Application for Drive Technology

applications
& TOOLS

MICROMASTER 4

Application Description

Load torque monitoring

SIEMENS

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2 Description

This function monitors the transmission of force between a motor and driven load within a defined frequency range. Typical applications include, for example, detecting when a transmission belt breaks or detecting when a conveyor belt is in an overload condition.

For the load torque monitoring, the actual frequency/torque actual value is compared to a programmed frequency/torque characteristic (refer to P2182 – P2190). Depending on P2181, the system monitors whether the permissible torque curve is either exceeded or fallen below. If the actual value lies outside the tolerance bandwidth, then after the delay time P2192 has expired, either alarm A0952 is output or fault F0452.

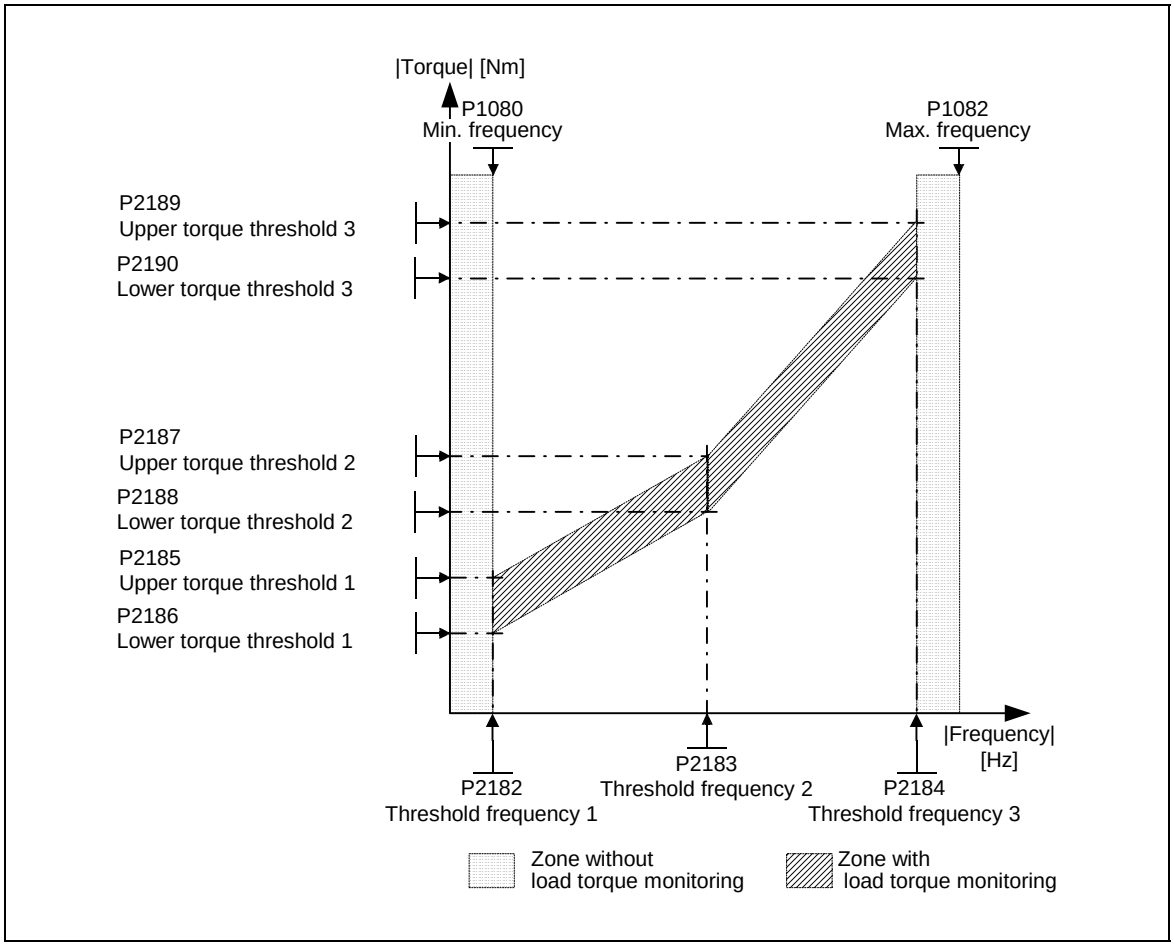

Fig. 2-1 Load torque monitoring

3 Note

- The "load torque monitoring" function is only active within the frequencies defined in parameters P2182 and P2184.
- Independent of the "load torque monitoring" function, all of the limits and protective functions of the MICROMASTER 4 drive inverter remain active. These include, for example, thermal motor protection, min./max. output frequency, max. output current etc.

