

Labs

GlobalSat TR-151 Protocol Adapter SDK Setup Guide

Version 1.0

Labs

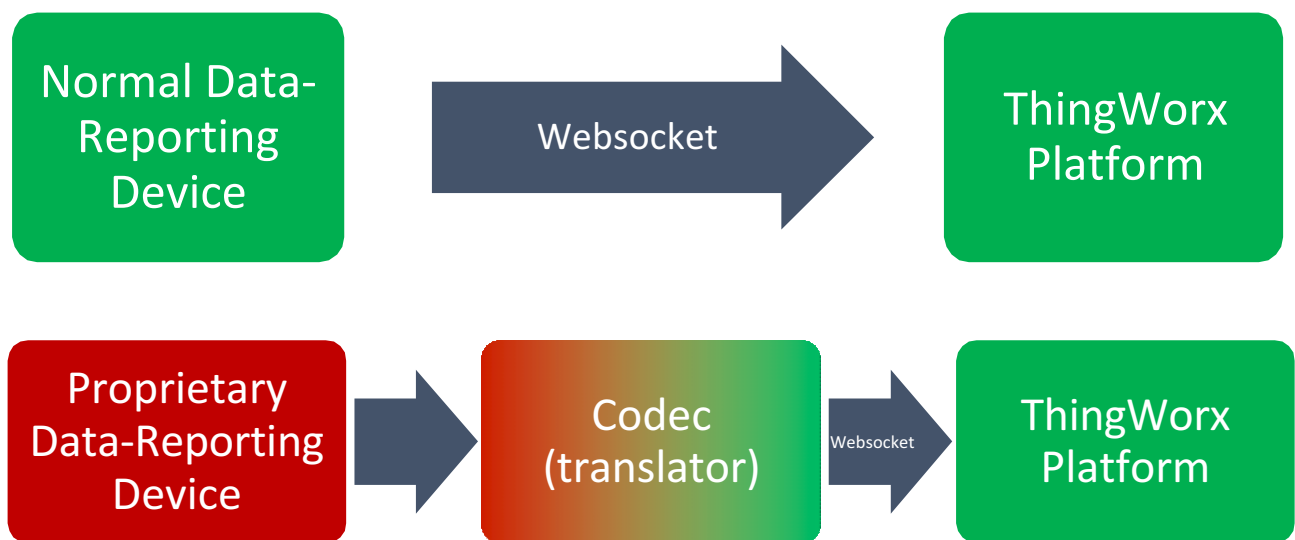
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Introduction

About the Protocol Adapter SDK

The Internet of Things is a rapidly-growing and oftentimes fragmented network of devices which frequently don't unify under a standardized "language" which connects them easily to each other. There exist many examples of devices which may be perfectly suited to reporting data in a specialized role, but for which their data reporting is shrouded in a proprietary format.

When the ThingWorx platform needs to connect to one of these devices, the need for a translator, or *Protocol Adapter*, arises. The Protocol Adapter SDK is a package provided by ThingWorx for the purposes of connecting such a device, whose firmware and/or data format is unchangeable and incompatible with ThingWorx, to the ThingWorx Platform:



Often, these devices open a TCP or UDP networking socket and send data using a proprietary format. To allow these devices to connect to the ThingWorx Platform, the Protocol Adapter SDK runs intermediary to the device and ThingWorx, and listens on a specified port for any incoming device messages, and it parses the incoming messages from the device's native format into properties that are then transmitted to the ThingWorx Platform.

It should be noted that the Protocol Adapter SDK **should ideally be set up to run on an intermediary server**, separate from the one on which the ThingWorx Platform is located (for scalability purposes). However, the Protocol Adapter SDK **may also be run on the same server** on which the ThingWorx Platform is located.

Typically, when available on devices which are capable, the ThingWorx Edge MicroServer is installed on a client device for collecting and reporting data to ThingWorx using a secure WebSocket connection, instead of the Protocol Adapter SDK.

