Table of content

1. General

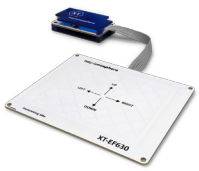
The Nexmosphere XT-EF Series offers E-field sensors in various sizes which are able to detect touchless input from the user. This document provides explanation of the available functionalities and instructions on how to install and integrate the sensor into your digital signage installation.

The information in this document is created for users who are familiar with the Nexmosphere API and are able to control a basic setup with a Nexmosphere API controller. If this is not the case yet, please read the general documentation on the Nexmosphere serial API first.

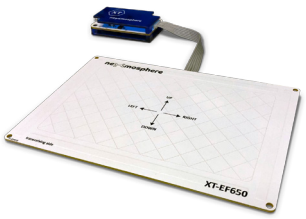
2. Product overview

The XT-EF Series consists out of 4 products:

XT-EF30



XT-EF630



XT-EF650

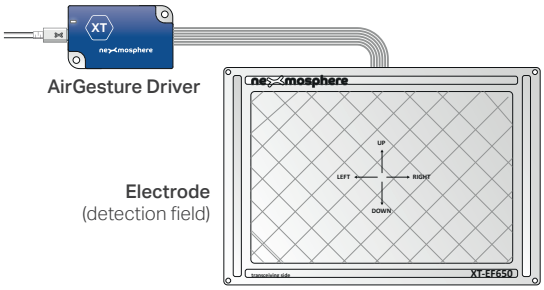
XT-EF680

All XT-EF sensors feature AirButton detection which will trigger whenever a person's hand either enters or leaves the sensor's detection field. The XT-EF630, XT-EF650 and XT-EF680 also offer AirGesture detection which includes detecting AirSwipes and AirWheels. The detection range of the sensors varies with the size.

	XT-EF30	XT-EF630	XT-EF650	XT-EF680
AirButton detection	✔	✔	✔	✔
AirGesture detection	✖	✔	✔	✔
Integrated sensor driver	✔	✖	✖	✖
Detection range AirButton	up to130mm	up to 130mm	up to 150mm	up to170mm
Detection range AirGesture	✖	up to 80mm	up to 100mm	up to 140mm
Sensor dimensions (L x W)	110x90mm	110x90mm	160x110mm	200x160mm

Nexmosphere
Le Havre 136
5627 SW Eindhoven • The Netherlands
T +31 40 240 7070
E support@nexmosphere.com

The XT-EF Series sensors consist out of 2 main parts: the AirGesture Driver and the Electrode. The sensor's electrode creates an electrical field which defines the detection area of the sensor. The driver analyses the signals coming from the electrode and connects to the Xperience controller via X-talk. The XT-EF6xx sensors all have a separate driver. The EF30 sensor has an integrated on-board driver.



3. Functionalities and API commands

The XT-EF Series sensors provide the following functionalities:

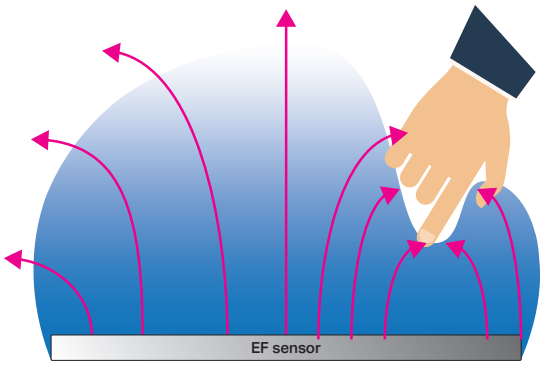
1. **AirButton** - detects when a hand enters or leaves the sensor's detection field
2. **AirSwipe** - detects swipes to the left, right, up and down
3. **AirWheel** - detects circular movements clockwise and anti-clockwise

The following sections will cover each of these functionalities in detail. Please note that for each API example in this document, X-talk interface address 001 is used (X001). When the sensor is connected to another X-talk channel, replace the "001" with the applicable X-talk address.

