Integrated Electric ZT Drive System Service and Repair Manual

BLN-0018
January 2018
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreword</td>
<td>1</td>
</tr>
<tr>
<td>Description and Operation</td>
<td>2</td>
</tr>
<tr>
<td>Introduction</td>
<td>2</td>
</tr>
<tr>
<td>General Description</td>
<td>2</td>
</tr>
<tr>
<td>External Features</td>
<td>3</td>
</tr>
<tr>
<td>System Components</td>
<td>4</td>
</tr>
<tr>
<td>Technical Specifications</td>
<td>5</td>
</tr>
<tr>
<td>Product Identification</td>
<td>5</td>
</tr>
<tr>
<td>Safety</td>
<td>6</td>
</tr>
<tr>
<td>Personal Safety</td>
<td>6</td>
</tr>
<tr>
<td>Tool Safety</td>
<td>6</td>
</tr>
<tr>
<td>Work Area Safety</td>
<td>6</td>
</tr>
<tr>
<td>Servicing Safety</td>
<td>6-7</td>
</tr>
<tr>
<td>Troubleshooting</td>
<td>8-13</td>
</tr>
<tr>
<td>Service and Maintenance</td>
<td>14</td>
</tr>
<tr>
<td>External Maintenance</td>
<td>14</td>
</tr>
<tr>
<td>Service and Maintenance Procedures</td>
<td>14</td>
</tr>
<tr>
<td>Fluids</td>
<td>14</td>
</tr>
<tr>
<td>Fluid Volume and Level</td>
<td>14</td>
</tr>
<tr>
<td>Fluid Change Procedure</td>
<td>15</td>
</tr>
<tr>
<td>Battery Charging</td>
<td>16</td>
</tr>
<tr>
<td>Digital Display Replacement</td>
<td>17</td>
</tr>
<tr>
<td>Double Pole Contactor Replacement</td>
<td>18</td>
</tr>
<tr>
<td>Traction Controller Replacement</td>
<td>19</td>
</tr>
<tr>
<td>Accelerator Replacement</td>
<td>20</td>
</tr>
<tr>
<td>Accelerator RTN Replacement</td>
<td>21</td>
</tr>
<tr>
<td>Accelerator Calibration (Right)</td>
<td>22</td>
</tr>
<tr>
<td>Accelerator Calibration (Left)</td>
<td>23</td>
</tr>
<tr>
<td>Smartec Interface Tool Functions</td>
<td>24</td>
</tr>
<tr>
<td>Deck Controller</td>
<td>25</td>
</tr>
<tr>
<td>Deck Motor Replacement</td>
<td>26</td>
</tr>
<tr>
<td>Deck Motor Nose Cone Replacement</td>
<td>27</td>
</tr>
<tr>
<td>Teardown &amp; Reassembly</td>
<td>28</td>
</tr>
<tr>
<td>How To Use This Manual</td>
<td>28</td>
</tr>
<tr>
<td>General Instructions</td>
<td>28</td>
</tr>
<tr>
<td>Transaxle Removal</td>
<td>28</td>
</tr>
<tr>
<td>Limited Disassembly</td>
<td>28</td>
</tr>
<tr>
<td>Tools</td>
<td>29</td>
</tr>
<tr>
<td>Torques</td>
<td>29</td>
</tr>
<tr>
<td>Transaxle Removal</td>
<td>30</td>
</tr>
<tr>
<td>Axle Hub Assembly</td>
<td>31</td>
</tr>
<tr>
<td>Brake Assembly</td>
<td>32</td>
</tr>
<tr>
<td>Speed Sensor</td>
<td>33</td>
</tr>
<tr>
<td>Axle Seal &amp; Retaining Ring</td>
<td>34</td>
</tr>
<tr>
<td>Side Housing</td>
<td>35</td>
</tr>
<tr>
<td>Sensor Gear &amp; Pinion Gear</td>
<td>36</td>
</tr>
<tr>
<td>Drive Motor</td>
<td>37</td>
</tr>
<tr>
<td>Internal Gears</td>
<td>38</td>
</tr>
<tr>
<td>Bull Gear &amp; Axle Shaft</td>
<td>39</td>
</tr>
<tr>
<td>Servicing Without Removing Axle Hub</td>
<td>40</td>
</tr>
<tr>
<td>Assembly After A Complete Teardown</td>
<td>41</td>
</tr>
<tr>
<td>Sealant Pattern</td>
<td>42</td>
</tr>
<tr>
<td>Housing Screw Tightening Sequence</td>
<td>42</td>
</tr>
<tr>
<td>Drive Transaxle Exploded View</td>
<td>44</td>
</tr>
<tr>
<td>Parts List</td>
<td>45</td>
</tr>
<tr>
<td>Glossary of Terms</td>
<td>46-47</td>
</tr>
<tr>
<td>Notes</td>
<td>48</td>
</tr>
</tbody>
</table>
Headquartered in Sullivan, Illinois, Smartec is a world leader in the design, manufacture, and service of quality electric drive systems for the lawn care industry. The mission of our company is to be recognized by our customers and the industry as a world-class supplier and the quality leader in everything we do.

This Service and Repair Manual is designed to provide information useful in servicing and troubleshooting the Smartec Integrated Electric Zero-Turn Transaxle drive system. Also included is a glossary of terms that are frequently used throughout the industry and in Smartec service publications. Understanding terminology is very important!

It is necessary, and a good shop practice, that your service area be equipped with the proper tools and the mechanics be supplied the latest information available. All repair procedures illustrated in this guide are suggested, but preferred methods of repair.

Internal repair procedures require that the transaxle unit be removed from the vehicle.

This is not a certification, test or study guide for a certification test. If a technician is interested in certification, they should contact an agent representing the EETC (Equipment and Engine Training Council) at (262) 367-6700 or their Central Service Distributor. Many distributors will be hosting certification testing. These study guides will cover most of the products and manufacturers in our industry.

For more information about Smartec or our products, please see www.hydro-gear.com for phone listings to contact your Central Service Distributor, or call our Customer Service Department at (217) 728-2581.
INTRODUCTION

The purpose of this manual is to provide information useful in servicing the Smartec Integrated Electric ZT (Zero-Turn) Transaxle and deck system. This manual includes the Smartec general descriptions, electrical schematics, technical specifications, servicing and troubleshooting procedures.

Other than recommended external maintenance, the transaxle and deck system normally will not require servicing during the life of the vehicle in which it is installed. Should other servicing be required, the exterior of the machine will need to be thoroughly cleaned before beginning most procedures. **Do not use a pressure washer to clean the transaxle or system components.**

General Description

The Smartec Integrated Electric ZT Transaxle and deck system is designed to provide a complete drive and cutting solution in an integrated electric only machine. It is a true drive by wire system, with no mechanical linkages for steering, braking or propulsion. It provides an infinitely variable speed range between zero and maximum in both forward and reverse modes of operation.

Lead acid batteries supply power to the 48 volt system. The Smartec Integrated Electric ZT drive system utilizes two electric motors that provide movement for the vehicle. Each motor powers an integrated gear drive for forward and reverse movement. Two electric motors drive the cutting blades for the deck system.

Power management and control is accom-
EXTERNAL FEATURES

— Outboard View —

— Top View —

Fail-Safe Brake
Manual Release

Drive Motor
Terminals

Temperature Sensor

Speed Sensor

Axle/Axle Tube

Hub

Fail-Safe Brake

Drive Motor

Oil Fill Port

Oil Drain Port

Smartec ZT
SYSTEM COMPONENTS

Traction Controller (2)

Traction Controller Cover (If Equipped)

Deck Motor (2)

Deck Controller (1)

Double Pole Contactor (1)

Accelerator (2)

Digital Display (if equipped)

Integrated Electric Transaxle (2)
TECHNICAL SPECIFICATIONS

### Smartec Integrated Electric ZT Drive System Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Transaxle Reduction</td>
<td>45.11:1</td>
</tr>
<tr>
<td>Output Torque</td>
<td></td>
</tr>
<tr>
<td>Continuous Operating Torque, lb-ft [N-m]</td>
<td>80   [108.4]</td>
</tr>
<tr>
<td>Peak Operating Torque, lb-ft [N-m]</td>
<td>322  [436.6]</td>
</tr>
<tr>
<td>Weight on Tires (per unit)</td>
<td></td>
</tr>
<tr>
<td>Maximum with 18” tires, lb [kg]</td>
<td>340  [154]</td>
</tr>
<tr>
<td>Axle Shaft Diameter, in [mm]</td>
<td>1.00  [25.4]</td>
</tr>
<tr>
<td>Axle Shaft End Options</td>
<td>4-Bolt Flange</td>
</tr>
<tr>
<td>Parking Brake Type</td>
<td>Electric</td>
</tr>
<tr>
<td>Electrical System</td>
<td>48v</td>
</tr>
</tbody>
</table>

PRODUCT IDENTIFICATION

The model and configuration of the Smartec Drive System can be determined from the label shown below.

