NEW LEADER

MODEL MARK III
and
MARK III DGPS

UNIT SERIAL NUMBER_____

MANUAL NUMBER: 72976-C

EFFECTIVE 1/2008

HIGHWAY EQUIPMENT COMPANY
1330 76TH AVE SW
CEDAR RAPIDS, IOWA 52404-7052

PHONE (319) 363-8281 ***FAX (319) 632-3081***

www.highwayequipment.com

BUILDING THE BEST SINCE 1939

TABLE OF CONTENTS

NEW LEADER LIMITED WARRANTY

BASIC WARRANTY

HIGHWAY EQUIPMENT COMPANY ("Highway") has manufactured or is distributing the equipment to which this warranty is attached, and warrants to its original reseller including Dealers, Distributors and Original Equipment Manufacturers (hereafter called Dealer) that the equipment will, under normal conditions of use and service, be free from material defects due to faulty manufacturing for a period of six (6) months from the date of delivery to the original user. For any equipment that does not conform to the aforesaid warranty within six (6) months from the date of delivery to the original user, your Dealer will, at its option, repair or replace parts, provided that you will pay all labor costs and costs for materials other than parts. If the equipment is defective in materials or workmanship, you must promptly notify your Dealer and return to Highway the warranty registration card (may also fax this information to 800/363-8267 or by utilizing the Internet at www.highwayequipment.com/warranty.htm and entering in the information) for such equipment before the expiration of the warranty period. If your Dealer determines that the defect is due to Highway's material or workmanship, your Dealer will, with Highway's consent, repair such defect during normal working hours, at their location, or such other location as the Dealer may designate. This warranty includes only the original equipment manufactured by Highway, and not any parts that may be added to the equipment or replaced by the dealer or user. The installation of any part that did not originate from Highway will void this Basic Warranty in its entirety. In the event of repair or replacement, the warranty period shall not be extended beyond the original warranty period.

NEW LEADER EXTENDED WARRANTY

In lieu of the basic warranty described above, if the warranty registration card (or warranty card information as provided above) is received at Highway within thirty (30) days after the date of delivery to the original user, Highway will warrant that the equipment will, under normal conditions of use and service, be free from material defects due to faulty manufacturing for a period of twenty-four (24) months from the date of delivery to the original user. For any equipment that does not conform to the aforesaid warranty within twenty-four (24) months from the date of delivery, your Dealer will, at its option, send you a new part, or give you full credit for the part, provided the replacement part is purchased through your Dealer. Labor costs for this extended warranty coverage will be paid by Highway to the Dealer at their standard shop rate, based on the amount of time Highway establishes to be the time reasonably necessary to make required repairs. If the equipment is defective in materials or workmanship, you must promptly notify your Dealer before the expiration of the warranty period. If your Dealer determines that the defect is due to Highway's material or workmanship, your Dealer will, with Highway's consent, repair such defect during normal working hours, at their location, or such other location as your Dealer may designate. In the event of repair or replacement, the warranty period shall not be extended beyond the original warranty period.

The #3 pintle chain conveyor is eligible for the warranties listed above plus an additional twelve (12) months for a total of thirty-six (36) months of warranty, subject to compliance of the terms for the New Leader Extended Warranty.

If you fail to return the warranty registration card (or warranty card information as provided above) **to Highway within thirty (30) days after the date of delivery, the extended warranty shall not apply, and your sole remedy for any defects in the equipment shall be under the basic warranty described above**.

The above warranties do not cover:

(1) equipment that is damaged by abuse, neglect, accident, or modification;
(2) fluids, towing, telephone, travel and cleaning cost;
(3) loss of use of vehicle, inconvenience, commercial loss, or consequential damages;
(4) any product, component, or part not manufactured by Highway; or
(5) the equipment itself if parts are installed on the equipment that did not originate from Highway.

The above warranties do not apply under the following conditions:

(1) when equipment has been improperly used or installed, or modified, or fitted with sideboards, or fails because of defects or inefficiency of components not furnished with equipment;
(2) when equipment is used for purposes for which it was not originally designed or intended;
(3) when equipment is used under abnormal operating conditions; or
(4) when the dealer or user fails to follow Highway instructions regarding the equipment, including the instruction to install only Highway-supplied parts onto the equipment.

HIGHWAY WILL BEAR NO OTHER EXPENSE, INCLUDING BUT NOT LIMITED TO LABOR AND MATERIAL COSTS (OTHER THAN THOSE SPECIFIED HEREIN) OF ANY KIND, AND YOUR EXCLUSIVE REMEDY, IN LIEU OF ALL INCIDENTAL, SPECIAL, CONSEQUENTIAL OR ANY OTHER DAMAGES, INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR NEGLIGENCE, IS LIMITED TO REPAIR OR REPLACEMENT AS HERETOFORE DESCRIBED. THE FOREGOING WARRANTIES ARE IN LIEU OF ALL OTHER REPRESENTATIONS OR WARRANTIES, EXPRESS OR IMPLIED OF ANY KIND REGARDING ANY EQUIPMENT, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE OR USE. IN NO CASE SHALL HIGHWAY BE LIABLE FOR ANY SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES BASED UPON BREACH OF WARRANTY, BREACH OF CONTRACT, NEGLIGENCE, STRICT TORT, OR ANY OTHER LEGAL THEORY.

Unless modified in a writing, signed by both parties, this Limited Warranty is understood to be the complete and exclusive agreement between the parties, superseding all prior agreements, oral or written, and all other communications between the parties relating to the subject matter of this Limited Warranty. No representative or agent of Highway nor any third party has authority to change or modify this warranty in any respect, nor to assume any other obligation or liability on behalf of Highway. Any action for breach of warranty must be commenced within six (6) months following the expiration of the Limited Warranty.

These warranties are extended only to the original Dealer and are not transferable. In the event of a warranty claim, you should promptly notify your Dealer and provide the following:

1. Model and serial number of the equipment;
2. Date of delivery to the original user;
3. Part number of the defective part;
4. Description of the difficulty encountered;
5. Date of repair.

Highway will work with your Dealer regarding instructions for repair, replacement, or refund, if the warranty claim can be validated.

Effective with equipment delivered to original user on or after December 1, 2007.

PREFACE

PLEASE ! ALWAYS THINK SAFETY FIRST !!

The purpose of this manual is to familiarize the person (or persons) using this unit with the information necessary to properly install, operate, and maintain this system. These instructions cannot replace the following: the fundamental knowledge that must be possessed by the installer or operator, the knowledge of a qualified person, or clear thinking necessary to install and operate this equipment. Since the life of any machine depends largely upon the care it is given, we suggest that this manual be read thoroughly and referred to frequently. If for any reason you do not understand the instructions, please call your authorized dealer or our Cedar Rapids, Iowa, Service Department at (319) 363-8281.

It has been our experience that by following these installation instructions, and by observing the operation of the spreader, you will have sufficient understanding of the unit, enabling you to troubleshoot and correct all normal problems that you may encounter. Again, we urge you to call your authorized dealer or our Cedar Rapids Service Department if you find the spreader is not operating properly, or if you are having trouble with repairs, installation, or removal of this unit.

We urge you to protect your investment by using genuine HECO parts and our authorized dealers for all work other than routine care and adjustments.

Highway Equipment Company reserves the right to make alterations or modifications in this equipment at any time. The manufacturer shall not be obligated to make such changes to machines already in the field.

When this manual was originally supplied, it was accompanied by the Highway Equipment Company *Operating and Maintenance Safety Manual*. The Safety Manual should be read thoroughly and referred to frequently. If you do not have the Safety Manual, we recommend that you obtain one from your dealer or from Highway Equipment Company before any installation, operation or maintenance of the spreader is attempted.

ACCIDENTS HURT !!!

ACCIDENTS COST !!!

ACCIDENTS CAN BE AVOIDED !!!

SAFETY

TAKE NOTE! THIS SAFETY ALERT SYMBOL FOUND THROUGHOUT THIS MANUAL IS USED TO CALL YOUR ATTENTION TO INSTRUCTIONS INVOLVING YOUR PERSONAL SAFETY AND THAT OF OTHERS. FAILURE TO FOLLOW THESE INSTRUCTIONS CAN RESULT IN INJURY OR DEATH.

In this manual and on the safety signs placed on the unit, the words "DANGER," "WARNING," "CAUTION" and "IMPORTANT" are used to indicate the following:

DANGER

Indicates an imminently hazardous situation that, if not avoided, **WILL** result in death or serious injury. This signal word is to be limited to the most extreme situations typically for machine components that, for functional purposes, cannot be guarded.

WARNING

Indicates a potentially hazardous situation that, if not avoided, **COULD** result in death or serious injury, and includes hazards that are exposed when guards are removed. It may also be used to alert against unsafe practices.

CAUTION

Indicates a potentially hazardous situation that, if not avoided, **MAY** result in minor or moderate injury. It may also be used to alert against unsafe practices.

IMPORTANT!

Is used for informational purposes in areas which may involve damage or deterioration to equipment, but generally would not involve the potential for personal injury.

The need for safety cannot be stressed strongly enough in this manual. At Highway Equipment Company, we urge you to make safety your top priority when operating any equipment. We firmly advise that anyone allowed to operate this machine be thoroughly trained and tested to prove they understand the fundamentals of safe operation.

The following guidelines are intended to cover general usage and to assist you in avoiding accidents. There will be times when you will run into situations that are not covered in this section. At those times the best standard to use is common sense. If, at any time, you have a question concerning these guidelines, please call your authorized dealer or our factory at (319) 363-8281.

SAFETY

AVOID ACCIDENTS

Most accidents, whether they occur in industry, on the farm, at home, or on the highway, are caused by the failure of some individual to follow simple and fundamental safety rules or precautions. For this reason, most accidents can be prevented by recognizing the real cause and doing something about it before the accident occurs.

Regardless of the care used in the design and construction of any type of equipment, there are many conditions that cannot be completely safeguarded against without interfering with reasonable accessibility and efficient operation.

A CAREFUL OPERATOR IS THE BEST INSURANCE AGAINST AN ACCIDENT. THE COMPLETE OBSERVANCE OF ONE SIMPLE RULE WOULD PREVENT MANY THOUSAND SERIOUS INJURIES EACH YEAR. THAT RULE IS:

NEVER ATTEMPT TO CLEAN, OIL OR ADJUST A MACHINE WHILE IT IS IN MOTION.

NATIONAL SAFETY COUNCIL

GENERAL DESCRIPTION

Mark III DGPS - Ready 28 Gallon Per Minute Ground Speed Control System.

The Mark III DGPS-Ready system is designed to vary the application rate of dry granular fertilizer or lime depending on the calculated requirement corresponding to a mapped location. This is achieved by the following steps:

1. A Differential Global Positioning Systems (DGPS) signal is received by a computer and interpreted by Geographical Information Systems (GIS) software. DGPS is a precise latitude, longitude and elevation derived from signals received from orbital satellites and differential transmitters. This hardware and software is not included in the Mark III DGPS-Ready system.

