GRADALL Bodas-service Installation and Operation

Bodas Software Installation and Operation for GRADALL Hydraulic Excavators & Industrial Maintenance Machines
Bodas-service Software (P/N 80414109) is available to allow configuration and diagnostics of all machines equipped with processor aided hydraulic systems. The use of the software allows much easier and faster interface with the machine.

Bodas-service is an upgrade of the Bodem software. Bodas is backwards compatible. No programming skills are needed to use Bodas-service.

In addition to the software, you will also need cable kit (P/N 80364206). For some laptops, you will also need a serial/USB adapter and driver. A kit is available from Cables to Go: (http://www.cablestogo.com) or equivalent.
Bodas-service installation requires the Bodas-service CD and security key (Do not install the security key until instructed!). Insert CD into your CD drive and use one of 2 methods to install:

1. Click START, RUN, and type ..SETUP.EXE
2. ...or Browse to the CD and double click setup.exe

Then click OK for English
Bodas-service Installation

Click Next at Setup Wizard

Check the “I accept”

Then click Next to accept license
Bodas-service Installation

Click Next for Full Install

Then click Next for default path
Bodas-service Installation

Click Install to accept default Menu Folder.

BODAS CD then installs the files.
When this screen appears, Install is complete! Just click Finish

* At this point you can install (Plug In) the USB Security Key included in the package with the software CD.
Open program from Programs, Bosch Rexroth, BODAS-service 3.X.
Note, the program is slow to load. Allow time for the program to load and configure itself on start up.

Click the magnify glass and Accept License agreement. In some cases, the program may have a warning the "com" port is busy. Click the magnifying glass a second time.
To change from Demo mode, click File - Interface

..then uncheck Demo and select COM. Bodas will only work with “COM” ports 1 – 8. If you do not have any of those ports available, contact your IT department for assistance in configuring your laptop.
Click Magnify again to scan for Processors

And then accept the LOL (Limitation of Liability)
Bodas-service Diagnosis

Bodas-service scans for controllers

Then lists all processors found along with software version
NOTE! different colors represent different status

A controller has one of these 5 connection states:

<table>
<thead>
<tr>
<th>Icon</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>🔴</td>
<td>Offline</td>
<td>No connection to the controller is established.</td>
</tr>
<tr>
<td>🟢</td>
<td>Online</td>
<td>The connection is established no data is yet read.</td>
</tr>
<tr>
<td>🟢</td>
<td>Read</td>
<td>All data has been read from the controller (parameter and process data elements).</td>
</tr>
<tr>
<td>🔵</td>
<td>Unknown</td>
<td>A new, unknown controller has been found while loading the configuration.</td>
</tr>
<tr>
<td>❌</td>
<td>N/A</td>
<td>A previously available controller has lost the connection or was disconnected.</td>
</tr>
</tbody>
</table>

To open controller, click “+” to the left. Then click, (Get controller data) button in Login section.
Click parameter display/edit and note the Menus section is empty, DONT PANIC!

..click File, then Language (early release) In late releases of the software, the language is moved to the “Option” menu.
Bodas-service Diagnosis

Make sure the Program Language = English, and Controller Language = 2

Repeat process to open processor and display parameters.
Click one of the menu categories to open the options.

Note – the menus of the processor should now show up properly.
Note – processdata values are now dynamic and the processor is being communicated live with the laptop and software.

Processdata is all inputs and outputs from/to the machine and processors. From processdata, the joystick CANBus circuit, all switched inputs, and all processor outputs can be read.
Actual errors / Saved errors can be checked

Live errors show up in RED
Saved errors can be cleared anytime during the session.

Note – every machine will have specific saved errors unique to machine configuration. This is normal due to specific start up routines the software runs each time the machine is started.
Datalogger opens a CSV file and lets you choose the categories to log.
Bodas-service Diagnosis

After logging the chart can be viewed in full.
If any parameters are changed, the values must be saved or they will be erased.

Parameters are used to adjust machine cycle times. Always use GRADALL specifications when setting machine cycle times. Only the Imx settings should be adjusted.

Calibration of machine throttle and in some cases pedals are required if replacing components. Bodas allows calibration.

A parameter file can be saved of machine settings from within Bodas.