3.1 - AirButton

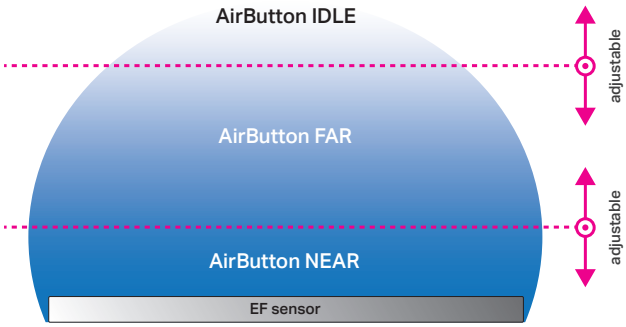
The XT-EF Series sensors can detect when a hand is placed above the sensor (both far and near) as well as when it leaves the detection field. The API output for these triggers is as follows:

X001B[Bs=FAR]	AirButton status FAR
X001B[Bs=NEAR]	AirButton status NEAR
X001B[Bs=IDLE]	AirButton status IDLE / hand left detection field



When implementing AirButton triggers, consider the following:

- The sensitivity/range of the FAR and NEAR detection level can be adjusted. Please see section 5 "Settings", page 9.
- The maximum range for AirButton detection is different for each XT-EF sensor model. Please see the overview on page 1 for more info.
- AirButton detection can be disabled. Please see section 5 "Settings", page 9.
- When an AirButton (far or near) is detected, the sensor checks for a short period of time if an AirGesture is detected as well. This avoids that both an AirButton and AirGesture API-command is send during an AirGesture event. The duration for which the system checks for AirGestures - and the AirButton trigger is delayed - is adjustable. Please see section 5 "Settings", page 9.



Nexmosphere
Le Havre 136
5627 SW Eindhoven • The Netherlands
T +31 40 240 7070
E support@nexmosphere.com

3.2 - AirSwipe

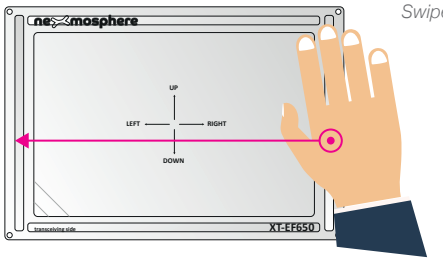
The XT-EF Series can detect swipe gestures within the detection field of the sensor.

The API output for these triggers is as follows:

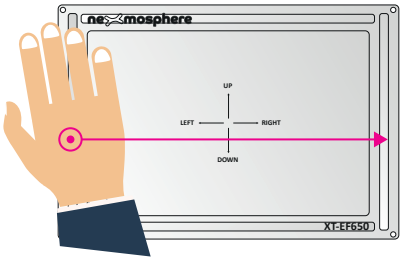
X001B[Sd=LEFT]	AirSwipe direction LEFT
X001B[Sd=RIGHT]	AirSwipe direction RIGHT
X001B[Sd=DOWN]	AirSwipe direction DOWN
X001B[Sd=UP]	AirSwipe direction UP

When implementing AirSwipe triggers, consider the following:

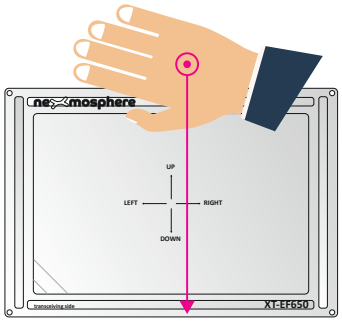
- The sensitivity/range of the AirSwipe detection level is fixed and can't be adjusted.
- The maximum range for AirSwipe detection is different for each XT-EF sensor model. Please see the overview on page 1 for more info.
- AirSwipe detection can be disabled. Please see section 5 "Settings", page 9.
- In order for a swipe gesture to be detected, the hand movement needs to cover a least 70% of the sensor 's length (left-right) or width (up-down).
- When an AirButton command is send while executing an AirSwipe, consider increasing the AirButton delay setting. Fore more info please see section 5 "Settings", page 9.
- Make sure the sensor is positioned in such a way that the swipe gestures can be performed in a natural way. Fore more info please see section 4.3 page 8.



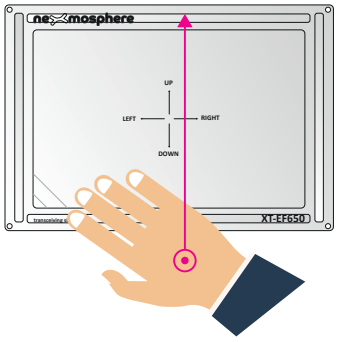
Swipe gesture LEFT



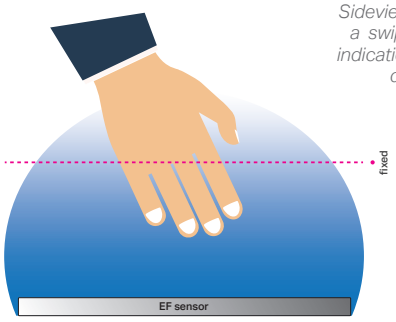
Swipe gesture RIGHT



Swipe gesture DOWN



Swipe gesture UP



Sideview illustration of a swipe gesture with indication of the (fixed) detection range