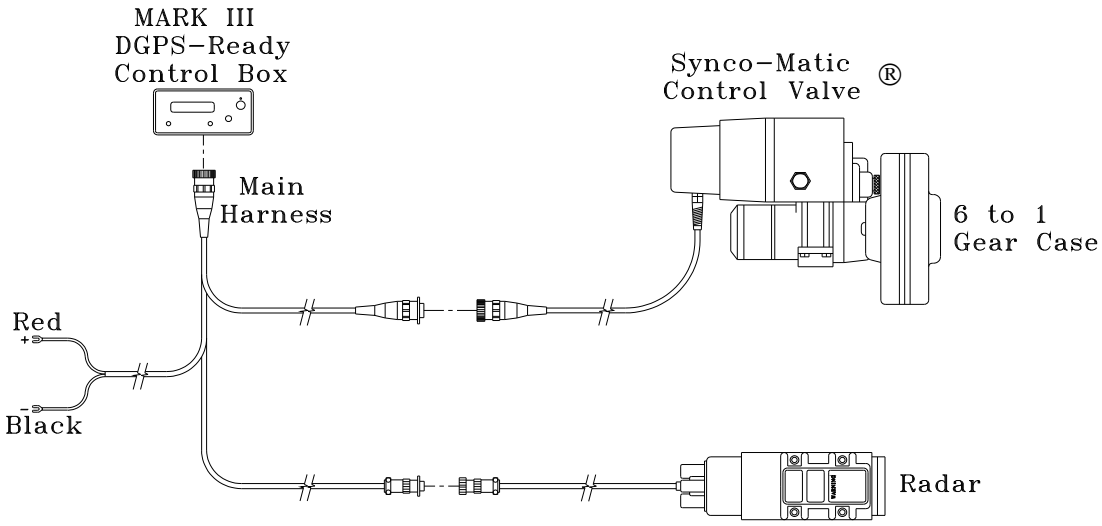
2. The GIS software informs the Mark III DGPS-Ready control box of the material application rate using the location and mapped field requirements.

3. Using "Echo-back" technology, the control box then updates the GIS software on which information was actually applied. This feature allows the Mark III to be used on a location that has not begun using GPS. The control, using the GPS/GIS system, can map the field and supply detailed maps of what was applied.

4. Ground speed information is also processed. The method of speed detection is a radar unit.

5. The control box then controls a 28 gallon per minute Synco-Matic® control valve. The Synco-Matic® control valve regulates the amount of hydraulic oil flow through a hydraulic motor driving a six-to-one ratio conveyor gear case.

6. The Mark III DGPS-Ready control box can also be operated without the DGPS system, with the application rate being adjusted manually. The application rate, when used with a L2020GT spreader, can vary from seventy-five pounds of fertilizer per acre to over three tons per acre of lime.



INSTALLATION INSTRUCTIONS

CONTROL BOX

Mount the control box inside the truck cab in a location where it is easily accessed and viewed by the operator, without obstructing normal driving view. Avoid interference between the control box and the shifting lever or any other vehicle controls. The control box should be mounted out of direct sunlight, preferably in a shaded area, and installed as far away from any two-way radios as possible. The mounting bracket may be attached to the top or bottom, as required.

Allow enough room behind the control box to permit easy access to the control cable connection. Drill a hole in the floor or fire wall to run the cable from the control box back to the Synco-Matic® control valve on the conveyor gear case and to the radar unit.

The control box has a liquid crystal display which will go blank in temperatures below -4° F. If the temperature is over 120° F, the liquid crystal turns black and will return to normal after it cools down.

CAUTION All holes in the truck cab walls, floor and firewall for control wires, hoses and cables are to be grommeted, plugged and sealed to prevent entrance of engine fumes, dust, dirt, water and noise.

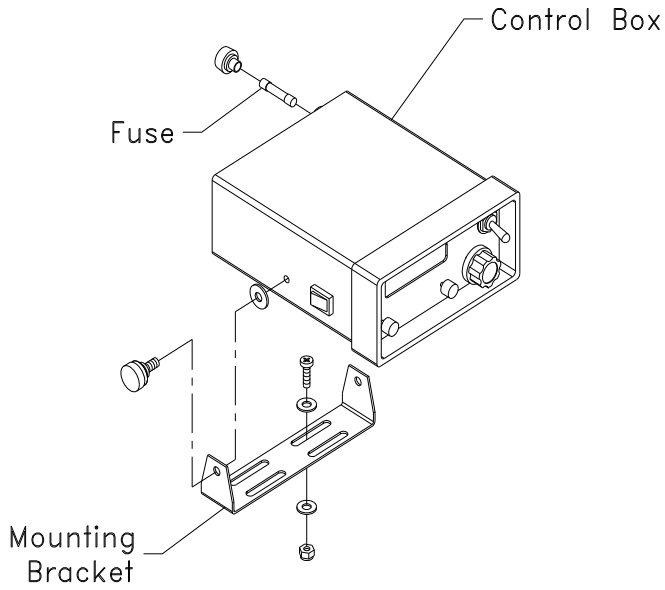


Figure 1 - Control Box Installation

CAUTION When drilling holes, make sure that the drill will not puncture the gas tank or harm any other obstruction!

INSTALLATION INSTRUCTIONS CONTINUED

RADAR

The mounting of the radar unit can be done several ways. The mounting kit supplied uses an "L" shaped bracket and mounting plate. There is also a plate mounting bracket drawing that can be used to fabricate a bolt-on version. Refer to the installation instructions included with the radar for more information.

The radar should be mounted facing rearward and at a 35° angle horizontally. (Figure 2)

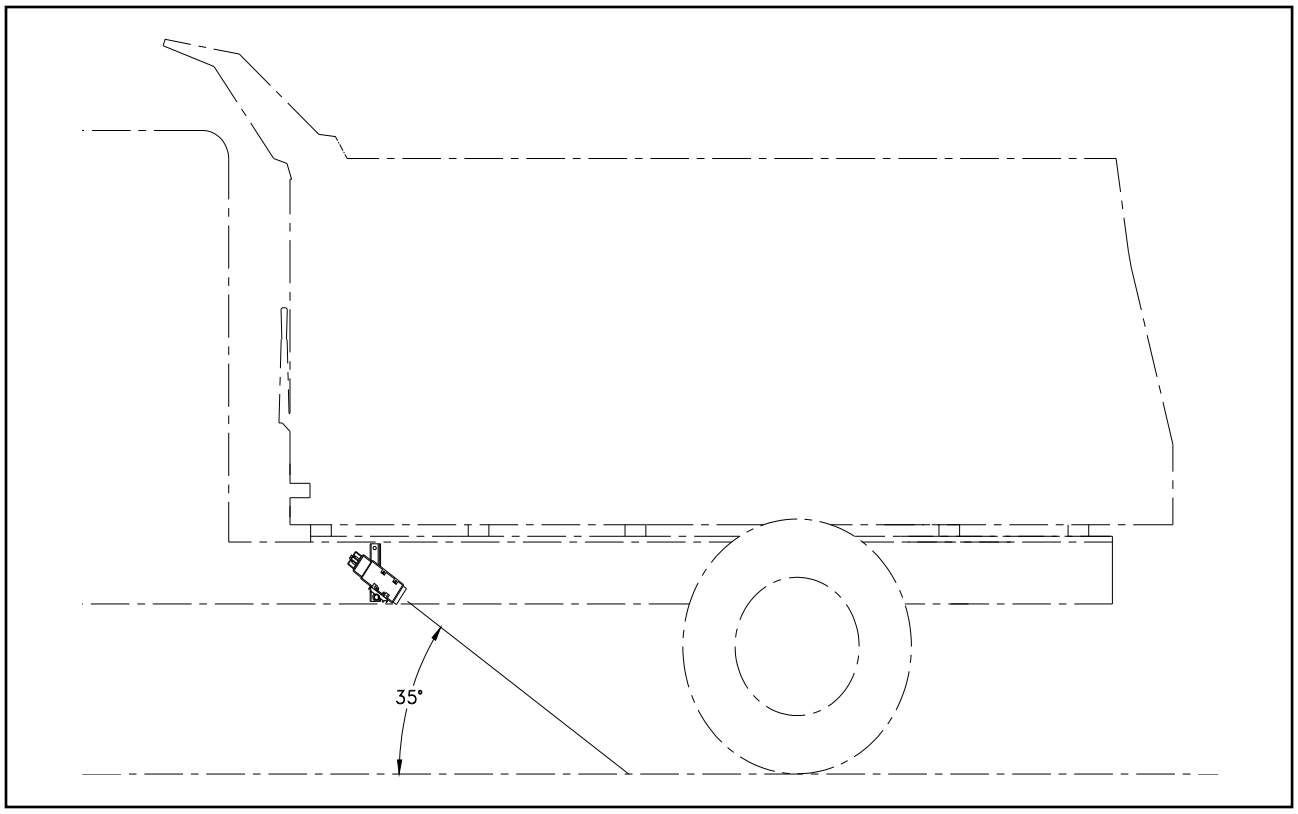


Figure 2 - Radar Mounting Angle

Wire Harness Routing

Route the wire harness where it will be protected from pinching, rubbing, or hot exhaust systems. Avoid sharp edges or moving parts. Use sufficient tie wraps to fasten harness securely.

IMPORTANT!	If at anytime an arc welder is used on the vehicle or anything connected to the vehicle, be sure to connect the welders ground directly to one of the two items being welded. **Disconnect power cable from the control box!** Failure to do so can result in damage to components on both the vehicle and spreader, in which case the warranty will be null and void by manufacturer of same.

OPERATING PROCEDURES

CONTROL BOX DISPLAY

The in-cab control box display shows the truck speed in miles per hour, the number of acres spread and the distance traveled in feet. The LCD display also shows yields in pounds per acre of fertilizer or tons per acre of lime, with rate control for increase or decrease.

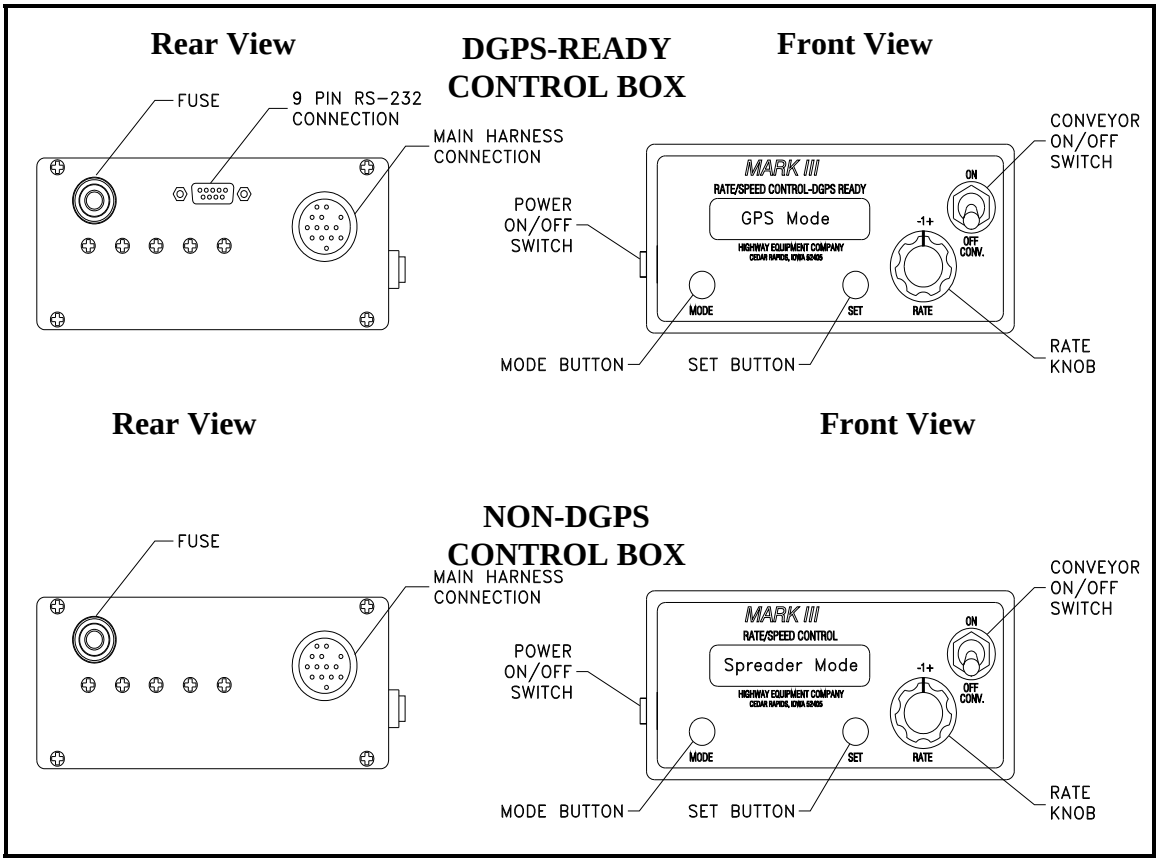


Figure 3 - Control Box Display

Power ON/OFF Switch

When in the ON position, power is provided to the entire control system. When in the OFF position, power is removed from the entire control system.

