Docklight Pro Monitor

Docklight Pro Monitor User Manual 10/2015

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Welcome to Docklight Pro Monitor

2   Welcome to Docklight Pro Monitor

2.1   Docklight Pro Monitor - Overview

Docklight Pro Monitor is a *Windows* tool for high speed and high resolution serial communications monitoring (RS232, RS422 and RS485).

It is designed to work with the Docklight Tap Pro and Docklight Tap 485 devices. Both, Tap Pro and Tap 485 use their own high resolution hardware time base for all serial data and serial line events monitored.

Key functions include

- **Logging RS232 or RS485/422 serial data** - Serial communication data can be logged and displayed in different representations: ASCII, Hexadecimal, Decimal and Binary. High-speed, flexible output formatting for both binary data and text-based protocols, including control characters.
- **Logging RS232 serial line states** - Status Line / Handshake signals (RTS, DTR, CTS, DSR, DCR, RI) and Break State.
- **High performance and high accuracy monitoring** - real-time data acquisition with milliseconds precision.
- **Real-time filtering** - hide/show logged data by type or source, while the communication is running.

2.2   Typical Hardware Setups

Monitor the communication between PC and device

Connect the Docklight Tap Pro or Docklight Tap 485 hardware between your device and your PC using at least one RS232 cable. Connect the Tap Pro to a PC running Docklight Pro Monitor using a USB cable. This can be the same PC used for communicating with the device.

Once the hardware has been connected, you can start Monitoring Serial Communication.
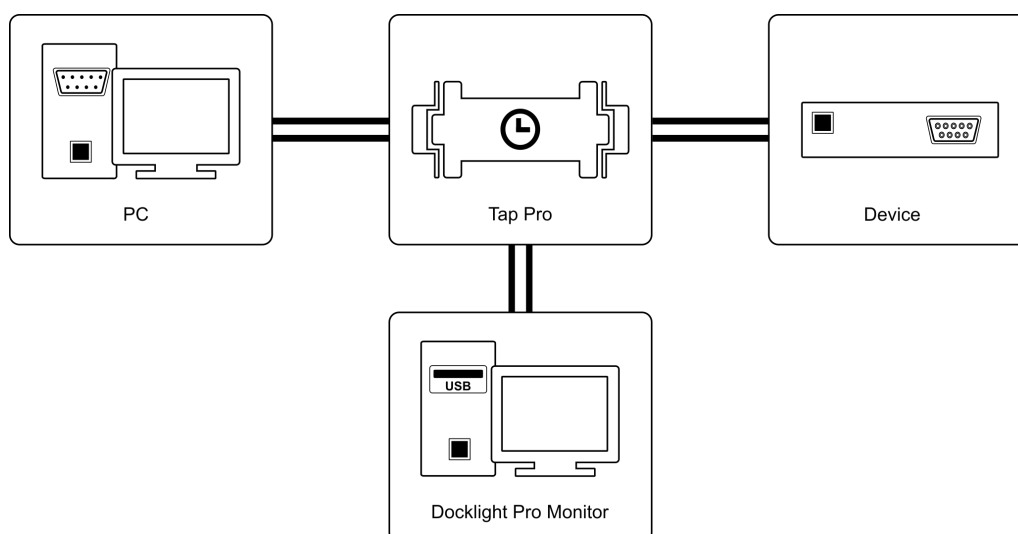
fig.: Monitoring the communication between PC and device

Monitor the communication between two PCs

Connect the Docklight Tap Pro or Docklight Tap 485 hardware between your two PCs using a null modem cable (**!**). This cable is required to crosslink the DTE and DCE lines for inter-PC communication. Connect the Tap hardware to a PC running Docklight Pro Monitor using the USB connection. This can be one of the PCs used for communicating with the device.

Once the hardware has been connected, you can start Monitoring Serial Communication.
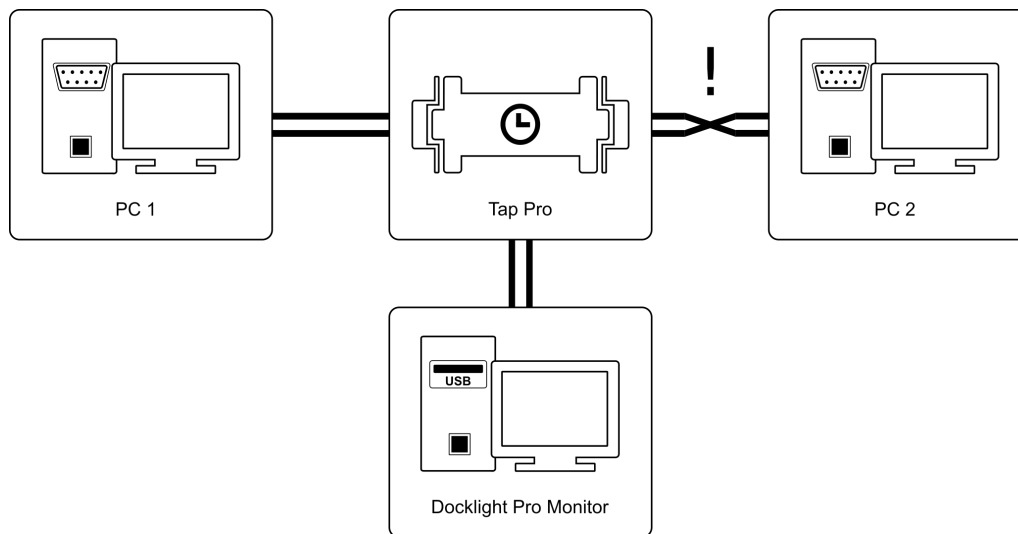
*fig.: Monitoring two PCs (null modem cable necessary **!**)*

2.3   System Requirements

Operating system
- *Windows 10, Windows 8, Windows 7, Windows Vista, Windows XP.*

Hardware requirements
- Docklight Tap Pro or Docklight Tap 485 for high precision serial monitoring

Additional cables may be required for connecting the equipment to be tested. See the Appendix Standard RS232 Cables for a description of these cables.

