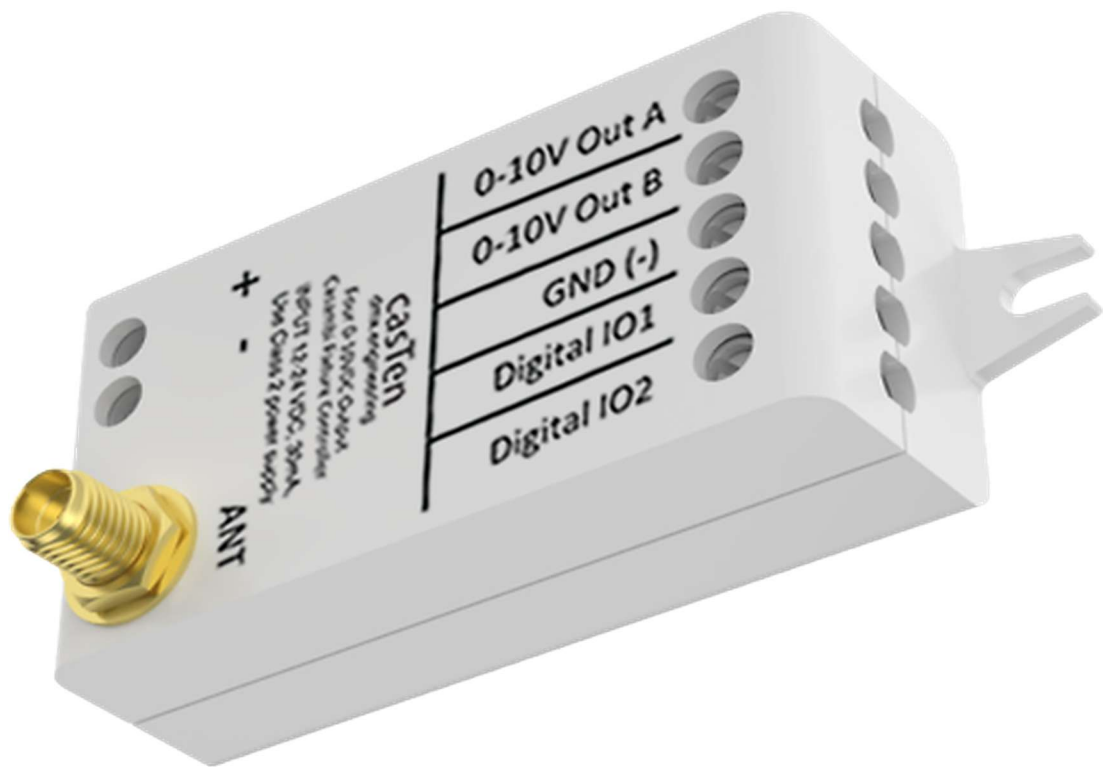


casTen

INSTALLATION + COMMISSIONING GUIDE

Two-channel 0-10 V controller with two universal digital I/O channels
Hardware reference: cas10

Project:
Type:
Contact:



PRODUCT ROLE casTen provides two independently controlled 0-10 V analog outputs plus two independently configurable dry-contact digital I/O terminals. Each digital terminal can be an input or an output; the Casambi profile and vendor parameters determine the field behavior.

At a glance	Installation value
Power	12-24 VDC Class 2; polarity sensitive; 30 mA maximum published input current
Analog control	Two 0-10 V source/sink channels with independent top and bottom trim
Digital control	Two universal dry-contact I/O terminals; each independently set to input or output
Environment	Indoor, IP20/open-type installation; preserve Bluetooth antenna clearance

1 Product overview

casTen is a Bluetooth Low Energy, Casambi-enabled controller for two 0-10 V control circuits and two dry-contact digital points. Analog channels A and B follow the first two Casambi control channels. When a digital terminal is configured as an output, I/O 1 follows Casambi channel 3 and I/O 2 follows channel 4. When configured as an input, the same terminal reports local contact activity to Casambi instead of following an output level.

The two digital terminals are not fixed-purpose inputs or outputs. The selected cas10LR3 fixture profile defines whether the Casambi fixture page depicts each pin as an output toggle or an input pushbutton. Direction, input action, input mode, and output polarity are also stored per terminal. The profile and Direction parameters must agree, making profile selection and per-pin configuration part of the project closeout record.

