



**Electronics
International Inc.**

FCD-TR1 Operating Instructions

1203181 Rev B



Field Calibration Device for Electronics International's TR-1-xx Instrument Line

Overview:

The FCD-TR1 is a field calibration device which will work with any Electronics International (EI) TR-1 instrument. The TR-1 can be configured or calibrated in the field using this device and an iPad or iPhone (iPad is recommended). The FCD-TR1 can be used for the following:

- Downloading Recorded Flight Data
- Calibrating a Fuel Tank Gauge
- Modifying the TR-1 brightness settings to match other instruments in your aircraft panel
- Adjusting the K-Factor for a Fuel Flow Gauge
- Calibrating the Torque Sensor for your aircraft
- Testing the External Warning Light outputs
- Testing the needle and the digital display
- Other calibration

IMPORTANT: The FCD-TR1 is not intended to be permanently installed. It is meant only for calibration or testing of a TR-1 gauge on the ground. It must be removed before flight.

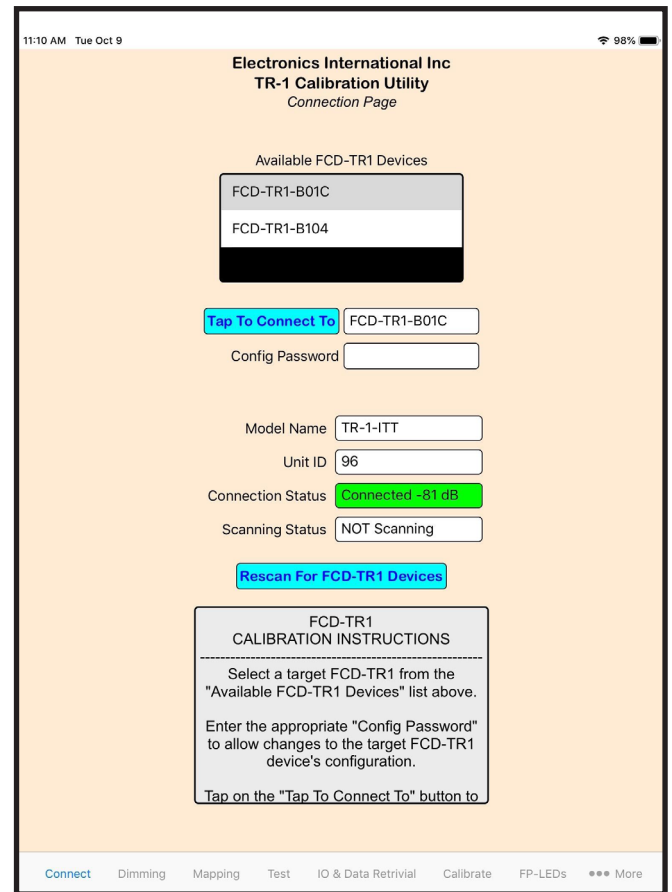
NOTE: The FCD-TR1 iPad App is periodically updated. Please ensure that you have the latest version by visiting the iTunes Store.



Connecting the FCD-TR1:

To use the FCD-TR-1, perform the following steps:

1. Install the EI Field Calibration Device application from the Apple App Store
 - a. On your iPad go to the App Store and search for FCD-TR1.
 - b. Get the App.
2. Gain access to the back of the TR-1.
3. Remove the TR-1 back connector.
4. Connect the FCD-TR1 inline between the TR-1 and the aircraft wire harness.
5. Open the FCD-TR1 App on your iPad.
6. Turn on the power to the TR-1.
 - a. The FCD-TR1 should show up in the available FCD-TR1 Devices window.
 - b. If you have more than one FCD-TR1 powered up, both will show up in the list. Choose the one you wish to connect to.
7. Tap the FCD-TR1 in the list, and then tap the 'Tap to Connect To' button on the App.
 - a. The Model Name and Unit ID should show the correct information.
 - b. The Connection Status should indicate "Connected" in green.



You are now connected to the FCD-TR1 and the TR-1 gauge itself. You can continue with the desired calibration. See below.

Important: Once you have completed making changes on any tab of the application, click the 'Store Changes On TR-1' button to save your changes to internal FLASH memory.

