

**The LLRP RFID Protocol plugin
PRINTED MANUAL**

LLRP RFID Protocol plugin

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1 Introduction

You can use our loggers and the LLRP Reader Protocol module to build a data collection server, and to integrate RFID readers that support the LLRP protocol into an enterprise's existing control and tracking system. In this system, RFID readers interact with tags and send data to Data Logger, which acts as the central server. The purpose of Data Logger is to pre-store and filter data, and possibly to write them to a log file or a database. Using the commonly used terminology, we can call this software solution "RFID Middleware."

This module has the following features:

- Can work as a client and polling the RFID readers and read tags;
- Can work as a server and receive notifications from a RFID reader;
- Can write information to the tag's memory;
- Can change tag's EPC ID.

2 System requirements

The following requirements must be met for "LLRP RFID Protocol" to be installed:

Operating system: Windows 2000 SP4 and above, including both x86 and x64 workstations and servers. A latest service pack for the corresponding OS is required.

Free disk space: Not less than 5 MB of free disk space is recommended.

Special access requirements: You should log on as a user with Administrator rights in order to install this module.

The main application (core) must be installed, for example, Advanced Serial Data Logger.

Notes for Microsoft Vista and above:

Since our software saves data to the registry and installs to the Program Files folder, the following requirements must be met:

1. You need Administrator rights to run and install our software
2. The shortcut icon of our software will be located on the desktop;
3. Windows Vista will ask for your confirmation to continue the installation.

NOTE: You can configure the user account only once in order not to see the above dialog box any more. Search Google for the solution of this problem.

3 Installing LLRP RFID Protocol

1. Close the main application (for example, Advanced Serial Data Logger) if it is running;
2. Copy the program to your hard drive;
3. Run the module installation file with a double click on the file name in Windows Explorer;
4. Follow the instructions of the installation software. Usually, it is enough just to click the "Next" button several times;
5. Start the main application. The name of the module will appear on the "Modules" tab of the "Settings" window if it is successfully installed.

If the module is compatible with the program, its name and version will be displayed in the module list. You can see examples of installed modules on fig.1-2. Some types of modules require additional configuration. To do it, just select a module from the list and click the "Setup" button next to the list. The configuration of the module is described below.

You can see some types of modules on the "Log file" tab. To configure such a module, you should select it from the "File type" list and click the "Advanced" button.

