

## Configuration Guide

# How to control RS-232 enabled devices with C-Bus Network Automation Controller – 5500NAC

Including connection to C-Bus Groups



# Safety Information

## Important Information

Read these instructions carefully before trying to install, configure, or operate this software. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



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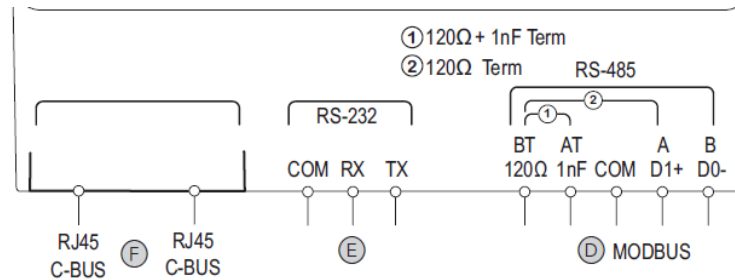
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# 1 Introduction

This configuration guide describes how to setup the C-Bus Network Automation Controller's built in RS-232 interface for communication with 3<sup>rd</sup> party devices represented by a "Barco brand" projector. The wiring, its initial settings and basic troubleshooting is described. Association with C-Bus groups and the incorporation of controlled devices to the scenes is also explained.



Sample image of "5500NAC" RS-232 connections

## 1.1 Real World Use

The real world applications for using a 5500NAC to interface to RS-232 equipment are many and varied. The RS-232 interface is still one of the most preferred methods of communication between AV, HVAC products that do not support either Ethernet, some proprietary Bus connection or a software API.

RS-232 can provide control and information exchange of:

- Projectors and displays
- Amplifiers, AV receivers and active speakers
- VRV/VRF Centralized Air Conditioners, heat pumps and other HVAC technologies
- Meteorological stations and other Sensing equipment.

**NOTE:** This list displays only a sample of some of the devices that can be controlled using this interface.

- User case 1: Connection of common RS-232 devices through most used connectors.
- User case 2: Configuration of BARCO CRWQ-62B projector and 5500NAC for communication over RS-232.
- User case 3: Simple command for switching of BARCO CRWQ-62B projector ON.
- User case 4: Including control of BARCO CRWQ-62B projector control into the scenes.

## 1.2 Competencies

There are a few necessary competencies to follow procedures mentioned in this configuration guide. It is mandatory to have knowledge of C-Bus commissioning via C-Bus ToolKit, basic 5500NAC configuration knowledge, fair knowledge of the RS-232 interface and its settings and of Lua scripting language in the scope described in the Product manual.

## 1.3 System prerequisites

Software / Product name	Version	Description/ Download link
Hercules setup utility	3.2.6	RS-232 / RS-485 serial comms "packet sniffer"
C-Bus Toolkit for NAC	1.15.0	<a href="http://www.schneider-electric.com.au">http://www.schneider-electric.com.au</a>

Table 1: System prerequisites

Part Number	Device ID	Description
5500NAC	C-Bus Network Automation Controller	C-Bus Network Automation Controller
Plug Pack	5500NAC Power supply	24Vdc 1.25A Plug Pack (Generic brand)
CRWQ-62B	BARCO CRWQ-62B	WQXGA, single chip DLP projector
UCAB232	RS-232 to USB "Type A" converter	Converter cable, used for temporary connection of your PC to the 5500NAC RS-232 port for diagnostics and testing

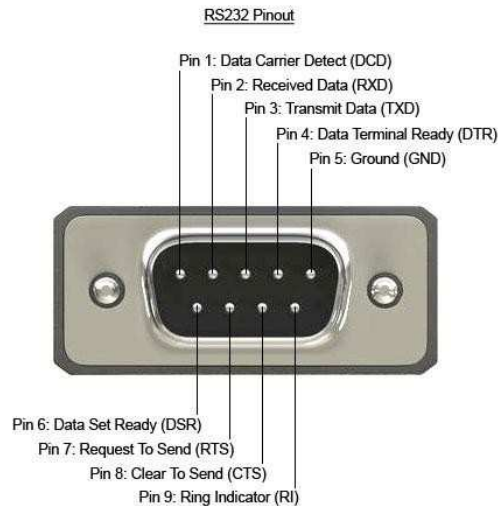
Table 2: List of used Hardware

# 2 Design

## 2.1 Hardware Connections

There are 2 typical connections commonly used for RS-232 control:

