

This document describes

LinTronic Features

TT455-RT-238 Signal Converter

BT-RS232 Bluetooth receiver/transmitter

Updated: 210121 (yymmdd)

<b>LinTronic.....</b>	<b>4</b>
Introduction.....	4
Windows / Apple .....	5
Easy Configuration.....	5
A Standalone controller.....	5
Updates automatically.....	5
License key.....	6
Firmware updates (bootloader) .....	6
Documentation/application-notes/videos .....	6
LinTronic Open-source communication protocol.....	6
Now working in 60+ countries.....	6
Feedback.....	6
Rating/Score .....	6
Facebook .....	7
Linkedin .....	7
YouTube.....	7
3 years warranty.....	7
<b>TT455-RT-238 Signal Converter .....</b>	<b>8</b>
Designed to do what ?.....	8
Inputs/outputs.....	9
Under the hood .....	11
Integrated 38 KHz infrared receiver .....	12
Remote controls (Apple, Logitech, NEC, Philips, Samsung).....	12
Digital data input (infrared, RF, data).....	12
Remote controls (Bang&Olufsen).....	12
RF (318/433 MHZ) .....	12
Infrared front booster (Dual-Band Wide-Angle High-Power Long-Range).....	12
455 KHz hardware oscillator .....	13
Smartphone camera verification .....	13
2 pcs Low-power infrared outputs .....	13
3-channel infrared distributor .....	13
I2C BUS .....	14
2 pcs bidirectional RS232 comports .....	14

<b>BT-RS232 bluetooth receiver/transmitter .....</b>	<b>15</b>
Designed to do what ?.....	15
1 pcs. bluetooth receiver/transmitter interface .....	15
Remote controls (Bang&Olufsen).....	15
1 pcs bidirectional RS232 comport.....	15
<b>Working with RS232.....</b>	<b>16</b>
Some of the products we can control by RS232 .....	16
<b>Working with the LinTronic protocol.....</b>	<b>17</b>
Protocol, Command 039.....	18
Protocol, Command 232.....	19

