



Tigo[®]

Troubleshooting Guide

TS4-F, TS4-R-F, TS4-A-F, TS4-A-2F and
RSS Transmitter

IMPORTANT SAFETY INSTRUCTIONS

LETHAL VOLTAGE MAY BE PRESENT IN ANY PV INSTALLATION

SAVE THESE INSTRUCTIONS

- This manual contains important instructions for installation and maintenance of the Tigo product models TS4-F, TS4-A-F, TS4-A-2F, and the RSS Transmitter.
- Risk of electric shock, do not remove cover, disassemble, or repair, no user serviceable parts inside. Refer servicing to qualified service personnel.
- Before installing or using the Tigo System, please read all instructions and warning markings on the Tigo products, appropriate sections of your inverter manual, photovoltaic (PV) module installation manual, and other available safety guides.
- Failure to adhere to these instructions may result in injury or death, damage to the system or voiding the factory warranty.
- To reduce risk of fire and shock hazard, install this device with strict adherence to National Electric Code (NEC) ANSI/NFPA 70 and/or local electrical codes. When the photovoltaic array is exposed to light, it supplies a DC voltage to the Tigo TS4 units and the output voltage may be as high as the PV module open circuit voltage (V_{oc}) when connected to the module. The installer should use the same caution when handling electrical cables from a PV module with or without the TS4 units attached.
 - TS4-F, TS4-A-F, and TS4-A-2F are shipped in the OFF position and will measure 0.6V at the output when the keep-alive signal is not present.
- Installation must be performed by trained professionals only. Tigo does not assume liability for loss or damage resulting from improper handling, installation, or misuse of products.
- Remove all metallic jewelry prior to installing the Tigo TS4 units to reduce the risk of contacting live circuitry. Do not attempt to install in inclement weather.
- Do not operate the Tigo TS4 units if they have been physically damaged. Check existing cables and connectors, ensuring they are in good condition and appropriate in rating. Do not operate Tigo TS4 units with damaged or substandard wiring or connectors. Tigo TS4 units must be mounted on the high end of the PV module backsheet or racking system, and in any case above ground.
- Do not connect or disconnect under load. Turning off the inverter and/or the Tigo products may not reduce this risk. Internal capacitors within the inverter can remain charged for several minutes after disconnecting all power sources. Verify capacitors have discharged by measuring voltage across inverter terminals prior to disconnecting wiring if service is required. Wait 30 seconds after rapid shutdown activation before disconnecting DC cables or turning off DC disconnect.
- Always assume TS4 units are in "ON" state, or may turn on when restarting.

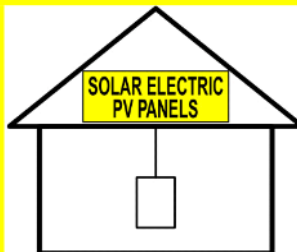
IMPORTANT SAFETY INSTRUCTIONS

Continued

- TS4-F, TS4-R-F, and TS4-A-F are shipped in the OFF position and will measure **0.6V** at the output when the keep-alive signal is not present.
- Failing to follow the sequence of installation steps may result in TS4 damage not covered under warranty.
- Connect all TS4-R-F or TS4-A-F units to their respective modules **before** connecting their outputs in series.
- Install all TS4-F, TS4-R-F, or TS4-A-F/TS4-A-2F units before powering on the RSS Transmitter.
- Power off RSS Transmitter before servicing system.
- If string is disconnected under load, wait 1 minute before reconnecting TS4-A-F. Verify that output voltage is 0.6V before reconnecting.
- Never apply an external voltage source to a module or string equipped with TS4-F, TS4-R-F, or TS4-A-F/TS4-A-2F units.
 - If parallel string connections are needed, first connect the TS4-F, TS4-R-F, or TS4-A-F to the PV modules, then connect all TS4-F, TS4-R-F, or TS4-A-F outputs in series, and finally pass one side (+ or -) of the homeruns through the PLC transmitter to turn the system ON.
- If connecting TS4-A-2F to a single PV module:
 - Connect PV module to **Input 1**, connect **Input 2** cables together
- TS4-F should not be mixed with TS4-S, TS4-O, or TS4-L.
- Place rapid shutdown system label no more than 1m (3ft) from initiator (AC disconnect) or service panel containing means of disconnection if not at same location.

SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN

TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION TO SHUTDOWN PV SYSTEM AND REDUCE SHOCK HAZARD IN ARRAY



Place safety labels in proper location

The RSS Transmitter control power supply **MUST** be on the same AC branch circuit as the inverter to meet rapid shutdown requirements.

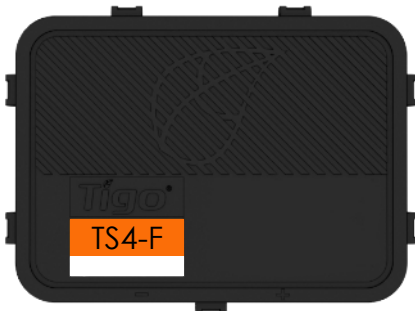
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TS4-F RAPID SHUTDOWN SYSTEM

Tigo's TS4-F (or TS4-A-F, TS4-A-2F) and RSS Transmitter are a UL-certified PVRSS (Photovoltaic Rapid Shutdown System) when installed together. The RSS Transmitter supplies a keep-alive signal along one of the DC homeruns and the TS4-F units on each module will shut down when the Transmitter is switched off.

Module-Level Power Electronics:



TS4-F

- NEC 2017 and 2020 690.12 rapid shutdown compliant
- Module-level deactivation
- PLC communication
- Plug & play, no configuration required

Transmitter:



RSS Transmitter

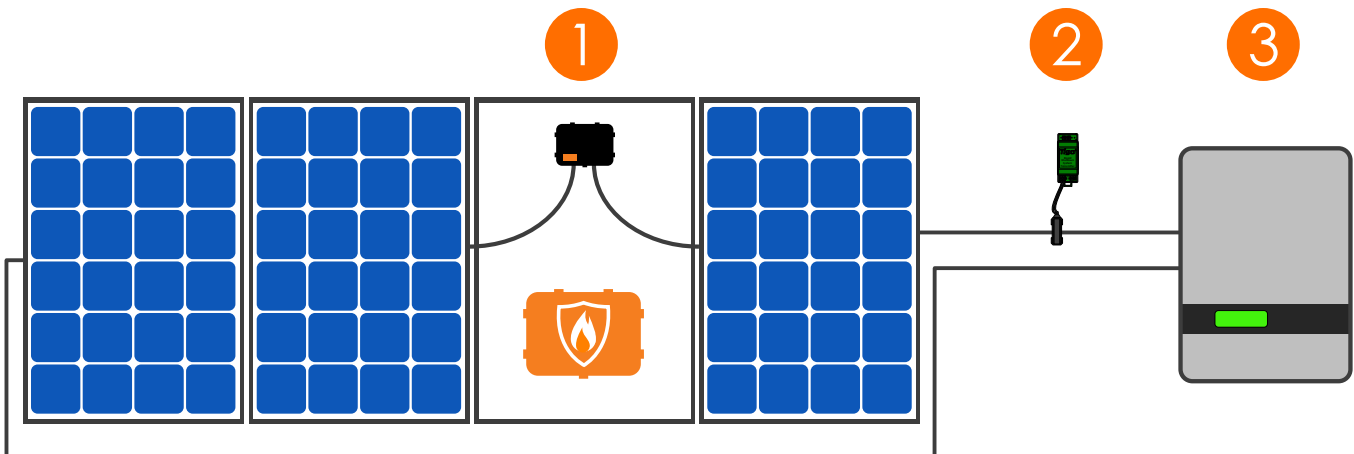
- Rapid Shutdown System Transmitter for rapid shutdown activation of TS4-F, TS4-A-F, or TS4-A-2F units
- The external device that provides a keep-alive signal to the TS4-F via Power Line Communication

