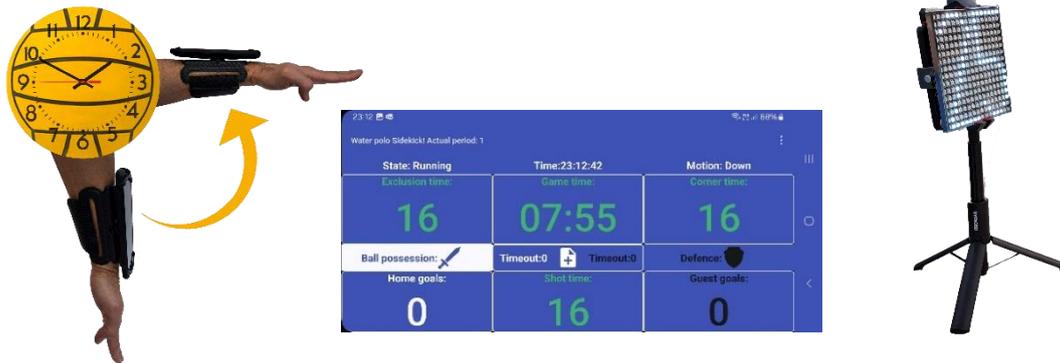


Water Polo Sidekick, Coach Support System user manual



1. Introduction

The Water Polo Sidekick Coaching Support System (the System) is designed to simplify and improve timekeeping tasks during water polo training sessions and matches.

The System responds to the coach's hand gestures (start, stop, restart) to regulate game time, allowing coaches to maintain focus on the game without requiring an additional timekeeper. This automation provides more accurate timing by eliminating human reaction time delays.

This innovative support system automates both timekeeping and record-keeping tasks during training sessions. The application detects coach movements to control timekeeping functions and automatically resets the shot clock without manual intervention.

The free mobile application runs on a smartphone, which can be secured to the coach's forearm using a phone holder.

Game information can be shared with players and spectators through multiple wireless displays.

2. Parts of the system

The Water Polo Sidekick system features a modular design. The basic setup requires only an Android- or iPhone compatible mobile phone with the Water Polo Sidekick app installed. When the phone is secured to the coach's forearm, the system is ready for use. Optional accessories can be added to share game information with players and spectators.

Basic Configuration:

1. Mobile phone
 - Runs the Water Polo Sidekick application
 - Required for basic system operation
 - Coaches can use their own devices (meeting minimum requirements).
2. Water Polo Sidekick app
 - Manages timing functions
 - Recognizes coaching gestures
 - Controls information displays.

3. Forearm phone holder
 - Secures phone to coach's arm
 - Positions display for optimal viewing
 - Enables accurate gesture detection

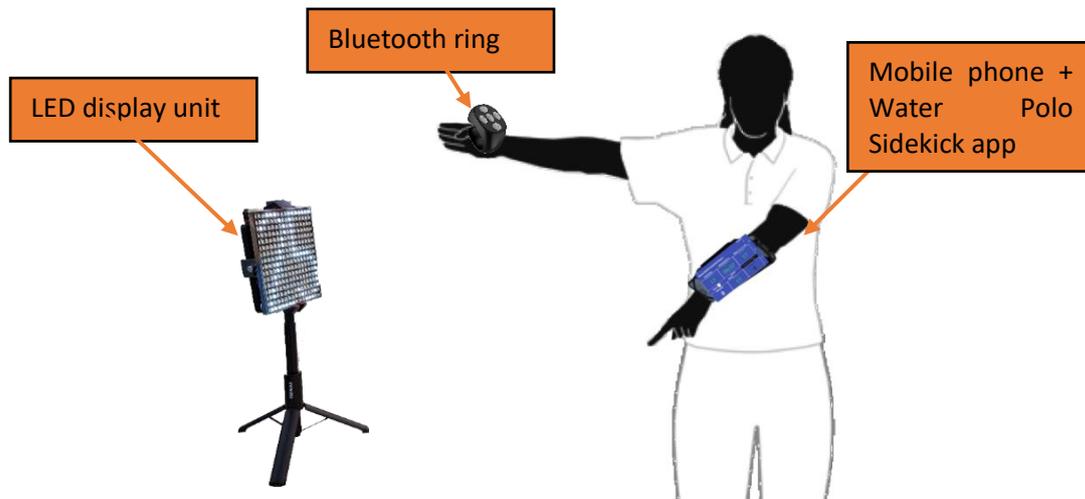


Figure 1 Water Polo Sidekick System architecture

Optional Additional Units:

4. LED Display Unit
 - Portable, self-powered color LED display
 - Displays game information for spectators and players
 - Features bright, easily visible pixel technology
5. WiFi Router (Hotspot of the Mobile phone can be used as a WiFi Router)
 - Creates dedicated wireless network for system components
 - Recommended for extended range operations
 - Supports multiple display connections
 - Alternative to mobile phone hotspot
 - Ensures stable data transmission between units
6. Bluetooth ring
 - The system can be controlled using the buttons on the ring.
 - Each button on the ring starts or stops the game, shot time
 - Allowing the control of a match without touching the Mobile phone.

3. Technical parameters

Size: LED matrix display: h: 16.5 cm, w: 3 cm, m: 16.5 cm (without tripod)
Maximum size of display set up: h: 26 cm, w: 26 cm, m: 130 cm
Weight: 590 g (without powerbank and phone)
Power supply display: micro USB, 5 VDC, max. 800 mA
Cable: micro USB (display), USB C (powerbank), length: 25 cm
Data connection: WiFi 2.4 GHz
LEDs: 256 (16 x 16) colour LEDs
Application: Water Polo Sidekick App

Application running environment. Min Android 21 or iOS 14
Environmental resistance : IP-20
Operating temperature range: 0 ... 40 °C

4. How the system works

The Water Polo Sidekick system offers two main configuration options:

Basic Configuration

- Utilizes only the base units
- Provides essential system functionality

LED Display Configuration

- Includes all base units
- Supports multiple LED display units
- Scalable based on venue requirements

4.1. Basic configuration

Required Units:

Mobile phone with Water Polo Sidekick app installed

Forearm phone holder

Key Functions:

