

Collins Aerospace TTR-2100/4100 Diagnostic Tool Overview



TTR-2100 and TTR-4100 Traffic Alert and Collision Avoidance System (TCAS II) traffic computer
 NextGen® traffic surveillance in a lighter, more capable system for air transport, rotary-wing, business and regional aircraft.



ADVANTAGES OF INNOVATION: TTR-2100 and TTR-4100

The TTR-2100 and TTR-4100 are functional replacements for the TTR-920, TTR-921 and TTR-4000 digitally equipped systems and use existing TCAS control panels, wiring and TRE-920 antennas.

The Collins Aerospace TTR-2100/4100 TCAS system consists of one transmitter receiver, two TRE-920 TCAS directional antennas or (one TRE-920 TCAS Directional and one L-Band OMNI Antenna), a TTC-920 control panel (or controlled via RTU) and a flight deck forward-field-of-view display to integrate the traffic display for the pilot

KEY FEATURES

- Simplified design with no manual tuning
- Maintains existing phase-based TRE-920 antennas
- ADS-B In provisioned
- TCAS 7.1 compliant
- Certified by FAA TSO C119C, DO-185B, DO-178B, DO-254, DO-160F
- Certified by EASA TSO C119C, ED-143, ED-12B, ED-80, ED-14F
- 30 target display capability
- 30-40 NMI maximum
- 5° RMS bearing accuracy, 10 peak
- Replacement for the TTR-920 and TTR-921

Directional Antenna Installation

- The TCAS II system requires two antennas
- One TRE-920 TCAS II Directional Antenna mounted on top of the fuselage
- One Directional Antenna on the bottom of the fuselage

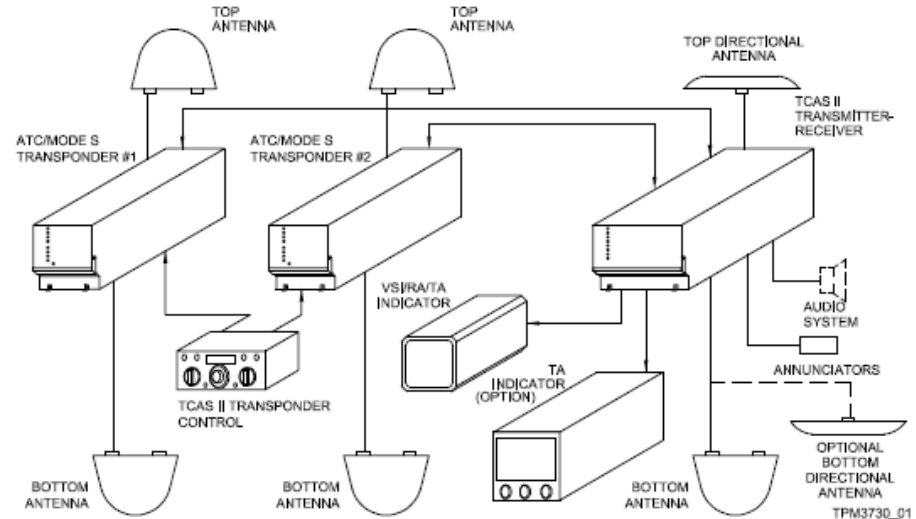
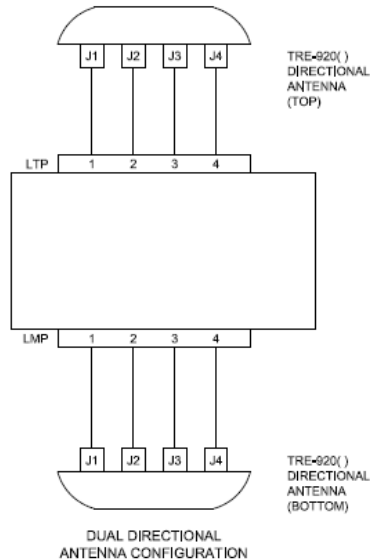
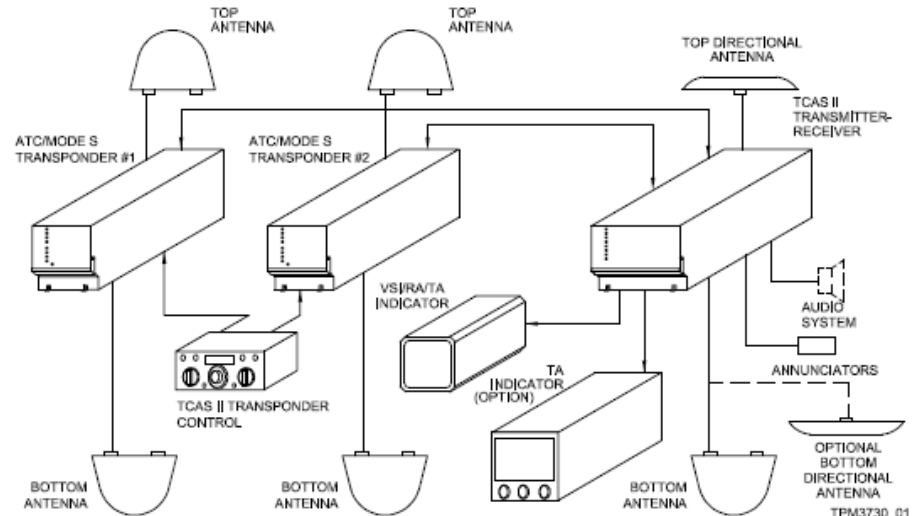
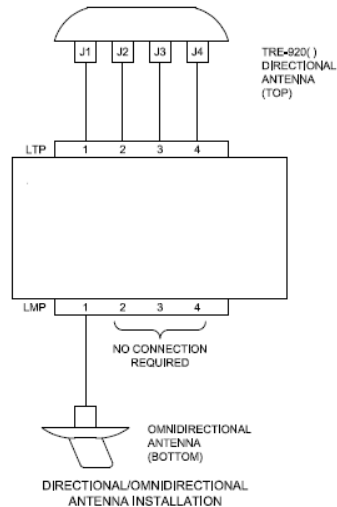


Figure 4-3. Typical TCAS II System

L-Band Omni Directional Antenna Installation

- The TCAS II system requires two antennas
- One TRE-920 TCAS II Directional Antenna mounted on top of the fuselage.
- The second antenna may be *either* another TRE-920 Directional Antenna or an **L-band Omnidirectional Antenna**.



Service Information Letter

Description of Diagnostic tool SIL TTR-2100/4100-18-1 Technical Publications # 523-0824882

Service Information Letter

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523-0824882-101000

TTR-2100 TRAFFIC COLLISION AVOIDANCE SYSTEM (TCAS) TRANSMITTER/RECEIVER
ROCKWELL COLLINS PART NUMBER (RCPN) 822-0911-001/020/021
TTR-4100 TCAS TRANSMITTER/RECEIVER RCPN 822-3075-001

Service Information Letter TTR-2100/4100-18-1
REVISION NO. 1

DESCRIPTION OF TTR-2100/4100 DIAGNOSTIC TOOL

TRANSMITTAL INFORMATION SUMMARY

Summary

This is revision 1 of Service Information Letter (SIL) TTR-2100/4100-18-1 for the TTR-2100/TTR-4100 TCAS Transmitter/Receiver.

