GPS/GLONASS

NV08C-RTK-EVK

Evaluation Kit

User Guide

Version 1.0

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Revision History

Revision ID	Date	Description
1.0	February, 2015	First release of the document

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1. Device Overview

Evaluation Kit NV08C-RTK-EVK (referred in this document as RTK-EVK later on) is a set of instruments for a developer of systems based on NV08C-RTK module. Use of RTK-EVK is a convenient way to learn functionality of NV08C-RTK module and start the system design quickly. Refer to NV08C-RTK GNSS Card datasheet and NV08C-RTK Receivers NMEA protocol specification for further details.

The RTK-EVK may be used in navigation systems to obtain advanced and high precision navigation functions. The RTK-EVK provides processing of code and phase differential correction in RTCM format (versions 3.x) to support DGNSS and RTK functionality both in base station and rover modes.

1.1. RTK-EVK package contents

RTK-EVK package contains:

- NV08C-RTK module PCB assembly in aluminum housing
- Active GPS/GLONASS Antenna
- Mini-USB cables – 2 pcs.
- USB memory stick with service software, USB drivers and documentation
- Packaging

1.2. External connectors and indicators

Figure 1. RTK-EVK Front and Rear panels

RTK-EVK 's External connectors and indicators:

- **RF** SMA Female connector – external active antenna connector
- **PPS** SMA Female connector – PPS output
- Mini-USB connectors (USB 2.0):

   USB1 – USB port of the NV08C-RTK module

   USB2 – two ports USB hub (USB to NV08C-RTK module's UART1 and UART2 bridge)

   USB1 (by default) or USB2 interface provides RTK-EVK with power supply (defined by JP1 jumper position)

- **PWR** LED – NV08C-RTK module's power indicator (red LED)
- **PPS** LED – NV08C-RTK module's PPS output (flashing indicator)

- **TX** LED – USB2 data transfer in progress (blinking indicator)
- **RS** button – asserts a Reset signal to the RTK-EVK module. After reset the RTK-EVK comes up with default configuration or settings that are previously set and stored by the user. Data in non-volatile memory remains intact.

1.3.   Power Supply

Power supply to RTK-EVK is provided via USB interface (Mini-USB connector USB1 or USB2 on the front panel defined by JP1 jumper position (USB1 by default, see Table 2).

2.   Evaluation Kit Interfaces and Settings

2.1.   Functional Diagram

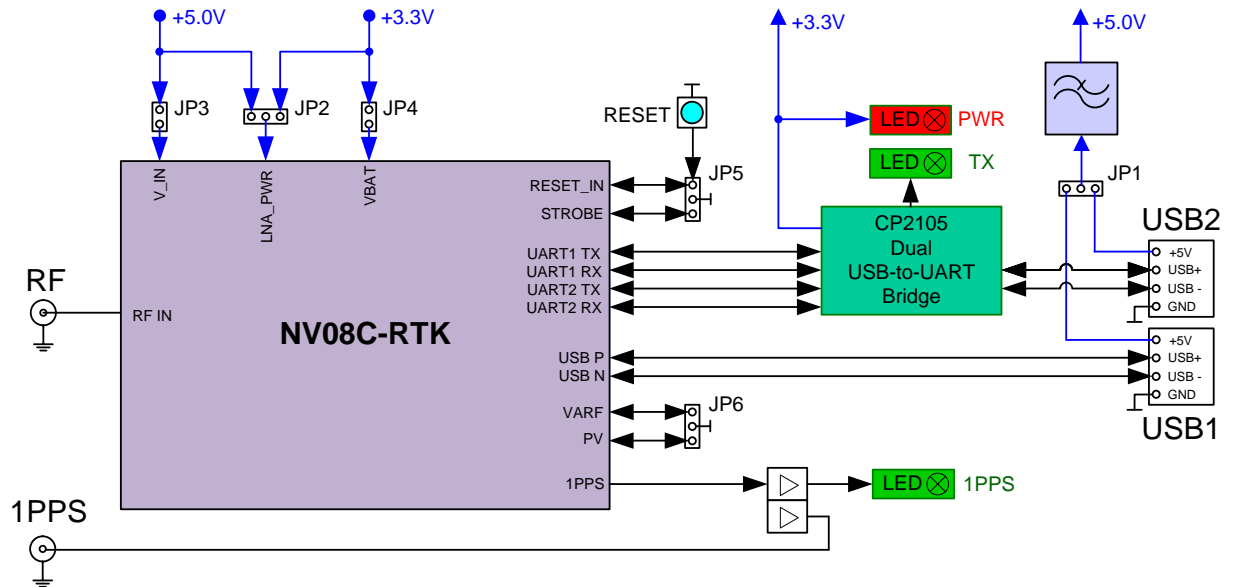General functional diagram of RTK-EVK is illustrated in Figure 2 below.

