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Requirement Specification
For the
NMB Wireless Keyboard with POINTING Devices
and
RF-Receiver and the HOST(Viewsonic)

Rev. 0.4

Revision History

DATE	Revision	Changes and Additions	By
02/16/01	0.1	First Draft	Ely Palarca
04/22/01	0.2		Ely Palarca
07/09/01	0.3		Ely Palarca
11/27/01	0.4		Ely Palarca

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1. Introduction

This document gives the minimum firmware specification required for a Custom Wireless NMB Keyboard with Pointing Device which is intended to be used with the Viewsonic Display Monitor.

2. Overview

This battery-powered remote keyboard transmits RF signal to the Base Unit (RF-Receiver), which connects to the Viewsonic Large Screen Monitor display unit through an UART serial interface. The communication medium is 2.4GHZ. It has 10 programmable channels and each remote unit has its Device ID to avoid interference.

Functional Block Diagram

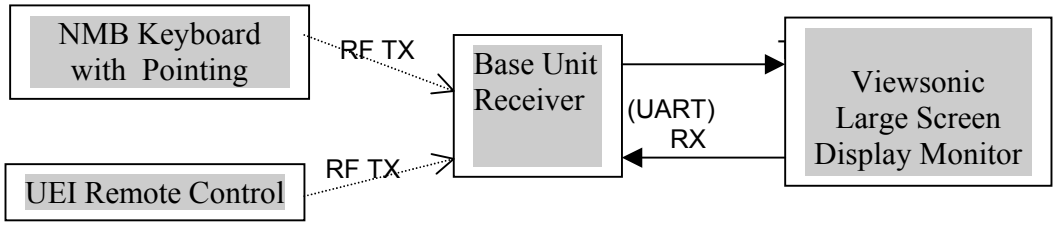


Figure 1: Keyboard/Remote, RF- Receiver and IP-Board interface (UART)

- The NMB remote devices communicate wirelessly through the Base Unit (RF-Receiver) one way and the Viewsonic Display Monitor interfaces to the Base Unit through an UART port.
- The NMB keyboard and the UEI Remote must have a minimum distance of one meter from the RF-Receiver for proper operation.

3. UART Interface

The UART interface requires only four lines, Receive (RX), Transmit (TX), GND, and +5Vcc.
The communication link will be half-duplex; meaning that each side is either a RF-Receiver or the HOST at any given time.

3.1 Protocol Format of RF-RECEIVER (UART) to the HOST.

The RF-Receiver communicates serially with the Host at 9600-baud over a 4-lines connection. Data packets are exchanged over the Receive and Transmit line.

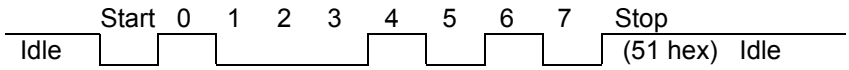


Figure 2: UART Protocol

3.2 Data Frame

Bit 1	Start Bit	Always '0'
Bit 2	D0	Data 0 (LSB)
Bit 3	D1	Data 1
Bit 4	D2	Data 2
Bit 5	D3	Data 3
Bit 6	D4	Data 4
Bit 7	D5	Data 5
Bit 8	D6	Data 6
Bit 9	D7	Data 7 (MSB)
Bit 10	Stop Bit	Always '1'

Table 1:Data Frame

4. Power-On-Reset

The wireless Keyboard with Pointing Device will generates a "power-on-reset" when power is first applied to the unit. The keyboard will test the checksum of the read-only memory (ROM), and random access memory (RAM) test. On satisfactory completion of the test, keyboard scanning begins and the pointing device will begin scan the sensor.

5. Sleep Mode

The keyboard and the pointing device unit are to provide reduced power consumption sleep mode. If no data packet is transmitted within XX seconds, RF transmitter can go to sleep mode. While in this mode, the unit must maintain the current status.

6. Wake Up Mode

When the keyboard key or pointing device is pressed or moved, the unit will wake up and transmit the key data or movement data.

7. Data Packet

It is recommended that for the FSK direct modulation system of the RF communications, the Data Format below is recommended.

Sync Byte	Preamble	Device Number	Device ID/ Status	X Coord /	Y Coord / Scan code	Checksum
16 bits	16 bits	8bits	8 bits	8 bits	8 bits	8 bits

Baud: 9600-baud rate (104.1 us/bit)

Total bits: 64 bits

Sync Bytes: Sync data bytes are used to stabilize the demodulation of the receiver side after a period of no signal input. Recommended four byte of "hex 0F".

Preamble: It is used for decoder bit sync. Recommended 2 bytes of "hex 55".