CAUTION Spinner is turning when power switch is in the ON position.

Conveyor ON/OFF Switch

This switch is used to start and stop the motion of the conveyor.

Rate Knob

This provides the operator with on-the-go application rate changes. Turning the knob clockwise increases and counterclockwise decreases application rates. The change in programmed yield when using the standard Mark III control box is 2%, while the DGPS-ready control produces a 6.67% change.

OPERATING PROCEDURES CONTINUED

Mode Button

The mode button switches through the programming sequence of options as well as each digit within the option. A cursor or line under the digit on the display is used to identify mode position. The cursor moves from right to left in the display. When the cursor has shifted to the last left digit, pushing the mode button will then change the display to the next mode.

Set Button

The set button is used during the programming sequence. Pushing the set button advances the number above the cursor digit and also cycles the unit between the fertilizer or lime mode, as well as DGPS and non-DGPS modes.

PROGRAM CHECKLIST

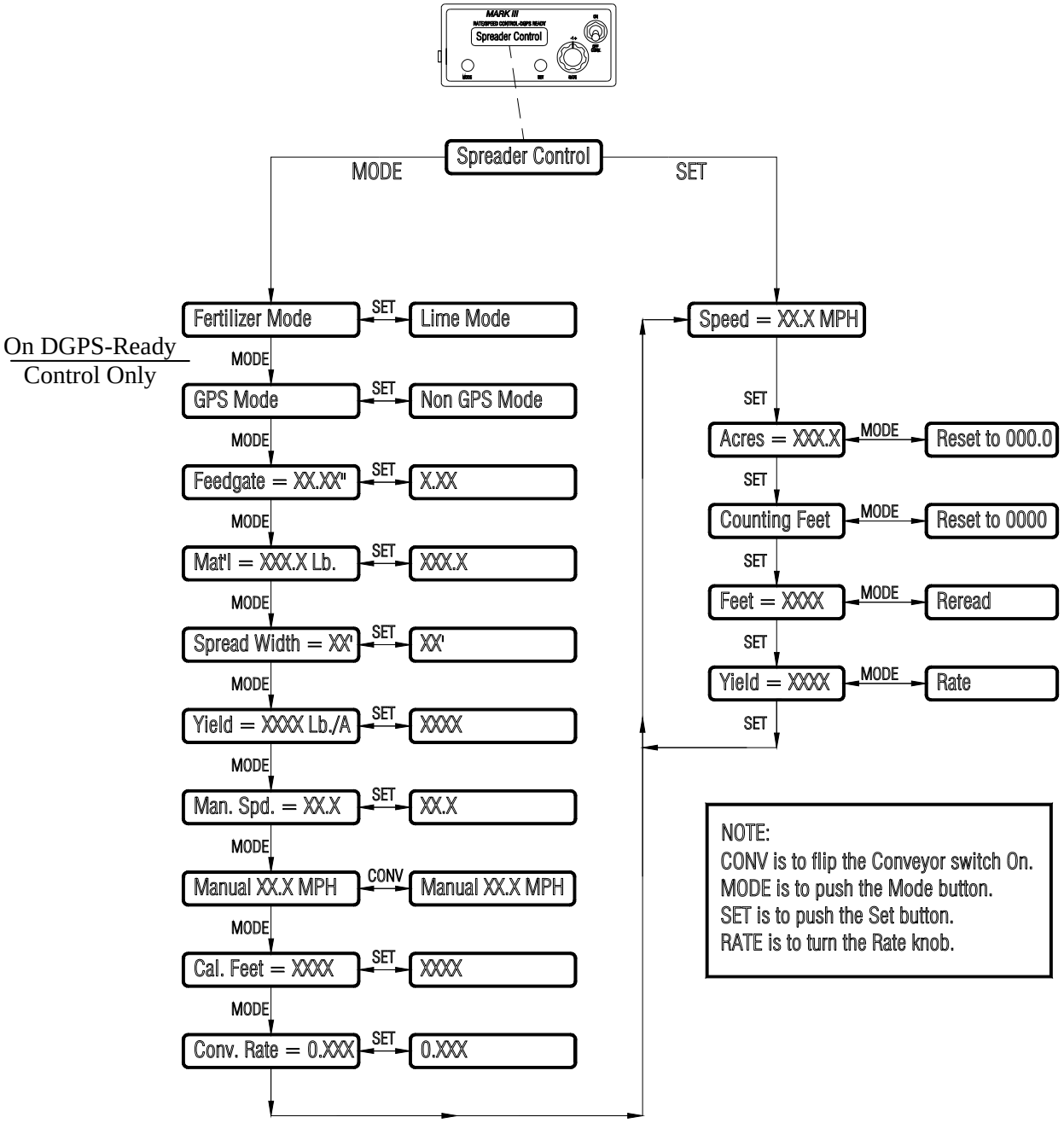
FERTILIZER	LIME
Spreader Control	Spreader Control
Fertilizer Mode	Lime Mode
Feedgate = __ __ . __ __	Feedgate = __ __ . __ __
Mat'l = __ __ __ . __ Lb	Mat'l = __ __ __ . __ Lb
Spread Width = __ __ '	Spread Width = __ __ '
Yield = __ __ __ __ Lb / A	Yield = __ . __ __ tons / A
Man. Spd. = __ __ . __ MPH	Man. Spd. = __ __ . __ MPH
Manual XX.X MPH	Manual XX.X MPH
Cal. Feet = __ __ __ __	Cal. Feet = __ __ __ __
Conv. Rate = __ . __ __ __	Conv. Rate = __ . __ __ __

IMPORTANT!	Whenever the radar angle to the ground is changed, the control box should be recalibrated by following the calibration procedure exactly. Increasing the "Cal. Feet" will decrease the conveyor speed and, therefore, decrease the yield.

OPERATING PROCEDURES CONTINUED

CONTROL BOX PROGRAMMING FLOWCHART

Figure 4 - Programming



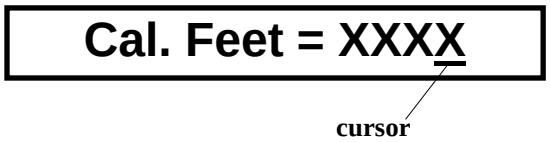
OPERATING PROCEDURES CONTINUED

CALIBRATION PROCEDURE

The control box must be calibrated before it can be used to spread accurately. If this is the first time the control box has been used with this particular truck or spreader, please follow the calibration procedure.

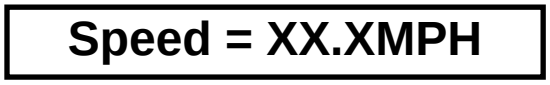
Step 1. Turn the power switch ON.

Step 2. Push MODE button repeatedly until the display shows "CAL. FEET."



Step 3. Use the SET button to set the calibration feet to 5280. Set the right hand digit to "0," then push the MODE button once to move the cursor left to the next digit. Set to "8," the next digit to "2," and the last digit to "5."

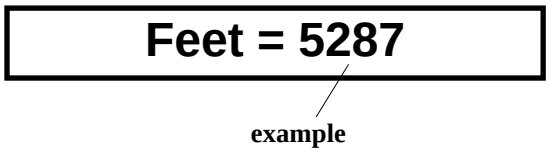
Step 4. Push the MODE button four more times to display speed.



Step 5. Push SET.

Step 6. Push SET again.

Step 7. Now drive the truck to the start of a measured one mile course. Press MODE to reset the odometer to zero. The display will show "Feet = XXXX." After a one second time delay, the display will return to showing the message "Counting Feet."
Drive the measured mile. At the end of the measured mile, press SET to display the message "Feet = XXXX." This is the number of feet that the radar has calculated you have driven. The program in the spreader control will use this number to compensate for calibration errors in the radar. Make a note of this number as you will need it in the next step.



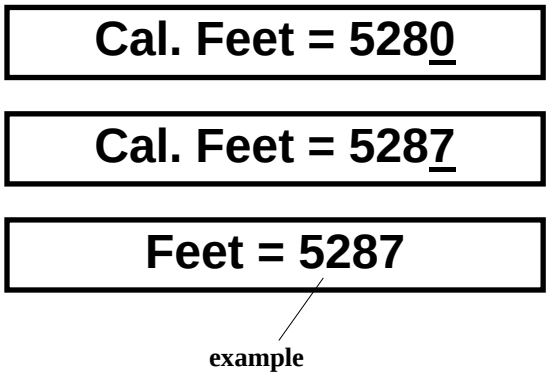
OPERATING PROCEDURE CONTINUED

CALIBRATION PROCEDURE CONTINUED

When using a radar unit, calibrate by driving over terrain similar to which will be spread. Calibrating over smooth surfaces, such as asphalt, and then spreading on rough surfaces such as farming terrain, may result in incorrect spreading. It is not necessary to have the conveyor ON/OFF switch in the ON position when calibrating the unit.

Repeat Step 7 three times and use the average.

Step 8. Turn the power switch OFF and back ON. Press Mode repeatedly until the message "CAL. FEET 5280" appears. Replace 5280 with the average number of the three test runs from Step 7.



Step 9. Drive over the measured mile again as in Step 7. This time the odometer should read within 25 feet of 5280. If it does not, the travel sensor may not be accurate.

IMPORTANT!	When repeating the calibration exercise, be sure to start over at Step 1.

Step 10. The calibration procedure is now complete, proceed to the programming procedures.

OPERATING PROCEDURES CONTINUED

PROGRAMMING PROCEDURE

Step 1. Turn the power switch ON. The message on the display will show "SPREADER CONTROL".

Spreader Control

Step 2. Enter the programming mode by pushing the MODE button. The message that appears will show either "FERTILIZER MODE" or "LIME MODE". Pressing the SET button changes from one mode to the other.

Lime Mode

Step 3. On DGPS-ready control, pushing the mode button again will show either "GPS MODE" or "NON GPS MODE." (If using standard control skip to Step 4.) Pushing the set button changes from one mode to the other.

GPS Mode

Step 4. Press the MODE button again to change the display to "FEEDGATE XX.XX". Program the feedgate opening in inches (opening height used while spreading). Pressing the MODE button will move the cursor to the left. Charts on pages 21 and 22 provide information on recommended gate settings for both fertilizer and lime.

Feedgate = XX.XX"

IMPORTANT! Be sure the feedgate is actually set to the value entered in the program at this step.

Step 5. After all the digits of the feedgate opening have been programmed, pushing the MODE button again changes the display to "MAT'L - XX.XX Lb." This is the density in pounds per cubic feet of the material to be spread. Enter in the same manner as previously done in the feedgate setting.

Mat'l = XXXX Lb.

Step 6. After the digits of the material weight have been programmed, pushing the MODE button again changes the display to "SPREAD WIDTH = XX'."
Enter the desired spread width in feet.

Spread Width = XX'

Step 7. After the digits of the spread width have been programmed, pushing the MODE button again changes the display to "YIELD = XXXX Lb/A" in fertilizer mode or "YIELD = XXXX Tons/A" in lime mode Enter the desired yield.

Yield = XXXX Lb/A

OPERATING PROCEDURES CONTINUED

Step 8. After the digits of the yield have been entered, pushing the MODE button again changes the display to "MAN. SPD. = XX.X.". This is a feature that can be used for pit dumping or for spreading if the radar fails. Enter the desired manual speed. Immediately after entering the last digit of the manual speed, the spreader control will calculate the corresponding conveyor speed. If the conveyor drag shaft speed is greater than 40 RPMs, the spreader control will beep and return to the beginning of the manual speed setting operation. A slower manual speed must be entered.

