



Technical Information

# Speed Sensor KPP Pulse Pickup (PPU)



**Revision***Table of Revisions***Revision History**

<b>Date</b>	<b>Page</b>	<b>Changed</b>	<b>Rev.</b>
09 Jul 2013	7	Corrected illustration title to Non-adjustable Wire Configuration (flat end and conical end)	BB
10 Aug 2009	6, 9-12, 18	Various content updated; Ordering Information; PPU Quick Reference table; Connector Pin Assignments	BA
25 Sep 2008	Various pages	Updated BLN-95-9045 to Technical Information (TI) format; updated Part Number Quick Reference table and various content	AA

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**Product Overview**
**Description**

The KPP pulse pickup accepts a supply voltage and, in response to the speed of a permanently magnetized speed ring on the motor's cylinder block or shaft, outputs a digital pulse signal. The output changes its high/low state as the north and south poles of the speed ring pass by the sensor's face. Because the output is digital, the KPP is ideal for low-speed measurement.

The KPP is designed for rugged outdoor, mobile, or heavy industrial speed-sensing applications that do not allow contact with the rotating shaft. It is custom-designed for Sauer-Danfoss pumps and motors.

**Features**

- Choice of directional or non-directional devices
- Choice of Delphi/Packard Weather-Pack®, Turck Eurofast® or Deutsch® connectors
- Rugged housing designed to withstand extreme environments
- You can order pre-mounted in Sauer-Danfoss pumps and motors
- You can use with digital or analog controllers
- Suitable for zero speed measurements

**Technical Data**
*Electrical and Environmental Data*

<b>Electrical</b>		
<b>Supply voltage (two ranges)</b>		
Regulated 4.5 to 8.5 Vdc	Battery 7 to 32 Vdc	
<b>Maximum operating current</b>		
20 mA at 1 Hz and 5 Vdc supply		
<b>Required current</b>		
12 mA at 5 Vdc (no load)		
<b>Output voltage in high state</b>		
Supply voltage minus 0.5 Vdc minimum (no load)		
<b>Output voltage in low state</b>		
0.5 Vdc, maximum (no load)		
<b>Maximum frequency</b>		
15 kHz		
<b>Load</b>		
15 kΩ to both ground and supply		
<b>Peak transient voltage</b>		
80 Vdc for 2 milliseconds, 4.5 to 8.5 Vdc models	300 Vdc for 2 milliseconds, 7 to 32 Vdc models	200 Vdc for 100 milliseconds, 7 to 32 Vdc models
<b>Peak reverse voltage</b>		
-15 Vdc continuous, 4.5 to 8.5 Vdc models	-32 Vdc continuous, 7 to 32 Vdc models	
<b>Environmental</b>		
<b>Operating and storage temperature</b>		
-40° to 110° C [-40° to 230° F]		

**Theory of Operation**

An external source powers the KPP pulse pickup (PPU). It needs a magnetic field to pass by its Hall switch(s) to provide a speed signal. The speed ring on the cylinder block has alternately magnetized north and south segments. For the non-directional PPU (KPPX12X), when a north segment is above the Hall switch, the switch output voltage is high, and when a south segment is above the switch, output is low. The digital (on-off-on-off) pulse train feeds to a controller, that interprets its rate of change as a speed.

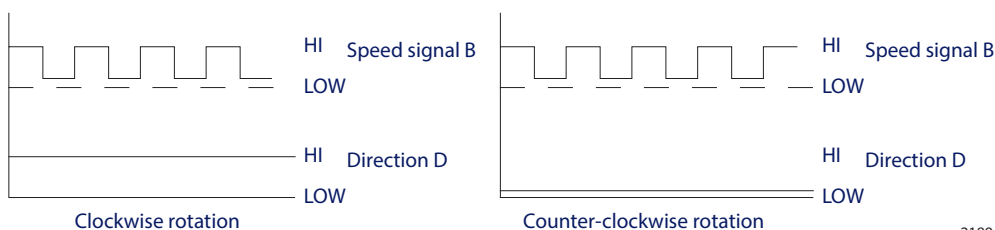
The direction-sensing PPU (KPPA13X) uses two Hall sensors mounted side-by-side in the same case. With proper orientation, the pulse train output from one sensor leads the other sensor by 90°. A logic circuit decodes the two signals to give a direction indication at the speed output (high or low depending on direction). For quadrature directional signal, the logic is bypassed and the direction signal is phase shifted by a nominal of 90° from the signal A. Refer to [Directional Pulse Train](#), on this page below.