Nexmosphere
Le Havre 136
5627 SW Eindhoven • The Netherlands
T +31 40 240 7070
E support@nexmosphere.com

3.3 - AirWheel

The XT-EF Series can detect circular gestures ("AirWheels") within the detection field of the sensor. The output for AirWheel detection can be set to two different modes: "incremental" and "absolute value". Per default, AirWheel detection is disabled. It can be activated by sending one of the following settings:

`X001S[7:2]`	Enable AirWheel incremental mode
`X001S[7:3]`	Enable AirWheel absolute value mode

Incremental mode

When the mode is set to incremental, an API output is send each time an AirWheel is detected. The API output for these triggers is as follows:

X001B[Wd=CW]	AirWheel direction CLOCKWISE
X001B[Wd=CCW]	AirWheel direction COUNTER-CLOCKWISE

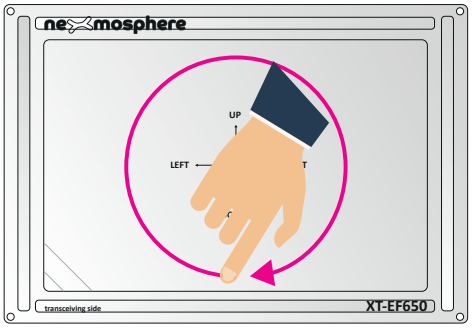
Absolute value mode

When the mode is set to absolute value, the sensor keeps track of a value between 1-100 and increases this value when the detected AirWheel direction is clockwise and decreases this value when the detected direction is counter clockwise. The API output for AirWheel detection in "absolute value" mode is as follows:

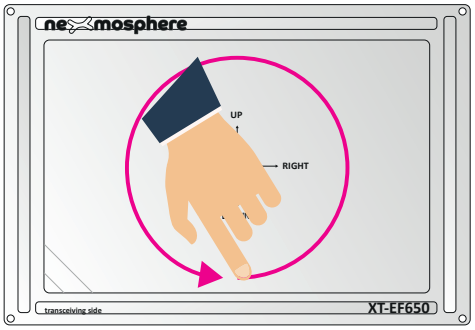
X001B[Wv=XXX]	AirWheel value *(XXX = 001-100)*

When implementing AirWheel triggers, consider the following:

- The amount of API triggers per full rotation can be adjusted. Please see section 5 "Settings", page 9.
- When the absolute value has reached 100 (max.), clockwise rotations will not result in new API triggers. The same goes for value 1 (min.) and counter clockwise rotations.
- The sensitivity/range of the AirWheel detection level is fixed and can't be adjusted.
- The maximum range for AirWheel detection is different for each XT-EF sensor model. Please see the overview on page 1 for more info.
- When an AirButton command is send while executing an AirWheel, consider increasing the AirButton delay setting. For more info please see section 5 "Settings", page 9.



Air Wheel Clockwise

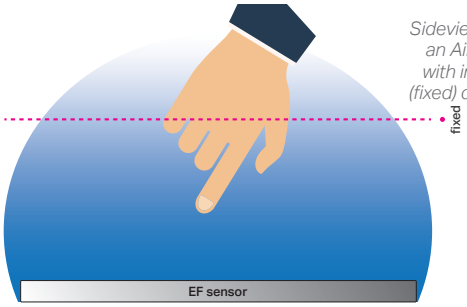


Air Wheel Counter-clockwise

The airwheel value can be (re)set to a value between 001-100 by sending the following API command:

`X001B[SETW=XXX]`	Set AirWheel value *(XXX= 001 - 100)*

For example, to set the AirWheel value to 075, send: X001B[SETW=075]



Sideview illustration of an AirWheel gesture with indication of the (fixed) detection range

Nexmosphere
Le Havre 136
5627 SW Eindhoven • The Netherlands
T +31 40 240 7070
E support@nexmosphere.com

4 - Installation requirements and guidelines

When integrating an XT-EF Series sensor into your digital signage installation, several installation requirements and guidelines need to be taken into account in order for the sensor to perform optimal and operate stable.