1. Pre-Game Setup
 - Coach configures app settings
 - Sets game parameters
2. During Game Operation
 - Monitors Game time
 - Detects coach's movements via phone's motion sensor
 - Displays match information
 - Signals end of Game time
3. Referee Controls
 - Manual time adjustments via touch screen
 - Game data entry options:
 - Goal scoring
 - Period tracking
 - Time-out management

4.2. LED Display Configuration

Required Units:

- Basic units:
 - Mobile phone with Water Polo Sidekick app
 - Forearm phone holder
- LED display units (1 or more)
- WiFi network connection

Network Setup Options:

1. Dedicated WiFi Router

- External standalone device
 - Connects all system components
2. Mobile Phone Hotspot
 - Phone acts as WiFi access point
 - Alternative to dedicated router

System Operation:

1. Network Requirements
 - All devices must share same WiFi network
 - Mobile phone and displays maintain constant connection
2. Data Communication
 - App sends real-time updates to all displays
 - Synchronized information across all units
3. Display Capabilities
 - Customizable information panels
 - Multiple display options:
 - Shot time
 - Game time
 - Score
 - Actual time

5. Installing the system

5.1. Base unit setup

Prerequisites:

- Android or iPhone mobile phone (personal device)
- Sufficient battery charge
- Internet connection for app installation

Step-by-Step Setup:

1. Install the Application
 - Visit Google Play Store or use direct link:
<https://play.google.com/store/apps/details?id=com.rundhall.waterpolosidekick>
 - Or visit Appstore:
<https://apps.apple.com/us/app/water-polo-side-kick/id6743676293>
 - Download and install Water Polo Sidekick app
2. Configure Match Settings
 - Launch the app
 - Access Settings menu
 - Adjust parameters:
 - Shot time duration
 - Period length
 - Other game preferences
3. Final Setup
 - Insert phone into forearm holder
 - Position for optimal viewing
 - Set up LED Displays (optional)

- Set up Bluetooth Ring (optional)

Using the Bluetooth ring

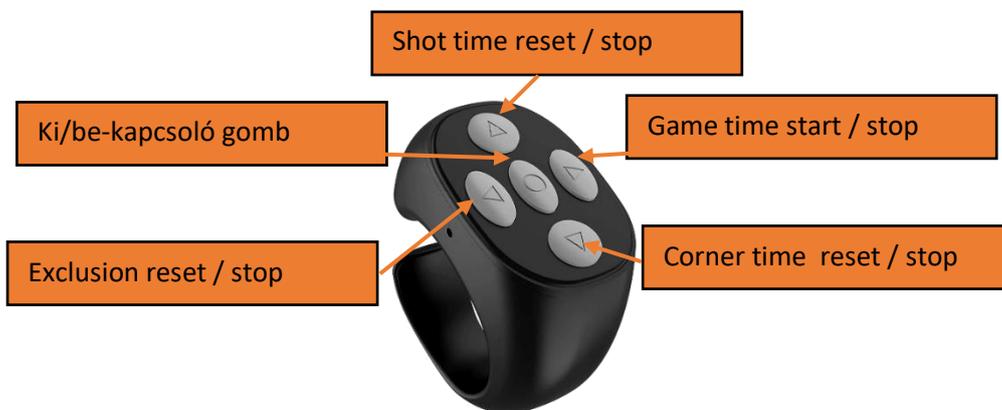
Before you use the ring for the first time, you must switch it on using the centre button. When the blue LED on the phone flashes continuously, you should search for it in the Bluetooth devices. Then connect to it.

In an Android environment:

Only compatible with the JX-05 ring. Use of the ring does not require any other adjustment

in an iOS environment:

The system is compatible with any ring that can generate an event corresponding to a 4-way swipe on the screen. To use this feature, go to Settings -> Accessibility -> Touch -> AssistiveTouch. This will display a cursor point that the ring will detect when the button is pressed. If the application does not work properly with the button press, you can tune the operation with the "Tracking Sensitivity" button on the same page.