Setting the Brightness and Dimming Levels:

The TR-1 gauges are equipped with a photocell to automatically dim the gauge in accordance with the ambient light. Also, all the TR-1 gauges can be set up to operate from an external dimming input. For either operation you can configure the bright and dim levels.

To set the Bright and Dim levels, perform the following steps:

1. Click on the 'Dimming' tab at the bottom of the screen.
2. Choose your Control Type (Press Done on keyboard once a selection is made).
 - a. Select 'Photocell' (If equipped) for auto dimming.
 - b. Select 'External Pot' for an external voltage or PWM input.
 - c. Select 'BAPFD Mode' (Bright At Pot Full Dim Mode). The 'BAPFD Mode' is for aircraft panels that use an external input, but wish to turn the dimming pot all the way down during daylight operation. Since the TR-1 has a digital display, turning the brightness all the way down will make the digits unreadable in daylight. So in this mode the dimming pot will lower the gauge brightness down as the pot is turned down, but then turns the TR-1 brightness to full bright at the very lowest setting of the pot.

3. If you changed the input type above, then click the ‘Send Changes to TR-1’ button so it will go to the new mode.
4. If you are using an external input, and that input voltage varies with the bus voltage, then click the appropriate bus voltage in the ‘Ratiometric’ setting. Select ‘NO’ if the external voltage has its own regulator or is PWM.
5. If you change this setting, then click the ‘Send Changes to TR-1’ button.
6. Set the input for full bright.
 - a. For Photocell, expose the gauge to a bright cockpit.
 - b. For an External Pot, turn the Pot all the way to full bright.
7. Ensure the Bright and Dim sliders are unlocked.
8. Move the “Bright” slider to a high level, such as 90% or 95%. Press “Test” to view this brightness on the TR-1. When the desired brightness is reached, push the “Lock” switch next to the slider to lock in that brightness.
9. Now set the input for full dim level.
 - a. For a Photocell, expose the gauge to a dim cockpit or use a blanket to simulate.
 - b. For an External Pot, turn to full dim level.
 - c. For control pot BAPFD mode, turn the dimmer knob full counter clockwise and then back it off 1/8 turn to a “Dim” position, leaving room at full counter-clockwise or full bright, but just above full counter clockwise.
10. Move the “Dim” slider to a low level, such as 5% or 10%. Press “Test” to view this dimness level on the TR-1. When the desired dimness is reached, push the “Lock” switch next to the slider to lock in that dimness.
11. Click the ‘Dim Lock’ button to hold this value.
12. Click the ‘Send Changes to TR-1’ button.
13. **Important:** Click ‘Store Changes On TR-1’ button to lock values into memory.

11:26 AM Tue Oct 9 96%

Electronics International Inc
TR-1 Calibration Utility
Dimming Configuration Page

Control Type

Input Level

Step 1. Set Panel Lights to Full Bright
Step 2. Adjust Bright Slider to Desired Brightness Level

Bright ☐ (Lock)

Bright Locked Value @

Step 3. Set Panel Lights to Full Dim
Step 4. Adjust Dim Slider to Desired Dim Level

Dim ☐ (Lock)

Dim Locked Value @

Ratiometric ☒ NO ☐ 12V ☐ 24V

Connect Dimming Mapping Test IO & Data Retrieval Calibrate FP-LEDs ... More

You should now be able to adjust your brightness control (or the cabin ambient light) and observe the programmed TR-1 brightness behavior.

Fuel Tank Calibration:

Most TR-1 gauges are fully calibrated at the factory and need no adjustment. However, some gauges such as fuel level may need to be calibrated for the tank in an aircraft. Follow these steps to map the values from the fuel probe to the correct units (Gallons, Liters, Pounds, etc.) for your gauge.