- 1/ 9 pin DE/DB9 serial plug



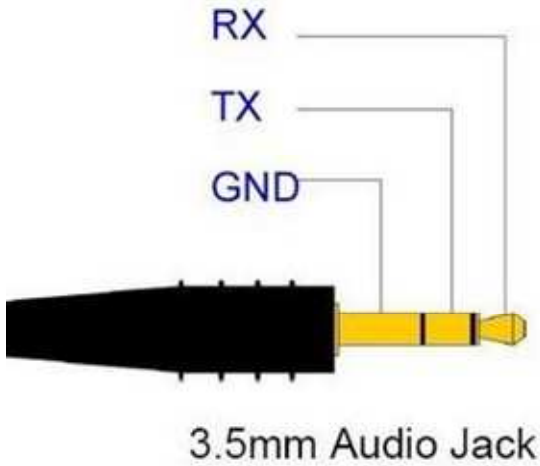
**Picture 1: 9 pin DB/DE 9 connector**

Please note that only 3 of the pins are used for the 5500NAC - RXD, TXD and GND.

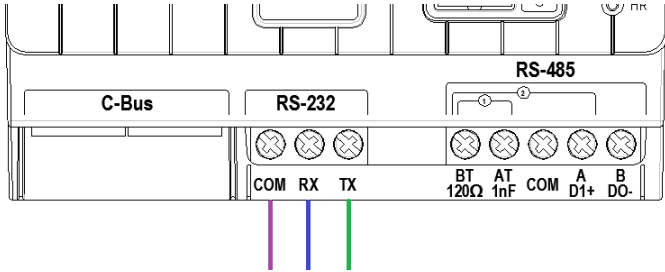
The other remaining pins are either not connected at all or some may be used as float control. If a device needs float control or is powered by any other pin aside from the RXD, TXD or ground, a USB to RS-232 converter is typically required.



2/ 3.5 mm Stereo Audio jack connection



Picture 4: 3.5 mm audio jack connector

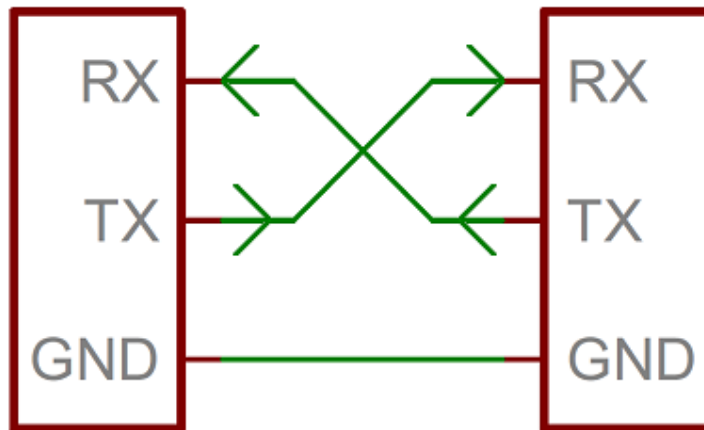


Picture 5: 5500NAC terminals connection

Baud Rate	Maximum RS-232 Cabling Distance Recommendations
57600	5 metres
28800	10 metres
<p><b>NOTE:</b> Typically the maximum distance for RS-232 control is 15metres. By using special “low capacitance” cables full speed communication can be maintained over longer distances (dependent upon the cable characteristics)</p>	

Table 3: 5500NAC RS-232 terminals connection

It is **a requirement** that the cable pins ‘cross or are transposed’ to ensure that TX = transmitting pin will be connected to the RX = receiving pin on the other end of the cable:



Picture 6: RS-232 'cross' connection

Please note: 5500NAC is using a standard RS-232C interface with a signal level of  $\pm 12$  Vdc.

If you wish to use a device with a different voltage level, for example RS-232TTL with signal level  $\pm 5$  Vdc, then an additional hardware converter **must** be used, to ensure proper function and prevention of damage of the 5500NAC or connected device(s). Check the manual of the device you wish to connect to first.

