DMX ENGINEERING LLC

casIO4

INSTALLATION + COMMISSIONING GUIDE

Four-channel Casambi dry-contact interface
Hardware reference: casIO4

Project:	
Profile:	
Contact:	



PRODUCT ROLE casIO4 connects four low-voltage dry-contact points to a Casambi network. It does not generate DMX or 0-10 V, and it does not power field loads.

At a glance	Verified installation value
Power	12-24 VDC, Class 2; less than 30 mA input current
Channels	Four shared dry-contact input-sense / low-current sink terminals
Output capability	25 mA maximum sink per channel; not for relay coils or loads
Environment	Indoor, open-type device; avoid metal enclosures

1 Product overview

casIO4 is a Bluetooth Low Energy, Casambi-enabled four-channel interface for wired switches and equipment dry-contact inputs. Each field channel is one shared terminal that can sense a closure to Ground (-) and can also pull the terminal to Ground (-) under Casambi control. The selected fixture profile determines which input and output functions the app exposes.

DRY CONTACTS ONLY Never apply an external power source to an I/O terminal. Connect input switches only between an I/O terminal and Ground (-). Use an output only with equipment designed to accept a low-current, non-powered contact closure.

1.1 Technical data

Item	Rating / description
Supply	12-24 VDC Class 2, polarity sensitive
Input current	Less than 30 mA
I/O channels	4, sharing one Ground (-) terminal
Input connection	Unpowered switch/contact closure from channel to Ground (-)
Output connection	Low-side NFET sink to Ground (-), 25 mA maximum
Operating temperature	-25 to +45 C (-13 to +113 F)
Maximum case temperature	+75 C (+167 F), Tc point on bottom
Storage temperature	-25 to +75 C (-13 to +167 F)
Relative humidity	0-80%, non-condensing
Overall size	72.6 x 30.0 x 18.0 mm (2.86 x 1.18 x 0.71 in), including mounting ears
Weight	23 g (0.8 oz)
Radio	Fanstel BT840 family, 2.4 GHz Bluetooth Low Energy; exact production variant to verify

1.2 Intended applications

- Wall switches, pushbuttons, occupancy contacts, and other passive contact closures.
- Remote control of equipment that already provides a low-current dry-contact sense input.
- Multi-location switching using the same Gang setting on multiple compatible Casambi devices.
- Mixed installations where some channels are inputs and others are outputs.

NOT A LOAD DRIVER The 25 mA output is a signaling contact substitute. It is not rated to energize a relay coil, solenoid, lamp, motor, or other load.

2 Terminals and installation



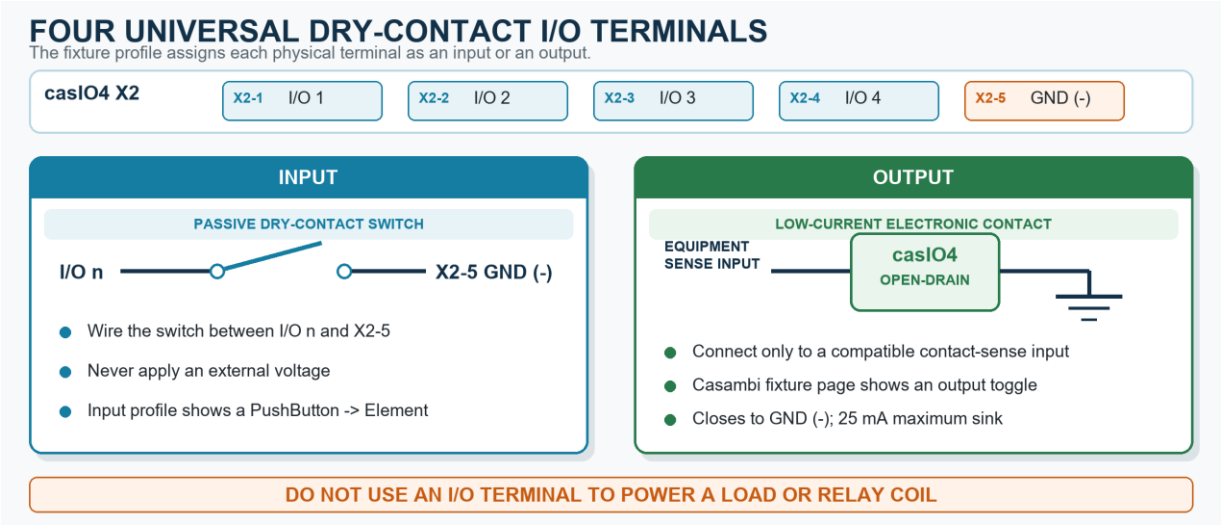
Each I/O terminal is a shared input-sense / low-current sink point. Use only with dry contacts.

