



HC 2500 Rate Controller & HM 1500 Monitor Operator's Manual

Version 1.52

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Dear Owner,

Thank you for purchasing a HARDI® product and welcome to the ever-increasing family of HARDI® sprayer owners.

Our sprayers and accessories are rapidly becoming a familiar sight on North American farms. We believe that this results from growers becoming increasingly conscious of crop protection input costs and the vital need for cost effective application equipment.

Please take the time to thoroughly read the Operator's Manual before using your equipment. You will find many helpful hints as well as important safety and operation information.

Some of the features on your HARDI® Controller/Monitor were suggested by growers. There is no substitute for "on farm" experience and we invite your comments and suggestions. If any portion of this instruction book remains unclear after reading it, contact your HARDI® dealer or service personnel for further explanation before using the equipment.

For Product, Service or Warranty Information:

- Please contact your local HARDI® dealer.

To contact HARDI® directly:

- Please use the HARDI® Customer Service number: 1-866-770-7063

- Or send your email to CUSTSERV@hardi-us.com

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Sincerely,

Tom L. Kinzenbaw
President



1.0 INTRODUCTION

The HARDI® Monitor 1500 and HARDI® Controller 2500 are for use in agricultural and horticultural production. The HM 1500 is an electronic monitor which displays the actual application rate. The HC 2500 electronically provides the automatic control of the application rate. The main components are the:

- Display
- Scanbox junction box
- Flow transducer
- Speed transducer

The display has two lines permitting any two of the following pieces of information to be shown at the same time: dosage applied, driving speed, liquid rate per minute, total area covered, total volume sprayed and 9 trip tellers for area covered and volume sprayed. It is illuminated internally so readout is possible for night-time work.

Additional features include calculation of the correct area covered (even with one or more boom sections shut off when using the HARDI® control box) and alarm functions for dosage and minimum tank contents (alarm message flashes in display and audible alarm can be set on or off).

The transducers used are chosen for long service life and good signal quality. The same transducer is used for the speed and revolutions (RPM) transducers. The flow transducer has an LED (Light Emitting Diode) built into the housing to indicate correct operation. As the rotor turns, the LED flashes on and off to indicate that it is working properly.

The HM 1500 & HC 2500 use a non-volatile memory with no battery, which simplifies the storage of constants. All settings in the menus are saved in the display's memory and are not lost when the power is disconnected.

The materials and electronic components have been developed to last many years under agricultural conditions.

Options include a 4-20 mA pressure transducer and revolutions (RPM) transducer.

2.0 SAFETY INFORMATION



WARNING!



**ALWAYS READ THE OPERATOR'S MANUAL BEFORE
USING THIS EQUIPMENT**

**DO NOT REMOVE ANY SAFETY DEVICES OR
SHIELDS. NEVER SERVICE, CLEAN OR REPAIR A
MACHINE WHILE IT IS OPERATING**

WARNING!



**ALWAYS WATCH FOR THIS SYMBOL TO POINT OUT
IMPORTANT SAFETY PRECAUTIONS**

**IT MEANS ATTENTION! BECOME ALERT!
YOUR SAFETY IS INVOLVED!**



3.0 GLOSSARY OF TERMS

HM 1500	HARDI® Monitor 1500.
HC 2500	HARDI® Controller 2500.
Scanbox	Junction box for HM 1500 and HC 2500.
Transducer	Device that transforms variations to a signal. Also called a sensor.
[x] or [y]	Variable figures.
PPU	Pulses per unit. For flow calibration. The unit measure is gallon.
UPP	Unit per pulse. For speed calibration. The unit measure is feet.
PPR	Pulses per revolution. For revolutions calibration.
EC	HARDI® electric control unit. For use with HARDI® diaphragm pumps.
EVC, ECP	HARDI® electric control unit (without main on/off valve). For use with HARDI® diaphragm pumps.
ESC, ECPC	HARDI® electric control unit (without main on/off valve). For use with HARDI® centrifugal pumps.
CB	Electric control unit (without main on/off valve). For use on trailed vineyard and orchard sprayers with HARDI® diaphragm pumps.



