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1 INTRODUCTION

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

- FS Surflin 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

- Proximity Alert between Watch and Mobile Phone
- Command control to phone. Which include:
 - Camera remote controller
 - Music player (Play / Pause / Next)
 - Find Phone
 - Tag Location

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)

Alarm

- One Daily Alarm

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"

Sport Information Display

- Display sport information form mobile App with: Sports time, Distance, Calories, Average speed, Elevation, and Direction.

Surf Information Display

- Display Surf information form mobile App with: Beach, Weather, Water Temperature, Wind Direction and Speed, Swell Height and Direct, Tide Height, Times and Graphic, Sunrise and Sunset

Electroluminescent (EL) backlight of LCD

- 3 seconds backlight after release the LIGHT button

Buzzer

- Optional Buzzer alert for all application event

Battery Low Detection

- Battery Low Detect and alert

3. Inputs and Outputs

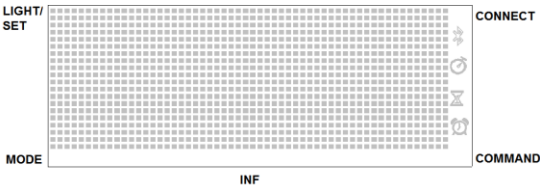
3.1. Manufacturing Option Inputs

N/A

3.2. Switches

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

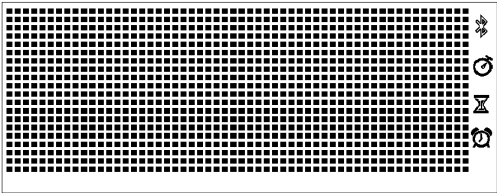
- [LIGHT/SET]: Active Backlight or set state entry
- [CONNECT]: Turn On/Off BLE module
- [COMMAND]: Toggle Alert presetting or Start/Stop Timing function (Chrono or Timer), Send Command
- [MODE]: Change function mode
- [INF]: Acknowledge BLE application event



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:

	BLE State Icon		Phone Battery Low (< 10%)
	Chat Message		Phone Battery Low (< 20%)
	SMS Message		Watch Battery Low (< 70%)
	Incoming Email		Calendar Alert
	Incoming Call		Timer Icon
	Missed Call		Chronograph Icon
	Alarm Alert		DST icon
	Mute		Degree
	Alarm Switch		

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 (***)

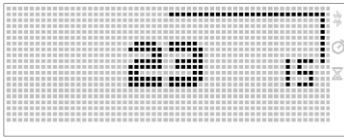
There is micro motor in watch which optional used for producing vibration to provide feedback for actions and to alert the user to various conditions.

*** There is no vibration motor for current Surf BLE Watch

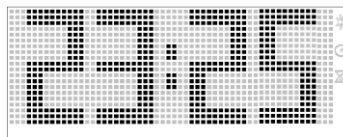
4. OPERATION

4.1 Display scene

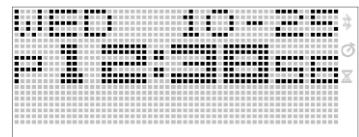
In TOD mode, and no button operation within 10s, automatically enter the scene mode,
There are four modes can be choosen.



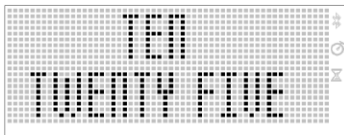
(Snake)



(Big-Digital)



(Time/Data)



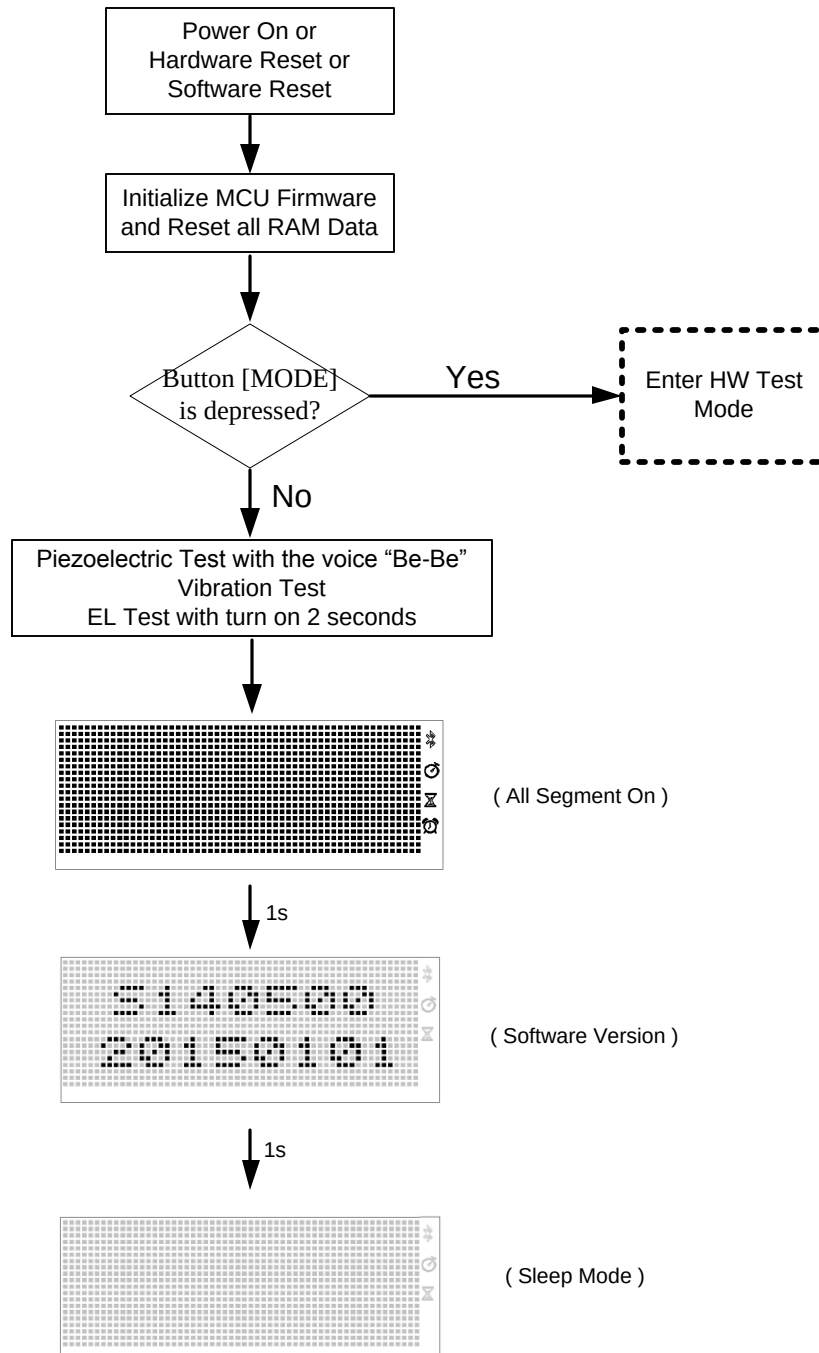
(Wordy)

4.2 Microcontroller Reset

There shall be 3 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'
- Press 4 buttons **MODE + LIGHT/SET + COMMAND + CONNECT** and hold for 3 seconds. (Software Reset)

The operation after microcontroller reset is described in below diagram.



4.3 Mode Architecture

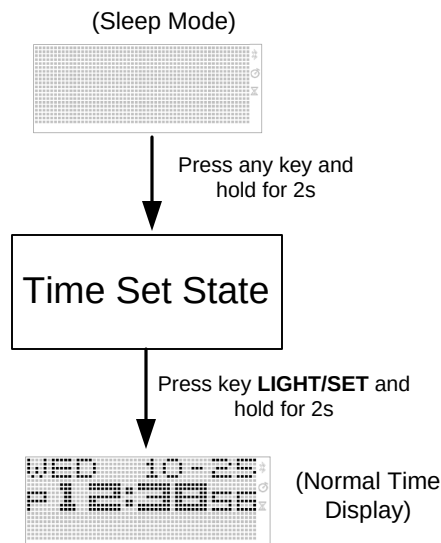
The watch shall employ the classic mode architecture for navigation between modes, whereby Time mode is the default mode and the user may click **[MODE]** button repeatedly to access other modes.