This revision updates SIL.

Black bars in the margins indicate the changes.

Replace the initial release with this revision.

Service Information Letter Revision History

REVISION	DATE OF RELEASE
Initial Release	May 14, 2018
Revision 1	August 29, 2018

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A. Purpose

This SIL describes the TTR-2100/4100 Diagnostic Tool as well as provides information to help trouble-shoot system faults on the aircraft.

B. Tool Information

- (1) The TTR-2100/4100 fault data can be extracted using a Windows® XP 7, 8, or 10 Personal Computer (PC) and the TTR-2100/4100 Diagnostic Tool, RCPN 831-9457-002. The PC connects to the TTR-2100/4100 Ethernet jacks under the front panel access door with either a straight or cross-over Ethernet cable. The PC Ethernet adapter must be configured for Auto-Negotiation. A user guide is included in the tool and can be accessed by clicking Help in the toolbar.
- (2) The diagnostic tool can be used for installations that have a bottom omni antennas, however it should be noted that the tool will slightly dim the bottom cable calibration results as the unit does not perform cable calibration for omni antennas. Omni antennas should have a resistance measurement of less than 1800 ohms on port 1 and high impedance (>186kohms) for the other three (3) bottom ports.
- (3) The TTR-2100/4100 Diagnostic Tool can be used for troubleshooting to extract faults from previous flight logs and to examine active faults real-time.

C. General Information

- (1) The TTR-2100/4100 and TTR-920/921/4000 units provide front panel Light Emitting Diode (LED)'s to indicate connection faults for the top and bottom antennas. The unit determines whether an antenna is properly connected by measuring the resistors found in each of the four ports of the antenna. If the antenna ports are connected erroneously, or if there is an open or shorted connection, the unit will light the red LED for the corresponding antenna.
- (2) The unit also performs a cable calibration routine to compensate for the various cable lengths of the four (4) antenna ports. This routine also includes a check to ensure that the Radio Frequency (RF) signal level is sufficient and the phase measurement accuracy is within tolerance. Cable calibration faults caused by the antenna, cabling, or connectors will not light the front panel antenna LEDs. The TTR-2100/4100 does not indicate an internal failure by setting Traffic Collision Avoidance System (TCAS) Unit Failure Bit 11 in Maintenance Label 350 on the Traffic Advisory/Resolution Advisory (TA/RA) Display Bus, or light the front panel red TCAS fail lamp for antenna cable calibration faults. This is in contrast to the TTR-920/921/4000 that does light the red TCAS fail lamp and sets Bit 11 for cable calibration faults. The TTR-2100/4100 will show a front panel green lamp during a self-test cable calibration failure and will only annunciate the failure in the cockpit.

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- (3) The TTR-2100/4100 requires a higher quality RF link due to ADS-B in and future growth provisions for passive surveillance. Therefore, the TTR-2100/4100 may produce a fault when installed with antenna systems that have degraded, but were still functional with the TTR-920/921/4000. When installing the TTR-2100/4100 in place of a TTR-920/921/4000, the TTR-2100/4100 Diagnostic Tool's Antenna Health Display can be used to examine the cable calibration results to ensure they have sufficient margin. If they indicate the installation is failing or marginally passing, the aircraft's antenna, cabling and connectors can be repaired before the aircraft is returned to service. This will help reduce the likelihood of future intermittent faults. For aircraft without a maintenance system, this tool can also be used to download fault logs from previous flight legs to identify the cause of a failure.
- (4) For additional troubleshooting assistance see the TCAS II Installation Manual, 523-0820642, section 5.3 Troubleshooting.

D. Recommendation

- (1) Rockwell Collins recommends using the Diagnostic Tool to reduce No Fault Found rates and prevent chronic aircraft due to TCAS faults.
- (2) The TCAS Diagnostic Tool can be found on the Customer Portal.
 - (a) In a web browser, navigate to <https://portal.rockwellcollins.com>.
 - (b) Sign in to your account. If you do not have an account, please Register for an account.

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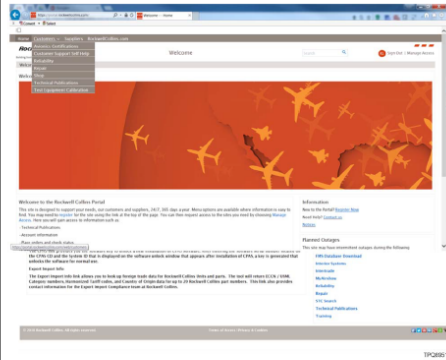
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Description of Diagnostic tool SIL TTR-2100/4100-18-1 Technical Publications # 523-0824882

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- (c) When signed in, select the "Customers" drop-down tab, then click "Customer Support Self Help". Refer to Figure 1.



Customer Support Self Help
Figure 1

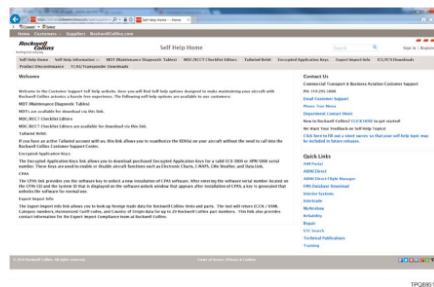
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- (d) Near the top of the screen, select the "TCAS/Transponder Downloads" tab. Refer to Figure 2.



TCAS/Transponder Downloads
Figure 2

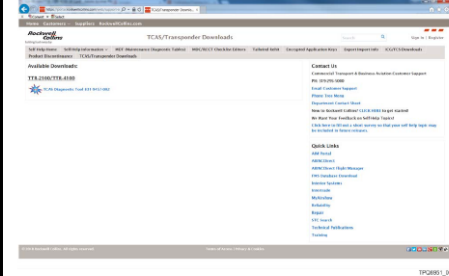
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- (e) Select the TCAS Diagnostic Tool. Refer to Figure 3.



