TABLE OF CONTENTS

1 CONNECTION TO PC .................................................................................................................................................. 3
2 HEADING DETERMINATION MODE [SINGLE+HEADING] .......................................................................................... 6
3 DGPS MODE ............................................................................................................................................................. 9
4 DIFFERENTIAL POSITIONING MODE [RTK+HEADING] ............................................................................................ 13
5 GENERATION OF RAW RANGING DATA ................................................................................................................... 16
6 NON-VOLATILE FLASH ............................................................................................................................................. 21
CONTACT ................................................................................................................................................................. 22
1 CONNECTION TO PC

NTL Browser is a software tool designed to communicate with NTL104 through NTL Adp Board (or other interface adapter designed by NTLab company). It is provided as a zip file. It is available on NTLab company FTP server. Link (password and login) may be provided on request.

Follow to the next steps to connect NTL104:

1. Install NTL Browser on computer.
3. Connect NTL104 to the NTL Adp Board.
4. Connect Master and Slave antennas to NTL104 (connector X1 and X2 of the NTL104, respectively).
5. Connect NTL Adp Board to PC through mini USB cable (connector X1 of the NTL Adp Board).

NTL Adp Board provides +5V supply voltage for navigation module and simplifies connection to host computer.

NTL104 UART outputs is available on PC via on-board 4xUART to USB converter (CP210x based) as virtual COM ports.

At this stage, four virtual COM ports should be detected on operating system. See example below. Two of four virtual COM ports provide access to Master PPU (Interface 0) and Base Station (BS) data input (Interface 1).
6. Run NTL Browser on computer. Then configure it:

- Select interface language in the upper right corner of welcome page;
- Connect to the COM227 Port. Port number could be different for alternative PC;
- Set up 115200 Baud rate and NTL Binary Protocol type or Set up Auto detect checkbox to define them automatically
- Click on the Connect button to continue.

NTL Browser Main page consists of the multiple windows, that can be switched on/off in Windows toolbar. Select necessary windows for your work.
Windows display different navigational information and may be configured on demand (see example below).

**Message Log** window displays periodical messages coming from the receiver. While the interface mode is NTL Binary, messages have binary format. You can see textual interpretation of their content in **Message Log** window printed in blue color. If the interface mode is NMEA, received data is printed directly in **Message Log** in black color.
2 HEADING DETERMINATION MODE (SINGLE+HEADING)

By default, master PPU channel operates in *Single solution* mode and processes GPS, GLONASS and NavIC signals. While operating in NTL Binary mode, configuration settings are available in *Settings* menu.

*Heading determination mode can be switched on:*

1. Select the *Settings/Show settings* section

2. Then select the *Solution parameters* section
• In the Solution Parameters sub-section, select ‘SINGLE+ANGLE’ as the Solution type;
• Click on the Save button. Exit the Settings section.

The information about 2D orientation (Heading) is displayed in the Course window, which represents information from HDG_DATA (it is available in NMEA mode to), YPR_DEG, HVECT_DATA messages.

3. Ensure that appropriate messages are switched on. To do this:
• Select the Settings/Show settings/DataSet section;
• Click on the Save button. Exit the Settings section.
4. Wait for the FIX Status in Course window (maximum accuracy mode).

Positioning mode is standalone [Single]. Orientation estimates are based on determination of mutual position of Master and Slave antennas (moving-base RTK mode).
3 DGPS MODE

**DGPS mode can be switched on:**

1. Switch on SBAS ON mode:
   - Select the Settings/Show settings/Solution Parameters section. In the Solution Parameters sub-section select 'SBAS ON' as the SBAS mode;
   - Click on the Save button. Exit the Settings section.

While we are in DGPS mode, only GPS+SBAS satellites will be used. DGPS mode indicated with '2' in the General Information window in the Quality sub-section (or status field of GGA message). See below.
2. Switch on SBAS+ mode:

- Select the **Settings/Show settings/Solution Parameters** section. In the **Solution Parameters** sub-section select ‘SBAS + ON’ as the **SBAS mode**;
- Click on the **Save** button. Exit the **Settings** section.

In this mode all available GNSS satellites will be used in navigation solution. GPS satellites will get full set of SBAS corrections. Measurements based on other GNSS systems will get only consistent part of SBAS corrections.

While we are in **SBAS+** mode SBAS satellite number is indicated in the last field of GGA message. GGA status field will remain ‘1’ [displayed in the **General Information** window in the **Quality** sub-section]. See below.
Internal logic of NTL104 selects the best SBAS satellite to be used in navigation solution. Up to 6 SBAS satellites may be tracked simultaneously.

- Select the **Settings/Show settings/Navigation systems** section to control SBAS satellites manually. By default, NTL104 module tracks EGNOS and GAGAN satellites;
- Click on the **Save** button.

SBAS satellite numbers 120 ..158 may be programmed on this page. Settings would have become active only after they are saved into FLASH memory and receiver reloaded.
3. Switch off SBAS mode (SBAS OFF) to enter regular SINGLE positioning mode:
   - Select the Solution Parameters section. In the Solution Parameters sub-section select ‘SBAS OFF’ as the SBAS mode;
   - Click on the Save button. Exit the Settings section.

