



Technical Note

Gen 5/Optima: Setup and Optimization

The following document describes the available settings of the Gen 5/Optima amplifier (sections 1 and 2) and how to optimize these settings for a given application (section 3).

1. GLOBAL SETTINGS

Digital Outputs – There are three selections for the USB digital output units. The choices are metric, English or bits. If the units are English or metric the data is *fully conditioned* (recommended, see details below). If bits are selected the data is not conditioned (this is not recommended for typical operation)

Analog Outputs – The analog output full scale range is ± 5 volts. The two conditioning selections are *Fully Conditioned* and *MSA 6 Compatible*. *Fully conditioned* is the recommended choice, with all Gen 5 signal conditioning features enabled. The Optima's analog output **MUST** be *Fully conditioned*.

Fully Conditioned

In the fully conditioned mode, the platform's calibration matrix is automatically applied to the signal; therefore crosstalk corrections and sensitivities are handled by the Gen5/Optima. The fully conditioned mode also accounts for voltage drop along the length of the cable and uses actual excitation and gains determined through calibration of the amplifier, not simply nominal values, to perform computations.

The Gen5/Optima allows you to define the working range (*Amplifier Range*) of each channel by adjusting the individual *Excitation* voltages, *Gains*, and *Zero Setpoints* until the *Amplifier Range* is appropriate for your application (see **Configuring the Gen 5/Optima for Optimal Mechanical Range**).

In the fully conditioned mode, you can also optimize the *Analog Outputs* (if using) to match your *Amplifier Range* by adjusting the *Analog Sensitivities* (see **Optimizing the Analog Outputs (fully conditioned mode)** below). In this mode converting the output voltage (± 5 V) to the chosen engineering units (N/Nm or lb/in-lb) is accomplished by simply dividing each channel's analog output (mV) by its user-defined *Analog Sensitivity*. This is the only computation required since the Gen5/Optima has automatically applied the calibration matrix and accounted for the selected, *Gain*, *Excitation* voltage and *Zero Setpoints*.

When using the digital output, the signal is already converted to the chosen engineering units (N/Nm or lb/inlb) and will fall within the *Amplifier Range*. *Analog Outputs* and *Analog Sensitivities* are irrelevant.

MSA 6 Compatible (Gen 5 only)

The *MSA 6 Compatible* choice was developed for people familiar with the AMTI MSA 6 amplifier who wish to use the Gen 5 in the same way (not available for Optima users). When running in *MSA 6 Compatible* mode the Gen 5 analog output range is ± 5 V. Individual excitation voltages, gain amplifications, and zero setpoints can be adjusted to define the working range of the force sensor (*Amplifier Range*). However, the calibration matrix is not automatically applied, nor are the amplifier's calibrated gains and excitations, and voltage drop along the cable is not accounted for. The user must apply this conditioning manually.

2. AMPLIFIER CONFIGURATION SETTINGS

Amplifier Range - The *Amplifier Range* is the full-scale output range available for all digital and analog output under the current configuration. Maximum and minimum values are displayed for each channel. These values are functions of the Gen 5/Optima electrical output range and the selected channel excitations, gains and setpoints. The range will update automatically if the settings are changed in the *Current Configuration* group of the dialog box and the *Apply* button has been pressed. The *Amplifier Range* should be optimized for the range of forces expected during the application being tested (see **Configuring the Gen 5 for Optimal Mechanical Range**)

Analog Outputs – The values listed in *Analog outputs* depend on output mode. If the analog output mode is set to *MSA 6 compatible* the *Analog Outputs* will not be visible and the output range will not be adjustable and will be identical to the *Amplifier Range*.

For *fully conditioned* analog outputs (recommended) the ranges are determined by the *Analog Sensitivities*. The *Analog Sensitivities* determine the output millivolts per unit of mechanical load for each channel. To exploit the full *Amplifier Range* while maximizing resolution, the *Analog Sensitivities* should be adjusted until the *Analog Outputs* closely match the *Amplifier Range* (see **Optimizing the Gen 5/Optima**).

3. OPTIMIZING THE GEN 5/OPTIMA

Configuring the Gen 5/Optima for Optimal Mechanical Range

For best results the Gen 5/Optima signal conditioner should be setup to achieve both the highest possible signal to noise ratio and maximum system resolution. This is accomplished by independently configuring each channel. The three adjustable configuration settings that affect the measurement range are excitation voltage, amplifier gain, and zero set point.

To achieve the best signal to noise ratio you want the Gen 5/Optima to output the largest possible excitation voltage. This will normally be 10 volts; except for the most thermally variable conditions. Under those conditions a lower excitation might be required to minimize thermal drift.