NOTE: Text shown in square brackets or in the rectangular window will be seen on the display.
Example: [**MAIN MENU**]

MAIN MENU
Display readout

4.0 ASSEMBLY

Please follow the configuration and connections for the assembly layout of your sprayer's plumbing system.

4.1 HM 1500 Monitor/HC 2500 Controller with electric control unit (EC, EVC, ECP, ESC, ECPC, CB)

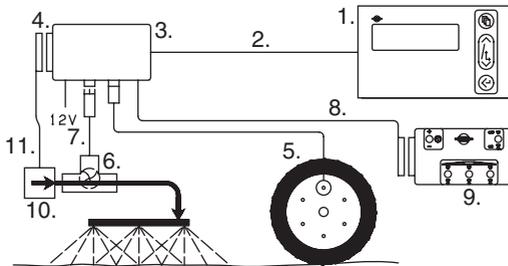
Active boom width is calculated automatically when the boom sections are operated.

NOTE: Extended menu setting (See section 11.0):

[**Control box**] is [**Lunchbox**].

[**ON/OFF valve**] is [**Present**] for EC and ECP.

[**ON/OFF valve**] is [**Not present**] for EVC, ESC, ECPC and CB.



1. HM 1500/HC 2500 display
2. Display connector cable
3. Scanbox (fuse inside)
4. 12 Volt On/off switch
5. Speed transducer
6. Flow transducer
7. To 12 Volt power supply
8. Control box connector cable
9. Control box for electric control unit
10. Electric control unit
11. Connector cable from control unit





4.2 Power supply

The power supply is 12 Volt DC.

Brown wire is positive “⊕”. **12V**

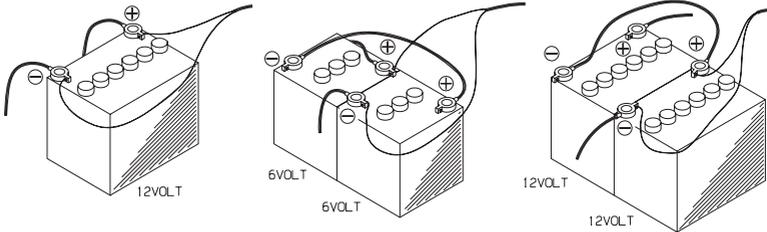
Blue wire is negative “⊖”. 

Power supply must come directly from the battery. The wires must be at least 16 awg. to ensure sufficient power supply.



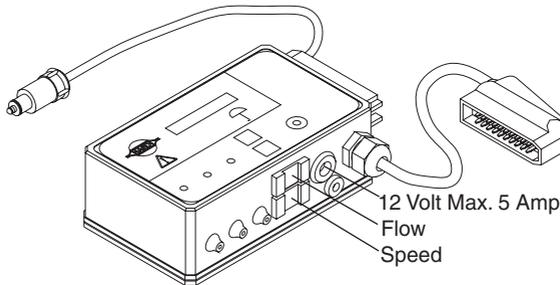
IMPORTANT: *Do not connect to the starter motor or generator/ alternator. Warranty is void if this is done.*

Use the HARDI® Electric distribution box (Ref. no. 817925) to ensure a good connection.



4.3 Scanbox

IMPORTANT: *The scanbox is not water proof and must be protected from moisture. Place in the tractor cab, for example, behind the driver's seat. It should be secured from movement.*



Fuses are located inside the scanbox.

