

TREK
DATA
TUTORIAL



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1 Welcome

The Telescience Resource Kit (TReK) is a suite of software applications and libraries that can be used to monitor and control assets in space or on the ground.

The TReK Data application provides the capability to manage data services such as receiving data, processing data, recording data, forwarding data, and displaying data.

This tutorial provides step-by-step instructions describing how to perform common application functions.

The topics in this tutorial require an understanding of the topics covered in the TReK Concepts document. Please be sure you have read the TReK Concepts document before proceeding with this tutorial.

This tutorial uses screen dumps taken on a Windows computer. However, the steps are the same regardless of whether you are running on Windows or Linux.

2 Technical Support

If you are having trouble installing the TReK software or using any of the TReK software, please contact us for technical assistance:

TReK Help Desk E-Mail, Phone & Fax:

E-Mail: trek.help@nasa.gov
Telephone: 256-544-3521 (8:00 a.m. - 4:00 p.m. Central Time)
Fax: 256-544-9353

If you call the TReK Help Desk and you get a recording please leave a message and someone will return your call. E-mail is the preferred contact method for help. The e-mail message is automatically forwarded to the TReK developers and helps cut the response time. The HOSC Help Desk (256-544-5066) can provide assistance as needed and is available 24x7.

3 Introduction

The TReK Data application provides the capability to manage data services such as receiving data, processing data, recording data, forwarding data, and displaying data. It can be configured to receive different types of data from multiple sources simultaneously. The configuration can be saved.

The Data application creates a TReK data store on application initialization. The data store is used by the application to store incoming data so it can be accessed using the

TReK Telemetry Application Programming Interface (API). When using the TReK Telemetry API, you will need the data store name. The Data application uses “TReKDataStore” as the default data store name. If you start another instance of the TReK Data application, and the “TReKDataStore” name is already in use, the application will prompt you to enter a new and unique name. There is also an option within the application to change the data store name.

4 Overview of the User Interface

4.1 Main Window

The main window consists of three main areas as shown in Figure 1. The top part of the main window contains the list of services. A Service is used to identify one or more incoming data streams and what type of services should be applied to the incoming data. When you start the Data application the list will be empty. This is because you have not yet added any services to the list. The middle part of the window is the Statistics area. Once you start receiving data, the Statistics area will display statistics information about the incoming data streams. It will also provide information about the services being performed like how many packets were recorded, how many packets were forwarded, etc. The Statistics area can be reconfigured to show several different views. The bottom part of the window is a message area that is used to display important status and information messages about the activities in progress.

You may have noticed that each service row has a color associated with it. The color provides information about the service. For example, when using the default colors, if the packet row is black, this indicates that the packet has not been activated. If the packet row is purple, this indicates that the service is initializing. If the packet row is blue, this indicates the packet has been activated but no data has arrived. If the packet row is green, this indicates that data packets are arriving. The colors are helpful in providing immediate information about the general configuration and status of each packet in the list.

Figure 1 shows two services in the Service area. The first service in the list is named **Science Data**. The Science Data service is configured to receive a data stream containing science data. The status is Active and the color is green to indicate that data is arriving. The second service in the list is named Health and Status Data. The status is Inactive and the color is black. This indicates that the service has been configured but not activated. Until the service is active, the Data application is not prepared to handle the incoming data. When a service is activated, it creates all the network sockets and other support needed to support the services requested. As soon as a service goes Active, the application will start applying the configured services to support any data that arrives (processing, recording, etc.).

The Statistics area and the Message Area are dock windows that you can float or dock. To float a dock window, use your left mouse button to click and hold the title area while dragging the window to another area of the screen. To dock, use the title bar to drag the dock window over the main window and drop.

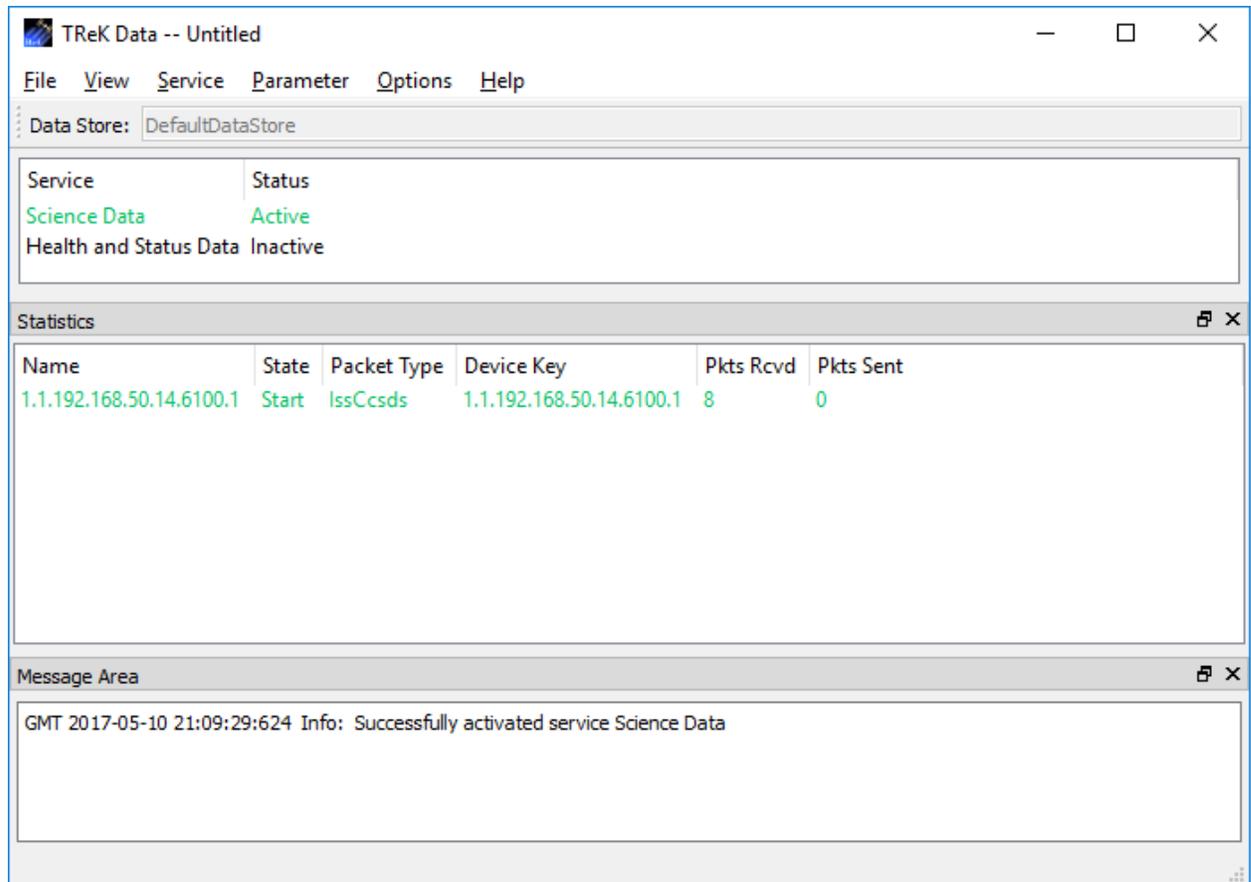


Figure 1 Main Window

Data Store Toolbar

The Data Store toolbar displays the name of the data store created by the application.

Service Area

The Service area provides a list of “Services”. A Service is used to identify one or more incoming data streams and the services to be applied to the incoming data.

Statistics Area

The Statistics area provides real time statistics information for active services.

Message Area

The Message Area displays important information, warning and error messages. The message area can be cleared using the View menu.

4.2 Menus

The application menus are: File, View, Service, Parameter, Options, and Help. Each of these menus is described in more detail below.

File Menu

The File menu provides the capability to create a new configuration, open a configuration, save a configuration, and exit the application.

View Menu

The View menu provides the capability to clear the main window message area and show and hide the main window message area.

Service Menu

The Service menu provides the capability to perform functions associated with services such as adding a service, activating a service, or deleting a service. The service menu also shows context dependent menu items corresponding to the configuration of the service. The context menu items will only appear when the service is active. For example in Figure 2 there is a service selected that is configured to record data. Therefore, when the service is active and selected there will be additional service menu items to control recording.

