

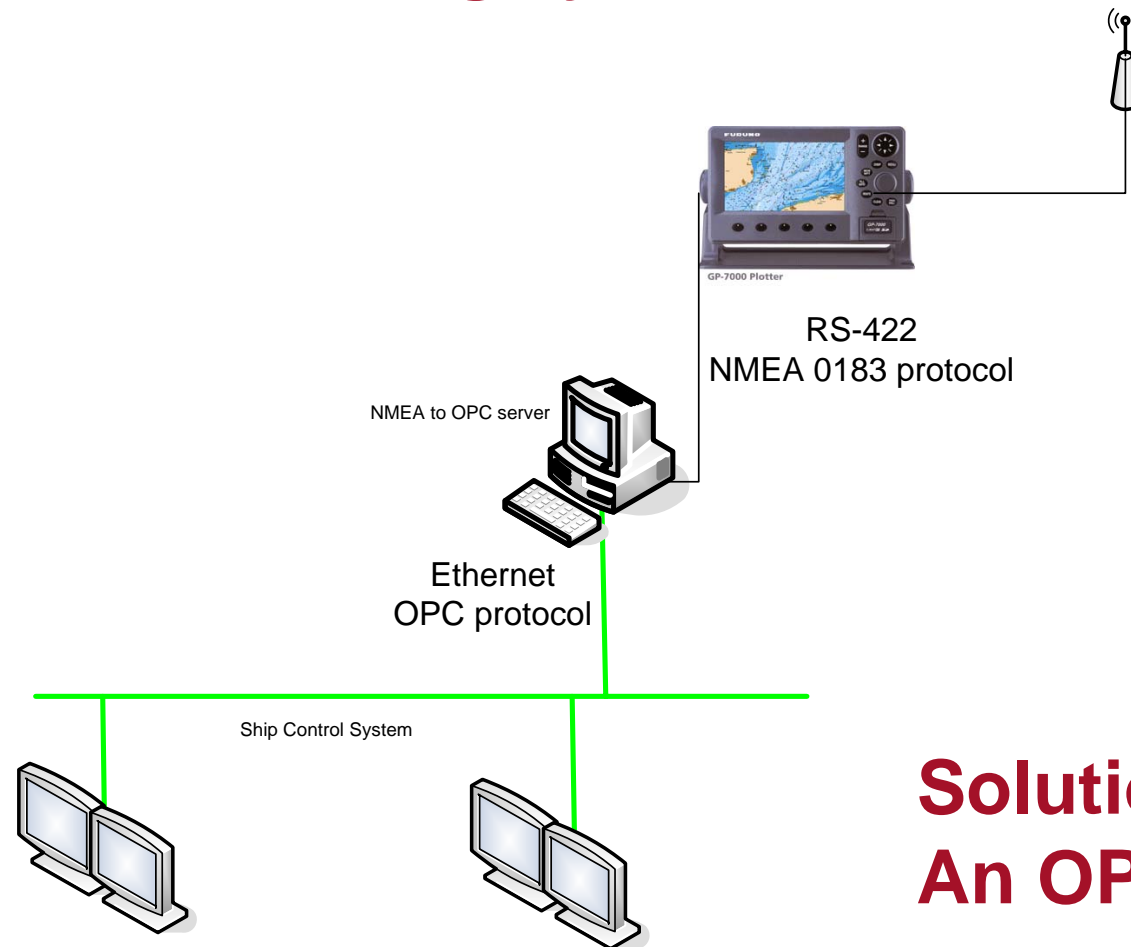
Getting NMEA 0183 data into marine vessel conning display: A practical solution

ver. 30. january 2007



Challenge:

How to get GPS data into the Ship Control and Monitoring system



Solution:
An OPC server

Links

Below is a list of resources and technical information that forms the basis for this data acquisition model

<http://www.automationworld.com/view-1947> A NMEA to OPC Case story (From the real world)

<http://www.nmea.org/> Official site for the NMEA organisation

<http://vancouver-webpages.com/peter/> Peter Bennets GPS / NMEA page

<http://www.kh-gps.de/nmea-faq.htm> Klaus H. Hirschelmann GPS site

<http://gpsinformation.net/> GPS information website

<http://www.sailsoft.nl> Sailsoft: A nice GPS simulator

<http://www.kernelpro.com> Software for virtual COM port

<http://www.kepware.com/> User configurable OPC server

<http://www.opcfoundation.org/> Official site for the OPC Foundation

http://www.interfacebus.com/Design_Connector_RS422.html Information about EIA/TIA 422 (Ex RS422)

<http://www.kep.com/> Demo SCADA software for creating the conning display

Preparing the PC

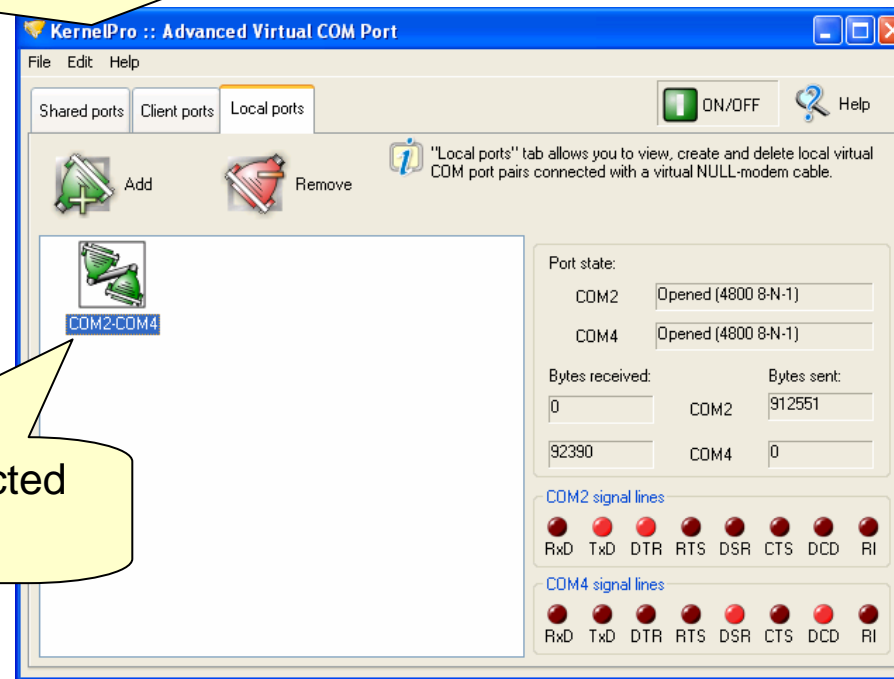
Download KernelPro and create virtual COM ports on your PC.

At Kernelpro's webpage you can download demo software, giving your PC virtual com ports, which are useful for testing software.

Download, install and configure 2 interconnected virtual ports.

Port 2 and 4 are used in the following example.

<http://www.kernelpro.com/>



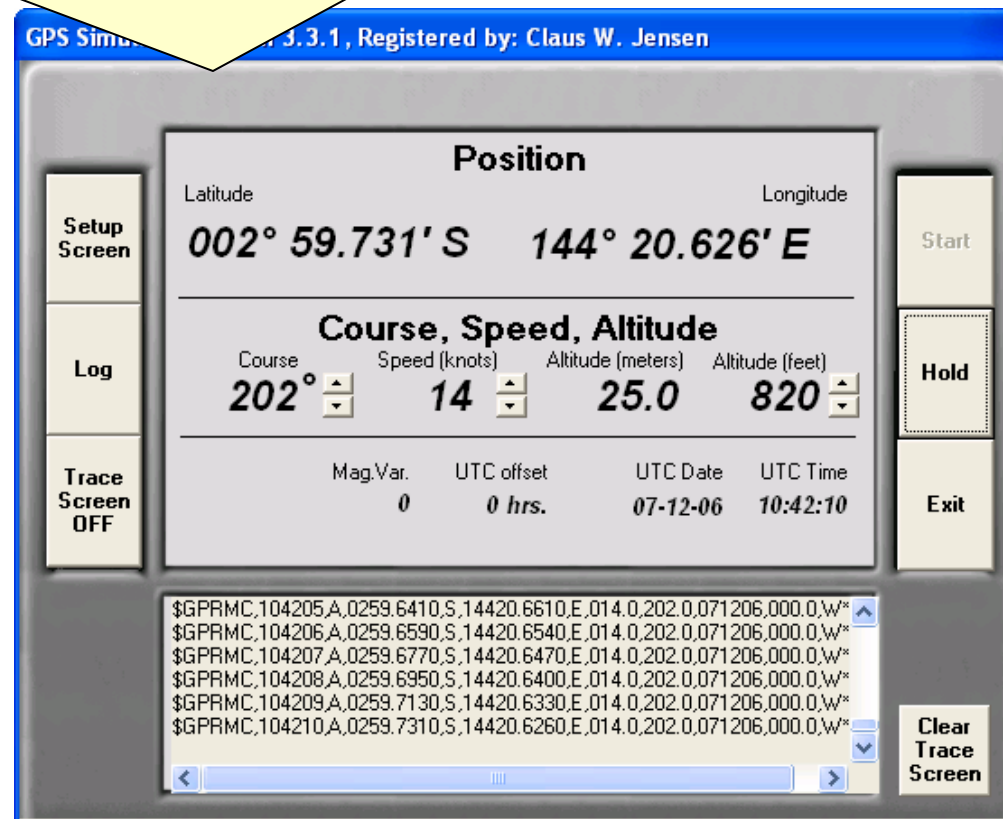
Port 2 and 4 are connected to each other

Download Sailsoft GPS Simulator



On Sailsoft you can download a very nice GPS simulator.
The demo version is stopping after 50 NMEA sentences.
License fee is only 15 EUR. (december 2006).

<http://www.sailsoft.nl>



Setup GPS simulator



Setup screen for the GPS simulator

GPS Simulator Version 3.3.1, Registered by: Claus W. Jensen

Setup parameters

Latitude 003° 00.775' S	Longitude 144° 20.220' E
Course (True CMG) 202	Speed (SOG) 14
Magn.Var. 0 <input type="radio"/> E <input checked="" type="radio"/> W	UTC offset 0
Altitude (meters) 25.0	Height ab WGS84 50.0
PDOP 2.0	HDOP 2.0
VDOP 2.0	

GPS fix quality
☐ GPS Fix
☒ DGPS Fix

Comm settings
About...

NMEA sentences to send
☐ \$GPGLL ☐ \$GPRMC
☒ \$GPRMC ☒ \$GPVTG

Transmit interval
1 seconds
☒ Checksum

Nav Screen
Log
Trace Screen ON

Start
Hold
Exit

Click "Comm settings"

Communication setup for the GPS simulator



The shown communication setup is standard for GPS using NMEA 0183

Notice that the simulator will transmit on com port 2, which is the one we virtual have connected to com port 4

The image shows a Windows-style dialog box titled "Communication Port Settings". It contains several groups of radio buttons for configuring serial communication. The "Baud Rate" group has options 300, 600, 1200, 2400, 4800 (selected), 9600, 14400, and 19200. The "Data Bits" group has options 7 and 8 (selected). The "Stop Bits" group has options 1 (selected) and 2. The "Echo" group has options On and Off (selected). The "Parity" group has options None (selected), Odd, and Even. The "Com Port" group has options Com1, Com2 (selected), Com3, and Com4. The "Flow Control" group has options None (selected), Xon/Xoff, RTS, and Xon/RTS. At the bottom, there is a note in red text: "Note: Standard NMEA settings are: baudrate 4800, 8 databits, 1 stopbit, no parity". There are "Cancel" and "OK" buttons at the bottom right.