SYSTEM OVERVIEW: TS4-F



TS4-F

- Module electronics are contained in the junction box, installed at the PV module factory.
- Connected in series like regular modules
- No additional wiring connections to make



1. Modules with integrated TS4-F
2. RSS Transmitter and RSS Core
3. Inverter

The TS4-F requires a Tigo RSS Transmitter or inverter with built-in transmitter for operation. The Tigo RSS Transmitter is installed in line with a solar PV inverter, as shown, and can be installed inside the inverter or external to it.

Method of Operation

All TS4-F units start in the OFF position and measure 0.6V at the output. When power is supplied to the RSS Transmitter, the TS4-F units turn ON and allow full PV module voltage.

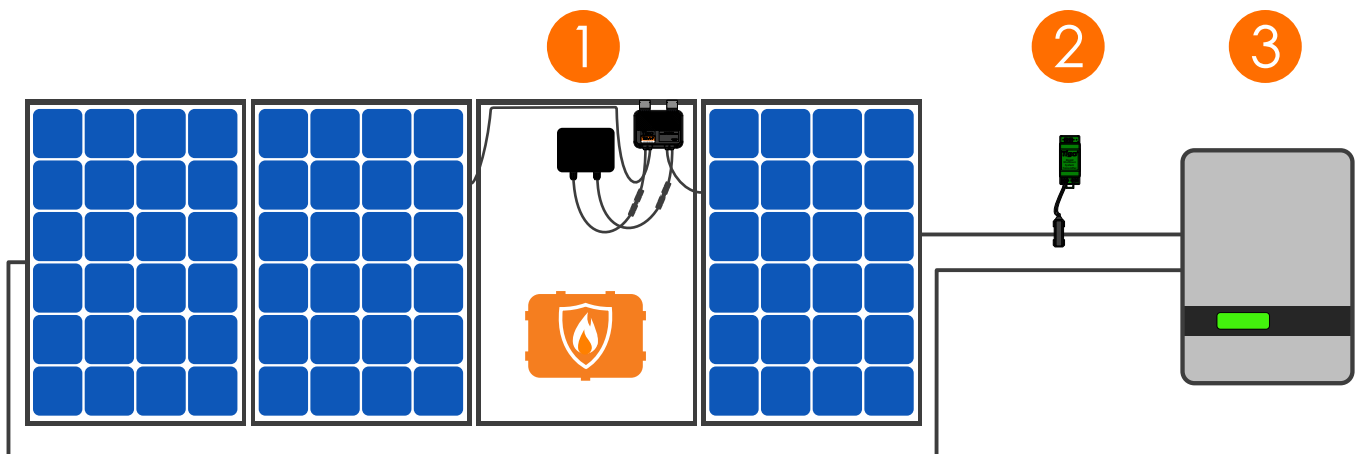
The units constantly receive a “keep-alive” signal from the transmitter over PLC. When power to the transmitter is cut, this keep-alive signal ceases, sending every TS4-F into shutdown mode with output reduced to 0.6V.

SYSTEM OVERVIEW: TS4-A-F



TS4-A-F

- Bracket clips to module frame without tools
- TS4-A outputs are connected in series to form a string
- No additional grounding required



1. Modules with TS4-A-F add-on
2. RSS Transmitter and RSS Core
3. Inverter

Note: connect modules to TS4-A inputs before connecting outputs

The TS4-A-F requires a Tigo RSS Transmitter or inverter with built-in transmitter for operation.