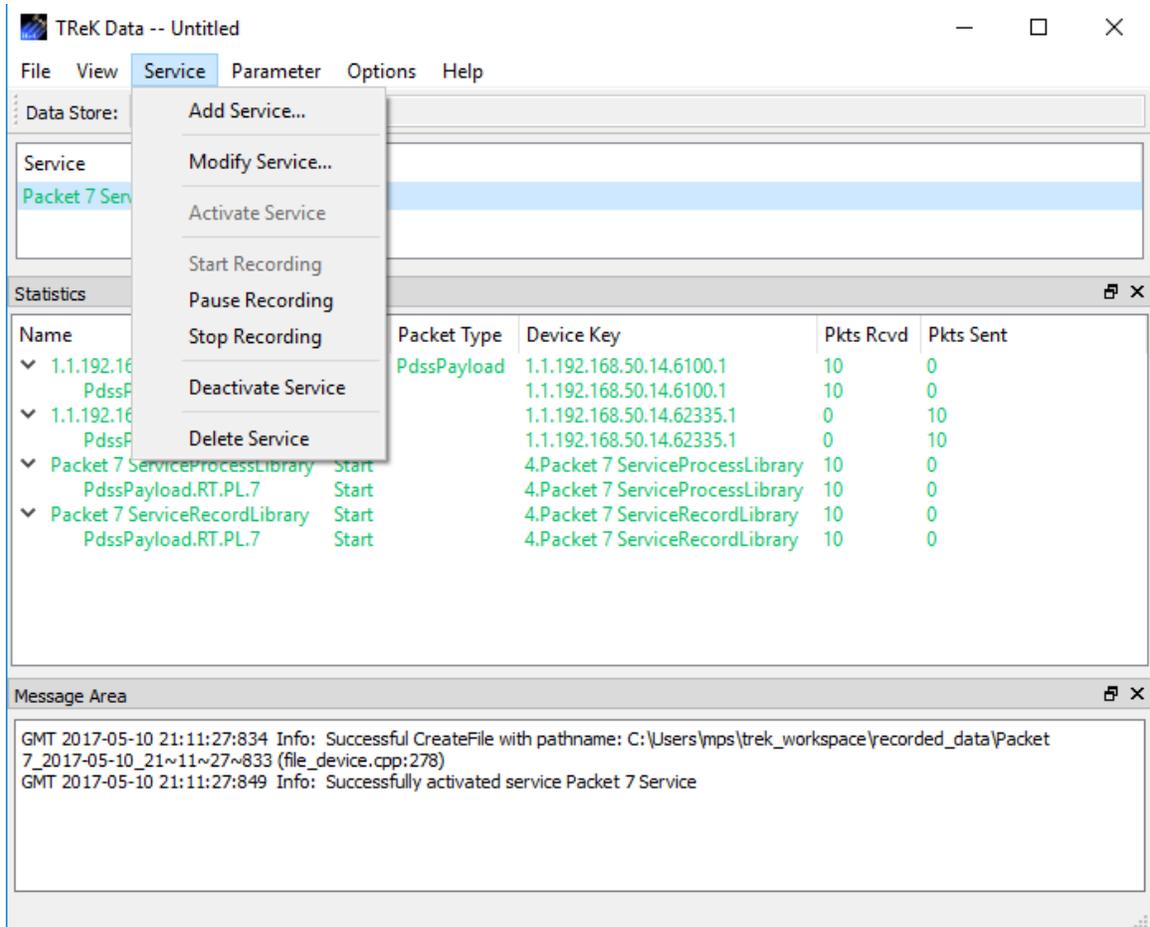


Figure 2 Service Menu Context Specific Menu Items

Parameter Menu

The Parameter menu provides access to parameter type capabilities such as displays.

Options Menu

The Options menu provides the capability to access statistics, reset statistics, configure statistics snapshot recording, and change the data store. It also provides access to the Messages dialog which can be used to display and filter application messages.

Help Menu

The Help menu provides access to on-line help and application version information.

5 TREK Data Tour

Sometimes it's easier to learn how to use an application by example. This section describes how to use the Data application to receive, process, record, and display incoming data.

This section was written assuming you have read the Introduction section and the Main Window section. If you have not read these sections, please go back and read them. They contain important information that is not repeated in this section.

The tutorial requires the use of TReK 3.1.3 or a previous version of TReK Release 3 software. If you do not have a version of TReK Release 3 software, please download TReK 3.1.3 from the TReK Web Site and install it on a Windows computer (Win7 or Win10) to perform the steps in this tutorial.

If at any time you need to exit the application so you can resume working through the Tutorial at a later time, File Save will allow you to save all the data you entered.

Please go through the tour in order. Some sections depend on data from previous sections.

5.1 Step-By-Step

This section provides step-by-step instructions that show how to configure the Data application to receive an incoming data stream, process the incoming data, and display the data.

1. Go to the operating system's menu to start the **TReK Data** application. You should see the **TReK Data** main window shown in Figure 3.

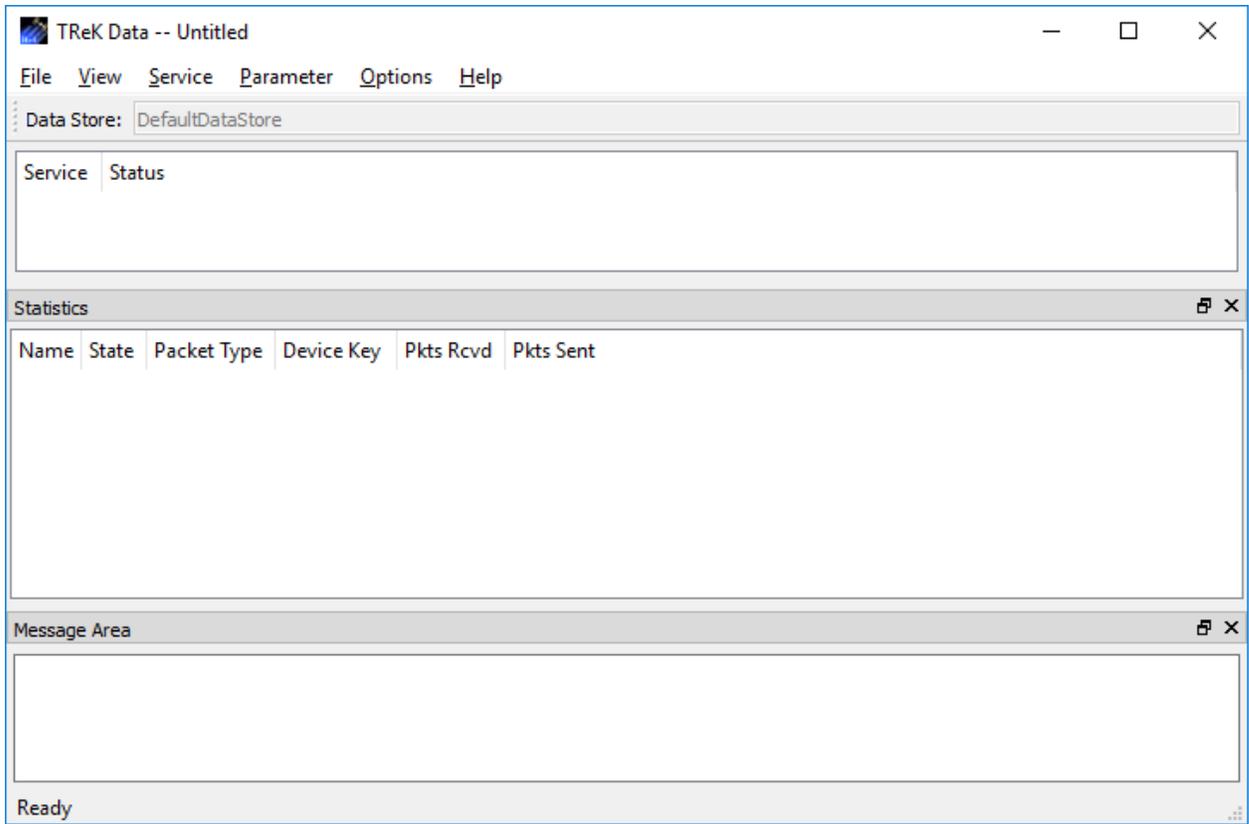


Figure 3 TReK Data Main Window

2. Go to the **Service** menu and select **Add Service**. You should see the dialog shown in Figure 4.

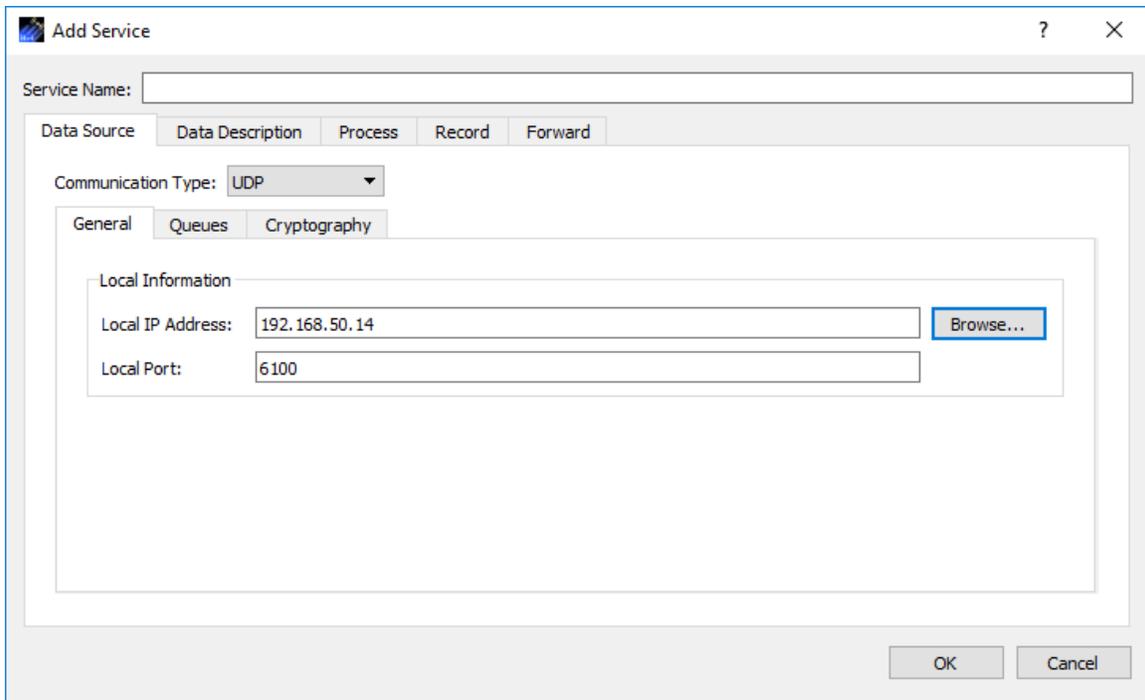


Figure 4 Add Service Dialog

3. In the **Add Service** dialog enter **Packet 24** in the **Service Name** field as shown in Figure 5. The **Local IP Address** should default to your local IP Address. But you need to check it to be sure. If it doesn't default to the right address, please enter your local IP address. All the other settings on this tab are set correctly.

