

**RADIO CONTROL SYSTEM MANUAL
FOR LOUIS A. GRANT'S
GOM-360BDRE MACHINE
(Version 2.0)**

USER'S REFERENCE FOR THE G.O.M. RADIO CONTROL SYSTEM

Safety Precautions and Conditions

Any operator of industrial mobile equipment needs to be aware of the inherent dangers associated with the operation of that equipment. Any number of single point failures in the control mechanisms associated with mobile equipment could cause erratic movement of the machine. Typical radio control systems for hydraulic mobile equipment utilize a hand held transmitter device with switches remotely driving a receiver with relay switches wired to electrically driven solenoid hydraulic valves driving cylinders and motors, etc. thereby allowing operation of the various functions of the machine. Each of the devices in this chain of control has a life expectancy and can and has failed to operate and/or react erratically.

We have provided all of the safety features available with today's technology to avoid erratic and/or non-response situations in our radio transmitters and receivers. This does not eliminate the possibility of a failure in hardware.

Any operator needs to be aware of the safety concerns and operate the machinery accordingly. In essence this means he must keep his body out of the way of potential harm from erratic movements, maintain distance from moving, swinging and tramming devices. Machine Stop devices are available for the operator to shut down the machine, the operator should be aware of and know the location of these devices as well as be aware of the time it takes for these devices to react. This time factor will help determine the safe operating distance he needs to maintain from any moving part.

The advantage of a radio remote operating system is to allow the operator to maintain a safe operating distance without being tied to the machine by tether and/or hand controls. This distinct feature should be taken advantage of and utilized making the overall machine a safer piece of equipment to operate. Please recognize this capability and utilize it to its full potential.

Introduction

The following is a brief description of the radio control system for the G.O.M. 360 line of machines. The radio system will consist of a transmitter, receiver and a remote antenna. The radio system was designed to be a direct replacement for the current umbilical system and operates on the same basis, but there are some differences. Please read the following for transmitter operation, receiver operation and diagnostics. Also there are drawings of both to pick out areas of discussion.

Transmitter Information

The transmitter is a hand-held controller approximately 9"H x 4.25"W x 2"D in size and, weighs about 3 pounds. The enclosure is built to a NEMA 4 standard, which states the unit can withstand water splashes, but the unit can not be submerged in water. The transmitter is made out of PVC plastic. This plastic is used for three reasons. It is strong, light, and it has good RF characteristics. Please keep metal away from the transmitter. Metal will shield the RF signal and cause poor reception.

The transmitter was designed to be a replica of the current umbilical controller. You will notice that the rocker levers on the front of the unit match the same functions on the umbilical unit. The controller was lengthened to include buttons for future use. There were some changes made to the bottom row of switches on the front cover. A throttle increase button and decrease button was included to replace the IDLE HI/LO button. To increase the machine idle press and hold the THROTTLE INCREASE button until the engine reaches the desired RPM. To decrease the RPM, press and hold the THROTTLE DECREASE button. Please note at machine startup, the receiver will automatically decrease the throttle for 2 seconds. This is for safety reasons.

The "HAMMER ON/OFF" switch remains in the same position as the old controller. One push activates the function, to deactivate the function push the button again. When the hammer is on, the yellow led at the top left of the transmitter will light up. When the hammer is turned off, the yellow led will go out.

On top of the transmitter are three toggle switches and one pushbutton. The second toggle switch in from the left side, and the pushbutton start the entire system. To power up the machine and transmitter the following sequences of events must happen. The "TX POWER" toggle must be switched from the off position to the on position. Next the start button is pushed. This button will start the machine's engine. Please note that when the green button is pushed, no other buttons can be activated. For example, if an operator has the "TILT" toggle in the "CW" position, the radio system will not let the machine start. For safety the machine will only start when no commands are operated. This also allows the radio system to scan for switches that are broke. If a button is stuck on, the machine will not start. Switch the TX POWER switch to the off position to remove power from the transmitter. The receiver will then shut the fuel solenoid off to the engine. The receiver will go into a scan mode looking for any transmitters that has an address that matches the receiver's address.

