

Poles and Zeros

Why do Guralp Poles and Zeros include a negative normalization factor, my analysis package does not accept it ?

Poles and Zeros for all instruments are obtained by the frequency response of the instrument is measured using the HP spectrum analyzer and a curve is then fitted to this data. All provided Poles and Zeros are provided from actual measured data and not generated from examination of theoretical calculations.

Whilst negative normalization factors are mathematically correct and give the correct results, Guralp systems has been made aware that however, the SEED convention does not allow for this and the standard RDSEED conversion program does not handle negative normalization factors properly.

By default the system that Guralp Systems uses will produce the lowest order transfer function that fits the data, for the response of the instruments this is always with a negative normalization factor. By increasing the order of the transfer function we have been able to provide an alternative fit to the data with a positive normalization factor.

All instruments that have there frequency responses measured at Guralp system have there frequency response data held on file here.

Due to the fact that the instruments are true feedback instruments with the response being defined by the parameters in the feedback path the frequency response of instruments are within at the long period 0.1% and at the high frequency end within 2%.

Alternative Generic Poles and Zeros with Positive Normalization Factors:

360 Second CMG-3T & CMG-1T Poles and Zeros in (Hz)

| Zeros | Poles | Normalization Factor @ 1Hz |
|--------------|---------------------|-----------------------------------|
| 0 | -80.0 | A = 2304000 |
| 0 | -160.0 | |
| | -180.0 | |
| | -1.964e-3+1.964e-3j | |
| | -1.964e-3-1.964e-3j | |

120 Second CMG-3T, CMG-3ESP & CMG-1T Poles and Zeros in (Hz)

| Zeros | Poles | Normalization Factor @ 1Hz |
|--------------|-------------------|-----------------------------------|
| 0 | -80.0 | A = 2304000 |
| 0 | -160.0 | |
| | -180.0 | |
| | -0.00589+0.00589j | |

| |
|-------------------|
| -0.00589-0.00589j |
|-------------------|

100 Second CMG-3T, CMG-3ESP & CMG-1T Poles and Zeros in (Hz)

| Zeros | Poles | Normalization Factor @ 1Hz |
|-------|-------------------|----------------------------|
| 0 | -80.0 | A = 2304000 |
| 0 | -160.0 | |
| | -180.0 | |
| | -0.00707+0.00707j | |
| | -0.00707-0.00707j | |

60 Second CMG-3T, CMG-3ESP, & CMG-40T Poles and Zeros in (Hz)

| Zeros | Poles | Normalization Factor @ 1Hz |
|-------|---------------------|----------------------------|
| 0 | -80.0 | A = 2304000 |
| 0 | -160.0 | |
| | -180.0 | |
| | -11.78e-3+11.78e-3j | |
| | -11.78e-3-11.78e-3j | |

30 Second CMG-3T, CMG-3ESP & CMG-40T Poles and Zeros in (Hz)

| Zeros | Poles | Normalization Factor @ 1Hz |
|-------|---------------------|----------------------------|
| 0 | -80.0 | A = 2304000 |
| 0 | -160.0 | |
| | -180.0 | |
| | -23.65e-3+23.65e-3j | |
| | -23.65e-3-23.65e-3j | |

1 Second to 100 Hz , CMG-40T Poles and Zeros in (Hz)

| Zeros | Poles | Normalization Factor @ 5Hz |
|-------|-------------------|----------------------------|
| 0 | -75 | A = 585800000 |
| 0 | -350 | |
| | -707e-3+707e-3j | |
| | -707e-3-707e-3j | |
| | -62.3816+135.392j | |
| | -62.3816-135.392j | |

DC to 100 Hz , CMG-5T / CMG-5TD / CMG-5TB Poles and Zeros in (Hz)

| Zeros | Poles | Normalization Factor @ 1Hz |
|--------------|---------------|-----------------------------------|
| | -755.89 | A = 1.939e9 |
| | -209.65 | |
| | -63.79-90.38j | |
| | -63.79+90.38j | |

For all other response options please contact support@guralp.com

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