Do not attempt to apply a quadrature output PPU without first consulting with a Sauer-Danfoss field applications engineer for specific application requirements.

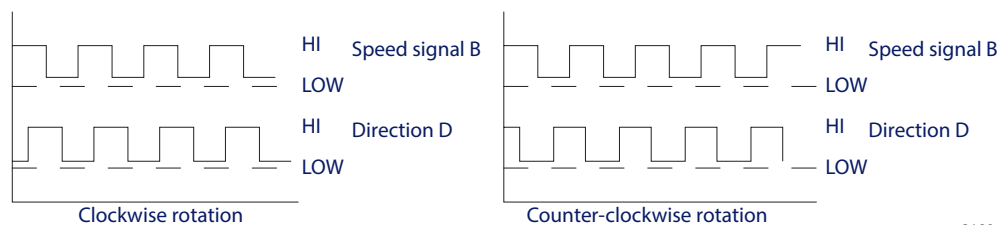
The KPPC,D,E models are an improved version of the KPPA12X PPU. It is not necessary to align the flats on its housing with the speed ring for proper speed readings.

Refer to [Typical Speed Control](#), page 13, as an example of a simple closed-loop speed control application for the PPU. Connections for a three and four-wire application, refer to [Connection Diagram](#), page 17.

The KPPXN8Nnn divides the standard signal output by two.

*Directional Pulse Train*


2189

*Quad Directional Pulse Train*


2190

**Improvements**

Continuous improvements to reduce environmental effects of moisture and corrosive liquids found in some mobile environments include:

**D Revision (June 1996)**

- Use of a potting compound around the lead wires exiting the housing was eliminated.
  - The sealing now works like an O-ring;
- The internal cavity of the housing was filled with a silicone oil.
- The wires now pass through a molded rubber piece compressed between two plates.

**E Revision (September 1996)**

- Silicone oil was replaced with a firm compound.
- External housing was changed to a zinc chromate finish.

**F Revision (June 1999)**

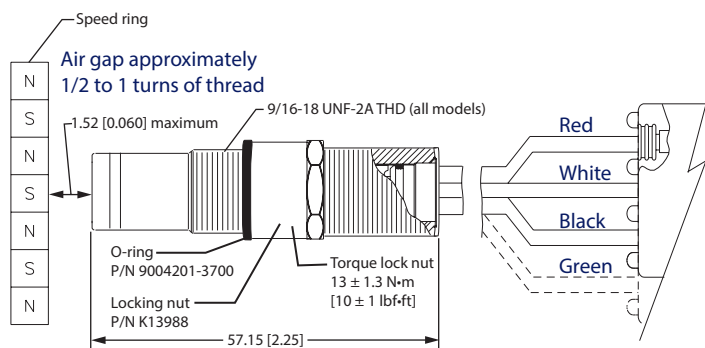
- The internal wire to the circuit board joint was modified.
- A new seal received and the circuit board assembly was improved.

**G Revision (February 2002)**

- The housing is now machined from a solid block of aluminum-silicone-bronze.

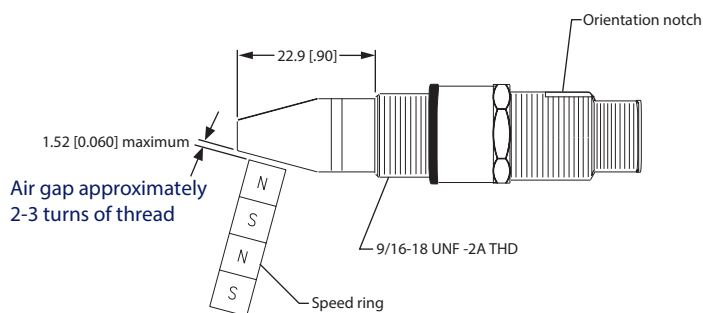
Dimensions

Common Lead Wire Configuration (flat end)



