1. Introduction

The Axia80-M50 is capable of measuring a wide range of force and torque combined loads without saturating due to its proprietary electronics and patent-pending instrumentation method. The purpose of this technical brief is to explain the determination of maximum possible complex loading before saturation will occur for both measurement ranges.

2. Axia80-M50 Rated Measurement Ranges

	Fxy (N)	Fz (N)	Txy (Nm)	Tz (Nm)
Measurement Range 0	**1200**	**2000**	**50**	**50**
Measurement Range 1	**480**	**800**	**20**	**20**

3. Determining Sensor Saturation

Section 4 of this document contains equations for determining if a given load will saturate the sensor.

Section 5 contains graphs which represent the same information as the equations in graphical form.

3.1: Example determination of sensor saturation by equation and graph methods

For this example, the goal is to determine if the sensor will saturate given the following applied loads and measurement range:

- Fxy = 850N
- Fz = 2000N
- Txy = 9Nm
- Tz = 50Nm
- Measurement Range 0 is used

Method 1: Graph Method

Looking at the Fxy/Tz graph for Measurement Range 1, it can be seen that the intersection of the 850N Fxy and 50Nm Tz applied loads lies on the 50% saturation line. Likewise, the Fz/Txy graph for Measurement Range 1 shows that the intersection of 2000N Fz and 9Nm Txy applied loads lies on the 60% saturation line. Combining the 50% saturation from the Fxy/Tz forces and the 60% saturation from the Fz/Txy forces, we find that the sensor is 110% saturated for this combined loading scenario. For any loading scenario where the combined saturation percent is greater than 100%, the sensor can saturate. As such, the sensor is saturated for the given load and all forces and torques read by the sensor will be invalid until the load is changed so that the sensor is no longer saturated.

Method 2: Equation Method

Simply plugging the applied force/torque values into the proper strain equation given in section 4 allows us another means to check for saturation. Plugging in the forces and torques, we get:

$$Saturation\ percent = 850 * 0.0247 + 2000 * 0.0237 + 9 * 1.4300 + 50 * .5782$$

$$Saturation\ percent = 110.2\%$$

This result again shows that the sensor will saturate and fail to report accurate forces/torques as the total saturation percent is greater than 100%.

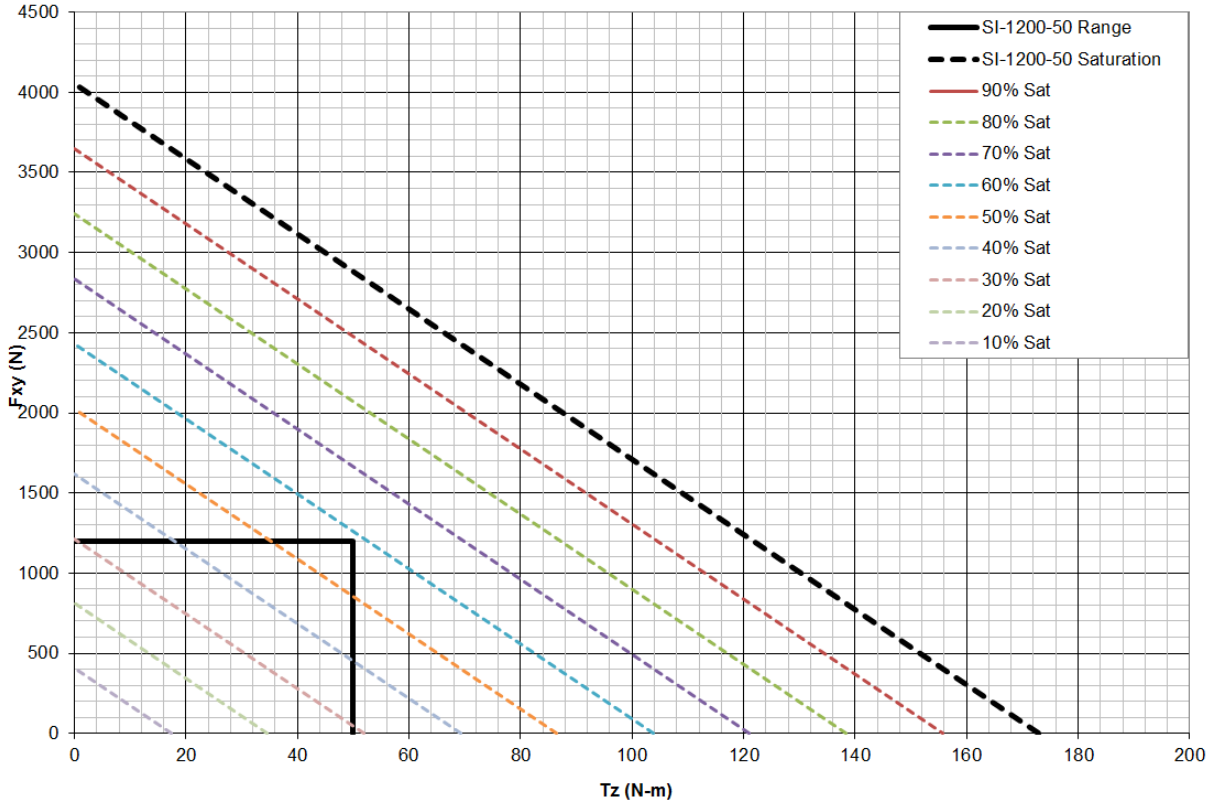
4. Equation to determine sensor saturation