Man. Spd. = XX.X

Step 9. Pushing the MODE button again will display the "MANUAL = XX.X MPH" message to check the manual speed. At this screen, the conveyor toggle switch turns the conveyor on and off. This mode will be skipped over if the manual speed is set to 00.0 MPH or if the conveyor toggle switch is already in the ON position when you try to enter the mode.

Manual = XX.XMPH

IMPORTANT! A speed has to be entered for the unit to operate. 00.0 MPH will not work.

Step 10. Pushing the MODE button again will display the message "CAL. FEET - XXXX". A number will be entered which will be determined when calibrating the unit. See page 14. If the unit has not been previously calibrated, enter the number 5280.

Cal. Feet = XX.X

Step 11. Pushing the MODE button again will display the message "CONV.RATE = 0.XXX". This is the conveyor rate (CFR) which is the number to be entered based upon the type of conveyor and spreader model. See charts on pages 21 and 22. The procedure on pages 18 and 19 shows how to refine and calculate a very accurate number to program.

Conv. Rate = 0.XX

Step 12. Pushing the MODE button one last time will automatically go to the spreading mode.

Speed = XX.X MPH

IMPORTANT! If the mode is set to “GPS MODE” and the Mark III is not connected to a computer, the “YIELD = __ __ __ __ Lb/A" reading will display the maximum yield rate. The unit must be in “NON GPS MODE” to spread properly without a computer connected and controlling the Mark III.

OPERATING PROCEDURES CONTINUED

ADJUSTING THE CFR VALUE

Before the actual CFR value can be determined, it is necessary to calibrate the Cal. Feet value in the control box program. To insure the greatest accuracy possible, be sure to follow these methods.

1. Be sure that the number of Cal. Feet is determined as outlined in this manual on pages 14 and 15.
2. Be sure the feedgate is accurate by measuring the depth of material on the conveyor.
3. For material weight, use a balance scale (HECO part #58897) or equivalent to determine the actual weight per cubic foot of material.
4. Check the control box program for the correct yield setting.
5. See the chart for the correct theoretical rate to start. (See pages 21 and 22.)

The next steps must be done while the machine is in operation, using a field of twenty (20) acres or more of square flat land.

IMPORTANT! The function knob must be fully engaged before spreading. See page 20.

6. Load the spreader with the correct amount of material to spread one half (1/2) the acres at half the rate. For example, in a twenty (20) acre field with a desired rate of 400 pounds per acre, plan to spread ten (10) acres at 200 pounds per acre. This would require 2,000 pounds of material in the hopper.
7. Proceed to the field and spread all of the material. Observe when the spreader empties out and note the acres actually spread.
8. Use the following formula to adjust the conveyor rate:

$$\frac{\text{ACRES PLANNED}}{\text{ACTUAL ACRES}} \times \text{CONVEYOR RATE} = \text{ADJUSTED CONVEYOR RATE}$$

EXAMPLE: Assume a L2020GT with a # 5 belt conveyor is used. The CFR value to use is .237

$$\frac{\text{10 ACRES PLANNED}}{\text{12 ACRES ACTUAL}} \times .237 = .197$$

In this example, the adjusted conveyor rate would be .197. With the adjusted value inserted into the program, the Conv. Rate should now correct the conveyor speed to a more accurate rate. By repeating steps one and two, the machine should now spread the ten (10) acres planned.

To correct the shortage on the first load, note that 10/12 = .83 or 83% of the load was spread on the planned ten (10) acres. This means it was 17% light or (.17 x 200 pounds per acre = 34) thirty-four (34) pounds per acre light.

OPERATING PROCEDURES CONTINUED

To cover the entire twenty (20) acres accurately:
1.) Load the remaining 6000 pounds of fertilizer.
2.) Reset the acre counter.
3.) Spread the first twelve (12) acres at a rate of 234 pounds per acre. Then reset the application rate to 400 pounds per acre for the remaining eight (8) acres. When the acre counter reaches twenty (20) acres, the hopper should also be out of product.

This example is for fertilizer. However, the same procedure will apply to lime or other products with different flow characteristics.

SPREADING MODE

Once in the "SPREADING MODE", there is no way to get to the "PROGRAM MODE" without turning the control box off and back on. This is to prevent changing any of the variables while spreading. If after setting the variables for either "FERTILIZER MODE" or "LIME MODE", you would now like to set the variables for the opposite mode, turn the power switch ON and then OFF, then press the MODE button.

To enter into the spreading mode from the "SPREADER CONTROL" message, press the SET button. The first message to appear after entering the spreading mode will be "SPEED = X.X MPH". This is a speedometer to show your truck speed in miles per hour.

Pressing the SET button once more displays "COUNTING FEET". Pressing the MODE button when the display shows "COUNTING FEET" clears the feet count to zero. This is an odometer which was used in an earlier step to calibrate your radar travel sensor. After calibration, this odometer will accurately measure your distance traveled in feet. Read the odometer by pressing the SET button to display "FEET = XXXX", the odometer does not stop, but continues to count the number of feet traveled. Pressing the MODE button will re-read the odometer and display the current distance traveled since last clearing the odometer.

Pressing the SET button again shows the YIELD = X.XX message that displays either pounds per acre or tons per acre, depending on the material mode (FERTILIZER MODE or LIME MODE).

Turning the RATE knob changes the yield. When spreading in the LIME MODE with very small yields (less than 0.10 tons per acre), the "YIELD" display may not change with every click of the switch, however the actual spreading rate will be correct. Anytime the RATE knob is turned, the display changes to the YIELD = 0.00’ message to show the rate that is currently being spread, no matter what other message has previously been shown. One more push of the SET button returns to the speedometer.

If the speed at which the spreader control can accurately operate is exceeded, the message "SLOW DOWN" will appear and the beeper sounds. This message indicates that the conveyor reached the maximum conveyor shaft speed of 40 RPM, which means the material being spread is at a lower rate per acre than the programmed value. Slow down to again spread accurately. The display will return to the previous message and the beeper will stop.

The radar speed sensor is accurate up to 25 MPH. An improper sensor cannot be detected by the spreader control, no warning can be displayed by the spreader control.

To exit the spreading mode and re-enter the setup mode, turn the power switch OFF and ON, then press the MODE button

FUNCTION KNOB

The function knob is located above the conveyor gear case adjacent to the hydraulic Synco-Matic® control valve. **THE FUNCTION KNOB MUST BE ENGAGED WHILE SPREADING**. Disengage for pit dumping or diagnostic purposes only.
NOTE: Pit dumping is more efficient by using the in-cab control box. To engage the function knob, push in toward the valve while turning the knob to align the pin with the slot. When the pin and slot align, the spring and ball detent will secure this position. **Do not force!**

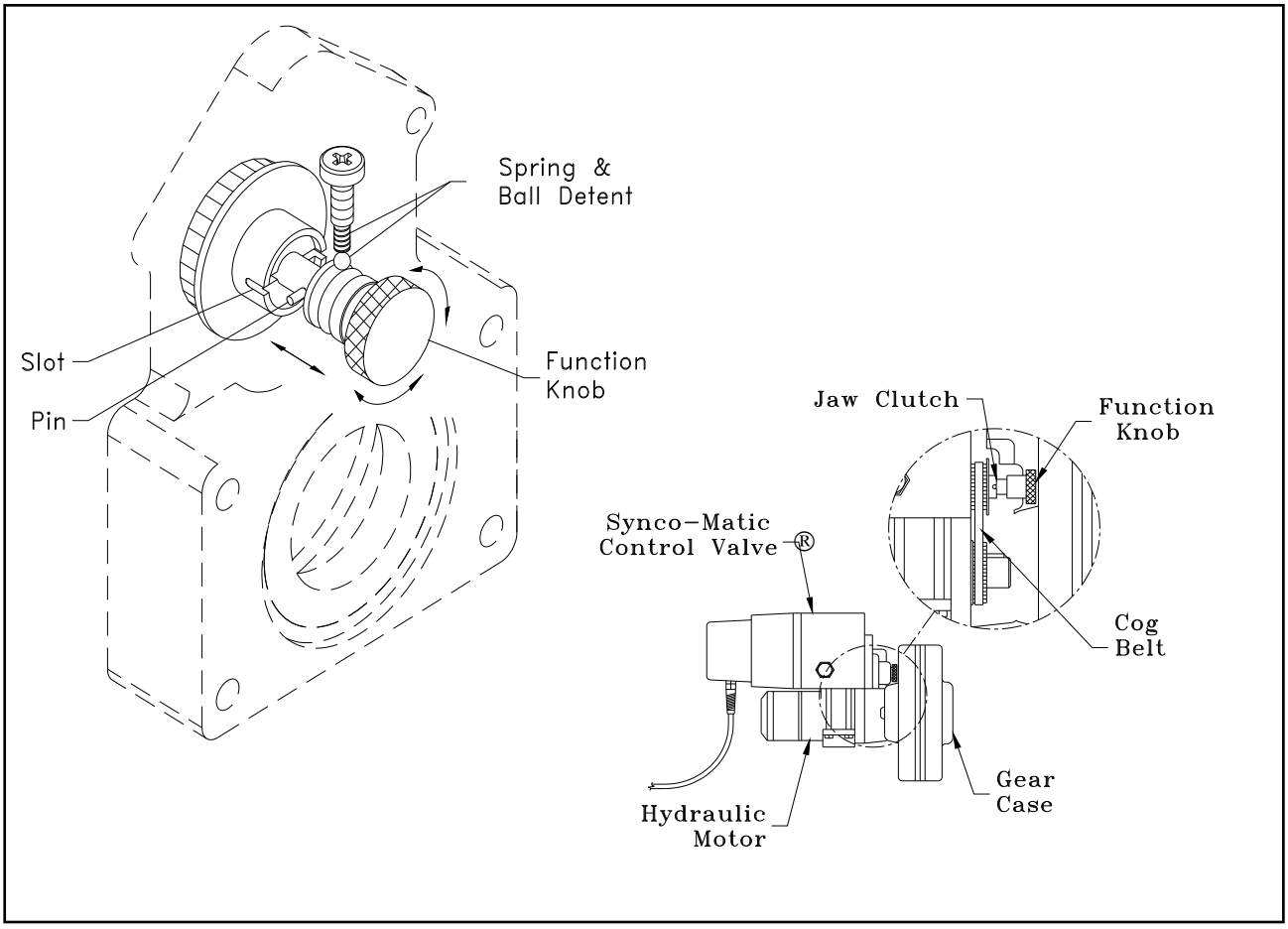


Figure 5 - Function Knob

CHARTS

NOTE: The following charts are only examples. Complete the equation to find the correct feedgate opening and recommended operating range.

