & ",
" & Chr(34) & "https://docklight.de" & Chr(34) & ")"
DL.AddComment "returns = " & DL.ShellRun("open",
"https://docklight.de")
DL.Pause 3000
DL.AddComment "Open Windows Device Manager:"
DL.AddComment "DL.ShellRun(" & Chr(34) & "open" & Chr(34) & ",
" & Chr(34) & "devmgmt.msc" & Chr(34) & ")"
DL.AddComment "returns = " & DL.ShellRun("open", "devmgmt.msc")
DL.Pause 1000
DL.AddComment "done"
```

10.2.2.21 UploadFile

Opens an existing file and sends out its contents. Starts the communication, if not already running (see StartCommunication).

Return Value

Void

Syntax

DL.UploadFile *filePathName* **[,** *representation***]**

The **UploadFile** method syntax has these parts:

Part	Description
filePathName	Required. String containing the file path (directory and file name) of the file to send. If no directory is specified, Docklight uses the current working directory. If *filePathName* is an empty string, a file dialog will be displayed to choose a file.
representation	Optional. String value to define the format of the *filePathName* file. "A" = ASCII (default): *filePathName* is a text file that is sent out directly, no further parsing. "H" = HEX: *filePathName* contains HEX sequence data, e.g. 5F 54 65 73 74 ... "D" = Decimal: *filePathName* contains Decimal sequence data, e.g. 095 084 101 115 ... "B" = Binary: *filePathName* contains Binary sequence data, e.g. 01011111 01010100 ... "R" = Raw Data: *filePathName* is a binary file that needs that is sent out unmodified.

Remarks

File upload is only possible in Communication Mode Send/Receive.

If *filePathName* does not exist, Docklight reports an error and the script execution is stopped.

The "A" ASCII default representation allows sending text files without further modification. For raw binary data files that need to be sent unmodified, use the "R" (Raw Data) option. It is not to be confused with the "B" (Binary) representation used by Docklight to display data with 0's and 1's only.

You can use the **UploadFile** method to transfer the contents of a Docklight Log file. Please make sure that your log file is in plain text mode (see Log File Settings), and the file contains the raw data only, with no additional comments and no date/time stamps (see Options).

The **UploadFile** method does not support specific compiler output file formats, such as "Intel HEX File". If you have any specific requirements, please contact our e-mail support.

NOTE: The data is sent in blocks of max. 512 bytes. If you send a Send Sequence manually during a file upload, the sequence will be sent between one of these blocks and will corrupt the data transmission.

Example

```
' Example Upload File

' Send a text file
DL.UploadFile "helloworld.txt", "A"

' Send raw binary data file directly
DL.UploadFile "test.dat", "R"

' Parse and send a HEX data file
DL.UploadFile "hexfile.txt", "H"
```

10.2.3 Properties

10.2.3.1 NoOfSendSequences

Returns the number of Send Sequences defined in the current Docklight project.

Return Value

Integer

Syntax

result = **DL.NoOfSendSequences**

Remarks

The **NoOfSendSequences** property is very useful to create loop structures that make use of all Send Sequences available. See the example below.

Example

```
' Example NoOfSendSequences

' Send out all Send Sequences defined, with a 1 seconds delay
' between the individual sequences
For i = 0 To (DL.NoOfSendSequences - 1)
   DL.SendSequence i
   DL.Pause 1000
Next
```

10.2.3.2 NoOfReceiveSequences

Returns the number of Receive Sequences defined in the current Docklight project.

Return Value

Integer

Syntax

result = **DL.NoOfReceiveSequences**

Remarks

See NoOfSendSequences.

10.3 OnSend / OnReceive Event Procedures

Docklight Scripting supports two dedicated procedures that are called by the Docklight Scripting engine before transmitting a new Send Sequence or after detecting a Receive Sequence.

Procedure Definition	Description
Sub DL_OnSend() *... my script code ...* **End Sub**	**DL_OnSend()** is called after a new 'send' operation has been triggered (manual send or DL.SendSequence). Special manipulation functions are available to read out and modify the data before it is actually transmitted. See Send Sequence Data Manipulation.
Sub DL_OnReceive() *... my script code ...* **End Sub**	**DL_OnReceive()** is called after a Receive Sequence has been detected. Special manipulation functions are available to read out and further process the data received. See Evaluating Receive Sequence Data.

The procedures can be defined anywhere in the script code at module-level (not within a class). See Send Sequence Data Manipulation for an example.

NOTE: The **DL_OnSend()** and **DL_OnReceive()** code is only executed while the script is running. Sending a Send Sequence does not automatically execute the related **DL_OnSend()** code. The script must be started manually using the menu **Scripting > Run Script**. Any error during script execution will stop the script and prevent that further **DL_OnSend()** / **DL_OnReceive(**) procedure calls are made.

NOTE: **DL_OnSend()** and **DL_OnReceive()** events are queued and can be processed at a later point. See Timing and Program Flow for more information.

TIP: If your script consist only of the **DL_OnSend()** and **DL_OnReceive()** procedures and nothing else, use a simple endless loop at module-level to prevent the script from terminating immediately. See the Send Sequence Data Manipulation example.

10.3.1 Sub DL_OnSend() - Send Sequence Data Manipulation

To allow additional calculations and algorithms (e.g. checksums) on Send Sequence data, the following procedure can be defined in a Docklight script:

Sub DL_OnSend()
... my script code ...
End Sub

Before sending out a new Send Sequence, the **DL_OnSend()** procedure is called by the Docklight script engine. Inside the **DL_OnSend()** procedure, the following functions are available to read and manipulate the current sequence data:

Function	Description
result = **DL.OnSend_GetSize()**	Returns the send data size / number of characters
result = **DL.OnSend_GetName()**	Returns the name of the Send Sequence to be transmitted. If this is a custom data sequence created by a DL.SendSequence command, the return value is an empty string ("").
result = **DL.OnSend_GetIndex()**	Returns its index within the Send Sequence list. If this is a custom data sequence created by a DL.SendSequence command, the return value is -1.
result = **DL.OnSend_GetData([***representation***])** Syntax 2: *result* = **DL.OnSend_GetData([***representation***] [,** *start***] [,** *length***])**	Returns a string containing the actual send data. *representation* specifies the format of *result*: "A" = ASCII (default), "H" = HEX, "D" = Decimal or "B" = Binary. The data returned does not contain any wildcards. All wildcard positions have already been replaced by actual characters. NOTE: If the original Send Sequence contains '#' wildcards (zero or one character), the length of the **DL.OnSend_GetData()** sequence can be shorter than the original sequence with wildcards. Syntax 2: Returns a string containing a specified number of characters from the data received. *start:* range: 1 .. **DL.OnSend_GetSize()**, or -1 = start at last character, -2 = start at second last character, ... Default value is 1. *length:* number of characters, or -1 = until last character, -2 = until second last character, ... Default value is -1.
DL.OnSend_SetData *newData* **[,** *representation***]**	Replaces the data to be transmitted with the data provided in the *newData* string. *representation* specifies the format of *newData* "A" = ASCII (default), "H" = HEX, "D" = Decimal or "B" = Binary. After exiting the **DL_OnSend()** procedure, Docklight will transmit *newData*, regardless of

	what the original Send Sequence looked like. The *newData* length can be different from the original Send Sequence length. NOTE: If *newData* is an empty string, the transmission of the original Send Sequence is effectively suppressed.
DL.OnSend_Poke *charNo*, *value*	Set the character at position *charNo* to *value*. *value* is the new character as an integer number from 0..255. See also **DL.OnSend_Peek(...)**
result = **DL.OnSend_Peek(** *charNo* **)** Syntax 2: *result* = **DL.OnSend_Peek(** *charNo*, *representation* **)**	Returns one character of the send data as an integer value from 0..255. *charNo* is the position within the send data. Valid *charNo* range: 1 .. **DL.OnSend_GetSize()**, or -1 = start at last character, -2 = start at second last character, ... Syntax 2: Returns a string instead of an integer value. *representation* specifies the format: "A" = ASCII, "H" = HEX, "D" = Decimal or "B" = Binary.

Remarks

Using the **DL.OnSend_GetSize()**, **DL.OnSend_Peek(..)** and **DL.OnSend_Poke** functions, checksum calculations and other algorithms can be easily implemented. See the example below.

The **DL_OnSend()** procedure is only executed while the script is running. While executing the **DL_OnSend()** code, no further communication processing and display updates are performed. To avoid performance and timing problems, keep the execution time low. Avoid nested loops for example, and do not perform time-consuming calculations.

See Timing and Program Flow for some insight on how Docklight handles send data events and executes the **DL_OnSend()** code section.

Example

```
' Example DL_OnSend() event code

' Predefined Send Sequences
' (0) Test: TestX<CR><NUL>

' Endless loop to prevent the script from terminating
immediately
Do
    DL.Pause 1 ' (the pause reduces CPU load while idle)
Loop

Sub DL_OnSend()
    ' Simple checksum: Last byte of sequence
    ' is a checksum on all previous bytes, mod 256
    seqSize = DL.OnSend_GetSize()
    ' we need at least a three-byte sequence
```

```
    If seqSize > 2 Then
        ' instead of the "X" after Test, put a random character
        DL.OnSend_Poke seqSize - 2, 65 + Rnd * 25
        ' calculate a simple checksum on the new sequence
        chksumHex = DL.CalcChecksum("MOD256",
DL.OnSend_GetData("H"), "H", 1, seqSize -1)
        ' Overwrite the last character of the Send Sequence
with the actual checksum value
        DL.OnSend_Poke seqSize, CInt("&h" + chkSumHex)
        ' Using the Peek function for additional documentation
        DL.AddComment vbCrLf & vbCrLf
        DL.AddComment "Checksum on", False, False
        For i = 1 To seqSize - 1
            DL.AddComment " " & DL.OnSend_Peek(i, "H"), False,
False
        Next
        DL.AddComment " is " &  DL.OnSend_Peek(seqSize, "H") &
"(Hex), " & DL.OnSend_Peek(seqSize, "D") & "(Decimal)"
    End If
End Sub
```

After starting the script and manually sending the "Test" sequence twice, the ASCII communication window of Docklight could display the following output:

```
Checksum on 54 65 73 74 53 0D  is 00(Hex), 000(Decimal)

23.06.2015 11:28:31.695 [TX] - 54 65 73 74 53 0D 00

Checksum on 54 65 73 74 4E 0D  is FB(Hex), 251(Decimal)