TCAS/Transponder Downloads Screen
Figure 3

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TTR-2100/4100 Diagnostic Tool Setup

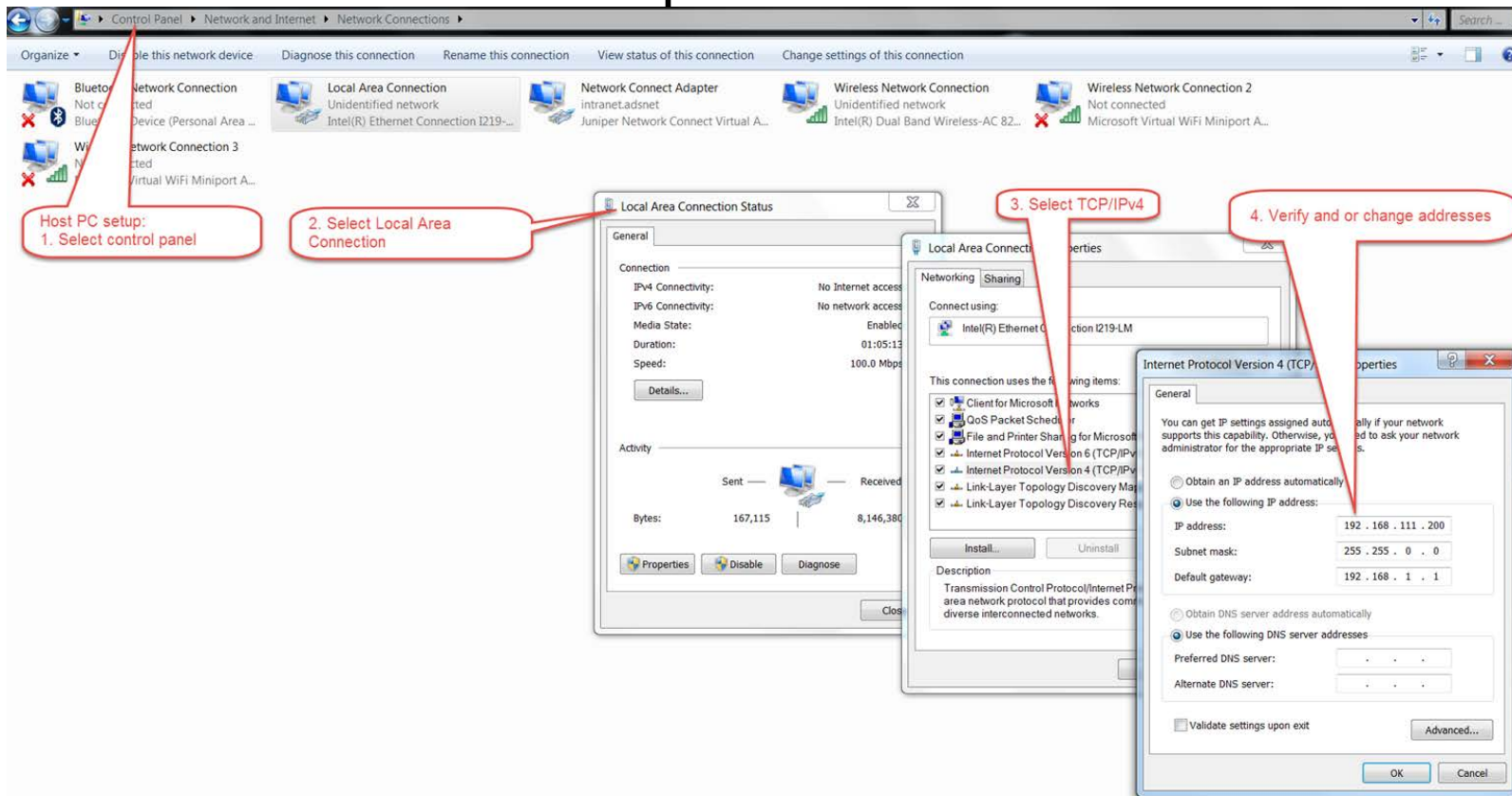
Host Maintenance PC Setup

- Install the TTR-2100/4100 Diagnostic Tool,
 - PN 831-9457-002.
- Configure the PC's Network Interface Controller (NIC) Internet Protocol Version 4 (TCP/IPv4) settings for the following:
 - IP Address: 192.168.111.200
 - Subnet Mask: 255.255.0.0
 - Default Gateway: 192.168.1.1



- The Host PC should be connected to the TTR via an Ethernet/RJ-45 cable located under the front panel access door.
- The SysIO port (top jack) is used only to download fault memory from the SysIO module.
- The Traffic port (middle jack) is used for real-time fault monitoring
- Traffic module NVRAM download of fault data and RA event logs, and Antenna Health Monitor Tool.
- The TXRX (bottom port) is not used with this tool.

Host Maintenance PC Setup



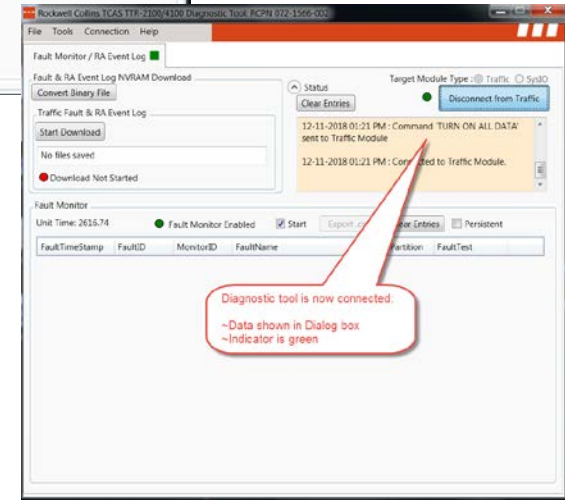
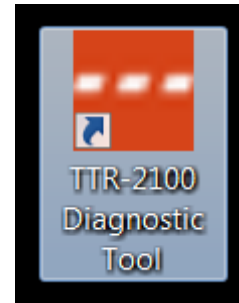
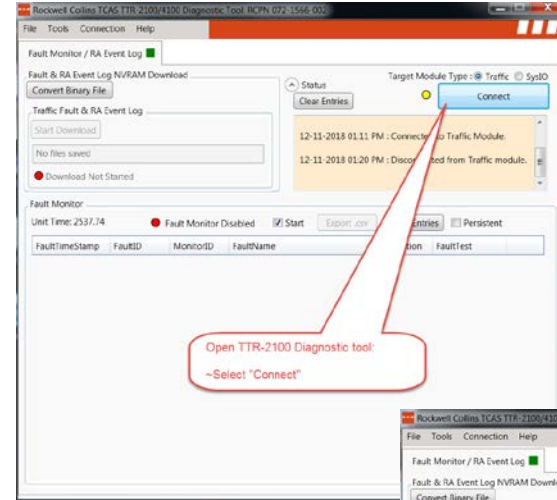
Connecting to the TTR

Select the desired Target Module Type to connect to by clicking on the radio button above the Connect button. Click Connect to establish the TCP/IP connection.