Figure 2. Functional Diagram of RTK-EVK

Refer to RTK-EVK electrical schematic in see Appendix 1 for detailed information.

2.2.   RTK-EVK Motherboard Connectors and Jumpers Assignment

Figure 3. RTK-EVK motherboard

The RTK-EVK connectors' assignment is described in the Table 1 below.

Table 1. Assignment of the Connectors on RTK-EVK motherboard

Designation on board	Description and function
X1	Mini-USB - USB port of the NV08C-RTK module
X2	Mini-USB - Dual USB to UART bridge (USB to NV08C-RTK module's UART1 and UART2 bridge)
X3	SMA female PPS CMOS Output
X4	SMA female external active antenna connector
X5	2x10 2 mm Pin Header – NV08C-RTK card Digital Connector
X6	MCX male NV08C-RTK card RF connector

The RTK-EVK motherboard contains jumpers for easy access to various signals of RTK-EVK. Jumpers may be used for signals state control and connection of an external power supply.

Table 2. RTK-EVK motherboard jumper assignment

Designation on board	Description	Pin	Assignment	Default setting
JP1	Power Source	1-2	X2 USB Connector	
		2-3	X1 USB Connector	X
JP2	External antenna power supply	1-2	+3.3V	
		2-3	+5V from USB	X
JP3	NV08C-RTK Card Main Power	YES	Applied	X
		NO	NA	
JP4	NV08C-RTK Card Backup Power	YES	Applied	
		NO	NA	X
JP5	Test Pins	1	Reserved	NA
		2	GND	
		3	RESET_IN	
JP6	Test Pins	1	Reserved	NA
		2	GND	
		3	Reserved	

2.3. PPS signal

The PPS is a time synchronization output signal with frequency of 1 Hz. It's provided on the «PPS» connector on the front panel of RTK-EVK.

PPS signal features:

- voltage logic levels – 3.3V
- frequency – 1, 2, 5, 10 Hz (corresponds to the frequency of navigation solution, 1 Hz by default)
- the true value of time corresponds to the leading or trailing edge pulse, leading edge by default
- pulse duration – 40 ns to 2,5 ms, 1 ms by default
- synchronization with GPS, GLONASS, UTC or UTC SU time scales, UTC by default
- accuracy of synchronization – 15 ns (RMS, not including delay in a cable)

2.4. Communication Protocols and Configuration

Default settings of the RTK-EVK communication interfaces to external user's devices support the following protocols:

RTK-EVK USB port	System Virtual COM port	NV08C-RTK port	Default Protocol	Baud rate
USB1	NVS USB to UART Bridge	USB	NMEA	230400 bps
USB2	NVS Dual USB to UART Bridge: UART1	UART1	NMEA	115200 bps
	NVS Dual USB to UART Bridge: UART2	UART2	RTCM	115200 bps

Basic configuration of the NV08C-RTK module is as follows:

- navigation mode: GPS +GLONASS
- RTK mode   Rover (automatic 3D/3D diff/Float/Fix)
- SBAS data: automatic
- RAIM: automatic
- PVT data rate: 5 Hz
- NMEA message types: GGA, RMC, GSV, GSA, BSS (default list)
- RTCM data format   RTCM v3.x

3. Initial setup and usage of RTK-EVK

3.1. Getting Started with RTK-EVK

1. Install NVS USB to UART Bridge Drivers before connecting the RTK-EVK device to the PC. Drivers are available on the provided NVS memory stick or can be downloaded at www.nvs-gnss.com.