23.06.2015 11:28:32.568 [TX] - 54 65 73 74 4E 0D FB
```

NOTE: Calculating and Validating Checksums and the Modbus protocol example describe how to calculate and validate common CRCs and other checksums without DL_OnSend() / DL_OnReceive() code. This processing happens before the sequence data is passed to the DL_OnSend() procedure. But if you want to modify your Send Sequence data before sending *and* require a checksum on the modified data, the above example is the correct solution.

10.3.2 Sub DL_OnReceive() - Evaluating Receive Sequence Data

To analyze the Receive Sequence data (e.g. check the actual values received for a wildcard area) or perform additional tasks after receiving the sequence, the following procedure can be defined in a Docklight script:

Sub DL_OnReceive()
... my script code ...
End Sub

After detecting a new Receive Sequence and performing the predefined Actions (add comment, send a sequence, ...), the **DL_OnReceive()** procedure is called by the Docklight script engine. Inside the **DL_OnReceive()** procedure, the following functions are available to read out the Receive Sequence data:

Function	Description
result = **DL.OnReceive_GetSize()**	Returns the received data size / number of characters

result = **DL.OnReceive_GetName()**	Returns the name of the corresponding Receive Sequence.
result = **DL.OnReceive_GetIndex()**	Returns its index within the Receive Sequence list
result = **DL.OnReceive_GetData([***representation***])** Syntax 2: *result* = **DL.OnReceive_GetData([***representation***] [,** *start***] [,** *length***])**	Returns a string containing the actual data received. *representation* specifies the representation of *result*: "A" = ASCII (default), "H" = HEX, "D" = Decimal or "B" = Binary. The data returned does not contain any wildcards. At wildcard positions, the actual characters received are returned. NOTE: If the original Receive Sequence contains '#' wildcards (zero or one character), the length of the DL.OnReceive _GetData() sequence can be shorter than the original sequence with wildcards. Syntax 2: Returns a string containing a specified number of characters from the data received. *start:* range: 1 .. **DL.OnReceive_GetSize()**, or -1 = start at last character, -2 = start at second last character, ... Default value is 1. *length:* number of characters, or -1 = until last character, -2 = until second last character, ... Default value is -1.
result = **DL.OnReceive_GetChannel()**	Returns the communication channel number on which this sequence has been detected. In Communication Mode "Monitoring", the return value is 1 or 2. In Communication Mode Send/Receive, the return value is 2 always (RX channel).
result = **DL.OnReceive_Peek(** *charNo* **)** Syntax 2: *result* = **DL.OnReceive_Peek(** *charNo*, *representation* **)**	Returns one character of the received data as an integer value from 0..255 *charNo* is the position within the received data. Valid *charNo* range: 1 .. **DL.OnReceive_GetSize()**, or -1 = start at last character, -2 = start at second last character, ... Syntax 2: Returns a string instead of an integer value. *representation* specifies the format: "A" = ASCII, "H" = HEX, "D" = Decimal or "B" = Binary.
myDateTime = **DL.OnReceive_GetDateTime()** *milliseconds* = **DL.OnReceive_GetMilliseconds()**	These functions return the actual Docklight date/time stamp when this Receive Sequence was triggered. The result is stored in two separate VBScript standard data types: *myDateTime:* VBScript Date value with the Date/Time in 1 seconds resolution *milliseconds:* Integer value with the corresponding milliseconds information from 0..999

Remarks

The **DL.OnReceive_GetData()** method is a good way to analyze the actual data received when you are using ASCII protocols with printing characters only. If you require the HEX or decimal value of individual characters, you may use the **DL.OnReceive_Peek(..)** function as a convenient alternative. See the DL_OnSend() event procedure for a related example.

The **DL_OnReceive()** procedure is only executed while the script is running. While executing the **DL_OnReceive()** code, no further communication processing and display updates are performed. To avoid performance and timing problems, keep the execution time low. Avoid nested loops for example, and do not perform time-consuming calculations.

DL_OnReceive() procedures are not executed while a Pause or a WaitForSequence method is blocking the program flow. If a Receive Sequence is detected, the DL_OnReceive() call is queued and executed after **Pause** (or **WaitForSequence**) returns. See Example 2 below for a workaround to this problem.

See also Timing and Program Flow for some insight on how Docklight handles receive data events and executes the **DL_OnReceive()** code section.

Example

```
' Example DL_OnReceive() event code
'
' Predefined Send Sequence
' (0) Send Value:
' VALUE=<?><?><CR><LF>
'
' Predefined Receive Sequence
' (0) Value Received:
' VALUE=<?><?><CR><LF>
'
' Run this test on a COM port with a loopback connector
' (TX connected to RX of the same port).

finished = False
DL.ClearCommWindows
Do
    DL.Pause 1 ' (the pause reduces CPU load while idle)
Loop Until finished

Sub DL_OnReceive()
    If DL.OnReceive_GetName() = "Value Received" Then
        DL.AddComment "Value received = " &
DL.OnReceive_GetData("A", 7, -3)
        ' Read the value from the receive data, but only the
changing "value" part
        myValue = Mid(DL.OnReceive_GetData(), 7, 2)
        ' Ensure this is a numeric value
        If IsNumeric(myValue) Then
            ' increase
            myValue = myValue + 1
            If myValue < 100 Then
                ' If the value is still below 100, send it out
again
            newValueStr = CStr(myValue)
```

```
                DL.SendSequence "Send Value", newValueStr
            Else
                DL.AddComment "VALUE=99, stopping..."
                finished = True
            End If
        End If
    End If
End Sub
```

After starting the script and manually sending out a "Send Value" sequence with parameter value "95", the Communication Window could look like this:

```
7/29/2012 15:43:43.823 [TX] - VALUE=95

7/29/2012 15:43:43.826 [RX] - VALUE=95
 Value received = 95

7/29/2012 15:43:43.879 [TX] - VALUE=96

7/29/2012 15:43:43.880 [RX] - VALUE=96
 Value received = 96

7/29/2012 15:43:43.926 [TX] - VALUE=97

7/29/2012 15:43:43.927 [RX] - VALUE=97
 Value received = 97

7/29/2012 15:43:43.977 [TX] - VALUE=98

7/29/2012 15:43:43.978 [RX] - VALUE=98
 Value received = 98

7/29/2012 15:43:44.025 [TX] - VALUE=99

7/29/2012 15:43:44.026 [RX] - VALUE=99
 Value received = 99
 VALUE=99, stopping...
```

Example 2

```
' Example using DL_OnReceive() in code with Pause statements

' Predefined Send Sequence
' (0) Hello:
' Hello<CR><LF>
'
' Predefined Receive Sequence
' (0) Hello:
' Hello<CR><LF>
'
' Run this test on a COM port with a loopback connector
' (TX connected to RX of the same port).

DL.ClearCommWindows
' Get the communication started
started = True
DL.SendSequence "Hello"
```

```
' Wait for about 1 second, but make sure that the
DL_OnReceive() events
' are processed meanwhile
pauseWithEvents 1000
' Stop sending and wait until all data came back properly
started = False
DL.Pause 20
' Data throughput?
DL.AddComment
DL.AddComment "Number of 'Hello' sequences detected: " &
DL.GetReceiveCounter("Hello")

Sub DL_OnReceive()
    If started Then
        myDate = DL.OnReceive_GetDateTime()
        msec = DL.OnReceive_GetMilliseconds()
        DL.AddComment " receive timestamp = " &
DL.GetDocklightTimeStamp(myDate, msec)
        ' Send out the same sequence that has just been
received
        DL.SendSequence DL.OnReceive_GetIndex()
    End If
End Sub

Sub pauseWithEvents(milliseconds)
    ' Unlike the DL.Pause command, this function allows
DL_OnReceive()
    ' statements to be processed while waiting
    startTime = Timer
    While (Timer - startTime) < milliseconds / 1000
        ' consider midnight 'jump' / reset of the Timer
variable
        If Timer < (startTime - 1) Then startTime = startTime -
86400
        DL.Pause 1
    Wend
End Sub
```

After starting the script, Docklight will keep sending and receiving the "Hello" sequence for about 1 second. The total number of sequences sent and received depends on the COM port settings (baud rate), PC speed and Docklight display settings. The Communication Window could look like this:

```
8/1/2012 11:00:41.830 [TX] - Hello<CR><LF>

8/1/2012 11:00:41.834 [RX] - Hello<CR><LF>
  receive timestamp = 8/1/2012 11:00:41.834

8/1/2012 11:00:41.846 [TX] - Hello<CR><LF>

8/1/2012 11:00:41.849 [RX] - Hello<CR><LF>
  receive timestamp = 8/1/2012 11:00:41.849

8/1/2012 11:00:41.861 [TX] - Hello<CR><LF>

...

8/1/2012 11:00:42.825 [TX] - Hello<CR><LF>
```

```
8/1/2012 11:00:42.827 [RX] - Hello<CR><LF>
  receive timestamp = 8/1/2012 11:00:42.827

8/1/2012 11:00:42.839 [TX] - Hello<CR><LF>

8/1/2012 11:00:42.841 [RX] - Hello<CR><LF>
  receive timestamp = 8/1/2012 11:00:42.841

8/1/2012 11:00:42.852 [TX] - Hello<CR><LF>

8/1/2012 11:00:42.855 [RX] - Hello<CR><LF>

 Number of 'Hello' sequences detected: 70
```

Example 3

```
' Example using Sub DL_OnReceive() to wait for ANY sequence

found = False
foundName = ""
foundDate = Now
foundMSec = 0

Do
    DL.Pause 1 ' (the pause reduces CPU load while idle)
Loop Until found

DL.AddComment
DL.AddComment "Sequence received: " & foundName
DL.AddComment "Date/Time received: " &
DL.GetDocklightTimeStamp(foundDate, foundMSec)