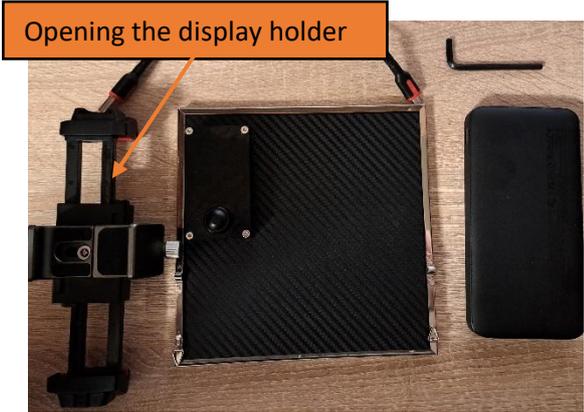


- System is ready for use

5.1. Installation of an external display



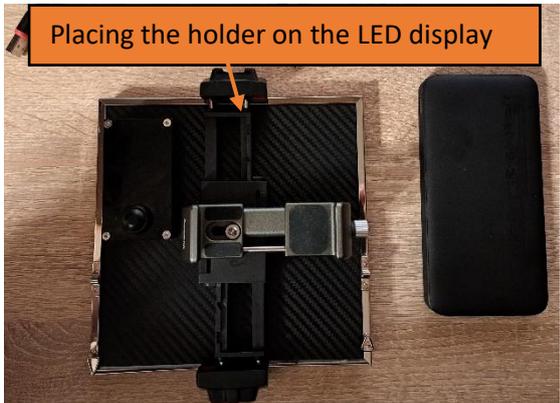
Rotate and fix the Powerbank holder



Opening the display holder



Opening the Powerbank holder

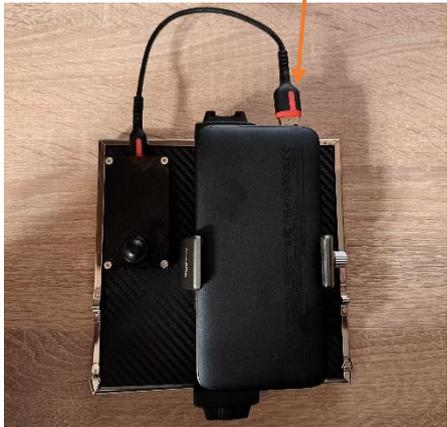


Placing the holder on the LED display

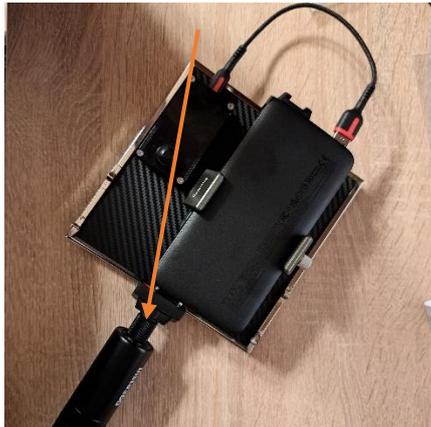


Powerbank installation

Connecting USBs



Screwing on the supporting leg



6. Parts of the main screen of the Water Polo Sidekick app

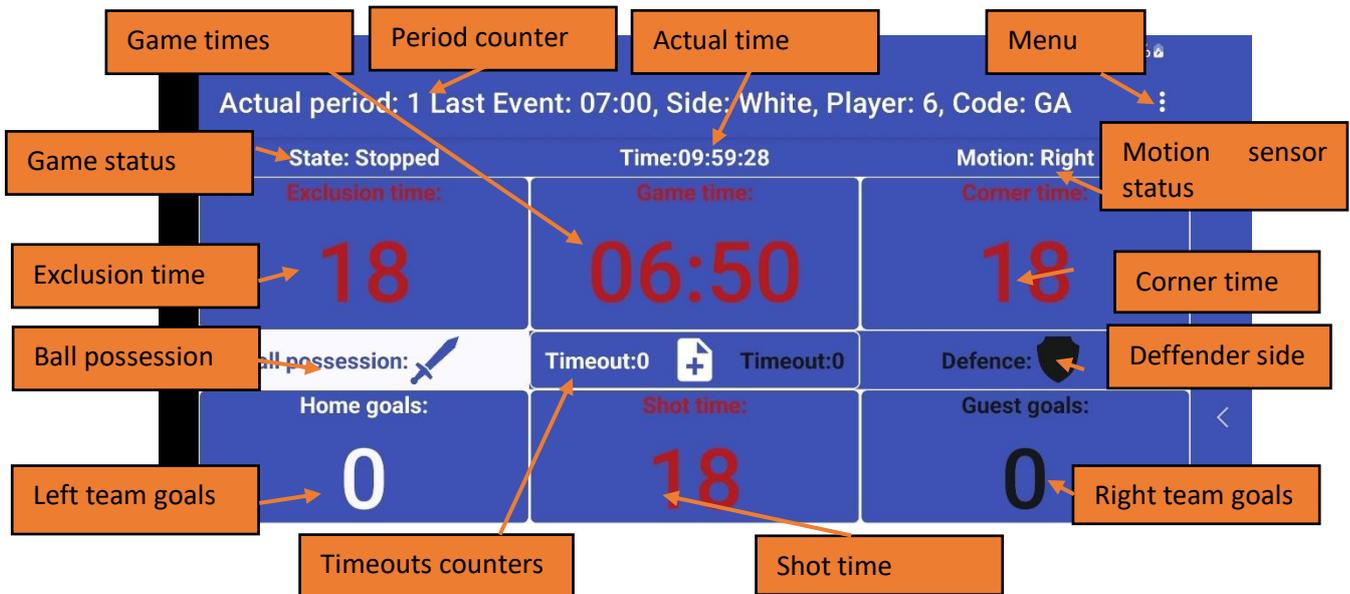


Figure 2 Main screen

7. Using the system

7.1. Match Setup and Initialization

A. Initial Setup

1. Mount the Phone
 - Place phone in forearm holder
 - Secure holder to forearm
2. Verify Game Settings
 - Check display data matches game rules
 - Confirm shot time (e.g., 30 seconds)
 - Verify game time (e.g., 7:00)
 - Adjust if needed: Menu -> Match Settings
 - For new match: Menu -> New Match
 - Verify team positions: Menu -> Side swap if needed

B. LED Display Unit Setup and Configuration

1. First-Time LED Display Setup:
 - Press and hold the button on the LED Display and connect to the Powerbank
 - LED Display shows "NO AP" or "AP ON"
 - LED Display creates "sidekick" network
 - Navigate to Menu -> Display Settings
 - Click Programming Display icon 
 - Connect to the AP of LED Display
 - Press "Connect to sidekick"
 - Select "sidekick" network
 - Connect phone
 - Back to Water Polos Sidekick App

- Verify Connection
 - Press "Check WiFi settings"
 - Confirm status shows "Connected to SSID: sidekick"
 - Setup Hotspot or external WiFi AP. Remember the SSID and password belongs to the network prepared to use it with this application.
 - To check the Hotspot setting of the phone press "Open Hotspot settings"
 - Configure Hotspot
 - Enter SSID and password
 - Press "Submit setting to display"
 - LED Display restarts with the new settings.
 - Turn on the external WiFi AP or the Hotspot of the phone by pressing "Turn on Hotspot" button
 - Search for the Display by pressing the Search button or continue with everyday LED Display Setup
2. Everyday LED Display Setup
- Enable phone's hotspot: Menu -> Start WiFi Hotspot or turn on external WiFi AP
 - Power up LED Display by connecting it to the powerbank
 - Check LED Display shows IP address
 - If the LED Display has a new IP address not know by the App it should be paired. Pair LED Display to Phone
 - Press menu -> Display Setting
 - Click on the Search icon  to find LED Displays
 - Verify matching IP addresses and select the IP address
 - LED Displays can be added manually by Enter name and IP address of the Display and then press "+" icon
 - Select display content:
 - Shot time
 - Game time
 - Goals
 - Actual time
 - Adjust brightness if needed
 - Return to the main screen by clicking the back icon 
- C. Starting the Match
1. Initial Ball Possession
 - Ball starts with team on left side
 - Use "Defend" button to switch ball possession 
 2. Activating Timer
 - Motion sensor starts paused
 - Click "Game time" or "Shot time" to begin
 - Timers turn green and start counting
 - Motion sensor activates
 - Game status changes to "Running"
 3. Stop or restart Timer
 - If the position of the phone is changed to elevated position it stops or restarts Timer
 - If "Game time" is pressed Timer is stopped
 - If "Shot time" is pressed timer is restarted