2.1 Terminal mapping

Terminal	Label	Function
X1-1	+12-24 VDC	Class 2 supply positive
X1-2	Ground (-)	Supply return
X2-1	Dry Contact I/O 1	Channel 1 shared input/output point
X2-2	Dry Contact I/O 2	Channel 2 shared input/output point
X2-3	Dry Contact I/O 3	Channel 3 shared input/output point
X2-4	Dry Contact I/O 4	Channel 4 shared input/output point
X2-5	Ground (-)	Common for all four dry-contact channels

2.2 Typical connections

X2-1 through X2-4 are universal dry-contact points. The selected fixture profile assigns each physical terminal as an input or an output; it does not change the terminal numbering. All four channels share X2-5 Ground (-).



Terminal role	Field connection	Casambi app
Input	Passive switch between X2-n and X2-5 Ground (-)	PushButton mapped to a Casambi Element
Output	Equipment contact-sense input to X2-n; sense common to X2-5	Toggle on the Casambi fixture page

ONE COMMON - TWO VERY DIFFERENT USES As an input, the terminal senses a passive closure to X2-5. As an output, it electronically closes a compatible low-current sensing circuit to X2-5. It does not source voltage, power a load, or directly drive a relay coil.

2.3 Installation procedure

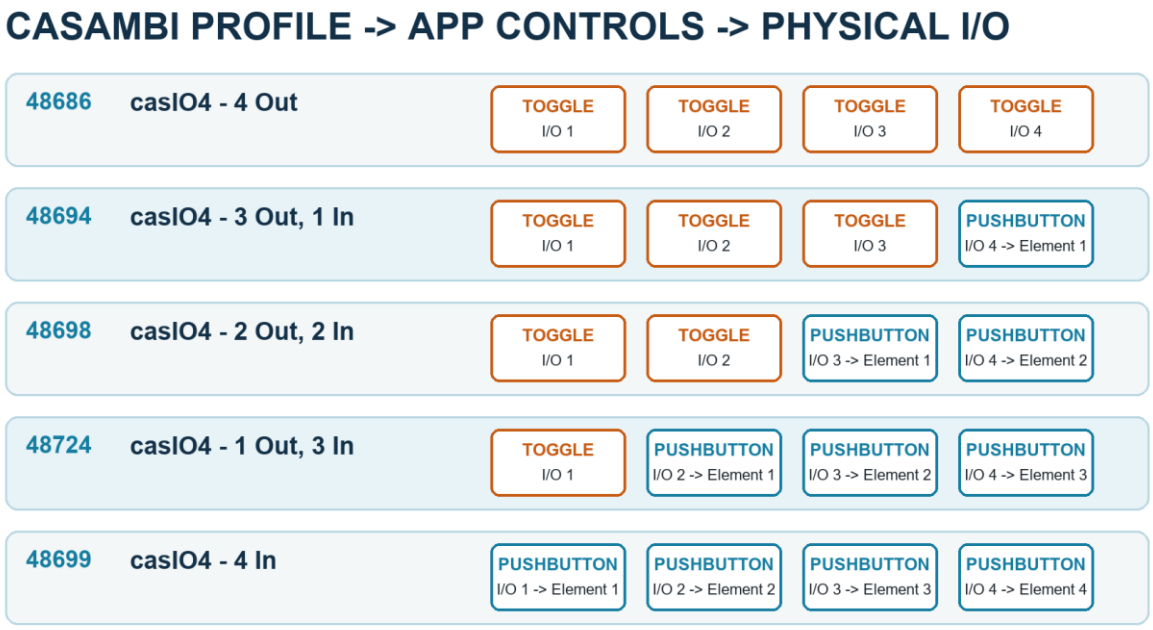
1. **Select a mounting location.** Use an indoor location protected from contamination and physical damage. Avoid metal enclosures or provide an approved external-antenna arrangement.
2. **Leave power off.** Verify the Class 2 supply is de-energized and confirm polarity before landing conductors.
3. **Connect the dry-contact wiring.** For an input, wire the switch between the selected I/O terminal and X2-5 Ground (-). For an output, wire the equipment's contact-sense input and its sense common to the selected I/O terminal and X2-5.
4. **Connect 12-24 VDC power.** Connect positive to X1-1 and return to X1-2. Do not use a constant-current LED driver.
5. **Inspect and energize.** Check for loose strands, shorts, reversed polarity, or any external voltage on X2 before applying power.