2. Connect RTK-EVK to the PC/Notebook by means of two USB cables. USB1 port will provide power to RTK-EVK. Red LED "PWR" will be solid. Operating system will detect a new device and begin with installing the drivers. Choose to search drivers on the local machine if the system begins searching the drivers in Windows Update.

3. Three virtual COM-ports will appear in Windows Device Manager (refer to the picture below):
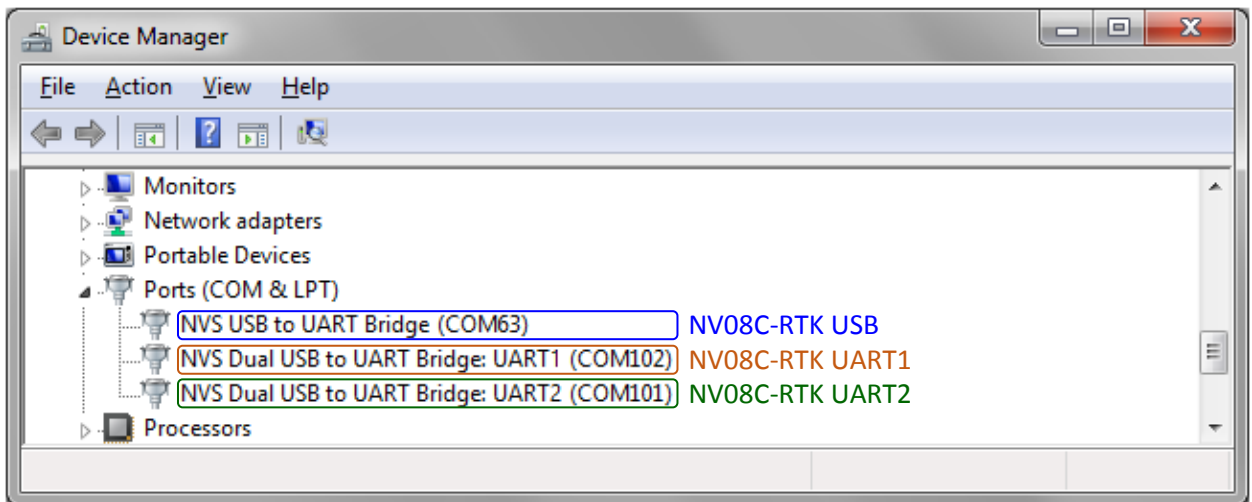
### 3.2. Communication and control of RTK-EVK by means of service SW

For testing purposes **Storegis** SW Tool (available on the provided NVS memory stick or can be downloaded at www.nvs-gnss.com) may be used for communication and control of RTK-EVK. The Tool provides receiving and visualization of navigation data from NV08C-RTK receiver, simple control of COM-port and navigation settings as well as sending NMEA messages to NV08C-RTK receiver.

To start communication with NV08C-RTK-EVK:

- run **Storegis** SW Tool
- Select PC COM-port corresponding to either USB or UART1 port of NV08C-RTK-EVK (COM63 or COM102 in the example above)
- Select NMEA protocol, **230400 bps** for USB or **115200 bps** for UART1
- Push <Record> button (see the picture below)
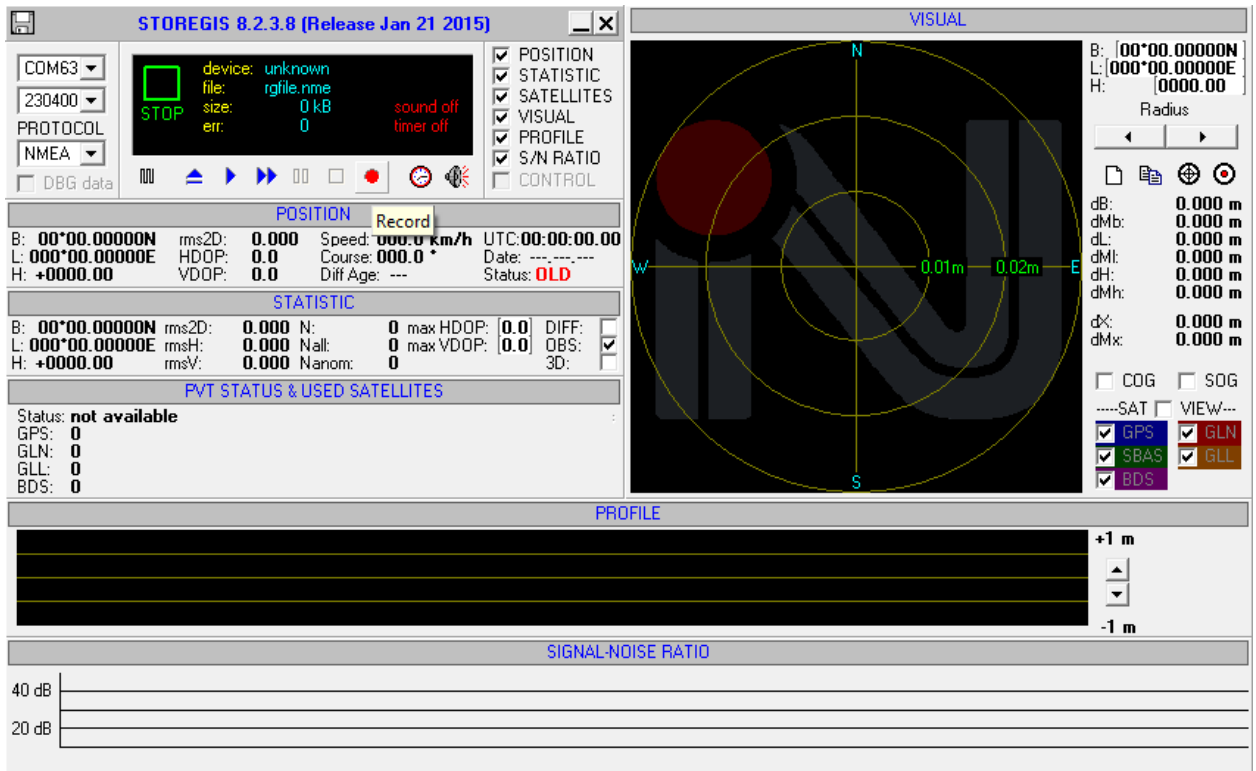
- After connection to NV08C-RTK-EVK Storegis will receive and display navigation data automatically:
