Manual Display Unit
Warning

Please be aware that information in this manual may be inaccurate, incomplete or contain typographical errors. The content of this manual is subject to change without notice and should, therefore, be used for informational purposes only. Consequently, replacement parts must always be ordered according to the part number engraved on the part.

If you find information in this manual that is incorrect or incomplete, we would appreciate your comments and suggestions.
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1. Technical Specifications
1.1. General Specifications

Designed to work seamlessly with every Drenth sequential gearbox, the Display Unit uses the rotary sensor signal to show the selected gear. Using the supplied software, it is possible to show up to 8 forward gears as well as neutral and reverse on the display with ambient light sensor. In addition, the Display Unit features an adjustable shift light and an option to control throttle blip or the reversing light. In combination with the DMS gear lever, the Display Unit can be used for flat-shifting which allows the user to set the cut time for each gear separately. This is also possible when using any other load cell or switch.

Features:

- Gear indication
- Shift light
- Flat-shifting
- Down shift throttle blip / Reverse light
- Automatic calibration
- DMS Gear Lever calibration
1.2. General Dimensions
1.3. Display Unit Mounting

The Display Unit should be mounted using the two M5 holes on the back. Mount the Display Unit so that vibrations are minimized.

Warning: Do not use glue to mount the Display Unit.
2. Drenth Display Unit Installation
2.1. Wiring Diagram Mechanical Ignition System
Please note that the maximum input voltage of the green wire (RPM Signal) is 1700V!
2.2. Wiring Diagram Distributorless Ignition System

Please note that the maximum input voltage of the green wire (RPM Signal) is 1700V!
2.3. Wiring Diagram Coil-On-Plug Ignition System
Please note that the maximum input voltage of the pink wire (RPM Signal) is 15V!
2.4. Output 2 Wiring Diagram
The purple wire of Output 2 can be used to wire the following functionalities:

- Reversing Light;
- Throttle Blip.

Reversing Light

Throttle Blip
2.5. Rotary Sensor Wiring

Drenth sequential gearboxes come with a Penny & Giles SRH280DP rotary sensor. Information related to the wiring of the sensor is shown in the table below.

<table>
<thead>
<tr>
<th>Cable Colour</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>+ 5 V Supply</td>
</tr>
<tr>
<td>Yellow</td>
<td>Output 1</td>
</tr>
<tr>
<td>White</td>
<td>Output 2</td>
</tr>
<tr>
<td>Black</td>
<td>0 V Supply (GND)</td>
</tr>
</tbody>
</table>

Depending on the type of gearbox, Output 1 or Output 2 is used. The table below shows which output is used for the different types of gearboxes:

<table>
<thead>
<tr>
<th>Gearbox Type</th>
<th>Output</th>
<th>Cable Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>DG350</td>
<td>Output 2</td>
<td>White</td>
</tr>
<tr>
<td>DG350 Direct Replacement</td>
<td>Output 1</td>
<td>Yellow</td>
</tr>
<tr>
<td>DG400</td>
<td>Output 2</td>
<td>White</td>
</tr>
<tr>
<td>DG450</td>
<td>Output 2</td>
<td>White</td>
</tr>
<tr>
<td>DG500</td>
<td>Output 2</td>
<td>White</td>
</tr>
<tr>
<td>DGT250</td>
<td>Output 2</td>
<td>White</td>
</tr>
<tr>
<td>DGT350</td>
<td>Output 2</td>
<td>White</td>
</tr>
<tr>
<td>Mitsubishi Lancer Evolution VI-IX</td>
<td>Output 1</td>
<td>Yellow</td>
</tr>
<tr>
<td>Mitsubishi Lancer Evolution X</td>
<td>Output 1</td>
<td>Yellow</td>
</tr>
<tr>
<td>MPG</td>
<td>Output 1</td>
<td>White</td>
</tr>
</tbody>
</table>
The Rotary Sensor has a male 3-way connector to connect it to the Display Unit. Information regarding the connector wiring, when using output 1 or output 2, is shown below:

Please note that the above information does not apply to other sensors!
The Display Unit has a female 3-way connector to connect it to the Rotary Sensor. Information regarding the connector wiring, is shown below:

<table>
<thead>
<tr>
<th>Cable Colour</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow</td>
<td>+5 V Supply</td>
</tr>
<tr>
<td>Grey</td>
<td>Output 1</td>
</tr>
<tr>
<td>Black</td>
<td>0 V Supply (GND)</td>
</tr>
</tbody>
</table>

Please note that the above information may differ for old versions of the Display Unit!
3. Drenth Display Unit / Gear Indicator Software V4
3.1. Installing the Software
The Drenth Display Unit / Gear Indicator Software must be installed on to the PC hard disk before it can be used. The software can be downloaded from the Drenth Gearboxes website, www.drenth-gearboxes.com. Multiple versions of the software are available so that they can be used if necessary. To install the software, first unzip the downloaded folder. Double click the downloaded file and follow the instructions. After installation, the software can be started by double-clicking the desktop icon.