4.1 Electrical installation requirements

Grounding

The XT-EF Series sensors transceives an electrical field and measures changes within that field. Based on these changes, it can detect AirButton and AirGesture input. In order for the electrical field to remain stable, the sensor needs to be grounded. This can be achieved via two main methods:

- Use a grounded power supply to power the Xperience controller (to which the XT-EF sensor is connected). An overview of the connection options is provided in section 4.2.
- Connect the Xperience controller (to which the XT-EF sensor is connected), to a mediaplayer or PC of which the DC output is grounded. Please note that most mediaplayers are not grounded.

Avoid proximity of floating ground planes

When the sensor is placed in close proximity to large floating ground planes, this can cause interference of the electrical field of the XT-EF sensor which can result into unstable behaviour. A typical example would be a large monitor which is not grounded. Please note that when the Xperience controller is powered with a grounded power supply, this will also ground the connected mediaplayer/PC, which subsequently will also ground the connected monitor.

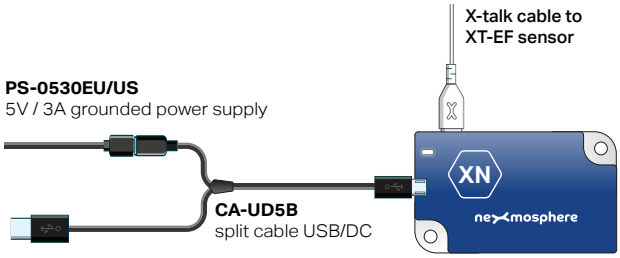
4.2 Connection Diagrams

There are multiple options for grounding the different Xperience controllers using a grounded power supply. Make sure the XT-EF sensor is connected to the X-talk interface before powering the Xperience controller. Otherwise, the XT-EF sensor will not be recognized by the Xperience controller and no sensor output will be provided.

XN Controllers (XN-135, XN-165, XN-185, XN-180)

All XN controllers are powered via USB. As USB power supplies are typically not grounded, a USB/DC split cable is needed to which a grounded power supply can be connected.

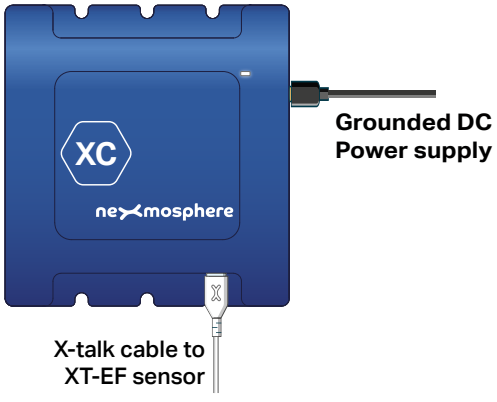
5V/3A grounded power supply EU: **PS-0530EU**
5V/3A grounded power supply US: **PS-0530US**



XC Controllers (XC-700, XC-800 and XC-900 Series)

All XC controllers are powered via 12 or 24V DC input to which a grounded power supply can be connected.

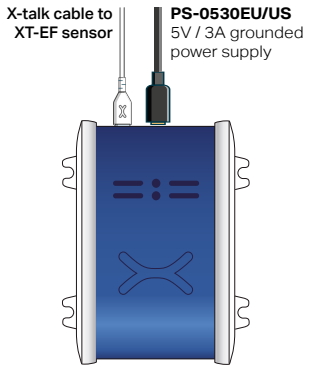
24V/1.67A grounded power supply EU: **PS-2416EU**
24V/1.67A grounded power supply US: **PS-2416US**
24V/3.75A grounded power supply EU: **PS-2438EU**
24V/3.75A grounded power supply US: **PS-2438US**



Nexmosphere
Le Havre 136
5627 SW Eindhoven • The Netherlands
T +31 40 240 7070
E support@nexmosphere.com

XM Controllers (XM-350 and XM-370)
All XM controllers are powered via 5V DC input to which a grounded power supply can be connected.

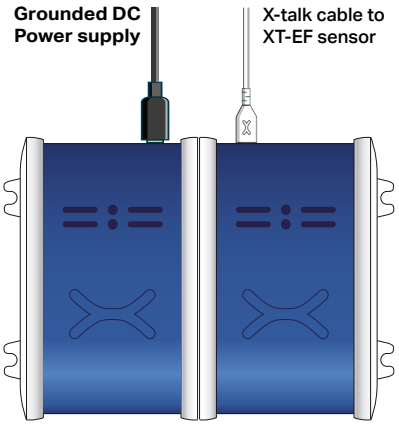
5V/3A grounded power supply EU: **PS-0530EU**
5V/3A grounded power supply US: **PS-0530US**



EM Modules (EM-2, EM-5 and EM-6)
Some EM modules have a DC power input to which a grounded power supply can be connected.

