ViewSonic Tweety RF Remote

Product Specification

Work Order: 50-954

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Rev. 2.9A

URCs: 4012B00

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Revision History

Product Revision History

Specification		Software		Sect.	Update Description	By
Rev	Date	Ver	Date			
A	12/6/00				Initial Draft	JE
B	12/20/00			1.1	Added Network Description	JE
				3.2.4	Added Make and Break data for MUTE	
				3.3.2	Revised ID Setup	
				3.3.3	Revised RF Channel Change	
				4	Added table on RF Transmission	
				5	Added Hardware Interface Table	
				6.1.2	Revised RF Channel Frequency table and added frequency control information.	
				6	Revised UEI key Data Packet information	
				6.1.6	Added Serial Input Timing Diagram	
				7.4	Added Battery life information and table	
C	01/12/01			1.0	Changed Part Number reflect SOP package	JE
				6.2	Changed Varapoint Data to reflect the Data in section 6.0	
D	02/05/01			ALL	Per new NMB Specification and Bill Browns Comments	JE
				3.3.2,	Programming Instructions per Anthony's request	
				3.2.4, 3.2.5	Added these sections per Anthony's request.	
E	02/13/01			1.1	Updated IC package and part number, added comment on poly-dome keys.	JE
				3.1.1	Updated IC Package Type	
				3.1.2	Referenced spec section for Mfg. Reset, SETUP, and Stuck Key Time-out, removed visible LED for SW only to No visible LED	
				3.1.3	Changed from double sided PCB to single sided PCB and added comment on Gold Flash required for Varapoint	
				3.2.4	Revised Key chart to match actual key labels.	
				3.3.1	Revised Stuck Key Time-out and added diagram for STUCK KEY data packet to be sent out to HOST and added diagram for IDLE MODE (SLEEP) data packet to be sent out to HOST	
				3.3.2	Revised ID Setup	
				3.3.3	Revised RF SETUP procedure	
				3.3.5	Added Factory Test mode for RF Channel Test	
				6	Added comment on packet data to be sent two times for all key presses to end of this section.	
				7.4	Revised Battery Life Section per Bill Brown	
				8.6	Added Color and Printing specification	
Rev1.0					Kicked-off Specification	JE
Rev 1.1				1.1	Revised IC from DIE package to QFP	JE
				3.2.1/2	Changed Target Device from TV to Viewsonic	
				3.2.4	Updated Key Table	
				3.3	Updated Definitions in regards to LED blinking methodology	
				3.3.1	Updated Stuck Key, sleep and Keep alive information and appendix	
				3.3.3	Updated RF Channel Change section	
				3.3.5	Updated Factory Test	
				3.3.9	Updated Low Battery section for the 6volt design	
				4	Changed data rate from max. 19.2 bps to fixed 9600 bps	
				6	Updated Data Packet and Pointing device information	
				7.4	Added statement on the each key press is calculates @ 1 second	
				10.1	Changed Low non operating range from –20 C to -10C	

Rev 2.0				3.1.1 3.3 3.1.3 3.1.4 3.1.5 3.4 1.1, 4, 6.1.1 4 4.1	Changed IC package to QFP (from DIE) Changed MUTE to RESYN in “Conventions and Notations” Changed PCB material from FR4 to Paper Phenolic Item 14- Added URC number Item 3- No FCC testing by UEI Revised “Remote UEI Key and Pointing Device Data Packet” Changed RF Operating Band range to 2446.7 – 2464.3MHz Table 2, Rqmt No. 4.10 – Changed to “Simplex” Added Manchester Data Coding table	Lee
Rev 2.1				5.1.1 5.1.2 5.1.3	Revised RF Channel and Operating Bands Revised RF Channels and Frequencies Added Pulse Width Timing section	JE
2.2				2.1.1 3.1.5 3.1.6 10.2	Added comment that NMB receiver Spec 0.9 takes precedence Modified item 3 to state FCC certification will be done by Optoma with UEI for support only. Item 1 (Batteries Included) has been changed from No to Yes-Bulk Item 2 (Batter Cover) Rating Label required has been changed from No to yes installed in specified area. Item 10 Device Label in addition to packaging changed from Yes to Installed on Unit Changed FCC requirement to read as follows “Optoma will certify the complete unit with remote and keyboard. With documentation and possible engineering support to Optoma from UEI.	JE
2.3				3.4 & 3.4.7.1 3.4.6.1 5.1.2	Added provision to allow for using the varapoint mouse and the left and Right select keys simultaneously Add notes on power state for entering Factory Test modes and E2 Revised RF Channels and Frequencies	JE
2.4				5.1.2	Revised RF Channel Data to match the transmission table	JE
2.5				7.6 11 3.2.4, 3.4.6.2	Updated Color Specification Chart Imported revised rendering dated 8/15/01 Style A rev 3.0 Updated Key charts for Smart and Enter Key	JE
2.6				3.4 3.4.3 3.4.5 4.12	Added Definition for Mouse Right and Left while used in conjunction with the mouse Updated Device Number Setup definition Updated E2 Initializtion Definition Changed power source from 2.2VDC to 2.2VDC	JE
2.7				3.2.4, 3.4.6.2, 7.6 11	Updated key-tables to reflect silk-screening changes Updated Rendering imported with silk-screening changes	JE
2.8				11	Updated Rendering with new Vara-touch pointer	JE
2.9				3.2.4, 3.4.6.2 3.4	Added Break Data ‘F6’ for the Sync Key Added Break Data ‘F6’ for the Sync Key Revised Comment in Re-Sync Section in regards to no Break-Code being sent after the Re-Sync key was released.	JE
2.91				1.1 4.9	Corrected Frequency Output power is –18dbm	RM

Approvals:

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Table of Contents

1.1 Description

The Viewsonic-Tweety remote will be a dedicated 2.4 gHz RF remote with 10 channel capability. This will be a 6V product and will use 4 AAA batteries. It will use a Samsung 16K (S3P/C80F9XFE-QZR5) (QFP) Micro-controller.

Network Description:
The RF modules support up to 10 channels in the ISM band of 2446.7MHz to 2464.3MHz, providing a form of frequency division multiple access (FDMA). This enables the simple implementation of systems requiring multiple devices to be operating continuously and concurrently.

Note: This document contains all functional specifications and testing/quality requirements that UEI will perform. By signing off on this document, the customer agrees that these product/project parameters are final. Any further revisions will be accompanied by Engineering Change Request and appropriate authorizations.

Features

- Samsung 16K(QFP)
- E2 (128 byte) –*To save RF Channel Data and Device ID*
- 34 keys
- 6V product (4 AAA)
- Varapoint
- W-Link 2.4 gHz RF transmitter
- Slide Door
- Poly Dome Keys

1.2 Project Type

OEM-West

2 Applicable Documents

Appendix A: NMB/UEI Remote Devices and Receiver Module Rev. 0.1
Appendix B: NMB RF-Receiver (UART) and HOST (Image Processor)

2.1 Project Documentation

The following documents of exact issue and date form part of this specification:

2.1.1 Customer Specification

NMB RF-Receiver and Host Image Processor rev 0.9
(This spec takes precedence a changes to the receiver software must also be made to the remote and keyboard)

2.1.2 Other Product Documentation

N/A

2.2 UEI Standard Documentation

UEI SPEC 0020, UEI SPEC HE003, UEI SPEC 0002

2.2.1 UEI Standard Glossary

N/A

2.2.2 UEI Standard Hardware General Information

Refer to Section 3.1.3

2.2.3 UEI Standard Operational Features Descriptions

2.2.4 UEI Standard Testing Procedures

Refer to Section 6.0, Section 7.0 and Section 9.0.

3 Functional Requirements

3.1 Product Summary

3.1.1 General Information

Functional Keychart Included	Yes
IC Type and size and package type	*Samsung (16K) (QFP)*
Keypad Parameters Specified	Yes
Mode Indicator LEDs	*No*
Multiple Devices (Jumpers)	No
OTPs Used for initial Production	Yes
Product Development Type: OFA, OEM, Private Label, Cable, Chip Only	OEM-West
Request Load Included	NA
Upgradeable Product (E2)	NA

3.1.2 Software Information

Channel Scan	No
Channel +/- Simulation w/Lock Option	No

Channel Lock	No
Device Mode Keys	DEDICATED
Dual Functional via Shift Key a) One Time Use b) Shift Lock w/Time-Out	 No No
E2 Auto-Sizing	No
E2 Device Mode Lock	No
E2 Upgradeable via Modem (997)	No
E2 Upgradeable via 6 pin interface	No
Factory Test Mode	Yes
Favorite Channel Scan (996)	No
Functional Keys – Additional a) brightness Control b) Color Control c) Menu d) Shifted Functions With/without time-outs e) Teletext – Simple f) Teletext – Fastext	 No No No No No No
Functional Keys – Standard	Yes
Hidden Keys	*No*
High Frequency Capable	No
ID Code Verification	No
ID Default Selection	No
ID Lock/Unlock for Specific Mode	No
ID – Number of Digits	NA
ID Offset a) Constant number offset to all Ids b) Offset by Hardware setting (Jumper,....) c) Custom renumbering to some or all Ids	 None None None
Illuminated Key Pad	No
Keymover (994) – Full with Synthesizer	No
Liquid Crystal Display (LCD)	No
Low Voltage Detection – Software	Yes
Macros a) Hard Coded b) Premium Channel c) User Defined 1) Single 2) Multi-level Rotating	 No No No No
Mode Reassignment (992)	No
Modem	No
Network Downloading	*No*
Power On Mode Key	No
Power Toggle	No
Power Up w/Default Device Mode and Codes	No
Power Up w/ No Defaults	No

Punch Through to Last Device (by Key Group)	No
Record Safety	No
Remote Finder with Lock Option	No
Reset to Defaults a) Operational Reset (980) b) Manufacturing Reset (981) Section 3.3.4	 No Custom
Set Up Section 3.3.2	Custom
Simultaneous Double Key Press - Standard Action	No
Simultaneous Double Key Press - Alternative Action	No
Sleep Feature via UEI w/Lock Option	No
Step and Set (991)	No
Stuck key Time-Out	Custom Keypress = 60 sec. Pointer = 120 sec.
Synthesizer	No
Visible LED - for user feedback	No
Visible LED - for mode indication	No
Volume Lock	No
	No