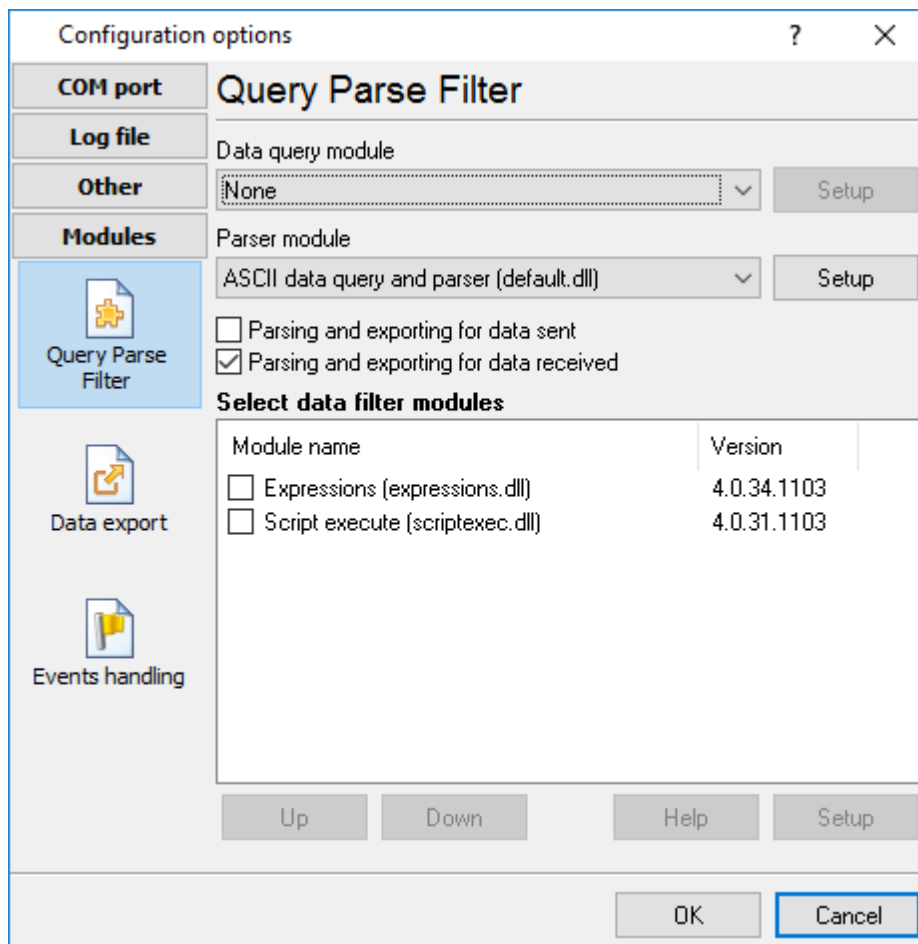


Fig.1. Examples of installed modules

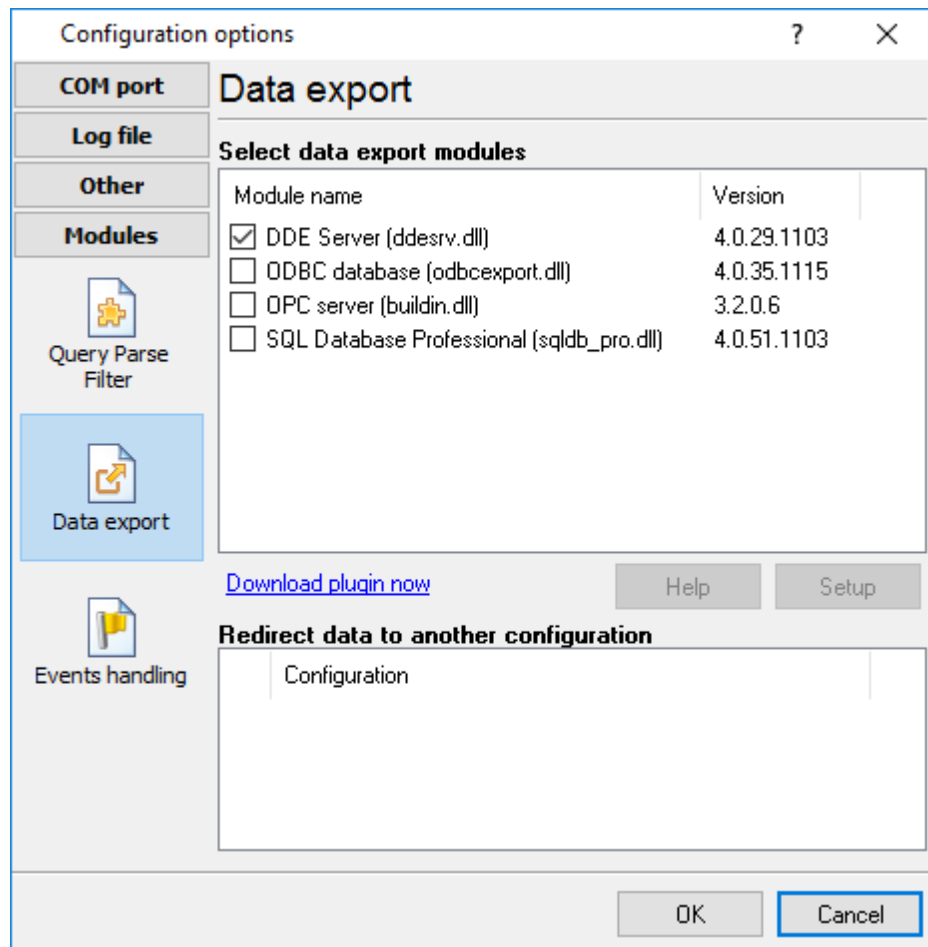


Fig.2. Examples of installed modules

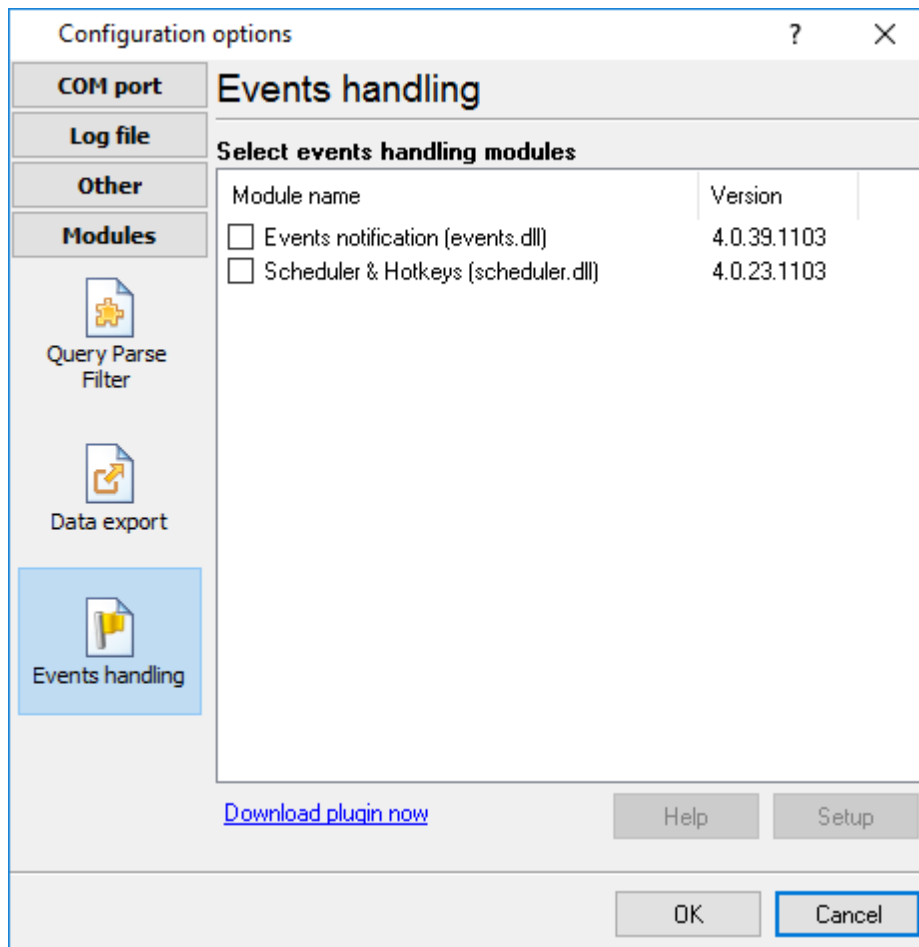


Fig.3. Examples of installed modules

4 Glossary

Plug-in - module

Main program – the program shell that uses this module. For example: Advanced Serial Data Logger

Parser – the module that processes the data flow singling out data packets from it and variables from data packets. These variables are used in data export modules after that.

Core - see "Main program".

5 User manual

Configuring the connection with the reader

Information: According to the LLRP protocol specification, TCP port number 5084 is used for data transfer.

An RFID reader usually acts as a TCP server. In this case, the computer (client) initiates a connection to the reader and acts as a TCP client.

Note: Do not confuse the terms “client” (as referred to the LLRP protocol) and “TCP client.”

Note: The logger's network activity may be blocked by your firewall. To make sure that the logger can do its job, add it to your firewall's exception list.

To configure the logger as a TCP client, specify the IP addresses of the RFID readers as shown in Figure 1.