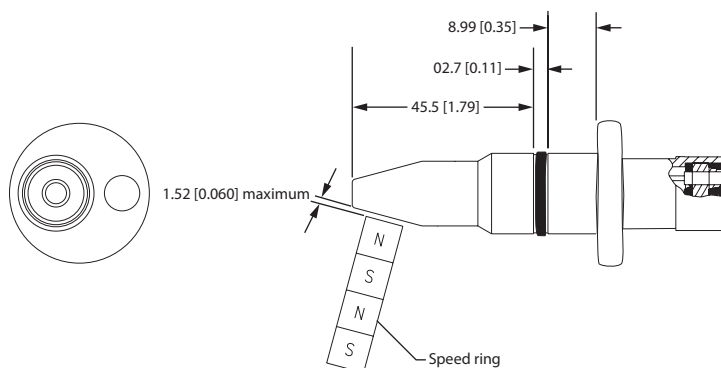
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Configuration Used Only for Series 51 and 51-1 Cartridge Motors (conical end)



3521

Non-adjustable Wire Configuration (conical end)



3522

Dimensions in mm [inches].

**Ordering Information****Considerations**

When specifying the pulse pickup there are important considerations listed below. For KPP selection see [Ordering Nomenclature](#), page 9 and [Part Number Quick Reference](#), pages 11 to 12.

**Supply Voltage**

You cannot power most KPP models directly from a battery because of the voltage transients (voltage spikes above 15 Vdc) that may cause permanent damage. Battery voltage transients are a common occurrence with 12 or 24 Vdc systems.

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Most mobile systems have an alternator that helps ensure a given voltage level but does not prevent against voltage transients. Therefore you must use a separate voltage regulator as the voltage source for the majority of KPP models.

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Those applications using a microcontroller can utilize their 5 Vdc regulated power supply to power the KPP models that are rated 4.5 to 8.5 Vdc. It is acceptable when powering the 4.5 to 8.5 Vdc models to use a *regulated* 15 Vdc maximum.

**Directional versus Non-directional KPPs**

When sensing speed only and supplying the KPP directly from the battery, always specify a KPP model that is rated 7 to 32 Vdc. If you require directional sensing, ensure the supply voltage is regulated.

**Housings**

There are two basic housings flat end and conical end. Refer to [Dimensions](#), page 7.

**4-wire KPP**

The 4-wire KPP can be used when only speed sensing is required. For these applications connect to pins A, B, C. Fill the unused cavity (D) with a cavity plug (refer to [Common Lead Wire Configuration \(flat end\)](#), page 7). Use the cavity plug offered in the 4 pin mating electrical connector kit, which is used with the 4 pin Delphi/Packard Weather-Pack connector (Sauer-Danfoss part number K03379).



Ordering Nomenclature

	KPP	X	X	X	X	XX
<b>Hall effect PPU</b>	_____	_____	_____	_____	_____	_____
<b>Revision</b>	_____	_____	_____	_____	_____	_____
<b>Mechanical configuration (housing)</b>	_____	_____	_____	_____	_____	_____
<u>1</u> Flat end						
<u>2</u> Conical end						
<u>3</u> Conical end, fixed position						
<u>4</u> Flat end, fixed position						
<b>Electrical configuration</b>	_____	_____	_____	_____	_____	_____
<u>2</u> Regulated supply 4.5 to 8.5 Vdc, 3 connection, non-directional, wire fault detection						
<u>3</u> Regulated supply 4.5 to 8.5 Vdc, 4 connection, directional, wire fault detection, low current						
<u>4</u> Regulated supply 4.5 to 8.5 Vdc, 4 connection, directional, wire fault on speed signal, open collector on direction signal						
<u>5</u> Regulated supply 4.5 to 8.5 Vdc, 4 connection, directional wire fault detection, high current, filtered speed output						
<u>6</u> Battery supply 7 to 32 Vdc, 3 connection, non-directional, limited wire fault detection						
<u>7</u> Regulated supply 4.5 to 8.5 Vdc, 4 connection, directional, wire fault detection, low current, quad output**						
<u>8</u> Regulated supply 4.5 to 8.5 Vdc, 4 connection, directional, wire fault detection, low current, output signal divided by 2						
<u>9</u> Regulated supply 4.5 to 8.5 Vdc, 4 connection, directional, wire fault detection, high current, quad output**						
<u>A</u> Battery supply 7 to 32 Vdc, 4 connection, directional, limited wire fault detection, high current, quad output**						
<u>B</u> Regulated supply 4.5 to 8.5 Vdc, 3 connection, non-directional, wire fault detection, high current, filtered speed output						
<b>Electrical connector</b>	_____	_____	_____	_____	_____	_____
<u>1</u> Amp Mate-n-Lok						
<u>4</u> <sup>1</sup> Delphi/Packard Weather-Pack (3 pin) <sup>2</sup> Delphi/Packard Weather-Pack (4 pin), used when direction signal is required						
<u>5</u> Delphi/Packard Metri-Pack						
<u>6</u> Integral Turck Eurofast (no leadwires)						
<u>7</u> <sup>1</sup> Deutsch DT04 (3 pin) <sup>2</sup> Deutsch DT04 (4 pin), used when direction signal is required						
<u>8</u> Delphi/Packard Metri-Pack 150 series plug						
<u>9</u> Delphi/Packard Metri-Pack 150 series jack						
<b>All leadwire length is described in inches unless denoted with <i>m</i> (meters)</b>						
<b>Specialties</b>						
<u>A</u> Special connector pinouts						
<u>B</u> Special connector pins						

