LANSEN
WIRELESS BUILDING TECHNOLOGY

CONFIGURATION OF REPEATER

Repeater (R3): LAN-WMBUS-R(X)3-M/B-(LR)-(X)
Repeater(R4): LAN-WMBUS-R(X)4-M/B-(LR)-(X)
Microrepeater: LAN-WMBUS-uR-B

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Introduction

The Lansen repeaters, LAN-WMBUS-R3, LAN-WMBUS-R4 and LAN-WMBUS-uR, are advanced and highly configurable repeaters that are used for extending the range between meter(s) and gateway(s). Furthermore, the repeaters can be cascaded and used in a multihop setup with support for up to four repeaters (three if software version is lower than 140) repeaters, as shown below.

Furthermore, note that some of the options in this document is only available for repeaters with protocol version 11 and some are restricted for our microrepeaters, LAN-WMBUS-uR-B.

Meter ➔ Repeater ➔ Repeater ➔ Repeater ➔ Gateway

Our repeaters are ready to use right out of the box. If configuration of the repeater is required to fit specific needs, then the repeaters can easily be configured using our program, Lansen Configurator, with a Lansen Configuration USB-dongle, either LAN-WMBUS-D1-TC or LAN-WMBUS-D2-TC.

NTOE: Our repeaters can be preconfigured from production if needed. Contact us for more information.

It is also possible to configure our repeater by sending out configuration packets using other transmitters, e.g., gateways. This allows for remote configuration.

In this document, the first method of using our program, Lansen Configurator, is going to be used. This is explained further in chapter **Setup of repeater using Lansen Configurator**. If the second method is preferred, then please contact us directly for more information about this.

Abbreviations

Abbreviations	Meaning
WMBUS	Wireless Meter-bus
GW	Gateway
RX	Receive
TX	Transmit
SW	Software
RSSI	Received Signal Strength Indication

General knowledge

Waking the repeater

A repeater needs to be listening to be able to configure it. To ensure a repeater is listening, a permanent magnet can be held at the serial number label on the repeater. When the repeater senses a magnet, it starts beeping and a red LED will flash once every second. This indicates that the so-called *reed timer* has started.

NOTE: The red LED can only be seen if the front cover is open.

When the reed timer has started, a repeater will repeat incoming data and stay in listen mode until the reed timer is up. The number of minutes in which this mode is active is configurable, as explained in chapter **Magnet reed timer**.

NOTE: For the first 60 seconds after activating the repeater with a magnet, the repeater will only listen and answer to configuration data. This can be useful in environments with lots of traffic, where it otherwise might be hard to get in contact with the repeater.

NOTE: If the parameter *Automatic meter installation* is enabled, then the internal routing list of the repeater will be cleared when the magnet is applied to it.

Clearing the internal routing list

Our repeaters can store up to 932 different meters (100 for LAN-WMBUS-uR-B) in their internal routing list. In other words, up to 932 (100 for LAN-WMBUS-uR-B) unique meters can be retransmitted by a repeater. The internal routing list can be cleared in two ways, either by using a magnet on the repeater or by using Lansen Configurator.

To clear the internal routing list with a magnet, simply follow the instructions in chapter **Waking the repeater**. Note that it is only possible to clear the list with a magnet if the parameter *Automatic meter installation* is enabled.

To clear the internal routing list using Lansen Configurator, see chapter **Delete meter(s)**.

Setup of repeater using Lansen Configurator

Our program, *Lansen Configurator* (download from our website www.lansensystems.com/download) can be used to setup different parameters. The following chapters will describe how to use this program to connect and configure repeaters. Refer to **Figure 1** and **Figure 2** for an overview for what Lansen Configurator looks like at startup.

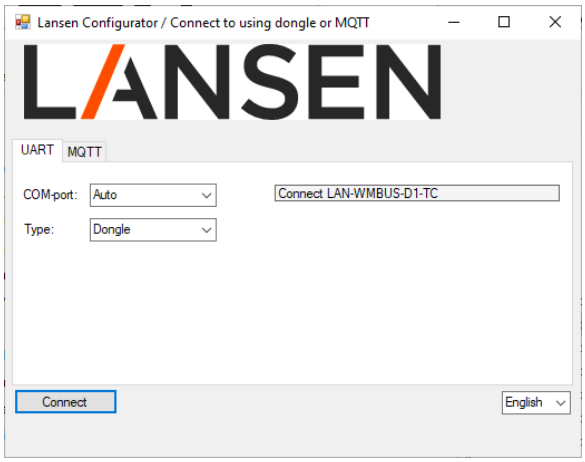


Figure 1: Start screen of Lansen Configurator. Here, a user can select which COM-port to use, if the type of connection is *Dongle* or *Wired connection* and change language from English to German.

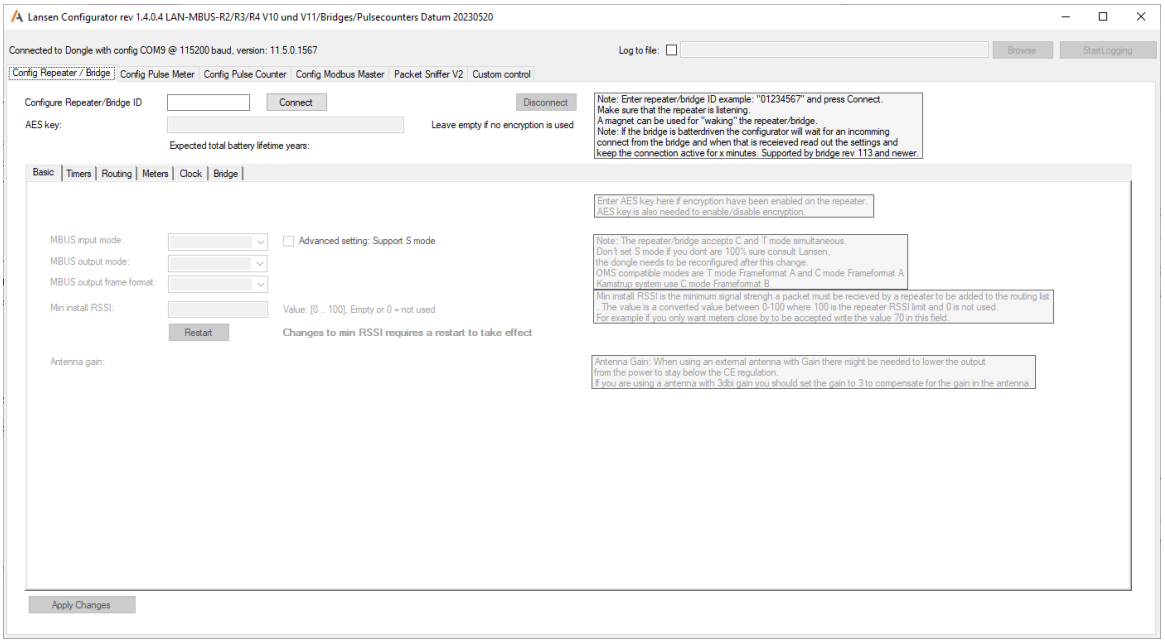


Figure 2: Overview of Lansen Configurator without any repeater connected.

