START HERE · PHYSICAL SETUP

Oar Sensor Kit

A printable setup and recording guide for iPhone and Android. Keep it with the kit so sensor identity, mounting and saved oar settings stay consistent.

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Charge, identify and assemble

1. **Charge the phone and both WitMotion sensors.** Identify INNER / SHAFT as the sensor closer to the handle and pin, and OUTER / BLADE as the sensor farther toward the blade. Record their addresses on page 10 and keep those identities every session.
2. **Fit the housing parts.** Each sensor uses a housing, two side clips, flexible ring, curved saddle and strap. Hook each clip’s retaining flange over the housing edge and press it fully home. Keep the long strap slots clear.
3. **Fit the ring and sensor.** Stretch the ring evenly around the sensor without twisting it. Insert the sensor through the housing’s open back. Keep the button and logo face visible through the front opening.
4. **Add the saddle.** Nest its matching curve against the back of the housing. Engage one edge lip, then flex the other until it snaps in. Check both lips, the sensor and the saddle are fully seated.
5. **Secure the strap.** Place the concave saddle against the shaft. Feed the strap through each clip from the oar side to the outside, then fold each end back onto itself on that same side. Keep the smooth back against the oar and the fastening faces together without twisting.

Position and direction

Place one sensor between the handle and the oar button, and the other on the blade side of the button. Keep the mounts clear of the oarlock and your hands. Follow the positions marked for your kit. Some kit layouts use approximate pin-reference distances of 10 in (25 cm) and 45 in (114 cm); always save the **actual measured dimensions**.

Orient both offset sensor buttons toward the blade: sensor **-Y faces the blade** and **+Y faces the handle**. With the oar upright, blade down, +Y points up. Keep this orientation repeatable.

> **Check the mounting**
> Neither sensor should slide, rotate or rock. Check again after feathering and squaring. A moving mount can look like oar bend. Repeat alignment and review stiffness settings after moving, rotating, removing or replacing a sensor.

IPHONE · CONNECTION

Choose and connect your oar

The iPhone app connects the oar sensors, displays live rowing feedback, records phone motion and GPS, saves workouts and uploads them for Cloud Analysis.

Connect in RitmoForceCurve

1. **Power on the sensors** and open the app. Allow the Bluetooth, motion and location access it requests. Manage the rowing connection inside RitmoForceCurve, rather than the iPhone Bluetooth Settings page.
2. Open **Connect Oar**. Under **Oars to connect**, choose the saved name and tap **Connect**. If the oar has a label, use **Scan oar label**, then check its physical shaft, sensor pair, side and positions.
3. For a new sensor pair, choose **Set up a new oar**. Connect the correct sensors, confirm their physical inner/shaft and outer/blade assignments, enter the oar name, side and type, then tap **Save and connect**. Set up away from other powered sensors when possible.
4. For the selected name, enable **Connect automatically next time** if you want it remembered at the next app launch. **Found** means detected nearby; **Connected** means fresh readings are arriving. Confirm all expected sensors are connected before rowing.

Check the intended saved record

In **Oar Settings**, choose the oar to inspect. Under **Active Oar details** or **Selected Oar details**, tap **Edit details**. Check Port/Starboard, Scull/Sweep, model, length, inboard/outboard, sensor positions, alignment and stiffness source. Selecting a details target does not change the rowing connection.

Manage Oars includes saved oars, named pairs and independent managed copies. Editing a saved oar updates that record; editing a managed copy updates the copy. For a named pair, save each oar first, then use **Create a sculling pair or two sweep oar pair** in Connect Oar. Select the saved oars, name the pair and tap **Save and connect**.

Saved pairs and shared setups

A saved pair uses four distinct sensors. A sculling pair contains one port and one starboard sculling oar; a sweep pair contains two sweep oars and can use the same side. Each oar keeps its own alignment and stiffness calibration. Confirm every expected connection before rowing.

A printed oar label can carry the selected oar details and alignment/stiffness values. In the calibration tools, use **Print oar labels** to print or **Share PDF**. After scanning a label on another phone, check that it still matches the physical shaft, sensor pair and mounting positions.