\*\*Do not attempt to apply a quadrature output PPU without first consulting with a Sauer-Danfoss field applications engineer for specific application requirements.

**Ordering Nomenclature Codes and Definitions**
*Mechanical Configuration (Housing)*

Code	Description
1	<b>Flat end:</b> Typical use, Sauer-Danfoss Series 90 pump and motor, M46 pump and motor, Series 42 pump (M46 pump pending)
2	<b>Conical end:</b> Typical use, Sauer-Danfoss Series 51 and 51-1 MV cartridge type motor

*Electrical Configuration*

Code	Description
2	<b>Non-directional:</b> Common, supply voltage 4.5 to 8.5 Vdc, 3 wire connection, speed sensing only with wire fault detection
3	<b>Directional:</b> Common, supply voltage 4.5 to 8.5 Vdc, 4-wire connection, direction and speed sensing with wire fault detection capability on both its speed and direction signals. Can also be used if only speed sensing is required (3 wire connection)
4	<b>Directional:</b> Special, supply voltage 4.5 to 8.5 Vdc, 4-wire connection, directional sensing signal compatible with the standard DC2 digital input lines. Higher current sinking capability and no wire fault detection for the direction signal only which can sink up to 20 mA and source nothing (open collector).
5	<b>Directional:</b> Special, supply voltage 4.5 to 8.5 Vdc, 4-wire connection, direction and speed sensing with wire fault detection capability on both its speed and direction signals. Capable of driving higher currents from its outputs. Special provision to filter the speed output signal for reducing electromagnetic emissions
6	<b>Non-Directional:</b> Common, supply voltage 7 to 32 Vdc, 3 wire connection, speed sensing only with limited wire fault detection
7	<b>Directional:</b> Special, supply voltage 4.5 to 8.5 Vdc, 4 wire connection, direction and speed sensing with wire fault detection capability, low current, features quadrature (decoded) directional output**
8	<b>Directional:</b> Common, supply voltage 4.5 to 8.5 Vdc, 4 wire connection, direction and speed divided by 2 sensing with wire fault detection capability on both its speed and direction signals
9	<b>Directional:</b> Special, supply voltage 4.5 to 8.5 Vdc, 4 wire connection, high current, direction and speed sensing with wire fault detection capability, high current, features quadrature (decoded) directional output**
A	<b>Directional:</b> Special, supply voltage 7 to 32 Vdc, 4 wire connection, direction and speed sensing with wire fault detection capability, high current, features quadrature (decoded) directional output**
B	<b>Non-directional:</b> Special, supply voltage 4.5 to 8.5 Vdc, 3 wire connection, speed sensing with wire fault detection capability, high current, filtered speed output

\*\*Do not attempt to apply a quadrature output PPU without first consulting with a Sauer-Danfoss field applications engineer for specific application requirements.

*Electrical Connector*

Code	Mating connector kit description	Sauer-Danfoss part number
4	Delphi/Packard Weather Pack 3 pin shroud	K08620
	Delphi/Packard Weather Pack 4 pin tower, used when directional signal is required	K03379
5	Delphi/Packard Metri-Pack 3 pin	K10309
6	Turck Eurofast 4 pin	K14956 (straight); K14957 (right angle)
7	Deutsch, 3 pin	K22335
	Deutsch, 4 pin, used when directional signal is required	K23511
8	Delphi/Packard Metri-Pack 4 pin plug	K22254
9	Delphi/Packard Metri-Pack 4 pin jack	K32219

**PPU Quick Reference**

Table continues on page 12.

