



OPERATION and INSTRUCTION
MANUAL for the
AS2 SPREADER CONTROL



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The **AS2** provides an accurate and reliable open loop electro-hydraulic spreader control for sand and salt dispensing vehicles. The **AS2** uses an advanced micro-controller to precisely calculate the ground speed and regulate the shaft speed of the auger (conveyor). The computer translates the sensor information into actual engineering units. The installer directly enters the required equipment specifics; counts per mile from the transmission sensor and pounds per minute output from the auger (conveyor). The control system is easy to setup and calibrated to deliver a regulated granular material in true lbs./mile.

The **AS2** spreader controller will operate in ground speed mode, referred to as *automatic* mode. The **AS2** will also function as a standard electro-hydraulic *manual* valve controller.

The **AS2** gives the user an independent electro-hydraulic control for both spreader functions. The auger (conveyor) output regulates the amount of material spread per mile, *feed rate*. The spinner output regulates the distance the material is spread, *lane width*.

The **AS2** has an optional remote display module, which gives the user a method to view the internal program settings. Each **AS2** is equipped with a modular connector located on the lower right front panel. This connector is used for attaching the optional remote display, part number RD201.

Overview of the Operational Features

The **manual** mode is used to drive the hydraulic valves without ground speed modulation. The manual mode ignores the transmission sensor so the valve outputs will then be unaffected by the vehicle speed. The manual auger output is divided evenly across the 9 knob positions. With each successive increment of the auger knob, the valve drive is increased by 1/9th, with the last position giving the operator 100% output.

To conserve material it's recommended you operate the spreader control in automatic mode. Without ground speed modulation you will spread too much material at lower speeds and too little at higher speeds. Manual mode should be used if the transmission sensor fails. Manual mode is also useful for dumping extra material back at the yard. In some special cases when the operator needs to spread a lot of material along the roadside, such as bus loading zones, the manual mode may be used.

The **automatic** mode uses ground speed to regulate the auger RPM in direct proportion to the vehicle speed. The automatic mode is calibrated to control the feed rate in lbs./mile. The operator can

select one of nine pre-programmed feed rates. The auger will automatically shut off at zero MPH.

The knob positions are numbered 1 thru 9 but the actual feed rate output assigned to each knob position can be anywhere from 100 up to 2000 lbs./mile. The actual output levels are decided by the installer. The operator should be made aware of the preset output levels for each of the feed rate knob positions.

Each installer will need to determine what is correct for that situation. The AS2 is factory programmed so that position one is equal to 100 lbs./mile and position two is equal to 200 lbs./mile, etc. Depending on the type of spreading and the spreading policy the actual output levels can be set to almost any value. Example: if only three outputs are desired the presets can be made equal for knob positions 3 thru 9. i.e.,

1 = 200 lbs./mi. 2 = 400 lbs./mi. 3 thru 9 = 600 lbs./mi.

The **lane width** control allows the operator to select one of nine preset spinner outputs. The operation of the spinner is the same in both the manual and automatic modes. The spinner output holds at the selected level regardless of vehicle speed. As with the auger, the spinner (in auto mode only) shuts off when the vehicle is stopped. The installer can preset each position of the lane width knob to a specific output value.

The **Blast** push-button sets the feed rate to 100% output. This allows the operator to override the auto or manual setting for a temporary period. The Blast function has an off delay timer. This timer keeps the Blast output on for an adjustable period of 0 to 10 seconds. The delay timer starts after the Blast button is released. If during a Blast output the
Overview (continued)

operator wishes to end the Blast timer, briefly press the Blast pushbutton a second time to instantly stop the timer and the feed rate output.

The **Status lamp** is used to indicate three different conditions. First, it informs the operator when the vehicle is stopped by blinking slowly to indicate the transmission pulses are **not** being received. Secondly, once the vehicle begins to move the lamp shines steady (not blinking) to indicate the feed rate output is active. Thirdly, if the vehicle goes faster than the feed rate is capable, the lamp will blink at a fast rate indicating the auger is overrunning. At this point the AS2 cannot regulate the feed to the set rate.

The **Product switch** lets the operator select between the primary or *normal* product and a secondary or *alternate* product. The installer programs a preset density ratio between the normal and alternate

product. The AS2 uses the product ratio to maintain the correct auger calibration with respect to the lbs./mile output. If your district does not use two products the product ratio should be set to 1.00 so that the position of the product switch will have no effect on the feed rate output.