The image shows a software dialog box titled "Add Service". At the top, there is a "Service Name:" label followed by a text input field containing "Packet 24". Below this, there are several tabs: "Data Source", "Data Description", "Process", "Record", and "Forward". The "Data Source" tab is selected, and within it, the "Data Description" sub-tab is active. Under "Data Description", there is a "Communication Type:" label with a dropdown menu showing "UDP". Below that, there are three sub-tabs: "General", "Queues", and "Cryptography". The "General" sub-tab is selected. Inside the "General" sub-tab, there is a "Local Information" section. This section contains two text input fields: "Local IP Address:" with the value "192.168.50.14" and a "Browse..." button to its right, and "Local Port:" with the value "6100". At the bottom right of the dialog box, there are "OK" and "Cancel" buttons.

Figure 5 Service Name Populated

4. Select the Data Description tab as shown in Figure 6.

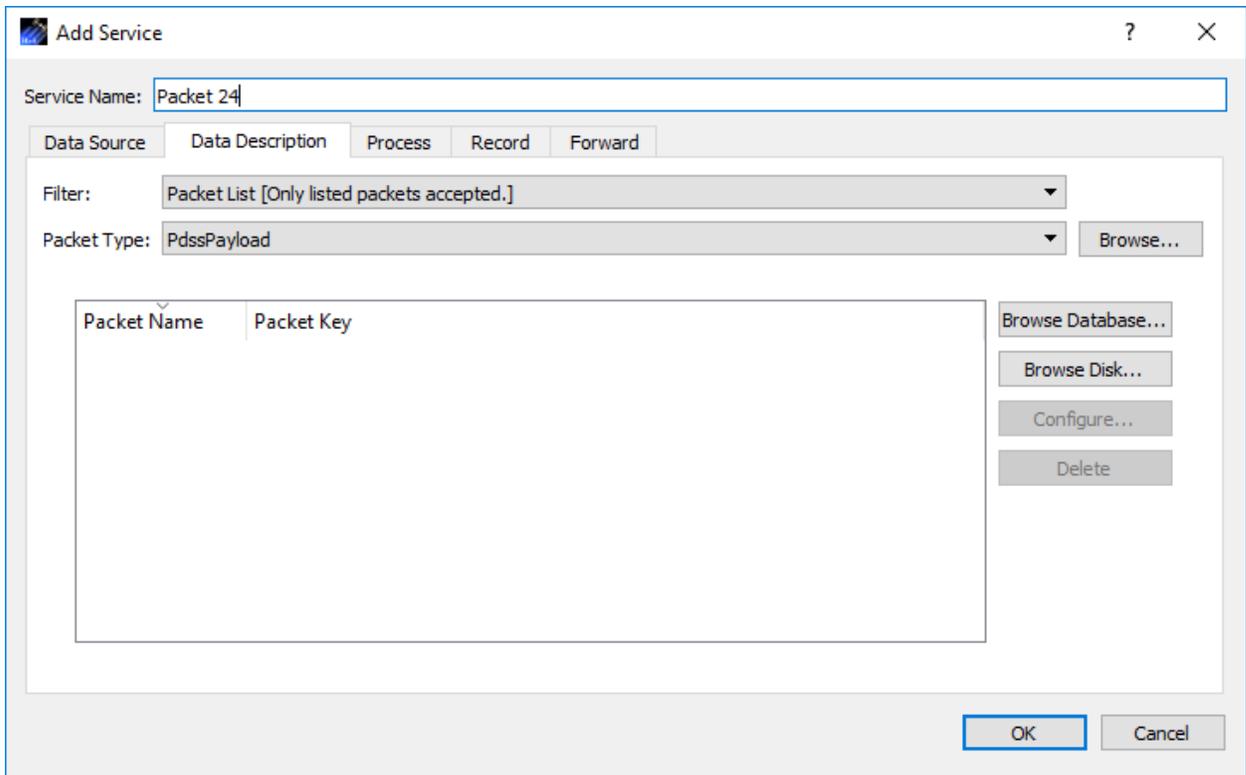


Figure 6 Data Description Tab

5. The Filter should be set to Packet List as shown. The Packet Type should be set to PdssPayload as shown. Push the Browse Disk... button to select and add a packet to the packet list. The packet information will be added by selecting a metadata file in the Open dialog. The Open dialog will be displayed when you push the Browse Disk dialog and should default to the `trek_workspace\metadata\telemetry_packet` folder in your home directory. Select the file named 'pdss_pl_apid_24.xml' and push the Open button to add this packet to the list. The dialog should look like the one shown in Figure 7. This step configures the service to identify and filter packets that are PDSS Payload packets with a Data Mode of Real-Time and an APID value of 24.

