B. Real Time Display Serial Stream

The RVP7 signal processor does not come with a built-in real time display. In most applications, real time A-Scope or PPI images are created and displayed on the host computer to which the RVP7 is attached. This is generally a good solution since the host computer both configures the RVP7 and also displays the resulting data. However, if CPU resources are limited, or if the host computer cannot be easily reprogrammed, then it is better for the real time display to be off-loaded onto some other device. To make this possible, the RVP7 supports a special asynchronous serial line protocol intended for direct connection to a dedicated real time display.

The real time serial stream simply "eavesdrops" on the data being sent to the host computer via the normal parallel or SCSI interface. The host computer remains in complete control of the RVP7 and should not experience any changes in timing or data flow when the serial stream is running. The serial data are output as long as the RVP7 continues to process new rays. If the host computer ceases operation, the serial output stream also comes to a stop.

An exception to this rule is the special Auto display mode. Here, the RVP7 begins processing data immediately after powerup, thus permitting the real time display to run off line with no computer intervention. The processing configuration that is used in this case is the one that was in effect at the time the last **S** (save) command was typed on the RVP7 setup TTY. Note that when Auto mode is in effect, the host computer may either be disconnected from the RVP7, or it may be connected but idle. If any I/O is detected from the computer, the display reverts to its normal On state, in which the computer controls the timing.

Although the serial stream is basically output only, the RVP7 does accept a brief set of commands from the display device. These commands choose the type and format of the output data. The real time display cannot alter which data are collected by the host computer, but it can select a reduced subset of the available data for serial output. This is important in matching the serial line throughput to the overall data rate and to the speed of the real time display itself. The output data stream operates independently of the input commands, i.e., there is no flow control or handshaking on the serial line. This means that the display device must be capable of keeping up with the full data rate from the RVP7. Baud rates up to 38.4K are available.

B.1 Serial Commands Received by the RVP7

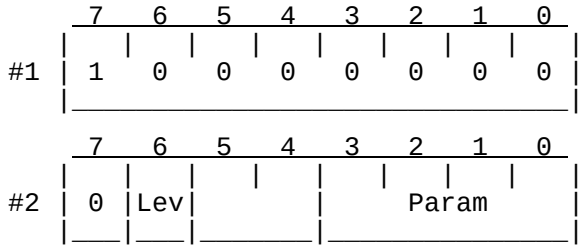
These commands may be sent to the RVP7 at any time. Each command packet begins with a unique sync character and ends with a stop character. The most significant bit is set in the sync and stop characters; all bytes in between have the MSB clear.

B.1.1 Select Output Parameters Command (SOUTP)

This command chooses which data are output on the serial stream. Up to four parameters may be chosen, and each parameter may be formatted as an 8-bit byte or as a 4-bit nibble. The "None" parameter permits fewer than four data types to be chosen. If a chosen parameter is not currently available in the RVP7, then that choice is corrected back to "None." If all four parameters equate to "None," then no data parameter packets are output. This effectively turns the serial output stream off.

The command also specifies the starting range of the data, the bin count, and the bin spacing. These are desired values only and may, according to the NCB bit in word #12, be corrected back to the nearest values that can actually be achieved. The correction is based on the best match with the range bins that have been set up by the host computer. For example:

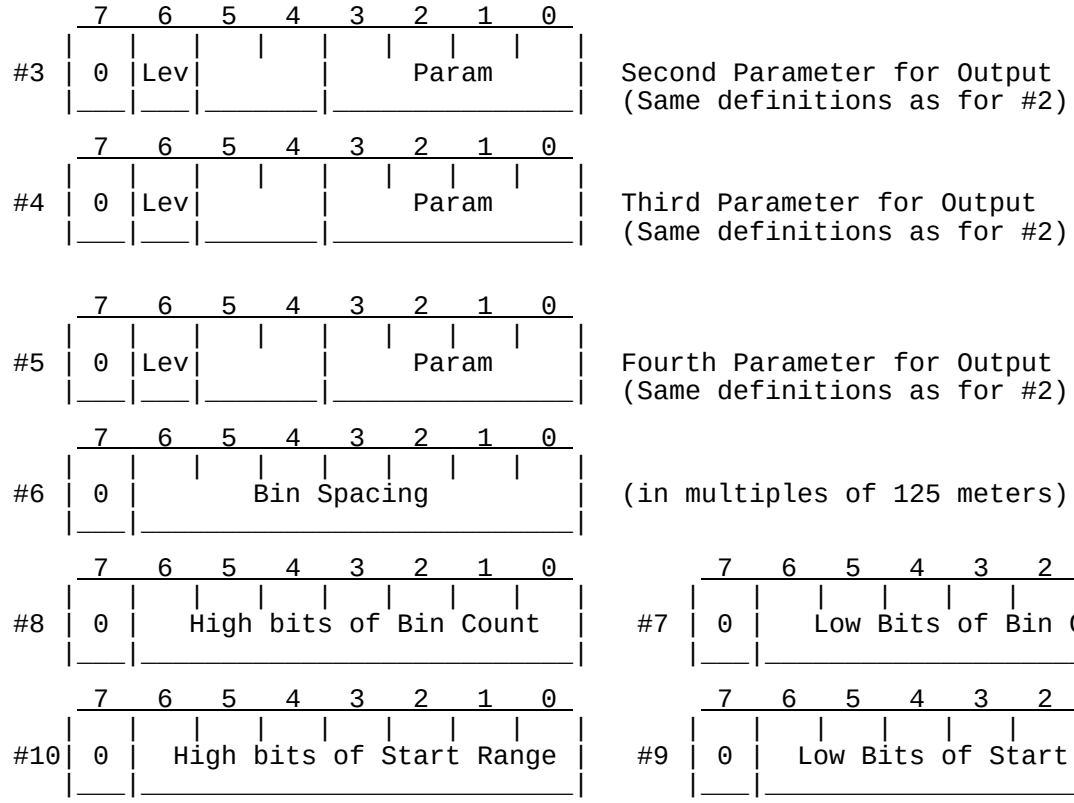
	Host Setup	Command Request	Corrected Value
Bin Count	200	150	150
Start Range	10km	0.0km	10km
Bin Spacing	1km	0.5km	1km



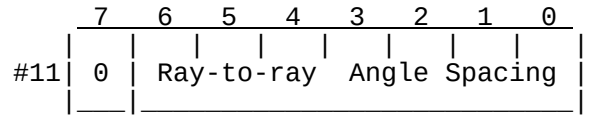
Lev — Levelize the parameter to 4-bits according to the most recent Load Levelization Info command (LDLEV). Otherwise, output the full 8-bit data.

Param — Selects the type of data for output

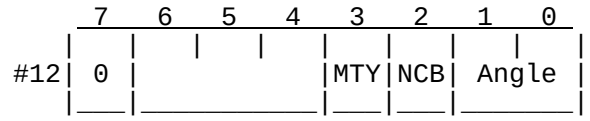
0 : None
1 : Uncorrected Reflectivity
2 : Corrected Reflectivity
3 : Velocity
4 : Width
5 : Differential Reflectivity (ZDR)
6 : KDP
7 : PHIdp
8 : RhoHV



The Start Range is specified in multiples of 125 meters.



The desired ray-to-ray angle spacing is specified in multiples of 0.1 degree. If this value is set to zero, every ray processed by the RVP7 is sent on the serial line. If the serial line bandwidth cannot handle this, the RVP7 discards intervening rays, and sends only the rays that become available when the serial output buffer is free. This may result in somewhat erratic ray spacing, so to compensate, the data rate can be reduced in a controlled way by choosing a non-zero angle spacing. The RVP7 then attempts to output rays uniformly spaced at this reduced angular resolution.



Angle — Determines which angles are reported in bytes 3–6 of the parameter data packets.

00 : Angle at the start of the ray

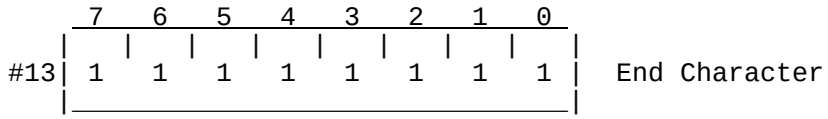
01 : Angle at the end of the ray

10 : Midpoint angle

NCB — This bit tells the RVP7 not to correct back the values that are supplied in the SOUTP command. The requested start range and bin spacing are used exactly as

specified, and RVP7 data is interpolated to that grid as best as possible. The requested bin count is honored as long as the total number of bytes in each parameter data packet does not exceed 1024. The NCB bit should be set when the real time display wants to keep a fixed display format, regardless of what the RVP7 and host computer are actually doing.

