The DPG is a microprocessor based digital governing system integrated with an electro-mechanical in a single pump-mountable housing and designed for BS series inline fuel injection pump. The fixed speed DPG has two connections: power and speed. To measure the engine speed, the DPG relies on a magnetic speed sensor. The sensor is positioned in close proximity to the engine’s ring gear. The governor then compares the actual speed with the desired speed. The digital electronics then adjusts the position of the rack to command the proper amount of fuel. Changes in engine speed are processed using the GAC’s highly developed EDGe™ PID algorithm for closed loop speed control.

There are two ways to control the DPG:
1. Via GAC’s SmartVU software. The EAM211 must be purchased separately in order to interface the DPG with a computer.
2. Via the DPI100, a hand held unit with physical buttons also sold separately. The DPI100 comes with the proper serial connector.

### INSTALLATION

Connecting DPI to the Pump:
1. Screw pin from DPI
2. Install pin and cut on pump rack
3. Move DPI close to the pump. Connect the DPI's link to the pin on the rack and secure

### Wiring

**NOTE:**
- If the DPI100 or 101 detects no input from the magnetic pickup, the system must be reset.
- If the DPI100 detects no input from the magnetic pickup, the system must be reset.

**POWER BUNDLE**

- **MATING CONNECTOR**: EC1300 (3 Pin)
- **FUNCTION**: Battery +
- **PIN**: A
- **COLOR**: Red

- **MATING CONNECTOR**: EC1300 (2 Pin)
- **FUNCTION**: Mag Pickup 1
- **PIN**: A
- **COLOR**: White

**MAGNETIC SPEED PICKUP BUNDLE**

- **MATING CONNECTOR**: EC1300 (3 Pin)
- **FUNCTION**: Battery -
- **PIN**: B
- **COLOR**: Black

**RECOMMENDATIONS**

- Shielded cable should be used for all external connections to the DPG controller.

**WARNING**

- If the DPI100 or 101 detects no input from the magnetic pickup, the DPG will set the actuator to 0% and set the speed to 0 RPM. After the DPG has detected loss of magnetic pickup, the system must be reset. To reactivate the DPG, DC power must be cycled.

### DPG100/101-F Digital Pump Governor

**PRODUCT NO.**

- **DPG100**: Basic unit
- **DPG101**: Basic unit plus power LED and extended travel

**PRODUCT NO.**

- **DPG100**: 12 Volt version
- **DPG101**: 24 Volt version

**PRODUCT NO.**

- **R**: Right-Hand Rack
- **L**: Left-Hand Rack

**Product Naming Convention**

- DPG100/101-F Digital Pump Governor
- 7.14

### Wiring

**NOTE:**
- There are two ways to control the DPG:
  1. Via GAC’s SmartVU software. The EAM211 must be purchased separately in order to interface the DPG with a computer.
  2. Via the DPI100, a hand held unit with physical buttons also sold separately. The DPI100 comes with the proper serial connector.

**Electrical Connection**

- **EC1523**
  - **EDGe Pinout**
    - **Pin Color**
      - **A**: Red
      - **B**: Black
      - **C**: Green

**Example**

- **MAGNETIC SPEED PICKUP**
  - **2 Pin Connector**
    - **White**
    - **Red**

**EAM211**

- **EN6**: Magnetic Speed Sensor

**POWER & SWITCHES**

- **Serial Connector** for Computer or DPI100

**TERMINATION**

- **Ferrite**
- **Fuse 10A Max**

**ENGINESensor**

- **Mag Pickup 1**
  - **A**
  - **White**

- **Mag Pickup 2**
  - **B**
  - **Blue**

**FUEL LIMIT**

- **Maximum allowable actuator % the system can command fuel**

**Droop Switch**

- **Sets the droop mode (On = Auto Dither, Off = Manual)**

**Lead / Lag**

- **Crank termination is the RPM at which the DPG switches from starting to governing.**
- **Throttle position rate of change.**
- **Starting position of the actuator during the start/crank cycle.**