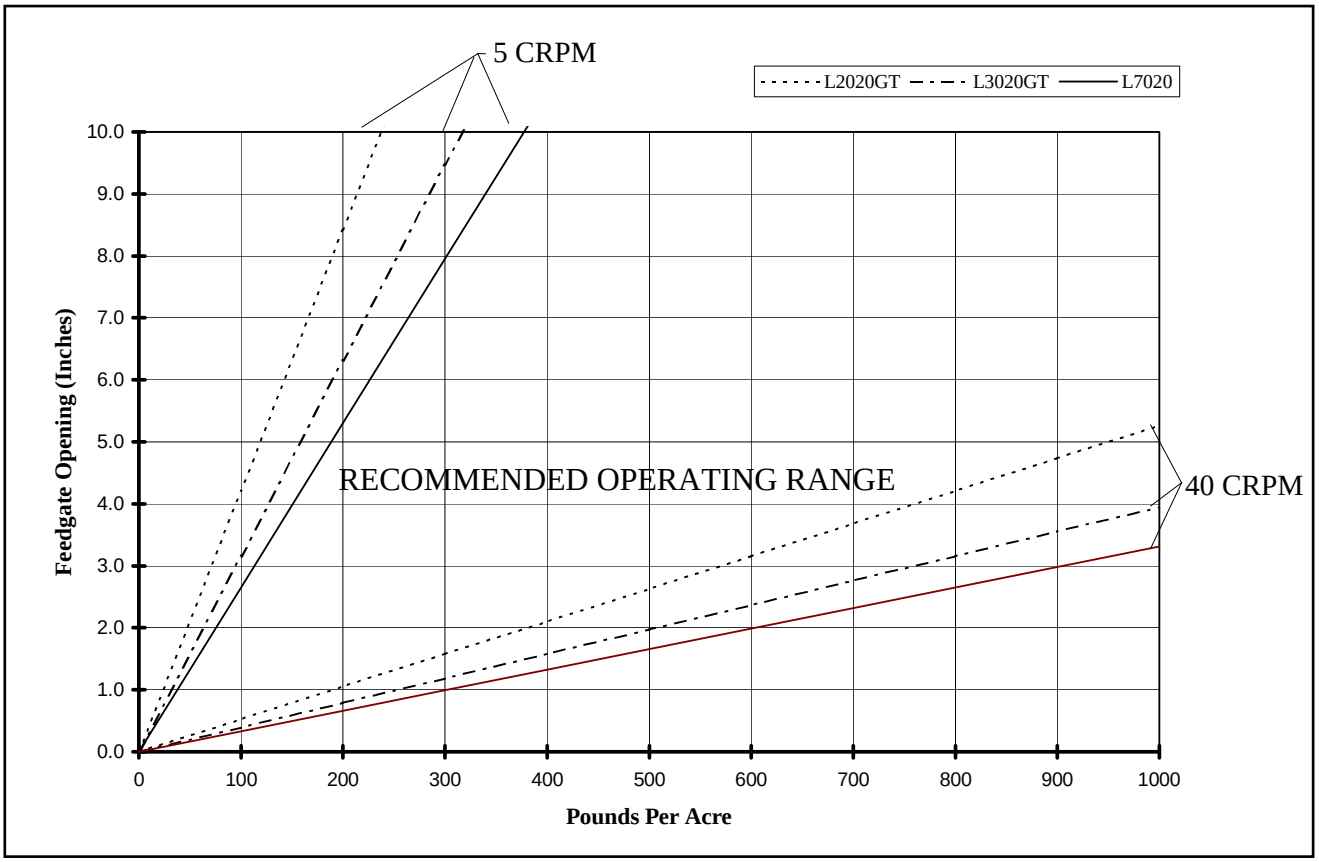
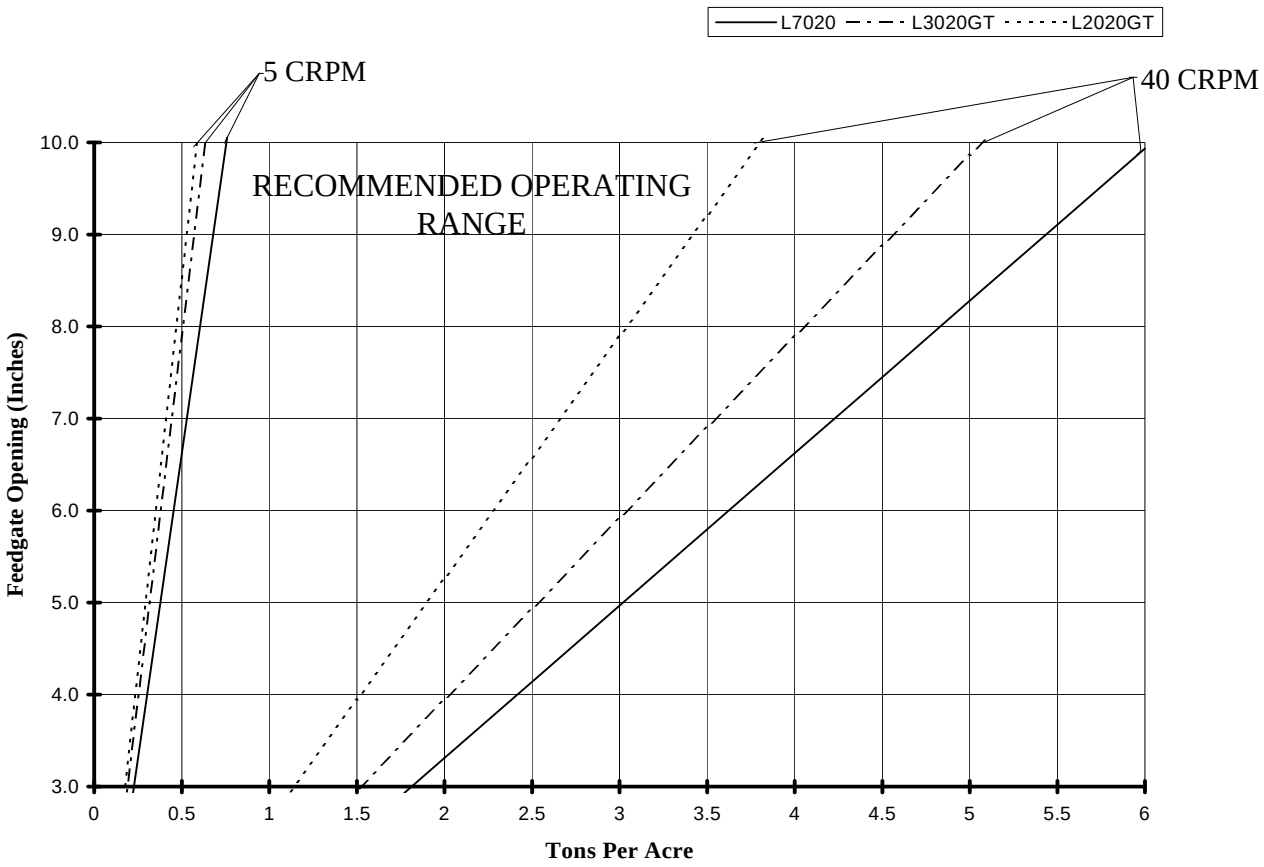


Figure 6 - Fertilizer Application Rates

CHARTS



EQUATION TO FIND FEEDGATE OPENING:

$$G = \frac{Y \times SW \times MPH}{495 \times CRPM \times MW \times CFR}$$

G = Feedgate Opening (Inches)
Y = Yield (Pounds per Acre)
SW = Spread Width (Feet)
MPH = Average Speed in Miles per Hour
CRPM = Conveyor Shaft Revolutions per Minute
MW = Material Weight (Pounds per Cubic Foot)
CFR = Conveyor Rate

Figure 7 - Lime Application Rates

SYNCO-MATIC® CONTROL VALVE REPLACEMENT

SYNCO-MATIC® CONTROL VALVE - REMOVAL

Repairs to the control box and valve assembly require special techniques and should not be attempted in the field. The complete unit should be removed in one piece and returned to your dealer for repair or replacement. The following instructions cover removal (Figure 8):

1. Thoroughly clean Synco-Matic® unit and area around it.

NOTE: Do Not use a high pressure hose!

2. Disconnect cable plug at "A" and remove.
3. Remove two hydraulic hose connections at top of Synco-Matic® control valve at "B". Cap holes to keep dirt out of valve.
4. Loosen four capscrews in saddle under hydraulic motor at "C".
5. Remove two allen head screws from the cog belt housing at "D".
6. Holding unit in both hands, move up and down to release from any sealing between unit and other parts and remove by drawing off motor.

REPLACEMENT

1. Using clean wiping cloth and a non-toxic, non-flammable degreasing solvent, thoroughly clean mating surfaces between Synco-Matic® control valve, hydraulic motor, and cog belt housing.
2. Replace "O" rings in hydraulic motor ports. Be sure threaded inset sleeves in motor ports are slightly below flush with the surface. These sleeves must not protrude at all. Do not push "O" rings into slot at motor port. "O" rings should only be set on top of slots. The valve body will seat them when installed.
3. Apply a narrow line of sealing compound around edges of cog belt housing and flat upper surface of motor where the Synco-Matic® control valve will seat. Do not overuse sealing compound.
4. Slip unit into place on motor and into cog belt housing, being sure shaft engages cogged pulley in cog belt housing and shaft slot engages cross pin.
5. Start four capscrews through saddle and into underside of Synco-Matic® control valve.
6. Tighten the two allen head screws at "D" and then uniformly tighten the four capscrews at "C". Torque to 18 ft.-lbs.
7. Reconnect hydraulic hoses at "B".
8. Reconnect cable plug at "A".
9. Road test unit to check for proper functioning.

SYNCO-MATIC® CONTROL VALVE REPLACEMENT CONT'D

REMOVAL OF COMPLETE SYNCO-MATIC® CONTROL VALVE WITH CONVEYOR GEAR CASE ASSEMBLY

1. Thoroughly clean Synco-Matic® unit and area around it.
   NOTE: Do Not use a high pressure hose!
2. Disconnect cable plug at "A" and remove.
   Remove two (2) hydraulic hose connections at top of Synco-Matic® control valve. Cap holes to keep dirt out of valve.
4. Drain gear case oil.
5. Remove the conveyor gear case torque arm pin. If using twin pinion gear case remove pipe plug from the center and remove allen head screw from the conveyor drive shaft through plug hole.
6. Slide the complete assembly off the conveyor drive shaft.
7. Reverse steps to reinstall. Carefully position the key inside the gear case before installation. The key must line up with the shaft or the conveyor will not operate