User Interface

3   User Interface

3.1   Main Window

```
1. Menu:  File  Channels ...

  ┌─────────────────────┐      ┌──────────────────────────────────────┐
  │ 2. Toolbar          │      │ 3. Status                            │
  └─────────────────────┘      └──────────────────────────────────────┘

  ┌─────────────────────┐      ┌──────────────────────────────────────┐
  │ 4. Representation   │      │ 8. Communication Window              │
  └─────────────────────┘      │                                      │
  ┌─────────────────────┐      │ 09:13:03.492 [App, CFG] - Communication started:
  │ 5. Channels         │      │ ....                                 │
  │                     │      │                                      │
  └─────────────────────┘      │                                      │
  ┌─────────────────────┐      │                                      │
  │ 6. Content          │      │                                      │
  │                     │      │                                      │
  └─────────────────────┘      │                                      │
  ┌─────────────────────┐      │                                      │
  │ 7. Format           │      │                                      │
  │                     │      │                                      │
  └─────────────────────┘      └──────────────────────────────────────┘
```
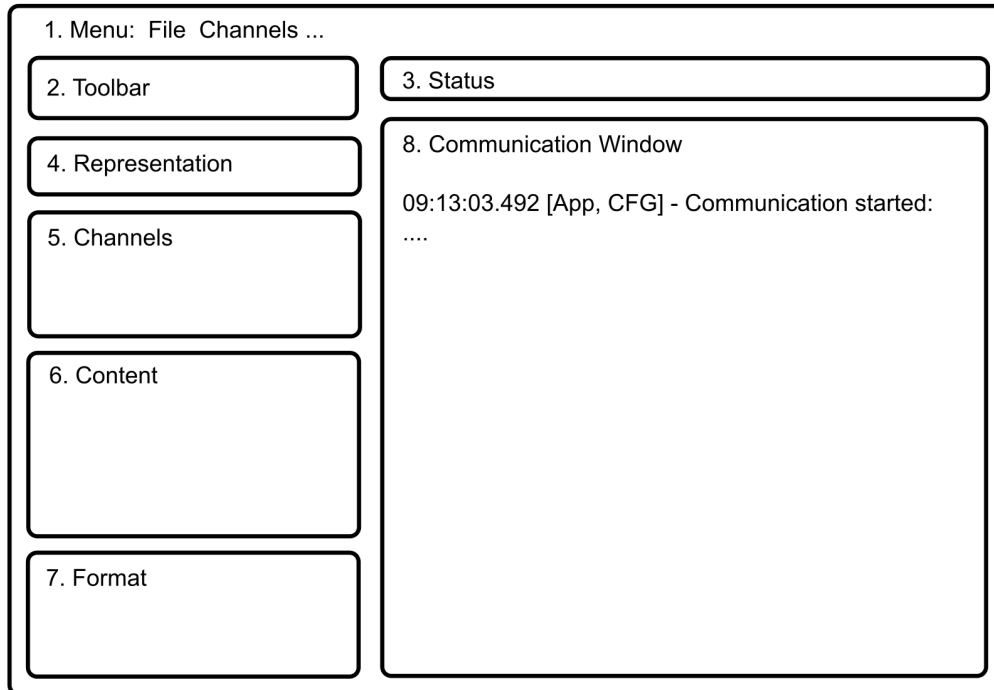
fig.: Main Window Layout

1. Menu bar
Use the File menu to open or save a project containing communication settings. Use the Channels menu to display the channel communication settings dialog. See Dialog: Channel settings and Project Files: Saving and Loading Communication Data.

2. Toolbar
Common Docklight Pro Monitor functions: Start or Stop communication, Clear the communication data, display Options, or Help to access this manual.

3. Status
Displays the current status of communication with the Tap Pro device: Idle, Running, Error, etc.

4. Representation
Possibility to control the format of displayed data: ASCII, Hex, Decimal or Binary.

5. Channels
Shows the current Docklight Tap Pro or Docklight Tap 485 device settings. To change the settings, click on the [...] buttons or by double clicking on any of the displayed settings. See Dialog: Channel settings.

6. Content (filtering)
Show or hide different types of content in the communication window. Content filters can be modified while communication is running. See Main window: Content filter.

7. Format

Configure the timestamp format and the appearance of control characters inside the communication window. Formats can be modified while the communication is running. See Dialog: Options.

8. Communication Window
Displays all communication data and serial line events monitored by Docklight Tap Pro or Docklight Tap 485. Communication data can be copied to clipboard by selecting text with the mouse cursor. See chapter Clipboard for details.

NOTE: The monitored data is stored in a ring buffer. This means that when large amounts of data are monitored, the oldest displayed data will be overwritten. When this happens, the status above the communication window will say "ring buffer mode, overwriting oldest data".

3.2   Clipboard - Copy & Paste

The current Docklight Pro Monitor software does not support logging to file, but *Windows* clipboard operations are fully supported in the Communication Window

To copy the complete monitoring data buffer contents, not just the visible part, use either the **right mouse button** to display context menu or keyboard shortcuts:

- **Ctrl+A** (Select All)

then

- **Ctrl+C** (Copy)

All data is copied in plain text format - colors and fonts are not preserved.