Installer pre-power checklist

- Supply is 12-24 VDC Class 2 and polarity is correct.
- No I/O terminal is connected to a voltage source or load.
- Every input switch closes only between its I/O terminal and X2-5 Ground (-).
- Every output target is a compatible dry-contact sense input drawing no more than 25 mA.
- The intended Casambi profile and per-channel role are recorded.

3 Fixture profiles and channel roles

The hardware always contains both an input-sense path and an output-sink path for every channel. The fixture profile controls how casIO4 appears in the Casambi app and which channel functions are exposed. Choose the profile before naming controls or building scenes.

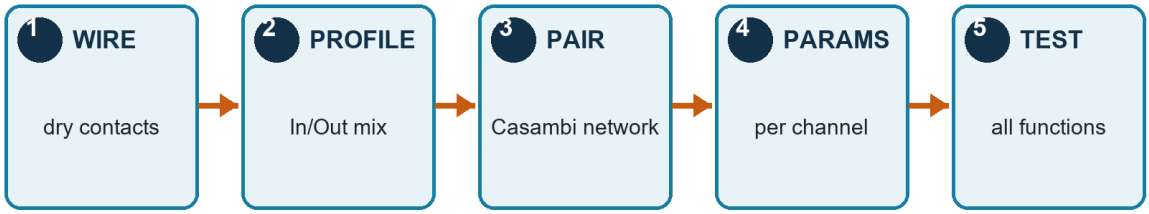


Each output is shown as a toggle button on the Casambi fixture page. Each input is shown as a PushButton that can be mapped to an Element. Output channels occupy the first physical I/O positions; input channels occupy the remaining positions.

Fixture ID	Profile	Fixture page	Element mapping
48686	casIO4 - 4 Out	I/O 1-4: four toggles	None
48694	casIO4 - 3 Out, 1 In	I/O 1-3: three toggles	I/O 4: PushButton -> Element 1
48698	casIO4 - 2 Out, 2 In	I/O 1-2: two toggles	I/O 3-4: PushButtons -> Elements 1-2
48724	casIO4 - 1 Out, 3 In	I/O 1: one toggle	I/O 2-4: PushButtons -> Elements 1-3
48699	casIO4 - 4 In	None	I/O 1-4: PushButtons -> Elements 1-4

PROFILE FIRST Changing the profile later can alter the controls exposed in the app and disturb names, scenes, automations, or switch assignments. Re-test every channel after a profile change.

4 Add casIO4 to the Casambi app



4.1 Pair and identify

1. **Power casIO4.** Confirm it appears in More > Nearby devices while the phone is within Bluetooth range.
2. **Choose the fixture profile.** Select the In/Out combination that matches the field wiring and intended channel roles.
3. **Add it to the project network.** Use the authorized network and credentials. A device can belong to only one Casambi network.
4. **Name each exposed control.** Use room, function, and channel identifiers that match the project schedule.
5. **Set vendor parameters.** Configure each channel deliberately using Section 5. Keep the device powered until the parameter-complete exchange has finished.
6. **Test and record.** Operate every wired switch and every output from the app, then test scenes and any gang behavior.

