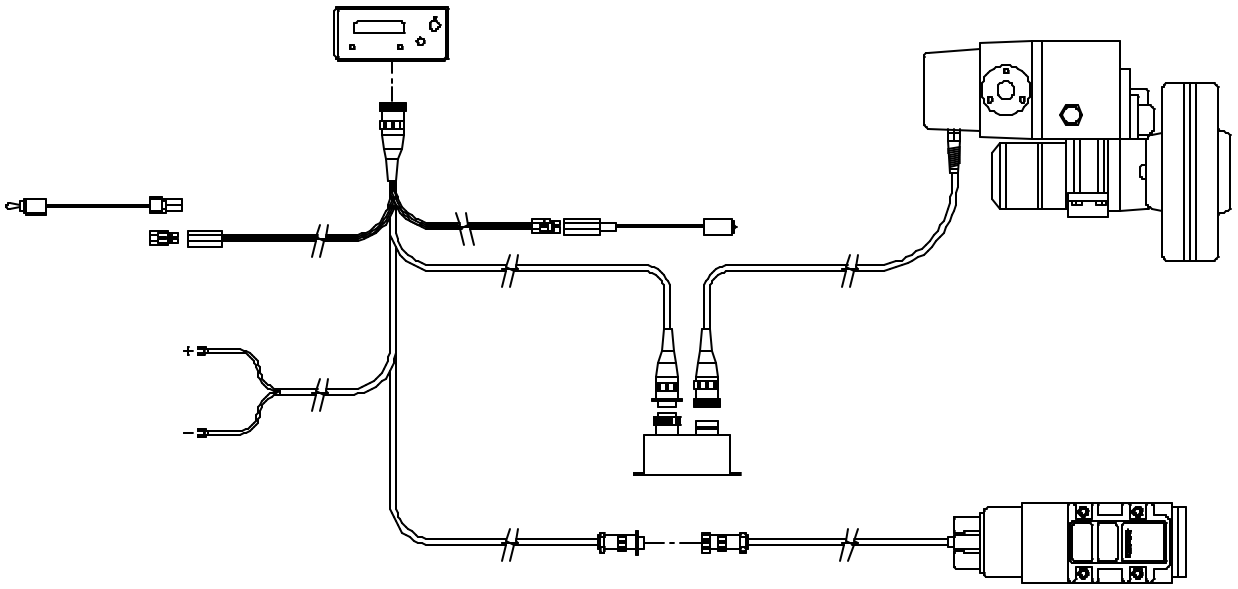
NEW LEADER *HIGHWAY EQUIPMENT COMPANY*

GENERAL MANUAL FOR

MARK IV.2
DGPS-READY



SAFETY GUIDELINES
ASSEMBLY
OPERATION
TROUBLESHOOTING
PARTS LIST

IMPORTANT: READ THE SAFETY GUIDELINES AND ALL INSTRUCTIONS CAREFULLY BEFORE OPERATING

HIGHWAY EQUIPMENT COMPANY - NEW LEADER DIVISION
1330 76TH AVE SW, CEDAR RAPIDS, IOWA 52404-7052
PH. (319) 363-8281 FAX (319) 632-3081
www.highwayequipment.com

NEW LEADER

MODEL MARK IV.2 DGPS-Ready

UNIT SERIAL NUMBER_____

MANUAL NUMBER: 84946-A

EFFECTIVE 3/99

HIGHWAY EQUIPMENT COMPANY
1330 76TH AVE SW
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PHONE (319) 363-8281 ***FAX (319) 632-3081***

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LIMITED WARRANTY

BASIC WARRANTY

HIGHWAY EQUIPMENT COMPANY ("Highway") has manufactured or is distributing the equipment to which this warranty is attached, and warrants to it's 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, Highway 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 Highway 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 Highway determines that the defect is due to Highway's material or workmanship, Highway will, within a reasonable time after such notification, repair such defect during normal working hours, at 616 D Avenue NW, Cedar Rapids, Iowa, or such other location as Highway 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 non-Highway manufactured parts in the equipment 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.

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 thirteen (13) months from the date of delivery to the original user. For any equipment that does not conform to the aforesaid warranty within thirteen (13) months from the date of delivery, Highway will, at its option, send you a new part, or give you full credit for the part, provided the replacement part is purchased through Highway. Labor costs for this extended warranty coverage will be paid by Highway at the Dealer's 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 Highway before the expiration of the warranty period. If Highway determines that the defect is due to Highway's material or workmanship, Highway will, within a reasonable time after such notification, repair such defect during normal working hours, at 616 D Avenue NW, Cedar Rapids, Iowa, or such other location as Highway may designate. In the event of repair or replacement, the warranty period shall not be extended beyond the original warranty period. **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, this 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 non-Highway manufactured parts are installed on the equipment.

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
(1) defects or inefficiency of parts or units 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-manufactured parts in 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 eighteen (18) months following delivery of the equipment to the original user. This warranty is limited to the United States and Canada.

These warranties are extended only to the original dealer and are not transferable. In the event of a warranty claim, you should promptly notify Highway by calling 1-800-363-1771, 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.

A representative of Highway will contact you regarding instructions for repair, replacement, or refund, if the warranty claim can be validated.

Effective with equipment delivered to original user on or after January 1, 2001.

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 Highway Equipment Company Service Department in Cedar Rapids, Iowa, 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 machine 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 machine.

We urge you to protect your investment by using genuine New Leader 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

CAUTION

If spreader is used to transport chemicals, check with your chemical supplier regarding DOT (Department of Transportation) requirements.

GENERAL DESCRIPTION

Mark IV.2 DGPS-Ready
30 Gallon Per Minute Ground Speed Control System for the L2020GT
40 Gallon Per Minute Ground Speed Control System for the L3020GT

The Mark IV.2 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 following these steps:

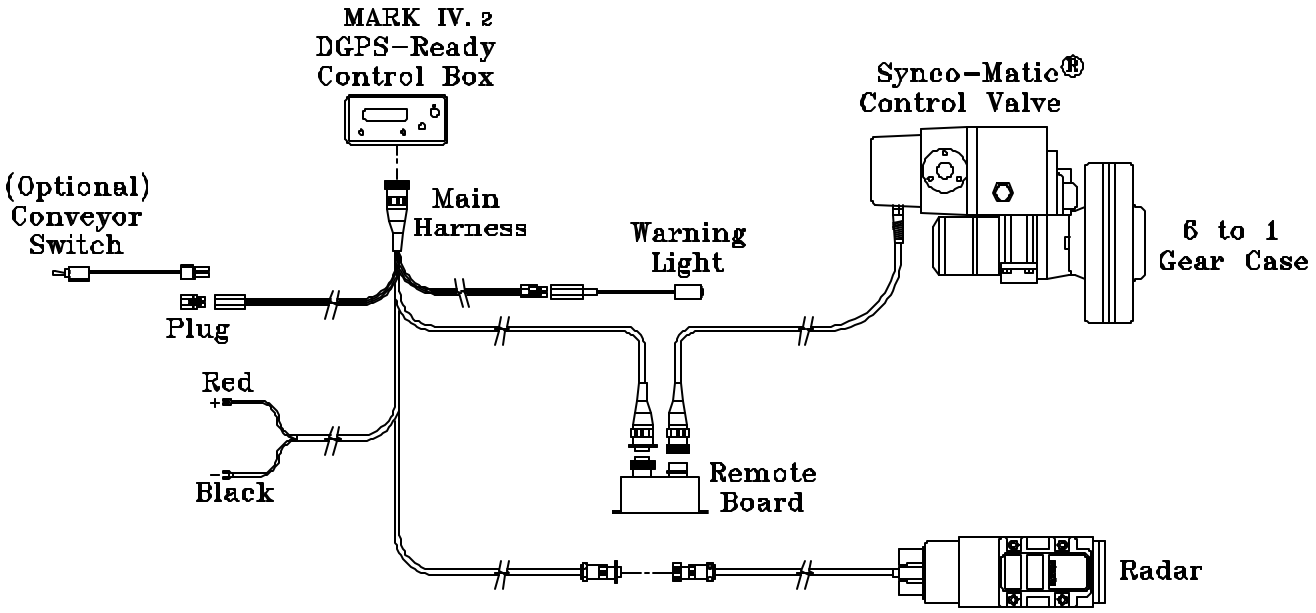
1. A Differential Global Positioning Systems (DGPS) signal is received by a computer and interpreted by Global Information Systems (GIS) software. DGPS is a precise latitude and longitude derived from signals received from orbital and stationary satellites. This hardware and software is not included in the Mark IV.2 system.

2. The GIS software in turn informs the Mark IV.2 control box of the material application rate using the location and mapped field requirements.

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

4. The control box then controls a 30-40 gallon per minute control valve. The control valve regulates the amount of hydraulic oil flow through the hydraulic motor(s) driving a 6 to 1 ratio conveyor gear case.

The Mark IV.2 can also be operated without the DGPS system with the application rate adjusted manually. The application rate when used with a L3020GT spreader can vary from 100 pounds of fertilizer per acre to over 6 tons of lime per acre. When used with a L2020GT spreader, the application rate can vary from 75 pounds of fertilizer per acre to over 4 tons of lime per acre.



INSTALLATION INSTRUCTIONS

CONTROL BOX

Mount the control box inside the truck cab either on or under the dash or in some other location accessible to the operator without obstructing or diverting 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 as possible from any two-way radios. 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 firewall to run the cable from the control box back to the Mark IV.2 unit on the conveyor gear case, and also to the radar unit if required.

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.