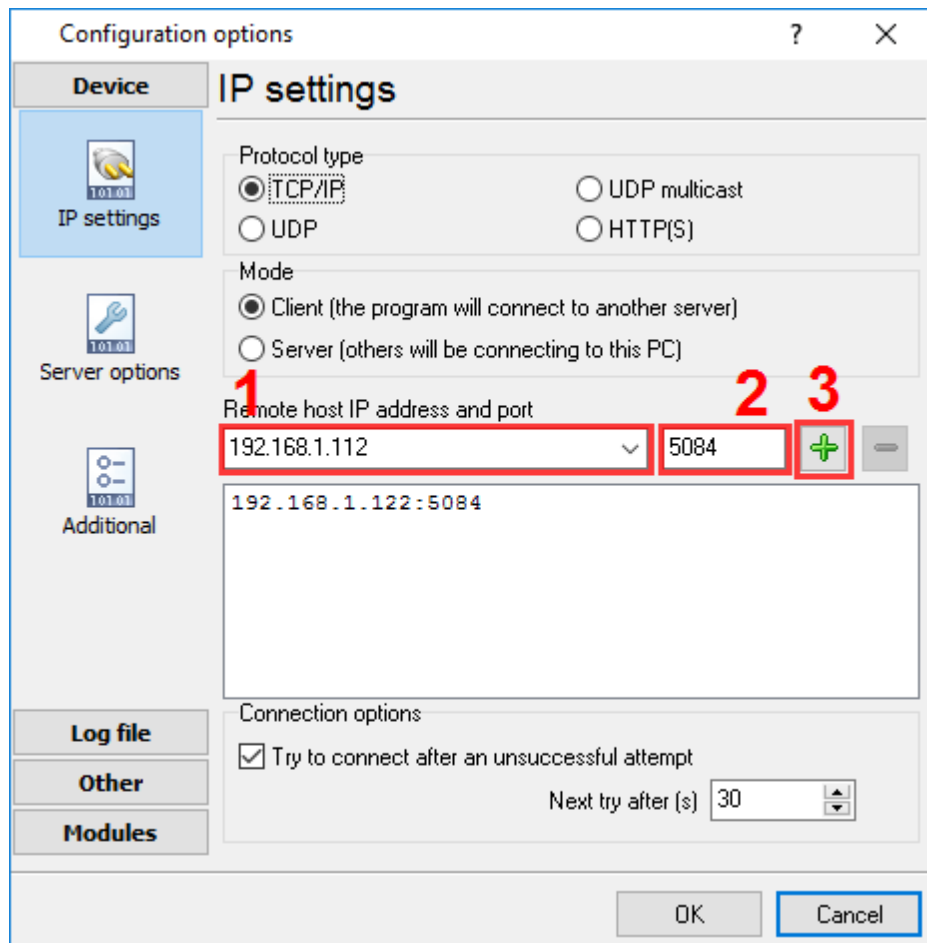


Figure 1: Configuring the TCP client mode

If the reader is configured as a TCP client (see the user manual for the reader), you should configure the logger as a TCP server. In this case, enter the server's IP address in each reader's settings. The

TCP server will be waiting for readers to connect. In the TCP logger's settings, enter only one address and one port (see Figure 2).

Information: One server can simultaneously handle multiple readers.

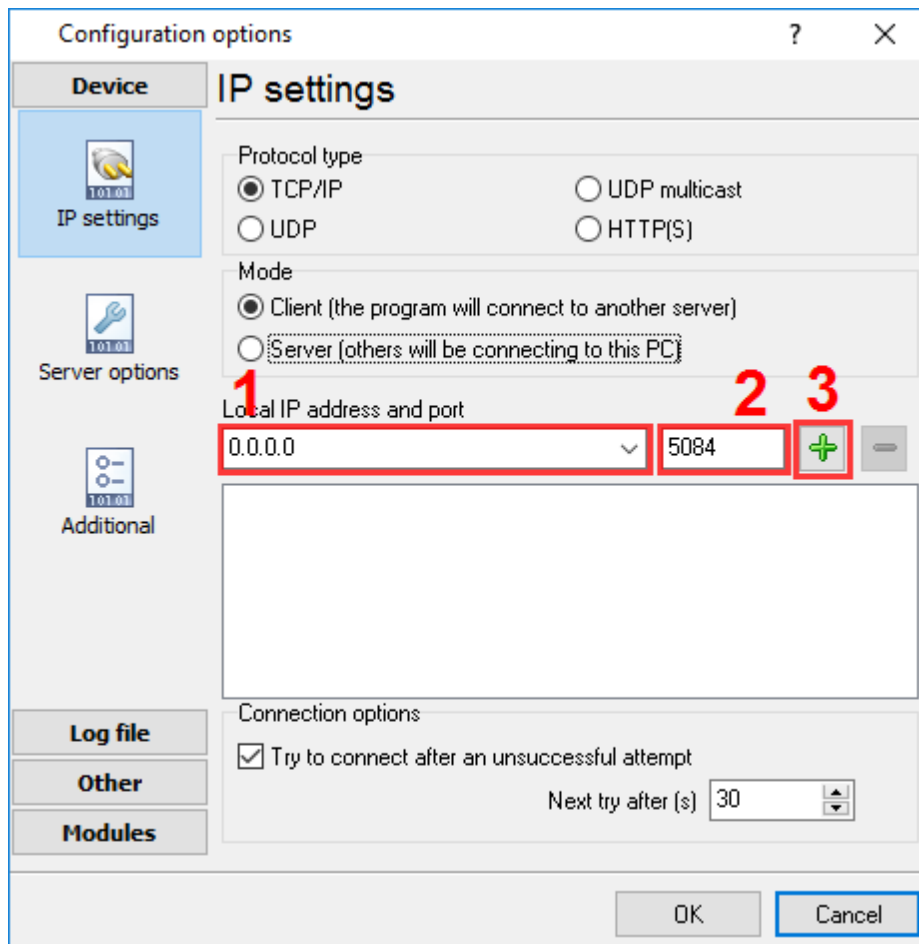


Figure 2: Configuring the TCP server mode

To ensure a stable connection with the readers, it is recommended to configure the selected options as shown in Figure 3.