The watch consist of 9 different modes. These are:

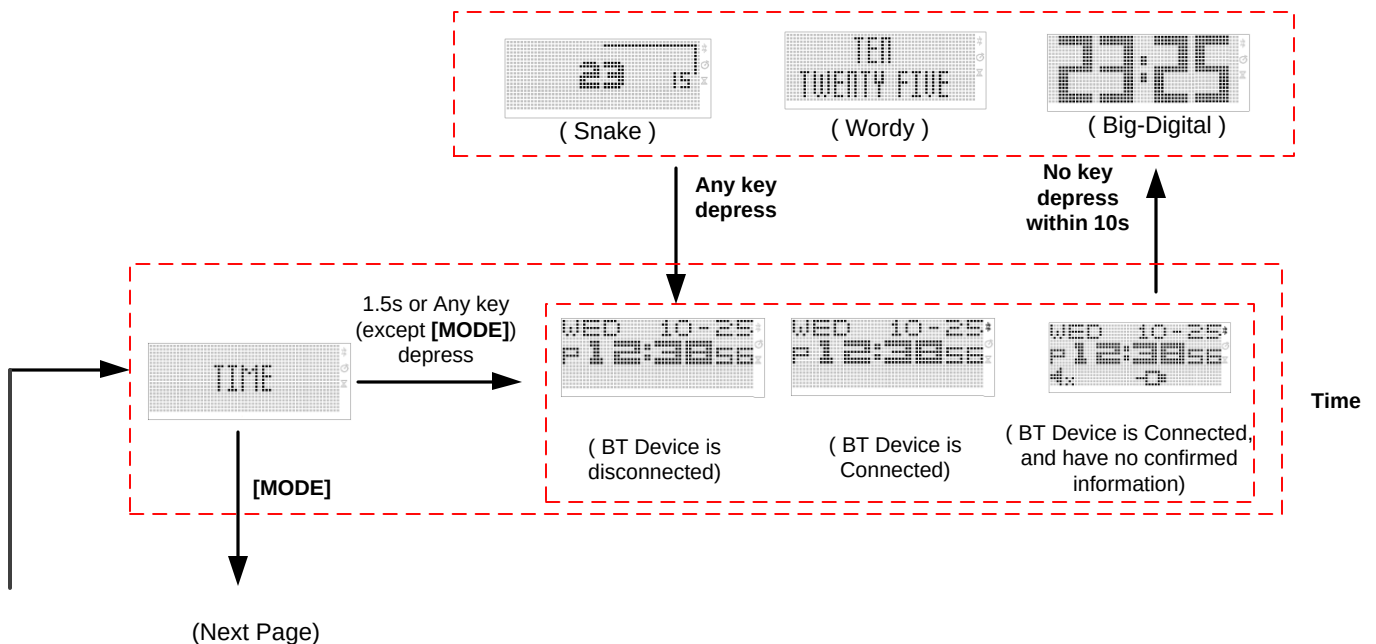
- ☐ Sleep Mode
- ☐ Time of Day (Primary Time)
- ☐ World Time
- ☐ Alarm
- ☐ Chronograph
- ☐ Timer
- ☐ Sport information Display
- ☐ Surf information Display
- ☐ Test (For manufactory test only)

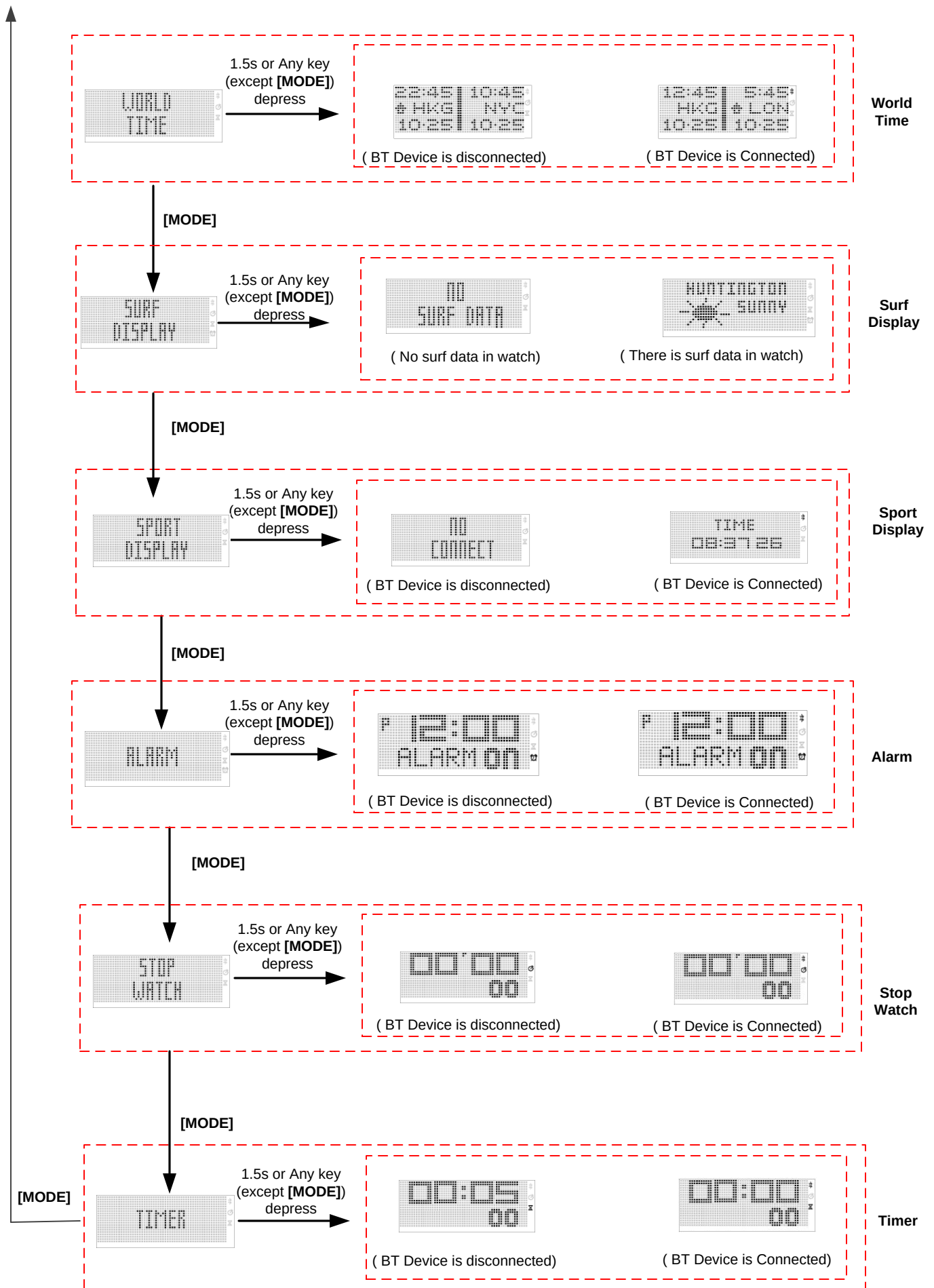
The mode sequence shall follow the order in below.
(Test Mode is a special mode which is not described here)

4.3.1 Wake up from Sleep Mode



4.3.2 Operation of Normal modes



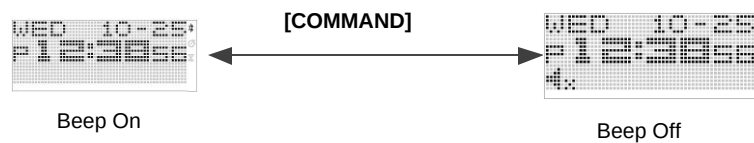


4.4 BLE Application

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 overridden 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:



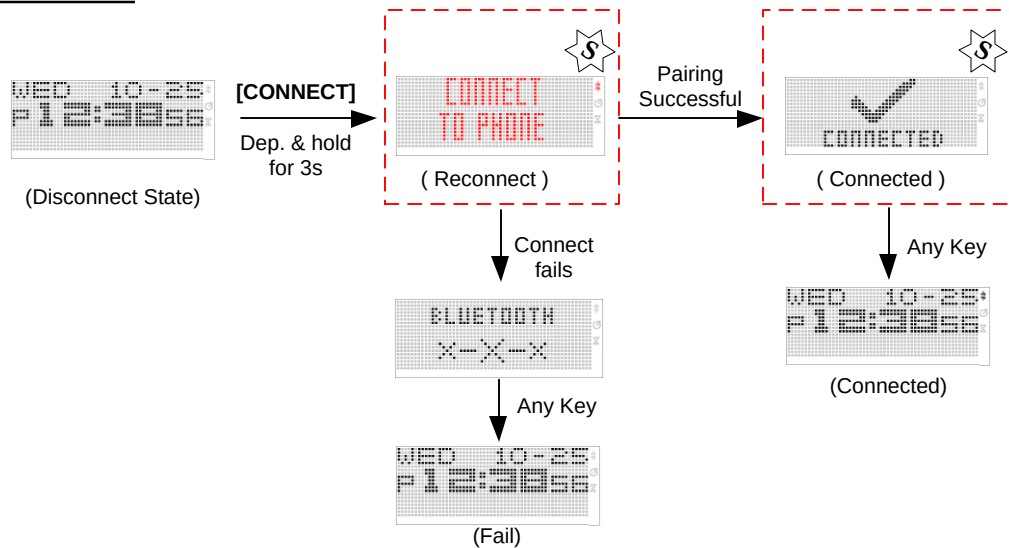
Short Alert, Two times of beep for this action



Common Alert, three times of short beep for this action

4.4.3 Connect / Disconnect Operation

Connect Operation Flow



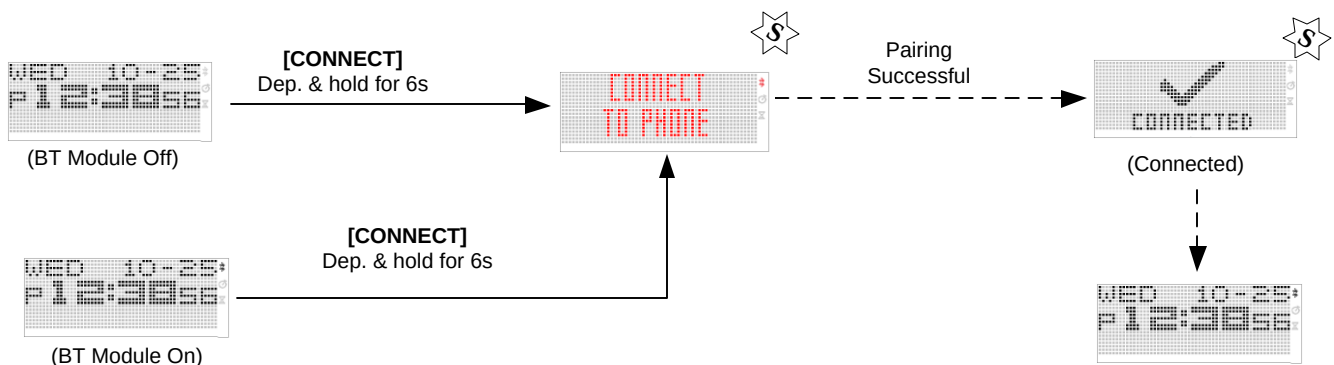
- Notes:
1. If no device is detected or pairing is failure, Bluetooth icon is always blinking until user stop this operation through depress and hold button [CONNECT] by 2 seconds.
 2. In above diagram, Vibration & Beep all are set as ON.
 3. Any icon is red that mean it is blinking with frequency 2Hz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

Disconnect Operation Flow



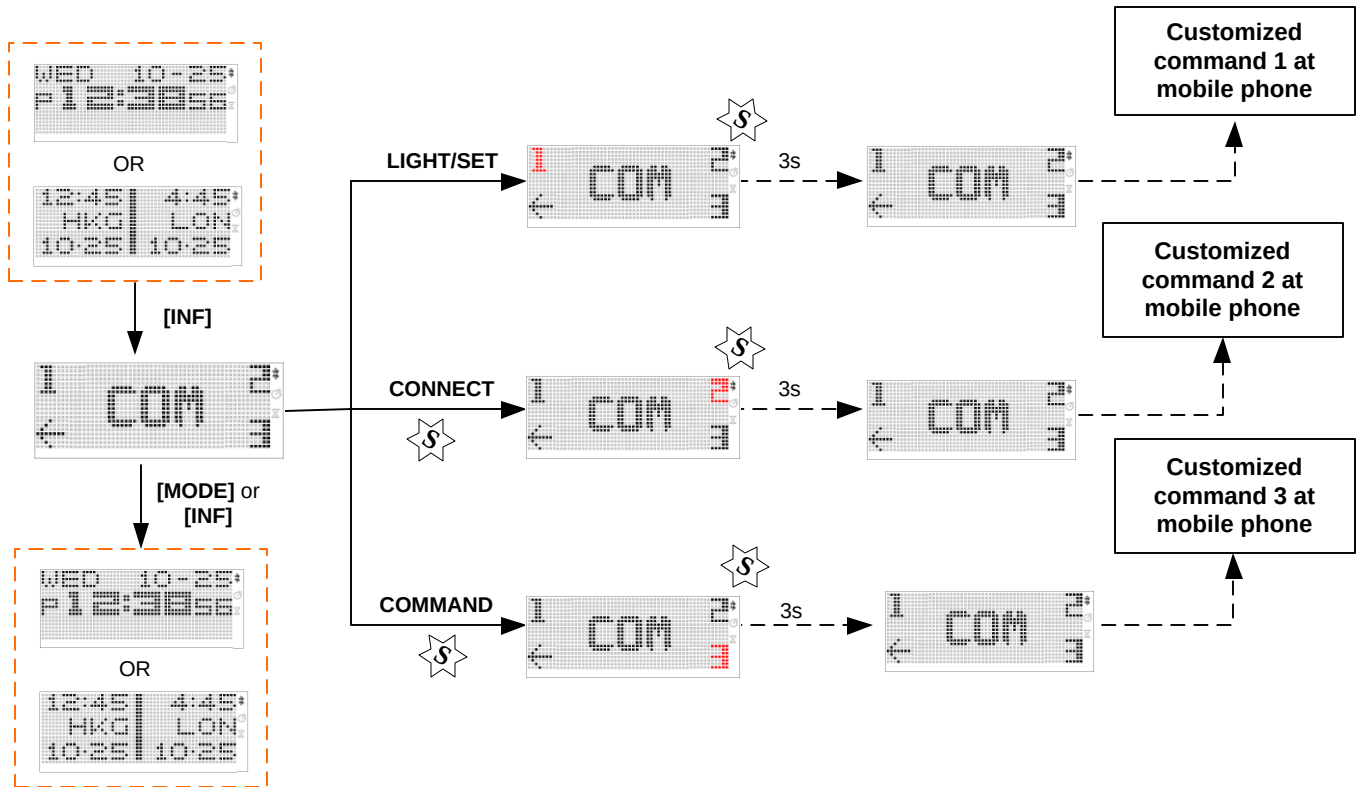
- Notes:
1. In above diagram, Vibration & Beep all are set as ON.
 2. Any icon is red that mean it is blinking with frequency 2Hz