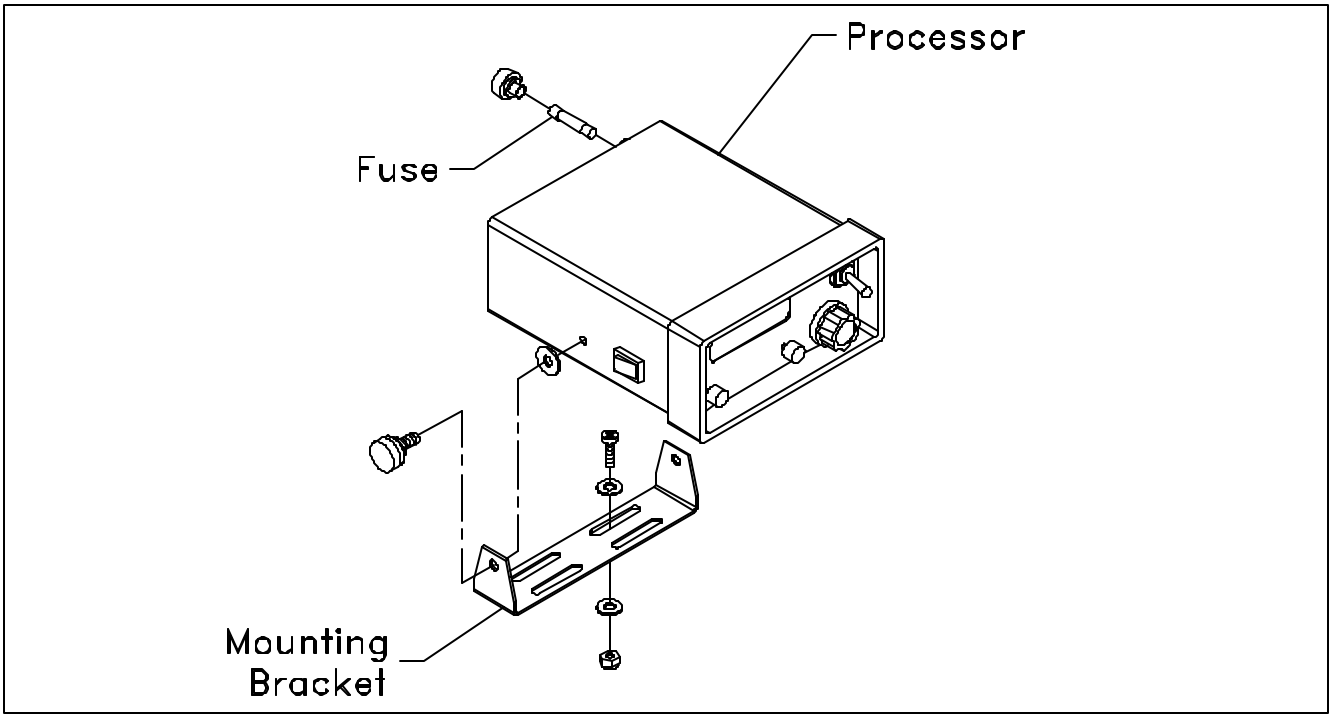


Figure 1 - Control Box Installation

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 3)

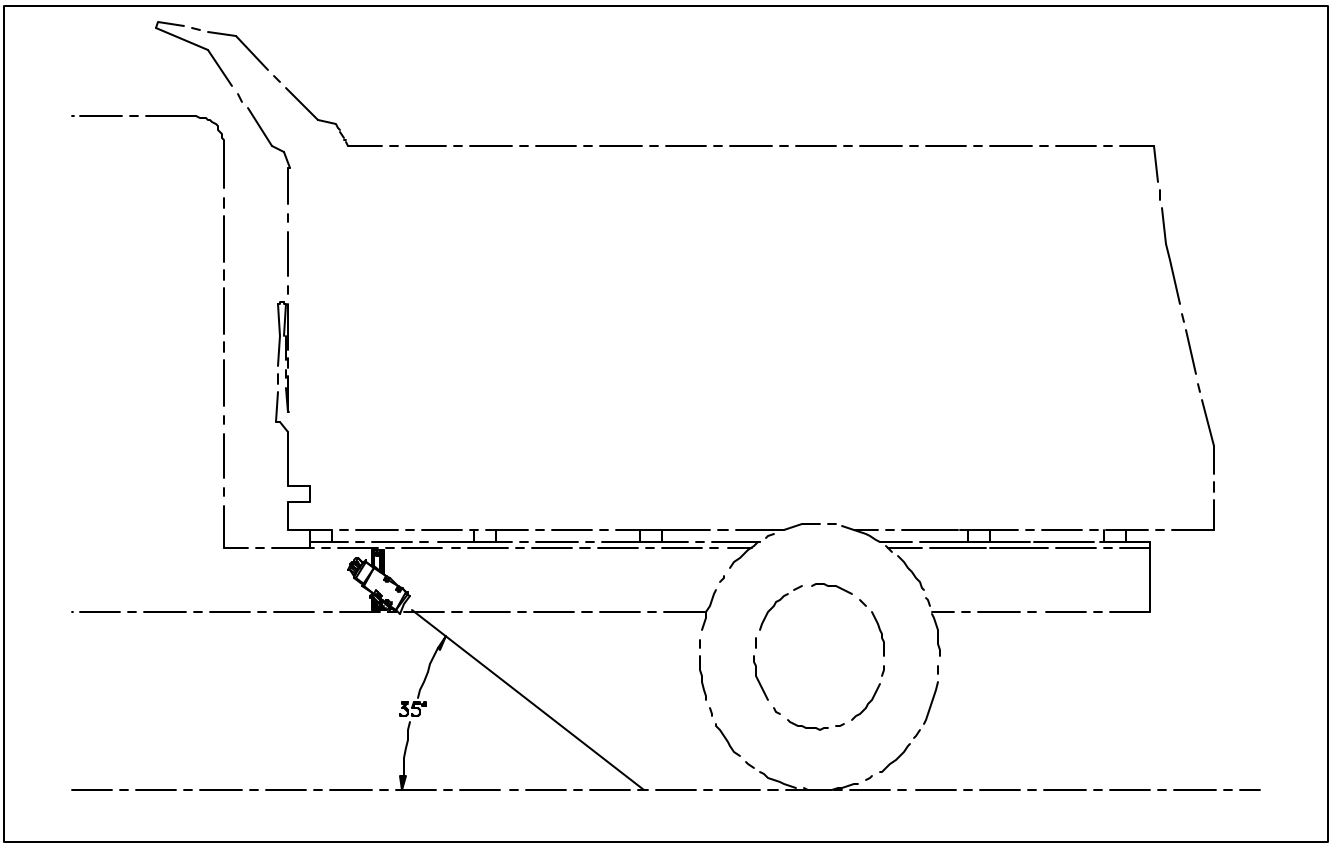


Figure 3 - Radar Mounting Angle

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 Mark IV.2 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.

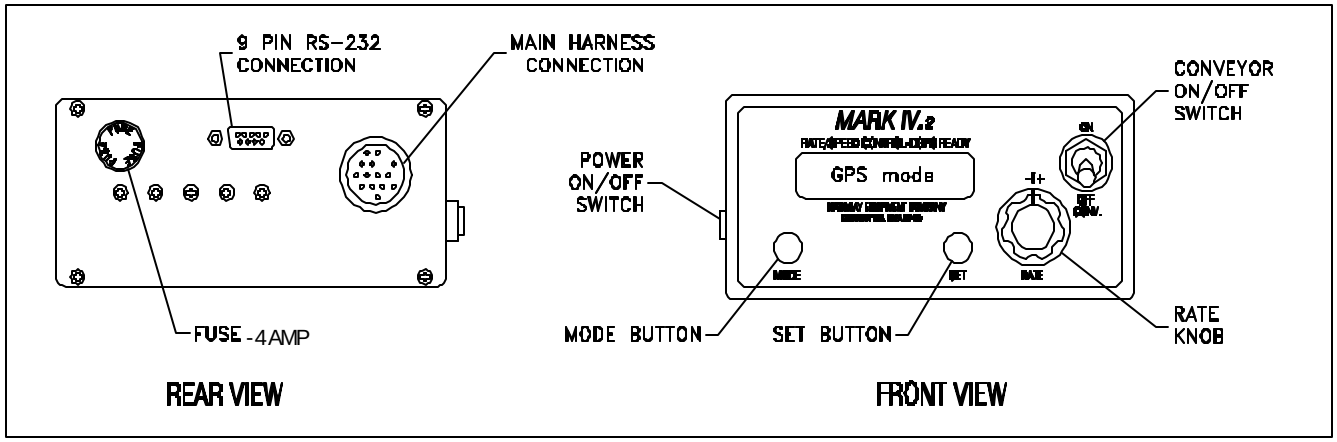


Figure 4 - Control Box Display

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.

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 6.67% of the programmed yield when operating in the non-GPS mode. The rate knob is not used when the unit is in the GPS mode.

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.

OPERATING PROCEDURES CONTINUED

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, GPS or non-GPS mode, as well as L2020GT or L3020GT mode.