![Figure 1. Configuration Label](image-url)
SAFETY

❗️ This symbol points out important safety instructions which, if not followed, could endanger the personal safety and/or property of yourself and others. Read and follow all instructions in this manual before attempting maintenance on your drive or deck system. When you see this symbol - HEED ITS WARNING.

WARNING

POTENTIAL FOR SERIOUS INJURY

Inattention to proper safety, operation, or maintenance procedures could result in personal injury, or damage to the equipment. Before servicing or repairing the Smartec™ system, fully read and understand the safety precautions described in this section.

PERSONAL SAFETY

Certain safety precautions must be observed while servicing or repairing the Smartec system. This section addresses some of these precautions but must not be considered an all-inclusive source on safety information. This section is to be used in conjunction with all other safety material which may apply, such as:

1. Other manuals pertaining to this machine,
2. Local and shop safety rules and codes,
3. Governmental safety laws and regulations,
4. OSHA and NFPA 70E Standards for Electrical Safety in the Workplace guidelines.

Be sure that you know and understand the equipment and the hazards associated with it. Do not place speed above safety.

Notify your supervisor whenever you feel there is any hazard involving the equipment or the performance of your job.

Verify that you are qualified and properly trained to perform the required work. Never allow untrained or unauthorized personnel to service or repair the equipment.

Wear appropriate clothing. Loose or hanging clothing or jewelry can be hazardous. Use the appropriate safety equipment, such as eye and hearing protection, and safety-toe and slip-proof shoes.

Never use compressed air to clean debris from yourself or your clothing.

TOOL SAFETY

Use the proper tools and equipment for the task.

Inspect each tool before use and replace any tool that may be damaged or defective.

WORK AREA SAFETY

The work area must be dry; free from any moisture, dampness or liquids.

Keep the work area neat and orderly. Be sure it is well lit, that extra tools are put away, trash and refuse are in the proper containers, and dirt or debris have been removed from the working areas of the machine.

The floor should be clean and dry, and all extension cords or similar trip hazards should be removed.

“Discard used cleaning material in the appropriate containers according to local, state, and federal regulations.”
SAFETY Continued.

SERVICING SAFETY

All procedures will require the vehicle to be disabled in order to prevent possible injury to the servicing technician and/or bystanders.

ALL wires leading to the MAIN GROUND TERMINAL must be disconnected from the battery pack (Figure 2).

De-energize the system/components by waiting 5 minutes prior to performing any repairs or adjustments.

Never touch two posts of any battery at the same time. Never touch the body frame and the positive lead at the same time.

As a General rule, keep batteries free of debris. Reference machine owners manual for proper battery cleaning and maintenance procedures.

Some cleaning solvents are flammable. Use only approved cleaning materials: Do not use explosive or flammable liquids to clean the equipment.

To avoid possible fire, do not use cleaning solvents in an area where a source of ignition may be present.

Discard used cleaning material in the appropriate containers.

Figure 2. Battery Diagram

WARNING

POTENTIAL FOR SERIOUS INJURY

Inattention to proper safety, operation, or maintenance procedures could result in personal injury, or damage to the equipment. Before servicing or repairing the Smartec™ system, fully read and understand the safety precautions described in this section.
**TROUBLESHOOTING**

**NOTE:**
- Digital interface codes beginning with 02A refer to the right side drive system. Codes beginning with 04A refer to the left side drive system. A code beginning with 16A refers to the Digital Display.
- The first 3 columns of the troubleshooting guide will refer to the codes found on either the digital display, or LED light on the dash of your mower.
- Smartec Interface Tool can be used for detailed diagnostic troubleshooting (Tool Functions, Page 23).

