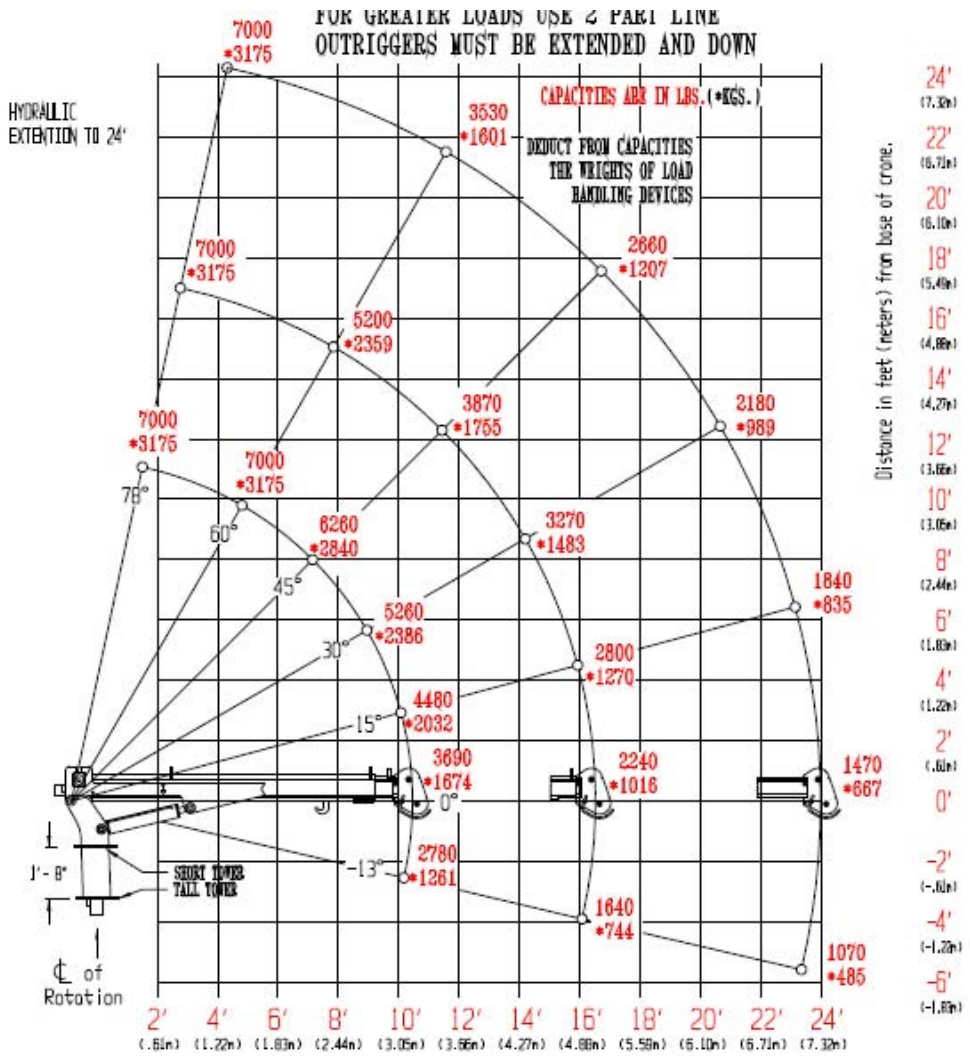
RADIO CONTROL SYSTEMS

LMI Load Moment Indication

LMI- Load Moment Indication
When lifting a load the loading of the boom depends on the weight of the load, the angle of the boom, and the distance the boom is from the truck.

Warning Light- We inform the operator of the current lifting status
Green Light – 0- 90% Load of the Crane
Yellow Light - 90-100% Load of the Crane
Red Light - 100%+ Load of the Crane

The LMI system allows the crane to pick up extra capacity in various positions, without increasing the overall foot-lb rating of the crane.



Transmitter

FM Transmitter

• 100% Proportional push button control. Allows for multiple speed control on each function independently. Non Contacting Push Buttons – Neoprene Seal
• Multiple Speed control settings for the Crane to allow for four speed rates From full speed to creep. Settings are 100%, 75%, 50%, and 25% for fine control
• Multiple functions can be enabled simultaneously without reduction in flow to other functions
• Fully sealed transmitter -Light weight- 70% weight reduction
• Belt clip attachment, for reduced job site loss
• Environmental Sealing IP66 rated Heavy Duty Water Spray Certified
• CE certified (for Europe)
•ON/OFF Button Removable to disable Radio
•300 Foot Range of Radio Control

Receiver

Receiver

- LCD Display - Complete Diagnostics for the crane that a field operator can easily read
- Alarm System - Names the functions - No obscure error codes
- Environmental Sealing - IP66 rated
- CE Certified for full Crane Operation and Machine Safety per EC rules
- Transmitter Signal Strength indicator (similar to cell phone bar graph)
- Transmitter Battery Life Display
    - Warning on Low Battery - 100 hours of functioning battery life (40% longer than previous remote)
- Verification of output to hydraulic valve as you actuate the FM transmitter
- Crane Hours are monitored with hours displayed on front screen
- USB port for programming, monitoring and diagnostics
- Full smooth "RAMP UP" and "RAMP DOWN" of each crane function independenly

Wireless Transmitter

OFF-ON-START/SPEED- Enables the transmitter to communicate with the Receiver and sets the Machine speeds

Off- Transmitter is Suspended From Operation and Shuts Down
NOTE: MUST BE TURNED TO THE OFF POSISITION TO PREVENT BATTERY DRAIN

On- Transmitter is told to activate and begin Communication- Status light will blink showing activation

Start/Speed- Momentary Setting- After Turning "ON" the transmitter "Start" tells the transmitter to talk to the Crane Receiver (think of it like a car's ignition key switch, start and run)

