Conveyor Scale and Yield Monitor

Installation
and
User
Manual

CS500
YM500

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CE Declaration of Conformity

Greentronics Ltd. declares that the products covered by this manual have been tested and found to conform with the requirements of European Council directive 2009/64/EC for EMC. Contains a Bluetooth radio module.

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1. Introduction

Thank you for purchasing the Greentronics in-line Conveyor Scale or Yield Monitor.

The CS500 Conveyor Scale is an in-line weighing system that weighs any product as it is moved on a conveyor to a truck, storage, or pile. The system is simple to install, calibrate, and use.

By continually measuring the weight of a small section of the conveyor belt, the Conveyor Scale computes the accumulated weight of product that passes over the conveyor. The Conveyor Scale also measures the speed of the conveyor drive shaft, thereby taking into account any variations in conveyor speed.

The quick and simple tare calibration allows the system to subtract out the weight of the conveyor belt, leaving only the net product weight.

The same Conveyor Scale technology forms the basis of the Yield Monitor system. The YM500 Yield Monitor requires only an external source of DGPS data to provide a complete integrated yield monitoring solution on any harvesting machinery that uses a conveyor to carry the harvested crop. Alternatively the YM500 can be configured to output real time yield data to a third party yield monitor for display and storage.

The Conveyor Scale system consists of the following major parts:

- **ECU –** Electronic Control Unit: connects to power; connects to load cells and other sensors; connects to display via CAN bus
- **Load Cells** – Mounted under conveyor belt to weigh product
- **Drive Shaft Sensor** – Mounted at drive shaft to measure conveyor speed
- **Tilt Sensor** – Sensor to measure the tilt angle of the conveyor (optional)
- **Crop Temperature Sensor** – Sensor to measure and record crop temperature (optional)
- **Touchscreen Display (TD)** – Graphical touchscreen display

The YM500 Yield Monitor provides additional components to make connections:

- **ISOBUS Cable** – Cable to connect to in-cab ISOBUS Universal Terminal display (option, replaces Touchscreen Display)
- **Yield Data Cable** – Cable to connect to third party display for yield map display and recording
- **GPS Cable** – Cable to connect to DGPS receiver (RS232 or CAN)

2. Installation Instructions

This section provides installation instructions for components to be mounted on the conveyor. Should you need further information, please contact your dealer or Greentronics.

Please read through the following instructions. It is important you have a basic understanding of the steps involved before you begin the work.

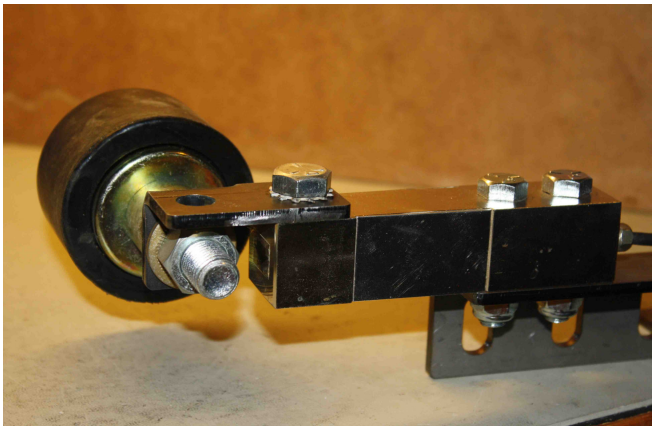
You will be installing load cells. Please note that the standard load cells in the Greentronics Conveyor Scale system have a maximum load capacity of 250 lb. You can exceed this when using a long wrench to tighten a connection to the load cell, or when an average size person hops onto the conveyor. There is some safety margin built into the design of the cell, but once it is over-stressed, the damage is

irreparable, and the load cell must be replaced.

The following instructions may be used as a guide for the installation of the in-line weighing system in a conveyor. Points listed below describe in general terms how each component of the system may be installed. Note that no dimensions are given. Each installation varies from the next. You will have to adapt the information here to suit your own situation. When choosing materials and deciding on dimensions, keep in mind that it is better to have as little "dead" weight as possible. Dead weight is the weight on the load cells with an empty conveyor. More dead weight usually means a reduction in accuracy.

2.1 Installation of load cells

NOTE: Be sure to mount the load cells with the arrow on the end of the load cell pointing down!



Conveyor Types

The in-line weighing system can be used on solid belt conveyors where the belt is supported by a continuous slide or on tube rollers. It can also be used on belted chain conveyors supported by individual rollers at the edges of the conveyor.

The conveyor in which the load cells are to be installed should have a sturdy frame, providing rigid support for the conveyor and the load cells. Any flexing of the conveyor's support frame will affect weight measurement accuracy.

The section of the conveyor in which the load cells will be installed should be supported at both ends. An "overhanging" conveyor inevitably experiences a lot of stress, which will affect measurement accuracy.

The conveyor does not have to be level, since the calibration steps will account for any tilt of the conveyor. However, if the conveyor's tilt angle is too steep, the crop being carried on the conveyor may experience roll-back or shifting, which will affect the accuracy of the weight measurements.

If the conveyor tilt angle changes during operation, you will need to install the optional tilt sensor. The tilt compensation automatically adjusts load cell output for the angle of the conveyor.

The next three sections describe installation of the load cells in the three different types of conveyors: belted chain, flat belt on a continuous support, and flat belt on tube rollers.

Belted Chain Conveyors

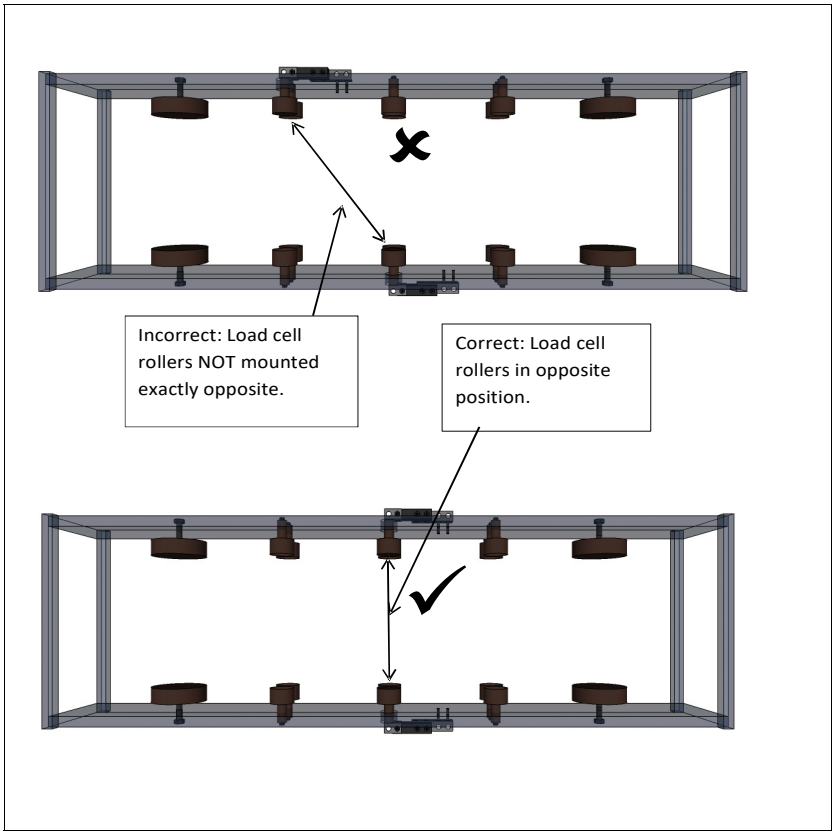
Select the most appropriate location for the load cells. Try to select a spot at least two support rollers away from the drive rollers. This avoids errors due to possible "wobble" or dirt build-up on the drive roller.

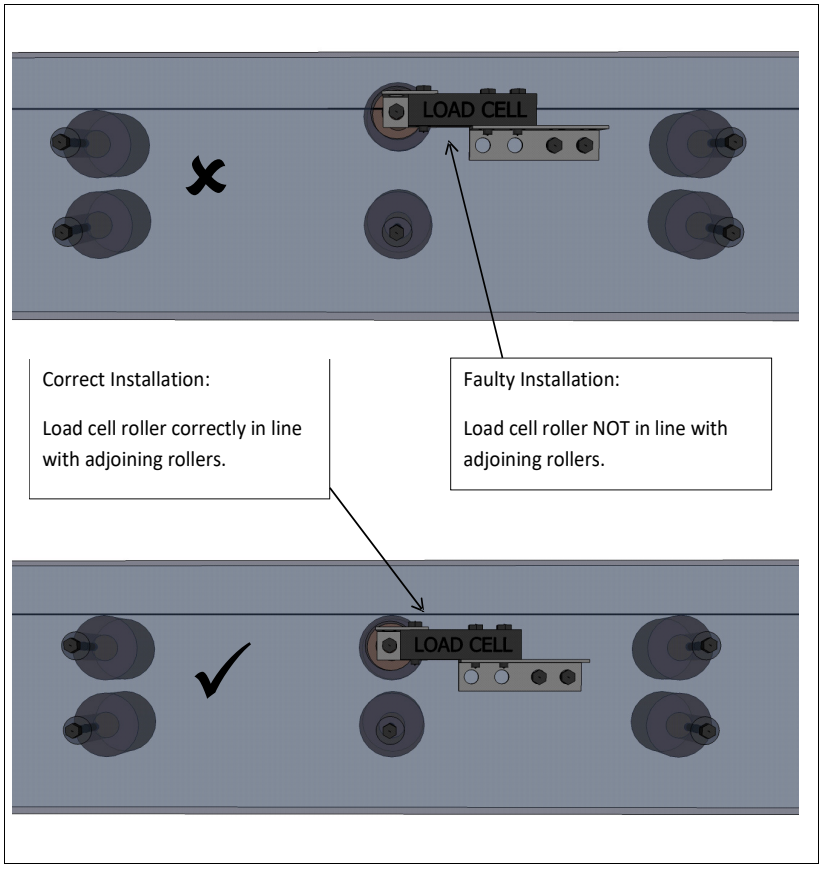
If the conveyor is inclined, it is best to install the load cells near the bottom of the conveyor. This minimizes the tension in the belt, which reduces weight errors due to any mechanical misalignment.

Remove the support rollers at the selected location. Note that in some conveyors rollers are not exactly opposite each other. In such cases, it is necessary to add a location (drill a hole) for a roller so that rollers mounted to the load cells end up opposite each other, perpendicular to the conveyor web. Adjoining rollers (the rollers before and after the rollers on the load cells) should also be moved opposite each other.

Carefully inspect the rollers you just removed. If they are in good condition, and revolve easily on their bearings, you can use them for installation on the load cells. If you are not satisfied, install new rollers.

You received roller mounting brackets with the load cells. Attach these to the load cells with the 1/2 inch fine threaded bolts. Also attach the load cell to the angle brackets provided in the kit. Be sure to mount the load cells with the arrow on the end of the load cell pointing down. Now position the load cells on the outside of the conveyor frame in such a way that the bolt hole through the bracket is exactly in line with the bolt hole of the roller





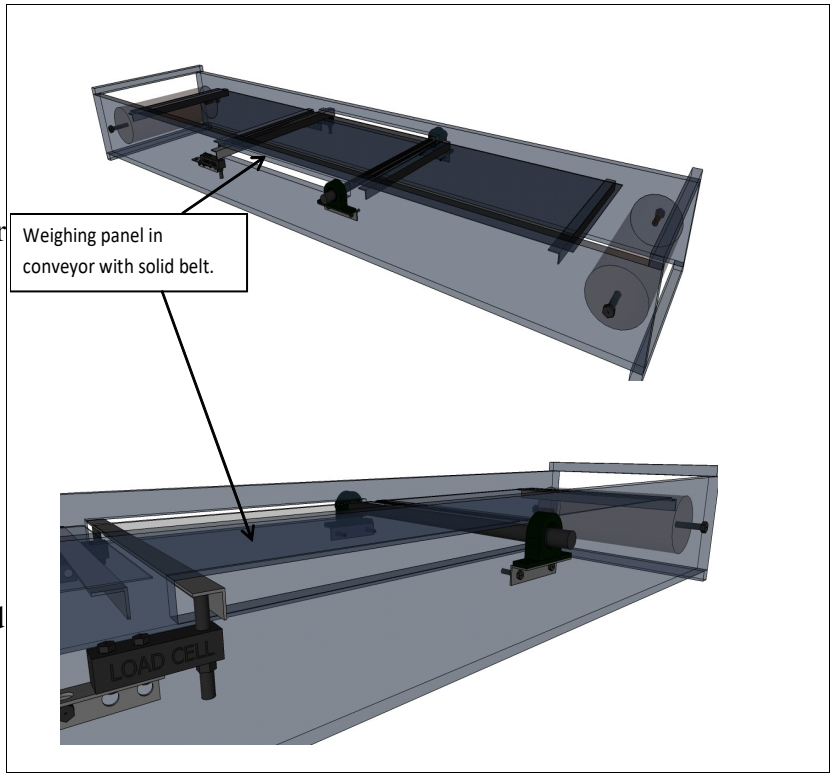
you removed. Measure the length of bolt you need through the bracket, conveyor frame, and roller so that the roller ends up back in its original position beneath the belt. You will need bushings or washers to achieve the proper distance.