### Troubleshooting Guide

<table>
<thead>
<tr>
<th>Code 02 = Right Side</th>
<th>Code 04 = Left Side</th>
<th>LED Flash Code</th>
<th>Symptom</th>
<th>Smartec Interface Tool</th>
<th>Why</th>
<th>How to Repair</th>
</tr>
</thead>
<tbody>
<tr>
<td>02A11</td>
<td>04A11</td>
<td>1-1</td>
<td>No Drive</td>
<td>Watchdog</td>
<td>Internal diagnostic malfunction.</td>
<td>Cycle key, if alarm persists traction controller will need to be replaced.</td>
</tr>
<tr>
<td>02A12</td>
<td>04A12</td>
<td>1-2</td>
<td>No Drive</td>
<td>EEPROM KO</td>
<td>Internal diagnostic malfunction.</td>
<td>Cycle key, if alarm persists traction controller will need to be replaced.</td>
</tr>
<tr>
<td>02A13</td>
<td>04A13</td>
<td>1-3</td>
<td>No Drive</td>
<td>AUX OUTPUT KO</td>
<td>Output did not respond to command.</td>
<td>Verify wire plug connection of fail safe brake. Repair or replace connection as needed. Replace fail safe brake if alarm persists.</td>
</tr>
<tr>
<td>02A14</td>
<td>04A14</td>
<td>1-4</td>
<td>No Drive</td>
<td>LOGIC FAILURE # 3</td>
<td>Internal diagnostic malfunction.</td>
<td>Cycle key, if alarm persists traction controller will need to be replaced.</td>
</tr>
<tr>
<td>02A15</td>
<td>04A15</td>
<td>1-5</td>
<td>No Drive</td>
<td>LOGIC FAILURE # 2</td>
<td>Internal diagnostic malfunction.</td>
<td>Cycle key, if alarm persists traction controller will need to be replaced.</td>
</tr>
<tr>
<td>02A16</td>
<td>None</td>
<td>1-6</td>
<td>No Drive</td>
<td>LOGIC FAILURE # 1</td>
<td>Low battery charge, loose or shorted connection at key switch.</td>
<td>Charge battery(s) and replace as needed. Verify, repair or replace wire connection at key switch as needed. If alarm persists traction controller will need to be replaced.</td>
</tr>
<tr>
<td>02A17</td>
<td>04A17</td>
<td>1-7</td>
<td>No Drive</td>
<td>VMN LOW</td>
<td>Low battery charge, loose or shorted connection at drive motor or traction controller.</td>
<td>Charge battery(s). Verify, repair or replace connections at drive motor and traction controller as needed. If alarm persists traction controller will need to be replaced.</td>
</tr>
<tr>
<td>02A18</td>
<td>04A18</td>
<td>1-8</td>
<td>No Drive</td>
<td>VMN HIGH</td>
<td>Excessive battery charge, loose or shorted connection at drive motor or traction controller.</td>
<td>Charge battery(s). Verify, repair or replace connections at drive motor and traction controller as needed. If alarm persists traction controller will need to be replaced.</td>
</tr>
<tr>
<td>02A19</td>
<td>None</td>
<td>1-9</td>
<td>No Drive</td>
<td>Contactor Closed</td>
<td>Contactor has been manually shorted. Short between contactor and positive battery connection.</td>
<td>Verify, repair or replace connection between contactor and positive battery connection as needed. Replace contactor if alarm persists.</td>
</tr>
<tr>
<td>02A21</td>
<td>None</td>
<td>2-1</td>
<td>No Drive</td>
<td>Contactor Open</td>
<td>Low battery charge, short between contactor and positive battery connection.</td>
<td>Charge battery(s) and verify, repair or replace connection between contactor and positive battery connection as needed. Replace contactor if alarm persists.</td>
</tr>
<tr>
<td>02A22</td>
<td>04A22</td>
<td>2-2</td>
<td>Reduced Drive Speed</td>
<td>Ebrake KO</td>
<td>Brake has malfunctioned during start sequence.</td>
<td>Replace Fail Safe Brake.</td>
</tr>
<tr>
<td>02A23</td>
<td>04A23</td>
<td>2-3</td>
<td>No Drive</td>
<td>I=0 EVER</td>
<td>Power connection is loose on the contactor, drive motors or traction controller. Internal diagnostic malfunction.</td>
<td>Check that all power connections are tightened to correct torque. Cycle key, if alarm persists traction controller will need to be replaced.</td>
</tr>
<tr>
<td>Code 02</td>
<td>Code 04</td>
<td>LED Flash Code</td>
<td>Symptom</td>
<td>Smartec Interface Tool</td>
<td>Why</td>
<td>How to Repair</td>
</tr>
<tr>
<td>---------</td>
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<td>------------------</td>
<td>------------------------</td>
<td>---------------------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>02A24</td>
<td>04A24</td>
<td>2-4</td>
<td>No Drive</td>
<td>STBY I HIGH</td>
<td>Internal diagnostic malfunction.</td>
<td>Cycle key, if alarm persists traction controller will need to be replaced.</td>
</tr>
<tr>
<td>02A25</td>
<td>None</td>
<td>2-5</td>
<td>No Drive</td>
<td>EMERGENCY</td>
<td>The emergency stop button is engaged.</td>
<td>Turn off emergency stop.</td>
</tr>
<tr>
<td>02A26</td>
<td>04A26</td>
<td>2-6</td>
<td>No Drive</td>
<td>CAPACITOR CHARGE</td>
<td>External device or shorted connection drawing power from positive battery connection or key switch.</td>
<td>Remove any unapproved device drawing power from system. Verify, repair or replace connections of positive battery and keyswitch as needed. If alarm persists replace traction controller.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Reduced Drive Speed</td>
<td>High Temperature</td>
<td>Traction controller baseplate temperature has exceeded maximum allowable.</td>
<td>Remove debris build up from traction controller and/or base. Replace traction controller if alarm persists.</td>
</tr>
<tr>
<td>02A27</td>
<td>04A27</td>
<td>2-7</td>
<td>Reduced Drive Speed</td>
<td>High Temperature</td>
<td>Debris not allowing traction controller(s) to cool properly.</td>
<td>Remove debris build up from traction controller(s) to cool properly.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No Drive</td>
<td>Traction controller baseplate temperature has exceeded maximum allowable.</td>
<td>Remove debris build up from traction controller and/or base. Replace traction controller if alarm persists.</td>
</tr>
<tr>
<td>02A28</td>
<td>04A28</td>
<td>2-8</td>
<td>No Drive</td>
<td>Encoder Locked</td>
<td>Speed feedback below minimum allowable.</td>
<td>Remove debris build up from drive motor. Correct traction controller and drive motor wiring per the manufacturer specifications. If alarm persists replace drive motor.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Reduced Drive Speed</td>
<td>Motor Temperature</td>
<td>Internal failure in drive motor.</td>
<td>Replace drive motor if alarm persists.</td>
</tr>
<tr>
<td>02A29</td>
<td>None</td>
<td>2-9</td>
<td>No Drive</td>
<td>Battery Low</td>
<td>Battery(s) not charged or won't hold charge.</td>
<td>Attempt to recharge and replace battery(s) if alarm persists.</td>
</tr>
<tr>
<td>02A30</td>
<td>None</td>
<td>2-10</td>
<td>No Drive</td>
<td>Encoder Locked</td>
<td>Speed feedback below minimum allowable.</td>
<td>Reconnect or replace speed sensor.</td>
</tr>
<tr>
<td>02A31</td>
<td>04A31</td>
<td>3-1</td>
<td>No Drive</td>
<td>Encoder Locked</td>
<td>Wheel blocked from spinning.</td>
<td>Remove source of blockage.</td>
</tr>
<tr>
<td>02A32</td>
<td>04A32</td>
<td>3-2</td>
<td>No Drive</td>
<td>Encoder Error</td>
<td>Speed feedback below minimum allowable.</td>
<td>Reconnect or replace speed sensor if alarm persists.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>High speed condition, speed sensor has quit working.</td>
<td>Cycle key, refer to owners manual for proper mower use, if alarm persists speed sensor will need to be replaced.</td>
</tr>
</tbody>
</table>
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<table>
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<th>Code 04 = Left Side</th>
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<th>Symptom</th>
<th>Smartec Interface Tool</th>
<th>Why</th>
<th>How to Repair</th>
</tr>
</thead>
<tbody>
<tr>
<td>02A33</td>
<td>04A33</td>
<td>3-3</td>
<td>No Drive</td>
<td>BRAKE</td>
<td>Brake switch input is high, disconnected brake switch, brake pedal not disengaging.</td>
<td>Verify, repair or replace brake wiring connections as needed, verify pedal is disengaged. Replace brake switch if alarm persists.</td>
</tr>
<tr>
<td>02A34</td>
<td>04A34</td>
<td>3-4</td>
<td>No Drive</td>
<td>THERMIC SENS KO</td>
<td>Internal diagnostic malfunction.</td>
<td>Cycle key, if alarm persists traction controller will need to be replaced.</td>
</tr>
<tr>
<td>None</td>
<td>3-5</td>
<td>No Drive</td>
<td>DRIVER SHORT-ED</td>
<td>Voltage low at contactor.</td>
<td>Verify contactor connection to negative battery for short or loose connection, repair or replace as needed. Replace contactor if alarm persists.</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>3-6</td>
<td>No Drive</td>
<td>CONTACTOR DRIVER</td>
<td>Voltage high at contactor.</td>
<td>Verify contactor connection to positive battery for short or loose connection repair or replace as needed. Replace contactor if alarm persists.</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>3-7</td>
<td>No Drive</td>
<td>COIL SHORTED</td>
<td>Voltage high at contactor.</td>
<td>Replace contactor if error happens during start sequence.</td>
<td></td>
</tr>
<tr>
<td>02A38</td>
<td>04A38</td>
<td>3-8</td>
<td>No Drive</td>
<td>VACC NOT OK</td>
<td>Malfunctioning accelerator, disconnected or shorted accelerator connection.</td>
<td>Verify, repair or replace accelerator connections as needed. Replace accelerator if alarm persists.</td>
</tr>
<tr>
<td>02A39</td>
<td>04A39</td>
<td>3-9</td>
<td>No Drive</td>
<td>FORW + BACK</td>
<td>Malfunctioning accelerator, disconnected or shorted accelerator connection.</td>
<td>Verify, repair or replace accelerator connections as needed. Replace accelerator if alarm persists.</td>
</tr>
<tr>
<td>02A42</td>
<td>04A42</td>
<td>4-2</td>
<td>No Drive</td>
<td>LOW VOLTAGE</td>
<td>Loose or shorted connection between positive battery(s) and/or traction controller, malfunctioning traction controller.</td>
<td>Verify, repair or replace connection(s) between battery(s) and/or traction controller as needed. Replace traction controller if alarm persists.</td>
</tr>
<tr>
<td>02A43</td>
<td>04A43</td>
<td>4-3</td>
<td>No Drive</td>
<td>MANUAL BRAKE REL</td>
<td>Fail safe brake has been manually overridden, malfunctioning manual brake release switch, loose or shorted connection.</td>
<td>Verify brake is not manually released, verify, repair or replace connections as needed. Replace manual brake release switch if alarm persists.</td>
</tr>
<tr>
<td>None</td>
<td>4-4</td>
<td>No Drive</td>
<td>No seat in run</td>
<td>Operator came out of seat while machine is moving, seat switch is making intermittent contact.</td>
<td>Stay in seat. Verify, repair or replace connections as needed. Replace seat switch if alarm persists.</td>
<td></td>
</tr>
<tr>
<td>02A45</td>
<td>04A45</td>
<td>4-5</td>
<td>No Drive</td>
<td>PEDAL WIRE KO</td>
<td>Disconnected or shorted accelerator connection.</td>
<td>Reconnect, repair or replace accelerator connection as needed. Check for debris in connector and clean as needed. Synchronize accelerator with Smartec interface tool.</td>
</tr>
<tr>
<td>02A46</td>
<td>04A46</td>
<td>4-6</td>
<td>No Drive</td>
<td>Deck CAN bus KO</td>
<td>External interference with the CAN communications. Damaged or loose connection. Damaged wire shielding or malfunctioning deck controller.</td>
<td>Cycle key. Verify, repair or replace connections from traction controller to deck controller as needed. Refer to mower manufacturer for wire shielding requirements, repair or replace shielding as needed. Replace deck controller if alarm persists.</td>
</tr>
<tr>
<td>02A47</td>
<td>04A47</td>
<td>4-7</td>
<td>No Drive</td>
<td>PROG VACC Not OK</td>
<td>Accelerator inputs not set.</td>
<td>Synchronize accelerator with Smartec interface tool.</td>
</tr>
<tr>
<td>None</td>
<td>4-8</td>
<td>No Drive</td>
<td>WRONG SET BATTERY</td>
<td>Incorrect or Improperly charged battery(s).</td>
<td>Charge or replace battery(s) per manufacturer’s recommendation.</td>
<td></td>
</tr>
<tr>
<td>02A51</td>
<td>04A51</td>
<td>5-1</td>
<td>No Drive</td>
<td>INPUT ERROR1 (PAL KO)</td>
<td>Internal diagnostic malfunction.</td>
<td>Cycle key, if alarm persists traction controller will need to be replaced.</td>
</tr>
<tr>
<td>None</td>
<td>5-2</td>
<td>No Drive</td>
<td>00 RELOAD HM MDI</td>
<td>Traction controller or digital dash display has been replaced.</td>
<td>Machine will default hours. Leave key in on position for two minutes then cycle key off and back on.</td>
<td></td>
</tr>
</tbody>
</table>
## Troubleshooting Guide