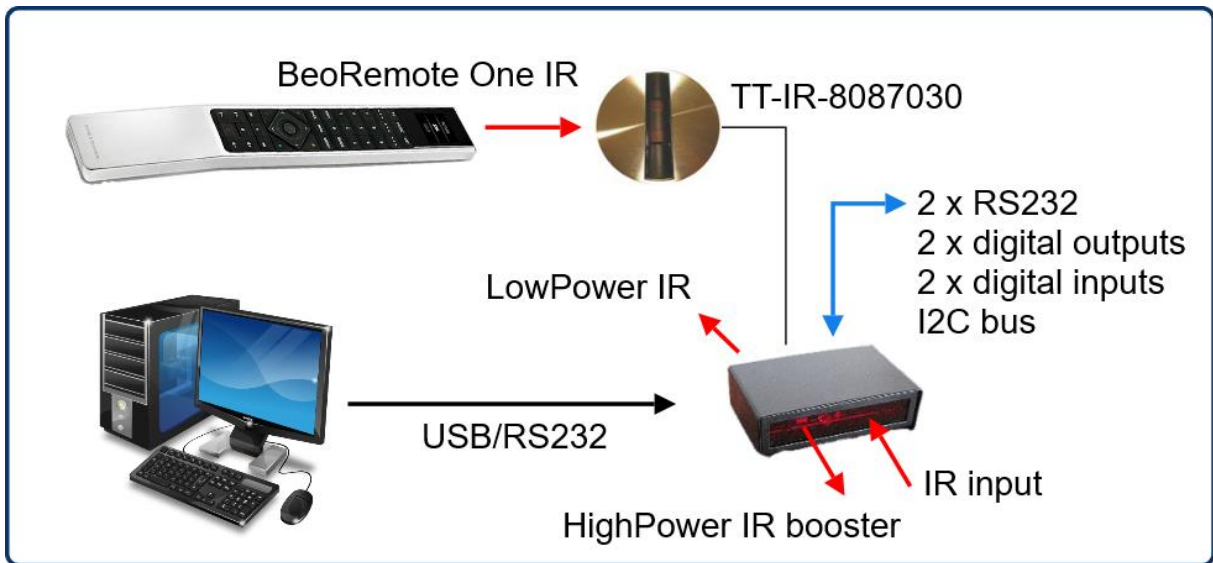
# LINTRONIC

## INTRODUCTION

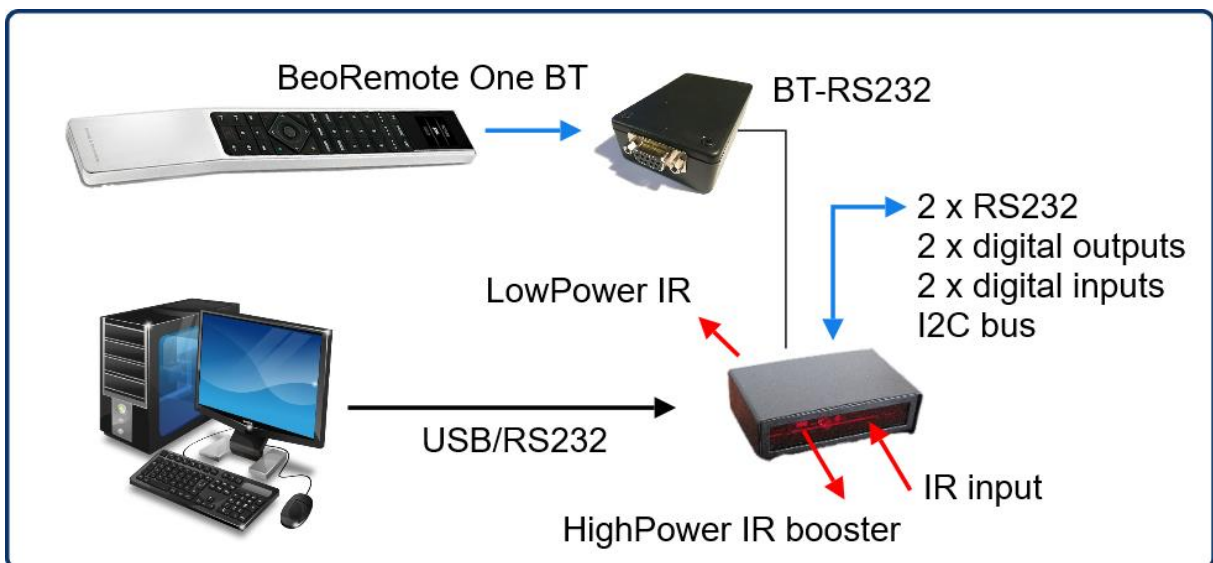
Our main product, since 2003, is the TT455-RT-238 Signal Converter, which converts Triggers into Actions: Triggers → TT455-RT-238 Actions →.

TT455-RT-238 is configured by the owner/user to react to the wanted Triggers and carry out the wanted Actions. Both **Triggers and Actions**, can be a mixture of remote-control commands, relays, switches, RS232 commands, etc.).

Triggered by a Beoremove One in InfraRed mode.



Triggered by a Beoremove One in Bluetooth mode.

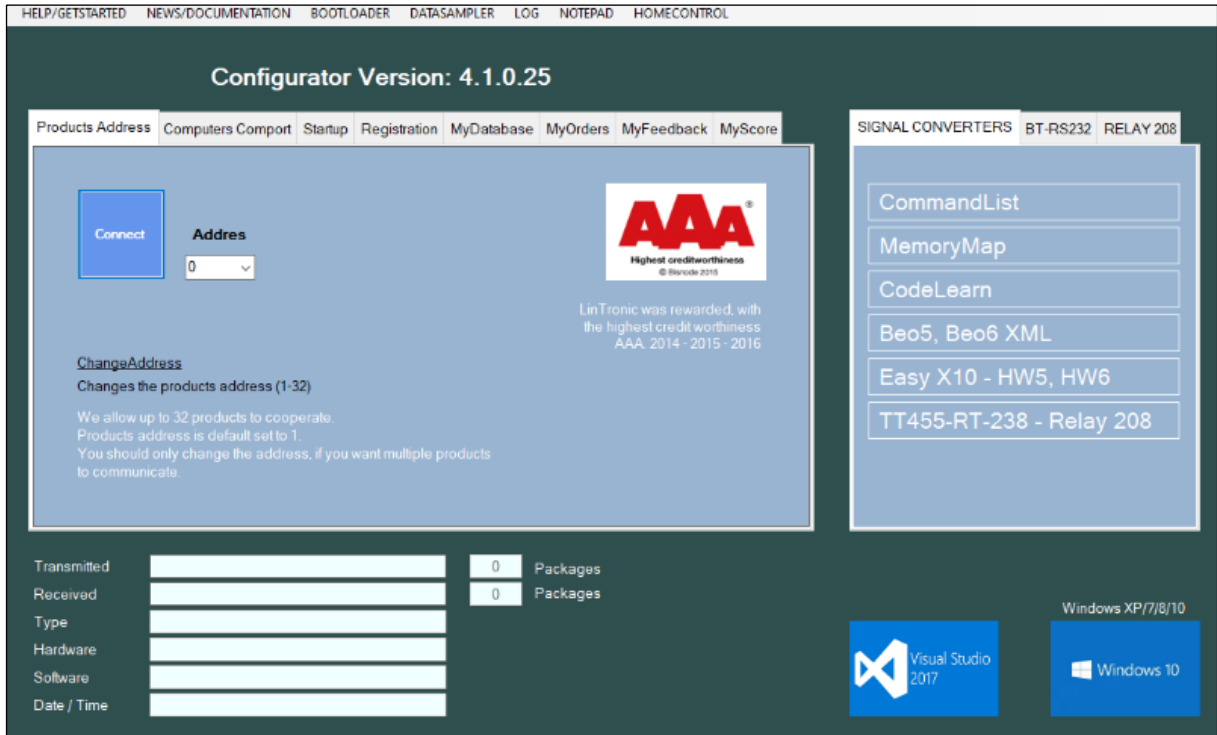


Further **description**, see below.