CONTROL BOX PROGRAMMING FLOWCHART

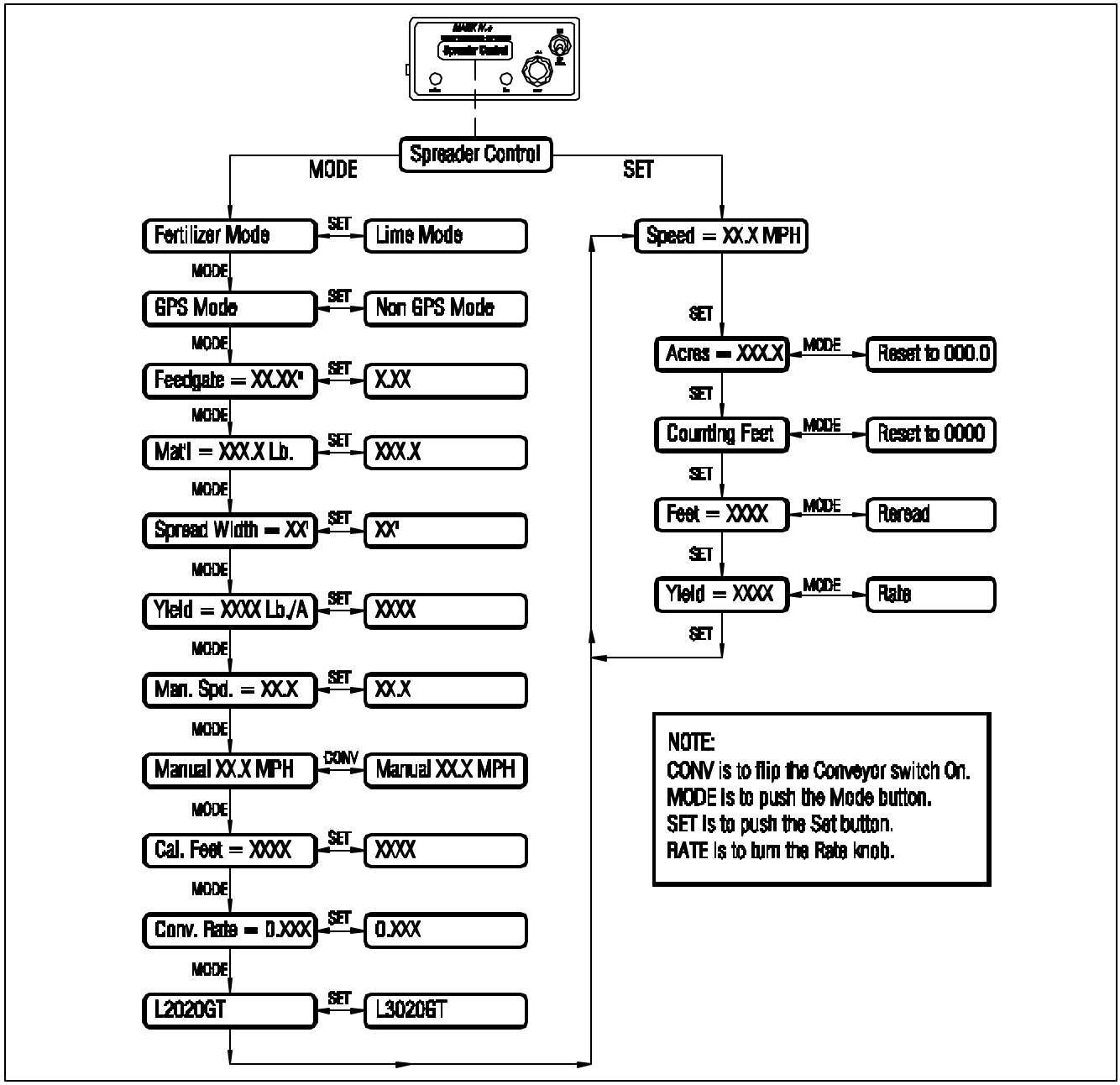


Figure 5 - Programming

OPERATING PROCEDURES CONTINUED

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 = __ . __ __ __
L2020GT/L3020GT Mode	L2020GT/L3020GT Mode

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, which will decrease the yield.

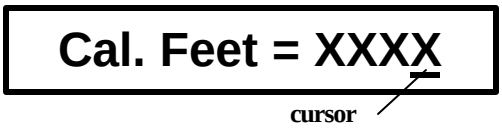
OPERATING PROCEDURES CONTINUED

CALIBRATION PROCEDURE

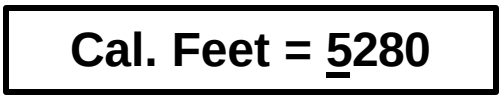
The control box must be calibrated before it can be used to spread accurately. If this is the first time the control box has been used with this particular truck or spreader, please follow the calibration procedure.

Step 1. Turn the power switch ON.

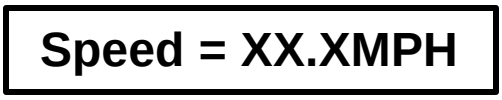
Step 2. Push MODE button repeatedly until the display shows "CAL. FEET."



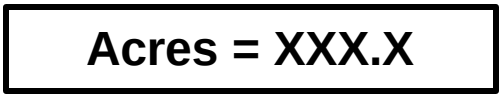
Step 3. Use the SET button to set the calibration feet to 5280. Set the right hand digit to "0," then push the MODE button to move the cursor left to the next digit. Set to "8," the next digit to "2," and the last digit to "5."



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

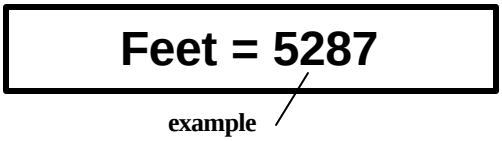


Step 5. Push SET.



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 encoder or radar has calculated you have driven. The program in the spreader control will use this number to compensate for calibration errors in the speedometer encoder or 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.

Cal. Feet = 5280

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.

Cal. Feet = 5287

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. If using a speedometer driven encoder, check to be sure that the speedometer cable is not binding.

Feet = 5287

example

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. Pushing the MODE button again will show either "GPS MODE" or "NON GPS MODE." Pushing the set button changes from one mode to the other.

GPS Mode

IMPORTANT!	If the mode is set to "GPS MODE" and the Mark IV.2 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 IV.2.

IMPORTANT!	To spread properly in "GPS MODE", the "NOMINAL RATE" in GIS software must be set to match "YIELD" in Mark IV.2 control box. See chart on page 21 to make sure yield in control box covers high and low rates in the given field. Using 250 in fertilizer mode and 2.5 in lime mode will match most common application rates.

Step 4. Press the MODE button again to change the display to "FEEDGATE XX.XX". Program the feedgate opening in inches (measure actual depth of material on conveyor). Pressing the MODE button will move the cursor to the left. Charts on pages 22 and 23 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.

OPERATING PROCEDURES CONTINUED

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.XXLb." 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 = XXX.XLb.

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 (driving centers) 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 using the chart on page 21.

Yield = XXXX Lb/A

Step 8. After the digits of the yield have been entered, pushing the MODE button again changes the display to "MAN. SPD. = XX.X". 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 50 RPMs for the L3020GT or 40 RPMs for the L2020GT, 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, allowing for pit dumping or spreading if the radar fails. 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 must be entered for the unit to operate. 00.0 MPH will not work.

OPERATING PROCEDURES CONTINUED

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 = XXXX

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 page 22 and 23. The procedure on page 19 shows how to refine and calculate a very accurate number to program.

Conv. Rate = 0.XXX

Step 12. Pushing the MODE button again will display either “L3020GT” or “L2020GT”. Pressing the SET button changes from one mode to the other. If using a 7020 spreader, select “L3020GT”. If using a L7000 spreader, select “L2020GT”.

L3020GT

Step 13. Pushing the MODE button one last time will automatically go to the spreading mode.

Speed = XX.X MPH

OPERATING PROCEDURES CONTINUED

ADJUSTING THE CONVEYOR FLOW RATE (CFR) VALUE

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. See pages 14 & 15.
2. For material weight, use a balance scale (HECO part #58897 or equivalent) to determine the actual weight per cubic foot of material.
3. See the charts on pages 22 and 23 for the correct theoretical rate to start.
4. Program the following values into the Mark IV.2 control box:
    a. Mode = Fertilizer
    b. Non-GPS
    c. Feedgate = 1.00”
    d. Mat’l = Actual Material Weight (Example: 67 lbs.)
    e. Spread Width = 60’
    f. Yield = 100 lbs/acre
    g. Man. Spd. = 8.2 MPH
    h. Cal. Ft. = adjust value per pages 15 and 16
    i. Conv. Rate = Set per charts on pages 22 and 23
    j. L3020GT or L2020GT (Set appropriate spreader)
5. Load the spreader with product and turn off spinners.
6. Adjust feedgate so 1” of material is on the conveyor.
7. Run the conveyor until material is just falling off the end.
8. Place an empty catch pan or bag under the conveyor. Record the weight of the empty collection device.
9. Run the conveyor in manual mode through console at normal operating RPM for 30 seconds.
10. Weigh the material in the catch pan. Make sure to subtract the weight of the collection device from the total weight.
11. Put the weight of the material collected into the following formula:

(WEIGHT ÷ 50) x SET CFR = ADJUSTED CFR

EXAMPLE: Assume a L3020GT with a #4 belt-over-chain conveyor is used.
The CFR value to use is .256.

(40 lbs ÷ 50 lbs) x .256 = .205

In this example, the adjusted Conveyor Flow Rate (CFR) would be .205. 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 5 through 10, the material should now weigh 50 pounds.

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

OPERATING PROCEDURES CONTINUED

SPREADING MODE

Once in the "SPREADING MODE", there is no way to get to the "PROGRAM MODE". 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 OFF and then ON, 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 again produces the “ACRES = XXX.X” message, which shows the number of acres you have spread. It can be cleared to zero at any time this message is displayed by pressing the MODE button.

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 speedometer cable driven encoder or 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 = X.XX” message to show the rate that is currently being spread, no matter what other message had previously been shown. One more push of the SET button returns to the speedometer.

If the speed is exceeded at which the spreader control can accurately operate, the message "SLOW DOWN" will appear and the beeper sounds. This message indicates that the conveyor reached the maximum conveyor shaft speed of 50 RPM for the L3020GT or 40 RPM for the L2020GT, 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