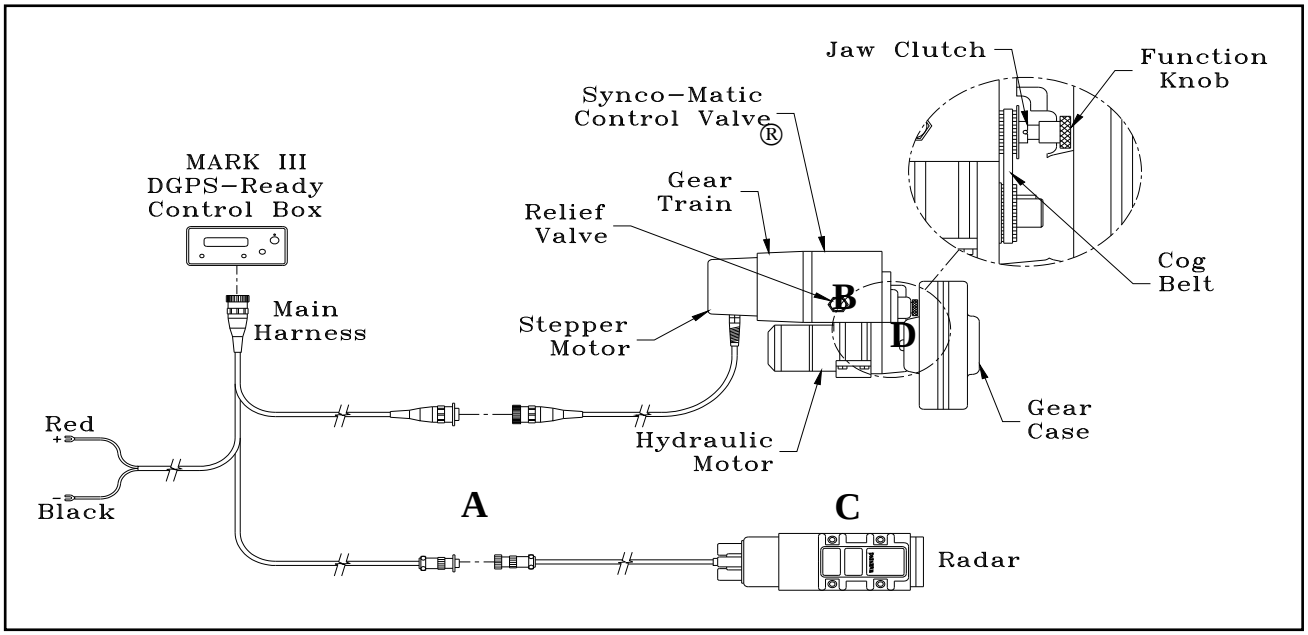


Figure 8- Synco-Matic® Assembly

TROUBLESHOOTING

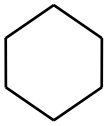
SYMPTOM	REASON
Power switch is turned ON, but display is blank.	1. Blown fuse. 2. Power leads not connected. 3. Dead vehicle battery. 4. Unit too cold. (Below -4° F.)
Power switch is turned ON, pushing SET displays MAN. SPD. = XX.X MPH, or beeps and stays at Spreader Control.	1. Incomplete program. 2. Check program values to be within limits.
Program skips from MAN. SPD. = XX.X MPH to CAL. FEET = XXXX.	Conveyor switch must be OFF to enter MANUAL XX.X MPH.
Program will not advance beyond display MAN. SPD. = XX.X MPH.	1. Program required more than 50 Conveyor Revolutions Per Minute. Program lower MPH or larger feedgate opening value. 2. Incomplete program.
Display reads SLOW DOWN and beeper sounds steadily.	1. Driving too fast. 2. Feedgate opening may need to be increased.
Display beeps intermittently.	1. PTO not engaged. 2. Defective or undersize hydraulic system components. 3. Function knob in manual position.
Display reads HYD. DRIVE OFF when spreading in GPS MODE.	1. Machine is in a zero rate area of application map. 2. Conveyor switch turned OFF.
Display fails to show reading in SPEED = XX.X MPH.	1. Radar cable improperly connected. 2. Faulty radar.
During programming, the display returns to SPREADER CONTROL.	1. Insure the actual feedgate opening matches program setting. 2. Check entire program for accurate values. 3. Check for proper CAL. FEET = XXXX. 4. Insure YIELD = XXXX Lb/A in program. Adjust with rate knob. 5. Adjust CONV. RATE = 0.XXX. 6. Faulty radar.
After programming, the display returns to SPREADER CONTROL.	Incomplete program.

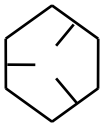
TROUBLESHOOTING

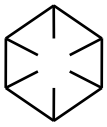
SYMPTOM	REASON
Problem completing program.	Turn power switch OFF and then back ON and start the program again.
Program in operation mode, but the conveyor does not move when the machine moves.	1. PTO not engaged. 2. Conveyor switch in OFF position. 3. Program has improper values. 4. Stepper motor unplugged.
Conveyor starts to run when PTO is engaged.	1. The built-in break in the stepper motor must be engaged as follows: Turn on the main power switch. Push SET button once. Turn ON the conveyor switch, drive the vehicle 10 feet, then turn OFF the conveyor switch. Control box power must be turned ON. Hydraulic pump flow too high.
Application rate per acre is incorrect.	1. Insure actual feedgate opening matches program setting. 2. Check entire program for accurate values. 3. Check for proper CAL. FEET = XXXX. 4. Insure for YIELD = XXXX Lb./A in program adjusts with rate knob. 5. Adjust CONV. RATE = 0.XXX. 6. Faulty radar.

STANDARD TORQUES NATIONAL COARSE (NC) CAPSCREWS

CAPSCREW GRADE IDENTIFICATION - MARKINGS ON HEAD

SAE GRADE 2  NO MARKINGS

SAE GRADE 5  THREE MARKS - 120 DEGREES APART

SAE GRADE 8  SIX MARKS - 60 DEGREES APART

USE GRADE 2 TORQUES FOR STAINLESS STEEL FASTENERS AND CARRIAGE BOLTS.

	TORQUE - FOOT / POUNDS					
CAPSCREW SIZE	GRADE 2		GRADE 5		GRADE 8	
	DRY	LUBE	DRY	LUBE	DRY	LUBE
1/4”	5	4	8	6	12	9
5/16”	11	8	17	13	25	18
3/8”	20	15	30	23	45	35
7/16”	30	24	50	35	70	55
1/2”	50	35	75	55	110	80
9/16”	65	50	110	80	150	110
5/8”	90	70	150	110	220	170
3/4”	100	120	260	200	380	280
7/8”	140	110	400	300	600	460
1”	220	160	580	440	900	650

INSTRUCTIONS FOR ORDERING PARTS

Order from the **AUTHORIZED DEALER** in your area.

1. **Always give the pertinent model and serial number of the spreader.**

2. **Give part name, part number and the quantity required.**

3. **Give the correct street address to where the parts are to be shipped, and the carrier if there is a preference.**

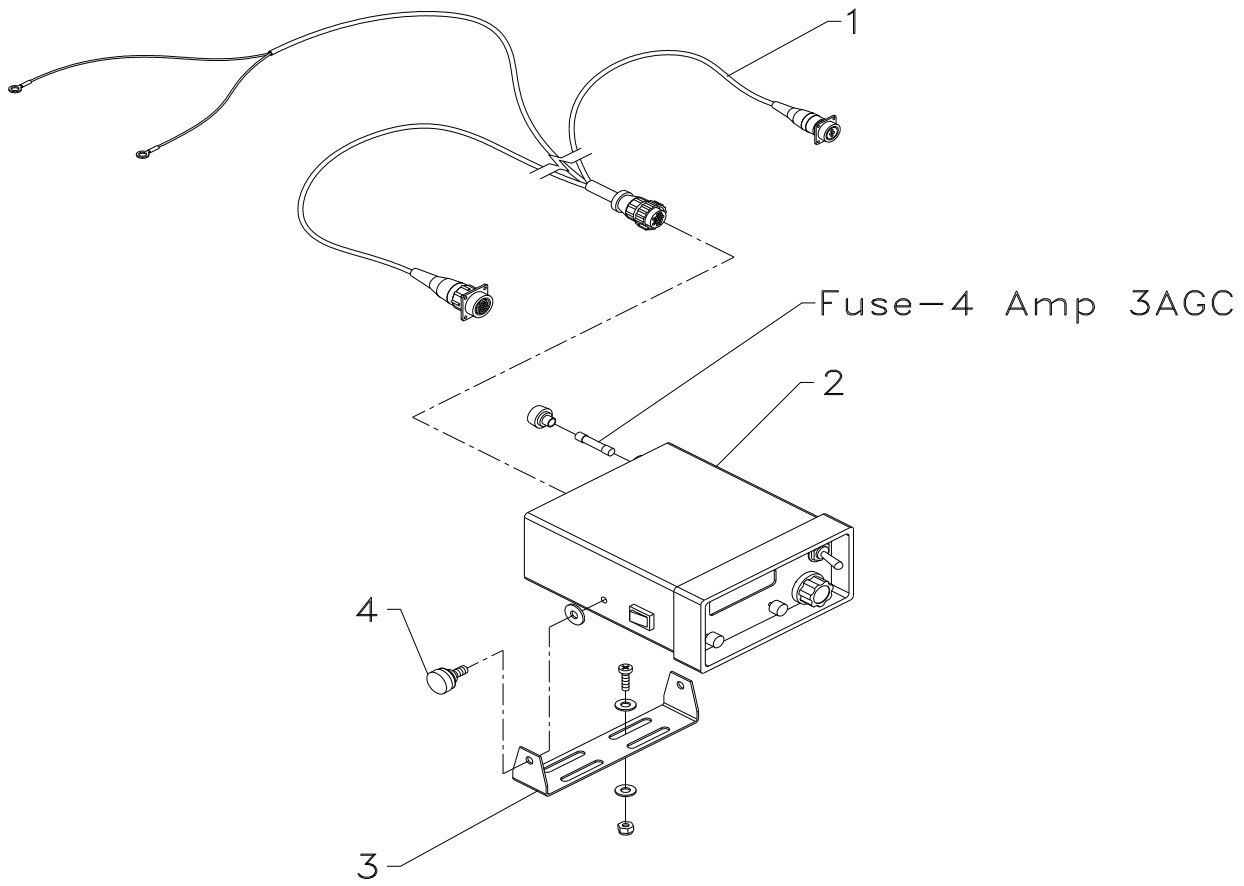
Unless claims for shortages or errors are made immediately upon receipt of goods they will not be considered. Any part returns should be directed through the dealer from which they were purchased.

When broken goods are received, a full description of the damage should be made by the carrier agent on the freight bill. If this description is insisted upon, full damage can always be collected from the transportation company.

No responsibility is assumed for delay or damage to merchandise while in transit. Our responsibility ceases upon delivery of shipment to the transportation company from whom a receipt is received showing that shipment was in good condition when delivered to them. Therefore, claims (if any) should be filed with the transportation company and not with Highway Equipment Company.

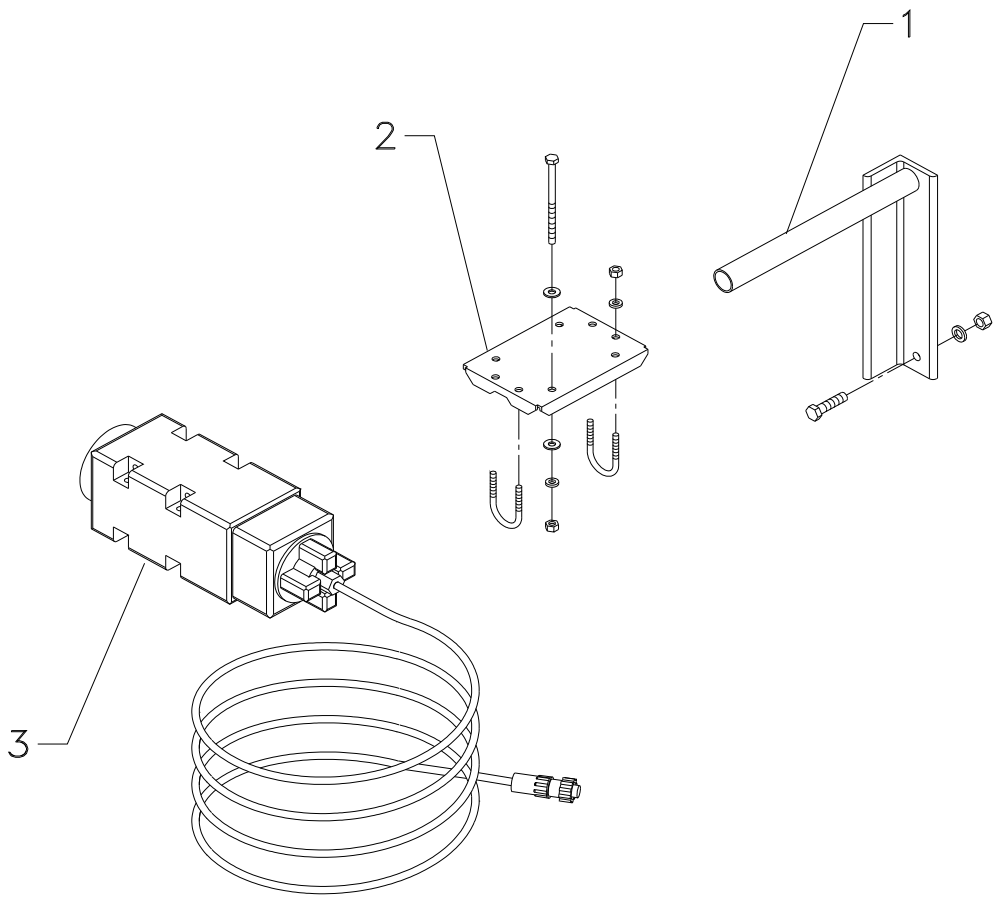
If your claims are not being handled (by the transportation company) to your satisfaction, please call the Parts Manager at Highway Equipment Company (319) 363-8281 for assistance.