Device Number: 8-bits, Device number will be maximum of decimal 99, hex 63

Device ID/ Status: 8-bits

Device ID:
Bit 0 - Bit 2 = 000b for RF-Receiver, 001b for NMB keyboard,
010b for UEI key data, 011b for NMB Pointing device, 100b for UEI Pointing device

Keyboard Status Data:
Bit 3 = Reserved (0)
Bit 4 = Reserved (0)
Bit 5 = Reserved (0)
Bit 6 = Reserved (0)
Bit 7 = Battery Status (0=ok, 1= low)

Pointing Device Status Data:
Bit 3 = Pointing Device Left Button Status (1 = Down, 0 = Up)
Bit 4 = Pointing Device Right Button Status (1 = Down, 0 = Up)
Bit 5 = X coordinate sign (0 = positive, 1 = negative)
Bit 6 = Y coordinate sign (0 = positive, 1 = negative)
Bit 7 = Battery Status (0=ok, 1= low)

X coordinate/ : 8 bits
Keyboard Data = Reserved (0)
Pointing Device =X-Data: 8 bits

Y coordinate/ Scan code: 8 bits

Keyboard Data: Scan Code (Make/Break) * Scan codes are shown in Table 2
Pointing Device = Y-Data: 8 bits

Checksum: (Device Number + Device ID/ Status + Xcoord + Ycoord/Scan Code)

8. Key Types

All keys including the Pointing Device buttons are make/break. When a key or button is pressed, the unit will transmit the following data as shown in the protocol.

For reliable data transmission, keystroke and control push buttons packets are transmitted twice wirelessly from NMB Remote Devices.

9. Stuck key

Transmitter shall enable the "Stuck Key" bit and transmit it to the Receiver when a stuck key is detected after xx ms.

10. Keyboard or Remote Sleep Mode

The remote devices shall enable the "Sleep Mode" bit when the Remote or Keyboard is to enter Sleep Mode.

11. Keep Alive

The remote devices shall enable the "Keep Alive" bit when the user is holding a key down (not typing) for more than 70ms.

12. Resync Button

Hold down the Resync button and press one of the numeric keys (1-0) to select the channel number. At this time, the 'signature ID' (Resync make code = 76hex) will be sent at the selected channel. The data format of the signature ID is the same as the key data packet described in the NMB keyboard data packet.

13. RF Power Management

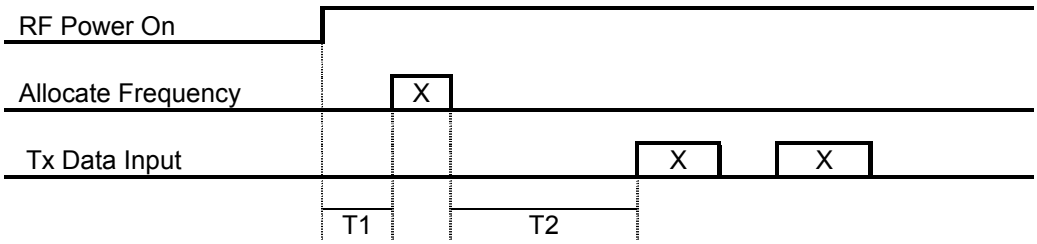


Figure 3. Timing Sequence in RF Power Management.

- T1 = Power On Stable Time. Typically, it should be T1 > 5ms
- T2 = Frequency Stable Time. Typically, it should be T2 > 20ms

14. Transmitter Data Input Level

The transmitter data input level should be fixed as the supply voltage drops when using battery. It is required that the Input level will be Vp-p = 100mv (+/- 10%).

15. Data Coding

Data coding is necessary for the wireless communication, which is to eliminate the DC offset of the demodulation caused by the series of 1's or 0's. The Manchester Coding is recommended here.

