7/26/2010

HYPACK

DREDGEPACK GUIDE TO CRANE SYSTEMS

Installers Guide | REV 2

This guide is not yet complete. Any topic that is lined out has not been completed. As the guide is completed it will be available for download from HYPACK by contacting Help@HYPACK.Com.

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INTRODUCTION

The system that is described in the following pages is designed to handle standard crane systems that dredge using a bucket. Using a GPS to monitor position and either a magnetic or optical sensor to monitor the direction and movement of the drum on the crane, DREDGEPACK can determine the depth and position of the bucket.

There will be optional items that are not required but can be used to enhance the operation of the system. One of these would be a GPS on the barge to show its position. The reason for this could be when the operator needs to know where he is putting the spuds down to help avoid possible obstructions on the bottom such as a submerged pipeline or an electrical cable.

Calibration of the system is quite simple after the initial installation. Whenever the operator feels that the bucket depth might be incorrect, all that must be accomplished is to place the bucket on the water and press a button. This will be sufficient to reset the depth 0 at that boom angle. Using the installed angle indicator the system will be calibrated at all angles.

HARDWARE DESCRIPTION

The system is comprised of only a few parts. The most important is the drum counter. There are two options for sensors with the drum. The magnetic option requires that the drum have something on it that the sensors can actually read. To make a reading the sensor must notice that it is close to and then further away in a rhythmic fashion at even intervals. It does not work if the points that are used are not evenly spaced because the sensor will count erratically.

***The installation of all equipment is the sole responsibility of the client or the reseller if arrangements have been made for this. HYPACK personnel may recommend where devices should be installed for the best installation but it is up to the installer to make sure that the sensors / cabinet is completed in a safe and effective manner.**

* POWER – The cabinet is powered with 24 VDC which is available on almost every crane. The other power requirements are for the computer and the monitor. These power requirements are best determined at the time of installation and are the responsibility of the client. If a stable source of power is not used, the system will suffer and could be physically damaged.

DEVICE LISTING

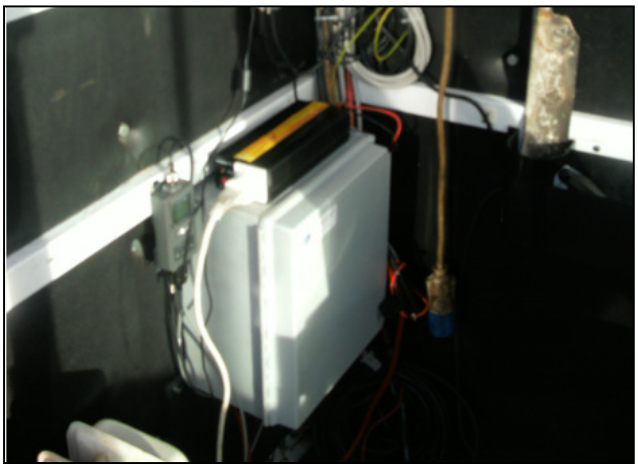
1. INTERFACE CABINET
2. Boom Angle Sensor
3. DRUM SENSORS
4. Operator Button Panel (Bucket / Reset Switch)
5. GPS Unit with Heading

OPTIONAL

6. Wireless Interface
7. Remote Display system

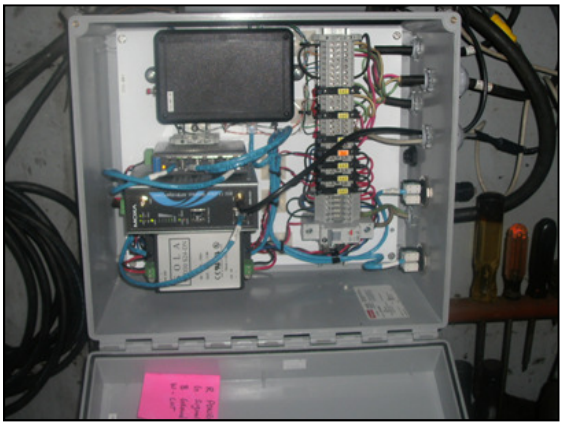
INTERFACE CABINET

Installation of the cabinet should be in a location that will not affect traffic and does not vibrate excessively. An engine room wall that is stable is acceptable whereas an engine room wall that shakes a lot is not advisable. A better installation would be in the back of the operator cabin if it is possible, and all of the cables will reach.



When mounting the cabinet many possible positions are possible. In the first image the cabinet is mounted with the hinge to the left, the other cabinet was mounted with the hinge to the bottom. The equipment inside will not be affected in either case.

On the inside of the door there is a printed label that describes the wiring location for each of the components. Each if the components that are interfaced to the system



Starting on the left at number one the connections are labeled on the sheet. Each of the +24 VDC connectors is a fused circuit breaker.