<table>
<thead>
<tr>
<th>Code 02 = Right Side</th>
<th>Code 04 = Left Side</th>
<th>LED Flash Code</th>
<th>Symptom</th>
<th>Smartec Interface Tool</th>
<th>Why</th>
<th>How to Repair</th>
</tr>
</thead>
<tbody>
<tr>
<td>02A54</td>
<td>None</td>
<td>5-4</td>
<td>No Deck Operation</td>
<td>PTO time out</td>
<td>Power saving software has turned on due to machine in stationary position with the blades engaged.</td>
<td>Cycle key and restart deck.</td>
</tr>
<tr>
<td>02A55 04A55</td>
<td>5-5</td>
<td>No Drive</td>
<td>VACC OUT OF RANGE</td>
<td>Malfunctioning accelerator, disconnected or shorted accelerator connection.</td>
<td>Verify, repair or replace accelerator connection as needed. Replace accelerator if alarm persists. Synchronize accelerator with Smartec interface tool.</td>
<td></td>
</tr>
<tr>
<td>02A56 04A56</td>
<td>5-6</td>
<td>No Drive</td>
<td>Display CAN BUS KO</td>
<td>Disconnected or shorted can bus connection between traction controller and digital display.</td>
<td>Verify, repair or replace wire connection between traction controller and digital display as needed.</td>
<td></td>
</tr>
<tr>
<td>02A57 04A57</td>
<td>5-7</td>
<td>No Drive</td>
<td>CAN bus KO</td>
<td>CAN communication interrupted</td>
<td>Cycle key, check CAN wiring for opens or shorts, check the CAN shield wire is connected to the vehicle chassis, replace Digital Display or Traction Controller.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Waiting For Node</td>
<td>Smartec Interface Tool is connected to the incorrect traction controller. CAN communication interrupted.</td>
<td>Switch interface tool to the other traction controller. Cycle key, check CAN wiring for opens or shorts, check the CAN shield wire is connected to the vehicle chassis, replace Digital Display or Traction Controller.</td>
<td></td>
</tr>
<tr>
<td>02A61</td>
<td>None</td>
<td>6-1</td>
<td>No Drive</td>
<td>NO SEAT START</td>
<td>Malfunctioning seat switch, disconnected or shorted connection.</td>
<td>Verify, repair or replace seat switch connection as needed. Replace seat switch if alarm persists.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Operator not in seat.</td>
<td>Verify operator is in seat when starting mower.</td>
<td></td>
</tr>
<tr>
<td>02A62</td>
<td>None</td>
<td>6-2</td>
<td>No Drive</td>
<td>NO NEUT START</td>
<td>Drive handle or pedal not in neutral position, cruise control on, malfunctioning neutral switch, disconnect- ed or shorted connection. If occurs while running, check the connection at the key switch</td>
<td>Verify pedal/handle position. Verify cruise control is off. Verify, repair or replace neutral switch connections as needed. Replace neutral switch if alarm persists.</td>
</tr>
<tr>
<td>02A63</td>
<td>None</td>
<td>6-3</td>
<td>No Drive</td>
<td>PTO ON AT START</td>
<td>PTO switch is on during start up. Malfunctioning PTO switch, disconnected or shorted connection.</td>
<td>Verify PTO switch is off. Verify, repair or replace PTO switch connection as needed. Replace PTO switch if alarm persists.</td>
</tr>
<tr>
<td>02A64</td>
<td>None</td>
<td>6-4</td>
<td>No Drive</td>
<td>ROS ON AT START</td>
<td>ROS switch is on during start up. Malfunctioning ROS switch, disconnected or shorted connection.</td>
<td>Verify ROS switch is off. Verify, repair or replace ROS switch connection as needed. Replace ROS switch if alarm persists.</td>
</tr>
<tr>
<td>02A65 04A65</td>
<td>6-5</td>
<td>No Drive</td>
<td>NO BRAKE START</td>
<td>Brake switch is not on during start up. Malfunctioning brake switch, disconnected or shorted connection.</td>
<td>Verify parking brake switch is on. Verify, repair or replace brake switch connection as needed. Replace brake switch if alarm persists.</td>
<td></td>
</tr>
<tr>
<td>16A06</td>
<td>None</td>
<td>None</td>
<td>No Digital Display</td>
<td>Digital display communication issue.</td>
<td>Cycle key. Verify, repair or replace CAN wire connections as needed. Refer to mower manufacturer for wire shielding requirements, repair or replace shielding as needed. Replace digital display if alarm persists.</td>
<td></td>
</tr>
</tbody>
</table>
TROUBLESHOOTING

Deck System Resistance Test Procedure

1. Make sure your Digital Multi Meter is capable of measuring up to 1.2 million ohms (Ω) resistance before beginning these steps. Refer to your Digital Multi Meter owners manual for correct dial settings.

2. Always disconnect the batteries before performing any maintenance or repair.

3. Wait 5 Minutes after disconnecting the batteries prior to working on the machine.

4. Remove any debris build up from all deck components.

5. Verify all power connections on deck motors and deck controller are torqued properly. If loose connections are discovered tighten to the correct torque values found in the service and repair manual. Reconnect the batteries per the instructions in the service and repair manual and check for proper deck operation. If loose connections are not found proceed to step 3.

6. Label all (8) deck controller connection points (per Figure 3, page 13) on the edge of the deck controller housing so they are easily viewed for correct re-connection.

7. To ensure correct re-connection, mark all (8) wire connections with the corresponding connection point labels from step 3.

8. Remove all (8) wire connections from the deck controller.

9. Measure deck controller resistance (Ω): Reference Figure 3, page 13.
   (A) Place the negative (-) probe of a digital multimeter on the positive (+) battery terminal of the deck controller.
   (B) Place the positive (+) probe of the digital multimeter on deck controller terminals AR, then BR, then CR. Resistance for each should read between 270k (Ω) and 330k(Ω). If resistance is above or below the specified range the deck controller will need to be replaced. Repeat process for deck controller terminals AL, BL and CL.

10. If steps 1-9 are completed and the issues persist please refer to the mower manufacturer’s procedure for wiring harness troubleshooting for possible repair or replacement.
TROUBLESHOOTING

Deck System Troubleshooting Guide

Figure 3. Deck Controller

Figure 4. Deck Motor

Figure 5. Motor Connector View
EXTERNAL MAINTENANCE

Regular external maintenance of the Smartec Drive & Deck system should include the following:

1. Check the vehicle operator’s manual for the recommended load ratings. Insure the current application does not exceed load rating.

2. Check oil level in accordance with Figure 6 Page 15.

3. Inspect the vehicle wiring harnesses for loose connections or broken wires. If wire insulation shows signs of cracking or wear, the wire harness should be replaced.

4. Inspect the cooling fins on the deck motors and deck controller for grass clippings, leaves, dirt, etc. Remove to ensure proper cooling and operation of these components.