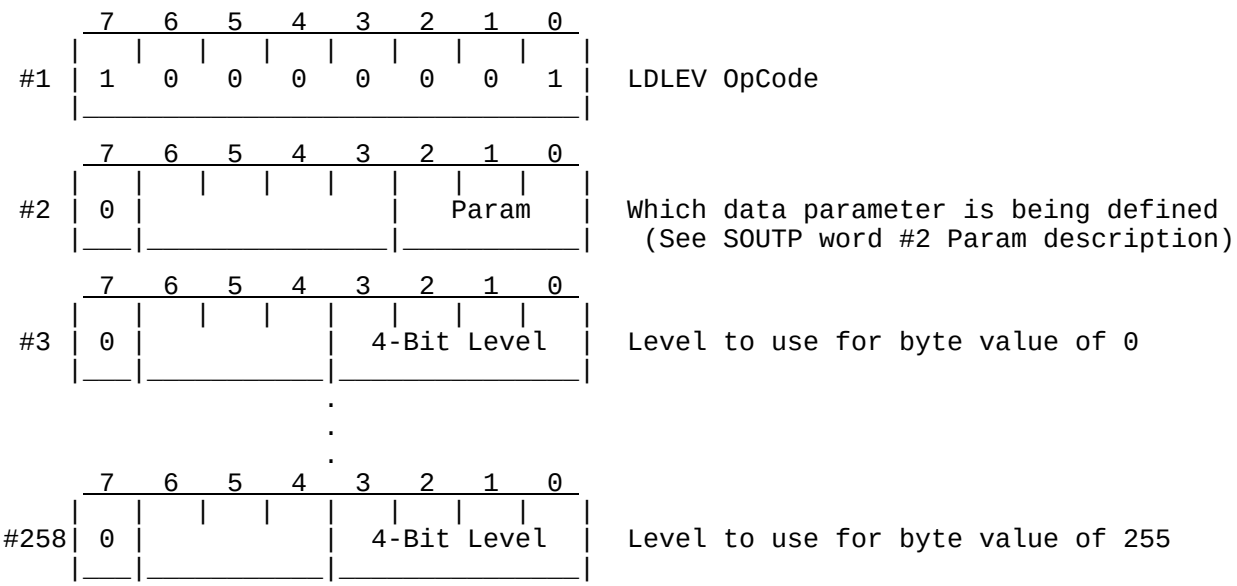
MTY When this bit is set, parameter data packets are output every time the RVP7 acquires a new ray, even if no parameters have been chosen for output (or equivalently, if none of the chosen parameters are available for output). This is useful if the real time display wants to track the angle information but does not need or want the current data.



B.1.2 Load Levelization Info Command (LDLEV)

This command defines a conversion table from 8-bit bytes to 4-bit nibbles. A separate table exists for each of the defined data parameters. Until this command is issued, a default mapping is used in which zero maps to zero, and the remaining byte space is mapped into 15 sections spanning 17 counts apiece.

Byte Values	Level
0	0
1 – 17	1
18 – 34	2
...	...
239 – 255	15



	7	6	5	4	3	2	1	0	
#259	1	1	1	1	1	1	1	1	End Character

B.1.3 GPARM Request (RQGPRM)

This command requests that the RVP7 format and output a GPARM information packet at its earliest convenience.

	7	6	5	4	3	2	1	0	
#1	1	0	0	0	0	0	1	0	RQGPRM OpCode

	7	6	5	4	3	2	1	0	
#2	1	1	1	1	1	1	1	1	End Character

B.1.4 Sample Noise Levels (RTNOISE)

This command requests that the RVP7 resample the "LOG", "I", and "Q" A/D converter noise levels. Processing is interrupted for one or two seconds while the new values are sampled. This command will only be processed if the RVP7 is running as a stand-alone real time display, i.e., the host computer, if any, has not performed any I/O with the RVP7 since powerup.

	7	6	5	4	3	2	1	0	
#1	1	0	0	0	0	0	1	1	RTNOISE OpCode

	7	6	5	4	3	2	1	0	
#2	1	1	1	1	1	1	1	1	End Character

B.2 Serial Data Output by the RVP7

All of the serial data output by the RVP7 occupy the full eight bits of each transmitted byte. This makes for the most efficient use of the serial line bandwidth. However, the simple MSB sync scheme used for command input cannot be carried over. Instead, each output packet begins with a SYNC byte (16Hex) followed by a packet ID byte. The 8-bit contents then follow, up until the next SYNC-ID pair which begins the next packet. In this way, the beginning of a packet can always be detected, even if there are transmission errors or momentary losses of synchronization. Note that there is no need for an end-of-packet character.

To complete the picture, any data byte having a value of 16Hex is transmitted as two SYNC's in succession. Thus, the SYNC character can only appear at the head of a new packet or as a pair within a packet to represent a single 16Hex byte. This must be kept in mind when interpreting the byte layouts which follow — the diagrams show the data formats after all SYNC pairs have been converted to single 16Hex bytes.