The Edge MicroServer is a powerful component of the ThingWorx architecture. The Edge MicroServer allows for the rapid deployment of connections between the ThingWorx platform and an associated

data reporting device, with minimal design requirements on the part of the user. It provides an “always-on” connection to the platform, and it opens a local web server that interacts with the REST API available on the platform.

About GlobalSat TR-151

The device – GlobalSat TR-151 – is a real-time tracking device for personal/vehicle applications using GPS and GSM technology. The device is capable of sending SMS and GPRS messages that constitute the GPS coordinates of the device, the IMEI number of the device, time, date, etc. The device has an SOS button that sends the GPS coordinates of the device to numbers that are registered on the device configuration tool for SOS updates, and runs on a rechargeable battery for truly mobile operations. The configuration tool is compatible with windows platforms.

This guide will follow the steps in configuring the GlobalSAT TR-151 device to report data to a ThingWorx server via the Protocol Adapter SDK. The Protocol Adapter SDK allows only for one-way communication in this case.

Installation

The Protocol Adapter SDK, for the purposes of this guide, should run on the same AWS server/local machine that runs the Thingworx platform. **Please note that this guide was written for a computer running Microsoft Windows.**

Refer to the Troubleshooting section of this guide for help with frequently asked questions.

Prerequisite: Installing the GlobalSat Configuration Tool and Drivers

1. Use the following link to download Configuration tool v1.8 and the newest version of firmware for the GlobalSat device. You may also be required to install USB drivers for the device if Windows does not automatically do so when you connect your device.
http://www.globalsat.com.tw/products-page.php?menu=2&gs_en_product_id=3&gs_en_product_cnt_id=24&img_id=53&product_cnt_folder=4
2. Extract the “TR151 User tool.exe” executable to a suitable location on the computer which will be connected to the TR151 device.

Configuration and Setup

Configuring the GlobalSat device

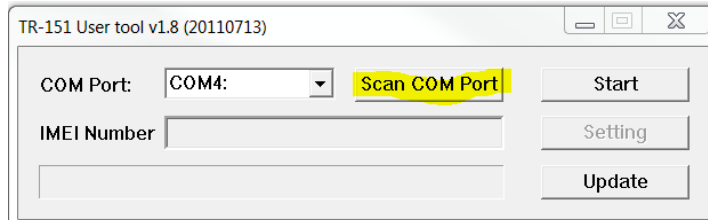
1. Remove the battery from the back of the TR-151 device. Following the instructions

in the user guide, toggle the DIP switches so that they are in the following positions: Switches 1,2, and 3 should be switched ON (up) for setup.

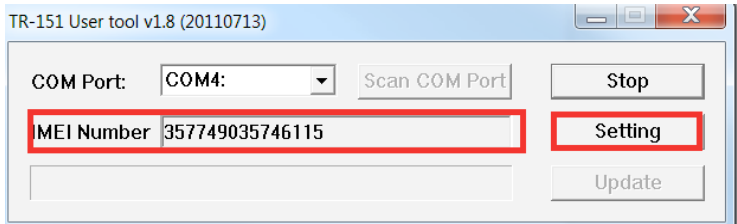
Following this, insert a valid and activated SIM card into the SIM card slot.

Connect the device to your computer via USB cable without connecting the battery. The “Warning” LED on the side should illuminate solid red.