To paste the content to desired application (*Microsoft* Notepad, Word, Excel,...) use either the right mouse button to display context menu of this application or use keyboard shortcut:

- **Ctrl+V** (Paste)

Working with Docklight Pro Monitor

4 Working with Docklight Pro Monitor

4.1 Monitoring RS232 Communication

Hardware Requirements

- A Docklight Tap Pro or Docklight Tap 485 device to tap serial data and status lines from both devices.
- The PC running Docklight Pro Monitor must have the latest Docklight Tap Pro USB drivers installed (see FTDI drivers).
- Device 1 and Device 2 in operational state.
- Correct Cable configuration (see Standard RS232 Cables).
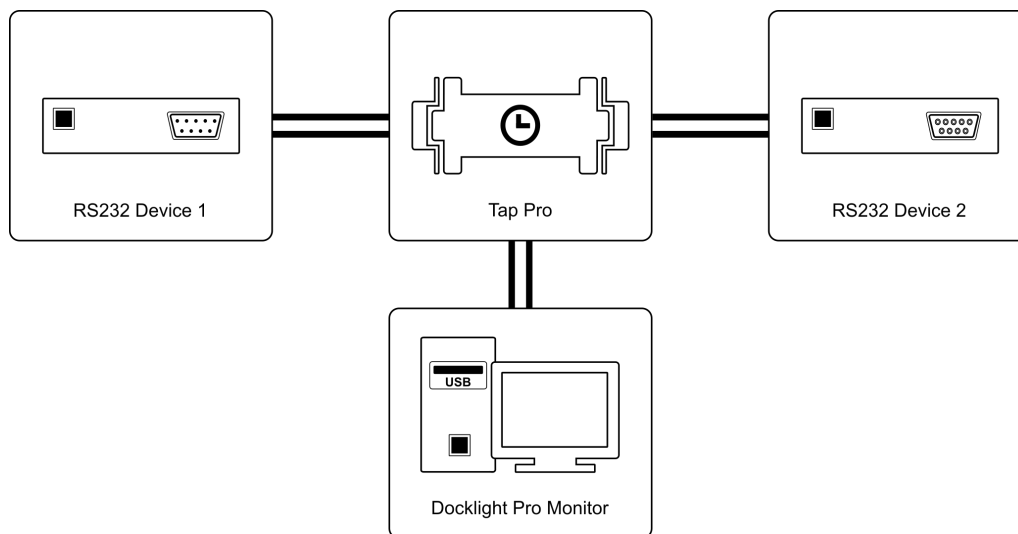

fig.: Monitoring two RS 232 devices

Monitoring the communication

1. Configure the channels according to the communication settings of your device hardware. To display the Channels Settings Dialog, click on the **[...]** button in the Channels section, or choose menu **Channels > Configuration**.

2. Click ▶ **Start** to start the communication. Select filter settings in the content section according to your needs. Your communication window will contain information similar to this:

```
16:34:06.090 [App, CFG] - Communication started: Test PC1 (VTP0), Test
PC2 (VTP1) @ (9600, 8, None, 1)
16:34:06.138 [Status Lines] - RTS=0 DTR=0 CTS=0 DSR=0 DCD=0 RI=0
16:34:10.207 [Status Lines] - RTS=0 DTR=0 CTS=1 DSR=0 DCD=0 RI=1
16:34:10.207 [Status Lines] - RTS=0 DTR=0 CTS=1 DSR=1 DCD=0 RI=1
16:34:15.412 [Status Lines] - RTS=0 DTR=0 CTS=1 DSR=1 DCD=0 RI=1
16:34:15.412 [Status Lines] - RTS=0 DTR=1 CTS=1 DSR=1 DCD=0 RI=1
16:34:15.463 [VTP0] - ----o Ping
16:34:15.491 [VTP1] - o---- Pong
16:34:19.258 [Status Lines] - RTS=0 DTR=0 CTS=1 DSR=1 DCD=0 RI=1
16:34:19.259 [Status Lines] - RTS=0 DTR=0 CTS=1 DSR=1 DCD=0 RI=1
16:34:23.598 [Status Lines] - RTS=0 DTR=0 CTS=1 DSR=0 DCD=0 RI=1
16:34:23.598 [Status Lines] - RTS=0 DTR=0 CTS=0 DSR=0 DCD=0 RI=0
16:34:23.598 [App, CFG] - Communication stopped
```

Example: communication window, ASCII

3. Use the Representation buttons (**ASCII**, **HEX**, **Decimal** or **Binary**) to change the representation of the displayed RX data. For example, change the representation to HEX.

```
16:34:06.090 [App, CFG] - Communication started: Test PC1 (VTP0), Test
PC2 (VTP1) @ (9600, 8, None, 1)
16:34:06.138 [Status Lines] - RTS=0 DTR=0 CTS=0 DSR=0 DCD=0 RI=0
16:34:10.207 [Status Lines] - RTS=0 DTR=0 CTS=1 DSR=0 DCD=0 RI=1
16:34:10.207 [Status Lines] - RTS=0 DTR=0 CTS=1 DSR=1 DCD=0 RI=1
16:34:15.412 [Status Lines] - RTS=0 DTR=0 CTS=1 DSR=1 DCD=0 RI=1
16:34:15.412 [Status Lines] - RTS=0 DTR=1 CTS=1 DSR=1 DCD=0 RI=1
16:34:15.463 [VTP0] - 2D 2D 2D 2D 6F 20 50 69 6E 67
16:34:15.491 [VTP1] - 6F 2D 2D 2D 2D 20 50 6F 6E 67
16:34:19.258 [Status Lines] - RTS=0 DTR=0 CTS=1 DSR=1 DCD=0 RI=1
16:34:19.259 [Status Lines] - RTS=0 DTR=0 CTS=1 DSR=1 DCD=0 RI=1
16:34:23.598 [Status Lines] - RTS=0 DTR=0 CTS=1 DSR=0 DCD=0 RI=1
16:34:23.598 [Status Lines] - RTS=0 DTR=0 CTS=0 DSR=0 DCD=0 RI=0
16:34:30.320 [App, CFG] - Communication stopped
```

Example: communication window, HEX

4. Use the Content Filter settings to show or hide information in the communication window. For protocols that do consider handshake signals states, choosing **Status Lines = Off** will give you a much better overview on the actual information.

```
16:34:06.090 [App, CFG] - Communication started: Test PC1 (VTP0), Test
PC2 (VTP1) @ (9600, 8, None, 1)
16:34:15.463 [VTP0] - 2D 2D 2D 2D 6F 20 50 69 6E 67
16:34:15.491 [VTP1] - 6F 2D 2D 2D 2D 20 50 6F 6E 67
16:34:30.320 [App, CFG] - Communication stopped
```

5. Click ⚙ Options to control how time stamps and control characters are displayed.

6. The logged information can be copied to the clipboard, using **Ctrl+A** (Select All) and **Ctrl+C** (Copy) clipboard operations.