Fuse 1.25 T Amp Slow acting (HARDI® ref. no. 261589)

Fuse 5.0 Amp Quick acting (HARDI® ref. no. 26176203)

The 2-pole 12 Volt socket has a **maximum rating of 5 ampere.**

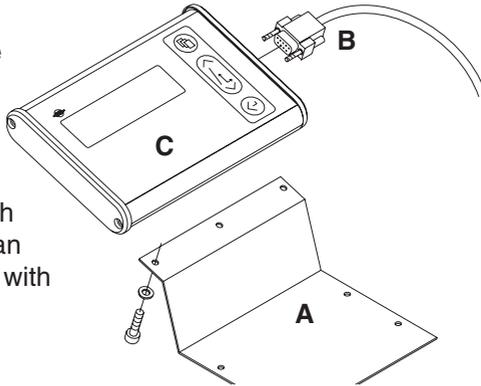
NOTE: The 12 Volt socket is intended for the HARDI® control box. It is insufficient to operate the HARDI® foam marker.



4.4 Display

The display is mounted in the tractor cabin at a convenient place. Use only the supplied screws.

The mounting plate (A) is used to mount the display with the switch box. The display can also be fitted to a flat surface with “Velcro” tape.

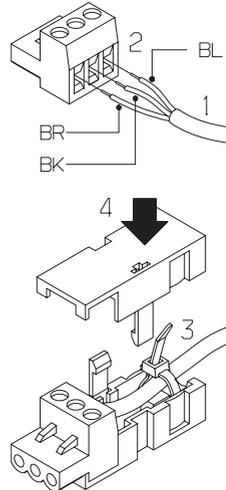


Place “Quick guide” decal at C if not already installed. (HARDI® ref. no. 978045)

IMPORTANT: Power must be disconnected from the scanbox before plug (B) is connected to the display.

4.5 Transducer color codes and plug assembly

1. Shorten cable to a suitable length. Allow enough slack for turning if transducer is fitted on a trailer sprayer.
2. Assemble as shown.
3. Run tie strap through hole under cable grip and secure cable to plug housing.
4. Trim tie strap length and assemble the housing. Tag the speed transducer by folding the identification sticker around the cable.
5. Secure plug housing with a tie strap.



Wire color codes for HARDI® transducers (speed, flow, revolutions (RPM) and pressure transducers) are as follows:

Wire color	Code	Connection for transducer
Brown	BR	12 Volt supply
Black	BK	GND
Blue	BL	Signal





4.6 Speed transducer

The HARDI® HM1500/HC2500 will work with either the magnetic speed transducer or proximity speed transducer.

DO NOT USE MAGNETS WITH THE PROXIMITY TRANSDUCER. A speed sensor adapter with "pull-up" resistor (#26005703) is required when a proximity transducer is used.

The following mount kits are available for infield installation to HARDI® trailer sprayers:

83305903 - Tandem Axle 6 Bolt

83306003 - Tandem Axle 8 Bolt (Single Axle 8 Bolt, Vineyard and Orchard sprayers)

83306103 - High Clearance/Single Axle 8 Bolt

10599603 - Single Axle 24" Wheel

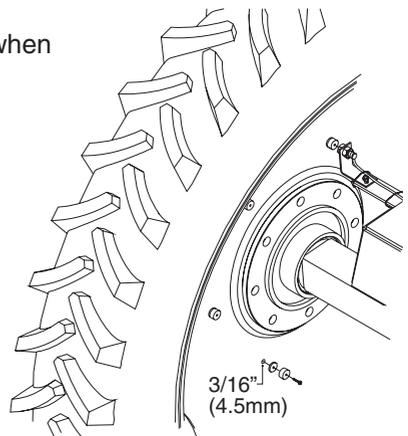
83306203 - High Clearance/Single Axle 10 Bolt

83306403 - Dual Axle/CM Suspension 10 Bolt
(Proximity sensor and adaptor included)

The magnetic speed transducer can also be mounted on the tractor or trailer sprayer wheel without the use of a mount kit. The magnets must be installed on the wheel at equal distances of at least 6" (150 mm) from one another. Drill 3/16" (4.5mm) holes in the wheel for installing the magnets. **The magnets are marked with an "S" on the south pole which must face the transducer.**

Recommended number of magnets when installing directly on the wheel (without mount brackets):

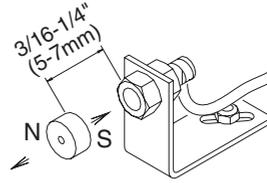
- Small wheel (rim size up to 20") 4
- Large wheel (rim size over 20")..... 6



MAGNETIC TRANSDUCER PLACEMENT:

The south side of the magnet must face the transducer.