DO NOT USE Do not connect the 0-10 V terminals to mains, DALI, a constant-current LED output, or a powered control signal. Do not apply external voltage to Digital I/O 1 or Digital I/O 2. Use dry contacts referenced to the casTen GND (-) terminal only.

1.1 Technical data

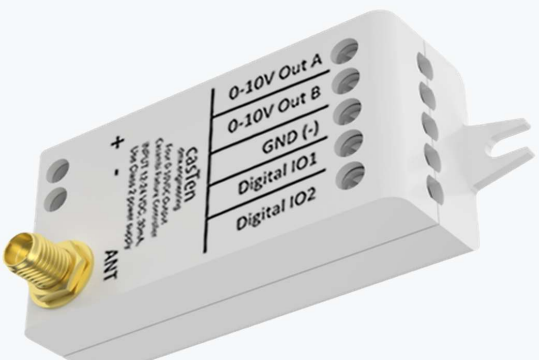
Item	Rating / description
Supply	12-24 VDC Class 2, polarity sensitive
Published input current	30 mA maximum; confirm production worst-case value before release
Analog outputs	Two independent 0-10 V channels; firmware supports source/sink operation and per-channel trim
Analog output loading	Legacy guide states 20 mA source and sink per channel; engineering confirmation required
Digital I/O	Two independent dry-contact points, each configurable as input or output
Digital input	Internal pull-up; active by dry closure to GND (-); no external voltage
Digital output	Solid-state/open-drain closure to GND (-); normal or inverted logical polarity
Ambient	-20 to +45 C (-4 to +113 F) per requested bottom-label treatment
Mechanical	72.6 x 30.0 x 18.0 mm overall; 56.0 mm body length; 23 g
Radio	Casambi-compatible CBM-003/Fanstel BT840 family shown in Rev. D design sources; final shipped variant must match label

1.2 Installation environment

Mount indoors with terminal openings accessible and the antenna end clear of metal, dense wiring, and grounded enclosures. Treat casTen as open-type equipment and provide a suitable enclosure where required. Maintain separation from line-voltage conductors and noisy switching wiring.

2 Terminals and installation

casTen REV. D - FIELD CONNECTION VIEW



POWER 12-24 VDC CLASS 2 | OBSERVE POLARITY
Digital I/O terminals must never be connected to an external voltage source.

FIELD TERMINALS

1	0-10 V OUT A ANALOG CHANNEL A
2	0-10 V OUT B ANALOG CHANNEL B
3	GND (-) SIGNAL / I/O COMMON
4	DIGITAL I/O 1 DRY CONTACT ONLY
5	DIGITAL I/O 2 DRY CONTACT ONLY

2.1 Terminal mapping

Position	Signal	Field function
Power +	+12 to +24 VDC	Class 2 supply positive
Power -	0 VDC / common	Class 2 supply negative
1	0-10 V Out A	Analog control channel A
2	0-10 V Out B	Analog control channel B
3	GND (-)	Analog and digital I/O reference/common
4	Digital I/O 1	Dry-contact input or solid-state output, selected by vendor parameter
5	Digital I/O 2	Dry-contact input or solid-state output, selected by vendor parameter

COMMON REFERENCE The GND (-) terminal is the signal reference for both 0-10 V outputs and both digital I/O points. Verify that the controlled equipment permits the required common connection.

2.2 Installation procedure

1. **De-energize all equipment.** Turn off the Class 2 supply and the controlled equipment before landing conductors.
2. **Mount casTen.** Keep the antenna end away from metalwork and maintain access to the terminals and label.
3. **Connect Class 2 power.** Observe polarity and verify 12-24 VDC before inserting the connector.
4. **Connect the analog channels.** Land Out A, Out B, and GND (-) according to the controlled equipment's 0-10 V wiring diagram.
5. **Connect dry contacts only.** For input use, connect the contact between the selected I/O terminal and GND (-). For output use, connect only a compatible low-voltage sensing circuit; do not drive a load directly.
6. **Inspect and power.** Check polarity, commoning, loose strands, external voltage on I/O, and antenna clearance before energizing.

3 Two-channel 0-10 V application

TYPICAL TWO-CHANNEL 0-10 V CONNECTION

Two independent analog outputs share signal common; driver power remains separate.