4.2   Monitoring RS422-485 Communication

Hardware Requirements

- A Docklight Tap 485 device to tap serial data and status lines from both devices.
- The PC running Docklight Pro Monitor must have the latest Docklight Tap Pro USB drivers installed (see FTDI drivers).
- Device 1 and Device 2 in operational state.
- Correct wiring configuration (see Tap 485 RS422/RS485 pin assignment).
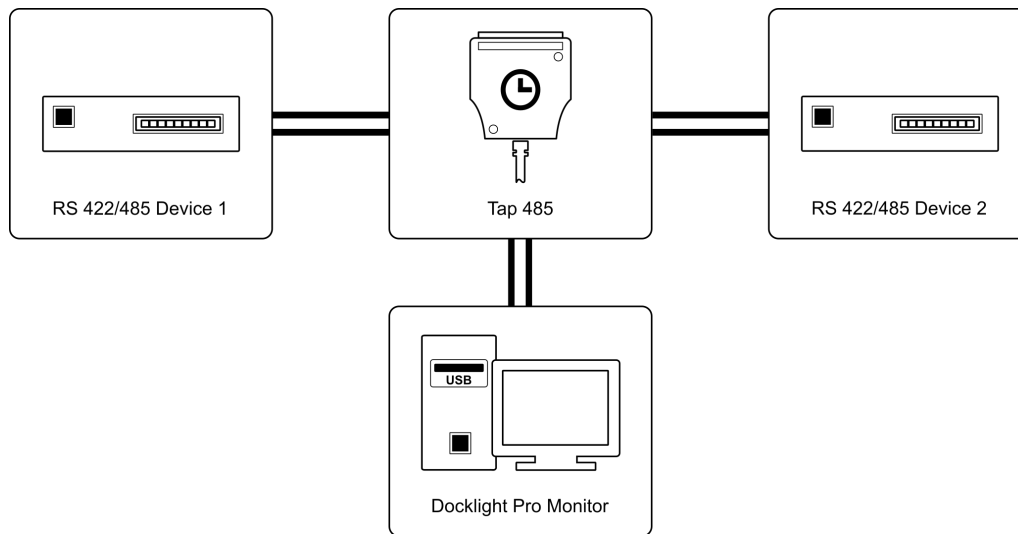
fig.: Monitoring two RS 422, RS485 devices

Monitoring the communication

NOTE: For RS422/RS485, Channel Configuration setting Tap Signal Level = RS422/485 must be used.

Monitoring of RS422 or RS485 communication works same way as described in the chapter Monitoring RS232 Communication.

4.3   Project Files: Saving and Loading Communication Settings

Docklight Pro Monitor remembers the channel configuration and display settings used after closing and re-opening the application. In addition, you can save these settings in a Docklight Pro Monitor project file (.dockzip), using the File menu.

Reference

5   Reference

5.1   Menu

File

New Project
Close the current Docklight Pro Monitor project and create a new one with default communication settings (9600 baud, 8 start bits, 1 stop bit, No Parity).

Open Project
Loads communication settings from a Docklight Pro Monitor project (.dockzip) file.

Save Project / Save Project As...
Save the current communication settings into a Docklight Pro Monitor project (.dockzip) file.

Exit
Quit Docklight Pro Monitor.

Channels

Configure...
Displays the Channel configuration dialog.

5.2   Toolbar

Start   Start logging the Tap data

Stop   Stop logging

Clear   Delete the contents of the communication window

Options
Configure the appearance of the logging information:
- o Date format
- o Time format
- o Display of control characters (ASCII)

5.3   Content Filter

The filters allow to show or hide information in the communication window. You can toggle filters while the communication is running. Content types include:

- Timestamp information. A new time stamp is added for each change in data direction, or with each communication event such as status line changes, or configuration information.
- Configuration Info, e.g. "Communication started", "Communication stopped".
- Data. The two communication data directions can also be filtered individually using the On/Off switches in the **Channels** area.

- Status lines (RTS, DTR, CTS, DSR, DCD, RI)
- Break State
- Errors

NOTE: The communication data buffer and the accumulated communication data is not modified when changing content filter settings. Only the communication window display changes.

5.4   Dialog: Channel Configuration

Configure your Docklight Tap Pro or Docklight Tap 485 serial communication parameters for your RS232, RS422 or RS485 monitoring.

To open the Channel Configuration dialog, click either **Edit (...)** in the Channels section or choose the menu **Channels** -> **Configure**.
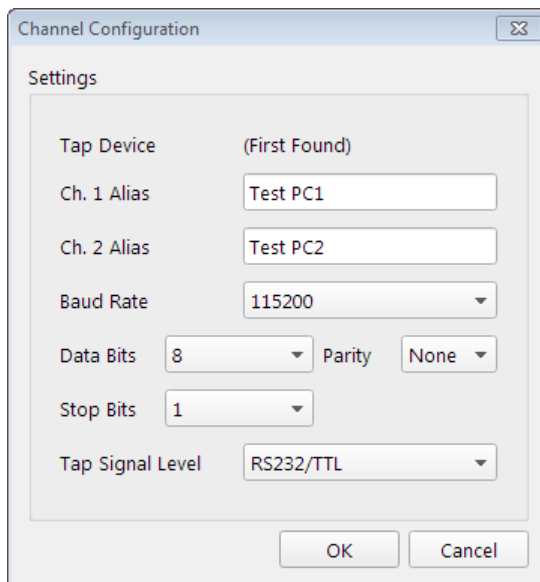
fig.: Channel configuration dialog

Ch. 1 Alias, Ch. 2 Alias

Enter alternative channel names for your data logging to replace the default values: VTP0, VTP1.
Consider the channel mapping:

- Channel 1 (default VTP0) - Tap Pro SUB D9 female side, connects to a DTE (e.g. a PC or a master control device)
- Channel 2 (default VTP1) - Tap Pro SUB D9 male side, connects to a DCE (e.g. a modem device)

Baud Rate
The Docklight Tap Pro and Docklight Tap 485 hardware supports baud rates from 300 bps to 921.6 kps.