## WINDOWS / APPLE

Configuration is carried out in a Windows computer-program called CONFIGURATOR SQL, which you download from [our support page](#).

The program can be executed on an Apple computer, in a Windows simulation.



## EASY CONFIGURATION

Configuration of TT455-RT-238 requires no special skills. If you can operate a mouse, you can do it.

- You mouse-click-select a Trigger, then mouse-click-select one or more of Actions, and save the Trigger/Actions combination.
- Configuration requires no coding, no programming, no scripting.
- [Online demo of the configurator](#).
- [Get started](#).

## A STANDALONE CONTROLLER

After the TT455-RT-238 has been configured to control your products, it can be disconnected from the computer and work as a standalone controller. No cabling is needed.

## UPDATES AUTOMATICALLY

The Configurator is created in Windows Visual Studio as a Click-Once package. When you start up the program it will automatically check online for a newer version. It is recommended that you always update to the latest version, if prompted by the program.

## LICENSE KEY

We spent a lot of time updating and maintaining the Configuration program as well as updating firmware for our products. All new features are available for all customers. Hence, we require our customers to purchase a license key to financially support this continuous development.



The license key is bundled free of charge when you buy a product that can be firmware updated.

You can order a license key on [our online shop](#).

## FIRMWARE UPDATES (BOOTLOADER)

A **bootloader** is integrated into the TT455-RT-238 and the BT-RS232, enabling you to update your products to the latest firmware.



When you connect your product to the computer and start up the Configuration program, it will automatically detect your product and check online for firmware updates. It is recommended that you always update to the latest version.

New product firmware consists of two files that need to be bootloaded to the product. For manually handled updates, the bootloader can be started manually and transfer the two files from your computer.

## DOCUMENTATION/APPLICATION-NOTES/VIDEOS

We try to keep everything documented and updated. We offer a simple way to seek the information you need. On [this documentation page](#) simply enter a search word and all documents holding this search tag will be listed.

## LINTRONIC OPEN-SOURCE COMMUNICATION PROTOCOL

Go to [Working with the protocol](#)

## NOW WORKING IN 60+ COUNTRIES

Our products are designed to work on 12-volt DC, so it can be powered by an adaptor working on 115 vac/60 Hz or 230 vac/50 Hz, meaning that our products can be used anywhere.

Today LinTronic is working in [700+ cities in 60+ countries](#).

## FEEDBACK

As a privately owned company working with niche products, we are depending on deserving a good reputation by delivering quality products.

If you are happy with our products, then we kindly urge you to help us with [your feedback here](#).

## RATING/SCORE

It would be fantastic if you would rate our services in the Configurator. You can see the [total result for all customers here](#).

**98,5 %**

## FACEBOOK

If you **like/follow us**, you will be the first to be informed about news.



## LINKEDIN

If you **like/follow us**, you will be the first to be informed about news.



## YOUTUBE

Some interesting videos can be found on our **LinTronic Channel**.



Customers can ask us to add their private videos to the **LinTronic Playlist**.

## 3 YEARS WARRANTY

Out of 17.000 sold products, we have had defects reported on only 7 pieces. Out of these 8 units, 6 were returned for repair. Out of these 6, we bootloaded new firmware into 3 of them, tested and returned the products to the owner. This means we potentially have had only 3 defective units.

Our error rate is  $3/17.000 = 0,017\%$ .



Customers write us, to let us know, that the TT455-RT-238 Signal Converter, is the only household product that never fails and never needs power recycled. It just keeps going and works every time.

The quality, and the stability of our products, allows us to offer you a no-questions-asked warranty of 3 years. If your TT455-RT-238 becomes defective, we will fix it or replace it at no cost. You only pay for the return freight.

## TT455-RT-238 SIGNAL CONVERTER

Technical Manual: [TT455-RT-238 Hardware Version 6.1](#)

### DESIGNED TO DO WHAT ?

The TT455-RT-238 is designed to convert one type of signal to another. The basic idea is to enable/allow different types of products to work together.

The products **controlling** the TT455-RT-238 are called **Triggers**.

The products **controlled by** the TT455-RT-238 are called **Actions**.

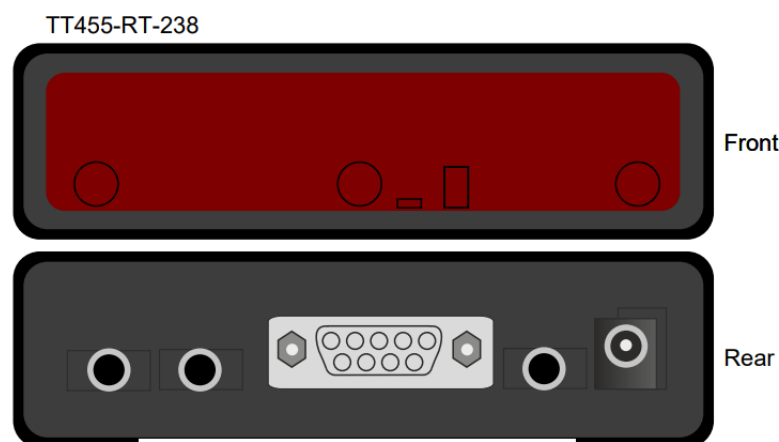
Also, you could say the Triggers are working with the TT455-RT-238's inputs and Actions are controlled by the TT455-RT-238's outputs.