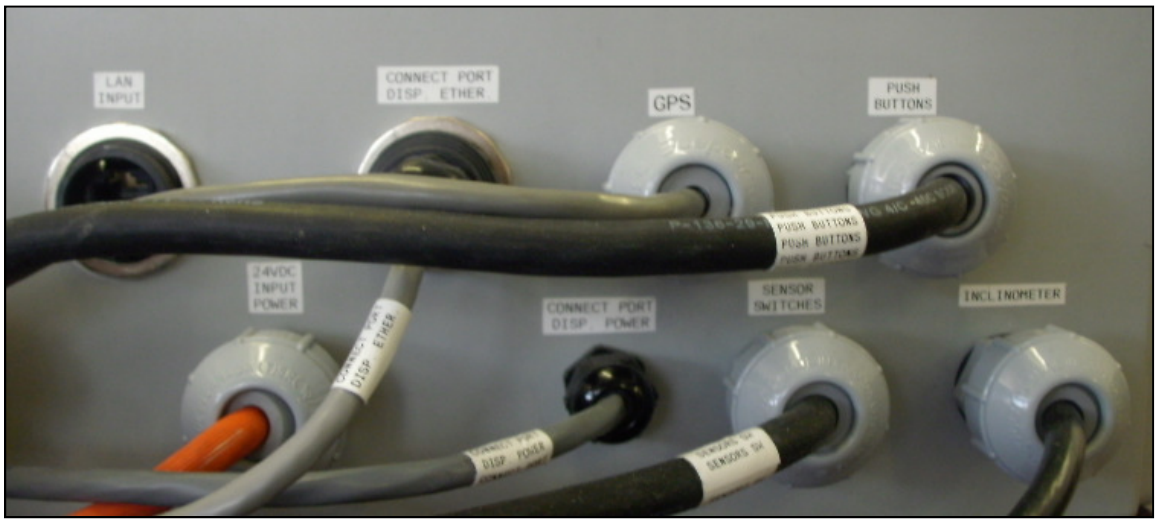
When the system is energized the Ethernet lights should blink rhythmically on the hub. This will indicate that the circuit card is sending the information out via the Ethernet cable.

The address of the control card is default set to 192.168.3.101. If you suspect there might be a connection problem, try to use the DOS command to ping the box from the DREDGEPACK computer. To do this you go to the START menu and select RUN in WINDOWS XP and when the menu comes up enter CMD and press enter or type CMD in the search bar for WINDOWS VISTA and press enter.

A DOS window will appear. Type the following command in and press enter.

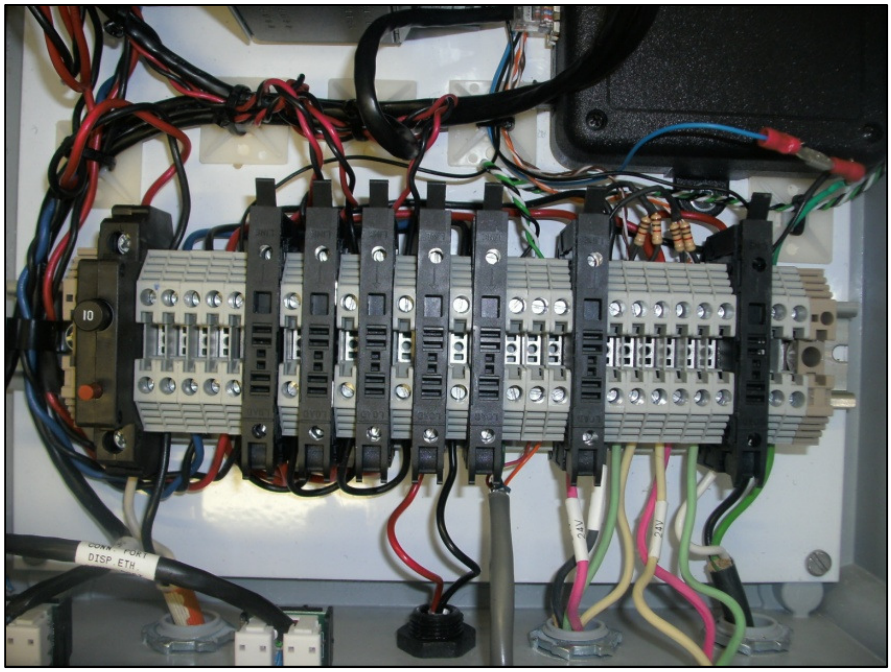
PING 192.168.3.101 < enter >

It will then show a series of attempts to reach the box. If it fails check you network settings and check to see if the lights are blinking in the cabinet on the Ethernet hub.



Above is a picture of the bottom/ side of the cabinet. It has many connection holes but they are all labeled. Each of the connectors has a rubber grommet that is placed around the wire to help keep the wires from pulling out of the cabinet and to help keep moisture out. A bag usually ships with the cabinet containing these grommets.

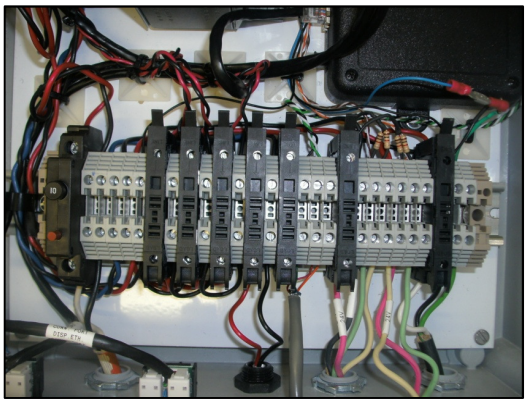
The terminal for the sensors is aligned with the edge of the cabinet so that the wires can easily be passed through the openings and connected using a straight screw driver. It must be a very small screw driver.