Setup computer tool Lansen Configurator

Step	Action	Troubleshooting
1	Connect a Lansen Configurator USB-dongle, either LAN-WMBUS-D1-TC or LAN-WMBUS-D2-TC to your computer. Download (from lansensystems.com/download) and extract the downloaded *.zip-file to a folder on your computer.	
2	Open the folder and double-click on the program file called LansenConfigurator.exe to start the program. The program shall open like left picture in **Figure 1**.	
3	If needed, change language from English to German (bottom left corner). Click *Connect* to let the program connect to the USB-dongle. If successful, the program will start as **Figure 2**.	• The USB-dongle was not found or recognized by your computer. Unplug and plug in the USB-dongle again, then restart Lansen Configurator. • If unable to connect to dongle, make sure the necessary driver for the USB-dongle is installed. Go to lansensystems.com/download and download the driver for either LAN-WMBUS-D1-TC or LAN-WMBUS-D2-TC (depending on the model you have) and install the driver. Restart Lansen Configurator before retrying. • Auto was unable to find correct COM-port. Restart Lansen Configurator but next time select a COM-port manually in the field *COM-port*.

Connect to a repeater using Lansen Configurator

Step	Action	Troubleshooting
1	Make sure the program Lansen Configurator is running and that the USB-dongle is connected according to chapter **Setup computer tool Lansen Configurator**.	
2	In the field *Configure Repeater/Bridge ID*, enter the ID of the repeater that is to be configured. The ID can be found on the label with the text LAS.XXXXXXXX.YY.ZZ, where the numbers marked with X is the ID. The repeater can be forced into listening mode by one of the methods below. • Connect the battery (if not connected) • Use a magnet on the red reed switch (located behind the serial number label) **NOTE**: It is possible to connect to a repeater if it is already in listening mode withing forcing it into listening mode. **NOTE:** A mains powered repeater is always in listening mode.	• Battery repeater: Check connections on both ends of the battery cable so it is fully connected • Mains repeater: Check power cable and connections so everything is fully connected • Cable break: Try moving the cable to different positions and check if the cable is faulty • Faulty battery: Try with another battery • The repeater is not in listening mode. Try using a magnet or remove and reinsert the battery again • The repeater is too close to the USB-dongle. Make sure the distance is at least 1m.

3	In the program, press **Connect** and wait up to a minute for all data to be transferred.
	
	The repeater is fully connected when the fields are filled with numbers as in **Figure 3**.
		• A popup with the text “Timeout awaiting data response” is shown if the program failed to connect to the repeater. Check the following and then try to reconnect:
		  ○ ID is correct
		  ○ Repeater is on (red LED-lamp is blinking)
		  ○ Repeater is within range
		
		• If the red LED is not blinking, use a magnet on the red reed switch (located behind the serial number label) to activate it again, or remove and reinsert the battery/mains power.

Configure a repeater

Step	Action	Troubleshooting
1	Make sure *Lansen Configurator* is running and that the USB-dongle is connected according to chapter **Setup computer tool Lansen Configurator**.	
2	A repeater must be connected according to chapter **Connect to a repeater using** Lansen Configurator. When a repeater is connected, it looks like **Figure 3.**	
3	For information about each individual parameter, check chapter **Repeater parameters**.	
4	In order to change a parameter, click in the required field and update the value. To apply changes, click on the button *Apply Changes*.	If any error is received after the button *Apply Changes* has been pressed, make sure that the following conditions are met: • The repeater is in listening mode • The repeater is close enough • The repeater is more than 1 meter away from USB-dongle • The correct encryption key is entered (if encryption to change the parameters has been enabled on the repeater)
5	After the changes have been successfully transferred to the repeater, the updated fields will turn from red to green.	

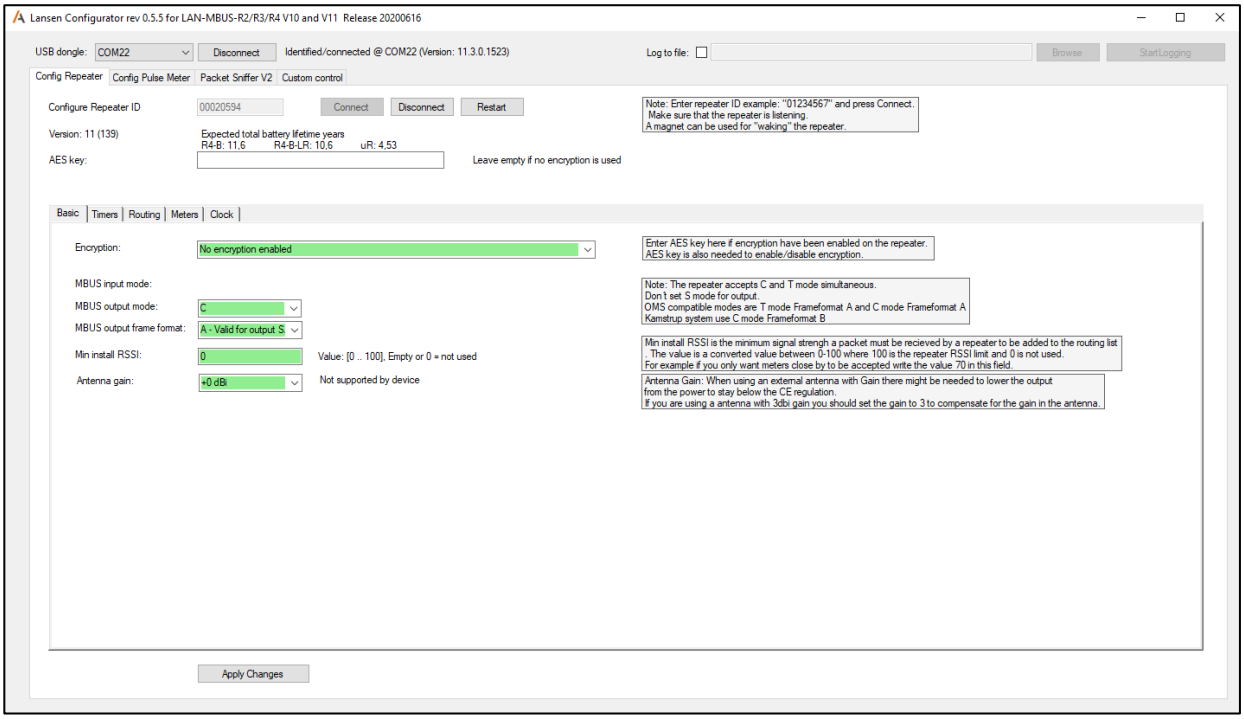


Figure 3: Overview of Lansen Configurator when a repeater is connected. A red field means that the parameter in the program does not match the value read from the repeater. Press "Apply Changes" to transmit the changes to the repeater.

Repeater parameters

In the following chapters, each tab and all parameter will be explained in greater detail.

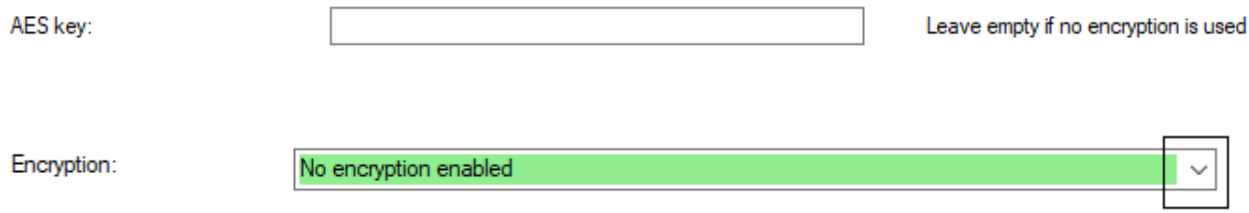
Basic-tab

This tab contains the so called “basic” parameters of the repeater.

AES key

NOTE: This option does not affect the encryption of incoming packets from sensors/meters.

This parameter is used to enable/disable the encryption options for a repeater. By default, the repeater is configured to not use encryption. This encryption is NOT used for encrypting incoming data packets from sensors/meters, it is only used for packets sent to the repeater for configuration and/or time synchronization.