Examples:

- We can receive signals from your remote control that normally controls your audio/video products, and turn them into RS232 commands controlling your amplifier, alarm, home automation computer/controller or relays controlling light, curtains, blinders, etc.
- We can receive RS232 commands from your computer/controller and convert them into infrared commands controlling your amplifier, tv, projectors, etc.
- We can detect when you activate the buttons on the B&O infrared receiver TT-IR-8087030 and we can convert the activation of a contact/switch/relay into power-off features turning off all or most of your products.
- We can receive/transmit radio frequency signals (318/433 MHz requires external modules).
- We can receive RS232 commands from the BT-RS232 Bluetooth receiver.
- and much more.

Over the years we have redesigned the functionality of the TT455-RT-238 to match the demands of the market. The current TT455-RT-238 design is the 6<sup>th</sup> generation. We have delivered more than 17.000 units into 700+ cities in 60+ countries.

The TT455-RT-238 is used in hotels, restaurants, casinos, pleasure boats, private residences, etc. etc.

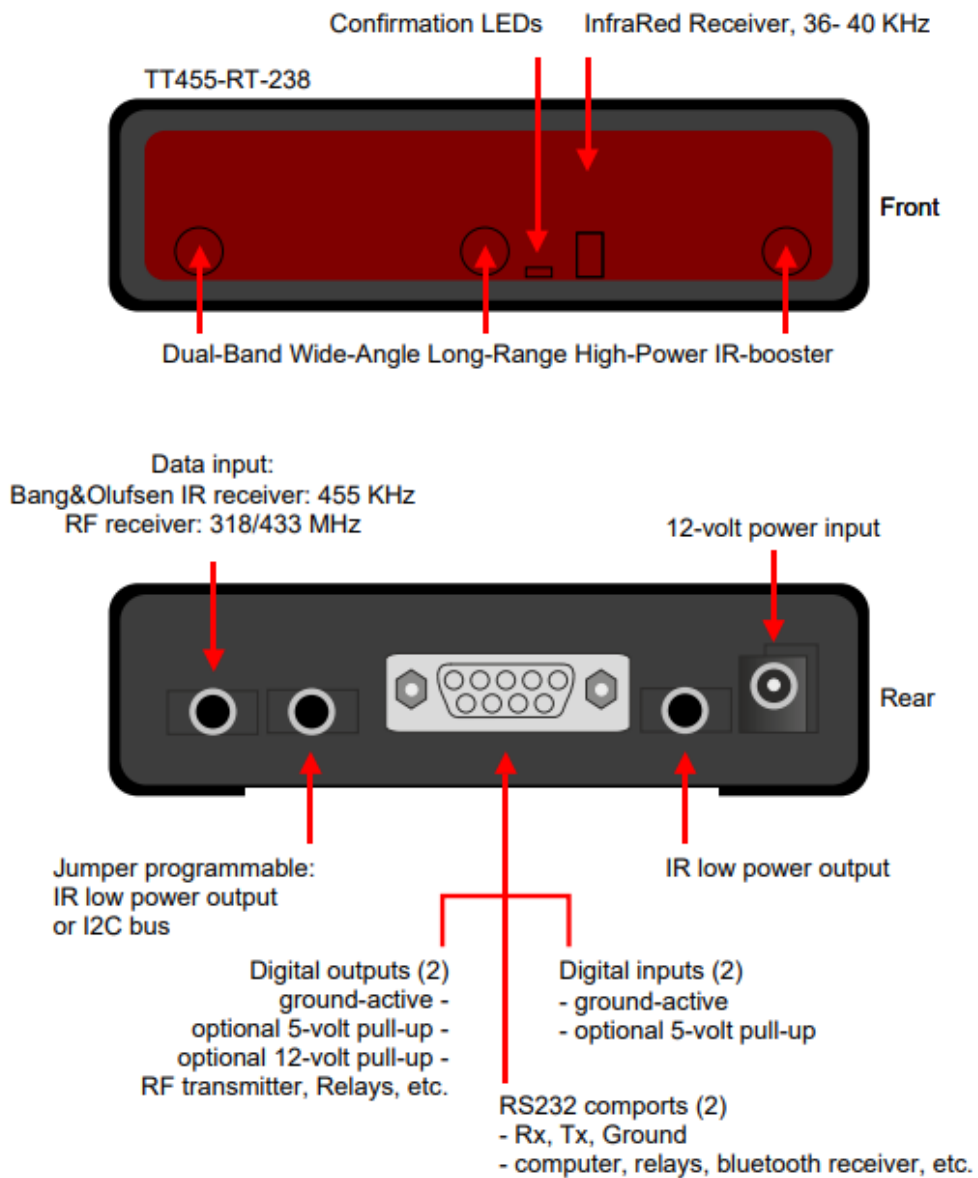




## INPUTS/OUTPUTS

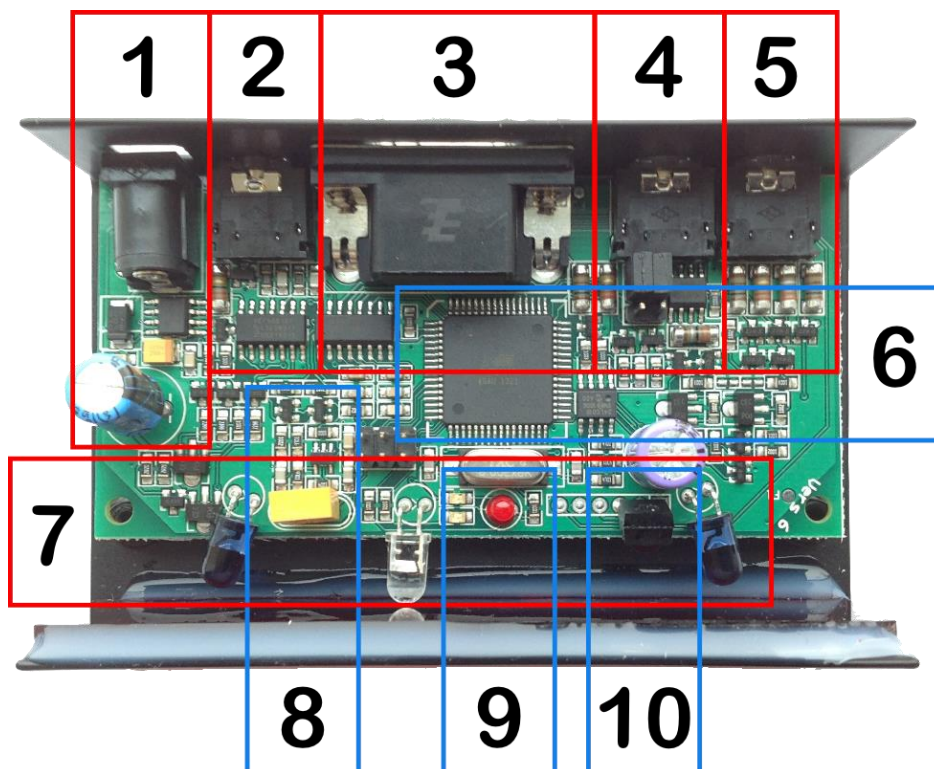
The TT455-RT-238 holds the following inputs/outputs:

- **Input: Digital data input (5-volt pull-up resistor, ground active)**  
Typically used to receive pulses/signals from an **external B&O IR receiver** (TT-IR-8087030) or a **radio frequency receiver** (could for example be a 318/433 MHz receiver).
- **Input/Output: Jumper configurable**  