Sub DL_OnReceive()
    If Not found Then
        found = True
        foundName = DL.OnReceive_GetName()
        foundDate = DL.OnReceive_GetDateTime()
        foundMSec = DL.OnReceive_GetMilliseconds()
    End If
End Sub
```

10.3.3 OnSend / OnReceive - Timing and Program Flow

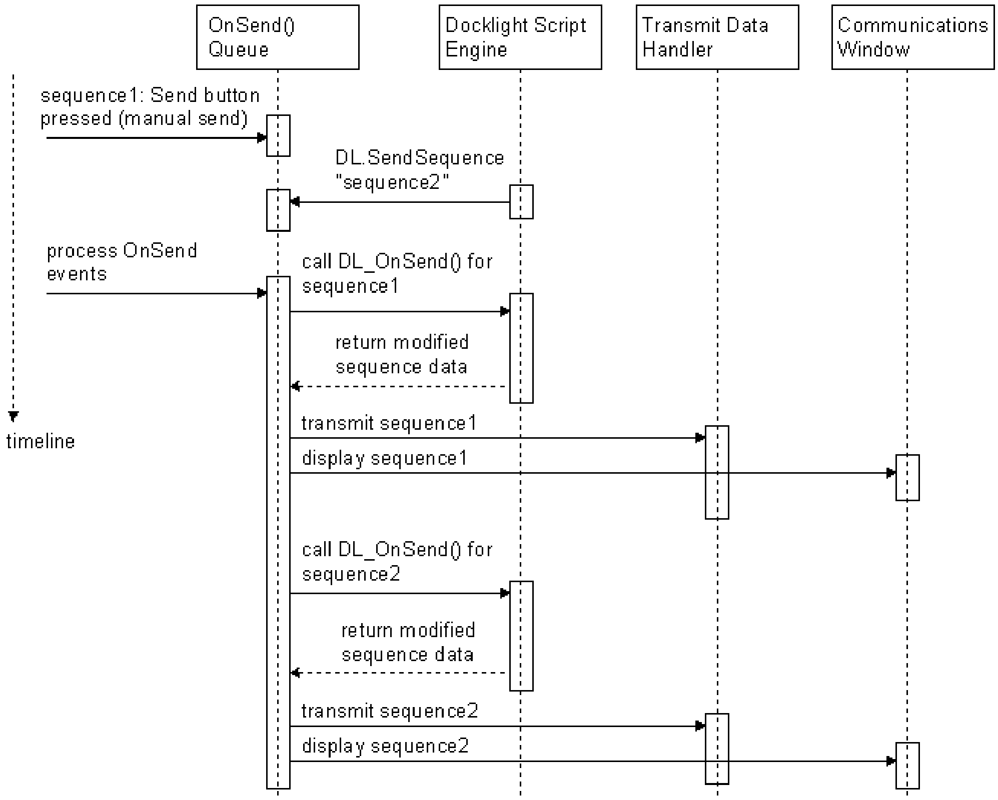
Sub DL_OnSend() Timing

While a script is running, the DL_OnSend() event procedure is executed once for each new Send Sequence. This applies to both, sequences sent by clicking the "Send" button, and DL.SendSequence calls.

The **DL_OnSend()** event procedure is only entered after the current line of script code has been executed. "Send" requests are buffered in the meantime.

The sequence diagram below shows the resulting timing behavior for an example with one 'manual' send request (sequence1), and a second Send Sequence triggered by script code (DL.SendSequence "sequence2").

NOTE: parameter wildcards and checksum fields are processed before the sequence data enters the OnSend() queue.

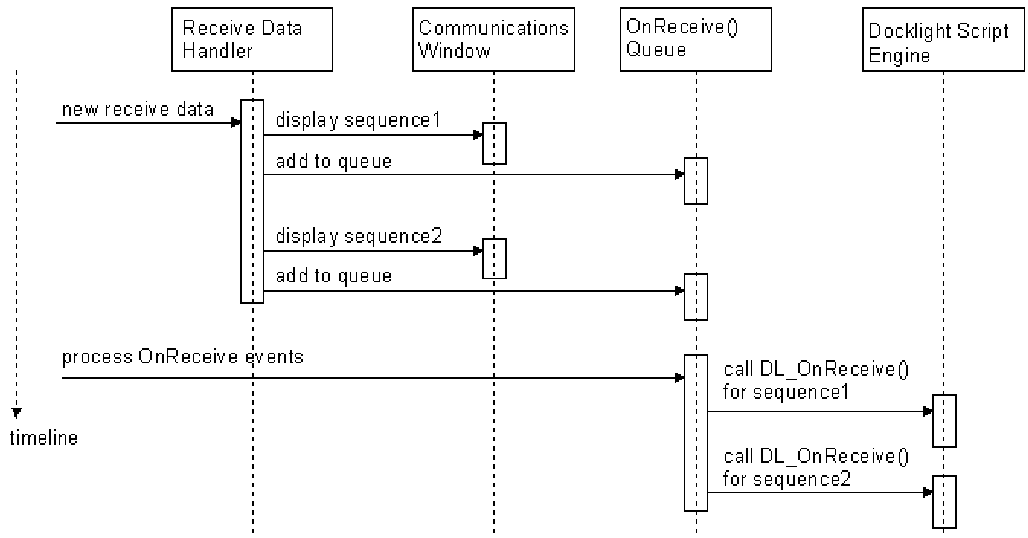


Sub DL_OnReceive() Timing

Similar to **DL_OnSend()**, the DL_OnReceive() event procedure is not executed immediately after Docklight has detected a new Receive Sequence match. Instead, the events are buffered and executed after the current line of script code has been executed.

The sequence diagram below shows the timing for an example where two different Receive Sequences are detected in one go, and the **DL_OnReceive()** code is executed at a later point.

NOTE: Checksum fields are processed in the Receive Data Handler, before the sequence data enters the OnReceive() queue.



10.4 FileInput / FileOutput Objects for Reading and Writing Files

Docklight Scripting provides additional objects than can be used to read a file with text or binary data, or create you own custom output file.

Object Name	Description
FileInput	Open existing files for sequential input, reading the file either character-by-character or line-by-line. See Reading Files.
FileOutput	Create a new file or append data to an existing file. Both binary data as well as text files can be created. See Writing Files.

10.4.1 FileInput - Reading Files

The global **FileInput** object provides an easy interface to process existing files, e.g. for transmitting them on the serial line using additional checksums and formatting.

Methods and properties available for **FileInput**:

Method / Property	Description
FileInput.OpenFile *filePathName* **[**, *rawData***]**	Opens an existing file for input. *rawData* = False (default): Open as a text file. *rawData* = True: Open as a raw binary data file.
FileInput.CloseFile	Closes the file.
result = **FileInput.GetLine()**	Returns a string with the next line of text. *result* does not contain the line break characters (CR / LF). The **GetLine** method can only be used for text files (*rawData* = False).
result = **FileInput.GetByte()**	Returns the next byte.
result = **FileInput.IsOpen**	Returns True if a file is open, False if not.
result = **FileInput.EndOfFile**	Returns True, if all data has been read and the end-of-file mark has been reached.
result = **FileInput.Dialog([***caption***,] [,** *defaultPath***] [,** *fileFilter***])**	Shows a "File Open" dialog and return the chosen file path, or an empty string, if aborted. The default value for *fileFilter* is:

	All Files (*.*)|*.*
result = **FileInput.FileExists(***filePath***)**	Returns True, if *filePath* exists.

Remarks

When a file cannot be opened **FileInput.OpenFile** creates an error and script execution stops. Use **FileInput.FileExists** to check if the file is available.

See also the FileOutput object.

Example

```
' FileInput / FileOutput example

DL.ClearCommWindows

' Create a simple text file
FileOutput.CreateFile "C:\test.txt"
FileOutput.WriteLine "Hello World!"
FileOutput.WriteLine "Goodbye, World!"
FileOutput.CloseFile

' Open the file and print its contents
path = FileInput.Dialog("Open a text for Docklight", "C:\",
"Text Files (*.txt)|*.txt")
If Len(path) > 0 Then
    DL.AddComment "Reading text file..."
    FileInput.OpenFile path
    Do Until FileInput.EndOfFile
        DL.AddComment FileInput.GetLine()
    Loop
    FileInput.CloseFile
End If

' Now try a raw data file
FileOutput.CreateFile "C:\test.bin", True
For i = 0 To 255
    FileOutput.WriteByte i
Next
FileOutput.CloseFile

' And load it...
DL.AddComment
DL.AddComment "Reading raw data file..."
FileInput.OpenFile "C:\test.bin", True
Do Until FileInput.EndOfFile
    DL.AddComment Right("0" + Hex(FileInput.GetByte()), 2) + "
", False, False
Loop
FileInput.CloseFile
```

The above script code produces the following output in the Docklight communication window:

```
Create text file C:\test.txt
Reading text file: C:\test.txt
Hello World!
Goodbye, World!
```

```
 Create binary data file C:\test.txt

 Reading raw data file...
00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F 10 11 12 13 14
15 16 17 18 19 1A 1B 1C 1D 1E 1F 20 21 22 23 24 25 26 27 28 29
2A 2B 2C 2D 2E 2F 30 31 32 33 34 35 36 37 38 39 3A 3B 3C 3D 3E
3F 40 41 42 43 44 45 46 47 48 49 4A 4B 4C 4D 4E 4F 50 51 52 53
54 55 56 57 58 59 5A 5B 5C 5D 5E 5F 60 61 62 63 64 65 66 67 68
69 6A 6B 6C 6D 6E 6F 70 71 72 73 74 75 76 77 78 79 7A 7B 7C 7D
7E 7F 80 81 82 83 84 85 86 87 88 89 8A 8B 8C 8D 8E 8F 90 91 92
93 94 95 96 97 98 99 9A 9B 9C 9D 9E 9F A0 A1 A2 A3 A4 A5 A6 A7
A8 A9 AA AB AC AD AE AF B0 B1 B2 B3 B4 B5 B6 B7 B8 B9 BA BB BC
BD BE BF C0 C1 C2 C3 C4 C5 C6 C7 C8 C9 CA CB CC CD CE CF D0 D1
D2 D3 D4 D5 D6 D7 D8 D9 DA DB DC DD DE DF E0 E1 E2 E3 E4 E5 E6
E7 E8 E9 EA EB EC ED EE EF F0 F1 F2 F3 F4 F5 F6 F7 F8 F9 FA FB
FC FD FE FF
```

10.4.2 FileOutput - Writing Files

The global **FileOutput** object provides an easy interface to create files, e.g. for writing custom data formats.

Methods and properties available for **FileOutput**:

Method / Property	Description
FileOutput.CreateFile *filePathName* **[,** *rawData***] [,** *appendData***]**	Create a new output file. *rawData* = False (default): Open as a text file. *rawData* = True: Open as a raw binary data file. *appendData* = False (default): Overwrite file, if exists. *appendData* = True: Append data to an existing file.
FileOutput.CloseFile	Closes the file.
FileOutput.WriteLine *data* **[,** *appendLineBreak***]**	Write the string *data* to the file. *appendLineBreak* = True (default): Append a CR / LF line break after the *data* string *appendLineBreak* = False: don't create a line break The **WriteLine** method can only be used for text files (*rawData* = False).
FileOutput.WriteByte *data*	Write the byte *data* to the file.
result = **FileOutput.IsOpen**	Returns True if a file is open, False if not.
result = **FileOutput.Dialog([***caption***] [,** *defaultPath***] [,** *fileFilter***])**	Shows a "File Save" dialog and return the chosen file path, or an empty string, if aborted. The default value for *fileFilter* is: `All Files (*.*)|*.*`
result = **FileOutput.FileExists(***filePath***)**	Returns True, if *filePath* exists.

Remarks

When **FileInput.CreateFile** cannot open the file, it produces an error and script execution stops.

See the FileInput object for an example.

10.4.3 Multiple Input Files / Multiple Output Files

If you require to read or write more than one file at a time, you can open up to 4 input files and 4 output files simultaneously, using additional global objects besides **FileInput** and **FileOutput**. The list of available objects is:

Object Name	Description
FileInput **FileInput2** **FileInput3** **FileInput4**	Open up to 4 different files for reading. See Reading Files.
FileOutput **FileOutput2** **FileOutput3** **FileOutput4**	Open up to 4 different files for writing. See Writing Files.

Example