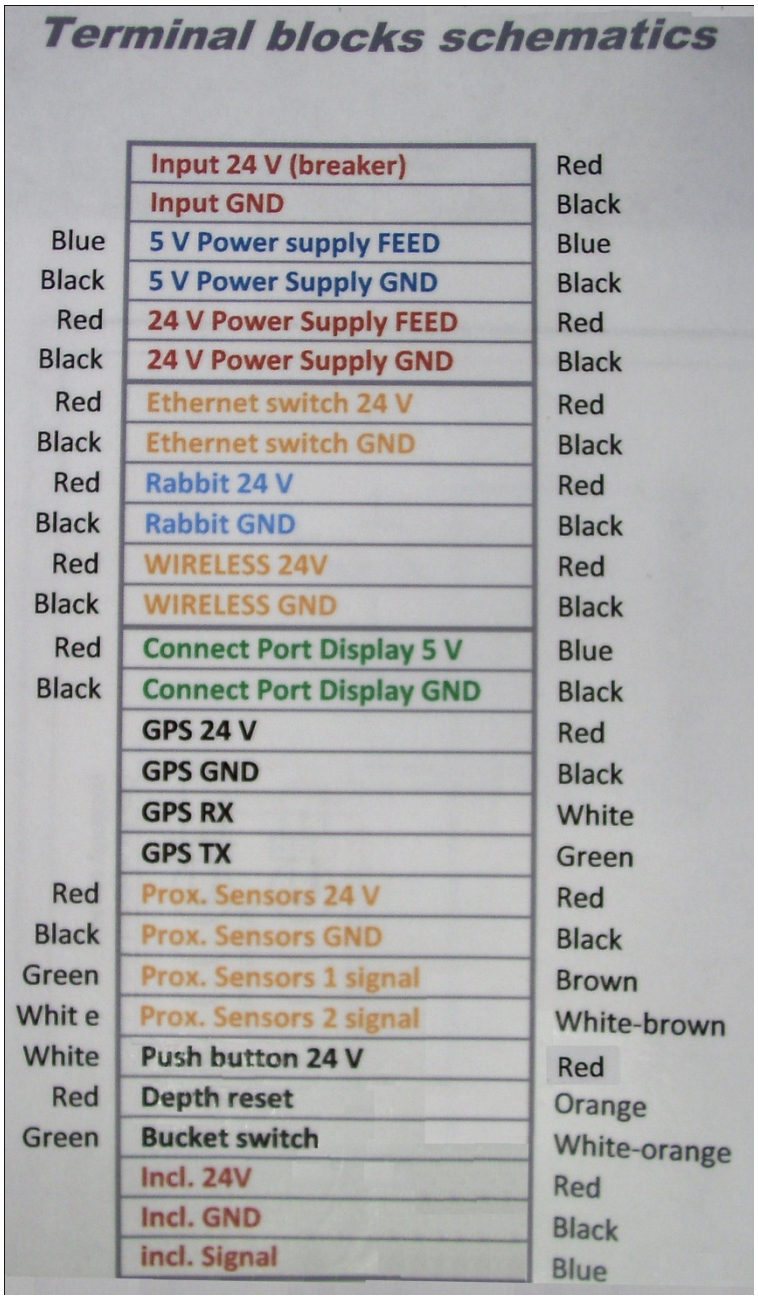


WIRING GUIDE

When connecting the power, open the Circuit by disabling the circuit breaker. This wiring guide is provided in the cabinet as well. Please refer to the one in the cabinet to make sure that they are the same prior to wiring in any devices. If they are not the same, the wiring guide that is in the cabinet supersedes the one that is provided here.

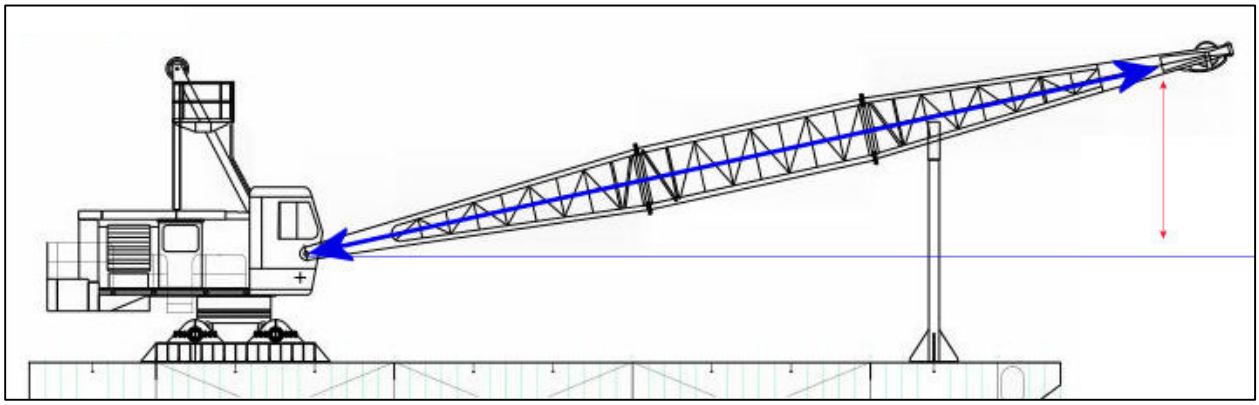
From the previous page the picture of the actual terminal blog reads left in that image is top in this one.





Angle Sensor

The angle sensor is used to compute the angle of the boom in relation to the horizontal plane. A perfectly horizontal boom should register a 0 degree angle. A perfectly vertical one should register 90 degrees.