7.1. Game Time Control Functions

Basic Time Controls

- A. Shot Time Control (Click on Shot Time Button)
 - Stops game time
 - Resets shot clock to 30 seconds
 - Switches ball possession
 - Use when: Ball changes possession to opponent
- B. Game Time Control (Click on Game Time Button)
 - Stops game clock only
 - Maintains current shot clock
 - Keeps current possession
 - Use when: Free throw, same team maintains possession

Special Time Controls

- A. Exclusion Button
 - Controls playing and attacking times
 - Default setting: 20 seconds
 - Adjustable duration in Settings menu
 - Motion sensor remains active
- B. Angled Button
 - Controls playing and attacking times
 - Default setting: 20 seconds
 - Adjustable duration in Settings menu
 - Stops motion sensor
 - Sensor resumes only when activated by:
 - Play button
 - Attack button
 - Angled time button

Goal Scoring Function

- Stops game clock
- Deactivates motion sensor
- Adds one point to scoring team
- Automatically transfers possession to opposing team

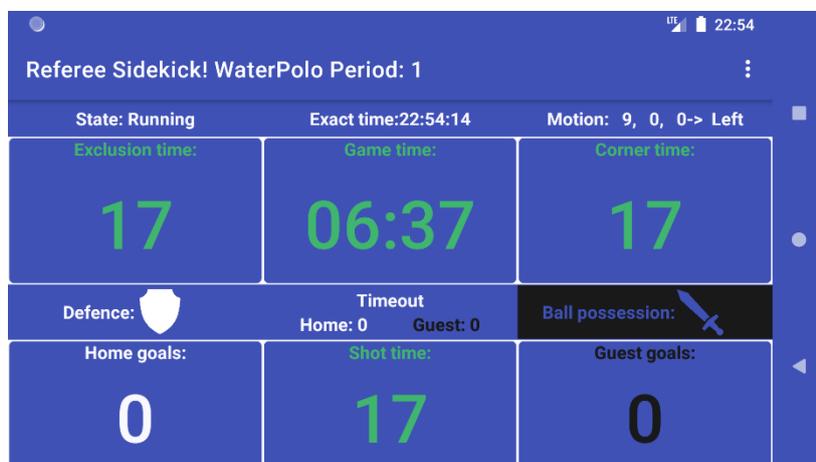


Figure 3 Corner, Exclusion

Motion Detection System

1. Overview
 - System detects referee hand positions
 - Features 5 distinct states
 - Position status displayed as "Motion:" in top right
 - Unrecognized positions show as "-----"
2. Motion States and Actions
 1. Down Position (State 1)
 - Arm Position: Forearm down
 - Action: Clock Running
 - Effects:
 - Game time starts
 - Continues until manually stopped or arm position changed
 - Stops when time limits reached (Shot or Game time)
 2. Up Position (State 2)
 - Arm Position: Forearm up
 - Action: Clock Stops
 - Effects:
 - Game time stops
 - Motion sensor deactivates
 - Requires screen button press to reactivate
 3. Left Position (State 3) - Left Foul
 - Arm Position:
 - Forearm sideways
 - Phone's long edge facing ground
 - Referee Signals:
 - Right arm indicates fouling player
 - Ball arm shows attack direction
 - Effects:
 - Game time stops
 - Resets Shot time (if right-side foul)
 - Transfers possession to ball side
 - Right team loses possession
 4. Right Position (State 4) - Right Foul
 - Arm Position:
 - Forearm forward
 - Phone display facing sky
 - Referee Signals:
 - Ball arm indicates fouling player
 - Right arm shows attack direction
 - Effects:
 - Game time stops
 - Resets Shot time(if ball-side foul)
 - Transfers possession to right side
 - Ball-side team loses possession
 5. Undefined Position (State 5)
 - Any position not matching States 1-4
 - Displayed as "-----" in motion sensor state
 - No specific action triggered



4. fig. Possible hand positions from ball: Down / Clock runs, Up / Clock stops, Left / Ball fault, Right / Right fault

7.1. Event Logging Feature

Location:

- Main screen center
- Blue "+" icon white notepad background 

Recording an Event:

1. Access Event Logger
 - Tap blue "+" icon
 - New window opens
2. Enter Event Details
 - Add note in text field
 - Select event type from radio button options
3. Purpose
 - Creates timestamped event record
 - Contributes to match statistics
 - Enables detailed match reporting

Note: This feature helps track important match moments for later analysis and reporting.

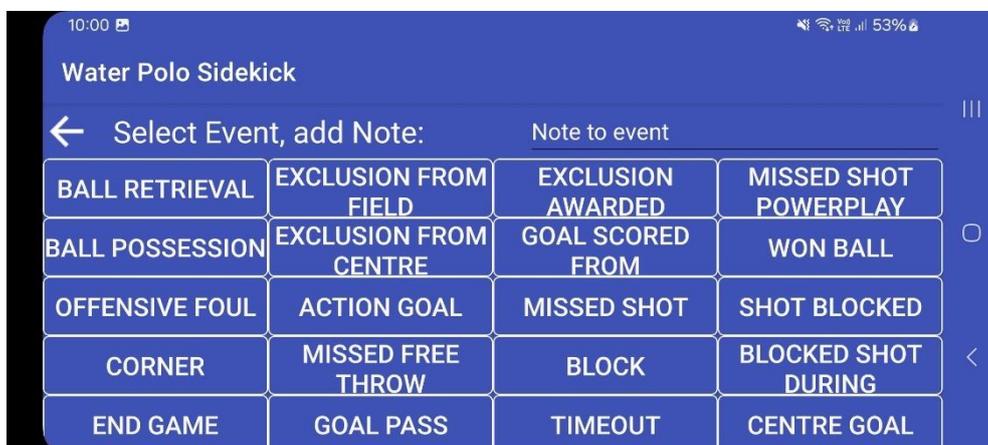


Figure 5 Recording events. Comment or select optional events

4. Player Selection
 - After choosing event type
 - Select player number
 - Team identification:
 - Home team: White numbers on blue background
 - Away team: White numbers on black background
5. Event Confirmation
 - System returns to main screen
 - Displays last event details in header
 - Provides immediate verification