```
' Multiple file output

' Create 4 text files
DL.AddComment "Writing 4 text files simultaneously..."
FileOutput.CreateFile "file1.txt"
FileOutput2.CreateFile "file2.txt"
FileOutput3.CreateFile "file3.txt"
FileOutput4.CreateFile "file4.txt"
' Write simultaneously
For i = 1 To 10
    FileOutput.WriteLine "File 1: Text line " & CStr(i)
    FileOutput2.WriteLine "File 2: Text line " & CStr(i)
    FileOutput3.WriteLine "File 3: Text line " & CStr(i)
    FileOutput4.WriteLine "File 4: Text line " & CStr(i)
Next
' Close all 4 files
FileOutput.CloseFile
FileOutput2.CloseFile
FileOutput3.CloseFile
FileOutput4.CloseFile
DL.AddComment "Done!"
```

10.5 Side Channels - Using Multiple Data Connections

Docklight Scripting offers a set of advanced script methods for basic multichannel applications. It allows you to create up to 8 secondary data connections for sending and receiving data, in extension to the main Docklight communication channels.

The additional / secondary data connections are called side channels. They are controlled via the OpenSideChannel / CloseSideChannel methods. To transmit data on a side channel, the DirectSend method is used.

10.5.1 OpenSideChannel / CloseSideChannel - Managing multiple channels

The **OpenSideChannel / CloseSideChannel** methods allow using multiple additional data connections in one Docklight Scripting instance. Incoming data from side channels can be distinguished / labeled using the *rxChannelTag* argument Transmitting data on side channels is possible via the DirectSend method.

DL Methods for side channel / multichannel management:

Method	Description
result = **DL.OpenSideChannel(** *newSettings* **[,** *channelNo*] **[,** *rxChannelTag*]**)**	Open a side communication channel using the communication channel settings from *newSettings*. *channelNo* = 3 (default) or 4-10 *rxChannelTag* = "Channel3" (default): RX data from this channel will be tagged like this: `<Channel3>`*... data received on this side channel...* `</Channel3>` *rxChannelTag* = "norx": The received communication data is not displayed at all. *rxChannelTag* = "" (empty string): No channel tags are used and you cannot distinguish the incoming data from "regular" Docklight RX data. *result* = True: Successfully opened the channel. *result* = False: Channel could not be opened, e.g. settings invalid or COM port not available.
DL.CloseSideChannel [*channelNo*]	Closes the side channel.

Remarks

The side channels depend on the main connection status and vice versa:

- OpenSideChannel will automatically execute a StartCommunication, if required.
- CloseSideChannel only closes the specified side channel. Other communication channels continue data transfer.
- StopCommunication closes the main communication channels and any open side channels.

See also StartCommunication / StopCommunication.

Example

```
DL.SetChannelSettings "LOCALHOST:10001"
DL.StartCommunication
DL.OpenSideChannel "SERVER:10001"
DL.ResetReceiveCounter
DL.SendSequence "", "Test", "A"
DL.Pause 1000
DL.AddComment "Stop the Channel3. This should cause a TCP
client connection error..."
DL.CloseSideChannel
DL.Pause 4000
' close all channels
DL.StopCommunication
```

The communication window output could look like this:

```
02.10.2019 12:44:23.622 [TX] - Test
02.10.2019 12:44:23.634 [RX] - <Channel3>Test</Channel3> [Channel3]

 Stop the Channel3. This should cause a TCP client connection error...
```

```
02.10.2019 12:44:24.179  DOCKLIGHT reports: Error on channel
LOCALHOST:10001:
TCP/IP connection closed by the remote computer
```

10.5.2 DirectSend

The **DirectSend** method is an alternative to SendSequence for specific applications. The syntax is similar to SendSequence syntax 2 and is used for the following purposes:

- Sending data on side channels - secondary data connections opened using OpenSideChannel.
- Transmitting / injecting additional data, bypassing the OnSend data queue and without adding communication window output. See **Remarks** and **Example 2** below for a practical example.

Syntax

result **= DL.DirectSend** *channelNo***,** *customSequence* **[,** *representation* **]**

The **DirectSend** method syntax has these parts:

Part	Description
channelNo	*channelNo* = 3 - 10: Send data on a side channel (see OpenSideChannel). *channelNo* = 1: Send on Docklight Channel 1 (Send/Receive or Monitoring Mode) *channelNo* = 2: Send on Docklight Channel 2 (Monitoring Mode only)
customSequence	Required. String containing the sequence to send. The sequence is passed in ASCII representation by default. For HEX, Decimal or Binary sequence data, use the optional *representation* argument described below.
representation	Optional. String value to define the format for *customSequence*. "A" = ASCII (default), "H" = HEX, "D" = Decimal or "B" = Binary.

Remarks

result is true, if *channelNo* is valid and the data could be transmitted.

The main application for **DirectSend** is in combination with OpenSideChannel. In addition, **DirectSend** can be useful when you are monitoring a data connection, and you need to inject additional data into the data stream between the two devices. You can effectively change the "passive monitoring" approach in Docklight into a "active monitoring" where Docklight can create e.g. additional fault conditions that do not appear in the original communication.

NOTE: **DirectSend** does not generate any communication window output, and does not use the OnSend data queue. It just transmits your text or binary data "as is".

Example 1

```
' Precondition: Docklight Communication Mode = Send/Receive
DL.StopCommunication
' Use a UDP loopback for Channel 1
DL.SetChannelSettings "UDP:LOCALHOST:10001", 1
```

```
DL.StartCommunication
DL.OpenSideChannel "UDP:LOCALHOST:10002"
DL.DirectSend 1, "TX Data on Channel 1" + vbCrLf
DL.DirectSend 3, "TX Data on side channel" + vbCrLf
' and wait for the reactions
DL.Pause 100
```

The communication window output could look like this:

```
02.10.2019 11:51:26.749 [RX] - TX Data on Channel 1<CR><LF>
<Channel3>TX Data on side channel<CR><LF>
</Channel3>
```

NOTE: The data only appears on the RX data display. No TX communication output is generated.

Example 2

```
' Precondition: Docklight Communication Mode = Monitoring
DL.StopCommunication
DL.SetChannelSettings "UDP:LOCALHOST:10001", 1
DL.SetChannelSettings "UDP:LOCALHOST:10002", 2
DL.StartCommunication
DL.DirectSend 2, "Bounce"
' and let this go on for a while
DL.Pause 1000
```

The communication window output could look like this:

```
02.10.2019 12:03:08.840 [UDP:LOCALHOST:10002] - Bounce
02.10.2019 12:03:08.840 [UDP:LOCALHOST:10001] - Bounce
02.10.2019 12:03:08.841 [UDP:LOCALHOST:10002] - Bounce
02.10.2019 12:03:08.848 [UDP:LOCALHOST:10001] - Bounce
02.10.2019 12:03:08.851 [UDP:LOCALHOST:10002] - Bounce
02.10.2019 12:03:08.864 [UDP:LOCALHOST:10001] - Bounce
```

NOTE: The data is repeatedly reflected between Channel 1 and Channel 2, because we use UDP loopbacks on both ends, and Docklight Monitoring Mode uses Data Forwarding by default.

10.6 Debug Object / Script Debugging

Docklight Scripting offers additional debugging features through the **Debug** object.

Method / Property	Description
Debug.Mode = *newValue*	Sets the script debug mode: *newValue* = 0: No Debugging, all **Debug** methods are ignored. *newValue* = 1: Debug Mode. The **Debug** methods described below are executed.
Debug.Assert *assertCondition*	Breaks the script execution, if *assertCondition* is False. The script execution can be continued manually using the **Continue Script** toolbar.
Debug.Break	Breaks the script execution unconditionally.
Debug.PrintMsg *debugMsg*	Adds an additional debug text to the communication window display, including a date/time stamp and the

	current line of script code.

Remarks

The **PrintMsg** and **Assert** methods are very useful to print and watch variable values at various points of execution.

For the **Debug** methods to have any effect, you need to enable Debug Mode first by setting the **Mode** property to one:

```
Debug.Mode = 1
```

Example

```
' Example Debug object

Debug.Mode = 1

Count = 0
Do
    Count = Count + 1
    ' print some debug information: the value of the count
variable
    Debug.PrintMsg "count = " & count
    ' break script execution when reaching 5
    Debug.Assert (Count <> 5)
Loop Until Count = 10

' now the same thing with debug mode 'off' - Debug methods have
no effect

Debug.Mode = 0
Debug.PrintMsg "this is never printed"
Debug.Break ' this is never executed

DL.AddComment "Debug test ended"
```

After running this script, the communication window could look like this:

```
07.04.2009 15:45:06.078  line #9 Debug: count = 1

07.04.2009 15:45:06.100  line #9 Debug: count = 2

07.04.2009 15:45:06.119  line #9 Debug: count = 3

07.04.2009 15:45:06.131  line #9 Debug: count = 4

07.04.2009 15:45:06.145  line #9 Debug: count = 5

07.04.2009 15:45:06.158  line #11 Debug: Assert is False
```

(here the user manually continues using the **Continue Script** button)

```
07.04.2009 15:45:07.781  line #9 Debug: count = 6

07.04.2009 15:45:07.805  line #9 Debug: count = 7

07.04.2009 15:45:07.830  line #9 Debug: count = 8

07.04.2009 15:45:07.853  line #9 Debug: count = 9
```

```
07.04.2009 15:45:07.881  line #9 Debug: count = 10
 Debug test ended
```

10.7 #include Directive

Instructs the Docklight script preprocessor to insert the contents of the specified file at the point where the **#include** directive appears.

Syntax

#include *filePathName*

The **#include** syntax has these parts:

Part	Description
filePathName	Required. String containing the file path (directory and file name) of the Docklight script file (.pts file) to include. The file extension .pts can be omitted. If no directory is specified, Docklight uses the current working directory.

Remarks

If *filePathName* is not a valid Docklight script file or does not exist, Docklight reports an error and the script is not started.

The **#include** directive tells the preprocessor to treat the contents of a specified file as if those contents had appeared in the source program at the point where the directive appears.

You can organize constant declarations and function definitions into include files and then use **#include** directives to add these definitions to any script. Include files are also useful for incorporating declarations of external variables and complex data types.

Example

```
' Example #include directive
'
#include "myIncludeFile.pts"
DL.AddComment " Pi = " & conPi
```

With **myIncludeFile.pts** containing the following definition:

```
Const conPi = 3.14159265358979
```

The resulting communication window output would look like this:

```
  Pi = 3.14159265358979
```

10.8 Command Line Syntax

The Docklight Scripting application supports command line arguments to load (and run) predefined project or script files. Use the following command syntax:

Docklight_Scripting.exe [-r] [-m] [-i] [*projectPathName.ptp* **]**
[*scriptPathName.pts* **]**

The Docklight scripting command line has these parts:

Part	Description
-r	Optional argument, used in combination with *scriptPathName.pts*. Runs the script immediately. If no run-time error or user stop occurs, the Docklight Scripting application is closed after the script execution ends.
-m	Optional argument. Minimize the Docklight Scripting application window on startup.
-i	Optional argument. Invisible operation / no main window. Useful in combination with the **-r** option and *scriptPathName.pts.*
projectPathName.ptp	Optional. Loads the Docklight project file *projectPathName.ptp*
scriptPathName.pts	Optional. Loads the Docklight script file *scriptPathName.pts*

Remarks

If your script uses the StartLogging or the FileInput / FileOutput interface, and you just provide a file name, but not a complete directory path as a parameter, Docklight Scripting will use the current script / project directory.

Example