> **Continue with this oar**
> Complete and save sensor alignment on page 3, then check dimensions and the active stiffness factor on page 4. The recording stores the setup used for the row.

IPHONE · ALIGNMENT

Align, then save a water reference

Open Oar Settings → Align Sensors for the intended oar. Keep the mounts secure and use the app’s start, stop, calculate and save prompts.

Four required alignment movements

Movement	What to do
1. Bias 10 seconds	Feather the blade, rest the oar on a stable support and keep it completely still.
2. Feather and square 5-6 repetitions	Point the shaft in one direction. Rotate fully between feathered and square without sweeping or lifting.
3. Feathered level sweep 5-6 repetitions	Keep the blade feathered and shaft approximately level. Sweep back and forth through at least 90°. Stay clear of the water.
4. Square level sweep 5-6 repetitions	Keep the blade square and shaft approximately level. Repeat the back-and-forth sweeps through at least 90°, clear of the water.

Moving recordings do not need a still pause at either end. After all four are recorded, **calculate the alignment, review it and save it** to the intended oar. Replacing a movement makes the old fit out of date; calculate and save again.

If **Align both oars** is offered for a connected saved pair, perform the movements together. Each oar retains its own alignment. Capture the optional float one oar at a time after saving the alignments.

Optional squared float - after saving alignment

1. **Square the blade and let it float naturally.** Keep the boat level and the oar steady. Do not force the blade down or hold it artificially high.
2. Check **Outboard, pin to blade tip**. If you have separately measured **Shaft-axis tip below water**, enable that entry and enter the measured value in the displayed units. If unknown, leave it off.
3. Confirm **Blade squared and floating; boat level**, then tap **Start 12-second float**. Keep the oar and boat steady for the capture.
4. After the capture is accepted, tap **Save to Oar Settings**.

> **A separate reference**
> The float does not change alignment or bias. A floating blade alone does not establish an absolute water depth; the optional measured shaft-axis tip depth supplies that information. It means depth below the surface, not water depth to the bottom.

The float reference travels with the oar and workout and is retained when alignment changes. Recheck it after rigging or boat-loading changes. A manual **waterline below pin (cm)** in Workout Settings takes priority until cleared: measure vertically from pin to water surface with the boat level; positive means below the pin.

IPHONE · STIFFNESS AND DIMENSIONS

Set the scale for loading

Alignment establishes the sensor reference. Stiffness calibration sets Moment/Bend Factor (MBF, N·m/°), which converts bend into moment. Keep dimensions filled in even when using a manual factor.

Measure the physical geometry

Measurement	Reference
Sensor positions S1 / S2	From the blade tip toward the handle, to each sensor position.
Outboard	Blade tip to the outboard-facing button reference face.
Inboard	The same button reference face to the handle end.
Overall length	Blade tip to handle end; inboard + outboard.
Taper / diameter stations	Distance from blade tip and shaft diameter at that position.

Known-weight stiffness calibration

1. In **Oar Settings**, select the intended oar, open **Calibrate Oar stiffness**, then **Perform Calibration(s)**. Confirm the target and its saved alignment.
2. Check the oar dimensions, sensor positions, shaft profile, load and support positions. Enter the known weight in the units shown.
3. Place the oar on stable supports. Tap **Tare** with no calibration load. Apply the weight at the recorded load point and let readings settle.
4. Review the bend and stiffness result, then save it to the correct oar. Keep the supports, mounts and weight fixed during measurement.

The fixture reference points are **Blade Tip, Load L1, S1 sensor, Button, S2 sensor, Support L2 and Handle End**. Measure positions from blade tip toward handle. The required fixture order is **Load L1 < Outboard < Support L2**; actual weight and support positions must match the entered values.

Which factor is active?

Source, in priority order	How the factor is obtained
Manual MBF	Uses the entered factor directly. Inboard still determines handle force.
Manual Cperm	Uses entered shaft stiffness plus current dimensions.
Measured Cperm	Uses selected measured stiffness plus current dimensions.

Saving a new measured calibration selects its Cperm and clears both manual overrides. Earlier measurements remain in history. Changing dimensions alone leaves an active direct MBF override in place. Check the displayed source, value and units before recording.