OFF-ON-START/SPEED

E-STOP

LED – Speed Indicator- Status

Main Boom- Up Down Speed Setting Buttons

Rotate- CW/CCW

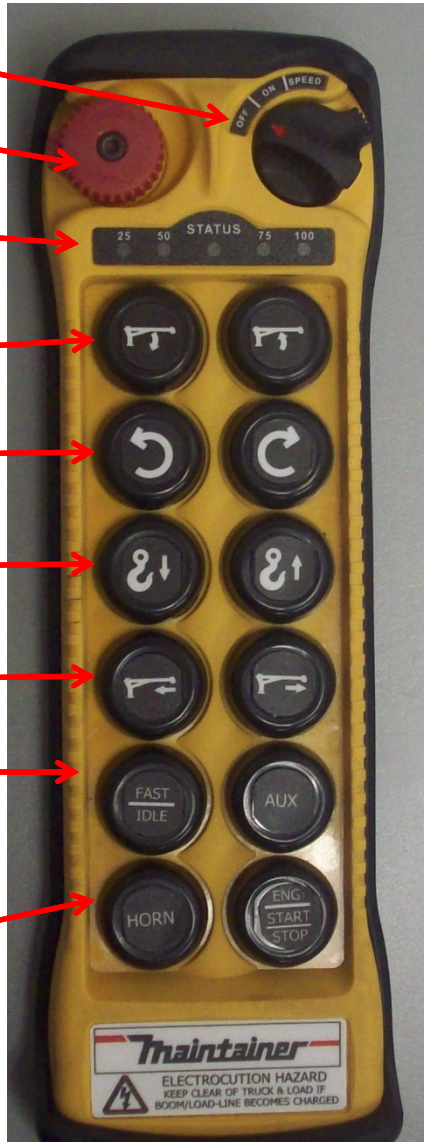
Hoist – Up/Down

Telescope- Extend/Retract

Engine Fast Idle- Auxiliary – A/C

Horn

Engine Start- Engine Stop



Setting Crane Speed

Start /Speed- By Holding the Start/Speed Switch and the Pressing Boom Up/Down Buttons the Speed of the Crane can be changed.

Action
Hold Down Start/Speed Switch, simultaneously press Up or Down on the MAIN BOOM Switches to change Speed output to the valves

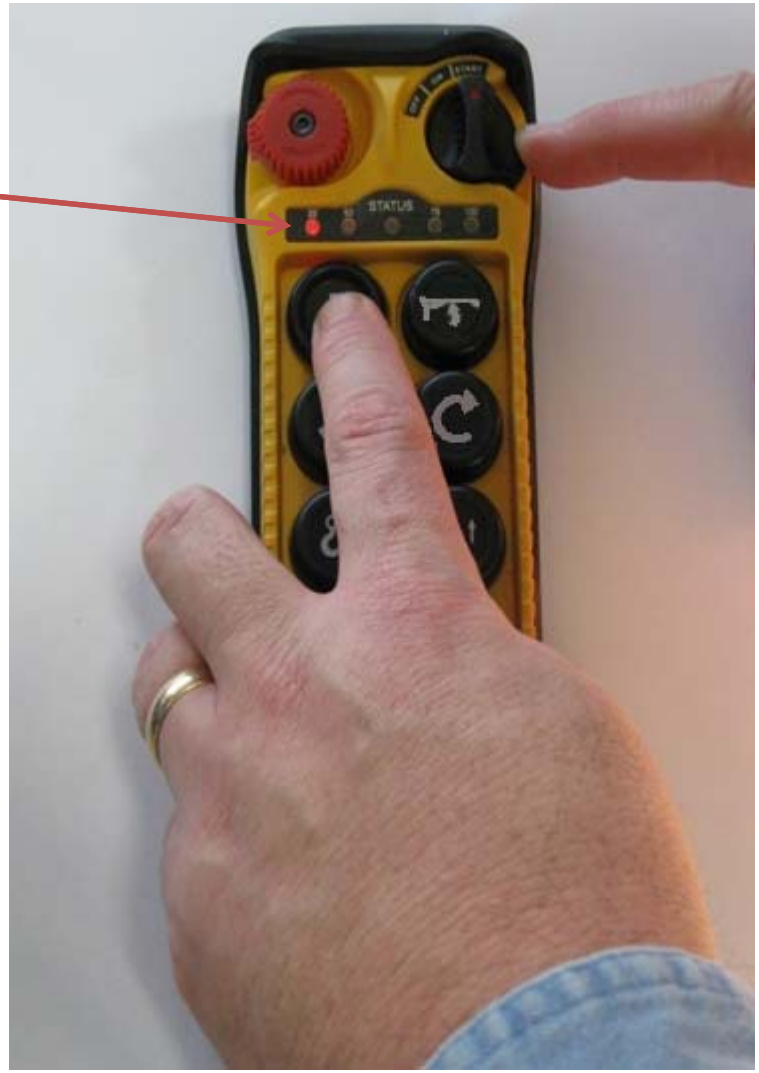
What does this mean-
Ability to change the maximum speed of the crane from 100% to 25% (creep) directly from the Transmitter

This allow the Operator to "CREEP" the load and allow for precise location of the load without fear of damage.

Status Indicator- Light flashes when button is pressed

Speed- 25%,50%,75%,100%
LED shows current speed selected
Center Status Light
turns Red when:

- You press a button while enabling the transmitter.
- When E Stop is pressed.
- Error in Transmitter.