- The connection status light to the left of the Connect button will indicate the following:

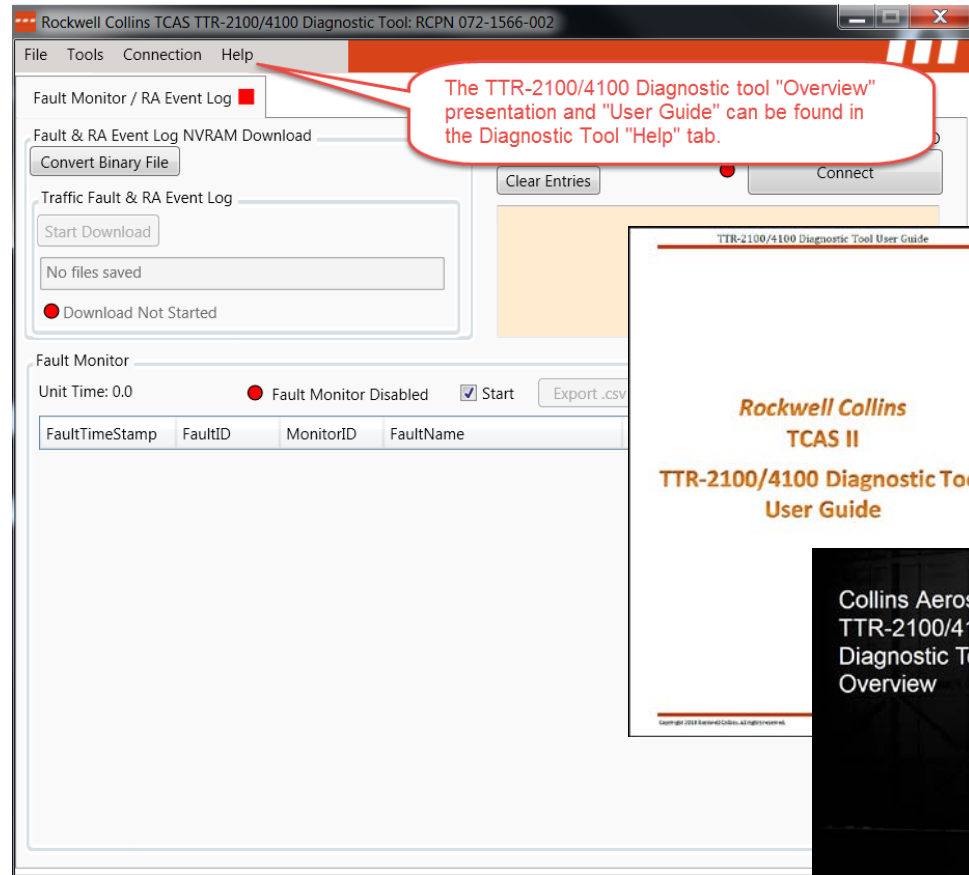
-  Red – Module Ethernet connection not detected.
-  Yellow – Module Ethernet connection detected.
-  Green – Module TCP/IP connection is currently established.

- Real-time fault monitoring will begin automatically once a connection to the Traffic module is established.



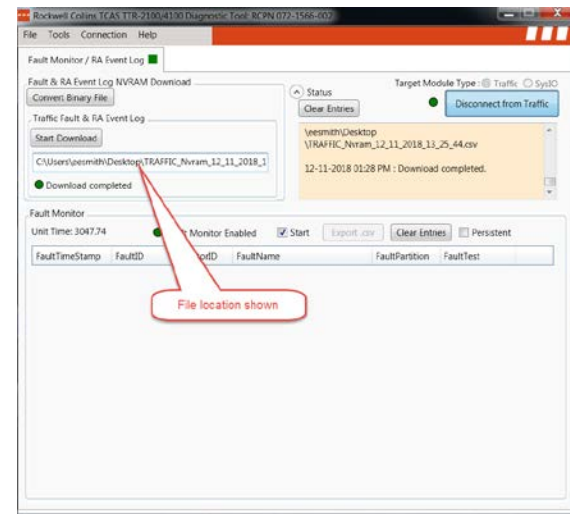
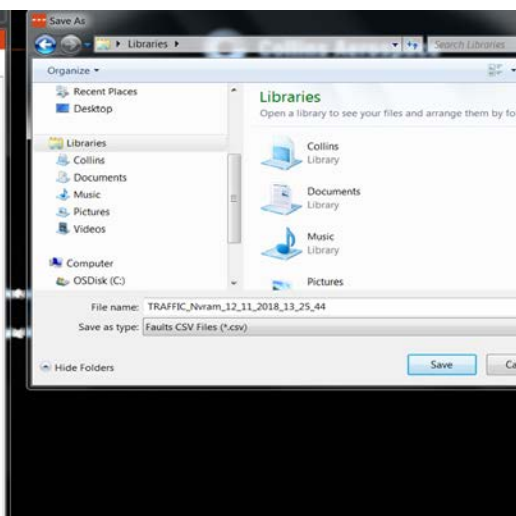
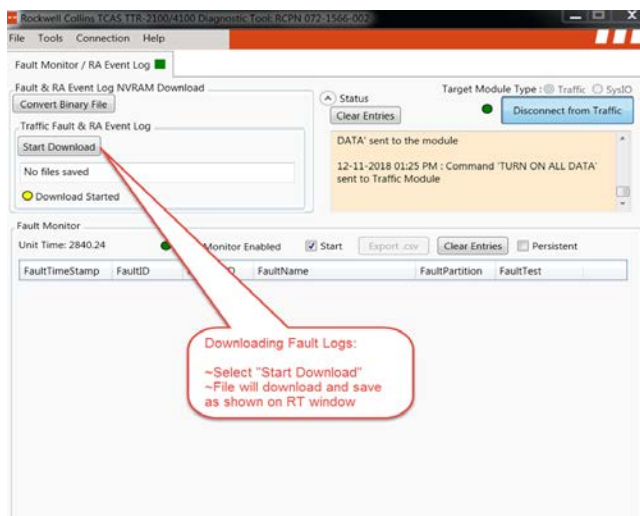
HELP

- The “Overview Presentation” is to provide an Avionics Technician a quick visual training presentation to **supplement** the “Diagnostic Tool User Guide”.
- It can be used for initial familiarity and used as a reference during on-wing troubleshooting in conjunction with the User Guide.
- The “Diagnostic Tool User Guide” provides a detailed use of the tool and contains **Fault Monitor Description Tables**.



Downloading Fault Logs and RA Events from NVRAM

Once the memory is downloaded, save the results either in a .csv or .bin file format.



Troubleshooting Units using NVRAM Fault Records

- Traffic fault memory is organized by power cycles. Traffic NVRAM will provide more history of past faults, as well as additional diagnostic data that can help when analyzing failures.
- Detailed info can be found in the Diagnostic Tool Guide found in the SW tool “Help” tab.