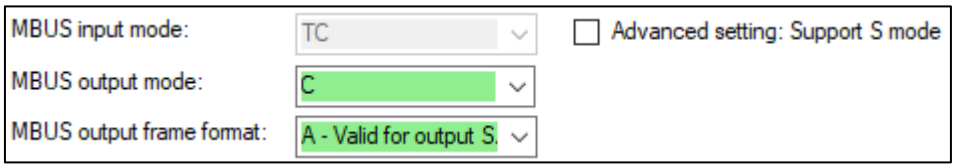


The different encryption options can be seen by clicking on the arrow marked by a box in the picture above. There are four options available, see table below. To change from one option to another, the correct AES key must be written in the field *AES key*.

Option	Meaning
No encryption enabled	Encryption is not enabled (default). When this option is enabled, the user does not need to write a key in the field *AES key* to change the other parameters for the repeater.
Enabled for configuration	Encryption is enabled. When this option is enabled, the field *AES key* must contain the correct key for the repeater to apply any parameter changes.
Enabled: OMS time sync	This option enables the OMS time sync. This option needs to be enabled to only allow encrypted time synchronization packets. Time synchronization packets are sent from a gateway using the OMS time synchronization format.
Enabled: OMS time sync and configuration	This option combines the two options above.

MBUS mode

These parameters are used to set the input and output communication format for the repeater.



By default, the repeater always accepts incoming data in C- and T-mode but the output mode can be changed to S-, C-, or T-mode with frame format A or B. Recommended use is:

- Input = TC
- Output = C
- Frame format = A

The repeater can listen for sensors in S-mode by first enabling “Advanced setting” and then setting the input more so S-mode. Make sure all other configurations of the repeater is done before setting it to S-mode as it will not be able to configure it afterwards.

NOTE: If input more is set to S, it will not be possible to configure the repeater further until the USB-dongle has been configured to send in S-mode. Contact Lansen for more information on how to proceed with this.

NOTE: If input mode is set to S-mode, then the repeater will not receive with C- and T-mode.

Min install RSSI

This parameter is used to ensure only meters with good signal strength is retransmitted by the repeater.

By using this parameter, one can control the minimum signal strength a meter must be heard by the repeater in order to be added to the internal routing list of the repeater. This can be used in an environment where multiple repeaters are deployed. By using this setting, only meters with a good connection to the repeater is handled, thus decreasing the risk for data collision in the air due to less retransmissions by fewer repeaters.

NOTE: A repeater must be restarted after this parameter has changed, otherwise the internal routing list will not be changed. A restart can be performed by disconnecting and connecting the power/battery again, restarting by clicking on *Restart* in Lansen Configurator, or by sending out the command from a gateway.

Antenna gain

This parameter is used if a repeater has a connected external antenna with a gain.

Having a large external antenna is advantageous since it allows a repeater to have a better reception. However, our repeaters are built to send on the maximum allowed output power and using an antenna with gain causes the repeater to transmit with an output power greater than the legal limit.

To counteract this, set this parameter to the specified gain on the external antenna and the repeater will lower its output power to match the gain, thus transmitting at the legal limit. This allows the repeater to use the full potential of the antenna when receiving while staying at the legal limit when transmitting.

NOTE: This parameter is only applicable to models which supports ONE external antennas (ending with -X on the label).

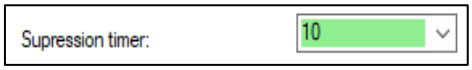
NOTE: This parameter is not needed for the model LAN-WMBUS-RX3-M-LR-X and LAN-WMBUS-RX4-M-LR-X since they use TWO external antennas: One for receiving (and can use a big antenna) and one separate for transmitting (and can use antenna without gain).

Timers-tab

This tab contains parameters for the repeater which are timer-based, such as listen and pause timer. It is also possible to configure if the repeater should wakeup on specific days, e.g., Mondays.

Suppression timer

This parameter is used to reduce how often packets from each meter is retransmitted by the repeater. In other words, it limits how often a receiver/gateway gets data from each meter. A higher value on this parameter lowers the risk of data collision in the air while making it easier for the repeater to retransmit more meters.



NOTE: Setting this parameter to zero should always be avoided if not used in small installations or during testing, due to increased risk for data collision in the air.

NOTE: This parameter only works with even numbers.

NOTE: As a rule of thumb, set this parameter to 3-4 times LOWER than how often data is needed.

NOTE: A repeater can handle about 1-2 packets per second so suppression timer must take this into account.

Example:
A meters transmit data often, every 15 seconds.
There are 800 meters in the area.
Data is needed once every 30 minutes.

To calculate the suppression timer, start by dividing how often data is needed by 3 or 4.

We need data every 30 minutes, so this gives us **30/3=10** or **30/4=7.5**. If we choose 10 minutes, then data from every meter is retransmitted once every 10 minutes even if the meters transmit more frequently.

However, since a repeater can handle 1-2 packets per second and we have 800 meters in the area, we need to see if the suppression timer is long enough to handle all those packets. As a worst case, a repeater can handle 1 packet per second. Since there are 800 meters in the area, it takes about 800 seconds (800/60s=13.3333… minutes) to handle all meters which we round up to closest even number, **14 minutes**.

So the suppression timer should be set to **14 minutes**, even though our first calculations gave us **10 minutes**.

Start time

This parameter is used to control at what time and how often a repeater should start listening on selected weekdays.

Every time the repeater wakes up, it retransmits for the duration configured on the parameter *Listen/pause timer* and then goes to sleep until it is time to wake up again. For this feature to work properly, the time in the repeater must be synchronized. Time synchronization is explained further in chapter **Clock-tab**.

NOTE: If repeaters are used in a multihop setup, then ONLY set this parameter (*Start time*) for the repeater closest to the gateway. The other repeaters will synchronize their listen time with the repeaters closer to the gateway if the parameter *Next Hop Repeater* is used.

NOTE: For examples on how to configure this parameter, see chapter **Using Start time in a multihop system**.

To setup this properly, four options are available. From left to right in the picture above, they mean:

- **Checkbox**: Activate/deactivate this parameter
- **Time field**: Define which time (UTC) the repeater should start listening
- **Period interval**: How often the repeater should start listening
- **Active days**: The repeater will start listening for each checkbox marked

Checkbox

When this checkbox is marked, the parameter ***Start time*** is active. The repeater will start listening at the time, intervals, and days specified by the next options.

Time field:

The time set in this field indicates what time (UTC) each day the repeater will wake up and retransmit packets. The time defined in this field must be equal or less than the chosen period interval. Furthermore, the repeater will be listening for the time defined in the parameter *Listen/pause timers*.

NOTE: On weekdays which has not been selected, the repeater will wake up for 60 seconds on the time set in this field and listen for configuration data. This way, one can reconfigure the device at least once a day.

Period interval:

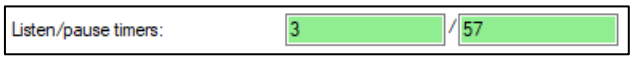
This option defines how often the repeater will start listening from the time set in the option *Time field*.

Active days:

This option controls which days the repeater is listening on. Simply mark the checkboxes for the days the repeater should be listening and uncheck the other. For the unchecked days, the repeater will wake up for 60 seconds at the time defined in option *Time field* and makes it possible to configure it even on inactive days.

Listen/pause timers

This parameter sets how many minutes a repeater should be listening (retransmitting packets) and pausing (not retransmitting). The repeater alternates between these states.



The ration between these two settings will affect the expected lifetime of the battery in the repeater and should be set according to the need for data from meters. Typically, we recommend the settings on the table below for our battery driven repeaters.

Note: For mains-operated repeaters (LAN-WMBUS-R4-M), this parameter can be set to 1/0 so they are always listening.