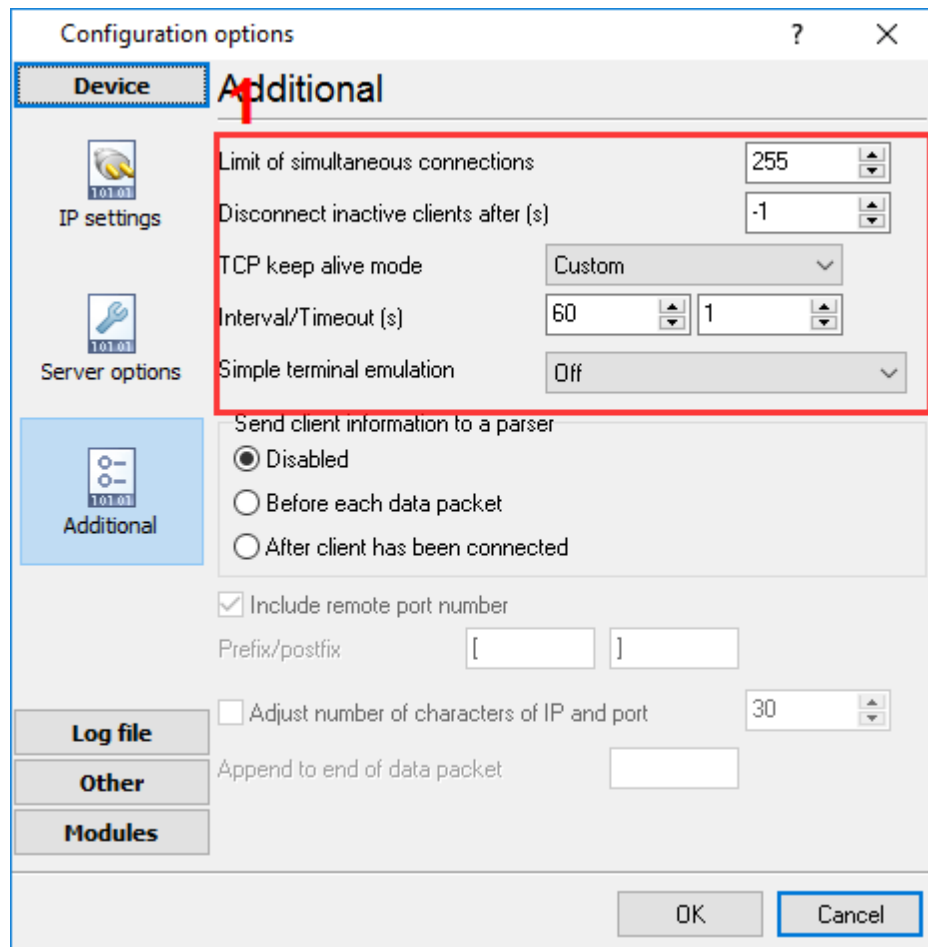


Figure 3: Additional TCP connection settings

Configuring the data parser

The purpose of the LLRP Reader Protocol parser module is to facilitate an interaction with the reader. When a TCP connection is established, the module will configure the reader's operation mode, and then will receive and process the incoming data.

Select the module from the two drop-down lists as shown in Figure 4.