EM-2 and EM-5
Currently, Nexmosphere does not have grounded 12V power supplies in it's product portfolio.

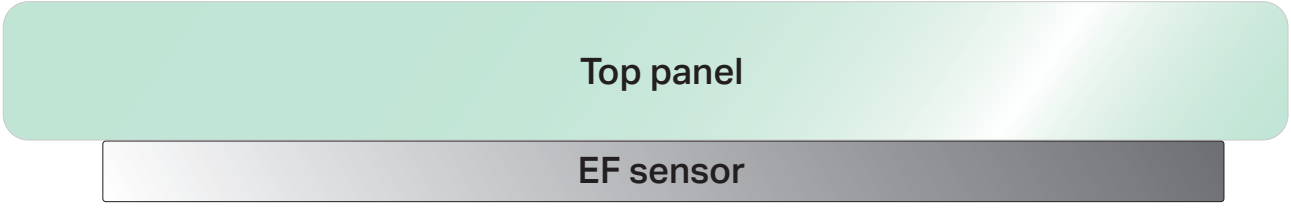
EM-6
24V/1.67A grounded power supply EU: **PS-2416EU**
24V/1.67A grounded power supply US: **PS-2416US**
24V/3.75A grounded power supply EU: **PS-2438EU**
24V/3.75A grounded power supply US: **PS-2438US**



4.3 Hardware integration guidelines

Top panel material
The XT-EF Series sensor can be installed behind any non-metal top panel, creating a completely invisible solution. The maximum recommended thickness for the **XT-EF30, XT-EF630** and **XT-EF650** is 22mm for acrylic or glass, and 18mm for wood. For these models, the material and thickness of the top panel will only have a minor affect (if any) on the detection range and the performance in general.

The **XT-EF680** has a different technical design to create a large sensor surface and high detection range. Therefore the XT-EF680 is more sensitive to the material and thickness of the applied top panel. There are 7 calibration profile settings available for the XT-EF680 to optimize the performance for a specific type of top panel (see section 5.2, page 10). This enables the sensor to be placed behind a thick surface such as 36mm of wood or 100mm of brick. Please note that the calibration profiles for these surfaces are tuned to a situation in which the sensor is only attached to the surface and has free space on the back. For example during a test situation, when placing the sensor on a table and then placing a 36mm wooden test panel on top, the sensor might not perform optimal as the back of the sensor is not free, but placed on a table top.



Nexmosphere
Le Havre 136
5627 SW Eindhoven • The Netherlands
T +31 40 240 7070
E support@nexmosphere.com

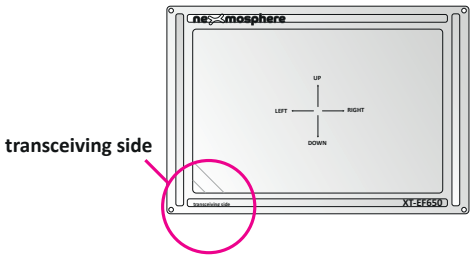
Double glazing

The XT-EF sensors do **not** work behind most types of double glazing used to insulate indoor environments from outdoor environments (e.g. double glazing used in windows or doors at store fronts). The reason for this is that most modern types of double glass have a very thin invisible metal foil inside to reflect heat. The metal foil blocks the electrical field of the sensor, causing the sensor not to detect any AirButton or AirGestures. Next to that, some types of gas applied to insulate the two glass panels may have a negative effect on the detection range.

Please note that the XT-EF sensor does work behind almost all other common types of glass, whether it is with 1 glass panel or multiple.

Transceiving side

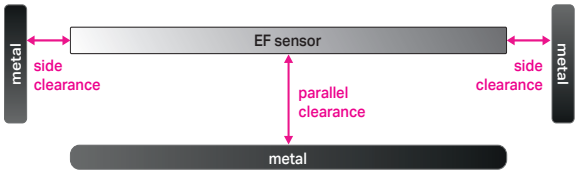
The XT-EF sensor electrode has a transceiving side and non-transceiving side. This is indicated on the sensor at the bottom left. Make sure the sensor is placed in such a way that the transceiving side is facing the user. When using a top panel, the transceiving side should be attached to the panel.