4.4.4 Pairing Operation



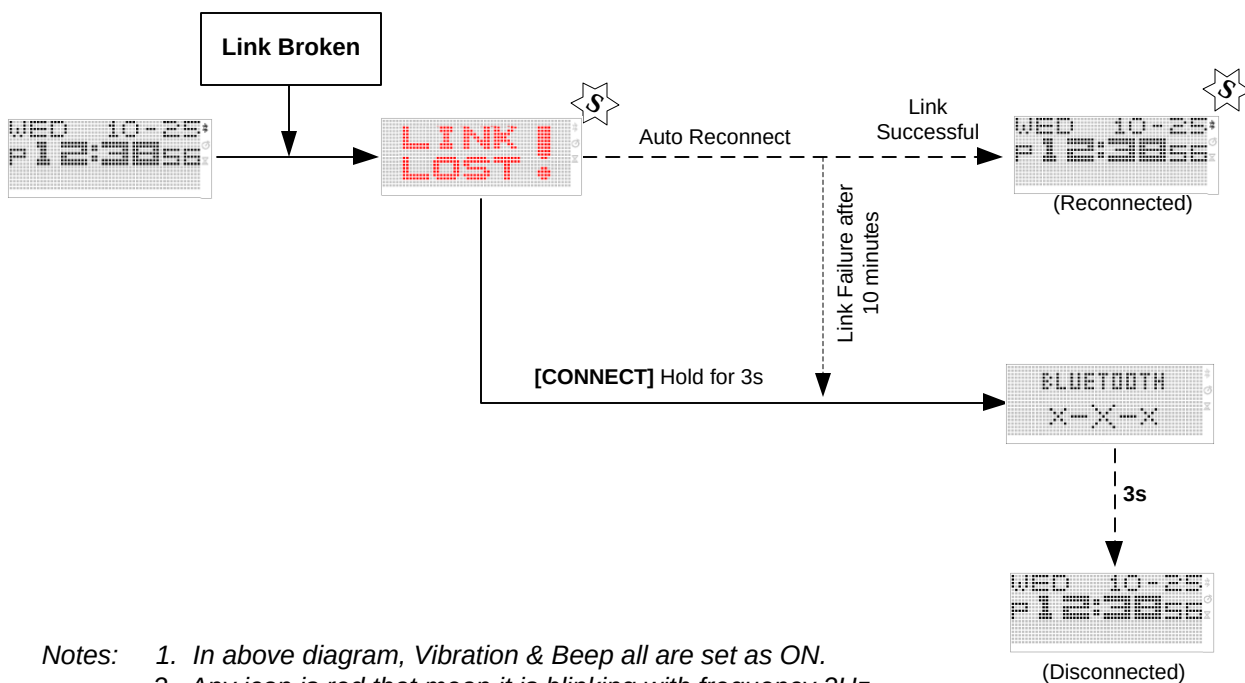
- Notes:
1. In above diagram, Vibration & Beep all are set as ON.
 2. Any icon is red that mean it is blinking with frequency 2Hz
 3. If pairing is not successful for 10 minutes, watch will stop the linking and turn off BLE module.

4.4.5 Command Controller



- 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. Only when Bluetooth module is connected and under Time or World Time mode can enter the page of Command Controller

4.4.6 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

4.5. Time Mode

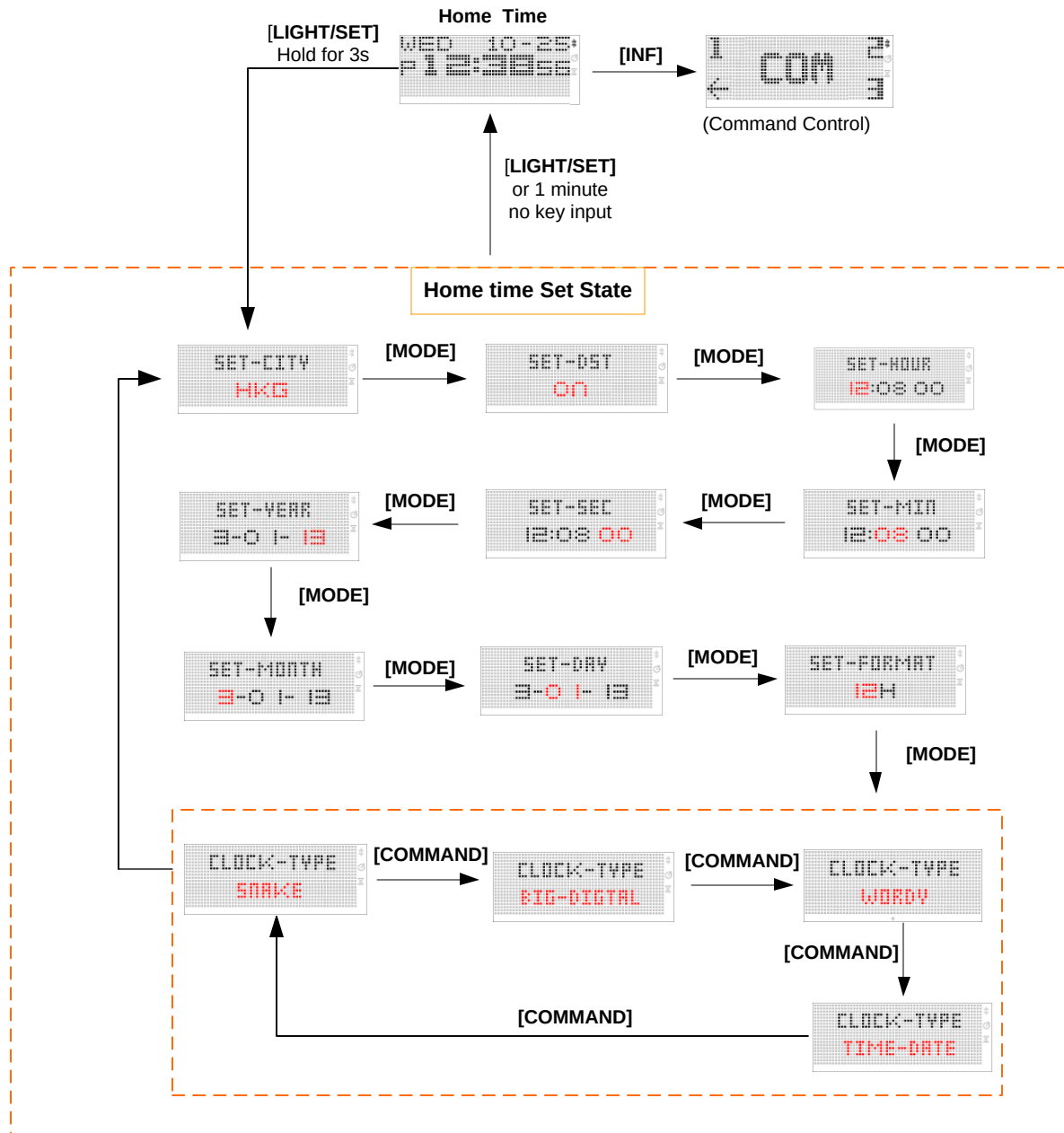
Mode data shall be initialized as follows:

Home time : 12:00 AM; January 1, 2014; Wednesday, 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

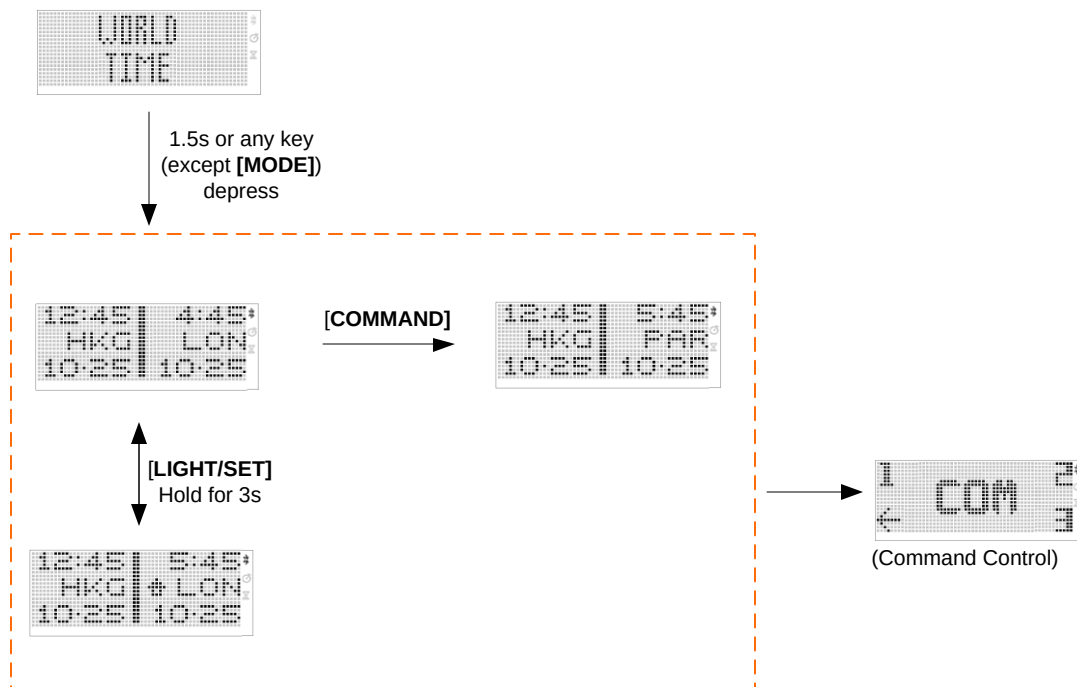
Mode data shall be initialized as follows:

World time : 12:00 AM; January 1, 2014; Wednesday, 12H; MM-DD format; NYC

Initial World time display as below:

12:00	12:00*
NYC	NYC
1-01	1-01

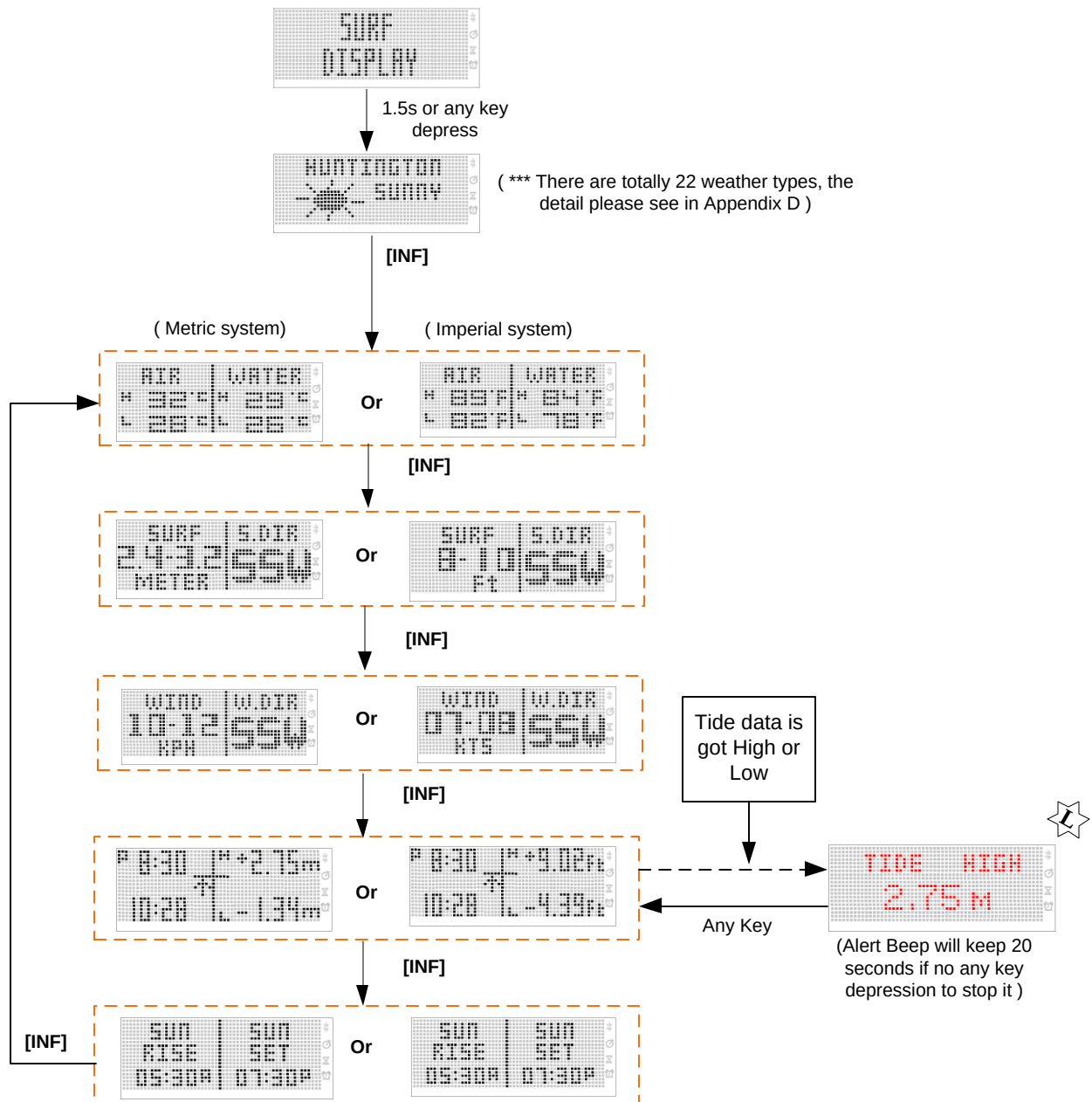
User can inquire total 32 cities real time which covered most for each city zone, user also can turn on/off the DST switch. The operation like below.



4.7 Surf Information Display Mode

In Surf information display mode, when the watch is connected with phone through BLE, the surf data of current day and 48 hours future can be transmitted from phone to watch, and then user can inquire those information at watch, which include the beach name, weather, water temperature, wind speed and direction, surf height and direction, tide height, sunrise and sunset.

The operation in this mode is described as below



Note:

- 1: When there is no surf data in Watch, the display is:

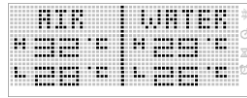


2. When there is no correct surf data or the data is out of the date, the display will be:



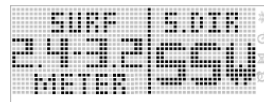
3: Temperature Display

Like below, there are two parts of temperature display, the left part is for Air Temperature in max and min. Right part is for current water temperature.



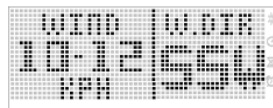
4: Swell Data Display

There are two part of swell information. The left side is for swell size and right side is for swell direction.



5: Wind Data Display

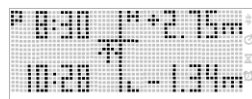
There are two part of Wind information. Wind speed is shown on the left and wind direction is shown on the right.



6: Tide Information Display

Size and Time for coming Hi/Lo Peak in same page,

In below sample display, 08:30P is the time of coming Hi peak, +2.75m is coming Tide Hi peak data, 10:28 is the time of last Lo peak and -1.34m is last Tide low peak data.



7: Sunrise / Sunset Display

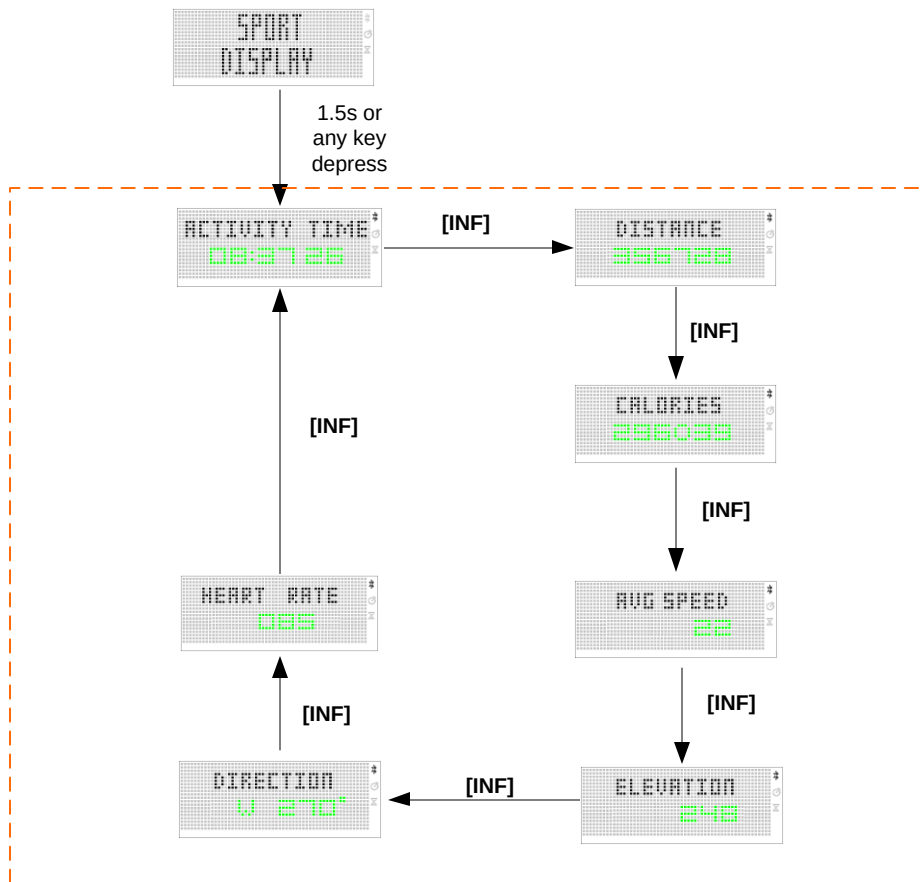
Sunrise / Sunset information is shown like below,



4.8 Sport Information Display Mode

In application display mode, when BLE on, and the Mobile phone application is on, the watch can receive the sport information from mobile App with: Sports time, Distance, Calories, Average speed, Elevation, and Direction.