5. Inspect the fail safe brake manual release linkage to insure proper operation of the brake.

SERVICE AND MAINTENANCE PROCEDURES

All the service and maintenance procedures presented on the following pages can be performed while the Smartec™ components are mounted on the vehicle, provided the vehicle frame allows access. Any repair procedures as mentioned in the tear down and assembly section of this manual must be performed after the component has been removed from the vehicle.

FLUIDS

The fluids used in Smartec™ products have been carefully selected, and only equivalent, or better products should be substituted.

Typically, an engine oil with a minimum rating of 9.0 cSt (55 SUS) at 230°F (110° C) and an API classification of SL is recommended. A 20W-50 engine oil has been selected for use by the factory and is recommended for normal operating temperatures. Biodegradable oils are not approved for this unit as they degrade to quickly while in service.

“All fluids should be handled and disposed of according to local, state, and federal regulations.”

FLUID VOLUME AND LEVEL

Fluid volume information is provided in the Table below.

Certain situations may require additional fluid to be added or even replaced. Refer to Figure 6, Page 15 and page 3 for the proper fill port location.

Fill the Smartec™ transaxle according to Figure 6, page 15 or the specifications below.

<table>
<thead>
<tr>
<th>Fluid Description</th>
<th>Volume-per transaxle</th>
</tr>
</thead>
<tbody>
<tr>
<td>20W50 engine oil</td>
<td>16.9 fl. oz. (500 ml)</td>
</tr>
</tbody>
</table>

Note: “Any and all Hydro-Gear components removed and replaced during service are recyclable.”
FLUID CHANGE PROCEDURE

This transaxle is designed in such a manner that the factory oil fill should last the life of the unit and is not required to be changed. However, should circumstances require the oil to be changed, follow the procedure below.

The following procedure can be performed with the transaxle installed in the vehicle, provided the vehicle frame allows access to the fill and drain ports. Otherwise the transaxle must be removed from the vehicle to change the oil. The vehicle must be on level ground.

1. Place an oil drain pan beneath the oil drain plug. Remove the oil fill plug to allow venting. Remove the oil drain plug from the transaxle to drain the oil.

2. After the oil has drained from the transaxle, replace the oil drain plug.

3. Fill the transaxle with new 20W50 motor oil through the fill port.

4. Install the oil fill plug. When tightening the oil fill plug, refer to the table on page 28 for the required torque values.

5. Install the oil fill plug.
BATTERY CHARGING

The Smartec charger is a solid state battery charger that charges 48-volt sealed or wet lead-acid deep cycle batteries to full charge and then maintains that charge on the batteries during non-use periods.

The charger maintains the batteries at full charge without degrading or overcharging the batteries, thus extending the life of the batteries.

Operating Instructions
Before charging the batteries familiarize yourself with all provided safety instructions.

WARNING
Do not turn the key “ON” while the batteries are charging. The key must be in the “OFF” position before connecting the charger to the vehicle.

1. Make sure the charger is connected to AC power and the GREEN LED is ON.

2. Place the vehicle key in the “OFF” position.

3. Plug the charger connector into the vehicle’s battery receptacle.

Safety Instructions

CAUTION
To reduce risk of injury, charge only 48-volt lead-acid type rechargeable batteries. Other types of batteries may burst causing personal injury or damage.

1. Before using battery charger, read all instructions and caution markings on the
   (a) Battery charger
   (b) Battery
   (c) Vehicle using the battery

2. Do not expose charger to rain or snow.

3. Use of an attachment not recommended or sold by the battery manufacturer may result in risk of fire, electric shock, or injuries to persons.

4. To reduce risk of damage to electric plug and cord, pull by plug rather than cord when disconnecting charger.

5. Extension cord should not be used unless absolutely necessary. Use of improper extension cord could result in risk of fire and electric shock. If extension cord must be used, make sure:
   a. The pins on plug of extension cord are the same number, size, shape, as those on the charger.
   b. The extension cord is properly wired and in good electrical condition.

6. Make sure cord is located so that it will not be stepped on, tripped over, or otherwise subject to damage or stress.

7. Do not operate charger with damaged cord or plug - replace immediately.

8. Do not operate charger if it has received a sharp blow, been dropped, or otherwise damaged in any way.

9. Do not disassemble or unscrew the charger for any repair or maintenance. This will void the warranty.

10. To reduce risk of electric shock, unplug charger from outlet before attempting maintenance or cleaning.

11. When charging batteries, keep in a well ventilated area.
DIGITAL DISPLAY REPLACEMENT

**WARNING**

Digital Display Replacement
1. Position the vehicle on level ground and place the key in the “OFF” position. Remove key from machine.

2. Disconnect main negative battery cable(s) at the battery and cover connector(s) in electrical tape (See pages 6-7).

3. Wait 5 minutes for discharge of the machine.


5. Remove 2 securing nuts from bracket and lift Digital display out of bracket and machine.

6. Install the new Digital Display into vehicle. Plug in 4 pin connector and secure device.

7. Reconnect the main negative battery cable(s) to the battery terminal.

Transferring hours to new display
Cycle the key to the on position and the display will read 02A52 (hour meter mismatch) for one minute During this one minute the traction controller is disabled. If no action is taken within the one minute via the Smartec Interface Tool, the digital display hour meter is overwritten with the hours stored in the traction controller. Therefore, the hour data is transferred automatically to the new display and no further action is required. Cycle the key off and back on to clear the error code.
DOUBLE POLE CONTACTOR REPLACEMENT

WARNING

Double Pole Contactor Replacement

1. Position the vehicle on level ground and place the key in the “OFF” position. Remove key from machine.

2. Disconnect main negative battery cable(s) at the battery and cover connector(s) in electrical tape (See pages 6-7).

3. Wait 5 minutes for discharge of the machine.

4. Mark the orientation of the wires for properly reconnecting.

5. Remove all wire connections from the contactor.

6. Remove securing device of contactor. Remove contactor from vehicle.

7. Install and secure new contactor in the vehicle. Connect all wires to the contactor. When securing the contactor, refer to page 28 for the proper torque values.

8. Reconnect the main negative battery cable(s) to the battery terminal.
TRACTION CONTROLLER REPLACEMENT

WARNING

Traction Controller Replacement

1. Position the vehicle on level ground and place the key in the “OFF” position. Remove key from machine.

2. Disconnect main negative battery cable(s) at the battery and cover connector(s) in electrical tape (See pages 6-7).

3. Wait 5 minutes for discharge of the machine.

4. Check Batt(-) and Batt(+) on the traction controller to be sure there is no power to the traction controller. If power is still present, contact Technical Support.

5. Mark all wires with their connection letter marked on the controller.

6. Remove Batt(-) and Batt(+) connections and cover wire connectors in electrical tape.

7. Remove connector plugs (A) and (B) from the existing traction controller.

8. Remove (U), (W), and (V) power connections.

9. Remove the four mounting screws, and the thermal grease (if applicable) from the mounting base.

10. Apply a new light layer of thermoconductive grease to the bottom of the new traction controller (if applicable).

11. Install the new traction controller in the vehicle. Reconnect all wires and connectors to the traction controller.

12. Connect the Smartec Interface Tool to connector “C” on the new traction controller and reconnect the main negative battery cables to the battery.

13. Place the key in the “ON” position to supply power to the new controller and Interface Tool. If error code 02A52 appears, proceed to step 14. If error code 02A52 does not appear, skip to step 15.

14. Within one minute, set the “LOAD HM FROM DIGITAL DISPLAY” parameter on the Interface Tool to “ON”. (Reference page 24 - Main Menu Adjustments) If this is not accomplished in the specified timeframe, the stored hours will be erased and set to match the new controller which most likely will be “0”.

15. Follow the steps outlined in the “Accelerator Sensor Calibration” section to calibrate the new traction controller to the accelerator sensors (Pages 22 or 23).

16. Once the traction controller has been calibrated, place the key in the “OFF” position and disconnect the Interface Tool from the traction controller. Place the rubber cap on connector “C” of the traction controller.
ACCELERATOR REPLACEMENT

NOTE: If applicable, when an Accelerator is replaced, the dead band calibration procedure should be performed on page 20 (right column) and it must be calibrated to the Smartec system per pages 22 or 23.