**Input: i<sup>2</sup>C bus:**  
Reads the operation of the TT-IR-8087030 buttons, controls a display, etc.  
**Output:** Infrared low-power output 2.  
Used to insert a TT-IR-ET02.
- **Output:** Infrared low-power output 1.  
Used to insert a TT-IR-ET02
- **Inputs:** Two digital inputs, 5-volt pull-up, ground active.  
Used to read on/off state of contacts, switches, relays, etc.
- **Outputs:** Two digital outputs, optional 5-volt pull-up, ground active or 12-volt active.  
Can for example be used to control two 12-volt relays for motors, lights, etc. - or generate **pulses for a tv-stand, control an RF transmitter**, etc.
- **Inputs/Outputs:** Two bi-directional RS232 comports.  
Used to communicate with computer for configuration, read commands from our **Bluetooth receiver BT-RS232**, and/or communicate with or control products like light systems, TV's, projectors, relays, amplifiers, etc. etc. See our **solutions**.
- **Input:** Infrared 38 KHz receiver  
Receives commands from infrared remote controls working in the range 36 – 40 KHz which is 98% of the market. For remote controls not working on this carrier, we can insert f.ex. a 56 KHz receiver or a 455 KHz receiver in the digital data input.
- **Output:** Infrared, programmable carrier, 16 to 80 KHz and 455 KHz.  
Dual-Band Wide-Angle High-Power Long-Range, 840 nM and 950 nM diodes.  
Programmable integrated 3-channel infrared distributor.  
Integrated 455 KHz hardware oscillator to produce 100% exact long-range Bang&Olufsen commands.
- **Input:** 12-volt DC power supply, 2.1 mm, negative ring.