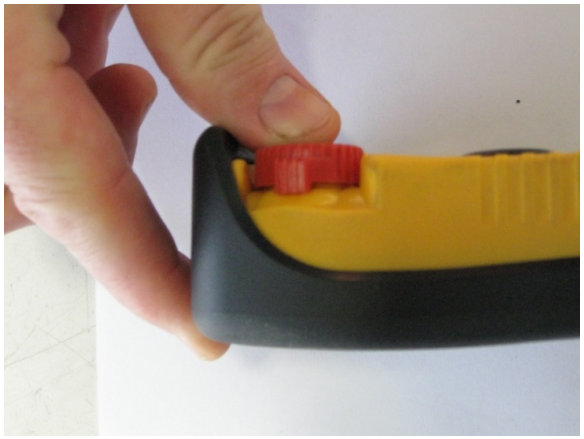
E-Stop

E Stop- Normal Operation Mode- E Stop is in the “UP” position

Release E Stop-
Use Your Thumb and Press “UP” on the E Stop - This will Snap back to the Normal Position.

NOTE: VERY IMPORTANT
To begin transmitting again the Start Indicator on the Right must be reactivated.

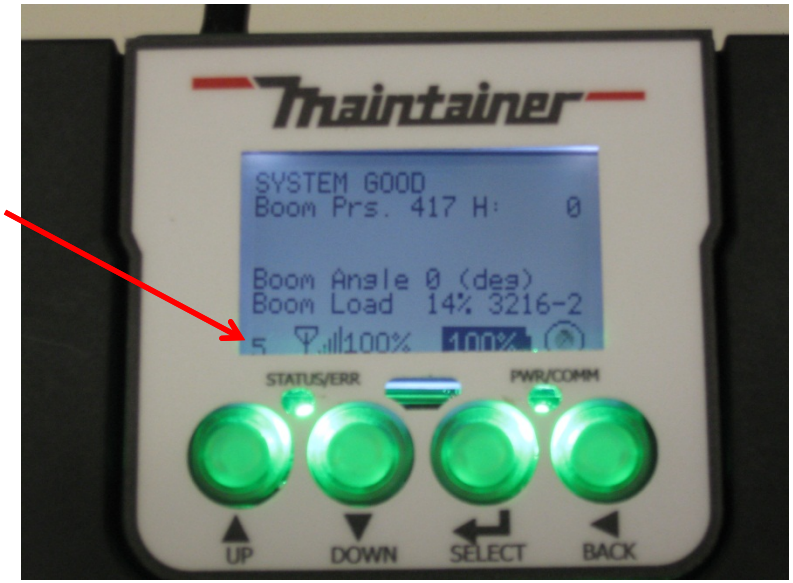
E Stop activated when pressed “DOWN” – Locks in this condition- All Outputs to the transmitter are stopped and the receiver will show E-Stop Activated. Additionally, the signal rate will go to zero (0)



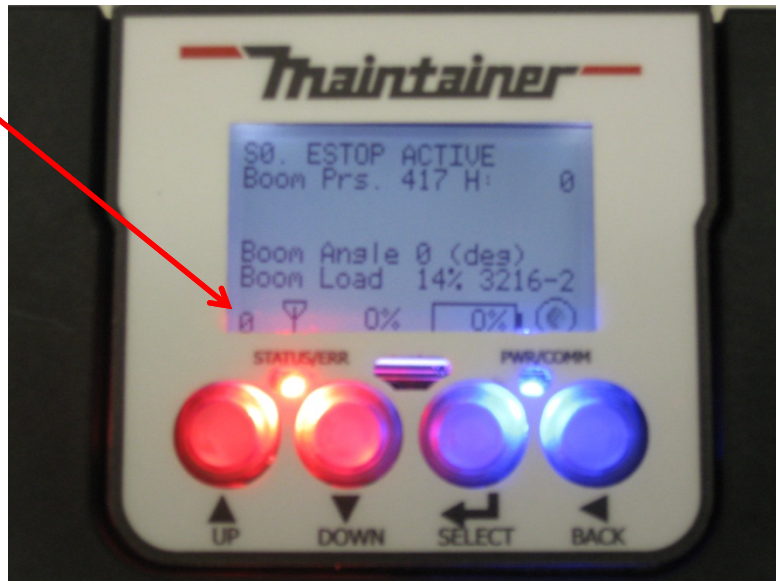
Sleep Mode

Sleep Mode- To save battery life the transmitter

When a System is “AWAKE” the transmitter will be sending messages- This number should read 5 or 6.



Transmitter goes to “Sleep Mode” after five (5) minutes of not operating.
When a system is in “Sleep Mode” the transmitter signals will read zero (0). Same as E-Stop