3.1.3 Hardware Information

1. Crystal IR Carrier Operation	No
2. Keyboard Layout and # of keys	*34*
3. LCD (Segmented, Pixel), Backlight (LED, EL)	*None*
4. IR LEDs (1,2) (W,WW,WN) [Wide, Narrow]	*NA*
5. Lighted Keypad (LED, EL), Color	*No*
6. Low Voltage Detection (Software Controlled)	Yes
7. Mode Indicator LEDs	No
8. Modem	No
9. PCB Material (Paper phenolic, FR4), Other	*Paper Phenolic*
10. PCB Type (Single Sided, Double Sided, Silver thru holes, etc.) 11. Gold Flash	*Single Sided* *Yes-Varapoint*
12. Plush Port	No
13. Plush Port Opening	No
14. RAM Retention	NA
15. RF Operation	Yes
16. RF Finder	No
17. Visible LEDs for user feedback (2, 3, 5 mm) (Red, Green)	*No*
18. 3 or 6 Volt Operation (AAA,AA) –4AAA	*6V (4 AAA)*
19. 6 pin E2 Interface	No
20. *Other (describe)*	*N/A*

3.1.4 Mechanical Information

1. Battery Compartment	Yes
2. Colors & Labels	Section 8.2.4
3. Force versus Travel (Keypad with Polydome)	Section 8.3.3
4. IR Lens	No
5. Key Clearance	Section
6. Keypad Definition	Yes
7. List of Consigned Parts	Microcontroller EEprom RF Transmitter Varapoint
8. Material	Section
9. Overlay	No
10. Packaging Requirements in BOM	*Bulk*
11. Plastic Case design or rendering included	Yes
12. Prototype/Model	Yes
13. Sliding Door	Yes
14. Unique Parts	No
15. URC with B00#	4012B00
16. Weight	*TBD*
17. *Other (describe)*	*Viewsonic Jewel*

3.1.5 Quality/ Testing Information

1. Environmental Testing	Yes
2. ESD Protection	Yes
3. FCC or UL Certification Requirements	No- Optoma to apply for certification UEI will supply support.
4. Production Line Testing Procedures	Yes
5. Quality Assurance Provisions	*UEI Standard*
6. Reliability Testing	Yes
7. SIO Test Verification	No
8. *Other (describe)*	*N/A*

3.1.6 Miscellaneous Information

1. Batteries (Included)	Yes-Bulk
2. Battery Cover a) Rating label silk screened on outside of battery door	Yes, label to be installed in specified area
3. Customer Service Support Required	No
4. Date Code Label	Yes
5. Labeling	Yes
6. Packaging	Yes-Bulk
7. Units per Box – shipping	*100*
8. Users Manual Development (Type: staples/folded map)	NA
9. User Manual Type Responsibility	Customer
10. Device Label- inside addition to package	Installed on unit
11. Country of Origin Location: Molded, Label, Silkscreened	On Rating Label

3.2 Product Library

This will be a dedicated remote.

3.2.1 Target Device Mode Mapping

Mode	Load/ Device Assignment
Viewsonic	Dedicated

3.2.2 Defaults

Mode/Feature	Default State
Viewsonic	RF Channel 1

3.2.3 Library Upgrade Support

N/A

3.2.4 Key Table

Key #	Key Label	Make Code	Break Code
1	POWER	75	F5
2	VL+	74	F4
3	VL-	73	F3
4	MUTE	6B	EB
5	CH+	6F	EF
6	CH-	70	F0
7	PREVIOUS	6D	ED
8	MENU/EXIT	6E	EE
9	PIP	6C	EC
10	ENTER	*	*
11	SMART	*	*
12	REVERSE	57	D7
13	PLAY	58	D8
14	FFD	59	D9
15	RECORD	5A	DA
16	STOP	5B	DB
17	PAUSE	5C	DC
18	INSTANT REPLAY	5D	DD
19	JUMP COMM	5E	DE
20	JUMP PRESENT	5F	DF
21	EPG	60	E0
22	+100	61	E1
23	MULTIVIEW	62	E2
24	1	13	93
25	2	14	94
26	3	15	95
27	4	16	96
28	5	17	97
29	6	18	98
30	7	19	99
31	8	1A	9A
32	9	1B	9B
33	0	1C	9C
34	RE-SYNC	76	F6

* SET and Reset in Pointing Device Data Packet

3.3 Operational Features

Conventions and Notations

The operation of the remote control and the programming sequence use the following shorthand notations.

The relational operator <<>> around a key is an instruction to press and hold the key for 3 seconds.

For example:
<<RESYNC + CH+ >>
Press RESYNC and hold for 3 seconds
The relational operator <> around a key is an instruction to press the key and then release.
For example:
<RESYNC>

3.4 Remote UEI Key and Pointing Device Data Packet

Data Packet Definition:

Byte10 (MSB)	Byte09	Byte08	Byte07	Byte06	Byte05	Byte04	Byte03	Byte02	Byte01	Byte0 (LSB)
0x0F	0x0F	0x0F	0x0F	0x55	0x55	0-0x63 (0-99 decimal)				

Sync Bytes	Preamble	Device Number	Dev Addr / Status	X Coord	Y Coord / ScanCode	CheckSum
32 bits	16 bits	8 bits	8 bits	8 bits	8 bits	8 bits

Sync Bytes: Four data bytes of 0x0F each are used to stabilize the demodulation of the Receiver side after a period of no signal input.

Preamble: Two data bytes of 0x55 each are used for decoder bit sync.

Device Number: Device number from 0 to 99 (decimal)

Device Address / Status:

Device Address / Status								Described Function
Batt	Pointing Device Status				Device Address			
b7	b6	b5	b4	b3	b2	b1	b0	
					0	0	0	RF Receiver
					0	0	1	NMB Keyboard Keypad
					0	1	0	UEI Remote Control Keypad
					0	1	1	NMB Keyboard Pointing Device
					1	0	0	UEI Remote Control Pointing Device
				Pointing Device Left Button Status (0=Up, 1=Down)				
			Pointing Device Right Button Status (0=Up, 1=Down)					
		X-Coordinate sign bit (0=Positive, 1=Negative)						
	Y-Coordinate sign bit (0=Positive, 1=Negative)							
Battery power level Status (0=Ok, 1=Low)								

X-Coordinate: Keyboard Data (0), X-Data for Pointing Device.

Y-Coordinate / Scan Code: Keyboard Data: Scan Code (Make/Break) [See Table 3: Scan Code Table], Y-Data for Pointing Device.

CheckSum: The sum of Device Number + Device Address / Status + X-Coordinate + Y-Coordinate/Scan Code. (Add all the indicated bytes without carry's).

LEFT/RIGHT MOUSE key Operation

1. When the **<Left>** key is pressed, its corresponding pointing device ***left key status*** (Bit 3) in the Device Address / Status Byte will be ***set***. This bit will be set as long as the **<Left>** key is held down, and it will be ***reset*** (or cleared) when the **<Left>** key is ***released***.

   1.1. While the **<Left>** key is held down:

   a) If the Pointing Device is ***not active***, the transmitted data packet will have Left key status bit in the Device Address / Status Byte ***set*** and the X-Coordinate Byte and Y-Coordinate / Scan Code Byte contained all zeros.
   b) If the Pointing Device is ***active***, the transmitted data packet will have Left key status bit in the Device Address / Status Byte ***set*** and the X-Coordinate Byte and Y-Coordinate / Scan Code Byte contained the X and Y positional values of the Pointer movement.

   1.2. While the **<Left>** key is pressed and held down, if ***another key*** (other than **<Right>** key) is now pressed, the pointing device Left key status bit in the Device Address / Status Byte will be reset.

   a) If the Pointing Device is ***not active***, no data packet will be transmitted. ***Both keys*** must ***be released*** for the remote to return to its normal operation
   b) If the Pointing Device is ***active*** *prior to the key presses as described in 1.2 above,* the transmitted data packet will have Left key status bit in the Device Address / Status Byte ***reset*** and the X-Coordinate Byte and Y-Coordinate / Scan Code Byte contained the X and Y positional values of the Pointer movement.

2. When the **<Right>** key is pressed, its corresponding pointing device ***right key status*** (Bit 4) in the Device Address / Status Byte will be ***set***. This bit will be set as long as the **<Right>** key is held down, and it will be ***reset*** (or cleared) when the **<Right>** key is ***released***.

   2.1. While the **<Right>** key is held down:

   a) If the Pointing Device is ***not active***, the transmitted data packet will have Right key status bit in the Device Address / Status Byte ***set*** and the X-Coordinate Byte and Y-Coordinate / Scan Code Byte contained all zeros.
   b) If the Pointing Device is ***active***, the transmitted data packet will have Right key status bit in the Device Address / Status Byte ***set*** and the X-Coordinate Byte and Y-Coordinate / Scan Code Byte contained the X and Y positional values of the Pointer movement.

   2.2. While the **<Right>** key is pressed and held down, if another key (other than **<Left>** key) is now pressed, the pointing device Right key status bit in the Device Address / Status Byte will be reset.

a) If the Pointing Device is ***not active***, no data packet will be transmitted. ***Both keys*** must ***be released*** for the remote to return to its normal operation
b) If the Pointing Device is ***active*** *prior to the key presses as described in 2.2 above*, the transmitted data packet will have Right key status bit in the Device Address / Status Byte ***reset*** and the X-Coordinate Byte and Y-Coordinate / Scan Code Byte contained the X and Y positional values of the Pointer movement.

3. When **<Left>** ***and*** **<Right>**) keys are both being held down (with one key is pressed before the other), the corresponding pointing device ***left key status*** (Bit 3) and ***right key status*** (Bit 4) in the Device Address / Status Byte will ***both*** be ***set***. These bits will be set as long as the **<Left>** ***and*** **<Right>** keys are held down. If any one of these two keys is released first, its corresponding status bit will be reset while the corresponding status bit of remaining key remains set. Both bits will be ***reset*** (or cleared) when both keys are ***released***. During this time, if the Pointing Device is not active, the X-Coordinate Byte and Y-Coordinate / Scan Code Byte will be all zeros in the transmitted data packet.

   Note*: It is up to the Host application software to make use of the case where both left and right key status bits in the Device Address / Status Byte are set. This condition would indicate that both* ***<Left>*** *and* ***<Right>*** *keys are currently being pressed and held down*.

4. When the ***Pointing Device*** is ***active*** and one (or both) of ***<Left>*** (or ***<Right>***) key is pressed, the X-Coordinate Byte and Y-Coordinate / Scan Code Byte will be updated with the X and Y value of their corresponding positional movements. The transmitted data packet will have the corresponding Left (or Right) key status bit in the Device Address / Status Byte set or reset accordingly.

Note*:*

If both keys ***<Left>*** *and* ***<Right>*** *are pressed at the same time, this would be considered as invalid (simultaneously key press). There will be no data packet sent out in this case*.