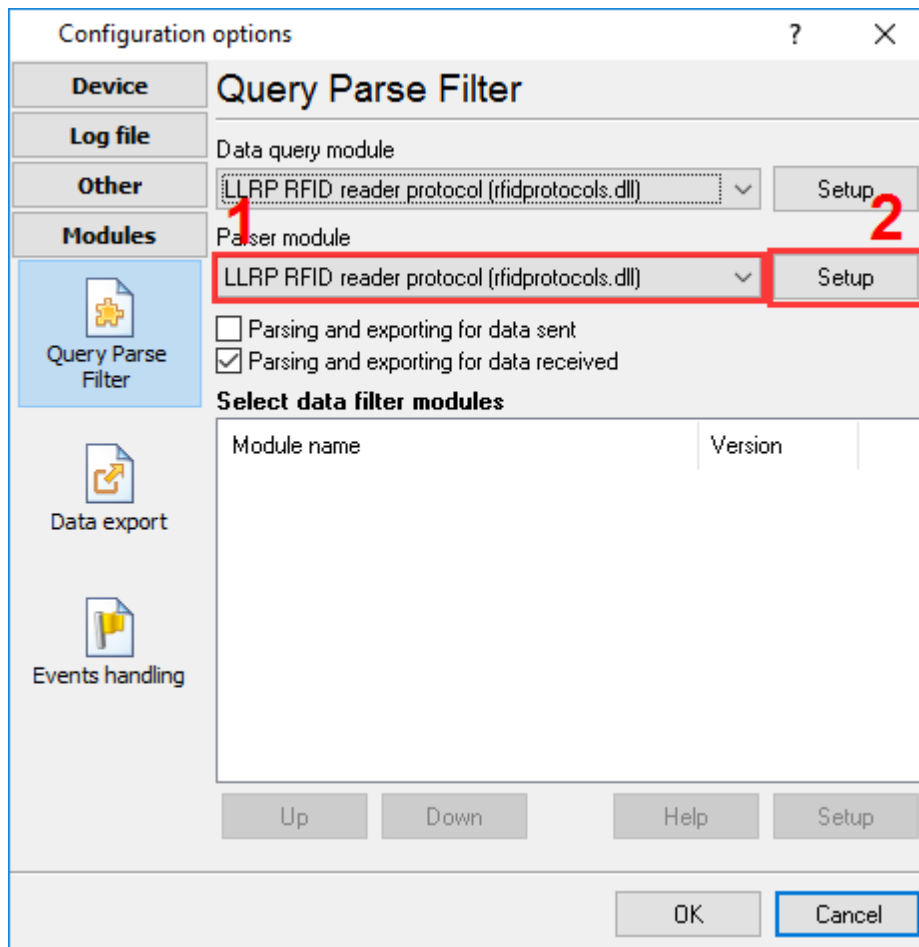


Figure 4: Selecting the parser module

To additionally configure the module, click the "Configure" button next the the selected module. The module configuration window will open (Figure 5).

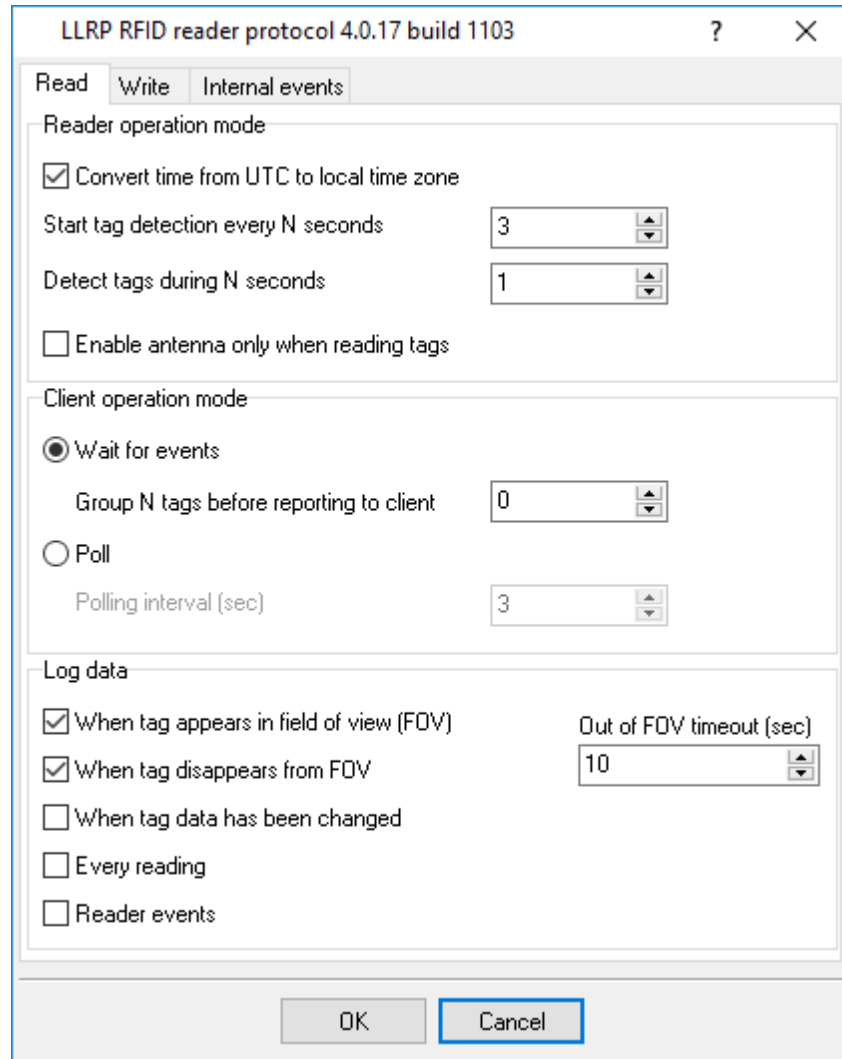


Figure 5: Configuring the module

Reader operation mode

Use the “Reader operation mode” parameter group to define how the reader should read RFID tags. These parameters will be sent to the reader when a connection is established.