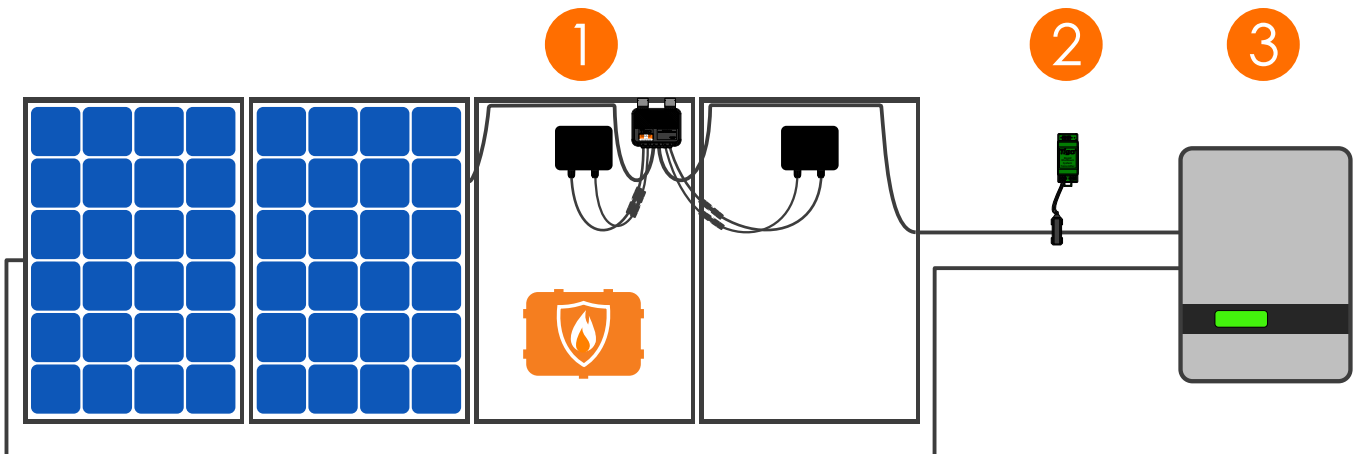
- TS4-A-F mounting is recommended on the upper right as shown, but can be placed elsewhere on the frame or bolted to the racking if needed.
- TS4-A-F cable glands must not be facing up.
- Allow clearance between PV module and mounting surface for air circulation around TS4-A-F.
- For installation on frameless modules, remove metal clips and bolt TS4-A to rail. Do not drill additional mounting holes in the frame or metal bracket.

SYSTEM OVERVIEW: TS4-A-2F



TS4-A-2F

- Bracket clips to module frame without tools
- TS4-A outputs are connected in series to form a string
- No additional grounding required



1. Modules with TS4-A-2F add-on
2. RSS Transmitter and RSS Core
3. Inverter

Note: connect modules to TS4-A inputs before connecting outputs

The TS4-A-2F requires a Tigo RSS Transmitter or inverter with built-in transmitter for operation.

- TS4-A-F mounting is recommended on the upper right as shown, but can be placed elsewhere on the frame or bolted to the racking if needed.
- TS4-A-F cable glands must not be facing up.
- Allow clearance between PV module and mounting surface for air circulation around TS4-A-F.
- For installation on frameless modules, remove metal clips and bolt TS4-A to rail. Do not drill additional mounting holes in the frame or metal bracket.

TESTING RAPID SHUTDOWN

TS4-F (or TS4-R-F, TS4-A-F, TS4-A-2F) and the RSS Transmitter are a solution to meet NEC 690.12 Rapid Shutdown requirements.

TS4-F, TS4-R-F, TS4-A-F, and TS4-A-2F units automatically enter rapid shutdown mode when the RSS Transmitter is switched off and resume energy production when power is restored to the RSS Transmitter.

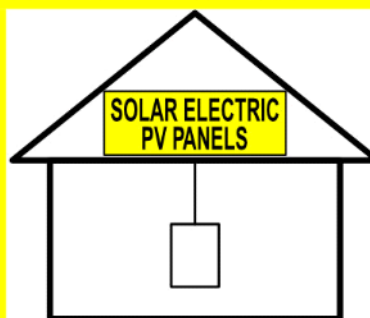
Wait 60 seconds after rapid shutdown activation before disconnecting DC cables or turning off DC disconnect.