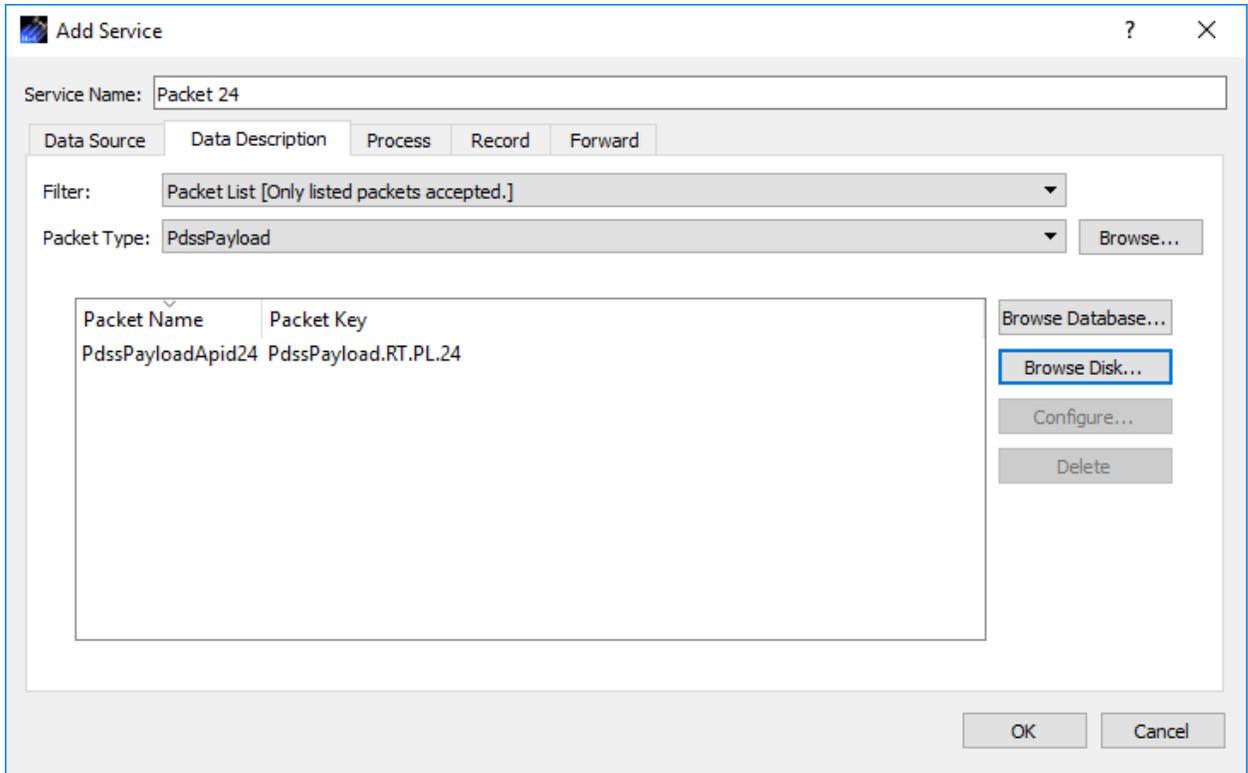


Figure 7 PdssPayload.RT.PL.24 Packet in Packet List

6. Select the Process tab. Your Process tab should look similar to the one shown in Figure 8.

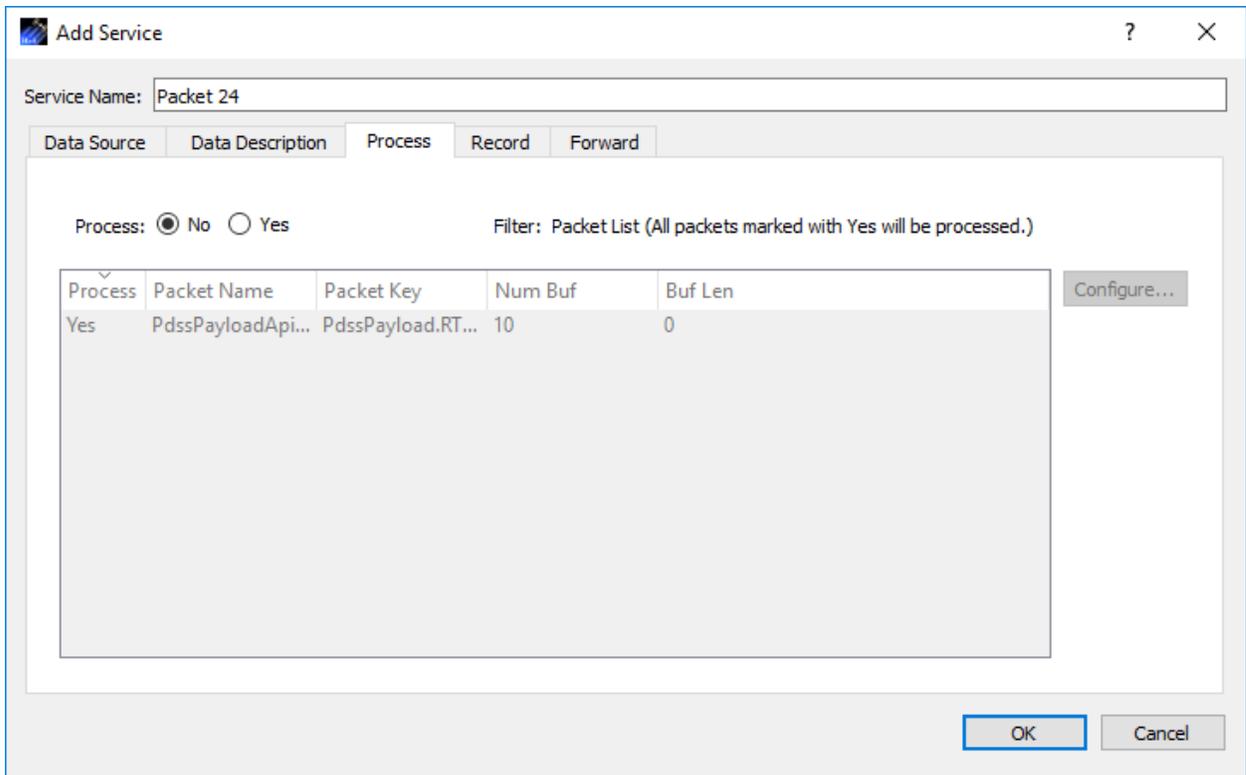


Figure 8 Process Tab

- In the Process Tab, select the Yes radio button to indicate the incoming data should be processed. You can see that the Packet List already contains the packet you added on the Data Description tab. Figure 9 shows the configuration with processing on. It also shows the number of buffers that will be used to store the incoming data for PdssPayload.RT.PL.24 defaults to 10 and the buffer length defaults to 0. A value of 0 indicates the length should be calculated using information in the packet definition. If you needed to change these values, they can be changed using the Configure button. They are fine as is for this tutorial.

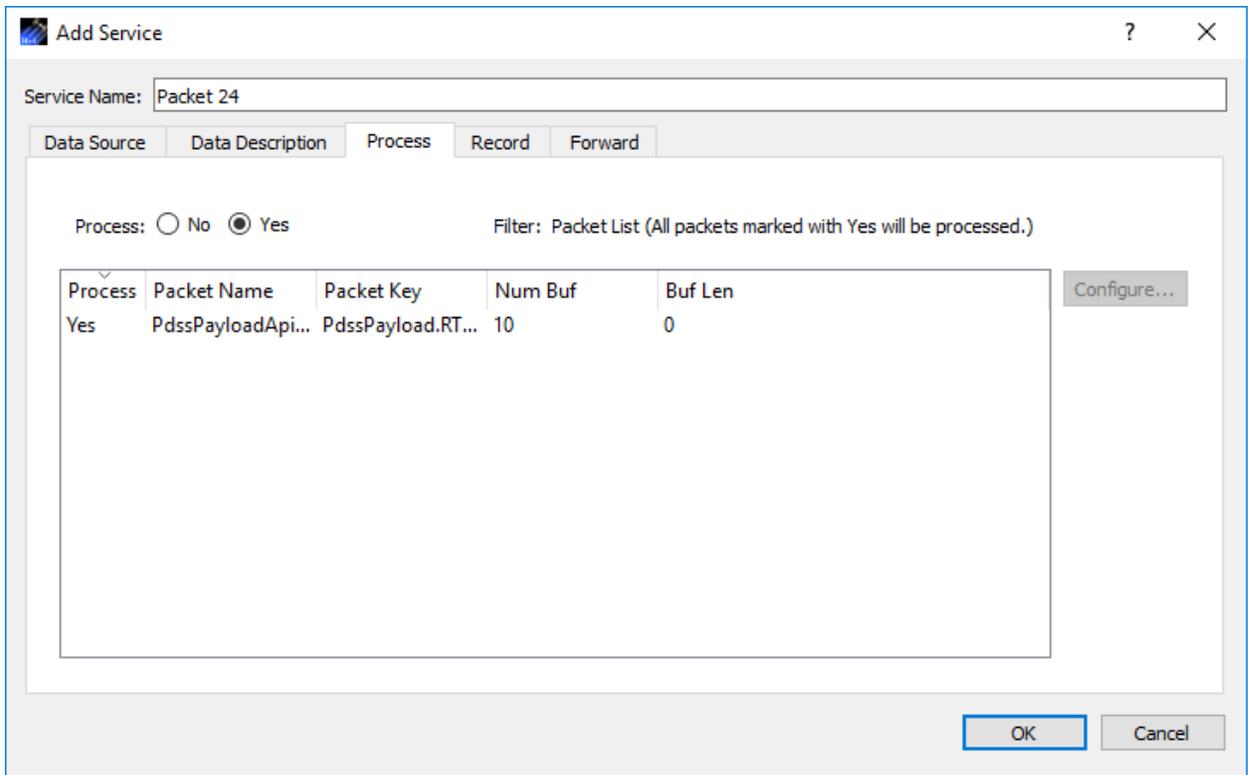


Figure 9 Processing Tab with Processing On

8. Select the Record tab. Your Record tab should look similar to the one shown in Figure 10.

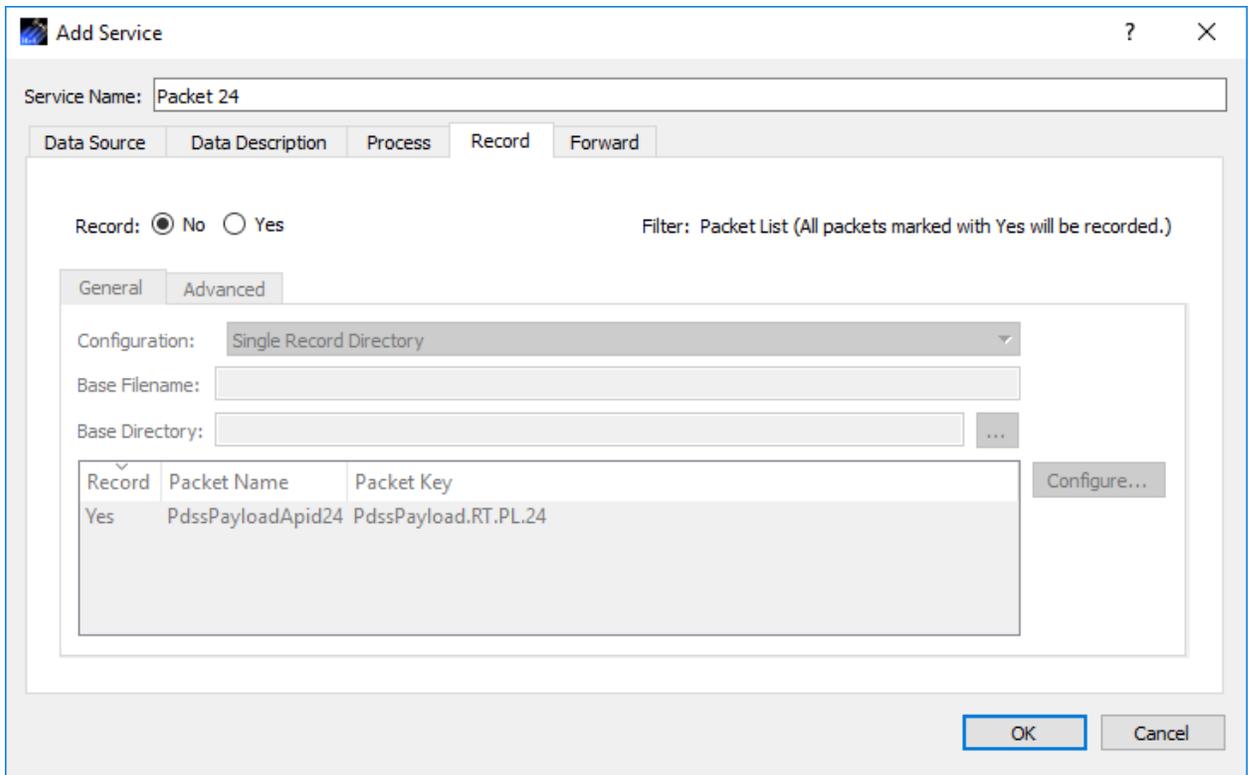


Figure 10 Record Tab

- In the Record Tab, select the Yes radio button to indicate the incoming data should be recorded. You can see that the Packet List already contains the packet you added on the Data Description tab. Figure 11 shows the configuration with recording on.