1. Select the 'Mapping' tab at the bottom of the screen.
2. Start with an empty tank and add the unusable fuel.
3. The 'Value Into Map' at the top of the screen indicates counts coming from your fuel probe. The 'Value Out of Map' just below this indicates the calibrated fuel level in your desired units. This value may not be accurate until calibration is complete.
4. Press the 'CV' button to calibrate for a 0 fuel level. Then press the 'Send Changes to TR-1' button.
5. You can calibrate the tank at 10 points but in this example we will only calibrate with 5.
6. Divide your full fuel level by 4 and enter the values into the 'OUT' fields. Example: full tank = 40 gallons / 4 = 10. We will enter 0, 10, 20, 30, and 40 for the first 5 entries and 0.0 for all the rest.
7. Now put 10 gallons in the tank (entry 2) and watch the 'Value into Map' change as you add fuel. The value must go up or down as fuel is added. If you go over the 10.0 gallon, you can correct the OUT value to match the pump.
8. Once the 'Value into Map' has stabilized, press the 'CV' button. Then press the 'Send Changes to TR-1' button.
9. Perform these same steps for each of the entries. Make sure the 'Value into Map' goes the same way (up or down) for each gallon of fuel added. It should not change directions.

Electronics International Inc
TR-1 Calibration Utility
Mapping Configuration Page

Value Into Map: -1241.02
Value Out of Map: -1241.02

ENTRY	IN	OUT
Entry 1	0.0	0.0
Entry 2	0.0	0.0
Entry 3	0.0	0.0
Entry 4	0.0	0.0
Entry 5	0.0	0.0
Entry 6	0.0	0.0
Entry 7	0.0	0.0
Entry 8	0.0	0.0
Entry 9	0.0	0.0
Entry 10	0.0	0.0

(CV = Use Current "Value Into Map" For IN)

Map Enabled: ☐

Extrapolation: ☒ (Off/On)
(On = display values beyond the range of the map)
(Off = Limit output to high and low range of the map)

Send Changes To TR-1
Store Changes On TR-1
Restore To Original Values

Connect Dimming Mapping Test IO & Data Retrieval Calibrate FP-LEDs ... More

Note: If your TR-1 is set to display fuel quantity in units other than gallons, such as liters or pounds, then enter the quantity for the correct units in the out values.

Important: Once you have finished calibrating the tank, press the 'Store Changes On TR-1' button. The fuel tank is now calibrated.

Adjusting the K-Factor for Fuel Flow:

Fuel flow transducers are affected by aircraft plumbing and installation. To ensure the fuel flow displayed on the gauge is calibrated to the flow to the engine, you may need to adjust the K-Factor on the TR-1. First, determine if the fuel flow gauge is reading as expected. This can be done with performance charts or by doing a flow test. If you find you need to adjust K-Factor on the TR-1, perform the following:

- Go to the main 'Connect' screen and enter the Config Password.
 - The default password is "level2" but it could be different if you have changed it.
 - The Config Password box should turn yellow.
- Go to the Calibrate screen.
- Write down the current K-Factor.
- Calculate the new K-Factor.
 - New K-Factor = Old K-Factor x (Displayed FF / Expected FF)
 - example:
 - Expected FF = 57.0 gph. Gauge Display FF = 55.3 gph, K-Factor = 38000
 - New K-Factor = $38000 * (55.3 / 57.0) = 36867$
- Enter the new K-Factor in the appropriate window.
- Click the 'Send Changes to TR-1' button.
- Important:** Click 'Store Changes On TR-1' button.

3:13 PM Tue Feb 7 94%

Electronics International Inc
TR-1 Calibration Utility
Main Calibration Page

Raw Value
Processed Value

Type Input
Ratiometric 12V 24V
Gain
Offset
Input @ Max
Max Value
K-Factor (P/Gal)
Ref Channel
Map Enabled ☐
Allow Negatives ☐
Filter
Dejitter
Round To
Decimals
Snap To Zero

Connect Dimming Mapping Test IO & Data Retrieval **Calibrate** FP-LEDs ... More

Calibrating your Torque Sensor (Or other sensor):

The TR-1 Torque gauge should be fairly well calibrated from the factory. However, all torque sensors do have a certain amount of tolerance built in. If you perform a dead weight test and find that you would like to more closely calibrate the TR-1 reading, you can follow these steps to do so.

NOTE: These steps can be followed for any other gauge with a linear input transducer and a well calibrated means of testing it.