The product switch can be used as a cutback feature. Example: by programming in a product ratio of 0.5 and using the alternate position for the standard spreading, when the product switch is set to the normal product position every auger output setting will be cut in half. Please refer to the programming section for more information on setting the product ratio.

INSTALLATION

Installation of the AS2 is accomplished in three stages: first the mechanical, second the electrical and third the calibration.

The **mechanical installation** uses the "U" bracket supplied with the unit. Select a location where the front panel can be directly viewed and allows for an easy connection from the rear. Secure the U-bracket to a solid structure. Use the two wing-knobs to fasten the AS2 to the U-bracket. Adjust the angle of the AS2 for best viewing by the operator and tighten the wing-knobs.

The **electrical connections** are made using the dealer supplied wiring harness. The harness routes from the AS2 to three vehicle locations; the hydraulic valves, the transmission sensor and the vehicle power.

Ensure the 9-pin CPC twist lock connector is free from stress. Do not force a tight bend radius. Route the cable harness through the cab body and along the truck frame. Avoid sharp edges, high heat, abrasion points and tight corners. Secure the cable with tie wraps along the entire path.

The **transmission sensor** will be either a two wire or three wire connection. The two wire sensors are referred to as VRM's and the three wire systems are referred to as Hall's. Depending on which sensor is used the AS2 may require an internal switch to be set. Refer to the wiring schematic in the back of this booklet describing the location and setting of the ground speed DIP switch. The AS2 is shipped from the factory set for VRM sensors. There is a sensitivity adjustment inside the AS2. It's factory set for 300 millivolts.

On the two wire VRM's sensors, the ground connection is arbitrary and if connected wrong the sensor will not work. This is usually evident because the dashboard electronic speedometer will also not work. If this happens reverse the two wires going from the sensor and the AS2.

The **vehicle power** should be connected to the main terminal block in the cab. There is an internal slow blow 5 amp fuse inside the AS2. With the valve trims properly adjusted the AS2 should typically draw no more than 4 amps. The fuse protection is designed for 5 amps to prevent any chance of circuit or wiring damage in the event of a short.

The two **hydraulic valves** are connected using four wires: one pair of wires for each valve coil. Each valve wire pair has a 12 volt supply and return signal wire. The valve coils do not have a polarity and can be connected either way. The valves are usually located in a very harsh environment. Use care to protect the wires and connections from road hazards, sand and salt. It's recommended to use a silicone (non-hardening) dielectric grease to keep moisture and corrosion from attacking the valve wire connections.

QUICK TEST

Once wired and plumbed the spreader system should be checked out for basic operation before proceeding with the calibration.

Each AS2 is shipped from the factory with settings that should allow you to immediately start up the system and operate the hydraulic valves. The system may not operate in a fully calibrated and optimized fashion, but it will be good enough to confirm that the hydraulics and electrical wiring are correct.

To test the installation of the AS2 first turn on and warm up the hydraulic system. Power up the AS2 in the manual mode. As you move the feed rate and the lane width knobs you should observe the auger and spinner motors functioning. Check to see that the rotations are in the correct direction and that there are no hydraulic leaks.

To confirm that the ground speed input is working, take the truck for a quick drive or jack up the rear wheels.

Please think safety and always use axle stands and wheel blocks.

With the AS2 powered up in the automatic mode and the rear wheels stopped the status lamp will slowly blink. When the wheels are moving at a speed of 1 to 2 mph, the status lamp should be on steady (not blinking). This confirms that the transmission sensor, wiring and internal dipswitch settings are correct.

Passing this test does confirm the basic completeness of the hydraulics and the electrical wiring system. The AS2 is able to operate the valves and read the mph sensor and is now ready to be a fully calibrated.

OPEN LOOP CALCUALTIONS

Use the following formulas to calculate the required spreader output to best meet your specific spreading policy.