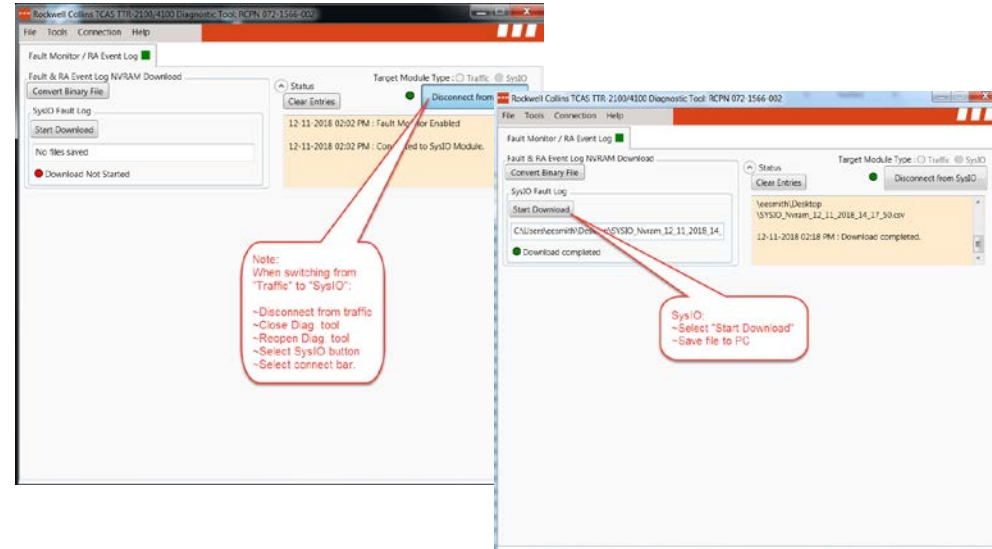
TRAFFIC_Nvram_12_11_2018_11_25_44 - Excel

example of Traffic NVRAM Data File

Fault	Cycle	Temp	Count	Unit Time	AirGnd	Altitude	Address	Date	Value0	Value1	Value2	Value3	Troubleshooting
Mode S Transponder #1 Bus Activity Monitor	33	40C	1	44	AIR	0	000000		00000000	00000000	00000000	00000000	
Mode S Transponder #2 Bus Activity Monitor	33	40C	1	44	AIR	0	000000		00000000	00000000	00000000	00000000	
Radio Altitude #1 Activity Monitor	105	44C	21603	54883	AIR	1124	AA2A7F		FFFFFFF0	FFFFFFF1	FFFFFFF2	FFFFFFF3	RadAlt=16,384ft, SSM=NO
Radio Altitude #1 Activity Monitor	106	30C	87695	2388	AIR	2880	AA2A7F		00000000	00000001	FFFFFFF2	FFFFFFF3	Label 164 Missing.
Radio Altitude #1 Activity Monitor	107	38C	135186	1702	AIR	2906	AA2A7F		00000000	00000001	FFFFFFF2	FFFFFFF3	Label 164 Missing.
Mode S Transponder #1 Bus Activity Monitor	125	54C	1	18778	GND	0	000000		00000000	00000000	00000000	00000000	
Mode S Transponder #2 Bus Activity Monitor	125	54C	1	18778	GND	0	000000		00000000	00000000	00000000	00000000	
Mode S Transponder #1 Bus Activity Monitor	152	35C	21	677	AIR	0	000000		00000000	00000000	00000000	00000000	
Mode S Transponder #2 Bus Activity Monitor	152	35C	21	677	AIR	0	000000		00000000	00000000	00000000	00000000	
Mode S Transponder #1 Bus Activity Monitor	188	41C	21	1559	GND	0	000000		00000000	00000000	00000000	00000000	
Mode S Transponder #2 Bus Activity Monitor	188	41C	21	1559	GND	0	000000		00000000	00000000	00000000	00000000	

Troubleshooting Units using NVRAM Fault Records

- SysIO fault memory is logged based on flight legs,
- SysIO NVRAM should be examined first to get an idea of faults that have occurred recently and how many hours the unit has been operating since last being serviced.
- The SysIO NVRAM structure is different between the -X0X and the -X2X unit statues.
- Detailed info can be found in the Diagnostic Tool Guide found in the SW tool “Help” tab.



Example of Sys IO Faults

SYSIO_Nvram_12_11_2018_14_17_50 - Excel

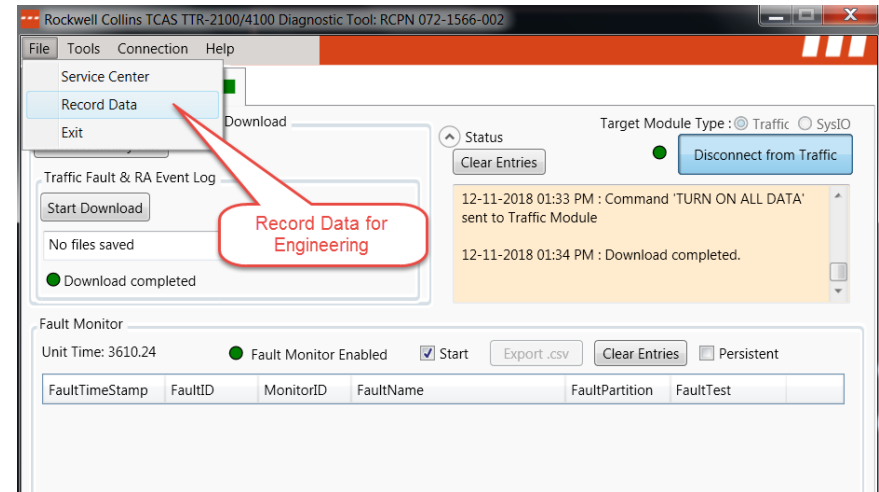
Example of SysIO NVRM file

See Diag user guide for fault table/description

	A	B	C	D	E	F	G	H	I	J	K	L
	Report Name	Fault ID	Monitor ID	Fault Name	Intermittence Count	Flight Phase	Fault State	Flight Date	Time of First Occurrence	Time of Last Occurrence	Aircraft ID	Fault Dependent Data
1	Leg[11] SysIO Reports - 0	400	403	Maintenance Bus Activity Monitor	2	UNKNOWN	ACTIVE	UNKNOWN	UNKNOWN	UNKNOWN		0x0000000000000000
2	Leg[11] Gnd Selftest - 6		20	Maintenance Bus Activity Monitor		UNKNOWN		UNKNOWN	UNKNOWN	UNKNOWN		
3	Leg[12] SysIO Reports - 0	400	403	Maintenance Bus Activity Monitor					UNKNOWN	UNKNOWN		0x0000000000000000
4	Leg[13] SysIO Reports - 0	400	403	Maintenance Bus Activity Monitor					UNKNOWN	UNKNOWN		0x0000000000000000
5	Leg[14] SysIO Reports - 0	400	403	Maintenance Bus Activity Monitor					UNKNOWN	UNKNOWN		0x0000000000000000
6	Leg[14] Gnd Selftest - 6		20	Maintenance Bus Activity Monitor		UNKNOWN		UNKNOWN	UNKNOWN	UNKNOWN		
7	Leg[14] Gnd Normal - 7					UNKNOWN		UNKNOWN	UNKNOWN	UNKNOWN		