Event Management

1. Cancel last event:
 - Navigate to Menu
 - Select "Last events"
 - Choose cancellation option
2. Data Handling Export events:
 - Navigate to Menu
 - Select "Export Events"
 - Creates CSV file
 - Available for sharing as attachment

Note: All event data clears automatically when starting new match

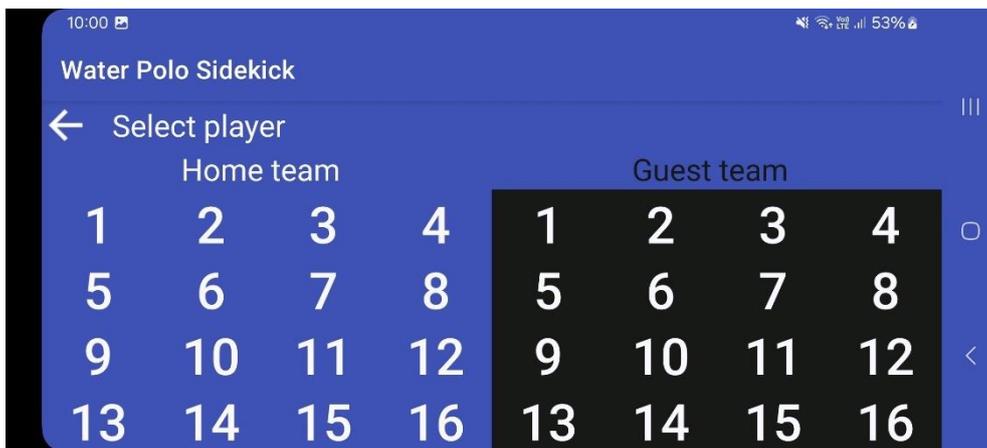


Figure 6 Recording events. player selection

7.2. Menu Functions

- A. Accessing the Menu
 - Location: Three dots in top right corner
 - Action: Click to display dropdown menu options
- B. Menu Options
 - A. WiFi Hotspot Setup
 - Purpose: Enable display connectivity
 - Process:
 - Select "Start WiFi HotSpot"
 - Complete phone authorization
 - Enable displays to connect

- B. Display Settings
 - Access: Click "Display settings"
 - Purpose: Manage and configure displays
 - Note: Detailed instructions provided separately
- C. Match Settings
 - Access: Click "Match settings"
 - Purpose: Configure game parameters
 - Note: Detailed instructions provided separately
- D. New Match
 - Purpose: Reset game state
 - Effects:
 - Resets all displays to default
 - Stops all timers
 - Deletes previous match data
- E. Next Period
 - Location: Period counter in address bar
 - Function:
 - Resets game and shot times
 - Increases period counter
 - Maximum 4 periods (default). Changeable at match settings
- F. Side Swap
 - Purpose: Switch team positions (typically after second quarter)
 - Effects:
 - Changes ball possession indicators
 - Updates timeout displays
 - Swap home and guest goal counts positions
 - Adjusts team colors and captions
- G. Timeouts
 - Home Team Timeout
 - Process:
 - Select "Home timeout" from menu
 - Increases home timeout counter
 - Starts timer (default: 45 seconds). Changeable at match settings
 - Guest Team Timeout
 - Process:
 - Select "Black timeout" from menu
 - Increases guest timeout counter
 - Starts timer (default: 45 seconds). Changeable at match settings

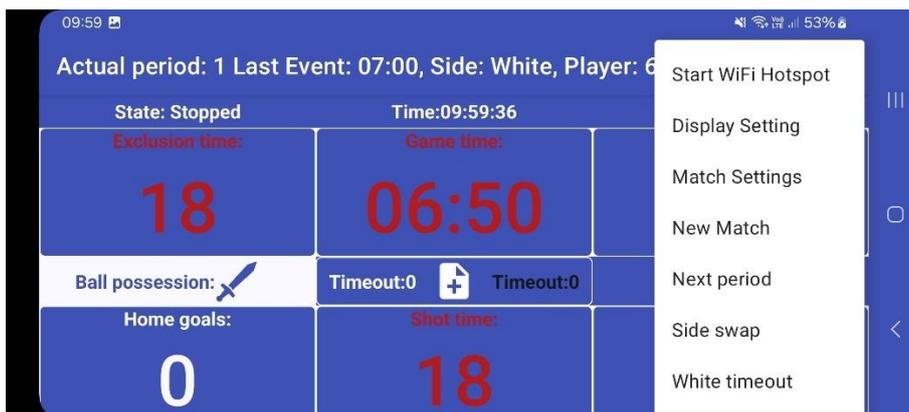


Figure 7 Menu items: new match, attacking time, substitution, reset goals, next period, sound off/on

H. Goal Management

- Scoring Functions
 - Click team's goal display to add point
 - Updates score immediately
- Score Corrections
 - Reset home team score: Select "Reset home goals"
 - Reset guest team score: Select "Reset guest goals"

Note: Allows score correction without match restart

I. Event Management

- Recording Events
 - Access: Click document icon (screen center)
 - Purpose: Track match events and comments
- Event Correction
 - Cancel last event: Menu -> "Undo last event"
- Event Export
 - Select: Menu -> "Export events"
 - Creates: CSV text file
 - Features:
 - Available for attachment sharing
 - Compatible with text editors
 - Optimized for Microsoft Excel
 - Uses semicolon separators for column organization

J. Motion Settings

- Access: Menu -> "Motion settings"
- Purpose: Configure motion sensor parameters
- Opens dedicated configuration sub-page

K. Help Section

- Access: Menu -> "New Match"
- Displays:
 - Current program version
 - Website link
 - Additional information
 - Contact details
 - Usage guidance



Figure 8 Menu items: sound on/off, vibrate on/off, displays on/off, motion sensor on/off, help, monitor mode, settings, motion sensor calibration

8. Settings subpages

There are 3 different settings subpages available in the Menu:

- A. Display Settings
 - Purpose: Configure and manage display units
 - Location: Menu -> Display Settings
 - Functions:
 - Display configuration
 - Device installation
 - Screen setup options
- B. Match Settings
 - Purpose: Customize game parameters
 - Location: Menu -> Match Settings
 - Functions:
 - Game-related configurations
 - Match parameter adjustments
- A. Motions Settings
 - Purpose: Calibrate motion detection system
 - Location: Menu -> Motions Settings
 - Functions:
 - Coach movement detection parameters
 - Sensor sensitivity adjustments
 - Motion recognition configuration

8.1. Display settings

Click on "Display settings" in the menu to open the settings window. The screen is divided into two parts. Changes to the parameters are automatically saved when the back button is pressed. 