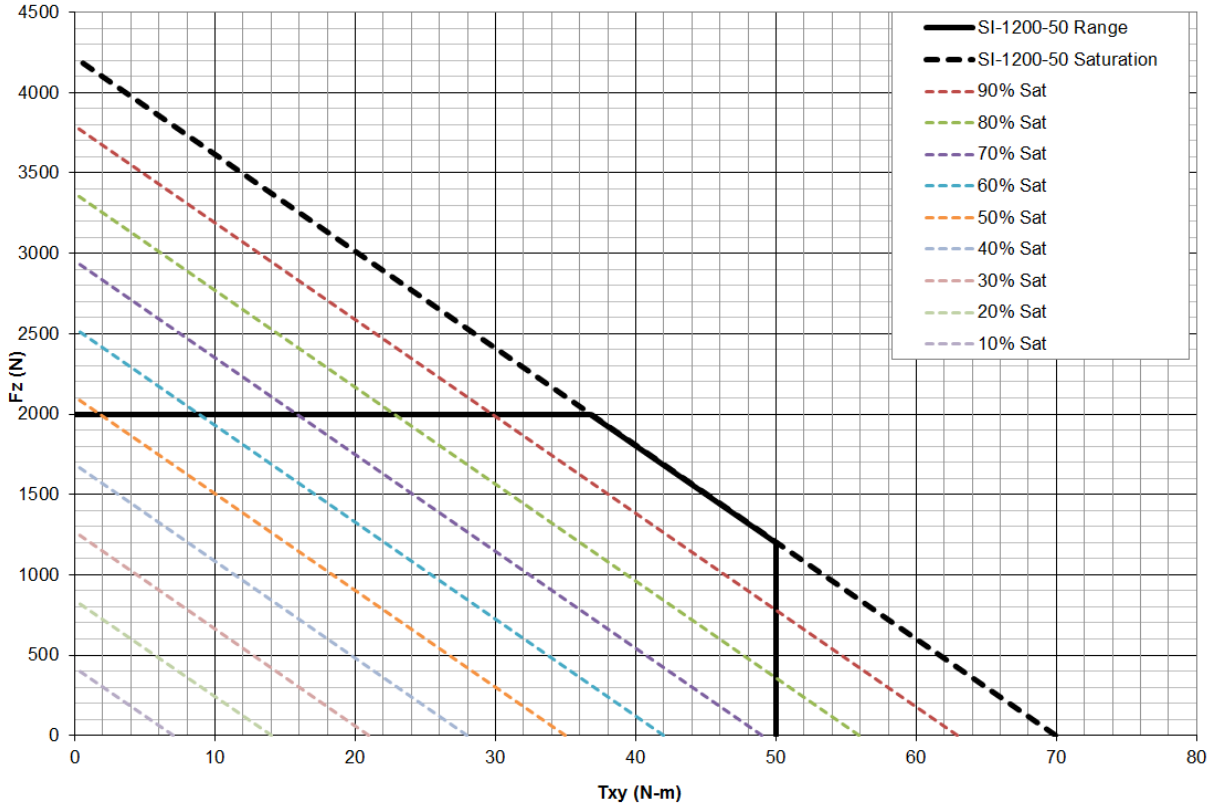
For this equation, the sensor can saturate and fail to report accurate forces and torques when the saturation percent exceeds 100%.

