

# **Instruction Radio Module USB 51-868**

## **Software V1.12**

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## Module Description

The „USB 51-868“ Module enables embedded systems networking among each other and with PCs with a minimum extend of development.

The Module is equipped with UART, USB, ADC and digital I/O.

Therefore, the Module can be used for measurement technology, controlling, monitoring technology and control engineering.

**It is a module of Receiver Class 3 (according to EN 300220-1) and therefore must not be used for safety-related applications!**

Please keep to these instructions as otherwise parameters may vary leading to a decline of the radio link or the CE boundary value may not be kept. In the worst case the Module can even be destructed.

## Commencing Operation

Copy the USB\_Demoware programme on the PC and start it.

The programme runs on Windows2000 or WindowsXP & Windows Vista.

The following must appear on the screen after the module has been plugged on to an USB port:

*Uhr gesetzt. (time set)*  
*Systemzeit: 20:00:00 (system time)*  
*Datum gesetzt. (date set)*  
*Systemdatum: 03.05.07 (system date)*

From now on all inputs are transmitted by the Module except commands.

All commands are entered at the bottom line of the window like data.

Generally, commands must be preceded by the „#“ sign as described in the next chapter.

Input data that cannot be defined as a command is processed as data and transmitted to the Module defined with „#snd“ (Module address). If you enter [0] as parameter all Modules are addressed by broadcast.

In case a PC is not equipped with Windows software or without USB port, you can address the Radio Module by UART.

The Module operates with high levels of 3,3V, whereby the input tolerance is up to 5V.

For connecting RS-232 of a PC or a similar device a level converter must be switched intermediately. The same access to the Module can be achieved by using a terminal programme like via USB.

The data rate of UART is set to 9600 Bit/s by factory.

When operating the Module via USB, the PC supplies the Module with current. However, operating by UART requires a 3,3V electric power supply. The 3,3V shall be stabilized by a voltage regulator for the range of 3,2V ... 3,5V. The ampacity shall be >60mA.

The normal voltage of the Radio Module must not show any disturbance signals caused by DC/DC converter or charging pumps (MAX232).

Such disturbances can affect functioning the Modules.

If the Module is operated on an USB port, it supplies 3,3V at PIN3 (VCC). This can be used as operating power for additional IC. The ampacity is 30 mA max.

**Please do not supply the Module with 3,3V and USB connector at the same time!**

When integrating the Module in a circuit it must be in standing position on the board. Furthermore, the antenna must not be close to other components.

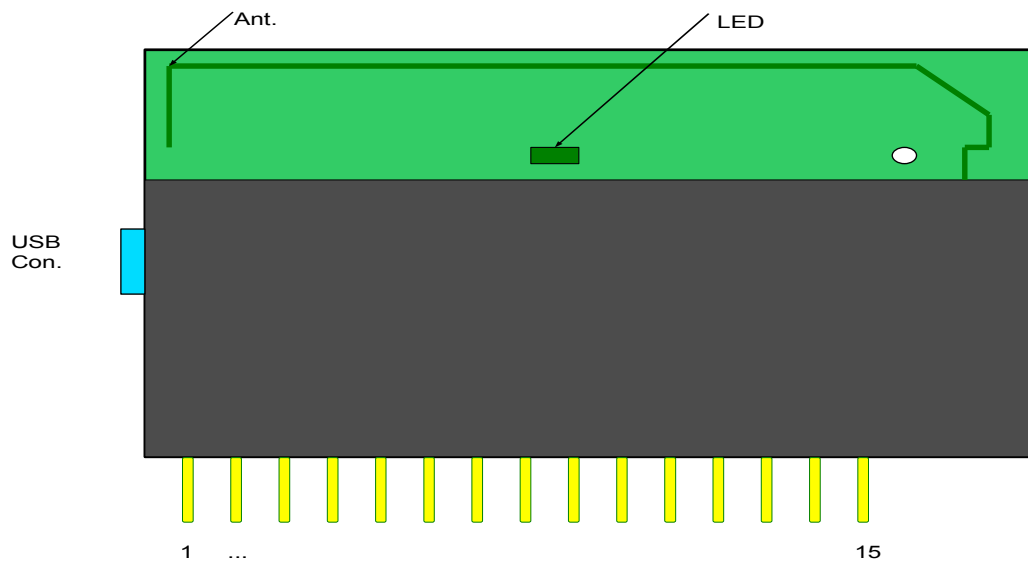
If the Module is fitted into a housing, it is important that the housing must not be made of metal or other conductible materials shielding the radio waves.