4.2 Radio placement

Bluetooth mesh range depends strongly on walls, metal, equipment, antenna orientation, and neighboring mesh nodes. Do not assume an open-air range will be available after installation. Test control from representative occupied locations and with the enclosure closed.

> **METAL ATTENUATES RADIO** Do not mount the internal-antenna model inside a metal junction box. Use a nonmetallic enclosure or an approved external-antenna product variant.

5 Vendor Parameters

casIO4 has 16 vendor parameters: the original three settings for each of four channels, plus four Press/Hold Speed settings. Tags 0-11 retain their deployed assignments; tags 12-15 select channel speeds. All parameters are WRITE / INTEGER with default and minimum 0. The firmware validates each write and ignores an out-of-range value, leaving the previous valid setting unchanged. Do not reorder tags in the fixture definition.

Firmware and fixture compatibility. This guide covers released firmware 1.4 behavior for Input Modes 0-6 and all three Output Modes. Firmware 1.4.3 contains diagnostic code for Input Mode 7, but Mode 7 has not passed hardware acceptance and is not approved for field commissioning. All 16 vendor parameters retain their existing tags and values. Fastest is a one-second full-range sweep.

Saving parameter changes. The PSoC saves the complete parameter set when Casambi sends Parameters Complete. Keep casIO4 powered until the parameter exchange finishes, then read back the settings before acceptance testing. Removing power before completion can leave the previously saved values in effect.

CONFIGURE ONE CHANNEL AT A TIME Choose Input Action, Input Mode, Output Mode, and Press/Hold Speed, then test the channel. Speed applies to held ramps in Modes 2-6. Mode 7 is development-only pending hardware acceptance. Settings may remain visible even when the fixture profile exposes only one role.

5.1 Exact parameter index map

Index	Suggested label	Purpose	Default
0	Channel 1 - Input Action	Standalone / inversion / Gang 1-10	0
1	Channel 1 - Input Mode	Follow, toggle, hold, or double-tap behavior	0
2	Channel 1 - Output Mode	Normal, inverted, or 500ms pulse	0
3	Channel 2 - Input Action	Standalone / inversion / Gang 1-10	0
4	Channel 2 - Input Mode	Follow, toggle, hold, or double-tap behavior	0
5	Channel 2 - Output Mode	Normal, inverted, or 500ms pulse	0
6	Channel 3 - Input Action	Standalone / inversion / Gang 1-10	0
7	Channel 3 - Input Mode	Follow, toggle, hold, or double-tap behavior	0
8	Channel 3 - Output Mode	Normal, inverted, or 500ms pulse	0
9	Channel 4 - Input Action	Standalone / inversion / Gang 1-10	0
10	Channel 4 - Input Mode	Follow, toggle, hold, or double-tap behavior	0
11	Channel 4 - Output Mode	Normal, inverted, or 500ms pulse	0
12	Channel 1 - Press/Hold Speed	0-9; hold ramps in modes 2-6; mode 7 pending	0
13	Channel 2 - Press/Hold Speed	0-9; hold ramps in modes 2-6; mode 7 pending	0
14	Channel 3 - Press/Hold Speed	0-9; hold ramps in modes 2-6; mode 7 pending	0
15	Channel 4 - Press/Hold Speed	0-9; hold ramps in modes 2-6; mode 7 pending	0