Note: This parameter should be the same for all battery-operated repeaters in a multihop setup.

Device	Listen/pause timers	Expected battery lifetime
R4-B	3/57	5 years
R4-B	3/117	10 years
R4-B-LR	30/690	5 years
R4-B-LR	20/1420	10 years
uR-B	10/1430	5 years

Magnet reed timer

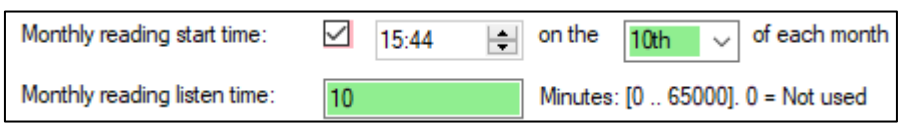
This parameter sets how many minutes a repeater is in forced listening mode when a magnet has been used against it. This can be used, for example, when configuration of a repeater is needed or during installation.

This mode is activated by using a permanent magnet against the label on the enclosure for at least one second. See chapter **Waking the repeater** for more information.

During the first minute after using a magnet, a repeater will only listen for configuration packets. This can be used if the repeater is being configured in an area with a lot of sensors in the area. For the rest of the time defined by this parameter, the repeater will retransmit incoming packets as normal with the suppression timer. Once this timer is out, the repeater will go to sleep according to the pause time set on the parameter *Listen/pause timer*.

Monthly reading start time

This parameter is a separate timer which is used to awake the repeater at a specific date and time once a month and is useful in systems where meter data is also needed at a specific date and time every month.

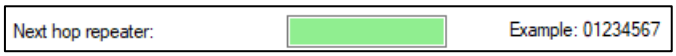


Routing-tab

This tab contains parameters for the repeater which are routing-based.

Next Hop Repeater

This parameter is used in multihop systems so repeaters can synchronize their listen time to ensure all repeaters start transmitting packets at the same time.



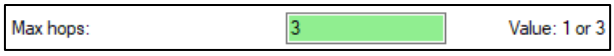
This parameter is used for setting the serial number of the repeater that is closer to the gateway in a multihop setup, as the picture below. The first repeater, which is the one closest to a gateway, does not need to use this parameter so leave this field empty. See the picture below for an example.

NOTE: Do NOT set this parameter for a battery-operated repeater if the next hop is a mains-operated repeater. A mains-operated repeater is always active so a battery-operated repeater will set itself up so it also is always on, thus draining the battery very quick (3-4 months).

Max hops

This parameter is used to adjust how a repeater retransmits packets from other repeaters.

NOTE: This parameter is not applicable for our microrepeaters, LAN-WMBUS-uR-B, since it does not support retransmission of other repeaters. It only retransmits packets coming directly from meters.



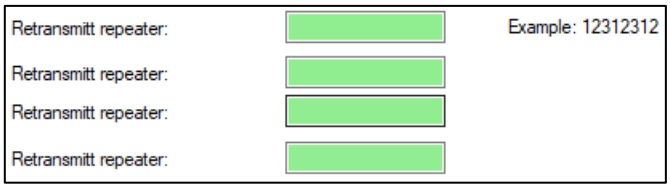
This field must only contain one of the following values:

- 1: **No multihop**: The repeater does not support multihop.
- 2: **Dynamic multihop**: All incoming packet are retransmitted if hop count of packet is less than two. With this setting, the parameters *Retransmit repeater* does not need to be set on a repeater.
- 3: **Static multihop**: Retransmits packets coming from repeaters set in parameters *Retransmit repeater* or coming directly from meters. Supports up to three hops.
- 4: **Static multihop**: Same as the option above but supports up to four hops. Note that this value is only supporter on repeater with software version of at least 141.

Retransmit repeater

This parameter is used in multihop setups where repeaters are used to extend the range between meters and gateway.

NOTE: This parameter is not applicable for our microrepeaters, LAN-WMBUS-uR-B, because they do not support multihop. Our microrepeaters only retransmits packets coming directly from meters.



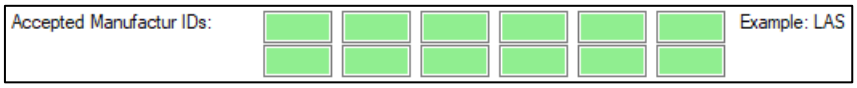
Each repeater can be configured to retransmit packets from up to four other repeaters. This allows a repeater to retransmit (forward) packets from other repeaters with the specified serial number written in these fields. The serial number of a repeater can be found on the label with the text LAS.XXXXXXXX.YY.ZZ, where the numbers marked with X make up the serial number.

Furthermore, up to four hops (three if repeater has software version lower than 141) can be made by a packet form a sensor. In other words, up to four repeaters can form a chain to extend the range between meters and a gateway, as in the example below.

NOTE: As a rule of thumb, a repeater needs approximately 0.5-1.0 second to process a packet. Each added repeater to the retransmit repeater list limits how many packets it can retransmit directly from meters. We recommend keeping the number or repeaters for this parameter to a minimum.

Accept Manufacturer ID

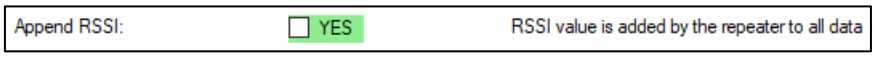
This parameter is used if the repeater should only retransmit packets from meters with a specific manufacturer code. In other words, this is manufacturer code filtering.



This setting acts as a filter for the repeater and helps minimizing packets in the air while controlling which meters are retransmitted. This is useful in areas where different companies and manufacturers are active. If all fields are empty, no filtering is done by the repeater and packets from all meters will be retransmitted.

Append RSSI

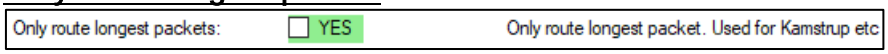
This parameter is used to know the RSSI of the received packet by the repeater from a meter.



If this parameter is enabled, then the repeater will add its serial number and the received RSSI of the packet at the end of the retransmitted packet. By using this option, one can see how good the connection is between a meter and a repeater.

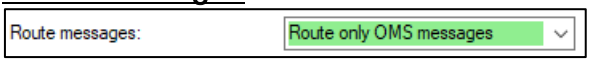
NOTE: This setting works best with meters that do not use manufacture specific VIF field.

Only route longest packet



If this box is checked, then information regarding the longest packet from each meter is stored. Only packets with this length is retransmitted by the repeater while shorter packets will be ignored. This is useful when communicating with meters that use compact mode and where gateways cannot handle compact mode.

Route messages



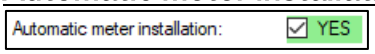
This parameter has two options, as explained below:

- Route only OMS messages: The repeater will only retransmit OMS compatible packets
- Route all messages: The repeater will retransmit both OMS and non-OMS compatible packets

Meters-tab

The parameters and options in this tab have to do with the internal routing list of a repeater. In this tab, meters can be viewed, added, and removed as explained in each chapter below.

Automatic meter installation



When this checkbox is marked, a repeater will automatically add received meters to its internal routing list of maximum 932 (100 for microrepeater, LAN-WMBUS-uR-B) unique meters. If it is not desired to add any more meters or to have full control of which meters are retransmitted by a repeater, uncheck the checkbox.

NOTE: It is recommended to uncheck this box for LAN-WMBUS-uR-B and add meters manually (see chapter

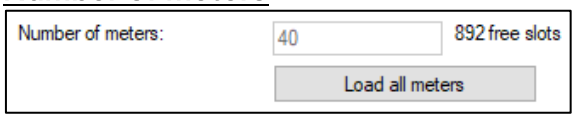
Add meter(s)) to ensure only needed meters are in the internal routing list.