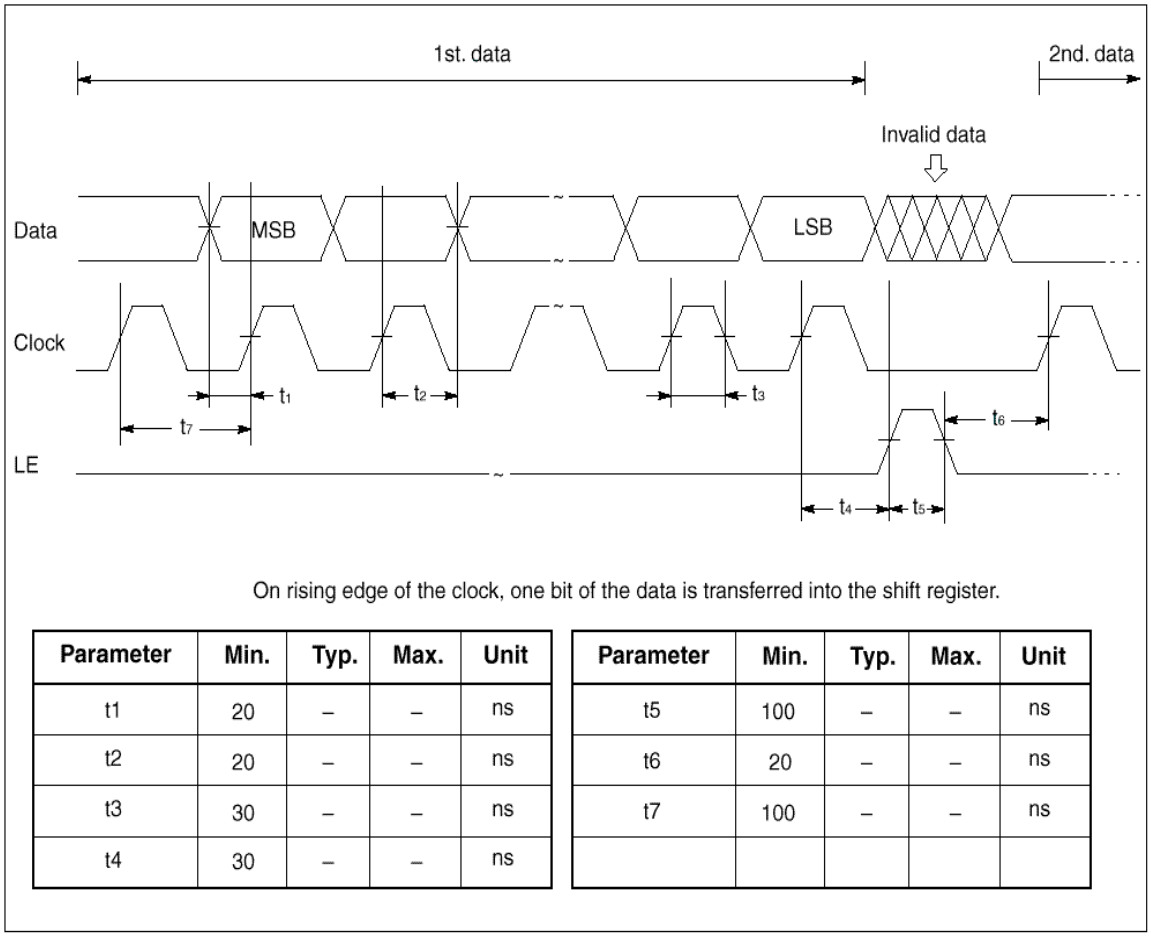
16. Hardware Interface

The interface to the RF-Transmitter and RF-Receiver module shall be described in the table below.

Parameter	Pin Number	Tx-Module	Rx-Module
Input voltage	1	2.2 V min.	3.3 V min.
Ground	2	Ground	Ground
TX-Data Input	3	Data input	Data output
Synthesizer Enable	4	TTL input	TTL input
Synthesizer SDA	5	TTL input	TTL input
Synthesizer SCK	6	TTL input	TTL input

Table 2:RF_Transmitter / RF_Receiver Hardware Interface

17. Serial Input Data Timing



On rising edge of the clock, one bit of the data is transferred into the shift register.

Parameter	Min.	Typ.	Max.	Unit
t1	20	–	–	ns
t2	20	–	–	ns
t3	30	–	–	ns
t4	30	–	–	ns

Parameter	Min.	Typ.	Max.	Unit
t5	100	–	–	ns
t6	20	–	–	ns
t7	100	–	–	ns

Table 3. Serial Input Data Timing for Selecting Channel.

18. General Specification

The performance requirements are contained in the table below

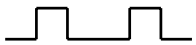
Table 2. General Specification

Rqmt No.	Parameter	Description	Tx Module	Rx Module
4.1	Number of channels		10 channels	10 channels*
4.2	Channel spacing		500 kHz	N/A
4.3	Receive frequency band		N/A	2400 to 2483.5 MHz
4.4	Demodulation		N/A	FSK detection
4.5	Receiver sensitivity	Minimum	N/A	-90 dBm
4.6	Data rate	Maximum	19.2 kbps	19.2 kbps
4.7	Transmit frequency band		2400 to 2483.5 MHz	N/A
4.8	Modulation		FSK	N/A
4.9	Radiated power FCC Requirements	Maximum Fundamental Spurious emissions	-10 dBm 50 millivolts/meter @ 3 meters 500 microvolts/meter @ 3 meters	N/A N/A 500 microvolts/meter @ 3 meters
4.10	Duplex type		Transmit only	Receive only
4.11	RF frequency tolerance		± 10 ppm	± 10 ppm
4.12	Temperature range	Operating Storage	0 to 50 °C -10 to 60 °C	0 to 50 °C -10 to 60 °C
4.13	Power source	Nominal	2.5 VDC	3.3 VDC
4.14	Power consumption	Maximum operational supply current	15 mA	40 mA
4.15	Dimensions		28mm x 22mm x 8mm	32 mm x 45mm x 8mm
4.16	Weight		To be determined	To be determined
4.17	Other requirements	PLL lock on time	50 ms	10 ms

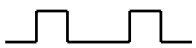
Note

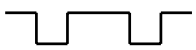
* : The output data of channel 1-5 and channel 6-10 are different.