Enlarge the original bolt holes in the conveyor frame so that there is at least 0.25 inches play around bolts and/or bushings. The larger hole size allows for the minute amount of movement in the load cells as loads are applied. It will also allow aligning the load cell/roller combination by shifting it up or down slightly.

To align the load cell/roller assembly for height, use a straight edge and place it over the support rollers on either side of the load cell roller. The load cell roller should just touch the straight edge. Now mark the mounting holes for the load cell brackets, drill holes, and mount the load cells.

Flat Belt on Continuous Support

In this type of conveyor, a solid belt is supported by a continuous flat slide. In order to do in-line weighing on this type of conveyor, it is necessary to cut out section of the slide and support it on the two load cells.



Select the most appropriate location for the load cells. They should not be located too close to the end of the conveyor, as imperfections in the drive roller or dirt build-up can cause the belt to lift and drop slightly.

The section to be weighed should generally be 2 to 4 feet in length. In general, the longer the weighed section, the better the accuracy of the system. However, making the weighed section too long will make it harder to keep the weighed section rigid. Also, the weight limit of the load cells must be respected.

Cut out the section of the slide that will be supported by the load cells. Shorten the cut section slightly to ensure there will be a gap at its front and back edges when it is installed back into the conveyor. You should leave gaps of at least 1/4", so cut the section about 1/2" short.

Attach a length of angle iron under one of the cut edges of this section. The angle iron should be long enough to protrude through the side walls of the conveyor.

Attach a similar length of round rod under the other cut edge of the slide section.

If the slide material is not sufficiently rigid, mount some lengths of angle iron lengthwise under the slide section to keep the slide section rigid.

Cut out openings in the conveyor side walls to allow the angle iron and rod ends to pass through.

Place the cut section back into the conveyor to align the mounting brackets.

The round rod end must be able to“hinge”, which is accomplished using pillow block bearings mounted on simple angle iron brackets mounted to the outside of the conveyor side walls. The round rod will fit into the pillow block bearings (which must match the diameter of the rod). Mount the bearing support brackets slightly low, so that you can use some washers to adjust the final height of the slide section.

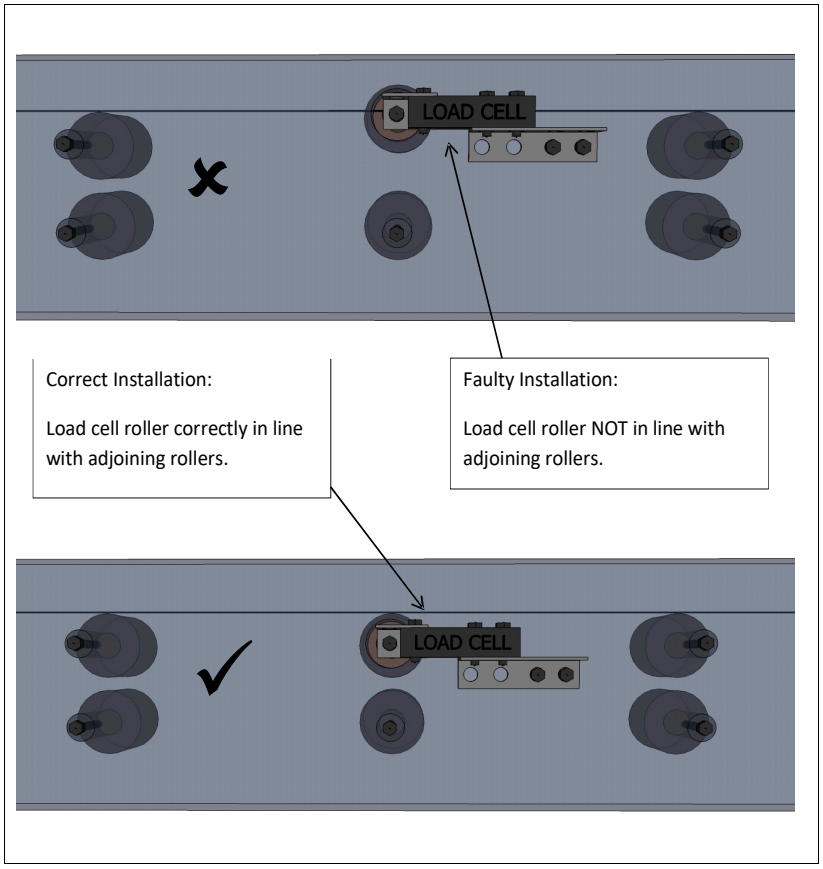
The angle iron end of the weighed slide section will be supported by the load cells. Mount the load cells to the outside of the conveyor wall using the supplied brackets. Position the load cells so they are slightly (1” or so) below the angle iron. This allows adjustment of the slide section height using the lengths of 1/2” fine threaded rod screwed into the load cell end.

Be sure to mount the load cells with the arrow on the end of the load cell pointing down.

After you have installed all the brackets and installed the pillow block bearings and the load cells, adjust the height of the weighed slide section. The goal is to have the weighed section line up exactly with the fixed section before and after it. At the pillow block bearing end, insert or remove washers to adjust the height of that end of the weighed section. At the load cell end, adjust the threaded rod in the load cells.

Once the weighed section is nicely aligned, check that the two load cells are sharing weight evenly. Do this by checking the Load Cells display in the Test menu. The readings do not need to be identical, but should be fairly close (within 500 counts or so). Small adjustments to the threaded rod will balance the weight between the two load cells.

After completing the adjustments, fix the threaded rod on the load cells in place by tightening a nut on the threaded rod against the load cell.



Flat Belt on Tube Rollers

In this type of conveyor, a solid belt is supported by a series of supporting tube rollers. In order to do in-line weighing on this type of conveyor, it is necessary to remove one of the support rollers and re-mount it on the two load cells.

Select the most appropriate location for the load cells. They should not be located close to the end of the conveyor, as imperfections of the drive roller or dirt build-up can cause the belt to lift and drop slightly.

Select the most appropriate location for the load cells. Select a roller at least

two support rollers away from the drive roller. Imperfections of the drive roller or dirt build-up can cause the belt to lift and drop slightly.

Remove the support roller at the selected location. Carefully inspect the roller you just removed. If it is in good condition, and revolves easily on its bearings, you can use it for installation on the load cells. If you are not satisfied, install a new roller.

You received roller mounting brackets with the load cells. Attach these to the load cells with the 0.5 inch fine threaded bolts. Also attach the load cell to the angle brackets provided in the kit. Be sure to mount the load cells with the arrow on the end of the load cell pointing down. Now position the load cells on the outside of the conveyor frame in such a way that the bolt hole through each bracket is exactly in line with the bolt hole of the roller you removed. Measure the length of bolt you need through the bracket, conveyor frame, and roller so that the roller ends up back in its original position beneath the belt. You will need bushings or washers to achieve the proper distance.

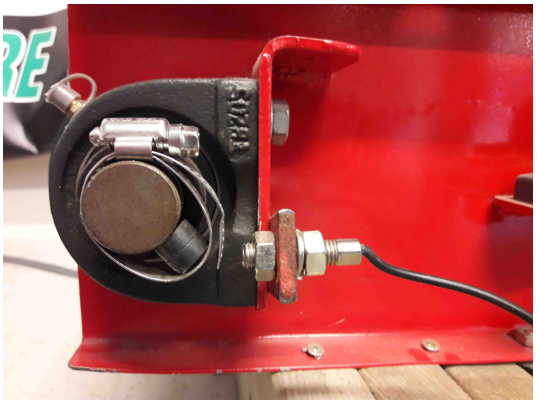
Enlarge the original bolt holes in the conveyor frame so that there is at least 0.25 inches play around bolts and/or bushings. The larger hole size allows for the minute amount of movement in the load cells as loads are applied, and also allows for alignment by shifting the entire load cell/roller combination.

NOTE: To avoid creating stress between the load cells, one end of the roller must be left free to move in the load cell's angle bracket!

When attaching the support roller to the load cells via the angle brackets, the bolts must be securely fastened to the roller. However, there needs to be some play at the angle bracket of one of the two load cells. This allows for some small side-to-side movement. If both ends of the roller are bolted solidly to the two load cells, there will be a great deal of lateral stress between the load cells. This stress will affect accuracy, and can damage the load cells.

To align the load cell/roller assembly for height, use a straight edge and place it over the support rollers on either side of the load cell roller. The load cell roller should just touch the straight edge. Now mark the mounting holes for the load cell brackets, drill holes, and mount the load cells.

2.2 Mounting Shaft Sensor and Magnets



Conveyor belt speed has to be measured to measure the total crop weight. We use very simple and reliable magnets and sensors for measuring conveyor speed. Small round disk magnets are provided in the kit. These magnets should be mounted to the conveyor drive shaft, held in place using a stainless steel hose clamp (supplied).

Stack 2 of the disk magnets on top of each other and stick them to the shaft. Place the hose clamp over the shaft and magnets, positioning the adjustment screw on the opposite side of the shaft from the magnets. Tighten the hose clamp so the magnets are held firmly in place, but do not over-tighten or the magnets might break. If there is a long tail of excess length on the hose clamp, cut it off to avoid problems with hitting the magnet sensor.

Next, prepare a sensor mounting bracket. The supplied stainless steel bracket provides a variety of

mounting holes, and can easily be bent as required. If you need to make your own bracket, use a short piece of one inch flat bar (1/8 inch material works well). Drill a hole in one end to fit the sensor, then bend this end to the correct angle so that the sensor ends up about 1/4" away from the magnets. The sensors are threaded so that fine adjustment is possible. Make sure the hose clamp adjustment screw clears the sensor.

2.3 Mounting the Tilt Sensor

If you purchased the tilt compensation option, a tilt sensor is used to measure the tilt angle of the conveyor so that weight readings can be corrected at varying tilt angles.

The tilt sensor (part # STXY04) must be mounted in the same plane as the load cells. In other words, the tilt sensor should be horizontal when the load cells are horizontal.

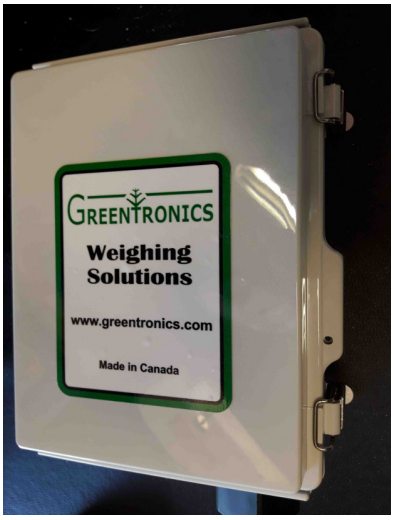
2.4 Mounting the Crop Temperature Sensor

If you purchased the crop temperature sensor option, an infrared temperature sensor is provided to measure the temperature of the crop.

The crop temperature sensor must be mounted above the conveyor carrying the crop. It is best to position it 18 to 36 inches (50 to 100 cm) above the maximum crop level. The sensor's field of view is a circle that is ¼ the diameter of the distance between the sensor and the crop. For example, if the sensor is mounted 24 inches (60 cm) above the crop, its field of view will be a 6 inch (15 cm) diameter circle.