1. Go to the main 'Connect' screen and enter the Config Password.
 - a. The default password is "level2" but it could be different if you have changed it.
 - b. The Config Password box should turn yellow
2. Go to the Calibrate screen.
3. Note and record the Gain and Offset readings. Typically only the Gain will need to be adjusted.
4. Calculate the new Gain based on your dead weight tester
 - a. $\text{New Gain} = \text{Old Gain} \times (\text{Expected Value} / \text{Displayed Value})$
 - b. Example:
 1. Dead Weight Tester = 3984 Ft-Lbs
 2. Gauge Reading = 3995 Ft-Lbs
 3. Old Gain = 0.9987
 4. $\text{New Gain} = 0.9987 \times (3984 / 3995) = 0.99595$
 - c. Enter the new Gain in the appropriate window.
 - d. Click the 'Send Changes to TR-1' button.
 - e. **Important:** Click 'Store Changes On TR-1' button.

3:13 PM Tue Feb 7 94%

Electronics International Inc
TR-1 Calibration Utility
Main Calibration Page

Raw Value
Processed Value

Type Input
Ratiometric
Gain
Offset
Input @ Max
Max Value
K-Factor (P/Gal)
Ref Channel
Map Enabled ☐
Allow Negatives ☐
Filter
Dejitter
Round To
Decimals
Snap To Zero

Connect Dimming Mapping Test IO & Data Retrieval **Calibrate** FP-LEDs ... More

Downloading Recorded Flight Data:

Recorded flight data can be downloaded by number of flights or by number of hours. Data is first retrieved and stored locally to the iPad/iPhone. You may save the flight data files using the iTunes software and then view them using the CSV viewer of your choice.

To retrieve, download and view recorded flight data:

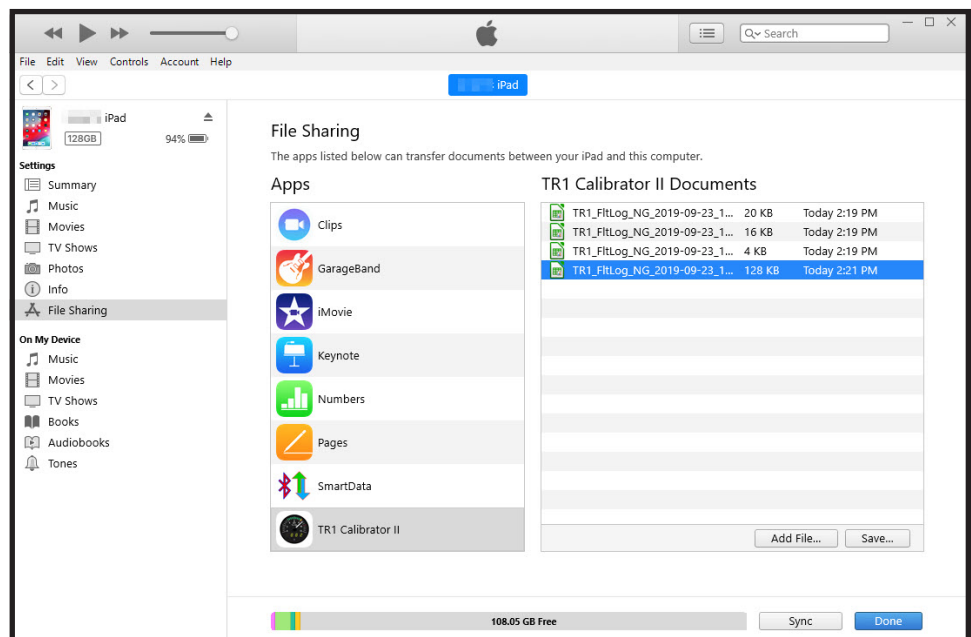
1. Select the 'IO & Data Retrieval' tab at the bottom of the screen.
2. You may choose to download either by 'Number of Hours' or by 'Number of Flights'. Identify your desired amount in their respective box and select 'Get' for the corresponding selection.

Note: You may choose the 'Retrieve All Data (Lengthy Process)' option; however, this may take a number of hours to download.

3. Once the retrieval process completes, you may disconnect from the TR-1 instrument and then connect your iPad/iPhone to your computer using your device USB cable.

4. Using iTunes, you may save the file to your computer and then view the CSV file using the CSV viewer of your choice (e.g. Microsoft Excel). If you need further assistance viewing the files on your iPad/iPhone device, you may search apple.com for "Use iTunes to share files between your computer and your iPhone, iPad, or iPod touch" and follow the instructions for your specific device. See the screenshot below, this represents what your iTunes software may look like when downloading the files.