Output packets may be sent in any order and at any time. Generally, most of the serial bandwidth is occupied with parameter data packets. However, other packets may be introduced in response to commands on the serial line or in response to changes made by the host computer.

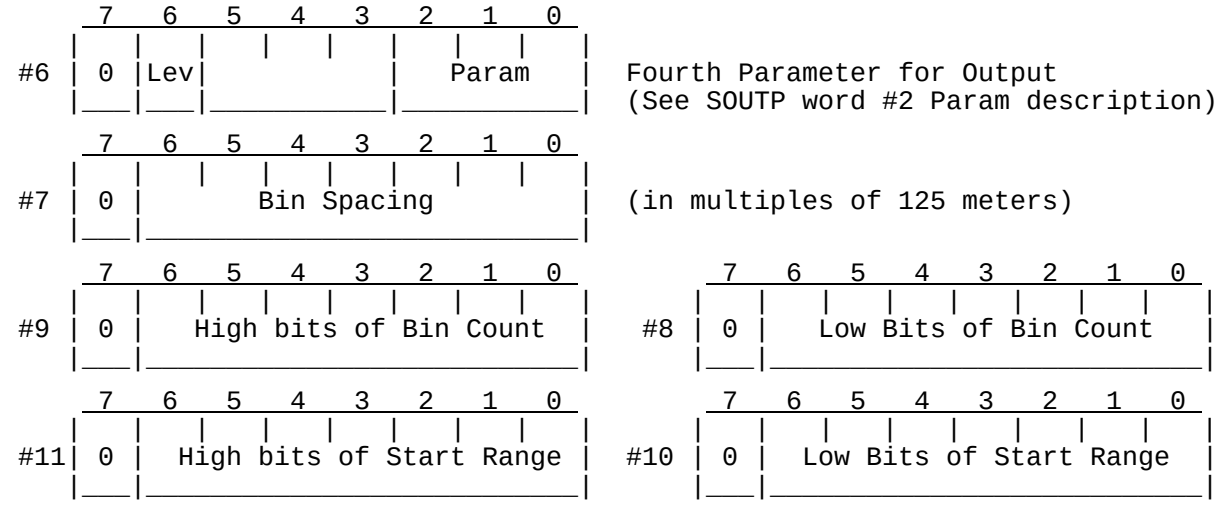
B.2.1 Parameter Description Packet

This packet describes the contents of the parameter data packets, and is sent by the RVP7 whenever there is any change in the format or interpretation of those packets. It is always sent after a SOUTP command or after any host computer transaction that alters the range mask or the type of data being collected.

	7	6	5	4	3	2	1	0	
#1	0	0	0	1	0	1	1	0	SYNC Byte
#2	0	0	0	0	0	0	0	1	Parameter Description Packet ID

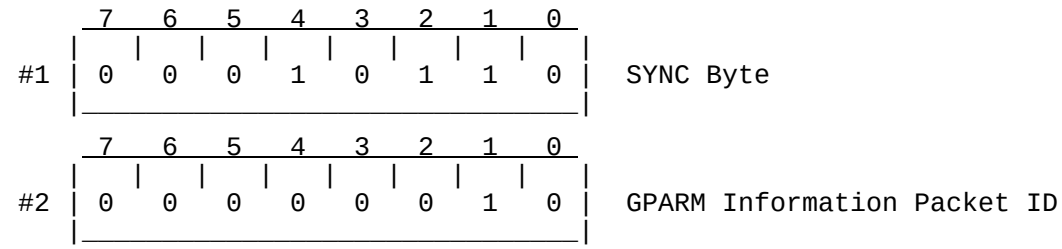
The next nine bytes are corrected back copies of the requested values from the last SOUTP command. See Section B.1.1 for a description of the bit fields.

	7	6	5	4	3	2	1	0	
#3	0	Lev			Param				First Parameter for Output (See SOUTP word #2 Param description)
#4	0	Lev			Param				Second Parameter for Output (See SOUTP word #2 Param description)
#5	0	Lev			Param				Third Parameter for Output (See SOUTP word #2 Param description)

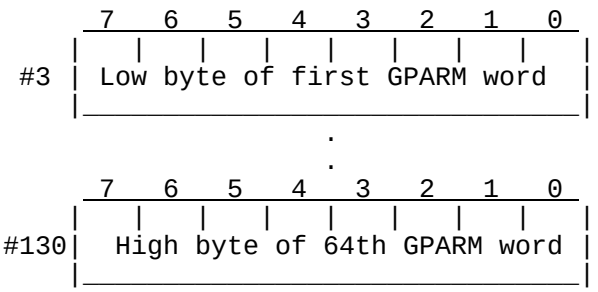


B.2.2 GPARM Information Packet

This packet contains the current 64-word RVP7 GPARM array (See Section 6.9). It is output in response to a RQGPRM serial command. The GPARM array defines many parameters that may be useful to the operation of a real time display.