Re-Sync Data Packet

Byte10 (MSB)	Byte09	Byte08	Byte07	Byte06	Byte05	Byte04	Byte03	Byte02	Byte01	Byte0 (LSB)
0x0F	0x0F	0x0F	0x0F	0x55	0x55	0-0x63 (0-99 decimal)		0x00	0x76	0xYY

Sync Bytes	Preamble	Device Number	Dev Addr / Status	X Coord	Y Coord / ScanCode	CheckSum
32 bits	16 bits	8 bits	8 bits	8 bits	8 bits	8 bits

How does the Re-Sync operates and When the "Re-Sync" code is sent:

Activating the <Re-Sync> key allows the user to send the "signature data" and to synchronize the RF Transmitter and Receiver RF-channel.

To activate the Re-Sync function:

- *Press <Re-Sync> key first.*
- *While <Re-Sync> key is held down, press a digit key <d> where d is any digit keys from 1, 2, 3, …, 8, 9, 0 representing RF-channel 1, 2, 3, …, 8, 9, 10 respectively*.

The process can pictorially be represented as below:

{{ <Re-Sync> + <d> }} **<d>** is <Digit> Key for Digit 1, 2, 3, …, 9, 0

Press/Release <d> key, while <Re-Sync> key is held down. The system first sets up "d" RF-channel for RF Transmitter (digit number corresponding to channel 1 through 10), it then sends out the "Re-Sync" Make code data packet, minimum of 10 or more, as long as key still held down.

- If the <Re-Sync> and <d> keys are both released
- If another <Digit> key is pressed/released while the <Re-Sync> key is still held down

The "Sleep" code data packet will be sent when no key activities are detected after 5 seconds (Refer to Sleep Code transmission section for details).

- The system will setup another RF-channel, corresponding to that digit key, for the Transmitter, it then sends out another "Re-Sync" Make code data packet in that RF channel setting.
- This process will be repeating as above in response to different <Digit> key is pressed/released while <Re-Sync> key is still held down.

This Re-Sync signature data transmission process will be repeated as described above each time another <Digit> key is pressed/released until both Transmitter and Receiver units match its selected RF-channel. This channel frequency will then be used to transmit the data packet.

3.4.1 Definitions

Stuck Key Time-out
After any key is pressed continuously for 60 seconds, the remote will stop sending data packets and turn off RF transmission to conserve battery life. Transmission can begin again, after all keys are released and key is pressed.

Stuck-Key Data Packet

Byte10 (MSB)	Byte09	Byte08	Byte07	Byte06	Byte05	Byte04	Byte03	Byte02	Byte01	Byte0 (LSB)
0x0F	0x0F	0x0F	0x0F	0x55	0x55	0-0x63 (0-99 decimal)		0x00	0xFC	0xYY

Sync Bytes	Preamble	Device Number	Dev Addr / Status	X Coord	Y Coord / ScanCode	CheckSum
32 bits	16 bits	8 bits	8 bits	8 bits	8 bits	8 bits

How and When the Stuck-Key code is sent:

The Stuck-Key Code Data Packet will be sent:

- *After two data packets of the Make Code of the detected key press, <K1> say, have been sent out. If this (same) key, <K1>, is still being held down for more than 60 seconds, then two data packets of Stuck-Key code will be sent with 10 ms delay time interval between data packets. A Make Code data packet of the same key sent every 70 ms time interval during this 60 seconds stuck key condition.*
- *For the pointing device, after sending out the X-Coord and Y-Coord continuously up to 2 minutes which is the time to be considered as stuck key timeout for pointing device. Two data packets of Stuck Code will be sent.*
- *Two data packets of Sleep Code will be sent following the Stuck Code data packet. The RF Transmitter will then be turned OFF.*

Sleep Mode
This is the idle state of the micro-controller when it draws the least amount of current. Upon entering the idle mode, the remote will transmit a unique byte (FD) to notify the receiver that it is entering into the sleep mode.

Sleep Data Packet

Byte10 (MSB)	Byte09	Byte08	Byte07	Byte06	Byte05	Byte04	Byte03	Byte02	Byte01	Byte0 (LSB)
0x0F	0x0F	0x0F	0x0F	0x55	0x55	0-0x63 (0-99 decimal)		0x00	0xFD	0xYY

Sync Bytes	Preamble	Device Number	Dev Addr / Status	X Coord	Y Coord / ScanCode	CheckSum
32 bits	16 bits	8 bits	8 bits	8 bits	8 bits	8 bits

How and When the Sleep code is sent:

The Sleep Code Data Packet will be sent:

- *After depressed key, <K1> say, is released and two Data-Packets of K1 Break Code sent, the RF Transmitter will be turned OFF. If no other key press activities are detected after 5 seconds, the RF Transmitter will then be turned ON to send two data packets of Sleep code , the RF Transmitter will again be turned OFF and the remote software goes into its actual Sleep mode.*

3.4.1.1 Repeated Make code Data Packet

Byte10 (MSB)	Byte09	Byte08	Byte07	Byte06	Byte05	Byte04	Byte03	Byte02	Byte01	Byte0 (LSB)
0x0F	0x0F	0x0F	0x0F	0x55	0x55	0-0x63 (0-99 decimal)		0x00		0xYY

Sync Bytes	Preamble	Device Number	Dev Addr / Status	X Coord	Y Coord / ScanCode	CheckSum
32 bits	16 bits	8 bits	8 bits	8 bits	8 bits	8 bits

How and When the repeated Make Code is sent:

The repeated Make Code Data Packet will be sent:

- *After a depressed key, <K1> say, is detected, two data packets of its Make code will be sent with 10 ms delay between data packets. The Make code packet of the same key will be sent out for every 70 ms time interval as long as this <K1> is still being held down and the overall time since its first key press detection does not exceed 60 seconds.*

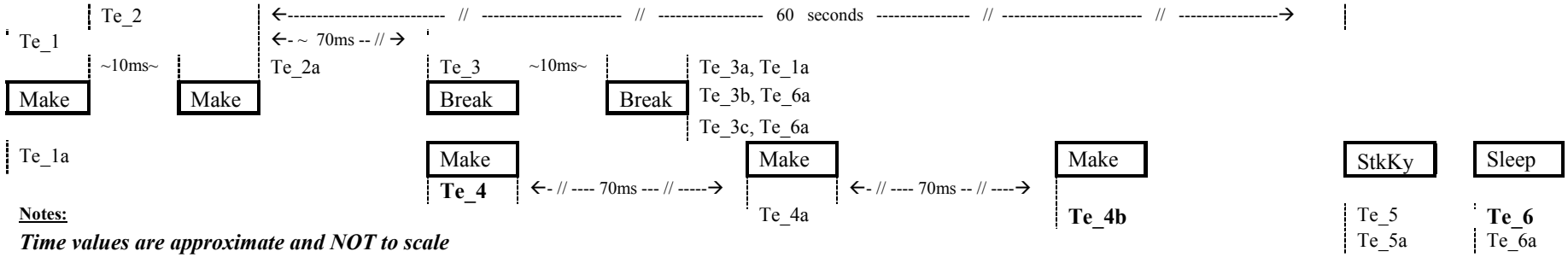
- *If another key, <K2> say, is pressed while <K1> is still held down, the Make code data packet of the same K1 key will be sent out as defined above. Until <K1> is released, two data packets of <K1> Break code will be sent with 10 ms delay between data packet. Since <K2> is now still held down, two data packets of <K2> Make code will be sent with 10 ms delay between data packets.*

Note:

Packet gap between the last Break Code of K1 sent and the first Make Code of K2 sent is 10 ms..

Timing Events versus Data Packet transmission for various operational situations:

3.4.2 Time Event / Data Packet Transmission Diagram



Notes:

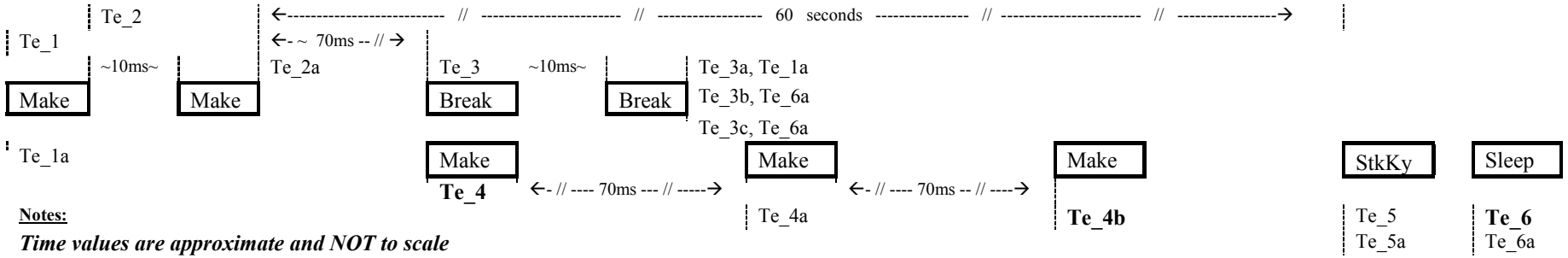
Time values are approximate and NOT to scale

Refer to APPENDIX for notation descriptions used in this Diagram and Table below.

Time Event / Data Packet Transmission

Time Event	Key Press & Time Event	Data Packet Transmission & Time Event	Remark
Te_1	<K1> is pressed and detected	First Make-Code-Data-Packet (<K1> Scan Code) will be sent. It follows by about 10 ms delay.	Case where a key press, <K1> say, is detected. Make-Code-Data-Packets are sent with 10 ms delay between the data packets.
Te_2	<K1> key is still being depressed	Second Make-Code-Data-Packet (of same <K1> Scan Code as above) will be sent.	
Te_4	70 ms after Te_2, <K1> is still being held from the time event Te_1 when the <K1> depress is first detected..	Make code data packets of K1 are now transmitted.	This is the case where: From the time event Te_1 and for every 70 ms elapsed time interval, and 60 seconds stuck-key timeout has not been reached, Make code Data-Packet of the same key will be sent out as long as key <K!> is still being held down.
Te_4a	Another 70 ms elapsed after Te_4 and <K1> is still being held down	Another Make code Data Packets are sent	
Te_4b	<K1> is still being held down 70 ms after Te_4a.	Another Data Packet of Keep-Alive code is sent. See remark column.	

Time Event / Data Packet Transmission Diagram (**continued**)



Notes:

Time values are approximate and NOT to scale

Refer to APPENDIX for notation descriptions used in this Diagram and Table below.