Communication Port Settings

Baud Rate
☐ 300 ☐ 600 ☐ 1200 ☐ 2400
☒ 4800 ☐ 9600 ☐ 14400 ☐ 19200

Data Bits ☐ 7 ☒ 8

Stop Bits ☒ 1 ☐ 2

Echo ☐ On ☒ Off

Parity ☒ None ☐ Odd ☐ Even

Com Port ☐ Com1 ☒ Com2 ☐ Com3 ☐ Com4

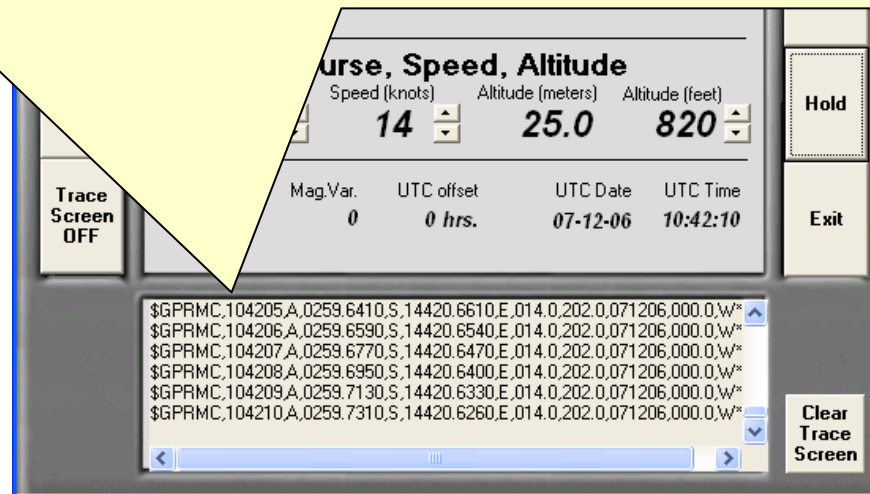
Flow Control ☒ None ☐ Xon/Xoff ☐ RTS ☐ Xon/RTS

Note: Standard NMEA settings are:
baudrate 4800, 8 databits, 1 stopbit,
no parity

Cancel OK

NMEA 0183 sentences

Begin with analyzing the NMEA sentence,
In the NMEA 0183 everything is sent as ASCII characters (1byte pr. character) and the sentence transmission is terminated by <CR><LF>
Define your OPC tag names, and find number of bytes and point of start in the sentence



\$GPRMC,112424,A,0345.3250,S,14402.8950,E,014.0,202.0,071206,000.0,W*7F

Example: "Course"
5 bytes, starts at place 48

Download Kepware's UCON server.



At Kepware's website you can download an evaluation package of their U-CONServer, which is a user configurable OPC server, which can be configured to read and write data from or to nearly any communicating device.

The screenshot shows the Kepware website with a green header banner that says "Automation's Best Friend™". Below the banner is a navigation bar with links: Home, About, News, Products, and Support & Services. A search bar is located in the top right corner. The main content area features a "Product Spotlight" for U-CONServer. On the left, there is a sidebar with "Kepware Sightings" including links to OPC Foundation Training, SPS/IPC/Drives, and CSIA Conference. Below this is a section for "KEPServerEX" dated November 17, 2006, version V4.210.367, mentioning enhancements for GE PACSystems RX3i and RX7i controllers. The main spotlight text describes U-CONServer as a reliable solution for connectivity to devices, highlighting its ability to build communication profiles and run them as standard OPC items/tags. It includes a diagram showing a computer connected to various industrial devices like a PLC, a motor, and a sensor. The text concludes with "Follow these Steps to Success and solve that device connectivity problem today."

Search Kepware

Automation's Best Friend™

Home About News Products Support & Services

Kepware Sightings

- > OPC Foundation Training
- > SPS/IPC/Drives
- > CSIA Conference

KEPServerEX

November 17, 2006
V4.210.367

A number of enhancements and fixes are available with this release of our **KEPServerEX** OPC server suite. Our GE Ethernet driver has been enhanced to support **GE PACSystems RX3i and RX7i** controllers. The driver and server provides optimal performance for OPC client applications by

Product Spotlight Kepware Technologies, OPC Servers, OPC Bridging Software, OPC Redundancy Software.

A Reliable Solution ...

U-CONServer

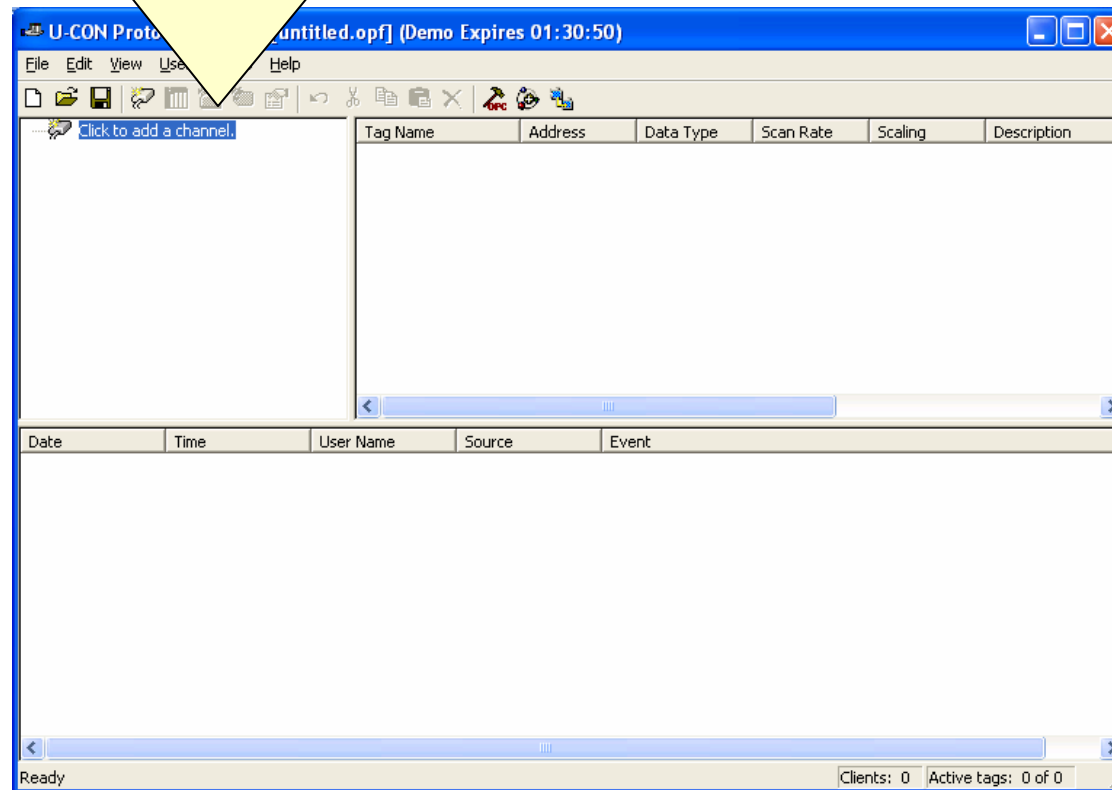
When no off-the-shelf solution exists for connectivity to your device, U-CON can solve the problem. Build powerful communication profiles then run them as standard OPC items/tags with Kepware's field-proven OPC server.

Follow these **Steps to Success** and solve that device connectivity problem today.

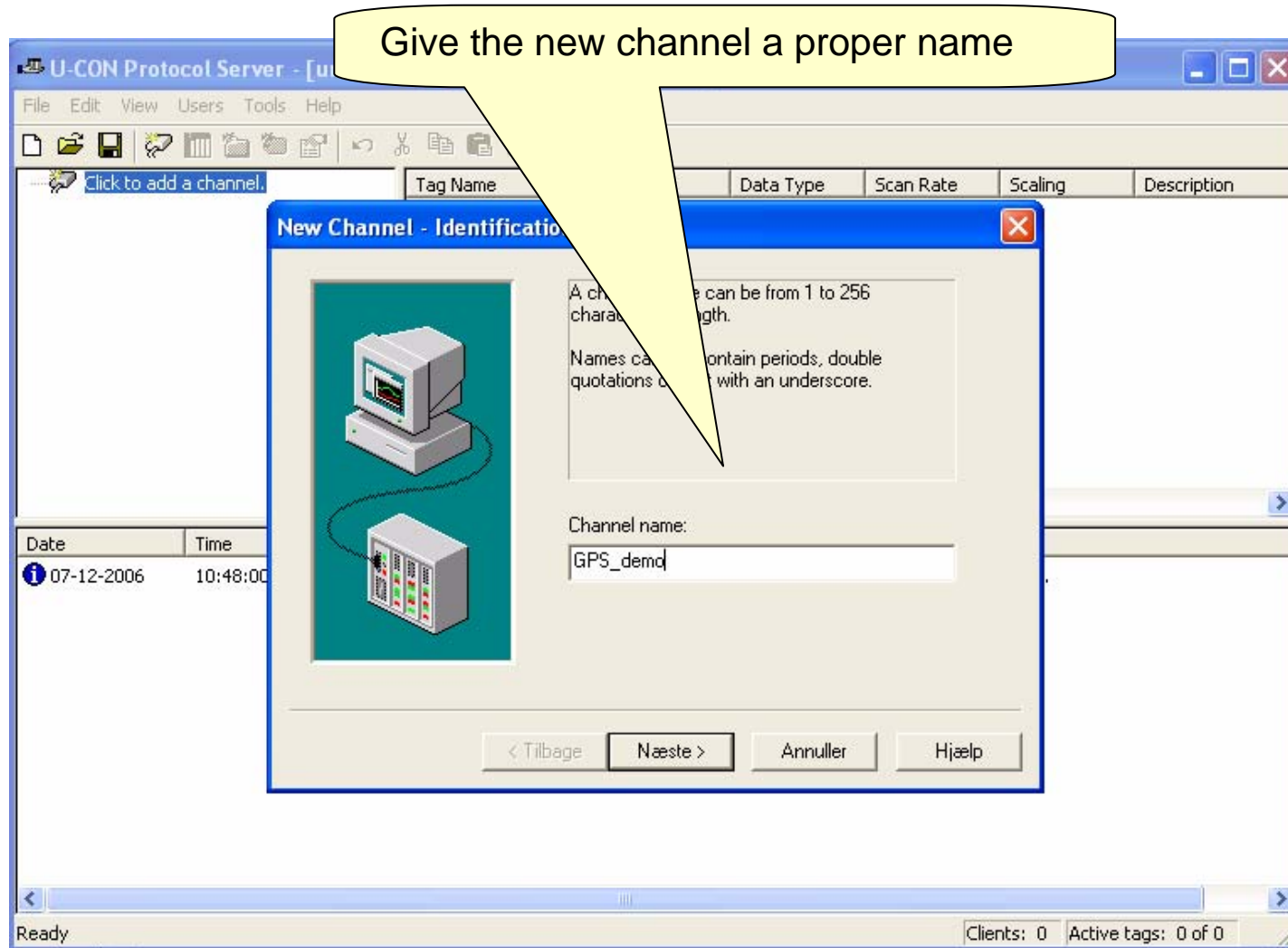
Install OPC server



Install, and run the UCONServer from Kepware.
Click on "Click to add a channel"