Channel 1~5 : Tx input data



Rx output data





19. Frequency Plan

Table 4: Transmitter Frequency Plan

Channel	Tx module transmit frequency
1	2446.7 MHz
2	2448.7 MHz
3	2449.7 MHz
4	2451.7 MHz
5	2454.7 MHz
6	2456.3 MHz
7	2457.3 MHz
8	2459.3 MHz
9	2462.3 MHz
10	2464.3 MHz

Table 5: Receiver Frequency Plan

Channel	Rx module Local frequency
1	2436.0 MHz
2	2438.0 MHz
3	2439.0 MHz
4	2441.0 MHz
5	2444.0 MHz
6	2467.0 MHz
7	2468.0 MHz
8	2470.0 MHz
9	2473.0 MHz
10	2475.0 MHz

20. Frequency Control

Serial data is processed using SDA, SCK, LE pins of the RF-Module for the Transmitter and the Receiver. Binary serial data is entered through the SDA pin. One bit of data is shifted into the shift register onto the rising edge of the clock (SCK). When the load enable (LE) pin is high, stored the data latched. After the two 19-bit register being latched, the frequency will be locked.

CH	Freq.	19-bit Register	19-bit Register
1	2446.7 MHz	0010000000001010001	0010111111000100110
2	2448.7 MHz	0010000000001010001	0010111111001001110
3	2449.7 MHz	0010000000001010001	0010111111001100010
4	2451.7 MHz	0010000000001010001	0010111111010001010
5	2454.7 MHz	0010000000001010001	0010111111011000110
6	2456.3 MHz	0010000000001010001	0010111111101100110
7	2457.3 MHz	0010000000001010001	0010111111101111010
8	2459.3 MHz	0010000000001010001	0010111111110100010
9	2462.3 MHz	0010000000001010001	0010111111111011110
10	2464.3 MHz	0010000000001010001	0011000000010000110

Table 6:Frequency Control for Transmitter

CH	Freq.	19-bit Register	19-bit Register
1	2436.0 MHz	1011000000000010001	0000100101101001000
2	2438.0 MHz	1011000000000010001	0000100101101001100
3	2439.0 MHz	1011000000000010001	0000100101101001110
4	2441.0 MHz	1011000000000010001	0000100101101010010
5	2444.0 MHz	1011000000000010001	0000100101101011000
6	2467.0 MHz	1011000000000010001	0000100101110000110
7	2468.0 MHz	1011000000000010001	0000100101110001000
8	2470.0 MHz	1011000000000010001	0000100101110001100
9	2473.0 MHz	1011000000000010001	0000100101110010010
10	2475.0 MHz	1011000000000010001	0000100110001010110

Table 7: Frequency Control for Receiver

* Default Remote Device Channel will be number 1 and Device Number will 00 respectively.

21. Functional Block Diagram

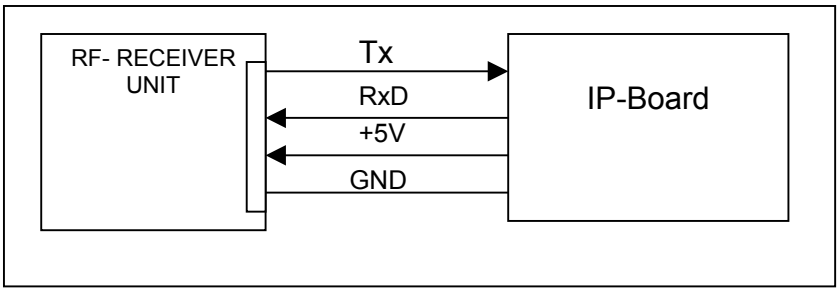


Figure 4: RF- Receiver and IP-Board interface (UART)

22. UART Interface

The UART interface requires only four lines, Receive (RX), Transmit (TX), GND, and +5Vcc.
The communication link will be half-duplex; meaning that each side is either a RF-Receiver or the HOST at any given time.

22.1 Protocol Format of RF-RECEIVER (UART) to the HOST.

The RF-Receiver communicates serially with the Host at 9600-baud over a 4-lines connection. Data packets are exchanged over the Receive and Transmit line.

The RF-Receiver only sends one make and one break code for each key pressed. After 70ms, Keep alive packet will be send until the key press is released.