1. What is the highest feed rate required for this vehicle?
_____ **LBS/MILE req.**
2. What is the fastest spreading speed required from this vehicle?
_____ **MPH req.**
3. Calculate the maximum required for your spreader.
Lbs./mile X MPH X 1/60 = _____ **LB/MIN req.**
4. Test your spreader to determine its maximum capability. Dump material with the spreader set at its maximum RPM. Dump at least 1/4 of the hopper. Time how long the dump takes. Weigh the truck before and afterwards and calculate the net amount dumped. Divide the material weight by the dump time. The result is your spreader's maximum output. _____ **LB/MIN max capability**

If your required output is larger than the spreader's capability then; 1) the spreader (or gearbox) could be modified, 2) increase the flow to the feed rate hydraulic motor, 3) increase the gate opening.

Likewise, if the requirement is less than the spreader's capability by more than 25% you should find a way to decrease the granular output. Increase the motor's displacement, change the gearbox or reduce the gate opening. The most common failing that installers make is to allow the output rate to exceed the requirements. This error forces the control system to operate the conveyor (or auger) very low in its RPM range. The result is that the hydraulic valve has to then operate at its lower flow rates. The non-linearity of the valve and motor at these lower flow rates causes larger inaccuracies in the open loop calculation by the controller.

If the spreader maximum output is not too much greater than the required output you can use the maximum trim setting of the AS2 to limit the valve's stroke. This will greatly improve the accuracy of the open loop control. Refer to the calibration section for further details.

CALIBRATION

The installer will use the front panel input knob and the program chart to establish each input variable. The input knob is divided into 10 sections and it will require that you carefully estimate the exact value to be entered. An option is to use the remote display module to directly view each numerical entry. The remote display module **RD201** is attached to the AS2 using the six pin

modular connector in the lower right corner of the front panel

Use the **feed knob** and **lane knob** to select each of the (24) calibration settings. The **INPUT** knob is used to enter the desired value for each program setting. The **Blast** button is used to save the entered value. Refer to the *program chart* for the complete list of calibration settings.

To calibrate the AS2 the first step is to put the controller into the program mode. To do this set the feed knob to **8** and the lane knob to **5**. With the Power switch off, hold the Blast button down. Now turn the Power switch on (manual or auto). Keep holding the Blast button down until the Status lamp continues to blink quickly. Then release the Blast button.

... Warning ...

During the entire procedure of calibrating the **AS2**, the hydraulic system will be active at certain times. This is necessary in order to correctly adjust the hydraulic functions.

Please think safety and use proper caution. Alert other personnel in the area to stand clear of the spinner and auger mechanical components.

The following programming chart lists each of the (24) settings

Variable	Selection code Feed knob / lane knob	Factory settings
Program mode	8 / 5	Blast + power (wait 5 seconds)
PWM freq.	2 / 3	100 hertz
Auger min	1 / 1	25%
Auger max	1 / 2	75%
Spinner min	1 / 3	25%
Spinner	1 / 4	50%
Lbs. / minute	2 / 2	300 lbs./min
MPH	2 / 1	n/a
Feed rate (1)	1 / 0	100 lbs./mi.
(2)	2 / 0	200 lbs./mi.
(3)	3 / 0	300 lbs./mi.
(4)	4 / 0	400 lbs./mi.
(5)	5 / 0	500 lbs./mi.
(6)	6 / 0	600 lbs./mi.
(7)	7 / 0	700 lbs./mi.
(8)	8 / 0	800 lbs./mi.
(9)	9 / 0	900 lbs./mi.
Lane Width (1)	0 / 1	11%
(2)	0 / 2	22%
(3)	0 / 3	33%
(4)	0 / 4	44%
(5)	0 / 5	55%
(6)	0 / 6	66%
(7)	0 / 7	77%
(8)	0 / 8	88%
(9)	0 / 9	99%
Blast timer	2 / 4	0 sec.
Product ratio	2 / 5	1.00 :1
Counts per mile	3 / 1	300 (x100)

CALIBRATION (continued)

The **Input Knob** is the key to all calibration settings. It is the only avenue for numerical entry. The faceplate around the Input knob is screened with numbers 0 thru 9. For each real variable being calibrated the Input knob value will need to be scaled. Below is a chart to reference each required scaling factor.