The crop temperature sensor connects to the ECU through a WA1073 cable. This cable connects to the ANALOG INPUT AIN1 terminal block: black to GND, white to AIN1, and red to +12V.

2.5 Mounting the ECU



The load cells and belt speed sensor connect to the ECU (Electronic Control Unit). A single cable connects the ECU to the Greentronics Touchscreen Display or ISOBUS display. This allows the display to be located away from the conveyor.

Choose a safe location for the ECU. Ideally, it should be mounted in a spot where it can not be hit by crop debris, stones, etc. It should also be in a dry spot, away from oil and grease. Keep in mind that load cells come with 20 ft of shielded wiring. The ECU should be mounted within this distance.

2.6 Mounting the Touchscreen Display

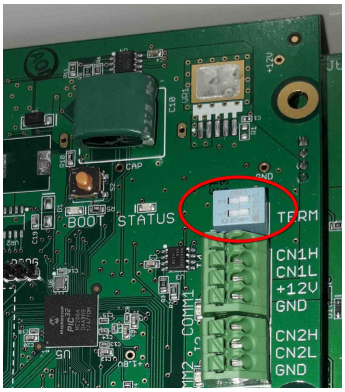
***NOTE**: If you have purchased the ISOBUS option for the YM500 yield monitor, the Greentronics Touchscreen Display is not used.*

If your system includes a Greentronics Touchscreen Display, it should be mounted in a position where the operator can easily see the display.

A RAM mount is provided with an adhesive pad to mount to the rear of the Touchscreen Display. Use the supplied alcohol wipe to clean both surfaces before installing the adhesive pad.

Once the Touchscreen Display is mounted, connect it to the ECU using the supplied cables. Cable WA1099 plugs into the rear of the Touchscreen Display, and plugs into a mating cable that connects to the ECU.

2.7 Connecting the Yield Monitor to ISOBUS



If you have purchased the ISOBUS option for the YM500 yield monitor, the Greentronics Touchscreen Display is not used. Instead you will be supplied an ISOBUS "Tee" harness (WA1101) that provides two Deutsch DT 4-pin connectors, one plug and one receptacle. This allows inserting the harness into an existing ISOBUS daisy-chain connection.

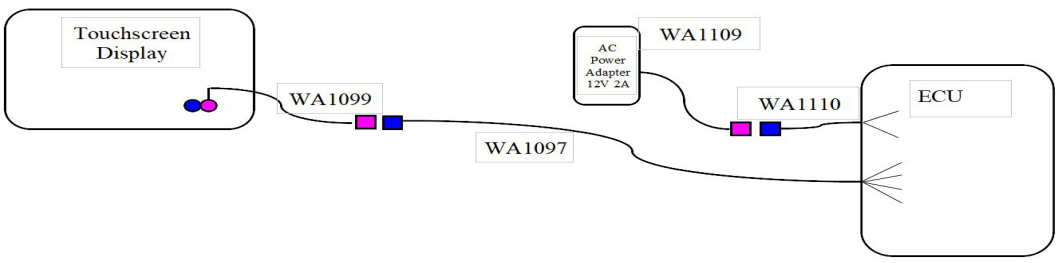
If the ISOBUS you are connecting to is not terminated, you can enable the ECU's internal terminator. Open the ECU lid, and locate the two small switches on the upper circuit board. Set switch 1 ON to enable the ISOBUS terminator.

2.8 Connecting Power and Display to the ECU

The ECU requires 12V DC power to operate. It also requires a CAN bus connection to a Greentronics Touchscreen Display or to an ISOBUS Universal Terminal display. How these connections are made depends on the type of system you are installing.

Conveyor Scale

A Conveyor Scale always uses the Greentronics Touchscreen Display. It is supplied with a 120V AC adapter that plugs into any standard 120VAC outlet.

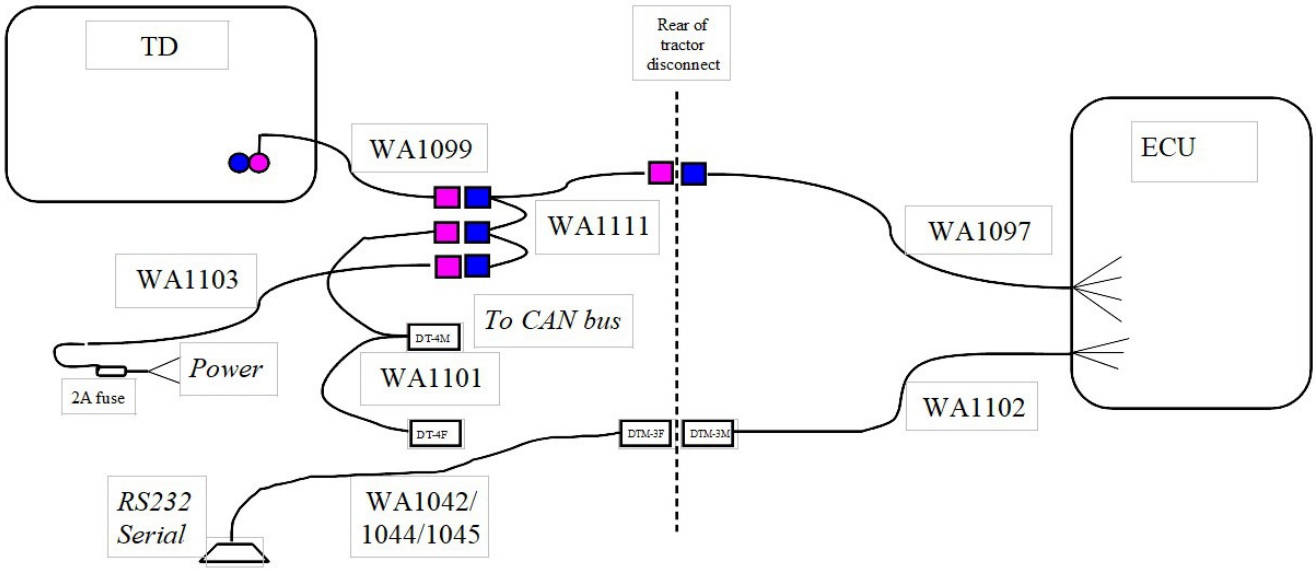


Yield Monitor with Greentronics Touchscreen Display

A Yield Monitor can use a Greentronics Touchscreen Display.

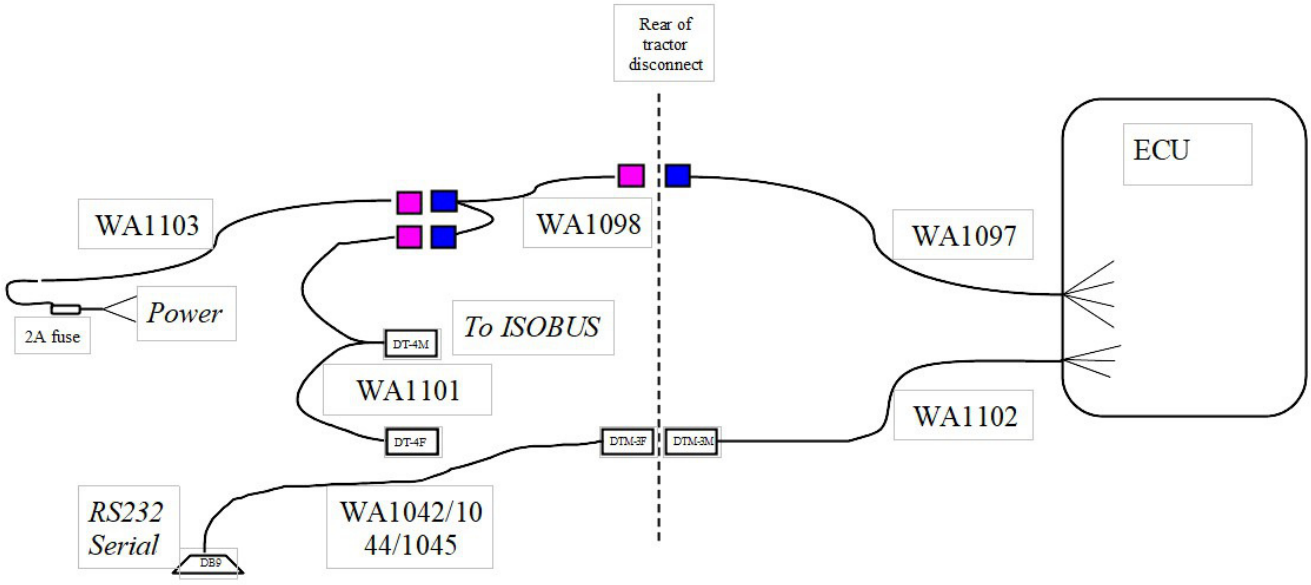
Power is supplied through a fused power cord that must be connected to a 12VDC power source that turns off with the ignition. Connect the black wire to Ground and the red wire to +12V.

It may also connect to the in-cab CAN bus for GPS data. And it can have an RS232 serial connection to a third party device for yield data recording.



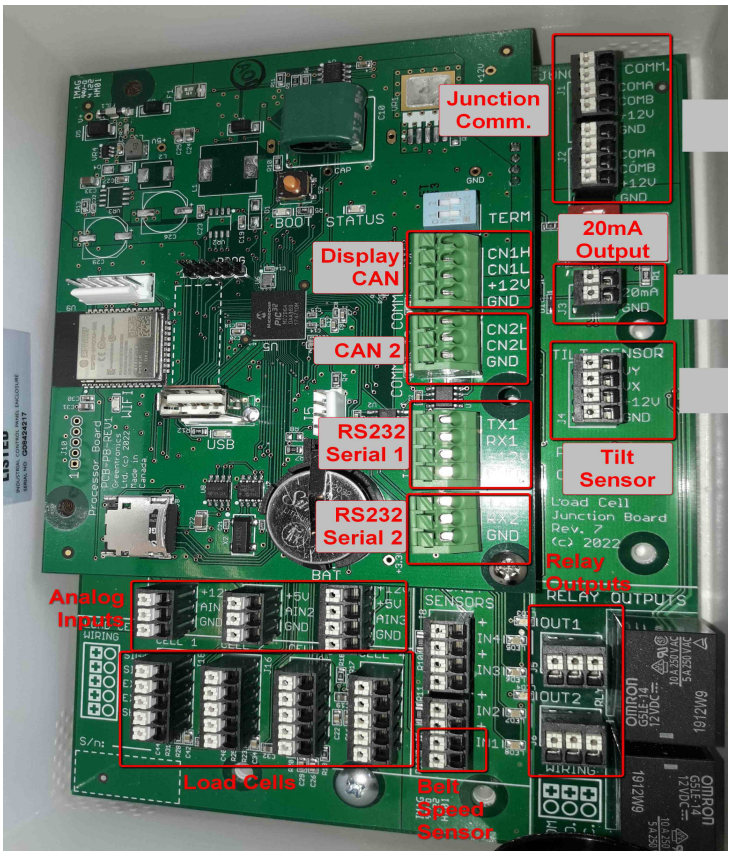
Yield Monitor with ISOBUS Universal Terminal Display

A Yield Monitor can use an ISOBUS Universal Terminal display in place of a Greentronics TD.



2.9 Wiring to the ECU

CAUTION! *Be sure to turn off power to the ECU before connecting wiring to the ECU. Working with the power on can result in sparks, blown fuses, and destroyed electronics.*



Run the load cell and magnet sensor cables to the ECU. Do not cut the load cell cables! It is difficult to add cable later if that becomes necessary. Also, adding connections later can reduce precision. Left-over cabling is easily coiled up and tucked away in a safe corner.

Choose the most direct and safest route. Keep cables well away from rotating shafts, sprockets, chains, sharp edges, etc. Also keep wiring away from work areas, or areas where dirt and stones pile up. Use cable ties to secure the wiring.

All cables enter the ECU through the cable glands on the bottom of the ECU.

Make sure that any unused cable entries are plugged. If necessary this can be done using a short piece of spare cable.

Following are instructions for connecting the various wires. A summary of these instructions is also included inside the ECU cover. Please follow these instructions carefully, since incorrect wiring could result in damage to the sensors and/or the electronics.

Inside the ECU are two circuit boards, one on top of the other. Most wire connections are made to the lower circuit board. The upper circuit board gets only CAN bus and RS232 serial connections.