For the same shaft, Cperm can cover unchanged sensor positions and modest geometry changes. Update dimensions or positions after changes greater than 0.5 cm. Larger changes, or sensor moves greater than 2 cm, need suitable taper measurements or a fresh known-weight calibration. Dimensions alone cannot supply unknown stiffness.

IPHONE · RECORDING AND UPLOAD

Record the whole workout

Keep the phone fixed to the hull. The app saves available oar motion, phone motion, GPS and heart rate with the oar settings used for that row.

Prepare and record

1. Confirm the oar name, sensor connections, side, dimensions, alignment and active MBF. Verify location and motion permissions. Check the water reference if the boat or rigging has changed.
2. Review **Workout Settings**, including the **Auto Piece Timer**. In **Rowing Views → Available Metrics & Curves**, choose the available measurements. Core choices start selected; question marks explain each item.
3. Use **Create & Edit Views** to build a display, then select it in **Active Rowing Views**. A missing input leaves the dependent measurement unavailable.
4. Tap **Start Rowing** on Home. Record through work and recovery intervals. Keep sensor mounting and identity unchanged. If a sensor disconnects, reconnect when practical without swapping its position or orientation.
5. Tap **End Row** when the workout is finished. Let it finish saving before switching off the sensors, and let analysis finish before opening its complete results.

> **Finishing a row**
> Home and workout history show progress. History may display **Finishing analysis - you can start another row**. Return to the app if processing or a pending upload needs to resume.

Upload for Cloud Analysis

1. Open **Home → Cloud Analysis** and sign in. Choose **Analyze latest** or **Choose a workout**.
2. Review **Recorded oar settings**, analysis inputs and included data. Use **Upload Saved Results** for supported saved results, or **Upload and Run Analysis** for raw-data analysis. An existing server job may instead offer **Upload Raw Data Again as New Analysis**.
3. Allow the upload to complete and check its status. Open the completed report or download it. **Change Settings and Re-run** is available when the original server files remain available.

For automatic upload, enable **Upload after each workout**. It waits for saving and processing. Pending uploads retry while the app is open and when you return; use the retry controls for an interrupted upload rather than creating an unrelated workout.

Review and retain the recording

Open **Workout History** for saved metrics, pieces, groups, recorded curves and available CSV exports. The original setup stays with the workout even if the active oar later changes. The report can add a route, curves and replay when the required data were recorded. Keep original recordings until you have opened and checked the results.

ANDROID · CONNECT AND ALIGN

Use WitMotion for the oar

Record the oar sensors in WitMotion. Record optional phone motion and GPS separately in Sensor Logger, then upload the matching files together.

Install and connect

1. Install the **WitMotion Android app** and, for phone motion/GPS, **Sensor Logger**. Charge and mount the kit as on page 1. Keep the same shaft, sensors, positions, orientation and strap tension for alignment and rowing.
2. Turn on the sensors and Bluetooth. Grant the Bluetooth, nearby-device and location permissions requested by your Android version. Connect inside **WitMotion**, rather than Android Bluetooth Settings.
3. On Main, open the connection/device list using the **chain/link icon** where shown. Use **Select Product** if needed and select your sensor model. Choose multiple-device mode, labeled **Multip**.
4. Connect both sensors by name/address. Use the recorded addresses or their last 3-4 characters when other crews are nearby. Set supported oar sensors to **200 Hz**. Return to Main, gently move the oar and verify changing live values for both; swipe between cards if needed.

One alignment recording, five blocks

Tap the red record circle with both sensors connected. Keep one continuous recording for the following blocks, in order. Keep the blade clear of the water during the moving blocks.

Block	Movement
1. Bias / still 10 seconds	Rest the oar on stable supports with both sensors completely still.
2. Feather and square 5-6 repetitions	Point the shaft in one direction. Rotate between feathered and square without sweeping or lifting.
3. Feathered level sweep 5-6 repetitions	Keep the blade feathered and shaft level. Sweep back and forth through at least 90° without rolling the shaft.
4. Square level sweep 5-6 repetitions	Keep the blade square and shaft level. Make the same sweeps through at least 90° without feathering.
5. Floating square blade 12 seconds	In the normal rowing position, square the blade and let it float naturally. Keep steady without pressing down, lifting it out, feathering or bumping the oarlock.