The screenshot shows the 'Electronics International Inc. TR-1 Calibration Utility' app. The title bar indicates the time is 11:27 AM on Tuesday, October 9, with a 96% battery level. The app is titled 'IO Configuration & Data Retrieval Page'. It features three main sections: 'RS-232 Output Configuration', 'Data Retrieval', and 'Data Recording Memory Statistics'. The 'RS-232 Output Configuration' section has fields for 'Data Type' (set to 'OFF - None'), 'Data Rate Delay' (set to '500'), and 'Baud Rate' (set to '57600'). Below these fields are three buttons: 'Send Changes To TR-1', 'Store Changes On TR-1', and 'Restore To Original Values'. The 'Data Retrieval' section has a note '(45 second download time per hour of data)' and fields for 'Number Of Hours' and 'Number Of Flights', each with a 'Get' button. Below these is a button for 'Retrieve All Data (Lengthy Process)'. The 'Data Recording Memory Statistics' section has fields for 'How Many Flights' (30), 'How Many Hours' (88.6), and 'Download Time (Est Hours)' (7.0). At the bottom of the app, there is a navigation bar with tabs: 'Connect', 'Dimming', 'Mapping', 'Test', 'IO & Data Retrieval' (which is selected), 'Calibrate', 'FP-LEDs', and 'More'.



Storing Changes on the TR-1:

Use the following buttons to send any changes you make to the TR-1 and store the values into FLASH memory. If the buttons do not appear on a particular page/tab, then you may need to enter the password first on the Connect page.

Operation of these buttons:

Send Changes to TR-1: Changes you make on the FCD-TR1 App are not changed on the TR-1 itself until you click the ‘Send Changes to TR-1’ button. At this point the TR-1 behavior should reflect the changes you made. These changes are not stored in the TR-1 FLASH memory until the Store Changes button is pressed. If you power off the TR-1 before pressing the “Store Changes” button, all changes will be lost.

Store Changes on TR-1: This button tells the TR-1 to save the current configuration into FLASH memory. The digits on front of the TR-1 should display “- - -” for a few seconds after this button is pressed. Once the digits go back to displaying numbers again, then the changes have been saved and the unit can be powered off.

Restore To Original Values: This button restores the values displayed on the FCD-TR1 App to what they were when you most recently connected to a TR-1. When you start the application and connect to a TR-1, the app collects the current values in the TR-1 and stores them in the iPad memory. If you make changes on the App, then click the ‘Restore to Original Values.’ The values obtained from the TR-1, when the app most recently connected to it, will be shown on the app. If you want these values to be sent to the TR-1, then click the ‘Send Changes to TR-1’ button.

The screenshot shows the 'Main Calibration Page' of the 'TR-1 Calibration Utility' app. The interface includes the following elements:

- Header:** Electronics International Inc. TR-1 Calibration Utility Main Calibration Page.
- Input Fields:** Raw Value (0.00), Processed Value (0.00), Type Input (Other (Voltage)), Ratiometric (NO, 12V, 24V), Gain (1.0000), Offset (0.0000), Input @ Max (64.5), Max Value (1795.0), K-Factor (P/Gal), Ref Channel (2nd Input), Map Enabled (toggle), Allow Negatives (toggle), Filter (3), Dejitter (Level 2), Round To (10.0), Decimals (0), Snap To Zero (0.0).
- Action Buttons:** Send Changes To TR-1, Store Changes On TR-1, Restore To Original Values, Restore To Factory Defaults.
- Footer:** Connect, Dimming, Mapping, Test, IO & Data Retrieval, Calibrate, FP-LEDs, More.

Note: The ‘Restore to Original Values’ button is not the same as the ‘Restore to Factory Defaults’ button described below.

Restore to Factory Defaults: Before the TR-1 leaves the factory, the current configuration values are stored in a secure factory reset location. So if you make changes to the TR-1 and then later want to revert the TR-1 to the way it was when it left the factory, then use this button.

Note: The Restore to Factory Defaults button only shows up on the Calibrate page and only shows up if the TR-1 has this feature enabled. If the button does not appear, first ensure you have the latest version of the FCD-TR1 application from I-Tunes. If the button still does not appear and you want to reset the unit back to factory default, you can return the unit to the factory.