```
Docklight_Scripting.exe -r C:\myScript.pts
```

Loads the Docklight script file **C:\myScript.pts** and executes it.

10.9 Dialog: Customize / External Editor

Menu Scripting > Customize / External Editor

Use external application as Docklight Script Editor

Check this option to disable the built-in script editor, and launch an external editor application for this purpose.

A flexible configuration syntax allows you to work with almost any editor that at least supports opening a file using a command line like
`myEditor.exe tempScriptFile.vbs`

Application Control

This configuration file defines how Docklight Scripting controls the external editor.

Load preset for...

Predefined configuration files for three widely available editors.

TIP: We recommend the Notepad++ editor available at https://notepad-plus-plus.org/. The Windows Notepad example is just for illustrative purposes and explains how the configuration files work. You can use it as a starting point for integrating your own editor.

How to integrate your own favorite editor

You can set the application path at the beginning of the configuration file, using the `path=` syntax. Example line:
`path=C:\Program Files\Notepad++`

All following lines of the configuration file have the following syntax:
<Edit Action> <Application Control>

Example line:
```
open: notepad.exe "%FILE%"
```

<*Edit Action*> can be one of the following Docklight editing actions:

Edit Action	Description
`open:`	Open a new script code file
`goto:`	Go to a line number within the script file
`save:`	Save the current file open
`close:`	Close the current file open

<*Application Control*> can be one of the following operations:

Application Control	Description
`sendkeys`	Send one or more keystrokes to the external editor. It uses the same argument syntax as the Windows Script Host SendKeys method. See the related Microsoft documentation for details. Example: `goto: sendkeys +^{HOME}{DOWN %LINE%}+{UP}`
`endtask`	End the external application. Example: `close: endtask`
`activate`	Activate the external application window. Example: `goto: activate`
`sleep`	Wait up to 500 milliseconds to give the external application some extra time to sort things out. This might be necessary when working with the `sendkeys:` operation described above. Example: `open: sleep 100`
Command Line	Besides the above operations, you can execute any Windows command line, e.g. for launching your external editor. Example: `open: notepad++.exe -nosession -lvb -n%LINE% "%FILE%"`

For each <*Edit Action*> you can define several command lines, e.g.
```
goto: sendkeys +^{HOME}{DOWN %LINE%}+{UP}
goto: activate
```

The following wildcards are available for <*Application Control*>

Wildcard	Description
`%FILE%`	Path to a temporary file containing the script code to edit. Docklight Scripting creates and manages the temporary file.
`%FILE_UNIX%`	Same as `%FILE%`, but uses a UNIX-style '/' for the path separator. This is useful for some open source editor packages that have problems with the Windows backslash ('\') separator.
`%FILE_ESC%`	Same as `%FILE%`, but uses a double backslash ('escape sequence') for the path separator. This is necessary e.g. when working with the SciTE free source code editor.
`%LINE%`	The current source code line number. This is used for the `goto:` action.

Remarks

The External Editor Support is a flexible and open solution to our users who are working with large script projects and would prefer to work with a full-featured editing package.

The application control interface offered described above gives you flexibility, but we are aware of the limitations of controlling third-party applications that are not really designed to be controlled from outside.

If you find a smart configuration file for your personal favorite editor, or you are experiencing problems with the above interface, our Customer Support would be happy to hear about it.

Support

11 Support

11.1 Web Support and Troubleshooting

For up-to-date FAQs and troubleshooting information, see our online support pages available at

www.docklight.de/support/

For Docklight-related news and information about free maintenance updates, see:

www.docklight.de/news.htm

11.2 E-Mail Support

We provide individual e-mail support to our registered customers. Please include your Docklight license key number in your request. We will contact you as soon as possible to find a solution to your problem. Send your support request to

support@docklight.de

Appendix

12 Appendix

12.1 ASCII Character Set Tables

Control Characters

Dec	Hex	ASCII Char.	Meaning
0	00	NUL	Null
1	01	SOH	Start of heading
2	02	STX	Start of text
3	03	ETX	Break/end of text
4	04	EOT	End of transmission
5	05	ENQ	Enquiry
6	06	ACK	Positive acknowledgment
7	07	BEL	Bell
8	08	BS	Backspace
9	09	HT	Horizontal tab
10	0A	LF	Line feed
11	0B	VT	Vertical tab
12	0C	FF	Form feed
13	0D	CR	Carriage return
14	0E	SO	Shift out
15	0F	SI	Shift in/XON (resume output)
16	10	DLE	Data link escape
17	11	DC1	XON - Device control character 1
18	12	DC2	Device control character 2
19	13	DC3	XOFF - Device control character 3
20	14	DC4	Device control character 4
21	15	NAK	Negative Acknowledgment
22	16	SYN	Synchronous idle
23	17	ETB	End of transmission block
24	18	CAN	Cancel
25	19	EM	End of medium
26	1A	SUB	substitute/end of file
27	1B	ESC	Escape
28	1C	FS	File separator
29	1D	GS	Group separator
30	1E	RS	Record separator
31	1F	US	Unit separator

Printing Characters

Dec	Hex	ASCII Char.	Meaning
32	20		Space
33	21	!	!
34	22	"	"
35	23	#	#
36	24	$	$
37	25	%	%
38	26	&	&
39	27	'	'
40	28	(	(
41	29	)	)

42	2A	*	*
43	2B	+	+
44	2C	,	,
45	2D	-	-
46	2E	.	.
47	2F	/	/
48	30	0	Zero
49	31	1	One
50	32	2	Two
51	33	3	Three
52	34	4	Four
53	35	5	Five
54	36	6	Six
55	37	7	Seven
56	38	8	Eight
57	39	9	Nine
58	3A	:	:
59	3B	;	;
60	3C	<	<
61	3D	=	=
62	3E	>	>
63	3F	?	?
64	40	@	@
65	41	A	A
66	42	B	B
67	43	C	C
68	44	D	D
69	45	E	E
70	46	F	F
71	47	G	G
72	48	H	H
73	49	I	I
74	4A	J	J
75	4B	K	K
76	4C	L	L
77	4D	M	M
78	4E	N	N
79	4F	O	O
80	50	P	P
81	51	Q	Q
82	52	R	R
83	53	S	S
84	54	T	T
85	55	U	U
86	56	V	V
87	57	W	W
88	58	X	X
89	59	Y	Y
90	5A	Z	Z
91	5B	[	[
92	5C	\	\
93	5D	]	]
94	5E	^	^
95	5F	_	_
96	60	`	`
97	61	a	a
98	62	b	b

99	63	c	c
100	64	d	d
101	65	e	e
102	66	f	f
103	67	g	g
104	68	h	h
105	69	i	i
106	6A	j	j
107	6B	k	k
108	6C	l	l
109	6D	m	m
110	6E	n	n
111	6F	o	o
112	70	p	p
113	71	q	q
114	72	r	r
115	73	s	s
116	74	t	t
117	75	u	u
118	76	v	v
119	77	w	w
120	78	x	x
121	79	y	y
122	7A	z	z
123	7B	{	{
124	7C	|	|
125	7D	}	}
126	7E	~	Tilde
127	7F	DEL	Delete

12.2 Hot Keys

General Hot Keys

Applies to
- Communication Window (ASCII, HEX, Decimal, Binary)
- Edit Send Sequence dialog / Edit Receive Sequence dialog
- Documentation Area

Function	Hot Key
Context-specific help	F1
Cut	Ctrl+X
Copy	Ctrl+C
Paste	Ctrl+V
Delete	Del
Select all	Ctrl+A

Context-specific Hot Keys

Docklight menu

Menu	Function	Hot Key
File	New Project	Ctrl+N

File	Open Project	Ctrl+O
File	Save Project	Ctrl+S
File	Print Communication	Ctrl+P
Edit	Find Sequence in Comm.Window	Ctrl+F
Run	Start Communication	F5
Run	Stop Communication	F6
Tools	Start Comm. Logging	F2
Tools	Stop Comm. Logging	F3
Tools	Keyboard Console On	Ctrl+F5
Tools	Keyboard Console Off	Ctrl+F6
Tools	Minimize/Restore Documentation/Script Area	F12
Tools	Minimize/Restore Sequence Lists	Shift+F12
Scripting	Run Script	Shift+F5
Scripting	Stop Script	Shift+F6
Scripting	Break Script	Shift+F7
Scripting	Continue Script	Shift+F8
Scripting	Save Script	Ctrl+T

Communication Window

Function	Hot Key
Find a Sequence	Ctrl+F
Clear All Communication Windows	Ctrl+W
Toggle Between ASCII, HEX, Decimal and Binary Representation	Ctrl+Tab

Send Sequences / Receive Sequences List

Function	Hot Key
Delete This Sequence	Del
Edit This Sequence	Ctrl+E
Send This Sequence - *Send Sequences List only* -	Space

Edit Send Sequence Dialog / Edit Receive Sequence Dialog

Function	Hot Key
Cancel	Esc
Wildcard '?' (matches one character)	F7
Wildcard '#' (matches one or zero characters)	F8
Function Character '&' (delay for *x* * 0.01 sec.)	F9
Function Character '%' - (Break state)	F10
Function Character '!' (handshake signals)	F11