The picture above shows the boom in relation to the horizontal line. Please note that

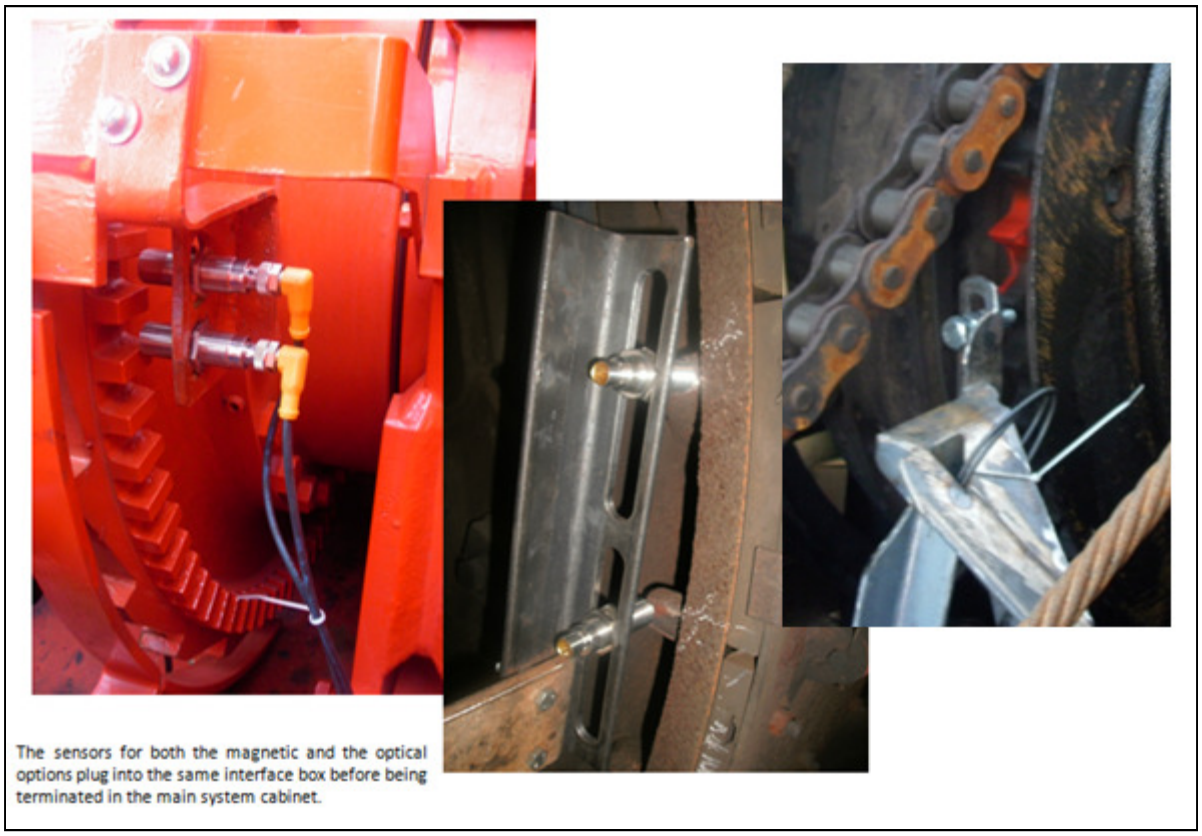
in this particular boom there is a tapered area near the cabin and the sheave at the top of the boom. This means that placing a digital level on the boom at this point will result in an incorrect boom angle.

The picture on the left shows a sensor that had been installed. The picture on the right shows a mounting plate that was built by the customer on a job to install the sensor. The box does not have a mounting plate that comes with it. One must be created on site. The box does have four screw holes that are under the cover but do not compromise the water resistant seal. It is not a sensor that should be submerged but rain will have no affect on it.

When the sensor is being installed check to see if it is a H4A1 or H4A2. The A1 model is 24 VDC but the A2 model is 5VDC.

DRUM COUNTER – MAGNETIC

The magnetic sensors only have the ability to detect metal within a very short distance. This is both good and bad. The sensors will be able to detect each of the points that are to be counted, but if they are installed too close or the drum shifts at all they can be destroyed very quickly. The sensors come with two locking screws. Typically they should be installed so that there is a lot of room between the sensor and the part of the drum you are counting.



The sensors for both the magnetic and the optical options plug into the same interface box before being terminated in the main system cabinet.

The initial distance should be greater than ¼" or 6 mm. This is probably farther than the sensor can work but it provides a margin of error for the initial test of spinning the drum slowly to check for clearance. In the pictures above, the drum on the left shows just how close the sensor is installed.

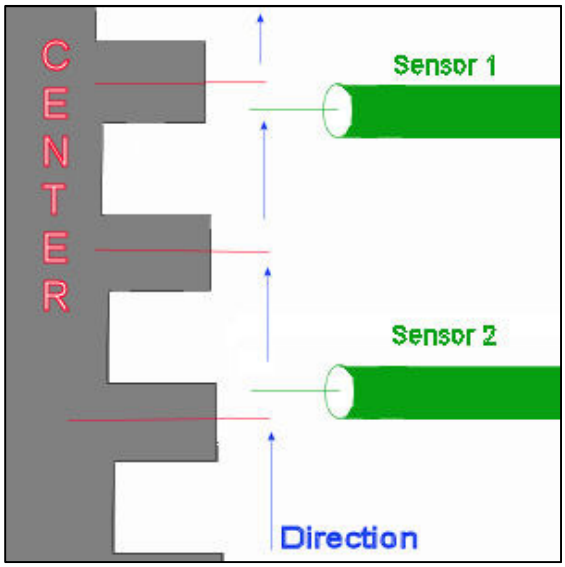
It is recommended that the drum objects to be used should be counted so that when the drum test is complete you will have an idea if the sensors counted every tooth. It is easy to be lulled into thinking that the system is working because it counts but it is not that simple.

The system uses a quadrature counter to read the four possible states to determine the position of the drum.

The sensors can be

S1 off S2 off State #1
S1on S2 off State #2
S1 on S2 on State #3
S1 off S2 on State #4

If the sensors are lined up exactly in the center of the distance between the two objects to be counted then the four states will not exist and the count will be invalid.