On the left side of the screen, the names and IP addresses of the LED displays can be managed. The IP addresses in the list will be sent information by the application. Broadcast / Group addressing is included in the list by default. This IP address (255.255.255.255) will broadcast messages to all devices on the network. As this feature is limited on several networks, it is possible to add individual IP addresses. The LED display will show the IP address of the LED display on startup if it is already connected to a WiFi AP.

To add a new display manually, fill in the Display name and IP Address fields above the list of displays, then press the "+"  button. To remove an unwanted LED display, click on the line of the display that needs to be removed in the list box and then press the trash can icon. 

To set up a new display, use the monitor and arrow icon . For more details, see the "Installing a new display" section. Click on the magnifying glass icon  to find displays on the network that are already installed but not yet paired with the phone. For more information, see "Finding a display".

The "List of active displays" contains previously recorded displays. Click on a row to access the settings and modification options for that display using the function buttons on the right of the screen.

Display selection

The display is selected using a preselector switch. This switch affects the operation of all the function controls below it. If the switch is set to 'One only', commands are sent to one display only - the last one selected in the 'Active displays list'. If the switch is set to "All", commands are sent to all displays at once.

Brightness adjustment

The control bar **Brightness:**  next to the "Brightness" label allows to adjust the brightness of the LED display(s). Changing the value of the bar will automatically change the brightness of the selected LED display. The brightness can be turned off completely, in which case the display will not show anything. Higher brightness is ideal for sunny outdoor use, while lower brightness is recommended for indoor use.

Counter, stopwatch

The function buttons next to the "Counter" and "Range" labels perform the functions of a stopwatch. Clicking on the "Play"  button will start the counter from 0 and run until it reaches the value set in the range. The counter will then restart from 0 and increase the number of laps. During counting, the "Play" button icon changes to a "Stop" icon; click this to stop counting. Clicking on the "Restart" button  will reset the "Counter" and "Laps" **00:00** to 0. The "Range" control bar can be used to set a number between 0 and 99. This determines how many seconds a lap will last.



Function switches

The LED display can show different information that can be adjusted using the function buttons. The "Turn on/off" buttons can be used to switch the LED display on and off. By pressing the "Time" key, the time used by the phone (hours and minutes) is sent to the LED display and it will show it. The LED display then measures the time independently of the phone. The buttons after the Show label set the following functions of the LED display in sequence: Shot time, Game Time, and Goals. After returning to the main screen, these contents will be shown on the LED display. The colour of the running clock and the stopped clock can be selected from a drop-down menu.

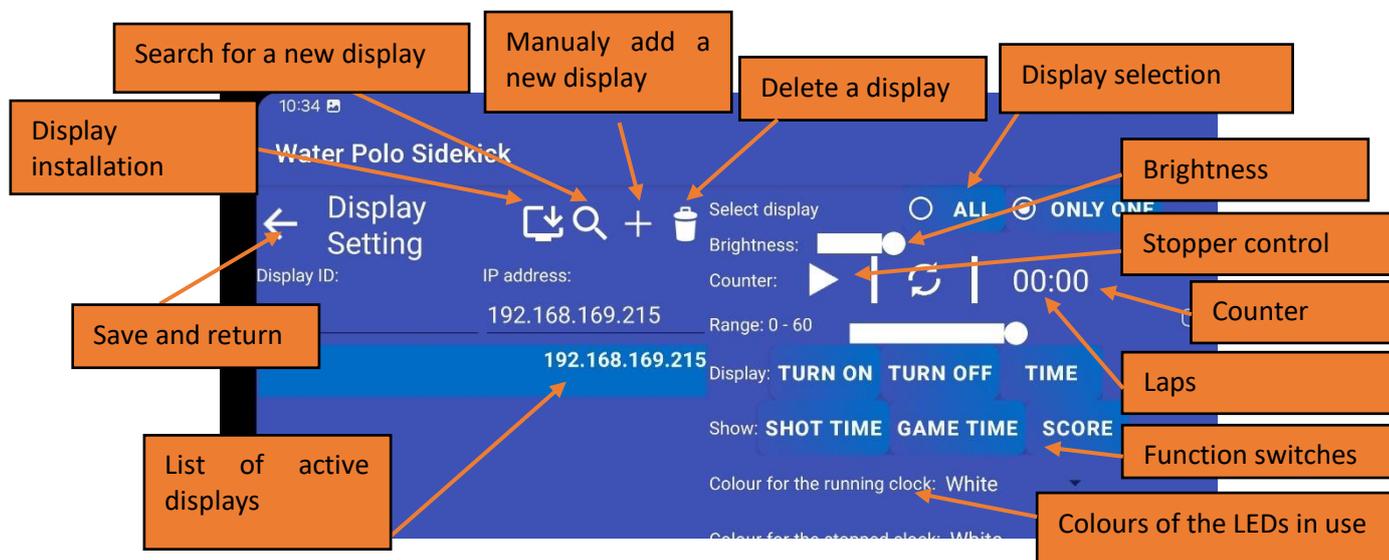


Figure 9 Settings, IP addresses of displays, setting game times

Orientation

The LED display can show data in two different orientations. The LED display can be assembled with the cable and connectors facing the ground, making the device less sensitive to rain from above, but more difficult to switch on because it is more difficult to connect the USB connectors from below. For this position, the orientation DOWN button must be pressed.

In the other position, the cables face upwards, making it easier to switch on and off, but from above it is easy for liquid to spill into the open connectors. In case of rain, it is advisable to place the device in a transparent protective bag. In this assembly, the orientation is to press the UP button.

The orientation setting is done only once and the LED display will then remember the setting.