Standard baud rates are available from the dropdown list:
300, 600, 1200, 2400, 4800, 9600, 19200, 28800, 38400, 56000, 57600, 115200,

230400, 460800, 921600

Custom baud rates can be typed in directly.

Data Bits, Parity, Stop Bits
Check your serial data link carefully for the correct settings, especially Parity. Standard settings are
8 Data Bits, 1 Stop Bit, Parity = None.

Tap Signal Level
Most applications will work with either standard RS232 voltage levels, or TTL voltage levels. Docklight Tap Pro and Docklight Tap 485 support both 3.3V and 5V TTL.
The RS422/485 setting only applies to Docklight Tap 485.

5.5   Dialog: Options

Date / Timestamp

You can choose the format of date and timestamp in the communication window according to your needs.
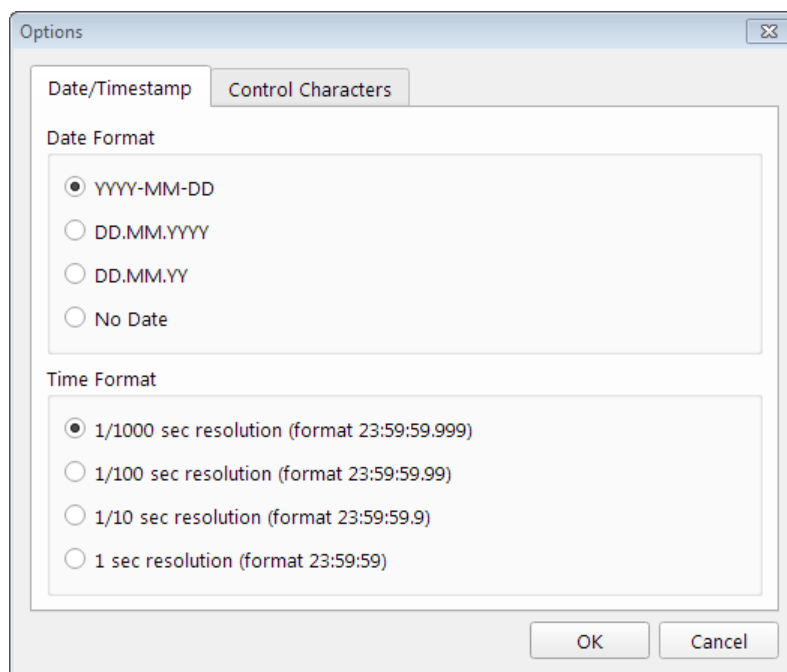
fig.: Options dialog - Date/Timestamp

Control Characters

Non-printable control characters (ASCII code 0-31, see ASCII Character Set Tables) are usually invisible or undefined character in ASCII mode.

To visualize these characters in ASCII mode you can choose following options:
- Activate the character description
- In addition you can suppress the original ASCII interpretation
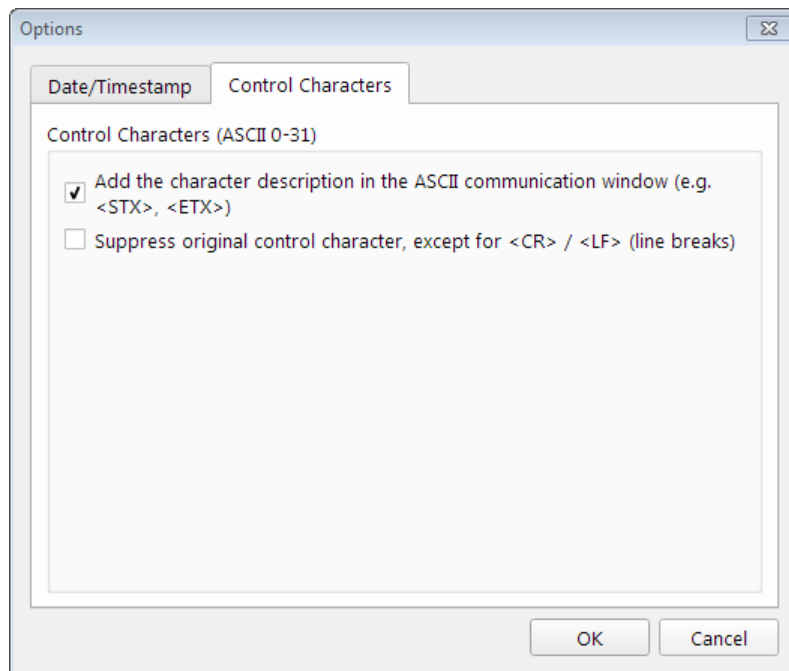
fig.: Options dialog - Control characters

Support

6   Support

6.1   Web Support and Troubleshooting

For up-to-date FAQs and troubleshooting information, see our online support pages available at

http://docklight.de/support/

NOTE: Docklight Pro Monitor is a new member of our Docklight family, so if you cannot find specific information on our website, please do not hesitate to contact us directly.

6.2   E-Mail Support

We provide individual e-mail support to our registered customers. We will contact you as soon as possible to find a solution to your problem. Send your support request to

docklight@fuh-edv.de

Appendix

7 Appendix

7.1 ASCII Character Set Tables

Control Characters

Dec	Hex	ASCII Char.	Description
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.	Description
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	7	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

7.2 RS232 Connectors / Pinout

The most common connector for RS232 is the 9-pole SUB D9 (EIA/TIA 574 standard), introduced by IBM.

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)

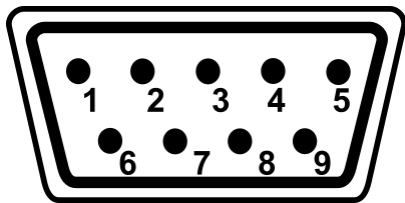*fig.: Sub D9 connector, male*

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

7.3 Standard RS232 Cables

RS232 Connections

When connecting two serial devices, different cable types must be used depending on serial device characteristics and type of communication used.