All the wires connect to terminal blocks on the circuit boards inside the ECU. Push the button on top of each terminal using a small screwdriver to release the contact, and insert the wire. Ensure each wire is fully inserted into the terminal, and no loose strands are exposed. Test each connection by gently pulling on the wire. Insulate bare wires with a sleeve or electrical tape.

LOAD CELL WIRING: Load cells 1 to 4 (bottom of lower circuit board)

SIG+	GREEN
SIG-	WHITE
EXC+	RED
EXC-	BLACK
SHLD	Bare wire

MAGNET SENSORS (bottom right of lower circuit board) – use cable WA1039
Magnet Sensor 1 – Drive shaft magnet sensor

+	RED
IN1	BLACK

Magnet Sensor 2, 3, 4 – Various uses (near bottom right of lower circuit board)

+	RED
IN2/3/4	BLACK

TILT SENSOR – Tilt sensor (right side of lower circuit board) – use cable WA1091

VY	GREEN
VX	WHITE
+12V	RED
GND	BLACK

Crop Temperature Sensor – AIN1 (bottom left of lower circuit board) – use cable WA1073

+12V	RED
AIN1	WHITE
GND	BLACK

RELAY OUTPUTS – OUT1 Alarm output (bottom left of lower circuit board)

COM	Common connection of relay contact
N.O.	Normally Open relay contact
N.C.	Normally Closed relay contact

4-20mA OUT – Analog current loop output (right of lower circuit board)

GND	Ground (return) connection for current loop
IOUT	Current output (4 to 20mA)

12VDC Power Input – J1 JUNCTION COMM. (top right of lower circuit board) – use cable WA1110

+12V	RED
GND	BLACK

CAN Communication to Display or ISOBUS – COMM1 (top right of upper circuit board) – use cable WA1097

CN1H	WHITE
CN1L	GREEN
+12V	RED

GND	BLACK

CAN2 Optional data output – COMM2 (right of upper circuit board) – use cable WA1097

CN2H	WHITE
CN2L	GREEN
GND	BLACK

RS232 Serial Port 1 (right of upper circuit board) – use cable WA1102

TX1	WHITE or GREEN
RX1	RED
+12V	not used
GND	BLACK

RS232 Serial Port 2 (lower right of upper circuit board) – use cable WA1102

TX1	WHITE or GREEN
RX1	RED
GND	BLACK

After completing all wire connections, close and secure the cover on the ECU.

2.10 Alarm Output (Optional)

***NOTE:** This is a licensed option. Contact Greentronics to purchase this option.*

The ECU is equipped with a relay output that can be configured to activate when the accumulated weight for a load exceeds the configured weight limit. This output is intended to activate an alarm indicator to tell the operator to stop loading a truck. The alarm output can also be used to automatically turn off power to a conveyor when the weight limit is reached.

The alarm output consists of an uncommitted relay contact, with access to the common, normally open (N.O.) and normally closed (N.C.) contacts. When the alarm output is active, it activates the relay, which closes the N.O. contact and opens the N.C. contact. The relay contacts are rated for 24VDC or 24VAC at up to 2A.

Refer to “Run” in section 5 for information about how to set weight limits.

2.11 20mA Current Loop Output (Optional)

***NOTE:** This is a licensed option. Contact Greentronics to purchase this option.*

The system is equipped with a 4 to 20mA analog current loop output. This output can be configured to provide an indication of accumulated weight, or of the rate at which material is passing by on the conveyor. This can be used to control a chemical pump or other equipment, or to provide data to a PLC or that requires weight information. Refer to the Config section for information on how to configure the 20mA output.

Connect a 2-wire cable to the 4-20mA OUT terminal block. The IOUT terminal should connect to the positive terminal of the pump or PLC, while the GND terminal should connect to the negative terminal.

If the pump or PLC requires a voltage input rather than a current input, set DIP switch 3 to ON. This will provide a voltage output of 2.0V to 10.0V on the IOUT terminal.

2.12 Connecting Cables

Following is a description of each of the cables in the system and where it should be connected.

ECU CAN Communication (WA1097): Connects ECU to Touchscreen Display or ISOBUS display. Has wire ends to connect to the CAN1 terminal of the upper circuit board, and a 4-pin Deutsch DTM receptacle to connect to the display harness.

Touchscreen Display Communication (WA1099): Connects Touchscreen Display to ECU communication harness. Has right angle M12 connector to connect to the Touchscreen Display, and a 4-pin Deutsch DTM plug to plug into the ECU harness.

ISOBUS Communication Harness (WA1101): Connects ECU CAN cable to ISOBUS. Has 4-pin Deutsch DTM plug to connect to the ECU harness, and a pair of 4-pin Deutsch DT connectors for connecting to ISOBUS.

CAN Communication Splitter (WA1098): Connects to WA1097 to provide dual connections. Has 4-pin Deutsch DTM plug to connect to the ECU harness, and two 4-pin Deutsch DTM receptacles.

CAN Communication 3-Way Splitter (WA1111): Connects to WA1097 to provide triple connections. Has 4-pin Deutsch DTM plug to connect to the ECU harness, and three 4-pin Deutsch DTM receptacles.

ECU Power Input (WA1110): Connects ECU to 12VDC power if power is not supplied through the WA1097 cable. Has wire ends to connect to terminal block J1 of the lower circuit board, and a 4-pin Deutsch DTM receptacle to connect to the AC adapter or 12VDC power cord.

120VAC Power Adapter (WA1109): Converts 120VAC into 12VDC to power the ECU and Touchscreen Display. Has standard 120VAC plug, and a a 4-pin Deutsch DTM plug to connect to the ECU harness.

12VDC Power Cord (WA1103): Connects to 12VDC to power the ECU and Touchscreen Display. Has wire ends to connect to +12V and GND, and a a 4-pin Deutsch DTM plug to connect to the ECU harness.

Magnet Sensor to ECU (WA1039): Connects the conveyor drive shaft sensor (IN1) and other magnet sensors (IN2/3/4) to the ECU. Has a 2-pin plug on one end (to connect to the magnet sensor), and 2 stripped wires (red and black) at the other end.

Tilt Sensor to ECU (WA1091): This cable is for the optional tilt sensor. The cable has a 4-pin plug on one end (to connect to the tilt sensor), and 4 stripped wires at the other end.

Crop Temperature Sensor to ECU (WA1073): This cable is for the optional crop temperature sensor. The cable has a 3-pin receptacle on one end (to connect to the crop temperature sensor), and 3 stripped wires at the other end.

ECU RS232 Serial Communication (WA1102): Provides RS232 serial connection to ECU.

Has wire ends to connect to serial port 1 or 2 of the upper circuit board, and a 3-pin Deutsch DTM receptacle to connect to the serial device connection cable (WA1043, WA1042, or WA1044).

RS232 Yield Data Output Cable for Yield Monitor (WA1043): Sends yield data to a third party yield device for live yield map display and/or data collection. Has a 3-pin Deutsch DTM plug on one end and a female DB-9 connector to connect to the third party device.

RS232 GPS Input Cable for Yield Monitor (WA1042): Has a 3-pin Deutsch DTM plug on one end, and male DB-9 connector that plugs into the serial port of a suitable DGPS receiver.

RS232 Y-Cable Assembly for GPS Input and Data Output for Yield Monitor (WA1044): Has 3 connectors. It is used to connect to both a GPS receiver and an external data logging monitor. Has a 3-pin Deutsch DTM plug, a male DB-9 connector to plug into the serial port of a suitable DGPS receiver, and a female DB-9 connector to plug into the serial port of a third party yield logging device.

RS232 John Deere Yield Doc Specialty Crop (WA1045): Has a 3-pin Deutsch DTM plug, and a 12-pin Ampseal connector to connect to the John Deere harness supplied with its YDSC yield mapping solution.

2.13 What Next?

You are now ready to start calibration. Refer to the "Initial Calibration Steps" below for a quick run-down of the necessary calibration steps.

If you have questions, please contact your dealer. You can also call Greentronics directly at 519-669-4698, or e-mail support@greentronics.com.

3. Initial Calibration Steps

The following calibration steps must be performed before the conveyor weighing system can be used:

1. Set the clock and Machine ID. Refer to section 7.27 and 7.17.
2. Tare length calibration.
3. The optional tilt sensor is normally pre-calibrated at the factory. If you are adding a tilt sensor to an existing system, perform Tilt calibration.
4. Tare calibration.
5. After running the system to load a truck, get the truck weighed and use that weight to perform a Span calibration.

4. Operating the System

The system can be operated using the Greentronics Touchscreen Display, or through an ISOBUS Universal Terminal (UT). The user interface works the same way on both.

4.1 Run Mode Operation

NOTE: *If the Power-on Run option is enabled, the system will automatically start up in the Run screen.*

When the system is powered up, it starts up in the main menu screen. Press the RUN button to begin operation.

You will be prompted to select the current Field, Crop, and Storage. The Field setting determines the file to which yield data is logged in memory. Individual weight totals are maintained for each Field, Crop, and Storage. The selected Field, Crop, and Storage names are also stored in the yield data file for later reference. Press CONT to accept your selections and proceed to the Run screen.

The Run screen shows a display something like this:

```
Yield:    350 cwt/acr    Run
Load Weight:  141.3 cwt [Clear]
Load #  [ - ]  7  [ + ]
# of Rows  [ - ]  4  [ + ]
Field #  16 Home Farm
Crop #    1 Burbank
Store #   1 B1West
      Crop Temp: 18.1C
```

The first line shows the current yield, and whether the harvester is running (“Run” or “Idle”).

The second line shows the total weight accumulated for the current load (141.3 cwt). You can clear the current load weight by pressing the [Clear] button.

The current load number is shown on the third line. You can switch to the next load number whenever you start filling a new truck. To select the next load number, press the [+] button beside the load number. The load number will go up by 1, and the previously accumulated weight (usually 0.0) for that load will be displayed. You can switch back to the previous load number by pressing the [-] button. You can also enter a load number directly. The system can store individual weights for up to 999 separate loads. The load weights will be retained until you clear them (see the "Data" menu below).

The “# of Rows” determines how many crop rows the harvester is picking up. You can change this on the fly using the [+] and [-] buttons or by directly entering a new number. It is important to keep this up to date with the correct number of rows being picked up in order to generate accurate yield maps.

The next lines show the selected field, crop, and storage number, and the name assigned to each. If data logging is enabled, the field number determines the file to which the yield data is saved. The crop and storage names are saved along with the yield data. The selected field, crop, and storage cannot be changed in the Run screen. If you move to a different field, or change crop or storage, you need to exit the Run screen, and then select the new field, crop, and storage when you re-enter Run mode.

If one or more analog input sensors are enabled for display, these are displayed below the crop name.

If any errors occur, error messages are displayed at the bottom of the Run screen.

To exit Run mode, press the HOME button.

WARNING: *Always exit Run mode before turning off power. This ensures that the system is not writing data to memory when the power is turned off, which could result in data corruption.*

4.2 Menu Tree Overview

This section provides a summary of all the menu options. Details of these options are provided in later sections of this manual.

To get the most out of the instructions below, read through them with the display in front of you and powered up.

All the various options are organized into a menu tree. At the root of the menu tree is the main menu, which provides the following options:

Main Menu:
- RUN
- TARE
- CFG
- CAL.
- TEST
- DATA
- OPT

Many of these options have sub-menus:

CFG:
- CFG1
  - Log to Memory
  - Logging Interval
  - Number of Rows
  - Row Width
  - Min Speed
  - Load Wt Limit
  - Min Weight
  - Crop Delay
  - Rate Filter T
- CFG2
  - Ser. 1 Baud
  - Ser. 2 Baud
  - Count Inputs
  - Enable Count
  - Use IN2 for
  - IN2 min. on T
  - IN2 min. off T
  - IN2 Pulse/Rev
- CFG3
  - Power-on Run
  - Machine ID
  - ISO Device Index
  - Unlock Code
  - CAN2 Address
- GPS
  - GPS Source

GPS Alarm if
GPS Offset Fr.
GPS Offset Rt.
CLOCK
Clock from GPS
Time Zone
UNITS
Weight Unit
Area Unit
Length Unit
Speed Unit
Temp Unit
TRACK
Tracking
RF Channel

CAL.:
L/C: Load Cell Cal.
Range
# of Load Cells
Sensitivity
T-LEN: Tare Length Calibration
TILT
Level Calibration
Tilt Calibration
TARE Calibration
SPAN Calibration
AIN: Analog Input Setup
Sensor type
Display on Run Screen
Filter Time
20MA:
20mA Output
20mA FullScale
20mA Delay

TEST:
TARE
TEST1
Load Cells
Speed Sensor
TEST2
Tilt Sensor
Input IN2
Inputs IN3/IN4
GPS
AIN1

```
    AIN2
    AIN3
  SIM: Simulate Yield
  IDS: Test Truck IDs
DATA:
  VIEW
    Load Weights
    Field Weights
    Total Weight
  VIEW2
    Crop Weights
    Storage Weights
  FILE
    Copy Files to USB
    Delete Files
    Read NAMES.TXT from USB
OPT:
  Device ID
  License
  Options
```

5. Error Messages

Following is a list of error messages you may encounter.