Clearance from metal objects/surfaces

Metal objects or surfaces parallel to the XT-EF sensor or to the side can cause interference of the electrical field which results into unstable behaviour. Please take the clearances indicated in the table below into account.

	parallel clearance	side clearance
XT-EF30 / 630	80mm	40mm
XT-EF650	100mm	50mm
XT-EF680	120mm	60mm

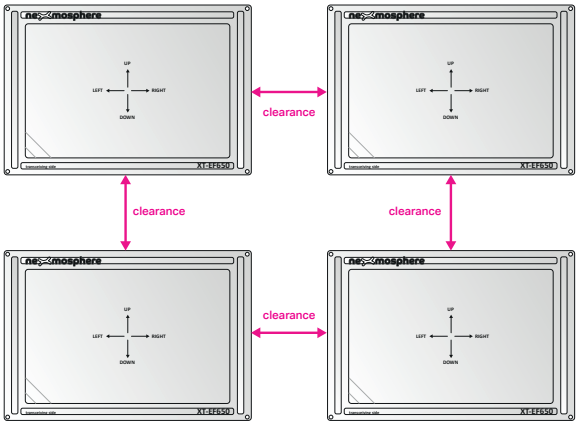


Multiple XT-EF sensors side-by-side

When using multiple XT-EF sensors side-by-side, the electrical fields of the sensors will interfere with each other when placing the sensors too close to each other. Therefore please make sure that the minimum spacing indicated in the table below are taken into account.

Furthermore, it is recommended to set each sensor to a different operating frequency, using setting 4. Please see page 10 for more info.

	recommended clearance
XT-EF30 / 630	60mm
XT-EF650	80mm
XT-EF680	100mm

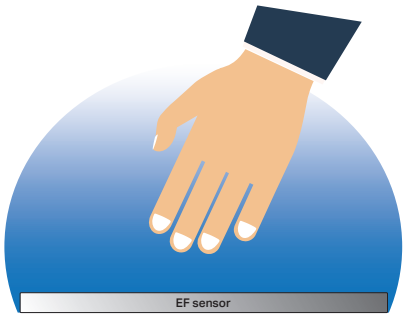


Nexmosphere
Le Havre 136
5627 SW Eindhoven • The Netherlands
T +31 40 240 7070
E support@nexmosphere.com

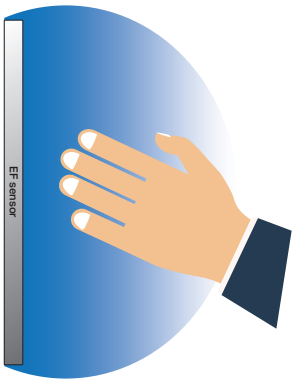
Positioning of sensor

The positioning of the sensor (height, angle and orientation) has a significant impact on how a person executes the AirGestures and -as a results- how well the XT-EF sensor is able to detect those gestures. Although we always recommend to test what works best for your application, below are some general guidelines as reference.

	recommended positioning	recommended height
AirButton	Any *(horizontal, vertical or angled)*	**horizontal or angled -** below shoulder height **vertical -** shoulder height
AirSwipe left/right	Any *(horizontal, vertical or angled)*	**horizontal or angled -** below shoulder height **vertical -** any height
AirSwipe up/down	Vertical or Angled	**vertical -** shoulder height **angled -** below shoulder height
AirWheel	Any *(horizontal, vertical or angled)*	**horizontal or angled -** below shoulder height **Vertical -** shoulder height



Horizontal



Vertical

Angled

Recalibration

The XT-EF sensor recalibrates each time an AirGesture is detected. When changing top panels or replacing the sensor, please perform a swipe gesture to activate the recalibration. The recalibration process lasts less than a second and does not interfere with normal operation.

Nexmosphere
Le Havre 136
5627 SW Eindhoven • The Netherlands
T +31 40 240 7070
E support@nexmosphere.com

5 - Settings

The XT-EF Series has multiple settings which determine the behaviour and output of the sensor. The settings can be adjusted by sending X-talk setting commands via the API. After a power cycle, the settings always return back to default.

Setting 1: Status LED behaviour

1. LED on	`X001S[1:1]`
2. LED off	`X001S[1:2]`
3. LED on, blink at trigger (default)	`X001S[1:3]`
4. LED off, blink at trigger	`X001S[1:4]`

Setting 5: (De)activate AirButton

1. Deactivate AirButton detection	`X001S[5:1]`
2. Activate AirButton detection (def)	`X001S[5:2]`

Setting 6: (De)activate AirSwipe

1. Deactivate AirSwipe detection	`X001S[6:1]`
2. Activate AirSwipe detection (def)	`X001S[6:2]`

Setting 7: (De)activate AirWheel

1. Deactivate AirWheel detection (def)	`X001S[7:1]`
2. Activate AirWheel increm. mode	`X001S[7:2]`
2. Activate AirWheel abs value mode	`X001S[7:3]`