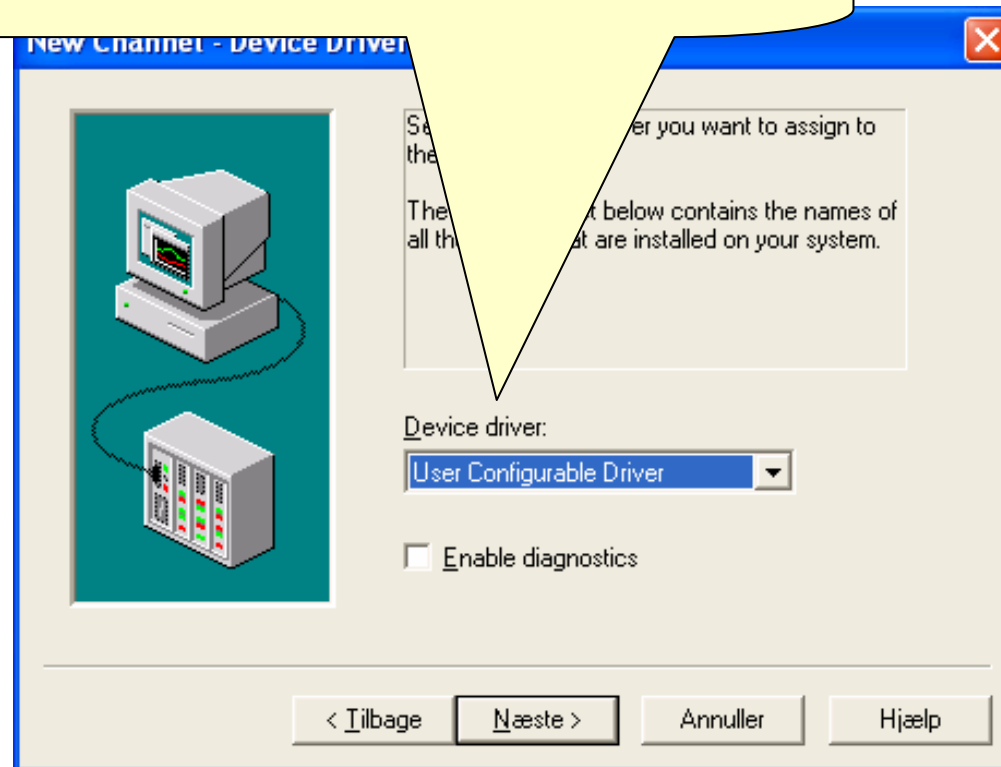
Create a communication channel



Define your own driver



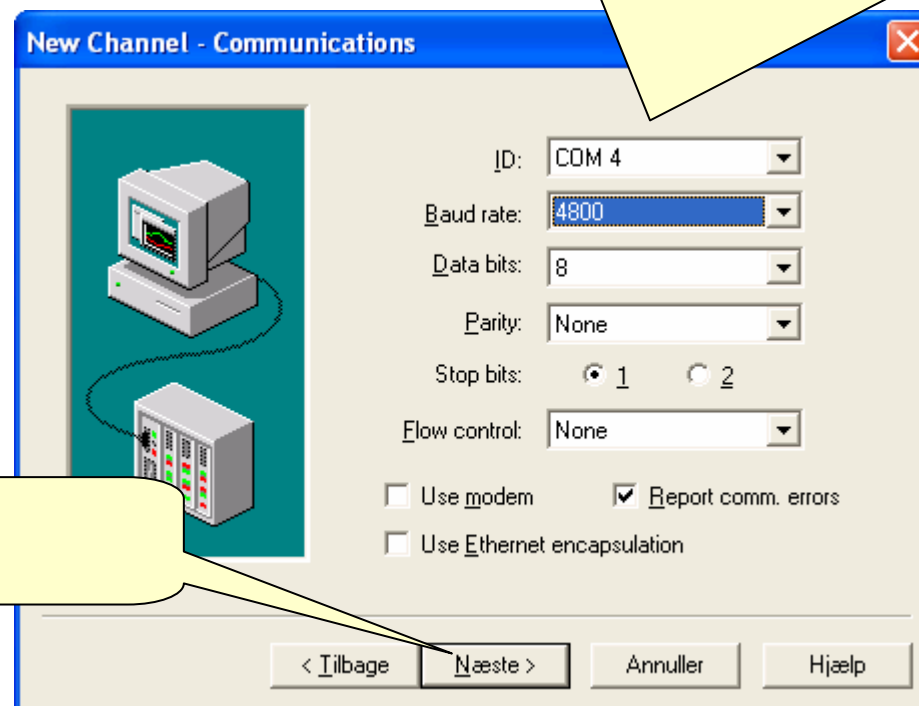
Select "User Configurable Driver"



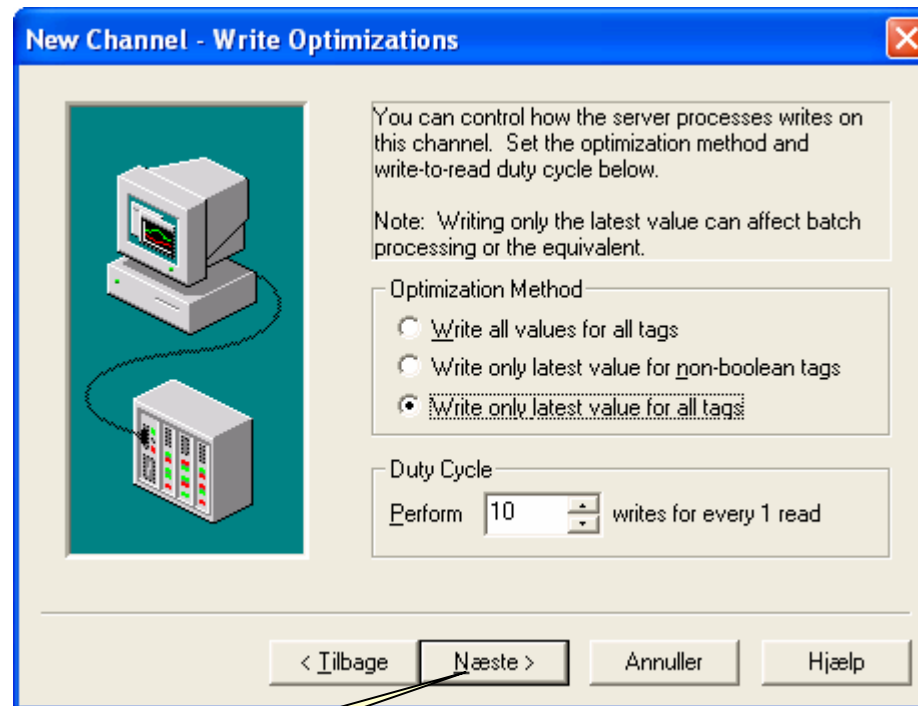
Set communication settings for your driver



1. Select the same Communication Port Settings as the simulator.
Remember also to set the com port to the same as which is virtual connected to the GPS simulator