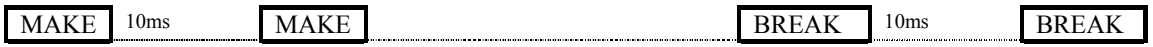
Time Event / Data Packet Transmission (**continued**)

Time Event	Key Press & Time Event	Data Packet Transmission & Time Event	Remark
Te_3	70 ms after Te_2a: <K1> key is now released.	Two Break-Code-Data-Packets (of <K1> Scan Code) will be sent, separated by about 10 ms time interval between them.	70 ms from the last Make-Code-Data-Packet sent and <K1> released.
Te_3a, Te_1a	70 ms after Te_2a: <K1> is released but another key is pressed, <K2> say within 5 seconds.	Two Break-Code-Data-Packets (of <K1> Scan Code) sent with 10 ms separation. The RF Transmitter will then be turned OFF. When another key, <K2>, is pressed within 5 seconds, the RF Transmitter will be turned ON to send two Make-Code-Data-Packets of K2 (10 ms between packets) as shown at Te_1a	Case where <K1> released, and <K2> pressed within 5 seconds after <K1> released.
Te_3b, Te_6a	70 ms after Te_2a: <K1> is released but NO other key press detected after 5 seconds elapsed.	Two Break-Code-Data-Packets (of <K1> Scan Code) will be sent with 10 ms time delay in between when <K1> is released. Since no other key press is detected beyond 5 seconds, a Sleep-Code-Data-Packet will be sent, the RF transmitter will then be turned OFF to conserve the power.	Case where <K1> released and no other key press is to be followed after more than 5 seconds.
Te_3c, Te_5a Te_6a	70 ms after Te_2a: While <K1> is still being held down, another key, <K2> say, is pressed	Make code data packet of K1 sent as defined before. If <K1> released, Break code data packets of K1 sent, 10 ms later, Make code data packet of K2 sent. If <K2> is still down, Make code data packet of K2 sent, etc.. , until <K2> released, then Break code data packet of K2 sent.	Case of Sequence Break-Code/Stuck/Sleep to indicate the situation.

Key Type Data Packet Transmission, a Summary:

All keys including the pointing device buttons are Make/Break type. When a key or button is pressed, the remote will transmit the data packet as shown in the protocol on previous pages.

For reliable data transmission, keystroke and control push buttons data packets are transmitted twice wirelessly from the Remote Control RF Transmitter. The transmission is one time for Keep-Alive code and a minimum of 10 times for Re-Sync code.



Followings are some scenarios of key press:

Case of a normal Key pressed/released:

Key Pressed — Make Code sent.
Key Released — Break Code sent, RF Transmitter turned OFF.
If no key press is detected after 5 seconds, RF Transmitter is turned ON and Sleep Code is sent. After that the RF Transmitter is again turned OFF and the unit goes to SLEEP mode.
If a key press is detected within 5 seconds, that key data transmission will be serviced as described above.
If a key pressed then stuck for a long time, then Make Code of the same depressed key will be sent for every 70 ms time interval within 1 minute from the time the original Make code sent. When 1 minute duration is expired, a Stuck code will be sent, followed by Sleep code and the RF Transmitter is then turned OFF. Note that the software would only be able to go to STOP (or SLEEP) mode when a stuck key is released.

Case of Make code kept resend (use <K1> and <K2> as an example):

<K1> pressed — Make Code of K1 sent.
<K2> is then pressed while <K1> is still down and both keys are now down within 1 minute. The Make code of K1 will be sent for every 70 ms time interval as described above, until one of the following conditions occurs:
<K1> is released first while <K2> is still held down. Break code of K1 will be sent and Make code of K2 will be sent after 70 ms.
<K2> is released first while <K1> is still held down. Nothing changes except the same Make code of K1 will be sent for every 70 ms time interval. Until <K1> is released and its Break code is sent.

Case of Re-Sync data packet sent:

{{<Re-Sync>+<Digit>}} A <Digit> key is pressed while <Re-Sync> key is held down:
A minimum of 10 data packets of Re-Sync code (0x76) will be sent with 10 ms delay separated each data packet. Or the Re-Sync data packets will be kept sending out as long as the keys are held down.

APPENDIX

Some notations used in the Time Event / Data Packet Diagram

Notation	Function Description
Make	Make Code for Scan Code of Keyboard Keypad or Remote Keypad, or X-Coordinate, or Y-Coordinate of the Pointing Device
Break	Break Code for Scan Code of Keyboard Keypad or Remote Keypad, or X-Coordinate, or Y-Coordinate of the Pointing Device
ReSyn	Make Code for Re-Sync
StkKy	Make Code for Stuck-Key
Sleep	Make Code for Sleep
Te_ij	Time Event _ij, where i = 1, 2, 3, etc … and j = nothing (empty) or a, b, c, etc …
<K1>	First Key press in the sequence of key press events
<K2>	Second Key press in the sequence of key press event after <K1>

3.4.3 Device Number Setup

Note: *To prevent possible interference from multiple users environment, each remote will be set to a specific User Device Number (User DN#, between 00 to 99). If the User DN# has not been setup, the OSD will prompt the user to program a device number setup.*

To program, press **<Re-Sync>** key first then press **<CH+>** key, hold down both keys for about 3 seconds, then released:

<<Re-Sync> + <CH+>>

1. The software is now expecting the user to enter two digit numbers representing the device number by press/release **<Digit> <Digit>** keys. (In the software test module, this process completes with 2 LED blinks indication).
2. If **<AnyKey>** key**,** other than **<Digit>** keys, is pressed after the above sequence, the software will abort the Device Number Setup mode. (In the software test module, this error condition will be indicated by a long LED blink).
3. Within 10 seconds (timeout value) after the above sequence entry, if NO key is pressed (or the timeout expired between **<Digit>** key press), the software will exit the Device Number Setup mode and the remote will retain the current settings. The software will then return to its normal operation without having the device number updated. During this 10 seconds time, if the Pointer device is activated, the software will exit the Device Number Setup mode and will service the pointer movement of the remote.

Each Remote has a Device ID and a Device Number (00-99). The Device ID shows the category of the Remote. The Host will validate the received data packet from the Remote, by checking the Device Number, to see if it has been registered for that Device ID or not.

After the channel synchronization, the Device ID and Device Number of each Remote will be registered in the Host.

> **Note**: For both Keyboard and Remote Control, the Keypad and Pointing Device have the same Device Number. During synchronization, only Device ID of the Keypad and the Device Number of the Pointing Device will be sent. The Host should also register the Device Number for the Pointing Device of the corresponding device.

3.4.4 RF Channel Change

Re-Sync Data Packet

Byte10 (MSB)	Byte09	Byte08	Byte07	Byte06	Byte05	Byte04	Byte03	Byte02	Byte01	Byte0 (LSB)
0x0F	0x0F	0x0F	0x0F	0x55	0x55	0-0x63 (0-99 decimal)		0x00	0x76	0xYY

Sync Bytes	Preamble	Device Number	Dev Addr / Status	X Coord	Y Coord / ScanCode	CheckSum
32 bits	16 bits	8 bits	8 bits	8 bits	8 bits	8 bits

How does the Re-Sync operates and When the "Re-Sync" code is sent:

Activating the <Re-Sync> key allows the user to send the "signature data" and to synchronize the RF Transmitter and Receiver RF-channel.

To activate the Re-Sync function:

- *Press <Re-Sync> key first.*
- *While <Re-Sync> key is held down, press a digit key <d> where d is any digit keys from 1, 2, 3, …, 8, 9, 0 representing RF-channel 1, 2, 3, …, 8, 9, 10 respectively*.

The process can pictorially be represented as below:

{{ <Re-Sync> + <d> }} **<d>** is <Digit> Key for Digit 1, 2, 3, …, 9, 0

Press/Release <d> key, while <Re-Sync> key is held down. The system first sets up "d" RF-channel for RF Transmitter (digit number corresponding to channel 1 through 10), it then sends out the "Re-Sync" Make code data packet, minimum of 10 or more, as long as key still held down.

- If the <Re-Sync> and <d> keys are both released
  - No Break Code data packet for "Re-Sync" will be sent. The "Sleep" code data packet will be sent when no key activities are detected after 5 seconds (Refer to Sleep Code transmission section for details).

- If another <Digit> key is pressed/released while the <Re-Sync> key is still held down
  - The system will setup another RF-channel, corresponding to that digit key, for the Transmitter, it then sends out another “Re-Sync” Make code data packet in that RF channel setting.
  - This process will be repeating as above in response to different <Digit> key is pressed/released while <Re-Sync> key is still held down.

This Re-Sync signature data transmission process will be repeated as described above each time another <Digit> key is pressed/released until both Transmitter and Receiver units match its selected RF-channel. This channel frequency will then be used to transmit the data packet.

3.4.5 E2 Initialization

EEPROM Initialization:

> ***Note:*** *The EEPROM device must have been previously initialized for the remote to be able to get into the Factory RF Channel Test Mode*.

Press **<Re-Sync>** key first then press **<CH->** key, hold down both keys for about 3 seconds, then released. The software will enter the E2 Initialization mode WHEN the **<Enter>** key is pressed and released after the above described sequence.

<<Re-Sync> + <CH->>

1. If **<Enter>** key is pressed/released after the above sequence, the software will initialize the EEPROM. (In the software test module, this process completes with 4 LED blinks indication)
2. If **<AnyKey>** key**,** other than **<Enter>** key, is pressed after the above sequence, the software will abort the EEPROM Initialization mode. (In the software test module, this error condition will be indicated by a long LED blink).

Within 10 seconds (timeout value) after the above sequence entry, if NO key is pressed, the software will exit the EEPROM Initialization mode and the EEPROM device will not be initialized. The software will then return to its normal operation. But during this 10 seconds time, if the Pointer device is activated, the software will exit the EEPROM Initialization mode and will service the pointer movement of the remote.