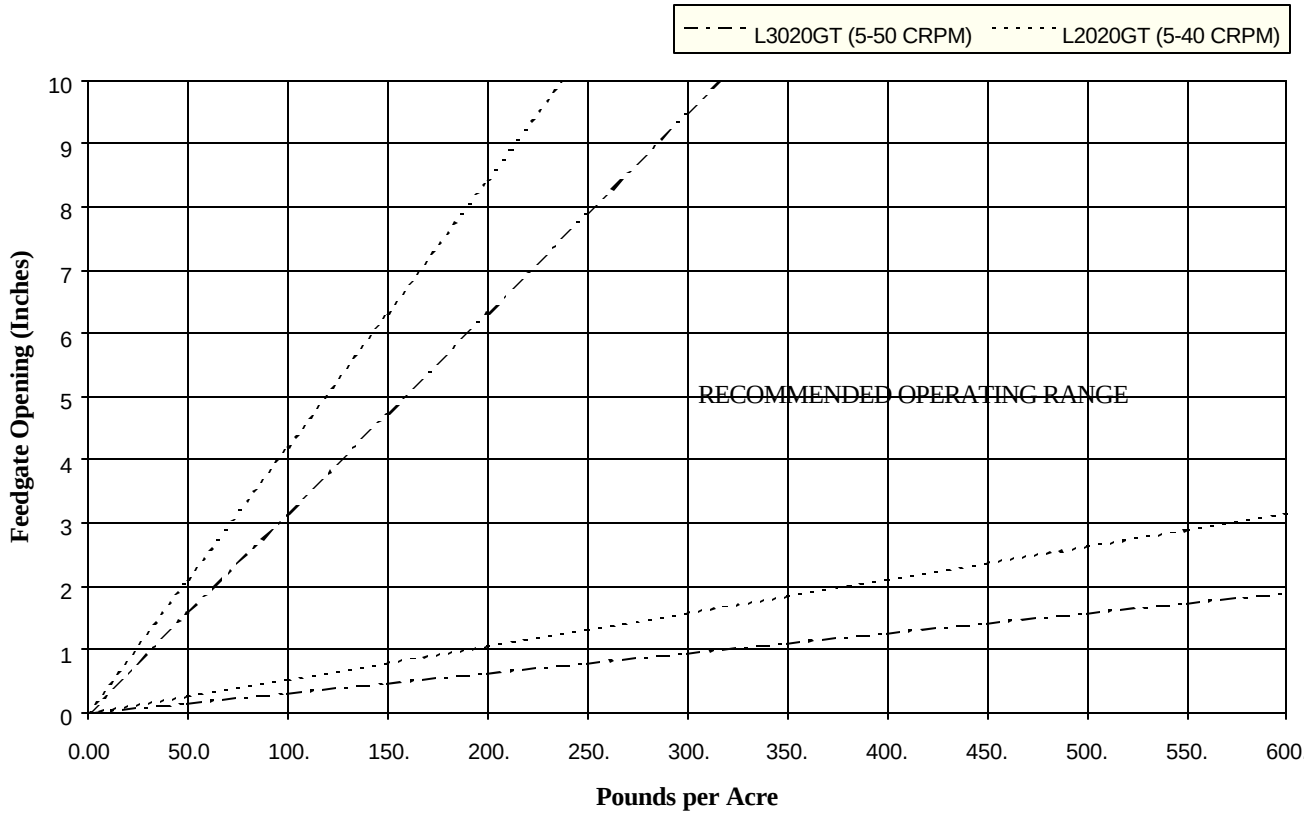
YIELD REFERENCE CHART

Switch	%	Fertilizer								Lime				
Position	Change	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate
16	106.72	207	310	413	517	620	724	827	930	1.0	2.1	3.1	4.1	5.2
15	100.05	200	300	400	500	600	700	800	900	1.0	2.0	3.0	4.0	5.0
14	93.38	193	290	387	483	580	677	774	870	1.0	1.9	2.9	3.9	4.8
13	86.71	187	280	373	467	560	653	747	840	0.9	1.9	2.8	3.7	4.7
12	80.04	180	270	360	450	540	630	720	810	0.9	1.8	2.7	3.6	4.5
11	73.37	173	260	347	433	520	607	693	780	0.9	1.7	2.6	3.5	4.3
10	66.70	167	250	333	417	500	583	667	750	0.8	1.7	2.5	3.3	4.2
9	60.03	160	240	320	400	480	560	640	720	0.8	1.6	2.4	3.2	4.0
8	53.36	153	230	307	383	460	537	613	690	0.8	1.5	2.3	3.1	3.8
7	46.69	147	220	293	367	440	513	587	660	0.7	1.5	2.2	2.9	3.7
6	40.02	140	210	280	350	420	490	560	630	0.7	1.4	2.1	2.8	3.5
5	33.35	133	200	267	333	400	467	533	600	0.7	1.3	2.0	2.7	3.3
4	26.68	127	190	253	317	380	443	507	570	0.6	1.3	1.9	2.5	3.2
3	20.01	120	180	240	300	360	420	480	540	0.6	1.2	1.8	2.4	3.0
2	13.34	113	170	227	283	340	397	453	510	0.6	1.1	1.7	2.3	2.8
1	6.67	107	160	213	267	320	373	427	480	0.5	1.1	1.6	2.1	2.7
0	**0**	**100**	**150**	**200**	**250**	**300**	**350**	**400**	**450**	**0.5**	**1.0**	**1.5**	**2.0**	**2.5**
-1	-6.67	93	140	187	233	280	327	373	420	0.5	0.9	1.4	1.9	2.3
-2	-13.34	87	130	173	217	260	303	347	390	0.4	0.9	1.3	1.7	2.2
-3	-20.01	80	120	160	200	240	280	320	360	0.4	0.8	1.2	1.6	2.0
-4	-26.68	73	110	147	183	220	257	293	330	0.4	0.7	1.1	1.5	1.8
-5	-33.35	67	100	133	167	200	233	267	300	0.3	0.7	1.0	1.3	1.7
-6	-40.02	60	90	120	150	180	210	240	270	0.3	0.6	0.9	1.2	1.5
-7	-46.69	53	80	107	133	160	187	213	240	0.3	0.5	0.8	1.1	1.3
-8	-53.36	47	70	93	117	140	163	187	210	0.2	0.5	0.7	0.9	1.2
-9	-60.03	40	60	80	100	120	140	160	180	0.2	0.4	0.6	0.8	1.0
-10	-66.70	33	50	67	83	100	117	133	150	0.2	0.3	0.5	0.7	0.8
-11	-73.37	27	40	53	67	80	93	107	120	0.1	0.3	0.4	0.5	0.7
-12	-80.04	20	30	40	50	60	70	80	90	0.1	0.2	0.3	0.4	0.5
-13	-86.71	13	20	27	33	40	47	53	60	0.1	0.1	0.2	0.3	0.3
-14	-93.38	7	10	13	17	20	23	26	30	0.0	0.1	0.1	0.1	0.2
-15	-93.38	7	10	13	17	20	23	26	30	0.0	0.1	0.1	0.1	0.2

NOTE: Switch position 0 equals the Yield programmed in the Mark IV.2.

CHARTS

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



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

THEORETICAL CFR VALUES		
CFR	CONVEYOR TYPE	MODEL
.192	Chain & BOC	L2020GT
.237	Belt	L2020GT
.256	Chain & BOC	L3020GT

* - To verify CRPM, mark conveyor shaft and run spreader in manual mode with current settings in processor. Count the revolutions the shaft makes in one minute at normal operating RPM. This is the actual CRPM.

EXAMPLE:
Y = 500 POUNDS/ACRE
MPH = 20 MILES/HOUR
SW = 60 FEET
MW = 60 POUNDS/CUBIC FOOT
CRPM = 5 - 50 CONVEYOR SHAFT REVOLUTIONS/MINUTE

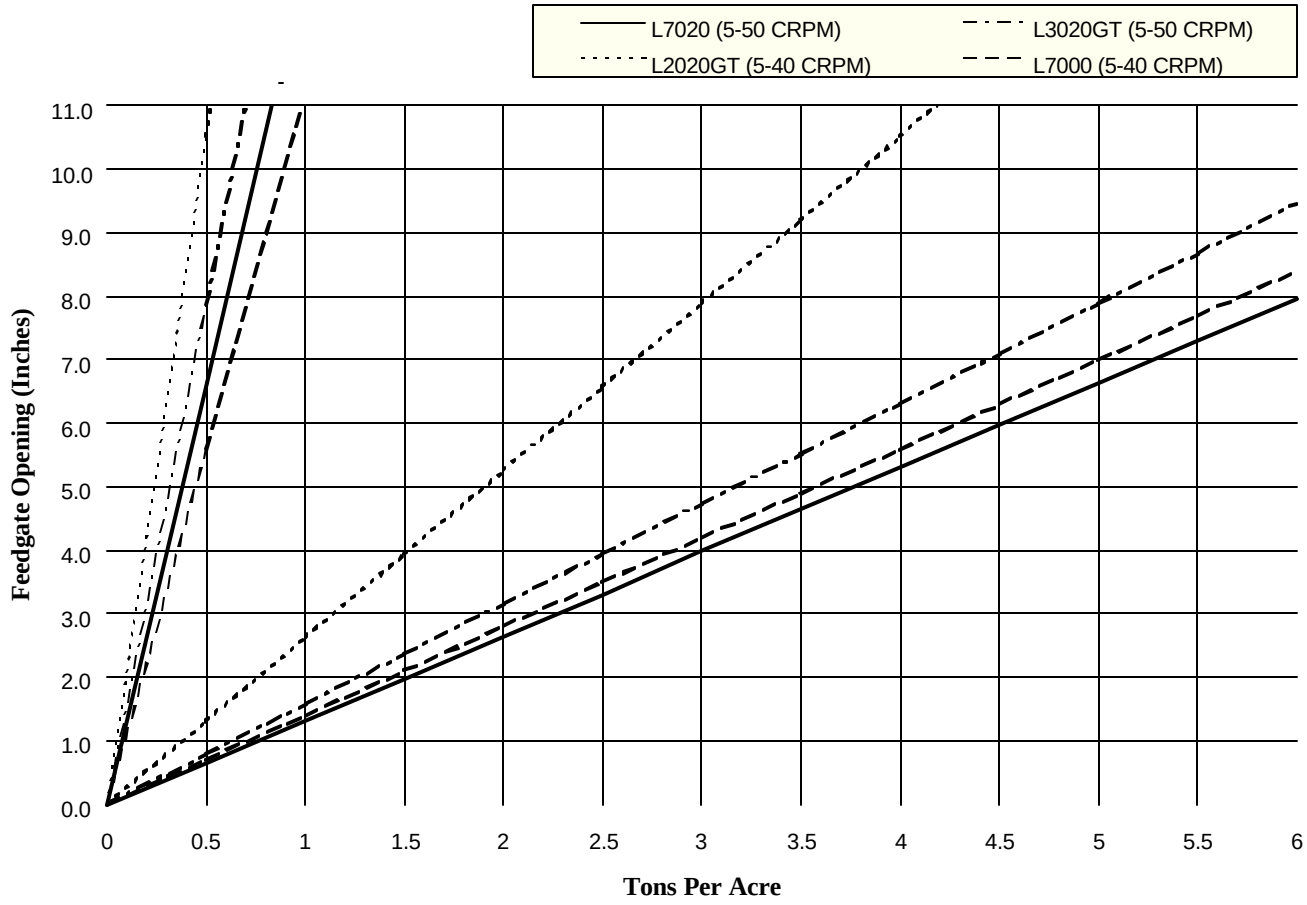
$$G = \frac{500 \times 60 \times 20}{495 \times 25 \times 60 \times .192}$$

$$G = \frac{600{,}000}{142{,}560}$$

G = 4.2" is within the 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

THEORETICAL CFR VALUES		
CFR	CONVEYOR TYPE	MODEL
.192	Chain & BOC	L2020GT
.237	Belt	L2020GT
.256	Chain & BOC	L3020GT
.305	Chain & BOC	L7020
.361	Chain	L7000

L7000 for litter only—Not recommended for spreading lime.