Overview of RS232 SUB D9 interconnections

Serial Device 1	Serial Device 2	Flow Control (handshaking)	Recommended SUB D9 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 full handshaking
DTE	DCE (Data Communications Equipment)	no handshake signals	simple three line cable
DTE	DCE	hardware flow control	1:1 cable, fully assigned
DCE	DCE	no handshake signals	simple null modem cable, but with SUB D9 male connectors on both ends

Simple Three Line Cable

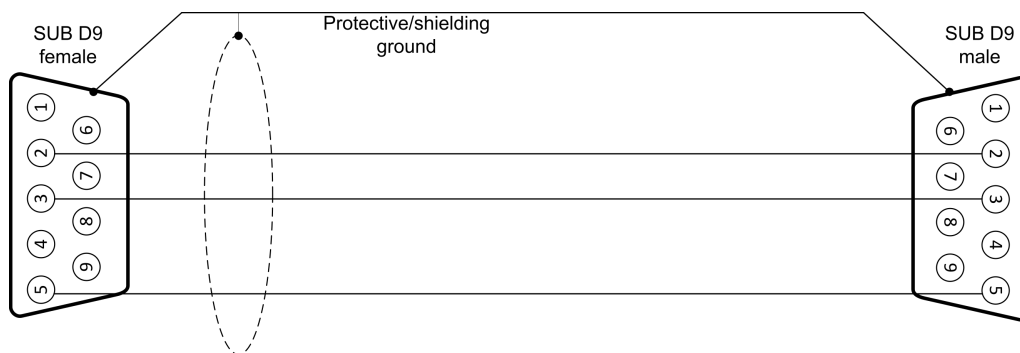Area of Application: DTE-DCE Communication where no additional handshake signals are used.

fig.: SUB D9 Simple Three Line Cable

SUB D9 1:1 Cable, Fully Assigned

Area of Application: DTE-DCE Communication with hardware flow control using additional handshake signals.

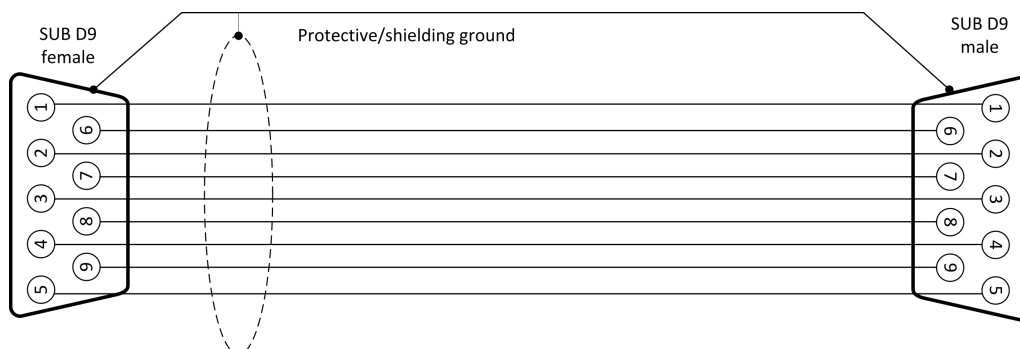fig.: SUB D9 1:1 Cable, fully assigned

SUB D9 Null Modem Cable Without Handshaking

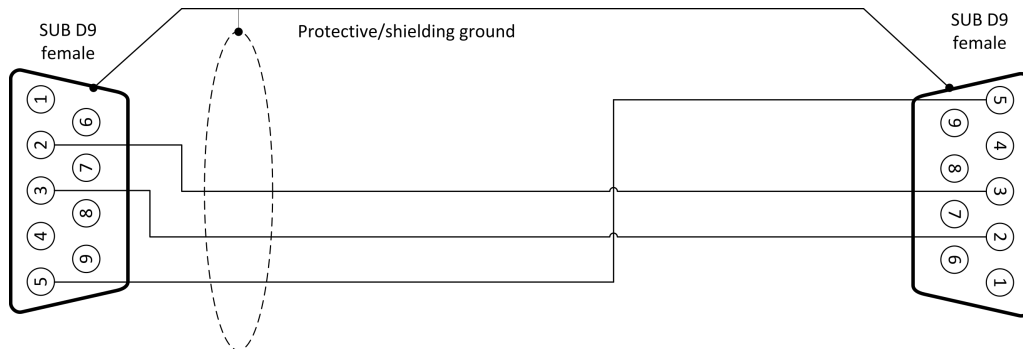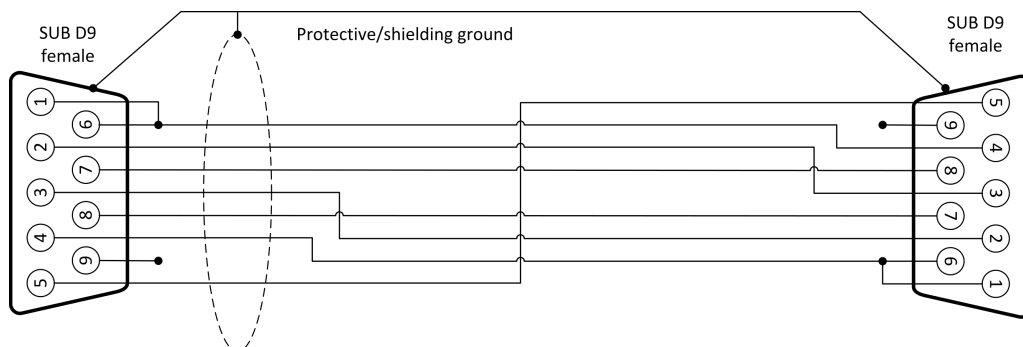Area of Application: DTE-DTE Communication where no additional handshake signals
are used.

fig.: SUB D9 Simple Null Modem Cable Without Handshaking

SUB D9 Null Modem Cable With Full Handshaking

Area of Application: DTE-DTE Communication where also handshake signals are used.