Located on the top of the transmitter are three LED's. When the transmitter is held in the operation position, the first LED to the left is the "HAMMER ON" led (yellow color). This LED lights when the "HAMMER ON" operation has been activated. The middle LED (colored green) is used to indicate when any switches have been activated. This LED indicates a number of different operations. The green LED lights when any switch has been operated. For example if you push "TILT CW", the green LED will light until the function is released. This light will also let the operator know when a button is

stuck. For example, at startup, if there is a stuck button the green LED will light when the operator pushes the "START" pushbutton. During operation if the green LED stays solid after a function has been released, immediately switch the "TX POWER" toggle switch to the off position. Try to restart the transmitter after power down. The transmitter needs repaired if the green LED comes on when the green pushbutton is pressed during the start up of the machine. The third LED (red) shows the operator battery status. When the transmitter has fresh batteries the LED will be off. The LED will blink when the batteries need changed. Please note that the transmitter starts monitoring battery life about ten minutes after the transmitter is started. A dead battery will start the transmitter, but as soon as the battery monitoring starts, the transmitter will shut down. This scenario will make an operator think there is problem with the machine, or radio system, but the batteries need changed. The batteries are two 9V batteries located under a protective cover at the bottom of the transmitter. Change both batteries at the same time. A bad battery will drain power from a good battery when put together. Two new alkaline batteries will provide an estimated 60 hours of continuous operation.

Two toggle switches are located on the outer edges of the top plate. These toggle switches have a shorter handle than typical toggle switches. Please note the difference between their height and the "TX POWER" toggle switch. These switches perform the same function as on the umbilical. The left toggle controls the "STICK" up and down functions, and the right controls the "TILT" clockwise (CW), and counter-clockwise (CCW) functions.

On the front of the transmitter under the rocker switch assembly is a selector switch. This switch was provided to select different operating channels or frequencies. The selector switch has eight different channels labeled 1 to 8. If a radio system seems slow, there is a good chance the radio system is seeing some interference. The operator then would select a different channel to operate the radio system on. Please remember the transmitter and the receiver channel selection must match. If the transmitter is set to channel 3, then the receiver must be set to channel 3. Please see the attached drawings for more information about setting the channel.

Receiver Information

The receiver was designed to be especially useful for the operator of the system. The receiver enclosure is approx. 12"L x 8"W x 2"H in size, and weighs about 5lbs. The shell is made of a rugged extruded aluminum shell. At one end of the unit is a twenty four position connector. This connects to the machine's solenoid block where the umbilical controller now connects. The receiver is connected via a cable to that block. At the other end of the receiver is a blank cover.

Located on the top of the receiver is a cluster of visible LED diagnostics for operator feed back. At the end closest to the connector are the machine functions. You will notice that there is a single row of LED's next to each function. When the green LED

is lit under the label "OK" the function is being operated. If the green LED does not light, a fuse has tripped inside the receiver unit. There is short between the receiver and the solenoid. The short circuit must be corrected for the function to work. The internal fuse takes about 5 minutes to reset. The fuse is thermal sensitive. The green LED should light after the short circuit has been corrected and adequate time was given for the fuse to reset. All 24 functions are fused the same way.

At the other end of the receiver is a bar graph along with six LED's labeled 1 through 6. The bar graph indicates signal strength. When the bar graph is fully illuminated (all 10 segments) the RF signal is strong. The signal is weak when one segment is lit and it is recommended to first check the antenna, and the cable that runs from the receiver to the antenna. If damaged, the antenna or cable must be replaced. If those two pieces are OK, then try the system with another transmitter. The current transmitter could be putting out a low signal. The transmitter should be sent back for adjustments. The next six LED's perform a more detailed check between the receiver and transmitter. The following occurs when the labeled LED lights.

LED 1- TX ON LINE- Solid ON for transmitter recognized, OFF for no transmitter recognized. Receiver has acquired a transmitter and control has been awarded to that one unique transmitter. Continuous messages are required to keep the fuel solenoid energized. If a message is lost for one second, the system will reset all outputs except the fuel solenoid. After two seconds all outputs are reset, the engine will stop, and the receiver will enter a search for transmitter mode.