Do one movement type at a time. Short pauses may separate blocks; the moving blocks do not require extra stillness before or after. Stop and save the short alignment TXT, clearly named. Start a **new recording** for the workout.

The first four blocks establish the sensor alignment; the fifth is a separate floating-blade reference. Keep all five in one file. Repeat after a sensor or setup changes. Review the report’s reference notes before assuming the float was applied to waterline or blade-depth calculations.

ANDROID · PHONE MOTION AND ROWING

Record the hull and the row

Sensor Logger runs in the background while WitMotion stays in the foreground. A rigidly mounted phone supplies boat motion and GPS from the same workout.

Prepare the Android phone

Use **Sensor Logger by Kelvin Choi**. Fix the phone to the hull or a structure that moves with it for the whole session. Any mounting angle is usable if the phone does not shift. A pocket, bag or sliding seat also records movement independent of the hull.

Sensor Logger stream	Setting
Accelerometer	Enable; keep its original name and units.
Gyroscope	Enable.
Orientation	Enable; keep the standard quaternion export.
Location / GPS	Enable.
Gravity	Recommended when available.
Total Acceleration	Recommended when available.

Request about **100 Hz** for motion, or up to 200 Hz if supported. GPS keeps its own normal rate, about **1 Hz**; 1-2 Hz is appropriate. Actual rates depend on the phone. Keep separate sensor streams and timestamps instead of repeating GPS at the motion rate.

Check background recording first

1. Grant motion, location and background access. If Android restricts the logger, allow background operation or use unrestricted/no battery optimization for the recording period.
2. Make a short trial: start Sensor Logger, switch to WitMotion, and record the oar sensors for a few minutes.
3. Check both exports. Confirm the logger continued in the background, both oar sensors were recorded and the two recordings overlap. If Android stopped the logger, adjust its background/battery settings and repeat.

Record the same workout

1. Use the phone’s correct date, time and timezone. Start **Sensor Logger** shortly before the WitMotion workout recording. Exact simultaneous starts are unnecessary; preserve both original clocks.
2. Confirm both oar sensors show live values. In **WitMotion**, tap the red record circle a few seconds before rowing. Keep WitMotion in the foreground through the row.
3. Keep sensor identities and mounting unchanged. Do not force-close the recording app or disconnect Bluetooth during the recording.
4. At the end, stop WitMotion with the square stop button, then stop and save Sensor Logger. Verify that the WitMotion recording is saved before powering off the sensors.

When recording without optional phone data, follow the same WitMotion steps. Oar alignment and stiffness remain separate: confirm the oar side, type, dimensions and Moment/Bend Factor for analysis.

ANDROID · EXPORT AND UPLOAD

Keep the matching files together

Retain the original recordings and timing. Upload one rowing workout, its matching phone recording and any needed alignment recording as one job.

Export the oar recordings

1. In WitMotion, tap the folder icon on Main and open the date/time folder. Select the saved **TXT**; the .wplay files are not the main upload files. A zipped recording folder can also preserve the originals.
2. Check the **DeviceName** column contains both sensor IDs and that the recording covers the full row. Keep timestamps, sensor identity, acceleration, gyro and other exported columns.
3. Share the original workout TXT to a location accessible from the uploader. Keep the short alignment TXT separate and clearly named. Export it too when the setup needs a new alignment.

Export the phone recording

In Sensor Logger, choose **Export → CSV in Zip File**. Keep the separate acceleration, gyroscope, location, orientation and other sensor CSVs with **Metadata.csv**, preserving filenames. Use the separate-CSV ZIP rather than Combined CSV, JSON or SQLite. Do not merge rows, delete columns or resample the streams.

You may also select the extracted CSVs with their original names, or place the WitMotion TXT beside an extracted Sensor Logger folder in one outer workout ZIP. Use one phone recording per workout; do not mix different phones or logger sessions.

