

# UPI

## User's Manual

## Introduction

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UPI or “Individual Pachom Unit” is used for detection of RF protection zones created by UBEP unit. It is intended to be worn by pedestrian workers on construction sites. It comes in a form of security bracelet and through this User’s Manual will be referred to as “UPI Bracelet”.

UPI Bracelet is powered by internal rechargeable battery and it supports the latest technology of Wireless Charging. It is delivered with proprietary UPI Wireless Charger that can be powered directly from USB port (will be referred to simply as “UPI Charger”).

Unit is equipped with RGB LED for Status display that can show various colors in various schemes. Two powerful vibration motors are built in for Status, Warning or Alert execution. The execution scheme of the motors depends on how RF protection zone is setup (UBEP unit configured by UCP unit) and it can be applied as continuous or pulsating vibration scheme together with amplitude adjustments. This makes UPI Bracelet a perfect unit for executing either weak warning schemes or strong high alert schemes with purpose of alarming the pedestrian workers on immediate danger and prevent accidents.

RF protection zone is detected by internal RF circuit but it is not limited to detection function only. UPI Bracelet can also transmit information back to UBEP unit that created the RF protection zone. UBEP unit can then use this information to activate alarm output lines in order to either alert the machinery operator or to automatically cut off the machinery in order to prevent the accident on happening.



Figure 1: UPI Bracelet and UPI Charger

## Charging

UPI Charger is based on latest technology of Wireless Charging. It is delivered with USB cable and can be powered either from USB port or from a standard 5V wall adapter.

It has a symmetrical design thus you can place UPI Bracelet on a charging pad in any of the two orientations. On the top of the UPI Charger there is Status LED available. Status LED will display various modes with different color.



Continuous White light represent Stand-by mode



Continuous Yellow light represent charging in progress



Contentious Blue light represent charging is finished



Blinking between White/Yellow light represent there was either an error or the charging was terminated because alignment issue

As we mentioned earlier this is proprietary charger which means that UPI Bracelet can be charged only with the original Pachom charger and no other. UPI Bracelet is equipped to detect the original charger and in case of failed detection it will terminate the charging.

In addition to this there is the alignment detection. In case that UPI Bracelet is not aligned well with the charging pad it will first show this by blinking Yellow color for 10 seconds after which it will terminate the charging in order to prevent any damage. Error can also happen in case of some internal fault either in UPI Charger or UPI Bracelet.

UPI Charger will stay in error mode for 5 minutes but it can be reset immediately but removing power supply and connecting it back again.

After the charging is done UPI Bracelet will automatically reset. There is also built in technology to reset UPI Bracelet whenever the unit is removed from the charging pad. After the reset UPI Bracelet will transmit its ID and show this by turning on Green light for one second. This ID can be used to pair the unit with UCP for the purpose of testing or extraction of serial number.




Figure 2: UPI Charger in Stand-by mode


## Status LED and vibration schemes


As we mentioned earlier Status LED can show a variety of different colors. Same colors can have different meaning depending on the operating mode and if they are shown continuously, in a slow pace blinking mode, in high pace blinking mode or whether they are combined with vibration sequence.

### Status LED in Detection mode - slow pace blinking without vibration:

Status LED in slow pace blinking mode (every 2-3sec as system “hear-beat”) without vibration is used to show the user that UPI Bracelet is in Detection mode (tuned on). The color of Status LED is representing the battery level.


 Blue light slow pace blinking mode without vibration means that UPI Bracelet is in Detection mode and Power level is good.


 Purple light slow pace blinking without vibration means that UPI Bracelet is in Detection mode and Power level is in middle range.


 Yellow light slow pace blinking without vibration means that UPI Bracelet is in Detection mode and Power level is low.


### Status LED in Detection mode – continuous, blinking or pulsating with vibration:

If Status LED is turned on during a Detection mode with vibration that means that UPI Bracelet is in Action mode. Action can be triggered either by RF protection zone or by internal status. RF protection zone configuration will determine the color and the sequence that will be applied both to the Status LED and Vibration motors. The color can be either Red, Green, Blue, Yellow, Purple, Cyan or White. We will describe the most usual ones and their meaning.

 Purple light in continuous or blinking sequence with mild vibration usually means an On Start action.


 Yellow light in continuous or blinking sequence with mild vibration usually means a Warning.


 Red light in blinking or pulsating sequence with strong vibration usually means an Alert.


 White light in blinking sequence with vibration (several cycles) means that UPI Bracelet entered Battery empty mode and can't operate no more.

### Status LED in Charging mode - continuous/blinking without vibration:

Charging mode will be presented on Status LED as continuous light that will last as long as the charging is in progress and will be confirmed with continuous Yellow light on UPI Charger. Status LED can be also used in blinking mode in case that UPI Bracelet is not aligned well with the charging pad and after 10 seconds it will switch to Red light and terminate the charging.

 Yellow light in continuous mode during the charging means that charging is in progress. Blinking mode means that UPI Bracelet is not aligned with the charging pad properly.

 Cyan light in continuous mode during the charging means that charging is in progress and almost done. Blinking mode means that UPI Bracelet is not aligned with the charging pad properly.

 Red light in continuous mode during charging means that UPI Bracelet was not aligned properly with the charger for more than 10 seconds and charging was terminated. This will cause UPI Charger to show error. Charging termination will last for 30 seconds on UPI Bracelet side after which it will be reset.