FIELD RULES

Follow the controlled equipment manufacturer's polarity and commoning instructions.
Never connect 0-10 V outputs to mains, DALI, LED current outputs, or powered inputs.
Set top and bottom trim only after measuring voltage at the controlled equipment.

3.1 Channel behavior

- Casambi channel 1 commands 0-10 V Out A; Casambi channel 2 commands 0-10 V Out B.
- Each output uses a 16-bit PWM engine and is scaled between that channel's configured bottom trim and top trim.
- Default effective trim is 0% bottom and 100% top on both channels.
- Top trim is encoded by the Casambi vendor parameter as 0-75 and converted by firmware to an effective 25-100% range.
- The firmware does not enforce bottom trim below top trim. Commissioning must avoid crossed or nonsensical limits.

3.2 Trim and calibration procedure

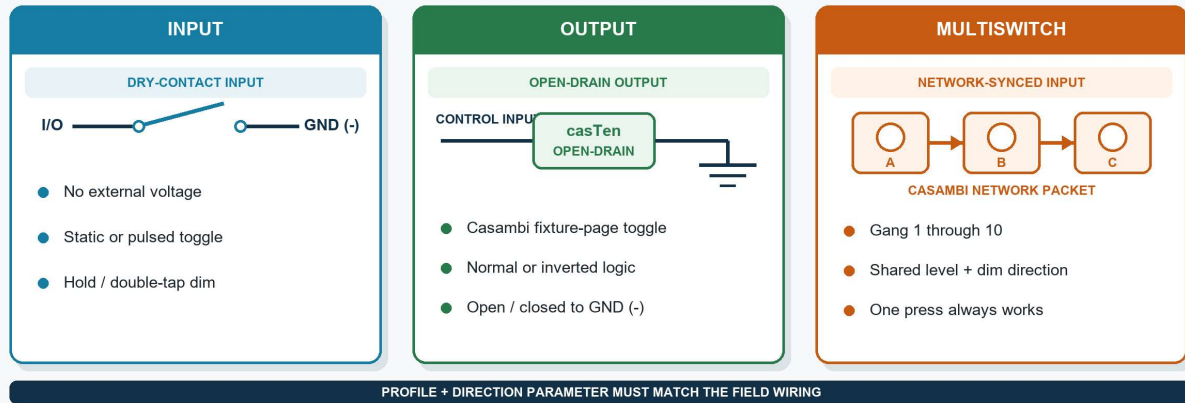
1. **Start from defaults.** Set bottom trim to 0% and top trim to 100% for both channels.
2. **Command minimum.** Set the Casambi control to 0% and measure Out A or Out B at the controlled equipment, referenced to GND (-).
3. **Set bottom trim only if required.** Raise the bottom trim to establish a reliable minimum, compensate for wiring drop, or match the equipment's usable threshold.
4. **Command maximum.** Set the Casambi control to 100%, measure at the load, and reduce top trim only when the equipment requires a lower maximum.
5. **Test intermediate levels.** Verify 25%, 50%, and 75%, then check scenes and fades for smooth behavior.
6. **Record the values.** Keep the unit powered at least 3 seconds after parameter completion and enter effective trim values in the closeout record.

MEASURE AT THE LOAD Long control wiring, shared commons, and the input impedance of the controlled device can change the voltage seen at the equipment. Calibrate at the equipment terminals, not only at casTen.

4 Universal digital I/O

TWO UNIVERSAL DIGITAL I/O TERMINALS

Select the direction of each terminal independently, then choose its behavior.



4.1 Direction is per terminal

Digital I/O 1 and Digital I/O 2 are configured independently in firmware. The selected cas10LR3 profile defines the intended I/O arrangement and the controls shown on the Casambi fixture page. The Direction parameters must match that profile: In1In2 requires both pins set to Input; In1Out2 requires I/O 1 Input and I/O 2 Output; Out1Out2 requires both pins set to Output.

Direction	Field connection	Network behavior
Input	Dry closure between I/O and GND (-)	Reports local action; input action and input mode apply
Output	Compatible sensing circuit between I/O and its permitted low-voltage reference	Follows Casambi channel 3 for I/O 1 or channel 4 for I/O 2; output polarity applies

4.2 Input modes

Mode	Firmware behavior
Static	Maintained contact produces 0%/100%; Normal or Inverted action selects logical sense.
Pulsed	Each debounced contact pulse toggles the stored local state.
Hold Dim Up	While held, raises level in 1/255 steps every 20 ms.
Hold Dim Down	While held, lowers level in 1/255 steps every 20 ms.
Hold Dim Toggle	Alternates dim direction on successive presses; gang feedback can synchronize direction.
Double Tap Dim Up/Down	First press can hold-dim; a second press within 400 ms starts an automatic ramp to the endpoint.
Double Tap Dim Toggle	As above, with alternating direction.