NMEA 0183 is a single talker, multi listener protocol



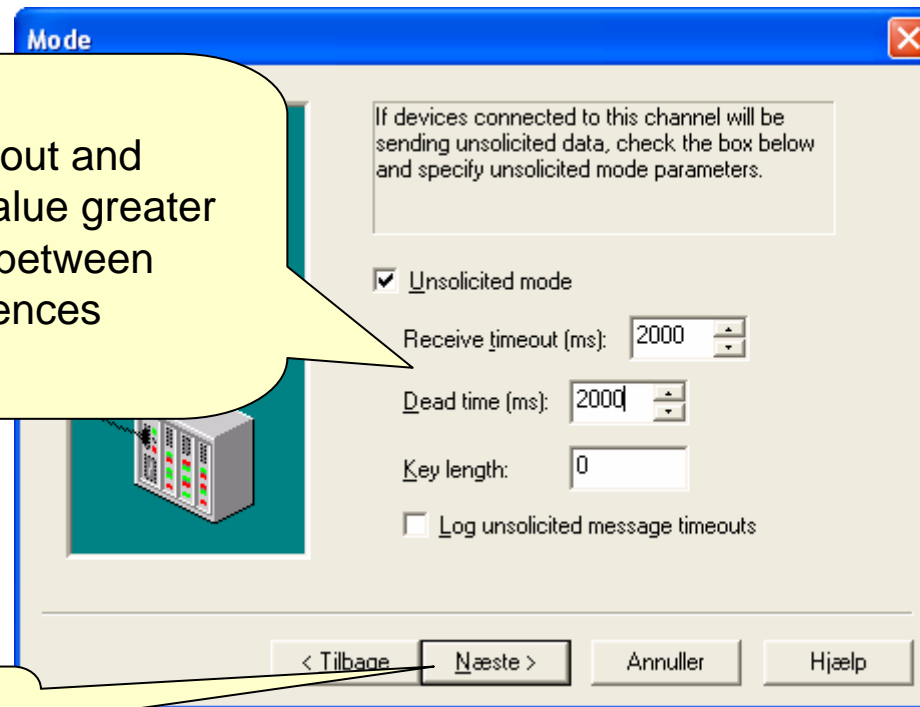
Click

Unsolicited? Yes, NMEA 0183 is transmitting on time basis without request

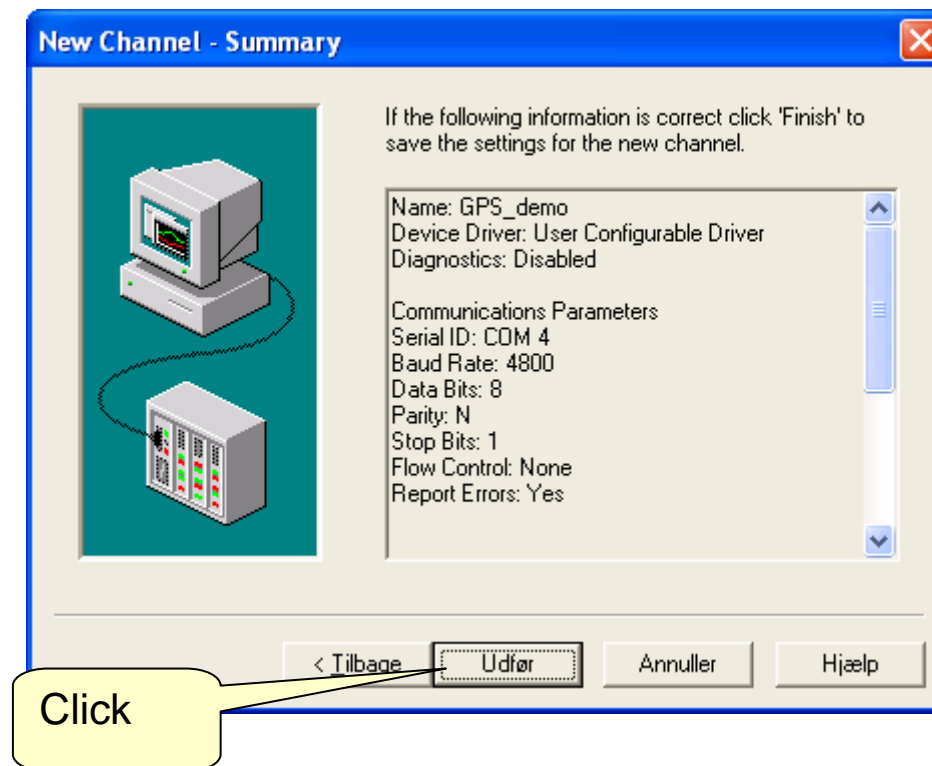


1. Set Receive timeout and Dead time to a value greater than the interval between your NMEA sentences

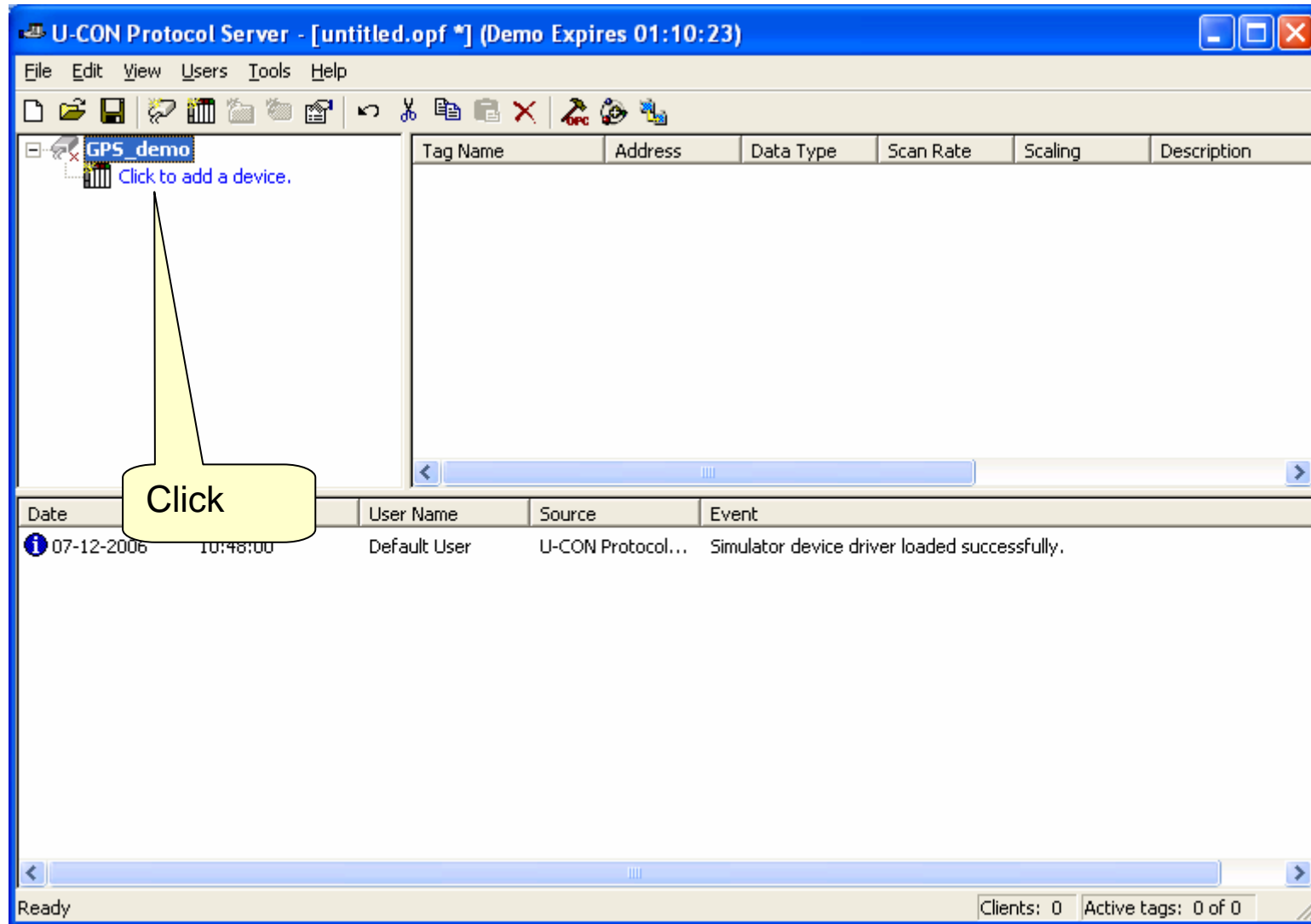
2. Click



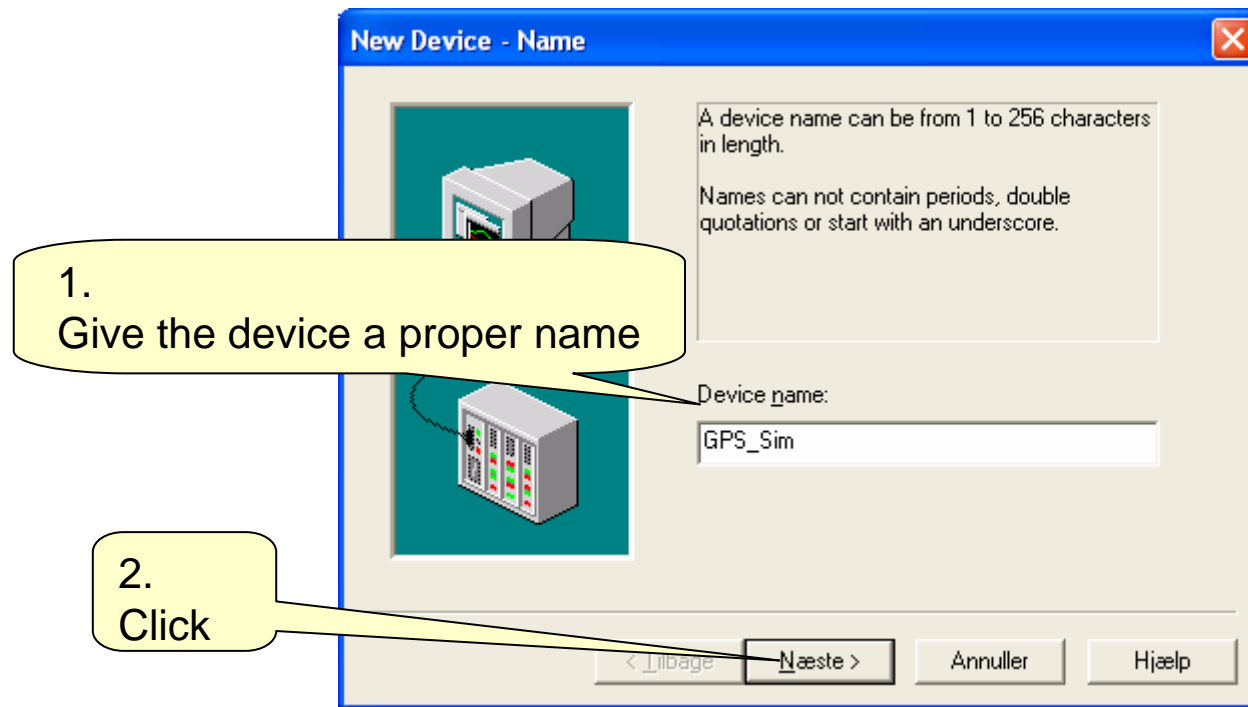
OK! Driver configured



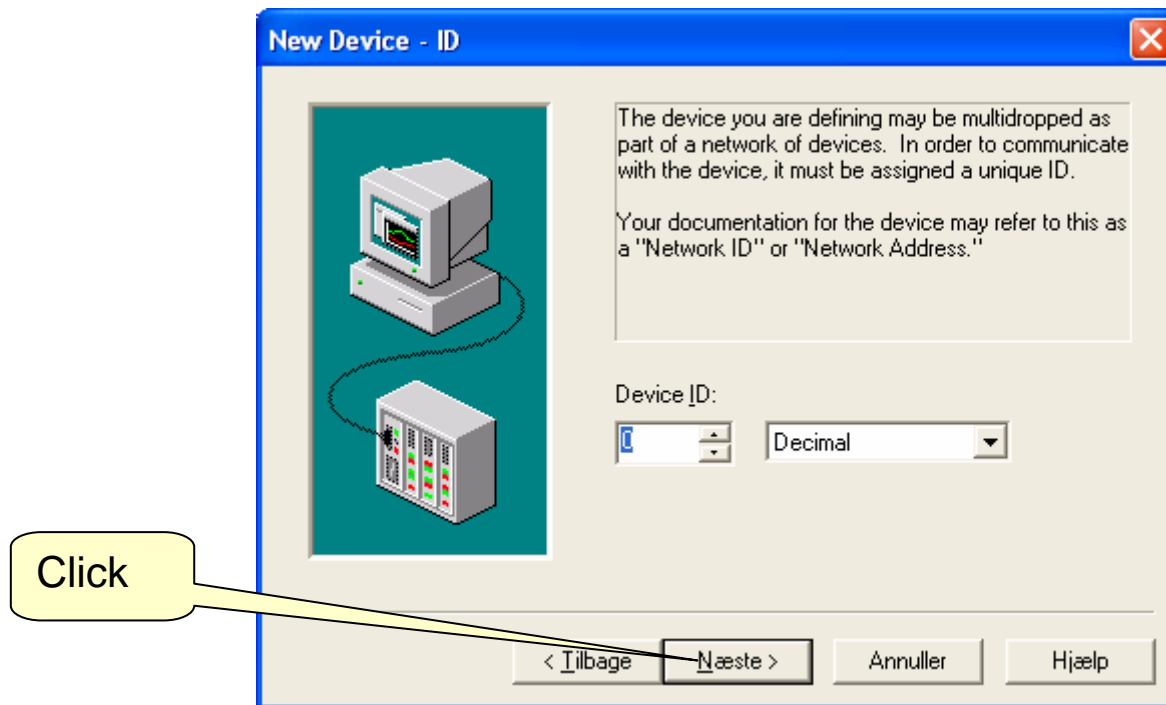
Add a device to the "GPS_demo" channel



The device must have a unique name



Since this is not a bus communication protocol, Device ID is not needed for NMEA 0183



Request timeout



1.

“Request timeout value”

Set the timeout value to a greater value than the communication rate, and the other values as shown.

2.

Click

A screenshot of a software configuration window titled "The device you are defining has communications timing parameters that you can configure." The window contains four settings, each with a numeric input field and a unit label: "Connect timeout: 3 seconds", "Request timeout: 2000 milliseconds", "Fail after 3 successive timeouts", and "Inter-request delay: 0 milliseconds". On the left side of the window is a small icon of a PLC rack. At the bottom, there are four buttons: "Tilbage" (disabled), "Næste >" (highlighted with a yellow callout), "Annuller", and "Hjælp".

The device you are defining has communications timing parameters that you can configure.