<i>Variable</i>	<i>Input knob</i>	<i>Scale</i>	<i>Range</i>
Feed rates	x 200	= lbs./mile	20 - 2000
Lane widths	x 10	= percent	0 - 100
Auger min & max	x 10	= percent	0 - 100
Spinner min & max	x 10	= percent	0 - 100
Auger calib.	x 100	= lbs./min	10 - 1000
PWM freq.	x 20	= Hz.(freq.)	20 - 200
Blast timer	x 1	= seconds	0.0 - 10.0
MPH calib.	n/a	(Blast @ 20 mph)	
Product ratio	x 1/10	= alt / norm	.10 - 1.00
Counts/mile	x 100	40-101600	

Note: the display will allow you to enter some numbers beyond the ranges stated. It's not recommend that you do so. Out of range numbers can cause erratic operation.

To Program or change a value in the AS2 memory

Below is a description of the common procedure that you must use for each variable you wish to change.

To make a change to any given memory location you must first be in the programming mode. Use the feed and lane knobs to select the variable you wish to change. Rotate the input knob to the desired numerical value and then push the Blast button (hold for 1 second) and release to save the value.

RD201 remote display module

To use the remote display module, simply plug in the modular connector in the lower right corner of the front panel. The RD201 will display the scaled numerical value automatically. As you hold the Blast button and rotate the input knob the resulting value will continually be updated on the display. Releasing the Blast Button will store the current displayed value. Without pressing the Blast button you will only view each of the selected variables.

Example 1

To **calibrate PWM freq.** set the feed knob to (2) and the lane knob to (3) (i.e. 2/3 on the chart). To calibrate the PWM freq. to 180 Hz. scale the input knob x 20 and set it to 9.0. (i.e. $9.0 \times 20 = 180$). With the input knob set to 9.0 push the Blast button and the value of 180 Hz is programmed into memory.

Example 2

To **calibrate valve trims** start first with the auger minimum valve trim. Set the feed knob to (1) and the lane knob to (1). (i.e. 1 / 1 from the chart). Note: the vehicle's hydraulic system should be operating so that you can observe the actual movement of the hydraulic function. To set a valve trim of 25% scale the input knob by x 10%, set the input knob to 2.5 (i.e. $2.5 \times 10\% = 25\%$) and push the Blast button to save a valve trim of 25% into the memory.

To help dial in the correct trim the valve output is active during this adjustment. With a (1/1) selected, observe the auger shaft rotation. Hold down the Blast button and adjust the input knob until the auger shaft is rotating at the slowest speed. When you release the Blast button the present valve trim is saved into memory.

Set the selector switches to (1/2) for adjusting auger maximum. When setting the auger maximum trim use care not to set the trim too high. The correct trim is that which is just enough to keep the auger at its maximum RPM. Use a hand held RPM meter to verify that the Auger trim is set just high enough to reach the maximum RPM. Setting the auger trim too high will result in the auger being out of calibration. Setting the auger maximum trim lower than the maximum RPM will help compensate for an auger than turns too fast.

Example 3

To **calibrate the auger** with a specific **lbs./minute** rate so the automatic mode will work correctly, you need to determine the amount of material which can be dumped from the auger in one minute. First, set the engine idle up to about 1000 RPM and set the hopper gate (if used) to its normal sanding position. Take the AS2 out of program mode by switching the power off then on again. After the truck is loaded with material, hold down the blast switch in order to dump material at a 100% rate. Weigh truck before and after this test to determine the total material dumped. Make a continuous dump for as long as the auger feeds smoothly, with no voids. You must time the entire dump. Next, divide the total weight of material dumped (lbs.) by the total time (minutes). The lbs./minute ratio is the auger calibration.

For example, you dumped 6500 lbs. and it took 9 minutes and 45 seconds. $6500/9.75 = 667$ lbs./min. The input knob is scaled by x 100 so you need to set it for 6.6 ($6.6 \times 100 = 660$). Set the feed knob to (2) and the lane knob to (2), with the input knob set to 6.6 push the Blast button. The auger is now calibrated to 660 lbs./min.

Example 4

To **calibrate the feed rate positions 1 thru 9** you must first decide what lbs./mile rates you want for each of the feed rate knob positions. Make a list of all the feed rates and divide each rate by 200. i.e., to assign 400 lbs./mile to position three take $400 / 200 = 2$.

Following this same example set the feed rate knob to (3) and the lane width knob to (0). Set input knob to 2 and push the Blast button. Continue for each of the other feed rate knob settings and at each position set the desired rate. It is allowable to make several of the feed rate positions equal to the same rate or to mix up the order making lower knob settings equal to higher rates and visa-versa.