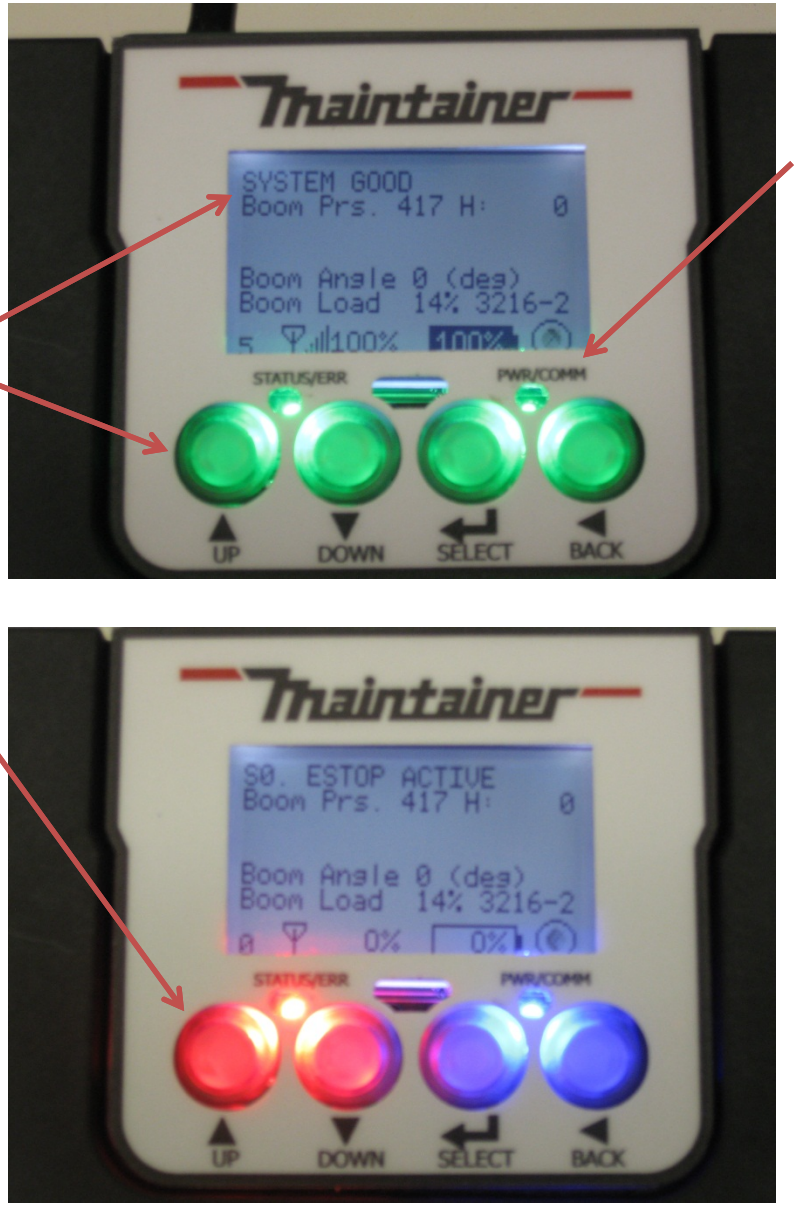
To bring the system out of “Sleep Mode”, press the Start/Speed button for 2 seconds.

Four Light Indicators

<u>UP/DOWN Lights</u>- These lights indicate all is good with a pair of Green Lights. When a Alarm as defined by Maintainer occurs then the Lights turn red.

SYSTEM GOOD- Indicates crane is ready and boom load pressure is below 600 PSI.

When an alarm is activated (such as E-Stop) then the UP/DOWN Light flags an issue and turns red.



The Status Error Light also show issues. The PWR/COM are used for data transfer and output.

All four buttons are used for accessing and changing the adjustable parameters of the program.

Machine Control
Proportional Buttons

Proportional Controls-
The transmitter controls the speed of each crane function the farther the button is depressed.

Ramping- All functions have a Ramp-On and Ramp-Off feature. Even when a button is quickly depressed, the function is “ramped”, which reduces the shock loading and bouncing of the boom.

Reducing shock loading means longer life, and less downtime.

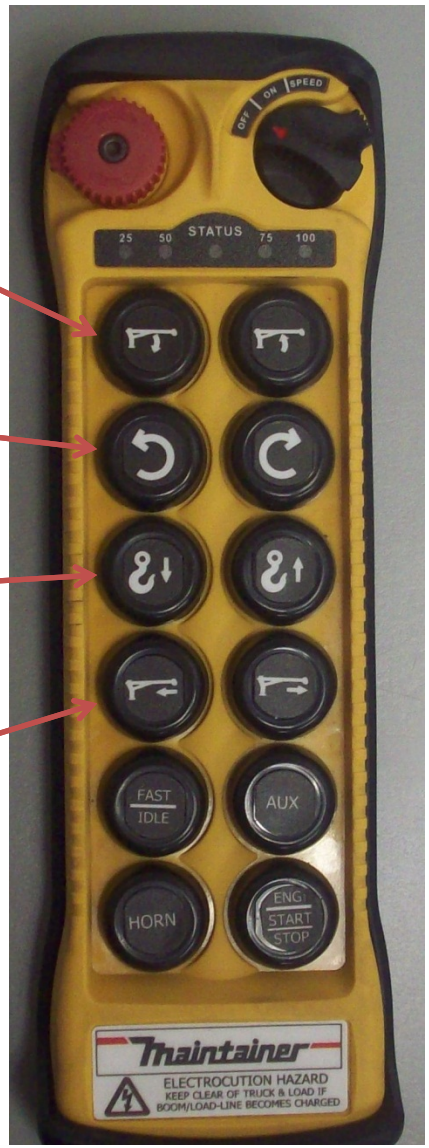
Variable speed to each function means the operator gets infinite control while reducing “bouncing” of the load.

Main Boom- Up Down Speed Setting Buttons

Rotate- CW/CCW

Hoist – Up/Down

Telescope- Extend/Retract



Transmitter Additional Functions

Fast Idle- Ramps engine from low-idle to high-idle. Pressing button toggles On/OFF

Auxiliary- Welder/ Air Compressor- Pressing button toggles On/OFF

Engine Start/Stop- Momentary- By pressing holding and holding, the receiver sends a command to the engine to stop
Pressing the button a second time gives a separate output for engine start.

Horn– Momentary- By pressing and holding, the Receiver sends a command to the horn for safety clear. (Required by OSHA)

Receiver Controller and Display

Receiver – Processing unit
The receiver takes the inputs from the transmitter and inputs from the crane sensors and sends outputs to the crane valve.

The LCD display allows the operator a clear and exact understanding of what is occurring on the crane.

The receiver explains what inputs and outputs are occurring and displays for the operator if there is a problem. The screen allows for clear understanding of machine functions for assisting and helping the operator.