## UNDER THE HOOD

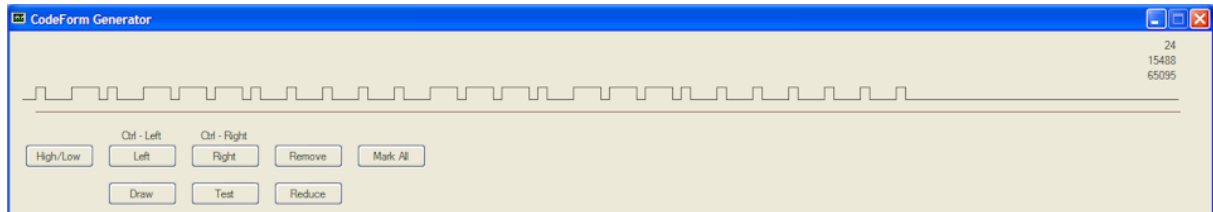
- 1 12-volt dc power supply connector
- 2 3.6 mm jack connector holding infrared low-power output 1
- 3 9 pin sub-d connector holding communication and bootloader  
2 pcs RS232 comports, 2 pcs digital inputs, 2 pcs digital outputs  
pin 1 Digital input 1  
pin 2 Comport 2, Tx  
pin 3 Comport 2, Rx  
pin 4 Digital input 2  
pin 5 Ground  
pin 6 Digital output 1  
pin 7 Comport 1, Rx  
pin 8 Comport 1, Tx  
pin 9 Digital output 1
- 4 3.6 mm jack connector programmable, holding:  
I<sup>2</sup>c communication port or infrared low-power output 2.
- 5 Digital data input (infrared, radio frequency or data).
- 6 Microprocessor, Memory Map, Triggers and Actions control.
- 7 Dual-Band Wide-Angle High-Power Long-Range infrared booster.  
Integrated 3-channel infrared distributor.
- 8 Bang&Olufsen 455 KHz hardware oscillator.
- 9 Heartbeat and confirmation LEDs.
- 10 36 – 40 KHz infrared receiver and codelearner.



## INTEGRATED 38 KHZ INFRARED RECEIVER

The integrated 38 KHz infrared receiver, allows the TT455-RT-238 to be controlled by an infrared remote control working in the range from 36 to 40 KHz, which covers 98% of the remotes on the market.

Infrared signals are **patterns of lights being pulsed on/off** in a specific timing sequence. Infrared signals are invisible to the human eye.



Reading a remote control requires constant monitoring of the on/off pulses and validation of the timing. A specific timing pattern is called a protocol or a code. A code is typically from 8 to 48 pairs of on/off signals. A part of the code is called the address and the other part is called the command.

## REMOTE CONTROLS (APPLE, LOGITECH, NEC, PHILIPS, SAMSUNG)

Many remote controls use the same type of codes that they buy from for example **NEC** or **Philips** but work with different addresses to separate them from each other.

We have firmware features in the TT455-RT-238, allowing it to be controlled from a range of remote controls using a known code set. Currently we support remote controls using code sets:

- From NEC - Apple, Bose, Denver, Epson, Hitachi, JVC, Kenwood and many more.  
See [products using codeid 716](#)
- From Philips, see [products using codeid 705](#), see [products using codeid 706](#)
- From Samsung, LG and more, see [products using codeid 723](#)
- From LinTronic (Logitech, SmartIr and learnable remotes)  
See [products using codeid 745](#) and [LinTronic codeset 745](#)

## DIGITAL DATA INPUT (INFRARED, RF, DATA)

The digital data input is designed to read on/off pulsing signals and decode these signals according to an expected protocol.

## REMOTE CONTROLS (BANG&OLUFSEN)

This enables the TT455-RT-238 to be controlled by signals from for example a **Bang&Olufsen infrared receiver** like the B&O typenumber 8087030 or 8089002 – or compatible receivers.

All infrared B&O remote controls can be used, for example:

Beocom 6000, Beo Keyring, Beolink 1000, Beo1, Beo4 (all variants), Beo5, Beo6, Beoremove One

## RF (318/433 MHZ)

You can connect a **radio frequency receiver**, enabling the TT455-RT-238 to be controlled or decode signals from for example a 318 MHz or 433 MHz radio frequency receiver.

## INFRARED FRONT BOOSTER (DUAL-BAND WIDE-ANGLE HIGH-POWER LONG-RANGE)

Handheld remote controls offer limited range, as they are running on batteries and would drain batteries relatively fast if designed to transmit at a higher power.

Since the TT455-RT-238 is powered by an adaptor working on your mains supply (115 volt or 230 vac), we have designed the TT455-RT-238 to hold a very power-full infrared booster/transmitter enabling the TT455-RT-238 to easily control your audio/video devices across a normal living room.

The infrared booster holds 3 effective fast-switching 850nm and 940 nm wavelength LED's, which cover all infrared products and offer long-range operation.

#### 455 KHZ HARDWARE OSCILLATOR

Our products are used by a wide number of Bang&Olufsen installers offering home automation solutions. Since they want to automate/control B&O products from a computer, and the Bang&Olufsen infrared products work on a frequency carrier of 455 KHz, we have designed the TT455-RT-238 to include a hardware oscillator (crystal/resonator) of 455 KHz, so that we can reproduce signals which 100% match what Bang&Olufsen products expect to receive.

Since we power the TT455-RT-238 by a power adaptor, we can feed the infrared booster with enough power for them to offer absolute top performance.