While you are in SINGLE positioning mode, tropospheric and ionospheric corrections are performed in accordance with GNSS ICDs. Due to multi constellation support there is a variety of available correction modes. Parameters in section Settings/Show settings/Atmospheric Corrections allow control over correction methods. Recommended parameters are on the picture below. Refer to «GNSS-PPU-SETUP-GUIDE-6-62-00.pdf» for details before making modifications.
4 DIFFERENTIAL POSITIONING MODE (RTK+HEADING)

We should provide base station measurements data to make RTK positioning mode available. In this example we will receive base station data from local VRS network via Internet. STRTOSVR utility will be used to redirect data flow to COM229 (Interface1).

**Differential positioning mode can be switched on:**

1. Run `strsvr.exe` utility from RTK LIB package

2. VRS network provides data in RTCM3 format. Novatel OEMv7 data format may be used as an alternative. Appropriate settings should be made in receiver:
   - Select the **Settings/Show settings/Interface** section. Make sure UART4 is set up

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1 Required tools are available on NTLab FTP server. Link (password and login) may be provided on request.
Click on the Save button.

Select the DataSet section. Make sure, the necessary messages are selected.

Select the Settings/Show settings/Solution parameters section. In the Solution type subsection, select 'RTK+ANGLE';

Click on the Save button. Exit the Settings section.

RTK settings sub-section contains some control parameters defining RTK positioning mode. Refer to «GNSS-PPU-SETUP-GUIDE-6-62-00.pdf» for details.

At first, receiver enters RTK FLOAT mode (Quality '5'):
In some time, receiver enters RTK FIX mode (Quality ‘4’) - the most accurate positioning mode. Base station number, corrections age and solution status are indicated in GGA messages.

Another one NTL10X-series receiver may be used as a reference receiver instead of VRS network. Refer to Section 5 to setup receiver as a source of raw ranging data.
5 GENERATION OF RAW RANGING DATA

Navigation module can be used as a source of raw ranging data for further post processing or differential positioning.

*This can be done as follows:*

1. Select the *Settings/Show settings/Interface* section. In the *RAW DATA* sub-section set UART1. Click on the *Save* button.

2. Select the *DataSet* section. In the *Data Set* sub-section deselect all checkboxes. Click on the *Save* button. After this action module stops NTL Binary periodic messages generation.
3. Select the Raw data section. In the Raw data rate sub-section, select ‘1 Hz’ and ‘NOVATEL’ as the RAW SHELL. In the Messages sub-section can be specified NOVATEL and RTCM3 messages type. Click on the Save button. Refer to «GNSS-PPU-SETUP-GUIDE-6-62-00.pdf» for other details.

4. Exit the Settings section.

5. Exit NTL Browser to release COM port. To do this, select Connection/Disconnect.

Generation of raw data in Novatel format is shown on the picture below. RTCM3 is not suitable to transmit measurements made on NavIC signals. RTKNAVI tool may be used to visualize and write Raw data measurements.
6. Run the `rtk_navi.exe` utility:
   - Click on the 'I' button;
   - In the Format sub-section select 'NovAtel OEM6';
   - In the Opt sub-section (Serial Options window) select 'COM227' as the Port, and '115200' as the Bitrate. Click on the 'OK' button;
   - Click on the 'L' button. Specify Log File Paths, to write raw data into. Click on the 'OK' button;
   - Click on the 'Options' button. Set Positioning Mode to 'Single'. Click on the 'OK' button;
   - Click on the Start.

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2 Required tools are available on NTLab FTP server. Link (password and login) may be provided on request.
The rtk_navi.exe utility get receiver position, so raw data accepted and processed. But RTKNAVI can’t visualize NavIC data.

7. Convert Novatel Raw data we have already written down into RINEX format to check ability of NavIC measurements:
   - Run the rtkconv.exe utility
     - Select source file and data format;
     - Setup Options as on the picture below. Click on the 'OK' button.
     - Click on the 'Convert' button.

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3 Required tools are available on NTLab FTP server. Link [password and login] may be provided on request.
NavIC measurements present in resulting *.obs file:

<table>
<thead>
<tr>
<th>Type</th>
<th>Station ID</th>
<th>Date/Time (UTC)</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Elevation</th>
<th>Range (km)</th>
</tr>
</thead>
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<tr>
<td>I</td>
<td>NavIC</td>
<td>2019 12  4 10  7</td>
<td>8.0000000 0 20</td>
<td>69.335</td>
<td>40.000</td>
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</tr>
<tr>
<td>G</td>
<td>NavIC</td>
<td>24630716.765</td>
<td>12943526.895</td>
<td>2572.844</td>
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<td></td>
</tr>
<tr>
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<td>NavIC</td>
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<td>11971810.054</td>
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<td>15424757.868</td>
<td>831.031</td>
<td>37.000</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>NavIC</td>
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<td></td>
</tr>
<tr>
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<td>11342257.826</td>
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<td>37.000</td>
<td></td>
</tr>
</tbody>
</table>

S-band measurements are not converted by RTKCONV. Some custom tools should be developed to get this data in RINEX format.
6 NON-VOLATILE FLASH

All receiver settings made in NTL Browser will be lost after the next power off if they are not saved into nonvolatile memory. NTL104 receiver allows two sets of controls to be saved into FLASH.

To do this:

1. Select Settings/Show settings/Save Settings section;
2. Enter textual tag for current scope of control parameters (optionally);
3. Select a name for current scope of controls: SET1 or SET2;
4. Select a set of controls to be loaded with (active set): DEFAULT or SET1 or SET2.

During the next power on saved setting will be restored and used during receiver start up.
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