Example 5

The **lane width calibration** may require actual dumping of material to achieve the best results. The AS2 will automatically turn on the auger to 50% output while you're setting the lane widths. This will allow you to dump sand onto the spinner and make more accurate settings. The nine factory settings are evenly spread between the minimum and maximum. Try the factory settings first and then change them for your specific requirements.

First, set the feed knob to (0) and one at a time increment through each of the 9 lane knob positions. The input knob is scaled in percentage of valve drive. To set a lane knob position to say 40% set the input knob to 4 and push the Blast button.

Example 6

To set the **MPH calibration** it is necessary to either take the truck for a ride at a speed of 20 mph or simply jack up the rear axle and let the wheels spin freely. (When blocking up the rear axle use care to restrain the front wheels so the vehicle does not roll off the stand.) If a two speed gear box is used put it into the range normally used for spreading.

Using the dashboard speedometer as our test instrument you want to take the speed up to 20 mph. From the programming mode, set the feed knob to (2) and the lane knob to (1). When the speed is 20 mph press the Blast button and the AS2 will automatically calibrate the correct counts per mile.

To verify the MPH for the AS2 you can run the vehicle speed up past 20 mph and you will notice that the status lamp goes out between 19 to 21 mph. This is an easy way to verify the AS2 is calibrated.

As an added feature the AS2 now has a read out and calibration for the counts per mile. If the actual counts / mile of the transmission sensor is known the number can be entered directly. Alternately, if one AS2 is calibrated and several more trucks also need to be set up, the counts / mile from the first AS2 can be read and then transferred to the other AS2's. This will eliminate the need to run each truck through the MPH calibration at 20 mph.

Example 7

The **Blast timer** is a simple feature that allows the operator to delay when the Blast turns off. The delay starts when the Blast button is released. Once the timer is active it can be ended the next time the button is pushed. To set the timer select the feed rate knob to (2) and the lane width knob to (4). From the chart that is a 2/4. Next, set the input knob for 5 if you want 5 seconds, and push the Blast button to save that time delay.

Example 8

The **Product ratio** is established by using the following formula. We will assume that the normal product will be the heavier one and the alternate product will be the lighter one. Thus the product ratio will always be less than 1.0.

$$\text{Product ratio} = \frac{\text{Alternate product density}}{\text{Normal product density}}$$

For this example let's use sand as the normal product with a density of 85 lbs. per cubic foot and a sand/salt mixture as the alternate product with a density of 70 lbs. per cubic foot. The resulting product ratio will be $70 / 85 = 0.82$.

The input knob chart shows that the product ratio = input knob / 10. Therefore, the product ratio of $0.82 \times 10 = 8.2 =$ input knob setting. Set the feed knob to (2) and the lane knob to (5) and the input knob to 8.2. Press the Blast button and the ratio is set.

The factory ships the AS2 with the product ratio set to 1.0. This ensures the front panel Product switch will have no effect.

END of PROGRAMMING To begin operation, turn the power switch off then on and it's ready to run.

Service

When you turn the power switch on the AS2 to either the manual or auto mode the status lamp should light up. It will blink if the vehicle is sitting still or it will be on steady if the vehicle is moving. If it does not come on, first check to ensure there is power available to the box from the vehicle power terminal. If power is available to the AS2 then internal fuse may be blown.