NOTE: If this parameter is enabled, then a repeater will clear its internal routing list when a magnet is applied to it. For more information, see chapter **Waking the repeater**.

NOTE: If this parameter is disabled and no meters are stored in the internal routing list, then no meters will be retransmitted by the repeater. In this case, meters must be added manually (see chapter

Add meter(s)).

Number of meters

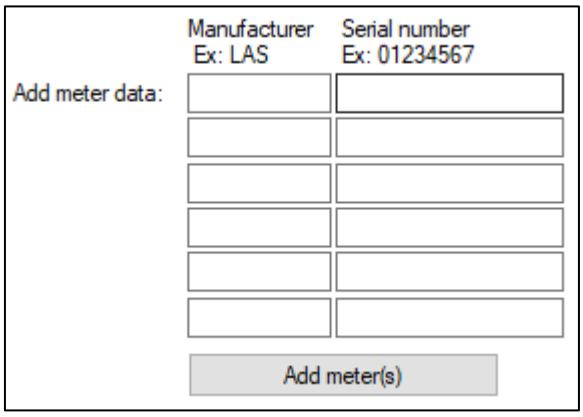


The field displays how many meters there currently are in the internal routing list of the repeater. On the right-hand side of the field is the currently available number of slots shown. To view all the meters in the internal routing list, click on the button **Load all meters**. This will fill up the list on the right-hand side of the program.

NOTE: The currently available numbers shown on the right-hand side are not for LAN-WMBUS-uR-B.

Add meter(s) manually to internal routing list

This is where a user can manually add a meter to the internal routing list of a repeater.



To add a meter to the internal routing list, fill in the manufacturer ID (left field) and the serial number (right field) and click on the button **Add meter(s)**. The meter(s) will then be added to the repeater.

NOTE: Adding meters manually can only be done if the parameter *Automatic meter installation* is disabled.

Add meter(s) from file to internal routing list

Instead of adding a meter one by one, a user can instead import a csv-file with many meters.

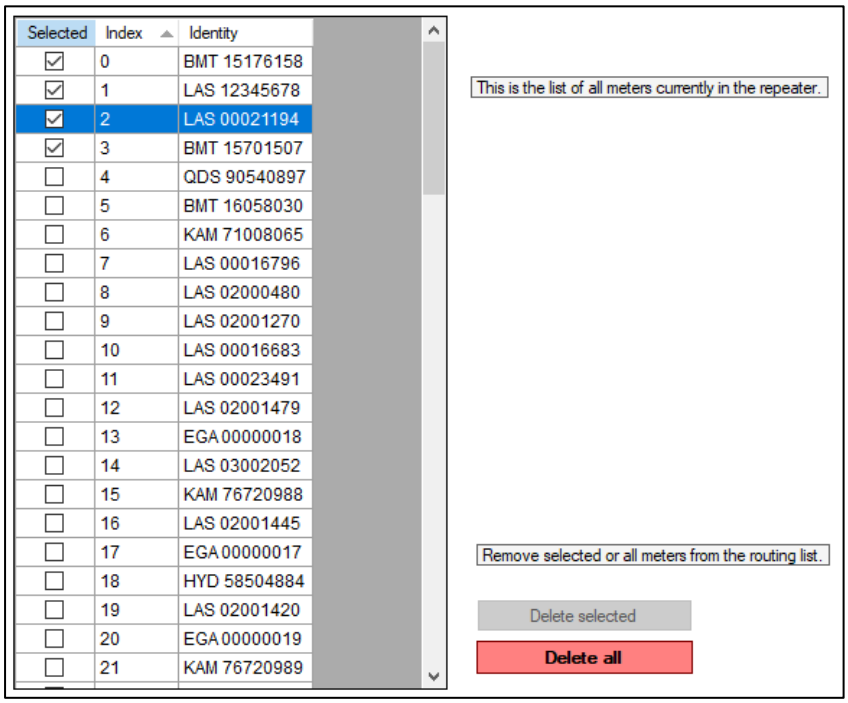
To add a whole file, click on “Browse” and select the csv-file with the meters to be added to the repeater. Once a file has been selected, click “Import csv-file” to start uploading the meters in the file.

NOTE: The csv-file **MUST** on the first row start with the text **ManufacturerCode;IdentificationNumber** otherwise the file will not be uploaded to the repeater.

NOTE: Adding meters manually can only be done if the parameter *Automatic meter installation* is disabled.

Delete meter(s)

This is done if one, or several, meter should not be retransmitted by a repeater.



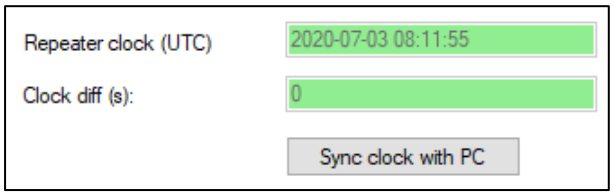
To remove all meters, click on the button **Delete all**. If the parameter *Automatic meter installation* is enabled, then the same function is achieved by applying a magnet to the repeater (see chapter **Waking the repeater**).

Use the button **Delete selected** if only selected meters should be deleted. Simply mark the meters in the list which are unwanted and click on the button **Delete selected** – the repeater will then remove the selected meters from its internal routing list.

NOTE: The button **Delete selected** is only enabled when the parameter *Automatic meter installation* is disabled.

Clock-tab

This tab shows information about the internal clock of the repeater.



The upper field (*Repeater clock (UTC)*) displays the internal clock of the repeater as UTC-time while the lower field (*Clock diff (s)*) shows how many seconds the internal clock of the repeater differs from the current clock on the PC.

To synchronize the repeater clock to the PC, simply click on the button **Sync clock with PC**.

NOTE: The time set on the repeater is the PC time converted to UTC. The repeater will NOT adjust for summer- or wintertime. If a repeater should use other time than UTC, then first change the PC time before pressing **Sync clock with PC**.

NOTE: To keep time synchronization in a battery-operated system, it is recommended to transmit time synchronization packets from the GW according to the OMS standard in regular intervals. The repeaters LAN-WMBUS-R3/R4 has a highly accurate onboard temperature compensated clock for minimum drift and the expected drift is less than 0.5 seconds / day.

Example configurations

In this chapter, different configurations and typical values for the different configurations will be presented. These examples can be used as guidelines during installation of the repeaters.

Testing multihop between repeaters

It is possible to test multihop with repeaters without having to put them at a greater distance between each other. This is done by forcing the repeaters which are closer to the gateway to ignore data from sensors. For this to work, the parameters *Min install RSSI* and *Retransmit repeater* will be adjusted.

In the picture below, the meter (S1) and the repeaters (R3, R2, R1) are placed as in **Figure 4**.

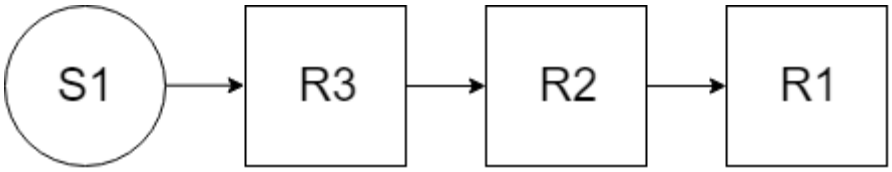


Figure 4: Setup to test multihop. The data from the meter (S1) will be transmitted to R3 and retransmitted to R2 and then R1.

The repeaters and their individual parameters can be seen in the table below. Notice how the repeater closest to the meter is missing both *Retransmit repeater* and *Min install RSSI*.

NOTE: The repeater must be restarted from the program after the parameter *Min install RSSI* has been updated, otherwise the internal routing list will not be changed.