Receiver Controller and Display

Machine/Alarm Status

Boom Pressure (psi)

Function Activated
Signal Percent %

Boom Angle
(Degrees)

Boom Load
(% of Total Load)

Active Signals From
Transmitter
0= Not Active
5-6 Active but Waiting
9-10 Means Button
being pressed

Transmitter Signal Range %
Signal strength from
transmitter to receiver

Battery Life In Transmitter
Explains How Much Expected
Life in AA Batteries
2 Batteries Per transmitter
% Percent left

Crane Hours- H….12

- = 12 hours

Watch Dog Timer-
Continuous rotation shows that
the processor in the receiver is
functioning properly

Receiver Additional Functions

Additional On/Off Functions displayed on Receiver

1. Fast Idle-
2. Auxiliary- For Compressor or other onboard equipment
3. Engine Start/Stop
4. Horn

Fast Idle

Auxiliary

Engine Start/Stop

Horn

Crane Alarms and States-Basic

Basic-
Standard Boom Pressure Transducer is installed but no boom angle sensor, or alarm status light

Alarms and Monitoring
The control system knows when things are in the correct state and functions are controlled in a particular way when we reach the state.

1. **Bridging- When boom Pressure is below 30 psi**
2. **OPEN**
3. **OPEN**
4. **OPEN**
5. **OPEN**
6. **Anti 2 Block Engaged**
7. **Load Moment Alarm 90%**
8. **Load Moment Alarm 100%**
9. **Slow Rotate Alarm- When Boom Pressure is above 600 PSI**
10. **OPEN**
11. **OPEN**
12. **Boom Pressure Transducer Error**

Crane Alarms and States-LMI

LMI-
Includes boom angle sensor and alarm status light

Alarms and Monitoring
The control system knows when things are in the correct state and functions are controlled in a particular way when we reach the state.

The LMI has better control as it has more available inputs

1. **Bridging- When boom Pressure is below 30 psi**
2. **OPEN**
3. **OPEN**
4. **Truck Angle Limit Warning 7% Slope (4.5 Degrees)**
5. **Truck Angle Limit Alarm 11.3 % Slope (6.5 Degrees)**
6. **Anti 2 Block Engaged**
7. **Load Moment Alarm 90%**
8. **Load Moment Alarm 100%**
9. **Slow Rotate Alarm- When Boom Pressure is above 600 PSI**
10. **Boom Angle Sensor Error- Cable issue or fault**
11. **Boom Angle Sensor out of Range**
12. **Boom Pressure Transducer Error**

Alarm: A1- Bridging

Bridging- A1 BOOM PSI LOW
When the boom Pressure Drops Below 30 PSI the A1 Alarm Occurs.

<u>Functions Allowed:</u>
Hoist/Winch Down
Boom Up
Boom Extend/Retract

<u>Functions Disabled:</u>
Hoist/Winch Up
Boom Down
Rotate- CW/CCW

Alarm A4 and A5 Truck Angle

<u>Truck Tilt Alarm</u>- with LMI

A4 - TRUCK TILT WARNING

- The alarm occurs when the truck is greater than 4.5 degrees out of level.
- Alarm status light flashes yellow
- All crane functions reduced to 50% maximum load

A5 - TRUCK TILT ALARM

- The alarm occurs when the truck is greater than 6.5 degrees out of level.
- Alarm status light flashes red
- All crane functions reduced to 50% maximum load
- Functions Allowed: Hoist/Winch down, Telescope In/ Retract

Alarm A6- Anti 2 Block

A6 Anti 2 Block

When the load block has been retracted too far, a limit switch is activated to prevent damage to the crane or load block.

Functions Allowed:

- Hoist/Winch Down
- Boom Up/Down
- Boom Retract
- Rotate- CW/CCW

Functions Disabled:

- Hoist/Winch: Up
- Extend Out

Note: The Limit Switch is wired normally closed, so a broken or disconnected limit switch will activate the alarm as well.

A7- 90% Load Alarm

A7 90% Load Warning

When the load value exceeds 90% of the allowed load moment for the crane the A7 Alarm activates.

The alarm status light goes from GREEN to YELLOW.

Function limits:

- Hoist/Winch Up- 100% Speed
- Hoist/Winch Down- 100%Speed
- Boom Up – 50% Speed
- Boom Down- 50% Speed
- Boom Ext- 75 % Speed
- Boom Retract- 75% Speed
- Rotate CW/CCW- 50% Speed

A8- 100% Load Alarm

A8 100% Load Alarm
When the load value exceeds 100% of the allowed load moment for the Crane the A8 Alarm activates.
The alarm status light goes from YELLOW to RED.

Functions Allowed:
Hoist/Winch Down- 50%Speed
Boom Retract- 50% Speed
Rotate CW/CCW- 25% Speed

Unloader Valve Opens

Functions Disabled:
Hoist/Winch - Up
Boom - Down
Boom - Up
Boom - Extend

A8- 100% Load Alarm- Reset

A8 100% Load Alarm
Once the Alarm is triggered and the Red light activated, the load must be reduced below the 100% point.

RESET- to reset out of 100% overload the boom pressure must be reduced by moving the load to eliminate boom pressure.