`Span Needed`

For a new installation this message will appear to remind you that a Span calibration needs to be performed.

`Clock not set`

The Real Time Clock is not set. A new installation requires you to set the Clock to the correct local date and time. For an existing installation this message may indicate that the clock's backup battery needs to be replaced. Refer to section 14 for details.

`Mach ID not set`

Go to the Config menu Machine ID option and enter a unique name for this machine.

`Comm. error`

The primary ECU is not receiving data from a secondary ECU (used for systems with more than 4 load cells). Check that the communication cable is correctly connected between the ECU's, and that the cable has not been pinched or damaged. Also make sure the address switches are set correctly in each ECU. Refer to section 14 for more information.

`No GPS`

`GPS Error`

The Yield Monitor is not receiving GPS data, or data with errors. Check that the Serial Baud Rate is correct, that the GPS receiver is connected, that the correct GPS NMEA sentences are enabled on the GPS receiver (see section 13.1), and the GPS message rate is 1 Hz.

`GPS poor signal`

`GPS no DGPS`

The GPS data received has poor accuracy or no differential correction. If the problem persists, check your GPS receiver for problems.

`Data not logged`

Yield data cannot be logged. This usually happens because the power supply voltage is too low. Check the power supply connections.

`Data write err`

There was a problem writing yield data. If the problem persists, please contact Greentronics.

`Power low`

The supply voltage to the system is too low for reliable operation. Check the power supply connections.

`> weight limit`

This message is displayed when the current load weight exceeds the configured Load Wt. Limit.

`Tilt error`

The tilt sensor is not connected, or is tilted at greater than 60 degrees.

The following error messages pertain to automatic Tracking of trucks being loaded through Greentronics RF Transponders.

`RF No Device`

No truck transponder in range.

`Load Truck Gone`

The transponder of the truck that was being loaded has gone out of range.

`Scanner Comm`

The ECU cannot communicate with the Scanner. Check that the communication cable is correctly connected between the ECU and the Scanner, and that the cable has not been pinched or damaged.

6. Calibration

All calibration functions are accessed through the CAL (Calibration) menu. Most of the calibration is performed at installation time and should not need to be repeated. If no changes are made to the conveyor, only a periodic Tare calibration is needed to keep the system operating accurately.

For convenient access, TARE is accessible from the main menu as well as from the Calibration menu.

6.1 Load Cells Calibration

The Load Cell Calibration screen is used at installation to set the number of load cells, their full load weight rating, and the sensitivity of each individual load cell.

The # of Load Cells option sets the number of load cells used. The standard system uses 2 load cells, but different installations may require more load cells. Note that using more than 2 load cells requires an option license.

The Range option sets the full load weight rating of the load cells. All load cells should have the same full load rating. The standard conveyor scale system uses 250 lbs rated load cells.

The Sensitivity option is used to set the individual sensitivity of each load cell. Even load cells with identical full load ratings have small differences in the level of their output voltage. Load cell sensitivity is expressed in "mV/V". This sensitivity is printed on each load cell. In most cases the default value of 3.0000 is close enough. For optimal accuracy, enter the individual sensitivity of each load cell. First select the desired load cell (1 to 4). The number selected matches up with the load cell number printed beside each load cell terminal block inside the ECU. For each load cell, enter the corresponding sensitivity (e.g. 3.0025).

6.2 Tare Length Calibration

The Tare Length option is used to set how long the conveyor runs during a Tare calibration.

First attach a marker (such as a piece of tape) to the conveyor belt so that you can see the marker as it comes around. Then select the T-LEN calibration function, and press Start.

Now start the belt running. Watch the belt until the marker is back to its starting position, indicating one complete belt revolution. At this point, press Stop. Then press Save Data to store the result of the calibration.

If the conveyor belt is short, one revolution may not be long enough to provide an accurate tare calibration. *It is recommended that the tare calibration run for at least one minute.* You can increase the tare calibration time by letting the belt make several complete revolutions during tare length calibration.

6.3 How to Perform a Span Calibration

To perform a Span calibration, first do a Tare calibration. Then start with an empty conveyor, and go into the Run screen. Fill up a truck, and run the conveyor empty again into the truck. Record the load weight displayed by the monitor. Get the truck weighed, and record the actual weight of crop in the truck.

Now select the CAL SPAN option. You will be prompted to enter two numbers. The first number is the accumulated weight that was displayed by the monitor (the default is the current load weight). The second number is the actual weight reported by the truck scale.

After entering both weights press the Save Data button to store the new calibration data.

The Span Value

The Span Value is shown at the bottom of the Span screen. It determines the amount of weight accumulated by the monitor. The factory default value is 1.0000.

After you perform a Span calibration, the Span Value displayed will change to show the amount by which you have adjusted the span calibration.

Edit Span

Normally a Span calibration is performed by entering two weights, as described above. However, sometimes you may want to change the Span Value directly. For example, you may want to restore a previous Span Value. Tap the Span Value at the bottom of the Span screen and enter a new value.

6.4 Tilt Calibration

NOTE: *If you do not have a tilt sensor, the Tilt Sensor option must be Disabled.*

If you have purchased the tilt sensor option, a two-axis tilt sensor is used to correct weight readings for varying conveyor inclination or sloping ground. The tilt sensor connects to the ECU. The tilt sensor must be configured and calibrated before it can be used. This is done using the Tilt Calibration menu.

NOTE: *If you ordered the Conveyor Scale or Yield Monitor complete with the tilt compensation option, the tilt sensor and load cells have been pre-calibrated at the factory. No load cell tilt calibration is necessary. Level calibration is required only if the tilt sensor is not installed in the same plane as the load cells. If you are adding a tilt sensor to an existing system, you will need to perform both Level and Load Cell Tilt calibrations.*

There are three steps to calibrating the tilt sensor: Sensor enable, Level calibration, and Load Cell Tilt calibration.

Tilt Sensor Enable

The Sensor option must be set to Enabled in order to use the tilt sensor.

Tilt Level Calibration

NOTE: *Level calibration is required only if the tilt sensor is not installed in the same plane as the load cells.*

Ideally the tilt sensor is mounted in exactly the same plane as the load cells (see section 2.3). The Level calibration accounts for any misalignment between the tilt sensor and the load cells.

To perform the Level calibration, first position the conveyor so that the load cells are exactly level.

Use a spirit level to check this. Then initiate the Level calibration. After a few seconds the display will indicate the calibration is completed.

Load Cell Tilt Calibration

There are two different ways to perform tilt calibration: before the load cells are installed, or after the load cells are installed.

NOTE: *It is much simpler and more accurate to calibrate the load cells before they are installed. This is the recommended calibration procedure. If the load cells are already installed, and it is impractical to level the conveyor, use the Default tilt calibration.*

Procedure for Calibrating Load Cell Tilt Before Installing Load Cells

NOTE: *This method requires that the load cells be unmounted from the conveyor, so this calibration step must be performed before mounting the load cells.*

To use this procedure, place the load cells on a flat level surface, and position them so they are lying on their side (product label facing up).

Select the "Not Mounted" option for the load cells, and press the "Start Tilt Calibration" button.

The display will prompt you to set the load cells on their side. Press OK to proceed. After a few seconds the display will report the new load cell tilt adjustment values have been saved.

Procedure for Calibrating Load Cell Tilt After Installing Load Cells

First level the load cells. That means moving or tilting the machine so that *the load cells are exactly level*. If the conveyor is inclined, this may require tilting the machine. Use a spirit level to check that the load cells are level on both axes. That is, check the level along the length of the load cell, and also across the load cell. It is important to level the load cells accurately. Once you are satisfied the load cells are level on both axes, press the "Perform Level Calibration button to set the new level position.

You must now perform Tilt calibration. For this step it is necessary to place some weight on the load cells, ideally 25 to 50 pounds (10 to 20 kg). Place the weight in the middle of the belt, between the two load cells.

IMPORTANT: *Ensure the weight does not shift during the calibration!*

Select the "Mounted" option, and press the "Start Tilt Calibration" button.

The display will prompt you level the load cells, and will show the tilt angle on the two tilt axes. For this part of the calibration, the load cells need to be near level (at 0 or 1 degree). They should both show zero if the load cells are still leveled from the preceding Tilt Level calibration. When both tilt

angles are at or near zero, press OK. The system will take a few seconds to record the load cell readings.

The display will then prompt you to tilt the load cells in the range of 10 to 30 degrees (positive or negative). It's best if you can get both tilt angles into the 10-30 degree range. *Be careful that the weight on the conveyor belt does not move.* Once you are satisfied with the tilt angles, press OK. The system will record the new load cell readings, and then calculate and store the tilt adjustment factor for each load cell.

Default Load Cell Tilt Calibration

If the load cells are already installed, and it is impractical to level the conveyor, you can use the Default tilt calibration. This sets default tilt calibration values, which does not require any particular positioning of the load cells.

Default tilt calibration assumes the load cells have no zero balance offset. For most load cells this will provide reasonably good tilt compensation, but it is not as accurate as performing tilt calibration before the load cells are installed.

6.5 Tare Calibration

Tare calibration is used to re-calibrate the system's tare (empty) weight measurement. Over time, the load cells and the conveyor belt may accumulate dirt, causing a shift in the tare weight measured by the system. To remove this error, a tare calibration must be performed.

To recalibrate the tare level, run the conveyor until it is completely emptied. Then select Tare at the main menu (or from the Calibration menu). The display will show a time count as well as a count of the belt's progress. When the belt has made one or more complete revolutions (as set by the Tare Length calibration, explained below), the calibration ends and you will be prompted whether you want to save the new data. Press Yes to save the new tare level.

If you need to interrupt the calibration at any time, press Cancel.

6.6 Span Calibration

Span calibration is used to calibrate the system with a measured truck weight. You can perform an approximate calibration by running a test weight over the conveyor, but a full truck load should be used to get an accurate calibration.

Once you have performed an accurate Span calibration, you will not need to re-do the Span calibration unless there is a physical change to the conveyor (such as a new drive mechanism).

NOTE: *Performing several span calibrations in quick succession will not improve accuracy. If weight accuracy is poor after a full truck load span calibration, check the tare calibration and the load cell installation alignment. Only after making corrections to these should you perform another span calibration.*

6.7 Config Analog Inputs

NOTE: *Using the analog inputs requires an option license.*

The ECU is equipped with three general purpose analog voltage inputs: AIN1, AIN2, and AIN3. These are used to optional Infrared (IR) crop temperature sensors. Future software updates may also provide for other types of sensors.

To configure an analog input, first select the desired input number.

Then select the sensor type:

Disabled	Nothing connected
Crop Temp.	Infrared crop temperature sensor connected
Air Temp.	Air temperature sensor connected

For each enabled analog input, there is a Filter Time setting that determines how much smoothing is done of the sensor readings. The default is 1 second. Select 0 seconds for no filtering. A higher value will produce smoother readings, but slower response to changing temperature.

For each enabled analog input, there is also an option to display its reading in the Run screen.

6.8 Config 20mA Output

NOTE: *Using the 20mA output requires an option license.*

The 20mA Output option selects how the 20mA analog current output signal is used.

Disabled	20mA output not used
Load Weight	20mA output indicates accumulated weight of current load
Weight/s	20mA output indicates weight per second passing on conveyor

The 20mA FullScale option sets the range of the 20mA analog current output signal. The current output will be at exactly 20mA once the full scale weight (or weight per second) is reached. At zero weight (or weight per second), the output will be at 4mA.