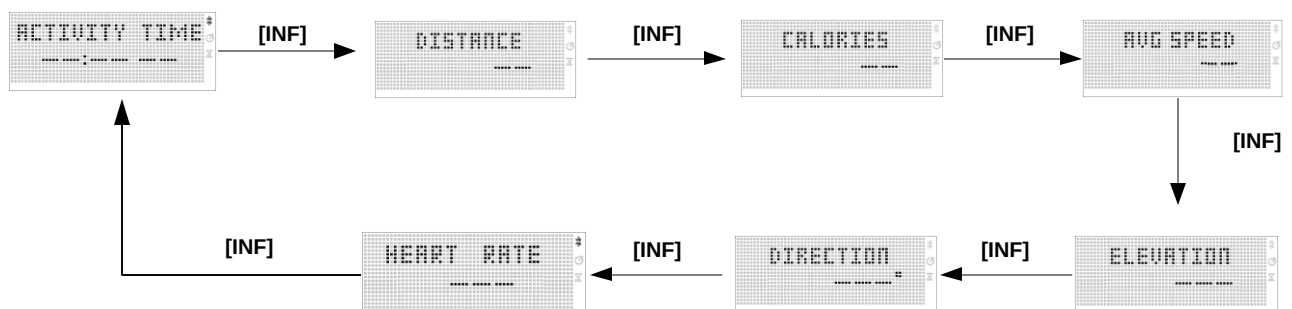
The operation in App Display mode is described as below



When BLE isn't connect, display as bellow:



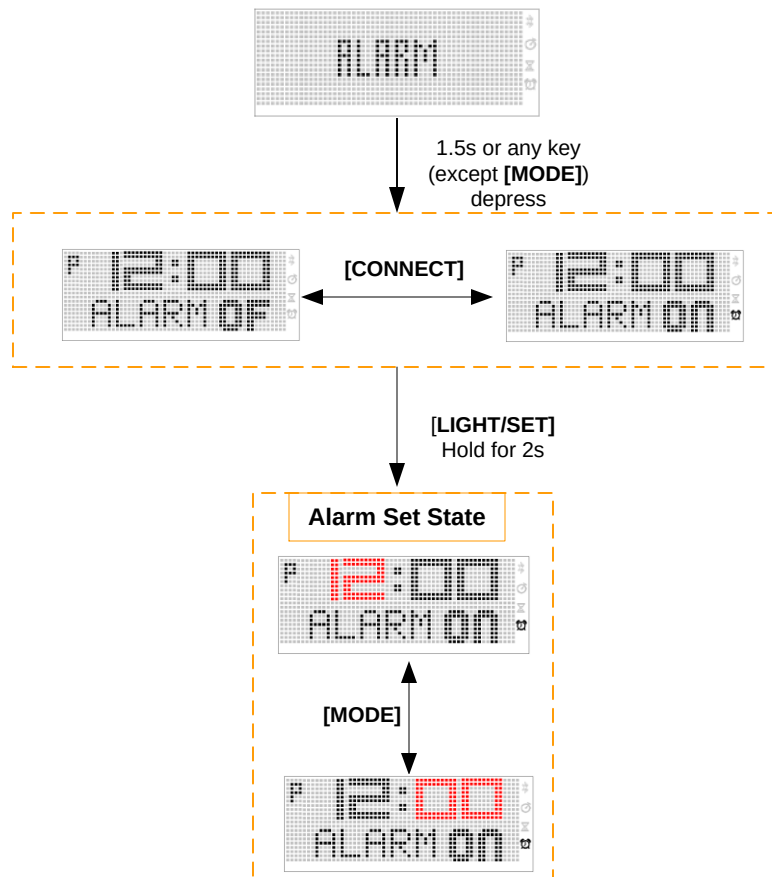
When BLE is connect. But Mobile application isn't start, display as bellow:



4.9 Alarm Mode

Initial conditions:

Initial Reset Data: 12:00 PM
Alarm Switch: Off



- Notes:
1. Once upon enter Alarm set state, Hour is blinking as the default set item. Depression of **[MODE]** will change the setting field.
 2. In Alarm 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. In above diagram, the digits or icon is red that means it is in flash with 1Hz refresh rate.

4.10 Chronograph Mode

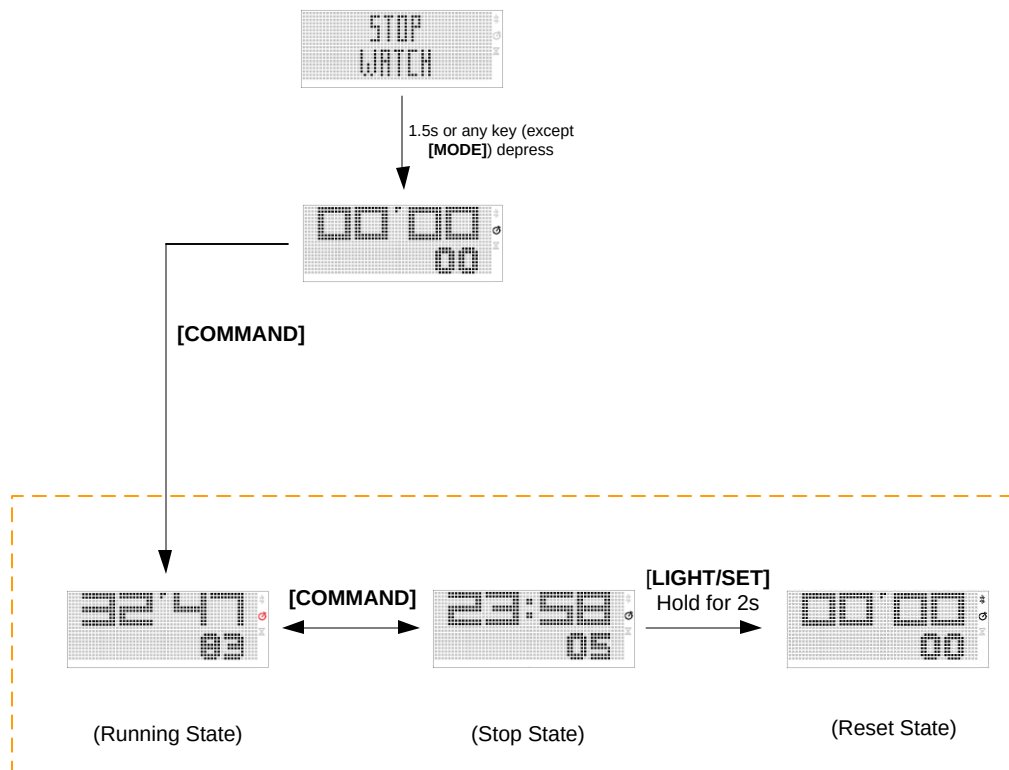
Initial conditions:

Reset Data: 00:00'00"00

Data Range:

Runout Data: 99:59'59"99

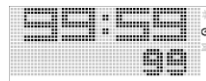
Precision: 1/100



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.