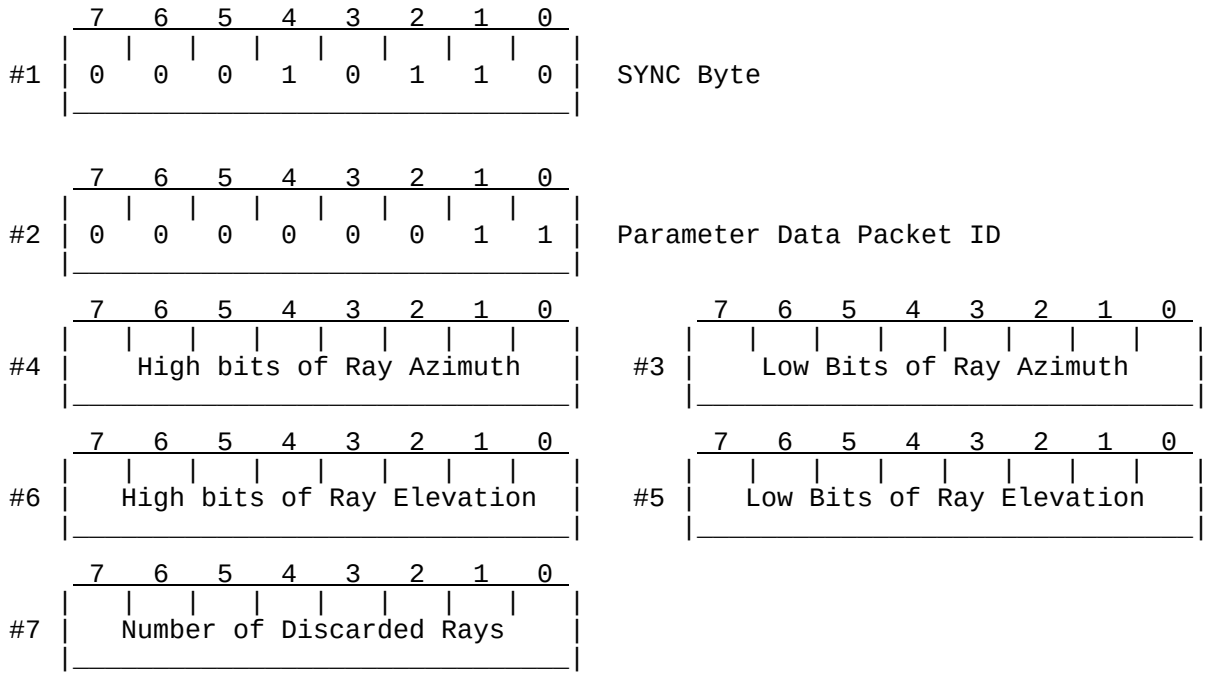


The following 128-bytes comprise the 64-word GPARM array.

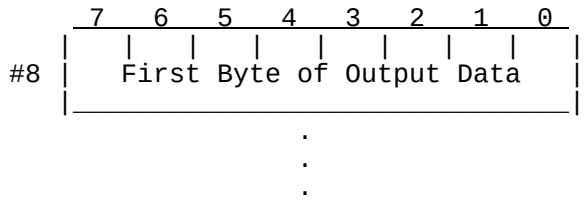


B.2.3 Parameter Data Packet

This packet contains an actual ray of real time display data. The packet is sent whenever the RVP7 acquires data for the host computer, and some subset of that data is desired by the real time display. If the MTY bit was set in Word #12 of the last SOUTP command, this packet is sent even if no subset of the internal data are output. The parameter data packet holds only the antenna angles and the processed data; all other information (that does not change from ray to ray) is available in other packets.



The real time serial stream is made by evesdropping on the rays that are acquired and processed for the host computer. There is a possibility that the serial stream cannot keep up with the host computer data rate. In that case, some rays are discarded, and the count is contained in this byte. By checking this value, the display device can get an idea of whether its desired angular resolution is matched to the scan resolution of the host computer.



The remainder of the packet consists of the data themselves — all of the bytes or packed nibbles for the first chosen parameter, then those for the second, third, and fourth parameters. If there are an odd number of range bins, the final nibble of a levelized parameter is padded with another four bits. This way each data set always begins on a byte boundary.