Repeater number	Serial number	Min install RSSI	Retransmit repeater
R3	00020594		
R2	00020593	3	00020594
R1	00020592	3	00020593

Routing between repeaters (multihop)

The repeaters can be used in such a way that they form a transmission chain between meters and a gateway, thus increasing the range between them. See **Figure 5** for how this can be achieved.

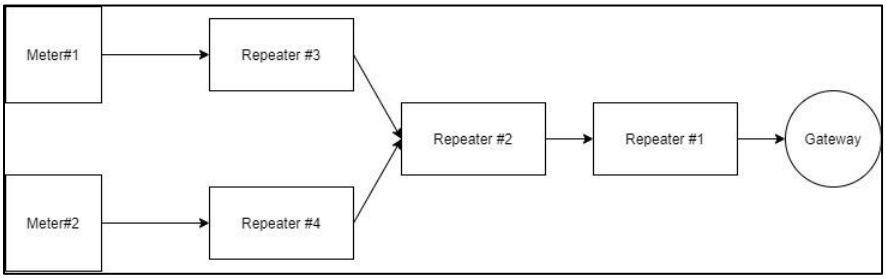


Figure 5: One way to setup the repeaters to increase the range from the meters (Meter#1, Meter#4), all the way to the gateway.

For this setup to work, there are mainly two different parameters that needs to be updated:

- *Next Hop Repeater*: The serial number of the next repeater which is closer to the gateway. If a gateway is the next hop, then this field is to be left empty.
- *Retransmit Repeater*: The serial number of the repeater(s) which are installed further away.

For this example to work, the repeaters must be configured as in the table below.

Repeater	Next Hop Repeater	Retransmit Repeater
Repeater#4	This field contains the serial number of Repeater#2 since that repeater is closer to the gateway.	Field left empty. There is no repeater before it, only meters.
Repeater#3	This field contains the serial number for Repeater#2 since that repeater is closer to the gateway.	Field left empty. There is no repeater before it, only meters.
Repeater#2	This field contains the serial number of Repeater#1 since this is the repeater closest to the gateway.	Two of the fields for this parameter is filled out: • One with the serial number for Repeater#3 • One with the serial number for Repeater#4
Repeater#1	Field left empty. There is no repeater after this one, only a gateway.	This field contains the serial number for Repeater#2 since that is the one prior to this one.

NOTE: The parameters *Listen/pause timers* must be the same for all battery-operated repeater in a multihop system.

NOTE: Do NOT set the parameter *Next Hop Repeater* for battery-operated repeaters if the next hop is a mains-operated repeaters, otherwise the battery-operated repeater will synchronize its listen timer to the mains-operated repeater, meaning it will always be active and drain the battery quick (3-4 months).

NOTE: Only set the parameter *Start time* for the repeater closest to the gateway since other repeaters with parameter *Next hop* repeater set will synchronize their listen time with the repeaters closer to the gateway.

NOTE: If there are only battery repeaters in a multihop system, we strongly recommend not using more than one *Retransmit repeater* for each repeater in the chain. Otherwise, the last repeater is the chain (repeater closest to the gateway) may be overburdened by packets sent by the other repeaters.

Daily readings with a repeater during a specified time

This configuration can be used if data from meters is needed only during a set interval each day.

In this example, data is needed every 4 hours on Mondays, Wednesdays, and Fridays starting at 02:15. To achieve this, the parameter *Start time* has been configured with the following (see **Figure 6**).

Checkbox: Enabled
Start time: 02:15
Period: 4h
Weekdays: Monday (Mo), Wednesday (We), Friday (Fr)

Next, *Listen/pause timer* needs to be set. This parameter is used to determine how long the repeater is to be active every time is starts listening. In this example, 10 minutes is deemed enough and gives an expected battery lifetime of 10 years. Notice that the second field for *Listenl Pause timer* is greyed out and that it cannot be changed. This is due to *Start time* being enabled and automatically calculates the correct pause time. Furthermore, note that the pause value changes when the parameter *Listen timer* or the period time is changed because it calculates the number of minutes to sleep until the repeater is to be active again.

It is advised to set the parameter *Suppression timer* as well. In this example, the timer is set to 6 minutes, i.e., we will get a reading from each meter every 6 minutes, which gives us a total of 2 readings during each interval.

Note: For this feature to work properly, the clock in the repeater must be synchronized to the real clock, see chapter **Clock-tab** for more information.

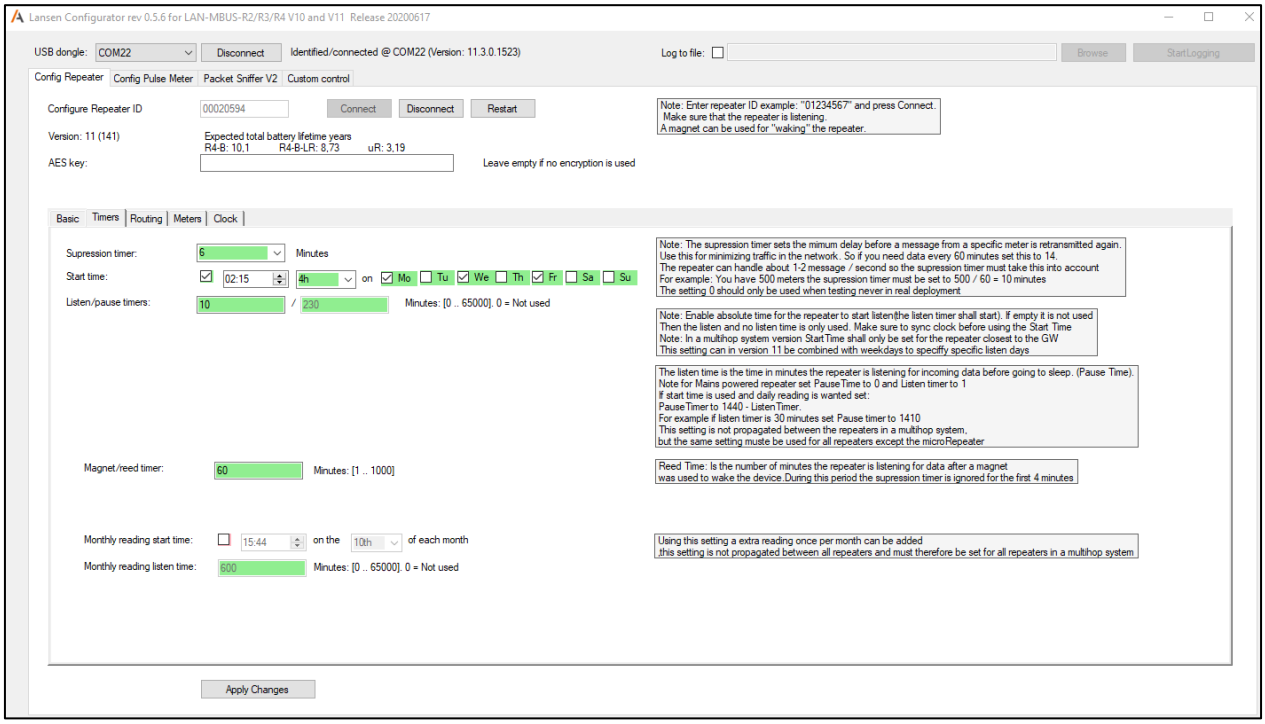
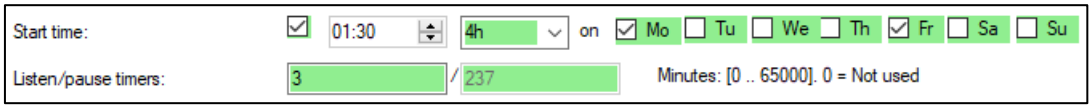


Figure 6: Example of how parameters can be set to use daily readings with a repeater.