LED 2- VALID MESSAGE DETECT- This LED flashes on receipt of valid messages when LED 1 is ON. A message contains the commands sent by the transmitter. A valid command will consist of two identical messages sent by the transmitter. A transmitter needs to be on-line (i.e. LED #1 is on). This LED also serves as a system watchdog. The watchdog has a slow flash when no transmitters are on or recognized (LED 1 OFF). This LED lets the operator know that receiver's internal processor is operating and scanning for available transmitters (in watchdog mode LED 1 will be off).

LED 3 - 2 SECOND DATA LOSS- There is a lapse of valid data for more than 2 seconds. The receiver will clear all outputs, including the fuel solenoid. LED #3 will come on for 1 second indicating a total system shut down. After this one second period, the receiver will re-enter the search mode (for a transmitter).

LED 4 - COMMANDED POWER DOWN - The operator powers down the transmitter. LED 4 stays on for approx. 1 second then the receiver goes into a search Mode (LED 6 comes on).

LED 5- ADDRESS CONFLICT ERROR - More than one transmitter is on and set to the same address codes. The receiver will refuse all commands until it sees one transmitter sending messages.

LED 6- ONE SECOND DATA LOSS - When a transmitter is on-line, (LED 1 is on) then this LED indicates there has been a one second lapse in valid messages from the transmitter. All momentary outputs are cleared until the next valid message is detected. Latched functions (fuel solenoid) are not affected. Normal operation will resume when a valid message is detected, unless the total time frame reaches 2 seconds. See LED #3 for further details.

If there is no transmitter on-line, LED #1 is off. This LED indicates that the receiver is aware of a transmitter, but it is refusing to accept it's signal because of a command being on (transmitter). For safety reasons all commands must be off at the transmitter before the receiver will award control to a transmitter. For example, if the operator walks out of range with the transmitter, a two second data loss will occur. If the hammer (latched command) was on, the receiver will not re-recognize the transmitter when the operator comes back into range, due to the hammer being on. In this case, LED #2 will be blinking slowly and LED #6 will be on. The operator will need to turn off the hammer function on the transmitter in order for the receiver to accept the signal.

Above the antenna on the receiver is a selector switch for operating channels. This switch was provided to select different operating channels or frequencies. The selector switch has eight different channels labeled 1 to 8. If a radio system seems slow, there is a good chance the radio system is seeing some interference. The operator then would select a different channel to operate the radio system on. Please remember the transmitter and the receiver channel selection must match. If the transmitter is set to channel 3, then the receiver must be set to channel 3. The relationship between the channel number and frequency are listed in the channel selection part of this manual.

Transmitter and Receiver Pairing

The first prototype systems used a serial number system having a three digit code for matching components. This serial number would match the machine's serial number with the radio system. The latest systems have the receiver and transmitter matched by internal software. Each transmitter is specifically matched to a receiver. For example transmitter number 102, will only work with receiver number 102. No other transmitter will work with receiver number 102. If the transmitter or receiver malfunctions (electronically), both units will need returned for servicing. If a transmitter toggle switch breaks, the unit does not need to be returned. The top plate assembly will be replaced with a new assembly, The old assembly will be returned for repair. The transmitter and receiver will need to be returned when there is a RF problem, or a software problem. General repairs can be done in the field. **The only items that need to be matched are the channel settings!**

Channel Selection

On the front of the transmitter under the rocker switch assembly, and above the antenna on the receiver is a selector switch. This switch was provided to select different