No conductive material, like cable, batterie or other boards shall be located close to the antenna.

Data is transmitted in packets. The size of each packet is 64 byte, 8 of them overhead.

One packet is transmitted if 56 bytes were sent to the Radio Module via USB or UART or if a CR was sent. The character set is limited to the range 0x20 ... 0xff.

## Connector Assignment:



### Pin assignment:

Pin	Function	Annotation
1	Reset	Low - active
2	RX buffer full	For UART
3	3,3V VCC	3,2V... 3,5V 60mA min.
4	TXD	
5	RXD	
6	SCL + factory reset *	I <sup>2</sup> C
7	SDA	I <sup>2</sup> C
8	digital out 1	
9	digital out 2	
10	digital in 1	5V tolerant (5,5V max.)
11	digital in 2	5V tolerant (5,5V max.)
12	ADU 1	10 bit (0V ... 2,44V)
13	ADU 2	10 bit (0V ... 2,44V)
14	ADU 3	10 bit (0V ... 2,44V)
15	GND	

LED flashes for 100 ms if one packet is sent.

LED flashes 200 ms if one packet is received.

\* To execute a factory reset, pull down pin 6 and switch the module off/on or do reset (pin 1)

ATTENTION: In normal operation pin 6 must not be pulled down!

## Commands:

### Overview of commands:

mem.	Parameter	Function/Description	Output
#clk	[hh:mm]	Readout/setting of realtime clock	
#dat	[dd.mm.jj]	Readout/setting of date	
#dof	[Module], without param. it refers to the Module connected	Radio Module in sleep mode (Alarm must be programmed!)	
#hlp		Help	Commands
#inf		All programmed information is listed.	S/N, channel, Bd, UART, ...
#prt	[Module],[x],[x]	Readout of port or setting port with parameter x,x (x=1) or reset (x=0)	ADU1, ADU2, ADU3, DigIn, DigOut
#pwr	[TX-Power]	Radiated power set up 0 - low / 15 – max. power	
#scn		Saves adjustments at EEPROM	
#rty	[Quantity] {0..255}	Defines number of retries	
#sdn	[Module Address] {1..255}	Setting up of Module address	default [1]
#ser	[Baud Rate] {1, 9, 19, 28, 38, 57, 115}	Configuration of UART	1k2, 9k6, 19k2, 28k8, 38k4, 57k6, 115k2
#snd	[Module Address, number of packets] {-, 0..255}, {1..65535}	Without address: start and stop of auto modus (packet to be sent in 1,5 s steps) Otherwise: destination address (8 Bit) to be set.	default [0]
#srd	[Bit Rate],[Channel] {12, 50, 100, 200} {1, 2, 3}	Setting of HF bit rate and transmission channel	
#ssi	[TX Address] {1..255}	Field intensity of Txadr to be defined	Data byte
#tem	[Module Address] {1..255}	Module temperature to be defined Without address: temperature of the Module connected	
#wup	[hh:mm,dd]	Wake up time/day to be defined. Without presenst parameter output.	
#rmt	[_Text]	Remote function	

## Description of Commands:

Each command must be preceded by the sign „#“ as otherwise it is not processed as a command and transmitted as text.

Data can only be transmitted as ASC-II characters in the range of 0x20 ... 0xff (32 – 255). If the sign „#“ shall be transmitted, it may not be noted as the first digit in order to avoid interpreting it as a command.

Samples are given in *italics* in the description.

The left colom shows the command (entry) and the right colom shows the following output.

### #clk

Realtime setting:

#clk 12:34                      *Uhr gesetzt. (time set)*  
                                    *Systemzeit: 12:34:00 (system time)*

Annotation: If the Module is connected with a PC via USB port it adapts the system time provided the Usb\_control.exe programme is running.

Readout of real time:

#clk                              *Systemzeit: 17:05:41 (system time)*

### #dat

Date is set to realtime:

#dat 03.05.07                      *Datum gesetzt. (date set)*  
                                    *Systemdatum: 03.05.07 (system date)*

Annotation: If the Module is connected with a PC via USB port, it adapts its date provided the Usb\_control.exe programme is running.

Readout of date:

#dat                              *Systemdatum: 03.05.07 (system date)*

### #dof

Switches the Module in sleep mode.

