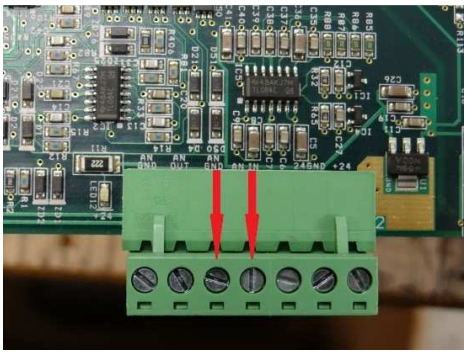
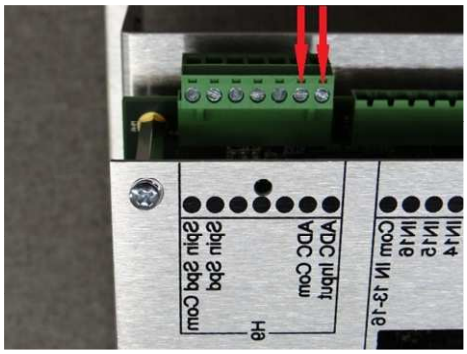
TB296 (Rev1) – Setting up Spindle Load Meter in CNC11

Purpose:
The CNC11 software now has the capability of having a visual representation of the load that is being exerted on the spindle motor. This tech bulletin will explain how to set it up. This can be implemented on any CNC11 system running CNC11 v3.14 or newer. If the system has a PLC board that does not have an analog input section, such as the GPIO4D or RTK4, then an additional ADD4AD4DA board will be needed in the system and the PLC program will need to be customized for the additional board.

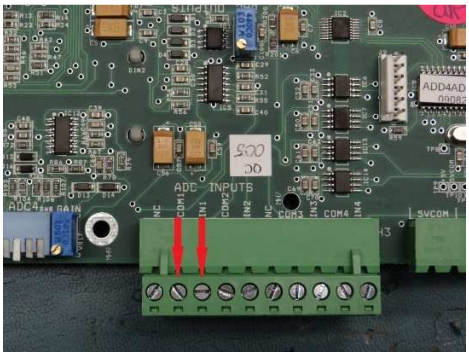
Requirements:
Spindle inverter, **V**ariable **F**requency **D**rive, capable of supplying an analog output voltage that is represented by the amount of torque or commanded current to the spindle motor
Spindle inverter manual
CNC11 system running v3.14 or newer
ALLIN1DC, OAK board, or ADD4AD4DA

Connections:
There are 2 connections that need to be connected on the Centroid component. The analog input, typically designated by AN IN on the OAK board, ADC Input on the ALLIN1DC, or IN1 – IN4 on the ADD4AD4DA board, and the analog input common, typically designated by AN GND on the OAK board, ADC Com on the ALLIN1DC, or COM1 – COM4 on the ADD4AD4DA board as shown in the photos below.


OAK Board



ALLIN1DC



ADD4AD4DA

Inverter Setup:
The setup for the inverter to supply an analog output signal that is directly related to the torque being commanded of the spindle motor varies between inverters and the manual should always be used to determine the pins that need to be connected as well as the parameters that need to be set. Some inverters may also require additional jumper or switch settings to be set accordingly. Please refer to the inverter's manual for the terminal designation, parameter and jumper/switch settings, as well as steps to take to program the inverter. Below are some inverters that have been setup by Centroid.

DuraPulse GS3

Connections

Pin AO connects to analog input on the Centroid component
Pin ACM connects to the analog input common on the Centroid component

Parameters

Set parameter 4.11 to 1

Delta VFD-VE

Connections

Pin AFM connects to analog input on the Centroid component
Pin ACM connects to the analog input common on the Centroid component

Parameters

Set parameter 03-18 to 4

Switch Settings

Set switch SW3 to 0-10V

PLC Logic:
Verify that the following is defined in the PLC program. **Note** – The input and word definitions may vary depending on the component that is being used to read the analog torque voltage from the inverter as well as what is already being defined in the PLC program

Input Definitions

AnalogInput1 IS INP241
AnalogInput2 IS INP257
AnalogInput3 IS INP273
AnalogInput4 IS INP289
AnalogInput5 IS INP305

Word Definitions

XMeterADC_W IS W14
YMeterADC_W IS W15
ZMeterADC_W IS W16
AMeterADC_W IS W17
SpindleMeterADC_W IS W20

Main Stage

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IF true THEN BTW XMeterADC_W AnalogInput1 16,
              BTW YMeterADC_W AnalogInput2 16,
              BTW ZMeterADC_W AnalogInput3 16,
              BTW AMeterADC_W AnalogInput4 16,
              BTW SpindleMeterADC_W AnalogInput5 16

IF XMeterADC_W > 32767 THEN XMeterADC_W = XMeterADC_W – 65536
IF YMeterADC_W > 32767 THEN YMeterADC_W = YMeterADC_W – 65536
IF ZMeterADC_W > 32767 THEN ZMeterADC_W = ZMeterADC_W – 65536
IF AMeterADC_W > 32767 THEN AMeterADC_W = AMeterADC_W – 65536
IF SpindleMeterADC_W > 32767 THEN SpindleMeterADC_W = SpindleMeterADC_W – 65536

; TODO: Pre-compute constants in initial stage
; The Delta drives put out +/-8V at max torque
; The spindle is +/-10V
IF true THEN XMeterADC_W = (100 * XMeterADC_W) / 1638,
              YMeterADC_W = (100 * YMeterADC_W) / 1638,
              ZMeterADC_W = (100 * ZMeterADC_W) / 1638,
              AMeterADC_W = (100 * AMeterADC_W) / 1638,
              SpindleMeterADC_W = (100 * SpindleMeterADC_W) / 2048

IF true THEN SV_METER_1 = abs(XMeterADC_W),
              SV_METER_2 = abs(YMeterADC_W),
              SV_METER_3 = abs(ZMeterADC_W),
              SV_METER_4 = abs(AMeterADC_W),
              SV_METER_6 = abs(SpindleMeterADC_W)
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CNC11 Parameters:
Verify that parameters 35, 57, 137, 143, and 313 are set correctly.

Parameter 35
This parameter tells the CNC11 software which axis set as the spindle axis. By default, it should be set to 6.

Parameter 57
This is bit based parameter that tells the CNC11 software which axes to turn the load meters on for.

Axis	1	2	3	4	5	6	7	8
Bit	0	1	2	3	4	5	6	7
Value	1	2	4	8	16	32	64	128

For example, we have a 3-axis system with a spindle in which it is desired to see the load meters of all the axes as well as the spindle. Therefore, bits 0, 1, 2, and 5 would be set. That means that parameter 57 would be a value of 1+2+4+32 = 39.

Parameter 137
This parameter tells the CNC11 software how many samples to use when calculating the average output for the load meter display. By default, it should be set to 0 but if the load meter jumps around a lot with it set to 0, this parameter can be adjusted to minimize the amount of “jumpiness” of the load meter display.

Parameter 143
This is another bit based parameter that controls the display of the axis load meters. By default, it should be set to 11 which enables the load meters as well as the Distance to Go DRO and provides an outline for the load meters.

Parameter 313
This parameter tells the CNC11 software which encoder input to look at for the 6th axis, which happens to be the spindle axis that was set by parameter 35. By default, it should be set to 6.

Document History
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