* - To verify CRPM, mark conveyor shaft and run spreader in manual mode with current settings in processor. Count the revolutions the shaft makes in one minute at normal operating RPM. This is the actual CRPM.

EXAMPLE:
Y = 3,000 POUNDS/ACRE
MPH = 10 MILES/HOUR
SW = 45 FEET
MW = 90 POUNDS/CUBIC FOOT
CRPM = 5 - 50 CONVEYOR SHAFT REVOLUTIONS/MINUTE

$$G = \frac{3{,}000 \times 45 \times 10}{495 \times 25 \times 90 \times .192}$$

$$G = \frac{1{,}350{,}000}{213{,}840}$$

G = 6.3" is within the RECOMMENDED OPERATING RANGE

Figure 7 – Lime & Litter Application Rates

SYNCO-MATIC® CONTROL REPLACEMENT

SYNCO-MATIC® MARK IV.2 - REMOVAL

Repairs to Synco-Matic® Mark IV.2 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.
2. Disconnect cable plug from remote board at "A" and remove.
3. Remove two hydraulic hose connections at top of control valve at "B". Cap holes to keep dirt out of valve.
4. Loosen four cap screws 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 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 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 cap screws through saddle and into underside of control valve.
6. Tighten the two allen head screws in cog belt housing at "D" and then uniformly tighten the four capscrews at "C". Torque to 18 ft.-lbs.
7. Reconnect hydraulic hoses on top of control valve at "B".
8. Reconnect cable plug to remote board at "A".
9. Road test unit to check unit for proper functioning.

SYNCO-MATIC® CONTROL REPLACEMENT CONTINUED

REMOVAL OF COMPLETE SYNCO-MATIC® MARK IV.2 CONTROL WITH CONVEYOR GEAR CASE ASSEMBLY

1. Thoroughly clean Synco-Matic® unit and area around it.
2. Disconnect cable plug from remote board at "A" and remove.
3. Remove two hydraulic hose connection at top of control valve at “B”. Cap holes to keep dirt out of valve.
4. Drain gear case oil.
5. Remove the conveyor gear case torque arm pin, remove pipe plug from the center of the gear case, 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.

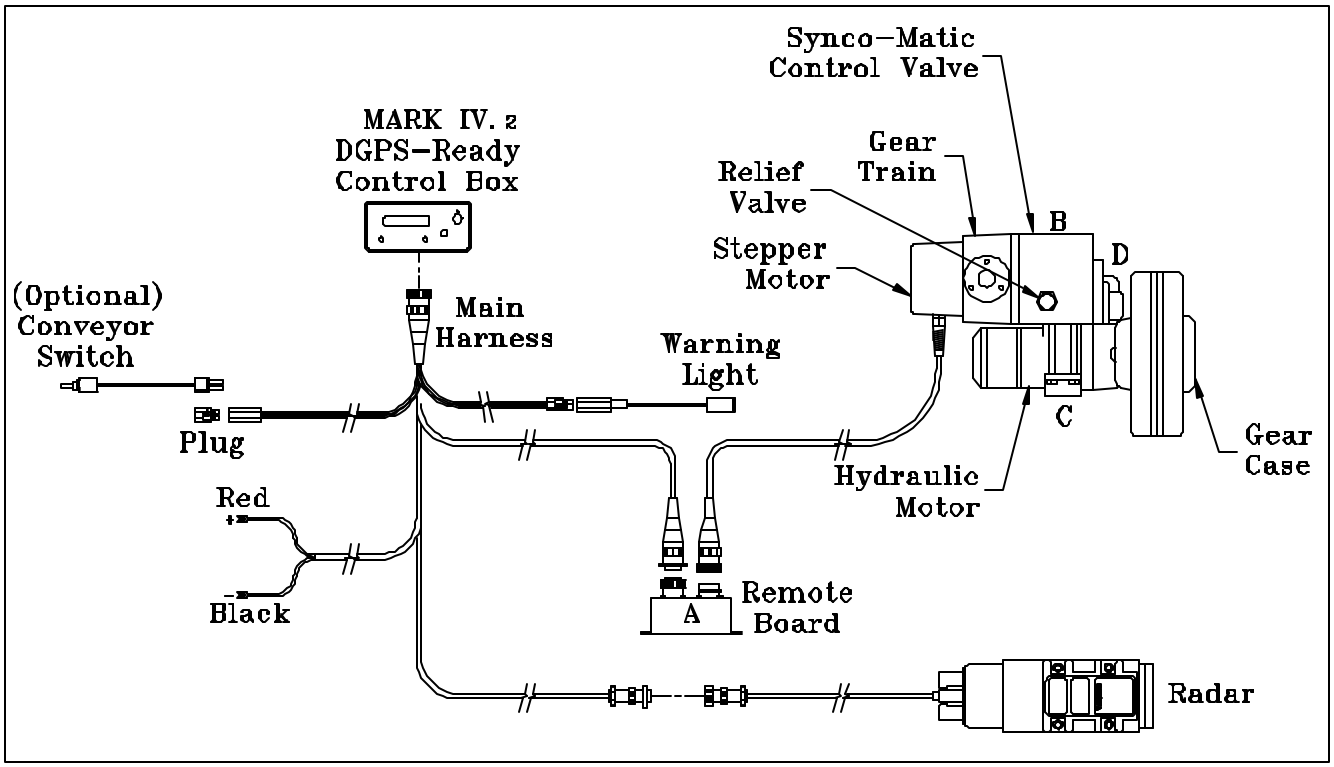


Figure 8 - Synco-MaticÒ Mark IV.2 Assembly

TROUBLESHOOTING

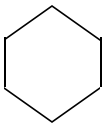
SYMPTOM	REASON
Power switch is turned ON, display is blank.	1. Blown fuse. 2. Power leads not connected. 3. Dead vehicle battery. 4. Unit too cold. (Below -4° F.)
Power switch is turned ON, pushing SET displays MAN. SPD. = XX.X MPH, or beeps and stays at Spreader Control.	1. Incomplete program. 2. Check 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.XMPH.
Program will not advance beyond display MAN. SPD. = XX.X MPH.	1. Program required more than 50 CRPM (Conveyor Revolutions Per Minute) for L3020GT or 40 CRPM for L2020GT. Program lower MPH or larger feedgate opening value. 2. Incomplete program.
Display reads SLOW DOWN and beeper sounds steadily.	Driving too fast.
Display beeps intermittently and warning light flashes.	1. PTO not engaged. 2. Defective or undersize hydraulic system components. 3. Hydraulic motors running to fast. Check hydraulic flow to Mark IV.2. 4. Hydraulic motors running too slow. a. Check hydraulic flow to Mark IV.2. b. Check conveyor relief valve. 5. Possible remote driver failure. Contact dealer.
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. Speedometer cable disengaged or broken. 2. Encoder or radar cable improperly connected. 3. Faulty radar.

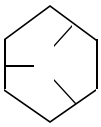
TROUBLESHOOTING

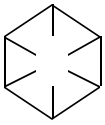
SYMPTOM	REASON
During programming, the display returns to SPREADER CONTROL.	1. Insure the actual feedgate opening matches program setting. 2. Check entire program for accurate values. 3. Check for proper CAL.FEET = XXXX. 4. Insure YIELD = XXXX Lb/A in SPREAD MODE matches YIELD = XXXX Lb/A in program. Adjust with rate knob. 5. Adjust CONV.RATE = 0.XXX. 6. Faulty radar.
After programming, the display returns to SPREADER CONTROL.	Incomplete program.
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. Bad connection from processor to valve. Check connections.
Conveyor starts to run when PTO is engaged.	1. Processor power must be turned on. 2. The built-in break in the stepper motor must be engaged as follows: a. Turn on the main power switch. b. Push SET button once. c. Turn ON the conveyor switch, drive the vehicle 10 feet, then turn OFF the conveyor switch. 2. Bad connection from processor to valve. Check connections. 3. 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) CAP SCREWS

CAP SCREW 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.

CAP SCREW SIZE	TORQUE - FOOT-POUNDS					
	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.**

