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1 INTRODUCTION

This specification provides the user-interface design of the following watch(es) (hereafter watch"):

- KC Calverton BLE Watch

All information specific to the watch that is necessary to program the embedded microcontroller IC is provided by this document.

2 FEATURES AND FUNCTIONS

The watch shall possess the following features and functions:

Bluetooth Low Energy Application with mobile phone

- Immediately Alert of application event for mobile phone, include Incoming call and Missed call, Incoming Email, SMS, MMS and Instant Message
- Calendar / Schedule Reminder and Simple Alarm Alert
- Proximity Alert between Watch and Mobile Phone
- Find Me each other in Watch and Mobile Phone
- Low Battery Alert for Mobile phone
- Low Battery Alert for Watch
- 3 customized commands which can be used as event trigger in mobile phone.
- Display sport information form Mobile App.

Time & Date

- Time displayed in 12H or 24H format
- Date inquire in Month/Date and Day of Week
- 100 years auto calendar

World Time

- 32 cities zone
- Time displayed in 12- or 24-hour format(Same as Local time setting)

Chronograph

- 1/100-second resolution up to 99h59'59"99

Count Down Timer

- 1-second resolution count down Timer.
- Max preset data as 23h59'59"

Electroluminescent (EL) backlight of LCD

- 3 seconds backlight after release the LIGHT button

Buzzer & Vibration Motor

- Optional set of buzzer and vibration for all alert output

3. Inputs and Outputs

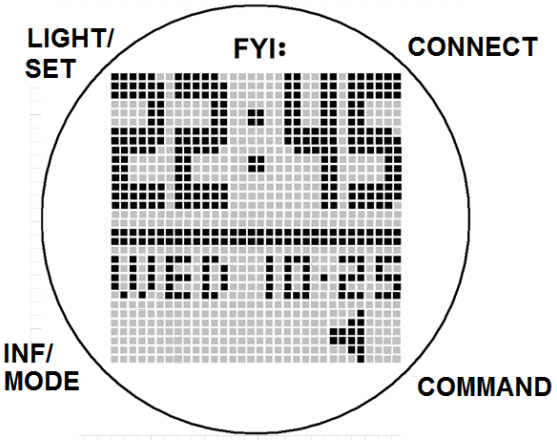
3.1. Manufacturing Option Inputs

N/A

3.2. Switches

The watch shall possess four switches, the definition as below:

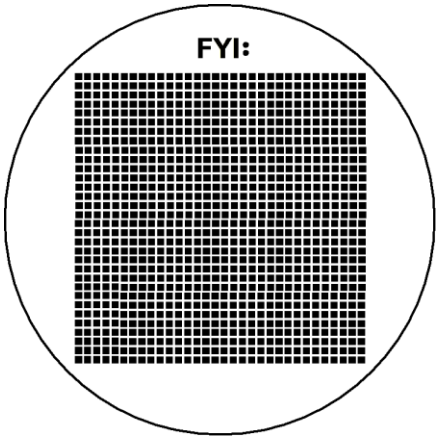
[LIGHT/SET]: Active Backlight or set state entry
[INF/MODE]: Acknowledge BLE application event or change function mode
[CONNECT]: Turn On/Off BLE module
[COMMAND]: Toggle Alert presetting or Start/Stop Timing function (Chrono or Timer), Send Command



3.3. LCD

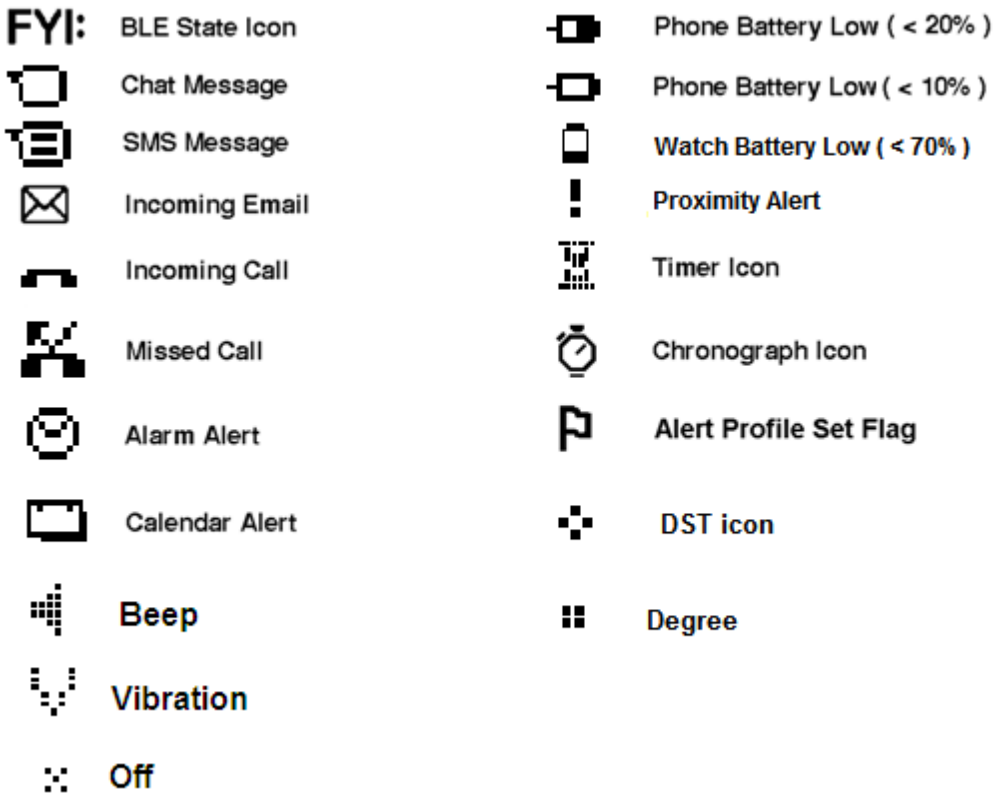
3.3.1 LCD Segment Layout

The LCD segment layout is shown below with all segments on.



3.3.2 LCD Flags

There are some application icons are defined as below:



3.4. Piezoelectric Buzzer

The watch shall possess a piezoelectric buzzer for producing tones to provide audible feedback for actions to alert the user various conditions.

All tones and melodies are defined in Appendix A

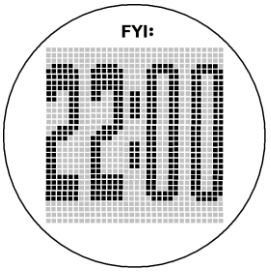
3.5 Vibration Motor

There is micro motor in watch which optional used for producing vibration to provide feedback for actions and to alert the user to various conditions.

4. OPERATION

4.1 Display scene

In TOD mode, and no button operation within 60s, automatically enter the scene mode, There are two modes can choose.



(Digital)

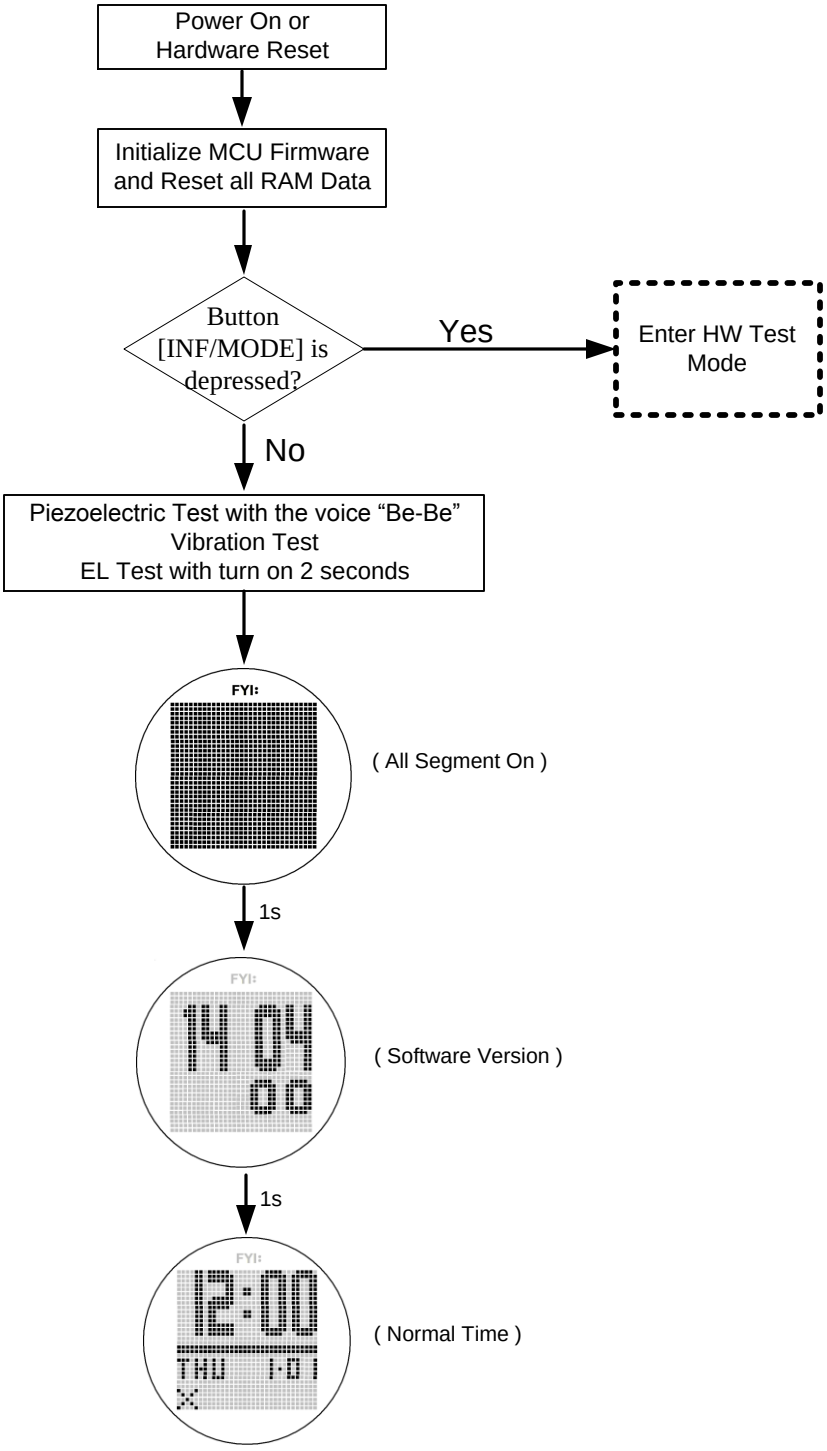
(Wordy)

4.2 Microcontroller Reset

There shall be 2 methods of causing a microcontroller reset:

- Applying power to the microcontroller (Power On Reset)
- There is a RESET pad in PCB board, Short this pin to VDD and hold over than 0.3 second will Reset the module. It is called ‘Hardware Reset”

The operation after microcontroller reset is described in below diagram.