3.2. Software Buttons
The Drenth Display Unit / Gear Indicator Software has a set of command buttons to perform general tasks, namely:

- Load Settings from File;
- Save Settings to File;
- Transmit Settings to Display;
- Receive Settings from Display;
- Help.

Load Settings from File
When Load Settings from File is selected, a file with predefined or user-defined settings can be opened by using the file explorer.

Save Settings to File
By pressing the Save Settings to File button, the user-defined settings can be saved to a file.

Transmit Settings to Display
By pressing the Transmit Settings to Display button, the user-defined settings will be saved to the Display Unit. Please note, when saving new settings on the Display Unit, the previous settings will be overwritten.

Receive Settings from Display
By pressing the Receive Settings from Display button, the user-defined settings will be loaded from the Display Unit. Please note, the software loads the default settings at start-up. In order to make changes to the user-defined settings, it is important to first load these settings by pressing the Receive Settings from Display button.
Help
Pressing the *Help* button opens the folder with the manuals.

3.3. Display Settings
The *Display Settings* are used for:

- Adjusting the Display Brightness;
- Setting the Number of Gears;
- Resetting the Display Unit to Default Settings;
- Automatic Calibration;

Brightness
The display brightness of the Display Unit can be adjusted as desired using one of the following settings:

- Automatic;
- Bright;
- Dark;

When the display brightness is set to *Automatic*, the Display Unit uses an ambient light sensor to adjust the display brightness based on the light conditions. The sensor lowers the brightness in dark locations and raises brightness in light conditions. The *Automatic* brightness is on by default and can be disabled by selecting either *Bright* or *Dark*.

Number of Gears
The number of gears is set using two columns, namely:

- *On/Off* checkbox column;
- *Display Text* column.

The *On/Off* checkbox column is used to set the number of gears including neutral and reverse. For example, for a 6-speed gearbox, including neutral and reverse, 8 checkboxes must be checked. Therefore, with the 10 available checkboxes, an 8-speed gearbox including neutral and reverse can be configured.
Next to the On/Off column, the Display Text column is displayed, in this column the gear sequence is selected by using the drop-down lists. The selected gear sequence in the Display Text column must have an increasing output signal from top to bottom. For example, if the rotary sensor has the lowest signal value in reverse gear and increases when shifting to higher gears, then the selected gear sequence in the Display Text column, top to bottom, is R-N-1-2-3-4-5-6 for a 6-speed gearbox. If the lowest signal value of the rotary sensor is in 6th gear and decreases when shifting to lower gears, then the selected gear sequence in the Display Text column, top to bottom, is 6-5-4-3-2-1-N-R for a 6-speed gearbox.

Default

By pressing the Default button, the default settings are loaded and the current settings are lost. Keep in mind that the default settings will not be activated until they are loaded onto the Display Unit.

Automatic Calibration

For correct gear indication, the Display Unit compares the signal value of the rotary sensor with stored reference values of each gear. Therefore, it is necessary to read the reference values of the gears in the Display Unit using Automatic Calibration. When Automatic Calibration is selected, a popup window will appear with instructions for reading the reference values of the different gears. For example:

“Select R and then press the Enter key or OK button to confirm.”

After selecting the indicated gear and confirming this, the output signal of the rotary sensor is read and stored as reference value for the indicated gear. After successful Automatic Calibration, the selected gear will be displayed correctly on the Display Unit.

Manual Calibration

Instead of using Automatic Calibration to read the reference values of the gears, this can also be done manually by using the Manual Calibration option. When Manual Calibration is selected, the Manual Calibration window appears with fields for filling in the reference value of the specified gear. The reference values of each gear must be manually pre-determined by using the Get Actual Position button in the Rotary Sensor menu of the Drenth Display Unit / Gear Indicator Software.
3.4. Ignition System
The \textit{Ignition System Settings} is used to configure below setting:

- Number of Cylinders & Type of Ignition.

\textbf{Number of Cylinders & Type of Ignition}

The drop-down list in the \textit{Ignition System Settings} is used to select the \textit{Number of Cylinders & Type of Ignition}. In the drop-down list you can choose from the possibilities below:

- 4-Cylinder Mechanical : 4-Cylinder engines with mechanical ignition system.
- 4-Cylinder Distributorless (DIS) : 4-Cylinder engines with distributorless ignition system (DIS).
- 4-Cylinder Coil-On-Plug (COP) : 4- Cylinder engines with Coil-On-Plug (COP) ignition system.
- 5-Cylinder Mechanical : 5-Cylinder engines with mechanical ignition system.
- 5-Cylinder Coil-On-Plug (COP) : 5-Cylinder engines with Coil-On-Plug (COP) ignition system.
- 6-Cylinder Mechanical : 6-Cylinder engines with mechanical ignition system.
- 6-Cylinder Distributorless (DIS) : 6-Cylinder engines with distributorless ignition system (DIS).
- 6-Cylinder Coil-On-Plug (COP) : 6-Cylinder engines with Coil-On-Plug (COP) ignition system.
- 8-Cylinder Mechanical : 8-Cylinder engines with mechanical ignition system.