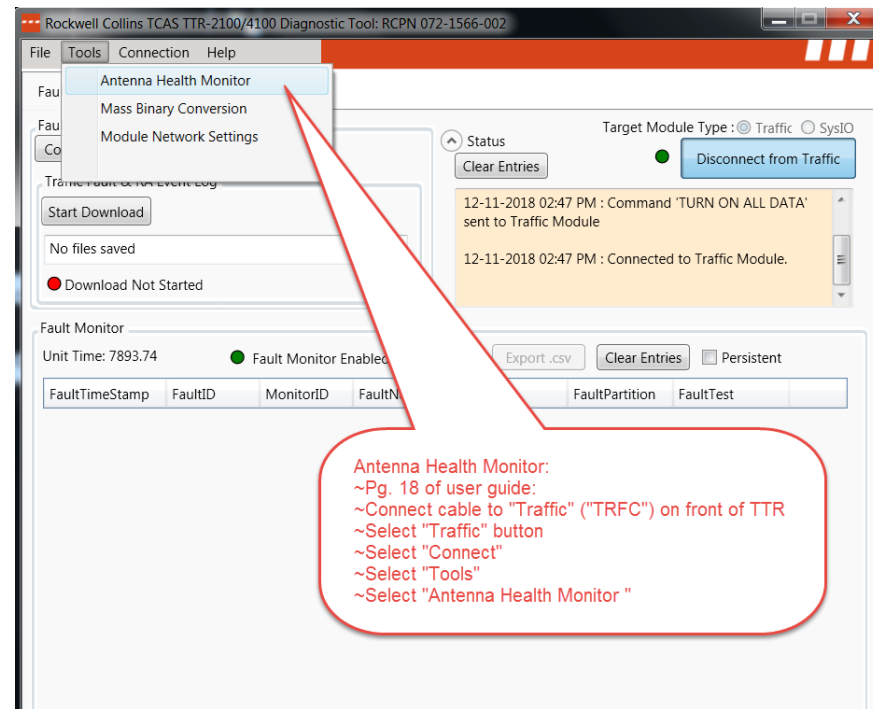
Recording Data for Engineering Evaluation

- While connected to Traffic, engineering data can be recorded
- Select File
- Record Data
- Select a location to save the binary file
 - It will start a new file with a similar name every 100MB
 - The file can be closed by selecting File->Quit Recording



Antenna Health Monitor Tool

- Graphically displays information about the antenna resistance measurements for each port of the top and bottom antennas.
- Consolidates cable calibration results for signal and phase measurements into two indicators for each antenna.
- Indicators are broken up into three sections (red, yellow, and green) to show the health of the antenna installation.



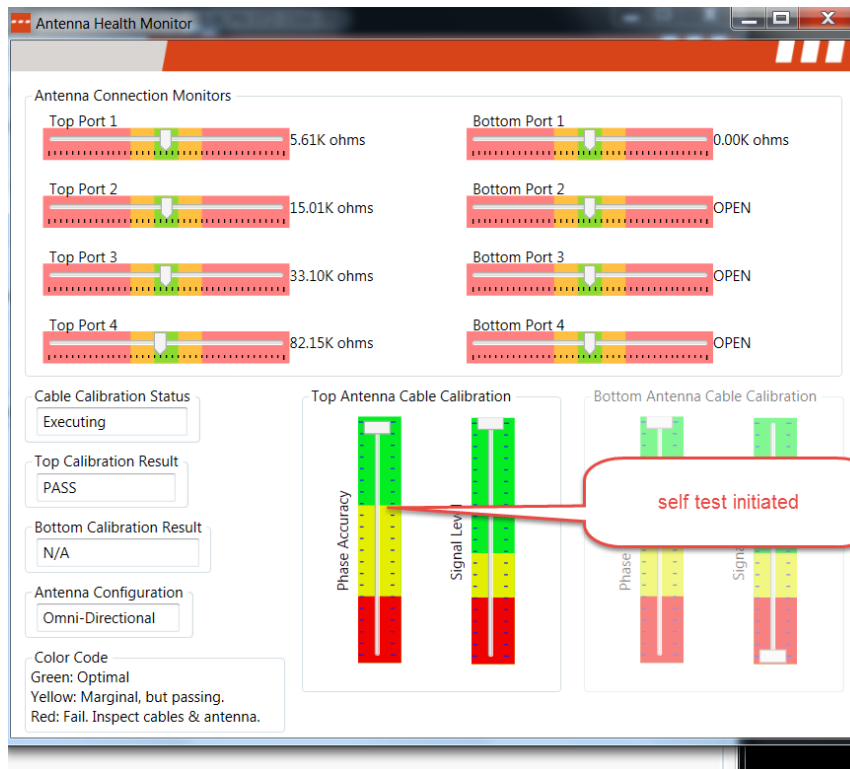
Antenna Resistor Indicators

- Green – Antenna resistor measurement results are within +10% of the optimal value for that port.
- Yellow – The results are between 10 – 30% of the optimal value.
- Red – The results are greater than 30% away from the optimal value and are failing the monitor.
- While measurements that fall in the yellow region are still passing, they may indicate that the port signal path has degraded. (loose, moisture contaminated, etc)
- If cable calibration faults are also present, these ports should be inspected first, as they could be the main contributor to the failure.
- Antenna connectors are color-coded as follows:
J1 – Yellow, J2 – Black, J3 – Blue, J4 – Red.



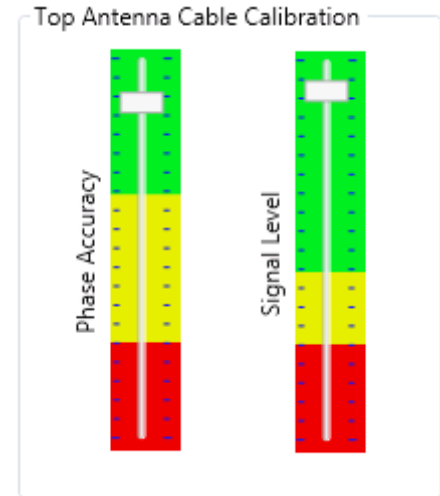
Antenna Health Monitor

- The “Antenna Health Monitor” provides a display of the instantaneous status and results of the “Cable Calibration Monitor”.
- When evaluating an installation for antenna health, a self-test should first be executed. Then the unit should be allowed to run in active mode while monitoring the antenna health monitor display for 10 minutes to ensure the monitor has produced no faults.
- The “Cable Calibration Status” box indicates whether the cable calibration background routine is executing. The cable calibration routine will stop executing if the unit is in standby, either due to a fault or as selected on the control panel.
- The calibration indicators will be greyed/dimmed out if cable calibration is not running.
- The “Top/Bottom Cable Calibration” result boxes will indicate whether the current cycle’s measurement for the antenna is passing, marginally passing, or failing due to being over the tolerance limits.
- The Antenna Configuration box will indicate the type of bottom antenna connected; either directional or omni. Cable calibration is not performed on an omni antenna; therefore, the bottom antenna calibration indicators will be greyed/dimmed out.
- If there is no connection to the unit, the Antenna Health Monitor window will grey out to indicate it is no longer receiving fresh data.