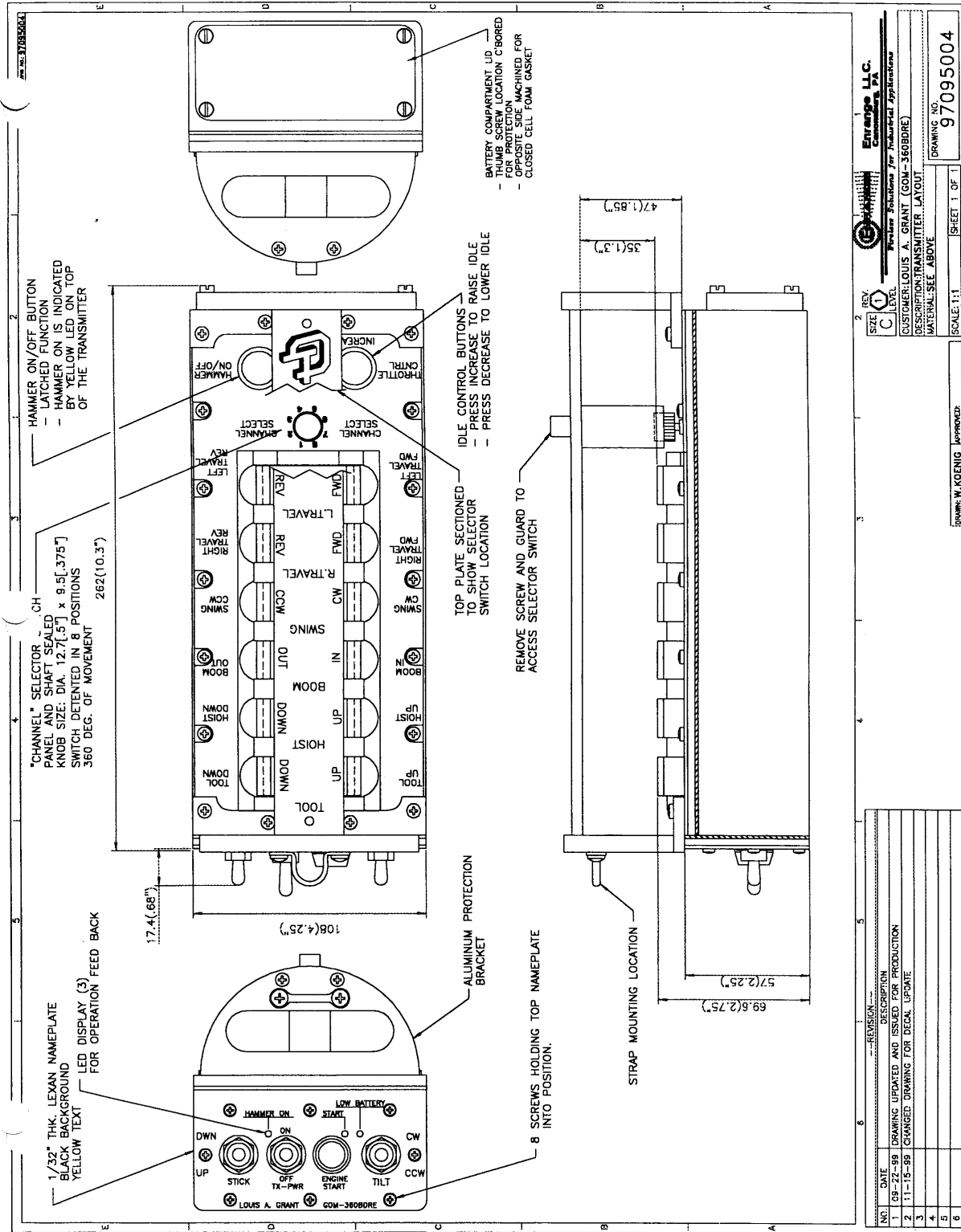
operating channels or frequencies. The selector switch has eight different channels labeled 1 to 8. If a radio system seems slow, there is a good chance the radio system is seeing some interference. The operator then would select a different channel to operate the radio system on. **Please remember the transmitter and the receiver channel selection must match!** If the transmitter is set to channel 3, then the receiver must be set to channel 3. The relationship between the channel number and frequency are listed in the channel selection part of this manual. The following list will show the operator what frequency each channel represents. Please the attached drawings for more information.