3.5. Ignition Cut Settings
The \textit{Ignition Cut Settings} are used to configure below settings:

- Cut Source;
- Advanced Settings Ignition Cut.

\textbf{Cut Source}

To be able to make an upshift, a request from the \textit{Cut Source} is required to activate the \textit{Ignition Cut}. The \textit{Cut Source} setting is used to set the type of source used for this:
Switch, NC (Normally Closed): A *Normally Closed (NC) Switch* opens the circuit when actuated, preventing the current from flowing. In its normal state the circuit is closed, causing the current to flow.

Switch, NO (Normally Open): A *Normally Open (NO) Switch* closes the circuit when actuated, causing the current to flow. In its normal state the circuit is open, preventing current flow.

Load Cell: The output signal of a *Load Cell*, which is bonded to the surface of the gear lever, changes as the gear lever bends slightly when force is applied. Please note that when *Load Cell* is selected as *Cut Source*, it is necessary to configure the *Load Cell Settings* to activate the *Ignition Cut*.

By default, the orange wire is switched to ground to control the *Ignition Cut*. By ticking the *Invert Output* checkbox, the orange wire is switched to 12V.

**Advanced Settings Ignition Cut**

When *Advanced Settings* is selected, the *Advanced Settings Ignition Cut* window opens in which the below settings can be configured:

- **Minimum RPM**: The *Minimum RPM* is used to set the RPM level below which the *Ignition Cut* is not activated.
- **Switch Debounce Time [ms]**: To prevent multiple *Ignition Cuts* from being triggered as a result of bouncing of the normally open or normally closed switch, the *Switch Debounce Time [ms]* is used to set how long the switch must be open or closed to trigger the *Ignition Cut* once.
- **Pause Time [s]**: To prevent accidental up- or downshifting, the *Pause Time [s]* is used to set the minimum time between two consecutive *Ignition Cuts*.
- **Cut Time [ms]**: In the *Cut Time* row of the *Upshift* table, the duration of the *Ignition Cut* is configured for each gear.
- **Delay Time [ms]**: In the *Delay Time* row of the *Upshift* table, the time between the *Ignition Cut* request and activation of the *Ignition Cut* is configured for each gear.
- **Blip Time [ms]**: In the *Blip Time* row of the *Downshift* table, the duration of the *Throttle Blip* is configured for each gear.
3.6. Load Cell Settings

The Load Cell Settings are only used when Load Cell is selected as the Cut Source in the Ignition Cut menu. In this case, the Load Cell Settings are used to configure below settings:

- Upshift Threshold [mV];
- Neutral Position [mV];
- Downshift Threshold [mV];
- Hysteresis Value [mV].

**Upshift Threshold Value [mV]**

The Upshift Threshold [mV] is used to set the level of force needed to trigger the Ignition Cut. If the voltage signal of the load cell goes above the Upshift Threshold [mV], and the Minimum RPM condition is satisfied, the Ignition Cut request is activated. The Upshift Threshold [mV] must be set at a level that prevents activation of the Ignition Cut due to vibrations. In general, it is advisable to set a Minimum Upshift Threshold of 2800 mV. The Display Unit has a pre-set Upshift Threshold of 3000 mV.

**Neutral Position Value [mV]**

The Neutral Position [mV] is used to set the voltage signal of the load cell in rest position. The Neutral Position [mV] should be ± 2500 mV, which is pre-set on the Display Unit. The Load Cell Settings menu features a Get Actual Position button which can be used to verify the Neutral Position [mV] of the load cell. In case this signal value differs from the pre-set value, the readout value can be used to set the Neutral Position [mV]. It is necessary to adjust the Upshift Threshold [mV] and Downshift Threshold [mV] accordingly.

**Downshift Threshold [mV]**

The Downshift Threshold [mV] is used to set the level of force needed to trigger the Ignition Cut and/or the Throttle Blip. If the voltage signal of the load cell goes below the Downshift Threshold [mV], and the Minimum RPM condition is satisfied, the Ignition Cut and/or Throttle Blip request is activated. The Downshift Threshold [mV] must be set at a level that prevents activation of the Ignition Cut and/or Throttle Blip due to vibrations. In general, it is advisable to set a Maximum Downshift Threshold of 2200 mV, which is pre-set on the Display Unit.