Functions Allowed:
Hoist/Winch Down- 50%Speed
Boom Retract- 50% Speed
Rotate CW/CCW- 25% Speed

Functions Disabled:
Boom - Down
Boom - Up
Hoist/Winch - Up
Boom - Extend

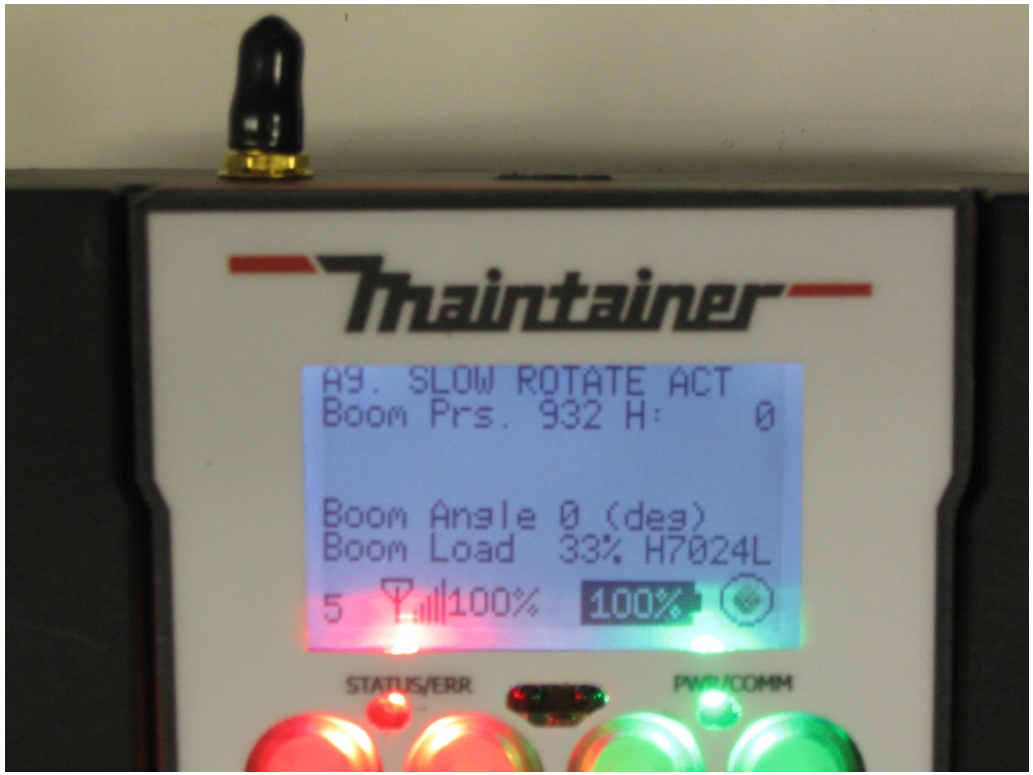
A9- Boom Slow Rotate

A9 SLOW ROTATE

When the Boom Pressure Transducer exceeds 600psi. The rotate speed goes from fast rotate to reduced speed rotation. This ensures that when a operator has no load, the boom is quick and nimble, but once loaded the speed is reduced to a safe rate to reduce undesirable load swing.

Functions Allowed:

Hoist/Winch Up/Down- Full Speed
Boom Up/Down – Full Speed
Boom Ext/Retract- Full Speed
Rotate CW/CCW- Max Speed 75%



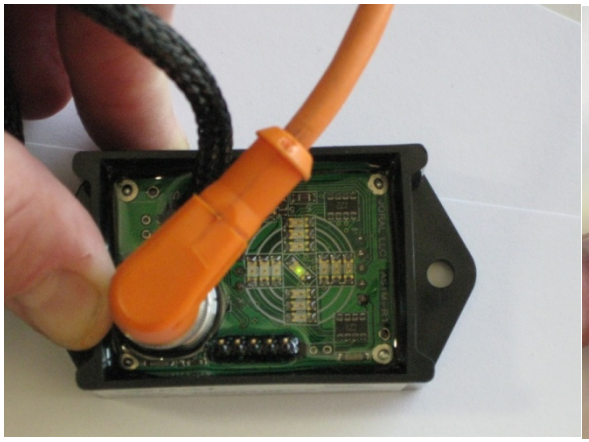
A10 - Boom Angle Sensor Error

A10 BOOM SENSOR ERROR

If the system must be in constant communication with the boom angle sensor. The sensor is powered if you can see Green or Red LED's on the base sensor.

- Green Centered LED means machine is level in both directions.
- Red LED's indicate amount of angle off in that direction.

If sensor fails the green light will flash on/off & all table values will default to the 30°boom operation values (As if it was a non-LMI system)



A11- Boom Angle Range

A11 BOOM ANGLE RANGE
If the Main Boom angle Sensor is less than – 15 degrees or greater than +85 degrees then this error occurs.

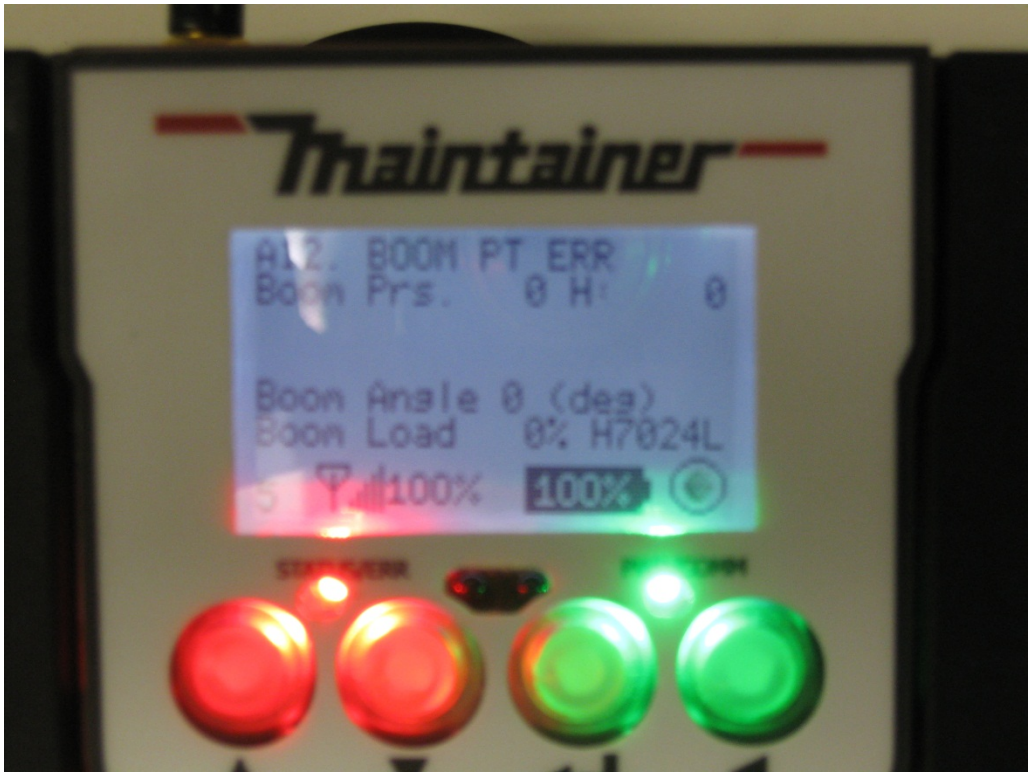
Functions Allowed:
Boom Up Normal
All other crane functions disabled