Reference [Ordering Nomenclature](#) and [Nomenclature Codes and Definitions](#), pages 9 and 10.

Material number		Supply voltage (Vdc)		Application		Electrical connector
		4.5 to 8.5	7 to 32	Common	Special	
	KPPG12408	X		X		4 <sup>1</sup>
	KPPG12508	X		X		5
	KPPG126	X		X		6
	KPPG12703A	X			X	7 <sup>1</sup>
	KPPG12704A	X			X	7 <sup>1</sup>
	KPPG12730A	X			X	7 <sup>1</sup>
	KPPG1273MA	X			X	7 <sup>1</sup>
	KPPG13403	X			X	4 <sup>2</sup>
	KPPG13408	X		X		4 <sup>2</sup>
	KPPG13436	X			X	4 <sup>2</sup>
	KPPG136	X		X		6
	KPPG13703	X		X		7 <sup>2</sup>
	KPPG13704	X			X	7 <sup>2</sup>
	KPPG13808	X		X		8
	KPPG14408	X			X	4 <sup>2</sup>
	KPPG146	X			X	6
	KPPG15408	X			X	4 <sup>2</sup>
	KPPG156	X			X	6
11046858	KPPG15824	X			X	8
	KPPG16008		X	X		4 <sup>2</sup>
	KPPG16408		X	X		4 <sup>1</sup>
	KPPG16508		X	X		5
	KPPG16511		X	X		5
	KPPG166		X	X		6
	KPPG16703A		X		X	7 <sup>1</sup>
	KPPG16704A		X		X	7 <sup>1</sup>
	KPPG16708		X	X		7 <sup>1</sup>
	KPPG16708B		X	X		7 <sup>1</sup>
	KPPG16719		X			7 <sup>1</sup>
	KPPG18408	X				4 <sup>2</sup>
	KPPG18708	X		X		7 <sup>2</sup>
	KPPG197XXB	X		X		7 <sup>1</sup>
	KPPG22408	X			X	4 <sup>1</sup>
	KPPG23408	X		X		4 <sup>2</sup>
	KPPG236	X		X		6
	KPPG23703	X		X		7 <sup>2</sup>
	KPPG23808	X		X		8
	KPPG256	X			X	6
	KPPG25808	X			X	8
	KPPG26008		X		X	4 <sup>2</sup>
	KPPG26408		X	X		4 <sup>1</sup>
	KPPG26508		X	X		5
	KPPG266		X	X		6
	KPPG26708		X	X		7 <sup>1</sup>
	KPPG26708B		X	X		7 <sup>1</sup>
	KPPG26724A		X		X	7 <sup>1</sup>
	KPPG33703*	X		X		7 <sup>2</sup>
	KPPG356*	X			X	6

\* Conical end, fixed position.

**PPU Quick Reference  
(continued)**

Reference [Ordering Nomenclature](#) and [Nomenclature Codes and Definitions](#), pages 9 and 10.

Material number		Supply voltage (Vdc)		Application		Electrical connector
		4.5 to 8.5	7 to 32	Common	Special	
	KPPG35708*	X			X	7 <sup>2</sup>
	KPPG35808*	X			X	8
	KPPG36708*		X		X	7 <sup>1</sup>
	KPPG36708B*		X		X	7 <sup>1</sup>
	KPPG36708B*		X		X	7 <sup>2</sup>
	KPPG456**	X			X	6
11068105	KPPG4A408**		X		X	4 <sup>2</sup>
	KPPG4B724B**	X			X	7 <sup>1</sup>

\* Conical end, fixed position.

\*\* Flat end, fixed position.