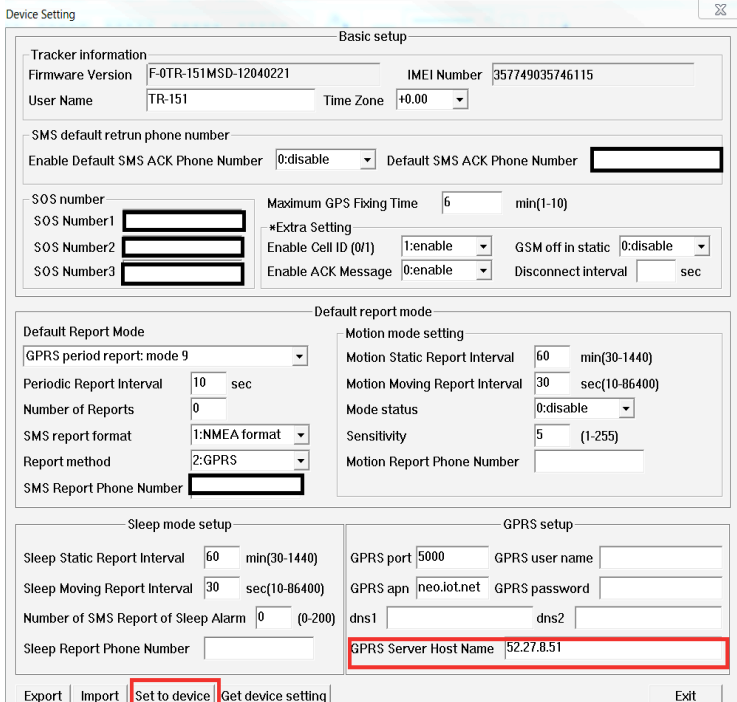
- Open the GlobalSat Config tool and scan your computer’s COM port. It should open the COM port. Before you begin configuration, ensure that you have updated the firmware of your device. Follow the guide for this device to update the Firmware, available on GlobalSAT’s website.



- Click the “Start” button to begin configuring. After a few moments, the tool should report the IMEI number of the device. When it becomes available, click the “Setting” button.



- The configuration of the device should look like image on the right. The GPRS server hostname should be set to the public IP address of the server/local machine running ThingWorx. Open Command Prompt in windows and use the “ipconfig” command to find the public IP of your computer. If you are hosting the Protocol Adapter on an AWS EC2 server, for instance, then you can obtain the public IP from the AWS EC2 management console.



GPRS APN: Check with your SIM Card network operator and obtain the APN for that network connection.

The port number may be set to 5000 by default. The Protocol Adapter will be

listening for incoming connections on this port.

Finally, confirm that your device's "Default Report Mode" is set to "**GPRS period report: mode 9**" as shown in the screenshot.

After entering your configuration details, Click on "Set to Device" to ensure that the device is configured. When you have finished, click "Exit" and then "Stop" to close the configuration tool.

5. When the configuration has completed, unplug the device from the computer. Reset the DIP switch 3 to OFF mode.
6. Connect the battery, and connect the USB cable from the computer to the device, and power it on.

Configuring the Protocol Adapter

1. Included in the starter kit for the TR-151 Protocol Adapter SDK package, you'll find a file labeled "config.json" in the root level of the GlobalSat.zip package. Open this file for editing with a text editor.

In config.json, change the value of **socketPort** under **ConnectionServerSettings** to 5000 (or the port value specified in the configuration tool previously). The Protocol Adapter will be listening on this port. Remember that the GPRS port for the device is the same.

2. In config.json, change the thingworxServerAPIKey to an Application Key currently being used by your Thingworx application. Set the thingworxServer and thingworxServerPort to the IP address and port number, respectively, of the machine that is running the Thingworx platform. Your configuration should resemble the image on the right.

The socketPort is set to 5000 which should be the same as the port assigned for configuring the GlobalSat GPRS port.

```
    "rows": {}
    "thingworxServerUseSSL": false,
    "thingworxServerAPIKey": "15a7d04c-e6ac-4161-96d7-5f33bb8753c8",
    "thingworxServerTimeout": 60000,
    "thingworxServer": "localhost",
    "thingworxServerPort": 8080
  }
},
"ConnectionServerSettings": {
  "description": "Connection server / socket settings",
  "isMultiRow": false,
  "name": "ConnectionServerSettings",
  "ordinal": 0,
  "dataShape": {"fieldDefinitions": {
    "socketPort": {
      "baseType": "INTEGER",
      "description": "Port the server should listen on for incoming connections",
      "name": "socketPort",
      "aspects": {"defaultValue": 4444},
      "ordinal": 0
    },
    "connectionServerThingName": {
      "baseType": "STRING",
      "description": "Port to listen on",
      "name": "connectionServerThingName",
      "aspects": {"defaultValue": "ConnectionServer"},
      "ordinal": 0
    }
  }
},
"rows": {}
"socketPort": 5000,
"connectionServerThingName": "myConnectionServer"
}
```

Running the Protocol Adapter SDK

Before running the Protocol Adapter SDK, make sure that the Thingworx application is running on the referenced port and server address. Make sure that the GlobalSat device is plugged in, switched ON, and it is located in an area with clear GPS signal (such as a window or outside area).