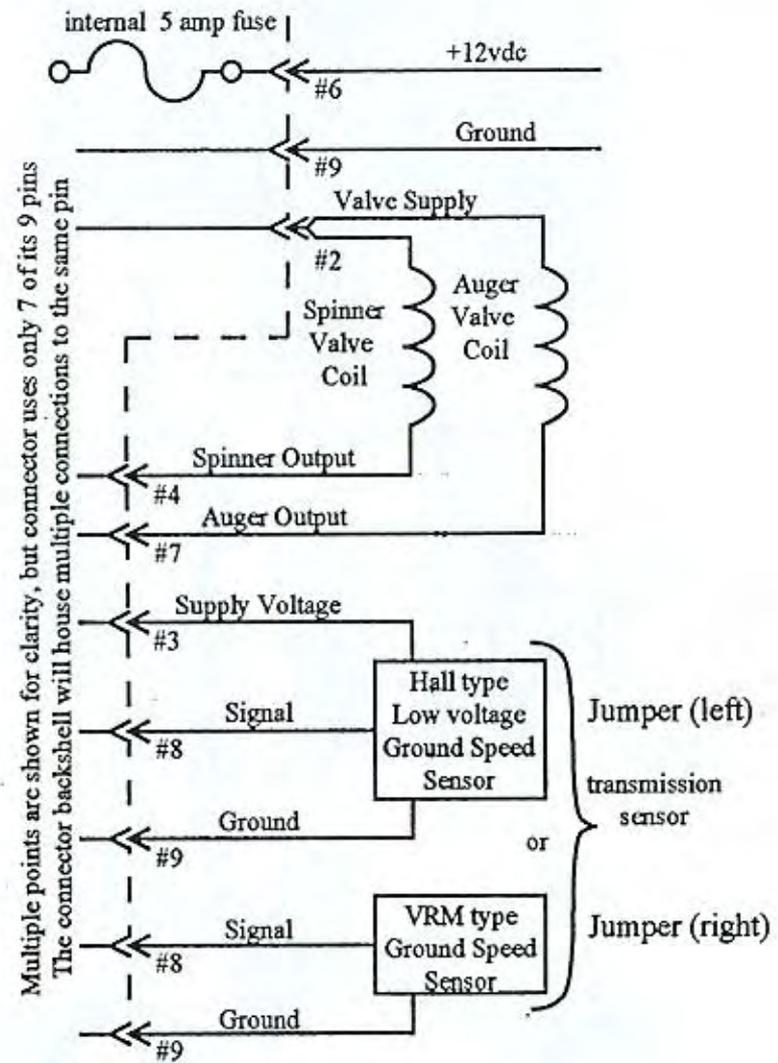
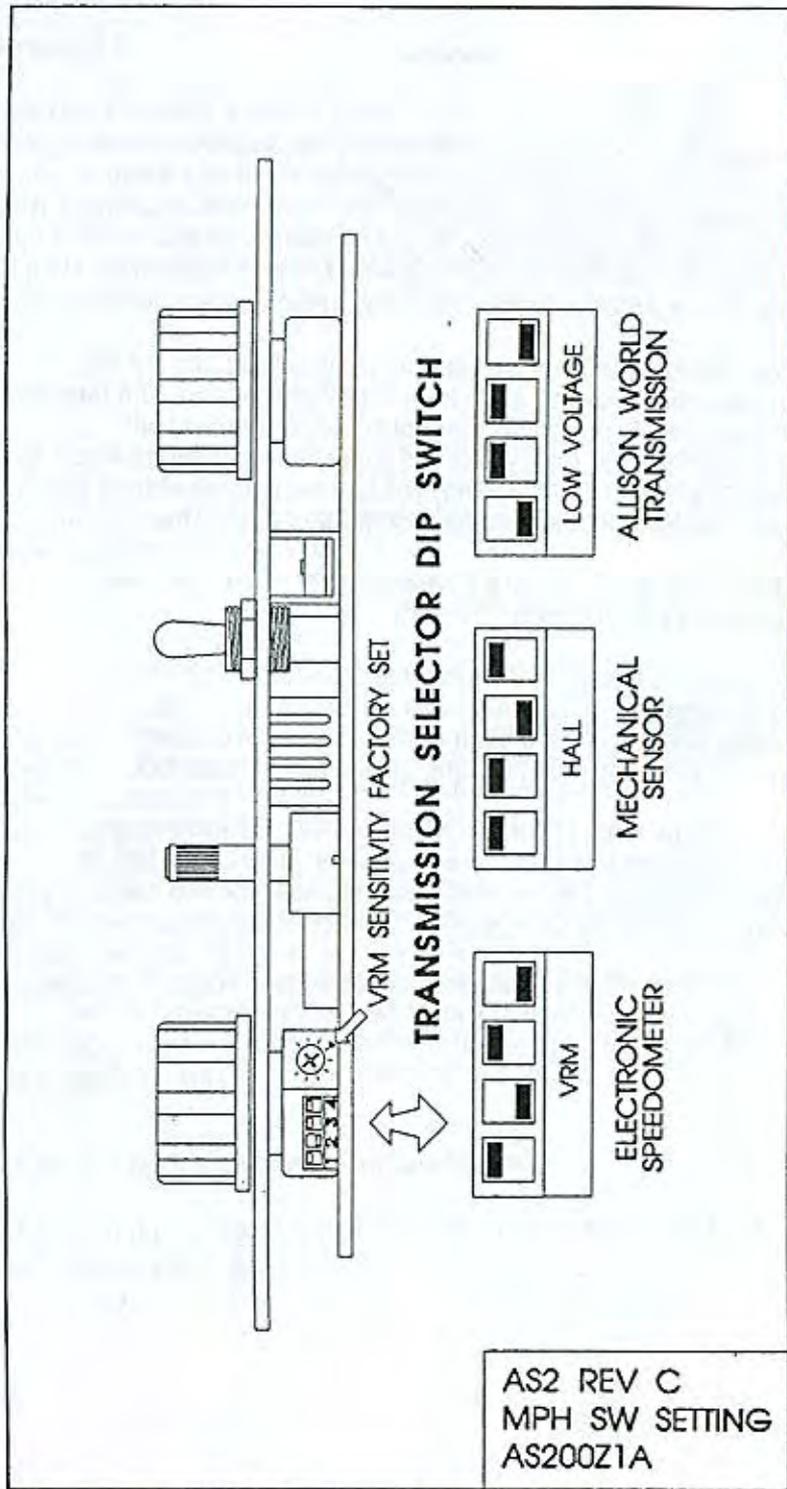
To check the fuse, remove the (4) front panel screws and pull the front plate out and away from the metal housing. Note, there are four tabs, one for each mounting screw that will block the removal of the internal circuit board. Use some care to joggle the board out, move first to the bottom and pull the top, then move to the top and pull the bottom. The fuse is mounted to two spring clips on the backside of the printed circuit board. Use only a 5 x 20 mm mini fuse, rated at **5 amp** slow blow. Manuf. part no. Littlefuse 218-005 or Buss GMC-5. These fuses may be obtained from your equipment dealer or a local Radio Shack store.