**SmartVU**

- **Setup Connection Menu**
  - **STARTING PARAMETERS**
    - **CRANK TERMINATION**
      - **Corel termination is the RPM at which the DPG switches from starting to governing.**
      - **Range**: 100 - 500 RPM
      - **Default**: 250 RPM
    - **THROTTLE RAMP TIME**
      - **Throttle position rate of change.**
      - **Range**: 0 - 1000 RPM/s
      - **Default**: 150 RPM/s
    - **THROTTLE BEGINDPOINT**
      - **Starting position of the actuator during the start/crank cycle.**
      - **Range**: 0 - 100%
      - **Default**: 100%

**SPECIAL FUNCTIONS**

- **OVERSPEED**
  - **D P I**
  - **2220 RPM**
  - **Range**: 0 - 3600 RPM
  - **Default**: 2220 RPM

**ENGINE RESPONSE PARAMETERS**

- **DPI100**
  - **The DPI100 is the user interface for configuring the either the DPG. All adjustments are made using the LCD and five buttons – 3 COLUMN select buttons. 1 UP ARROW, 1 DOWN ARROW.**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Definition</th>
<th>Range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>P</strong></td>
<td>Proportional (P) set point</td>
<td>[0% - 100%]</td>
<td>50%</td>
</tr>
<tr>
<td><strong>I</strong></td>
<td>Integral (I) set point</td>
<td>[0.5 - 5]</td>
<td>0.3</td>
</tr>
<tr>
<td><strong>D</strong></td>
<td>Derivative (D) set point</td>
<td>0 - 20</td>
<td>0</td>
</tr>
</tbody>
</table>

**NOTE**

- The parameters found in SmartVU can also be found on the DPI100.

**Terminology**

- **Main display consists of most frequently adjusted parameters**
- **There are 3 configuration menus: Main, Special, and Advanced**
- **Main display consists of most frequently adjusted parameters**
- **There are 5 rows with 3 parameters in each row**
### Special Menu

**The Special Menu** is used to view and change lesser parameters.

#### Special Menu Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Definition</th>
<th>Range</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOFT</td>
<td>Soft Coating</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LEAD</td>
<td>Lead Circuit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DSW</td>
<td>Drive Slow Off</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DTH</td>
<td>Drive Throttle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DRNG</td>
<td>System Current</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RATE</td>
<td>Time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FLTR</td>
<td>Number</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GAIN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DROOP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DTH</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIL</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Advanced Menu

**The Advanced Configuration Menu** is used to manipulate the operating characteristics of the PID control.

**Parameters included in PID update rate, Filter, Gain, Stability, and Deadtime compensation scale adjustments.**

**WARNING**

Modifying the advanced parameters without thorough knowledge of their use can damage the engine or cause injury.

### ADJUSTABLE MAIN MENU PARAMETERS

<table>
<thead>
<tr>
<th>OVERSPEED</th>
<th>#TEETH</th>
<th>CRANK</th>
<th>RPM</th>
<th>Locked</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RPM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NAME</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DSW</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DSW</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NOTE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RED</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BLACK</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RED &amp; BLACK</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Speed Ramp Parameters**

<table>
<thead>
<tr>
<th>START</th>
<th>FUEL</th>
<th>RPM</th>
<th>Locked</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RPM</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>RPM</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>RPM</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Start up Parameters**

<table>
<thead>
<tr>
<th>Engine</th>
<th>RPM</th>
<th>Locked</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RPM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RPM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RPM</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Gain Stability**

| Proportional (P) set point of PID control | | |
| Proportional (P) set point of PID control | | |
| Proportional (P) set point of PID control | | |
| Proportional (P) set point of PID control | | |

### Pre-Start Setup

The following parameters must be set before starting the engine:

#### Setup & Safety Parameters

- **CRANK TERMINATION**
- **THROTTLE RAMP TIME**
- **RAMP**
- **BEGIN POINT**

#### Fixed Speed Parameters

<table>
<thead>
<tr>
<th>SPEED</th>
<th>IDLE SPEED</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPM</td>
<td></td>
</tr>
<tr>
<td>RPM</td>
<td></td>
</tr>
<tr>
<td>RPM</td>
<td></td>
</tr>
<tr>
<td>RPM</td>
<td></td>
</tr>
</tbody>
</table>

### Adjusting for Stability

Once the engine is running at operating speed and at no load, the following governor performance adjustment can be made to increase engine stability.