A12- Boom Pressure Transducer Error

A12- BOOM PT ERROR
If the Pressure Transducer is damaged or disconnected, the control system senses the missing transducer, and there will be an A12 alarm

No more “hotwired” pressure switches!

Functions Disabled:
All crane functions disabled



Pressure Transducer

Boom Pressure Transducer:

The Boom Transducer is a 0-3000 psi sensor.

The sensor is given a 5 Volt Supply Signal but reads from 0.5 for 0 psi to 4.5 volts for 3000 psi.

If a cable is broken , the system can sense the error and it is displayed on the LCD Screen.

System Alarms- Proportional Output Error

System Errors-

If the cable to the coil is broken or not connected the system can see this problem. The receiver monitors the current out to a function and monitors the current back from the function. When you read the output signal to a valve coil you are actually looking at the current returning from the valve coil. If the function displays 0% while the transmitter button is fully depressed, the coil is disconnected or broken.

System Errors

The S error codes are the System Errors S(xx).

Alarm Text	Cause of alarm	Effect of alarm	Recovery Action
S0. ESTOP ACTIVE	Estop activated from the transmitter	1. Both Estop outputs active 2. All outputs shutoff as defined by the project	Disable condition that activated estop and press start
S1. CAN RX TO	Reception of a CAN message timed out	1. CAN message not received and processed 2. Depending on how the CAN messages are used, outputs may be shutoff as defined by the project	Determine why the message(s) is(are) not being received. Once message(s) is(are) received again, the alarm will clear
S2. TEMP OUT OF RANGE	Temperature is out of the operating range of -40C to +85C	Outputs are shut off	Get temperature into acceptable operating range and the alarm will clear after 1 minute permitting outputs to operate again
S16. OUT 1 OC ERR	When the output was activated, a current of over 3.5A was being drawn by the output. The output was shutoff to prevent damage to the hardware.	Output is shutoff and will not operate until the cause is fixed and power to the system is cycled	Determine what has caused the over current draw, fix the cause, and power cycle the system