WARNING

Accelerator Replacement

1. Position the vehicle on level ground and place the key in the “OFF” position. Place steering handles in neutral and outward position. Remove the key from machine.

2. Disconnect main negative battery cable(s) at the battery and cover connector(s) in electrical tape (See pages 6-7).

3. Wait 5 minutes for electrical discharge of the machine.

4. Remove wire connector from Accelerator.

5. Remove mounting devices in order to remove accelerator from machine.

6. Install the new accelerator so the mounting studs are centered in the slotted mounting holes. Hand tighten the nuts and attach wire connector. Reconnect the main negative battery cable to the battery.

7. Perform the Calibration Procedure on pages 22 or 23.

8. Perform the Dead Band Calibration Procedure (page 20 right column) on machines that continue to move while in neutral after performing the calibration procedure on page 22 or 23.

DEAD BAND CALIBRATION PROCEDURE

NOTE: The machine drive wheels must be securely off the ground while performing this procedure. This procedure requires 2 people, as one person will need to sit on the machine to move the steering handles.

1. Turn key on to allow power to the drive system (Do not engage mowing blades).

2. Move the steering handles inward to the drive position and place in the neutral position. **Note:** The drive wheels may start to move at this time.

3. Loosen the mounting nuts holding the accelerator.

4. Adjust the mounting position by gently twisting left or right on the accelerator until the drive wheel stops moving.

5. Tighten the mounting nuts with the correct torque from the owners manual.

6. Calibrate the accelerator using the procedures on pages 22 or 23.
ACCELERATOR RTN REPLACEMENT

NOTE: Components highlighted in grey can be removed from the RTN assembly without the need to calibrate the accelerator.

If any other RTN components are removed, the accelerator will need to be calibrated per pages 22 or 23.

WARNING

RTN Replacement Dissassembly
1. Position the vehicle on level ground and place the key in the “OFF” position. Place steering handles in neutral and outward position. Remove the key from machine.
2. Disconnect main negative battery cable(s) at the battery and cover connector(s) in electrical tape (See pages 6-7).
3. Wait 5 minutes for electrical discharge of the machine.
4. Remove wire connector from Accelerator.
5. Remove accelerator and RTN the from machine.
6. Remove torx head bolt(), washer (), and control RTN () from mounting bracket ()
7. Slide the control RTN () off of the actuating shaft ()

NOTE: Further disassembly will require calibration of the accelerator.

8. Remove the hex bolt (), spacer (), and neutral arm (). Discard the hex bolt
9. Remove the two hex screws () attaching the accelerator () and mounting bracket ()
10. Remove the mounting bracket () actuating shaft (), washer (), retaining ring (), and washer () from the accelerator ()

Assembly
1. Install all RTN components in reverse order.
2. Install the new accelerator so the mounting studs are centered in the slotted mounting holes. Hand tighten the nuts and attach wire connector. Reconnect the main negative battery cable to the battery.
3. Perform the Calibration Procedure on pages 22 or 23.
4. Perform the Dead Band Calibration Procedure (page 20 right column) on machines that continue to move while in neutral after performing the calibration procedure on page 22 or 23.
ACCELERATOR CALIBRATION (Right side)

Whenever the accelerator sensor and/or traction controller is replaced, the accelerator sensor must be calibrated to the system.

NOTE: The vehicle will not move during programming.

1. Plug the Smartec Interface Tool into connector “C” on the traction controller.

2. Place the key in the “ON” position.


4. Press “ENTER”.

5. Press “ENTER” to clear the old settings.

6. Push the vehicle’s right control lever forward. Hold for 1 second to set the forward bias.

7. Release the right control lever and place it in the neutral position for 1 second.

8. Pull the right control lever to the reverse position. Hold for 1 second to set the reverse bias. Do not release the control lever.

9. With the control lever in the reverse position, press the “OUT” button on the Interface Tool.

10. Press “ENTER” to save the new settings.

11. While keeping the lever in the reverse position, turn the key to the “OFF” position.

12. Disconnect the Interface Tool from the traction controller. Place the rubber cap on connector “C”.

Smartec Interface Tool
ACCELERATOR CALIBRATION (Left side)

Whenever the accelerator sensor and/or traction controller is replaced, the accelerator sensor must be calibrated to the system.

NOTE: The vehicle will not move during programming.

1. Plug the Smartec Interface Tool into connector “C” on the traction controller.

2. Place the key in the “ON” position.


4. Press “ENTER”.

5. Press “ENTER” to clear the old settings.

6. Push the vehicle’s left control lever forward. Do not go past 0.4. Hold for 1 second to set the forward bias. NOTE: The vehicle will not move during programming.

7. Release the left control lever and place it in the neutral position for 1 second.

8. Pull the left control lever to the reverse position. Hold for 1 second to set the reverse bias. Do not release the control lever.

9. With the control lever in the reverse position, press the “OUT” button on the Interface Tool.

10. Press “ENTER” to save the new settings.

11. While keeping the lever in the reverse position, turn the key to the “OFF” position.

12. Disconnect the Interface Tool from the traction controller. Place the rubber cap on connector “C”.

Smartec Interface Tool
Smartec Interface tool must be plugged into connector “C” on the primary controller. See page’s 19, 21 & 22.
DECK CONTROLLER REPLACEMENT

WARNING

1. Position the vehicle on level ground and place the key in the “OFF” position. Remove key from machine.

2. Disconnect main negative battery cable(s) at the battery and cover connector(s) in electrical tape (See pages 6-7).

3. Wait 5 minutes for discharge of the machine.

4. Disconnect all wires and connectors from the deck controller and label each accordingly. Remove all fasteners from the deck controller and remove the deck controller from the vehicle.

5. Place the new deck controller on the vehicle and secure with the required fasteners. Connect all the wires and connectors that were removed in the previous step (Figures 7 and 8).

6. Reconnect the wire(s) that were disconnected from the main negative battery terminal.

Wire Connection Table

<table>
<thead>
<tr>
<th>CONNECTION</th>
<th>CONNECTED TO</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-L</td>
<td>“A” on Left Deck Motor</td>
</tr>
<tr>
<td>B-L</td>
<td>“B” on Left Deck Motor</td>
</tr>
<tr>
<td>C-L</td>
<td>“C” on Left Deck Motor</td>
</tr>
<tr>
<td>+</td>
<td>Battery Positive (+ 48 VDC)</td>
</tr>
<tr>
<td>-</td>
<td>Battery Ground</td>
</tr>
<tr>
<td>C-R</td>
<td>“C” on Right Deck Motor</td>
</tr>
<tr>
<td>B-R</td>
<td>“B” on Right Deck Moto</td>
</tr>
<tr>
<td>A-R</td>
<td>“A” on Right Deck Moto</td>
</tr>
</tbody>
</table>

Figure 7. Wiring Configuration

Figure 8. Wiring Configuration
DECK MOTOR REPLACEMENT

WARNING

1. Position the vehicle on level ground and place the key in the “OFF” position. Remove key from machine.

2. Disconnect main negative battery cable(s) at the battery and cover connector(s) in electrical tape (See pages 6-7).

3. Wait 5 minutes for discharge of the machine.

4. Disconnect all wires and connectors from the deck motor and label each accordingly.

5. Remove the blade and all fasteners from the deck motor. Use caution as blades may be sharp. **Note:** Refer to machine owners manual for removing blades and blade adaptors.

6. Remove the deck motor from the deck.

7. Install the new deck motor onto the deck with the required fasteners.

8. Install the blade and torque fastener according to OEM specifications.

9. Reconnect all wires from the Deck Controller according to Figure 8 (page 24).

10. Reconnect the wire(s) that were disconnected from the main negative battery terminal.

![Figure 9. Deck Motor(Connections)](image)
DECK MOTOR: NOSE CONE REPLACEMENT

Refer to Figure 10.

Complete the steps below when the deck motor has been completely removed from the machine and disconnected from any wires attached.

1. Remove 4 screws that connect nose cone to deck motor.
2. Remove nose cone from deck motor.

Inspection
1. Check nose cone for any damage.

Assembly
1. Reassemble all parts in the reverse order of disassembly.
2. When tightening the 4 screws, refer to the table on page 29 for the required torque values.

NOTE: As a general rule, use the low end of the torque specification on fasteners when reassembling the unit.