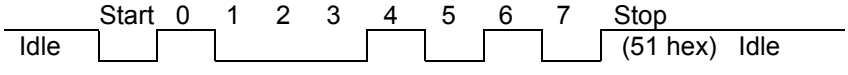


Figure 5: UART Protocol

22.2 Data Frame

Bit 1	Start Bit	Always '0'
Bit 2	D0	Data 0 (LSB)
Bit 3	D1	Data 1
Bit 4	D2	Data 2
Bit 5	D3	Data 3
Bit 6	D4	Data 4
Bit 7	D5	Data 5
Bit 8	D6	Data 6
Bit 9	D7	Data 7 (MSB)
Bit 10	Stop Bit	Always '1'

Table 8: Data Frame

23. Power Down

In the event of Power Down, all the critical parameters and Channel Number in the RF-Transmitter and RF-Receiver unit will be save.

24. Timing Protocol

Transmission of Data Packet between the RF-Receiver and the HOST must have a delay at least four byte times (about 4ms at 9600 baud) between the last byte of one data packet and the first byte of the ID code of the next data packet.
There must be no more than two bytes times delay (about 2ms at 9600 baud) between the ID code and data byte(s) within a packet.

25. Set/Reset Keyboard Status Indicators

Three Status indicators Num Lock, Caps Lock, and Scroll Lock can be activated or deactivated by pressing the respective keys from the transmitter keyboard. Once the HOST receives the scan code of these keys, the HOST will activate and deactivate the status of each function in the screen

26. Repeat Keys

When a key is pressed and held, the make scan code is sent. After a delay of 70ms +/- 20%, the Remote Device will send a "Keep Alive Data"- packet every 70ms until the break scan code is received.

27. Device ID and Device Number

When remote device has a Device ID and Device Number. Device ID shows the category of the Remote device. The following table shows the device Ids for different categories.

Remote Device	Device ID
Keyboard Keypad	1
Remote Control Keypad	2
Keyboard Pointing Device	3
Remote Control Pointing Device	4

Table 9: Device ID and Remote Devices

Device Number is pre-loaded in the factory before the device is shipped. The number is chosen randomly from 0 to 99. The Host will validate the received data packet by checking the Device Number is registered for that Device ID or not. After the channel synchronization, the Device Number of each remote device will be registered in the host. Note that for both keyboard and remote control, keypad and pointing device have the same Device Number. During synchronization, only Device ID of the keypad and the Device Number will be sent. The host should also register the Device Number for the pointing device of the corresponding device.

28. Channel Synchronization

There are 10 channels, which are numbered from 1 to 0, to be used in the communication between the RF-Receiver and the remote devices as keyboard and remote control.

For reliable data transmission, keystroke and control push buttons packets are transmitted twice wirelessly from UEI /NMB Devices.

28.1 Changing Channel of the RF-Receiver

The Host using the command “Set Channel” can change the channel of the RF-Receiver. The details can be found in the section, Set Channel. Normally, the HOST will show the channel number on the screen and then wait for the reception of the signatures (i.e. Re-Sync code, 76hex, defined in Table 2) from the remote devices for confirmations.

28.2 Changing Channel of the Remote Device

The channel of the remote device can be changed as the following procedure.

1. Hold down the Sync button on the device
2. Press the button on the numeric keypad on the remote device to select the channel number. At this time, the signature will be sent continuously at the selected channel until the button is released. The data format of the signature id the same as the key data packet describe in the section, NMB keyboard Data Packet.

29. Commands Summary

The following commands that the HOST may send and their hexadecimal values.

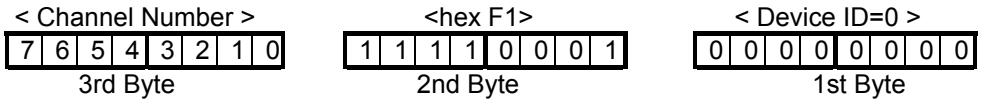
Table 10: RF-Receiver commands from the HOST

Command	Hex Value
Set Channel	F1
Channel Open	F2
Channel Close	F3
Get Version Number	F4
Read RSSI	F5

29.1 Set Channel (Hex F1)

This command will be used to set the RF channel of the receiver.

Host Command:



1st Byte: Bit 0 - Bit 2 = < Device ID = 000b >
Bit 3 - Bit 7 = Reserved
2nd Byte: <CMD =hex F1>
3rd Byte: <Channel Number>

RF-Receiver Respond:

1st Byte Bit 0 - Bit 2 = < Device ID = 000b >
Bit 3 - Bit 7 = Reserved
2nd Byte <Channel Number>

29.2 Channel Open / Close Commands

The System can issue Channel Open or Close commands (hex F2 or hex F3) to the RF-Receiver. The default state on power-on will be Channel Close. When the Channel is Close the RF-Receiver will ignore incoming RF data.

29.2.1 Channel Open (Hex F2)

On the receipt of this command, The RF-Receiver will open the communication link between the HOST and RF-Receiver.