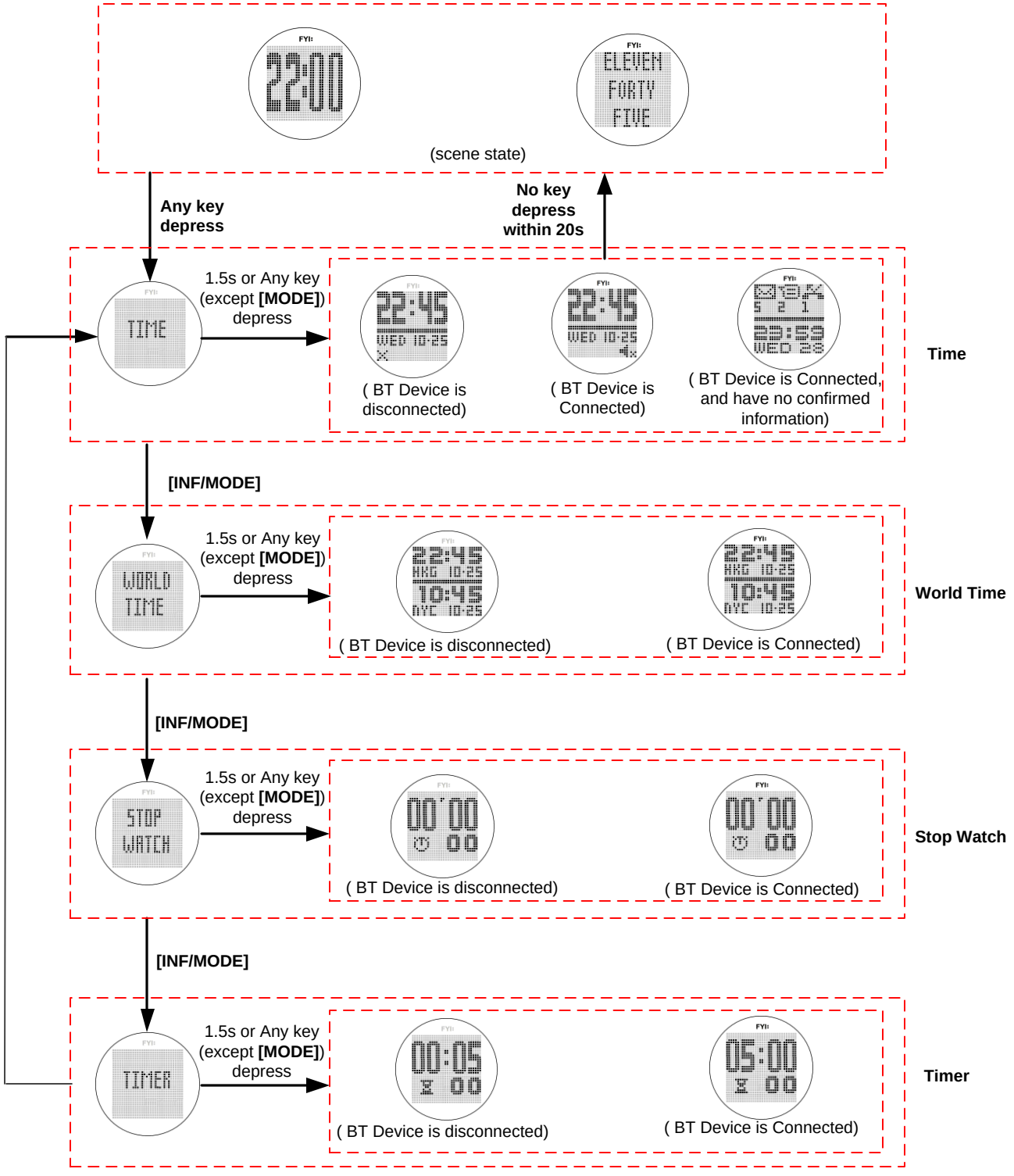
4.3 Mode Architecture

The watch shall employ the classic mode architecture for navigation between modes, whereby Time mode is the default mode and the user may click **[INF/MODE]** button repeatedly to access other modes.

The watch consist of 5 different modes. These are:

- Time of Day (Primary Time)
- World Time
- Chronograph
- Timer
- Test (For manufactory test only)

The mode sequence shall follow the order below.
(Test Mode is a special mode which is not described here)

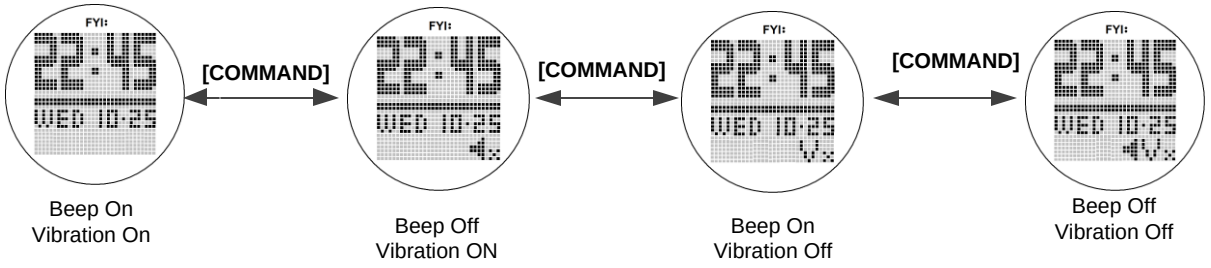


4.4 BLE Application

In any mode except Test mode, user can turn On/Off the BLE module, and under connected state, the watch can receive the application event from other device (Mobile phone) and send out the relative respond.
(Following diagrams are all sampled in Time Mode)

4.4.1 Alert Switch Preset

When Bluetooth module is turned ON, and under Time display state, user can preset the alert output switch of BLE application event, and all event alert will be overrided by this setting.
The details operation is described as below.



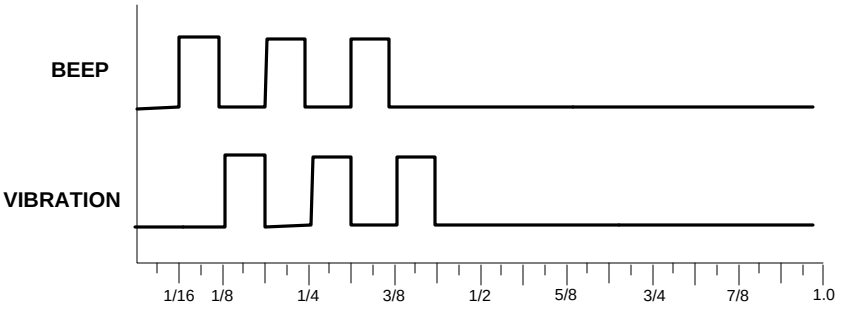
4.4.2 Alert Action Definition

There are two type of alert action which used for Bluetooth application event. They are defined as:

Short Alert, Two times of beep or (and) vibration for this action

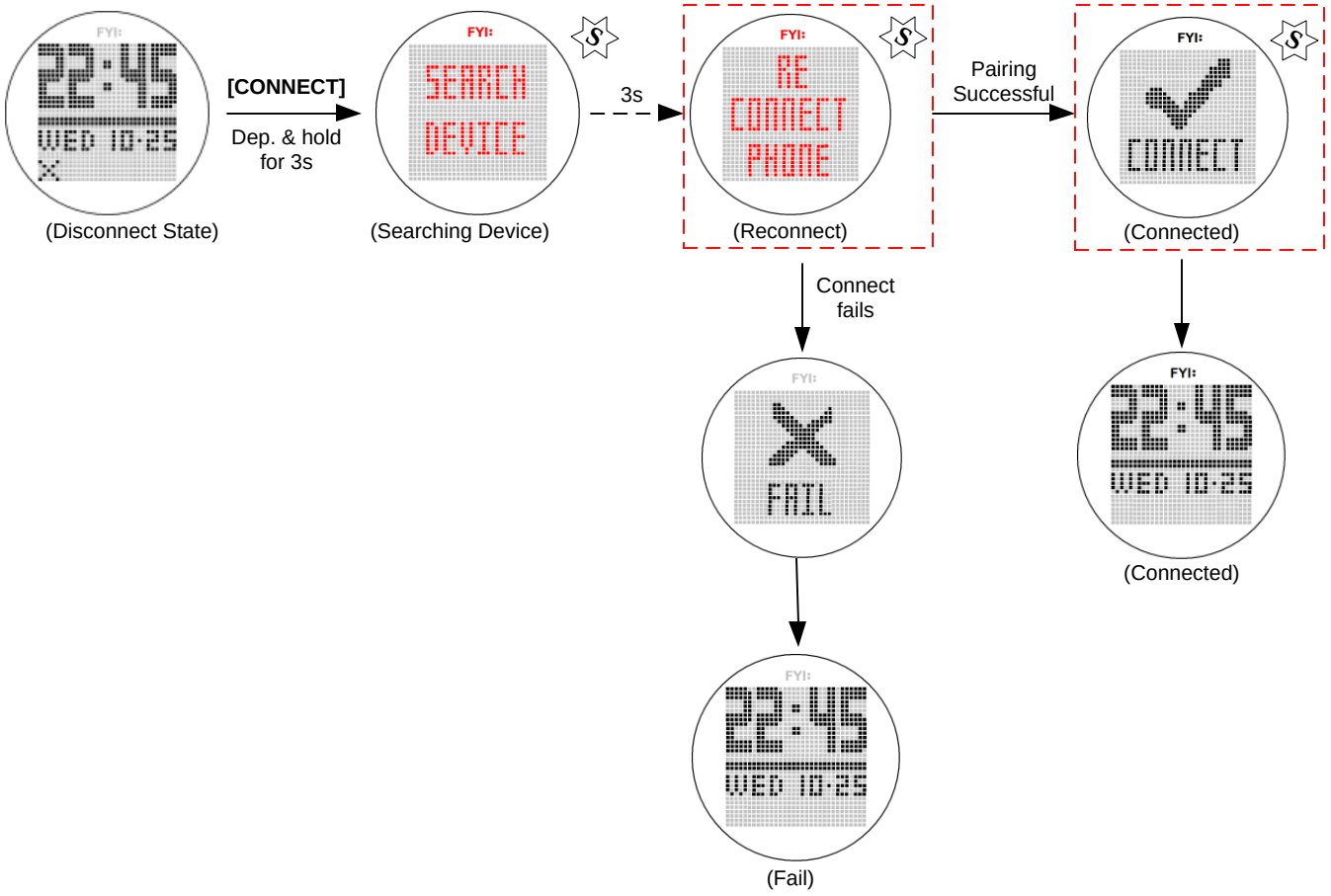
Common Alert, three times of short beep or (and) vibration for this action

For reduce the power drain of battery, when alert switch set as both ON and an application event is generated, Beep and Vibration are not acted together, the output sequence will be: (Sampled with Common Alert)



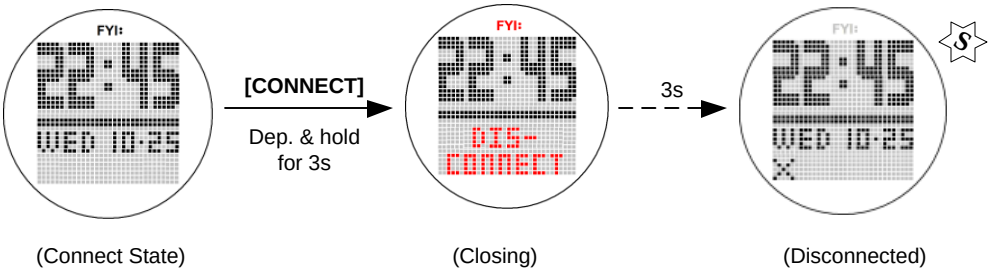
4.4.4 Connect / Disconnect Operation

Connect Operation Flow



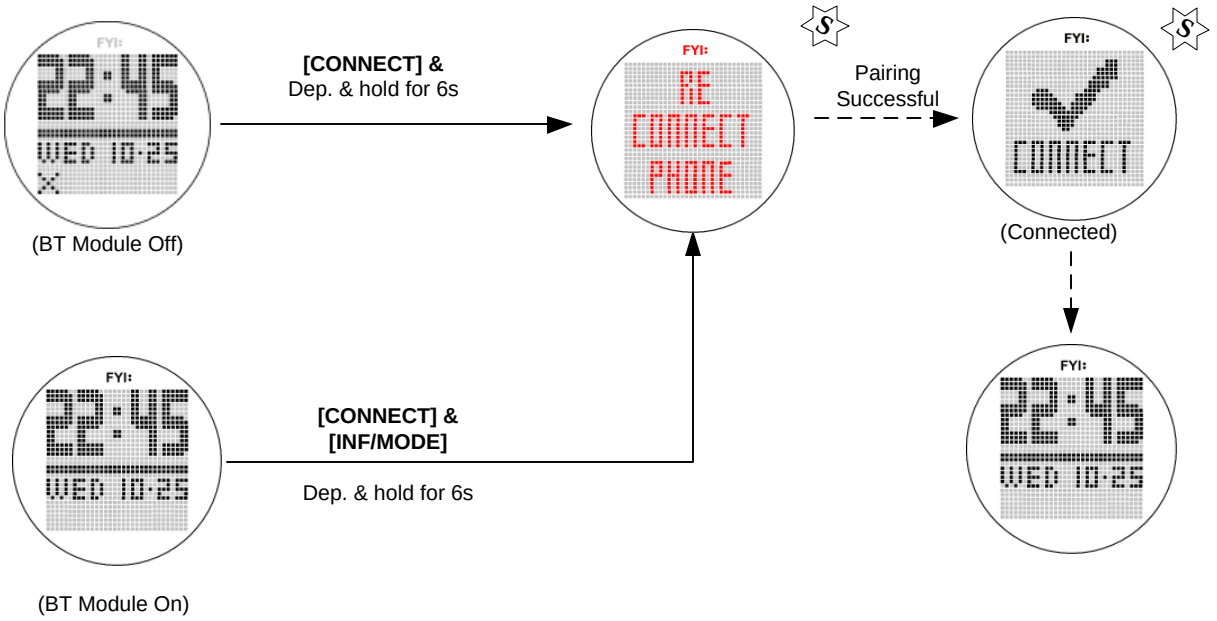
Notes: 1. If no device is detected or pairing is failure, icon FYI is always blinking until user stop this operation through depress and hold button [CONNECT] by 2 seconds.
2. In above diagram, Vibration & Beep all are set as ON.
3. Any icon is red that mean it is blinking with frequency 2Hz
4. After 10 minutes, the linking is still not successful, watch will force to turn off BLE module.

Disconnect Operation Flow



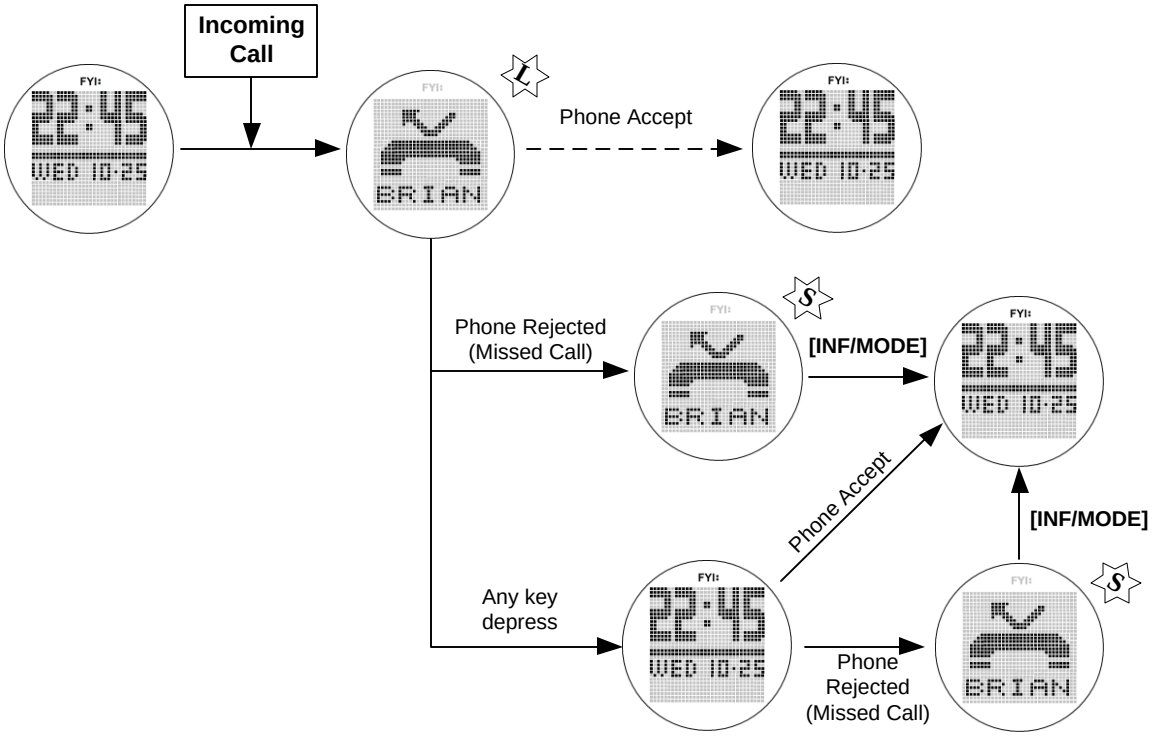
Notes: 1. In above diagram, Vibration & Beep all are set as ON.
2. Any icon is red that mean it is blinking with frequency 2Hz

4.4.5 Pairing Operation



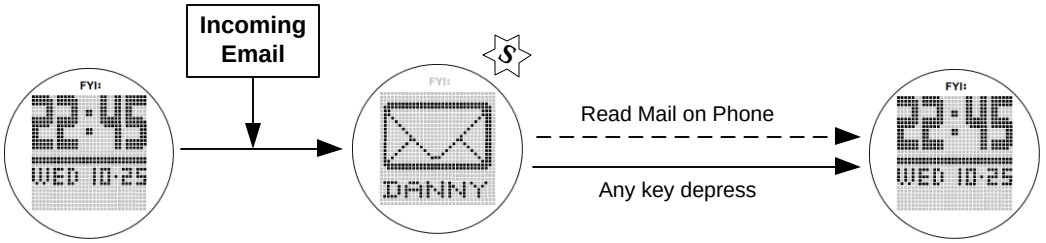
Notes: 1. In above diagram, Vibration & Beep all are set as ON.
2. Any icon is red that mean it is blinking with frequency 2Hz
3. If paring is not successful for 10 minutes, watch will stop the linking and turn off BLE module.