- 1 Using Eclipse IDE: Import the project into the eclipse workspace. File->Import->Java->Existing Projects... -> browse to the folder containing the project.

Note: Create a new Java Project in your IDE if necessary before importing.

- 2 Build a “Runnable JAR” file using File > Export > Runnable JAR File, and run it from command line (alternatively, run within Eclipse IDE) using the command:
Java -jar <jar-filename>.jar
- 3 While the program is running, you should see a series of output messages, beginning with a successful connection message, and including an “Accepted client connection...” message indicating that the Protocol Adapter is receiving an incoming message from the TR151 device (see the example log below).

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```

ConnectionServer [Java Application] C:\Program Files (x86)\Java\jre1.8.0_51\bin\javaw.exe (Aug 31, 2015, 4:22:23 PM)
16:23:10.850 [NettyClient-NIO-1] DEBUG i.n.h.c.h.w.WebSocket08FrameDecoder - Decoding WebSocket Frame length=0
16:23:25.288 [Client-EndpointMonitor-2] DEBUG c.t.c.c.e.m.CommunicationEndpointMonitorTask - CommunicationEndpoint Monitor - checking for disconn
16:23:25.288 [Client-EndpointMonitor-1] DEBUG c.t.c.c.e.m.CommunicationEndpointMonitorTask - CommunicationEndpoint Monitor - checking for disconn
16:23:40.385 [Client-EndpointMonitor-2] DEBUG c.t.c.c.e.m.CommunicationEndpointMonitorTask - CommunicationEndpoint Monitor - checking for disconn
16:23:40.385 [Client-EndpointMonitor-1] DEBUG c.t.c.c.e.m.CommunicationEndpointMonitorTask - CommunicationEndpoint Monitor - checking for disconn
16:23:49.745 [Thread-6] INFO c.t.deviceServer.server.TCPListener - Accepted client connection.../88.198.46.51:47516
16:23:49.756 [Thread-6] INFO c.t.deviceServer.server.TCPListener - Connecting...
16:23:55.464 [NettyClient-NIO-1] DEBUG c.t.c.c.c.n.ThingworxClientConnectionHandler - [ClientHandler: 18390110] Client has been idle, sending web
16:23:55.464 [NettyClient-NIO-1] DEBUG i.n.h.c.h.w.WebSocket08FrameEncoder - Encoding WebSocket Frame opCode=9 length=0
16:23:55.464 [NettyClient-NIO-1] DEBUG i.n.h.c.h.w.WebSocket08FrameDecoder - Decoding WebSocket Frame opCode=10
16:23:55.464 [NettyClient-NIO-1] DEBUG i.n.h.c.h.w.WebSocket08FrameDecoder - Decoding WebSocket Frame length=0
16:23:55.670 [Client-EndpointMonitor-1] DEBUG c.t.c.c.e.m.CommunicationEndpointMonitorTask - CommunicationEndpoint Monitor - checking for disconn
16:23:56.211 [Client-EndpointMonitor-2] DEBUG c.t.c.c.e.m.CommunicationEndpointMonitorTask - CommunicationEndpoint Monitor - checking for disconn
16:23:59.347 [Thread-13] DEBUG c.t.c.c.e.CommunicationEndpoint - Sending synchronous message, waiting for response [sync key: 3, message: BindReq
16:23:59.347 [NettyClient-NIO-1] DEBUG i.n.h.c.h.w.WebSocket08FrameEncoder - Encoding WebSocket Frame opCode=2 length=29
16:23:59.348 [NettyClient-NIO-1] DEBUG i.n.h.c.h.w.WebSocket08FrameDecoder - Decoding WebSocket Frame opCode=2
16:23:59.348 [NettyClient-NIO-1] DEBUG i.n.h.c.h.w.WebSocket08FrameDecoder - Decoding WebSocket Frame length=17
16:23:59.349 [NettyClient-NIO-1] DEBUG c.t.c.c.e.DispatchingClientEndpoint - RESPONSE received [endpoint id: 0, duration: 2] ResponseMessage [req
  
```

If you do not receive these messages in the log, verify that the connection settings on both your TR-151 Device and in the config.json files are correct. In addition, verify that the specified listener port is “open” on your server and that no firewalls are blocking a connection.