Upload and check the timezone

1. At **www.ritmoforcecurve.com**, open **Cloud Analysis** and choose **Start new upload**. This gives the next recording its own workout ID and clears the previous recording and settings.
2. Select the **workout TXT** and matching **Sensor Logger ZIP** together. For a first upload or changed mounting, also select the short five-block **alignment TXT**, or include it in the upload ZIP.
3. Confirm oar identity, sensor assignment, side, Scull/Sweep, dimensions and **Moment/Bend Factor**. With **Uploaded alignment first**, the supplied alignment takes priority. A saved account alignment can be reused for later rows with the same unchanged setup.
4. Check **Recording timezone** matches the row’s location, for example America/Los_Angeles. Metadata may supply it; an explicitly selected value takes precedence.
5. Review the settings, then tap **Analyze workout**. Open the completed report. Use **Start new upload** for a different recording or **Re-analyze** for settings changes to the existing one.

> **Keep the clocks intact**
> Sensor Logger uses absolute timestamps; WitMotion date/time text normally represents local time. A wrong timezone can separate matching recordings by hours. Keep Metadata.csv and original clocks. If no phone data overlap, check the files and timezone before changing settings; do not align the first rows by hand.

Automatic oar-side detection is enabled by default. To use a known side manually, choose it in **Oar info** and turn off **Automatically detect oar side**. The resolved side also sets the animation.

QUICK REFERENCE

Checks at the boat

Keep sensor identity, mounting and the saved setup together. A short test recording is useful before relying on a full session.

Connection and recording troubleshooting

Problem	What to check
One sensor or no sensors	Power, proximity and Bluetooth permissions. In iPhone, check the selected saved oar and its sensors; reconnect in Connect Oar. In Android, choose Multip and enable both switches in WitMotion.
Many nearby sensors / wrong identity	Match the recorded sensor addresses or their last 3-4 characters. Check which physical sensor is INNER / SHAFT and which is OUTER / BLADE.
Visible in Android Settings only	Connect within WitMotion. Forget or ignore the system pairing if it interferes.
Live values stop changing	Reconnect and verify fresh readings from both sensors before starting a new recording. Check whether another phone or app is using a sensor.
Curves reversed, noisy or implausible	Check oar side, sensor assignment, mount tightness and orientation. Verify alignment, dimensions and active MBF before changing calibration factors.
Alignment poor or missing	Repeat the matching alignment carefully. iPhone: record the four movements, calculate and save. Android: retain all five blocks in the alignment TXT, including the steady 12-second float.
GPS or boat motion missing	Check motion/location permissions and a phone mount fixed to the hull. On Android, confirm the matching files, overlapping time and recording timezone.
Sensor Logger stopped	Review background-location access and battery restrictions. Repeat the short background-recording check.
Phone export too large or awkward	Use separate sensor CSVs in the normal ZIP. Keep GPS at its own rate, around 1-2 Hz, without repeating it at the motion rate.
Cannot find a WitMotion recording	Use the folder icon, open the date/time folder and share the TXT. Verify it contains both sensors and the whole session.

PRINT AND KEEP WITH THE KIT

Before you launch

Use this checklist at the boat. Fill in the record below for each kit and oar, with units and measurement references.

Fast pre-launch check

Check	iPhone	Android
Sensors charged, tight and correctly identified	Yes	Yes
Oar dimensions, side and stiffness	Saved and checked in app	Confirm for upload
Matching sensor alignment	Calculated and saved	Five-block WitMotion TXT
Phone fixed to hull / GPS enabled	Motion and location access	Sensor Logger configured
Workout recording	Start Rowing in app	WitMotion in foreground
Phone recording, when used	Collected in app	Sensor Logger in background
Upload	From Cloud Analysis in app	Oar TXT + phone ZIP

Kit / oar record

Fill in once, then update it whenever the physical setup changes. Write each position with its unit and measurement reference.

Oar name / boat	
Side / type / model	
INNER / SHAFT sensor address	
OUTER / BLADE sensor address	
Inner / outer sensor positions	
MBF (N·m/°) / source / notes	

After the upload

Keep original files until the report is checked. The report brings together available oar, boat, GPS, timing and body measurements, with curves, route and replay supported by the recorded inputs. Current written guides and metric explanations are under **Help** at www.ritmoforcecurve.com.