Connect timeout: 3 seconds

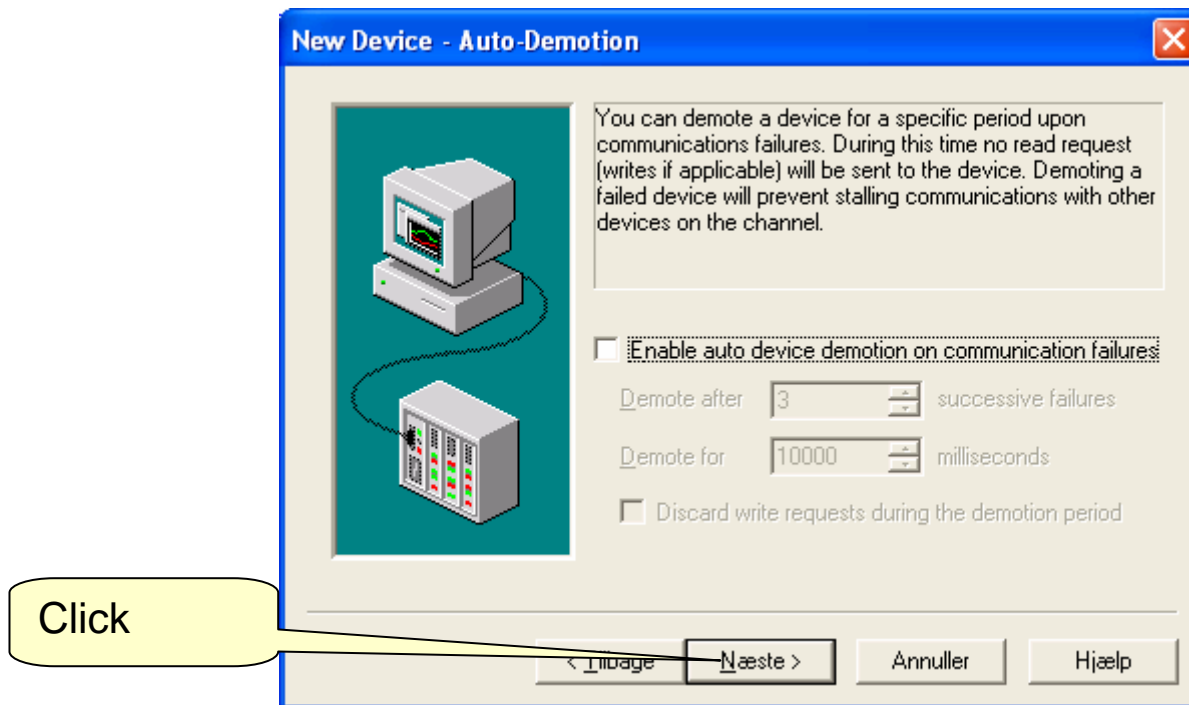
Request timeout: 2000 milliseconds

Fail after 3 successive timeouts

Inter-request delay: 0 milliseconds

Tilbage Næste > Annuller Hjælp

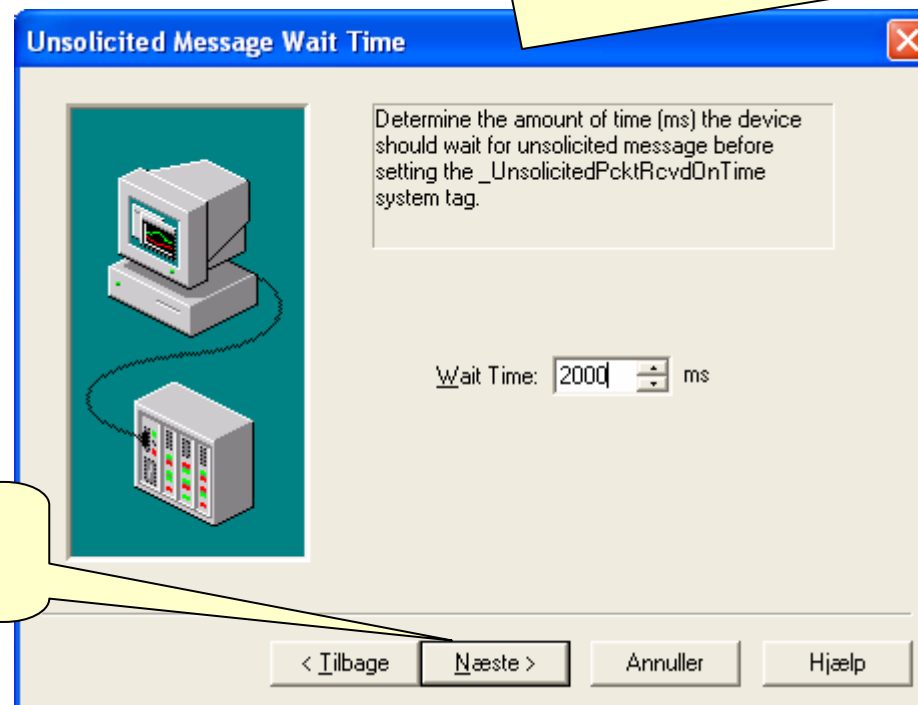
No device demotion needed!



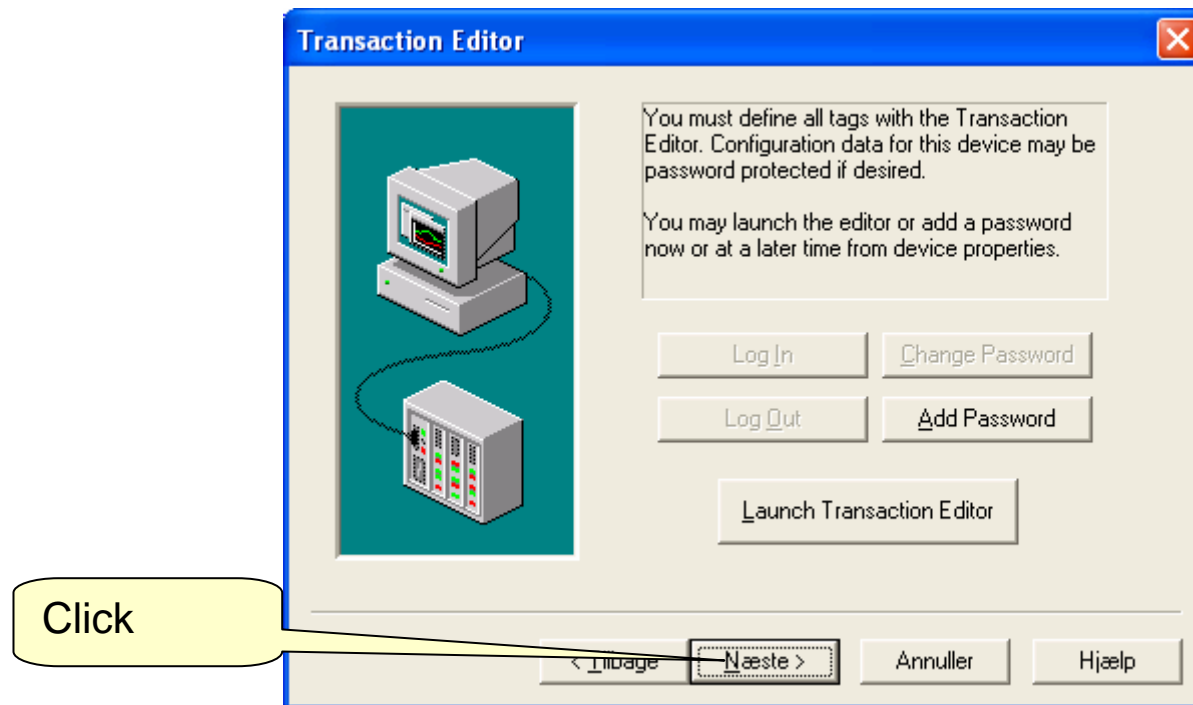
Unsolicited Message Wait Time



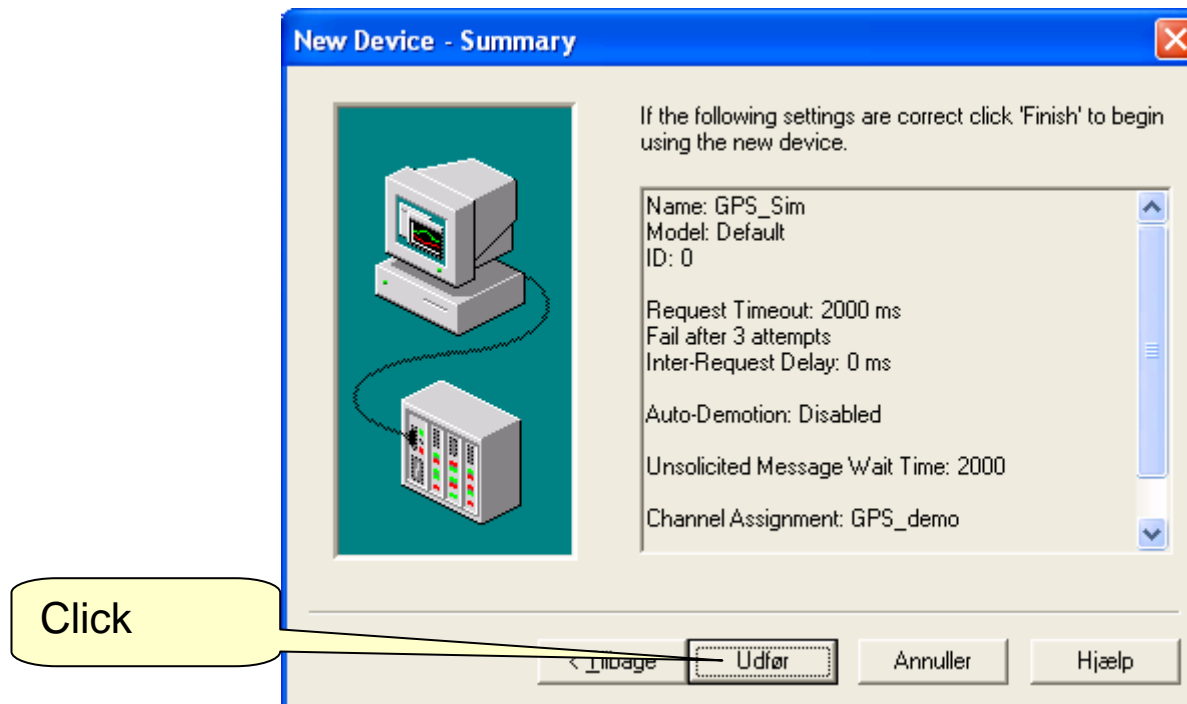
1. Set the timeout value to a greater value than the communication rate.
The tag “_UnsolicitedPcktRcvdOnTime” which is visible from an OPC client, will be set to “1” if no sentence is received within the “Wait Time”!