Documentation Area

Function	Hot Key
Default Font	Ctrl+D

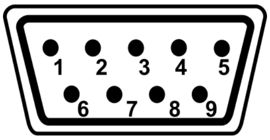
12.3 RS232 Connectors / Pinout

The most common connectors for RS232 communications are

- 9-pole SUB D9 (EIA/TIA 574 standard). Introduced by IBM and widely used. See below.
- 25-pole SUB D25 (RS232-C). This is the original connector introduced for the RS232 standard. It provides a secondary communication channel.
- 8-pole RJ45 (different pinouts for Cisco/Yost wiring, EIA/TIA-561, and other manufacturer-specific pinouts).

RS232 SUB D9 (D-Sub DB9) Pinout

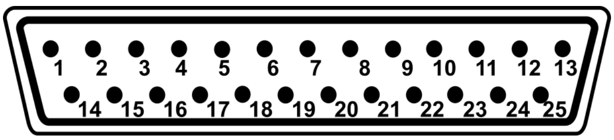
View: Looking into the male connector.
Pinout: From a DTE perspective (the DTE transmits data on the TX Transmit Data line, while the DCE receives data on this line)



Pin No.	Signal Name	Description	DTE in/out
1	DCD	Data Carrier Detect	Input
2	RX	Receive Data	Input
3	TX	Transmit Data	Output
4	DTR	Data Terminal Ready	Output
5	SGND	Signal Ground	-
6	DSR	Data Set Ready	Input
7	RTS	Request To Send	Output
8	CTS	Clear To Send	Input
9	RI	Ring Indicator	Input

RS232 SUB D25 (D-Sub DB25) Pinout

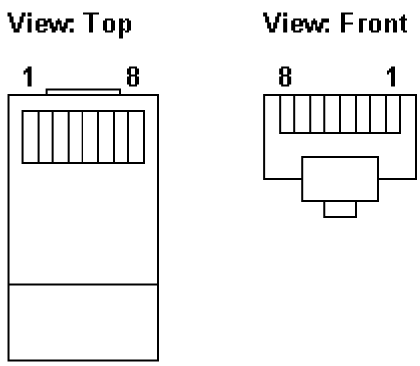
View: Looking into the male connector.
Pinout: From a DTE perspective.



Pin No.	Signal Name	Description
1	-	Protective/Shielding Ground
2	TX	Transmit Data
3	RX	Receive Data
4	RTS	Request To Send
5	CTS	Clear To Send
6	DSR	Data Set Ready
7	SGND	Signal Ground
8	DCD	Data Carrier Detect

9	-	Reserved
10	-	Reserved
11	-	Unassigned
12	SDCD	Secondary Data Carrier Detect
13	SCTS	Secondary Clear To Send
14	STx	Secondary Transmit Data
15	TxCLK	Transmit Clock
16	SRx	Secondary Receive Data
17	RxCLK	Receive Clock
18	LL	Local Loopback
19	SRTS	Secondary Request To Send
20	DTR	Data Terminal Ready
21	RL/SQ	Remote Loopback / Signal Qualify Detector
22	RI	Ring Indicator
23	CH/CI	Signal Rate Selector
24	ACLK	Auxiliary Clock
25	-	Unassigned

RJ45 8-pole pinouts



Several conflicting pinouts exist and are in use for RJ45 connectors in RS232 communications:

Cisco Console / Yost Cable / Rollover cable applications

Pinout: From a DTE perspective (the DTE transmits data on the TX Transmit Data line)

Pin No.	Signal Name	Description
1	CTS	Clear To Send
2	DCD	Data Carrier Detect
3	RX	Receive Data
4	SGND	Signal Ground
5	SGND	Signal Ground
6	TX	Transmit Data
7	DTR	Data Terminal Ready
8	RTS	Request To Send

NOTE: The Cisco/Yost pinout is used with cables that are wired "mirror image" on one end., similar to a Null Modem Cable with Handshaking. Every device has the same RJ45 female socket and transmits data on the same pin. See also the Yost Serial Device Wiring Standard .

EIA/TIA-561 standard for RJ45 / 8P8C modular connector

Pin No.	Signal Name	Description
1	DSR / RI	Data Set Ready / Ring Indicator
2	DCD	Data Carrier Detect
3	DTR	Data Terminal Ready
4	SGND	Signal Ground
5	RX	Receive Data
6	TX	Transmit Data
7	CTS	Clear To Send
8	RTS	Request To Send

NOTE: Though this is an official standard, it is more likely that you will find RS232 RJ45 products with different pinout, either the Cisco/Yost variant above or manufacturer-specific pinouts, e.g. MOXA Nport.

12.4 Standard RS232 Cables

Classic RS232 Connections

When connecting two serial devices, different cable types must be used, depending on the characteristics of the serial device and the type of communication used.

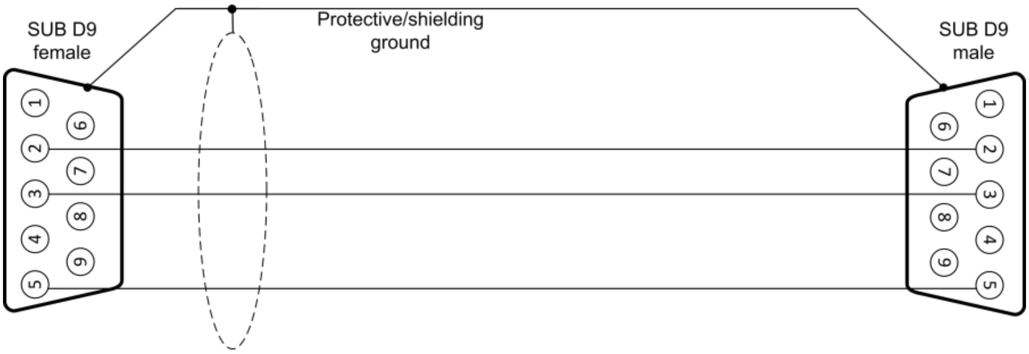
Overview of RS232 SUB D9 (D-Sub DB9) interconnections

serial device 1	serial device 2	flow control (handshaking)	recommended cable
DTE (Data Terminal Equipment)	DTE	no handshake signals	simple null modem cable
DTE	DTE	DTE/DCE compatible hardware flow control	null modem cable with partial handshaking
	DCE (Data Communications Equipment)	no handshake signals	simple straight cable
DTE	DCE	hardware flow control	full straight cable
DCE	DCE	no handshake signals	simple null modem cable, but with SUB D9 male connectors on both ends
DCE	DCE	hardware flow control	null modem cable with partial handshaking but with SUB D9 male connectors on both ends

NOTE: A great alternative to make the correct interconnection between various DTE and DCE type devices is to use the Yost Serial Device Wiring Standard approach by Dave Yost.

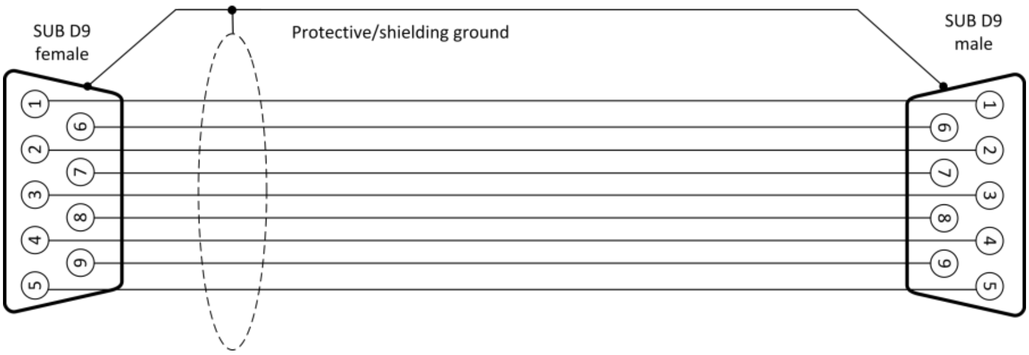
SUB D9 Simple Straight Cable

Area of Application: DTE-DCE Communication where no additional handshake signals are used.



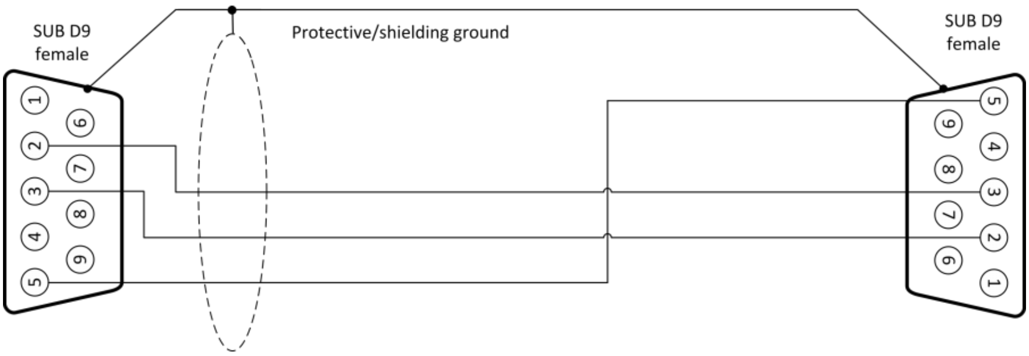
SUB D9 Full Straight Cable

Area of Application: DTE-DCE Communication with hardware flow control using additional handshake signals.



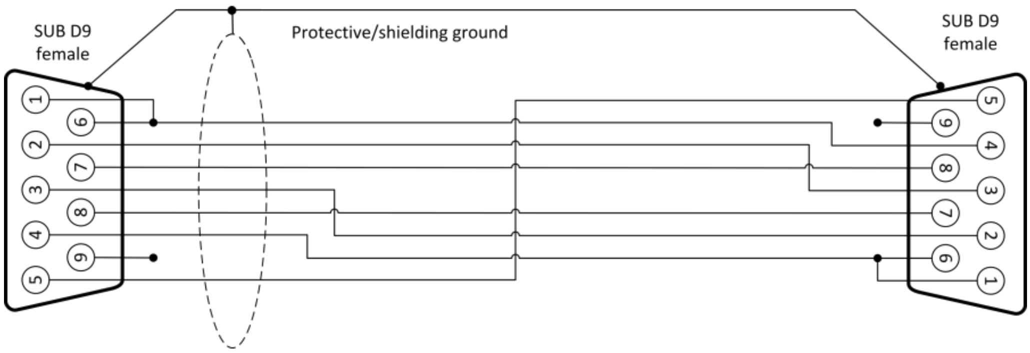
SUB D9 Simple Null Modem Cable without Handshaking

Area of Application: DTE-DTE Communication where no additional handshake signals are used.



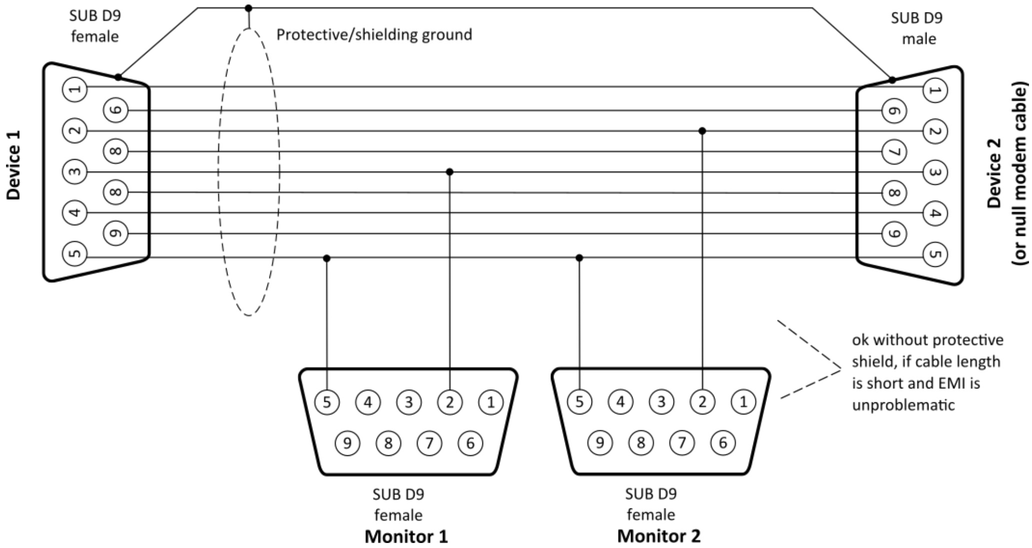
SUB D9 Null Modem Cable with Full Handshaking

Area of Application: DTE-DTE Communication with DTE/DCE compatible hardware flow control. Works also when no handshake signals are used.


SUB D9
female
Protective/shielding ground
SUB D9
female

12.5 Docklight Monitoring Cable RS232 SUB D9

Docklight Monitoring Cable is a RS232 full duplex monitoring cable that is designed for Monitoring serial communications between two devices.



We offer a rugged and fully shielded RS232 Monitoring cable acessory. For more details see our product overview pages and the Docklight Monitoring Cable datasheet.

NOTE: Our Docklight Tap or Tap Pro / Tap RS485 data taps offer superior monitoring characteristics, and do not require two free RS232 COM ports on your PC. Only in rare or legacy applications the Docklight Monitoring Cable is still the preferred choice today.

TIP: An inexpensive and quick solution for basic monitoring can be making your own Monitoring Cable using a flat ribbon cable and SUB D9 insulation displacement connectors, available at any electronic parts supplier.

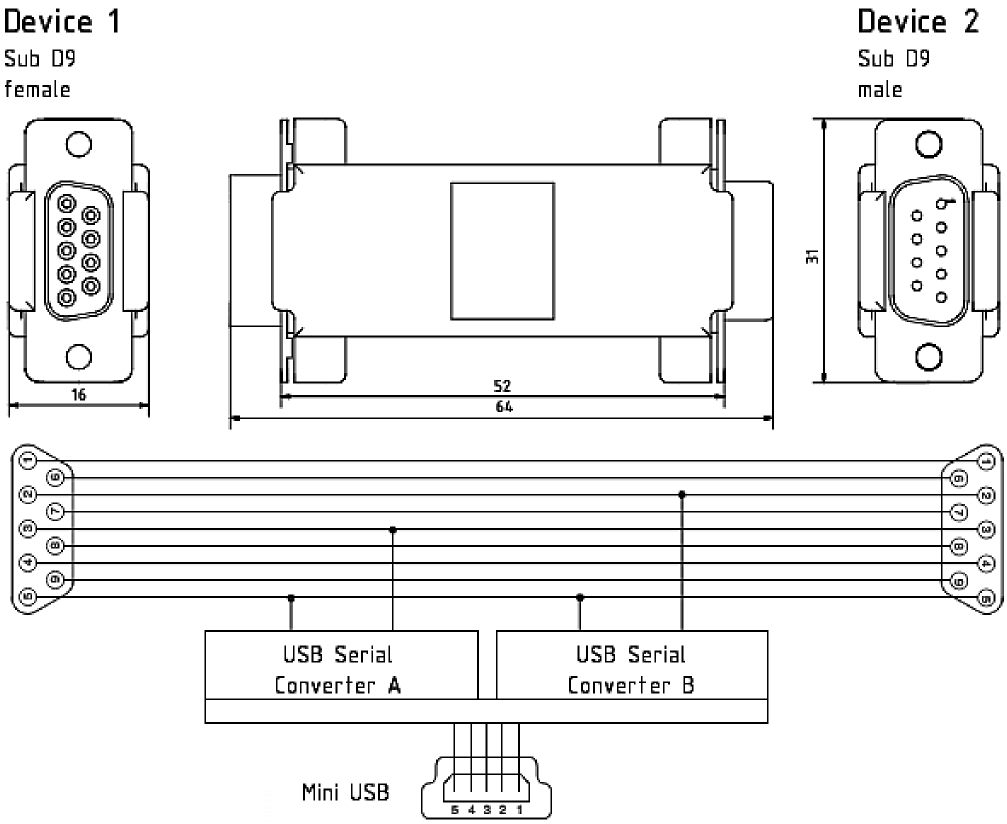
12.6 Docklight Tap

Docklight Tap is a full-duplex RS232 communications monitoring solution for the USB port.

Area of Application: Monitoring serial communications between two devices

Docklight has built-in support for the Docklight Tap. It recognizes the dual port USB serial converter and offers high-speed, low-latency access to the monitoring data. Use Docklight **Monitoring Mode** and Receive Channel settings **TAP0** / **TAP1**. See the Docklight Project Settings and How to Obtain Best Timing Accuracy for details.

Please also see our product overview pages for more information about the Docklight Tap.



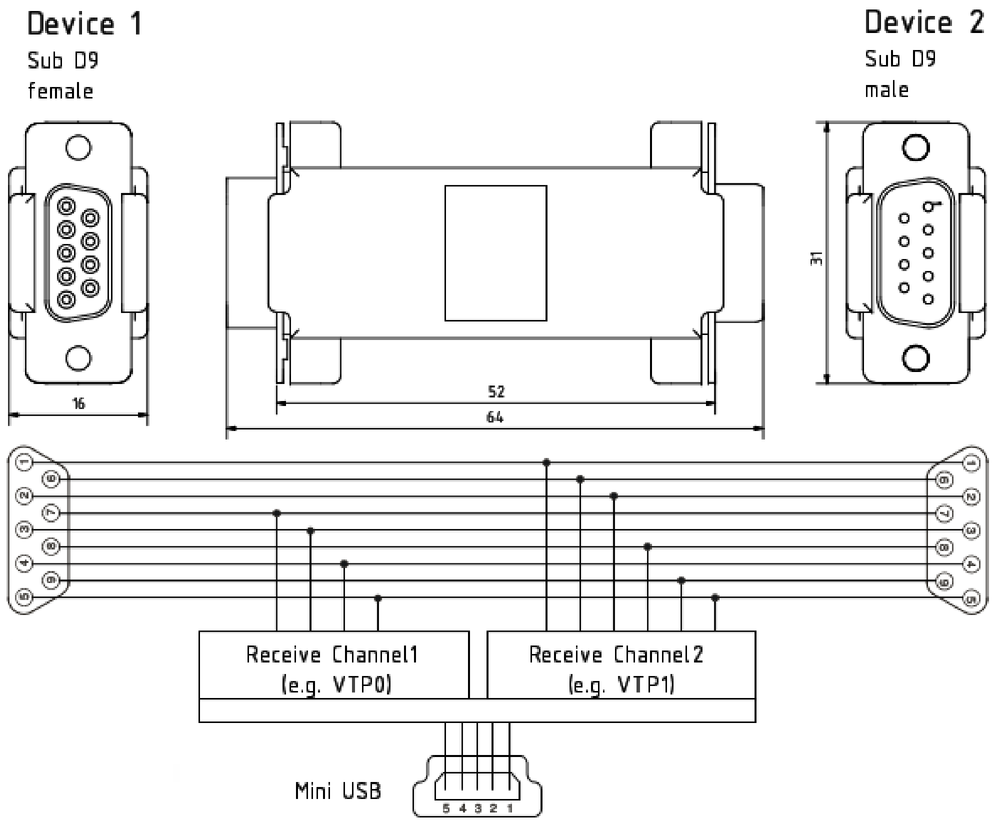
12.7 Docklight Tap Pro / Tap 485

Docklight Tap Pro and Docklight Tap 485 are advanced, high-resolution monitoring solutions for the USB port. They allow true milliseconds time measurements and monitoring high-speed data connections including RS232 status/handshake lines. They are supported by Docklight in a similar way as the Docklight Tap.

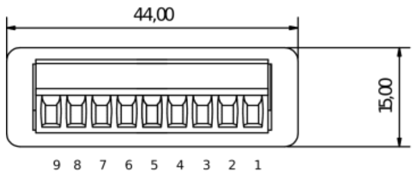
For Docklight Tap Pro and Tap 485 applications, use Docklight **Monitoring Mode** and Receive Channel settings **VTP0** / **VTP1**. See the Docklight Project Settings for more details.

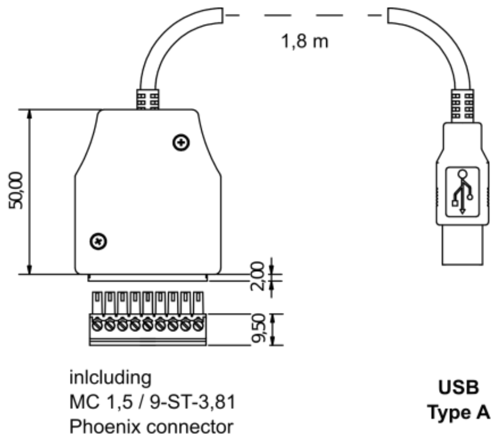
Please also see our product overview pages for more information about the Docklight Tap Pro and Docklight Tap 485.

Docklight Tap Pro



Docklight Tap RS485


44,00
15,00
9 8 7 6 5 4 3 2 1


1,8 m
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MC 1,5 / 9-ST-3,81
Phoenix connector
USB
Type A

Glossary / Terms Used

13 Glossary / Terms Used

13.1 Action

For a Receive Sequence, the user may define an action that is performed after receiving the specified sequence. Possible actions are

- Sending a Send Sequence
  Only Send Sequences without any wildcards can be used
- Inserting a comment
  A user-defined text or an additional date/time stamp is added to the communication data window and log file
- Triggering a Snapshot
- Stopping communication

13.2 Break

A break state on an RS232 connection is characterized by the TX line going to Space (logical 0) for a longer period than the maximum character frame length including start and stop bits. Some application protocols, e.g. LIN, use this for synchronization purposes.