![Figure 10. Nose Cone Removal](image_url)
Each subassembly illustrated in this section is illustrated by an exploded view showing the parts involved. The item reference numbers in each illustration are for assembly instructions only. See page 45-46 for part names and descriptions. A complete exploded view and item list of the transaxle is provided on pages 42 and 43.

Many of the parts and subassemblies of this transaxle can be removed and serviced independently of other components. Where some components and assemblies must be removed before a given assembly can be serviced, that information is given at the beginning of the disassembly instructions.

GENERAL INSTRUCTIONS

Cleanliness is a primary means of assuring satisfactory life on repaired units. Thoroughly clean all exposed surfaces prior to any type of maintenance. Cleaning of all parts by using a solvent wash and air drying is usually adequate. As with any precision equipment, all parts must be kept free of foreign material and chemicals.

Protect all exposed sealing surfaces and open cavities from damage and foreign material. The external surfaces should be cleaned before beginning any repairs.

Upon removal, it is recommended that all seals, O-rings, and gaskets be replaced. During installation lightly lubricate all seals, O-rings, gaskets with a clean petroleum jelly prior to assembly. Also protect the inner diameter of seals by covering the shaft with a cellophane (plastic wrap, etc.) material. Be sure all remnants of this covering are removed after servicing.

Parts requiring replacement must be replaced from the appropriate kits identified in the Items Listing, found on page 43. Use only original Hydro-Gear® replacement parts found in the authorized dealer section of the Hydro-Gear web site. www.hydro-gear.com

TRANSAXLE REMOVAL

It is necessary to remove the Smartec Electric Transaxle from the vehicle before performing the repair procedures presented in this section.

LIMITED DISASSEMBLY

The following procedures are presented in the order in which they must be performed to completely disassemble the unit. Do not disassemble the unit any farther than is necessary to accomplish the required repairs. Each disassembly procedure is followed by a corresponding assembly procedure.

Reassembly is accomplished by performing the “Assembly” portions of the procedures. If the unit has been completely disassembled, a summary of the assembly procedures, in the order in which they should occur, is given on page 40.
TOOLS

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Torque</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>HFHCS, 1/4-20 x 1.25</td>
<td>105-155 in-lbs [11.8-17.5 Nm]</td>
<td>Housing Screw</td>
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<td>Plug, 9/16-18 (Metal) - Magnetic</td>
<td>180-240 in-lbs [20.3-27.1 Nm]</td>
<td>Plug</td>
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<td>40-56 in-lbs [4.5-6.3 Nm]</td>
<td>Electric Brake Kit Screw</td>
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<tr>
<td>58</td>
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<td>40-56 in-lbs [4.5-6.3 Nm]</td>
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<tr>
<td>68</td>
<td>SHCS, M6 x 1.0 x 20</td>
<td>40-56 in-lbs [4.5-6.3 Nm]</td>
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<tr>
<td>142</td>
<td>Nut, Hexlock / Patchlock 3/4-16</td>
<td>240-260 ft-lbs [271.2-298.3 Nm]</td>
<td>Axle/Hub Nut</td>
</tr>
<tr>
<td>*</td>
<td>Screw, Torx M5 X .8</td>
<td>65-95 in-lbs [7.3-10.7 Nm]</td>
<td>Nose Cone Screw</td>
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<td>*</td>
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<td>53 in-lbs [5.9 Nm]</td>
<td>Drive Motor Terminal Nut</td>
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<tr>
<td>*</td>
<td>Nut, M6</td>
<td>48-53 in-lbs [5.4-5.9 Nm]</td>
<td>Traction Controller Terminal Nut</td>
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<td>Contactor Terminal Nut</td>
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<tr>
<td>*</td>
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<td>35-55 in-lbs [3.9-6.2 Nm]</td>
<td>Deck Controller Terminal Nut</td>
</tr>
<tr>
<td>*</td>
<td>Nut, M6</td>
<td>35-55 in-lbs [3.9-6.2 Nm]</td>
<td>Deck Motor Terminal Nut</td>
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* Not designated by an item number

TORQUES

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</table>

* Not designated by an item number
TRANSAXLE REMOVAL

NOTE: It is necessary to remove the Smartec Integrated Electric Transaxle from the vehicle before performing the repair procedures presented in this section.

Before starting any disassembly, make certain that your work area is neat and clean. Clean the external parts of the transaxle.

The following procedures are presented in the order recommended for a complete tear down of the transaxle.

Do not disassemble the unit any farther than necessary to accomplish the required repairs.

Reassembly is accomplished by performing the “Assembly” portions of the procedures. If the unit has been completely disassembled, a summary of the assembly procedures, in the order in which they should occur, is given on page 41.

1. Position the vehicle on level ground and place the key in the “OFF” position. Remove key from machine.
2. Disconnect main negative battery cable(s) at the battery and cover connector(s) in electrical tape (See pages 6-7).
3. Wait 5 minutes for discharge of the machine.
4. Disconnect the Motor Temperature Sensor.
5. Disconnect the Electric Brake.
6. Disconnect the Electric Brake Linkage Pin.
7. Disconnect the Speed Sensor. (143).
9. Remove the transaxle from the vehicle.

Figure 11. Smartec Integrated Electric Transaxle
AXLE HUB ASSEMBLY

Refer to Figure 12.

**Note:** Any model other than a 1210-1001 needing the hub removed should use a Hydro-Gear hub puller to do so. Contact your nearest Central Service Distributor (www.hydro-gear.com) to obtain a hub puller in assisting with the taper lock hub removal. For removal of the side housing without removing the hub see page 40.

Complete steps 1-4 with the transaxle installed in the vehicle.

1. Remove the nut cap (144).
2. Remove the locknut (142).
3. Remove the tapered hub assembly (207).
4. Remove the axle tube (143).
5. Remove the transaxle from the vehicle.

**Inspection**

1. Check all components for excessive wear or damage. Replace if necessary.

**Assembly**

**Note:** Anytime a hub and/or hub nut is removed from the axle shaft it must be replaced by a new hub and/or hub nut.

1. Reassemble all parts in the reverse order of disassembly.
2. When tightening the lock nut (142), refer to the table on page 29 for the required torque values.

**Note:** As a general rule, use the low end of the torque specification on fasteners when reassembling the unit.

---

Figure 12. Axle Hub Assembly
BRAKE ASSEMBLY

Refer to Figure 13

1. Mark the orientation of the brake (201) with a paint pen.
2. Remove the three capscrews (56) from the brake.
3. Remove the brake (201) from the drive motor.

Inspection

1. Check all components for excessive wear or damage. Replace if necessary.

Assembly

1. Reassemble all parts in the reverse order of disassembly.
2. Be sure to line up the paint reference mark when installing the brake.
3. Install the cap screws (56)

When tightening the cap screws (56) refer to page 29 for the required torque values.

NOTE: As a general rule, use the low end of the torque specification on fasteners when reassembling the unit.

Figure 13. Brake Assembly
SPEED SENSOR

Refer to Figure 14.

1. Remove the drain and fill plugs (16) from the transaxle and drain the oil out of the housing.
2. Remove the capscrew (68).
3. Remove the speed sensor (67) from the housing.

Inspection

1. Check all components for excessive wear or damage. Replace if necessary.

Assembly

1. Place the speed sensor (67) in the housing.
2. Install the capscrew (68).
3. Install the drain plug (16).
4. At the fill port, fill the transaxle with clean 20W50 motor oil.
5. Install the oil fill plug (16).

When tightening the plugs (16) and capscrew (68), refer to the table on page 29 for the required torque values.

NOTE: As a general rule, use the low end of the torque specification on fasteners when reassembling the unit.

Figure 14. Speed Sensor
AXLE SEAL & RETAINING RING

Refer to Figure 15.

1. Remove the axle seal retaining ring (109).
2. Remove the axle seal (110).

Inspection

1. Check all components for excessive wear or damage. Replace if necessary.

Assembly

1. Protect the axle seal from cuts by placing cellophane over the axle shaft before installing the seal (110).
2. Install the seal (110).
3. Install the retaining ring (109).
4. Remove the cellophane from the axle shaft.

Figure 15. Axle Seal & Retaining Ring
SIDE HOUSING

Refer to Figure 16.

For ease of disassembly, rotate the transaxle so that the drive motor is facing down and the axle is facing up. Keep the unit in this position for the remaining disassembly steps.