INPUT TIMING Static contact changes use a 100 ms sense interval. Pulsed, hold-dim, and double-tap edges use 50 ms debounce. Double-tap recognition uses a 400 ms window.

5 Casambi commissioning

Commissioning must establish both the two-channel analog behavior and the direction/behavior of each universal digital terminal. The selected Casambi fixture profile must expose the controls and vendor parameters expected by the LR3 firmware.

5.1 Select the profile that matches the I/O wiring

PROFILE SELECTION DEFINES THE CASAMBI FIXTURE-PAGE I/O CONTROLS

45166

cas10_2Chan_In1In2

ANALOG CONTROLS

0-10 V OUT A

0-10 V OUT B

DIGITAL I/O CONTROLS

PUSHBUTTON

I/O 1 -> ELEMENT

PUSHBUTTON

I/O 2 -> ELEMENT

46652

cas10_2Chan_In1Out2

ANALOG CONTROLS

0-10 V OUT A

0-10 V OUT B

DIGITAL I/O CONTROLS

PUSHBUTTON

I/O 1 -> ELEMENT

TOGGLE

I/O 2 OUTPUT

46653

cas10_2Chan_Out1Out2

ANALOG CONTROLS

0-10 V OUT A

0-10 V OUT B

DIGITAL I/O CONTROLS

TOGGLE

I/O 1 OUTPUT

TOGGLE

I/O 2 OUTPUT

Profile ID	Profile name	Physical I/O	Casambi fixture-page result
45166	cas10_2Chan_In1In2	I/O 1 Input; I/O 2 Input	Two Pushbuttons; each maps to its own Element
46652	cas10_2Chan_In1Out2	I/O 1 Input; I/O 2 Output	One Pushbutton mapped to an Element; one output Toggle
46653	cas10_2Chan_Out1Out2	I/O 1 Output; I/O 2 Output	Two output Toggle buttons

PROFILE CONTROLS THE DEPICTION

All three profiles retain the two 0-10 V analog controls. The selected profile changes the two digital I/O controls: outputs appear as Toggle buttons; inputs appear as Pushbuttons that can be mapped to Casambi Elements.

PROFILE/DIRECTION INTERLOCK After selecting a profile, set I/O 1 Direction and I/O 2 Direction to the matching arrangement. A mismatch can make the app show a toggle for a physical input or a pushbutton for a physical output.

DMX Engineering LLC

August 2026

Document Version 1.00

5.2 Configuration conversation

Decision	Question to resolve with the user
Analog A	What load or function does Out A control? Required minimum and maximum voltage?
Analog B	What load or function does Out B control? Independent dim, warm/cool pair, or another relationship?
Digital I/O 1	Input or output? If input: Normal, Inverted, or Multiswitch gang? Which input mode? If output: Normal or Inverted?
Digital I/O 2	Input or output? If input: Normal, Inverted, or Multiswitch gang? Which input mode? If output: Normal or Inverted?
Profile/UI	Which of the three profiles matches the wiring? Which Element should each input Pushbutton control?
Closeout	Who owns vendor-parameter changes, and where are the final values recorded?

5.3 Pair and configure

1. **Power and identify casTen.** Confirm the intended unit appears in Casambi Nearby devices and verify the physical location.
2. **Select the approved profile before pairing.** Choose In1In2, In1Out2, or Out1Out2 to match the physical wiring and the fixture-page controls required by the user.
3. **Pair to the project network.** Use the specified network and project naming convention.
4. **Set analog trims.** Start from defaults and calibrate only after measuring the connected equipment.
5. **Match the Direction parameters to the profile.** In1In2 = Input/Input; In1Out2 = Input/Output; Out1Out2 = Output/Output. Then configure the settings relevant to each pin.
6. **Map input Pushbuttons.** For each input pin, assign the profile's Pushbutton to the intended Casambi Element and test the complete action, mode, and scene behavior.
7. **Allow the deferred save.** After the Casambi parameter transaction completes, keep casTen powered for at least 3 seconds before cycling power.
8. **Test all four control paths.** Prove analog A, analog B, digital I/O 1, and digital I/O 2, including scenes, switch actions, gangs, and inverted logic.