Test your rapid shutdown system by switching off the AC power to the RSS Transmitter or inverter with built-in transmitter.

TS4-F, TS4-R-F, TS4-A-F, and TS4-A-2F units will reduce their output to 0.6V when the RSS Transmitter is powered off.

SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN

TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION TO SHUTDOWN PV SYSTEM AND REDUCE SHOCK HAZARD IN ARRAY



Place safety labels in proper location

The RSS Transmitter control power supply **MUST** be on the same AC branch circuit as the inverter to meet rapid shutdown requirements.

[Click here](#) for more info about Rapid Shutdown

TROUBLESHOOTING BASICS

TS4-F, TS4-R-F, TS4-A-F, TS4-A-2F, Tigo RSS Transmitter

Troubleshooting this kind of system will require basic PV system knowledge and the ability to measure voltage.

Before and during all service or maintenance activities on a PV array, the service technician should inspect equipment for visible damage. Any physical damage on PV modules, wires, connectors, or MLPE units should be checked for and acted upon.

Whenever damage is encountered on an MLPE unit, please take clear pictures of the unit. The serial numbers should be legible and the damage visible.

When powering off the RSS Transmitter, wait 1 minute before disconnecting any TS4 cables from the string.

After disconnecting any TS4 output cables from the string, wait at least 1 minute before reconnecting the cables.

TROUBLESHOOTING - STRING-LEVEL

Issue	String has no DC voltage (0.0V)
Description	TS4-F, TS4-R-F, and TS4-A-F should pass 0.6V per unit when the string is not connected to an active transmitter. If the output voltage is measured at 0.0V on a string, there is an open circuit condition. This is most often caused by a wiring issue within the string.
Step 1	Verify the string has been correctly disconnected from the inverter and any parallel strings before the individual string voltage is measured.
Step 2	Perform a visual inspection of the modules, TS4 units, wiring, and connectors. Check if all equipment is connected properly.
Step 3	Apply standard electrical tests to localize the potential open circuit condition.
Step 4	Should the source for the open circuit condition be located within a TS4-F integrated module, see section ‘TS4-F Module has no DC Voltage (0.0V)’ Should the source be located within a TS4-R-F or TS4-A-F unit, see section ‘TS4-R-F / TS4-A-F has no DC Voltage (0.0V)’

TROUBLESHOOTING - MODULE-LEVEL

Issue TS4-F integrated module has no DC voltage (0.0V)

Description An integrated TS4-F unit should pass 0.6V when connected to a PV module and the string is not connected to an active transmitter.

If an output voltage of 0.0V is measured on a TS4-F integrated module, a connection problem between the junction box base and the cover might be present.

Step 1 Shut down the system, wait 60 seconds and disconnect the output leads of the unit.

- If 0.6V is measured at the outputs, reconnect module to string and ensure connectors are properly seated.

Step 2 If the module output is still 0V, please [contact Tigo support](#).

TROUBLESHOOTING - MODULE-LEVEL

Issue

TS4-R-F / TS4-A-F has no DC voltage (0.0V)

Description

A TS4-R-F / TS4-A-F / TS4-A-2F unit should pass 0.6V when connected to a working module and the string is not connected to an active transmitter.

If an output voltage of 0.0V is measured on a TS4-R-F / TS4-A-F / TS4-A-2F unit, it is possible there is a wiring issue, the unit has a problem, or the module has an issue.

Step 1

Shut down the system, wait 60 seconds and disconnect the output leads of the unit. If there was a short, the output will be 0V for 30s.

- If 0.6V is read after this time, the unit shorted or there was an installation issue. At this point, please review your system for possible issues.
- If the output is still 0V, please proceed with the troubleshooting guide.