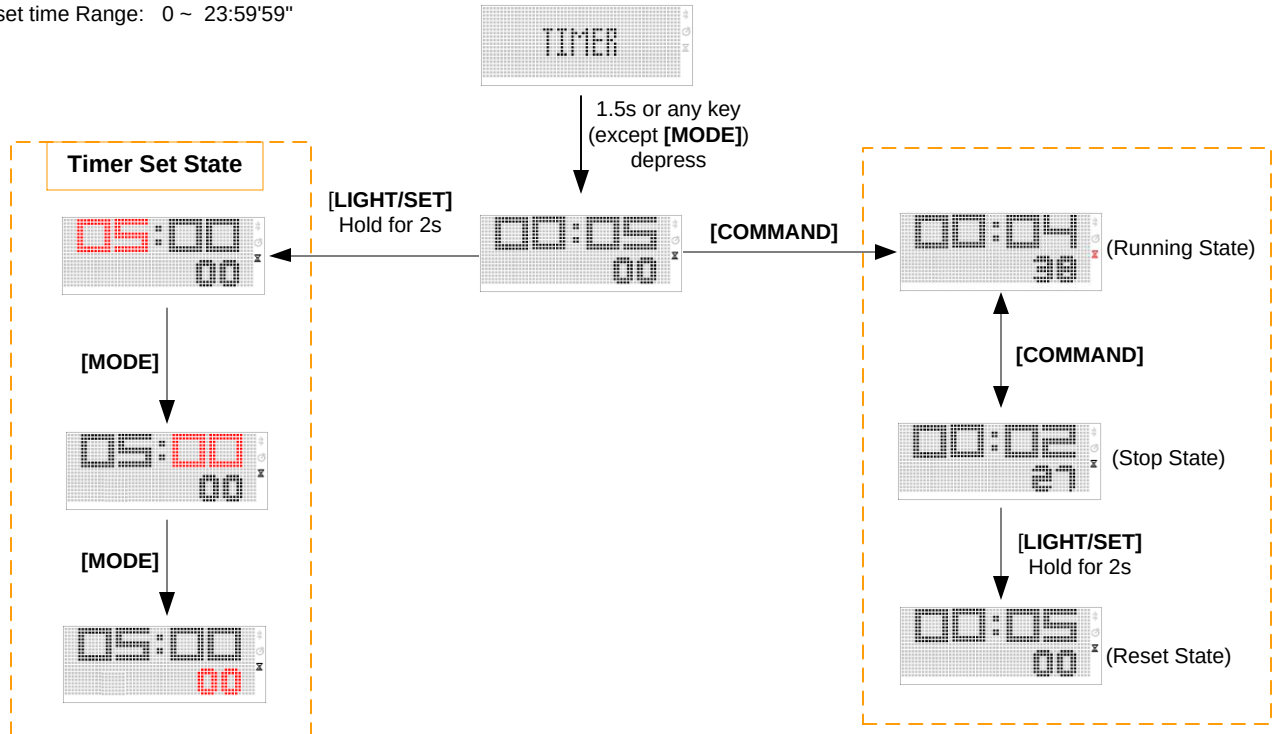
4.11 Timer Mode

Initial conditions:

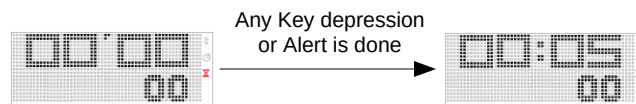
Initial Reset Data: 00:05'00"

Data Range:

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



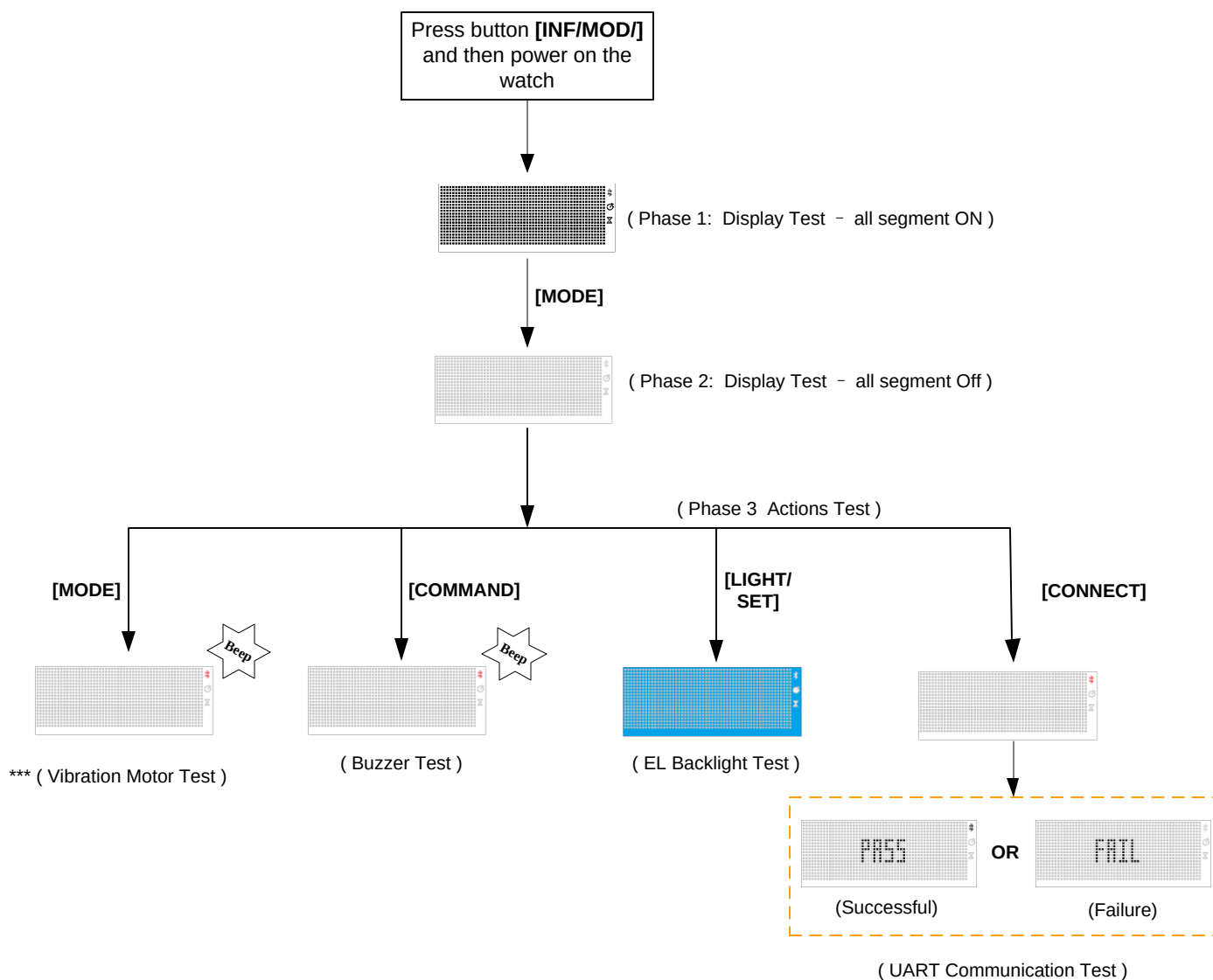
- Notes:
1. Once upon enter Timer set state, Hour is blinking as the default set item. Depression of [MODE] will change the setting field.
 2. In Timer Set state, depression of [CONNECT] or [COMMAND] will increase / decrease the value of current item. And hold those buttons over 3 seconds then enter 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.

4.12. 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:



*** There is no vibration motor for current Surf BLE Watch

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 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

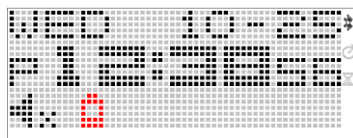
Tide Peak Alert

- 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, an indicator command can be sent out to paired device (phone) to show the notification. And a low battery icon is flashing on watch optionally. (***)

The display as below:

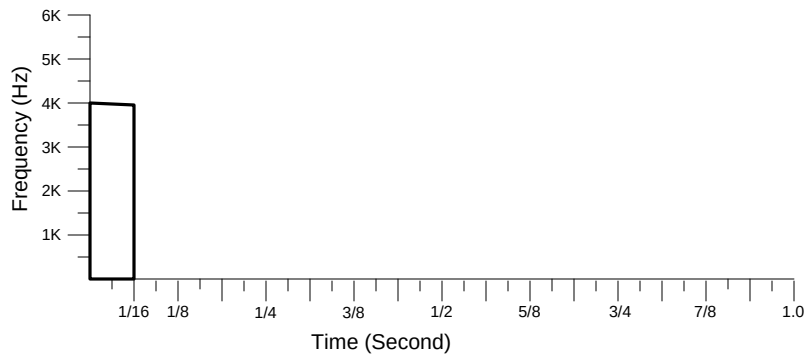


*** There is no low battery indicator on watch for current Surf BLE Watch

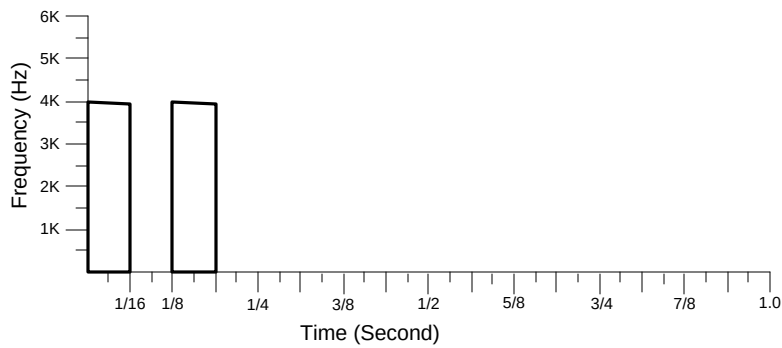
6. Appendix

6.1. Appendix A : Alert and Melody tones

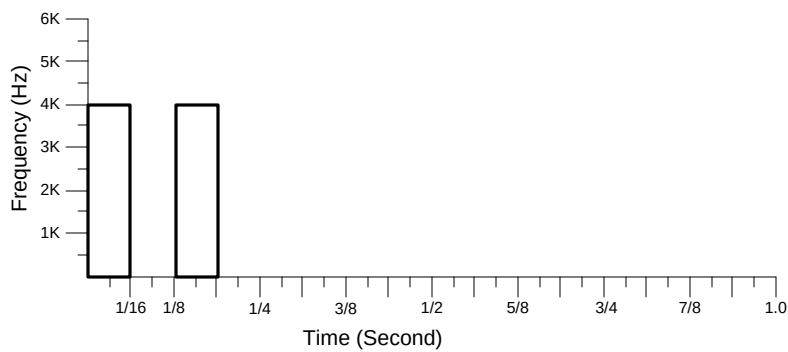
A : Button Beep



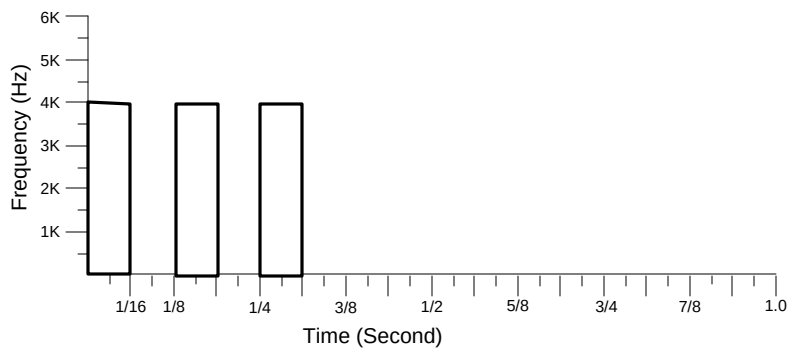
B : Confirmation Beep



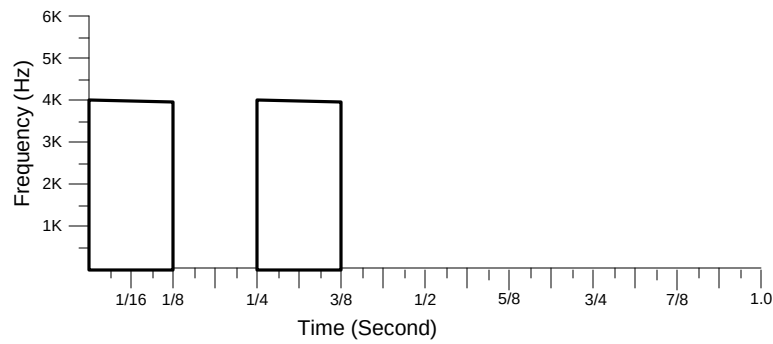
C : Immediately Alert Beep A



D : Immediately Alert Beep B



E : Timer Expired Alert



6.2. Appendix B : Keys Operation

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

*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

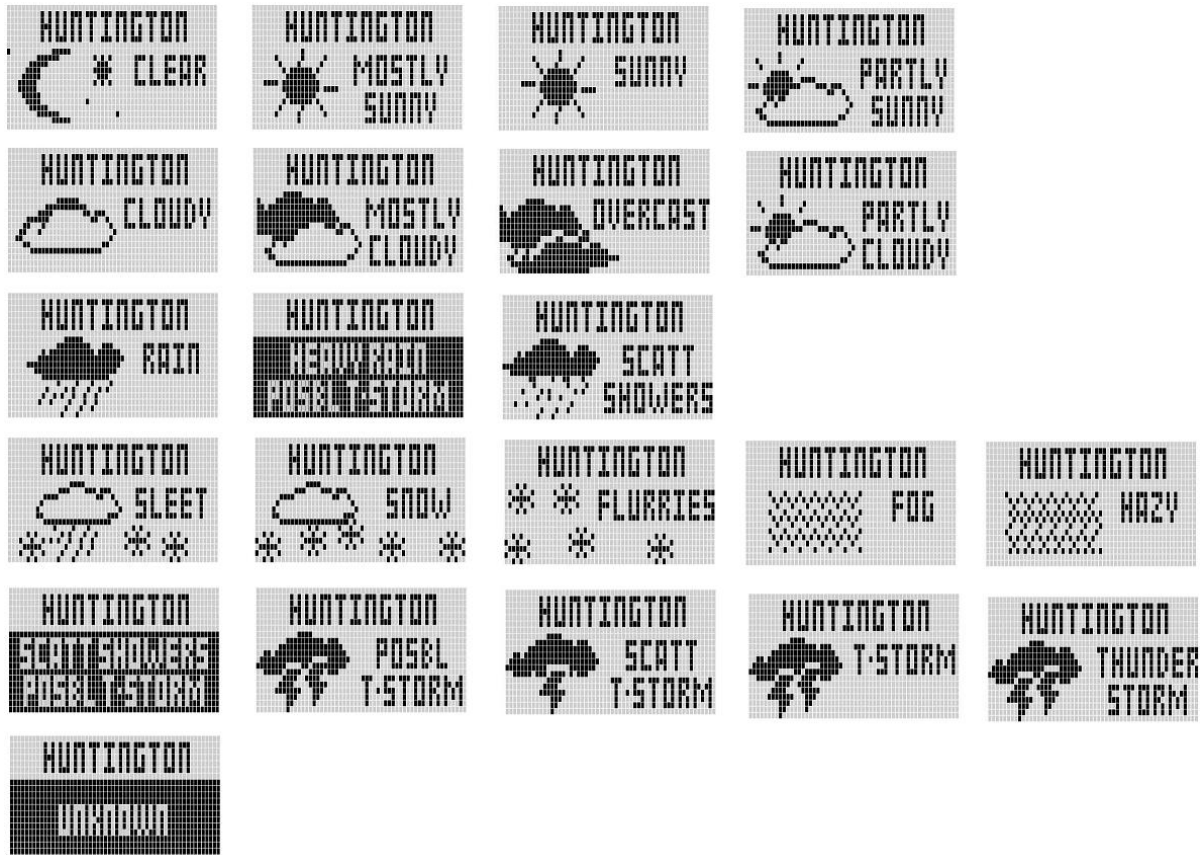
	UT differential	City code	City	Other major cities in the same time zone
1	-11	PPG	PAGO PAGO	----
2	-10	HN L	HONOLUL U	PAPEETE
3	-9	ANC	ANCHORAGE	
4	-8	VAN	VANCOUVER	LAS VEGAS, SEATTLE, DAWSON CITY, SAN FRANCISCO
5		LA	LOS ANGELES	
6	-7	DEN	DENVER	EL PASO, EDMONTON
7	-6	ME	MEXICO CITY	HOUSTON, DALLAS/FORT 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, HELSINKI, 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, RABAU
30		SYD	SYDNEY	
31	+11	NO U	NOUMEA	PORT VILA
32	+12	WLG	WELLINGTON	CHRISTCHURCH, NADI, NAURU ISLAND

6.4. APPENDIX D – Weather type

There are totally 22 weather segments, which are:

- Clear
- Mostly sunny
- Sunny
- Partly sunny
- Cloudy
- Mostly cloudy
- Overcast
- Partly cloudy
- Rain
- Possible t-storms
- Scattered showers
- Sleet
- Snow
- Flurries
- Fog
- Hazy
- Scattered showers possible t-storms
- Heavy rain possible t-storms
- Scattered showers t-storms
- T-Storms
- Thunderstorms
- Unknown

The display at watch for these weather are below pictures.



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.