3.4.6 Factory Test Mode(s)[1]

To enter this RF Channel test mode, *press and hold* a combination keys **<<1>+<3>>** *for at least 3 seconds* then released, *within 6 seconds* after the battery/power is applied to the unit:

<<1> + <3>>[2]

The software will start with setting up RF-channel 1 and send through the Transmitter the entire packet for the first channel continuously for the first 300 ms, with a 10-20ms gap between each channel. The process is automatically with the next RF-channel setup until all 10 RF-channels have been cycled through per Table1 below:

3.4.6.1 Table1: Factory Test Mode for RF Channel Test

Test Channel	Time (ms)	Packet Sent
1	0 - 300	0F 0F 0F 0F 55 55 FF FF **01 01** 00
	300 - 400	Nothing sent while changing RF Ch. 1
2	400 - 700	0F 0F 0F 0F 55 55 FF FF **02 02** 02
	700 - 800	Nothing sent while changing RF Ch. 2
3	800 - 1100	0F 0F 0F 0F 55 55 FF FF **03 03** 04
	1100 - 1200	Nothing sent while changing RF Ch. 3
4	1200 - 1500	0F 0F 0F 0F 55 55 FF FF **04 04** 06
	1500 - 1600	Nothing sent while changing RF Ch. 4
5	1600 -1900	0F 0F 0F 0F 55 55 FF FF **05 05** 08
	1900 - 2000	Nothing sent while changing RF Ch. 5
6	2000 - 2300	0F 0F 0F 0F 55 55 FF FF **06 06** 0A
	2300 -2400	Nothing sent while changing RF Ch. 6
7	2400 - 2700	0F 0F 0F 0F 55 55 FF FF **07 07** 0C
	2700 - 2800	Nothing sent while changing RF Ch. 7
8	2800 - 3100	0F 0F 0F 0F 55 55 FF FF **08 08** 0E
	3100 - 3200	Nothing sent while changing RF Ch. 8
9	3200 - 3500	0F 0F 0F 0F 55 55 FF FF **09 09** 10
	3500 - 3600	Nothing sent while changing RF Ch. 9
0 End test	3600 - 3900	0F 0F 0F 0F 55 55 FF FF **00 00** FE
	3900	Nothing sent while changing RF Ch. 10

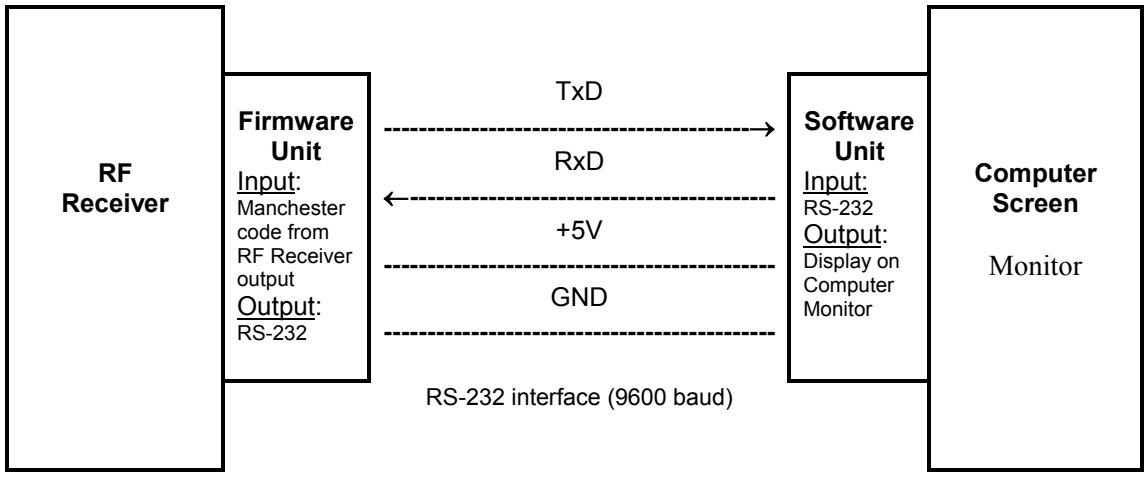
[1]FACTORY TEST MODE can be entered upon cold power up and/or warm power up

[2] IF E2 is not initialized, the remote will not enter the FACTORY TEST MODE.

Key Test (Also used in Factory Test for Key):

An integrated hardware/firmware/software test unit will be designed for the Key Test. This Key Test Unit can be used during this project software development as well as for factory test in an actual production manufacturing. No special combination key sequence is required to get into this Key Test mode.

The integrated Key Test unit is functionally represented as below:



3.4.6.1 Firmware Unit:

This so-called “unit” is *actually a firmware portion* that processes to keep 5 bytes of the 11-byte data packet after striping off all the Sync bytes and Preamble bytes. It then output these 5 bytes through the RS-232 protocol format.

Byte4	Byte3	Byte2	Byte1	Byte0
Device Number	**DevAddr/Status**	**X-coordinate**	**Y-coordinate / Scan Code**	**CheckSum**
(8 bits)	(8 bits)	(8 bits)	(8 bits)	(8 bits)

Byte0 **CheckSum**
The result of the addition (without carry) of Byte1 through Byte4 (Device Number + Device Address / Status + X-coordinate + Y-coordinate / Scan Code)

Byte1 **Y-coordinate / Scan Code**
Y-data for Remote Control Pointing Device, or
Make/Break Scan Code of the pressed/released key on the Remote Control Keypad. See Table2 for details.

Byte2 **X-coordinate**
X-data for Remote Control Pointing Device.
Always 0 for Remote Control Keypad

Byte3 **Device Address / Status**
Please refer to details on next page

Byte4 **Device Number**
Device Number is chosen from 0 to 99 by system Host interface. The Host will validate the received data packet by checking the Device Number if it is registered for that device.

Byte3 details:

Device Address / Status								Details Byte3 Description	
b7	b6	b5	b4	b3	b2	b1	b0		
					0	1	0	UEI Remote Control Keypad	
					1	0	0	UEI Remote Control Pointing Device	
				Pointing Device Left Button Status (0=Up, 1=Down)					
			Pointing Device Right Button Status (0=Up, 1=Down)						
		0						Positive	Sign Bit of X-coordinate
		1						Negative	
	0							Positive	Sign Bit of Y-coordinate
	1							Negative	
0								OK, good	Battery power level status
1								Low	

3.4.6.2 Software Unit:

This so-called “unit” *is actually a software portion* (in the integrated Key Test Unit). After it receives a data packet of 5 bytes, as described above, through the RS-232 communication protocol, it will display the output on the computer screen monitor. The display output information will depend on the data input information received from the RS-232 inputs.

The display output will be designed as such:

- All 34 keys (Table2, columns 1 & 2) are to be programmed to be graphically displayed as key buttons (with proper key label if possible). A color-coded scheme are to be designed to visually represent the key status condition depending on (b2b1b0=010 in the Device Address / Status byte).

Color-coded	Key press status
Gray	Indicates a key that had never been pressed and/or released, or the key is malfunctioned that the remote could not detect when pressed.
Red	Indicates when the key is pressed and the software receives its Make Code corresponding to that key.
Green	Indicates when the key is released and the software receives its Break Code corresponding to that key.

- Two allocated display locations on the screen monitor are to be programmed to show the value of X-coordinate and Y-coordinate of the Pointing Device. These values are data received in Byte2 and Byte1 when the pointing device on the remote control is activated (b2b1b0=100 in the Device Address / Status byte).

- An allocated display location on the screen monitor is to be programmed to show the status of the battery level condition. This status is to be decoded from bit b7 of Byte 3 (Device Address / Status byte) in the received data packet.

- An allocated display location on the screen monitor is to be programmed to show the Device Number. This value is to be extracted from Byte4 in the received data packet.

Table2: Key Test (Also used for Factory Key Test)

Note: *Make Code and Break Code are in Hexadecimal*.

Key #	Key Label	Make Code	Break Code
1	POWER	75	F5
2	VL+	74	F4
3	VL-	73	F3
4	MUTE	6B	EB
5	CH+	6F	EF
6	CH-	70	F0
7	PREVIOUS	6D	ED
8	MENU/EXIT	6E	EE
9	PIP	6C	EC
10	ENTER	*	*
11	SMART	*	*
12	REVERSE	57	D7
13	PLAY	58	D8
14	FFD	59	D9
15	RECORD	5A	DA
16	STOP	5B	DB
17	PAUSE	5C	DC
18	INSTANT REPLAY	5D	DD
19	JUMP COMM	5E	DE
20	JUMP PRESENT	5F	DF
21	EPG	60	E0
22	+100	61	E1
23	MULTIVIEW	62	E2
24	1	13	93
25	2	14	94
26	3	15	95
27	4	16	96
28	5	17	97
29	6	18	98
30	7	19	99
31	8	1A	9A
32	9	1B	9B
33	0	1C	9C
34	RE-SYNC	76	F6

* Set and Reset in Pointing Device Data Packet

Other allocated display locations on the screen monitor:

ID Number : xx
Battery Good / Battery Low
X-data of Pointing Device

Y-data of Pointing Device

3.4.7 Low Battery Indicator

When the batteries in the unit reach approximately 3.4 Volts the remote will send a specific frame of data to indicate the remote batteries are low. The user will be prompted via an onscreen display to change the batteries.

When the unit's batteries reaches 2.9 Volts +/- 200 mV the remote will not respond to key presses.

4 RF Transmission General Specification

The performance requirements are contained in the table below

Table 2. General Specification

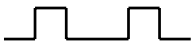
Rqmt No.	Parameter	Description	Tx Module
4.1	Number of channels		10 channels
4.2	Channel spacing		1,2,3 & 1.6 MHz
4.3	Receive frequency band		N/A
4.4	Demodulation		N/A
4.5	Receiver sensitivity	Minimum	N/A
4.6	Data rate	Fixed	9600 bps
4.7	Transmit frequency band		2446.7 to 2464.3 MHz
4.8	Modulation		FSK
4.9	Radiated power FCC Requirements	Maximum Fundamental Spurious emissions	-18 dBm 50 millivolts/meter @ 3 meters 500 microvolts/meter @ 3 meters
4.10	Simplex type		Transmit only
4.11	RF frequency tolerance		± 10 ppm
4.12	Temperature range	Operating Storage	0 to 50 °C -10 to 60 °C
4.13	Power source	Nominal	2.5 VDC
4.14	Power consumption	Maximum operational supply current	15 mA
4.15	Dimensions		28mm x 22mm x 8mm
4.16	Weight		To be determined
4.17	Other requirements	PLL lock on time	50 ms

Note

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

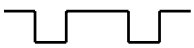
Channel 1~5 : Tx input data

Rx output data



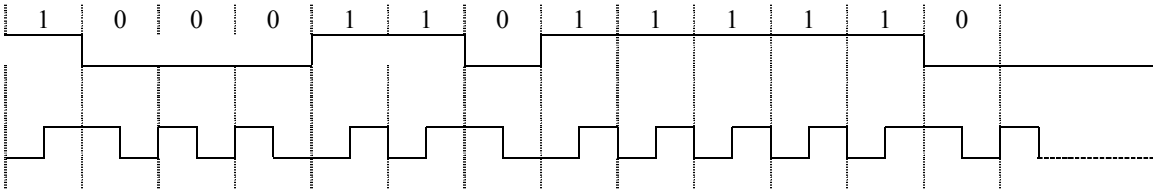
Channel 6~10: Tx input data

Rx output data



4.1 Data Coding

Data coding is necessary for the wireless communication, which is to eliminate the DC offset of the demodulation caused by the series 1's or 0's. Following describes Manchester Coding implementation:



5 Hardware Interface

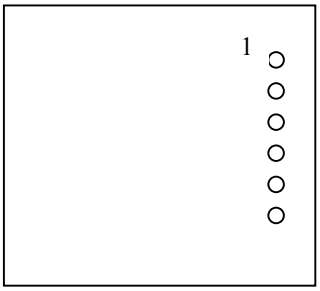
The interface to the module shall be as described in the table below.

