CASCADIA MOTION

7929 SW Burns Way
Suite F
Wilsonville, OR

Phone: 503 344-5085
Fax: 503 855-4540
sales@cascadiamotion.com

Setting up the PM/RM Controller to run with Parker Motors

Revision 4.8

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sales@cascadiamotion.com

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1. Introduction

This document describes the setup of multiple types of Parker motors with the PM, RM and CM Family controllers from Cascadia Motion.

Parker produces many different types of motors. The ones of principle interest with Cascadia Motion controllers are from the GVM family. Currently, following motor variations are supported:

Motor
GVM142-100S6
GVM142-125Z6
GVM210-050F6
GVM210-050J6
GVM210-050R6
GVK210-075P6
GVM210-100D6
GVM210-100F6
GVM210-100J6
GVM210-100K6
GVM210-100M6
GVM210-100Q6
GVK210-125P6
GVM210-150G6
GVM210-150J6
GVM210-150N6
GVM210-150P6
GVM210-150R6
GVM210-150S6
GVM210-150T6
GVM210-200H6
GVM210-200Q6
GVM210-200R6
GVM210-200S6
GVM210-200T6

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GVM210-200V6
GVM210-300K6
GVM210-300P6
GVM210-300Q6
GVM210-300S6
GVM210-300T6
GVM210-400N6
GVM210-400Q6
GVM210-400R6
GVM210-400S6
GVM210-400T6
GVM210-400W6
C-GVM142-125S6
GVM142-050K6
GVM210-400V6
GVM210-200J6

There are two sets of connections between the motor and the controller, the resolver/temperature sensor and the motor power leads. Both must be done properly for the motor to operate correctly.

Refer to Figure 1 (for PM100/PM150) and Figure 2 (PM250) below for the connections between the Parker motor and the controller. A resistor must be added as shown for the temperature sensor to work properly in the PM100/150. This resistor must be 1.00K ohm, 1% tolerance. The power rating of the resistor is not critical but should be at least 1/4W. For the PM250 the resistor is included by making the jumper to the pins as shown in Figure 2. Refer to the PM100 User's Manual for more information on the controller connectors.

Note: Customers/Parker have not been consistent about the type of temperature sensor ordered with the motor. There are two types that are supported, the NTC thermistor (Omega 44008) and the PTC thermistor (KTY84). Please note that the motor type numbers are specific to a certain temperature sensor type. For the sensor to work it must match the data in the table below. Both sensors types use the same electrical wiring and same pull-up resistor.

The mating connector to the Parker Motor is Souriau part number UT0W61419SH. Various contacts can be used with this connector depending on the wire size to be used. Figure 1 shows 4 individually shielded pairs of wires. This is the best option from a shielding point of view. If necessary a single shielded cable with 4 twisted pairs could also be used. Generally we have found that connecting the resolver shield to the motor actually increases the noise in

the system. **The shield should be left disconnected inside the motor connector.**

The Souriau connector can be purchased from Cascadia Motion as part number 86-0135.

Some Parker motors have also been found to come with a 12 pin connector. Contact Cascadia Motion for more information if this is the case.

Cascadia Motion offers a customer made resolver cable that is well suited to the motor (Cascadia Motion p/n G2-0016-01). Contact Cascadia Motion for more information on this.

***** Note that Parker motors built before 1/20/2014 use a different Resolver Connector. Contact Cascadia Motion for more information.**

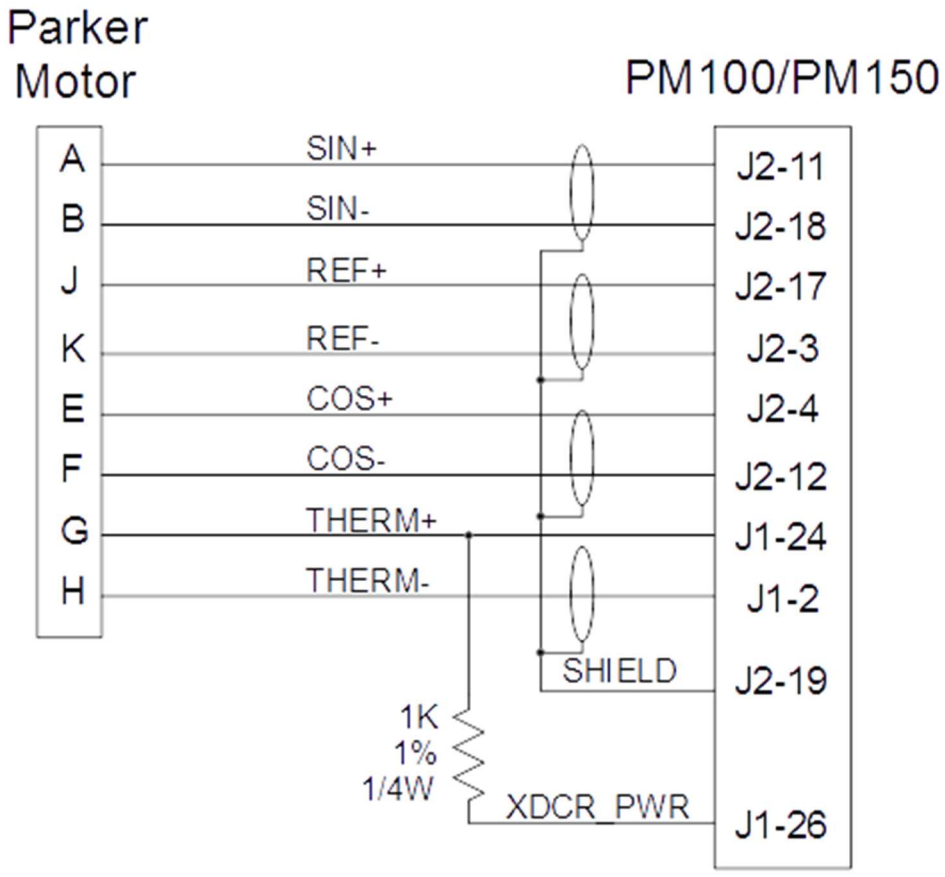

Figure 1: Resolver Connections for PM100/PM150

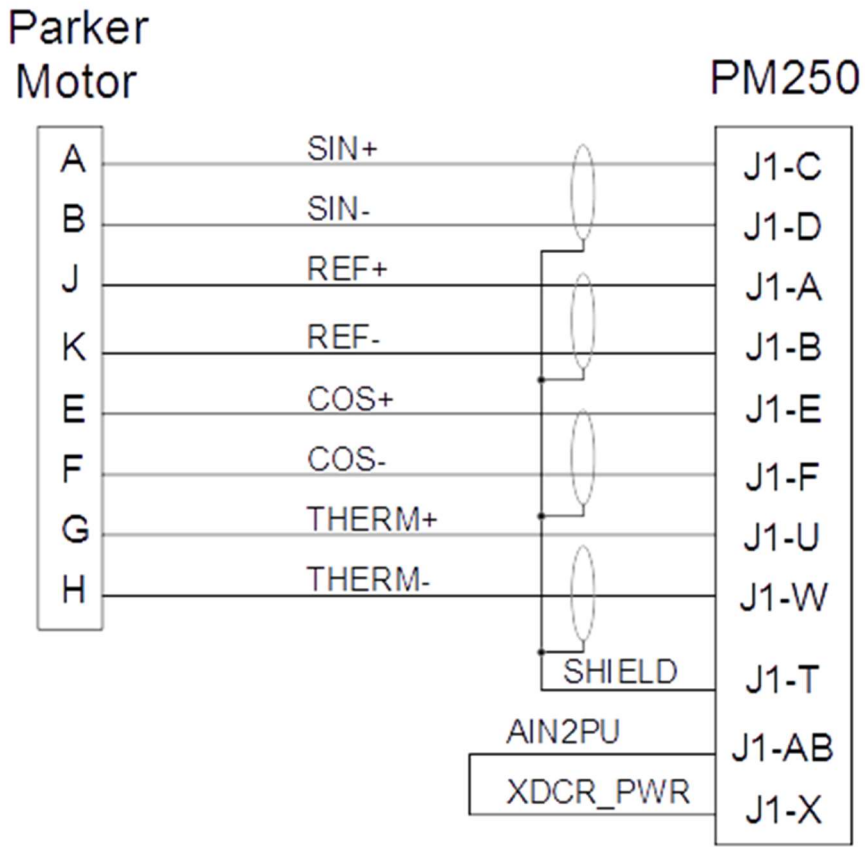

Figure 2: Resolver Connections for PM250

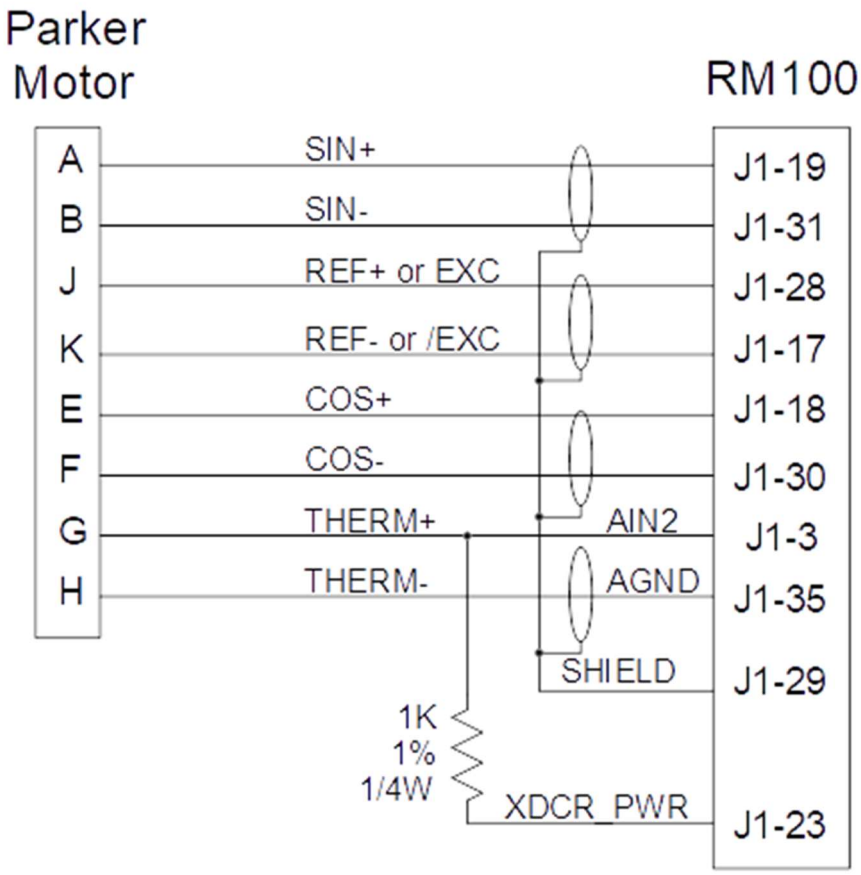

Figure 3: Resolver Connections for RM100

The motor cables must be connected in a specific order between the motor and the PM/RM controller.

The terminal box cover of the GVM motors is labels the connections as A, B, C. They are to be connected to inverter terminals A, B, C respectively on the PM Family Inverters. On the RM100 inverter A, B, C are connected to W, V, U respectively.

Following the connections scheme outlined here will result in a motor shaft that turns Clock-wise when facing the shaft for positive/forward speed.

If it desired to have the direction of rotation for positive/forward speed by changed contact Cascadia Motion for more information.

2. Setting the 'Motor Type'

The PM 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. This is done via the Motor_Type_EEPROM parameter. Refer to the Programming EEPROM Parameters using GUI manual for more information on programming EEPROM parameters. For the Parker Motors the following motor types are used:

Model	Motor Type	Temperature Sensor Type	Firmware Version
GVM210-400T6	68	Omega 44008	
GVM210-400Q6	69	Omega 44008	
GVM210-100M6	70	Omega 44008	
GVM210-150T6	74	Omega 44008	
GVM210-100K6	83	Omega 44008	20141212 SWRP 1935
GVM210-050J6	86	Omega 44008	20150423 SWRP 1945
GVM210-100J6	88	Omega 44008	20150701 SWRP 1951
GVM210-150J6	89	Omega 44008	20150701 SWRP 1951 Updated in 20191212 SWRP 2023
GVM210-150P6 *special 4 pole resolver, can't be used with standard resolver	93	KTY84	20150922 SWRP 1955
GVM210-150P6 Normal resolver	112	Omega 44008	20160429 SWRP 1974
GVM210-150P6 Normal resolver	152	KTY84	20180511 SWRP 19B4
GVM210-200Q6	94	Omega 44008	20150929 SWRP 1956
GVM210-200Q6	148	KTY84	20180122 SWRP 19AB
GVM142-100S6	98	KTY84	20151124 SWRP 1960
GVM210-150N6	99	Omega 44008	20151203 SWRP 1961
GVM210-150R6	100	KTY84	20151203 SWRP 1961
GVM210-200S6	103	Omega 44008	20160205 SWRP 1964
GVM210-100Q6	104	KTY84	20160205 SWRP 1964
GVM210-100Q6	108	Omega 44008	20160316 SWRP 1971
GVM210-300Q6	109	Omega 44008	20160324 SWRP 1972
GVM210-200H6	115	KTY84	20160720 SWRP 1981
GVM210-050R6	119	Omega 44008	20161007 SWRP 1987
GVM210-200V6	120	Omega 44008	20161015 SWRP 1988
GVM210-150G6	124	KTY84	20161031 SWRP 1991

GVM142-125Z6	127	KTY84	20161111 SWRP 1992
GVM210-200T6	133	Omega 44008	20160117 SWRP 1996
GVM210-400S6	134	Omega 44008	20160210 SWRP 1999
GVM210-300S6	136	KTY84	20170426 SWRP 19A2
GVM210-150R6	137	Omega 44008	20170515 SWRP 19A3
GVM210-100D6	138	Omega 44008	20170515 SWRP 19A3
GVM210-400N6	139	Omega 44008	20170515 SWRP 19A3
GVM210-200S6 With 2X Resolver	140	KTY84	20170707 SWRP 19A6
GVM210-200H6 With 2X Resolver	141	KTY84	20170707 SWRP 19A6
GVM210-050F6	142	Omega 44008	20170807 SWRP 19A7
GVK210-075P6	142	KTY84	Customer specific
GVK210-125P6	143	KTY84	Customer specific
GVM210-400W6	146	KTY84	20171003 SWRP 19A9
GVM210-300K6	149	KTY84	20180208 SWRP 19AD
GVM210-400R6	150	Omega 44008	20180316 SWRP 19AF
GVM210-200R6	159	Omega 44008	20180625 SWRP 19B6
C-GVM142-125S6	160	KTY84	20180911 SWRP 2015
GVM142-050K6	161	KTY84	20180911 SWRP 2015
GVM210-150S6	165	Omega 44008	20181105 SWRP 2016
GVM210-300P6	173	Omega 44008	20181220 SWRP 2017
GVM210-200H6	182	Omega 44008	20190823 SWRP 2018
GVM210-400V6	188	Omega 44008	20191114 SWRP 2022
GVM210-300T6	205	Omega 44008	20200528 SWRP 2029
GVM210-100F6	212	Omega 44008	20200710 SWRP 2033
GVM210-200J6	215	Omega 44008	20200820 SWRP 2035
GVM210-150S6	220	KTY84	20201019 SWRP 2040 * CM and Gen5 firmware version 651D for the CM200 inverters

***** Please note that motor type numbers above 60 must use the Group 2 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.

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	This parameter sets the maximum value of the torque producing current that can be commanded. The amount of allowable current is dependent on the motor type and the controller type. The current is set in peak Amps times 10. For example, 300 A_{rms} = 4250.
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 Cascadia Motion or the 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.
Regen_Torque_Limit_EEPROM_(Nm)_x_10	This sets the maximum regen torque command when operating in VSM mode.

2.1 Recommended Settings for Parameters

The table below shows the Cascadia Motion recommended settings for the parameters that are motor specific. There are many factors that may influence a decision to deviate from these settings. If there are questions about setting please contact either Cascadia Motion or Parker for more information.

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.*
GVM210-400T6 Type 68	PM100DX	320	*	495	450	4,000	2,500	450
	PM100DXR PM150DX			636	450			578
	PM100DZ	650		283	283	8,000	5,000	257
	PM150DZ			425	425			386
	PM150DZR			566	450			514
	PM250DZ			849	450			741
GVM210-400Q6 Type 69	PM100DX	320	*	495	TBD	TBD	TBD	TBD
	PM100DXR PM150DX			636	TBD			TBD
	PM100DZ	650		283	TBD	TBD	TBD	TBD
	PM150DZ			425	TBD			TBD
	PM150DZR			566	TBD			TBD
GVM210-100M6 Type 70	PM100DX PM100DXR PM150DX	320	*	479	200	8,500	4,500	200
	PM100DZ	650		283	200	10,500	9,000	125
	PM150DZ			425	200			187
	PM150DZR			479	200			200
GVM210-150T6 Type 74	PM100DX	320	*	495	450	10,500	6500	161
	PM100DXR PM150DX			636	450			207
	PM250DX			929	450			301
	PM100DZ	Not a recommended configuration, base speed is too high.						
	PM150DZ							
	PM150DZR							
GVM210-100K6 Type 83	PM100DX PM100DXR PM150DX	320	*	337	200	10,500	4,000	167
	PM100DZ	650		282			8,000	140
	PM150DZ PM150DZR			337				167
GVM210-050J6 Type 86	PM100DX	240	*	300	120	8,500	4,500	80

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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.*
GVM210-100J6 Type 88	PM100DZ	650	*	282	161	8,500	5,000	180
GVM210-150J6 Type 89	PM100DX	320	*	328	161	6,000	1,750	313
	PM100DZ	650		282			3,500	269
GVM210-150P6 Type 93 Type 112 Type 152	PM150DX	320	*	550	250	6,900	3,300	300
GVM210-200Q6 Type 94 Type 148	PM100DX	320	*	495	250	4,500	3,200	320
	PM150DZ	650		424		8,000	6,400	275
GVM142-100S6 Type 98	PM100DX	300	*	495	135	12,000	12,000	63
GVM210-150N6 Type 99	PM100DX	320	*	495	150	8,000	3,250	291
	PM150DZR	650		566			6,500	333
GVM210-150R6 Type 100 Type 137	PM150DXR	320	*	778	220	8,000	4,500	335
GVM210-200S6 Type 103 Type 140	PM100DXR PM150DX	320	*	636	400	8,000	3,700	412
GVM210-100Q6 Type 104 Type 108	PM100DXR PM150DX	320	*	601	300	8,000	6,000	195
GVM210-300Q6 Type 109	PM150DZ	650	*	424	300	8,000	4,500	409
GVM210-200H6 Type 115 Type 141 Type 182	PM100DZ PM150DZ	650	*	277	55	5,000	2,800	391
GVM210-050R6 Type 119	PM100DXR	96	*	618	300	8,000	3,700	89
GVM210-200V6 Type 120	PM100DXR PM150DX	44	*	636	400	8,000	4,500	389

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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.*
GVM210-150G6 Type 124	PM100DZ	650	*	248	100	5,700	2,700	294
GVM142-125Z6 Type 127	PM100DXR	96	*	636	400	10,000	4,500	63
GVM210-200T6 Type 133	PM100DX	320	*	495	350	8,000	4,500	219
	PM150DX PM100DXR	320	*	636	350		4,500	275
GVM210-400S6 Type 134	PM150DX	320	*	636	400	8,000	1,900	641
	PM250DZ	650		809			3,300	816
GVM210-300S6 Type 136	PM250DZ	650	*	807	400	8,000	4,800	610
GVM210-100D6 Type 138	PM150DZ	650	*	75	65	5,000	3,500	103
GVM210-400N6 Type 139	PM150DZ	650	*	424	240	4,500	2,500	669
GVM210-050F6 Type 142	PM100DZ	650	*	177	100	8,000	7,300	88
GVK210-075P6 Type 142	RM100DX	320	*	566	300	9,000	5,900	144
GVK210-125P6 Type 143	RM100DX	320	*	566	300	9,000	3,500	237
GVM210-400W6 Type 146	PM250DZ	650	*	849	400	10,000	5,800	630
GVM210-300K6 Type 149	PM100DZ	650	*	283	0	4,700	2,600	484
GVM210-400R6	PM150DX	320	*	636	300	1,700	4,250	733
GVM210-200R6 Type 159	PM150DX	320	*	636	350	7,000	3,000	420
C-GVM142-125S6 Type 160	PM100DX	340	*	495	250	9,000	9,000	97.2
GVM142-050K6 Type 161	PM100DZ	350	*	122.3	50	9,000	7,750	30.8

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.*
GVM210-150S6 Type 165 Type 220	CM200DX	320	*	849	849	10,000	5,000	321
	RM100DX	320	*	566	300	5,000	5,000	214
GVM210-300P6 Type 173	PM150DZ	600	*	424	200	8,000	3,700	462
GVM210-400V6 Type 188	PM250DZ	800	*	849	400	10,000	6,150	703
GVM210-300T6 Type 205	PM250DZ	650	*	849	450	10,000	6,800	581
GVM210-100F6 Type 212	PM100DZ RM100DZ	650	*	201	108	6,500	3,400	188
GVM210-200J6 Type 215	RM100DZ	660	*	311	100	3,000	2,800	337

* Do not change the Veh_Flux level from the default that is set when the motor type is changed.

** The motor over-speed parameters are given based on the capability of the given motor for the particular battery voltage and inverter. The Parker GVM210 motors are rated for 8,000 rpm continuous and 10,500 rpm intermittent.

*** Note that the maximum torque command shown does not indicate that the motor will actually achieve that torque. The torque number shown does not include saturation effects that will reduce the actual torque to be less than the number shown. The torque command shown is given to indicate the torque command that is needed to achieve the maximum current of either the motor or the inverter.

Revision History

Version	Description of Versions / Changes	Responsible Party	Date
0.1	Initial version	Chris Brune	2/14/2014
0.2	Added GVM210-150T6 Motor. Updated overall motor descriptions.	Chris Brune	8/6/2014
0.3	Added GVM210-100K6 motor.	Chris Brune	12/12/2014
0.4	Added GVM210-050J6	Chris Brune	4/23/2015
0.5	Added GVM210-100J6 and GVM210-150J6	Chris Brune	7/1/2015
0.6	Added GVM210-150P6 and GVM210-200Q6	Chris Brune	9/29/2015
0.7	Added GVM142-100S6. Added information about temperature sensors used on the various motors.	Chris Brune	11/24/2015

0.8	Added GVM210-150N6 and GVM210-150R6.	Chris Brune	12/1/2015
0.9	Correct Over-speed and Break Speed on motors 99 and 100	Chris Brune	1/18/2016
1.0	Added GVM210-200S6 and GVM210-100Q6	Chris Brune	2/5/2016
1.1	Added motor type 108, variant of GVM210-100Q6 with Omega temperature sensor.	Chris Brune	3/16/2016
1.2	Added motor type 109, GVM210-300Q6. Added diagram for PM250 wiring of resolver.	Chris Brune	4/20/2016
1.3	Added motor type 112, GVM210-150P6 with the normal resolver and temperature sensor that comes with the motors.	Chris Brune	4/29/2016
1.4	Reordered the motor list at the beginning of the document. Added motor type 115, GVM210-200H6.	Chris Brune	7/20/2016
1.5	Added motor type 119, GVM210-050R6. Minor edits.	Chris Brune	10/07/2016
1.6	Removed note discussing the Parker built resolver cable.	Chris Brune	10/12/2016
1.7	Added motor type 120, GVM210-200V6	Chris Brune	10/15/2016
1.8	Added motor type 124, GVM210-150G6	Chris Brune	10/31/2016
1.9	Corrected mistake in type 124 data. Added motor type 127, GVM142-125Z6.	Chris Brune	11/16/2016
2.0	Added PM250DZ to motor type 68.	Chris Brune	12/8/2016
2.1	Added GVM210-200T6 motor type 133.	Chris Brune	1/19/2017
2.2	Added GVM210-400S6 motor type 134.	Chris Brune	2/10/2017
2.3	Added GVM210-300S6 motor type 136.	Chris Brune	5/1/2017
2.4	Added GVM210-150R6 with Omega sensor, type 137, added motor type GVM210-100D6, type 138, added motor type GVM210-400N6, type 139.	Chris Brune	5/15/2017
2.5	Added type 140 as a 2X resolver alternative to 103. Added 141 as a 2X resolver alternative to 115.	Chris Brune	7/7/2017
2.6	Added motor type 142, GVM210-050F6	Chris Brune	8/7/2017
2.7	Corrected typo on motor type 142.	Chris Brune	8/8/2017
2.8	Added motor types 142 and 143.	Chris Brune	9/22/2017
2.9	Added motor type 146, GVM210-400W6	Andrew Louie	10/4/2017
3.0	Added motor type 148, GVM21-200Q6 with KTY sensor.	Chris Brune	1/22/2018
3.1	Added motor type 149, GVM210-300K6	Andrew Louie	2/22/2018
3.2	Added motor type 150, GVM210-400R6	Chris Brune	3/16/2018
3.3	Added motor type 152, GVM210-150P6 with KTY sensor	Chris Brune	6/4/2018
3.4	Added motor type 159, GVM210-200R6	Michael Wu	7/23/2018
3.5	Added motor type 160, C-GVM142-125S6 Added motor type 161, GVM142-050K6	Andrew Louie	9/12/18
3.6	Added motor type 165, GVM210-150S6 with 3X resolver and Omega sensor.	Andrew Louie	11/12/2018

3.7	Added motor type 173, GVM210-300P6 with 3X resolver and Omega sensor.	Andrew Louie	12/20/2018
3.8	Modified motor type 94/148 information in table to add PM150DZ.	Chris Brune	1/15/2019
3.9	Added Motor type 182.	Chris Brune	8/23/2019
4.0	Added motor type 188, GVM210-400V6 with 3X resolver and Omega sensor.	Andrew Louie	11/14/2019
4.1	Updated motor type 89, GVM210-150J6 to show operation with a PM100DX. Changes effective in software version 2023.	Chris Brune	12/12/2019
4.2	Updated motor type 99, GVM210-150N6 to show operation with a PM100DX.	Chris Brune	1/15/2020
4.3	Added motor type 205, GVM210-300T6.	Chris Brune	5/28/2020
4.4	Added motor type 212, GVM210-100F6	Chris Brune	7/30/2020
4.5	Added motor type 215, GVM210-200J6 with 3X resolver and Omega temperature sensor.	Andrew Louie	8/20/2020
4.6	Added motor type 220, GVM210-150S6 with 3X resolver and KTY84 type temperature sensor.	Chris Brune	10/19/2020
4.7	Added torque values for GVM210-150T6	Chris Brune	6/2/2021
4.8	Added CM200DX settings for GVM210-150S6	Travis Gintz	1/12/2022