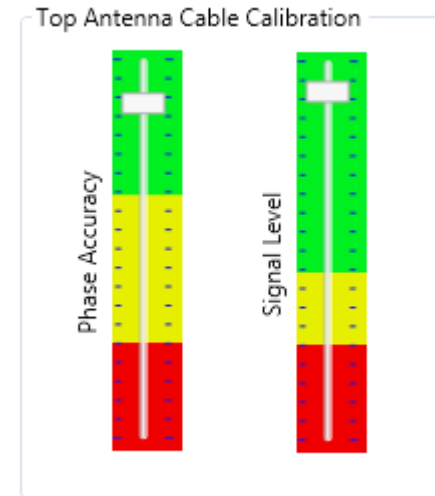
Phase Accuracy Indicator

- Green – These are optimal measurement results that are close to the expected result. It is normal for the indicator to move around this area as the cable calibration routine executes.
- Yellow – These are marginal measurements results. The connectors and cabling should be examined for degradation if results routinely fall in this area to ensure sufficient margin in all conditions.
- Red – This indicates phase measurement results that are far outside the expected result. These measurements are discarded and the fault debounce counter is incremented. If the measurements consistently fall in this area, a fault will be declared. Occasionally, measurements will fall into this area due to interference. If measurements frequently enter this area, the cables, connectors, and the antenna should be inspected for degradation. If the phase accuracy is low, but the signal level is consistently high, this may indicate the TCAS needs to be serviced.



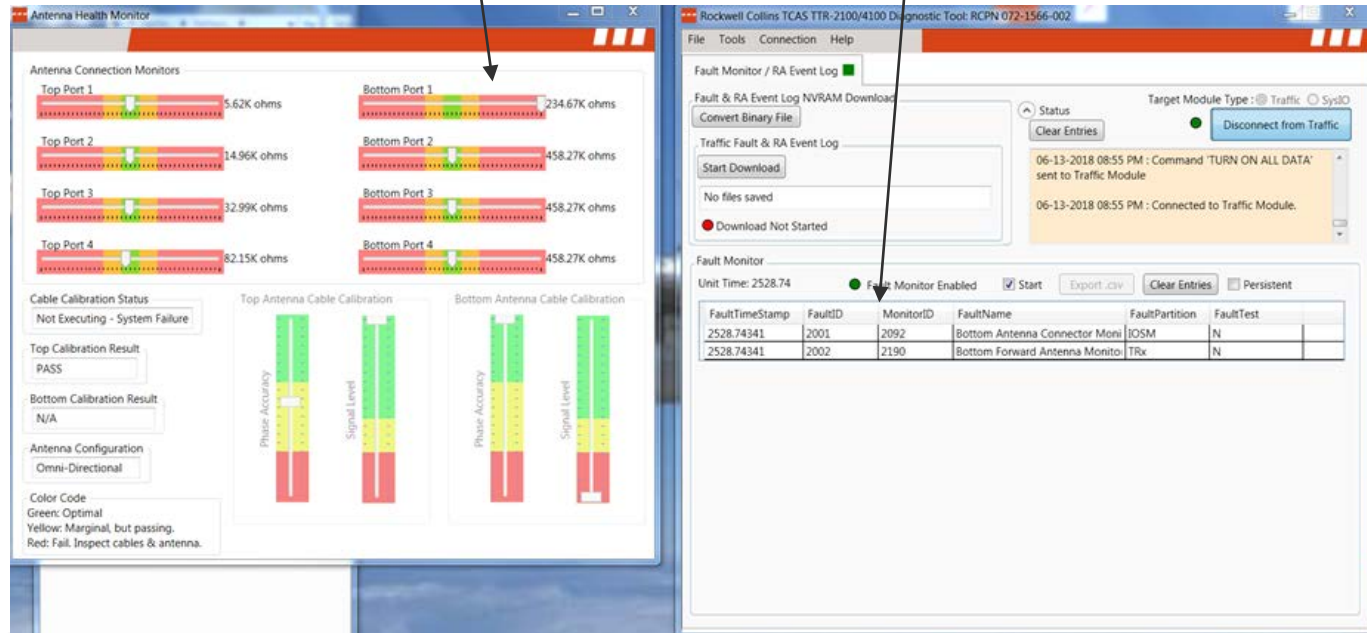
Signal Level Indicator

- Green – This represents optimal measurements for the 1030MHz and 1090MHz test pulse signal strength. Signal levels in the green ensure that the phase measurements can be acquired without excessive interference from outside sources.
- Yellow – This indicates the measurement result is marginal, but still useful. This lower signal level may result in larger phase measurement errors. Investigation into what is causing an attenuated signal may be necessary to ensure sufficient margin in all conditions.
- Red – This indicates the signal level is too low. These measurements are discarded and the fault debounce counter is incremented. If the measurements consistently fall in this area, a fault will be declared. Cables, connectors, and the antenna should be inspected for degradation.



