TNG-4 Streaming Protocol

Original Protocol:

From TNG-4:
Separator Byte: AAh (10101010) alternating with 55h (01010101).
Analog Channel 1 (8-bits)
Analog Channel 2
Analog Channel 3
Analog Channel 4
Analog Channel 5
Analog Channel 6
Analog Channel 7
Analog Channel 8
B-Port Digital Data
C-Port Digital Data
D-Port Digital Data

[19.2k baud data rate. 12 bytes/packet. Therefore, 160 packets/second (maximum).]

To TNG-4:
Separator Byte: A5h (10100101) alternating with 5Ah (01011010).

Attribute Byte:

7	6	5	4	3	2	1	0
D4	D3	D2	D1	0	D	C	B

If B-bit =1: "B" (42h)
            B-Port Configuration Byte (bit = 1 for input, 0 for output)
            B-Port Output Data (masked by configuration byte)

If C-bit=1: "C" (43h)
            C-Port Configuration Byte
            C-Port Output Data

If D-bit=1: "D" (44h)
            D-Port Configuration Byte
            D-Port Output Data

Port C bit 0 = test switch (input)
Port C bit 1 = DAC enable line (output)
Port C bit 3 = SPI clock (output)
Port C bit 4 = SPI data in (input)
Port C bit 5 = SPI data out (output)
Port C bit 6 = RS-232 data out (output)
Port C bit 7 = RS-232 data in (input)

If (D1 or D2 or D3 or D4 = 1): "A" (41h)

If (D1 = 1):	DAC Channel 1 Value
If (D2 = 1):	DAC Channel 2 Value
If (D3 = 1):	DAC Channel 3 Value
If (D4 = 1):	DAC Channel 4 Value

Only sections with new data are sent as per the attribute byte. The minimum packet size is two bytes. The maximum packet size is 16 bytes.

The maximum rate that one digital port could be changed is (19.2k baud=1920 bytes per second / 5 bytes = 384 Hz). Similarly, the maximum rate that one DAC channel could be changed would be 480 Hz. All four DAC channels can be updated at 274 Hz.

New TNG-4 SPI Streaming-mode Protocol:

This protocol replaces all the current SPI protocols and is **not** backwards-compatible with previous SPI protocols.

1. The attribute byte (2nd byte) of the streaming protocol is modified such that the currently unused bit would be used to signify that SPI information is part of the packet, thusly:

7	6	5	4	3	2	1	0
D4	D3	D2	D1	S	D	C	B

Attribute Byte: S=1 if SPI information is attached; otherwise = 0.

2. If S-bit=1: "S" (53h) followed by an SPI flag byte and 1-7 SPI data bytes. The SPI Flag Byte = 0 if no SPI data follows; otherwise:

7	6	5	4	3	2	1	0
R/W	S2	S1	S0	CM	D2	D1	D0

R/W: This bit = 0 when data is output only.
        This bit = 1 when reading data.

S2-S0: These bits specify which SPI enable line to use.
        000 = Port C bit 2
        001 = Port D bit 7
        010 = Port D bit 6
        011 = Port D bit 5
        100 = Port D bit 4
        101 = Port D bit 3
        110 = Port D bit 2
        111 = Port D bit 1

CM: This bit=ON causes a reinterpretation of the SPI flag byte. No SPI data is sent, and the next byte in the stack is expected to be another SPI flag byte (or 0).

With CM=1 The SPI flag byte is interpreted as:

7	6	5	4	3	2	1	0
SMP	CKE	---	CKP	1	---	SSPM1	SSPM0

SMP = SSPSTAT:SMP bit for PIC with same meaning.
 0 = Input sampled at end of output (default).
 1 = Input sampled in middle of output bit.

CKE = SSPSTAT:CKE bit for PIC with same meaning.
 0 = Data output on leading edge of clock.
 1 = Data output on trailing edge of clock (default).

CKP = SSPCON:CKP bit for PIC with same meaning.
 0 = Clock normally low (default).
 1 = Clock normally high.

SSPM1 and SSPM0 set the clock rate.
 00=FOSC/4 (1MHz, default)
 01=FOSC/16 (250kHz).
 10=FOSC/64 (62.5kHz).
 11=undefined (don't do it!).

This command redefines SPI operations until the next SPI configuration byte is received or TNG-4 is power-cycled.

Please note that the DAC is an SPI device and that changes to SPI function may adversely affect the operation of the built-in DAC.

D2-D0: These bits specify the number of data bytes to send/receive (1-7). If D2-D0 = 7 the next byte in the sequence will be interpreted as the number of SPI bytes to send and/or receive. If the byte is 0, no bytes are sent. Do not exceed 31 bytes!

This protocol will support MAX3100/3110 operations if you do the initialization yourself, and send two bytes where the first byte is always 080h.

3. When requesting that SPI-data be read back, after the normal outgoing data stream completes transmission and SPI data is being sent, TNG-4 will send a 0FFh byte instead of the separator character. SPI data will be returned in the same form and order that it was requested including the SPI-flag bytes.

The following is an example:

From computer: A5 08 53 92 xx yy

This says send an SPI message. The message is two bytes (xx and yy) using Port D bit 7 as the enable line and which should return SPI data.

From TNG-4:   AA a1 a2 a3 a4 a5 a6 a7 a8 bd cd dd ED e0 e1 e2 e3 FF 92 xx yy

This message is the usual 8 analog channels (a1-a8) and digital I/O ports (bd, cd, and dd) followed by extended resolution A/D data bytes and the returned SPI data.