**Speed Rings**

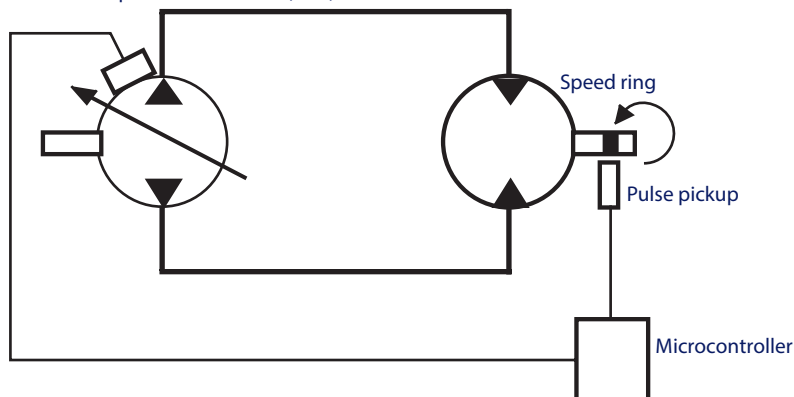
Speed rings vary according to the diameter of cylinder block to which they are attached. You may order them directly from the pump manufacturer or a Sauer-Danfoss Global Service Partner may retrofit them to existing pumps and motors (mounting requires some specialized tooling). Order them using numbers in the following table. Pump and motor listed is typical. Several may use the same speed ring.

*Speed Ring Part Numbers*

Speed ring part number	Pump/motor	Total pole pairs per revolution
KK14701	51V060	45
KK14702	51V080	49
KK14703	51V110	54
KK14704	51V160	61
KK14705	51V250	71
KK14706	M25 & 90P030	43
KK14707	90P042	48
KK14708	90P055	52
KK14709	90P075	58
KK14710	90P100	63
KK14711	90P130	69
KK14712	LV25 & 42P028	41
KK14713	40P046	51
KK14714	SMF21089	65
KK14715	60/470	78
KK14716	60/1048	101
KK14717	60/1750	121
KK14718	60/780	93
KK14719	60/606	86
KK14720	90P180	77
KK14721	90P250	85
KK14722	42P041	47
KK14723	MF035 & 044D	46

*Typical Speed Control*

## Electrical displacement control (EDC)



1668A

**Product Installation****Procedures for Flat End and Conical End Models**

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Refer to [Installation Diagrams](#), page 16, regarding these procedures.

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**Procedure A**

Non-directional KPP flat end models. Models included: KPPG12XXX, KPPG16XXX. Installation steps:

1. Turn in (CW) by hand until bottom end gently touches the speed ring.
2. Back out (CCW) 1/2 to 3/4 turn.
3. Using a 1/2 inch wrench to hold the KPP, torque the lock nut to 13 N•m [10 lbf•ft] with an 11/16 inch hex wrench.

**Procedure B:**

Directional KPP flat end models. Models included: KPPG13XXX, KPPG14XXX, KPPG15XXX, KPPG18XXX. Installation steps:

1. Turn in (CW) by hand until bottom end gently touches the speed ring.
2. Back out (CCW) 1/4 turn. Continue backing out until the flats are 22° (most open-end wrenches have a 22° offset) either side of pump or motor shaft center line (20° to 30° is acceptable). Do not back out the KPP more than 3/4 of a turn from touching.
3. Using the 1/2 inch wrench to hold the KPP, torque the lock nut to 13 N•m [10 lbf•ft] with an 11/16 inch hex wrench.
4. Special KPP FLAT END models include: KPPG17XXX, KPPG19XXX, KPPG1AXXX. Installation range is application specific:
5. Turn in (CW) by hand until bottom end gently touches the speed ring.
6. Back out (CCW) 1/4 turn. Continue backing out until the flats are 22° (most open-end wrenches have a 22° offset) either side of pump or motor shaft center line (acceptable range is determined per application). Do not back out the KPP more than 3/4 of a turn from touching.
7. Using the 1/2 inch wrench to hold the KPP, torque the lock nut to 13 N•m [10 lbf•ft] with an 11/16 inch hex wrench.

**Procedures for Flat End and Conical End Models (continued)****Procedure C**

Non-directional and Directional KPP conical end models. Models included: KPPG2XXXX. Installation steps:

1. Turn in (CW) by hand until bottom end gently touches the speed ring.
2. Back out (CCW) 2 turns. Continue backing out until the KPP orientation notch is  $180 \pm 15^\circ$  to motor shaft center line, (reference [Directional Conical End Models, Series 51 and 51-1 Cartridge Motors Only](#), page 17).
3. Using the 1/2 inch wrench to hold the KPP, torque the lock nut to 13 N·m [10 lbf·ft] with an 11/16 inch hex wrench.