#dof

The Module switches in sleep mode only if a wake up time is set by the previous command #wup; otherwise the following error message appears:

#dof 2                              *keine Alarmzeit! (wake up time missing)*

If an address is given, the actual time data is transmitted provided the alarm was programmed and the Module addressed was set in sleep mode (date/time/alarm).

The module will not be able to set to sleep mode if powered by USB!

### #hlp

Shows the commands available:

#hlp                              *Befehle: (Commands)*  
                                    *#hlp #inf #srd #pwr #ser #scn #clk #dat #wup*  
                                    *#snd #ssi #sdn #prt #tem #rty #flh #dof #rmt*

### #inf

Listing of all programmed configurations of the Radio Module

#inf                                      *Software : V0.72*  
   *Seriennummer : 47/7 (serial number)*  
   *Device Number: 3*  
   *Bitrate : 12 kbps*  
   *Retry : 1*  
   *RS232 BR : 9600 Baud*  
   *Sendeleistung: 15 (radiated power)*  
   *Interner Osz.: 15998692 (internal oscillator)*  
   *Sendekanal : 1 (radio channel)*  
   *Zielmodul : 0 (target Module)*  
   *Modulspannung: 3255 mV (Module voltage)*  
   *Chip-Temp. : 31.8°C*  
   *gesendet: 0 - empfangen: 0 - nicht bestätigt: 0*  
   *(sent) (received) (not confirmed)*

### #pwr

If the command is entered without parameters, the radiated power currently selected is shown (0 = lowest power, 15 = max. power):

#pwr                                      *Sendeleistung: 1 (radiated power)*

In order to change the value, please add the parameter to the command:

#pwr 5                                   *Sendeleistung: 5 (radiated power)*

Saving the adjustment at EEPROM is done by '#scn'.

### #scn

Saves the present adjustments/parameter at EEPROM, so that the parameters are available after an interruption of the operating voltage.

Stored are: baud rate, HF data rate, channel, device number, retries and radiated power.

#scn                                      *EEProm initialisiert... (EEProm initialized...)*

### #rty

Display and number of retries for the confirmed communication:

#rty                                      *Retries: 1*

#rty 2                                   *Retries: 2*

Factoring setting is [1].

### #prt

By entering #prt the ports of the Radio Module are read out:

#prt *Module 1: 1,1,113,26,26*  
(DigIn1, DigIn2, ADC1, ADC2, ADC3)

If the ports of a module shall be read out by radio, the device number must be entered as parameter:

#prt 2 *externes Modul angesprochen... (external Module is addressed)*  
*Module 2 : 1,1,526,59,58*

If the Module cannot be reached by radio or if a Module does not exist with the device number given, the following output is given:

#prt 12 *externes Modul angesprochen... (external Module addressed)*  
*kein ACK (no ACK)*

Digital output can also be set up; output is given by returning the status of entries:

#prt [Device address],[X],[X] Please note: when setting up, the Module connected must be addressed by its device address.

#prt 2,1,1 *externes Modul angesprochen... (external Module addressed)*  
*Modul 2 : 1,1,526,59,58 (Module 2: ...)*

Value range of ADU: 0 .. 1023, whereby 1023 corresponds to electric potential ( $V_{REF} = 2.44 \text{ V}$ )

### #sdn

Shows or defines the address of the radio module (device address):

#sdn *Device Number : 5*

#sdn 1 *Device Number : 1*

The address range of the module is 1...255, „0“ as device address is not allowed.

Factoring setting is [1].

### #ser

Sets up the baud rate of the UART of the Radio Module. The following baud rates are possible:

1k2, 9k6, 19k2, 28k8, 38k4, 57k6, 115k2 (please enter one figure prior to the „k“ only).

Please see '#inf' for present set up.

#ser 19

Factory setting is 9600 baud

### #ssi

Shows the field intensity of the last data packet received.

#ssi *RSSI(95%): [#####]*

The field intensity received can also be checked with another Module.

#ssi 2 *Module 2:*  
*RSSI(84%): [#####]*



### #snd

Without address: starts and stops auto modus (packet to be sent in 1,5 s steps, 100 times).

This modus is helpful for hardware and range tests. If a data packet was received correctly at the other Module is shown by a blinking LED or by confirmed data traffic.