Replace the fuse with only a 5 amp. Larger rated fuses will cause damage to the AS2.

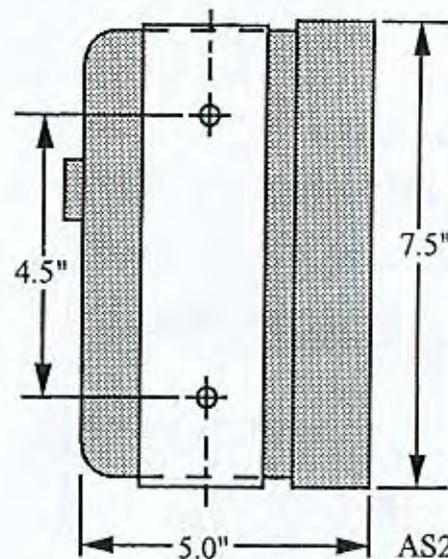
The fuse can blow if the maximum trims are set too high. Some valves can draw up to twice the rated current. Trimming the max. valve drive too high is not a good practice since it will allow the valve coil to draw too much current, get hot and shorten its life.

If the fuse blows often check the wiring and valve coils for shorts. Valve coils can measure for 3 ohms up to 12 ohms depending on the manufacture and the temperature. The cable harness can measure up to 1 ohm depending on the size of the wire.

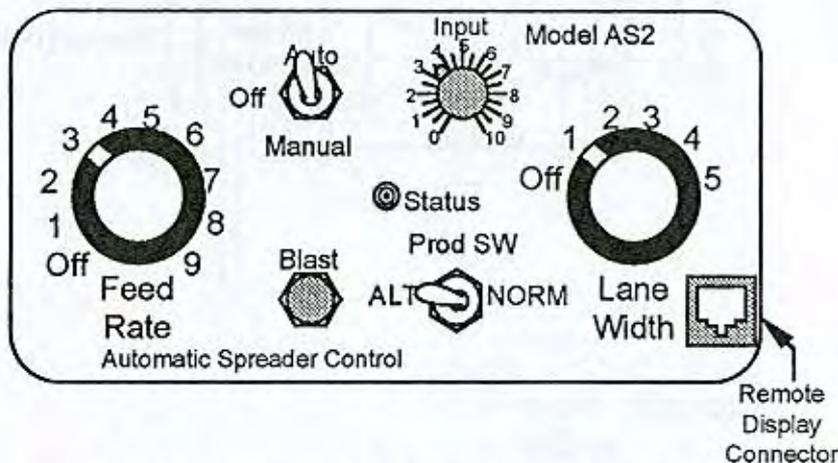
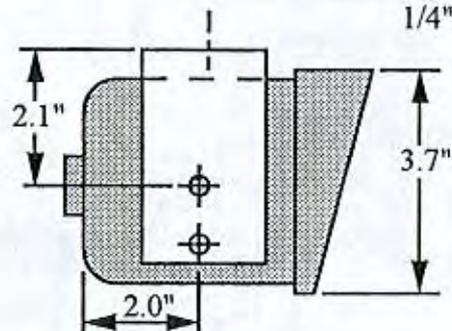
The AS2 has no other serviceable parts besides the fuse. If you experience any problems you should contact your dealer. Trained personnel are available to assist.