5.2 Input Action - what this channel controls

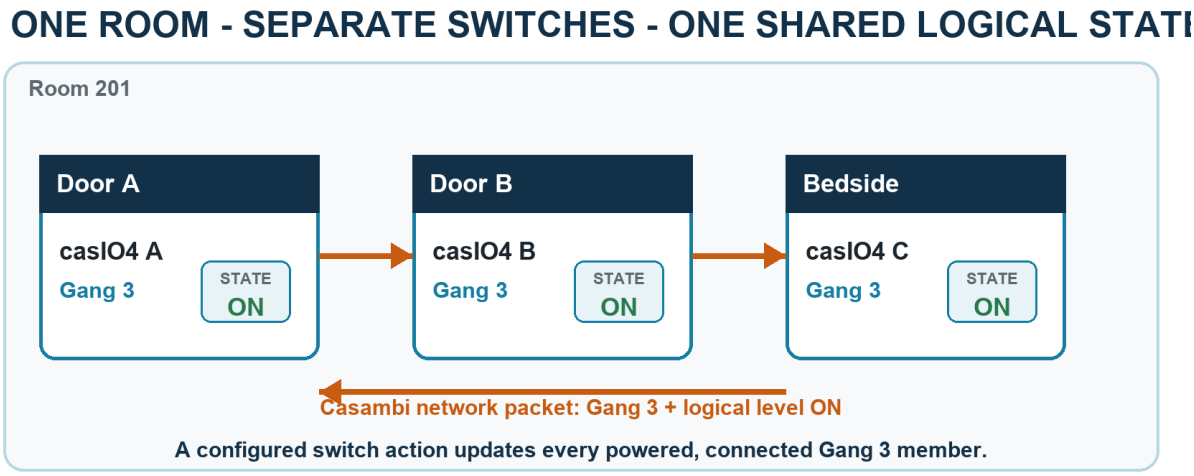
Input Action selects normal or inverted contact sensing, or membership in Gang 1-10. Each input controls the light, group, scene, or other target assigned in the Casambi app. Input Action does not change output FET polarity.

Value	Suggested label	User-facing behavior
0	Standalone - Normal	Closed contact reports ON; open contact reports OFF.
1	Standalone - Inverted	Closed contact reports OFF; open contact reports ON.
2	Gang 1	Shares state with every compatible channel set to Gang 1.
3	Gang 2	Shares state with every compatible channel set to Gang 2.
4	Gang 3	Shares state with every compatible channel set to Gang 3.
5	Gang 4	Shares state with every compatible channel set to Gang 4.
6	Gang 5	Shares state with every compatible channel set to Gang 5.
7	Gang 6	Shares state with every compatible channel set to Gang 6.
8	Gang 7	Shares state with every compatible channel set to Gang 7.
9	Gang 8	Shares state with every compatible channel set to Gang 8.
10	Gang 9	Shares state with every compatible channel set to Gang 9.
11	Gang 10	Shares state with every compatible channel set to Gang 10.

GANG NUMBERS Gang 1 through Gang 10 are identifiers, not physical channel numbers. Use the same gang value on every channel that must stay synchronized, and use a different value for each independent group.

5.3 Why Multiswitch Gangs exist

A MultiSwitch Gang lets two or more separated wall stations control the same room or lighting function without traveler wiring. Program participating units identically: same gang, input mode, speed, and assigned Casambi target. They must share a network and compatible vendor messaging. Each station remembers the final level reached at the other stations.



THE PROBLEM IT SOLVES Without Gang synchronization, a remote switch may still remember OFF after another station turned the room ON. Its first operation then changes only its stale local memory from OFF to ON, so the user sees no lighting change and must operate it again. With Gang synchronization, every member already remembers ON; the next single operation at any member commands OFF as expected.

5.4 What happens when a Gang member is operated

1. **The user operates a switch. The local input immediately controls its assigned Casambi target. Modes 2-4 ramp while held; modes 5 and 6 start their hold ramp after 400ms. Mode 7 is development-only pending hardware acceptance.**
2. **The action finishes. Momentary modes wait for release and 100ms without another press before broadcasting the final level. Double-tap modes also wait for completion of the gesture. Locking mode 0 broadcasts after a contact change passes 100ms debounce.**
3. **Idle matching members update their memory. The packet carries gang ID, final absolute level, direction, and source channel. Reception does not repeat the lighting command or echo the packet.**
4. **The next station starts from the shared level. If station A toggles OFF, the next press at station B toggles ON. Matching channels on the same unit also share completed state.**
5. **An active local gesture takes priority over incoming state. Gang memory is not retained through power loss. Verify alternating station use, simultaneous operation, and mesh recovery on site.**

5.5 Gang packet and switch behavior

Gang field	Behavior
Gang ID	Input Action values 2-11 correspond to Gang 1-10. Receivers synchronize by Gang ID, not by physical channel number.
Level	Final absolute level 0-255. Hold ramps send the final level after release, not a vendor stream while held.
Direction	Retained in the packet: 1 for dim-up, 0 for dim-down or endpoint commands. Mode 4 alternates direction on each accepted press and stops on release.
Source channel	Identifies the originating input. The sender also reports its own PushButton level to the mapped Casambi function.
Receiver action	Idle matching inputs remember the final level for their next action, without a lighting command or echo.

