The Packet Structure ICD (SCI-PT-ICD-07527 describes the packet services and low-level packet transfer protocol messages to be available on the Herschel spacecraft for the control and transfer of data between different subsystems. This note defines those services and messages that will be used by the SPIRE instrument.

1. APIDs

The Application ID is used to identify the source or destination of a telemetry packet. Herschel uses different APIDs for different types of packet (see AD1) as well as for different instruments. The APIDS to be used by SPIRE are given in the following table:

ID	Telemetry types	APID (hex)
APID1	SPIRE Telecommands, Telecommand Verification and Events	500
APID2	SPIRE Periodic Housekeeping	502
APID3	SPIRE Photometer Science Data	504
APID4	SPIRE Spectrometer Science Data	505
APID5	SPIRE Mechanism Science Data	506

2. PACKET TRANSFER PROTOCOL

At the low-level the Packet Transfer Protocol provides a series of sub-address messages to control and transfer data between subsystems. Some of these implement the packet transfer itself, others provide alternative methods of transferring data and controlling the transfer. This section identifies the sub-addresses used/accepted by the SPIRE instrument.

Description	Sub-address(es)	Comments
Mode Command	SA 0R	Used to identify the RT addressed in this subframe. The instrument responds only to its own address. For burst mode this is only set when the instrument has indicated that it has data to transfer and the BC will download a packet in that subframe
	SA 0T, 31T, 31R	Not Used
Unit Control	SA 1R	Not Used

	~~SA 1R~~ SA, 1T	~~Not Used~~ Used to provide the unit status limited to the Subframe Counter and the BIT word. We are currently not compliant re. the latest proposed additions, i.e. the TM transfer confirmation and the subframe counter for the last invalid TM. As it was clarified many times in DMWG meetings (especially the last one) the OBS has no way to know when a TM packet transfer was not successful. The OBS will not issue a new TM PTR in absence of a valid TM PTC for the previous packet; if the first attempt to transfer a TM packet was unsuccessful the BC will try a "retry", and if that fails again then it will give a PTC anyway. This, I believe, was the agreement reached; the ability to perform the retry resides with the BC and hence the RT, having no way to know about the retry status, is not in the condition to know when a transfer went wrong.
Data Send	SA 2T, 3T, 4T, 7T, 9T, 29T	Not Used
Data Receive	SA 2R, 7R, 9R, 15R-26R, 29R	Not Used
Asynchronous Short Commands	SA 3R, 4R	Not used
Event Messages	SA 5R, 5T, 6R, 6T	Not Used
Time Messages	SA 8T	Not used
	SA 8R	Used to transfer spacecraft time from CDMU to instrument (in subframe 33) rather than use packet service (9,5)
Packet Transfer TM Transfer Request	SA 10T	Used by instrument to indicate to CDMU that a TM packet is ready to transfer
TM Transfer Confirmation	SA 10R	Used in the normal handshake protocol; it is not used in burst mode~~Not Used - ignored by the instrument~~
TC Transfer Confirmation	SA 27T	Instrument sends a copy of TC Transfer Descriptor to indicate reception of TC
TC Transfer Descriptor	SA 27R	Used by the instrument to prepare for TC transfer
TM Data Send	SA 11T-26T	Used to transfer TM packets from instrument to CDMU
TC Data Receive	SA 11R-14R	Used to transfer TC packets from CDMU to instrument
Low-level Commands	SA 28T, 28R	Not Used
Data Wrap	SA 30T, 30R	Made available for BC-handled 1553 troubleshooting. Not used by the instrument~~Not Used, TBC~~ Note: This is mandatory according to the PS-ICD

3. TELECOMMAND PACKET TYPES

The Packet Structure ICD (AD1) defines many types of service that can be provided by an application. The following table shows the telecommand packet types that will be accepted by the SPIRE instrument.

Description	Service Type	Service Sub-Type	Comments
Telecommand Verification Service	1		N/A
Device Command Distribution	2		Not Used
Housekeeping and Diagnostic Data Reporting	3		Not Used
Event Reporting	5		N/A
Memory Management			
Load Memory Using Absolute Addresses	6	2	
Dump Memory Using Absolute Addresses	6	5	
Check Memory Using Absolute Addresses	6	9	
Function Management			
Start Function	8	1	
Stop Function	8	2	
Perform Activity of Function	8	4	
Report Function Status	8	5	
Time Management			
Synchronise User	9	3	Not Used
Enable Time Synchronisation	9	4	Not Used ~~(TBC)~~
Time Code	9	5	Not Used ~~(TBC)~~
Verify User Time	9	6	Not Used
Enable Time Verification	9	7	
Synchronise Central Time Reference	9	10	Not Used
On-Board Scheduling	11		Not Used
On-Board Monitoring			
Enable Monitoring of Parameters	12	1	TBD
Disable Monitoring of Parameters	12	2	TBD
Clear Monitoring List	12	4	TBD
Modify Monitoring List	12	5	TBD
Delete Parameters from Monitoring List	12	6	TBD
Report Current Monitoring List	12	8	TBD
Packet Transmission Control			
Enable Generation of Telemetry Packets	14	1	
Disable Generation of Telemetry Packets	14	2	
Report Enabled Telemetry Packets	14	3	
On-Board Storage and Retrieval	15		Not Used
On-Board Traffic Management	16		Not Used
Test Service			
Perform Connection Test	17	1	
On-Board Control procedures	18		Not Used
Action/Event Service	19		Not Used
Information Distribution Service	20		Not Used
Science Data	21		N/A
Context Saving Service	22		TBD

4. TELEMETRY PACKET TYPES

The Packet Structure ICD (AD1) defines many types of service that can be provided by an application. The following table shows the telemetry packet types that will be produced by the SPIRE instrument.

Description	Service Type	Service Sub-Type	Comments
Telecommand Verification Service			
Telecommand Acceptance Report - Success	1	1	
Telecommand Acceptance Report - Failure	1	2	
Telecommand Execution Report - Started	1	3	
Telecommand Execution Report - Progress	1	5	
Telecommand Execution Report - Completed	1	7	
Telecommand Execution Report - Failure	1	8	
Telecommand Contents Report	1	9	Not Used
Device Command Distribution	2		N/A
Housekeeping and Diagnostic Data Reporting			
HK Parameter Report Definitions Report	3	10	
Diagnostic Parameter Definitions Report	3	12	
Housekeeping Parameter Report	3	25	
Diagnostic Parameter Report	3	26	
Event Reporting			
Event Report	5	1	
Exception Report	5	2	
Error/Alarm Report	5	4	
Memory Management			
Memory Dump, Absolute Addresses	6	6	
Memory Check Report, Absolute Addresses	6	10	
Function Management			
Function Status Report	8	6	
Time Management			
Central Time Reference	9	8	Not Used
Time Verification Report	9	9	
On-Board Scheduling	11		Not Used
On-Board Monitoring			
Current Monitoring List Report	12	9	TBD
Packet Transmission Control			
Enabled Telemetry Packets Report	14	4	
On-Board Storage and Retrieval	15		Not Used
Test Service			
Connection Test Report	17	2	
On-Board Control procedures	18		Not Used (TBC)
Action/Event Service	19		Not Used
Information Distribution Service	20		Not Used
Science Data			
Nominal Science Data Report	21	1	
Science Type B Data Report	21	2	
Diagnostic Science Data Report	21	3	
Auxiliary Science Data Report	21	4	
Context Saving Service	22		TBD