The 20mA Delay option sets the lag time applied to the output, in seconds. The default value is 0, for no lag. This only applies when the 20mA Output is configured for Weight per second.

This feature is useful when the 20mA output is used to control the flow rate of a pump applying a chemical treatment to the crop downstream of the conveyor scale. Set the 20mA Delay to the time it takes the crop to travel from the scale to the treatment area to ensure the pump always applies the correct amount of chemical.

7. Configuration Options

This section describes all the options accessed through the CFG menu. Note that not all of these options are available, depending on the type of weighing system you purchased.

7.1 Config Log to Memory

The Log to Memory option determines whether or not yield or weight data is logged internally by the Touchscreen Display. This option is available only if the Data Logging license has been purchased. Choose from these options:

No	Do not log data
Yes	Log yield or weight data to internal data storage

7.2 Config Logging Interval

This option determines how often the system logs yield data. Default is 1 second.

7.3 Config Rows

The Rows option sets the number of rows that the harvester is picking up. This can also be changed in the Run screen for on-the-go changes.

7.4 Config Row Width

The Row Width option sets the width of one row in the field, in inches or cm. This number is multiplied by the Rows setting to calculate the total swath width for yield calculations.

7.5 Config Min. Speed

The Min. Speed option sets the minimum ground speed for calculating yield. At ground speeds below this setting a value of 0 will be recorded for yield. Default value is 0.5 km/h (0.31 mph).

7.6 Config Load Weight Limit

The Load WT Limit option sets the weight limit for a truck load. When the load weight exceeds the limit, an alarm message is displayed. If the Relay Output option is licensed, the relay will be activated, which can be used to sound an alarm horn, or to shut off the loading conveyor. Setting the Load WT Limit to 0.0 disables the alarm.

7.7 Config Minimum Weight

The Min Weight option sets a low-weight threshold to avoid false weight accumulation when the conveyor is running empty. If the weight per second is below the threshold, the monitor will not add the weight to the total. Setting the Min Weight to 0.0 disables this function.

7.8 Config Crop Delay

The Crop Delay option sets the time it takes the crop to travel from the harvester's pick-up to the point where the crop is weighed by the load cells. Select a value from 0 to 25 seconds. Default is 0.

7.9 Config Rate Filter T

In many installations, the weight per second varies considerably from one second to the next. To get a more stable reading of product flow rate (or yield), weight readings can be averaged over several seconds. Set Rate Filter T to the number of seconds you want to average. The default is 1 second, which provides no filtering.

7.10 Config Ser. 1 and 2 Baud Rate

The Ser. Baud options for RS232 serial ports 1 and 2 set the baud rate used to connect with various devices. Select from 4800, 9600, 19200, or 38400.

Ser. 2 is used for receiving data from a GPS receiver, for sending yield data to third party devices, and for sending data to a Greentronics remote display.

Ser. 1 is used for connecting to label printers, bar code readers, and RFID readers.

7.11 Config Use IN2 for

The IN2 sensor input in the ECU can be used for a variety of functions:

Not used	Input IN2 not used
Next load	Activating IN2 switches to next load
Clear load	Activating IN2 clears current load weight
Enable yield	Yield data is output only when IN2 is active
Boom Running	For Tracking, IN2 detects when boom is running
Log RPM	IN2 connects to a shaft sensor for logging RPM

The Next load and Clear load options can be used to allow a remote switch to select a new load number, or to clear the load weight.

Normally the system records yield data whenever the conveyor is running. If you select the Enable yield option, the Touchscreen Display will instead log (or output) yield data whenever input IN2 is active. You must connect a signal to Input 2 that is active (+12V) whenever the machine is running. That way the system will continue to output active yield data even while the conveyor is momentarily stopped, providing continuous location mapping.

7.12 Config IN2 min. on/off T

The IN2 min. on T and IN2 min. off T options set the minimum on and off time for input IN2, in seconds. The Next load and Clear load options act whenever input IN2 becomes active. To prevent false triggering of these actions due to short input pulses, the IN2 min. on T option sets the minimum time the IN2 input must be on before the action is taken, and the IN2 min. off T option sets the minimum time the IN2 input must be off before the event can be triggered again.

7.13 Config IN2 Pulse/Rev

This option is used when IN2 is used to Log RPM. It sets the number of pulses the shaft sensor produces for each revolution of the shaft. The default is 1.

7.14 Config Belt Min. RPM

This option lets you set the minimum operating speed of the conveyor drive shaft that is measured by the magnet sensor. Enter the lowest operating speed, in RPM. The default is 30.0 RPM.

7.15 Config Belt Magnets

This option tells the system how many pulses the magnet sensor sees for each shaft revolution. The default value is 1.

For example, if you have installed two magnets on opposite sides of the shaft, then change this to 2.

7.16 Config Power-on Run

The Power-on Run option determines whether or not the system automatically initiates Run mode at power-up. This is useful for unattended operation.

Enabled	automatically start Run mode at power-up
Disabled	Start in the main menu at power-up (default)

7.17 Config Machine ID

The Machine ID option allows you to enter a unique name for the harvester on which the yield monitor is installed. This machine ID is included in the yield data logged to the Flash drive.

7.18 Config ISO Device Index

If you are are operating two or more identical devices with the same ISOBUS UT display, you need some way of identifying each device. Set the Device Index of each device to a unique number. The UT will display the index along with the device name so you always know which device you are controlling.

Device Index can be set to any value from 0 to 9. Default is 0.

7.19 Config UT Number

The ISOBUS protocol allows multiple Universal Terminal displays (servers) to be present. Each UT

server is identified by an index number ranging from 1 to 16. By default the Greentronics ECU will connect to UT number 1. The UT Number option lets you connect to a different UT server. After changing the UT Number you must reboot the system to connect to the new UT server.

Note that if the designated UT server is not found within one minute, the ECU will attempt to connect to any other UT server on the CAN bus.

7.20 Config CAN2 Address

If the system is licensed to output yield data on its CAN2 port, this option selects the CAN source address used for sending the data. The default value is 128. Recommended values are in the range of 128 to 239.

7.21 Config Serial 1 Output

This option configured whether a printer is connected on on serial port 1. Choose from the following options:

Disabled	
Label Printer	EPL compatible label printer

When the operator presses PRINT in the Run screen, a multi-line label will be generated and sent to the attached label printer. The label includes the load number and weight, date and time, and the names of the currently selected Crop, Field, and Storage.

7.22 Config Serial 2 Output

This option sets the type of data that is transmitted on serial port 2. Choose from the following options:

Remote Weight	Show weight on remote display
Remote Rate	Show flow rate on remote display
Remote 2-Line	Show weight and rate 2-line remote display
Remote 4-Line	Show detailed information on 4-line remote display
Rate Control	Send rate data for use by third party controller

7.23 Config Serial Format

The Serial Display option is used only for a Conveyor Scale. It determines the number of decimal places displayed on the optional remote display device connected to serial port 2. Choose one of these options:

Default	Automatically select optimal number of decimal digits
0 - XXXXXX	No decimal digits
1 – XXXXX.X	One digit after the decimal point
2 – XXXX.XX	Two digits after the decimal point
3 – XXX.XXX	Three digits after the decimal point

7.24 Config GPS Source

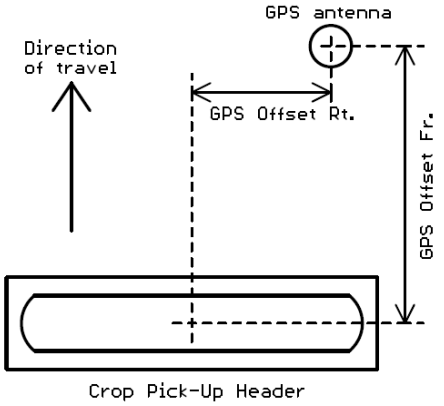
Choose whether GPS data is provided through an RS232 Serial port or through a CAN bus connection.

7.25 Config GPS Alarm if

The "GPS Alarm if" option controls whether an alarm is sounded when the system is not receiving good GPS data. An error message is still displayed even if the alarm is not sounded. Choose from these options:

Never	Never sound alarm for GPS errors
No GPS	Sound alarm if no GPS data is received at all
No DGPS	Also sound alarm if no differential correction

7.26 Config GPS Offset Fr. / Rt.



GPS receivers provide the location of the GPS antenna. But the point where the crop is actually picked up may be some distance away from the GPS antenna. The GPS Offset settings correct for this.

GPS Offset Fr. is the front-to-back distance from the pick-up point to the GPS antenna. Enter a positive value if the GPS antenna is in front of the pick-up point, or a negative value if the GPS antenna is behind the pick-point.

GPS Offset Rt. is the sideways distance from the pick-up point to the GPS antenna. Enter a positive value if the GPS antenna is to the right of the pick-up point, or a negative value if the GPS antenna is to the left of the pick-point.

7.27 Config Clock

This option sets the ECU's built-in real time clock. Set the year, month, day, hour (24-hour clock), and minute, and press the Set button.

The ECU has an internal backup battery so the clock keeps time even when the system is powered off.

7.28 Config Clock from GPS

If the system is connected to a GPS receiver, the date and time provided by the GPS receiver can be used to automatically keep the ECU's internal clock at the correct time.

No	No GPS correction, clock must be set manually (default)
Yes	Use GPS date and time to correct the internal clock

7.29 Config Time Zone

If Clock from GPS is set to Yes, the system will use the date and time from the connected GPS receiver.

However, GPS date and time is in UTC (Universal Coordinated Time, or Greenwich Mean Time), which is not the same as local date and time. To convert to local time the software needs to know the local time zone. Select your local time zone from the list. To keep in step with daylight savings time, it is necessary to switch the time zone twice a year.

7.30 Config Weight Unit

The Weight Unit option is used to set the weight unit used to display weight data on-screen. Select from the following list:

kg	kilograms
lbs	pounds
cwt	hundred weight (100 pounds)
ton	imperial ton (2000 lbs)
tne	metric ton (1000 kg)

7.31 Config Area Unit

The Area Unit is used to select whether yield is expressed per acre or per hectare. Select from the following list:

ha	hectare
acr	acre

7.32 Config Length Unit

The Length Unit option is used to select the unit used for row width. Select from the following list:

cm	centimetre
in	inch

7.33 Config Speed Unit

The Speed Unit option sets the unit used to display speed. Select from the following options:

km/h	kilometres per hour
mph	miles per hour

7.34 Config Temperature Unit

The Temp. Unit option is used to select the unit used to display data from temperature sensors. Select from the following list:

Celsius
Fahrenheit

7.35 Config Tracking Enable

If the Yield Monitor is equipped with a RiteTrace Scanner this option determines whether or not automatic tracking is performed of the trucks being loaded. Set to “Yes” to enable tracking, or “No” to

disable truck tracking.

7.36 Config Tracking RF Channel

If Tracking is enabled, this option sets the RF channel used by the RiteTrace Scanner. The default value is 13. Do not change this unless there are RF interference problems.

NOTE: *All Scanners in a RiteTrace system must use the same RF channel.*

7.37 Config Tracking Set Truck ID

This screen lets you change the name and weight capacity of a truck transponder.

Press Scan to see the nearest truck Transponder. Update its information and press Set to write the information to the Transponder.

If more than one truck Transponder is in range the display will show a warning, and will then proceed to show the Transponder with the strongest signal. Usually that will be the closest truck, but if you're not sure you should move other trucks out of range or disconnect power from their Transponders.

8. Data

The Data option of the main menu is used to view and clear weight data, to copy data to a USB Flash drive, and to delete yield data files from internal storage memory.

8.1 Data VIEW: Loads, Fields, Crops, Storages, Total

The VIEW and VIEW2 screens allow you to view the accumulated weight for each load, field, crop, and storage, as well as the total weight harvested to date. Each weight can be cleared by pressing the corresponding Clear button. There are also buttons to clear all Loads, Fields, Crops, or Storages.

The Total Weight is not affected by the clearing of individual weights.

8.2 Data FILE Copy Files to USB

Pressing the Copy Files to USB button copies all internal data files to a USB Flash drive plugging into the USB connector of the upper circuit board in the ECU. Files copied include all yield data files and the calibration log file (CFG-LOG.TXT).