Setting 11: Detection range for AirButton FAR

Set AirButton FAR detection range `X001S[11:X]`

X is a value between **2-100** and its default value is **10**. It has an inversed correlation with the detection range for AirButton "FAR" detection. **So the lower the X value, the higher the detection distance and vice versa.**

Setting 12: Detection range for AirButton NEAR

Set AirButton NEAR detection range `X001S[12:X]`

X is a value between **1-100** and its default value is **20** (for XT-EF680 default is **15)**. It has an inversed correlation with the detection range for AirButton "NEAR" detection. **So the lower the X value, the higher the detection distance and vice versa.** Please note that the 1-100 range for AirButton NEAR has a different correlation to the absolute detection range then the 1-100 range for AirButton Far.

Setting 13: Hysteresis for AirButton FAR

Set AirButton FAR hysteresis `X001S[13:X]`

X is a value between **1-50** and its default value is **10**. It determines how far the hand needs to be placed above the AirButton FAR threshold in order for the sensor to detect an AirButton IDLE state. It has an inversed correlation: decreasing X will increase the responsiveness for a switch from FAR to IDLE, but can also make the sensor more twitchy. Vice versa, increasing X will make the switch from FAR to IDLE less responsive, but can also make the sensor's FAR / IDLE detection more stable.

Setting 14: AirButton trigger delay

Set AirButton FAR hysteresis `X001S[14:X]`

X is a value between **1-200** and its default value is **40**. When an AirButton is detected, the sensor checks for a short period of time if an AirGesture is detected as well. This avoids that both an AirButton and AirGesture API command are send during an AirGesture event. The duration for which the system checks for AirGestures (and the AirButton trigger is delayed) is determined by the X value. The delay time is X * 5mS. For example if X is 40, the delay time is 40*5mS = 200mS.

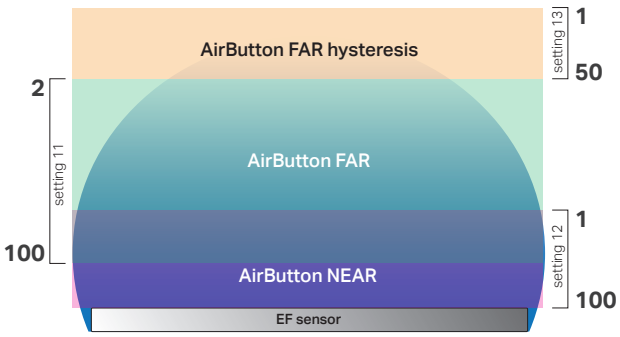
Setting 21: Trigger resolution for AirWheel detection

1. Trigger 8x per rotation	`X001S[21:1]`
2. Trigger 4x per rotation	`X001S[21:2]`
3. Trigger 2x per rotation (default)	`X001S[21:3]`
4. Trigger 1x per rotation	`X001S[21:4]`

Setting 27: (De)activate interference indication red LED

1. Deactivate indication	`X001S[27:1]`
2. Activate indication (default)	`X001S[27:2]`

When activated, the red status LED on the XT-EF driver will blink when a high level of interference (e.g. large electronic equipment with floating ground planes) is detected.



Nexmosphere
Le Havre 136
5627 SW Eindhoven • The Netherlands
T +31 40 240 7070
E support@nexmosphere.com

5.2 - Settings: calibration

The XT-EF Series has multiple settings which can be used to calibrate the sensor to its environment and setup. These settings typically only need to be used when installing multiple sensors side-by-side or when installing the XT-EF680 sensor behind a thick frontpanel.

Setting 4: Carrier frequency

1. Carrier frequency 44 KHz	`X001S[4:1]`
2. Carrier frequency 67 KHz	`X001S[4:2]`
3. Carrier frequency 88 KHz	`X001S[4:3]`
4. Carrier frequency 103 KHz	`X001S[4:4]`
5. Carrier frequency 115 KHz (def)	`X001S[4:5]`

The carrier frequency determines the frequency at which the sensor electrodes transmit a square wave signal, creating the electrical field. When installing multiple sensors next to each other, it is highly recommended to set each adjacent sensor to a different frequency. This will eliminate cross interference and will make sure the setup remains stable and responsive.

In very rare cases, it can also be that environmental noise conditions can cause a single-sensor setup to work less stable or responsive than usual. In these cases it can also be beneficial to change the carrier frequency.

Please note that typically a single-sensor setup should work optimally on the default carrier frequency of 115 KHz.