S16-31

- **Output 1-16 Over Current Errors- Current over 3.5 Amps on Output.**

S32-47

- **Output 1-16 Over Voltage beyond + V Battery.**

S48-63

- **Output 1-16 Sees a negative Voltage below – V Battery 0 Volts**

- **For detailed error codes reference Receiver Manual**

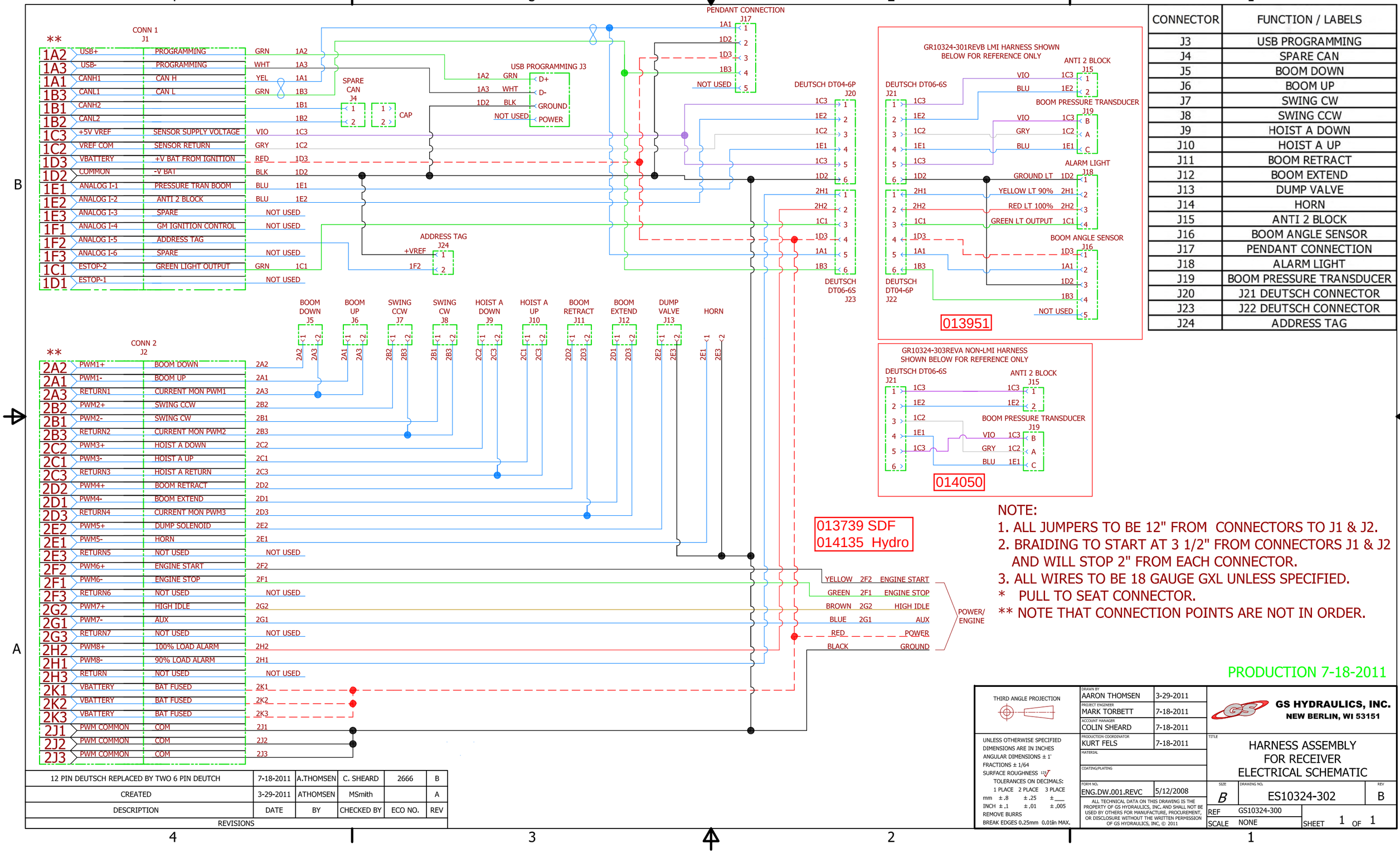
12/1/11

Magnetek Error Codes

IO1 Boom up
IO2 Boom Down
IO3 Rotate CW
IO4 Rotate CCW
IO5 Hoist/winch Up
IO6 Hoist/winch Down
IO7 Boom Extend
IO8 Boom Retract
IO9 Horn
IO10 Dump Solenoid
IO11 Engine Stop
IO12 Engine Start
IO13 Auxiliary
IO14 High Idle
IO15 90% alarm (light)
IO16 100% alarm (light)

12/15/11
Nathan Schiermeyer

Light	Status
Green-solid	All systems good, no errors
Yellow-solid	90% load warning
Red-solid	100% load alarm
Green-yellow flashing	4.5° truck tilt warning
Green-red flashing	6.5° truck tilt warning



CONNECTOR	FUNCTION / LABELS
J3	USB PROGRAMMING
J4	SPARE CAN
J5	BOOM DOWN
J6	BOOM UP
J7	SWING CW
J8	SWING CCW
J9	HOIST A DOWN
J10	HOIST A UP
J11	BOOM RETRACT
J12	BOOM EXTEND
J13	DUMP VALVE
J14	HORN
J15	ANTI 2 BLOCK
J16	BOOM ANGLE SENSOR
J17	PENDANT CONNECTION
J18	ALARM LIGHT
J19	BOOM PRESSURE TRANSDUCER
J20	J21 DEUTSCH CONNECTOR
J23	J22 DEUTSCH CONNECTOR
J24	ADDRESS TAG

DESCRIPTION	DATE	BY	CHECKED BY	ECO NO.	REV
REVISIONS					
12 PIN DEUTSCH REPLACED BY TWO 6 PIN DEUTCH	7-18-2011	A.THOMSEN	C. SHEARD	2666	B
CREATED	3-29-2011	ATHOMSEN	MSmith		A

THIRD ANGLE PROJECTION

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
ANGULAR DIMENSIONS ± 1°
FRACTIONS ± 1/64
SURFACE ROUGHNESS 125
TOLERANCES ON DECIMALS:

	1 PLACE	2 PLACE	3 PLACE
mm	±.8	±.25	±___
INCH	±.1	±.01	±.005

REMOVE BURRS
BREAK EDGES 0.25mm 0.01in MAX.

DRAWN BY	AARON THOMSEN	3-29-2011
PROJECT ENGINEER	MARK TORBETT	7-18-2011
ACCOUNT MANAGER	COLIN SHEARD	7-18-2011
PRODUCTION COORDINATOR	KURT FELS	7-18-2011
MATERIAL		
COATING/PLATING		
FORM NO.	ENG.DW.001.REVC	5/12/2008

GS HYDRAULICS, INC.
NEW BERLIN, WI 53151

TITLE
HARNESS ASSEMBLY
FOR RECEIVER
ELECTRICAL SCHEMATIC

SIZE	DRAWING NO.	REV
B	ES10324-302	B

REF	GS10324-300	SHEET	1 OF 1
SCALE	NONE		

Notice: This vehicle is equipped with remote engine Start/Stop.

<u>Automatic Transmissions</u>: The parking brake must be applied and the truck in park or neutral for this feature to work.

<u>Manual transmissions</u>: Truck must be in neutral and parking brake applied with the hinged arm of the neutral safety bracket around the shifter for this feature to work.

If you are experiencing problems with the starting of the engine or engine shutting off during operation, contact Maintainer Corporation for possible trouble shooting information on this problem.

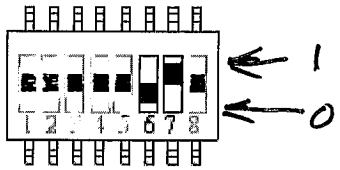
Phone: 1-800-831-8588

B. Inactivity Time-Out Timer

Bits 6 and 7 on the dip-switch allows the user to define a time after which if no buttons on the transmitter are pressed, the Flex Pro will send an OFF command to the receiver and power down. To restart, the user must turn the On/Off/Start switch to the Off position, then back to On again to resume operation.

Note: When all bits of the dip-switch are set to "1", the Flex Pro will read Inactivity Timer settings from the I-CHIP instead of the dip-switch.

Time Out	Dip-switch Setting
5 minutes	01
10 minutes	10
15 minutes	11
Never shut off	00



(Fig.09)