This option also generates a weight summary file. This file is named WEIGHTS.TXT, and includes the weight data for all loads, fields, crops, and storages, and the total weight.

Before starting, insert a USB Flash drive into the USB connector inside the ECU.

NOTE: *The USB Flash drive must be formatted as a FAT32 file system.*

Copying the yield data files can take a few minutes, depending on the amount of data that has been stored.

The data on the USB Flash drive can be read on any standard computer with a USB port.

8.3 Data FILE Delete Files

This button is used to delete all the yield data files from internal storage. The calibration log and weight summary are not deleted.

WARNING: *Be sure to use Copy Files to copy all yield data files to a USB Flash drive before deleting the yield data from internal storage.*

8.4 Data FILE Read NAMES.TXT from USB

This button is used to load a set of names for Fields, Crops, and Storages. When this button is pressed, the system looks for a file named NAMES.TXT on the USB Flash drive plugged into the USB connector inside the ECU. If the file is found, all the Field, Crop, and Storage names defined in the file are stored in the ECU's internal memory.

The file NAMES.TXT can be created on any computer using a text editor such as Notepad. The format of the file is simple:

F1 Home Farm 1

F2 Smith Farm

F3 16th Line

C1 Yukon Gold

C2 Trial B

S1 West 1

S2 East 1

Each line starts with an “F”, “C”, or “S” to indicate whether it’s a Field, Crop, or Storage name. Immediately following this letter is a number from 1 to 99, indicating the field, crop, or storage number. After the number there must be one or more spaces or tabs, followed by the name assigned. If no name is given, the name for the respective field, crop, or storage will be cleared from the ECU's memory.

8.5 Data FILE Copy Backup to USB

The ECU maintains a backup copy of the last deleted yield data files. If the data files are accidentally deleted before being copied to a USB Flash drive, use the Copy Backup to USB button to retrieve the deleted files. The files will be copied to the USB Flash Drive, but will not be restored to regular storage inside the ECU.

9. Test

The Test menu is used to verify that the load cells, the drive shaft magnet sensor, and any other sensors and connections are functioning correctly.

9.1 Test Tare

This function is used to evaluate the accuracy of the current Tare calibration. The display shows

cumulative weight and weight per second. No data is recorded by Test Tare.

If you suspect the Tare calibration for your conveyor may be off, run Test Tare for a few minutes to see if the cumulative weight gradually increases or decreases. You can then decide to run a Tare calibration if necessary.

NOTE: *The Run display cannot be used for evaluating Tare accuracy if Minimum Weight has been set in the Config menu.*

9.2 Test TEST1

The TEST1 test screen shows the readings from the load cells, belt speed sensor, and power supply voltage.

Load Cells

For each load cell, the gross weight reading is shown. No tare level is subtracted from these readings.

With the conveyor belt empty and stopped, these numbers should be stable, and typically within 1 pound of each other. As you press on each load cell, its reading should increase. If a load cell does not respond correctly, check for dirt build-up around the load cells, and check that the load cell wiring is correct.

Speed Sensor

The display shows the RPM of the conveyor drive shaft, as well as a count of the number of revolutions of the shaft.

You should see the count increase by 1 for every revolution of the drive shaft. If the belt count does not increase, or the RPM varies a lot, check that the magnet on the drive shaft and the magnet sensor are both firmly mounted, and the space between the sensor and magnet is about ¼" (6mm) at closest approach. Also check for nearby build-up of grease, as lubricating grease can affect the operation of the magnet sensor.

Supply Voltage

The supply voltage should typically be between 11V and 14V. If the voltage is low, check the power supply connection to the ECU.

9.3 Test TEST2

The TEST2 test screen shows readings from the tilt sensor, digital inputs IN2-4, analog inputs, and GPS.

Tilt Sensor

Shows the two tilt angles measured by the 2-axis tilt sensors, in degrees.

Input IN2

Shows the state of input IN2, either “OFF” (no voltage) or “ON” (+12V).

Input IN3/4

If inputs IN3 and IN4 are enabled for use, this shows the state of these inputs.

Quad IN3/4

If inputs IN3 and IN4 are enabled to read a quadrature sensor, this field shows the progressive count (positive or negative) as the shaft is turned.

GPS

Shows the GPS data being received. The display shows whether GPS is being received, the number of satellites in view of the GPS receiver, the ground speed, and the latitude and longitude.

If no GPS data is being received, check the connection to the GPS receiver. For an RS232 serial connection check the serial2 baud rate setting, and make sure that the GGA, RMC, and VTG sentences are enabled in the GPS receiver.

For RS232 serial data the Serial line will show continually updating strings of letters and numbers separated by commas. If you see nothing at all, there may be a problem with the connection to the GPS receiver. Check the connections to make sure everything is plugged in securely. Then confirm that the Transmit signal from the GPS receiver is connected to the Receive line of the ECU (pin 2 of the male 9-pin connector of the WA1042 harness, which connects to pin 3 of the Deutsch DTM3 connector). If you see a lot of question marks or odd symbols, the baud rate is likely wrong.

Test Analog Sensors

Shows the temperature measured by each enabled temperature sensor.

9.4 Test SIM: Simulate Yield

Tests the serial port connection to an external yield monitoring device (eg. Trimble or John Deere), or the logging of yield data to internal data storage memory.

The system will output simulated yield data, without the need for any actual input from load cells or a drive shaft sensor. This allows you to make a test run without actually running the harvester to ensure that yield data is correctly logged.

The display provides Start and Stop buttons to simulate the harvester running or stopping.

The weight input field determines the yield weight data being output (weight per second). You can change this to see whether the logging device correctly tracks changes in yield weight.

9.5 Test Relays

Allows you to activate the relay outputs of the ECU to test their operation.

9.6 Test 20mA Output

Allows you to test the operation of the 20mA analog current output of the ECU. Enter the percentage to change the 20mA output value. The initial value of 0% corresponds to an output current of 4mA, while 100% corresponds to 20mA.

9.7 Test Truck ID's

If the Yield Monitor is equipped with a RiteTrace Scanner, this test screen shows all truck transponders within range. Each transponder shows its assigned name as well as the signal strength. The signal strength indicates how strong a signal is being received from the transponder (0 is very weak, and 255 is strongest). A "*" behind the signal strength indicates that the truck's unload conveyor is running.

10. OPT Screen

The OPT screen shows currently installed features, and allows you to enter license keys to add new features.

Contact Greentronics or your dealer to purchase options.

In order to obtain a license key, you must provide the Device ID of your system, which is the 10-digit number displayed (eg. 1234-567-890). Provide this Device ID along with the name of the option you wish to add to your system.

In return you will receive a 10-digit license key. Enter this key in the License input field.

Available Options

Currently available options include:

- ISOBUS – enables ISOBUS communication with third party Universal Terminal (UT) display
- Tracking – enables truck tracking as part of the RiteTrace system
- Max L/C – for installations requiring more than two load cells
- Logging – enables data logging to ECU internal storage memory
- File DwnLd – enables wireless file transfer via WiFi
- Yld Out – enable yield data output to a third party monitor (Trimble, JD, Ag Leader, ...)
- CAN2 Yld – enable yield data output on the CAN2 bus
- 20mA Output – enables 4-20mA current loop output
- Relay Output – enables relay contact output to indicate weight limit reached
- Weight Info – enables wireless weight display via WiFi

- 4-Line Disp – enables use of external 4-line display to show weight, rate, and other info

11. Update Firmware

Feedback from customers and dealers often results in firmware updates. The system allows in-field firmware upgrades using a USB Flash drive plugged into the USB connector inside the ECU.

To obtain the Firmware Update File, contact Greentronics or your dealer and request the firmware update be emailed to you.

Steps to update Firmware:

1) Save the firmware file(s) on a USB Flash drive. *The USB Flash drive must be formatted with a FAT32 file system.*
2) Go to the Main Menu screen.
3) Go to the ECU and open the cover. Plug the USB Flash drive into the USB connector on the upper circuit board.
4) Press and hold the small BOOT button on the upper circuit board until the red BOOT LED begins to flash, then release the button.
5) The red BOOT LED will light while the new firmware is copied from the USB Flash drive. The system will then shut down, install the new firmware, and boot up running the new firmware.
6) Check the display to see that it is now running the new firmware by checking the "FW Rev" shown in the Main Menu screen.
7) Remove the USB Flash drive and close the ECU cover.

12. Yield Data Output to Third Party Devices

The Yield Monitor can output yield data on the RS232 serial2 port or on its CAN2 CAN bus port.

To enable yield data output you must purchase the appropriate license. Contact Greentronics or your dealer for details.

RS232 Serial Yield Data Output

The serial port can be connected to displays from Trimble, John Deere, Ag Leader, and other third party displays that interpret the Greentronics yield data sentence output. Together with a DGPS receiver, this can provide a complete yield mapping solution with on-the-go yield map display for any harvesting machinery that uses a conveyor to carry the harvested crop.

To use the yield data output from the ECU, connect the serial cable's 3-pin connector to the ECU harness 3-pin connector (see section 2.12). The other end of the serial cable has a standard female DB-9 connector to plug into a standard RS-232 serial port connector.

For a John Deere monitor with the Yield Documentation Specialty Crop option installed, use the WA1045 cable to plug into the John Deere supplied 12-pin AmpSeal connector.

The ECU defaults to output data at 9600 baud, using 8 data bits, 1 stop bit, and no parity. The baud

rate can be changed using the Serial2 Baud rate setting in the Config menu.

Yield data is output only while the system is in Run mode, or in Simulate Yield mode (in the Test menu). At each sample interval (as set by the Config Logging Interval) the ECU transmits a new data string.

If Trimble output is licensed, data is output in a format proprietary to Trimble. The Trimble monitor should be configured for yield monitor type “AgLeader YM2000” or “Serial Data Input”. Contact your Trimble dealer or Greentronics for settings appropriate for current Trimble software.

If JD GreenStar output is selected, data is output in a format proprietary to John Deere. The JD GreenStar monitor must be equipped with the Yield Documentation Specialty Crop option, including the appropriate application controller and software to interface to the YM500. Contact your John Deere dealer or Greentronics for details.

If Ag Leader output is licensed, data is output in a format proprietary to Ag Leader. An Ag Leader Application Rate Module (Ag Leader part # 4000160-1) is required. A Greentronics WA1044 split serial cable is used, along with a male-to-male adapter to connect to the Ag Leader's female DB-9 connector. Contact your Ag Leader dealer or Greentronics for settings appropriate for current Ag Leader software.

If the Greentronics yield data output option is used, detailed weight and yield data is output in a custom data sentence defined by Greentronics. Contact Greentronics for details.

CAN Bus Yield Data Output on the CAN2 Port

If the CAN bus yield data output option is licensed, the Yield Monitor will transmit yield and weight data on its CAN2 port. Contact Greentronics for details.

The CAN2 port operates at 250 Khz. If necessary, a terminator can be enabled on the ECU by setting DIP switch 2 ON on the top circuit board.

13. Yield Data Logging to Internal Storage

The Yield Monitor can log yield data to its internal data storage. This provides a complete stand-alone yield monitoring solution.

This feature requires installing the Data Logging license, and setting the Log to Memory option to Yes. A GPS receiver must be connected to provide location data.

IMPORTANT: *To prevent data corruption, always exit Run mode before powering off.*

All data is stored in the ECU's internal data storage. To move the data to a computer for processing into yield maps, copy the data from the ECU's internal memory to a USB Flash drive (see section 8.2).

The Flash drive will have a separate yield data file for each field that has been selected. For example:

FIELD09.CSV

Each entry in the file consists of a single line of data. The data fields in each line are separated by commas, making it very simple to import the data into any spreadsheet program or yield mapping program. The first line of the file provides a title for each data field.

13.1 GPS Receiver Configuration

A good quality DGPS (Differential GPS) receiver should be used to ensure high quality yield maps.

Serial RS-232 GPS Data

Many GPS receivers provide output through an RS232 serial data connection.

These GPS receivers provide position and speed data by outputting different types of data strings, or "sentences", defined by the NMEA standard. The Greentronics Yield Monitor requires at least three NMEA sentences:

GGA

VTG

RMC and/or ZDA

The GPS receiver must be configured to output the GGA and VTG sentences, and either the RMC or the ZDA sentence (or both). Refer to the documentation for your GPS receiver for information on how to configure the GPS receiver.