Click on the controller and (Save to eeprom)
COMBINED ELECTRICAL MANUAL FOR SIII RT & CRAWLER MACHINES
Introduction

- This manual will detail locations of electrical components as used on GRADALL SIII Rough Terrain (RT) and Crawler machines.
- The heading of each page will denote if the page is specific for a specific type machine (RT or Crawler) is common to both.
- This manual will show the location of all major electrical components and should be used in conjunction with the electrical schematics when servicing a machine.
- Some minor components may not be shown and may be contained within one of the major components.
- Any specifications listed were current at time manual was produced.
- A section of circuit schematics for specific circuits is included with this manual.
Reservoir Assembly
(Includes Fuel Tank)

Valve Compartment
(Includes Main Valve, Pilot Manifold, and Processors)

Main Wiring Harness

Water Valve for heater
(Under cab)

Cab

Batteries - 12V System

Swing Lights
(Also Tail/Brake lights on RT machines)

Service Panel

Power Unit
(Engine and associated electrics)

Bulkhead behind Cab
(Includes VEC and Engine ADM)

Upperstructure frame has numerous electrical components located on the frame. Individual component breakdown will be shown in the following pages.
A service panel is provided in the engine compartment. The disconnect switch for the battery is located on the service panel. A positive terminal to be used for jumper cables is also provided. The negative post is a bolt on the engine block that retains the ground cable to the block.

The system is a 12V electrical system. Use of other than 12V accessories, batteries, or quick start devices may cause serious damage.

If any welding is required on the machine, all processors and the battery MUST be disconnected.
The engine assembly has several important electrical components installed on it. Starter, alternator, engine ECU, and AC compressor are all part of the engine assembly. The pump has a solenoid for electronic horsepower reduction as well.

A bolt attached to the engine retains the ground cables from the batteries. The bolt is long by design to allow it to be used as a connection for jump starting as needed.

Alternator is rated at 12V, 100A with an integral regulator. Nominal charge output is 14V +/- .3 V.
A solenoid is installed on the main pump to limit pump horsepower under certain operating conditions. The processors read throttle position and engine RPM and limit pump horsepower as needed to avoid lugging or shutting down the engine. Operating the machine with the solenoid disconnected will result in excess loading on the engine due to pump horsepower setting.
On the bulkhead behind the operators cab, the engine ADM and vehicle electrical center (VEC) are installed. The VEC provides power and ground distribution for the machine along with some relays to control machine functions.

The engine ADM provides the interface between the engine ECU and the operator. The ADM has a template loaded at Gradall to provide proper function of the engine.
VEC (Vehicle Electrical Center) is located between the operator’s cab and radiator. It contains fuses and relays required for machine power distribution. A decal is provided listing fuse rating and circuit protected by the fuse or operated by the relay. The chart below lists each circuit.

If the cover is left open or is damaged on the VEC, it is possible moisture or dirt can enter the VEC and damage the unit. If the cover is left open or damaged, the VEC may need to be replaced to avoid damage.
Console located on LH side of operator’s cab provides mounting for the monitor, circuit board & fuse panel, and data port connector for the processors. A 12V power supply port is available for use in the cab. Electrical connectors are provided to interface the console with the main harness and seat harness in the cab.

A decal is provided on the inside of the cover over the circuit board to provide a description of circuits that are fused along with rating of the fuse. Do not use fuses rated above or below correct rating or damage may result.

The data port connector requires a cable to interface with a laptop. Bodas software available from Gradall will allow access to the processors for troubleshooting.
Decal installed on inside of door over circuit board listing circuit and fuse ratings. Fuses are standard ATC type fuses.

The circuit board, in addition to the fuses and wire connectors that are attached, has relays for specific machine functions as part of the circuit board. The relays are:

1. Horn Relay
2. Ignition Relay
3. Accessory Relay
4. Accessory Relay 1
5. Accessory Relay 2
6. Swing Light Relay

Terminals are also provided for accessories. Spare terminals are marked on the circuit board. Terminals will be marked SP BAT, SP-1, SP-2 (etc), SP-IGN, ACC-1, ACC-2, SP-IGN, and GND
An electronic monitor is located in the console on the LH side of the cab. Engine, machine information, and hydraulic information can be displayed on the monitor. Warnings are displayed visually and with an audible alarm.

Ignition switch and control selection switch are located in the monitor unit. Refer to the operators manual for detail on monitor and switch operation.
The steering column in the operator’s cab contains important controls and warning lights associated with the RT undercarriage operation. The LH stalk provides for F-N-R selection along with 1st & 2nd gear selection.

The RH stalk controls the driving lights and turn signals. A separate button controls the emergency flashers.

2 panels of lights provide visual indication of specific functions.