Convert time from UTC to local time zone — If this option is turned on, the application installed at the computer will convert the UTC time (sent by the reader according to the LLRP protocol) into the computer’s local time. If this option is turned off, the application will not do the conversion but will export the time as received from the reader.

Start tag detection every N seconds — If this parameter is not set to zero, the reader will be checking for any tags in its field of view (FOV) at the specified time interval. If this parameter is set to zero, the reader will be continuously checking for any tags in its field of view. This parameter directly affects the amount of data transferred between the reader and the computer. The more the time interval, the less the traffic.

Detect tags during N seconds — This parameter defines the time during which the reader will be

polling the tags. It is recommended to set this parameter less than the tag detection interval.

Enable antenna only when reading tags — If this option is turned on, the reader will be enabling the antenna only when the tags are being read. If the tag reading interval is sufficiently large, disabling the antenna of the active reader may considerably reduce the reader's power consumption, and may also reduce the level of electromagnetic radiation in the room where the antenna is installed.

Client operation mode

In the terms of the LLRP protocol, the logger is always a client, regardless of the TCP/IP operation mode.

Wait for events — In this mode, the logger awaits data from the reader. The reader will start sending data if it detects one or more tags in its FOV. The larger the tag detection interval specified in the reader's settings, the less frequent the events.

Group N tags before reporting to client — This parameter lets you additionally optimize the data transfer from the reader to the computer in the event mode. If this parameter is not set to zero, the data will be sent to the computer if the tag polling interval is over and at least one tag was detected, or if N tags were read within that interval. The reader may read the same tag more than once during the polling interval, so the value of N per se doesn't guarantee that multiple different tags have been read.

Poll — In this mode, the logger will be sending a request to the reader at the interval specified in the "Polling interval" field, and check for any data. The tags will be stored and grouped in the reader. It is recommended to use this mode in case of a large number of tags in the FOV, as it considerably reduces the amount of traffic between the reader and the computer.

Data logging

Use the "Log data" parameter group to configure pre-filtering of the data read by the reader.

"When tag appears in field of view" and **"When tag disappears from FOV"** — If these options are turned on, the logger will log the data only at the moment when a tag appears in and/or disappears from the reader's FOV.

Important! Configure time synchronization with an accurate time for the reader. A considerable difference between the reader's time and the data collection server's time may cause a false operation of the algorithm that detects tag appearance/disappearance in/from the FOV.

When tag data has been changed — Each tag that has been read is characterized by a set of associated data, such as the time of appearance, the number of readings, signal level, etc. If this option is turned on, the data will be logged only if one or more of the associated values change.

Every reading — All data read will be logged.

Reader events — The reader's additional internal events, such as enabling/disabling of the antenna, connection of a client, etc. will be logged. You can configure the events manually (see "Fine-tuning the reader").

Exported variables

The LLRP Reader Protocol parser module generates variables, which are sent to the data export modules. Before getting to the data export modules, the variables are pre-filtered via the "Data

logging” parameter group.

Each variable consists of a name and a value of a certain type (see Table 1). In the data export module, you can refer to a variable by its name.

The application works with the reader as follows:

1. Data are received from the reader.
2. The data are parsed.
3. The data are pre-filtered.
4. Variables are prepared.
5. The prepared variables are sent to each of the enabled filtering modules (see Figure 4). Note that variables for each reading are sent to the filtering modules separately from variables for other readings. If any filtering module has blocked the data, they will not be processed any more (go to Step 7).
6. The prepared variables are sent to each of the enabled data export modules (see “Configuring data writing to a Firebird database”).
7. The variables created at Step 4 are deleted. The variables “live” only while being processed by the filtering modules and/or the data export modules.

Table 1

Name	Description	Data type
TAGREPORTDATA_EPCDATA	Tag identifier	String
TAGREPORTDATA_ANTENNAID	Antenna identifier	Integer
TAGREPORTDATA_PEAKRSSI	Transmitter’s peak value	Integer
TAGREPORTDATA_FIRSTSEENTIMESTAMPUTC	Date and time of the first tag detection. The time corresponds to one set in the reader. If UTC time is used in the reader, the value will contain UTC time.	DateTime
TAGREPORTDATA_LASTSEENTIMESTAMPUTC	Date and time of the last tag detection.	DateTime
TAGREPORTDATA_TAGSEENCOUNT	Number of tag detection attempts.	Integer
TAG_OUT_OF_FOV	Indicates that a tag has disappeared from the FOV. This variable appears only if you have enabled the logging of tag disappearance from the FOV. If the value of this variable is 1, the data corresponds to the “Tag disappearance from FOV” event.	Integer

Note: The composition of variables may change. Other variables may be added, depending on how you fine-tune the reader.