The TT455-RT-238 transmits even more powerful than the famous and popular Beo4.

We performed a demonstration of the TT455-RT-238 for Bang&Olufsen, Denmark and they were flabbergasted by its performance and range.

#### SMARTPHONE CAMERA VERIFICATION

If you want to verify whether the TT455-RT-238 is transmitting, then bring your smartphone into camera mode and point the camera to the front glass of the TT455-RT-238. When the TT455-RT-238 transmits, you should see white flashes/blinking on your camera. This trick can also be used on most handheld infrared remote controls.

#### 2 PCS LOW-POWER INFRARED OUTPUTS

The TT45-RT-238 infrared front booster is very powerful and operates most if not all audio/video products in the room, but it cannot reach **products stored in a closed cabinet**.

If you have products stored in a closed cabinet, you will enjoy that the TT455-RT-238 holds two low-power infrared outputs capable of controlling products in a cabinet.

You can leave the TT455-RT-238 out in the open and feed the low-power infrared cables (TT-IR-ET02) into the cabinet and glue them onto the infrared eye on the products – or – you can move the TT455-RT-238 into the cabinet and leave the Bang&Olufsen infrared receiver outside the cabinet.

#### 3-CHANNEL INFRARED DISTRIBUTOR

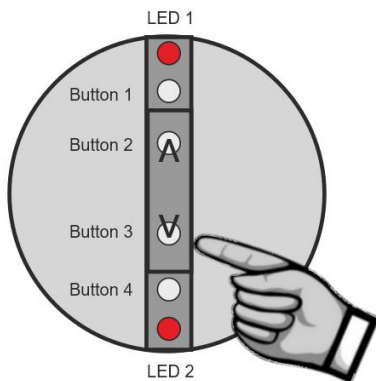
The TT455-RT-238 holds an integrated and programmable infrared 3-channel IR distributor, enabling the TT455-RT-238 to send the outgoing infrared signal to one or more outputs:

- To the front booster output only
- To the low-power output 1 only
- To the low-power output 2 only
- or any combination of the above

As default all signals are copied to all infrared outputs.

## I2C BUS

As default, the low power IR output 2, is jumper-programmed to read whether the user operates the buttons of the **external Bang&Olufsen receiver**. In this mode, we have added support for writing to an **I<sup>2</sup>c display**.



External B&O receiver



I<sup>2</sup>C display

## 2 PCS BIDIRECTIONAL RS232 COMPORTS

The TT455-RT-238 holds two bidirectional RS232 comports. Both comports work on 3 wires: Rx, Tx and Ground. No hardware handshake signals are offered or needed. Both comports can be used for communication with a computer/controller and/or any other products capable of communicating on 2.400 – 38.400 bits pr. second, Odd, Even og None parity, 7 or 8 databits and 1 or 2 stopbits.

Default: 19.200 bps, No parity, 8 databits, 1 stopbit.

Comport 1: pin 8 = Tx, pin 7 = Rx, pin 5 = ground.

Comport 2: pin 2 = Tx, pin 3 = Rx, pin 5 = ground.

Go to [Working with RS232](#)

## BT-RS232 BLUETOOTH RECEIVER/TRANSMITTER

Technical Manual: [BT-RS232](#)

### DESIGNED TO DO WHAT ?

The BT-RS232 is designed to pair with a bluetooth remote control, receive the commands from the remote and send the keys as RS232 commands onto an RS232 comport.

### 1 PCS. BLUETOOTH RECEIVER/TRANSMITTER INTERFACE

The BT-RS232 holds an integrated Bluetooth receiver and transmitter (a transceiver).

In the initial design we make use of the receiver only to read the signals from the remote. At this point we are not ready to transmit Bluetooth signals.

### REMOTE CONTROLS (BANG&OLUFSEN)

The BT-RS232 works with the following remote controls:

- Beoremote One Bluetooth (tested and verified)
- Beoremote Essence (not tested)

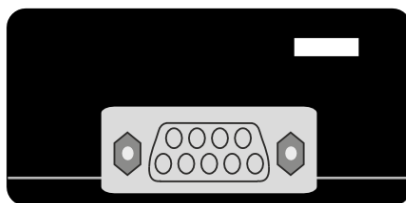
### 1 PCS BIDIRECTIONAL RS232 COMPORT

The BT-RS232 holds one bidirectional RS232 comport, working on 3 wires: Rx, Tx and Ground. No hardware handshake signals are offered or needed. The comport can be used for communication with a computer/controller and/or any other products capable of communicating on 2.400 – 38.400 bits pr. second, Odd, Even og No parity, 7 or 8 databits and 1 or 2 stopbits.

Default: 19.200 bps, No parity, 8 databits, 1 stopbit.

Comport: pin 2 = Tx, pin 3 = Rx, pin 5 = ground.

Go to [Working with RS232](#)



## WORKING WITH RS232

RS232 is a reliable way of communicating, which has been around since 1960.