NOT A CASAMBI LUMINAIRE GROUP A Multiswitch Gang synchronizes the internal switch memory of compatible NED devices. It is separate from a normal Casambi luminaire group, scene, or Element mapping. The Gang keeps the wall stations in step; the mapped Casambi function determines what the lighting system controls.

5.6 Match the switch type

Switch type	Recommended Input Mode	Gang behavior
Maintained wall switch	Hold (On / Off (follow contact))	Either physical transition toggles the shared logical state. Lever positions at different locations do not need to match.
Momentary pushbutton	Toggle (each press)	The debounced closure toggles the shared state once; releasing the button does not create a second toggle.
Hold-to-dim button	Press/Hold to Dim Up or Down	The selected speed controls the local ramp. The final level is shared after release and 100ms quiet.
Standalone input	Input Action 0 or 1	No gang synchronization packet is used; the input controls only its own mapped Casambi function.

COMMISSION THE WHOLE GANG A Gang is a distributed room behavior, not only a parameter on one device. Turn the room ON at station A, then operate station B once; the room must turn OFF on that first operation. Repeat among every pair of stations, then prove dim direction, network recovery, and any replacement or profile change.

5.7 Input Mode - how the contact is interpreted

Value	Suggested label	Best with	Behavior
0	Hold	Maintained switch	Standalone follows contact polarity. In a gang, either stable contact edge toggles the shared state.
1	Toggle on Pulse (>10ms)	Momentary pushbutton	Each debounced press toggles remembered OFF/full ON; release does not toggle.
2	Press/Hold to Dim Up	Momentary pushbutton	While held, level increases at the channel speed; release stops.
3	Press/Hold to Dim Down	Momentary pushbutton	While held, level decreases at the channel speed; release stops.
4	Press/Hold to Toggle Dim	Momentary pushbutton	Hold to ramp at the selected speed; release stops. Each new press reverses direction. Endpoints clamp without reversal.
5	Double-Tap Full ON	Momentary pushbutton	Double tap sends full ON. Hold the first press for 400ms to dim up from the actual target level; release stops.
6	Double-Tap OFF	Momentary pushbutton	Double tap sends OFF. Hold the first press for 400ms to dim down from the actual target level; release stops.
7	Development - Double-Tap Toggle	Engineering test only	Intended: double tap toggles OFF/full ON and each hold reverses direction. Not hardware-approved in firmware 1.4.3; do not commission.

DIMMING AND FADES casIO4 generates held dimming ramps in Modes 2-6 using its own timers and the selected Press/Hold Speed. Release stops the ramp. Mode 5/6 double taps send the ON/OFF endpoint command immediately; they do not run the timed hold ramp. The second tap must be accepted within 400ms after the first release. Mode 7 remains development-only pending hardware acceptance.

Double-tap press and hold underlay. In Modes 5 and 6, a brief first tap does not move the light. Holding the first press for 400ms starts dim up or dim down respectively, using the selected channel speed. Release stops the ramp; holding at an endpoint does not reverse it. A long hold cancels double-tap detection. This allows the double-tap endpoint command and press-and-hold dimming to coexist on one button.

A valid second tap in Mode 5 sends full ON immediately; Mode 6 sends OFF immediately, even if the second press remains held. If another app or station subsequently changes the light to an intermediate level, the next hold reacquires the actual target level and ramps from that level instead of jumping from a stale endpoint. Gang stations share the final level after the gesture settles.

Mode 7 release status. The firmware defines double-tap toggle plus alternating hold, including target-level reacquisition and direction recovery after an external level change. Firmware 1.4.3 simulator tests pass, but bench testing reported that both the Mode 7 double tap and hold failed on all four inputs. Do not select Mode 7 for a commissioned installation until a later release is hardware-approved.