Wait to launch the Transaction Editor



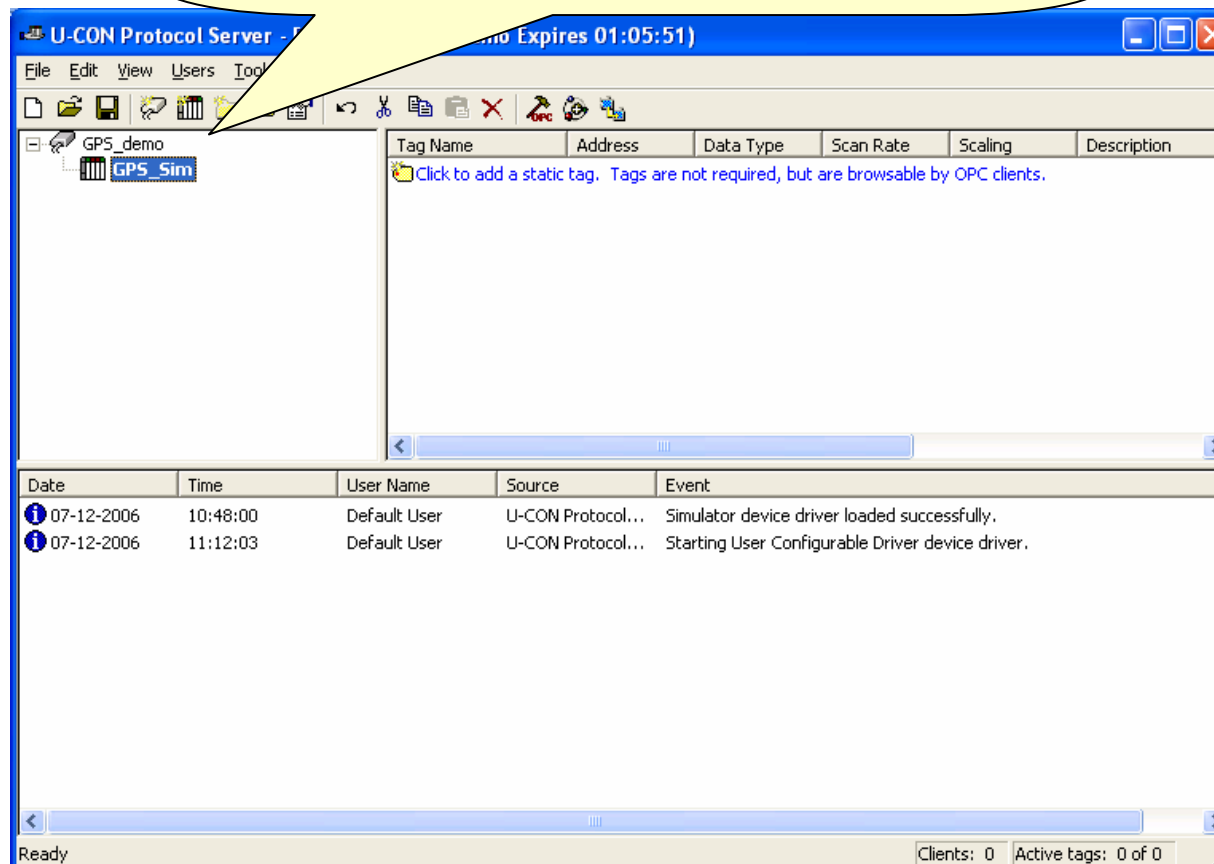
The device “GPS_Sim” is configured, and now the OPC tags need to be defined



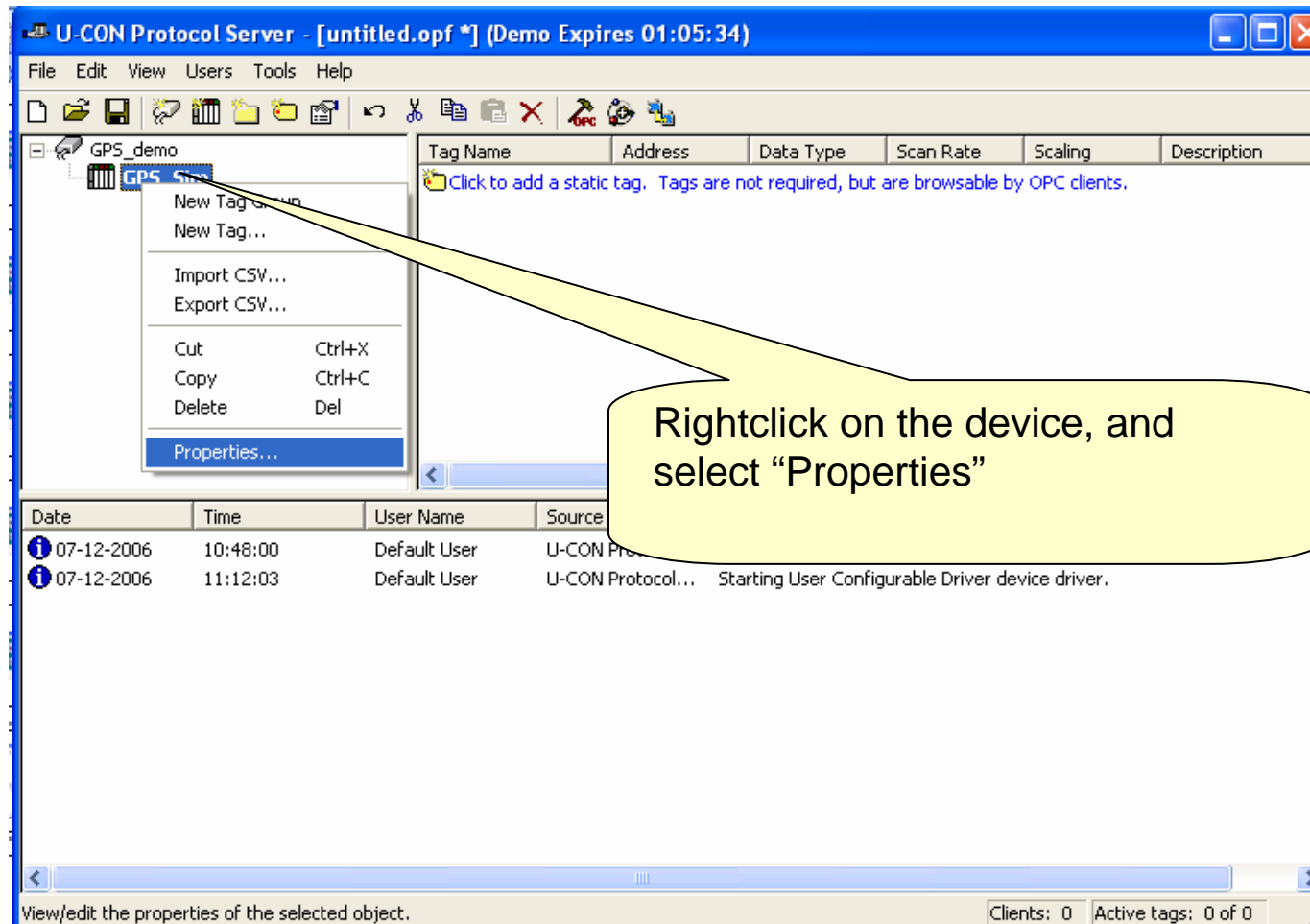
Channel and device in the OPC server



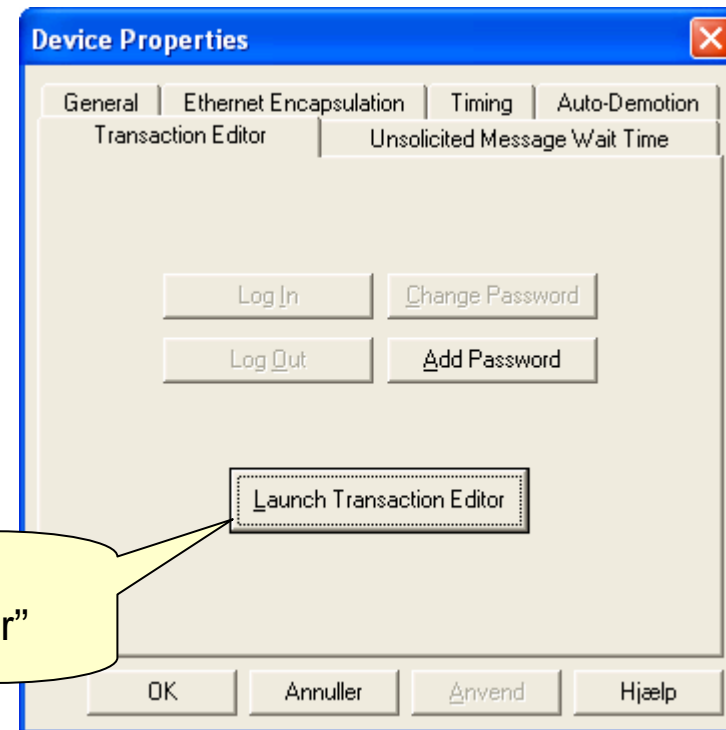
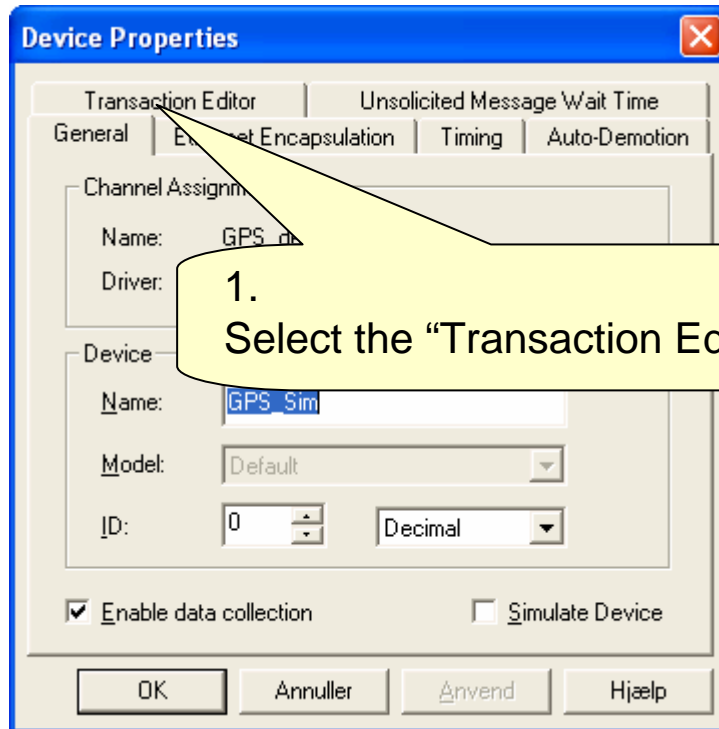
Channel "GPS_demo" with the device "GPS_Sim" should look like this