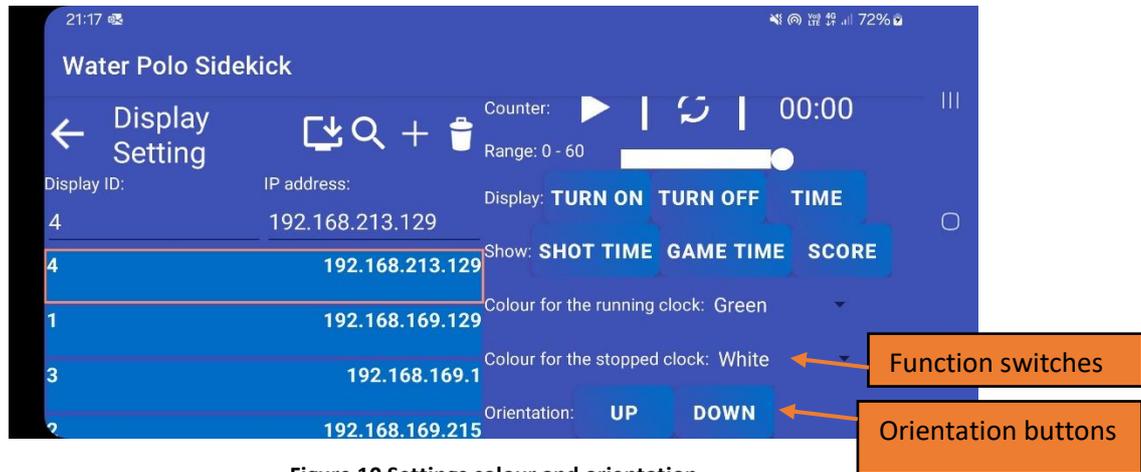


Figure 10 Settings colour and orientation

8.2. Match settings

The default parameters are the parameters of the currently used water polo matches. They can be set freely.

Shot time (sec): length of Shot time in seconds (in seconds). For example: 30.

Game time (sec): the length of time in seconds for a period of a game. For example: 420.

Corner time (sec): length of corner time in seconds. Number of seconds (in seconds). E.g.: 20.

Exclusion time (sec): length of exclusion time in seconds. Number of seconds (in seconds). E.g.: 20.

Timeout (sec): The length of time in seconds for a timeout. For example: 45.

Sound on?: When the switch is turned on, the phone emits a sound signal when the shot or the game time expires.

Is vibration on?: When this switch is turned on, the phone vibrates when the shot or the game time expires.

Number of Periods: a match may consist of periods. A number between 1 and 99 must be entered. For example: 4.

Number of timeouts: the number of timeouts per team can be entered here. A number between 1 and 99 must be entered. For example: 4

Timeout time(sec): Exposure length in seconds. Number of seconds (in seconds). For example: 20.



Figure 11 Motion sensor calibration window

8.3. Motions settings

Click on Menu-> "Motions settings" to bring up the Motion Sensor settings window. The Motion Sensor Settings window allows to set motion sensor thresholds for each movement. See Figure 1.

Each movement has 6 limit levels, with a minimum and a maximum value per axis. To calibrate, set the device to the desired position and correct the limit levels according to the values in the Measured value line.

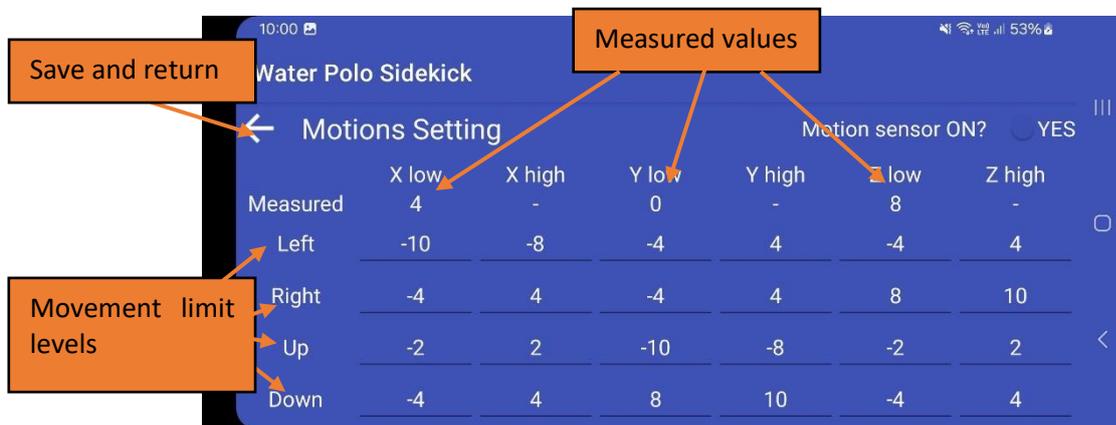
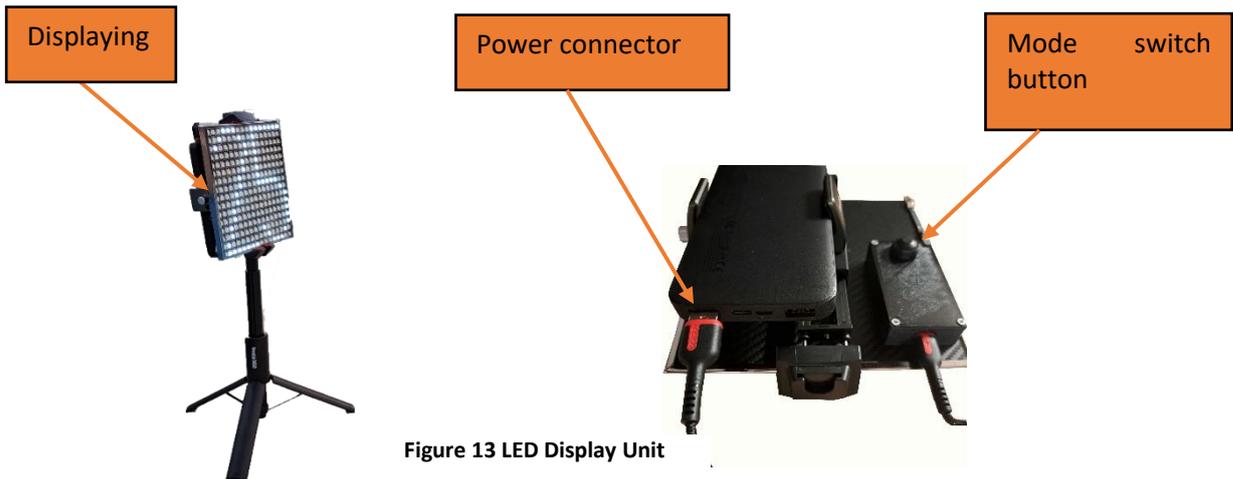