5.7.1 Press and hold dimming speed

Set Channel 1-4 Press/Hold Speed with tags 12-15. Values 0-9 select the full-range time below for held ramps in Input Modes 2-6. Default is 0, Fastest. Mode 7 uses the same speed table only in diagnostic firmware and is not approved for field use. These speed settings do not affect toggles, double-tap endpoint commands, or output pulses.

Value	Speed	Full-range time
0	Fastest	1 second
1	Very Fast	4 seconds
2	Fast	5 seconds
3	Normal	7 seconds
4	Medium	10 seconds
5	Relaxed	13 seconds
6	Slow	17 seconds
7	Very Slow	21 seconds
8	Extra Slow	25 seconds
9	Slowest	30 seconds

The times describe a commanded sweep from 0x00 to 0xFF, or the reverse. A partial sweep takes proportionally less time: halfway to full takes about 0.5 seconds at Fastest or 15 seconds at Slowest. Release stops the ramp at its current level.

The sweep begins after debounce and acquisition of the starting level. Modes 2 and 3 retain their level across consecutive presses; another local control action requires fresh level state, while gang updates provide the shared level. Radio and network response can affect the visible result. Use the same speed on matching gang stations.

Parameter format: Input Action is 4 bits, range 0-11; Input Mode is 4 bits, range 0-7; Output Mode is 2 bits, range 0-2; Press/Hold Speed is 4 bits, range 0-9. All are WRITE / INTEGER, default 0. A firmware upgrade preserves valid legacy Input Action, Input Mode, and Output Mode values. If the saved record has no valid speed extension, all four Press/Hold Speed values initialize to 0, Fastest.

5.8 Output Mode and the 500ms pulse

Value	Suggested label	Electrical result
0	Normal (closed when on)	Casambi ON closes the electronic contact to Ground (-); OFF releases it.
1	Inverted (open when on)	Casambi ON releases the electronic contact; OFF closes it to Ground (-).
2	Short Pulse when ON (500ms)	An OFF-to-ON condition closes the FET for 500ms, then releases it even if ON remains.

TEST THE RECEIVING EQUIPMENT The words normal and inverted describe the casIO4 contact state, not the final machine action. After changing polarity, confirm the connected equipment's safe state at Casambi ON, OFF, power-up, network loss, and casIO4 power loss.

Pulse mode always shorts the output to Ground (-) for a fixed 500ms, independent of Input Action and Press/Hold Speed. It is edge-triggered: the first Casambi OFF-to-ON transition starts the pulse. Repeated ON updates do not extend or retrigger it; OFF during the pulse does not truncate it. A new pulse requires OFF, completion of the active pulse, and then a fresh ON. Transitions received while the pulse is active are not queued.

Live parameter changes. A changed Input Action, Input Mode, or Output Mode cancels the channel gesture and pulse. Unchanged values resent with a speed edit do not reset the gesture. A changed Press/Hold Speed applies to the active ramp without changing its level or direction; unchanged speeds do not restart timing. After saving any mode change, wait for Parameters Complete, read the value back, power cycle casIO4, and retest the physical input before commissioning.

5.8.1 Commission the pulsed output

Test the pulse as a state sequence, not only by watching one ON command. Use the Casambi control and the receiving equipment or a current-limited indicator that clearly shows contact closure.

Step	Casambi command	Required electrical result
1	Set Output Mode to value 2 and command OFF	Output is open after any active pulse finishes.
2	Command ON from OFF	Output closes to Ground (-) for approximately 500ms, then opens.
3	Send ON again while state remains ON	No second pulse and no extension of the first pulse.
4	Command OFF during an active pulse	The active pulse completes its full 500ms; OFF does not truncate it.
5	After the pulse ends, command OFF and then ON	A new 500ms pulse occurs only on the fresh OFF-to-ON transition.