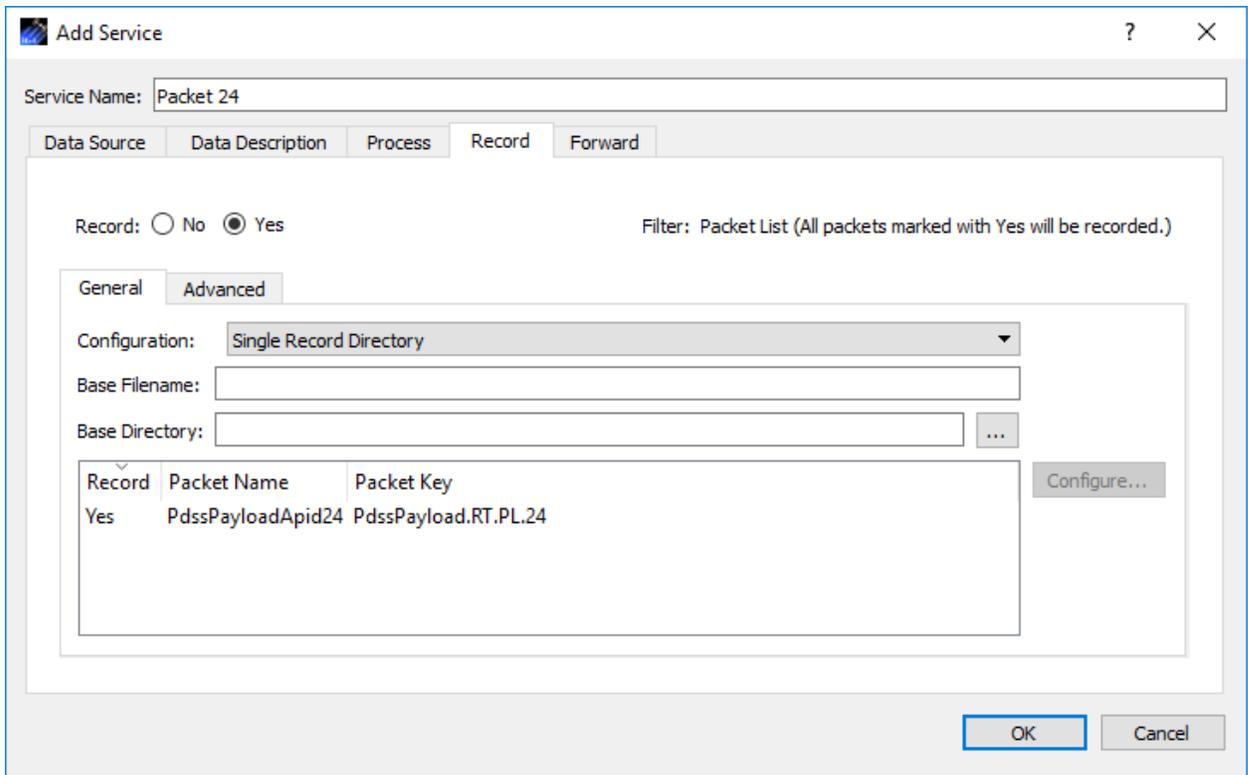


Figure 11 Record Tab with Recording On

Base Filename is used for part of the filename and the rest of the filename is generated by the TReK software. The complete filename indicates the time the file was created and closed. When you want to play the data back, you will be asked to provide this Base Filename. Therefore, you should try to select a meaningful name that will be easy to remember and is closely associated with the data that you are recording. The Directory information is used to identify which directory should be used for the recorded data files. You can use the ... button to select a directory. The Open dialog will default to the `trek_workspace` recorded_data directory.

Enter the following settings as shown in Figure 12.

Configuration: Single Record Directory
 Base Filename: Packet 24
 Base Directory: <Home Directory>\trek_workspace\recorded_data

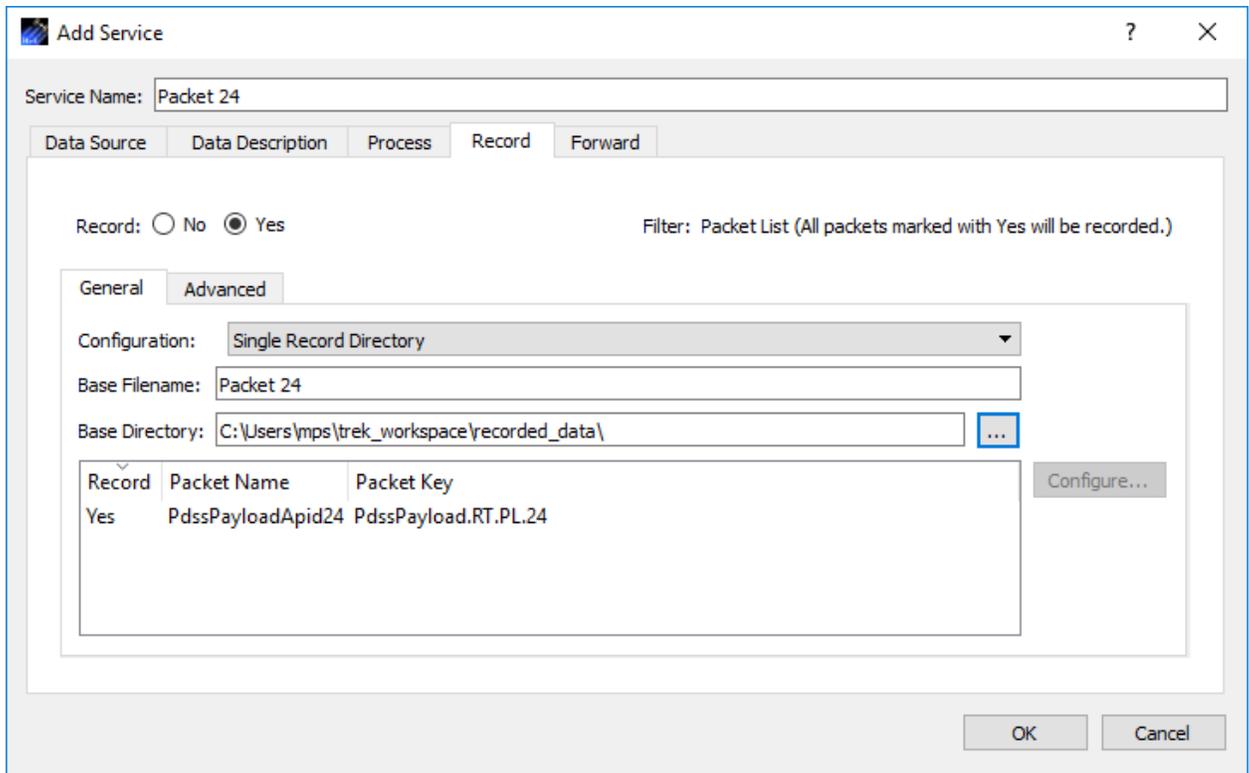


Figure 12 Record Tab Populated

10. Push the OK button in the **Add Service** dialog to close the dialog.
11. Select Packet 24 in the Main Window as shown in Figure 13.