CONTROL BOX



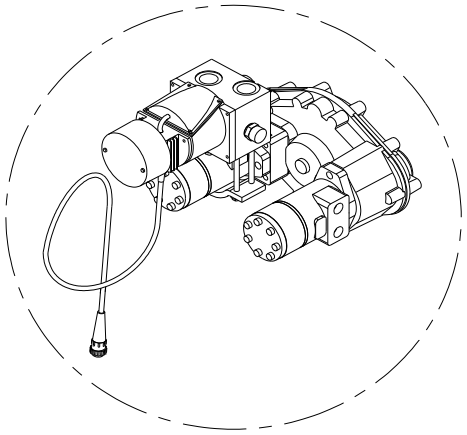
ITEM	PART NO.	DESCRIPTION	QTY
	81995	Kit - Mark III Control Box, DGPS-Ready	
	72829	Kit - Mark III Control Box, Not DGPS-Ready	
1	72803	Harness - Control Box	1
2	81996	Control Box - DGPS-Ready	1
	72802	Control Box - Not DGPS-Ready	1
	39199	Face - Decal, DGPS-Ready	1
	39198	Face - Decal, Not DGPS-Ready	1
3	72805	Bracket	1
4	72806	Kit - Hardware	1
		Screw - Thumb	2
		Screw - Machine	4
		Washer - Plastic	2
		Washer - Flat	8
		Nut - Hex, Lock	4

RADAR

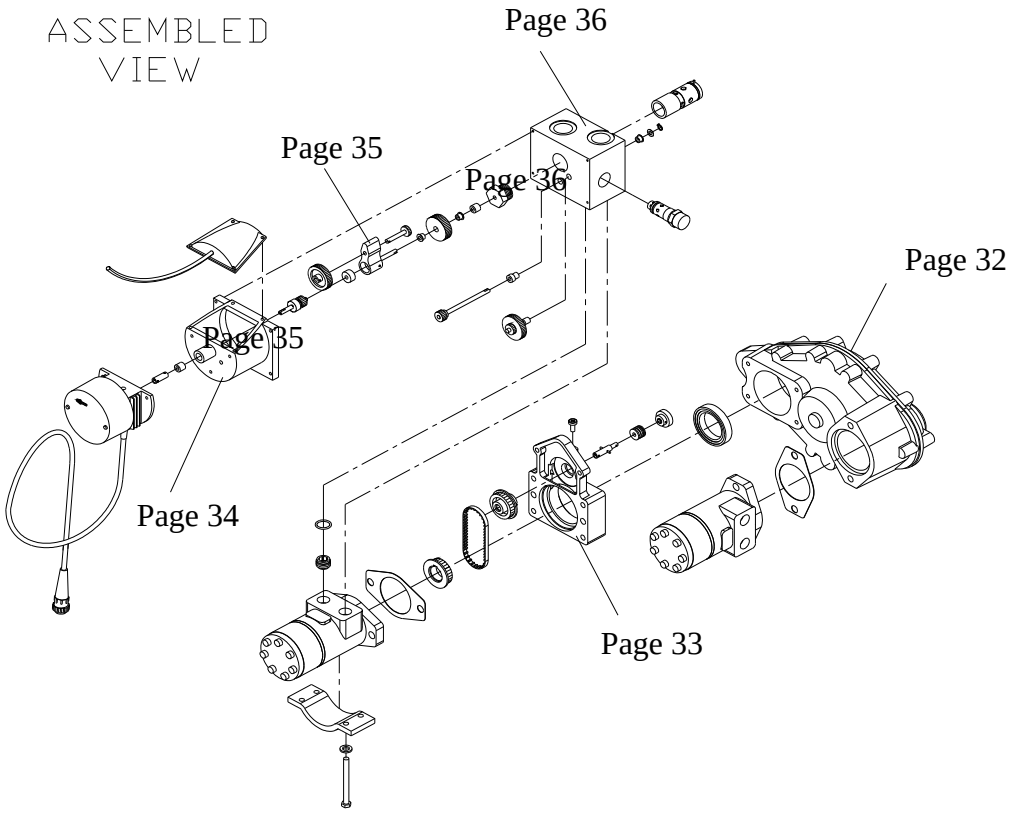


ITEM	PART NO.	DESCRIPTION	QTY
	79857	Kit - Radar Velocity Sensor	
1	79860	Kit - "L" Pipe Mounting Bracket	1
		"L" Pipe Mounting Bracket	1
		Screw - Cap, 3/8-16 x 1 1/2	2
		Washer - Lock, 3/8	2
		Nut - Hex, 3/8-16	2
2	79859	Kit - Mounting Bracket	1
		Mounting Bracket	1
		"U" Bolt	2
		Screw - Cap, 1/4-20 x 4	4
		Washer - Flat, 1/4	8
		Washer - Lock, 1/4	8
		Nut - Hex, 1/4-20	8
3	79858	Kit - Sensor	1
		Sensor	1
		Installation Instructions	1

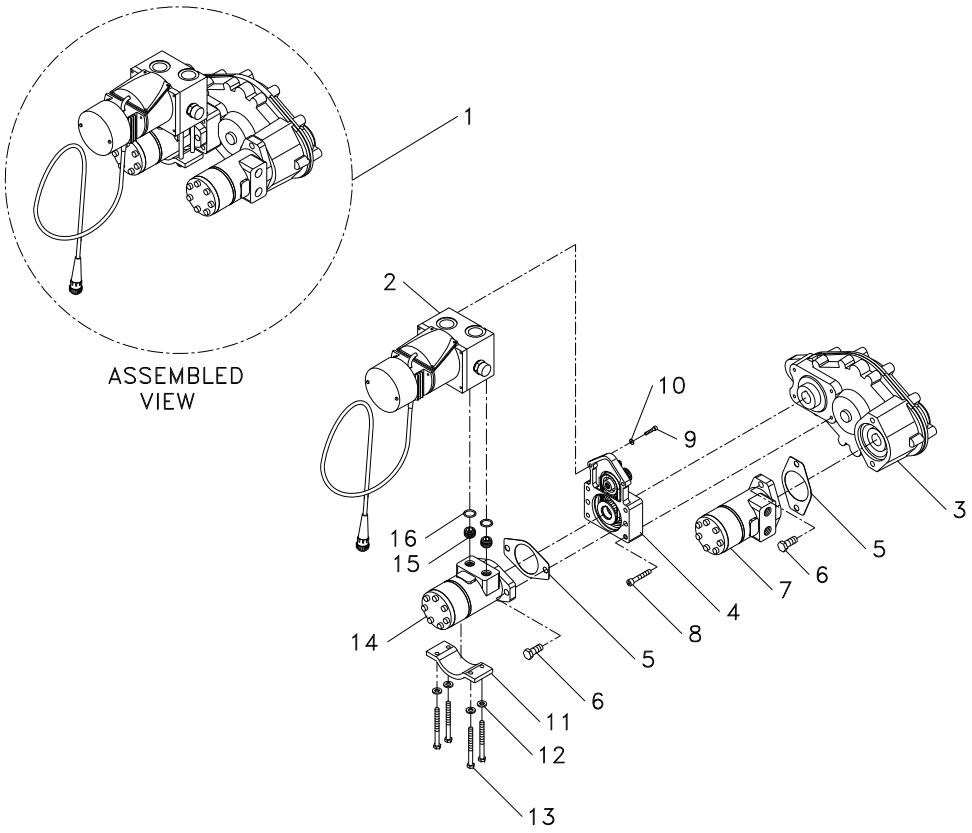
MARK III SYNCO-MATIC® CONTROL VALVE ASSEMBLY



ASSEMBLED VIEW

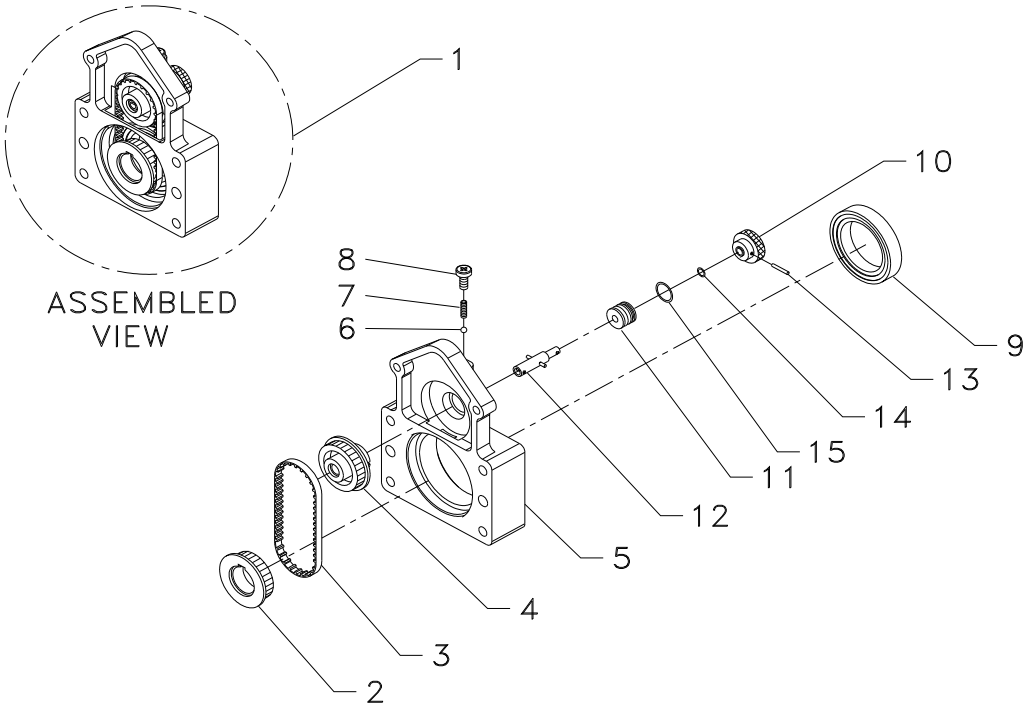


MARK III SYNCO-MATIC® CONTROL VALVE ASSEMBLY



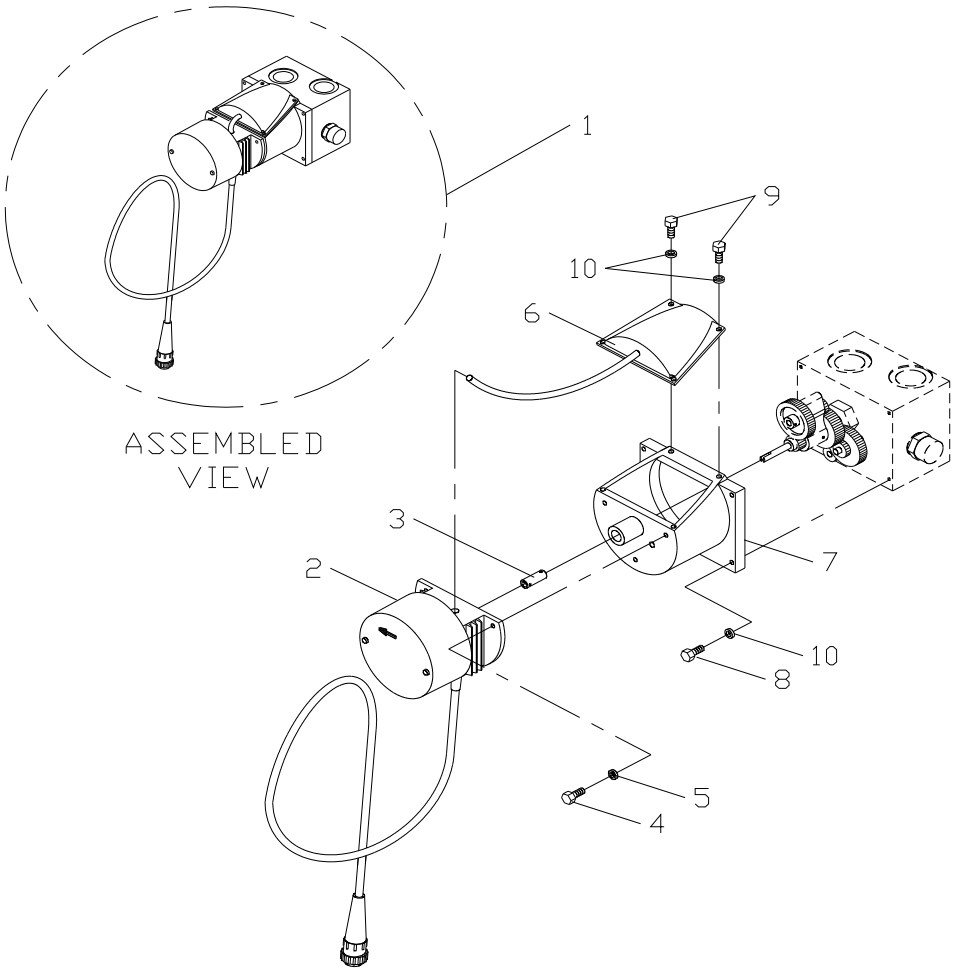
ITEM	PART NO.	DESCRIPTION	QTY
1	73325	Assembly - Drive, Single (Standard)	1
	82465	Assembly - Drive, Dual (Shown in Assembly)	1
2	73324	Body - Valve	1
3	43501	Gear Case - Single Pinion (Standard)	1
	55971	Gear Case - Dual Pinion (Shown in Assembly)	1
4	43503	Group - Cog-belt Drive	1
5	37005	Gasket	A.R.
6	20040	Screw - Cap	9
	20711	Washer - Lock	9
7	82459	Motor - Hydraulic, 1 1/4” (Dual Pinion)	A.R.
8	44456	Screw - Socket Head, 5/16 x 2	4
9	44454	Screw - Machine	2
	44442	Screw - Cap, Special	2
10	44451	Washer - Lock, 3/16	2
11	44407	Saddle - Motor	1
12	36419	Washer - Lock, 5/16	4
13	47277	Screw - Cap, 5/16 x 3 1/2	4
14	82462	Motor - Hydraulic, 1 1/4” Modified (Dual Pinion)	1
	46395	Motor - Hydraulic, 1 1/2” (Single Pinion)	1
15	44409	Port Adapter	2
16	29854	“O” Ring	2