5.9 Common configurations

Use case	Input Action	Input Mode	Output Mode	Expected result
Maintained local switch	Standalone - Normal	Hold (On / Off)	Normal	Closed = on; open = off
Momentary local pushbutton	Standalone - Normal	Toggle	Normal	Each press toggles
Maintained multi-location switches	Same Gang n on all	On / Off	As required	Every switch transition toggles gang
Momentary multi-location buttons	Same Gang n on all	Toggle	As required	Each button closure toggles gang
Press-and-hold dimmer	Standalone or same Gang n	Press/Hold Up or Down	As required	Hold ramps at selected speed; release stops
Equipment contact input	Input setting unused	Input setting unused	Normal	Casambi ON closes to ground
Equipment pulse input	Input setting unused	Input setting unused	500ms pulse	ON closes FET for 500ms, then releases

6 Startup, acceptance testing, and troubleshooting

Check	Acceptance requirement
Power	Unit remains powered and visible; no abnormal heating.
Profile	Profile role count and displayed channel order match the field schedule.
Inputs	Every configured Mode 0-6 switch reports the intended ON/OFF or dimming behavior without chatter. Mode 7 is not accepted for field use.
Outputs	Every output reaches the intended receiving input and never exceeds the 25 mA interface limit.
Polarity	Normal/inverted behavior and all safe states are verified.
Gangs	Each gang operates only its intended members and remains synchronized.
Scenes	All assigned scenes and automations produce the intended state.
Mesh	Control succeeds from representative occupied locations with enclosure closed.
Record	Profile, channel roles, parameter values, and connected equipment are documented.

6.1 Troubleshooting

Symptom	Likely cause	Corrective action
Not visible nearby	No/incorrect power; out of range; already paired	Measure 12-24 VDC at X1. Move phone closer. Check network ownership.
Input never changes	No Ground (-) return; external voltage; wrong profile	Remove power source; wire contact to X2-5; confirm an input profile.
Input changes twice	Momentary button using follow-contact behavior	Select Toggle (each press) for a momentary button.
Output does not operate target	Wrong common/polarity; target is not compatible	Confirm target accepts a <=25 mA low-side contact closure and shares sense common.
Gang behaves unexpectedly	Gang ID mismatch; wrong switch mode	Use the same Gang n. Use On/Off for maintained switches or Toggle for momentary buttons.
Short radio range	Metal enclosure or obstruction	Use a nonmetallic enclosure or approved external-antenna variant; re-test mesh.
Hold speed seems wrong / Mode 7 does not operate	Wrong channel speed; endpoint mode selected; Mode 7 selected	Check tags 12-15. Modes 2-6 require a 400ms first hold where applicable. Test a full sweep: 1s at value 0, 30s at value 9. Mode 7 is not field-approved.

6.2 Before leaving site

- Confirm no I/O channel is exposed to an external voltage source.
- Exercise every input, output, scene, automation, and gang from both local controls and the app.
- Record all 16 vendor-parameter values, including the four Press/Hold Speed settings, even when a profile exposes only one role per channel. Read back the values after Parameters Complete and verify the configured Mode 0-6 behavior on every input. A closeout record containing Mode 7 is not acceptable until a hardware-approved firmware release is issued.
- Label the supply, casIO4, field wires, and connected equipment consistently with the closeout schedule.

7 Closeout record

Field	Record
Project / area	
casIO4 identifier	
Casambi network	
Fixture profile	
Firmware version	
Supply voltage measured	
Commissioned by / date	

7.1 Per-channel parameter record

Ch	Role	Connected device	Input Action	Input Mode	Output Mode	Press/Hold Speed
1						
2						
3						
4						

7.2 Product identification and certification label

The casIO4 back-label artwork uses the same controlled Fanstel label treatment as casTen. It includes the ETL mark and control number 5016831, CE and IP20 markings, WEEE symbol, indoor-use and ambient markings, nRF52840/BT840 radio identifiers, UL/CSA conformity wording, and the equipment-category statement.



LABEL CONTROL Use this back-label image as the controlled artwork reference. Confirm that the internal-antenna or external-antenna Fanstel variant installed in the shipped casIO4 matches the applicable FCC identifier before print release; do not redraw or substitute certification marks.