Host Command:

1st Byte: Bit 0 - Bit 2 = < Device ID=0 >
Bit 3 - Bit 7 = Reserved

2nd Byte: <CMD =hex F2>

RF-Receiver Respond:

1st Byte Bit 0 - Bit 2 = < Device ID = 000b >
Bit 3 - Bit 7 = Reserved
2nd Byte <Channel Number>

29.2.2 Channel Closed (Hex F3)

On the receipt of this command, The RF-Receiver will closed the communication link between the HOST and RF-Receiver.

Host Command:

1st Byte: Bit 0 - Bit 2 = < Device ID=0 >
Bit 3 - Bit 7 = Reserved
2nd Byte: <CMD =hex F3>

RF-Receiver Respond:

1st Byte Bit 0 - Bit 2 = < Device ID = 000b >
Bit 3 - Bit 7 = Reserved
2nd Byte <Channel Number >

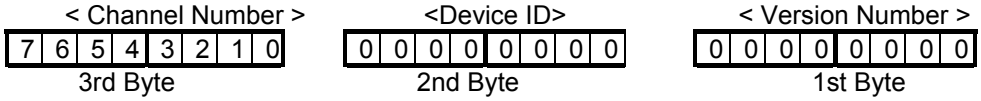
29.3 Get Version Number (Hex F4)

On the receipt of this command, The RF-Receiver will send the version number of the firmware to the HOST.

Host Command:

1st Byte: Bit 0 - Bit 2 = < Device ID=0 >
Bit 3 - Bit 7 = Reserved
2nd Byte: <CMD =hex F4>

RF-Receiver Respond:



1st Byte <Version Number, max = dec. 99, hex 63>
2nd Byte Bit 0 - Bit 2 = < Device ID = 000b >
Bit 3 - Bit 7 = Reserved

3rd Byte <Channel Number >

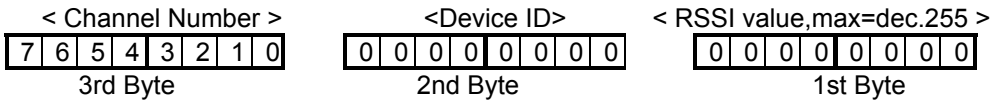
29.4 Read RSSI (Hex F5) Not implemented

On the receipt of this command, The RF-Receiver will send the RSSI value of the current channel to the HOST. This command is used for testing purpose or future enhancement.

Host Command:

1st Byte: Bit 0 - Bit 2 = < Device ID=0 >
Bit 3 - Bit 7 = Reserved
2nd Byte: <CMD =hex F5>

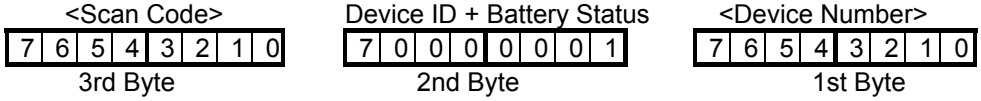
RF-Receiver Respond:



1st Byte < RSSI value,max=dec.255 >
2nd Byte Bit 0 - Bit 2 = < Device ID = 000b >
Bit 3 - Bit 7 = Reserved
3rd Byte <Channel Number >

30. NMB Keyboard Data Packet

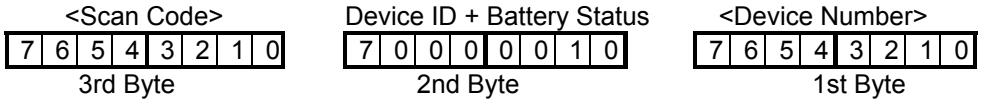
The Keyboard data packet format is three bytes long. The first byte consists of the Device Number followed by the second byte = Device ID (001b) and the battery status bit, the third byte = Scan Code (Make/Break) of the Keyboard. Scan Code Table 10



1st Byte: <Device number, max. of dec. 99>
2nd Byte: Bit 0 - Bit 2 = Device ID = 001b
Bit 3 - Bit 6 = Reserved (0)
Bit 7 = Battery Status, 0 = ok, 1 = low
3rd Byte: <Scan Code> (Make / Break) * Scan Code are shown

31. Remote UEI Key Data Packet

The Remote UEI key data packet format is three bytes long. The first byte consists of the Device Number followed by the second byte = Device ID (010b) and the battery status bit, the third byte = Scan Code (Make/Break) of the Remote Key. Scan Code Table 10.



1st Byte: <Device number, max. of dec. 99, hex 63>
2nd Byte: Bit 0 - Bit 2 = Device ID = 010b
Bit 3 - Bit 6 = Reserved (0)
Bit 7 = Battery Status, 0 = ok, 1 = low
3rd Byte: <Scan Code> (Make / Break) * Scan Code are shown

32. NMB Pointing Device Data Packet

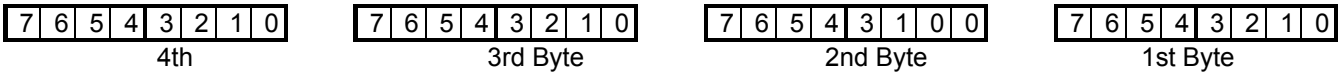
The data packet format is four bytes long.