4.4.6 Calls



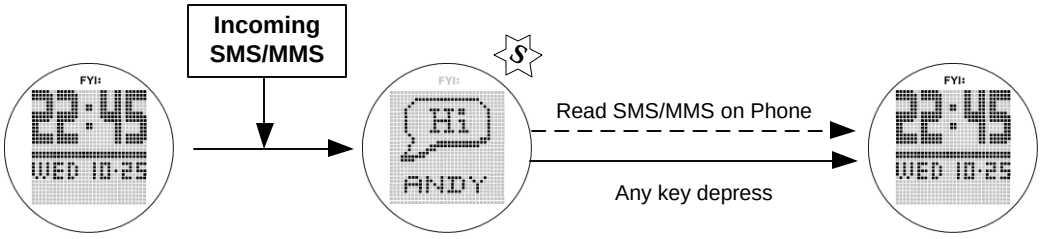
Notes: 1. In above diagram, Vibration & Beep all are set as ON.
2. Any icon is red that mean it is blinking with frequency 2Hz

4.4.7 Emails



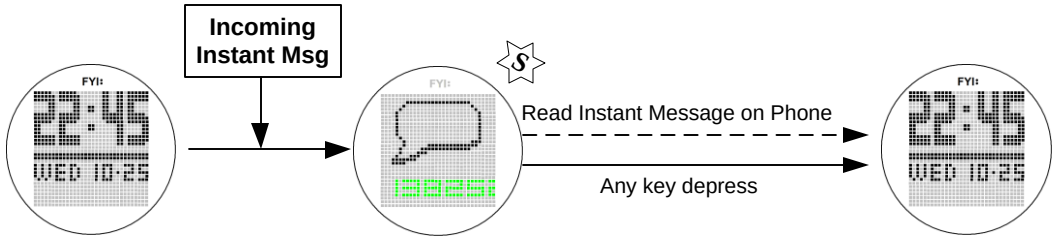
Notes: 1. In above diagram, Vibration & Beep all are set as ON.
2. Any icon is red that mean it is blinking with frequency 2Hz

4.4.8 SMS/MMS



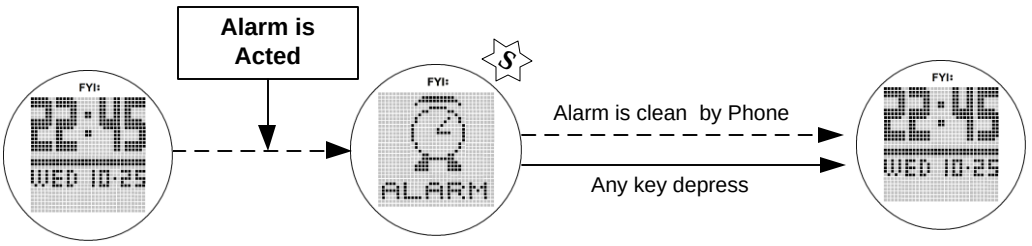
Notes: 1. In above diagram, Vibration & Beep all are set as ON.
2. Any icon is red that mean it is blinking with frequency 2Hz

4.4.9 Instant Message



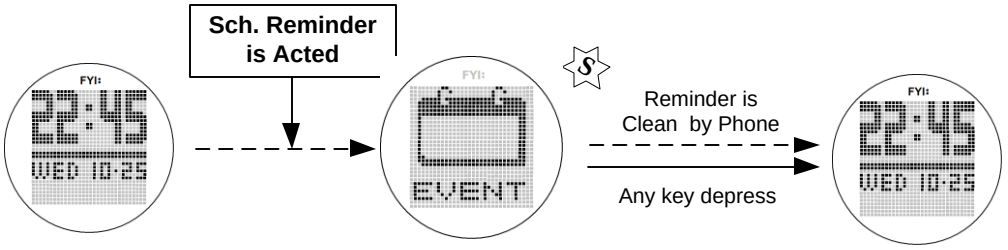
Notes: 1. In above diagram, Vibration & Beep all are set as ON.
2. Any icon is red that mean it is blinking with frequency 2Hz

4.4.10 Alarm (Mobile Phone)



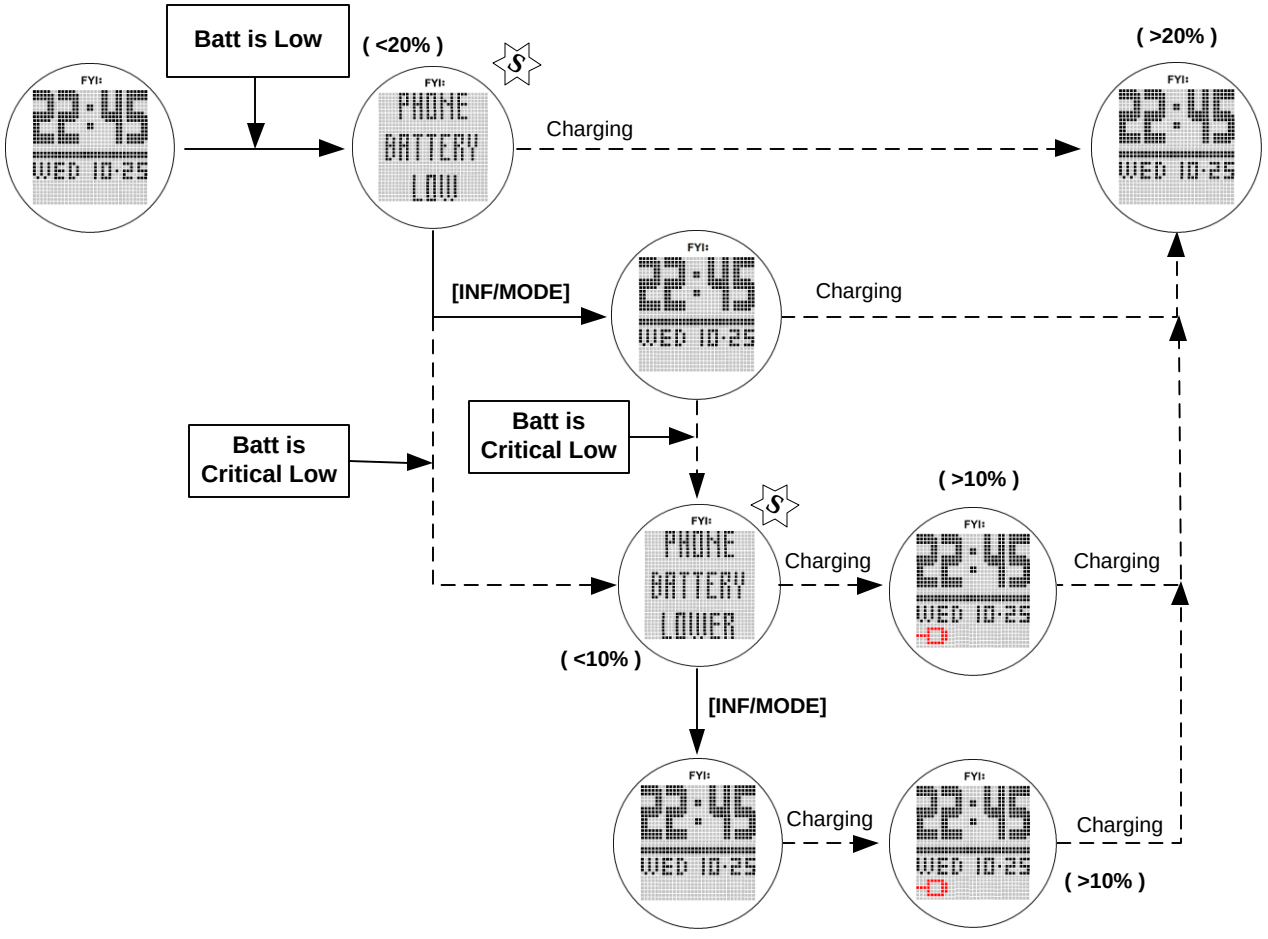
Notes: 1. In above diagram, Vibration & Beep all are set as ON.
2. Any icon is red that mean it is blinking with frequency 2Hz

