

# Setting up the Cascadia Motion Inverters For AVID AF Motors

**Revision 1.2**

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## 1. Introduction

This document describes the multiple types of AVID motors. It also describes the process to set up the motor type.

Currently, following AVID motors are supported:

1. AF-140 12T PM Motor
2. AF-140 4T
3. AF-140 3T with 1X Resolver
4. AF-140 3T with 3X Resolver
5. AF-130 3T
6. AF-230 6T / AF-130 6T
7. AF-130 3T with 5X Resolver
8. AF-130 6T with 5X Resolver
9. AF-130 5T
10. AF-140 4T ½ Stack
11. AF-140 6T
12. AF-125 4T
13. AF-132-2
14. AF-125 3T
15. AF-130 4T

## 2. Setting the ‘Motor Type’

The controller firmware has the ability to drive several different motor types. The user must tell the controller what type of motor it is to be used with.

There are currently two different firmwares available for the PM and RM Family Controllers. Group 1 firmware is used for motor types 0 thru 59. Group 2 firmware is used for motor types 60 and above. The controller must be loaded with the proper Group firmware to access the desired motor type. The firmware is available from the Cascadia Motion web site, [www.cascadiamotion.com](http://www.cascadiamotion.com). Changing which motor the inverter is configured for is done via the Motor\_Type\_EEPROM parameter. Refer to the manual, PM/RM Family Software Manual for more information on programming EEPROM parameters.

For AVID motors, the following motor types are used:

Model	Motor Type	Resolver Poles	Firmware Version
<b>Group 1</b>			
AF-140 12T	6	2	< 1900
AF-140 4T	16	2	< 1900
AF-140 3T 1X Resolver	17	2	< 1900
AF-130 3T	18	2	< 1900
AF-230 6T / AF-130 6T	19	2	< 1900
AF-140 3T 3X Resolver	23	6	19AE
AF-130 3T 5X Resolver	26	10	< 1900
AF-130 6T 5X Resolver	27	10	< 1900
AF-130 5T	30	2	< 1900
AF-140 4T ½ Stack	32	2	< 1900
AF-140 6T	35	2	< 1900
AF-125 4T	50	2	< 1900
<b>Group 2</b>			
AF-132-2	62	2	1903
AF-125-3	90	2	1953
AF130 4T	105	2	1969

The firmware version column in the above table indicates at which firmware version the motor type was included in the firmware.

When you set the motor type via the GUI it will automatically adjust some default parameters. However, there are several additional parameters that should be reviewed and adjusted if desired.

### 3. Resolver Connections

The motor contains a resolver (position sensor). The resolver of the motor must be connected to the proper inputs on the controllers.

Signal	Avid Pin	PM100/PM150	PM250	RM100
Ref+ (EXC)	1	J2-17	J1-A	28
Ref- (/EXC)	2	J2-3	J1-B	17
COS+ (COS)	3	J2-4	J1-E	18
COS- (/COS)	4	J2-12	J1-F	30
SIN+ (SIN)	5	J2-11	J1-C	19
SIN- (/SIN)	6	J2-18	J1-D	31

## 4. EEPROM Setup

When you set the motor type via the GUI it will automatically adjust some default parameters. However, there are several additional parameters that should be reviewed and adjusted if desired.

EEPROM Parameter	Description
Veh_Flux_EEPROM_(Wb)_x_1000	This is the back EMF (flux) constant for the motor. It will automatically default to the correct value when the motor type is changed. There is no need to change this.
IQ_Limit_EEPROM_(Amps)_x_10	<p>This parameter sets the maximum value of the torque producing current that can be commanded.</p> <p>The amount of allowable current is dependent on the motor type and the controller type.</p> <p>The current is set in peak Amps times 10. For example, 300 A<sub>rms</sub> = 4250.</p>
ID_Limit_EEPROM_(Amps)_x_10	This parameter sets the maximum amount of field weakening current.
Mtr_OverTemp_Limit_EEPROM_(C)_x_10	This parameter sets the motor over-temperature fault limit. It is set in degrees C times 10. Thus for 150°C it would be set to 1500. It would be wise to set this parameter so that if a cooling system failure occurs it would fault immediately.
Motor_Overspeed_EEPROM_(RPM)	This parameter sets the speed at which an over-speed fault will be generated. It should be set based on the needs of the vehicle system for over-speed protection.
Max_Speed_EEPROM_(RPM)	This parameter sets the maximum speed that the controller will command.
Break_Speed_EEPROM_(RPM)	The Break Speed is the speed at which the torque capability of the motor starts to decrease due to lack of voltage from the motor controller. This value should be set based on information from either CM or motor manufacturer on the performance of the motor with the particular battery voltage being used.
Motor_Torque_Limit_EEPROM_(Nm)_x_10	This sets the maximum torque command when operating in VSM mode.

## 5. Recommended Settings

Motor	Inverter	Battery	Vehicle Flux	IQ Limit	ID Limit	Motor Over-speed	Break Speed	Torque Limit (Motor/Regen)
		Volts	Weber	A (pk)	A (pk)	RPM	RPM	N.m.
AF140-3 Type 17 Type 23	PM100DX	320	*	495	100	2,500	4,500	490
AF130-3 Type 18	PM100DX	320	*	495	250	8,500	4,500	297
AF125-3 Type 90	PM100DX	320	*	495	250	12,000	4,500	200
	PM100DXR PM150DX			636	250			250
AF130-4 Type 105	PM100X PM150DX	320	*	440	250	8,500	3,400	350

When first setting up a motor it is recommended that the ID Limit be set to zero. When field weakening is activated by setting the ID Limit greater than zero the motor can produce unexpected torque at higher speeds. It is not recommended to run the motor without load with the ID Limit above zero.

## 6. Motor Temperature Sensors

The AVID Motors have two temperature sensors. Both sensors are RTD PT100 type.

This type of sensor requires a special type of conditioning circuit. It cannot be read by Analog Input #2 as is normally used with most motors.

The inverters comes with two PT100 inputs. On older Gen2 (G2) units the PT100 inputs are called RTD4 and RTD5. On newer Gen3 (G3, newer PM100, PM150, and PM250) units there are only two RTD inputs and they can be configured for either PT100 or PT1000 depending on the application. For the AVID motors the Gen3 RTD inputs must be set for PT100. This is done by setting the RTD\_Selection\_EEPROM\_(BITS\_1\_0) = 3.

In both Gen2 and Gen3 the pins on the connector to be used are the same.

Signal	Avid Pin #	PM100/PM150	PM250	RM100
Front Stator RTD	7	J1-5	J1-G	32
Front Stator RTD Return	8	J1-17	J1-H	20
Rear Stator RTD	9	J1-6	J1-R	21
Rear Stator RTD Return	10	J1-19	J1-S	22

## Revision History

Version	Description of Versions / Changes	Responsible Party	Date
0.1	Initial version	Chris Brune	5/24/2011
0.2	Added new motor type, EVO AF-130 5T	Azam Khan	6/3/2011
0.3	Added new motor type, EVO AF-140 4T ½ Stack	Azam Khan	8/3/2011
0.4	Added new motor type, EVO AF-140 6T	Azam Khan	10/31/2011
0.5	Added new motor type, EVO AF-125 4T	Chris Brune	11/15/2012
0.6	Added information about the temperature sensor	Chris Brune	3/5/2013
0.7	Added new motor type, EVO AF132-2	Chris Brune	8/5/2013
0.8	Added new motor type, AF125-3	Chris Brune	7/24/2015
0.9	Added new motor type AF130-4	Chris Brune	2/8/2016
1.0	Added settings info on AF130-3 motor	Chris Brune	10/25/2017
1.1	Added motor type 23, AF140-3 with 3X resolver. Corrected minor formatting issues.	Chris Brune	3/6/2018
1.3	Changed header to Cascadia Motion. Changed references to AVID motors. Added more details about RTD connections. Added more details about the resolver.	Chris Brune	8/6/2019