6 Vendor parameters

The LR3 firmware stores twelve vendor parameters in nonvolatile flash. IDs 0-3 calibrate the two analog outputs. IDs 4-11 configure the two universal digital terminals. Casambi sends a Parameters Complete message after the set; firmware then waits 2.5 seconds before writing the configuration.

6.1 Analog parameters - IDs 0 through 3

ID	Parameter	Values	Default	Effect
0	Top Trim Ch 1	Raw 0-75; effective 25-100%	Effective 100% (raw 75)	Upper endpoint for Out A
1	Bottom Trim Ch 1	Raw percentage byte; profile range must be controlled	0%	Lower endpoint for Out A
2	Top Trim Ch 2	Raw 0-75; effective 25-100%	Effective 100% (raw 75)	Upper endpoint for Out B
3	Bottom Trim Ch 2	Raw percentage byte; profile range must be controlled	0%	Lower endpoint for Out B

PROFILE VALIDATION REQUIRED Firmware accepts parameter bytes without range checking. The Casambi profile must prevent invalid trim values and should prevent bottom trim from exceeding the effective top trim.

6.2 Digital I/O parameters - IDs 4 through 11

ID	Parameter	Values	Default
4	I/O 1 Direction	0 Input; 1 Output	Input
5	I/O 1 Input Action	0 Normal; 1 Inverted; 2-11 Multiswitch 1-10	Normal
6	I/O 1 Input Mode	0 Static; 1 Pulsed; 2 Hold Up; 3 Hold Down; 4 Hold Toggle; 5 Double Up; 6 Double Down; 7 Double Toggle	Static
7	I/O 1 Output Polarity	0 Normal; 1 Inverted	Normal
8	I/O 2 Direction	0 Input; 1 Output	Input
9	I/O 2 Input Action	0 Normal; 1 Inverted; 2-11 Multiswitch 1-10	Normal
10	I/O 2 Input Mode	0 Static; 1 Pulsed; 2 Hold Up; 3 Hold Down; 4 Hold Toggle; 5 Double Up; 6 Double Down; 7 Double Toggle	Static
11	I/O 2 Output Polarity	0 Normal; 1 Inverted	Normal

INACTIVE SETTINGS REMAIN STORED Direction selects which setting group is active; firmware does not erase the other settings. If a pin changes from input to output and later back to input, its previous input action and mode can become active again. Review all four settings per pin during recommissioning.

KEEP PROFILE AND DIRECTION TOGETHER Changing between profile IDs 45166, 46652, and 46653 changes the controls depicted in the Casambi app. Update the two Direction parameters to match, then retest output toggles, input Pushbuttons, and Element mappings.