**Hysteresis [mV]**

The Hysteresis [mV] is used to set the value that the voltage signal of the load cell needs to change before a new Ignition Cut request is activated. For Example: If the set Upshift Threshold is 3000 mV and the Hysteresis value is 100 mV, to make an upshift the gear lever needs to be pulled backwards until the output signal of the load cell increases above 3000 mV. If the Minimum RPM for Ignition Cut and Throttle Blip condition is satisfied, the Ignition Cut
request is activated. Then the gear lever must be released until the output voltage of the load cell decreases below 2900 mV (Upshift Threshold – Hysteresis) before a new Ignition Cut request is activated. In case of downshifting, set Downshift Threshold of 2200 mV, the gear lever needs to be pushed forward until the output signal of the load cell decreases below 2200 mV. If the Minimum RPM for Ignition Cut and Throttle Blip condition is satisfied, the Ignition Cut and/or Throttle Blip request is activated. Then the gear lever must be released until the output voltage of the load cell increases above 2300 mV (Upshift Threshold + Hysteresis) before a new Ignition Cut and/or Throttle Blip request is activated.

3.7. Shift Light Settings
The Shift Light Settings are used to configure below settings:

- Shift Light Mode;
- Maximum (Upshift) RPM.

Shift Light Mode

The drop-down list in the Shift Light Settings is used to select the desired Shift Light Mode. The Display Unit has 4 shift light modes:

Mode 1: At the set Maximum (Upshift) RPM, all LEDs will turn on and the display starts flashing.
Mode 2: At the set Maximum (Upshift) RPM, all LEDs will turn on.
Mode 3: 750 RPM before the set Maximum (Upshift) RPM, all LEDs will turn off and then at every increase of 100 RPM, the LEDs will turn on, per row from bottom to top, until all LEDs are on.
Mode 4: 750 RPM before the set Maximum (Upshift) RPM, all LEDs will turn off and then at every increase of 100 RPM, the LEDs will turn on flashing, per row from bottom to top, until all LEDs are on.

The different modes can be demonstrated in the software using the horizontal scrollbar in the Shift Light Settings menu. If desired, the Shift Light can be turned off by ticking the Shift Light off checkbox.

Maximum (Upshift) RPM

The Maximum (Upshift) RPM setting is used to set the desired RPM for upshifting. This can be equal to the maximum engine RPM, however, any other RPM can be set. Please note that this setting is not related to the rev limiter. It only affects the operation of the shift light!
3.8. Output 2 Settings
The Output 2 Settings are used to configure the below setting:

- Output 2.

Output 2
The drop-down list in the Output 2 Settings is used to set the desired function of Output 2. Output 2 can be used to control the following functionalities:

- Reversing Light;
- Throttle Blip;
- No Function.

By default, Output 2 is switched to ground to control the Reversing Light or Throttle Blip. By ticking the Invert Output checkbox, Output 2 is switched to 12V.

Please note that when the Throttle Blip function is selected, it is necessary to configure the duration of the throttle blip for each gear in the Advanced Ignition Cut Settings window.

3.9. Rotary Sensor
The signal value of the Rotary Sensor can be checked using the Get Actual Position button in the Rotary Sensor menu. This function can be used to determine the reference values for each gear which are entered in the Manual Calibration table when performing Manual Calibration. In addition, this function can also be used to align the Rotary Sensor after is has been reassembled. When reverse gear is selected, the output signal of the Rotary Sensor must be: 0.7V.
4. Contact Information
4.1. Contact Details
Drenth Motorsport Gearboxes
Fleuweweg 10
7468 AG Enter
The Netherlands

www.drenth-gearboxes.com

Spare Parts:  +31 (0)547 38 26 96
sales@drenth-gearboxes.com
Appendix A: Technical Bulletins
<table>
<thead>
<tr>
<th>Date</th>
<th>Revised</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>02-01-2017</td>
<td>Wire Colors</td>
<td>The wire colors of the wires used to connect a Normally Open (NO) or Normally Closed (NC) switch, in case no Load Cell is used, have been changed. Prior to 2017, white/black and yellow/black wires were used to connect the NO or NC switch. From 2017, this has changed to white and black wires. White/ black has changed to white. Yellow/black has changed to black.</td>
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</table>
Appendix B: Amendments
<table>
<thead>
<tr>
<th>Date</th>
<th>Page</th>
<th>Modification</th>
</tr>
</thead>
<tbody>
<tr>
<td>04-06-2018</td>
<td></td>
<td>1st Issue of completely revised manual</td>
</tr>
<tr>
<td>11-06-2018</td>
<td>19 &amp; 20</td>
<td>Help &amp; Automatic Calibration section changed</td>
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