This image shows the way that the sensors should be aligned with the teeth on the drum to ensure that the four distinct states are encountered as the drum turns.

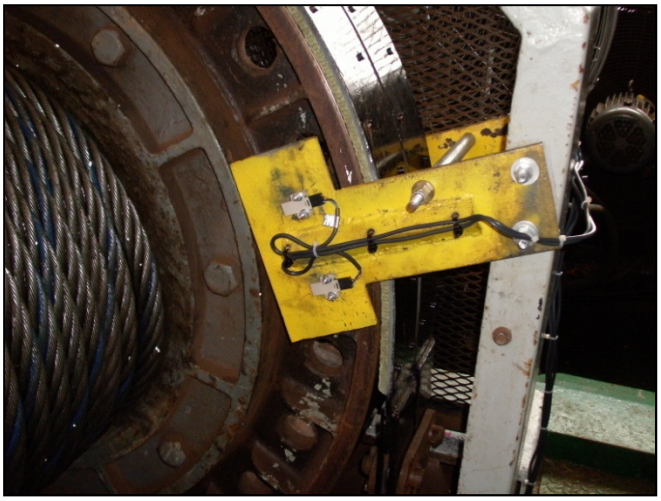
On the back of each sensor is a light. It will light up as the sensor detects the metal of the tooth. Once the system is completely installed the bucket should be lifted or lowered slowly so that the lights can be observed as the teeth pass them.

When installing the sensors, measure the distance between the teeth and add about 1cm / 0.4 inches. This will be the distance that the sensors should be from center to center to make them work. You may have to adjust them slightly to get a valid count but this is a good start.

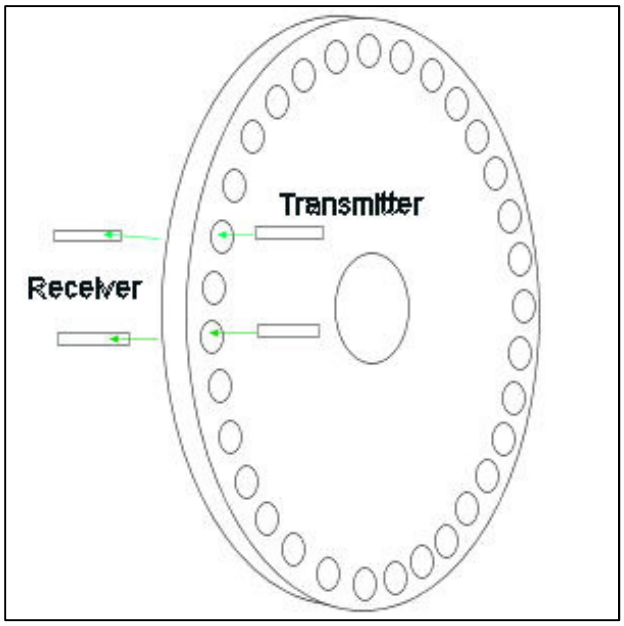
It is advisable to mark the starting tooth so that as the drum completes a turn it is visible that the system has been completed. The system uses a Quadrature Encoder so that the number of teeth multiplied by four is the number of counts that you should receive when the drum has made a complete revolution.

DRUM COUNTER – OPTICAL

The optical sensors are different in that the sensors distance to the drum does not matter as long as the two parts can see each other through a hole in the drum. There are four pieces that comprise two sensors. Each of the two sensors should be offset from the center of the opening as the magnetic sensors are from the teeth to ensure the four states of the counter.



The system is designed so that the interface box for the optical sensors and the magnetic sensors is the same. By opening the box and removing the magnetic cables, the optical cables can be screwed in to the same terminal points. The control card in the main cabinet does not know which sensors are installed. It merely counts the change in state of the two sensors.

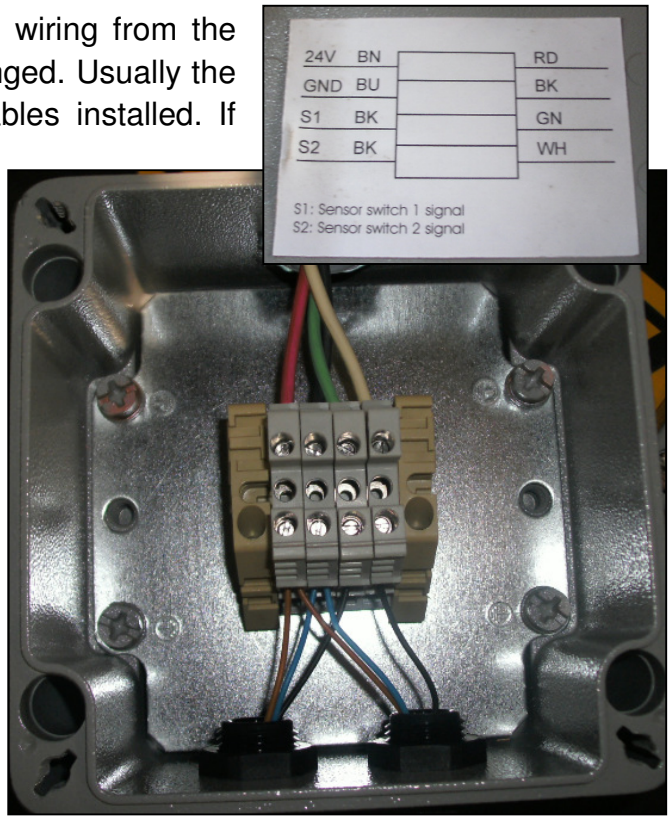


It must be remembered that these are optical sensors and can stop working if the light path becomes obstructed. If the sensors begin to fail it may be required to clear the obstruction from one or more of the sensors.