Writing data to the tag's memory or a change of the tag's EPC identifier

You can use the “Write” tab (Figure 6) to write data to the tag's memory (if the tag supports that action). This feature can be used only with tags that support the “Class-1 Gen-2” standard.

LLRP RFID reader protocol 4.0.17 build 1103

Read Write Internal events

Class-1 Gen-2 tags only!

Reader

IP address 192.168.0.15

Antenna 1

Tag ID (HEX, empty - all tags) 00000123

Tag memory

Tag ID

New tag ID (HEX) 00000123

Arbitrary data block (DANGEROUS! USE AT YOUR OWN RISK!)

Memory bank/word pointer 1 0

Data type

Data (HEX, for example: AB0089)

ASCII text (for example: data)

AB0089

Write...

OK Cancel

Figure 6: Writing data to the tag's memory

IP address — The reader's IP address. The reader should be duly configured, its IP address should be specified in the TCP/IP settings (see “Configuring the connection with the reader”), and a connection with the reader should be established.

Antenna — The number of the reader's antenna located near the tag.

Tag ID — A unique identifier of the tag in HEX format.

Select the data writing mode in the “Tag memory” parameter group.

New tag ID — A new tag identifier. The application will automatically write the new identifier to the correct memory area.

Arbitrary data block — You can write any data block to any memory bank, starting from any memory cell.

Memory bank — The number of the memory bank:

- 0 — Reserved block.
- 1 — Memory block for storing the identifier.
- 2 — Memory block of the TID type.
- 3 — Memory block for storing user data.

WORD pointer — A memory cell address to start writing data from. Memory cell numbering starts from 0. Each cell's size is 2 bytes (WORD data type).

Note 1: A memory cell address should be specified, not a byte address in the memory. As each cell contains 2 bytes, the size of data written (in bytes) should be a multiple of two.

Note 2: The size of each memory block depends on the tag's maker.

6 Troubles?

6.1 Possible problems

No data for publication/exporting – no data is passed for exporting. Solution: configure the parser, make sure that one or more variables are declared in the parser.

Error on binding variable with name %s [%s] – the error usually occurs if data does not correspond to the specified format. For example, the date and time format does not correspond to the data.

Unable to disconnect from the database [%s] and **Unable to connect to a database [%s]** – it is impossible to connect/disconnect to/from the database. You should check the parameters of the database connection. The analysis of the additional information will help you locate the error.

Database access error [%s]. Stop operations with the database? – the message appears if an error occurs during an attempt to execute an SQL query if the second variant of reacting to errors is selected. The message implies a "Yes" or "No" answer. The analysis of the additional information will help you locate the error.

Unable to verify your SQL script [%s] – the message appears when an attempt to analyze your SQL query fails. Check if the syntax of your SQL query is correct.

Tested successfully – the message appears if your database connection is successfully tested. It requires no additional actions.

Database isn't used – the message appears if the module is temporarily disabled (the "Temporarily disabled" check box is selected) or the database name field is empty. Check the connection parameters.

Database isn't selected - the message appears if the database type is not selected. Check the connection parameters.

Database: %s – %s contains the database name. The message appears if the database connection is successful. Usually, you see it when you call the module for the first time. It requires no additional actions.

Invalid data block length (columns=%d,length=%d) – an internal application error. It means that the data sent by the parser is in an invalid format. Perhaps, you are using the module incompatible with the version of the Advanced Serial Data Logger kernel. Update the versions of both the kernel and the module.

The time of connection is not due yet (%d,%d) – the message appears during an attempt to connect to the database after the connection to it has been lost and the "Reconnect after" option is enabled. No additional actions are required.

Invalid procedure call. Bad arguments – an attempt to call the module using invalid parameters. Perhaps, you are using the module incompatible with the version of the Advanced Serial Data Logger kernel. Update the versions of both the kernel and the module.

Writing to the database is complete - the message appears if your queue of SQL queries is successfully executed. It requires no additional actions.

Writing to the database is complete with errors – the message appears if the executing your queue of SQL queries was interrupted by an error. It requires no additional actions.

Your SQL is empty. Please, specify some SQL text first – the message appears if you do not enter the text for your SQL query. Check if the options on the "SQL queue" tab are configured correctly.

Invalid temporary path – the path to the temporary file specified by you does not exist. Enter a new path in the "Temporary folder" field on the "Errors handling" tab.

%s, %d – will be replaced by additional information.