4.4.11 Calendar Alert / Schedule Reminder



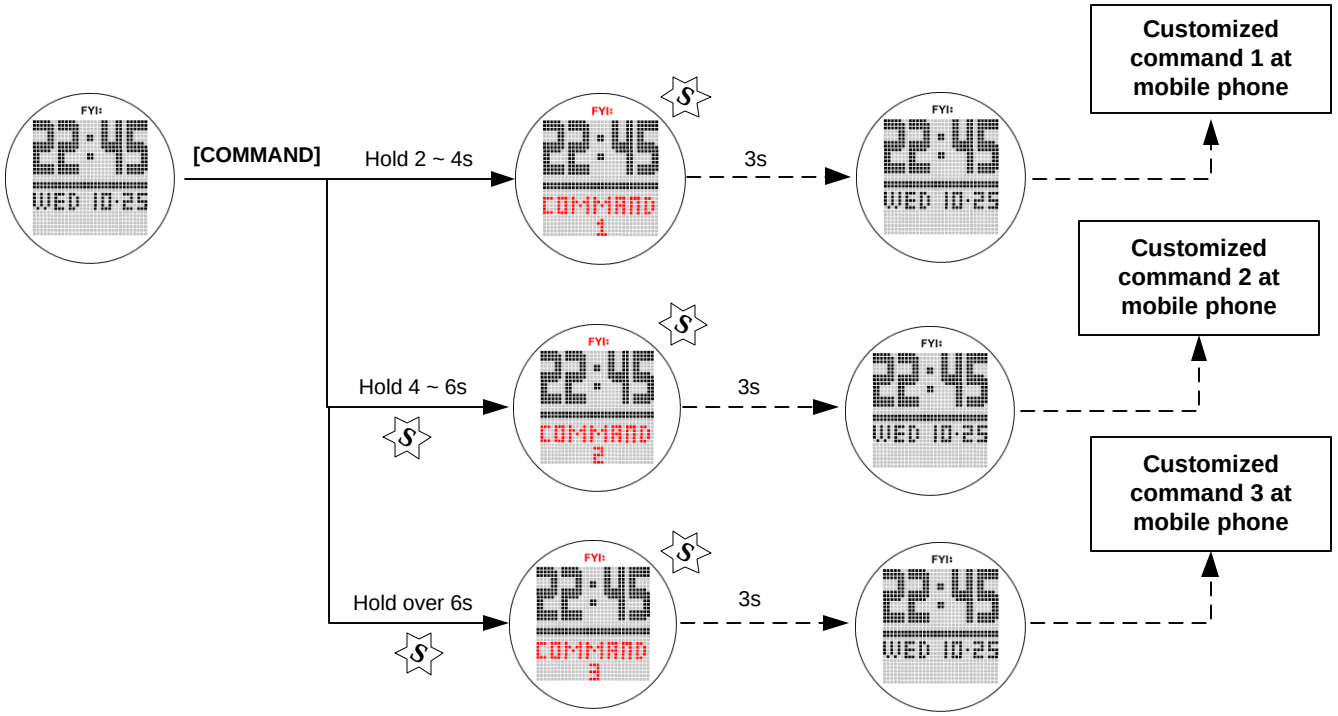
Notes: 1. In above diagram, Vibration & Beep all are set as ON.
2. Any icon is red that mean it is blinking with frequency 2Hz

4.4.12 Battery Low (Mobile Phone)



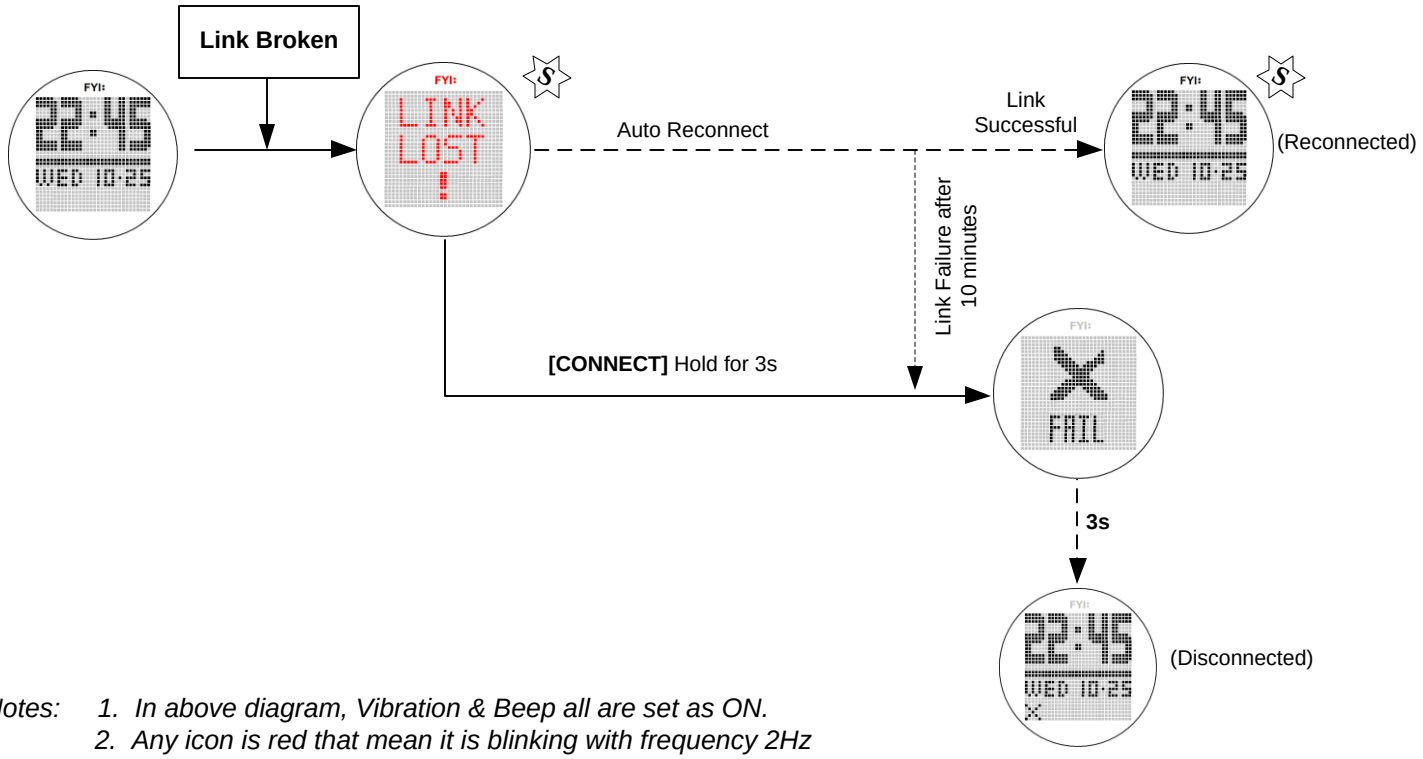
Notes: 1. In above diagram, Vibration & Beep all are set as ON.
2. Any icon is red that mean it is blinking with frequency 2Hz

4.4.13 Notification



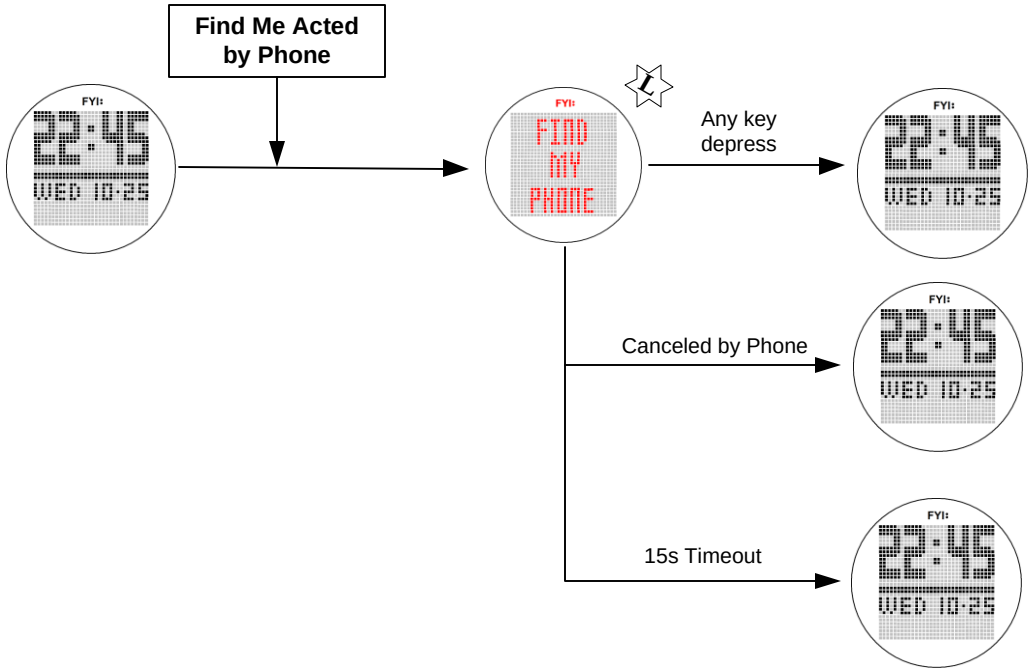
Notes: 1. *In above diagram, Vibration & Beep all are set as ON.*
2. *Any icon is red that mean it is blinking with frequency 2Hz*

4.4.14 Proximity Alert



Notes: 1. *In above diagram, Vibration & Beep all are set as ON.*
2. *Any icon is red that mean it is blinking with frequency 2Hz*