7.4   Docklight Tap Pro

Docklight Tap Pro is an advanced, high-resolution monitoring solution for the USB port.

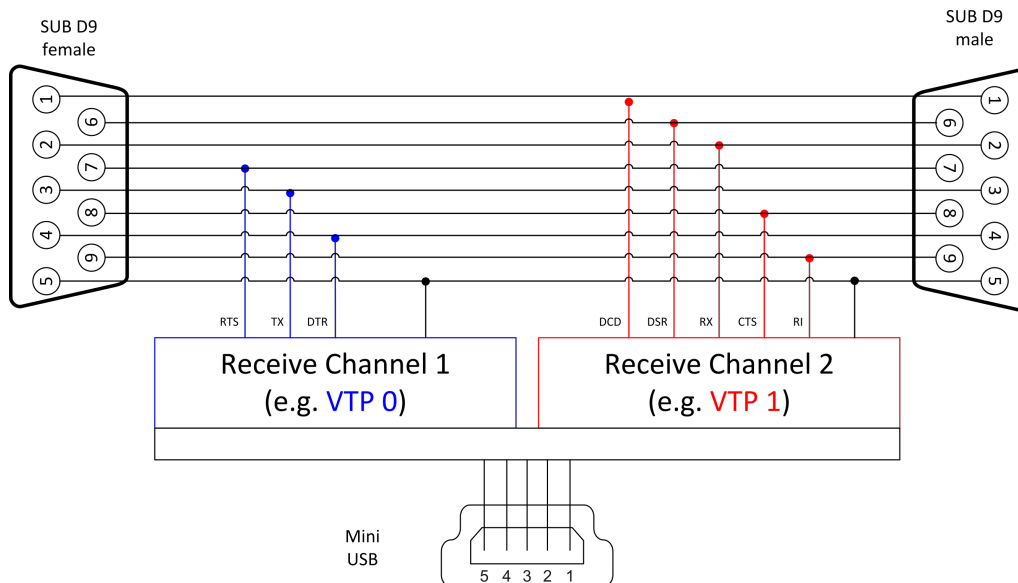Please also see our product overview pages for more information about the Docklight Tap Pro.

fig.: Docklight Tap Pro logic

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**

Monitoring Data Rate:	300 bps to 921.6 kbs
Com Settings Support:	7 / 8 bit data, 1 / 2 stop bits, Odd/Even/Mark/Space/ No Parity
Certifications:	CE approval
Compliances:	RoHS, REACH
Operating temperature:	-40°C to 85°C

7.5   Docklight Tap 485

Docklight Tap 485 is an advanced, high-resolution monitoring solution for RS232, RS422 and RS485 communications. It is equipped with a nine-pole screw terminal connector for the various RS232/422/485 wiring options.

Docklight Tap 485 has the same performance characteristics as the Docklight Tap Pro, but includes RS422/485 differential line receivers (-/+ or A/B)

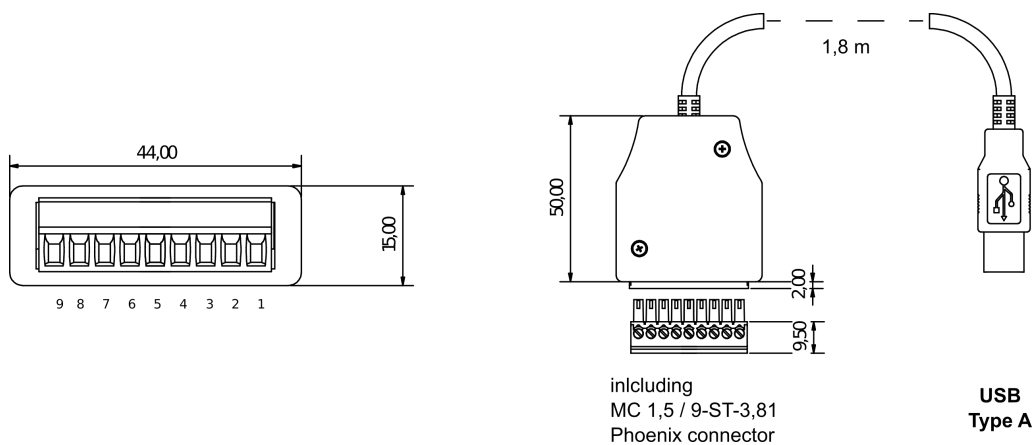Please also see our product overview pages for more information about the Docklight Tap Pro and Docklight Tap RS485.

inlcuding
MC 1,5 / 9-ST-3,81
Phoenix connector

USB
Type A

fig.: Docklight Tap 485

Tap Signal Level : RS232 / TTL

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**

Tap Signal Level : RS422 / 485

Pin No.	Signal Name	Description	DTE in / out
1	TX+	TD B (+), Transmit Data +	**Output**
2	TX-	TD A (-), Transmit Data -	
3	RTS+	Request To Send +	**Output**
4	RTS-	Request To Send -	
5	SGND	Signal Ground	-
6	RX+	RD B (+), Receive Data +	**Input**
7	RX-	RD A (-), Receive Data -	

| 8 | CTS+ | Clear To Send + | **Input** |
| 9 | CTS- | Clear To Send - | **Input** |

Monitoring Data Rate:	300 bps to 921.6 kbs
Com Settings Support:	7 / 8 bit data, 1 / 2 stop bits, Odd/Even/Mark/Space/ No Parity
Certifications:	CE approval
Compliances:	RoHS, REACH
Operating temperature:	-40°C to 85°C

Glossary / Terms Used

8   Glossary / Terms Used

8.1   Break State

A *break state* on a 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.

Docklight Pro Monitor shows break events as information

[VTP0, BRK] - Break detected

Example: Break logging

8.2   Character

A *character* is the basic information unit processed by Docklight Pro Monitor. It always uses one byte(8 bit). Communication settings also allow data transmission with 7 bits or less, but character information will always be stored and processed using in byte format.