Setting 28: Calibration profile (XT-EF680 only)

1. No top panel - *for testing*	`X001S[28:1]`
2. Acrylic 3mm (default)	`X001S[28:2]`
3. Acrylic 6mm	`X001S[28:3]`
4. Acrylic 10mm	`X001S[28:4]`
5. Wood 18mm	`X001S[28:5]`
6. Wood 36mm	`X001S[28:6]`
7. Brick/stone100mm	`X001S[28:7]`

The **XT-EF680** sensor has a slightly different technical design than the other XT-EF models to create a larger sensor surface and higher detection range. This enables the sensor to be placed behind a thick surface such as 36mm of wood or 100mm of brick. As a result the XT-EF680 is more sensitive to the material and thickness of the applied top panel.

Via this setting, the sensor can be calibrated to a profile matching the top panel of your setup closest. Please note that the calibration profiles for these thick surfaces are tuned to a situation in which the sensor is only attached to the top panel and has free space on the back. For example during a test situation, when placing the sensor on a table and then placing a 36mm wooden test panel on top, the sensor might not perform optimal as the back of the sensor is not free, but placed on a table top.

This setting only applies for the **XT-EF680.** When sending this setting to one of the other XT-EF variants this will have no effect.

Nexmosphere
Le Havre 136
5627 SW Eindhoven • The Netherlands
T +31 40 240 7070
E support@nexmosphere.com

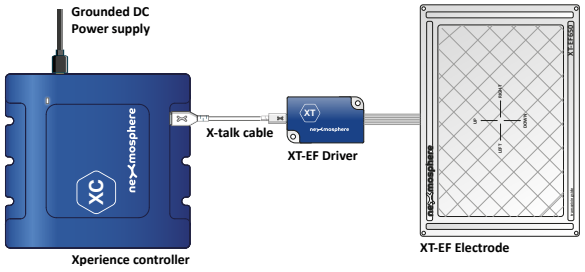
6. Quick test

In order to test if the XT-EF sensor is installed correctly, please follow the test procedure below:

Step 1 - Setup

First, connect the XT-EF sensor to an Xperience controller. Secondly, power the Xperience controller by plugging in the grounded power supply (see section 4.2, page 6 for more info)

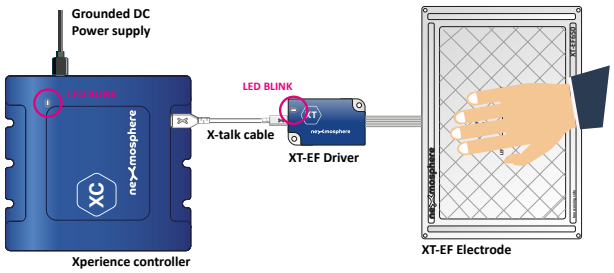
The white status LED of the XT-EF driver should go on. The status LED of the controller will start to blink and once power-up is completed will be lit continuously



Step 2 - Test AirButton trigger

Place your hand above the XT-EF sensor electrode. Make sure your hand is placed well within the range of the sensor.

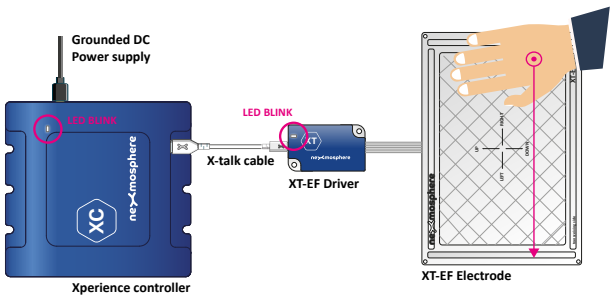
Both the white status LED of the XT-EF driver and the status LED of the controller should blink once.



Step 3 - Test AirSwipe trigger

Swipe your hand above the XT-EF sensor electrode to the left or right. Make sure your hand is placed well within the range of the sensor.

Both the white status LED of the XT-EF driver and the status LED of the controller should blink once.



In case any of the 3 steps above does not provide the expected result, please check the installation guidelines in this document.

For a full test we recommend to connect the setup to a mediaplayer or PC and test all API commands listed in this document (see section 3, page 2-5). For more information on how to setup a test for your controller, please see the Quick Start Guide of the Xperience controller you are using. These are available on nexmosphere.com/support-documentation

Please contact support@nexmosphere.com for any support questions you may have.

Nexmosphere
Le Havre 136
5627 SW Eindhoven • The Netherlands
T +31 40 240 7070
E support@nexmosphere.com