Refer to operator’s manual for additional detail on operation of controls and lights.
Attached to both sides of the operator’s seat assembly are consoles with switch panels installed to control machine operation. Refer to operator’s manual for complete detail of operation, refer to the parts manual for service parts within the console.
Attached to both sides of the operator’s seat assembly are consoles with switch panels installed to control machine operation. Refer to operator’s manual for complete detail of operation, refer to the parts manual for service parts within the console.
Operator controls for the machine hydraulic functions are controlled by joysticks (2) and foot pedals (crawler - 2, RT - 1). The joysticks are located in the arm consoles to the left and right of the operator seat. The pedal(s) are located in the floor plate in front of the operator.

The joysticks and pedals use position sensors and are connected to the processors through the CAN Bus circuit. Movement of the control displaces the position sensor which generates a signal to the CAN circuit. Increasing CAN signal to the processor results in increased machine movement.

The joysticks are also equipped with analogue buttons to allow operation of other functions. Horn, boom tilt, tilt override, and bucket shake are all controlled by the analogue buttons.

BODAS software allows viewing the CAN signals from the joysticks and pedals.
Brake pedal for the service brakes is located on the cab floor of the RT machines. The brake light switch along with the accumulator charge switch is located in the brake pedal assembly.

A dig brake solenoid is provided for remote operation of the brakes. The dig brake switch on the LH console selects brake mode at the processor. The dig brake solenoid is activated by the processor for automatic brake operation when movement stops when digging. See operator’s manual for detail of the modes available from the brake switch.

If the dig brakes are in automatic mode, the brake pedal will automatically depress once the engine starts.

The accumulator charge switch warns of low accumulator charge pressure for the service brake circuit.
1. Activating the Joysticks
2. Left Hand Arm Pod
3. Hall Effect Switch for joystick lockout

As part of the LH arm pod assembly in the operators cab, a joystick lockout lever is provided. The lever must be up to start the engine and down to allow control operation. A Hall Effect switch is inside of the arm pod to sense lever position.
Valve Compartment
(Front)

At the front of the valve compartment on the RH side of the machine, houses the processors and pilot manifold. Mounted externally are work lights (not shown) and driving lights (RT only).

See System Operation for a list of all input/output functions of the processors. Only those functions listed are controlled by the processors. To access the processors requires BODAS software using the data port in the cab.

Pilot manifold has 3 coils that control specific machine functions. All 3 coils are identical 12V coils. 1 coil is used for pilot enable; 1 coil for swing brake; and 1 coil for swing lock (RT) or 2 speed shift (crawler). A transducer is provided for pilot pressure readings on the cab monitor. The readings at the monitor are to be used for troubleshooting purposes only and not pressure setting.

Work lights (not shown) are mounted to the valve compartment cover or frame depending on machine configuration. The work lights are typically halogen lights but standard incandescent or HID may used depending on machine configuration.
<table>
<thead>
<tr>
<th>#</th>
<th>Description</th>
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<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hoist Up Prox (Cushion) Switch</td>
<td>13</td>
<td>RT - Tilt CCW Solenoid</td>
</tr>
<tr>
<td>2</td>
<td>Main Pressure (LS) Transducer</td>
<td>14</td>
<td>Crawler Left Travel Forward Sol.</td>
</tr>
<tr>
<td>3</td>
<td>Boom Extend Solenoid</td>
<td>15</td>
<td>RT - Tilt CW Solenoid</td>
</tr>
<tr>
<td>4</td>
<td>Boom Retract Solenoid</td>
<td>16</td>
<td>Crawler Left Travel Reverse Sol.</td>
</tr>
<tr>
<td>5</td>
<td>Tool Close Solenoid</td>
<td>17</td>
<td>Swing Right Solenoid</td>
</tr>
<tr>
<td>6</td>
<td>Tool Open Solenoid</td>
<td>18</td>
<td>Swing Left Solenoid</td>
</tr>
<tr>
<td>7</td>
<td>Hoist Up Solenoid</td>
<td>19</td>
<td>Auxiliary 1 Solenoid</td>
</tr>
<tr>
<td>8</td>
<td>Hoist Down Solenoid</td>
<td>20</td>
<td>Auxiliary 2 Solenoid</td>
</tr>
<tr>
<td>9</td>
<td>RT Travel Forward Solenoid</td>
<td>21</td>
<td>RT Chassis Supply A Solenoid</td>
</tr>
<tr>
<td>10</td>
<td>Crawler Right Travel Forward Sol.</td>
<td>22</td>
<td>Crawler Tilt CCW Solenoid</td>
</tr>
<tr>
<td>11</td>
<td>RT Travel Reverse Solenoid</td>
<td>23</td>
<td>RT Chassis Supply B Solenoid</td>
</tr>
<tr>
<td>12</td>
<td>Crawler Right Travel Reverse Sol.</td>
<td>24</td>
<td>Crawler Tilt CW Solenoid</td>
</tr>
</tbody>
</table>
On the RH side of the machine, the hydraulic tank and reservoir have electrical components. At the hydraulic tank, a hydraulic level probe is installed. It sense lack of fluid and signals the operator via the monitor of low oil level. This switch is an emergency switch and should not be used for routine oil level checks.