1. Remove the fifteen capscrews (8) that hold the main and side housing together.
2. Use a pry tool at the housing pry points to separate the housing.
3. Remove the side housing (2).
4. Scrape and clean all the old sealant off the housings.

Inspection

1. Check all components for excessive wear or damage. Replace if necessary.

Assembly

1. Apply a bead of sealant to the main housing. Refer to page 41 Figure 22.
2. Slide the side housing over the axle and mate it to the main housing.
3. Install the fifteen capscrews (8) into the side housing. When tightening the capscrews (8), refer to the table on page 29 for the required torque values and refer to Figure 23 on page 42 for the torque sequence.

NOTE: As a general rule, use the low end of the torque specification on fasteners when reassembling the unit.
SENSOR GEAR AND PINION GEAR

Refer to Figure 17.

1. Remove the retaining ring (49).

2. Remove the speed sensor target gear (80).

3. Remove the pinion gear (69).

Inspection

1. Check all components for excessive wear or damage. Replace if necessary.

Assembly

1. Install the pinion gear (69).

2. Install the speed sensor target gear (80).

3. Install the retaining ring (49).

Figure 17. Sensor Gear and Pinion Gear
DRIVE MOTOR

Refer to Figure 18.

1. Remove the four drive motor capscrews (58).
2. Pull the lip seal (50) and wave washer (51) from the motor shaft.
3. Remove the retaining ring (49).
4. Remove the speed sensor target gear (80).
5. Remove the pinion gear (69).

Inspection

1. Check all components for excessive wear or damage. Replace if necessary.

Assembly

1. Install the wave washer (51) and lip seal (50) on the motor shaft.
2. Mate the drive motor to the main housing. Secure with the four capscrews (58). When tightening the capscrews (58), refer to the table on page 29 for the required torque values.

   NOTE: As a general rule, use the low end of the torque specification on fasteners when reassembling the unit.

3. Install the pinion gear (69).
4. Install the speed sensor target gear (80).
5. Install the retaining ring (49).

Figure 18. Drive Motor
(Internal gears removed for illustration purposes)
INTERNAL GEARS

Refer to Figure 19.

1. Remove the two washers (93) and jackshaft pins (92).
2. Remove the 39T/12T gear (90) and the 12T pinion gear (91).
3. Remove the 12T/23T pinion gear (81) and the 12T/44T helical gear (84).
4. Remove the two remaining washers (93).

Inspection

1. Check all components for excessive wear or damage. Replace if necessary.

Assembly

NOTE: If the unit has been disassembled with the hub intact on the axle shaft reference page 40 as some of the gears will have to be assembled to the side housing.

1. Install two of the flat washers (93).
2. Install the 12T/44T helical gear (84) and the 12T/23T pinion gear (81). Pay attention to the orientation of the pinion gear.
3. Install the jackshaft pin (92) and washer (93).
4. Install the 12T pinion gear (91) and the 39T/12T gear (90).
5. Install the final jackshaft pin (92) and washer (93).

Figure 19. Internal Gears
(Bull gear and axle shaft removed for illustration purposes)
BULL GEAR & AXLE SHAFT

Refer to Figure 20.

1. Remove the flat washer (102) and spacer (101) from the axle shaft (103).
2. Remove the retaining ring (100).
3. Separate the axle shaft (103) from the bull gear (15).
4. Remove the bull gear dampers (94) only if damaged.

Inspection

1. Check all components for excessive wear or damage. Replace if necessary.

Assembly

1. Install the bull gear dampers (94), if removed.
2. Insert the axle shaft (103) into the bull gear (15).
3. Install a new retaining ring (100) onto the axle shaft.
4. Slide the spacer (101) onto the axle shaft.
5. Slide the flat washer (102) onto the axle shaft.
6. Place the assembly in the main housing (1).

Figure 20. Bull Gear & Axle Shaft
SERVICING WITHOUT HUB REMOVAL

Refer to Figure 21.

When the transaxle is disassembled with the hub left on the unit, it will be disassembled and assembled in the orientation below. This is not a complete teardown of the transaxle. Reference pages 30-38 for a complete teardown.

1. Remove the side housing screws (Page 34) and pull the side housing (2) away from the main housing (1).

NOTE: The housing will come apart with gear set A and B remaining in the main housing (1) and gear set C remaining in the side housing (2).

2. Remove gear sets A, B, and C from the housings.

NOTE: The bull gear can remain attached to the axle via the retaining ring. If removal is necessary, reference page 38.

Assembly

1. Assemble the reduction gear set A to the main housing (1) and electric motor (202).
2. Assemble the reduction gear set B to the main housing (1).
3. Assemble the reduction gear set C to the side housing (2).
4. Assemble the main housing (1) and the side housing (2) together and secure with side housing screws. Reference page 34.

Figure 21. Servicing Without Hub Removal
ASSEMBLY AFTER COMPLETE TEARDOWN

If the transaxle has been torn down completely, the following summary identifies the assembly procedures necessary to completely assemble the transaxle. Each assembly procedure is located by a page reference.

The part reference numbers provided in each assembly procedure are keyed to the individual exploded views, and are also keyed to the complete unit exploded view on page 41.

1. Assemble the axle shaft (103) and bull gear (15) assembly. Page 39
2. Install the internal gears. Page 38
3. Install the drive motor (202), lip seal (50) and wave washer (51). Page 37
4. Install the sensor gear (80) and pinion gear (69). Page 36
5. Apply sealant to the main housing (1). Page 42 Figure 21
6. Install the side housing (2). Page 35
7. Install the axle seal (110) and retaining ring (109). Page 34
8. Install the speed sensor (67) and drain plug (16). Page 33
9. Fill the drive transaxle with new 20W50 motor oil.
10. Install the oil fill plug (16). Page 33
11. Install the brake assembly (201). Page 32
12. Install the axle tube (143), hub assembly (207), locknut (142) and nut cap (144) onto the axle shaft. Page 31
Figure 22. Housing Sealant Pattern

Figure 23. Housing Screw Torque Sequence
Parts included in 206 seal kit (50, 109 & 110)
Parts included in main housing (1) kit (12, 111 & 112)
Parts included in side housing (2) kit (105, 111 & 112)
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<tr>
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<td>Label, adhesive bar code</td>
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<td>10</td>
<td>Gasket material (Loctite 5900)</td>
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<td>Oil, 20W50</td>
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<td>Washer, Flat</td>
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<td>15</td>
<td>Gear, 53T</td>
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<td>Plug, 9/16-18 (metal) - magnetic</td>
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<td>Gear, 12T/23T pinion</td>
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GLOSSARY OF TERMS

**Accelerator:** An electric sensor that replaces the trunnion arm and mechanical linkage function that is found in a traditional hydrostatic drive system.

**CAN:** Control Area Network, A communication protocol for active components in a system.

**Continuity:** Is an uninterrupted path from point A to point B.

**Contactor:** An electromagnetic switch device (a relay) used for switching an electrical circuit.

**Deck Controller:** The computer controller for the deck motors, reports to the Traction Controller.

**Deck Motor:** The electric motor that powers the cutting blades.

**Digital Display:** LCD dash display that communicates system status from the traction controller to the operator.

**DMM:** Digital Multi-Meter; combination ohm, voltage and current meter.

**Drive Motor:** The electric motor that powers the gear case.

**Integrated Electric Transaxle:** The electric motor and gear case assembly that transmits power to the wheels.

**Electric Current:** Is the rate of charge flow past a given point in an electric circuit measured in Amps.

**Electric Short:** A low resistance connection between two points in an electrical circuit. The current flows through the area of low resistance, bypassing the intended current flow in the circuit.

**NC:** Normally closed switch.

**NO:** Normally open switch.

**Ohm Meter:** A meter that only measures resistance, measured in ohms.

**Resistance:** Is the level of opposition to current flow in a electrical system, measured in Ohms.

**Smartec Interface Tool:** Diagnostic tool for use with the Traction Controller to aide in trouble shooting and repairs.
**Traction Controller:** The computer controller for the drive and deck system.

**Voltage:** Is a measurement of the electrical energy in a circuit at a given point; measured in volts.

**Voltage Inverter:** An electrical device that converts the system DC voltage to AC voltage.

**Wiring Harness:** Grouping of conductors (wires) that carry information and electricity.