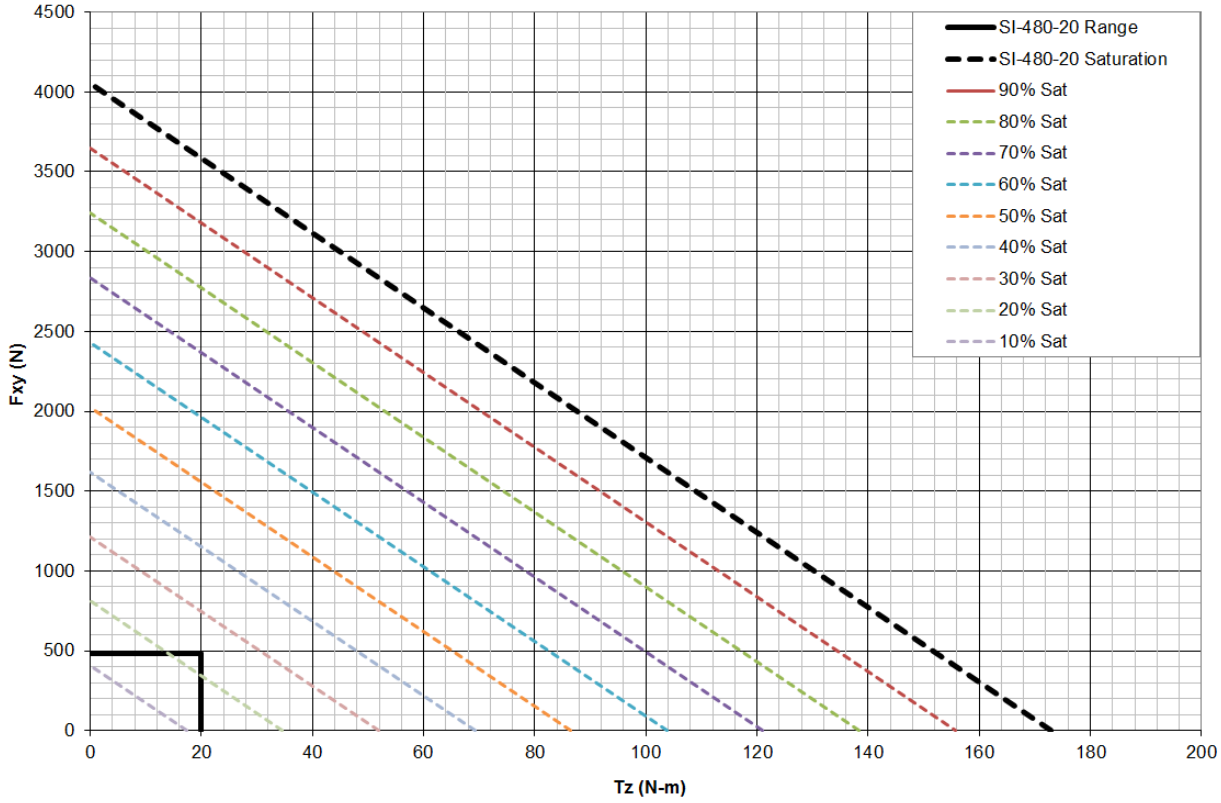
Measurement range 0 and 1:

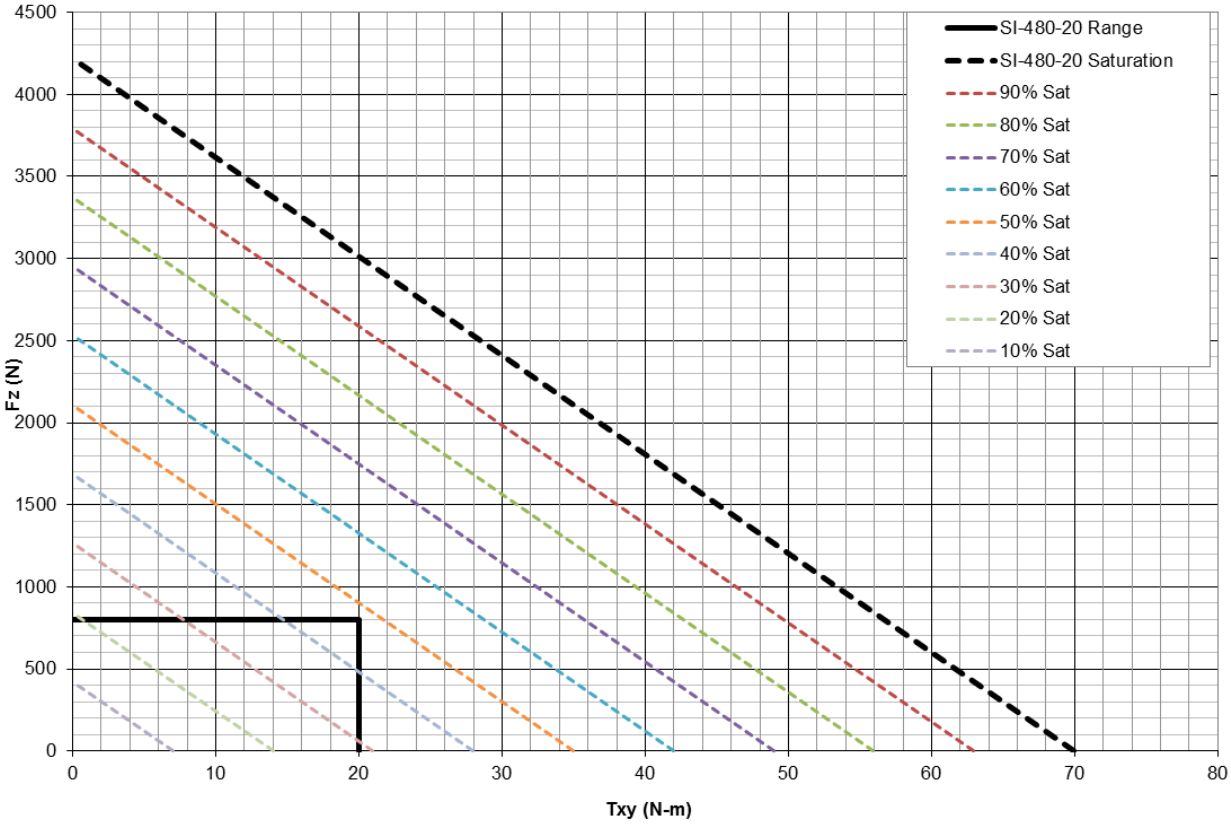
$$Saturation\ percent = Fxy * 0.0247 + Fz * 0.0237 + Txy * 1.4300 + Tz * .5782$$

5. Complex Loading Graphs






SI-480-20 Range
SI-480-20 Saturation
90% Sat
80% Sat
70% Sat
60% Sat
50% Sat
40% Sat
30% Sat
20% Sat
10% Sat
Fxy (N)
Tz (N-m)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
0
20
40
60
80
100
120
140
160
180
200


SI-480-20 Range
SI-480-20 Saturation
90% Sat
80% Sat
70% Sat
60% Sat
50% Sat
40% Sat
30% Sat
20% Sat
10% Sat
Fz (N)
Txy (N-m)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
0
10
20
30
40
50
60
70
80