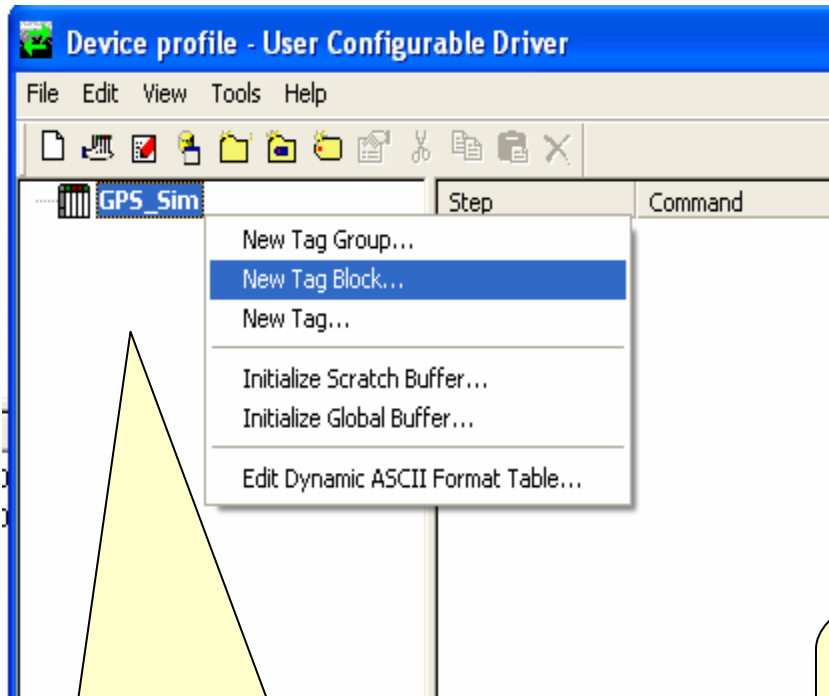
Device properties



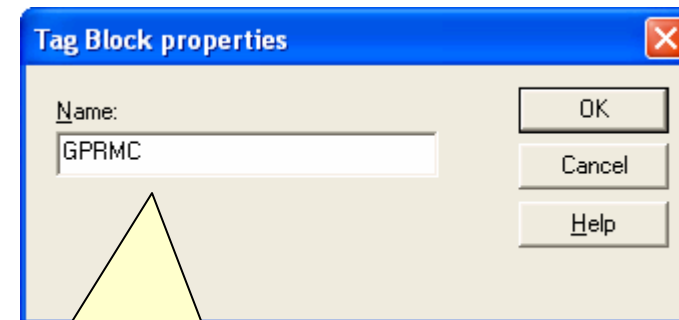
Transaction Editor



Tag Block

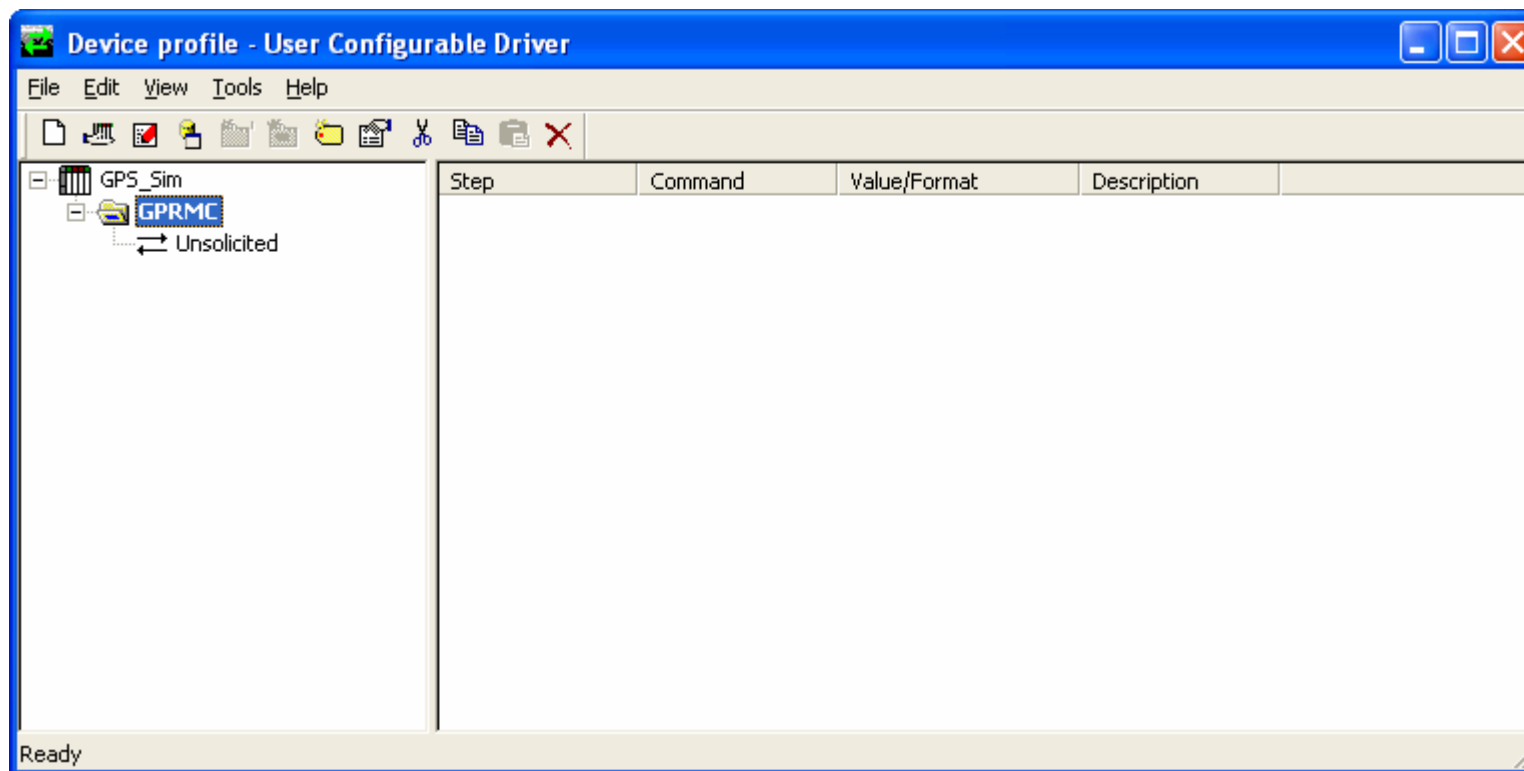


1.
Rightclick on the device
"GPS_Sim", and select "New Tag
Block"



2.
Give the Tag Block a proper name. Since
the GPS simulator is set up for NMEA
sentences of type RMC, I will call the
block "GPRMC" because the definition of
the single tags, is closely related to the
data order in the specific sentence type

Tag Block defined



Unsolicited - read commands



The screenshot shows a software window titled "Device profile - User Configurable Driver". The interface includes a menu bar (File, Edit, View, Tools, Help) and a toolbar with various icons. On the left, a tree view shows a hierarchy: "GPS_Sim" > "GPRMC" > "Unsolicited". A yellow callout bubble points to the "Unsolicited" item with the text: "1. Highlight 'Unsolicited'".

The main area of the window is a table with the following headers: "Step", "Command", "Value/Format", and "Description". A right-click context menu is open over the table area. The menu options are: "Write Commands...", "Read Commands...", "Conditional Commands...", "Processing Commands...", "Read Response...", and "Update Tag...". The "Read Response..." option is highlighted. A second yellow callout bubble points to this menu with the text: "2. Right click in this area and select 'Read Response'".

At the bottom of the window, a status bar displays the text: "Create a new Read Response command."

<Carriage return>
<Line feed>



Read Response command properties

Termination method

☐ Wait for number of bytes

☒ Wait for stop characters

Number of bytes:

0

ASCII characters:

010	0x0A	^J	<LF>
011	0x0B	^K	<VT>
012	0x0C	^L	<FF>
013	0x0D	^M	<CR>
014	0x0E	^N	<SO>
015	0x0F	^O	<SI>

Add >>

<< Remove

Stop characters:

013 0x0D ^M <CR>
010 0x0A ^J <LF>

Description:

☒ Clear RX buffer before read

☒ Log timeout errors

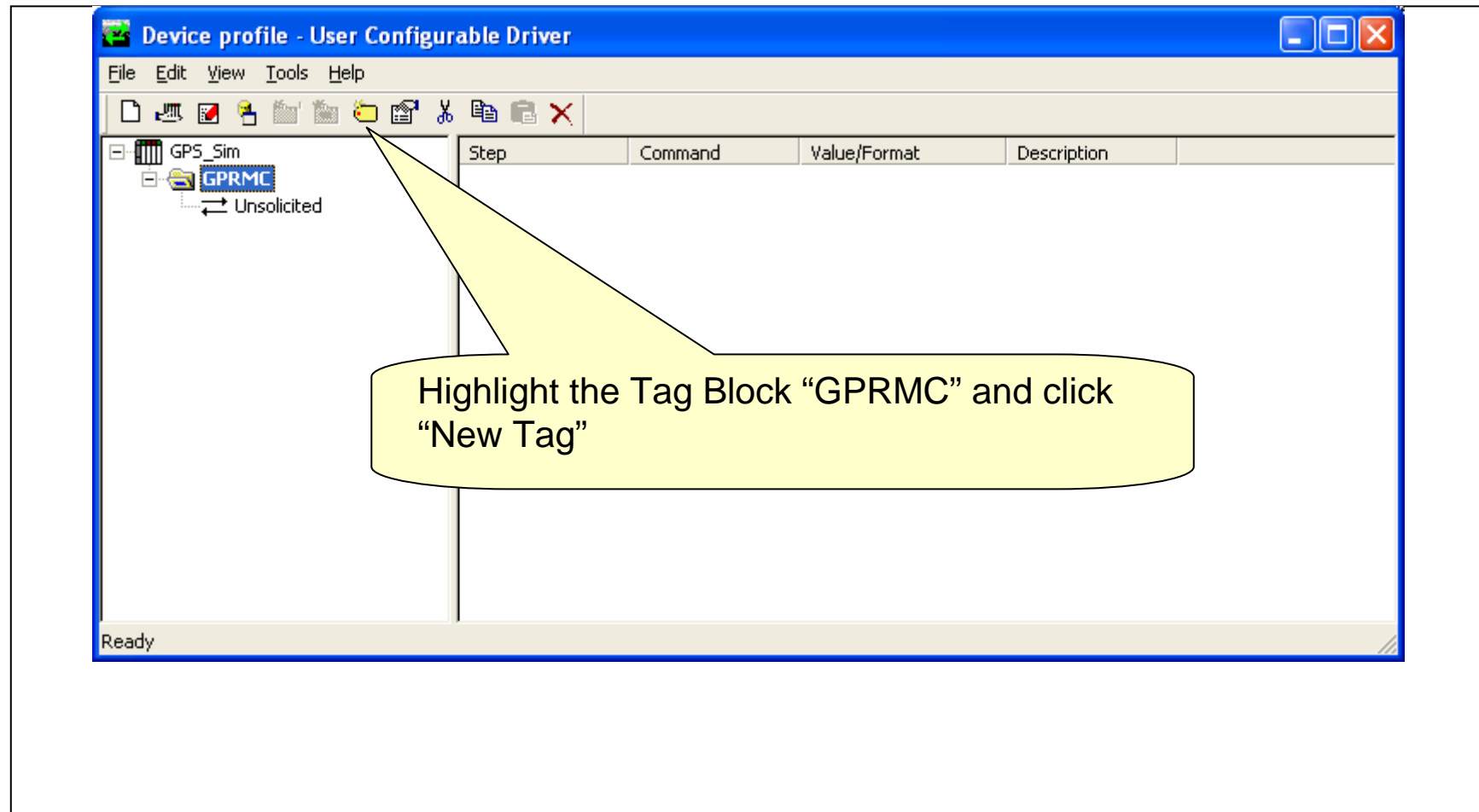
OK

Cancel

Help

<CR><LF> is in NMEA 0183 used for indicating end of transmission

New Tag



Defining tags from NMEA sentences



NMEA 0183 RMC sentence

\$GPRMC,112424,A,0345.3250,S,14402.8950,E,014.0,202.0,071206,000.0,W*7F

Course
5 bytes starts at place 48

The Tag "Course" is a string consisting of 5 bytes which starts at byte 48

Defining the tag named "Course"



The "Tag properties" dialog box is shown with the following settings:

- Identification:**
 - Name: Course
 - Description: Ship course
- Data properties:**
 - Data type: String
 - Format: ASCII String [ccc...]
 - Format properties... (button)
 - Data length: 5
 - Client access: Read Only

Buttons: OK, Cancel, Help, and navigation arrows.

Set the properties for the Tag "Course" as shown here and then click "OK"

The "ASCII String format properties" dialog box is shown with the following settings:

- ☒ Fixed length
- String length: 5
- Pad type: Zeros (0x30)
- Parse termination method:
 - ☐ Parse to next delimiter if present
 - Delimiter: 000 0x00 ^@ <NUL>
 - Read up to: 1 bytes from frame end.