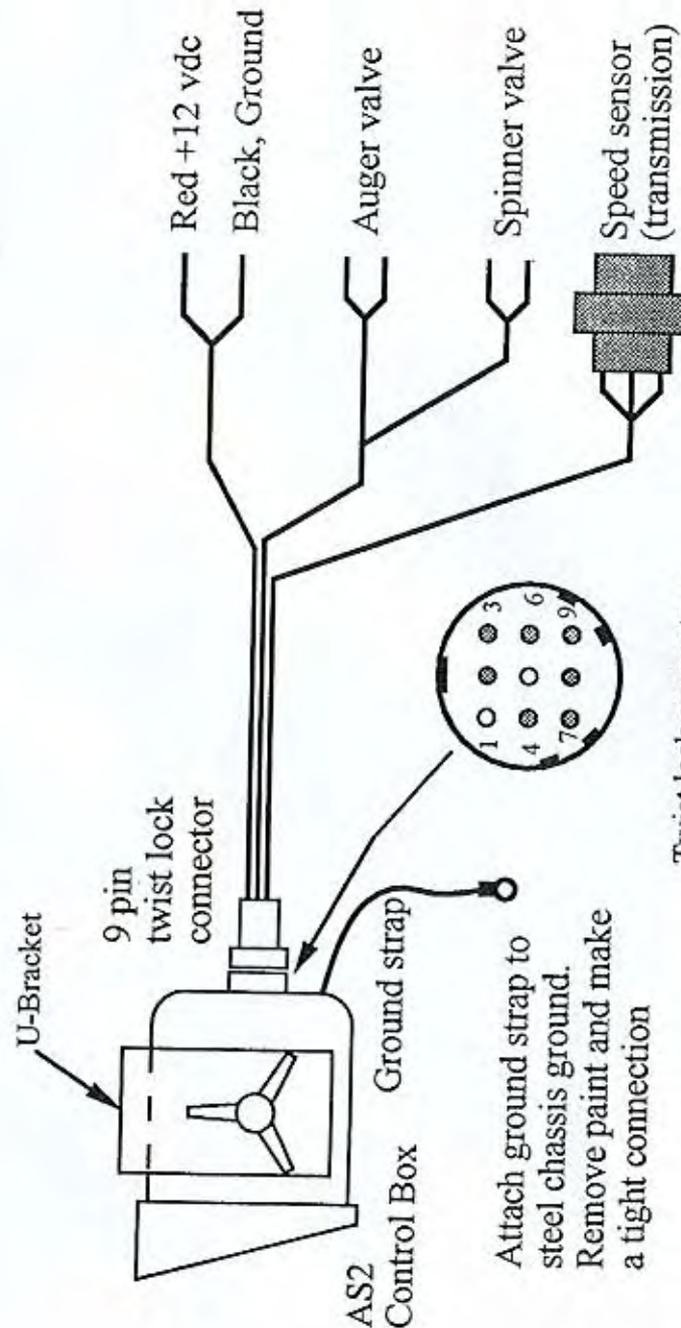
AS2 Wiring Schematic



AS2 shown with mounting bracket
1/4" mounting holes



AS2 Mechanical Layout and Front Panel



Twist lock connector as viewed from back panel
Mating connector AMP p/n's plug (1) 206708-1 cable clamp (1) 206966 -1 sockets (9) 66101-2

Attach ground strap to steel chassis ground.
Remove paint and make a tight connection

AS2 Wiring harness