# 3 Configuration

## 3.1 Communication configuration

First thing, refer to the manufacturer's documentation for the device that you wish to control. The 5500NAC will need to be configured to suit the existing manufacturer settings. RS-232 control is enabled in the BARCO CRWQ-62B projector by default. Communication settings must be included in the RS-232 control script:

Connection Settings	Value
Baud Rate	19200 bps
Data Bits	8 bits
Parity	None
Stop Bits	1 bit
Flow control	None

Table 4: Connection parameters

Sample Script for opening the RS-232 port and setting its parameters, *flushing the buffer should also be done in case of any read / unsent / leftover data*):

```
-- Include library before calling serial functions
if not port
then
require('serial'
)
-- Setting port parameters and open serial
port = serial.open('/dev/RS232', {
  baudrate = 19200,
  databits = 8,
  stopbits = 1,
  parity =
  'none',
  duplex =
  'full'
})
-- Flushes any read/unsent
bytes port:flush()
```

## 3.2 LUA RS-232 commands

Data can be sent to the RS-232 port, however it does depend on the controlled hardware device itself. A list of supported commands is typically provided by the device manufacturer. Table 4 displays a sample from the BARCO CRWQ-62B projector's instruction manual:

### Control Commands List

Command Description	Header (WORD)	Address Code (BYTE)	Size Of The Payload (WORD)	CRC16 For The Entire Packet (WORD)	Msg ID (WORD)	Msg Size (WORD)	Command Code (BYTE)	Value (BYTE)	Comment
Power On	0xefbe	0x10	0x0005	0xffc6	0x1111	0x0001	0x01		See Note 2
Menu	0xefbe	0x10	0x0005	0xbfc7	0x1111	0x0001	0x02		
Up	0xefbe	0x10	0x0005	0x7e07	0x1111	0x0001	0x03		
Down	0xefbe	0x10	0x0005	0x3fc5	0x1111	0x0001	0x04		
Left	0xefbe	0x10	0x0005	0xfe05	0x1111	0x0001	0x05		
Right	0xefbe	0x10	0x0005	0xbe04	0x1111	0x0001	0x06		

Table 5: sample list of RS-232 control codes

#### Note:

The serial module will send out data in a *"string format"*.

#### ASCII format:

To send commands in an *ASCII format* instead, please use the following code sample:

```
-- Write data to serial
port:write('Powr_
1')
```

To send raw data, please view the following code segment:

```
-- Write data to serial port
msg = string.char(0x49, 0x52, 0x47, 0x42, 0x5F, 0x5F, 0x5F,
0x31) port:write(msg)
```

The data being written to the serial port is treated as a string, on the serial port side it is read as raw data. This means that any raw data being sent *must be written as an ASCII equivalent*. Refer to the code segment above, consider if you wished to send the raw data number '49'. To achieve this, it must be written in an ASCII format. Using an ASCII "look up table" the equivalent ASCII format is 'l' which is (0x49) in hexadecimal. The serial port does not read this as ASCII and will recognize these characters to represent the number '49'.

Data can also be read from the RS-232 port. Below we see an example of an alert in the 5500NAC alert when confirmation from the projector is received:

```
-- Read data from serial port
if port:read() == 'Powr__1'
-- Send alert when condition matched
then alert('Projector is
ON') end
```

The RS-232 port should then be closed, when it is no longer needed:

```
-- Closing serial
port port:close()
```

Complete code sample for switching the BARCO CRWQ-62B projector to “ON”:

```
-- Include library before calling serial functions
if not port
then
require('serial'
)
-- Setting port parameters and open serial
port port = serial.open('/dev/RS232', {
  baudrate = 19200,
  databits = 8,
  stopbits = 1,
  parity =
  'none',
  duplex =
  'full'
})
-- Flushes any read/unsent
bytes port:flush()
-- Write data to serial port corresponding to the projector's manual
msg = string.char(0x7E, 0x30, 0x30, 0x30, 0x30, 0x20, 0x31,
0x0D) port:write(msg)
-- Closing serial
port port:close()
end
```

### 3.3 Including RS-232 commands into C-Bus Networks

The following sample, displays how to include commands to switch ON/OFF the BARCO CRWQ-62B projector when mapped C-Bus groups change state.