Channel	Frequency
1	903.3Mhz
2	906.3Mhz
3	907.8Mhz
4	909.3Mhz
5	912.3Mhz
6	915.3Mhz
7	919.8Mhz
8	921.3Mhz

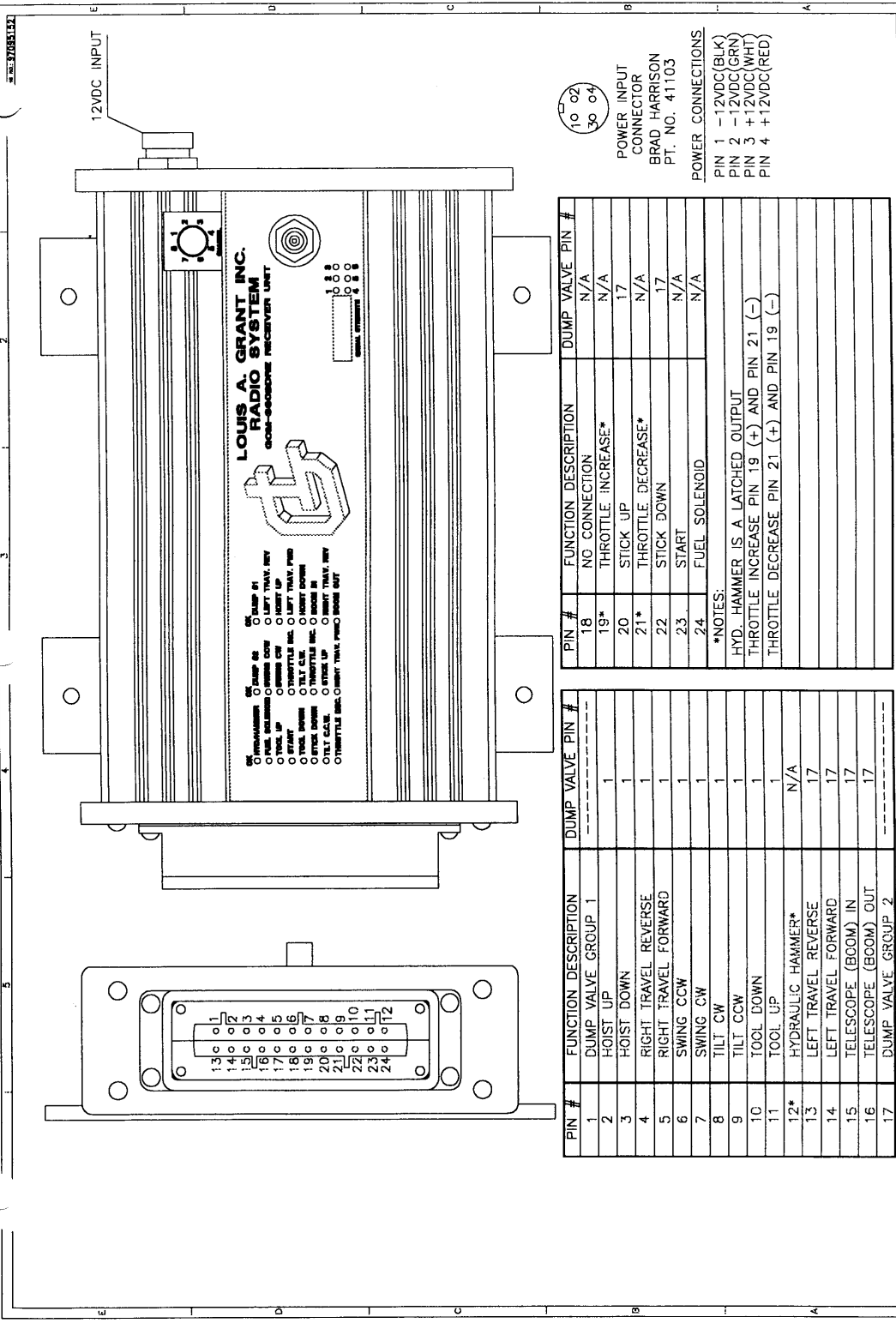
Drawing Listing

The drawings of the receiver and transmitter will illustrate the areas discussed above. Please read over and understand the system. This will help insure that the system is operated correctly and safely.