Table 1. Hardware Interface

Parameter	Pin Number	Tx Module
Input voltage - Vcc	1	2.2 volts
Ground	2	Ground
Data	3	Data input
Synthesizer enable	4	TTL input
Synthesizer SDA	5	TTL input
Synthesizer SCK	6	TTL input

5.1 Transmitter Outline /Interface

Dimension 28* 22*8 mm or smaller if 04/02 components are used



1. Vcc (2.2 V)
2. GND
3. Data in (Vp-p = 0.1V)
4. LE (TTL)
5. SDA (TTL)
6. SCK (TTL)

5.1 Product Performance Requirements

5.1.1 RF CHANNEL and OPERATING BANDS

2400 to 2483.5 MHz

5.1.2 RF Channels and Frequencies

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
0	2464.3 MHz

Frequency Control

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

Transmitter

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
0*	2464.3 MHz	0010000000001010001	0011000000010000110

***Channels 6,7,8,9, and 0 will be inverted when transmitted.**

5.1.3 Pulse Width Timing for RF Transmitter

Long Low:	108.0us (+/- 5%)
Long High:	102.0us (+/- 5%)
Short Low:	53.0us (+/- 5%)
Short High:	50.0us (+/- 5%)

5.1.4 RF Channel Operation Range

The remote shall communicate at a minimum distance of 5m in a direct line of site

5.1.5 RF Modulation Scheme and Modulation Level

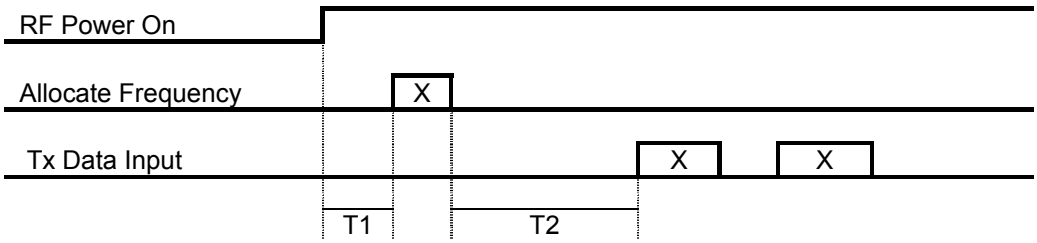
Modulation Scheme
Frequency Shift Keying (FSK

Modulation Level
± 70 kHz (Nominal)

5.1.6 Maximum Bit Rate

9600 baud (bps)

5.1.7 RF Power Management



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

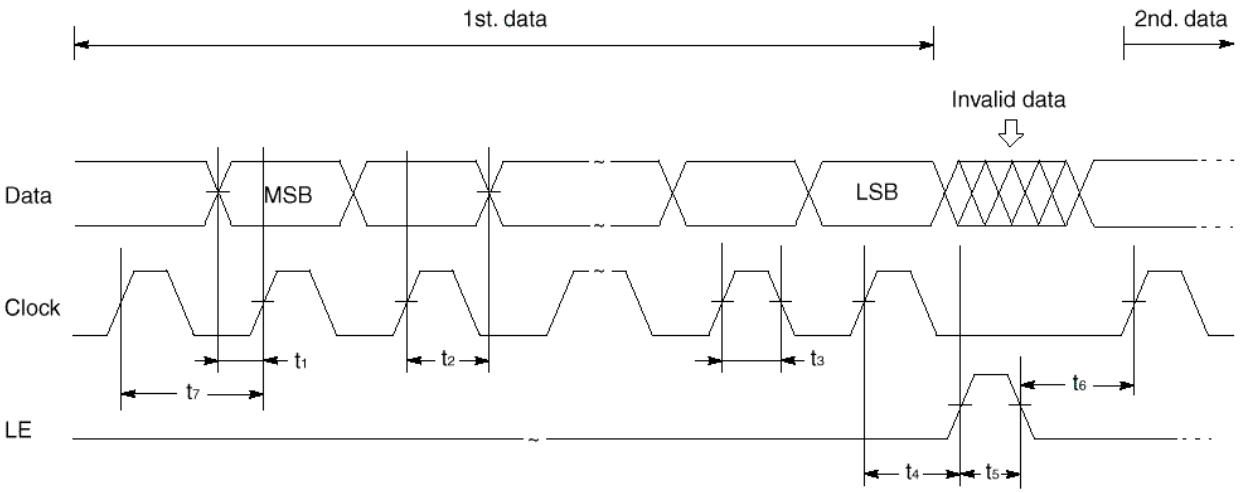
5.1.8 Transmitter Data Input Level

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%).

5.1.9 Communication Link

Simplex – one way communication from remote control unit to base unit.

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

6 Electrical Requirements

6.1 Power

The remote shall operate from (4 - AAA) alkaline batteries. Power requirements shall be a maximum operating voltage of 6.4 volts.

6.2 Visible LEDs

NA

6.3 Transmission IC

Samsung 16K (S3P/C80F9XFE-QZR5) (QFP)

6.4 Battery Life

4 new AAA cells will provide approximately 10 months of battery life.

This is the time at which the remote will begin sending the specific frame of data to indicate the remote batteries are low.

This assumes the following usage:

5 hours of operation per day

Approximately:

14.4 key presses per hour (@ 1 second each)
120 Seconds of Pointer operation per hour

6.5 Range

Minimum 5meters in direct line of site.

7 Mechanical Requirements

7.1.1 HRC Assembly

The HRC assembly must meet UEI mechanical drawing and industrial design requirements**.**

7.1.2 Assembly LED's

NA

7.2 Enclosure

7.2.1 Enclosure and Battery Cover Shape

The shape of the enclosing plastic parts including the top case, bottom case and battery cover can be specified by a set of mechanical part drawings and CAD files in the form of DXF and/or IGES format or Pro-E, Ashlar Vellum or AutoCAD format.

7.2.1.1 Part Form

All plastic parts must meet the shape and proportions embodied in their respective UEI mechanical drawings and industrial designs.

7.2.1.2 Part Alignment & Mismatch

All plastic parts must align correctly as specified in the respective UEI mechanical drawings.

7.2.1.3 Battery Cover

The battery cover shall be designed to have a minimal lateral movement in the battery compartment and to disengage the latch mechanism at 700±300 grams.

7.2.2 Material

Recommended material selection for standard use plastic parts is ABS GPM, ABS T- grade or other engineering approved resin. The properties are described as follow:

Physical:

Specific Gravity, solid	1.02-1.05

Mechanical:

Tensile Strength	5,000-6,900 psi (35-50 MPa)
Tensile Modulus	260,000- 360,000 psi (1,800-2,500 MPa)
Flexural Strength	8,500-12,300 psi (60-85 MPa)
Flexural Modulus	270,000-380,000 psi (1,900-2,600 MPa)

Impact:

Izod Impact @ 73°F	3.1-7.5 ft-lb/in (170-400 J/m)
Izod Impact @ -40°F	1.2-2.6 ft-lb/in (65-140 J/m)

Flame Class Rating:

UL94HB	0.0579-0.0630 in. (1.47-1.6mm)

7.2.3 Texture

Texture shall be Mold-Tech MT-11010 or UEI engineering approved equivalent as follows:

UEI SPEC. (MOLD-TECH)	HONG KONG (YICK SANG)	CHINA (HON NGAI)	SIN OR MEXICO (PHILIPS)	KOREA (KYUNG SUNG)
MT-11010	D-428	MK-111	9-410-UN-D249	K-112G

7.2.4 Color

The Pantone Matching System (PMS) will be used as the general UEI color standard. Refer to the "Pantone Color Formula Guide 1000" for specific color selection and color coordination.

7.3 Keypad with Polydome

For further detailed information, see the UEI Keypad Design Guideline Manual (Spec. # 0004).

7.3.1 Material

The keypad is usually molded from compression molded silicon rubber. The recommended material shall be 50 to 60 shore A hardness, which provides good tactile feel and long life.

Physical

Specific Gravity @ 25C	1.1-1.4
Durometer (Shore A)	55 ± 5
Tensile Strength	55 - 75 kg/cm^2
Compression Set %	11 - 22
Insulation Breakdown	26 kV/mm

Flame Class Rating

UL94HB

The Polydome assembly is a die cut Polyethylene terephthalate (PET) sheets. It contains 0.05mm main dome sheet, adhesive, and 0.1mm spacer. The travel and tactile feed back are provided by the main dome sheet.

7.3.2 Tactile Feel

The switch should operate smoothly throughout its entire travel with good tactile feedback.

7.3.3 Force Vs. Travel

The force values are represented by gram and the travel values are represented by millimeter.

P1 (Peak force)	=	General range: 200±50 grams and it is dependent on specific product application; therefore, see the keypad part drawing for exact specification.
P2 (Contact force)	=	General range: 50-90% of P1.
PR (Return force)	=	40 grams minimum.
S (Travel)	=	0.4 ± 0.1mm and it is dependent on specific product application; therefore, see the keypad part drawing for exact specification.

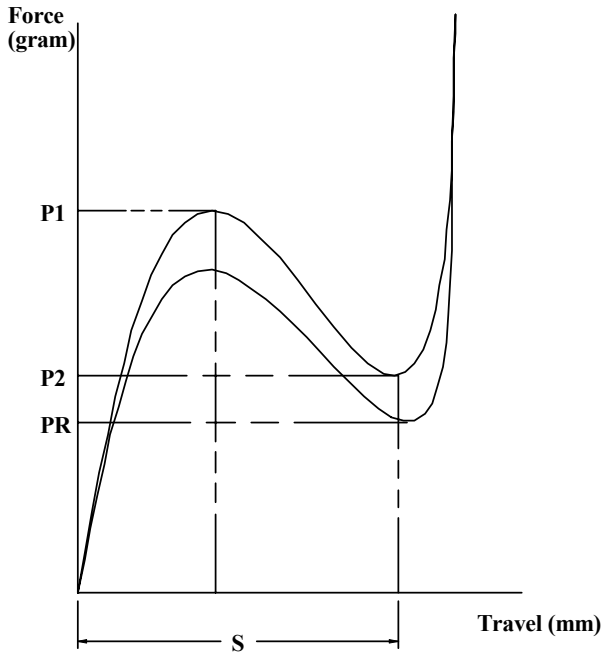


Figure 1: Force vs. travel

	Peak force, P1	Return force, PR	Snap ratio, TR	Stroke, S
Rubber keypad only	150±30 grams	40 grams minimum	40% to 60%	1.0±0.2mm
Keypad with polydome	200±30 grams	40 grams minimum	40% to 70%	0.4±0.1mm

7.3.4 Life

Key Pad with Polydome
All keys must continue operation within specification, after being subjected to500,000 cycles of key activation at , 250 grams of force @ 120 cycles per minute under normal operating conditions.