1st Byte: <Device Number, max = dec 99, hex 63>
2nd Byte: Bit 0 - Bit 2 = Device ID = 011b
Bit 3 = Left Button Status (1=Down, 0=Up
Bit 4 = Right Button Status (1=Down, 0=Up)
Bit 5 = X-Coordinate sign (0=positive, 1=negative)
Bit 6 = Y-Coordinate Sign (0=positive, 1=negative)
Bit 7 = Battery Status, 0 = ok, 1 = low)

3rd Byte: <X-data>
4th Byte: <Y- data>

33. UEI Pointing Device Data Packet

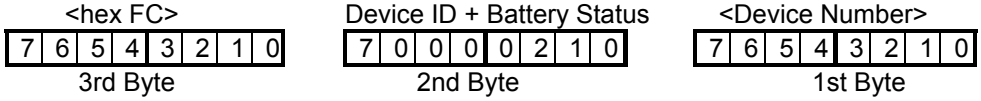
The data packet format is four bytes long.



1st Byte: <Device Number, max = dec 99, hex 63>
2nd Byte: Bit 0 - Bit 2 = Device ID = 100b
Bit 3 = Left Button Status (1=Down, 0=Up
Bit 4 = Right Button Status (1=Down, 0=Up)
Bit 5 = X-Coordinate sign (0=positive, 1=negative)
Bit 6 = Y-Coordinate Sign (0=positive, 1=negative)
Bit 7 = Battery Status, 0 = ok, 1 = low)
3rd Byte: <X-data>
4th Byte: <Y- data>

34. Stuck Key Data Packet

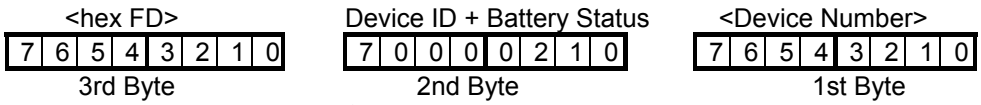
Receiver shall send this command when a stuck key is detected.



1st Byte: <Device number, max. of dec. 99, hex 63>
2nd Byte: Bit 0 - Bit 2 = Device ID (001 = Keyboard, 010b = Remote)
Bit 3 - Bit 6 = Reserved (0)
Bit 7 = Battery Status, 0 = ok, 1 = low
3rd Byte: <CMD = hex FC>

35. Sleep Data Packet

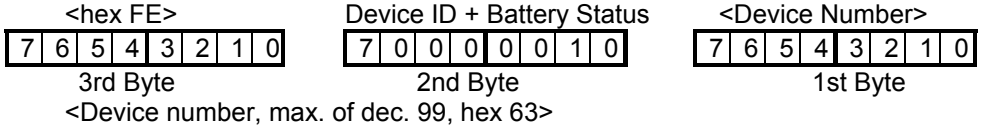
Receiver shall send this command when the Remote or the wireless keyboard is about to enter sleep mode. This way, the IP board can fully aware of the transmitter state.



1st Byte: <Device number, max. of dec. 99, hex 63>
2nd Byte: Bit 0 - Bit 2 = Device ID = 010b
Bit 3 - Bit 6 = Reserved (0)
Bit 7 = Battery Status, 0 = ok, 1 = low
3rd Byte: <CMD = hex FD

36. Keep Alive Data Packet (Revised)

This code will be sent only when the user is holding a key down (not typing), this is to provide a keep alive timeout in the IP board. If the Keep Alive code is not receive within 200ms, the IP board will timeout and release the Break Code of the held key.



1st Byte: <Device number, max. of dec. 99, hex 63>
2nd Byte: Bit 0 - Bit 2 = Device ID (0 01 = keyboard, 010= remote control)
Bit 3 - Bit 6 = Reserved (0)
Bit 7 = Battery Status, 0 = ok, 1 = low
3rd Byte: <CMD =hex FE>

37. RF-Receiver connector

Connector type:
Vendor: Long Chu Electronics Co. Ltd
Type: P200 (Straight Type)
Pitch: 2.0mm
Current rating: 2amp
Insulation Resistance: 1000 mega ohm, min.

Table 11: RF-Receiver connector pinout

Pin #	Name	Comments
1	Vcc	+5V power
2	GND	Ground
3	RxD	Received serial data from IP board to RF-Receiver.
4	TxD	Transmitted serial data from RF-Receiver to IP board.
5	NC	No Connect
6	GND	Ground

38. RF-Receiver mechanical

Add mechanical outline of module including dimension, mounting, etc..