The system uses the same Quadrature Encoder as the magnetic sensors. This means that if you count the number of openings and multiply by four you will know how many counts you will have when the drum makes one revolution.

SENSOR INTERFACE BOX

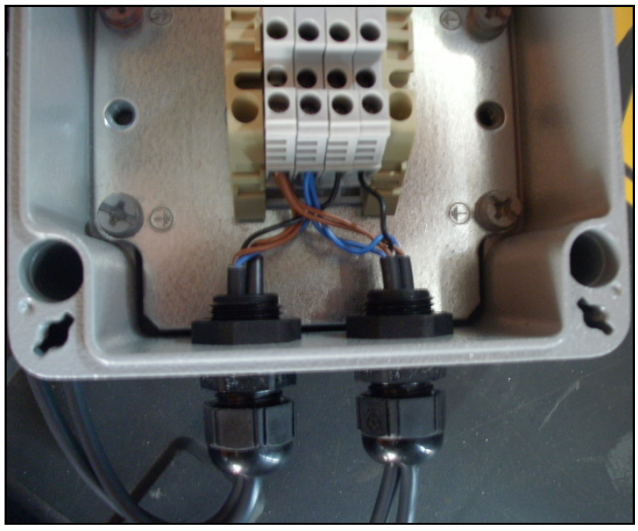
Once the type of sensor is determined the wiring from the Sensor Interface Box might need to be changed. Usually the system ships with the magnetic sensor cables installed. If you are going to swap sensors to the optical ones, the wires to the main interface cabinet from the Sensor Interface Box are the same, it is the wires from the interface box to the sensors that changes.



The image to the right is of the Sensor Interface Box as it is wired with the magnetic sensor.

The brown wire is the positive voltage, the blue wire is the ground. This is important because the optical sensors have two parts and four wires.

The second picture of the Sensor Interface Box is of the box after the magnetic sensor has been removed and the optical sensors have been installed. Notice that there are two wires in each of the box penetrations. There are four brown wires and four blue wires. These wires are ganged together in the connection so that all four brown wires are connected to the red wire terminal, and all four blue wires are connected to the black wire terminal.



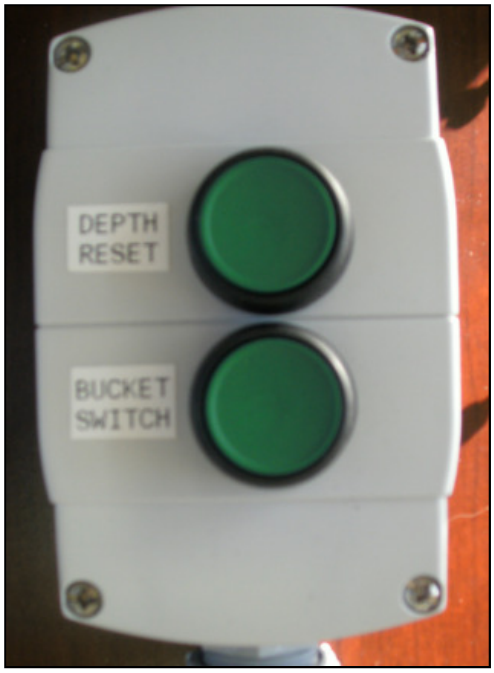
Each optical sensor pair only has one black wire. It does not matter which pair is connected to the green or white terminal. As long as each pair of sensors has a connection with the black wire. This connection is attached to the receiver side of the optical sensor. The receiver can be easily identified by the red light on the end of the sensor. This light will illuminate when the sensors are aligned and energized.

OPERATOR BUTTON PANEL

The Operator Button Panel is used to both reset the depth and mark buckets in the software.

To mark a bucket in the software you must first configure the Bucket Marks in DREDGEPACK. This will be explained later.

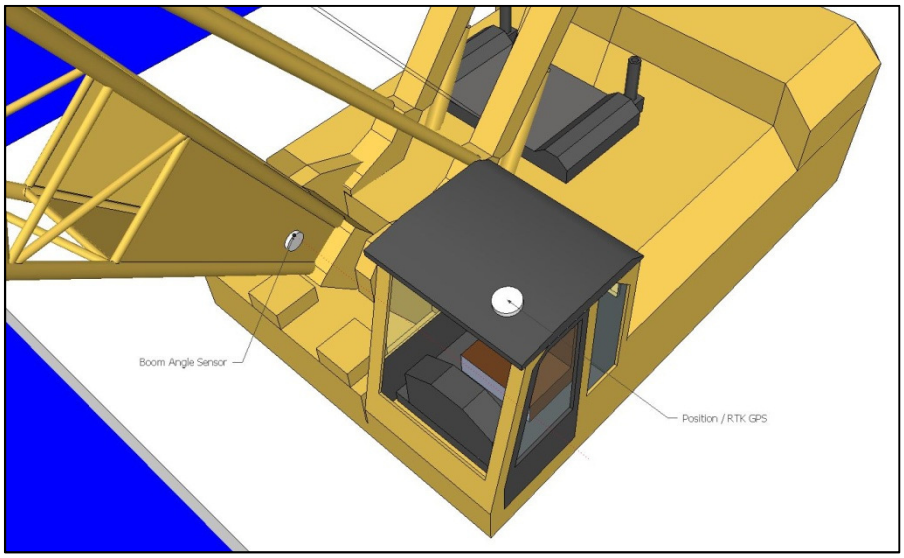
The Depth Reset button is much more important. Every time the bucket needs to be reset to zero because the operator determines that the depth does not match, all that is required is to place the bucket at the waterline and press this button. It has no affect on the installation calibration. All the depth reset button is actually doing is to make the Drum Counter value 0.