7.3.5 Keypad Pull-out Force

The key top must not be separated from its base after 1kg vertical pull up force is applied.

7.3.6 Key stick and key stuck

All keys should rebound to their original height smoothly and instantaneously. All keys should not get stuck under the key openings whichever location of the key is pressed.

7.4 PCB Material

Material specification needs to be provided to Engineering and approved by Engineering prior to usage. Layout shall be based on UEI Specification 0029. If carbon ink is used, UEI Specification 0007 should be followed.

7.5 Battery Compartment

- The battery compartment must be clearly marked for battery size and polarity.
- The battery compartment must be designed to accommodate all brands per American National Standard Dry Cell and Battery Specification (ANSI C18.1M-1992).
- The battery must be retained by coil or leaf springs, tight enough to avoid rocking and loose enough for easy replacement.
- The battery compartment must be designed to prevent contact in case of reverse polarity during installation.
- The batteries must remove from the battery compartment when a force of 300 to 500 grams is exerted outward.
- The battery springs must be properly positioned to make contact with the batteries.
- The battery springs must remain properly seated when a force of 500 grams is applied.
- The battery springs must be insulated from each other.

7.6 Printing

A pad printing or silk-screening process shall be used for all legends that print on plastic surface. A silkscreen printing process shall be used on keypad.

All printing shall be free of visible blurs, alignment, or any distortion defects. Ink thickness shall be sufficient to cover the underlying material's color.

Key name	Rubber Pantone color	Case label text	Key label text	Case / Key label Pantone Color
Power	GS 056	European Power Symbol		NMB White U
MENU/EXIT	NMB Midnight Gray ABT 10936A		MENU/EXIT	NMB White U
VOL UP	NMB Midnight Gray ABT 10936A	▲	VOL	NMB White U
VOL DN	NMB Midnight Gray ABT 10936A	▼		NMB White U
CH UP	NMB Midnight Gray ABT 10936A	▲	CH	NMB White U
CH DN	NMB Midnight Gray ABT 10936A	▼		NMB White U
ENTER	NMB Midnight Gray ABT 10936A	ENTER		NMB White U
SMART	DS 161	SMART		NMB White U
MUTE	NMB Midnight Gray ABT 10936A	MUTE		NMB White U
PIP	NMB Midnight Gray ABT 10936A	PIP		NMB White U
PREV CH	NMB Midnight Gray ABT 10936A	PRE CH		NMB White U
REWIND	NMB Midnight Gray ABT 10936A	◀◀		NMB White U
PLAY	NMB Midnight Gray ABT 10936A	▶		NMB White U
FAST FORWARD	NMB Midnight Gray ABT 10936A	▶▶		NMB White U
RECORD	NMB Midnight Gray ABT 10936A	●		Pantone 1788
STOP	NMB Midnight Gray ABT 10936A	■		NMB White U
PAUSE	NMB Midnight Gray ABT 10936A	II		NMB White U
INST REPLAY	DS 161		INST REPLAY	NMB White U
JUMP COMM	DS 161		JUMP COMM	NMB White U
JUMP PRESENT	DS 161		JUMP PRESENT	NMB White U
EPG	DS 161		EPG	NMB White U
+100	DS 161		+100	NMB White U
MULTIVIEW	DS 161		MULTIVIEW	NMB White U
1	NMB Midnight Gray ABT 10936A	1		NMB White U
2	NMB Midnight Gray ABT 10936A	2		NMB White U
3	NMB Midnight Gray ABT 10936A	3		NMB White U
4	NMB Midnight Gray ABT 10936A	4		NMB White U
5	NMB Midnight Gray ABT 10936A	5		NMB White U
6	NMB Midnight Gray ABT 10936A	6		NMB White U
7	NMB Midnight Gray ABT 10936A	7		NMB White U
8	NMB Midnight Gray ABT 10936A	8		NMB White U
9	NMB Midnight Gray ABT 10936A	9		NMB White U
0	NMB Midnight Gray ABT 10936A	0		NMB White U
RESYNC	NMB Midnight Gray ABT 10936A		RESYNC	NMB White U

Housing will be NMB Midnight Gray ABT 10936A for top and back case.

7.7 Labeling

7.7.1 Date Code

All assembly units require date code information. This information shall be marked inside the battery compartment in a form hot stamp/cold stamp or label. The date code information contains seven alphanumeric digits as describe below:

XXXXXXX

First Digit	Factory code
Second and Third Digit	Last two digits of year produced
Fourth and Fifth Digit	Week # of year produced
Sixth and Seventh Digit	Revision level of the latest Engineering BOM

Factory Code

A - Samjin
D - Kimex
E - WKK
G - Computime
J - Jetta
K - Jeckson
M - Philips Mexico
N - Sejin
P - Philips Singapore
S - SMK Mexico
U - Universal Electronics

Example: U001002

Factory:	Universal Electronics
Year:	2000
Week:	10
BOM Rev.:	02

7.7.2 Part Number Label

All assembly units require a label with the appropriate URC number applied inside the battery compartment, unless this URC number has been printed on the battery cover door per submitted artwork.

7.7.3 Country of Origin

All assembly units require country of origin either embossed or printed on bottom case or battery door (except units shipped to Europe).

8 QUALITY

This section defines the appearance, cosmetic, and durability testing requirements for plastic parts and assemblies, on all universal remote controls. However, when UEI customer requirements mandate, stricter (tighter) evaluation and testing methods must be used by the factory.

8.1 Appearance

The unit shall be constructed in accordance with the mechanical requirements set forth in this section. These requirements must not be changed without written approval of Universal Electronics Inc.

- Key height shall be from 1.8±0.2 mm above the surface of the plastic case when in a static condition.
- The gap between key and plastic opening shall be 0.1mm minimum and 0.5mm maximum. (Suggested nominal gap 0.3 mm).
- The plastic cases shall mate accurately with minimal overhang. The maximum allowable overhang from the top case to the bottom case is 0.2mm. The maximum allowable overhang from the bottom case to the top case is 0.1mm.
- The plastic cases shall mate with a consistence gap around the peripheral. The gap shall be within 0.2mm from its designed dimension.

8.2 Cosmetic

8.2.1 Evaluation Criteria

8.2.1.1 Evaluation Criteria

- Lighting to be directly overhead.
- Surface to be evaluated held at a 45° angle to the line of sight, at a distance of 51cm (20”) maximum to the center of surface.
- Unit under evaluation to be rotated 30° in both directions about the 45° inclined axis.

8.2.1.2 Lighting

The light source shall be Cool White Fluorescent, non-directional at an intensity of 1000±215 Lux (100±20 footcandles).

8.2.2 Definition of Flaw and Defect

The cosmetic features are divided into two categories: Flaws and Defects

1) Flaw is an acceptable imperfection or blemish.
2) Defect is a flaw that exceeds the cosmetic limit.

8.2.3 Definition of Classes

Class I : The area usually viewed by user.
Class II: The area occasionally viewed by user.
Class III: The area seldom viewed by user.

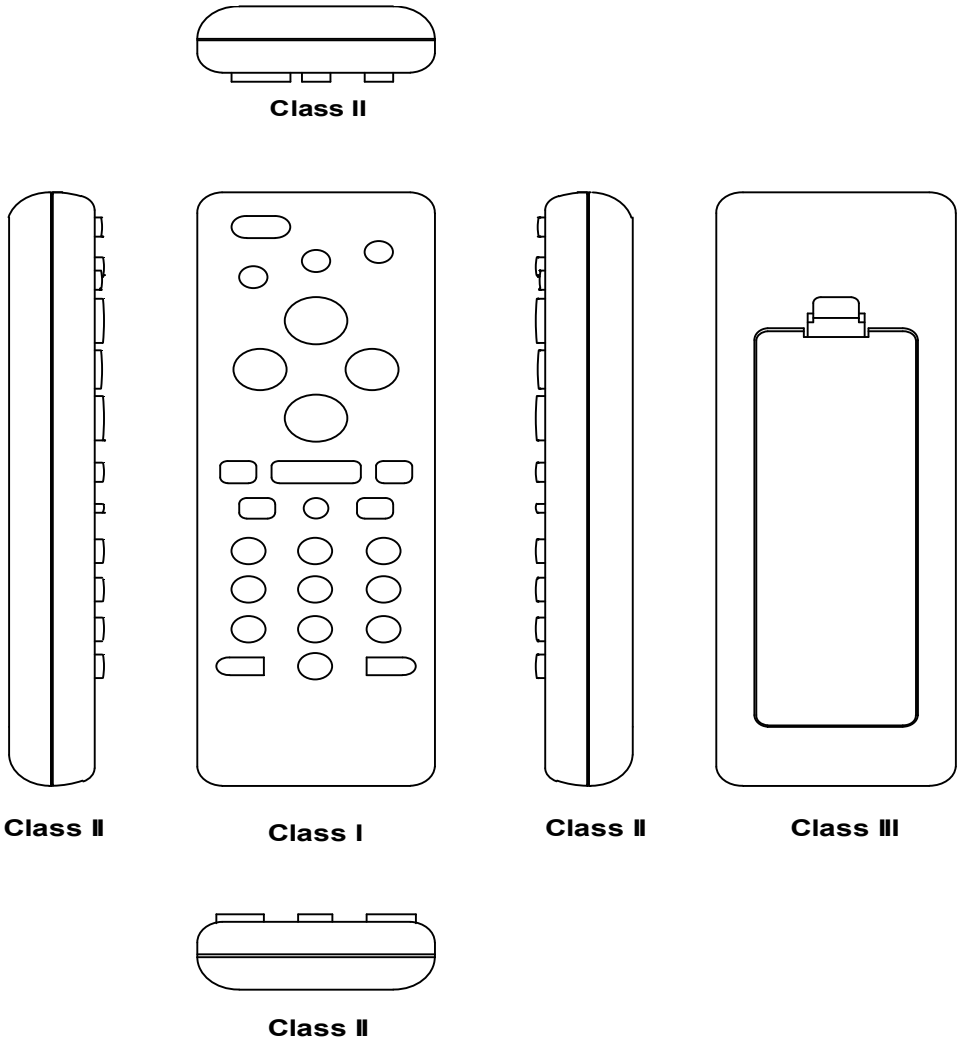


Figure 2: Definition of Classes

8.2.4 Cosmetic Evaluation

Part must not be "pre-inspected" at a distance closer than that allowed in the Viewing Angle and Distance criteria.