#snd

*Auto\_Send on*

*Nachricht an Modul: 6 100-> bestätigt (message to Module:  
6 100-> confirmed)*

*Nachricht an Modul: 6 99-> bestätigt*

*Nachricht an Modul: 6 98*

*Nachricht an Modul: 6 97*

*Nachricht an Modul: 6 96*

*Nachricht an Modul: 6 95-> bestätigt*

*Nachricht an Modul: 6 94-> bestätigt*

#snd

*Auto\_Send off*

With parameter the command is used for setting the destination address.

#snd 3

*Zielmodul: 3 (target module: 3)*

All data entered is transferred to the Module with device address 3.

If [0] is entered as parameter, data is broadcasted to all Modules.

[0] is factory setting.

In order to change the number of packages to be sent (pre-setting: 100), just enter a second parameter with comma (without destination address). This value is not saved.

#snd ,1000

### #srd

In order to set HF data rate and broadcast channel.

As HF data rate 12, 50, 100 und 200 kbit are possible.

Attention: the range declines with increasing data rate!

If the first parameter is entered only, the bit rate is changed only.

#srd 50

*Parameter ok!*

If the second parameter is also given, the transmission and receiving channel is changed.

#srd 50,1

*Parameter ok!*

The HF data rates are limited available in all channels. Combinations not allowed are not adjusted and lead to an error message.

Splitting:

Channel	1 (868,300 MHz)	2 (868,950 MHz)	3 (869,475 MHz)
HF data rate allowed	12, 50, 100, 200	12, 50, 100	12, 50

By #inf the adjustments can be checked and read out.

When using the #srd command the packet counter is reset.

By using the #scn command the adjustments can be stored at EEPROM.

### #tem

Shows the temperature of the own or addressed Module.

Please note that the chip temperature is shown and not the ambient temperature.

#tem

*Temperatur: 37.3°C (temperature)*

#tem 2

*Modul 2 -> Temperatur: 33.5°C*

### #wup

Set up of wake up time/day:

#wup 19:52,12

*Alarm-Zeit gesetzt. (alarm time set)*

*WakeUp gesetzt. (wake up set)*

*WakeUp: 19:52:00 12.05.07*

Checking wake up time/day:

#wup

#wup

*WakeUp: 19:52:00 12.05.07*

### #rmt

Remote function. Commands can be entered at another Module.

Precondition:

Broadcasting address to be set to target modus (for example, '#snd 3' → set to Module 3)