A sensor is installed in the hydraulic return line to measure oil temperature. Output is read at the monitor and also through the processor data port connection.

The fuel level sender installed in the fuel tank signals fuel level. When full, the ohm reading of a good sender is – 33 Ω; half full – 114 Ω; and empty – 249 Ω

Not shown, but on RT machines, an electrical centerpin is installed in the center frame area to allow electrics to be available to the undercarriage. Crawlers do not have an electrical centerpin.
RT Electric Centerpin

Electric centerpin is mounted at the top of the hydraulic centerpin. Slip rings and brushes within the electric centerpin allow electricity to go between the material handler and undercarriage.

Each slip ring/brush assembly is connected to individual circuits within the center pin wire harness. Connectors at each end of the wire harness mate with wiring harness in the material handler or chassis.

The electrical centerpin does not have serviceable components within the assembly. Removal and replacement of the electrical center pin requires removing electrical connector connecter on the chassis to withdraw the harness from the center pin.

Wires must be replaced in correct location within the connecter. Refer to chart below for wire locations within connecter.
RT undercarriage frame has 4 electrical actuated control valves mounted standard. The 4 valves are used to control the undercarriage functions from the operator’s cab.

At the front of the chassis is a blade/outrigger control valve. An identical valve is mounted at the rear of the chassis also. The blade/outrigger valve(s) are used to control the optional blade or outrigger installation. Each valve uses solenoid valves to select the desired function. The functions are blade/outrigger up & down. Hydraulic oil for the blade/outrigger valves is supplied from the chassis supply valve on the upperstructure.

The steer axle oscillation lock valve is located in front of the swing bearing adapter. A solenoid valve signaled by the processor control axle oscillation.

Transmission control valve has a double stack solenoid valve to select 1st or 2nd gear. Pilot oil from the upperstructure is used by the transmission control valve to shift the transmission and to release the parking brake. With no electrical signal to the transmission control valve or no pilot pressure, the parking brake sets.
Specific Electrical Circuits

- The following circuit schematics are to be used with the full schematics for specific circuits.
- Always use the schematics supplied with the manual in addition to the circuit drawings.
- Processor functions require the use of Bodas Software to read values of inputs and outputs. Refer to the System Operation manual for charts listing all inputs and outputs of the processor.
- Use schematics and the electrical manual along with the system operation manual when servicing machine.
Engine CAN Bus Circuit

Engine CAN Bus circuit provides communication between engine MR and engine ADM2 (machine interface) mounted at rear of cab. Mercedes Benz diagnostic tools are required for this circuit.
Pilot Cutoff Circuit

Gradall Industries, Inc.
Hoist Up Proximity Switch
RT - Swing Circuit
RT – Dig Brake Circuit

LEFT ARMPOD

SWITCH PWR

DIG BRAKE

AUTO

1

4

OFF

2

5

3

6

DIG BRAKE AUTO

DIG BRAKE OFF

HD36-24-31PN

1

2

3

4

UPPER CAB ASSEMBLY HARNESS

UPPER EXPANSION MODULE

RC 12-4

Gradall Industries, Inc. 3-51
CR - Travel Alarm Circuit

TRAVEL ALARM

WORK LT GND

TRVL ALM

75

UPPER PROCESSOR
RC 6-9
RT - Travel Alarm Circuit

LEFT ARMPOD

SWITCH PWR

TRV ALM

OFF

ON

HIWAY ALV SW

HD34-24-31PN

21

UPPER CAB ASSEMBLY HARNESS

HIWAY ALM SW

HD36-24-31SN

73

UPPER PROCESSOR RC 6-9

TRV ALM

WORK LT GND

TRAVEL ALARM

Gradall Industries, Inc.
RT – Axle Oscillation Circuit
CR – Speed Circuit
AC Circuit