Load torque monitoring

4 Important parameter settings

Parameter value	Designation	Note / comments
P2181 = ?	P2181: Load torque monitoring Possible settings: 0 function de-activated 1 alarm: Actual frequency/torque too low 2 alarm: Actual frequency/torque too high 3 alarm: Actual frequency/torque too low or too high 4 fault: Actual frequency/torque too low 5 fault: Actual frequency/torque too high 6 fault: Actual frequency/torque too low or too high	Application-specific! Using this parameter, the function is either activated/de-activated, the ranges to be monitored defined and the response defined.
P2182 =	P2182; frequency threshold 1	Application-specific!
P2183 =	P2183; frequency threshold 2	Application-specific!
P2184 =	P2184; frequency threshold 3	Application-specific!
P2185 =	P2185: Upper torque - threshold value 1	Application-specific!
P2186 =	P2186: Lower torque - threshold value 1	Application-specific!
P2187 =	P2187: Upper torque - threshold value 2	Application-specific!
P2188 =	P2188: Lower torque - threshold value 2	Application-specific!
P2189 =	P2189: Upper torque - threshold value 3	Application-specific!
P2190 =	P2190: Lower torque - threshold value 3	Application-specific!
P2192 =	P2192: Delay time, load torque monitoring.	Application-specific! We recommend that P2192 > P1120.

5 Commissioning steps

1. In order to define the position of the tolerance bandwidth, different characteristics must be determined as a function of the required load torque monitoring (P2181). A differentiation can be made between the following cases:

   a) **P2181=1/4**:
   Load torque monitoring to detect a broken belt, i.e. under fault conditions, the actual load torque is below the permissible tolerance bandwidth. In this case, the load torque characteristic with minimum permissible load should be determined.

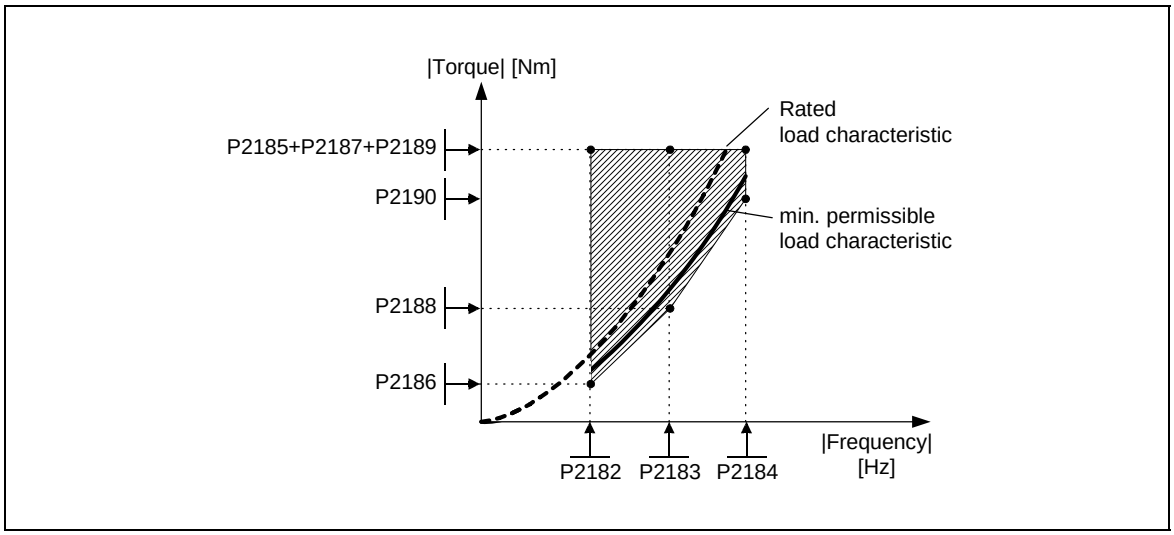

Fig. 5-1 Load torque monitoring with min. permissible load characteristic

   b) **P2181= 2/5:**
   Load torque monitoring as anti-stall protection. This means that when a fault occurs, the actual load torque is above the permissible tolerance bandwidth. In this case, the load torque characteristic with maximum permissible load should be determined.