To achieve the best system resolution, apply the largest gain setting available where the Gen 5/Optima measurement range is greater than the expected application range. By strategically utilizing the Gen 5/Optima *Zero Setpoint* feature to offset the Gen 5/Optima measurement range, a higher gain than normal can occasionally be accomplished.

| | Fx | Fy | Fz | Mx | My | Mz | |
|-----------------|---------|---------|----------|----------|----------|----------|-----|
| | lbs. | lbs. | lbs. | in-lbs | in-lbs | in-lbs | |
| Amplifier Range | 162.69 | 163.28 | 1287.38 | 6486.06 | 5158.78 | 2726.49 | Max |
| | -162.69 | -163.28 | -1287.38 | -6486.06 | -5158.78 | -2726.49 | Min |

| | Fx | Fy | Fz | Mx | My | Mz | |
|---------------|------|------|------|------|------|------|---------|
| Excitation | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | Volts |
| Gain | 2000 | 2000 | 1000 | 1000 | 1000 | 1000 | |
| Zero Setpoint | 0 | 0 | 0 | 0 | 0 | 0 | Percent |

The figure above shows the portion of the *Amplifier Configuration* dialog box used for configuring measurement range. You can access this window through NetForce under *Setup, Hardware installation, Modify*, and then by clicking on the *Configure* button next to the list of installed amplifiers.

Each channel's *Amplifier Range* is a function of the excitation, gain, and zero set point selection displayed in the combo boxes below it. To modify the amplifier ranges simply choose your selections and then press *Apply*. Pressing *Apply* will download the new setting to the signal conditioner and update the *Amplifier Range* on the display. Press *Save* in the main *AMTI System Configuration* window to save these setting to the amplifier for future use.

To optimally configure the Gen 5/Optima, start with an initial excitation setting of 10, a gain of 500, and a zero set point of 0. If the amplifier range is greater than the expected applied load range increase the gain to next level and continue to do so until you discover the largest gain you can apply and still encompass the expected applied load range for that channel. You will get a better signal to noise ratio using 10 V of excitation, rather than a lower excitation and higher gain.

Optimizing the Analog Outputs (fully conditioned mode)

If you are using the analog output from the Gen 5/Optima, after the optimal *Amplifier Range* has been defined, the *Analog Outputs* should be optimized. This option is only present in the *fully conditioned* mode. The *Analog Outputs* are dependent on the user-defined *Analog Sensitivities*. To modify the *Analog Outputs*, change the *Analog Sensitivity* for the corresponding channel and press Apply. The display will update to indicate the new *Analog Output* range.

The screenshot shows the AMTI Amplifier Configuration window for SN: 2055. The window is divided into two main sections: Configuration Information and Current Configuration.

Configuration Information:

| | Fx lbs. | Fy lbs. | Fz lbs. | Mx in-lbs | My in-lbs | Mz in-lbs | |
|-------------------|------------|------------|------------|--------------|--------------|--------------|-----|
| Platform Capacity | 1000.00 | 1000.00 | 2000.00 | 23600.00 | 15700.00 | 11800.00 | |
| Amplifier Range | 325.61 | 326.69 | 1289.45 | 6489.38 | 5132.40 | 2707.79 | Max |
| | -325.61 | -326.69 | -1289.45 | -6489.38 | -5132.40 | -2707.79 | Min |
| Analog Outputs | 333.33 | 333.33 | 1282.05 | 6250.00 | 5000.00 | 2777.78 | Max |
| | -333.33 | -333.33 | -1282.05 | -6250.00 | -5000.00 | -2777.78 | Min |

Current Configuration:

Optimization: Force Platform Single Load Cell Cable length: 30.00 Feet

| | Fx | Fy | Fz | Mx | My | Mz | |
|---------------------|---------|---------|--------|------------|------------|------------|-------------|
| Excitation | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | Volts |
| Gain | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | |
| Zero Setpoint | 0 | 0 | 0 | 0 | 0 | 0 | Percent |
| | mV/lb | mV/lb | mV/lb | mV/(in-lb) | mV/(in-lb) | mV/(in-lb) | |
| Analog Scale Factor | 15.0000 | 15.0000 | 3.9000 | 0.8000 | 1.0000 | 1.8000 | Conditioned |

Buttons: Calibration, Apply All, Apply, OK

To optimize the *Analog Outputs*, adjust the *Analog Sensitivities* until the *Analog Outputs* match the *Amplifier Range* relatively closely. If the *Analog Outputs* range is much smaller than the *Amplifier Range* you will not be able to reach the highest capacity indicated in your *Amplifier Range*. If your *Analog Outputs* range is much larger than the *Amplifier Range*, you are not using the full output voltage range of the amplifier; therefore you will have less resolution.

Make sure that you hit *Apply* before closing the Amplifier Configuration window, and then press *Save* in the *AMTI System Configuration* window. *Apply* will allow you to see the computations based on the current settings, and *save* will save these settings to the Gen 5/Optima for future use. If you do not click *save* then next time the amplifier is powered on the last saved settings will be used.

In the fully conditioned mode you simply need to divide the output voltage (mV) by the Analog Sensitivity you defined for each channel to convert your signal into engineering units (N/Nm or lb/in-lb)