Special KPP CONE END models include: KPPG29XXX. Installation range is application specific:

1. Turn in (CW) by hand until bottom end gently touches the speed ring.
2. Back out (CCW) 1 turn. Continue backing out until the KPP Orientation Notch is  $180^\circ$  to motor shaft center line, acceptable range is determined per application, (reference [Directional Conical End Models, Series 51 and 51-1 Cartridge Motors Only](#), page 17).
3. Using the 1/2 inch wrench to hold the KPP, torque the lock nut to 13 N·m [10 lbf·ft] with an 11/16 inch hex wrench.

**Procedure D**

When Directional KPP flat end models are used for sensing speed only, the same installation steps in Procedure A are acceptable. Models included: KPPG13XXX, KPPG14XXX, KPPG15XXX, KPPG18XXX.

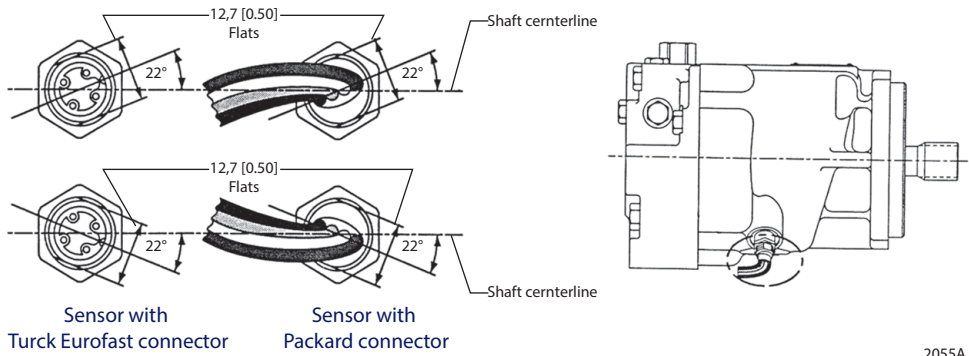
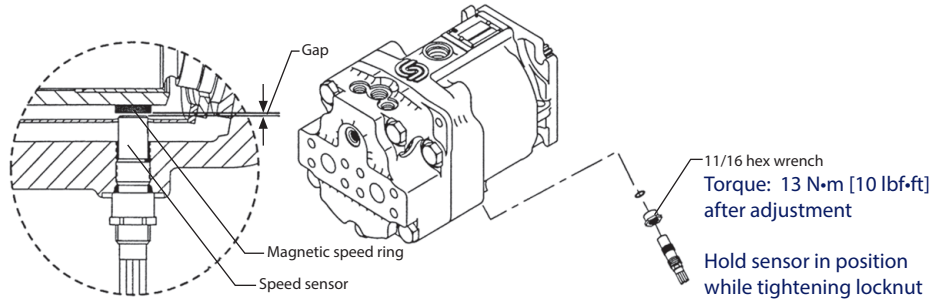
**Procedure E**

Fixed position. Non-directional and Directional KPP conical end models KPP3XXXX and flat end models KPP4XXXX. Installation steps:

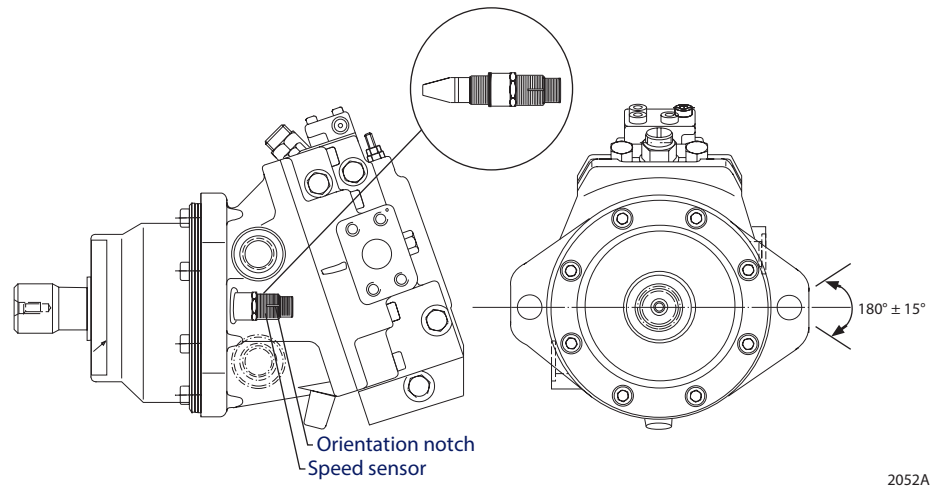
1. Insert PPU housing; align the hole in mounting flange with mounting hole in block housing.
2. Torque M6x12 capscrew  $8 \pm 1$  N·m [ $5.9 \pm 0.7$  lbf·ft].