- When your Protocol Adapter listener successfully receives a connection from the GlobalSAT device, it should automatically create a remote thing on your ThingWorx instance, to which you may bind a Remote Thing entity on the platform and add data bindings.

Data forwarded from the Protocol Adapter will be visible under “Manage Remote Bindings” on a Remote Thing entity in ThingWorx which carries the same name/identifier as that created by the Protocol Adapter on the platform.

The screenshot shows the ThingWorx interface for a RemoteThing entity. The 'My Properties' table is as follows:

Edit	Name	Type	Alerts	Additional Info	Default Value	Value	DataChange
	# Speed	Speed	0 Alerts	Read Cache, Push VALUE +/- 0		0.4	Set VALUE
	# SatelliteCount	SatelliteCount	0 Alerts	Read Cache, Push VALUE +/- 0		4.0	Set VALUE
	- ReportMode	ReportMode	0 Alerts	Read Cache, Push VALUE		GPRS Period Report	Set VALUE
	- Model	Model	0 Alerts	Read Cache, Push VALUE		TR-151	Set VALUE
	- MessageType	MessageType	0 Alerts	Read Cache, Push VALUE		SMS Text Message	Set VALUE
	Location	Location	0 Alerts	Read Cache, Push VALUE		40.0566 - 75.6713	Set VALUE
	- IMEI	IMEI	0 Alerts	Read Cache, Push VALUE		357749035746115	Set VALUE
	- Heading	Heading	0 Alerts	Read Cache, Push VALUE +/- 0		252.5	Set VALUE
	# HDOP	HDOP	0 Alerts	Read Cache, Push VALUE +/- 0		1.7	Set VALUE
	- GPS_State	GPS_State	0 Alerts	Read Cache, Push VALUE		GPS 3D Fixed	Set VALUE
	- DeviceId	DeviceId	0 Alerts	Read Cache, Push VALUE		GlobalSat	Set VALUE
	# Altitude	Altitude	0 Alerts	Read Cache, Push VALUE +/- 0		191.9	Set VALUE

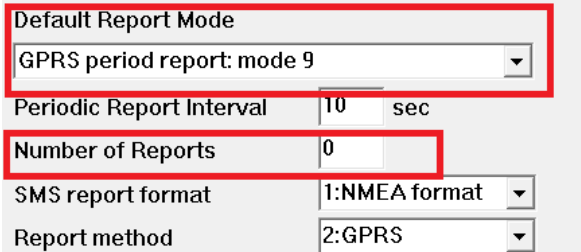
The 'RemoteThing - Properties' table is as follows:

Name	Type	Alerts	Additional Info	Default Value	Value	DataChange
isConnected		0 Alerts		false	true	Set
lastConnection		0 Alerts			2015-08-20 16:38:00	Set

Above: Successful data reporting from the Protocol Adapter to the Thingworx platform. Note the value of “isConnected” is set to “True”.

Troubleshooting

	Problem	Solution(s)
1.	In the GlobalSat Configuration tool, I am unable to open/connect to a COM port.	<ol style="list-style-type: none"> 1. Check if the DIP switch no. 3 of the device is in the ON position. The device battery should <u>not</u> be connected. 2. Close the configuration tool, remove the USB cable, and re-insert the USB cable into the device and your computer. Re-open the Configuration tool. 3. Ensure that you get a solid red light on the device. If not, repeat steps 1 and 2. 4. Confirm that your computer has the proper COM port drivers installed. If not, open Device Manager, and manually add a COM/LPT port device driver, and try again.
2.	Cannot open the Setting menu in the GlobalSat Configuration Tool.	<ol style="list-style-type: none"> 1. Ensure that the device is updated with the newest version of the firmware. 2. Verify that you are using the latest version of the configuration tool (v1.8 or later). 3. Check if the DIP switch no. 3 of the device is in the ON position. The device battery should <u>not</u> be connected. 4. Close the configuration tool, remove the USB cable, and re-insert the USB cable into the device and your computer. Re-open the Configuration tool, and try again.
3.	Settings will not update / write to the GlobalSat Device.	<ol style="list-style-type: none"> 1. Ensure that device is running the latest firmware. 2. DIP switch 3 should be ON while setting changes via the configuration tool and turned OFF after setting the device. 3. Make sure that the set to device button is clicked and wait till all the settings are loaded.