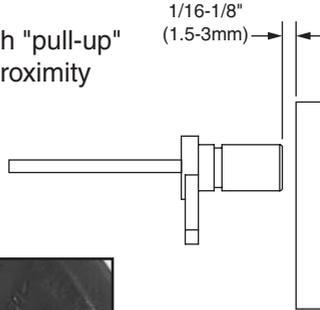
The distance between them must be $3/16"$ to $1/4"$ (5 to 7mm).



PROXIMITY TRANSDUCER PLACEMENT:

The sensor must be placed $1/16"$ to $1/8"$ (1.5 to 3mm) from the ribs on the hub. **DO NOT USE MAGNETS WITH THE PROXIMITY TRANSDUCER.**

IMPORTANT: A speed sensor adapter with "pull-up" resistor (#26005703) is required when a proximity transducer is used.

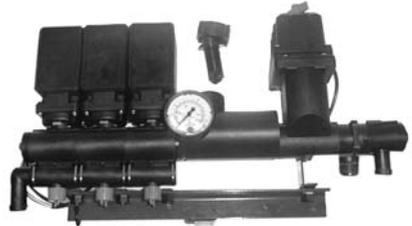


PROXIMITY SENSOR



4.7 Flow transducer for EVC and ESC control units

For the EVC control units, the flow housing is installed just prior to the distribution valves. The flow transducer is installed into the housing and connected to the Scanbox with a 3-pole plug.



EVC

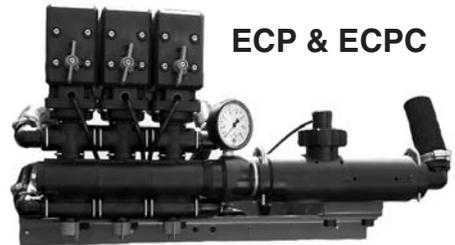
For the ESC control units, the flow housing is installed just prior to the control unit on the fluid delivery hose from the pump. The flow transducer is installed into the housing and connected to the Scanbox with a 3-pole plug.



ESC

4.8 Flow transducer for ECP and ECPC control units

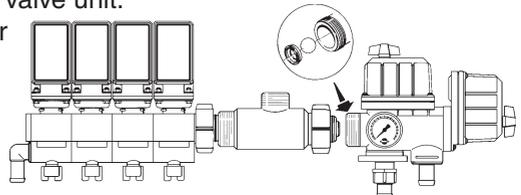
For the ECP and ECPC control units, the flow housing is installed just prior to the distribution valves. The flow transducer is installed into the housing and connected to the Scanbox with a 3-pole plug.



ECP & ECPC

4.9 Flow transducer EC control unit

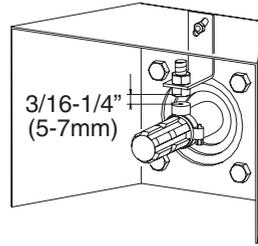
1. Remove the distribution valve unit from the main ON/OFF valve unit. Note the orientation of the ball seat and remove it from the distribution valve unit.
2. Mount the flow transducer housing just before the distribution valves.
3. Attach distribution valves with flow housing and the ball seat on the end of the main ON/OFF valve unit.
4. Install the flow transducer into the housing and connect to the Scanbox with a 3-pole plug.



4.10 Optional transducers

Revolutions (R.P.M.) transducer

The south side of the magnet must face the transducer. The distance between them must be $3/16"$ to $1/4"$ (5 to 7mm). An adjustable hose clamp drilled with a $3/16"$ (4.5 mm) hole can be used to attach the magnet to the shaft.