13.3 Character

A character is the basic unit of information processed by Docklight. Docklight always uses 8 bit characters. Nevertheless, the communication settings also allow data transmission with 7 bits or less. In this case, only a subset of the 256 possible 8 bit characters will be used but the characters will still be stored and processed using an 8 bit format.

13.4 CRC

Cyclic Redundancy Code. A CRC is a method to detect whether a received sequence/message has been corrupted, e.g. by transmission errors. This is done by constructing an additional checksum value that is a function of the message's payload data, and then appending this value to the original message. The receiver calculates the checksum from the received data and compares it to the transmitted CRC value to see if the message is unmodified. CRCs are commonly used because they allow the detection of typical transmission errors (bit errors, burst errors) with very high accuracy.

CRC algorithms are based on polynomial arithmetic, and come in many different versions. Common algorithms are CRC-CCITT, CRC-16 and CRC-32. An example of an application protocol that uses a CRC is Modbus over Serial Line.

A popular article about CRCs is "CRC Implementation Code in C" by Michael Barr, formerly published as "Slow and Steady Never Lost the Race" and "Easier Said Than Done":
https://barrgroup.com/Embedded-Systems/How-To/CRC-Calculation-C-Code

Docklight Scripting's CRC functionality (DL.CalcChecksum) was inspired by the above article and the proposed Boost CRC library:
http://www.boost.org/libs/crc/index.html

Last not least, if you are truly fascinated by CRC alchemy, you will sooner or later run into mentions of the following classic article from 1993:
"A Painless Guide to CRC Error Detection Algorithms" by Ross N. Williams:
http://ross.net/crc/crcpaper.html / http://ross.net/crc/download/crc_v3.txt

13.5 DCE

Data Communications Equipment. The terms DCE and DTE refer to the serial devices on each side of an RS232 link. A modem is a typical example of a DCE device. DCE are normally equipped with a **female SUB D9** or SUB D25 connector. See also DTE.

13.6 DTE

Data Terminal Equipment. The terms DCE and DTE refer to the serial devices on each side of an RS232 link. A PC or a terminal are examples of a typical DTE device. DTE are commonly equipped with a **male SUB D9** or SUB D25 connector. All pinout specifications are written from a DTE perspective. See also DCE.

13.7 Flow Control

Flow control provides a mechanism for suspending transmission while one device is busy or for some reason cannot further communicate. The DTE and DCE must agree on the flow control mechanism used for a communication session. There are two types of flow control: hardware and software.

Hardware Flow Control
Uses voltage signals on the RS232 status lines RTS / DTR (set by DTE) and CTS / DSR (set by DCE) to control the transmission and reception of data. See also RS232 pinout.

Software Flow Control
Uses dedicated ASCII control characters (XON / XOFF) to control data transmission. Software flow control requires text-based communication data or other data that does not contain any XON or XOFF characters.

13.8 HID

HID (Human Interface Device) is a device class and API used for USB and Bluetooth devices.

Docklight Scripting supports HID access via VID / PID (vendor ID / product ID) or the full *Windows* USB device path. Docklight Scripting allows binary and text-oriented data transfers via HID Input and Output Reports.

A common application (besides standard *Windows* keyboard/mouse integration) for the HID device class are Embedded Devices with a custom protocol for simple data transfer, e.g. measurement gauges or sensors

TIP: For more information on accessing HID devices via Docklight Scripting, see also our online support resources at www.docklight.de/support/.

NOTE: Docklight Scripting currently only supports HID Input/Output Reports. Feature reports are *not* supported.

13.9 LIN

Local Interconnect Network. A low cost serial communication bus targeted at distributed electronic systems in vehicles, especially simple components like door motors, steering wheel controls, climate sensors, etc. See also the Wikipedia entry about LIN .

13.10 Modbus

Modbus is an application layer messaging protocol that provides client/server communications between devices connected on different types of buses or networks. It is commonly used as "Modbus over Serial Line" in RS422/485 networks, but can be implemented using TCP over Ethernet as well ("Modbus TCP").

Two different serial transmission modes for Modbus are defined: "RTU mode" for 8 bit binary transmissions, and "ASCII mode". "RTU mode" is the default mode that must be implemented by all devices.

See www.modbus.org for a complete specification of the Modbus protocol.

13.11 Multidrop Bus (MDB)

Multidrop Bus (MDB) is a more exotic RS232/RS485 application, used for example in vending machine controllers, which requires a 9 bit compliant UART. The 9th data bit is used for selecting between an ADDRESS and a DATA mode.

A way to monitor and simulate such communication links using standard 8-bit UARTs, i.e. standard RS232-to-USB converters, is to use temporary parity changes.

See also Wikipedia on MDB and the original MDB 3.0 specification for more information and details.

13.12 Named Pipe

A Named Pipe is a shared-memory mechanism that can be used for communication between two processes on a *Windows* PC.

Docklight Scripting can open a client connection to a Named Pipe server and send or receive 8-bit ASCII or byte data.

For details on Named Pipes see the Windows Development Center.

13.13 Receive Sequence

A Receive Sequence is a sequence that can be detected by Docklight within the incoming serial data. A Receive Sequence is specified by
1. an unique name (e.g. "Modem Answer OK"),
2. a character sequence (e.g. "6F 6B 13 10" in HEX format),
3. an action that is triggered when Docklight receives the defined sequence.

13.14 RS232

The RS232 standard is defined by the EIA/TIA (Electronic Industries Alliance / Telecommunications Industry Associations). The standard defines an asynchronous serial data transfer mechanism, as well as the physical and electrical characteristics of the interface.

RS232 uses serial bit streams transmitted at a predefined baud rate. The information is separated into characters of 5 to 8 bits lengths. Additional start and stop bits are used for synchronization, and a parity bit may be included to provide a simple error detection mechanism.

The electrical interface includes unbalanced line drivers, i.e. all signals are represented by a voltage with reference to a common signal ground. RS232 defines two states for the data signals: mark state (or logical 1) and space state (or logical 0). The range of voltages for representing these states is specified as follows:

Signal State	**Transmitter Voltage Range**	**Receiver Voltage Range**
Mark (logical 1)	-15V to -5V	-25V to -3V
Space (logical 0)	+5V to +15V	+3V to +25V
Undefined	-5V to +5V	-3V to +3V

The physical characteristics of the RS232 standard are described in the section RS232 Connectors / Pinout

13.15 RS422

An RS422 communication link is a four-wire link with balanced line drivers. In a balanced differential system, one signal is transmitted using two wires (A and B). The signal state is represented by the voltage across the two wires. Although a common signal ground connection is necessary, it is not used to determine the signal state at the receiver. This results in a high immunity against EMI (electromagnetic interference) and allows cable lengths of over 1000m, depending on the cable type and baud rate.

The EIA Standard RS422-A "Electrical characteristics of balanced voltage digital interface circuits" defines the characteristics of an RS422 interface.

Transmitter and receiver characteristics according to RS422-A are:

Signal State	**Transmitter Differential Voltage V_{AB}**	**Receiver Differential Voltage V_{AB}**
Mark (or logical 1)	-6V to -2V	-6V to -200mV