Buttons: OK, Cancel, Help.

Unsolicited- Update Tag



The screenshot shows a software window titled "Device profile - User Configurable Driver". The window has a menu bar (File, Edit, View, Tools, Help) and a toolbar. On the left is a tree view showing a hierarchy: GPS_Sim > GPRMC > Course > Unsolicited. The "Unsolicited" item is highlighted. A yellow callout bubble points to it with the text "1. Highlight 'Unsolicited'". In the center-right area, a context menu is open, showing options: "Write Commands...", "Read Commands...", "Conditional Commands...", and "Processing Commands...". The "Read Commands..." option is selected, and a sub-menu is open showing "Read Response..." and "Update Tag...". The "Update Tag..." option is highlighted. A second yellow callout bubble points to this area with the text "2. Right click in this area and select 'Update Tag'". Below the tree view, a status bar says "Create a new Update Tag command.".

Step	Command	Value/Format	Description
1	Read Response	Stop after: 0x0D 0x0A	

1. Highlight "Unsolicited"

2. Right click in this area and select "Update Tag"

"Course" Tag



Name: Course
Data start byte: 48

The dialog box is titled "Update Tag command properties" and has a standard Windows-style title bar with a close button. It contains the following elements:

- Tag:** A dropdown menu currently showing "Course".
- Data source:** A group box containing four radio buttons: "Read buffer" (selected), "Scratch buffer", "Global buffer", and "Event counter".
- Global buffer:** A small numeric spinner box next to the "Global buffer" radio button, showing the value "1".
- Data starts at current buffer pointer:** An unchecked checkbox.
- Data start byte:** A numeric spinner box showing the value "48".
- Description:** A text area at the bottom of the dialog.
- Buttons:** "OK", "Cancel", and "Help" buttons are located on the right side of the dialog.

Update OPC server



1.
Click "Update Server"

2.
Click "Yes"

Device profile - User Configurable Driver

File Edit View Tools Help

GPS_Sim
├─ GPRMC
│ └─ Course
└─ Unsolicited

Step	Command	Value/Format	Description
1	Read Response	Stop after: 0x0D 0x0A	
2	Update Tag	Course	

User Configurable Driver

? This process is irreversible.
Are you sure you want to update server?

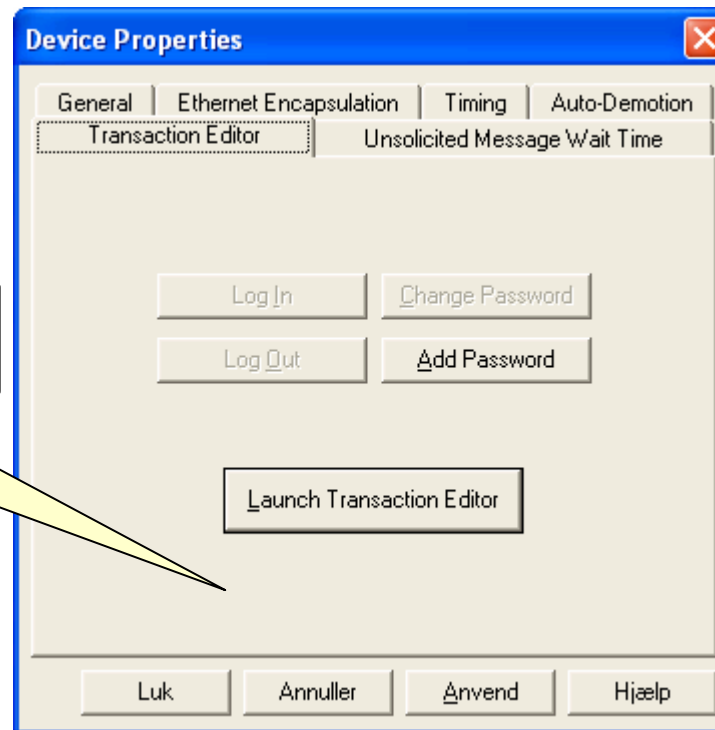
Tak Niej

Ready

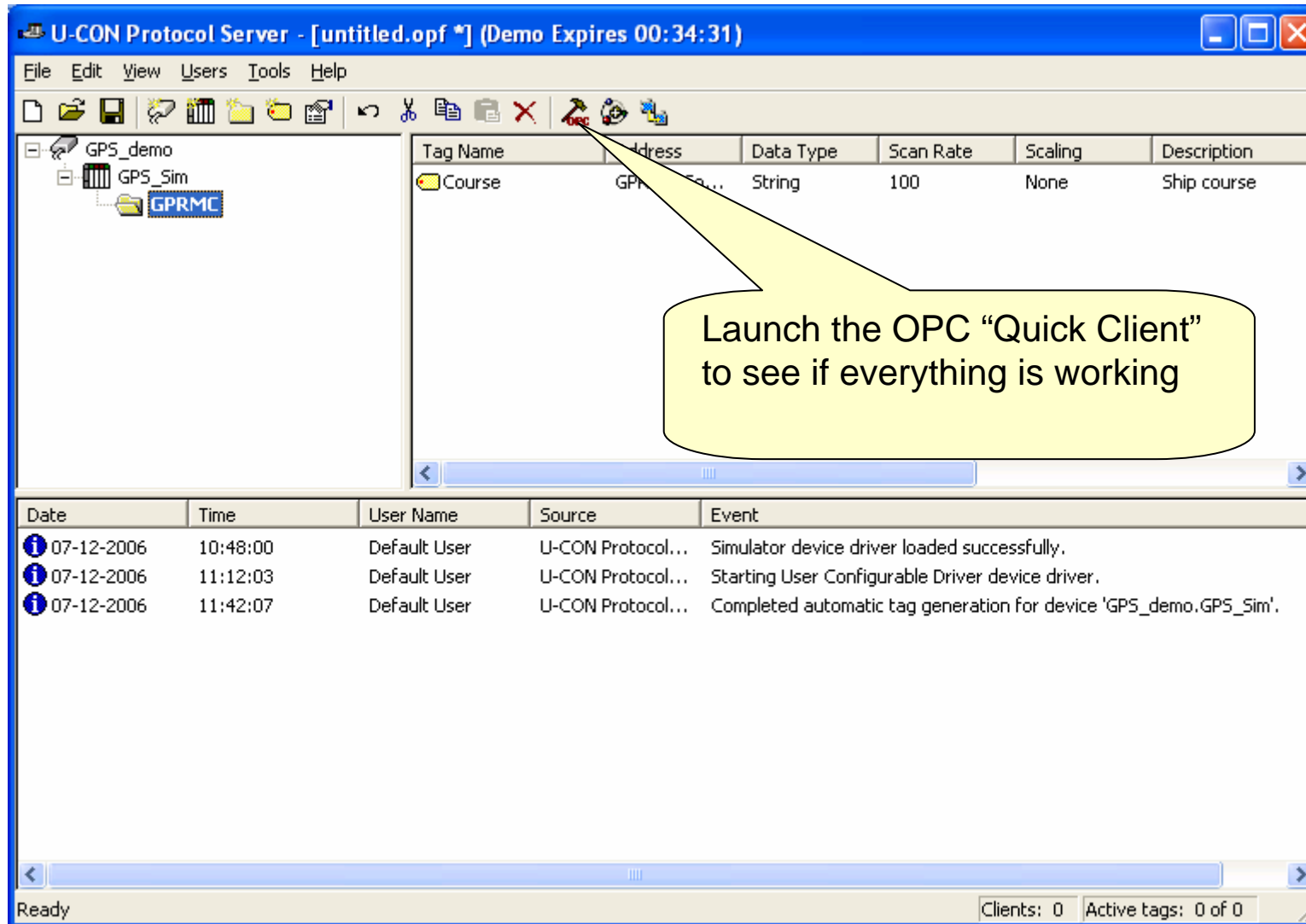
Apply and close



Click "Apply" and "Close"



Launch "Quick Client"



Confirm Simulator value with "Quick Client" output



The screenshot shows the OPC Quick Client interface. The title bar reads "OPC Quick Client - Ikke-navngivet *". The menu bar includes "File", "Edit", "View", "Tools", and "Help". The toolbar contains icons for file operations and data viewing. The left pane shows a tree view of the OPC hierarchy under "KEPware.U-CON", with "GPS_demo.GPS_Sim.GPRMC" selected. The main pane displays a table with the following data:

Item ID	Data Type	Value	Timestamp	Quality	Update Count
GPS_demo.GPS_Sim.GPRMC.Course	String	122.7	11:44:28:796	Good	10

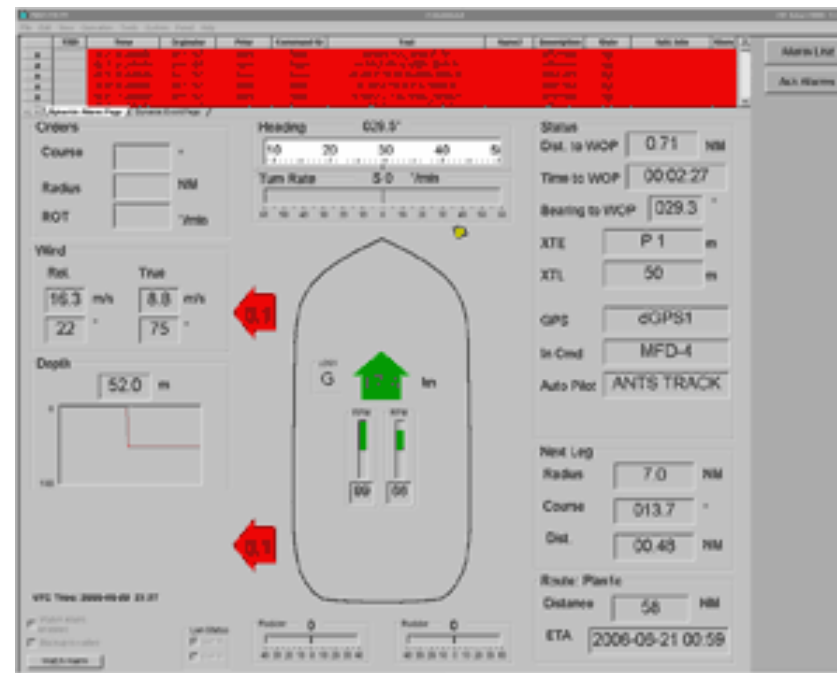
At the bottom, there is an event log table:

Date	Time	Event
07-12-2006	11:43:39	Added group 'GPS_demo.GPS_Sim' to 'KEPware.U-
07-12-2006	11:43:39	Added 18 items to group 'GPS_demo.GPS_Sim._Sy
07-12-2006	11:43:39	Added group 'GPS_demo.GPS_Sim.GPRMC' to 'KEP
07-12-2006	11:43:39	Added 1 items to group 'GPS_demo.GPS_Sim'.

The status bar at the bottom left says "Ready" and the bottom right says "Item Count: 51". A yellow callout bubble points to the value "122.7" in the table, containing the text: "YES! Communication is OK, we are actually sailing 122.7° at the moment".

Conning display

- Final step is creating the ships conning display in the SCADA software, and animating the objects by connecting them to the OPC tags defined in the Kepware OPC server



Source: www.kongsberg.com