1.) GENERAL TRANSMITTER LAYOUT	DRAWING 97095004 REV. 2
2.) GENERAL RECEIVER LAYOUT	DRAWING 97095003 REV. 1
3.) SETTING THE CHANNEL (TX)	DRAWING 97095025 REV. 1
4.) SETTING THE CHANNEL (RX)	DRAWING 97095026 REV. 1
5.) SYSTEM STARTUP	DRAWING 97095007 REV. 2
6.) TRANSMITTER OPERATION	DRAWING 97095008 REV. 2
7.) BATTERY INFORMATION	DRAWING 97095010 REV. 2
8.) RECEIVER LED FUNCTIONS	DRAWING 97095012 REV. 3
9.) RECEIVER PIN OUT DRAWING	DRAWING 97095152 REV. 2



NO.	DATE	DESCRIPTION
1	08-22-98	DRAWING UPDATED AND ISSUED FOR PRODUCTION
2	11-15-98	CHANGED DRAWING FOR DECAL UPDATE
3		
4		
5		
6		



- HAMMER
- HOIST UP
- HOIST DOWN
- RIGHT TRAVEL REVERSE
- RIGHT TRAVEL FORWARD
- SWING CCW
- SWING CW
- TILT CW
- TILT CCW
- TOOL DOWN
- TOOL UP
- HYDRAULIC HAMMER*
- LEFT TRAVEL REVERSE
- LEFT TRAVEL FORWARD
- TELESCOPE (BOOM) IN
- TELESCOPE (BOOM) OUT

- DUMP #1
- DUMP #2
- LEFT TRAVEL REVERSE
- LEFT TRAVEL FORWARD
- RIGHT TRAVEL REVERSE
- RIGHT TRAVEL FORWARD
- SWING CCW
- SWING CW
- TILT CW
- TILT CCW
- TOOL DOWN
- TOOL UP
- HAMMER
- HOIST UP
- HOIST DOWN

PIN #	FUNCTION DESCRIPTION	DUMP VALVE PIN #
18	NO CONNECTION	N/A
19*	THROTTLE INCREASE*	N/A
20	STICK UP	17
21*	THROTTLE DECREASE*	N/A
22	STICK DOWN	17
23	START	N/A
24	FUEL SOLENOID	N/A

PIN #	FUNCTION DESCRIPTION	DUMP VALVE PIN #
1	DUMP VALVE GROUP 1	---
2	HOIST UP	1
3	HOIST DOWN	1
4	RIGHT TRAVEL REVERSE	1
5	RIGHT TRAVEL FORWARD	1
6	SWING CCW	1
7	SWING CW	1
8	TILT CW	1
9	TILT CCW	1
10	TOOL DOWN	1
11	TOOL UP	1
12*	HYDRAULIC HAMMER*	N/A
13	LEFT TRAVEL REVERSE	17
14	LEFT TRAVEL FORWARD	17
15	TELESCOPE (BOOM) IN	17
16	TELESCOPE (BOOM) OUT	17
17	DUMP VALVE GROUP 2	---

*NOTES:
 HYD. HAMMER IS A LATCHED OUTPUT
 THROTTLE INCREASE PIN 19 (+) AND PIN 21 (-)
 THROTTLE DECREASE PIN 21 (+) AND PIN 19 (-)

NO.	DATE	REVISION
1	10-13-98	DRAWING ISSUED FOR PRODUCTION
2	10-18-98	CHANGED SWING AND RIGHT TRAVEL OUTPUTS
3	12-17-98	PIN 18 CHANGE TO NO CONNECTION, ADDED 12V POWER CONNECTOR
4		
5		
6		

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CUSTOMER: LOUIS A. GRANT (GON-360BDR)
 DESCRIPTION: RECEIVER PIN OUTPUT DIAGRAM

DRAWING NO. 97095152
 SHEET 1 OF 1