Figure 12 Motion sensor calibration window

8.4. Install a new display

In order to keep spectators and players informed about the match status or the time of the game, a WiFi network needs to be set up. To do this, either activate the Hotspot function of the phone or set up a WiFi Router (this can be a Hotspot of another phone). The WiFi Router and Hotspot settings may vary from device to device, so it is needed to follow the instructions of the device to set up a WiFi Access Point. In the settings, the UDP broadcast packet between each client should be enable or the IP address of the specific LED Display could be used in the Settings menu of the Water Polo Sidekick application. Most Android or iPhone Hotspot and WiFi routers enable this by default. The SSDI and password parameters required to connect to the WiFi Access Point must be set on the LED Display Units and the Mobile Phone to connect to a shared network.

8.5. Installation of LED display unit



Connect the USB-C connector to the powerbank, check that the display shows "sidekick" in white when switched on.

If no WiFi network has been set up on the LED display, or a connection is needed for the LED display to use an another WiFi network, press and hold the mode switch button when switching on the LED display, the LED display will then start in Access Point mode.

Go to Settings -> Display setup -> Monitor and arrow icon  and click on the Install new display window.

Click on the "Connect to Sidekick button". This will display all available WiFi networks and then connect to the WiFi network called "sidekick". No password is required to connect. Go back to the application.

Clicking on the "Check WiFi settings" button it will display the following text in the Status/Results field: connected SSID: " sidekick" if the connection was successful.

If the SSID and password of the Hotspot or WiFi AP are unknown, click on the "Open Hotspot Settings" button to view or change it.

Enter the SSID name and password in the appropriate field, then press the "Submit setting to display" button. If the setup was successful "Login successfully sent!" message will be displayed while the Status/Results field will say "Display is set, start the hotspot!". The display will restart and try to connect to the WiFi AP.

The phone's Hotspot can be activated by clicking on the Turn on Hotspot button. If the setting is successful, the unique IP address will be displayed.

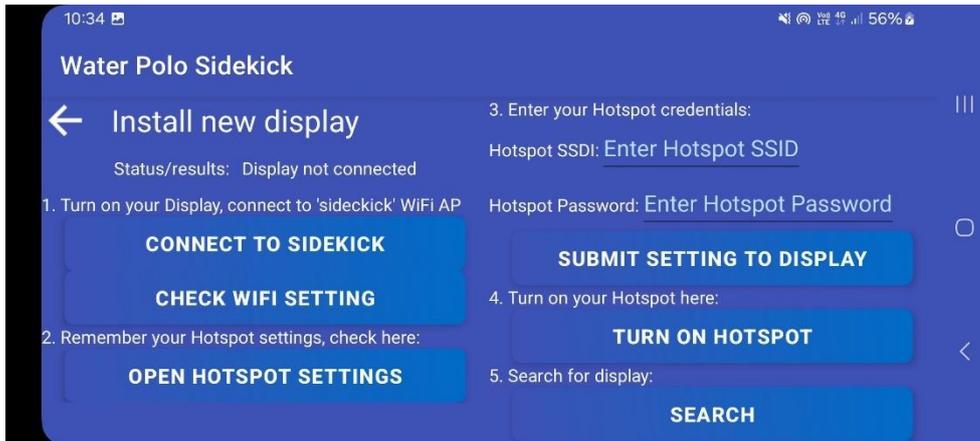


Figure 14 Display installation

In the application, clicking on the "Search" button will open a new window. Here can be seen the IP addresses of all the displays on this WiFi network that are not yet paired with the phone. These LED Displays will show their IP address.

If the phone and the LED Display are on the same network, the IP address shown on the LED display will appear in this list. Click on the IP address to pair the display with the phone. When the pairing is complete, the application automatically returns to the Display settings window, where the new device is already visible in the list of displays. The device is then ready to change its settings.

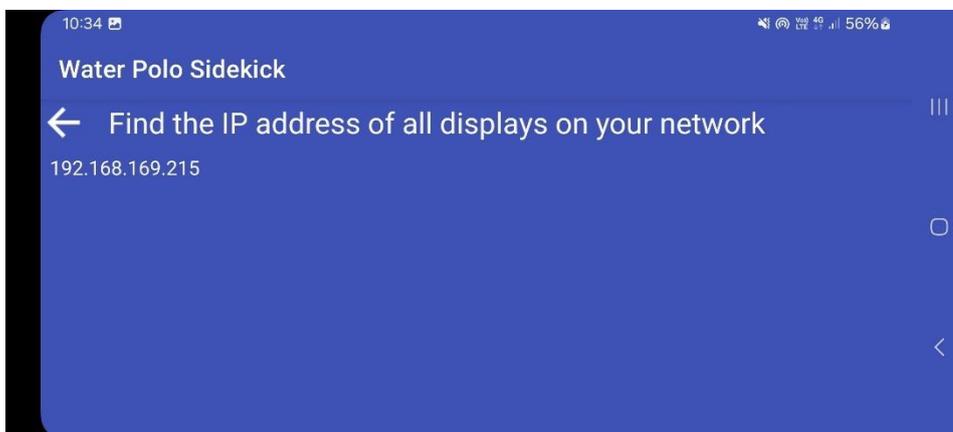


Figure 15 Display installation

9. Maintenance

For mobile phones and power banks, maintenance should be carried out according to the type of phone. The LED display should be cleaned regularly to prevent dirt build-up from impairing visibility.

The LED Display is not rainproof or waterproof, so it is recommended to put a transparent bag on top of the display when it rains. Set it up on the poolside in a stable position so that it does not fall into the pool.

Contact: waterpolosidekick@retrosc.hu

For more information: <https://retrosc.hu/waterpolosidekick/>