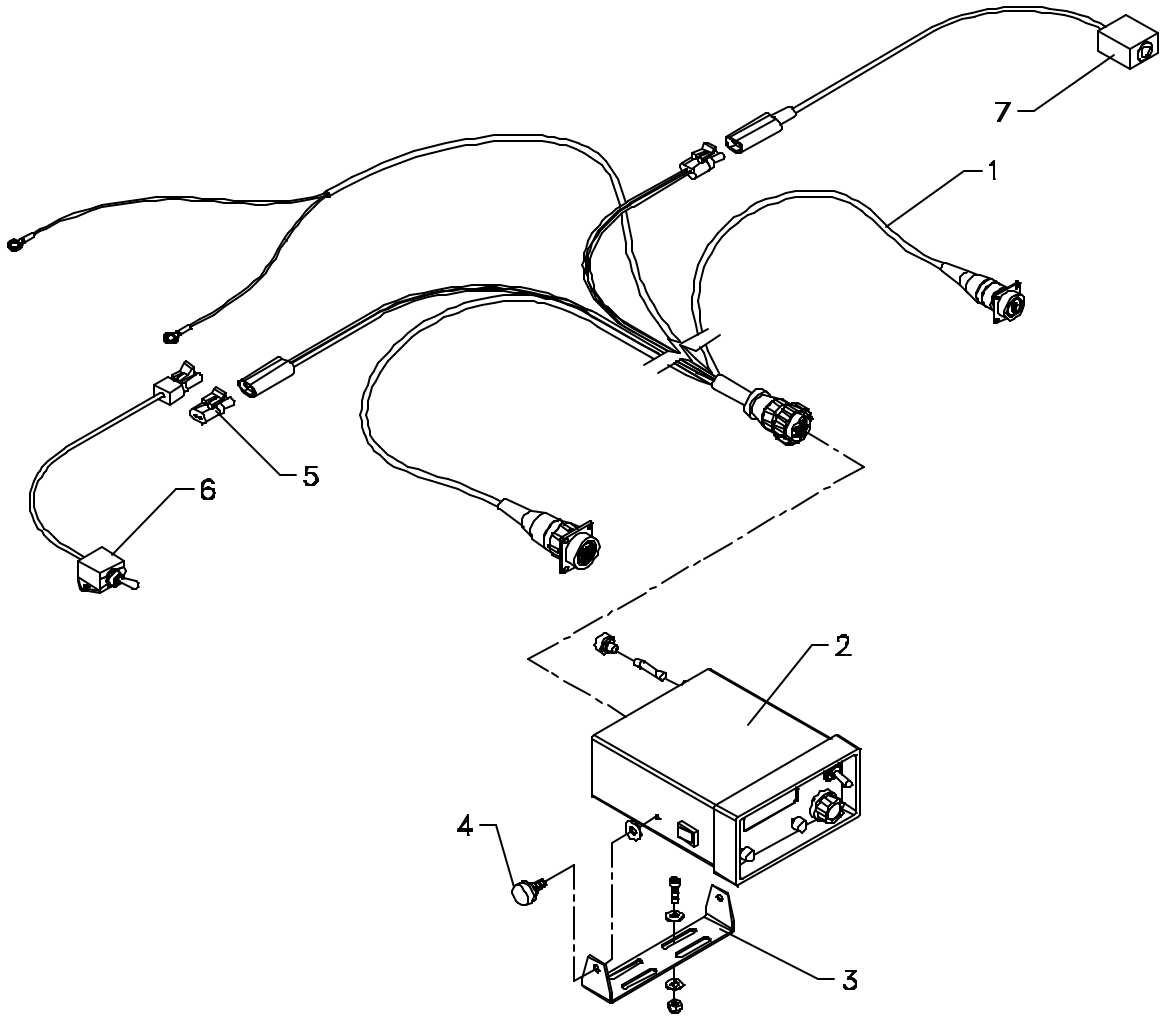
Unless claims for shortages or errors are made immediately upon receipt of goods they will not be considered. Any part returns should be directed through the dealer from which they were purchased.

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.

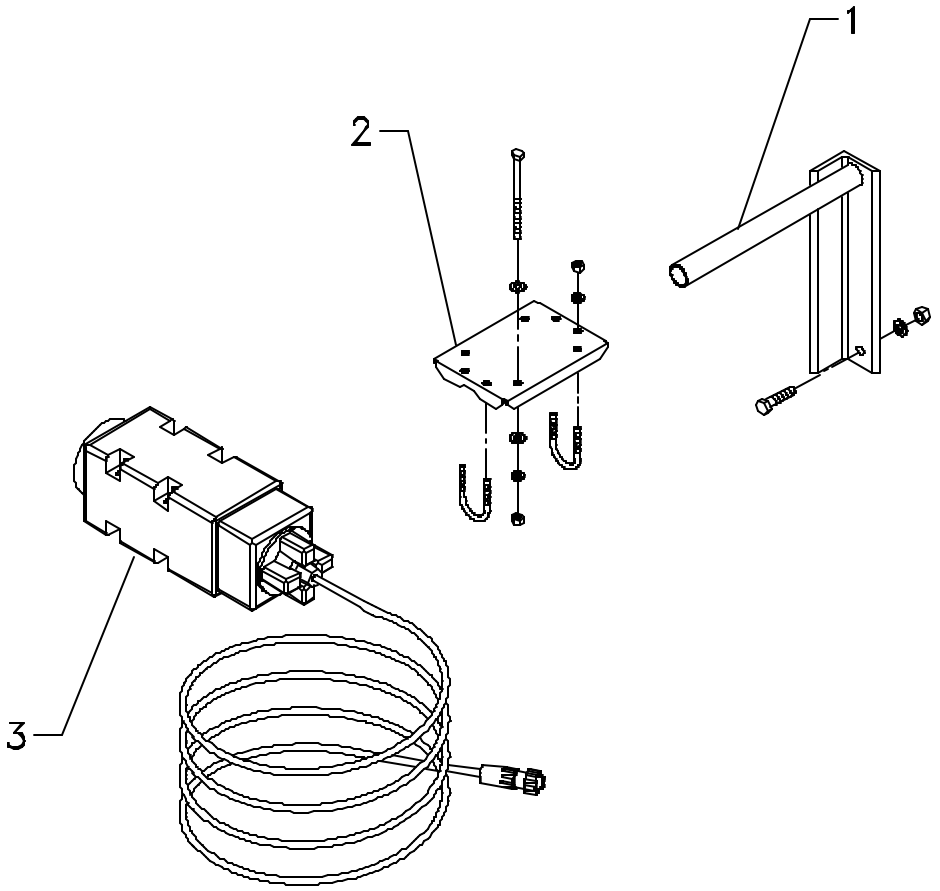
If your claims are not being handled (by the transportation company) to your satisfaction, please call the Parts Manager at Highway Equipment Company (319) 363-8281 for assistance.

CONTROL BOX ASSEMBLY



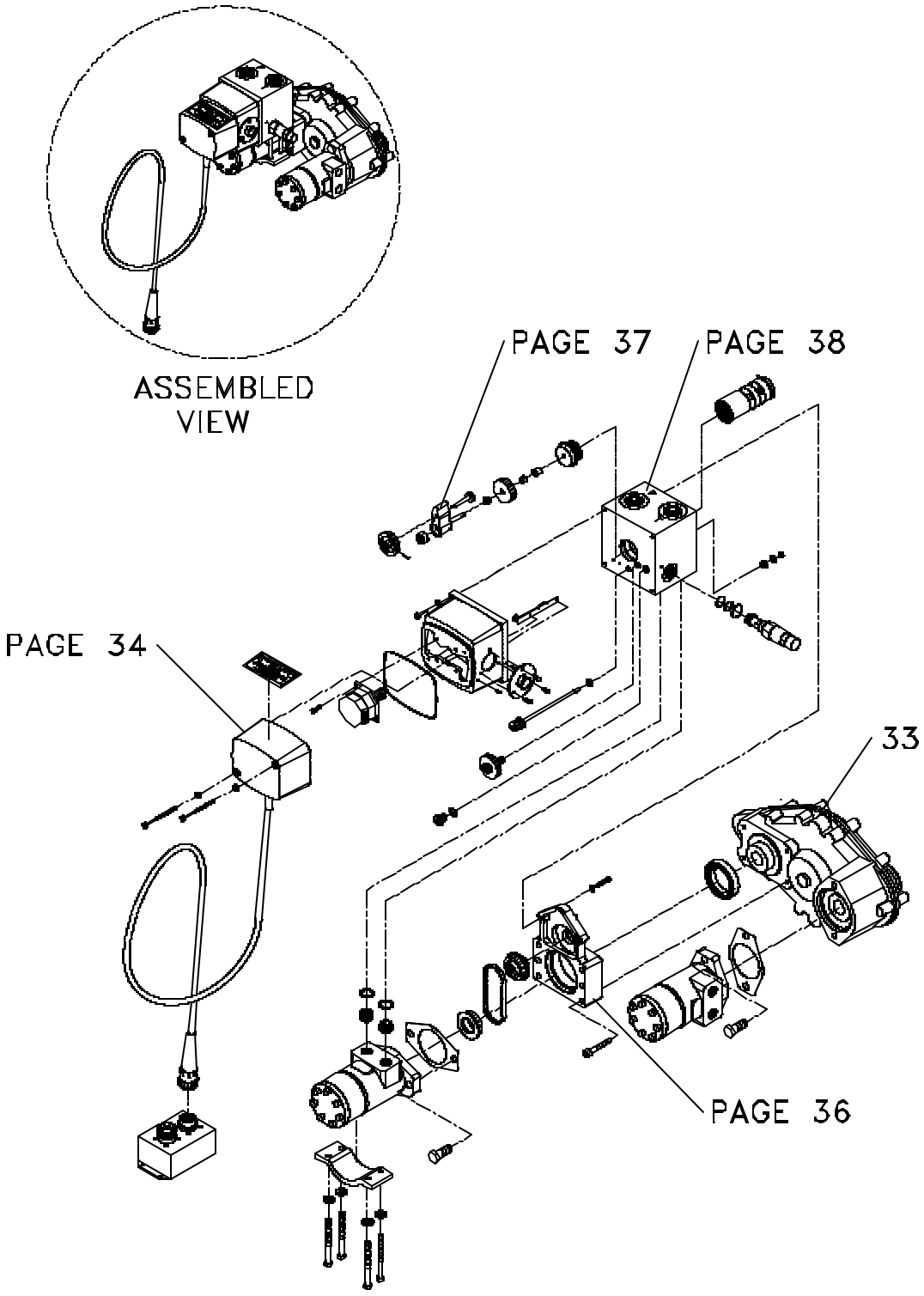
ITEM	PART NO.	DESCRIPTION	QTY
	84950	Kit – Control Box, Mark IV.2	
1	84952	Harness – Control Box	1
2	84951	Control Box	1
3	72805	Bracket	1
4	72806	Kit – Hardware	1
		Screw – Thumb	2
		Screw – Machine	4
		Washer – Plastic	2
		Washer – Flat	8
		Nut – Lock	4
5	84947	Plug	1
6	84949	Conveyor Switch (Optional)	1
7	84948	Indicator Light Assembly	1