Table 12: Scan Code Table

Key #	Description	Make Code	Break Code	Key #	Description	Make Code	Break Code
1	ESC	01	81	61	Page Down	3D	BD
2	F1	02	82	62	L_Shift	3E	BE
3	F2	03	83	63	Z	3F	BF
4	F3	04	84	64	X	40	C0
5	F4	05	85	65	C	41	C1
6	F5	06	86	66	V	42	C2
7	F6	07	87	67	B	43	C3
8	F7	08	88	68	N	44	C4
9	F8	09	89	69	M	45	C5
10	F9	0A	8A	70	, / <	46	C6
11	F10	0B	8B	71	. / >	47	C7
12	F11	0C	8C	72	/ / ?	48	C8
13	F12	0D	8D	73	Right_Shift	49	C9
14	Num_Lock	0E	8E	74	Up Arrow	4A	CA
15	Print Scrn	0F	8F	75	End	4B	CB
16	Scroll Lock	10	90	76	Control	4C	CC
17	Pause	11	91	77	FN	4D	CD
18	` / ~	12	92	78	LWIN	4E	CE
19	1 / !	13	93	79	ALT	4F	CF
20	2 / @	14	94	80	Space Bar	50	D0
21	3 / #	15	95	81	APP	51	D1
22	4 / $	16	96	82	INS	52	D2
23	5 / %	17	97	83	DEL	53	D3
24	6 / ^	18	98	84	Left Arrow	54	D4
25	7 / &	19	99	85	Down Arrow	55	D5
26	8 / *	1A	9A	86	Right Arrow	56	D6
27	9 / (	1B	9B	87	Reverse	57	D7
28	0 /)	1C	9C	88	Play	58	D8
29	- / _	1D	9D	89	Forward	59	D9
30	= / +	1E	9E	90	Record	5A	DA
31	Back Space	1F	9F	91	Stop	5B	DB
32	Home	20	A0	92	Pause	5C	DC
33	Tab	21	A1	93	Instant Replay	5D	DD
34	Q	22	A2	94	Jump CH	5E	DE
35	W	23	A3	95	Jump Present	5F	DF
36	E	24	A4	96	EPG	60	E0
37	R	25	A5	97	+100	61	E1
38	T	26	A6	98	Multi-View	62	E2
39	Y	27	A7	99	Back	63	E3
40	U	28	A8	100	Forward	64	E4
41	I	29	A9	101	Stop	65	E5
42	O	2A	AA	102	Refresh	66	E6
43	P	2B	AB	103	Search	67	E7
44	[/ {	2C	AC	104	Favorites	68	E8
45	] / }	2D	AD	105	Web home	69	E9
46	\ / |	2E	AE	106	Get mail	6A	EA
47	Page Up	2F	AF	107	Mute	6B	EB
48	Caps Lock	30	B0	108	Pip	6C	EC
49	A	31	B1	109	Previous	6D	ED
50	S	32	B2	110	Menu	6E	EE
51	D	33	B3	111	Channel Up	6F	EF
52	F	34	B4	112	Channel Down	70	F0
53	G	35	B5	113	Right Click	*	*
54	H	36	B6	114	Left Click	*	*
55	J	37	B7	115	Volume Down	73	F3
56	K	38	B8	115	Volume Up	74	F4
57	L	39	B9	115	Power	75	F5
58	; / :	3A	BA	116	Re-Sync	76	F6
59	' / "	3B	BB	117			

60	Enter	3C	BC	118			

* Set and Reset in Pointing Device Data Packet.

39. Change Device Number

- Press “Re_sync + Fn” and held down for 3 seconds, then enter 2- digits Device Number 0-9.

40. Select Device Channel Number.

- Press “Re_Sync” and held down, then enter Channel Number 1 or 2, 3, 4, 5, 6, 7, 8, 9, 0.

40. Test Mode

- Channel testing. Transmitter channel must default to channel 1.
  Press “1 + 3 + C” and held down for 6 seconds and release, Ten channels will be tested and after the testing, the channel number will return to default channel.

- Frequency testing.
  Press “1 + 3 + F” and held down for 6 seconds and release. The device channel frequency can be measured by using spectrum analyzer. Pressing “F4”, the transmitter will transmit “one and zero” continously. Pressing “F3”, the transmitter will exit on frequency testing.

FEDERAL COMMUNICATIONS COMMISSION
INTERFERENCE STATEMENT

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-- Reorient or relocate the receiving antenna.
-- Increase the separation between the equipment and receiver.
-- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
-- Consult the dealer or an experienced radio/TV technician for help.

CAUTION:

Any changes or modifications not expressly approved by the grantee of this device could void
the user's authority to operate the equipment.

FCC RF Radiation Exposure Statement

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator and your body.