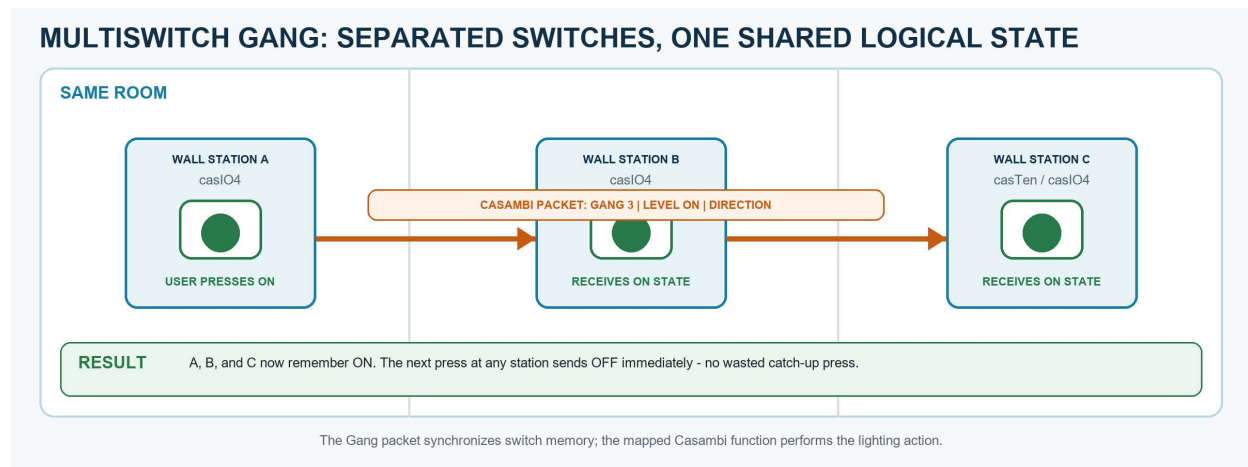
7 Input actions and Multiswitch gangs

7.1 Normal and inverted actions

For a static input, Normal reports 100% when the contact is active and 0% when released. Inverted reverses those levels. Normal/Inverted are local actions; they do not transmit a Multiswitch vendor Gang message.

7.2 Why Multiswitch gangs exist

A Multiswitch Gang is normally used when two or more wall stations control the same room or lighting function but are physically separated. No traveler wire is required between the switches. Instead, compatible NED devices - commonly casIO4 wall interfaces, and casTen when configured as an input - exchange a vendor packet over the Casambi network. The packet keeps each member's internal on/off level and dim direction synchronized.



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

7.3 What happens when a Gang member is operated

1. **A user operates one switch.** The local casIO4 or casTen input calculates the new shared level and, for toggle-dim modes, the current dim direction.
2. **The device transmits a Gang packet.** The vendor message carries Gang ID, level, direction, and source channel over the Casambi network.
3. **Every matching member updates its memory.** Devices assigned to that Gang accept the level automatically. Toggle-dim members also update the direction used for the next operation.
4. **The operated device reports its local pushbutton level.** Normal Element, scene, or control behavior proceeds while the Gang packet keeps the other wall stations logically aligned.
5. **The next station starts from the shared state.** A single press at any separated Gang member now produces the expected opposite command; no catch-up press is required.

7.4 Gang packet and device behavior

Gang field	Behavior
Gang ID	Input Action values 2-11 correspond to Multiswitch 1-10.
Level	0-255 shared logical level. Static or pulsed edges toggle between 0 and 255; dim modes distribute intermediate levels.
Direction	Carries up/down state for Hold Dim Toggle and related behavior so separated stations continue in the expected direction.
Source channel	Identifies the originating local input; receiving devices synchronize by Gang ID, not by source channel.
Receiver action	Every compatible input assigned to the same Gang updates its stored network level automatically, even though its local contact was not operated.
Local action	The sender also reports its own pushbutton level, allowing the mapped Element or Casambi function to respond normally.

NOT A CASAMBI LUMINAIRE GROUP A Multiswitch Gang synchronizes the internal switch state 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.

7.5 Commission and prove the complete Gang

COMMISSION THE WHOLE GANG A Gang is a distributed room behavior, not only a parameter on one device. The acceptance criterion is simple: after any station changes the room state, one press at every other station must immediately produce the opposite state.

Test	Required result
Assignment	Confirm every intended casIO4/casTen input uses the same Multiswitch 1-10 selection and no unrelated switch shares that Gang ID.
On/off catch-up test	Turn the room ON at station A. Press station B once; the room must turn OFF on that first press. Repeat among every pair of stations.
Dim-direction test	For Hold/Double-Tap Toggle modes, dim from one station and continue from another. Verify level and direction remain synchronized.

Test	Required result
Network recovery	Power-cycle or temporarily disconnect one member, restore it, operate the Gang, and verify it resynchronizes on the next received Gang message.
Replacement/profile change	After replacing a device or changing its profile, restore the Gang assignment and repeat the complete multi-station test.

7.6 Recommended user-facing names

Control	Recommended profile labels
Direction	Input / Output
Input Action	Normal, Inverted, Multiswitch 1 ... Multiswitch 10
Input Mode	Static, Pulsed Toggle, Hold Dim Up, Hold Dim Down, Hold Dim Toggle, Double-Tap Dim Up, Double-Tap Dim Down, Double-Tap Dim Toggle
Output Polarity	Normal / Inverted

8 Startup, acceptance, and troubleshooting

Check	Acceptance requirement
Power	casTen remains powered, visible, and paired to the correct network.
Out A	0%, 25%, 50%, 75%, and 100% produce the intended voltage/function; trims recorded.
Out B	0%, 25%, 50%, 75%, and 100% produce the intended voltage/function; trims recorded.
I/O 1	Direction, contact/output wiring, action, mode, polarity, scenes, and gang behavior verified.
I/O 2	Direction, contact/output wiring, action, mode, polarity, scenes, and gang behavior verified.
Save	Power was held for at least 3 seconds after final parameter completion; settings survive a power cycle.
Mesh	Control succeeds from representative occupied locations.
Record	Profile, firmware, all twelve parameter values, wiring functions, and user decisions are documented.