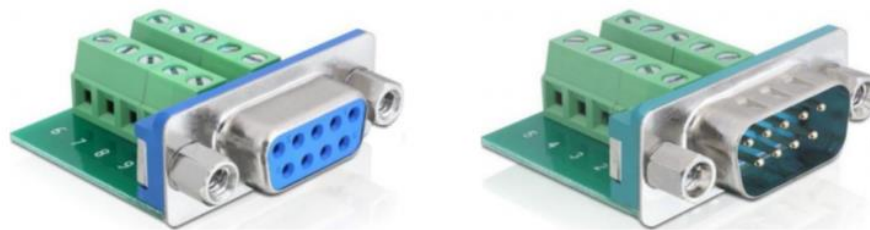
Wiki: <https://en.wikipedia.org/wiki/RS-232>

It is very easy to connect products by RS232. We have created a [document](#) which explains and simplifies.

If you want to know how to communicate with our products, then see:

Go to [Working with the LinTronic protocol](#)

We recommend the use of breakout interfaces which allows you to easily carry out the required connections with a few wires and a screwdriver.



Go to [TT455-RT-238 Signal Converter](#)

Go to [BT-RS232 Bluetooth receiver/transmitter](#)

### SOME OF THE PRODUCTS WE CAN CONTROL BY RS232

- See online, some of the [products we can control by RS232](#).
- [Controlling 8 relays by RS232](#):



## WORKING WITH THE LINTRONIC PROTOCOL

If you are a programmer or an installer working with automation systems, at one point you might want to be communicating with our products and will need to consult our easy-to-use **open-source protocol**: <[To][From][Command][Data][Checksum]>

In the Configurator you can turn on the Configurator's Log and see the communication flow to learn/verify how the protocol works.

You can use the Configurators terminal program called Datasampler, to receive/send/test your commands.

## PROTOCOL, COMMAND 039

Command 039 is used by a computer, when instructing the TT455-RT-238 to send an infrared code, a radio frequency code, an RS232 command on comport 1, or control one of the digital outputs (can be set to control relays).



If you want the TT455-RT-238 to send out an infrared code or control one of the digital outputs, then:

- Go to the Configurator’s CommandList
- Find the product holding the wanted commands
- Mark the command to be transmitted/executed
- Click the yellow “Test” button
- Copy the RS232 command to your computer program  
(example here is: <0100039717012001021000000000003246>)  
the IR code is marked with the red color.

717	012	001	006	000	000	000	003	7
717	012	001	007	000	000	000	003	8
717	012	001	008	000	000	000	003	9
717	012	003	079	000	000	000	003	BLUE
717	012	001	017	000	000	000	003	CHANNEL DOWN
717	012	001	016	000	000	000	003	CHANNEL UP
717	012	003	077	000	000	000	003	GREEN
717	012	001	020	000	000	000	003	MUTE
717	012	001	021	000	000	000	003	POWER
717	012	003	076	000	000	000	003	RED
717	012	001	056	000	000	000	003	TEXT

Test  
 Favorite  
Upload

Delete Lines   Copy Line

Computer RS232 command used to send this command

<0100039717012001021000000000003246>

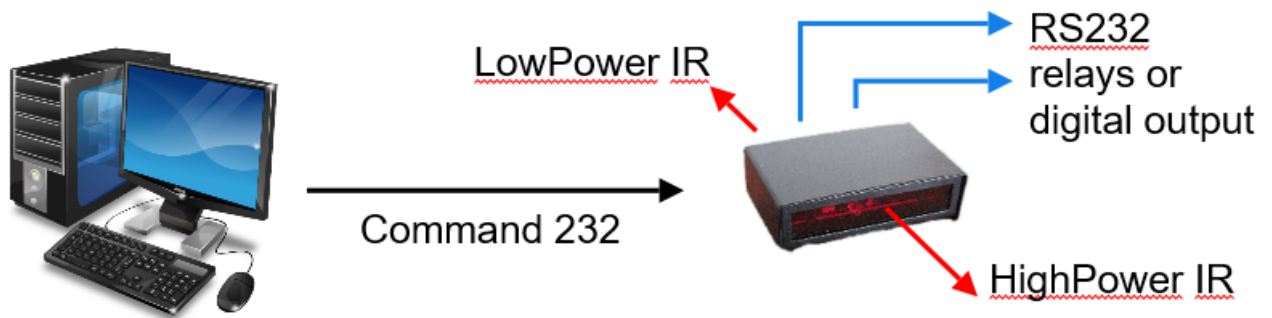
## PROTOCOL, COMMAND 232

Command 232 is often used by computer programmers of for example Crestron systems. The "Command 232" sends out a number in the range from 000 to 255. Each number is individually detected by the TT455-RT-238 and the Memory Map converts each command into whatever is needed in your home.

The nice thing about this setup, is that the computer program, does not need reprogramming if you get new products. All you will need to do, is reconfigure the TT455-RT-238's Memory Map to react to the same commands from the computer, but send out something else, in order to control the new products.

For example:

- Command 010 turns on the power of your TV
- Command 001 set the channel to 1
- etc.



Getting a computer program changed is often very expensive. Changing the Memory Map of the TT455-RT-238 is not.

--- End Of Document ---