RADAR ASSEMBLY

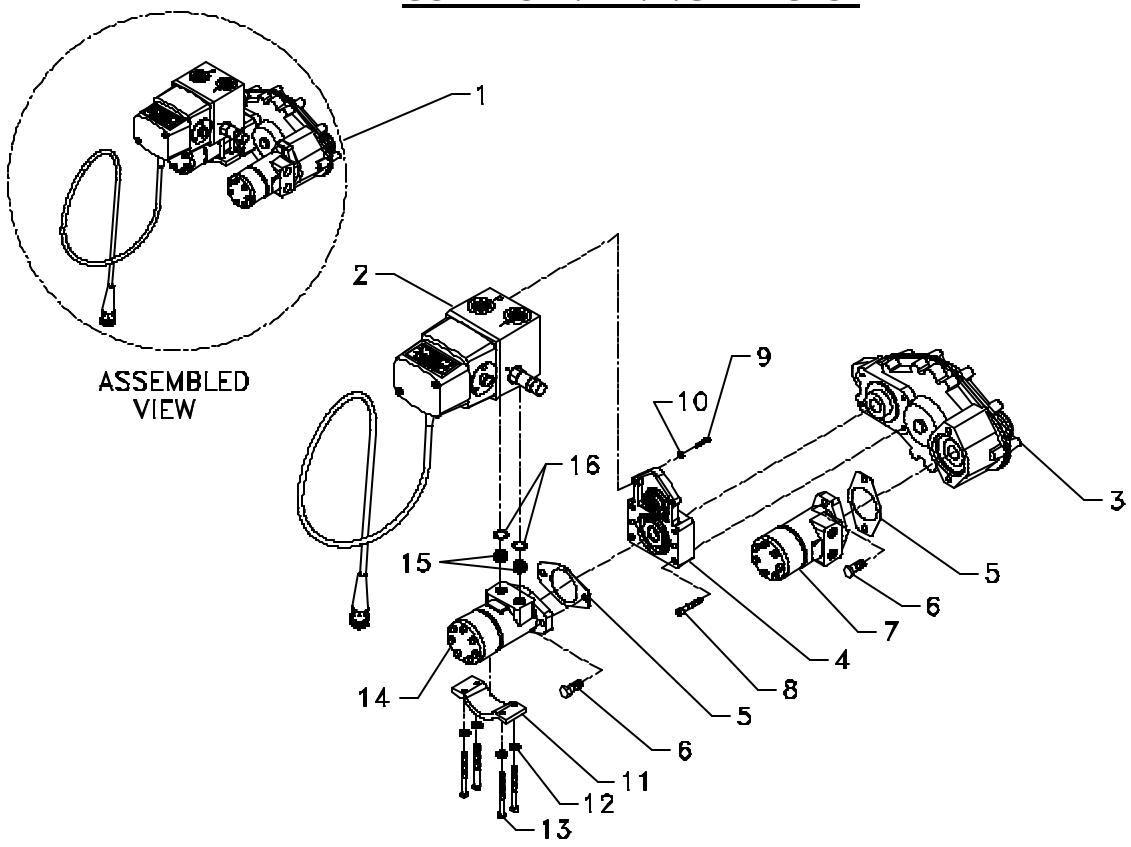


ITEM	PART NO.	DESCRIPTION	QTY
	79857	Radar Velocity Sensor Kit	1
1	79860	"L" Pipe Mounting Bracket Kit	1
		Bracket – Mounting, "L" Pipe	1
		Cap Screw – 3/8-16 x 1 1/2	2
		Washer – Lock, 3/8	2
		Nut – Hex, 3/8-16	2
2	79859	Mounting Bracket Kit	1
		Bracket - Mounting	1
		U-Bolt	2
		Cap Screw – 1/4-20 x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

MARK IV.2 CONTROL VALVE ASSEMBLY



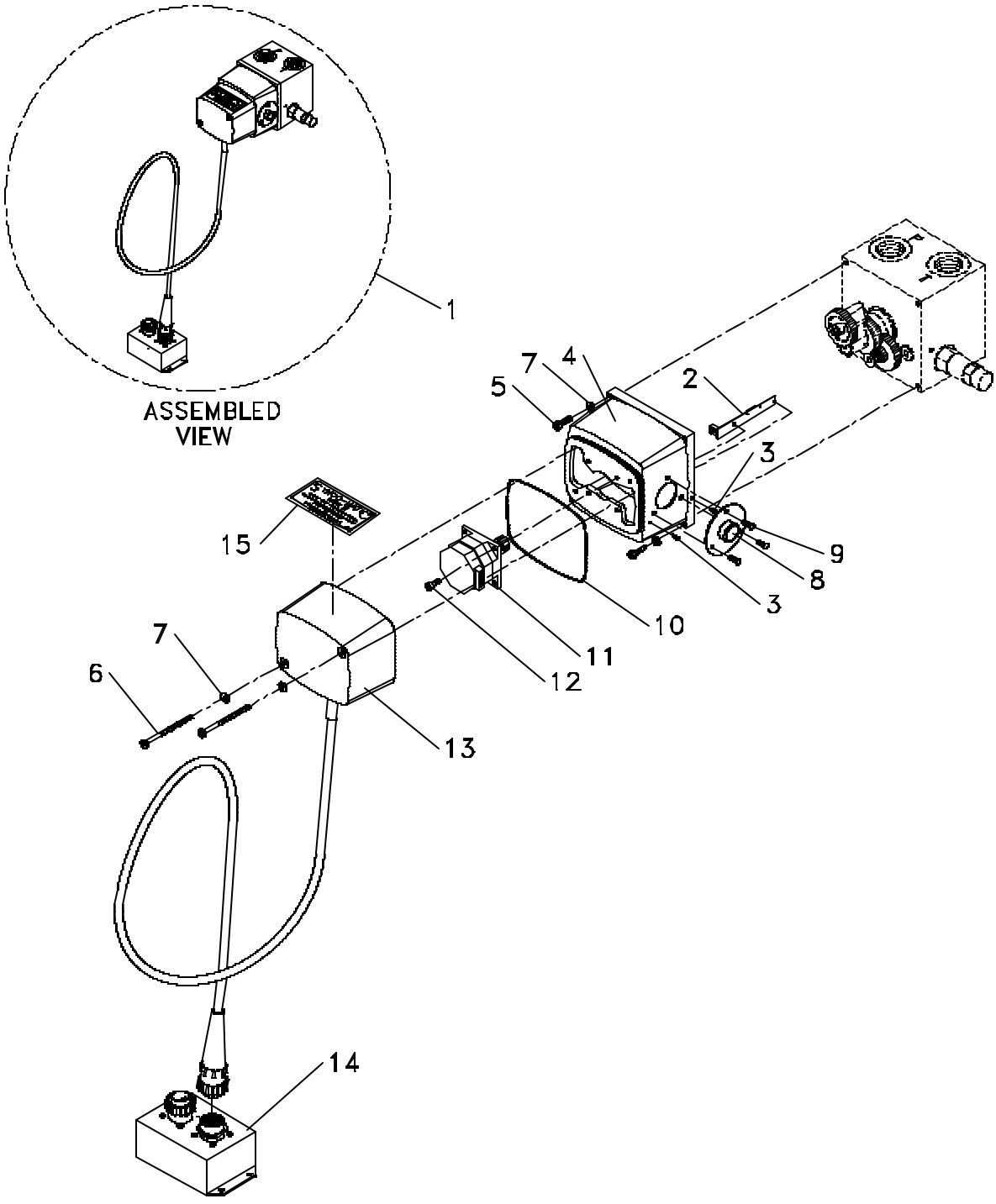
MARK IV.2 CONTROL VALVE ASSEMBLY - CONTROL VALVE/GEAR CASE



ITEM	PART NO.	DESCRIPTION	QTY
1	84957	Control Valve/Dual Gear Case, 1 1/4 Motors Assy	1
	* 84956	Control Valve/Single Gear Case, 1 1/2 Motor Assy	1
2	84933	Valve Assembly	1
3	55971	Gear Case	1
4	84940	Valve Adapter Kit	1
5	74524	Gasket	2
6	44442	Cap Screw	4
7	82459	Motor – Hydraulic, 1 1/4	1
8	44456	Screw – Socket Head	2
9	44454	Screw – Socket Head	2
10	20724	Washer – Seal	2
11	47276	Saddle – Motor	1
12	36419	Washer	4
13	47277	Cap Screw	4
14	82462	Motor – Hydraulic, 1 1/4 Modified	1
	* 46395	Motor – Hydraulic, 1 1/2	
15	44409	Port Adapter	2
16	29854	O-Ring	2

* - Not Shown

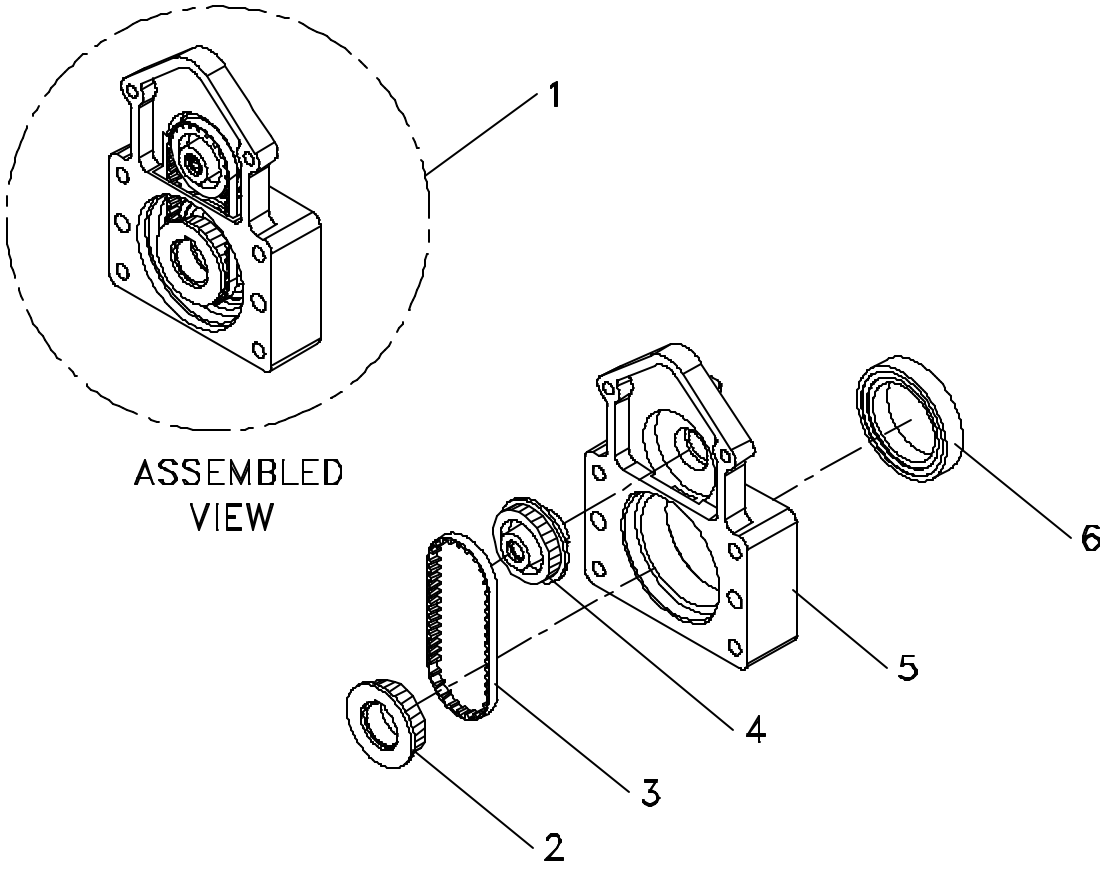
MARK IV.2 CONTROL VALVE ASSEMBLY - VALVE