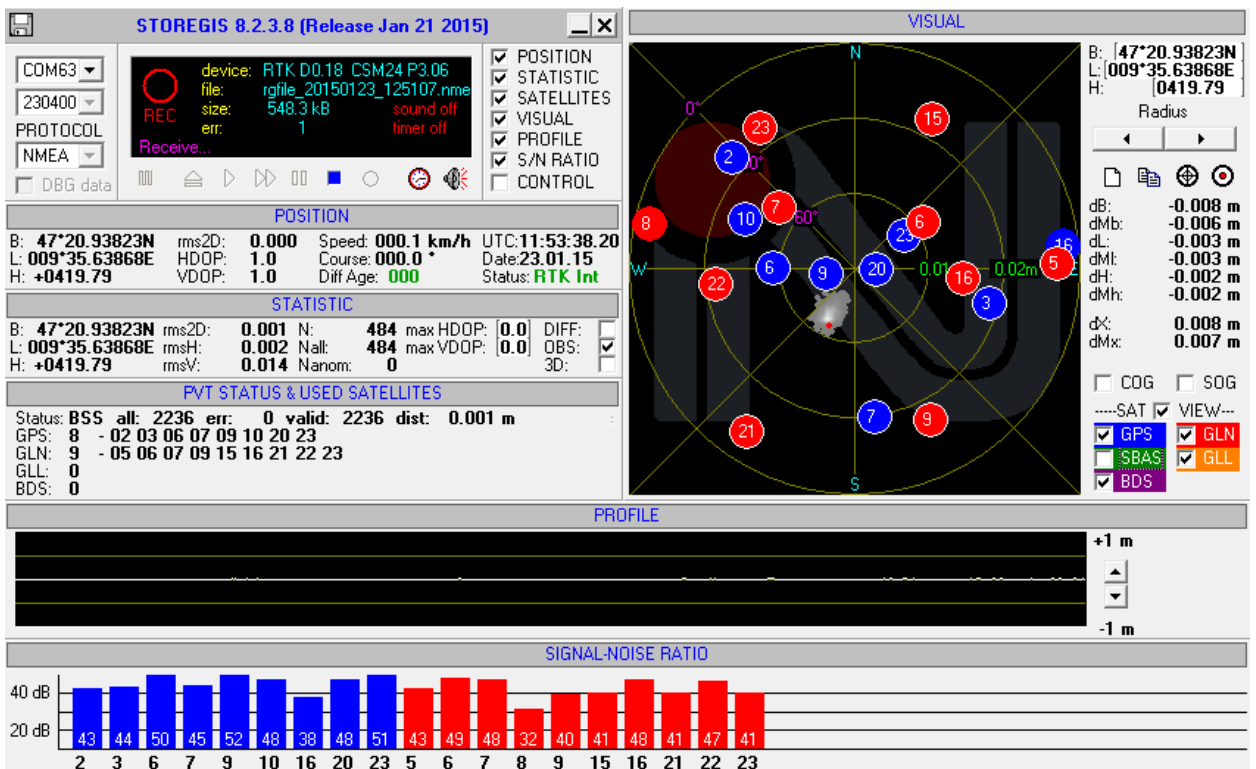
Navigation settings of NV08C-RTK-EVK can be controlled in CONTROL window (see picture below):
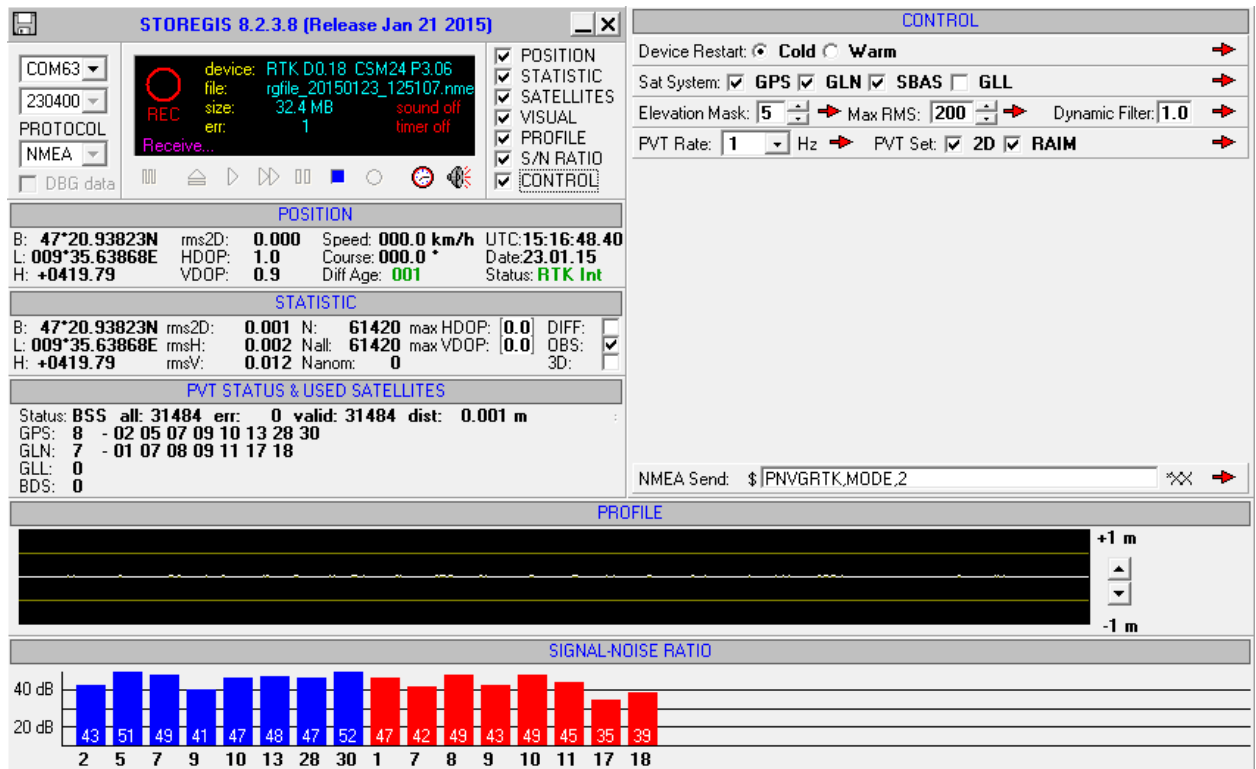
The CONTROL window supports the most frequently used configuration commands as device cold or warm restart, choosing of navigation systems etc. as well as sending NMEA messages as a string for manual control of NV08C device.