You will need to create an object for use in controlling the projector:

Application:	100 - MyApplication	+
Group address:	1 - MyProjector	+
Keywords:		
Log:	<input type="checkbox"/>	
High priority log:	<input type="checkbox"/>	
Export:	<input type="checkbox"/>	
Object comments:	Cbus group for use in controlling my projector	

Picture 7: Scene object properties

You can control the projector through C-Bus groups with the use of an 'Event script':

Name	Group address	Event script
Local/My Application/My Projector	0/100/1	

Picture 8: Object link to the event script

#### 3.3.1 Script to control a projector's on/off status with a C-Bus group

When the following script runs, it will check if the "C-Bus group state" is "on" or the C-Bus level is anywhere from 1 through 255 (ie: ON, but dimmed), and will send an "on" command to the projector. It will also check if the C-Bus group state is "off" or the level = 0, and will send an "off" command to the projector.

You will be able to put the projector object into a scene and turn it on / off and it will integrate with other C-Bus interfaces, if you wish to use different C-Bus levels for triggering commands you will need to edit the code and use the "C-Bus Level command", please refer to the "Helper functions" in the 5500NAC for further information.

```

value = getCbusState(0,100,1)

--if the cbus group is off, turn off the projector
if value == false then
  if not port then
    require('serial')
    -- Setting port parameters and open serial port
    port = serial.open('/dev/RS232',
    {
      baudrate = 19200,
      databits = 8,
      stopbits = 1,
      parity = 'none',
      duplex = 'full'
    })
    port:flush()
  end
  -- Write data to serial port Projector OFF
  msg = string.char(0x7E, 0x30, 0x30, 0x30, 0x30, 0x20, 0x30, 0x0D)
  port:write(msg)
  port:close()

  --if the cbus level is on, turn on the projector
elseif value == true then
  if not port then
    require('serial')
    -- Setting port parameters and open serial port
    port = serial.open('/dev/RS232',
    {
      baudrate = 19200,
      databits = 8,
      stopbits = 1,
      parity = 'none',
      duplex = 'full'
    })
    port:flush()
  end
  -- Write data to serial port Projector ON
  msg = string.char(0x7E, 0x30, 0x30, 0x30, 0x30, 0x20, 0x31, 0x0D)
  port:write(msg)
  port:close()
end
end

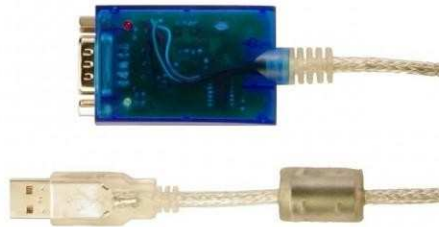
```

### 3.4 Connection setting and testing

For connection setting and testing, a number of utilities can be used. Freeware “Hercules” software utility is one of them:

[http://www.hw-group.com/products/hercules/index\\_en.html](http://www.hw-group.com/products/hercules/index_en.html)

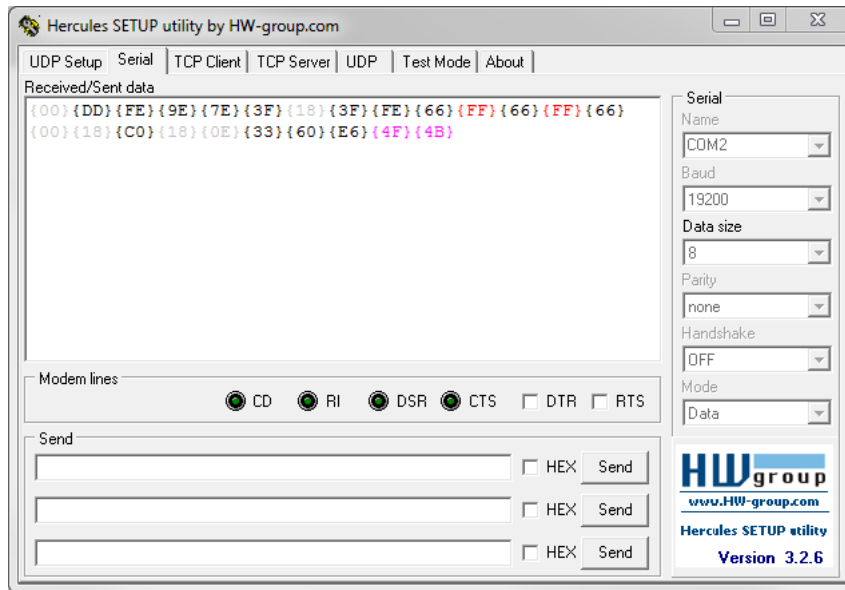
A RS-232 to “USB Type A” cable is required. An ASIX UCAB232 cable was used in this example. This cable has two LEDs which provide indication of “incoming / outgoing” communications.



