Blockette 54 and 61.

[54] Response (Coefficients) Blockette

Name:	**Response (Poles & Zeros) Blockette**
Blockette Type:	**054**
Control Header:	**Station**
Field Station Volume:	**Some Response Required**
Station Oriented Network Volume:	**Some Response Required**
Event Oriented Network Volume:	**Some Response Required**

This blockette is usually used only for finite impulse response (FIR) filter stages. You can express Laplace transforms this way, but you should use the Response (Poles & Zeros) Blockettes [53] for this. You can express IIR filters this way, but you should use the Response (Poles & Zeros) Blockette [53] here, too, to avoid numerical stability problems. Usually, you will follow this blockette with a Decimation Blockette [57] and a Sensitivity/Gain Blockette [58] to complete the definition of the filter stage.

This blockette is the only blockette that might overflow the maximum allowed value of 9,999 characters. If there are more coefficients than fit in one record, list as many as will fit in the first occurrence of this blockette (the counts of Number of numerators and Number of denominators would then be set to the number included, not the total number). In the next record, put the remaining number. Be sure to write and read these blockettes in sequence, and be sure that the first few fields of both records are identical. Reading (and writing) programs have to be able to work with both blockettes as one after reading (or before writing). In July 2007, the FDSN adopted a convention that requires the coefficients to be listed in forward time order. As a reference, minimum-phase filters (which are asymmetric) should be written with the largest values near the beginning of the coefficient list.

Sample of an asymetrical FIR filter (Quanterra F96CM), with coefficients listed in forward time order:

Blockette 57

Notes for fields:

1 Standard blockette type identification number.

2 Length of the entire blockette, including the 7 bytes in fields 1 and 2.

3 The stage that is being decimated.

4 The incoming sample rate, in samples per second.

5 The decimation factor. When this number of samples are read in, one final sample comes out. Calculate the output sample rate by dividing field 4 by the decimation factor.

6 This field determines which sample is chosen for use. Make the value of this field greater than or equal to zero, but less than the decimation factor. If you pick the first sample, set this field to zero. If you pick the second sample, set it to 1, and so forth.

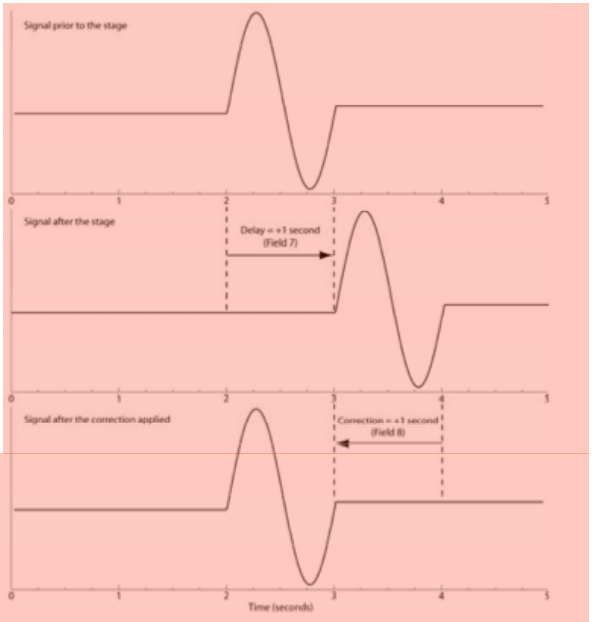

Illustration of stage delay (field 7) and correction applied (field 8).

7 The estimated pure delay for the stage. This value will almost always be positive to indicate a delayed signal. Due to the difficulty in estimating the pure delay of a stage and because dispersion is neglected this value should be considered nominal. Normally the delay would be corrected by the recording system and the correction applied would be specified in field 8. In most cases field 7 and field 8 should be the same or very similar.

8 The time shift applied to correct for the delay at this stage. This field uses a sign convention opposite that of field 7: a positive value indicates time advance (shift in the direction opposite of the positive delay of field 7) and a negative value indicates time delay (shift in the same direction of the positive delay of field 7). In common usage the estimated delay and correction applied are both positive to cancel each other. Refer to the schematic delay below for a graphical representation of these conventions. This correction does not account for dispersion. This field allows the user to know how much correction was used in case a more accurate correction is to be applied later. A zero here indicates no correction was applied.

Fixed Section of Data Header (48 bytes)

The data record header starts at the first byte. The next eight bytes follow the same structure as the control headers. Byte seven contains a data quality indicator character. (The eighth byte, or third field, is always an ASCII space — shown here as a "Δ"). The next ten bytes contain the station, location, and channel identity of the record. The rest of the header section is binary.

	Note	Field name	Type	Length	Mask or Flags
	1	Sequence number	D	6	"######"
	2	Data header/quality indicator	A	1	
V2.4 -		("D"|"R"|"Q"|"M")			
	3	Reserved byte ("Δ")	A	1	
	4	Station identifier code	A	5	[UN]
	5	Location identifier	A	2	[UN]
	6	Channel identifier	A	3	[UN]
V2.3 -	7	Network Code	A	2	[ULN]
	8	Record start time	B	10	
	9	Number of samples	B	2	
	10	Sample rate factor	B	2	
	11	Sample rate multiplier	B	2	
	12	Activity flags	B	1	
	13	I/O and clock flags	B	1	
	14	Data quality flags	B	1	
	15	Number of blockettes that follow	B	1	
	16	Time correction	B	4	
	17	Beginning of data	B	2	
	18	First blockette	B	2	

Notes for fields: * indicates mandatory information

1 * Data record sequence number (Format "######").

2 * "D" or "R" or "Q" or "M" — Data header/quality indicator. Previously, this field was only allowed to be "D" and was only used to indicate that this is a data header. As of SEED version 2.4 the meaning of this field has been extended to also indicate the level of quality control that has been applied to the record.

D — The state of quality control of the data is indeterminate.

R — Raw Waveform Data with no Quality Control

Q — Quality Controlled Data, some processes have been applied to the data.

M — Data center modified, time-series values have not been changed.

Band Code

The first letter specifies the general sampling rate and the response band of the instrument. (The "A" code is reserved for administrative functions such as miscellaneous state of health.)

Band code	Band type	Sample rate (Hz)	Corner period (sec)
F	...	≥ 1000 to < 5000	≥ 10 sec
G	...	≥ 1000 to < 5000	< 10 sec
D	...	≥ 250 to < 1000	< 10 sec
C	...	≥ 250 to < 1000	≥ 10 sec
E	Extremely Short Period	≥ 80 to < 250	< 10 sec
S	Short Period	≥ 10 to < 80	< 10 sec
H	High Broad Band	≥ 80 to < 250	≥ 10 sec
B	Broad Band	≥ 10 to < 80	≥ 10 sec
M	Mid Period	> 1 to < 10	
L	Long Period	≈ 1	
V	Very Long Period	≈ 0.1	
U	Ultra Long Period	≈ 0.01	
R	Extremely Long Period	≥ 0.0001 to < 0.001	
P	On the order of 0.1 to 1 day[1]	≥ 0.00001 to < 0.0001	
T	On the order of 1 to 10 days[1]	≥ 0.000001 to < 0.00001	
Q	Greater than 10 days[1]	< 0.000001	
A	Administrative Instrument Channel	variable	NA
O	Opaque Instrument Channel	variable	NA

1. These are approximate values. The sample rate should be used for the correct Band Code.