seepex.com

Emerson Industrial Automation
7120 New Buffington Road
Florence, KY 41042
Application Engineering: 800 626 2093
www.emerson-ept.com

F O R M
9708E
November 2012

Installation and Maintenance Manual For IntelliGear Plus™ MD and BW1 Variable Speed Drives

C UL US ce

UL Listed
E211799
Ind. Cont EQ. 54 DN

MCIM12260E • 9708E • Printed in USA

EMERSON
Industrial Automation

Thank you for choosing an IntelliGear Plus Gearmotor.

General Safety Instructions

⚠ WARNING

- Read and follow all instructions carefully.
- Disconnect and lock-out power before installation and maintenance. Working on or near energized equipment can result in severe injury or death.
- Disconnect power at least 2 minutes prior to servicing to allow capacitors to discharge. Handling wires sooner than this could result in electric shock, severe injury, or death.
- Do not operate equipment without guards in place. Exposed equipment can result in severe injury or death.
- Any eyebolts that have been supplied with the gearmotor are designed for lifting only these components. Lifting additional weight attached to these components may break the eyebolt and result in personal injury or death, and product damage.

⚠ CAUTION

- All electrical work should be performed by qualified personnel and compliant with local and national electrical codes.
- Periodic inspections should be performed. Failure to perform proper maintenance can result in premature product failure and personal injury.

NOTICE

- IntelliGear Plus contains parts sensitive to static electricity. Care should be taken to discharge static prior to handling these components to avoid damage to them.
- Contact Emerson Power Transmission for recommendations for units running at slow speeds or unusual conditions.

IntelliGear Plus™ Variable Speed MD Gearmotors

Contents

IntelliGear Plus™ Variable Speed MD Gearmotors

General Information

1 - General Information

1.1 - General operating principle

The IntelliGear Plus is a combination of a 3-phase induction motor and an integrated open loop vector variable speed drive. The motor can be combined with many gear types from Emerson Power Transmission's range.

In the standard product version, the integrated drive does not require any connection other than the power supply. The options may be used to broaden the application range of the IntelliGear Plus.

IntelliGear Plus motors meet the requirements of the Low Voltage Directive 73/23/EEC, modified by 93/68/EEC. The harmonized standards of the DIN VDE 0160 series in connection with standard VDE 0660, part 500 and EN 60146/VDE 0558 are also applicable.

1.2 - Product name

115V Single Phase Power Supply		**230V Single Phase Power Supply**	
Rating	Power (HP)	Rating	Power (HP)
310 M 050	0.50	31 M 050	0.50

IntelliGear PLUS Controlling Options	
Designation	Description
RPD	4-20 mA follow or local Keypad (manual control)

IntelliGear PLUS Accessories	
Designation	Description
KEYPAD LCD	Parameter setting console w/cable to locally reprogram to customize parameters
VMA30SOFT	CD w/cable and USB to locally reprogram to customize parameters

1.3 - Environmental Characteristics

Characteristics	Level - IntelliGear PLUS	
Degree of protection	TEFC Version	TEFC motor and NEMA 4/12 Controller
Storage temperature	-40 °C to +70 °C	
Transport temperature	-40 °C to +70 °C	
Ambient operating temperature	-20 °C to +40 °C (above 40 °C requires derating 1% per °C)	
Altitude	Up to 3000 feet above sea level without derating	
Ambient humidity	95% non-condensing	
Humidity during storage	93%, 40 °C, 4 days	
Vibration	- Exposed product: 0.01 g^2 / Hz 1 hr. in accordance with IEC 68-2-34 - Sinusoidal vibration: 2-9 Hz 3.5 ms^{-2} - 9-100 Hz 10 ms^{-2} in accordance with IEC 68-2-6	
Shocks	Packaged product: 15 g, 6 ms, 500 times/direction in all 6 directions in accordance with Standard IEC 68-2-29	
Immunity	Conforming to EN61000-6-2	
Radiated and conducted emissions	Conforming to EN500081-2 with filter	
UL and CUL	Conforming to UL 508 C (E211799)	

1.4 - Radio-frequency interference:

1.4.1 - General

Variable speed drives use high-speed switches (transistors, semi-conductors) which switch high voltages (around 660V for 3-phase drives) at high frequencies (several kHz). This provides better efficiency and a low level of motor noise. As a result, they generate radio-frequency signals which may disturb operation of other equipment or distort measurements taken by sensors:

- due to high frequency leakage currents which escape to ground via the stray capacity of the drive/motor cable and that of the motor via the metal structures which support the motor
- by conduction or feedback of R.F. signals on the power supply cable; conducted emissions
- by direct radiation near to the main supply power cable or the drive/motor cable: radiated emissions

These phenomena are of direct interest to the user. The frequency range concerned (radio-frequency) does not affect the energy distribution company.

1.4.2 - Standards (Emission)

The maximum emission level is set by (EN 50081-2) and (EN 50081-1). IntelliGear Plus conforms to:

- EN 50081-2 as standard
- EN 50081-1 with filter option

1.4.3 - Standards (Immunity)

The maximum immunity level is set by (EN 50082-2) and (EN 50082-1). IntelliGear Plus conforms to:

- EN 50082-2 and EN 50082-1 as standard

1.5 - Description of cables and protection devices (Customer Supplied)

NOTICE: When using a circuit-breaker, it must be a motor circuit-breaker (D curve).

- Comply with the size of protection fuses.
- The cable size may vary according to legislation applicable in the country, which will take precedence over the values given in the table below without exception.

Motor HP Rating	115V Single Phase Power Supply				230V Single Phase Power Supply			
	IntelliGear Plus Number	Input Amps	Wire Gauge	Fuse Size	IntelliGear Plus Number	Input Amps	Wire Gauge	Fuse Size
0.50	I 310M 050	5	14AWG	10 A	I 31M 050	2.5	14AWG	8A

1.6 - UL conformity

1.6.1 Specified mains supply

The drive can be incorporated in an installation with short circuit capacity of 5000 A rms maximum at voltage 264 VAC rms maximum for 230 V (TL) drives or 528 VAC rms maximum for 400 V (T) drives.

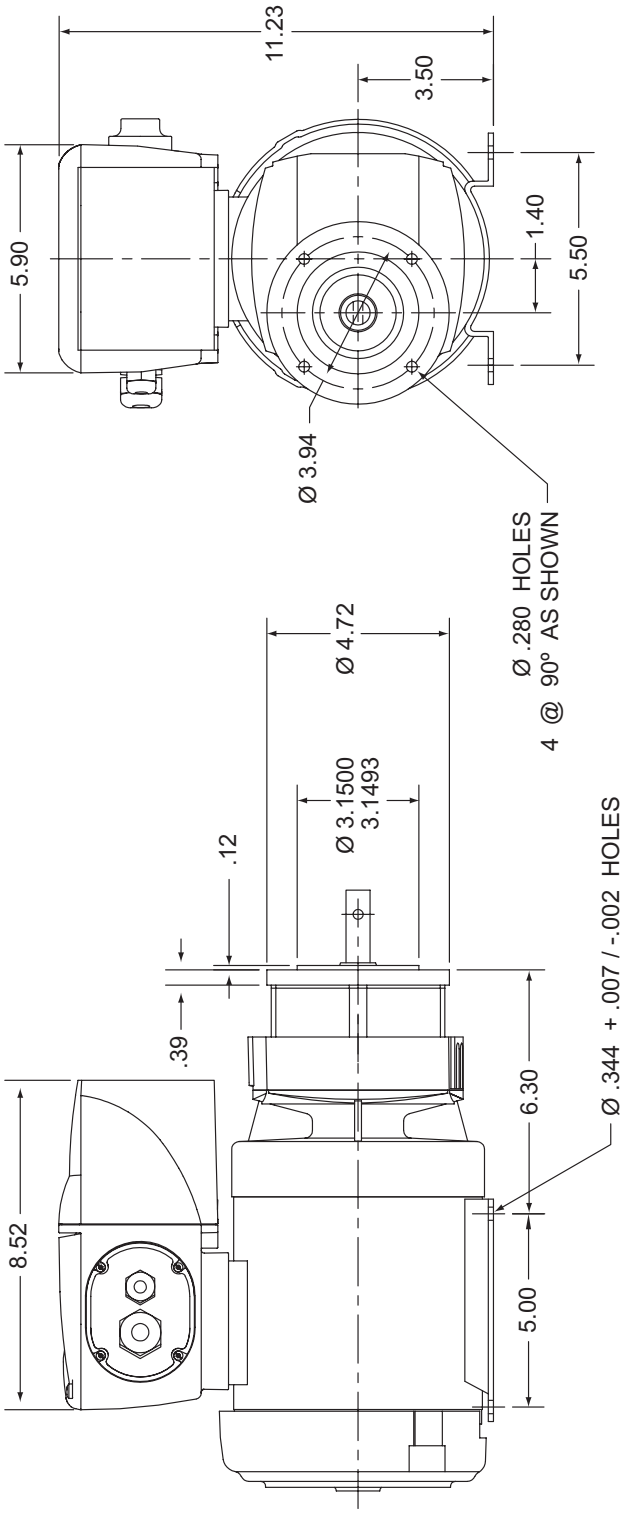
1.6.2 Cables

Only class 1 copper cables 60/70° C (140/167° F) should be used.

1.6.3 Fuses

UL conformity is adhered to if the fuses are UL-listed, fast-blow fuses (class CC up to 30 A) with a rating as indicated in the above table and if the short-circuit symmetrical current does not exceed 5 kA.

1.8 - Dimensions



1 Ø Voltage Power	Model No.	CCI Number	Gear Ratio	Standard RPM Range
115	XS9507	CCI-123G	4.5	600-19
230	XS9508	CCI-124G	4.5	600-19

2 - Installation

After connection, ensure that the seals are firmly in place, and that the screws and cable glands are watertight to ensure drive protection. Clear any condensation from the drain holes at the bottom of the motor.

2.1 - General

The IntelliGear Plus is usually fitted to the gear and mounted to the machine with flange or foot mounting. The motor fan cools the whole assembly. Make sure that the ventilation air inlet is free of obstruction.

3 - Connections

Connection with copper conductor only.

3.1 - Control Terminal Blocks

- Remove the terminal block from it's fixed holder (unplugged) before making any connections, to avoid putting pressure on the card.

CAUTION: The IntelliGear Plus has a positive logic configuration. Using a drive with a control system which has a different control logic may cause unwanted starting of the motor.

- The control circuits in the drive are isolated from the power circuits by single insulation (IEC 664-1).
- The installer must ensure that the external control circuits are isolated against any human contact.
- If the control circuits need to be connected to circuits conforming to SELV safety requirements, additional insulation must be inserted to maintain the SELV classification.

Removable screws in terminal block:

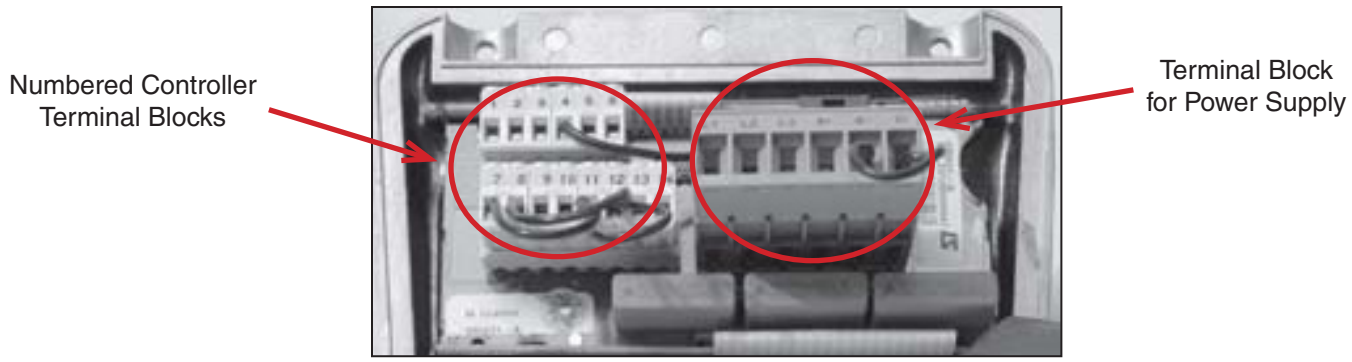
- Tightening torque = 2.62 in. lbs.
- Maximum cross section = 17 AWG

3.2 Power terminal blocks

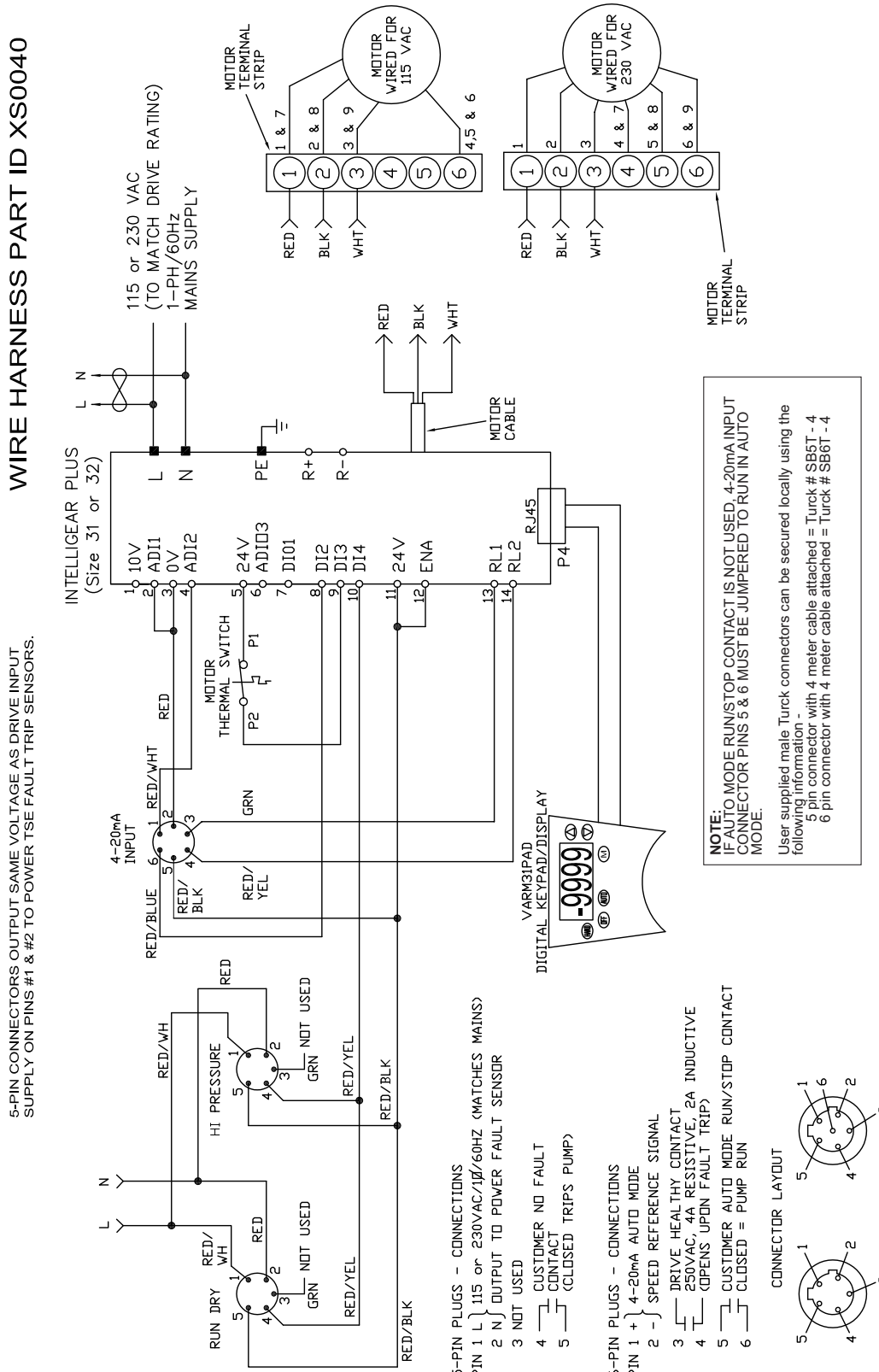
3.2.1 Terminal block for power supply PB1 (marked L&N)

This terminal block is used to connect the 3 phase power supply when the RFI filter is not used in an IntelliGear Plus. Otherwise, the RFI filter output is screwed onto this connector and the power supply should be attached to the terminals located on top of the filter. (See table below)

Screw terminal blocks	310M & 31M
Tightening Torque	7.1 in. lbs.
Max. cross-section	AWG 14



3.3 Wiring diagram based on standard configuration



3.4 Terminal block assignments and MD functionality

Controller Terminal Number	Designation	Function	Characteristics	
1	10V	+10VDC Analog Internal Source	Accuracy	±2%
			Maximum Output Current	30 mA
2	ADI1	Kick Start Speed Reference	Voltage Input	
			Full Scale Voltage	10 VDC ±2%
			Input Impedence	95 kΩ
3	0V	Logic & Analog Circuit Common		
4	ADI2	Auto Mode Speed Reference **	Current Input	
			Current Range	4-20 mA ±5%
			Input Impedence	500 Ω
			Resolution	10 bits
			Sampling	6 ms
5 11	24V	+24VDC Logic Internal Source	Output Current	30 mA
			Overload Current	60 mA
			Accuracy	±5%
			Protection	Current Limiting & Overload Fault Trip
6	ADIO3	Analog Output Proportional to Motor/Pump RPM	Voltage Output	
			Voltage Range	0 to 10 VDC
			Load Resistor	2 kΩ Minimum
			Protection	Short Circuit (40 mA Maximum)
7	DIO1	Logic Output 1 Drive Running	Logic Output	
			Voltage Range	0 to +24 VDC
			Sampling/Refresh Rate	2 ms
			Maximum Output Current	50 mA
			Overload Current	50 mA
8	DI2	Logic Input 2 Auto Mode Run/Stop	Characteristics	Logic Input (Positive Logic)
			Thresholds	"0": <5 VDC "1": >10 VDC
9	DI3	Logic Input 3 Motor Thermal Input	Voltage Range	0 to +24 VDC
			Sampling/Refresh Rate	2 ms
10	DI4	Logic Input 4 Fault Signal Input from Run Dry and/or High Pressure Sensor	Absolute Maximum Voltage Range	0 to +35 VDC
			Load Impedence	15 kΩ
			Input Threshold	7.5 V
12	ENA	Drive Enable	Voltage Range	9 to +33 VDC
			Load Impedence	820 Ω
13 14	RL1 RL2	Drive Healthy Contact Closed Upon Power Up Unless Drive Tripped	Characteristics	Normally Open Single Pole Contact
			Rated Voltage	250 VAC
			Current Rating	Resistive Load: 4 A Inductive Load: 2 A

** Provides setpoint feedback function when drive is programmed for full PI mode of operation

4. Commissioning

WARNING! Before switching on the IntelliGear Plus unit, check that the electrical connections are correct, and that any moving parts are mechanically guarded.

WARNING! For the safety of personnel, the IntelliGear Plus must not be switched on with any protective covering removed.

5. Operator Pad

Each RPD IntelliGear unit has a keypad on the controller lid equipped with operator elements for H-O-A selection, manual control of unit, display of pump speed, faults and the ability to change some factory set parameters.

REF.	Function
A	Displays operating RPM of pump
B	- Displays drive status including faults - Displays parameter number and setting during drive programming/setup
C	"Hand" command button starts motor running in Hand mode
D	"Off" button to stop motor
E	"Auto" command button initiates Auto mode for operation from a 4-20 mA speed reference analog signal
F	- Set the pump speed in Hand mode - Set maximum pump speed in Auto mode - Parameter selection and adjustment in drive programming/setup mode
G	"Mode" button to initiate parameter setting mode - In parameter setting mode, opens and locks parameter settings

5. 1 Fault Mode Troubleshooting Guide

LED Pad Display	Drive Status/Fault Indication	Actions Required
Blank Display	Drive not powered	Check for drive input power
	Display unplugged or failed	Check display plug connection
0019 - 0600	Numeric display shows Pump RPM, indicates motor running	
rdY	Drive Ready (Enabled & Not Running)	In AUTO mode, make sure AUTO-RUN contact is closed between pins 5 & 6 of 6-pin connector if pump should be running
inh	Drive Inhibited (Not Enabled)	Install jumper between IntelliGear terminals 11-12
tr01	Motor thermostat trip - Overtemp	Check motor thermostat connections between IntelliGear terminals 5 & 9 (Install jumper if motor has no thermostat wires -P1/P2)
		Check motor fan & clean debris or obstruction to air flow
		Check for motor overload
tr02	Internal brake resistor trip - Overtemp	Contact factory
tr03	Pump RUN DRY or HIGH PRESSURE fault trip	Check for proper flow and pressure in pump
UU	DC Bus Undervoltage	Check incoming power for voltage level too low
OU	DC Bus Overvoltage	Check incoming power for voltage level too high
		Check for over-running load (pressure over-driving pump)
		Adjust drive parameter 04 (deceleration time) to a higher setting using drive keypad/display
ph.AC	Loss of a motor phase	Check motor connections at IntelliGear grey terminal strip
OI.AC	Overcurrent at Drive Output	Check motor connections at IntelliGear grey terminal strip
		Check for ground fault or line-line fault in motor wiring
		Check for moisture or insulation damage in motor windings
It.AC	Motor Overload (I X t)	Check for excessive torque load at pump
Oht1	Overheating in Output Transistors	Check heatsink fins for debris or obstruction to air flow
		Provide supply of cool air if ambient exceeds 40°C
		Reduce torque load from pump
Oht2	Overheating in Brake Transistor	Adjust drive parameter 04 (deceleration time) to a higher setting using drive keypad/display
		Reduce start/stop frequency
rS	Stator Resistance Measurement Fault	Check motor connections at IntelliGear grey terminal strip
SCL	Serial connection between keypad and drive broken	Check display plug connection
EEF	EEPROM fault in drive	Contact factory
OI.br	Overcurrent at Brake Transistor	Contact factory

5.2 Additional Troubleshooting

Symptom	Probable Cause(s)	Actions Required
Not Running, No Fault Indication on Display	Drive not in HAND or AUTO mode	Press HAND or AUTO button on Keypad
	Drive in AUTO mode, but AUTO-RUN contact not closed	Close AUTO-RUN contact or Jumper pins 5-6 on 6-pin connector cable
Unit Runs Only at Low Speed in AUTO mode	4-20 mA signal is not present	Connect 4-20 mA signal and Verify that the signal current is present (pins 1 & 2 of 6-pin connector)
	4-20 mA signal polarity is reversed	Verify current enters pin 1 of 6-pin connector Reverse the connections if necessary
In AUTO, Unit Does Not Achieve Maximum Output RPM at 20 mA Signal Input	4-20 mA signal not achieving full 20 mA at maximum speed reference	Signal source may not be capable of producing 20 mA with the drive input impedence of 500 ohms - must be able to produce at least 10 VDC at pin #1 of 6-pin connector cable
	Maximum speed setting of operator keypad setting is not set to 100%	Press UP ARROW on keypad until maximum speed is attained
	IntelliGear MAXIMUM SPEED setting has been turned down	Adjust drive parameter 02 to 2700 RPM using drive keypad/display

5.3 Field Modifications Of Parameters

The new IVD controller with keypad allows some factory set parameters to be adjusted in the field. The table below provides the factory settings for each parameter and then optional ranges for selection of a new setting. Follow the steps detailed below, using the keypad "M" key and UP and DOWN arrows to achieve customized settings for your IVD gearmotor.

Step 1 - Power up the controller to "Ready" mode

Step 2 - Press "M" key

Step 3 - Use UP or DOWN arrow to go to parameter number to be changed

Step 4 - Press "M" key

Step 5 - USE UP or DOWN arrow to change the actual parameter setting

Step 6 - Press the "M" key to save the new parameter value

PAD Parameter #	Parameter Description	Normal Value	Optional Range For New setting	Units	New Field Setting
01	Motor Minimum Speed	90	91-350 Δ	RPM (of motor) ‡‡	
02	Motor Maximum Speed	2700	100 - 2699	RPM (of motor) ‡‡	
03	Acceleration Rate - Seconds/1000 RPM	1.0	0.1-600	Seconds/1000 RPM	
04	Deceleration Rate - Seconds/1000 RPM	5.0	0.1-600	Seconds/1000 RPM	

‡‡ To determine new setting for this parameter, multiply pump RPM desired by gear ratio shown on gear nameplate.
example - Desire max. pump RPM of 375 requires change to parameter #2 from "2700" to "1688" (gear ratio is 4.5, so 375 x 4.5 = 1688)

Δ To achieve "0" speed at minimum mA input, change setting for parameter #1 to "0"

6 - Gear Lubrication

Series 3000 CbN gearing is shipped with one of the following synthetic lubricants per the table below. The gear reducer has been filled to accommodate any mounting position. In the case of synthetic oil, the lubricant does not require changing, but it is recommended that proper oil level be checked periodically.

Synthetic

No Backstop

Manufacturer	-25˚ F to 125˚ F (-30˚ C to 50˚ C)
Fuchs®	Sintogear® 125
Mobil®	SHC 629
Shell®	Omala® Fluids HD 150

With Backstop

Manufacturer	-25˚ F to 125˚ F (-30˚ C to 50˚ C)
Shell	Omala RL 100

Acceptable Mineral Oil Lubricants

Ambient Range of Installation					
-4˚ F to 14˚ F (-20˚C to 10˚C)	14˚F to 122˚F (-10˚C to 50˚C)				122˚F and Above (50 ˚C+)
	No Backstop			With Backstop	
ISO VG 68	ISO VG 100	ISO VG 150	ISO VG 220	ISO VG 150	ISO VG 320

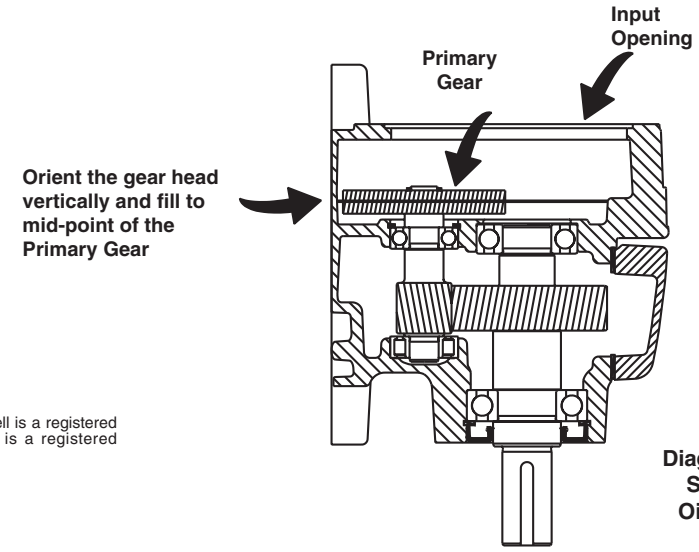
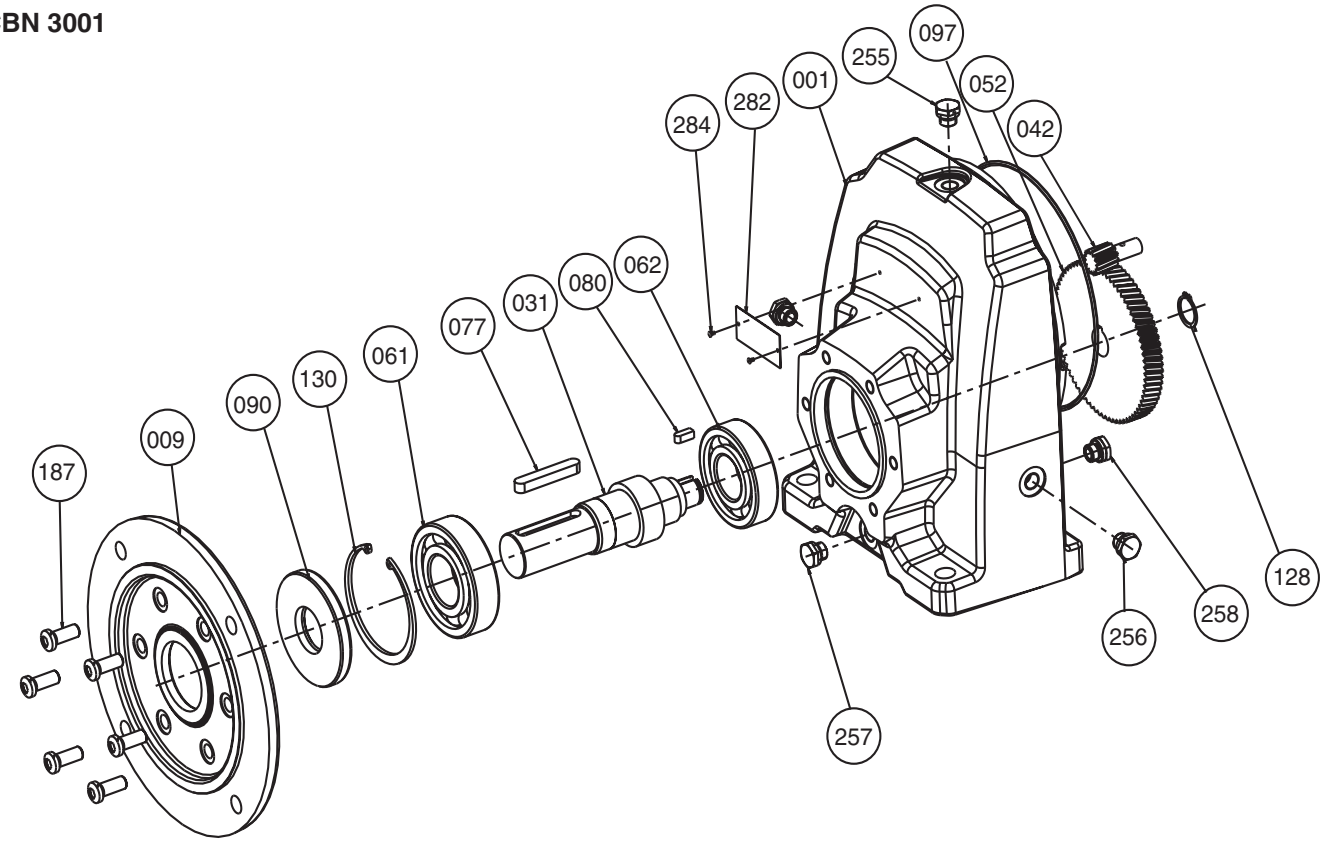


Diagram for Size 30 Oil Level

Fuchs is a registered trademark of Fuchs Petrolub; Shell is a registered trademark of Shell Petroleum Incorporated. Omala is a registered trademark of Shell Trademark Management.

7.0 - Gear Parts List

CBN 3001



Rep	Description	Quantity
001	Housing	1
009	Output flang ring	1
031	Output shaft	1
042	Pinion	1
052	Gear	1
061	Bearing front	1
062	Bearing back	1
077	Output shaft key	1
080	Gear Key	1

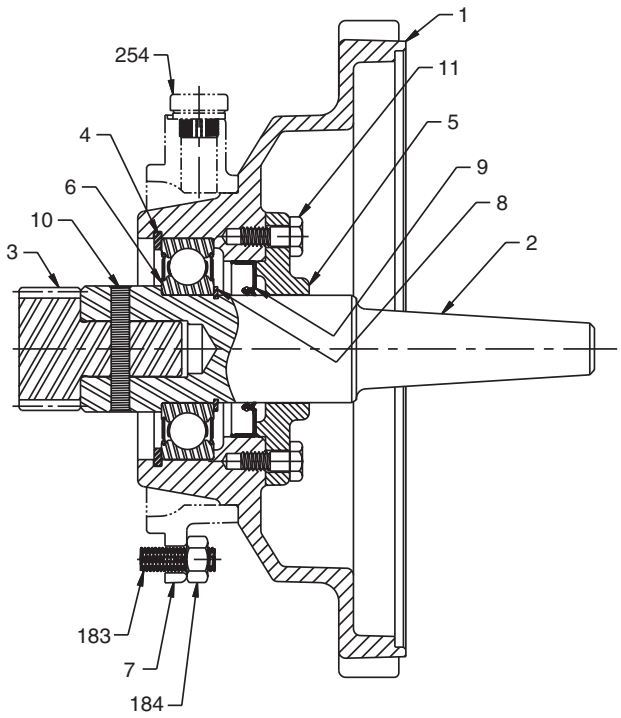
Rep	Description	Quantity
090	Oil seal	1
097	Input o-ring	1
127	Gearing snap ring*	1
130	Gearing snap ring	1
175	Input bracket screw	4
185	Washer for gear*	1
186	Screw washer*	1
187	Bolt	4
282	Nameplate	1

* Not illustrated on diagram

Typical Maintenance Items - Bearings and Seals

Gear Frame	Item Description By Location		
	Bearings		Seal (mm)
	61	62	90
30	6205 ZZ	6005	25 x 52 x 7 DL nitrile

CbN 30 (Quantity Per Unit)



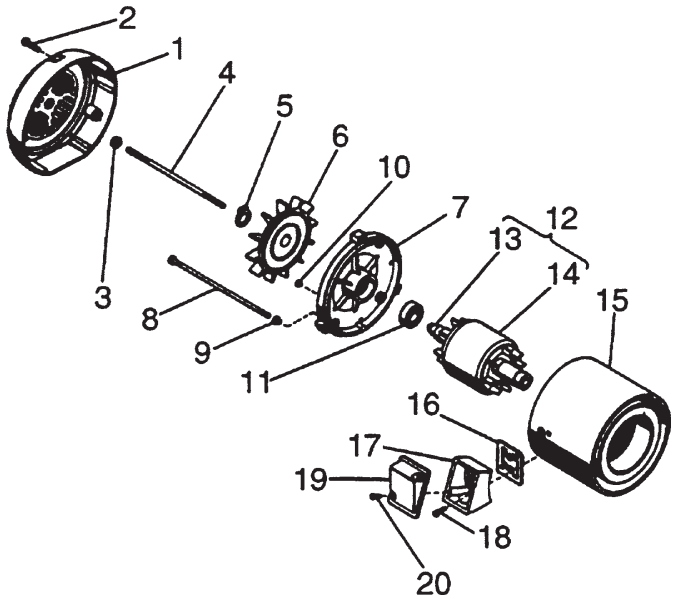
Rep	Description	Quantity
1	Motor adapter	1
2	Input shaft	1
3	Pinion	1
4	Internal snap ring	1
6	Bearing	1
8	External snap ring	1
9	Seal	1
10	Pinion pin	1
183	Stud	4
184	Nut	4

Gear Frame	Bearing	Seal (mm)
	6	9
30	6005 2RS	47 x 25 x 7

8.0 Motor Parts List

Part #	Description	Qty.
1	Fan Cover	1
2	Self Tapping Screw	3
3	Hex Nut	1
5	Retaining Snap Ring	1
6	Fan	1
7	Bracket	1
8	Screw	4
9	Bushing	4
10	Plastic Plug	4
11	Ball Bearing	1
12	Rotor Assembly (includes items 13 & 14)	1
13	Shaft	1
14	Rotor Core	1
15	Wound Stator Assembly	1
16	Gasket	1
17	Outlet Box Base	1
18	Self Tapping Screw	2
19	Outlet Box Cover	1
20	Self Tapping Screw	2

FRAME 56



MCIM12260E• 9708E • Printed in USA

EMERSON™
Industrial Automation