#rmt\_#srd 100,2

carries out '#srd 100,2' to the target modus

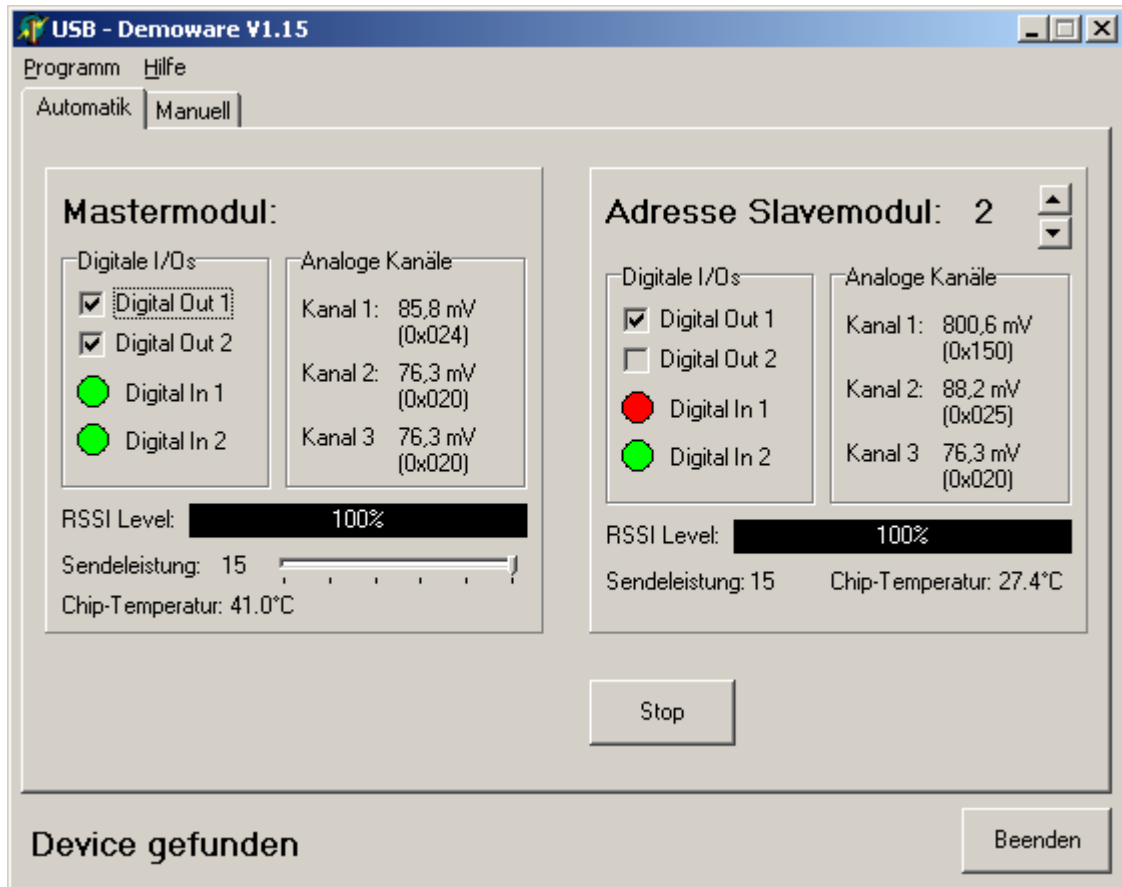
#rmt\_#snd ,1000

target modus starts auto send function with 1000 packets

### Important!:

'\_' Use the underline function between command and command line, no spaces!

## Program "USB-Demoware"



Demoware offers a simplified way to control extern Radiomodules. The "Automatik" Button opens this menue.

In the left part of the window the data of the module, connected to the PC (Master Modul), is shown.

Update is done by using the Button "Start"/"Stop".

In detail there is shown:

- States of the digital I/Os (green High – Pegel/red Low – Pegel)
- ADC – channels ( mV and hexvalue od ADC)
- RSSI – Level of last recived packed
- Actual transmission power (adjustable in the mastermodul by using Trackbar)
- Chiptemperature

Digital outputs are able so be set directly by clicking the checkbox.

In the right part of the window, the states of the adressed slavemodule is shown.

## Frequency ranges and legal basics

<b>Frequency Range in MHz</b>	<b>Channel grate Channel band width in kHz max.</b>	<b>Radiant Power max. (ERP)</b>	<b>Relative Duration of Frequency Allocation</b>
433,050...434,790	no restriction	10 mW	no restriction
868,000...868,600	no restriction	25 mW	< 1 %
868,700...869,200	no restriction	25 mW	< 0,1 %
869,300...869,400	25 kHz	10 mW	no restriction
869,400...869,650	25 kHz	500mW	< 10 %
869,700...870,000	no restriction	5mW	no restriction

The frequency range of 869,400 bis 869,650 can also be used partially or totally as a connected channel for very fast data exchange if the broadcasting capacity of the 25 kHz channels is not sufficient.

The relative duration of frequency allocation (duty cycle) in % shows the broadcasting duration of one broadcast station referring to one hour. The total time of broadcasting can be split up to several intervals.

The frequency range of 433,050...434,790 is also used for devices or production units and for local use of high frequency energy for industrial, scientific, medical, home and other requirements (ISM applications).

Audio and video signals are not allowed on 868 MHz frequencies.

All details according to Vfg 71 / 2003

General allocation of frequencies for public use of non-public radio applications at short range.

Non-specific Short Range Devices (SRD)“

**Technical Data:**

	<b>min.</b>	<b>typ.</b>	<b>max.</b>
<b>Normal voltage</b>	3,2V	3,3V	3,5V
<b>Current RX</b>		43 mA	
<b>Current TX</b>	33 mA		56 mA
<b>Current sleep mode</b>		20 µA	
<b>Frequency range</b>	868 MHz	Channel 1: 868,300 MHz Channel 2: 868,950 MHz Channel 3: 869,475 MHz	870 MHz
<b>Modulation</b>		FSK	
<b>Data rate [kbit]</b>	12,5		200
<b>Operating temperature</b>	- 20 °C - 10 °C	für 100 & 200 kbit/s für 12.5 & 50 kbit/s	70 °C 60 °C
<b>Dimensions (mm)</b>		47 x 34 x 9	
<b>Weight</b>		7 g	

Technical data subject to change.