8.1 Troubleshooting

Symptom	Likely cause	Corrective action
Analog output reversed or wrong level	Incorrect common/polarity; trim error; wrong profile channel	Verify GND (-), output assignment, load wiring, and effective trim values; measure at the load.
I/O input does not respond	Pin set to Output; external voltage; wrong action/mode; contact not referenced to GND (-)	Remove external voltage. Set direction to Input. Verify dry closure, action, mode, and contact timing.
I/O output does not switch	Pin set to Input; incompatible load; wrong Casambi channel; inverted polarity	Set direction to Output. Verify channel 3/4 control and use a compatible sensing input.
Pulses missed or double-triggered	Pulse shorter than debounce; contact bounce/noise	Use a clean dry contact, adequate pulse width, short wiring, and separation from noisy conductors.
Gang devices disagree	Gang ID mismatch; stale level/direction; mixed firmware behavior	Confirm identical gang assignment, operate through endpoints, and test all members together.
Settings lost after power cycle	Power removed before deferred flash write	Reapply parameters and keep power on at least 3 seconds after completion.

9 Closeout, support, and product label

9.1 Configuration record

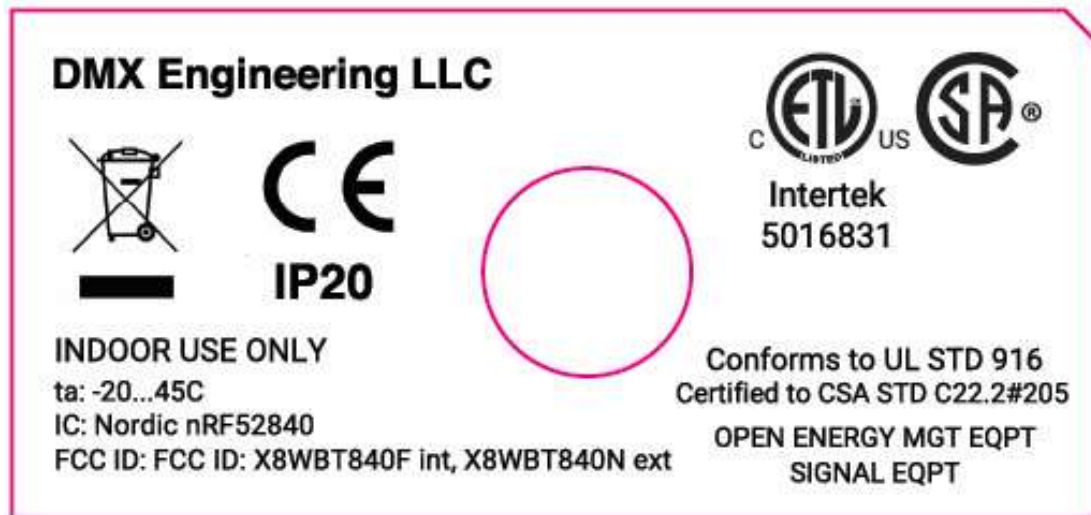
Field	Project record
Project / location	
casTen name / profile name / profile ID	
Firmware version	
Out A function / bottom / top trim	
Out B function / bottom / top trim	
I/O 1 direction / action / mode / polarity	
I/O 2 direction / action / mode / polarity	
Multiswitch gang members	None / list devices and gang ID
Commissioned by / date	

9.2 Technical support

DMX Engineering LLC
1908 N. 101st Place
Mesa, Arizona 85207
480-993-7972
sales@dmx.engineering
<https://dmx.engineering>

9.3 Product identification and certification label

The casTen Fanstel bottom-label artwork is shown below using the same large identification-page treatment as the casDMX guide. 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 casTen label image as the controlled artwork reference. Confirm the shipped internal-antenna or external-antenna Fanstel variant matches the applicable FCC identifier before print release; do not redraw or substitute certification marks.