Picture 10: ASIX UCAB232 cable

When connected and properly configured, a PC can both receive commands from 5500NAC and send commands to a controlled device for testing purposes. A sample of a “sent control code” with confirmation from the projector is – hexadecimal code 4F 4B at the end = OK in ASCII.





Picture 11: Hercules utility environment with received code

### 3.5 RS-232 connections & adding additional (RS-232)

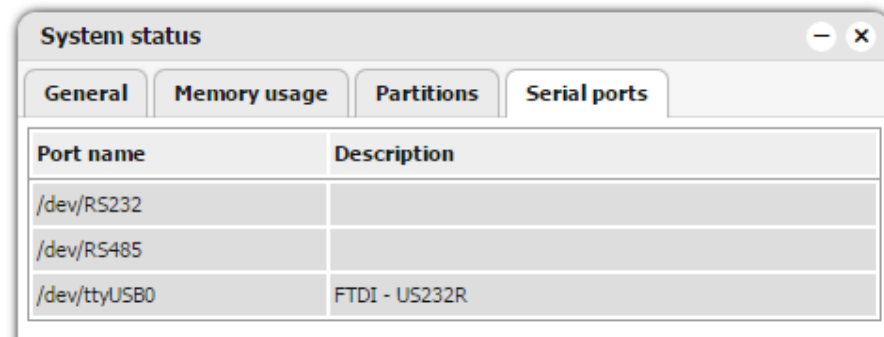
The 5500SHAC RS232 Physical port address is located in:

“Configurator > Utilities > System > Status > System Status > Serial Ports ‘/dev/RS232’.

The picture below shows the RS232 port in the 5500SHAC as the first port. As mentioned before this is only a 3 wire connection on the 5500SHAC (COM, RX, TX).

If the device you wish to control requires hardware “flow control”, then it will need a 4 wire RS-232 connection. To provide this 4<sup>th</sup> wire, you would need to add a compatible USB<>RS-232 adaptor that will give you the additional connections. This will also work through an external USB hub (with its own external hub power), so that you can connect multiple USB adaptors onto the one USB connection on the 5500SHAC.

The picture below also shows the 3<sup>rd</sup> port as a “FTDI chipset” USB<>RS232 adaptor, this was plugged into the USB-A slot on the 5500SHAC. The 5500SHAC auto detects the FTDI chipset USB device and adds it to the GUI (does not require a refresh /re-load / etc for screen to update).



The screenshot shows a window titled "System status" with four tabs: "General", "Memory usage", "Partitions", and "Serial ports". The "Serial ports" tab is selected, displaying a table with two columns: "Port name" and "Description".

Port name	Description
/dev/RS232	
/dev/RS485	
/dev/ttyUSB0	FTDI - US232R

Having separate adaptors also allows you to specify individual baud rates to each USB adaptor according to what your equipment needs.

## 4 Conclusion

5500NAC can be used as a gateway / interface for control of RS-232 devices using C-Bus devices / wall controls / touchscreens / Tablets (via 5500NAC Dashboards).

Proper settings and connection is imperative for correct functionality. It is critical to get valid sets of codes from the manufacturer of the device as all manufacturers are different.

# 5 Appendix

## 5.1 Glossary

The following table describes the acronyms and defines the specific terms used in this document.

Abbreviation	Description
RS-232	Telecommunications standard for binary serial communications between
bd	Baud = unit for transmitted symbols per seconds
hexadecimal	Positional number system with base of 16
ASCII	American Standard code for Information Interchange

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