Using Start time in a multihop system



When using this parameter in a multihop system, only configure the repeater closest to the gateway. The other repeaters will synchronize their listen time to the next repeater in the chain if they are setup correctly. For more information on how to setup a multihop system, check out chapter **Routing between repeaters (multihop)**.

In the figure above we have the following setup:

Start time:
Set to 01:30. For each weekday marked, the repeater will wake up at 01:30 o'clock plus the period time chosen. The repeater will stay awake for the time set in the first field of parameter *Listen/pause timers*. For each unmarked weekday, the repeater will wake up at 01:30 and stay awake for 60 seconds.

Period time:
This is how often a repeater should wake up, counting from "Start time". In this case, the repeater will wake up every 4 hours from 01:30, that is, 05:30, 09:30, 13:30, 17:30, and 21:30.

Weekdays:
This is which weekdays the repeater should wake up. In the example above, it is set to Mondays (Mo) and Fridays (Fr).

Listen/pause timers:
This is how long the repeater is listening/pausing. With the current configuration, the repeater will be listening for 3 minutes every time it wakes up and then sleep for the reminder of the time (237 minutes). Note that the field for "Pause timer" is grayed out, due to being calculated based on the time set for "Period time".

Typical settings for hourly readings

This configuration is used the most and allows a repeater to transmit data in fixed intervals.

In this example, following constraints apply:

- Data from two different manufacturers are needed
- The two meters come from different manufacturers, MEG and BTM
- There are 600 meters in the building
- We need data once every two hours
- The repeater is battery-operated

With these constraints, we can now configure the repeater to be able to behave properly.

First, we need to consider how many meters the repeater will need to handle. A rule of thumb is that the repeater requires about one second to process each packet. Therefore, the listen timer should reflect on how many meters there are in the expected area. In this case, there are 600 meters in the area and the repeater will need about 600 seconds (6 minutes) to handle at least one packet per meter while listening.

With the information above, we can set an adequate value for *Listen/pause timers* in the Timers-tab. In this case, we use 6 minutes listen and 114 minutes pause (6 minutes + 114 minutes = 120 minutes = 2 hours). In other words, the repeater is retransmitting packets for 6 minutes every two hours. This gives an expected battery lifetime of 5 years.

Next, *Suppression timer* should always be set. This parameter is used to minimize the traffic in the air, which is especially important in a building with many meters. As a rule of thumbs, this value should be set to a value between 3 to 4 times less than how often we require data. Therefore, suppression timer is set to 30 minutes since we need data every two hours.

Lastly, we want to filter out the needed meters. This is done by adding the manufacturer ID, MEG and BTM, to the fields for *Accepter Manufacturer ID* in the Routing-tab.

Check routed messages with Packet Sniffer V2

Our program, Lansen Configurator, also includes a sniffer tab called *Packet Sniffer V2*. This page is seen in **Figure 7**. By using *Packet Sniffer V2*, henceforth called the Sniffer, one can observe all packets sent in the area, both by meters and repeaters.

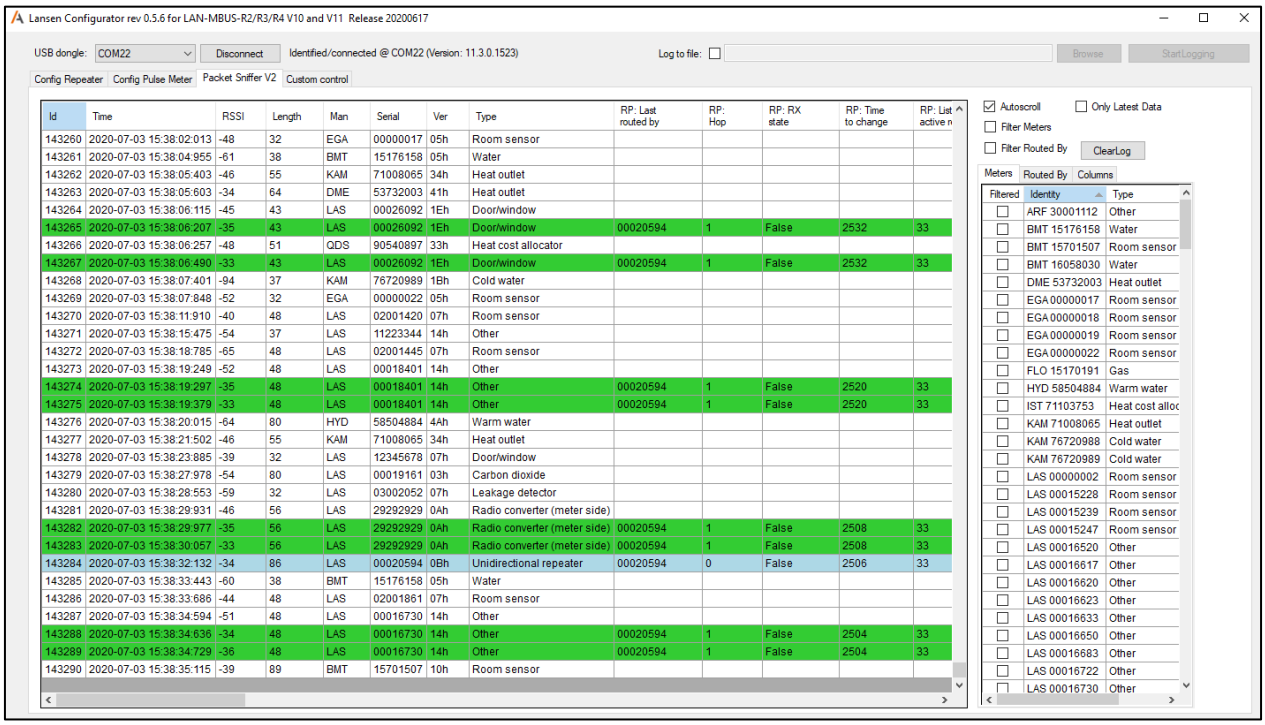


Figure 7: Overview for the page Packet Sniffer V2.

Overview of the Sniffer

The Sniffer-view, as seen in the picture above, contains two lists – *Primary list* (left side) and *secondary list* (right side). The *primary list* shows information about the packets which the USB-dongle picks up while the *secondary list* contains some tabs which change what is shown in the list.

Furthermore, there are a couple of options in **Figure 7**, located in the upper right corner, that can be used to sort out or filter out necessary data in the *primary list*.

Sniffer options

The Sniffer has some options in the upper right corner which can be used to change what is shown in the *primary list*. Each option is explained below in greater detail.

Note: It is advantageous to disconnect the USB-dongle if the options are going to be changed to quicken up the process.

Autoscroll

While active, the Sniffer will automatically scroll down to the bottom of the *primary list* every time a new packet is received. This option can be disabled so the user can scroll up in the *primary list* to observe older packets while still receiving new packets.

*Filter **Meters***

When this option is enabled, then data will be filtered by the devices chosen in the tab *Meters* in the *secondary list*. By using this option, one can see packets from one (or more) specific meter which makes it easy to see if a meter is being retransmitted by a repeater or if packets from a repeater is being retransmitted by another repeater in a multihop setup. Simply mark the checkboxes of the meters which should be filtered in the *secondary list*.

Note: This option filters on the serial numbers visible in the column called **Serial** in the *primary list*.

Filter Routed By

This option is similar to the previous option, *Filter Meters*, but instead of filtering data which has been sent by selected meters, this option filters out data which has been transmitted from the specific repeater chosen in the tab *Routed by* in the *secondary list*.