Installation Diagrams

Pulse Pickup Installation



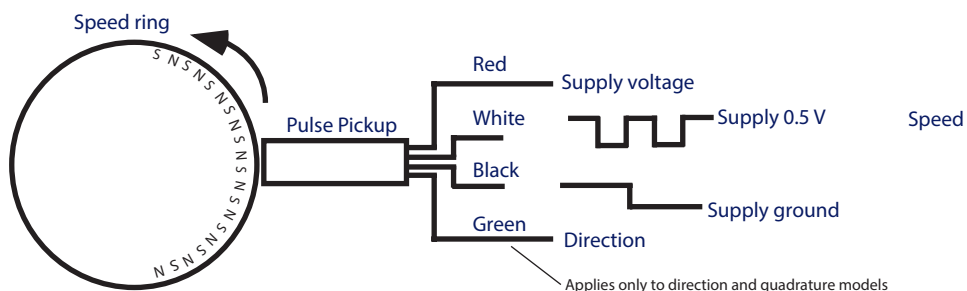
Directional Conical End Models, Series 51 and 51-1 Cartridge Motors Only





Installation Diagrams  
(continued)

Connection Diagram



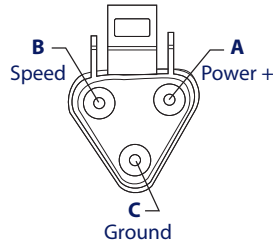
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System Wiring Guidelines

1. Protect all wires from mechanical abuse. Run wire in flexible metal or plastic conduits.
2. Separate high current wires such as solenoids, lights, alternators, or fuel pumps from control wires.
3. Run wires along the inside of, or close to metal machine frame surfaces where possible. This simulates a shield, which minimizes the effects of EMI/RFI radiation.
4. Do not run wires near sharp metal corners. Consider running the wire through a grommet when rounding a corner.
5. Do not run wires near hot machine member or engine exhaust pipes
6. Provide strain relief for all wires.
7. Avoid running wires near moving or vibrating components.
8. Avoid long, unsupported wire spans.
9. Use harness anchors that allow wires to float rather than rigid anchors.

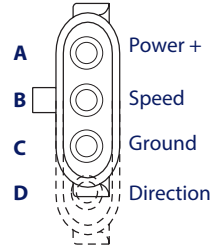
Connector Pin Assignments

3 pin Deutsch Plug DT Series connector



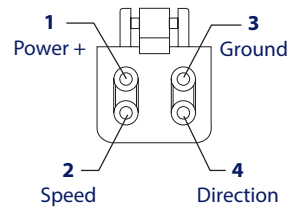
3523

3 or 4 pin Delphi Connector



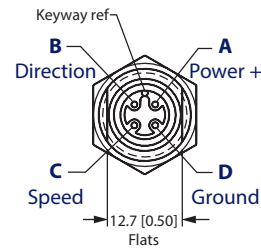
3524A

4 pin Deutsch® Plug DT Series Connector



3525

4 pin Turck Eurofast connector



3526

Troubleshooting Steps

The following steps require a 1/2 inch open end wrench with standard 22° offset and a Volt Ohm Meter (VOM):

1. Installation

First ensure that KPP is installed correctly. There are distinct directional and installation procedures, (reference [Procedures for Flat End and Conical End Models](#), page 14 to 15).

2. Speed Signal

Check for speed output using a VOM. Place VOM across the ground and speed pins or terminals, (reference [Dimensions](#), page 7) and set VOM to the DC Volt scale and low range. To check for an output, turn pump or motor very slowly by hand or check output just as the prime mover is coming to a stop. Note a voltage pulse at meter. It will likely be difficult to read exactly, simply note a pulse (approximately .60 pulses per rev.). If there is no indication of a pulse, replace KPP.

3. Directional Signal

Check for a direction signal change using a VOM. Use the same VOM setup as in the above speed signal check. Turn the motor slowly and note a polarity change ( $\pm$ ) on the VOM display as you change the motor direction.

Notes



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