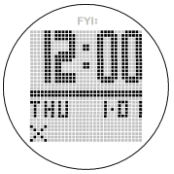
4.4.15 Find Me Alert



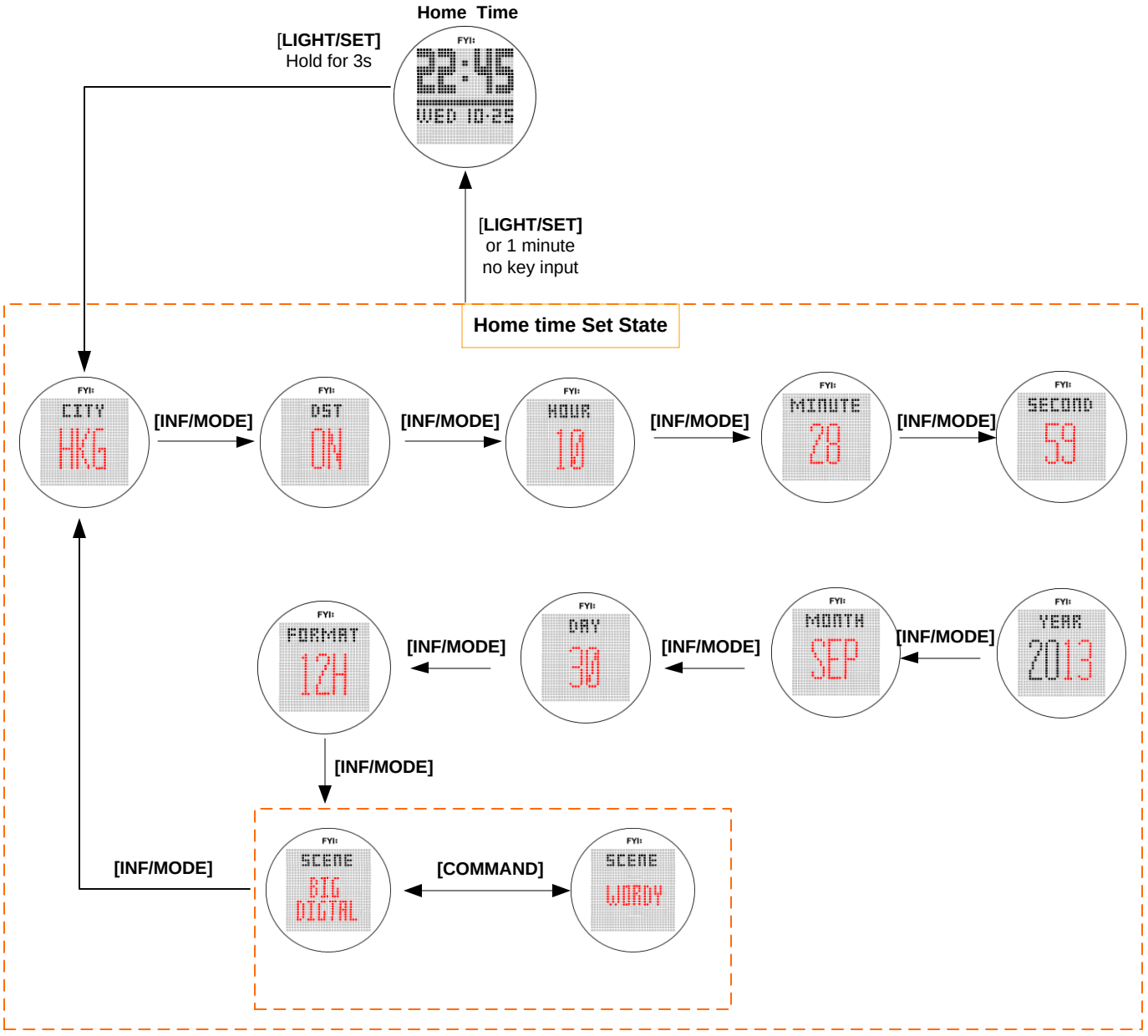
Notes: 1. *Once there is an event of Find Me, the watch will output responding beep and keep it in active until it is force to stop by button depression, event cancel from phone or time expired.*
2. *In above diagram, Vibration & Beep all are set as ON.*
3. *Any icon is red that mean it is blinking with frequency 2Hz*

4.5. Time Mode

Mode data shall be initialized as follows:
Home time : 12:00 AM; January 1, 2013; Sunday, 12H; MM-DD format; NYC
Initial Home time display as below:



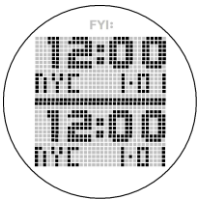
The operation in Time mode is described as below



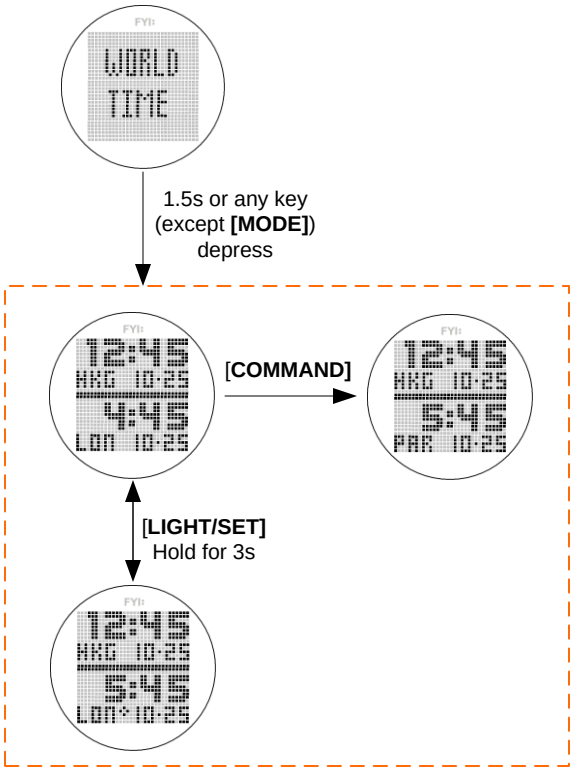
Note:
1. In above diagram, the red digits or icon that mean it is blinking with 2Hz refresh rate.
2. In all set fields except Hour Format and Seconds, depress of [CONNECT] will increase the set value and [COMMAND] will decrease the set value.
   Depress and hold these buttons for 3 seconds will fast adjust the value with 8 per second.
3. Depress of [CONNECT] or [COMMAND] in Seconds setting will force the second data as zero, and for Hour Format setting, the set data will be 12H or 24H.
4. 1 Minute no any user input will exit to default state automatically.

4.6 World time Mode

Mode data shall be initialized as follows:
World time : 12:00 AM; January 1, 2013; Sunday, 12H; MM-DD format; NYC
Initial World time display as below:



User can inquire total 32 cities real time which covered most for each city zone, user also can turn on/off the DST switch. The operation like below.



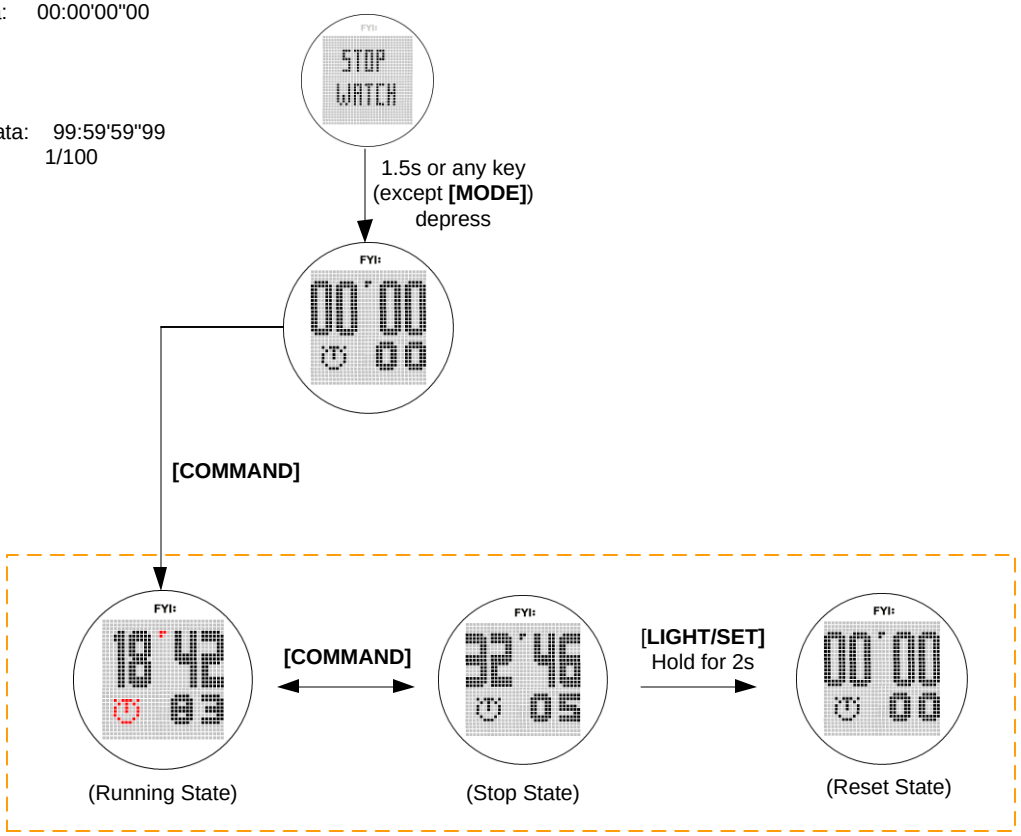
4.7 Chronograph Mode

Initial conditions:

Reset Data: 00:00'00"00

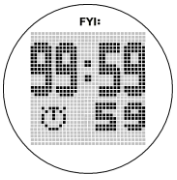
Data Range:

Runout Data: 99:59'59"99
Precision: 1/100



Noted: 1. When the chrono data is less than one hour, it will display as Minute, Second and centisecond, but once it is arrived one hour, the display will be Hour, Minute and Second. Like below:

2. When the chronograph is run out, it will be auto stopped at 99h59'59"99, the display like below:



3. In above diagram, the red digits or icon that mean it is blinking with 2Hz refresh rate.

4. In Chronograph RESET state, no any user input for 3 minutes, it will return to Time mode automatically.

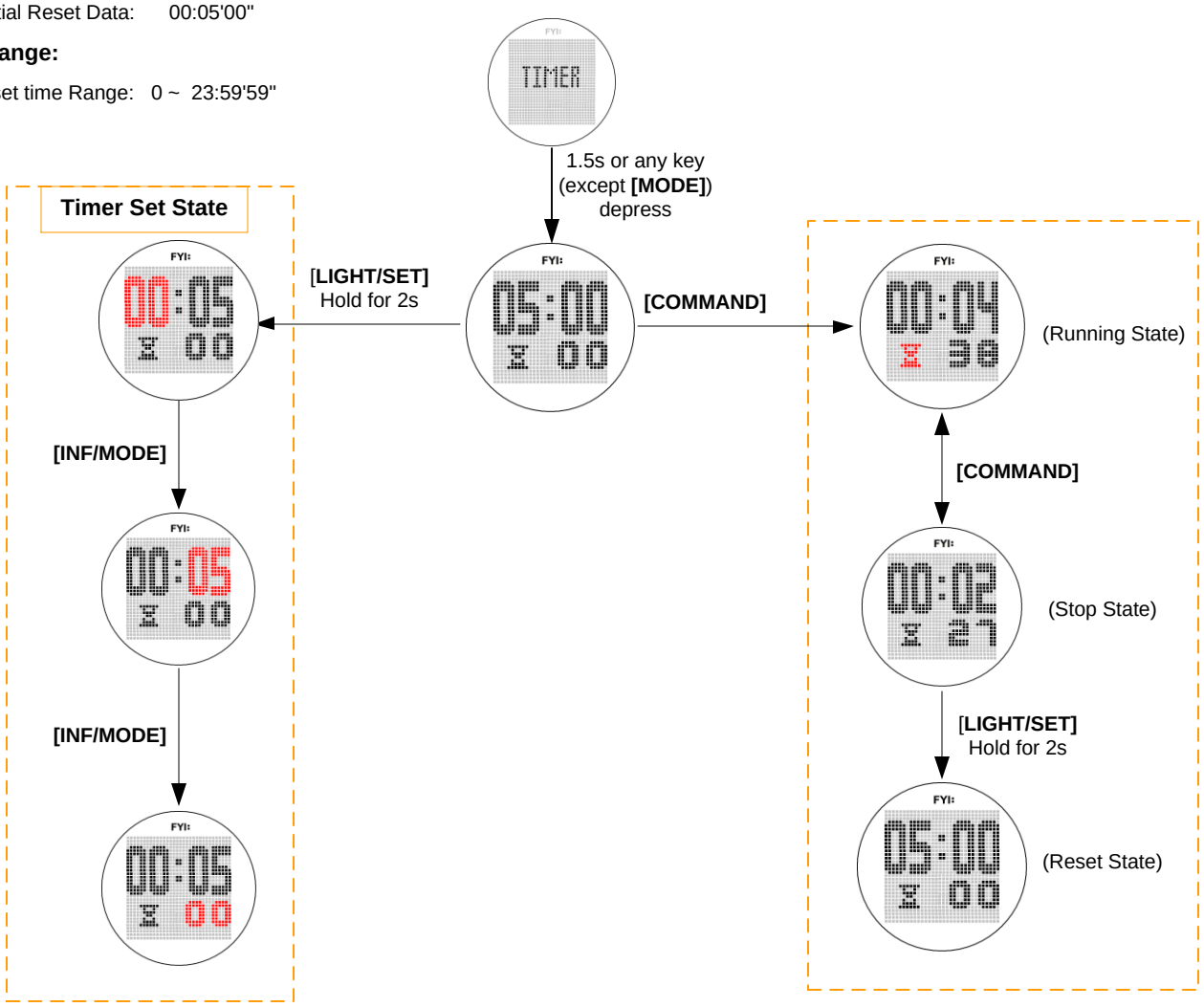
4.8 Timer Mode

Initial conditions:

Initial Reset Data: 00:05'00"

Data Range:

Preset time Range: 0 ~ 23:59'59"

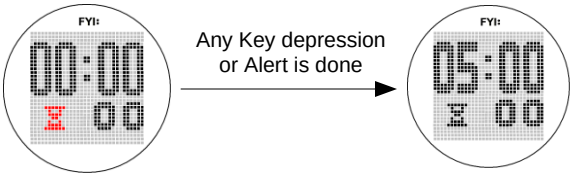


Notes: 1. Once upon enter Timer set state, Hour is blinking as the default set item. Depression of **[INF/MODE]** will change the setting field.

2. In Timer Set state, depression of **[CONNECT**] or **[COMMAND]** will increase / decrease the value of current item. And hold those buttons over 3 seconds then enter advance adjust state with 8 times per second.

3. No more user input for 30 seconds in set state, it will auto return to Time mode.

4. Once Timer is count down to zero, it will stop automatically and a the alert action is generated for 20 seconds, once the alert is done or press any button during alert, it will return to RESET state. the display as below:

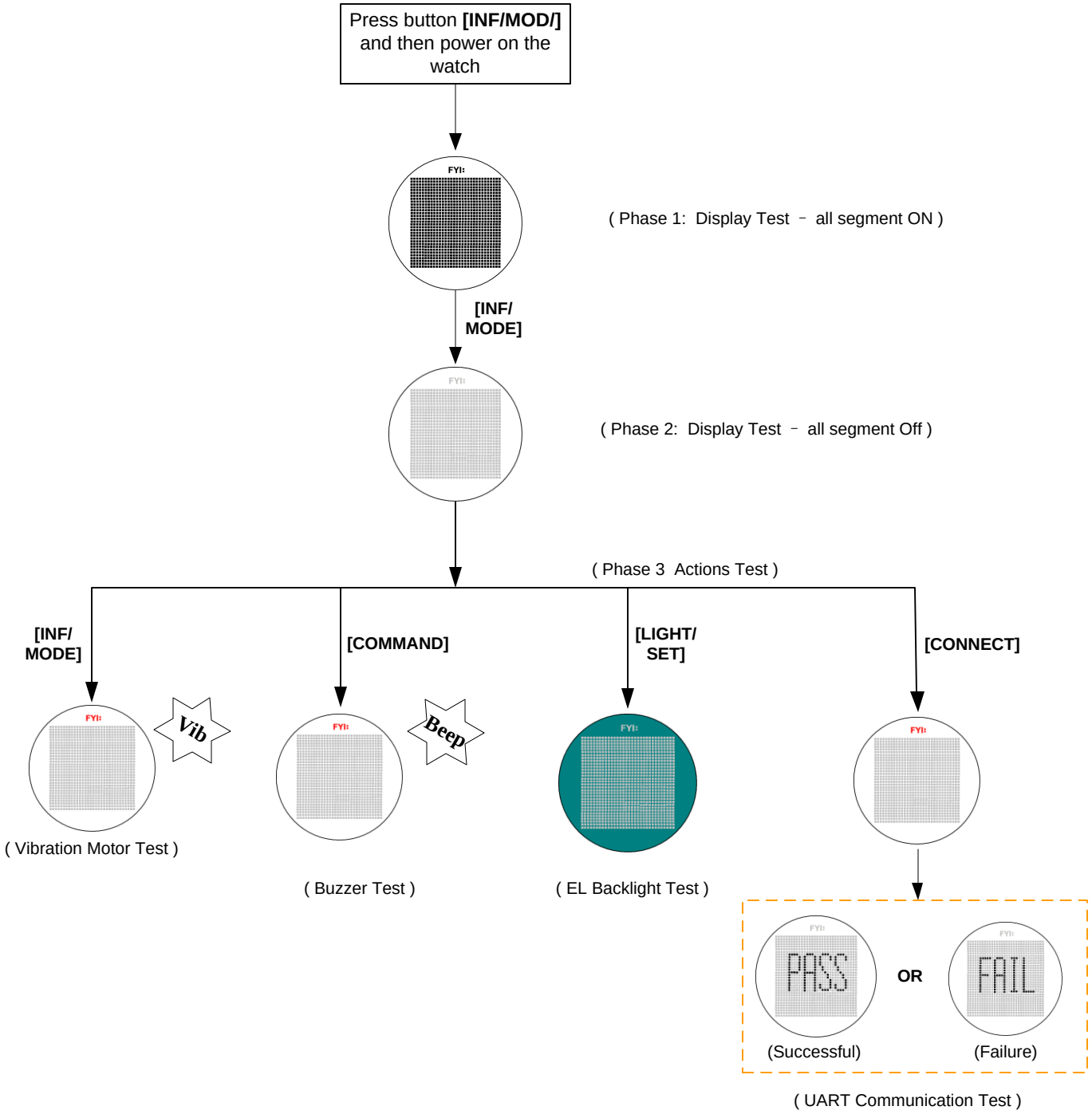


5. In above diagram, the digits or icon is red that means it is in flash with 1Hz refresh rate.

6. Once Timer is stay in RESET state, no any user input for 3 minutes, it will return to Time mode automatically.

4.10. Test Mode

Depress of button [MODE/ACK] and then reset the watch, it will enter a special Test Mode which will test all peripheral device. The test flow like below:



5. Global Rules

5.1. Blinking

-- All fields that are set shall be blinking at the rate of 2Hz with 50% duty cycle, meaning that a field is display at 500ms and cleared at 500ms.

5.2. Auto Return

-- In all set state, when have no any operation for 60 seconds, it will exit from set state with the confirmation of current setting.

-- In Chrono mode, except the chronograph is running, it will auto return to Normal Time mode after 3 minutes without any user I input.

-- In Timer mode, except the timer is running, it will auto return to Normal Time mode after 3 minutes without any user input.

5.3. Alert and Melody Description

-- An application alert is defined as a sound coupled to an application indicating to the user that something or an important event of the application should be watched over. These are BLE Application alert, Timer expire alert, etc.

When more than one alert are to be processed at the same time, the following hierarchy must be followed:

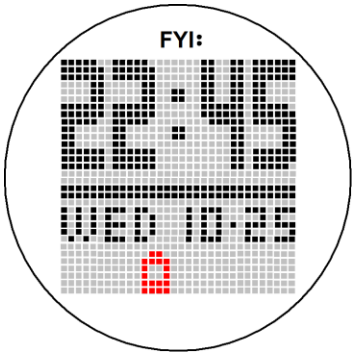
BLE Application Alert

Timer Alert

-- A Button press shall cancel any alert in progress.