Note: This option filters on the serial number in the column called **Last Routed By** in the *primary list* in **Figure 7**.

Only Latest Data

By using this option, the latest packet which has been picked up, whether it is a message transmitted from a meter or retransmitted from repeaters, will be shown. For example, if there is one meter and two repeaters in a setup, then there will be three rows in total. The values in the rows is updated whenever the Sniffer picks up a new packet.

This option can be used to minimize the number of rows shown in the program to get a better overview of all meters and repeaters in the area. If all packets need to be displayed in the Sniffer, then this option must be disabled.

ClearLog

This button is used to clear all the packets read so far with the program and will therefore clear the *primary list*.

Primary list

This list, shown on the left side of the program, displays all the packets which has been received so far by the USB-dongle. How the packets and information for each packet is shown depends on the options selected in chapter **Sniffer options** and

Columns. One thing to note in **Figure 7** is that each row is colored, and each color has a meaning. This is described in **Table 1** below. The reception depends on the *RP: RSSI*-column, i.e., how strong the signal is between the repeater and a meter.

It is also possible to sort the rows in this list by clicking on the top row of the columns which is going to be sorted. For example, all meters and repeaters will be sorted by serial number, from low to high, when clicking on **Serial**.

Table 1: Meanings of each color observable in the Sniffer. The reception is measured between repeater and meter.

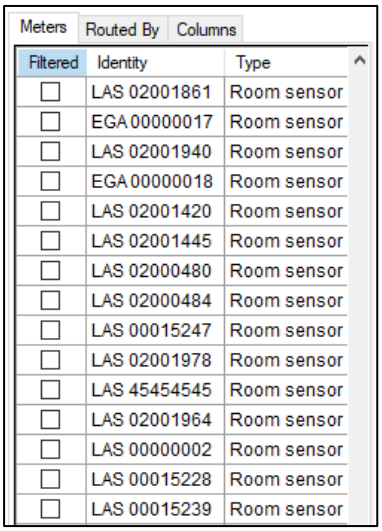
Color meaning	Color
Good reception between meter and repeater	
Okay reception between meter and repeater	
Medium reception between meter and repeater	
Bad reception between meter and repeater	
Really bad reception between meter and repeater	
Meter packet picked up directly by USB-dongle	
Status packet sent by a repeater (not meter data)	

Secondary list

This list is used as a complement to the options in chapter **Sniffer options** and changes what is displayed in the *primary list.* As seen in **Figure 7**, there are three tabs in this list: *Meters*, *Router By*, and *Columns*.

Meters

This tab, as seen by the picture on the right, contains three columns. For each new meter which has been received by the program, a new row is created, and each row contain the meter manufacturer code, serial number, and type.



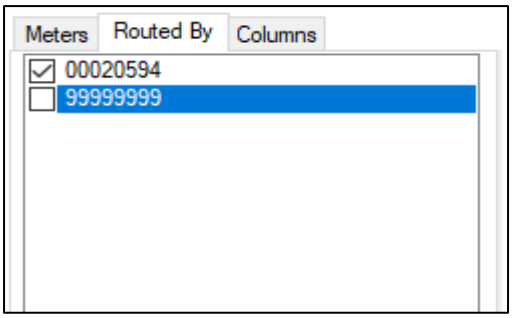
The first columns, *Filtered*, is used together with the option *Filter Meters*. If the option *Filter Meters* is enabled, then only the meters marked in this tab will be displayed in the *primary list*. This is useful if there are a lot of meters in the area and only a couple of meters are of interest.

The next columns, *Identity*, contains the manufacturer code and serial number for each meter received. By clicking on the test *Identity*, the list will be sorted alphabetically (A to Z), and numerically (low to high) for each manufacturer code.

The third column, T*ype*, shows which type of meter it is. This column can also be used to sort the list by clicking on the name *Type* which then will sort the list alphabetically (A to Z).

Routed By

This tab, seen in the picture on the right, only contains a checkbox and a serial number. For each new repeater received by the Sniffer, a new checkbox is created with the corresponding serial number of the received repeater.



This tab is used together with the option *Filter Routed By.* If the option is enabled, then only packets transmitted or retransmitted by the selected repeaters will be shown in the *primary list*.

Columns

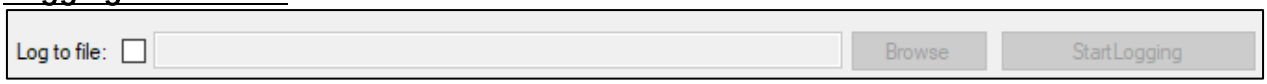
This tab is used to change which columns are shown in the *primary list*. Each available option is displayed in the table below.

Column name	Meaning
Id	When a packet is received, it is assigned an ID number. Each time a new packet is received, the ID is incremented by 1.
Time	Timestamp when the packet was received by the computer.
RSSI	Signal strength of the packet sent by a repeater/meter and received by the USB-dongle. Value goes from 0 (strong signal) to larger negative values (weaker signal).
Length	Number of bytes in the received data packet.
Man	Manufacturer ID of the device, either repeater or meter, which sent the packet.
Serial	Serial number of the device, either repeater or meter, which first sent out the packet.
Version	Version of the device, either repeater or meter, which first sent out the packet.
Type	Shows what type of device, either repeater or meter, which first sent out the packet.
RP: Last routed by	Shows the serial number of the repeater which retransmitted the data most recently.
RP: Hops	Number of times the data has been retransmitted by repeaters.
RP: RX state	Shows which transmission state the repeater is currently in. TRUE=Listening and FALSE=Pausing. **Note**: If a magnet has been used to wake up the repeater, then it is possible for the repeater to transmit data even if this column is FALSE.
RP: Time to change	Indicates how many seconds it is left until the repeater changes the RX-state.
RP: Current time	Shows the current time on the repeater.
RP: Start time	Shows the time set for the parameter *Start time* if it is active.
RP: Listen days	Shows the selected weekdays for the parameter *Start time* if it is active.
RP: Microrepeater	Shows if the repeater is a microrepeater (1) or a normal repeater (0).
RP: Mains connected	Shows if it is a mains-operated (1) or battery-operated (0) repeater.
RP: Listen active reason	Shows what the current listening reason is. See **Table 2** for more details. Note that multiple reasons can be active at the same time.
RP: RSSI	Signal strength of the packet sent by a repeater/meter and received by the repeater. Value goes from 0 (strong signal) to larger negative values (weaker signal).
Raw packet	Shows all bytes in the received packet.

Table 2: Description of the different values in columns RP: Listen active reason.

Bit	Meaning
0 (0x01)	Listen timer running
1 (0x02)	Short listen window (60 seconds) for parameter *Start time* is running
2 (0x04)	Long listen window (time set in parameter *Listen/pause timer*) and parameter *Start time* is running
3 (0x08)	Monthly listen timer running
4 (0x10)	NOT USED
5 (0x20)	Magnet/reed timer running

Logging data to file



The Sniffer allows the user to log the received packets in the program onto a file on the computer. To do this, follow the steps below:

1. Click in the checkbox so it is marked. This will enable the button **Browse**.
2. Click on the button **Browse** and navigate to a place on your computer where you want to save the file. Give the file a name in the field called *File name* and click on **Save**. This will activate the button **StartLogging**.
3. Click on the button **Start logging**. The program will now save all packets with all columns shown in the *primary list*.

Revision history

Updated (date)	Revision	Updated by	Comments
2020-05-01	0a	Martin Stanic	Document created.
2020-05-02	0b	Martin Stanic	Updated all chapters according to the new Lansen Configurator (from 5.2.0 and newer).
2020-07-06	1	Martin Stanic	Document released.
2021-07-05	1a	Martin Stanic	Added some information regarding microrepeater.