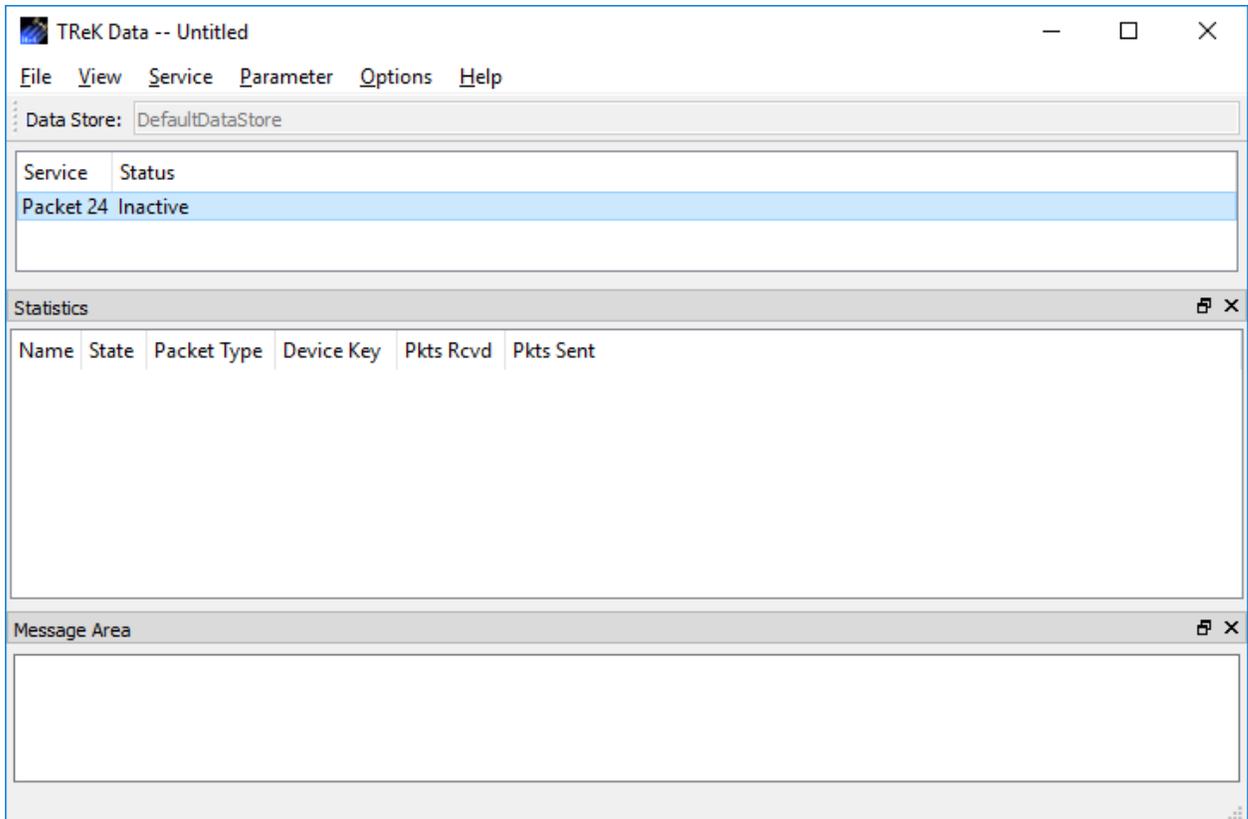


Figure 13 Packet 24 in the Data Main Window

12. With **Packet 24** selected, go to the **Service** menu and select **Activate Service**. Your Main Window should look like the one shown in Figure 14. Now you have everything configured to receive and process the packet.

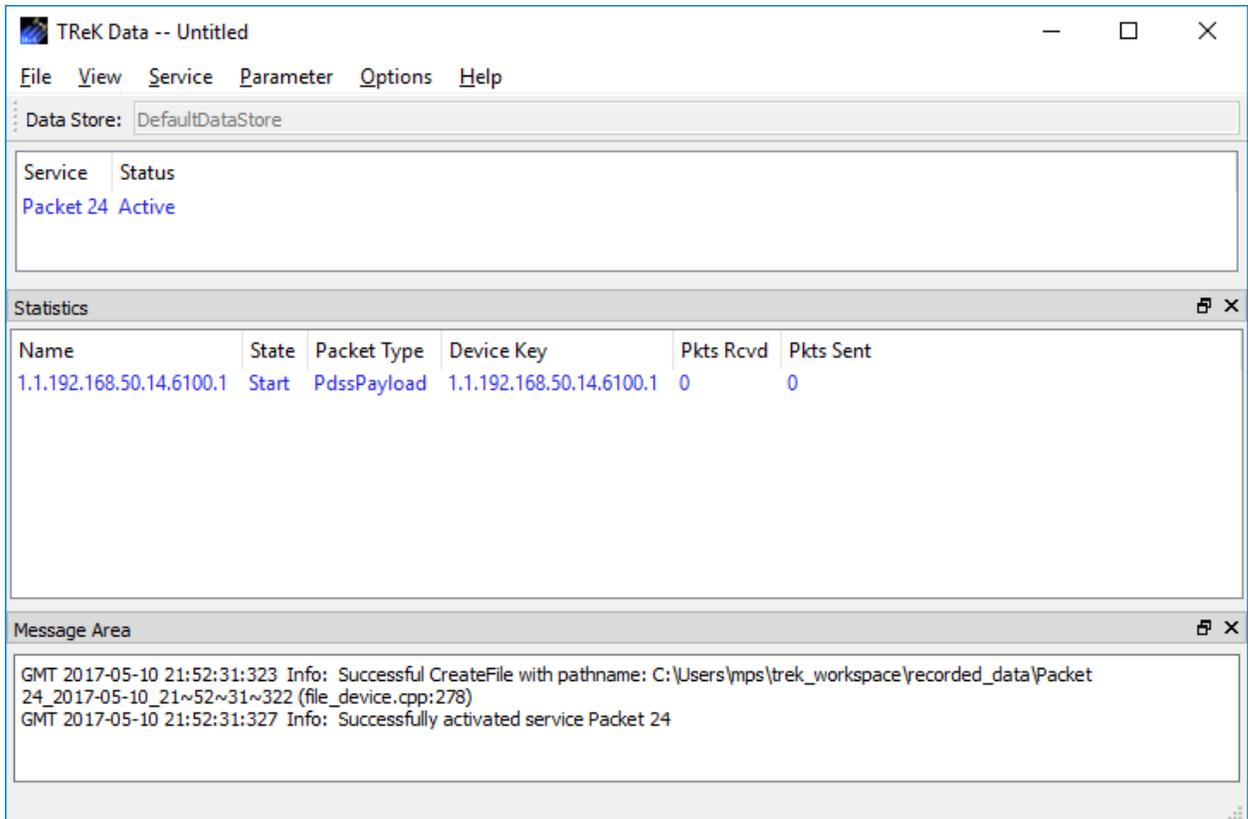


Figure 14 Packet 24 Activated

13. In the **Parameter** menu, select **Show Displays**. You should see the dialog shown in Figure 15.

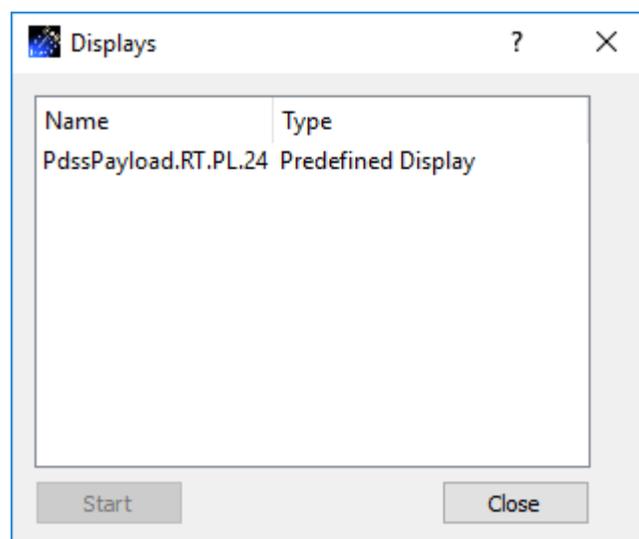


Figure 15 Displays Dialog

14. In the **Displays** dialog, select **PdssPayload.RT.PL.24** and push the **Start** button. You should see the dialog shown in Figure 16. Now you have a display to see the processed data each time a packet is received. The Value and Status columns are empty because you have not received any data.

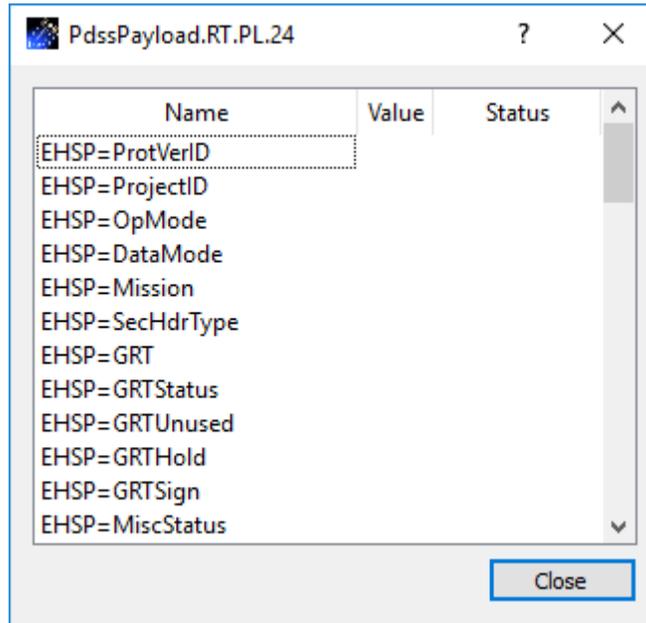


Figure 16 PdssPayloadApid24 Packet Display

15. Now we need to flow some data. Go to the operating system's menu to start the **TReK Telemetry Trainer** application. This is an application in TReK Release 3.1.3. You should see the Telemetry Trainer Main Window shown in Figure 17.

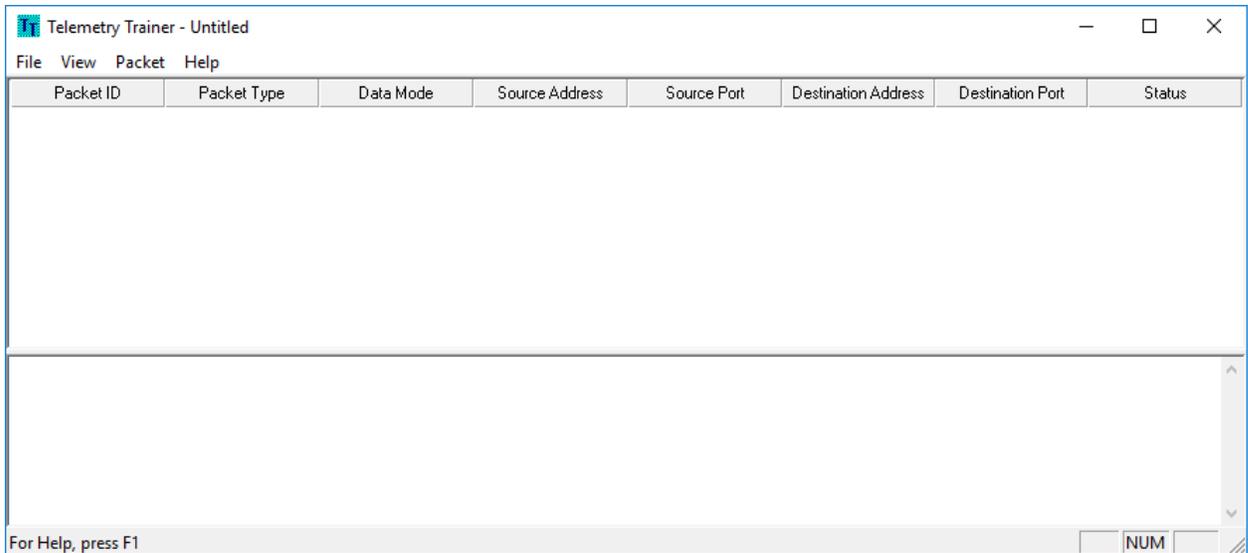


Figure 17 Telemetry Trainer Main Window

16. In the **Telemetry Trainer** application, go to the **Packet** menu and select **Add A Packet**. You should see the dialog shown in Figure 18.

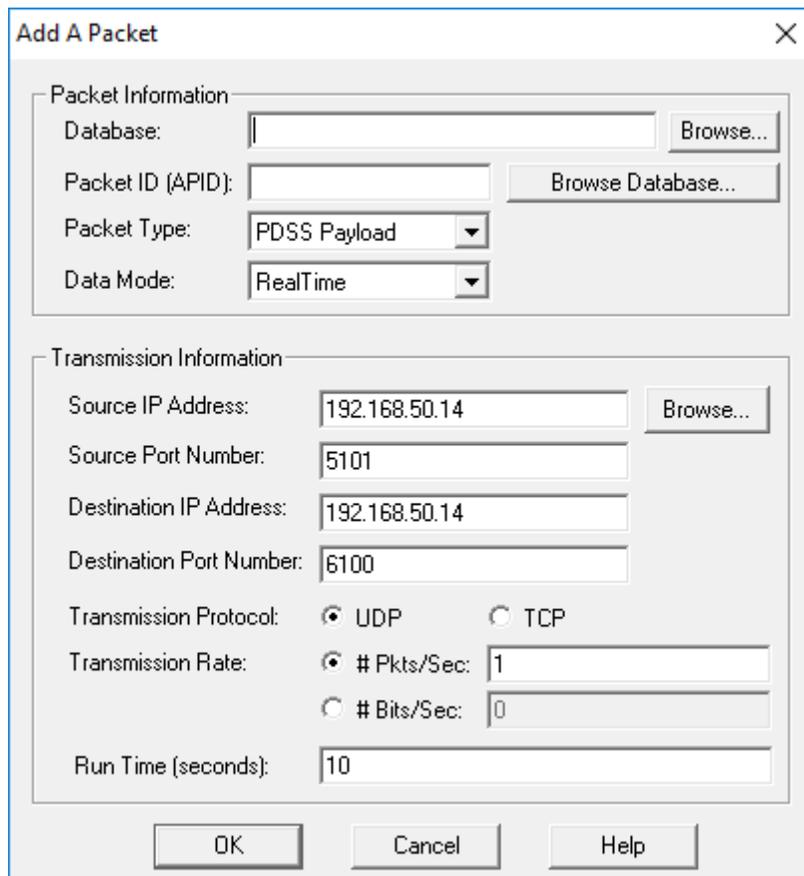


Figure 18 Telemetry Trainer Add A Packet Dialog

17. Enter the following values in the dialog:

Database	Browse to select the TelemetryDatabase.mdb delivered with TReK 3.1.3.
Packet ID (APID)	24
Packet Type	PDSS Payload
Data Mode	RealTime
Source IP Address	Enter your local IP Address.
Source Port Number	5101
Destination IP Address	Enter your local IP Address
Destination Port Number	6100
Transmission Protocol	UDP
Transmission Rate	# Pkts/Sec set to 1
Run Time (seconds)	30

18. Your dialog should look similar to the one shown in Figure 19. Please be sure the Source IP Address and Destination IP Address fields contain your local IP Address. Push the **OK** button to close the dialog. Your Main Window should look like the one shown in Figure 20.

Add A Packet [X]

Packet Information

Database: C:\Users\mps\AppData\Roaming\TReK\ Browse...

Packet ID (APID): 24 Browse Database...

Packet Type: PDSS Payload

Data Mode: RealTime

Transmission Information

Source IP Address: 192.168.50.14 Browse...

Source Port Number: 5101

Destination IP Address: 192.168.50.14

Destination Port Number: 6100

Transmission Protocol: UDP TCP

Transmission Rate: # Pkts/Sec: 1 # Bits/Sec: 0

Run Time (seconds): 30

OK Cancel Help

Figure 19 Telemetry Trainer Add A Packet Dialog

Telemetry Trainer - Untitled [Min] [Max] [Close]

File View Packet Help

Packet ID	Packet Type	Data Mode	Source Address	Source Port	Destination Address	Destination Port	Status
24	PDSS Payload	RealTime	192.168.50.14	5101	192.168.50.14	6100	Ready

For Help, press F1 NUM

Figure 20 Telemetry Trainer with Packet 24

19. Now that you have identified the telemetry packet to send, you can start the data flow. In the Telemetry Trainer go to the **Packet** menu and select **Send Packet**. The packet in the Telemetry Trainer will turn green to indicating it is generating Packet 24 as shown in Figure 21.

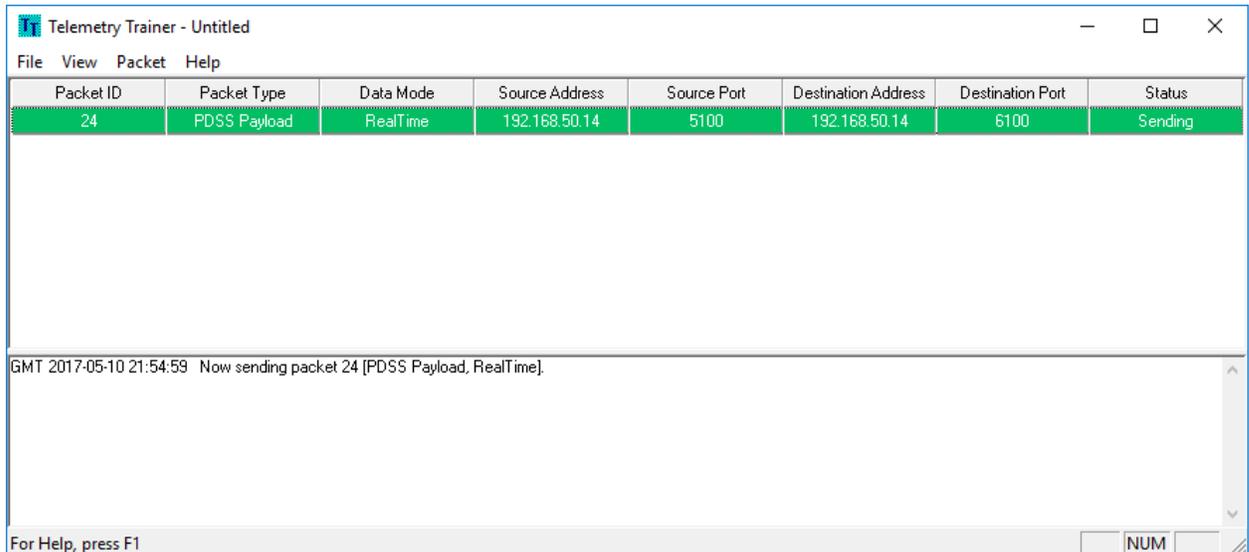


Figure 21 Telemetry Trainer Sending Packet 24

20. Look at the **TReK Data Main Window**. The service named **Packet 24** is green indicating it is receiving data as shown in Figure 22.

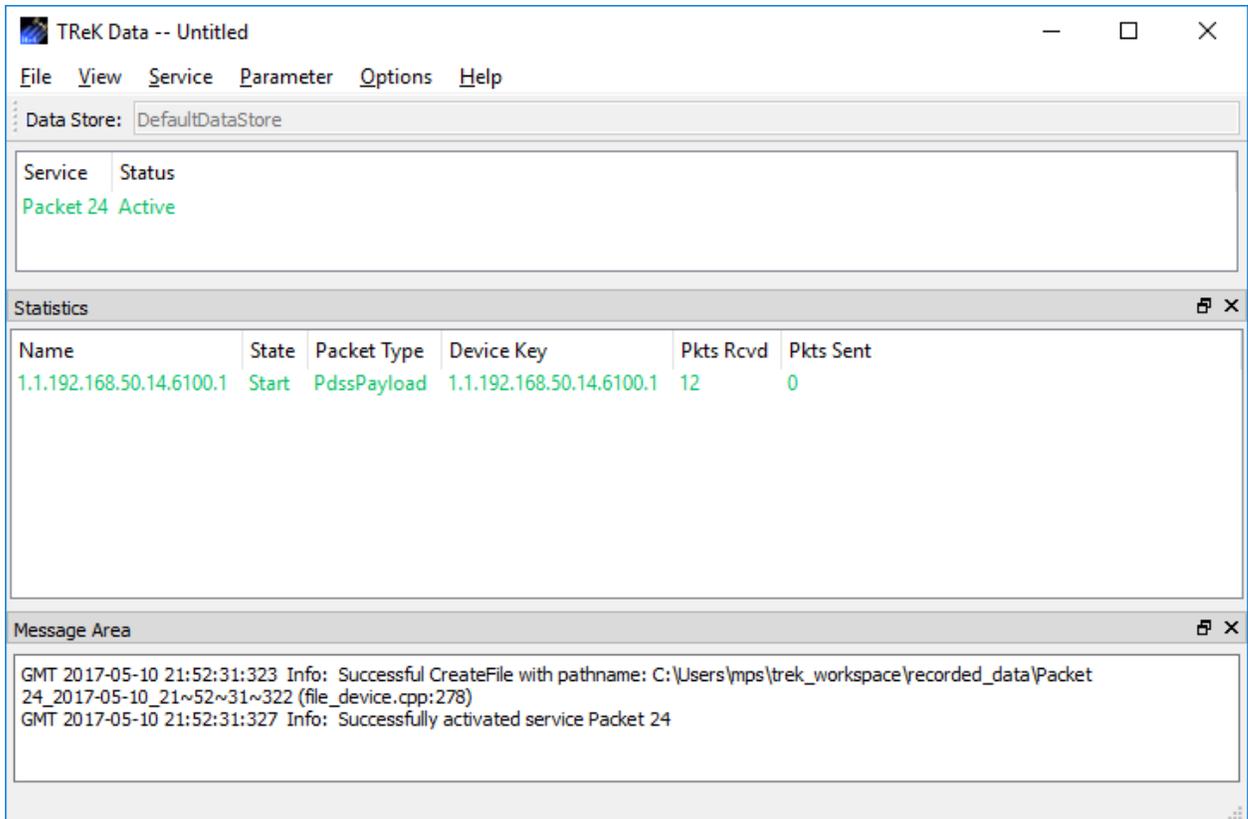
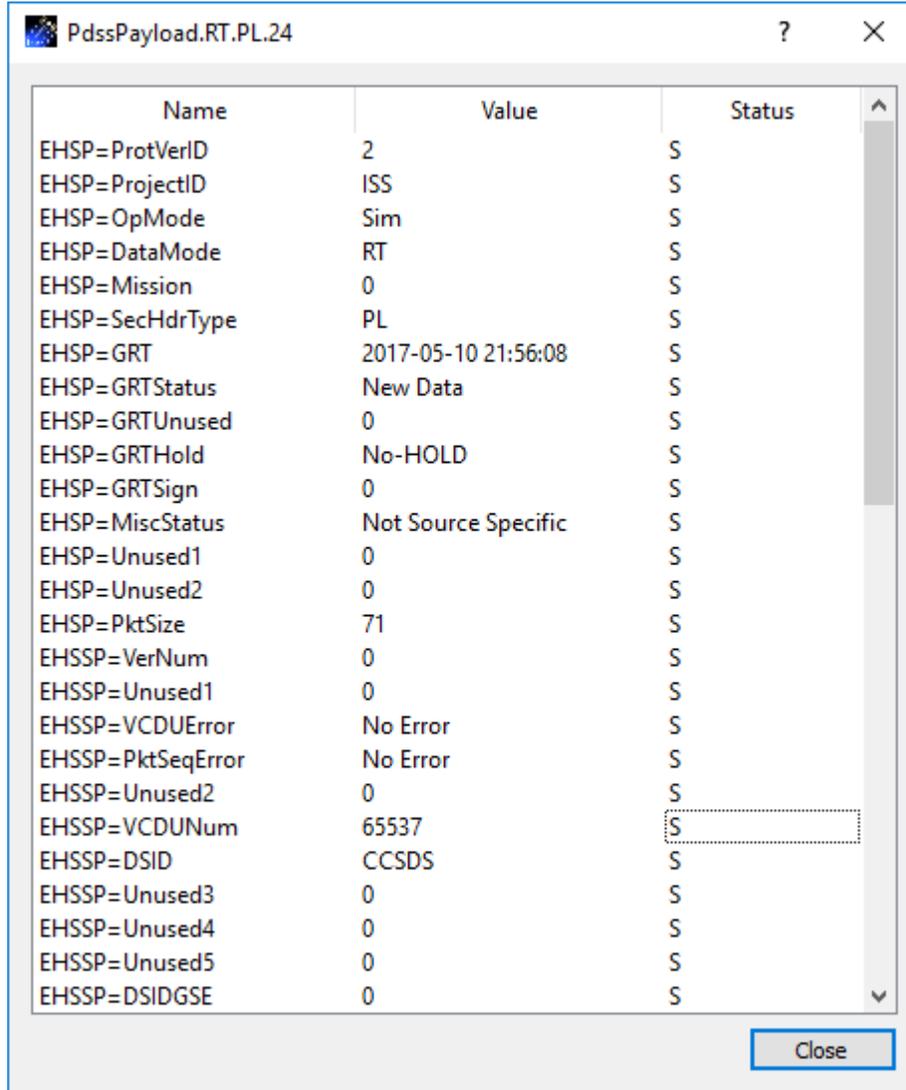


Figure 22 TReK Data Receiving Packet 24 Data

- Look at the **PdssPayload.RT.PL.24** display. The **Value** column should contain data values as shown in Figure 23. The data value of each parameter in the packet is displayed on the display each time a new packet of data arrives and is processed by the Data application. When you stop receiving data you will see the 'S' status character in the **Status** column to indicate the data is stale as shown in Figure 24.

Name	Value	Status
EHSP=ProtVerID	2	
EHSP=ProjectID	ISS	
EHSP=OpMode	Sim	
EHSP=DataMode	RT	
EHSP=Mission	0	
EHSP=SecHdrType	PL	
EHSP=GRT	2017-05-10 21:55:40	
EHSP=GRTStatus	New Data	
EHSP=GRTUnused	0	
EHSP=GRTHold	No-HOLD	
EHSP=GRTSign	0	
EHSP=MiscStatus	Not Source Specific	
EHSP=Unused1	0	
EHSP=Unused2	0	
EHSP=PktSize	71	
EHSSP=VerNum	0	
EHSSP=Unused1	0	
EHSSP=VCDUError	No Error	
EHSSP=PktSeqError	No Error	
EHSSP=Unused2	0	
EHSSP=VCDUNum	65537	
EHSSP=DSID	CCSDS	
EHSSP=Unused3	0	
EHSSP=Unused4	0	
EHSSP=Unused5	0	
EHSSP=DSIDGSE	0	

Figure 23 PdssPayload.RT.PL.24 Packet Data Values



Name	Value	Status
EHSP=ProtVerID	2	S
EHSP=ProjectID	ISS	S
EHSP=OpMode	Sim	S
EHSP=DataMode	RT	S
EHSP=Mission	0	S
EHSP=SecHdrType	PL	S
EHSP=GRT	2017-05-10 21:56:08	S
EHSP=GRTStatus	New Data	S
EHSP=GRTUnused	0	S
EHSP=GRTHold	No-HOLD	S
EHSP=GRTSign	0	S
EHSP=MiscStatus	Not Source Specific	S
EHSP=Unused1	0	S
EHSP=Unused2	0	S
EHSP=PktSize	71	S
EHSSP=VerNum	0	S
EHSSP=Unused1	0	S
EHSSP=VCDUError	No Error	S
EHSSP=PktSeqError	No Error	S
EHSSP=Unused2	0	S
EHSSP=VCDUNum	65537	S
EHSSP=DSID	CCSDS	S
EHSSP=Unused3	0	S
EHSSP=Unused4	0	S
EHSSP=Unused5	0	S
EHSSP=DSIDGSE	0	S

Figure 24 PdssPayload.RT.PL.24 Display with Stale Data

22. In order to close the data recording file, select the Packet 24 Service in the Main Window and then go to the Service menu and select **Stop Recording**. This will stop the data recording and close the data recording files. You should see the following types of files:

Packet 24_2017-05-10_21~24~59

Packet 24.con

The Packet 24_2017-05-10_21~24~59 file is the file that contains the recorded data. The filename consists of a Start Time (the time associated with the first

packet in the file) and the Base Filename you provided when you set up the service.

The Packet 24.con file is a configuration file that provides information about the contents of the data recording file. It is important to keep this file in the same directory with the data recording file since it is used by the TReK Playback application during data playback.

Congratulations – you have successfully completed the Tutorial!