Step 2

If there are no visible issues with the unit, redo the wiring and test the output voltages. First, test the output voltage of the TS4-R-F / TS4-A-F / TS4-A-2F unit. Then test the output voltage of the module.

- If the output voltage of the TS4-R-F / TS4-A-F / TS4-A-2F unit is now 0.6V when connected to the module, the issue has been resolved
- If the output of the TS4-R-F / TS4-A-F / TS4-A-2F unit is 0V, but the module voltage is between 16V and V_{oc} , the issue may be the TS4-R-F / TS4-A-F / TS4-A-2F unit. Please proceed to the next step.

Step 3

Swap the TS4-R-F / TS4-A-F / TS4-A-2F unit with another unit known to be functioning. Always wait 60 seconds after shutdown before disconnecting output leads.

- If the output of the known functional unit now measures 0V, there is an issue with the module output.
- If the known functional unit measures 0.6V when connected to the module, please [contact Tigo support](#).

TROUBLESHOOTING - MODULE-LEVEL

Issue

TS4-F / TS4-R-F / TS4-A-F / TS4-A-2F with active RSS Transmitter not passing full voltage

Description

The RSS transmitter is turned on and appears active, but the TS4-F, TS4-R-F, TS4-A-F, or TS4-A-2F are not passing full PV module output voltage to the string. This is most often caused by the transmitter's signal being interrupted. The interruption may be related to improper installation of the RSS Transmitter, transmitter failure, or improper string/inverter wiring.

Step 1

Confirm proper design and installation guidelines were followed:

- Confirm the TS4-F / TS4-R-F / TS4-A-F / TS4-A-2F and inverter are listed as compatible
- Up to 10 strings per RSS Transmitter Core (CT)
- Up to 30 modules per string
- Max 150A per RSS Transmitter Core
- Verify RSS Transmitter Core is properly connected
- Verify distance:
 - String length up to 1000 ft (total length from the positive to the negative homerun at the inverter)
- Homeruns through RSS Core must be of the same polarity (all positive or all negative)
- Use the Tigo RSS Signal Detector to test whether the transmitter signal is present at each TS4.

Step 2

Verify that the RSS Transmitter is working correctly.

- The homeruns should pass through an RSS Core with the correct polarity and the RSS Transmitter should be powered ON.
- The signal from the RSS Transmitter will not pass through a string of PV modules if it is an open circuit.

Step 3

Confirm that the strings have been properly wired through the RSS Core to the inverter:

- Begin with one string and turn on the Transmitter
- Repeat the process for each string
- If the issue persists, [contact Tigo support](#)

TROUBLESHOOTING - SYSTEM-LEVEL

Issue

Reduced Production

Description

The performance of a solar array shows a visible reduction in production within a short period of time, not related to changing environmental factors like weather, insolation, etc.

Step 1

Prior to troubleshooting the system components, external factors should be ruled out.

Verify there are no shading conditions, including - but not limited to:

- Shade
- Dirt
- Debris
- Other foreign objects

Step 2

Check the string voltage with an active transmitter at V_{OC} :

- If the voltage is less than the module V_{OC} multiplied by the number of modules, ensure that the RSS Transmitter is correctly installed and the PLC keep-alive signal is present, '[RSS Transmitter Operation Check](#)'.
- Visually inspect the modules, TS4-F / TS4-R-F / TS4-A-F / TS4-A-2F units, and the wiring for signs of damage.

Step 3

Check the string voltage without an active RSS Transmitter. If the voltage is less than 0.6V multiplied by the number of modules, there may be a connection issue with one or more TS4-F or TS4-R-F / TS4-A-F / TS4-A-2F units. Locate the units with no voltage;

- If these are TS4-F units, follow the troubleshooting steps for [integrated modules](#).
- If these are TS4-R-F / TS4-A-F / TS4-A-2F, follow the troubleshooting steps for [add-on units](#).