3.3. RTK-EVK Operation Modes

NV08C-RTK supports the following 3 modes:

- RTK-Rover mode (by default)
- Base mode
- Autonomous mode

Operation mode setting is provided by **$PNVGRTK,MODE,x** NMEA message (see also NV08C-RTK NMEA Protocol Specification):

> **$PNVGRTK,MODE,2** message turns NV08C-RTK to **RTK-Rover mode**.
> **$PNVGRTK,MODE,1** message turns NV08C-RTK to **Base mode**.
> **$PNVGRTK,MODE,3** message turns NV08C-RTK to **Base mode** with antenna position averaging.
> **$PNVGRTK,MODE,0** message turns NV08C-RTK to **Autonomous mode**.

3.3.1. Switching of RTK-EVK to Base mode

Switching of NV08C-RTK to Base mode must be accompanied by setting of the base antenna coordinates in XYZ or BLH formats. The antenna coordinates can be setup either automatically by the antenna position averaging procedure or manually by transmitting of known antenna coordinates to the NV08C-RTK. After switching to Base mode NV08C-RTK will continuously transmit RTCM data to **UART2 port**.

NV08C-RTK-EVK can be switched to Base mode after predefined time of antenna position averaging by the following NMEA messages:

$PNVGRTK,MODE,3 message turns on antenna position averaging with automatic switching to Base mode. The default averaging time is 30 min. There is no need to send **$PNVGRTK,MODE,1** message prior to this message.

$PNVGRTK,AVGTIME,MM message sets the required averaging time, where MM is averaging time in minutes.

Both messages can be combined as following:

$PNVGRTK,MODE,3,AVGTIME,1440   message will switch NV08C-RTK to antenna position averaging mode with 24-hour of averaging time.

Instead of running of the antenna position averaging procedure the known base antenna coordinates can be setup manually by sending of NMEA message:

$PNVGRTK,BASEXYZ,4268995.210,721584.974,4668481.373 message sends the coordinates in XYZ format.

$PNVGRTK,BASEBLH,4720.9382274,N,00935.6386753,E,467.704 message sends the coordinates in BLH format.