The GPS receiver connects to the ECU through an RS232 serial port. The baud rate (communication speed) of the GPS receiver and the Yield Monitor must match (see section 7.10).

To avoid overloading the serial port, it is best to set the GPS receiver output rate to 1 Hz (once a second).

CAN GPS Data

Many GPS receivers output GPS data through a CAN bus connection. This is especially convenient if the Yield Monitor is connected to an ISOBUS UT display, since the GPS receiver is generally connected to the same CAN bus used for ISOBUS communication.

The Greentronics Yield Monitor requires these three CAN messages:

PGN 65254 Date and Time

PGN 65256 Speed and Direction

PGN 65267 GPS position

14. Troubleshooting

14.1 Connection between ECU and Display

The user display is provided by either a Greentronics Touchscreen Display or a third party ISOBUS Universal Terminal display. Regardless of which display is used, the ECU communicates with the display over its CAN1 port.

When the CAN bus communication is working properly, the Yield Monitor or Conveyor Scale screen will appear on the display within 30 seconds of power being applied to the ECU. (ISOBUS displays may take longer to boot up.)

If nothing shows up, open the ECU cover and check the green STATUS LED and the orange COMM1 LED on the upper circuit board.

STATUS LED (green)	**COMM1 LED (orange)**	**Description**
On	Blinking	Normal communication with display
Blinking	Off	No CAN communication – check cables and termination
Off	Off	No power – check power supply
Blinking	Blinking	Some CAN communication, but cannot connect to display – check connection to correct CAN bus

14.2 Real Time Clock Battery Replacement

The ECU has a built-in Real Time Clock that keeps time using a backup Lithium battery. The backup battery will keep the Real Time Clock up to date for 5 years or more. When the backup battery is depleted, you will see the "Clock not set" error message. It is important to replace the battery as soon as possible, since all logged data is time stamped using the Real Time Clock.

The backup battery is a standard Lithium coin cell of type 2032.

To replace the backup battery, first disconnect power from the ECU. Open the ECU cover. You will see the battery in a holder near the bottom of the upper circuit board. The battery is held in place by a metal holding tab. Slide the battery out from under the holding tab.

Now insert the new battery under the holding tab, with the + side facing up.

Close the ECU cover, power the system on, and set the Clock in the Config menu.

15. Major System Components

YM550 or

CS550 ECU (Electronic Control Unit)

TD500	Touchscreen Display
LC250	Load cell, 250 lbs rating
SM002	Magnet sensor (drive shaft speed sensor)
WA1039	Magnet sensor cable
STXY04	Tilt Sensor
WA1091	Cable for tilt sensor
SIRT01	Crop temperature sensor
WA1073	Cable for crop temperature sensor

16. Specifications

Touchscreen Display supply voltage: +12VDC, 2A max.

Load cells:

Rated load:	250 lbs, 50% max. overload
Sensitivity:	3.0 mV/V
Environment:	Sealed to IP65, -18C to +65C

ECU: 8.6 x 7.0 x 4.0 inches (22 x 28 x 22 cm)
Liquid tight cable entries

Touchscreen Display: 8.7 x 6.4 x 1.3 inches (22 x 26 x 3.5 cm)

Cases are made of impact resistant and flame retardant ABS, with gaskets to seal out moisture and dirt.

17. Abbreviated End-User Firmware License Agreement, Warranty and Limited Liability Statement

Full length version is available at www.greentronics.com/Downloads/.

Greentronics Ltd. (or "Company") reserves the right to update its policies and agreements from time to time at its sole discretion and without prior notice to dealers and customers.

IMPORTANT! PLEASE READ BEFORE YOU INSTALL OR USE A PRODUCT OR SERVICE FROM GREENTRONICS LTD.: Your installation or use of a product(s) or service(s) provided by Greentronics Ltd. will constitute your agreement to all terms and conditions contained in the "**Policies"**. The **Policies** include the expanded full length End-User License Agreement for the use of Firmware as well as the Product Return, Warranty and Limited Liability Statements. Company will repair or replace Products in accordance with this Abbreviated End-User License Agreement, Warranty and Limited Liability Statement and our expanded **Policie**s available on our website. Greentronics Ltd. is pleased to provide a hard copy of the expanded **Policies** on request.

1. DEFINITIONS

"Firmware" shall mean software which is embedded or otherwise written in to the Read-Only Memory of the computer contained within a Greentronics Ltd. product.

"Product" shall mean any item of hardware or software, created by or for Greentronics Ltd. exclusively for the economic

use and benefit of same through sale or licensing to customers and the general public.

"Service" shall mean action(s) taken by Greentronics Ltd. in support of its products including installation assistance, troubleshooting and technical support in person, by phone, email, fax or any other method.

2. WARRANTY

Greentronics Ltd. warrants to the End-User of each Product that such Product will be free from defects in materials or workmanship from the date of purchase for a period of one (1) year (the "Warranty Period").

During this warranty period, the Company will, at its option, repair or replace defective Products or defective components thereof. This warranty is limited to the cost of the repaired or replaced product and does not cover time, labour, travel, shipping or any other expenses incurred by the Company and its OEM partners, distributors, dealers, customers and suppliers in meeting obligations herein. This warranty also does not cover damage due to external causes, including wear and tear, accident, abuse, misuse, or use or care not in accordance with Product documentation. Products for repair or replacement must be returned to Company in accordance with our Return Policy. Repair or replacement will not extend warranty except as referenced in the Return Policy. Additional warranties may be provided by suppliers of non-Company branded Products in the documentation for such Products. Company is not liable or responsible for such warranties.

3. LIABILITY

THE ABOVE LIMITED WARRANTY IS THE ONLY WARRANTY APPLICABLE TO THE PRODUCTS. TO THE MAXIMUM EXTENT PERMITTED BY LAW, COMPANY DISCLAIMS ALL OTHER WARRANTIES AND CONDITIONS, EXPRESS OR IMPLIED, IN RESPECT OF PRODUCTS OR SERVICES, INCLUDING, IMPLIED WARRANTIES, CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. NO ORAL OR WRITTEN INFORMATION, GIVEN BY COMPANY, ITS AGENTS OR EMPLOYEES WILL IN ANY WAY INCREASE THE SCOPE OF THIS LIMITED WARRANTY.

COMPANY'S SOLE LIABILITY AND RESPONSIBILITY IS LIMITED TO REPAIR OR REPLACEMENT AS SET FORTH IN THIS STATEMENT. COMPANY WILL NOT BE LIABLE FOR LOST PROFITS, LOSS OF BUSINESS, LOST DATA OR DIRECT, INDIRECT, CONSEQUENTIAL, SPECIAL OR PUNITIVE DAMAGES, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, OR FOR ANY CLAIM BY ANY THIRD PARTY. YOU AGREE THAT FOR ANY LIABILITY RELATED TO THE PURCHASE OR SUPPLY OF PRODUCTS OR SERVICES, COMPANY IS NOT LIABLE OR RESPONSIBLE FOR ANY AMOUNT OF DAMAGES ABOVE THE AGGREGATE DOLLAR AMOUNT PAID BY YOU FOR THE PRODUCT OR SERVICE IN QUESTION.

SOME JURISDICTIONS DO NOT PERMIT SOME OF THE FOREGOING EXCLUSIONS, CONDITIONS OR LIMITATIONS. THEREFORE THE FOREGOING DISCLAIMERS MAY NOT APPLY TO YOU.

4. Agreements Incorporated by Reference

This Abbreviated End-User License Agreement, Warranty and Limited Liability Statement and the "**Policies"** including their respective terms form parts of the same Agreement. Together, the "**Policies"** constitute the entire Agreement between You and Greentronics Ltd. in respect of warranties, representations and liability.

5. Inconsistencies and Avoidance of Conflicts

Notwithstanding section 4, in the event that any provision of this Abbreviated version conflicts or is inconsistent with our "**Policies"**, the "**Policies"** will govern to the extent of the inconsistency.

18. Important Notes Related to Product Return Process

Return of Goods procedure

The details below, as well as other details, are available under "Policies" at www.greentronics.com/Downloads.

During the first 30 days from the invoice date, the User may apply for an agreement to return goods for credit. Goods may only be returned with the prior written consent of Greentronics Ltd. The steps to follow are described under "What to do in case of unsatisfactory performance or defects?" below.

Greentronics Ltd. reserves the right to withhold a 25% restocking fee. Returned goods must be in "as new" condition. Further deductions may be applied for goods returned in unsatisfactory condition. Damaged goods will be rejected.

To return Products, you must ship the Products to Company in their original condition, and in original packaging or other packaging suitable for that purpose, prepay shipping charges and accept the risk of loss or damage during shipment. Shipping goods to Company for return will constitute your understanding and acceptance of the foregoing.

What to do in case of unsatisfactory performance or defects?

Sometimes problems are not due to product limitations or defects, but due to incorrect wiring connections, set-up issues, or wrong installation or operation. Most of those problems can be solved quickly and without any expense by re-reading the installation and operation manual and, failing that, with technical assistance via telephone or email from your dealer or Greentronics Ltd.

User satisfaction with our product is of primary importance to Greentronics Ltd. From time to time, a product may not perform as expected. If one of its products fails to perform as needed, User may apply for a Return Merchandise Authorization ("RMA") number during the first 30 days from invoice date. An RMA will only be issued if User has made use of all the technical support that the retailing dealer and/or Greentronics Ltd. has been able to provide. No RMA will be issued and no credit offered prior to the request for, and the provision of technical assistance by either dealer or Greentronics Ltd. Once User has received an RMA, the steps described below must be followed to return the product and be eligible for a credit.

In the event a product proves defective within the warranty period, complete the simple steps described below to qualify for repairs, replacement, or credit as applicable under warranty. Note that the identical process must be followed if you want to have defective products repaired **outside** the warranty period, or if you are returning complete products within 30 days from the invoice date.

1. Within 30 days of reporting the problem, User must request an RMA (Return Merchandise Authorization) number. If you purchased your product through a dealer, you must send this request to the dealer who will complete the steps below for you. If your product was purchased direct from Greentronics Ltd., call or email Greentronics Ltd. with your request. Provide the following details with each RMA request and keep copies with the items you are planning to return:

·Product name, model, serial number, purchase date and invoice number.
·A brief written description of the reason for the return.

2. Once Greentronics Ltd. consents and issues an RMA#, you, the User or your dealer must complete the next few steps:
·Prepare the return shipment by ensuring the items are clean and free of any chemical contamination. This is important! Dirty or contaminated items will not be accepted, and will be returned to the sender at their expense.

·Package the item(s) in a proper box complete with the details you prepared in Step 1.

·Clearly write the RMA# on the outside of the package and send it freight pre-paid to Greentronics Ltd., **75 Arthur St N, Elmira, ON N3B 2A1 Canada.**

3. Once the parcel arrives at Greentronics Ltd., the items will be examined within a reasonable amount of time to categorize the return as:

A) New merchandise return due to unsatisfactory performance
B) Warranty Repair
C) Out of Warranty Repair.

For A): The item(s) will be examined for cleanliness, contamination and damage, then tested thoroughly to determine functionality. If necessary, repairs and adjustments will be made to bring the item(s) back to original specifications. Labour and parts costs plus a restocking fee will be applied against any credit. A cheque for the net credit will be issued to you.

For B): The item(s) will be examined for cleanliness and contamination. At its discretion, Greentronics Ltd. will repair or replace the item(s) with a comparable item at no charge and prepare a return to the customer via prepaid freight. The returned item(s) will carry the remainder of the warranty period. Note, labour and return freight charges will be invoiced in cases where items returned under warranty show no fault after diagnostic tests.

For C): After an examination for cleanliness and contamination, the item(s) will go through diagnostic tests to determine the reason for the defect. A repair estimate Including estimated return freight costs will be prepared and communicated to you. At that point you must decide and inform Greentronics Ltd. within five business days whether the item(s) are to be repaired, returned "as is", or scrapped. Any repairs must be prepaid according to the estimate. Greentronics Ltd. will not return repaired items until all taxes and charges have been paid in full. All repaired or replaced out of warranty item(s) will carry a 90-day warranty from the date of return to you.