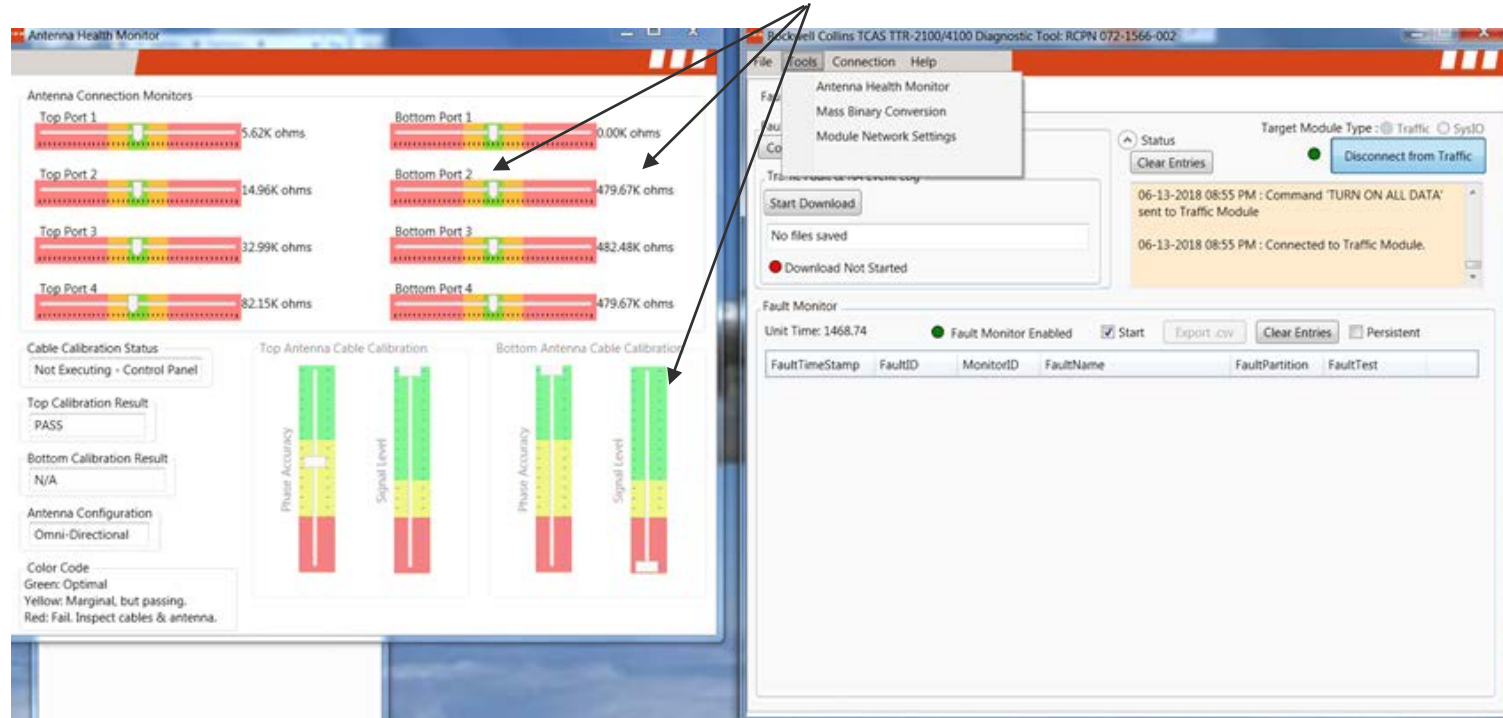
Example of a faulty cable connection

- The lower L-Band Omni Directional Antenna connector was removed, resulting in the Bottom Port #1 changing from 0.0k ohms to being pegged high at 234.67 k ohms.
- Fault Monitor displayed current faults.



CRJ A/C Configuration: Example

- Upper Antenna, Directional
- Lower Antenna is an L-Band Omni Directional and as such “Bottom Ports 2,3,4” and “Signal Level CAL” are not used.

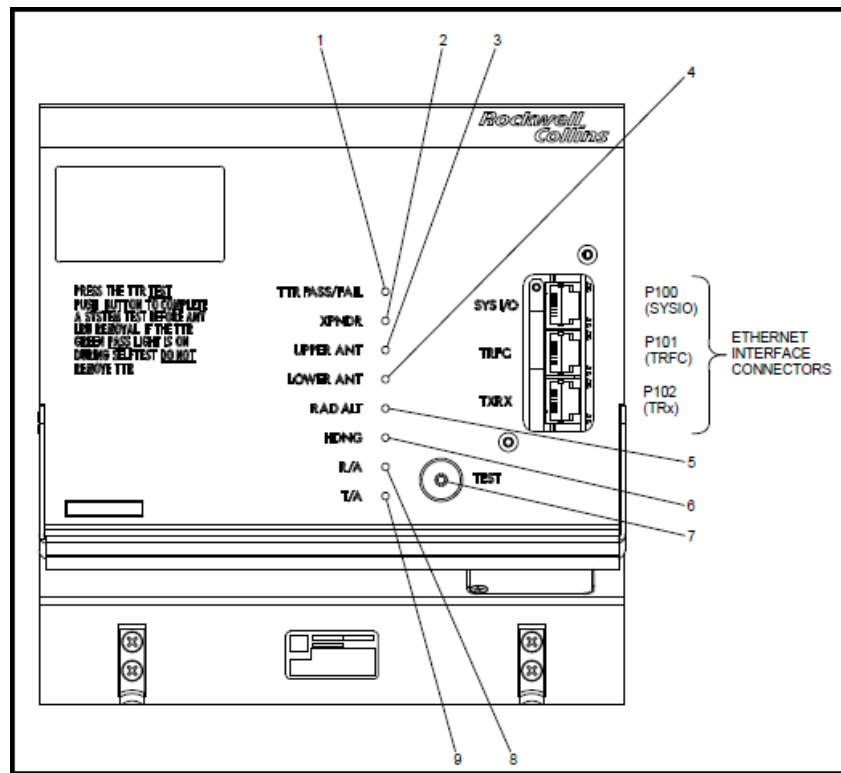


Eight LED indicators on the front panel of the TTR

- The LEDs show the result of the most recent power-up self-test.
- The indicators also show self-test results when the front panel TEST push-button is pushed and held down for more than three seconds.

INDEX NO	INDICATOR (CONTROL)	INDICATOR COLOR	DESCRIPTION
1	TTR PASS/ FAIL	GREEN / RED	Lights green to indicate TTR self-test was successful. Lights red to indicate an internal TTR unit failure.
2	XPNDR	RED	Lights to indicate transponder or data link interface failure.
3	UPPER ANT	RED	Lights to indicate upper TCAS antenna failure.
4	LOWER ANT	RED	Lights to indicate lower TCAS antenna failure.
5	RAD ALT	RED	Lights to indicate absence of radio altimeter data.
6	HDNG	RED	Lights to indicate absence of heading data.
7	TEST (push button switch)		Starts self-test when pushed.
8	R/A	RED	Lights to indicate failure of RA indicator.
9	T/A	RED	Lights to indicate failure of TA indicator.

Front Panel Controls and Indicators



LED Fault Indicator General Information

Reference page 2 of SIL TTR-2100/4100-18-1

- The TTR-2100/4100 units provide front panel Light Emitting Diode (LED)'s to indicate connection faults for the top and bottom antennas. The unit determines whether an antenna is properly connected by measuring the resistors found in each of the four ports of the antenna. If the antenna ports are connected erroneously, or if there is an open or shorted connection, the unit will light the red LED for the corresponding antenna.
- The unit also performs a cable calibration routine to compensate for the various cable lengths of the four (4) antenna ports. This routine also includes a check to ensure that the Radio Frequency (RF) signal level is sufficient and the phase measurement accuracy is within tolerance. Cable calibration faults caused by the antenna, cabling, or connectors will not light the front panel antenna LEDs. The TTR-2100/4100 does not indicate an internal failure by setting Traffic Collision Avoidance System (TCAS) Unit Failure Bit 11 in Maintenance Label 350 on the Traffic Advisory/Resolution Advisory (TA/RA) Display Bus, or light the front panel red TCAS fail lamp for antenna cable calibration faults. This is in contrast to the TTR-920/921/4000 that does light the red TCAS fail lamp and sets Bit 11 for cable calibration faults. The TTR-2100/4100 will show a front panel green lamp during a self-test cable calibration failure and will only annunciate the failure in the cockpit.