GPS

Proper installation of the GPS equipment is critical to getting the bucket in the correct location. In a standard installation only one GPS is required. A GPS that has heading is preferred as the position of the bucket is derived from the angle of the boom and the position of the trunion point.

The GPS should be normally mounted on the cabin of the crane. The location on the roof is dependant upon the amount of other structure that exists. The GPS must have a clear view of the entire sky.



In the case that you are using RTK GPS for positioning the vertical offset of the GPS is to the water line. This is because the HYPACK CRANE SYSTEM is calibrated to the water line. A vertical offset is NOT required for the HYPACK CRANE SYSTEM because of the fact that it is calibrated to the waterline.

Without heading the use of bucket marks is not advised because the heading will rotate randomly based upon GPS location.

CALIBRATION – Initial Installation

ANGLE SENSOR

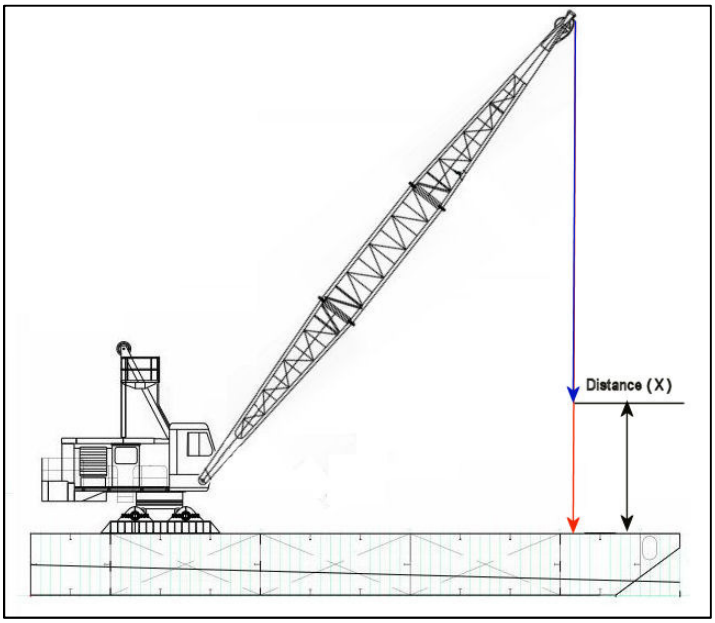
The most accurate method for calibrating the sensor is to invest in a Digital Level. They are available in the US at most home improvement centers, a small one will cost less than $50.00 USD. It is handy because you place the level on a point that is parallel to the axis of the crane pins and read the number. This is entered in the web interface of the control cabinet.

The simplest way to calibrate the angle sensor is to use the mechanical inclinometer that is outside the crane cabin on most cranes for the operator to know what angle his boom is on. It is not as accurate and the first method is preferred but it can be used in a pinch to get the system working. Set the boom at a known angle that is easily distinguished on the indicator and then enter this in the web interface of the control cabinet.