8.3   CTS

Clear to send is a control signal for flow control. A receiver raises CTS line to allow the transmitter to send. Raising and lowering of the CTS line allows device drivers with hardware flow control to maintain a reliable data connection between transmitter and receiver.
Refer to RS232 Connector / Pinout for pin assignment.

Docklight Pro Monitor displays handshake information in Status Line Messages:

[Status Lines] - RTS=0 DTR=1 CTS=1 DSR=1 DCD=0 RI=1

Example: Status Lines logging

8.4   DCD

Data Carrier Detect is a status signal most typically used to, e.g. indicate connections between two modems. This "high/low" status bit is sent "from DCE to DTE".

Refer to RS232 Connector / Pinout for pin assignment.

Docklight Pro Monitor displays handshake information in Status Line Messages:

[Status Lines] - RTS=0 DTR=1 CTS=1 DSR=1 DCD=0 RI=1

Example: Status Lines logging

8.5   DCE

Data Communication Equipment. The terms DCE and DTE refer to the serial devices on each side of a RS232 link. A modem is a typical example of a DCE device. DCE are

normally equipped with either **female SUB D9** or SUB D25 connector. See also DTE.

8.6   DSR

Data Set Ready is a control signal to indicate that the terminal is ready to receive data. Refer to RS232 Connector / Pinout for pin assignment.

Docklight Pro Monitor displays handshake information in Status Line Messages:

[Status Lines] - RTS=0 DTR=1 CTS=1 DSR=1 DCD=0 RI=1

Example: Status Lines logging

8.7   DTE

Data Terminal Equipment. The terms DCE and DTE refer to the serial devices on each side of a RS232 link. PCs are typical examples for DTE devices. DTEs are commonly equipped with either **male SUB D9** or SUB D25 connector. All pinout specifications are written from DTE perspective. See also DCE.

8.8   DTR

Data Terminal Ready is a control signal transmitted from DTE (e.g. Terminal PC) to DCE (e.g. modem). DTR indicates that terminal is ready for communication and enables modem to communicate.
Refer to RS232 Connector / Pinout for pin assignment.

Docklight Pro Monitor displays handshake information in Status Line Messages:

[Status Lines] - RTS=0 DTR=1 CTS=1 DSR=1 DCD=0 RI=1

Example: Status Lines logging

8.9   Flow Control

Flow control is a mechanism for regulation of transmission. The DTE and DCE must agree on the flow control mechanism used for communication session. There are two types of flow control:

Hardware Flow Control
Uses voltage signals on the RS232 status lines RTS / DTR (set by DTE) and CTS / DSR (set by DCE) to control transmission and reception of data. See also RS232 pinout.

Docklight Pro Monitor allows you to check all status line changes with milliseconds accuracy.

[Status Lines] - RTS=0 DTR=1 CTS=1 DSR=1 DCD=0 RI=1

Example: Status Lines logging

Software Flow Control
Uses specific ASCII control characters (XON / XOFF) to control data transmission. Software flow control requires text-based communication data or other data not containing any XON or XOFF characters.

8.10   FTDI device drivers

FTDI device drivers are required for using Docklight Tap Pro and Docklight Tap 485.

On Windows 10,8,7 and Windows Vista the driver installation is automated. As soon as Docklight Tap Pro is connected, Windows Update will automatically download and install the drivers.

For Windows XP or any situation where you cannot use Windows Update to obtain the drivers, please use the following download:
http://www.docklight.de/download/Docklight_Tap_Drivers.zip

For additional instructions and installation details for Windows XP, please consult the installation guides on the FTDI website:
http://ftdichip.com/Documents/InstallGuides.htm

8.11   LIN

Local Interconnect Network. A low cost serial communication bus for electronic systems in vehicles, especially simple components like door motors, steering wheel control, climate sensors, etc. See also http://www.lin-subbus.org

8.12   MODBUS

MODBUS is an application layer messaging protocol that provides client/server communication 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 as well be implemented using TCP over Ethernet ("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 http://www.modbus.org for a complete specification of the MODBUS protocol.

8.13   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.

See also Wikipedia on MDB and the original MDB 3.0 specification for more information and details.

8.14   RI

Ring Indicator. This is a signal sent from the DCE to the DTE which indicates to the terminal device: phone line is ringing.
As implemented in PC hardware, a hardware interrupt is generated that can be captured by the processor any time the RI signal changes state. This functionality was originally present in the 8250 UART - the chip responsible for providing the serial port - which was

present in the original IBM PC XT. Virtually all serial hardware for newer PC's, including the popular 16550 UART, has maintained this functionality. Having support for this hardware interrupt means that a program or operating system can be informed of a change in state of the RI pin, without requiring the software to constantly 'poll' the state of the pin.

Refer to RS232 Connector / Pinout for the pin assignment.

Docklight Pro Monitor displays handshake information in Status Line Messages:

[Status Lines] - RTS=0 DTR=1 CTS=1 DSR=1 DCD=0 RI=1

Example: Status Lines logging

8.15 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. 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

8.16 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:

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

8.17 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.

8.18 RTS

Request to send is a control signal used for flow control. A transmitter raises RTS line to enforce an interrupt on receiver side. Raising and lowering of the RTS allows device drivers with hardware flow control to maintain a reliable data connection between transmitter and receiver
Refer to RS232 Connector / Pinout for pin assignment.

Docklight Pro Monitor logs this information in Status Line Messages:

[Status Lines] - RTS=0 DTR=1 CTS=1 DSR=1 DCD=0 RI=1

Example: Status Lines logging

8.19 UART

Universal Asynchronous Receiver / Transmitter. The UART is the hardware component that performs main serial communications tasks:
- converting characters into a serial bit stream
- adding start / stop / parity bits
- checking for parity errors on receiver side
- all tasks related to timing, baud rates and synchronization

Common UARTs are compatible with 16550A UART. They include a 16 byte buffer for incoming data (RX FiFo) as well for outgoing data (TX FiFo). Usually these buffers can be disabled/enabled using *Windows* Device Manager and opening the property page for the

appropriate COM port (e.g. COM1).