These messages can be combined with **$PNVGRTK,MODE,1** message as following:

**$PNVGRTK,MODE,1,BASEXYZ,4268995.210,721584.974,4668481.373** or

$PNVGRTK,MODE,1,BASEBLH,4720.9382274,N,00935.6386753,E,467.704

3.3.2. Sending RTCM data to RTK-EVK

UART2 of RTK-EVK is configured as RTCM v3 115200 bps and ready to receive RTCM corrections from a BASE Station in RTCM v3 format.
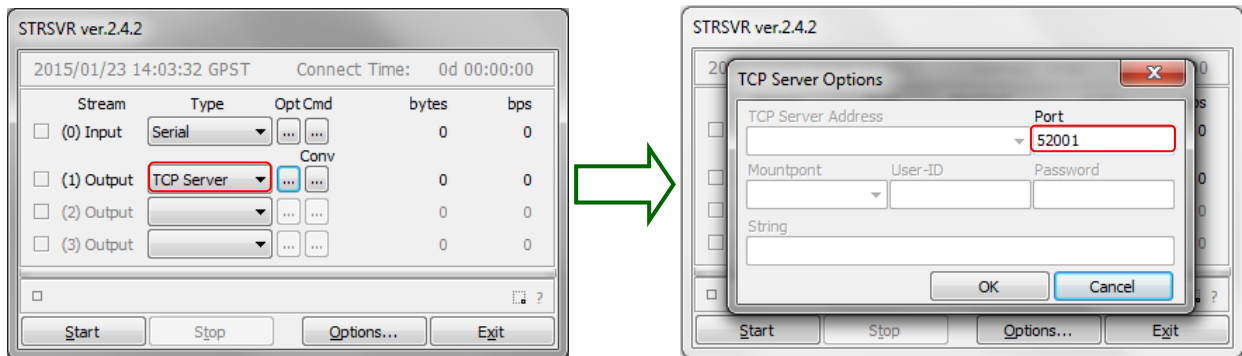
strsvr.exe SW Tool from RTKLib package (www.rtklib.com) can be used to transmit RTCM data available at a NTRIP Caster/Server over a radio link, Internet or LAN and retranslate the data to RTK-EVK.

The SW support data retranslation between NTRIP Server/Client or TCP Server/Client and Serial COM-ports in any combination. One instance of running **strsvr.exe** program supports one data source and up to three data targets.
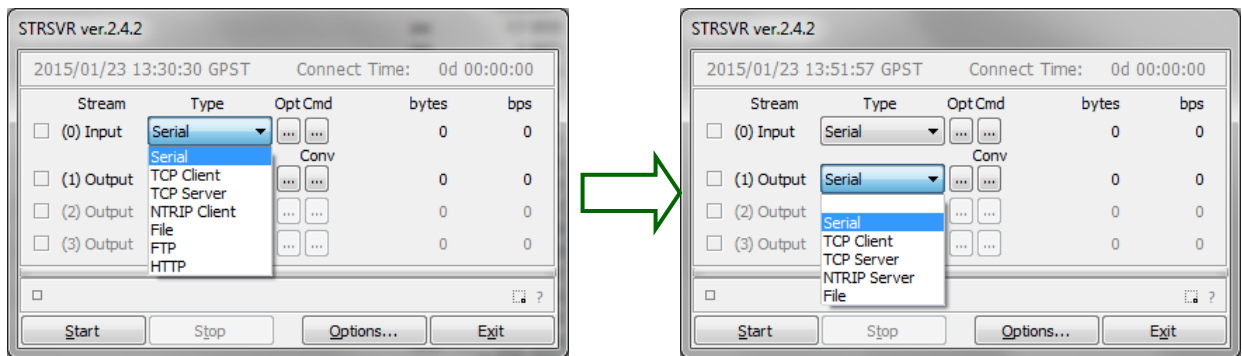
Below is an example of **strsvr.exe** configuration for retranslation of RTCM data from NV08C-RTK Base to NV08C-RTK Rover within LAN:

NV08C-**Base** configuration: UART2 → TCP Server

NV08C-**Rover** configuration: TCP Client → UART2

4. Appendix 1. RTK-EVK electrical schematic