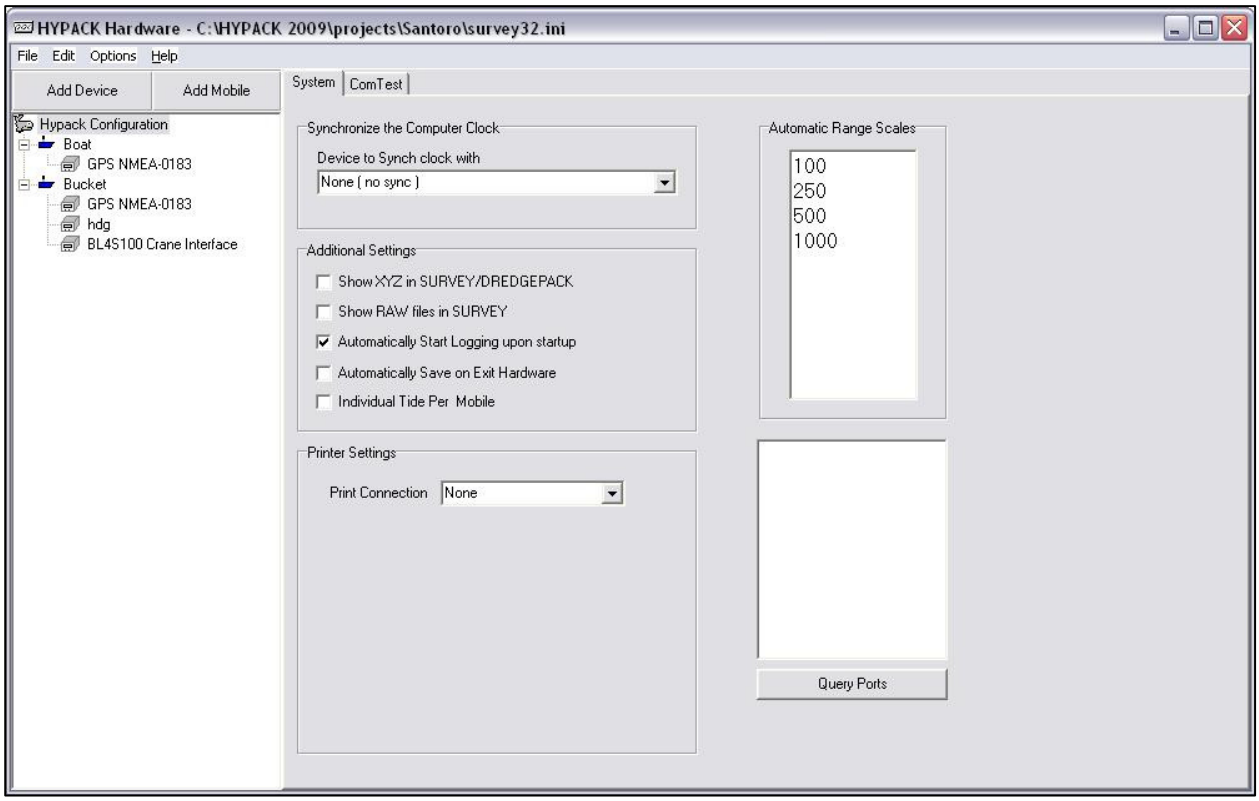
ROTATION COUNTER

Regardless if the rotation is counted with a optical or magnetic sensor, the calibration is the same. This procedure is only required once during initial installation, if performed properly and the sensors are counting all of the teeth, the system should never require this unless the sensors are moved.

1. Place the bucket on the deck.
2. In the web interface click the START button.
3. Raise the bucket a known distance.
4. Observe the counts as the bucket is raised to be sure that they are changing.
5. Enter this distance (x) in the web interface and click Enter.
6. The system is not calibrated. Place the bucket on the water and press the Reset Depth Button.



SOFTWARE – HYPACK HARDWARE



The HARDWARE program is meant to interface the sensors to the DREDGEPACK program. In the above example the configuration is #3 from the GPS section. There is an RTK GPS on the boom tip and a GPS with heading on the cabin of the crane.

On this screen you can set the Automatic Range Scales that are available to the user during the operation of DREDGEPACK for setting map scale.

MOBILES

In HYPACK a mobile is any object that has a position that can be tracked. This is important because on a crane everything is on one physical vehicle but can be comprised of several mobiles in HYPACK. Above we have two mobiles, the crane and the bucket. The first mobile in HYPACK is always referred to as the BOAT. This is for internal reasons. All of the extra mobiles, not the first one, can be named anything.

Every mobile must have a position device as a minimum. If no heading source is defined then the system will use the mobiles course over ground as heading.

DEVICE INTERFACES

The following list of devices are not all of the drivers that you will need, but this is a list of commonly used drivers and their purpose within DREDGEPACK.

BL4S100.dll

GPS.dll

GENOFFSET.dll

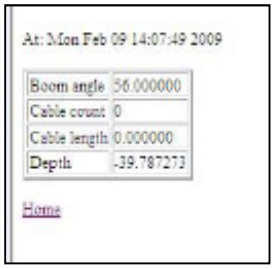
PosData.dll

RelHdg.dll

WEB INTERFACE

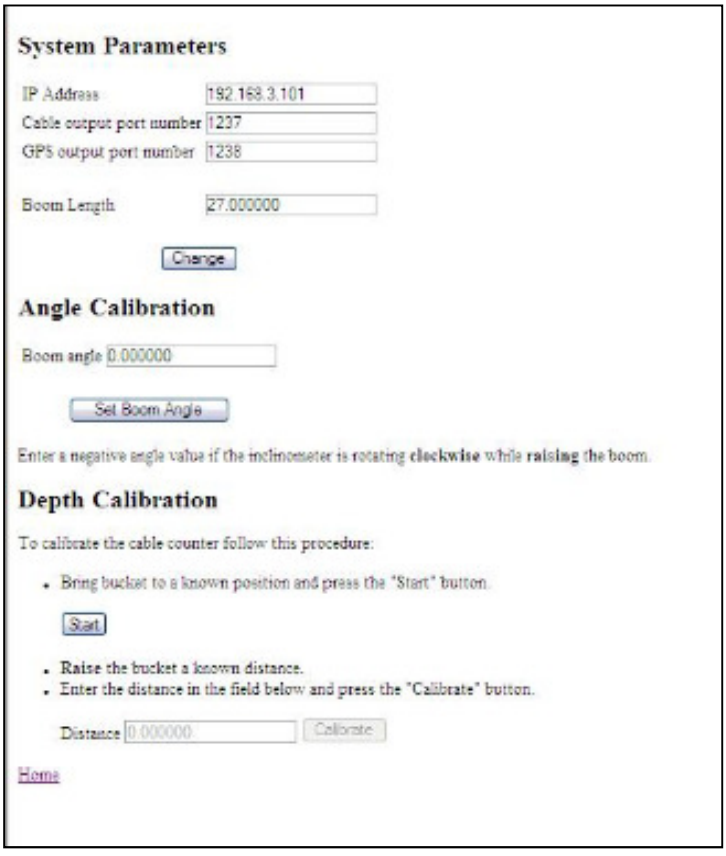
The Web Interface is how the user accesses the Control Cabinet. In a standard installation the Control Cabinets web address is 192.168.3.101. This can be changed in the Web Interface but first you need to access it.

There are only two parts to the Web Interface, the Status Page and the Control Page.



The Status Page is merely a display of the values in measured by the Control Module. The items on the display are the Boom Angle, Cable Count, Cable Length and Calculated Depth. The interface updates at a rate of once every few seconds.

The System Parameters Page is used to calibrate and configure the system. The options are displayed here to the right. The IP Address and outgoing port number can be set as well as the pass through port if you choose to send the GPS through the Ethernet cable as well.



The Calibration Angle and the Depth Calibration are more for the Installer than the actual user. Once the System Parameters are set they should not have to be changed unless something drastic happens. The replacement of a sensor should not affect the operation of the system because you are still counting the same number of teeth in the same distance.