MARK IV.2 CONTROL VALVE ASSEMBLY – VALVE CONTINUED

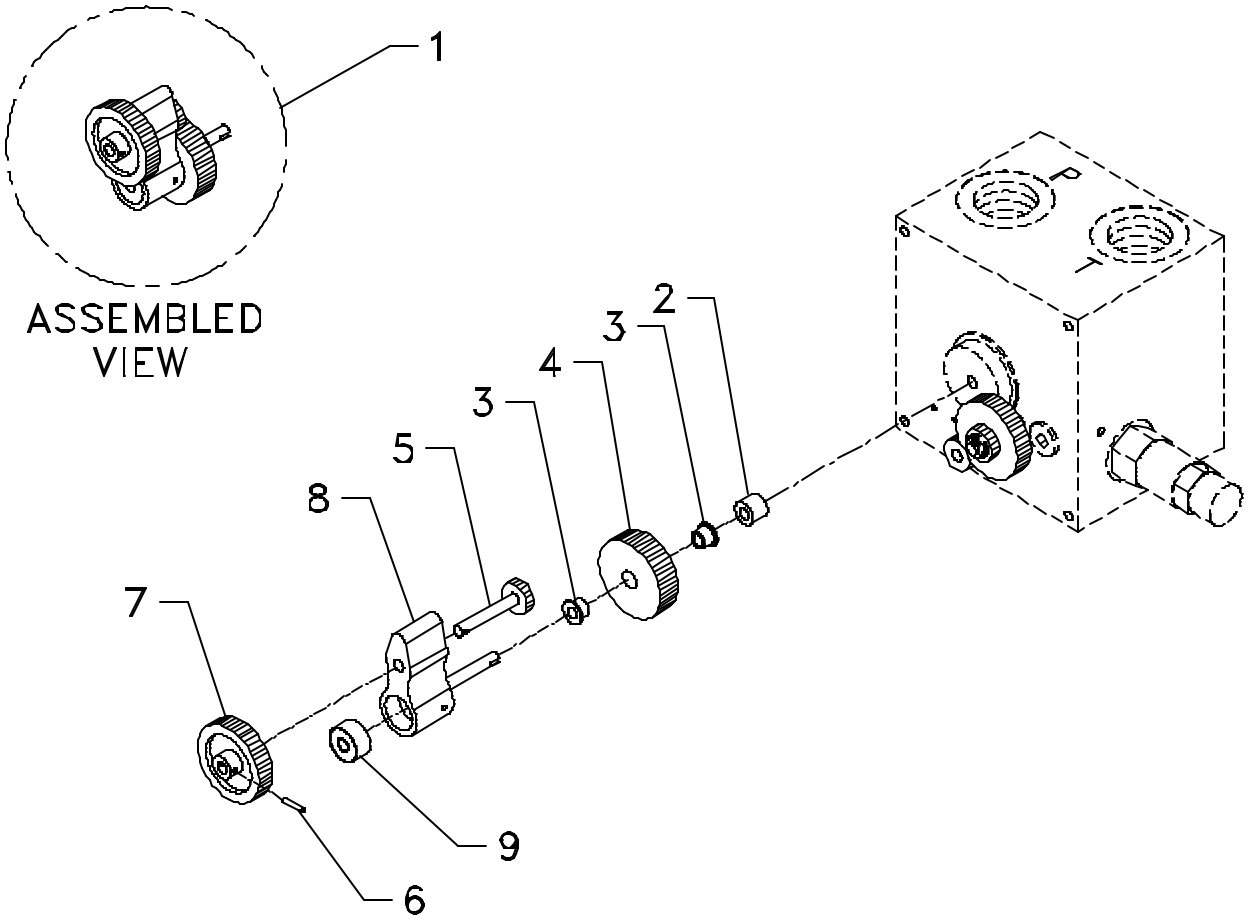
ITEM	PART NO.	DESCRIPTION	QTY
1	84933	Valve Assembly	1
2	84934	Reed Switch Board	1
3	84935	Bolt	2
4	84936	Housing	1
5	44483	Screw – Machine	4
6	83645	Screw – Machine	1
7	20724	Washer – Seal	6
8	84937	Cover – Service Assembly	1
9	84938	Bolt – O-Ring	3
10	13207	Seal – O-Ring	1
11	83642	Motor Assembly	1
12	83643	Screw – Socket Head	4
13	84939	Cap Assembly	1
14	84953	Remote Driver Board	1
15	90665	Decal – Synco-Matic®	1

MARK IV.2 CONTROL VALVE ASSEMBLY – VALVE ADAPTER



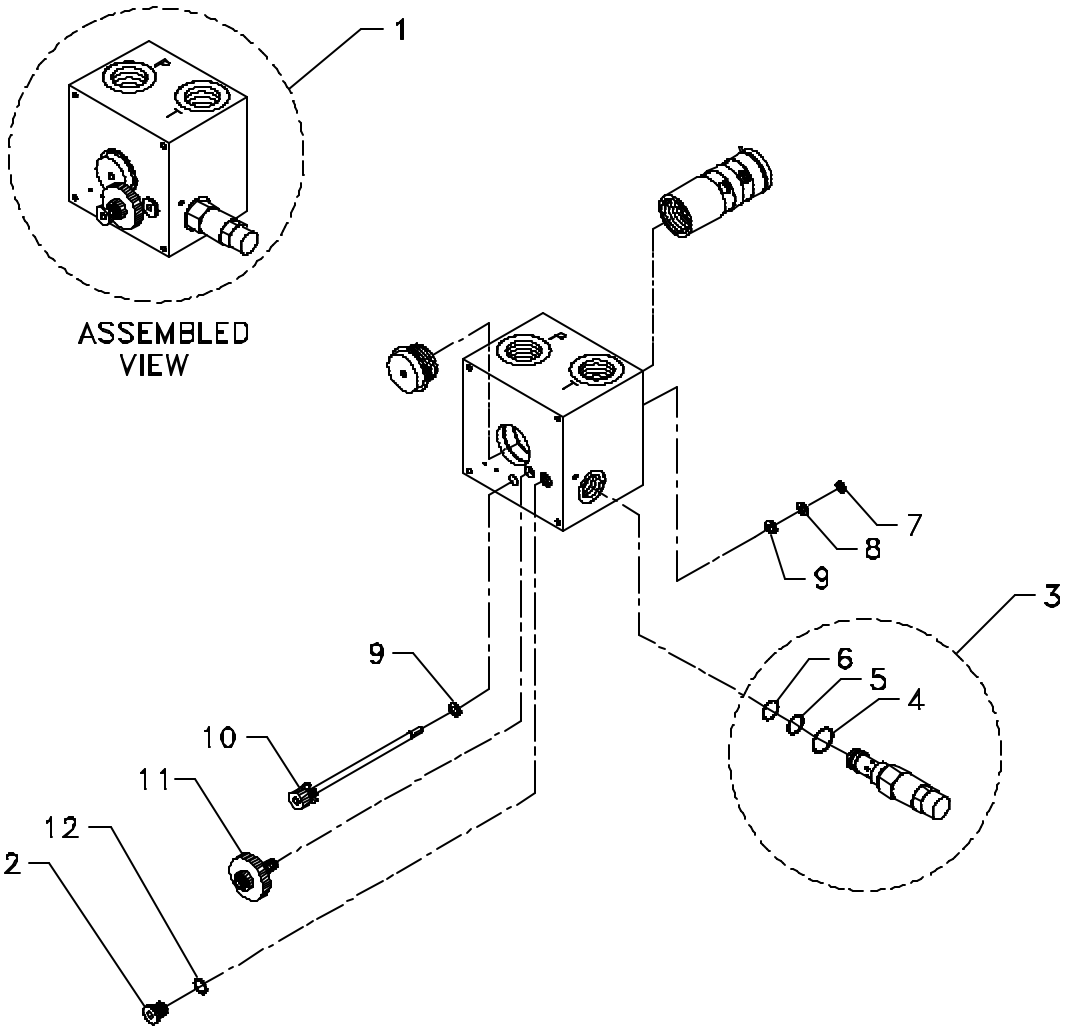
ITEM	PART NO.	DESCRIPTION	QTY
1	84940	Valve Adapter Kit	1
2	44440	Pulley – Drive	1
3	44439	Belt – Timing	1
4	84941	Pulley – Timing	1
5	84942	Adapter	1
6	44445	Seal	1

MARK IV.2 CONTROL VALVE ASSEMBLY - IDLER



ITEM	PART NO.	DESCRIPTION	QTY
1	83640	Idler Assembly	1
2	44431	Spacer	1
3	44433	Bushing	2
4	44434	Gear – Resolve	1
5	44428	Gear Assembly	1
6	44461	Pin – Roll	1
7	44432	Gear	1
8	44429	Idler Arm Assembly, Includes Item 9	1
9	44435	Bearing	1

MARK IV.2 CONTROL VALVE ASSEMBLY - VALVE BLOCK



ITEM	PART NO.	DESCRIPTION	QTY
1	84943	Valve Block Assembly	1
2	83627	Plug	1
3	83623	Relief Valve Assembly	1
4	83624	"O" Ring	1
5	83632	Back-up Ring	1
6	83625	"O" Ring	1
7	44464	Ring - Snap	1
8	44449	Shim - Nylon	1
9	84944	Bearing	2
10	84945	Input Shaft Assembly	1
11	83636	Idler Gear Assembly	1
12	83626	"O" Ring	1