4.	Protocol Adapter SDK giving error: Refilling connections on [endpoint 0, uri: ws://localhost:80/Thingworx/WS] failed : Connection authentication/registration FAILED	<ol style="list-style-type: none"> 1. Ensure that the config.json has the correct port number, server address, and Application key for the Thingworx application. 2. Ensure that Tomcat is running and ThingWorx is running at the specified port. 3. Verify that the specified port is open and that your url is correct. Try to connect with SSL disabled.
5.	While the GlobalSat is running and reporting data to the server, the Protocol Adapter SDK is merely stating the following debug message: [ClientHandler: 1299411443] Client has been idle, sending websocket ping...	<p>The GlobalSat device is not able to connect to the Protocol Adapter SDK.</p> <ol style="list-style-type: none"> 1. Check the GlobalSat settings and make sure that it is similar to the picture in the configuration section. Make sure that the GPRS server hostname is set to the "public" IP address of the Computer/AWS server running the Protocol Adapter SDK. Make sure that set to device is clicked. Wait till you see the "setting message OK" message before closing the configuration tool.

		<ol style="list-style-type: none"> 2. Disable firewall setting for TCP port 5000 (The socket port listening for the GlobalSat device messages). 3. Ensure that the GlobalSat device is kept somewhere outside building. Use a SSH client such as PuTTY to connect to the GlobalSat device via usb and verify that it is sending data and has a GPS and cellular signal. 4. Verify your SIM card's data and GPRS capability and try an alternate SIM card if necessary.
<p>6.</p>	<p>Protocol Adapter SDK accepts the connection but Info message from the Protocol Adapter: "Incoming message" does not begin with a long string starting with '\$' or '?'</p>	<p>GPS is not fixed on the device.</p> <ol style="list-style-type: none"> 1. Connect the device to your computer via USB and open the COMPort using any terminal application such as PuTTY. Restart the device. It should take a minute for the device to connect to the base station of network service of your SIM card. Check the messages on the COM Port. You should obtain a string similar to \$355632004245866,1,1,040202,093633,E12129.2252,N2459.8891,00161,0.0100,147,07,2.4! 2. If GPS is still not fixed and continuously reports "GPS Not fix" on the terminal application, restart the device. 3. Ensure that the SIM card supports GSM and it is capable of sending SMS & GPRS messages. 4. Check the settings of GlobalSat. The report mode should be set to "GPRS Period report : Mode 9". And the number of reports should be set to 0 for continuous reception of GPRS messages.  <p>The screenshot shows a configuration window for GlobalSat. The 'Default Report Mode' dropdown is set to 'GPRS period report: mode 9'. Below it, 'Periodic Report Interval' is set to 10 seconds. The 'Number of Reports' is set to 0. Other options include 'SMS report format' set to '1:NMEA format' and 'Report method' set to '2:GPRS'.</p>

Compatibility

This guide has been tested for compatibility with the GlobalSat Device and the following ThingWorx platform, server, and operating system:

ThingWorx Platform Version	ThingWorx 6.0.1
OS	Windows 7, Service Pack 1, Windows Server '12 hosted on AWS
GlobalSat Device	TR-151, Firmware v F0TR-151MSD-12040221, User Tool v1.8

Document Revision History

Revision Date	Version	Description of Change
September 1, 2015	1.0	Initial Release