Step 4

If the TS4-F or TS4-R-F / TS4-A-F / TS4-A-2F units provide the correct voltages with and without an active RSS Transmitter, the performance issue can not be attributed to the Tigo components.

TROUBLESHOOTING - RSS TRANSMITTER

Issue Tigo RSS Transmitter operation check

Description When AC power is connected to the power supply unit, the RSS Transmitter should be turned on and the PLC keep-alive signal should be activated. The TS4-F or TS4-R-F / TS4-A-F / TS4-A-2F units will then provide full voltage to their string.

Operation When AC power is connected to the power supply unit, the Tigo RSS Transmitter should be turned on and signaling be activated. The power LED is blue while the signal LED is green.

Verify that the RSS Transmitter is working correctly:

- Power LED is 'Solid' and Signal LED is 'Blinking': the Transmitter is powered ON and generating PLC keep-alive signal
- Power LED and Signal LED are 'Off': the Transmitter is OFF or is not receiving power. Review wiring to Transmitter, verify power supply is functional, and that AC power is on.
- Power LED is ON, but the Signal LED is OFF: power cycle the unit, if Signal LED stays off, please [contact Tigo support](#)

Wiring Verify that RSS Transmitter is connected to power supply and that RSS Core(s) are installed with correct polarity. Refer to [installation manual](#) for wiring instructions.

Signaling Use the Tigo RSS Signal Detector to verify that the PLC keep-alive signal from the Tigo RSS Transmitter is present along the string of TS4-F or TS4-R-F / TS4-A-F / TS4-A-2F units.

- If the PLC signal cannot be detected along the string, there is likely an open circuit condition. Review wiring connections and check for [string-level issues](#).
- If the LEDs on the Transmitter indicate proper functioning but the signal is not received by any unit, please [contact Tigo support](#).

Tigo's RSS (Rapid Shutdown) Signal Detector is a functionality testing device for sensing the power-line communication (PLC) signal from Tigo's RSS Transmitter to Tigo's UL-certified TS4-F (Fire Safety) units.



Operation

Flip the switch on the RSS Signal Detector to the ON position.

- Place the sensor area of the RSS Signal Detector within 2in (5cm) of a TS4-F unit. Make sure the TS4-F, TS4-R-F, TS4-A-F or TS4-A-2F units are correctly installed on their modules and the RSS Transmitter is connected and powered on.
- When the keep-alive signal is detected, the LED will change from blue to yellow and an audible alert will sound to confirm.
- If the signal is not detected, the LED will remain blue and there will be no sound.

TROUBLESHOOTING - CONTACTING TIGO SUPPORT

Before contacting Tigo Support

In any event where the inverter has an error code, please check the inverter's operation and safety manual for troubleshooting guidance or contact the inverter manufacturer for further assistance.

Should an issue persist after following the troubleshooting steps as described in this manual, a summary of the performed tests and a list of system related information detailed below should be provided to Tigo support.

Unresolved Issues

Contact Tigo Technical Support

Required Information

System

Provide the following system information:

- System name
- System owner
- System address
- System Installer

Technical Info

Provide the following technical information:

- Serial number(s) of the affected TS4-F or TS4-R-F / TS4-A-F units in the system
- Number of strings per MPPT
- Number of modules per string
- Total length of each string from the positive to the negative homerun at the inverter
- Inverter production, current, and voltage graphs (if applicable and available)

Datasheets

Provide the following product documentation:

- Module datasheets
- Inverter datasheets

Send

Provide the information to technical support at Tigo:
Support@tigoenergy.com



For more details on troubleshooting and servicing solutions powered by Tigo, please visit:

- [Tigo Academy](#)
- [Resource Center](#)

For sales info:

sales@tigoenergy.com or 1.408.402.0802

For product info:

www.tigoenergy.com/products

For technical info:

training.tigoenergy.com

For service info:

support.tigoenergy.com

For additional info and product selection assistance, use Tigo's online design tool at www.tigoenergy.com/design