5.4. Watch Battery low

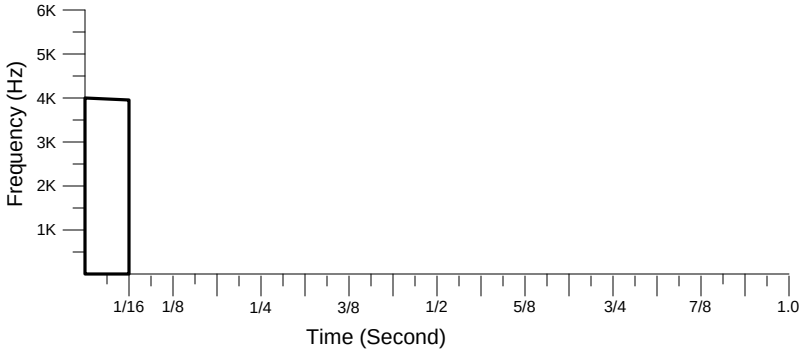
-- The MCU Supply Voltage Detection (SVD), and defined the SVD criteria voltage = 2, 7 volts.
Accuracy of this SVD = +/- 4%, When the supply voltage (battery voltage = Vbatt) is lower than the SVD criteria, the low battery icon is flashing.
The display as below:



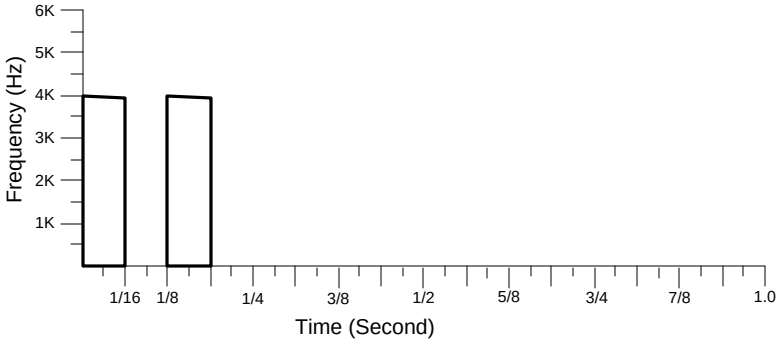
6. Appendix

6.1. Appendix A : Alert and Melody tones

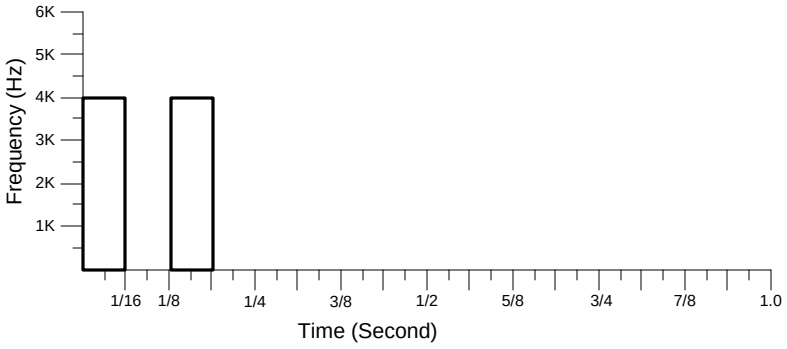
A : Button Beep



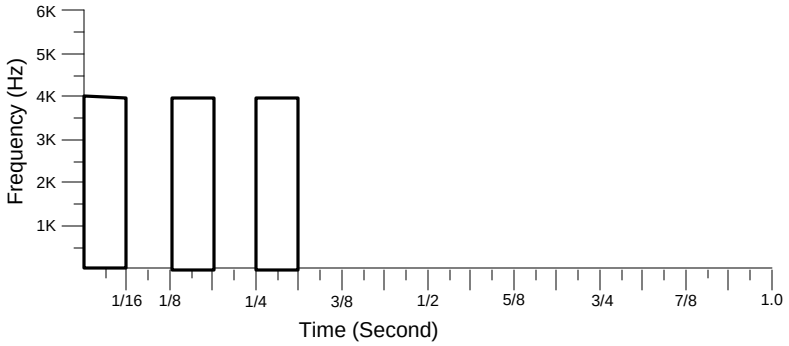
B : Confirmation Beep



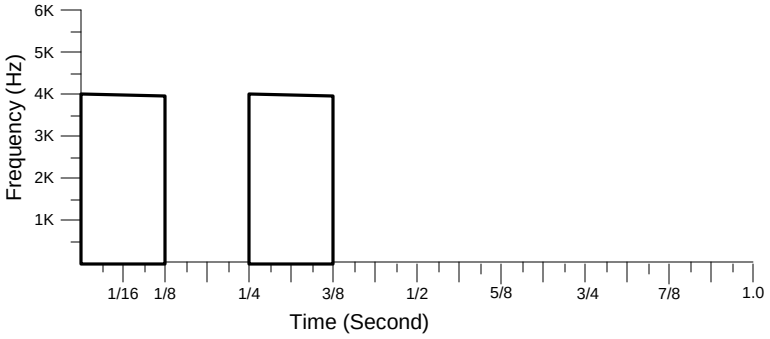
C : Immediately Alert Beep A



D : Immediately Alert Beep B



E : Timer Expired Alert



6.2. Appendix B : Keys Operation

		INF/MODE		CONNECT		COMMAND		LIGHT/SET	
		Press Once	*Press Hold*	*Press Once*	*Press Hold*	*Press Once*	*Press Hold*	*Press Once*	*Press Hold*
TIME	*Default State*	Ack Event/Next Mode	Alert Profile Preset	---	BT ON/OFF	Preset Alert Switch	Customized Functions (*1)	EL On	Set Entry
	Set State	Next Field	---	Adjust Up	Fast Adjust Up	Adjust Down	Fast Adjust Down	EL On	Set Exit
World Time	*Default State*	Ack Event/Next Mode	---	---	BT ON/OFF	Increment City	---	EL On	Toggle DST
CHRONO	*Reset State*	Ack Event/Next Mode	---	---	BT ON/OFF	Start Chrono	---	EL On	---
	Stop State	Ack Event/Next Mode	---	---	BT ON/OFF	Restart Chrono	---	EL On	Data Reset
	Running State	Ack Event/Next Mode	---	---	BT ON/OFF	Stop Chrono	---	EL On	---
TIMER	*Reset State*	Ack Event/Next Mode	---	---	BT ON/OFF	Start Timer	---	EL On	---
	Stop State	Ack Event/Next Mode	---	---	BT ON/OFF	Restart Timer	---	EL On	Data Reset
	Running State	Ack Event/Next Mode	---	---	BT ON/OFF	Stop Timer	---	EL On	---
	Set State	Next Field	---	Adjust Up	Fast Adjust Up	Adjust Down	Fast Adjust Down	EL On	Set Exit

*1: Hold 2 ~ 4s, Customized Function 1

6.3. APPENDIX C - WORLD TIME CITIES

All Digits/Characters in this project are defined as below

City code table

	GMT differential	City Code	City	Other major cities in the same time zone
1	-11	PPG	PAGO PAGO	----
2	-10	HNL	HONOLULU	PAPEETE
3	-9	ANC	ANCHORAGE	
4	-8	VAN	VANCOUVER	LAS VEGAS, SEATTLE, DAWSON CITY, SAN FRANCISCO
5		LA	LOS ANGELES	
6	-7	DEN	DENVER	EL PASO, EDMONTON
7	-6	ME	MEXICO CITY	HOUSTON, DALLAS/FORT WORTH, NEW ORLEANS WINNIPEG
8		CHI	CHICAGO	
9	-5	MIA	MIAMI	MONTREAL, DETROIT, BOSTON, PANAMA, CITY, HAVANA, LIMA, BOGOTA
10		NYC	NEW YORK	
11	-4	SAN	SANTIAGO	LA PAZ, SANTIAGO, PORT OF SPAIN
12	-3	RIO	RIO DE JANEIRO	SAO PAULO, BUENOS AIRES, BRASILIA, MONTEVIDEO
13	+0	LON	LONDON	DUBLIN, LISBON, CASABLANCA, DAKAR, ABIDJAN
14	+1	PAR	PARIS	MILAN, FRANKFURT, AMSTERDAM, VIENNIA, ALGIERS, STOCKHOLM, HAMBURG
15		MAD	MADRID	
16		ROM	ROME	
17		BER	BERLIN	
18	+2	IST	ISTANBUL	ATHENS, HELSINKL, BEIRUT, DAMASCUS, CAPE TOWN, JERUSALEM
19		CAI	CAIRO	
20	+3	MOW	MOSCOW	KUWAIT, RIYADH, ADEN, ADDIS ABABA, NAIROBI
21	+4	DBI	DUBAI	ABU DHABI, MUSCAT
22	+5	KHI	KARACHI	----
23	+5.5	DEL	DELHI	MUMBAI, KOLKATA
24	+6	DAC	DACCA	COLOMBO
25	+7	BKK	BANGKOK	JAKARTA, PHNOM PENH, KANOI, VIENTIANE
26	+8	SIN	SINGAPORE	KUALAUMPUR, TAIPEI, PERTH, BEIJING, MANILA, ULAANBAATAR
27		HKG	HONG KONG	
28	+9	TYO	TOKYO	PYONGYANG, SEOUL
29	+10	GUM	GUAM	MELBOURNE, RABAUL
30		SYD	SYDNEY	
31	+11	NOU	NOUMEA	PORT VILA
32	+12	WLG	WELLINGTON	CHRISTCHURCH, NADI, NAURU ISLAND

FCC statements:

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications or changes to this equipment. Such modifications or changes could void the user's authority to operate the equipment.

NOTE: 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.

Power is so low that no RF exposure calculation is needed.