Space (or logical 0)	+2V to +6V	+200mV to 6V
Undefined	-2V to +2V	-200mV to +200mV

Permitted Common Mode Voltage V_{cm} (mean voltage of A and B terminals with reference to signal ground): -7V to +7V

13.16 RS485

The RS485 standard defines a balanced two-wire transmission line, which may be shared as a bus line by up to 32 driver/receiver pairs. Many characteristics of the transmitters and receivers are the same as RS422. The main differences between RS422 and RS485 are

- Two-wire (half duplex) transmission instead of four-wire transmission
- Balanced line drivers with tristate capability. The RS485 line driver has an additional "enable" signal which is used to connect and disconnect the driver to its output terminal. The term "tristate" refers to the three different states possible at the output terminal: mark (logical 1), space (logical 0) or "disconnected"
- Extended Common Mode Voltage (V_{cm}) range from -7V to +12V.

The EIA Standard RS485 "Standard for electrical characteristics of generators and receivers for use in balanced digital multipoint systems" defines the characteristics of an RS485 system.

13.17 Send Sequence

A Send Sequence is a sequence that can be sent by Docklight. A Send Sequence is specified by
1. an unique name (e.g. "Set modem speaker volume"),
2. a character sequence (e.g. "41 54 4C 0D 0A" in HEX format).

There are two ways to make Docklight send a sequence:

- Sending a sequence can be triggered manually by pressing the send button in the Send Sequences list
(see Main Window).
- Sending a sequence may be one possible reaction when Docklight detects a specific Receive Sequence within the incoming data (see Action).

13.18 Sequence

A sequence consists of one or more 8 bit characters. A sequence can be any part of the serial communications you are analyzing. It can consist of printable ASCII characters, but may also include every non-printable character between 0 and 255 decimal.
Example:
ATL2 (ASCII format)
41 54 4C 0D 0A (HEX format)
This sequence is a modem command to set the speaker volume on AT compatible modems. It includes a Carriage Return (0D) and a Line Feed (0A) character at the end of the line.

The maximum sequence size in Docklight is 1024 characters.

13.19 Sequence Index

The Sequence Index is the element number of a Send Sequence within the Send Sequence List, or of a Receive Sequence within the Receive Sequence List. The Sequence Index is displayed in the upper left corner of the Edit Send Sequence or Edit Receive Sequence dialog.

13.20 Serial Device Server

A Serial Device Server is a network device that offers one or more serial COM ports (RS232, RS422/485) and transmits/receives the serial data over an Ethernet network. Serial Device Servers are a common way for upgrading existing devices that are controlled via serial port and make them "network-enabled".

13.21 Snapshot

Creating a snapshot in Docklight means generating a display of the serial communication shortly before and after a Trigger sequence has been detected. This is useful when testing for a rare error which is characterized by a specific sequence. See Catching a specific sequence and taking a snapshot... for more information.

13.22 TCP

Transmission Control Protocol. TCP is, along with UDP, is the main transport-layer protocol used in IP networks. TCP is connection-oriented - before two network hosts can communicate using TCP they must first establish a connection. TCP is a byte stream protocol that guarantees delivery. TCP ensures that data packets are transmitted error-free and in the right order, even if the underlying network is unreliable.

TCP uses port numbers 1-65535 to identify application end-points. Examples of well-known TCP applications and port numbers are FTP (21), TELNET (23), SMTP (25), HTTP (80) and POP3 (110).

13.23 Trigger

A Trigger is a Receive Sequence with the "Trigger" option enabled (see Dialog: Edit Receive Sequence). When the Snapshot function is enabled, Docklight will not produce any output until a trigger sequence has been detected in the serial communication data. See Catching a specific sequence and taking a snapshot... for more information.

13.24 UART

Universal Asynchronous Receiver / Transmitter. The UART is the hardware component that performs the main serial communications tasks:
- converting characters into a serial bit stream
- adding start / stop / parity bits, and checking for parity errors on the receiver side
- all tasks related to timing, baud rates and synchronization

Common UARTs are compatible with the 16550A UART. They include a 16 byte buffer for incoming data (RX FiFo), and a 16 byte buffer for outgoing data (TX FiFo). Usually these buffers can be disabled/enabled using the *Windows* Device Manager and opening the property page for the appropriate COM port (e.g. COM1).

13.25 UDP

User Datagram Protocol. UDP is a transport-layer protocol used in IP networks. UDP is a connectionless protocol - the communication partners do not establish a connection before transmitting data. UDP does not provide reliable or in-order transmissions.

Datagrams can arrive out of order, arrive duplicated, or go missing during transmission. Applications requiring ordered reliable delivery of streams of data should instead use TCP.

UDP is faster than TCP and has advantages for many lightweight or timing-critical network applications. UDP is used for the Domain Name System on the Internet, for streaming media applications like Voice Over IP, and for broadcasting in IP networks.

UDP uses port numbers 1-65535 to identify application end-points. Examples of well-known UDP services and port numbers are DNS (53), TIME (37), and SNMP (161 and 162).

13.26 Virtual Null Modem

A virtual null modem is a PC software driver which emulates two serial COM ports that are connected by a null modem cable. If one PC application sends data on one virtual COM port, a second PC application can receive this data on the second virtual COM port and vice versa.

By using a virtual null modem driver on your PC you can easily debug and simulate serial data connections without the use of real RS232 ports and cables.

Virtual COM connections do not give you the same timing as real RS232 connections and usually do not emulate the actual bit-by-bit transmission using a predefined baud rate. Any data packet sent on the first COM port will appear in the second COM port's receive buffer almost immediately. For most debugging and simulation purposes, this limitation can be easily tolerated. Some virtual null modem drivers offer an additional baud rate emulation mode, where the data transfer is delayed to emulate a real RS232 connection and its limited transmission rate.

For an Open Source *Windows* solution that has been successfully tested with Docklight, see
https://sourceforge.net/projects/com0com/
We recommend the com0com v2.2.2.0 signed x64 version, which we tested successfully *Windows 10* and *Windows 11*:
https://sourceforge.net/projects/com0com/files/com0com/2.2.2.0/com0com-2.2.2.0-x64-fre-signed.zip/download

13.27 Wildcard

A wildcard is a special character that serves as a placeholder within a sequence. It may be used for Receive Sequences when parts of the received data are unspecified, e.g. measurement readings reported by a serial device. Wildcards can also be used to support parameters in a Send Sequence.

The following types of wildcards are available in Docklight:
Wildcard '?' (F7): Matches exactly one arbitrary character (any ASCII code between 0 and 255)
Wildcard '#' (F8): Matches zero or one character. This is useful for supporting variable length command arguments (e.g. a status word) in Send / Receive Sequences. See Checking for sequences with random characters or Sending commands with parameters for examples and additional information.
Other placeholders that allow random data:
Function Character '!' (F12): Bitwise comparison. This is useful if there are one or several bits within a character which should be tested for a certain value. See Function character '^' (F12) - bitwise comparisons for details and an example.