8.2.4.1 All Classes

General: Blush marks, burns, pits, pulling, short shot, silver-streaks, slay, and weldlines are not acceptable.

Cleanliness: Part must be free of dust, oil, grime, grease, and other contaminants. Dust caused by shipping material is acceptable if it can be blown off by air or wiped off.

8.2.4.2 Class I- Acceptable Flaws table

Maximum Inspection Time: 10 seconds

Type	Size	Qty
Parting Line Flash	0.15mm	1
Key Opening Flash	0.05mm	per opening
Mismatch	0.15mm	1
Scratches (within texture depth)	1.5x0.2mm	3
Contamination	0.5mm	4
Sink	not allowed	

8.2.4.3 Class II- Acceptable Flaws table

Maximum Inspection Time: 5 seconds

Type	Size	Qty
Parting Line Flash	0.15mm	1
Mismatch	0.15mm	1
Scratches	2.0x0.2x0.3mm	4
Contamination	0.8mm	4
Sink	0.2mm	2

8.2.4.4 Class III- Acceptable Flaws table

Maximum Inspection Time: 5 seconds

Type	Size	Qty
Parting Line Flash	0.15mm	1
Mismatch	0.15mm	1
Scratches	3.0x0.2x0.4mm	3
Contamination	1.0mm	4
Sink	0.5mm	3

8.2.4.5 Defects

- Any flaw that exceeds the limit of the above flaw table is a defect.
- Any two flaws on a given surface closer than 25mm is a defect.
- No more than three types of flaws are allowed on any one surface.

8.3 Durability Testing

8.3.1 Structure and Strength

- The plastic parts shall withstand a 5 kg compressive force for 3 seconds at several points without any physical damage by using a Slimline force gauge McMaster P/N 1365T24 (See Appendix, Figure C).
- The plastic parts shall withstand a bending force of 3 kg for 3 seconds applied at the ends of the plastic assembly by using a Slimline force gauge McMaster P/N 1365T24 (See Appendix, Figure D).
- The keypad buttons shall withstand a 3kg over activation load vertically for 3 seconds by using a Slimline force gauge McMaster P/N 1365T24 (See Appendix, Figure E).
- The base of the keypad must not be exposed from the key opening after the 1.5kg lateral force is applied by using a Slimline force gauge McMaster P/N 1365T24 (See Appendix, Figure F).
- The keypad shall not be damaged in normal operation using pen, pencil, or fingernail.

8.3.2 Printing

- All text printed on plastic surfaces or switch buttons must withstand normal shipping and handling.
- All printed legends must pass the Scotch Super strength packaging tape (3M cat no. 3506) test. Scotch tape is applied on the test surface and then removed three times at a 45° angle (each time a new tape). The printing shall not exhibit evident defects such as flaking, chipping, blistering, or de-lamination.
- All printed legends on plastic surfaces and keypad must be readable after being subjected to 500 cycles of abrasion @ 500 gram load with standard 100% cotton cloth as test piece.

8.3.3 Battery Contact

- All forms of battery contacts, such as coiled spring and stamped spring, must not be permanently deformed after the drop test.
- The batteries must remain in contact after being inserted/removed 20 times.
- The battery door must maintain its closing/latch integrity after being inserted/removed 20 times.

8.3.4 Painting wear test (if necessary)

The base plastic material cannot be shown after being subjected to 2000 cycles of abrasion @ 500 gram load with standard STAEDTLER eraser as test piece.

8.3.5 Rubber coating wear test (if necessary)

The base plastic material cannot be shown after being subjected to 2000 cycles of abrasion @ 500 gram load with standard STAEDTLER eraser as test piece.

8.3.6 Epoxy key test

8.3.6.1 Reliability tests

- Adhesion test (see Figure G):
  The key with epoxy top will be cut 1mm between the epoxy top and silicon rubber, then peeled off by finger. More than 50% of silicon must be attached to the epoxy top.

- Impact resistance test (see Figure H):
  At room temperature, a 1.5-kg load will be dropped vertically onto the epoxy surface from 50cm high. There should be no visible crack or delamination.

- Ultra-violet resistance test:
  The key with epoxy top will be tested per ASTM–D1148 method B for 2 hours. There should be no sign of de-laminating, cracking or discoloration.

- Heat resistance test:
  After the test-piece is exposed to 100°C for 12 hours, there should be no change of transparency and color.

- Lateral load test (see Figure J):
  There should be no delamination between the epoxy and the rubber key when 2-kg lateral load at any point on the epoxy and rubber key common edge.

- Life test:
  The key with epoxy encapsulated will be tested for 500,000 cycles with 250 grams force at 120 cycles per minute. There should be no visible delamination.

8.3.6.2 Cosmetic tests

See Section 6.2.1.

1. There should be no overflow larger than 0.15mm, and void (bubble) larger than 0.04mm.

2. There should be no visible scratch, crack, cloudy (milky) spot, foreign objects such as fiber, dust, etc.

9 ENVIRONMENTAL & SHOCK REQUIREMENTS

9.1 Temperature

Operating range:
0°C to +50°C

Non-operating range:
-10°C to +60°C

9.2 Humidity Test

The unit under evaluation will be exposed to 40±3°C, 95% relative humidity, non-condensing for 24 hours without batteries or power. Functional tests will be performed after the HRC has stabilized at normal room conditions for two hours.

9.3 Low Temperature Test

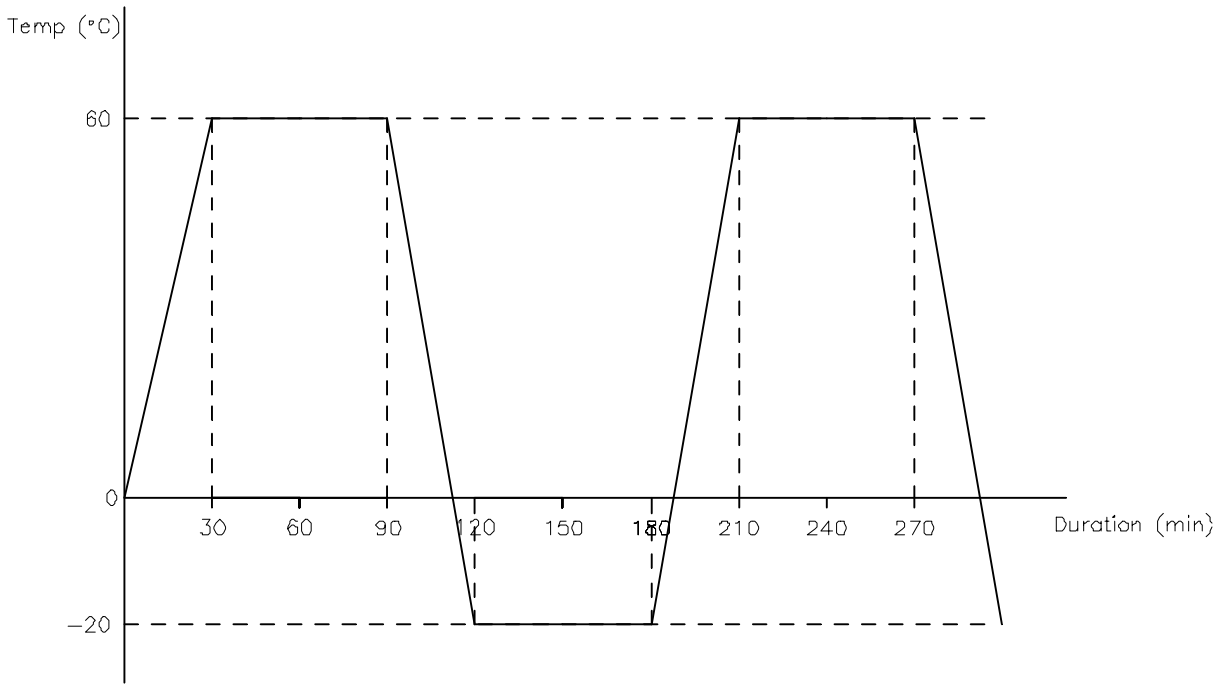
The unit under evaluation will be exposed to -20±3°C for 24 hours without batteries or power. Functional tests will be performed after the HRC has stabilized at normal room conditions for two hours.

9.4 High Temperature Test

The unit under evaluation will be exposed to 60±3°C for 24 hours without batteries or power. Functional tests will be performed after the HRC has stabilized at normal room conditions for two hours.

9.5 Thermal Shock

The unit under evaluation (no batteries or power) will be subjected from -20°C to 60°C for 5 cycles with a dwell time of 1 hour at high and low temperature (as shown below). Functional tests will be performed after the HRC has stabilized at normal room conditions for two hours.



9.6 Drop Test

The unit under evaluation must withstand one drop from 36 inches on six surfaces and four corners onto hardwood flooring (suggested 0.75" thick oak). For further specification details, see UEI Spec. #0005-0005.

For a product with three batteries or less, the battery door and batteries should not be dislodged during the test.

9.7 Solvent Resistance

The unit under evaluation shall not be deformed or disfigured in any way by the application of 409 All Purpose Cleaner with 0.3% Alkyl dimethyl benzyl ammonium chloride or Windex with Ammonia-D to any exposed surfaces. Caustic solvents and cleaners such as porcelain, stainless, toilet or oven cleaners shall not be used. Apply two (2) sprays of the cleaner directly onto any surface. The unit is then cleaned by wet towel after five (5) minutes drying.

9.8 Liquid Spill

Eight (8) ounces of black coffee (no sugar added) will be poured over the keypad area at an angle of 30 degrees inclined (normal remote holding position). The unit with batteries installed is then turned up side down for five (5) seconds to allow coffee to drip off. The test sample must function properly after 48 hours stabilization.

10 Standard Compliances

10.1 ESD Protection

The HRC shall meet the following ESD profile per UEI Specification 0020 based on IEC 801-2.

10.2 FCC

Optoma will certify the complete unit with remote and keyboard.
With documentation and possible engineering support to Optoma from UEI.

11 Rendering

I N S T R U C T I O N S M A N U A L

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 euipment into an outlet on a circuir 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 his device could void the user's authority to operate the equipment.

The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. End-users and installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance