

## Using TPS to read CCSDS transfer frames

To read transfer frames, strip the virtual channel packet TM data and then process the TM data, all in real-time, requires two separate concurrently running version of TPS either on the same or separate PCs. For simplicity, the following installation notes assume both TPS's run on the same PC.

For this example:

The TPS used to directly read Transfer frames is termed '**TPSCCSDS**'

The TPS used to process the stripped virtual channel packet data is termed '**TPSTMPKT**'

i.e. TPSCCSDS reads transfer frames and strips out the virtual channel data, recording it to a file VCDATAN.DAT (where n=virtual channel number 0-7) and TPSTMPKT simultaneously reads one of the virtual channel data files to process the packet data contained in virtual channel n. To concurrently process the telemetry packets in each virtual channel, you need to run a separate copy of TPSTMPKT as TPS can only lock on to one packet synchronisation pattern at any one time.

Note, TPSCCSDS and TPSTMPKT are separate, concurrently running, versions of the same physically installed TPS, unless you run them on separate PCs.

You do not need to run TPSTMPKT if you only want to read transfer frames and save the virtual channel data to a disk file. You can read the virtual channel disk files (VCDATAN.DAT) either concurrently or any time later using TPSTMPKT.

To process Transfer Frames, follow these steps:

1. Start a copy of TPS to read the transfer frames, we call this copy TPSCCSDS
2. Configure TPSCCSDS to read transfer frames: this is only a matter of configuring the TPS 'Packet Format' Please see the online help CCSDS topic for details on all assumed frame sizes etc. and how they are derived. Note, TPS currently only process frames with lengths between 1119 and 1279 byte transfer frames (1279 includes 160 byte Reed Solomon check symbols). Normally, the frames are only either 1119 bytes (no Reed Solomon check symbols) or 1279 bytes (with Reed Solomon check symbols).

Double click the display to unlock it and then select the Transfer, Pkt format menu item and enter the following values:

Synchronisation Pattern	0x1ACFFC1D
Packet Length	Usually 1119 or 1279 bytes *
Sync loss reporting on	Check on

\* 1275 is the Transfer frame length for Reed Solomon encoded frames with a data frame field of 1115 bytes and an interleave depth of 5 - the extra four bytes making 1279 bytes are for the Attached Synchronisation Marker (ASM) which TPS includes in the total frame length. Currently TPS only supports this interleave depth of 5..

Press the `CCSDS` button to present the CCSDS dialog box

Set the CCSDS On switch to on (check the box)

Switch on `Frame Error Control Word` (if present in the frame)

Select the desired Virtual channels to be processed. (Check or clear each box)

Channel *n* accordingly - *n* is the virtual channel number 0-7).

Press **OK** to accept the settings and clear the CCSDS dialog box

Press **OK** again to accept the settings and clear the Packet format dialog box

3. Now save the settings - select the **Options, System, Save settings** menu item.

This is all that is required. TPSCCSDS is now ready to read transfer frame data either from a file or via the serial ports.

If you have transfer frame data in a file, it must be in raw binary format, i.e. an exact copy of the data as it is normally received from the outside world. This is, of course, not a TPS proprietary format so we will assume this is the case.

**Before replaying your data, we advise you first put TPSCCSDS into *step-mode* so that you can see what's happening and slowly gain some confidence.**

4. Replay your data (for a file, use the **File, Replay, Raw** binary menu item) and, whilst observing the TPS error view-port, press **ENTER** to read the first transfer frame whilst in *step-mode*.

The standard TPS page 10 is useful for the first few frames of replay. If you are confident that the frame synchronisation is ok, try page 33 on the samples disk which displays all the Transfer Frame header fields.

Check the error view-port doesn't show a **Lost sync 0001** error. If it does, either the incoming transfer frames are not 1279 bytes (or whatever total length you used) or the synchronisation pattern is wrong.

Pages 65-69 on the samples disk displays the first 1536 bytes of the frame in the familiar hexadecimal packet dump format, you may find these pages useful to diagnose the data in the event of problems. Furthermore, try the TPS diagnostics (`Options`, `Switches`, `Diagnostics` menu item) which dumps the raw incoming data to the `TPSERR.TXT` file in a readable ASCII format when lost-sync errors occur.

Assuming you can step through the frames ok, you may wonder what is now happening.

TPSCCSDS will now strip the Frame data field for each virtual channel and put that data in a raw binary file, filename `VCDATAn.DAT` where 'n' is the virtual channel number 0-7. TPSCCSDS will only strip data which is not 'IDLE'. The virtual channel files reside in the TPSCCSDS installation directory.

The `VCDATAn.DAT` files contain ALL the frame data field and so probably contains several different multiplexed TM packets. The replay of `VCDATA` files and the de-multiplexing of the TM packets is the responsibility of the separately running `TPSTMPKT`.

5. To read the virtual channel files '`VCDATAn.DAT` files

start `TPSTMPKT` (start a second copy of `TPS`, we call it `TPSTMPKT` herein)

Now configure it to read a selected TM packet. As for `TPSCCSDS`, this is done via the Packet Format configuration dialog box.

For the TM packet synchronisation pattern, this V5.0 implementation uses the 2-byte Packet Identification field. This is the first two bytes of the TM packet and is fixed for each virtual channel.

6. Configure `TPSTMPKT` packet format as follows, (Double click the display to unlock it first)

Synchronisation Pattern	2-byte Packet Identification
Packet Length	user defined - fixed or variable.
Sync loss reporting	OFF

Press the `CCSDS` button to present the `CCSDS` dialog box

`CCSDS` switch OFF (OFF not ON! see note below)

All other switches can be left as they are.

Press `OK` to clear the `CCSDS` dialog box and accept the settings

Press `OK` to clear the Packet Format dialog box and accept the settings

Note, the `CCSDS` processing state is OFF for `TPSTMPKT` unlike `TPSCCSDS` - this is because `TPSTMPKT` reads virtual channel TM packets and not transfer frames.

The 'Sync loss reporting' is also OFF. This is so that `TPSTMPKT` will not report a sync loss when it reads packets other than those with a packet identification used for the synchronisation pattern. If your frame data contains many different packets, i.e. different application IDs, `TPS` will lose sync when it meets an unrecognised ID.

7. One extra step which must be performed is to set the 'Open-on-EOF' TPS option on so that TPSTMPKT will not close the VCDATA file when it reaches the end. This is because TPSCCSDS will be continually writing to it and, invariably, TPSTMPKT will usually read to the end of the VCDATA file before TPSCCSDS has time to put more data in it. Normally, with Open-on-EOF switched off, as soon as TPS reaches the end of a file, it will switch the replay off.

Switch Open-on-EOF by selecting the `File, Replay, Open-on-EOF` menu item.

18. Now save the format settings as before for TPSCCSDS, see step 13.

This is all that is required. TPSTMPKT is now ready to read the virtual channel data processed by TPSCCSDS.

When first testing, leave TPSTMPKT step-mode OFF when replaying VCDATA - this is so that you can see if any VCDATA is generated. Because of the disk caching latency effect (discussed below), Using Step-mode on TPSTMPKT will only exacerbate real-time receipt of virtual channel data by TPSTMPKT.

Suppose your desired TM packets are in virtual channel 5, then you must replay the TPSCCSDS file VCDATA5.DAT.

Select the TPSTMPKT `File, Replay, Raw binary` menu item and browse to find the VCDATA5.DAT file in the TPSCCSDS home directory (this is, of course, not the default directory for TPSTMPKT).

**FILE LATENCY:** When running both TPSCCSDS and TPSTMPKT concurrently, there is a latency between TPSCCSDS generating virtual channel data and TPSTMPKT reading the data. TPS buffers virtual channel data before writing it to disk. The 'File, Record, Buffer size' is a new configuration option. By default, the size is set to 16Kb for each separate channel. 16Kb is approximately 14 frames of virtual channel data (at 1279 bytes per Transfer frame). Thus, if you are reading an infrequently transmitted virtual channel, you will not, in principle, see any TM data arrive at TPSTMPKT until 14 frames of the same virtual channel have been received and processed by TPSCCSDS. Rather than decrease the recording buffer size (of TPSCCSDS) to increase the frequency, it is preferable to configure the TPSCCSDS record buffer `Flush Period` so that TPS flushes the buffer regularly rather than waiting for it to fill. See the section Enhanced Serial I/O and Recording in the V5.0 Supplement (V50SUPL.DOC in the Docs folder) for more details.

Note, you must set the 'Buffer Size' **BEFORE** switching on CCSDS - use the master switch in the CCSDS dialog box to temporarily switch CCSDS On/Off without having to switch any other options or change the packet format etc.

### **Excessive Disk Use - 'disk thrashing'**

It may well be that with high rate (10Kb/sec plus) incoming frame data, and one or more virtual channels being processed, the host PC disk is getting severely exercised - see the section 'Enhanced Serial I/O and Recording' in the V5.0 Supplement (V50SUPL.DOC in the Docs folder) for details on how to alleviate this problem. Read also the 'File Latency' Notes immediately above.

## Other Points

Because the packet format was configured with the 'Sync loss reporting' OFF, you will not be able to see lost sync errors if the TM packets length do not match the length configured. Instead, observe the hex dump and the page 10 PKTSRD parameter. If PKTSRD increments, then TPSTMPKT is reading TM packets ok. If you do see the bytes incoming on the hexadecimal packet dump display, but the PKTSRD counter does not increment, then you will see many Lost Sync errors ('LOSTSYNC' increments) and so it is very likely the packet length is incorrectly configured.

Pages 65-69 on the samples disk display the first 1536 bytes of the packet in the familiar hexadecimal packet dump format, you may find these pages useful to diagnose the data in the event of problems. Furthermore, try the TPS diagnostics (*Options, Switches, Diagnostics* menu item) which dumps the raw incoming data to the TPSEERR.TXT file in a readable ASCII format.

The standard TPS page 10 is useful for the first few TM packets of replay. If you are confident that the packet synchronisation is ok, try page 34 on the samples disk which displays all the Packet header fields.

That's it... Now let TPSCCSDS and TPSTMPKT simultaneously run through the data by switching off step-mode on TPSCCSDS.