#### PARAMETER ADJUSTMENT PROCEDURE

1. **Gain**
   - Increase this parameter until instability develops.
   - Gradually decrease this parameter until stability returns.
   - Finally, decrease the parameter one increment further to insure stable performance.
   - If instability persists, adjust the next parameter.

2. **Stability**
   - Follow the same adjustment procedure as the P parameter.
   - If instability persists, adjust the next parameter.

3. **Deadtime**
   - Follow the same adjustment procedure as the P parameter.

**NOTE**

- **P** & **G** parameter adjustments may require minor changes after engine is applied. Normally, adjustments made at no load achieve satisfactory performance. If further performance improvements are required, refer to Advanced Menu Parameters in Section (6) and SYSTEM TROUBLESHOOTING in Section (9)

### OTHER FEATURES

**Speed Ramp Operation**

Drive replicates a mechanical governor’s response to a load change. In Drop Operation, the engine speed will decrease as engine load increases. DROOP (Single Event) is specific to the Governor during Advancesettings.

**Deadtime Compensation scale adjustments.**

**WARNING**

Performing any test described in this manual will disable the governor system.

### System Inoperative

If the governor system does not function, the fault may be determined by performing the voltage tests described in Steps 1 through 3. Position (+) and (-) refer to motor polarity. Should normal values be indicated during troubleshooting steps, then the fault may be with the actuator or the wiring to the actuator. Tests are performed with battery power on and the engine off, except where noted. See actuator publication for testing procedure on the actuator.

### System Troubleshooting

**NOTE**

- **DC battery power not energize**
- **Rect speed operating**
- **Overspeed shut down**
- **Engine Drive**

**Unsatisfactory Performance**

**Instability**

#### SYMPTOM

- **Overspeed**
- **Abnormal Speed**

### Probable Cause of Abnormal Reading

- **Gain stability**
- **Deadtime**
- **Actuator or linkage binding**
- **Control unit defective**
- **Gain stability**

**OVERSPEED**

1. **Power)**
   - Power (Red & Black)
   - Battery Supply (12 or 24V DC)

2. **Mag Pickup Blue & Mag Pickup Bundle Blue (Ground)**
   - Gap between speed sensor and gear head too great
   - Check Gap
   - Improper or defective wiring to the speed sensor
   - Resistance between the Mag Pickup Bundle Blue wire & the Mag Pickup Bundle Black wire (Ground) should be 20 to 120 ohms. Determine Magnetic Pick-up data for resistance. Defective speed sensor.

3. **Actuator does not generate torque**
   - Measure the voltages at the battery wire crankng.
   - Check or replace battery.

4. **Engine does not get to correct speed**
   - If the voltage is less than 10% of the DC voltage, run.
   - Check or replace battery.
   - If the speed sensor signal is erroneous, then check the wiring.
**PERFORMANCE**

- Isochronous Operation: ± 0.25%
- Speed Range / Governor: 400 - 10 kHz
- Drop Range: 1 - 5% regulation

**INPUT / OUTPUT**

- Supply: 12-24 VDC Battery Systems (7.0 to 33 VDC)
- Polarity: Negative Ground (Case isolated)
- Power Consumption (12VDC): 40mA MAX (no load), 6A MAX (full load), 2.5 - 4.5A Operating Range
- Power Consumption (24VDC): 40mA MAX (no load), 3A MAX (full load), 1.3 - 1.7A Typical Range, 1.0 - 2.0A Operating Range
- Speed Sensor Signal: 1.0 - 120VRMS
- Mechanical Shutdown Lever Force Required: 22 lbs-in (2.3 N-m)
- Mechanical Max Fuel Rack Stop Adj Screw Range: 12mm

**PHYSICAL**

- Dimension: See Section 12
- Weight: 3.1 lbs (1.41 kg)

**RELIABILITY**

- Vibration: 4G, 20-500 Hz
- Shock: 20G Peak
- Testing: 100% Functional Testing

**ENVIRONMENTAL**

- Ambient Temperature: -40° to 85°C (-40 to 180°F)
- Relative Humidity: up to 95%
- All Surface Finishes: Fungus Proof and Corrosion Resistant

**COMPLIANCE / STANDARDS**

- Agency: CE and RoHS Requirements
- Communications: RS-232-C, IEEE J1939