Load torque monitoring

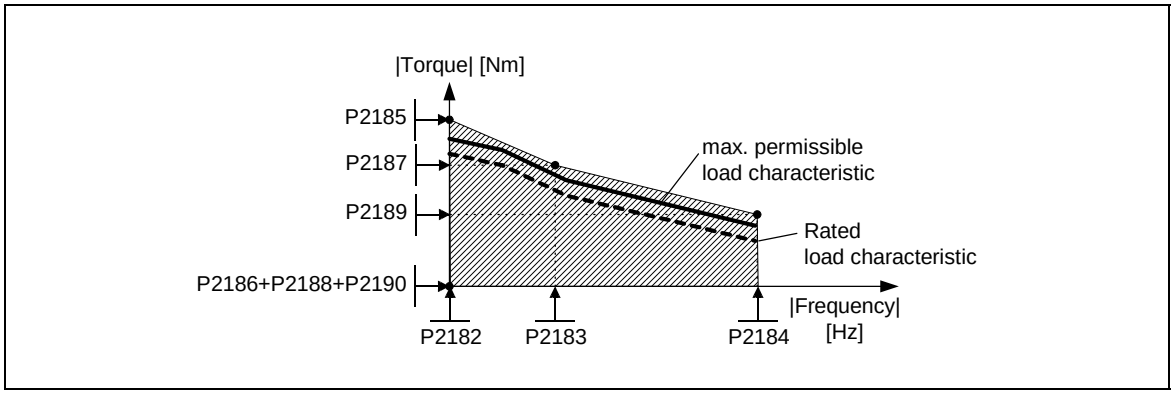

Fig. 5-2 Load torque monitoring with max. permissible load characteristic

c) **P2181= 3/6:**
Load torque monitoring to detect whether the drive is blocked (stalled) or a transmission belt has broken. This means that when a fault occurs, the load torque is either above or below the permissible tolerance bandwidth. In this case, the load torque characteristic with the minimum and maximum permissible load should be determined.

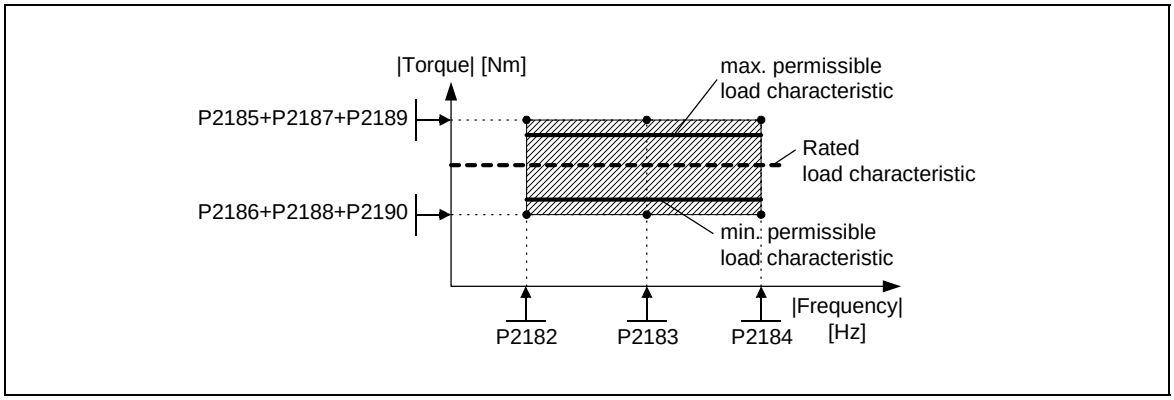

Fig. 5-3 Load torque monitoring with min. and max. permissible load characteristic

Load torque monitoring

2. The permissible load torque characteristic must be determined in the operating range of the plant or system. This characteristic can be determined as follows:

   a) Theoretical determination

      In this case, the prerequisite is that the load torque characteristic in the operating range must first be known. Frequently, this is not the case in practice. Especially changing mechanical effects involve investigations that require considerable time and costs if they are to be forecast in advance.

   b) Practical determination

      The load torque characteristic is directly determined at the plant/system using a "teach-in technique". In this case, the operating range is passed-through step-by-step and the value pair comprising the actual output frequency r0021 and actual torque r0031 are read-out in the steady-state condition. If necessary, this should be carried-out for both directions of rotation.

3. The position of the tolerance bandwidth (P2182-P2190) is determined by defining the 3 points along the characteristic.

4. In order to prevent the torque monitoring responding unnecessarily, dynamic states should be suppressed using delay time P2192. As a rule of thumb, P2192 should be > P1120.

Load torque monitoring

Note:

- The load torque monitoring is active in all 4 quadrants!
- If it is not possible to determine the min. or max. load torque characteristic at the drive in operation, then the load torque characteristic should be determined for operation at rated load. By taking into account the tolerances, the max. or min. permissible load characteristic can be calculated (e.g. the max. load characteristic is obtained from the 120% rated load characteristic).
- Independent of the setting of P2181 the two valves for the upper and lower torque threshold value for the frequency threshold must be parameterized. It is important to ensure that the upper torque threshold value is **greater** than the lower torque threshold value.
- If only a specific frequency range is to be monitored, then it is sufficient to plot the load characteristic between the frequency thresholds of the envelope curve (P2182, P2184).
- If the drive is only permitted to have one direction of rotation, then the load characteristic should only be determined for the permissible direction of rotation.
- The load characteristic and/or envelope curve determined should be represented in a frequency-torque diagram, e.g. using Microsoft Excel

6 Excel working folder

The Excel working folder provided in the zip file "Load torque monitoring.zip" is used to support commissioning the "load torque monitoring" function. In the sheets, the permissible torque characteristic is determined either by making measurements or by calculating it. The optimum points along the characteristic (P2182-P2190) can then be determined. The permissible torque characteristic and the programmed tolerance bandwidth are shown in common diagrams for comparison purposes. The optimum parameter values can be found by repeatedly entering the 3 points along the characteristic (interpolation points).