SUB-ASSEMBLY - SYNCO-MATIC® CONTROL VALVE
COG-BELT DRIVE



ITEM	PART NO.	DESCRIPTION	QTY
	43503	Group - Cog-belt Drive	
1	44438	Assembly - Adapter	1
2	44440	Pulley - Drive	1
3	44439	Belt - Timing	1
4	44441	Pulley - Timing	1
5	44443	Adapter	1
6	44418	Ball	1
7	44417	Spring	1
8	44498	Screw	1
9	44445	Seal	1
10	44421	Knob	1
11	44444	Clutch - Bushing	1
12	44446	Clutch - Shaft	1
13	44463	Pin - Roll	1
14	29872	Ring - Quad	1
15	29875	“O” Ring	1

SUB-ASSEMBLY - SYNCO-MATIC® CONTROL VALVE HOUSING AND INPUT DRIVE

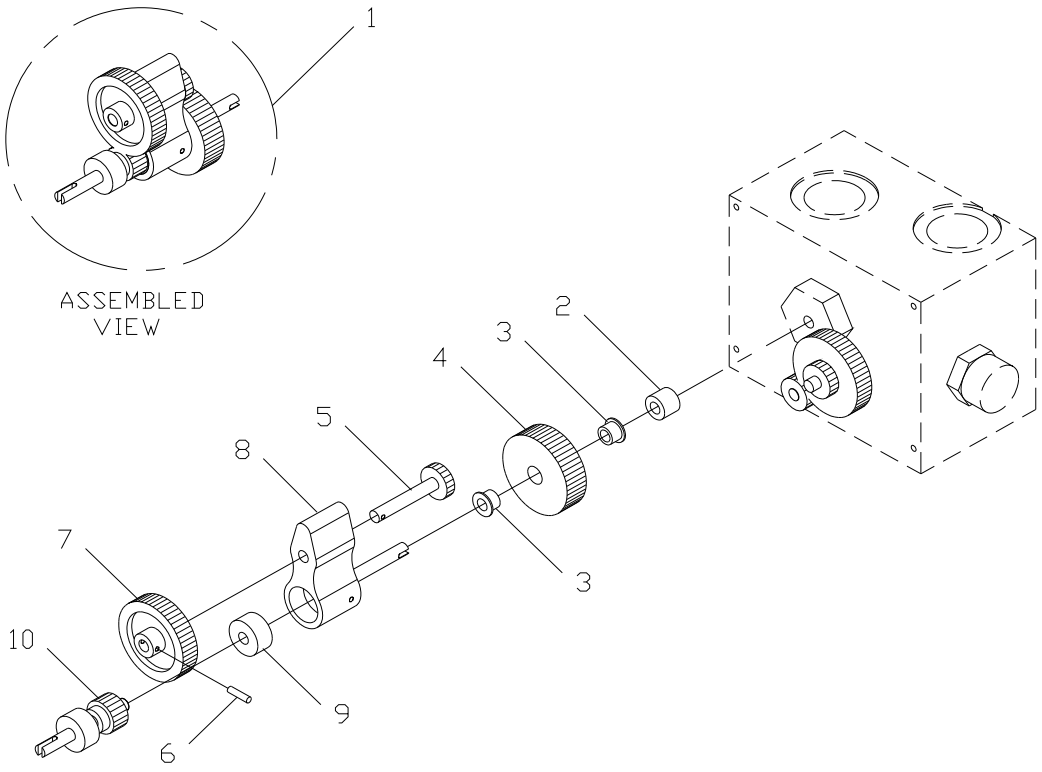


ITEM	PART NO.	DESCRIPTION	QTY
1	73324	Assembly - Valve	1
	72807	Assembly - Input Drive with Cap (Includes Items 2 - 6)	1
2	72831	Drive - Input	1
3	72337	Coupler - Drive	1
4	42408	Screw - Machine	3
5	20724	Washer - Seal	3
6	72832	Assembly - Cap, 2-Wire	1
	44413	Cap	1
7	44412	Housing - Bell	1
8	44453	Screw - Machine	4
9	44452	Screw - Machine	4
10	44451	Washer - Lock, 3/16	8
	* 8396	Cap - Plastic (Top)	2
	* 29341	Cap - Plastic (Bottom)	2

* - Not Shown

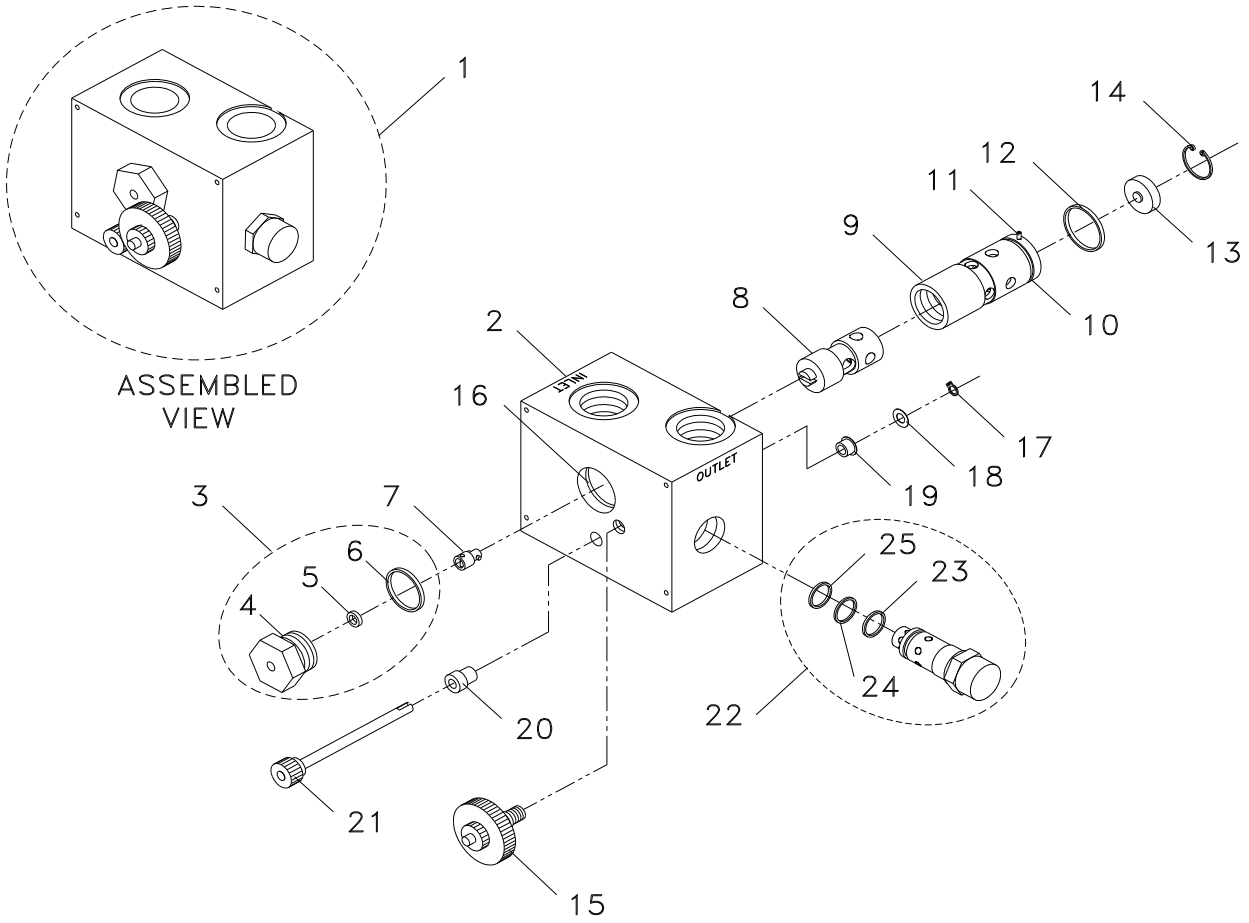
ALWAYS USE GENUINE PARTS - PLEASE GIVE PART NO., DESCRIPTION AND UNIT SERIAL NO.

SUB-ASSEMBLY - SYNCO-MATIC® CONTROL VALVE
IDLER



ITEM	PART NO.	DESCRIPTION	QTY
1	44411	Assembly - Idler	1
2	44431	Spacer	1
3	44433	Bushing	2
4	44434	Gear - Resolve	1
5	44428	Assembly - Gear	1
6	44461	Pin - Roll	1
7	44432	Gear	1
8	44429	Assembly - Idler Arm	1
9	44435	Bearing (One Each Included in Items 8 and 10)	2
10	44430	Assembly - Two-speed Input Shaft	1

SUB-ASSEMBLY - SYNCO-MATIC® CONTROL VALVE
VALVE BLOCK



ITEM	PART NO.	DESCRIPTION	QTY
1	53715	Assembly - Valve Body (2000 PSI)	
2	44424	Valve Body	1
	44423	Assembly - Spool & Liner (Includes Items 3 - 14)	1
3	44427	Assembly - Plug (Includes Items 4 - 6)	1
4	N.S.	Plug - Spool	1
5	29872	Ring - Quad	1
6	29855	"O" Ring	1
7	44426	Assembly - Shaft - Coupling	1
8	N.S.	Assembly - Spool	1
9	N.S.	Liner - Spool	1
10	29874	"O" Ring	1
11	44457	Pin - Roll	1
12	29862	"O" Ring	1
13	N.S.	Disc - Spool End	1

N.S. - Not Serviced

SUB-ASSEMBLY - SYNCO-MATIC® CONTROL VALVE
VALVE BLOCK CONTINUED

ITEM	PART NO.	DESCRIPTION	QTY
14	44425	Ring - Snap	1
15	44447	Assembly - Idler Gear With Shoulder Bolt	1
16	24544	"O" Ring	3
17	44464	Ring - Snap	1
18	44449	Shim	1
19	44433	Bushing	1
20	44450	Bushing	1
21	44448	Assembly - Motor Input Shaft	1
22	44402	Assembly - Relief Cartridge (Includes Items 22 - 24)	1
23	29854	"O" Ring	2
24	29871	Ring - Back Up	1
25	29876	"O" Ring	1