## Status LED in other events:

In addition Status LED can present some other events that can not fit into previously described groups. Some of them can be applied with vibration and some of them without it.



Green light in continuous mode without vibration (1 second duration) means that UPI Bracelet is transmitting its ID. This can happen when unit is reset or asked for identification by UCP unit.



White light is very often used to display a certain events. This is the list of different events that can occur and will be presented with:

- Pulsating sequence light with vibration (5 seconds duration) - means that UPI Bracelet is responding to external Demo command initiated by UCP unit
- Continuous short light with vibration (1 second duration) - means that UPI Bracelet is responding to external Identification command initiated by UCP unit

## Vibration Motors

UPI Bracelet is equipped with two powerful vibration motors. Their main purpose is to execute the Warning or Alert events in case that unit detects RF protection zone. Secondly, their purpose is to execute different Status events like Battery Empty, Identification etc.

In case of Warning or Alert events the amplitude and scheme of vibration depends on how the RF protection zone is setup (UBEP unit configured by UCP unit). There are several possible vibration action schemes: Warning L, Warning H, Alert L, Alert H, Random L, Random H.

Warning L and Warning H action schemes will have continuous vibration with about 10% and 25% amplitude. Alert L and Alert H action schemes will have pulsating vibration with about 50% and 100% amplitude. Random L will have continuous vibration with about 10% while Random H will have pulsating vibration with about 50% amplitude.

Warning and Alert action schemes will be executed the exact number of vibration cycles set by RF protection zone, while Random action scheme will execute the number of vibration cycles between 1 and what is set by RF protection zone.



Figure 3: Vibration Examples

## RF Detection

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UPI Bracelet is equipped with highly sensitive RF circuit capable of detecting RF protection zone created by UBEP unit. Upon its detection UPI Bracelet will execute Warning or Alert depending on the configuration setup within that RF protection zone as described in previous chapters. In addition to detection of RF protection zone UPI Bracelet can receive commands from UCP unit. For example, Identification command or Demo command.

Built in RF circuit is also capable of transmitting the information back to the UBEP or UCP unit. When asked for identification by UCP unit or upon reset UPI Bracelet will transmit its ID and show this by turning on Green light for one second. This ID can be used to pair the unit with UCP for the purpose of testing or extraction of serial number. What's more important UPI Bracelet will transmit Reply to the UBEP unit in case that RF protection zone is configured to do so.

This Reply will be used on UBEP unit side to activate one of the alarm output lines in order to either alert the machinery operator or to automatically cut of the machinery to prevent the accident on happening.

Both detection and transmission are omnidirectional. This means that UPI Bracelet is capable of detecting RF protection zone from any direction and with any orientation. Also, it can transmit in all directions which is important in order to send Reply back to the UBEP unit as described earlier.



Figure 4: UPI Bracelet RF Field

## Testing and Maintenance

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There are several ways how you can test and verify the functionality of UPI Charger and UPI Bracelet.

### Testing of UPI Charger

Verification of UPI Charger functionality is very simple. You should put your UPI Bracelet on a charging pad. Within a few seconds the charging should begin and both UPI Charger and UPI Bracelet will show this by keeping the constant ongoing Yellow light (or Cyan if charging is almost done). For more details on the charging and Status LED schemes refer to the corresponding chapters in this manual.

### Testing of UPI Bracelet with UCP unit

First, you should pair UPI Bracelet with UCP unit. This is done by clicking the corresponding button in UCP Pairing submenu and making UPI Bracelet transmit its ID. As described earlier this can be done by resetting the unit by placing it on and off the UPI Charger. After the pairing you can use Check ID UPI command in the same UCP submenu to verify you are paired with appropriate unit.

Second, you should go to UCP Test submenu and Send UPI Demo command. UPI Bracelet should start vibrating in pulsating sequence with White LED flashing (for 5 seconds) and UCP should pick up a Reply from UPI and show Red ALERT message on the screen.

This verifies the Status LED, Vibration and RF functionality of the UPI Bracelet.

### Testing of UPI Bracelet with UBEP unit

Probably the best way to verify the UPI Bracelet functionally is to test it with UBEP unit within the safe test environment.

UBEP unit should be configured to create the RF protection zone configured to expect the Reply from UPI Bracelet. The range of the RF protection zone can be set for example at 2 meters and UPI Action could be set to activate White light on Status LED and to use Alert H action scheme for 2 or 3 seconds.

Once UPI Bracelet enters the RF protection zone it will execute the alert according to the setup and send the Reply back to the UBEP unit activating one of the alarm output lines.

This verifies the Status LED, Vibration and RF functionality of the UPI Bracelet in a real life environment.

## General Specifications

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UPI bracelet operational temperature range:

- while charging: 0 – 45 °C
- while discharging: -20 – 60 °C

UPI Bracelet Ingress Protection: IP67 - Dust Tight, Waterproof

UPI Bracelet battery duration (when charged to full):

- storage mode: approx. 12 weeks
- operating without alarms: approx. 28h
- operating with alarm every 5 min: approx. 24h

UPI Bracelet battery charging:

- approx. 3 hours from empty to full
- recommended to do full charge before entering the construction site or placed in storage mode

UPI charger operational temperature range: 0 – 45 °C

USB Support:

- Power Supply Input: 5V DC
- Connector type: micro-B form factor

UPI Charger Maximum Power Consumption:

- while charging: 1W
- stand-by mode: 0.27W