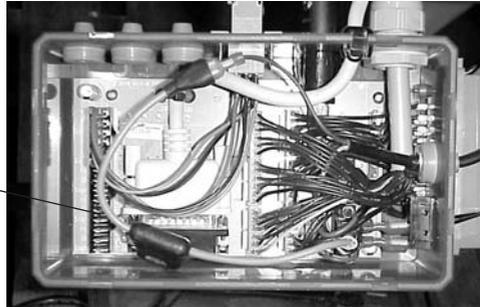


IMPORTANT: Make sure that the power is off before connecting or disconnecting any transducer cables to the Scanbox. Transducer cables are fed through the Scanbox grommets. Connection is directly to the Scanbox circuit board.

NOTE: A 6-1/2 ft. (2 meter) cable extension set with plugs and sockets is available (HARDI® ref. no. 741610).

Analog transducer
Input is 4 to 20 mA.

Connection pins



Cables

All the cables and wires must be routed so they do not get pinched, snagged or melted. Do NOT coil up any excess cable. Shorten the cable to length or run the excess cable back and forth, then secure with cable ties.

NOTE: Some communication systems (e.g. 2 way radio, cellular telephones) may cause interference with the sprayer computer. Keep communication system units and cabling away from the sprayer computer units and cabling. If interference is noted, avoid using the communication system.





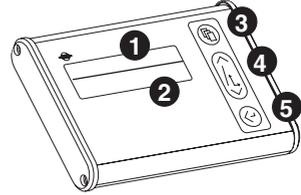
5.0 START-UP

IMPORTANT: Make sure that the power is off before connecting or disconnecting all plugs on the Scanbox. After connecting the plugs, the power is turned on at the Scanbox. Model, version number, boom sections and size is displayed briefly.



5.1 Display

1. Display, upper line.
2. Display, lower line.
3. Key for menu.
4. Arrow keys.
 - For programming application rate (HC 2500).
 - For setting dose alarm values (HM 1500).
 - To get to (scroll).
 - To change a setting.
5. Key to accept or exit a menu.



NOTE: Press keys with the tip of your finger, avoid using fingernails.

Reading chosen volume rate

To read the chosen volume rate, press briefly either arrow keys on the display. The chosen rate is shown.



CHANGE VOL. RATE
xxx gpa

The main display returns after 5 seconds of inactivity or by pressing the accept key.

5.2 HM 1500: Changing the desired volume rate for alarm

The desired rate must be entered if you wish to operate with the alarm. Press either arrow key on the display. The rate per area is shown. To raise the displayed rate, press the “up” arrow key. To lower the displayed rate, press the “down” arrow key. When either key is released, the display shows the new rate for a moment and then returns to the main display.



5.3 HC 2500: Changing the volume rate

The rate can be changed:

- Automatically, by changing the desired rate on the HC 2500 display.
- Manually, by raising and lowering the pressure on the control box.

Automatic dosage

To alter the chosen application rate, press either arrow key on the display. The current application rate (gpm) is shown. To raise the displayed rate, press the “up” arrow key. To lower the displayed rate, press the “down” arrow key. When either key is released, the display shows the new rate for a moment and then returns to the main display.

NOTE: A minimum speed of 1.25 mph (2 km/h) is needed before the system will regulate automatically.



Manual dosage

To dose in manual mode, use the pressure switch on the control box. With HC 2500, the manual mode is indicated on the bottom line with a flashed text [MAN.] over the displayed information. The bottom line of the display is cleared when [MAN.] is displayed.



To go from manual to automatic dosage, briefly touch the arrow key on the HC 2500.





Reading and reset of area trip

It is possible to choose up to 8 area trip registers (1-8) for calculation of 8 different individual areas. Area trip 0 is a total of area trips 1 to 8. The treated area is memorized when the system is switched off.

Area	xxxx.xx ac
Y	xxxxx gal

1. Press enter key for area covered and volume sprayed. 
2. Press enter key again to return. If it is not pressed again it will return to the main display after 15 seconds.

To reset the active register, press and hold the enter key continuously for approximately 5 seconds. To cancel, release the enter key before the 5 seconds have passed.

Alarms display

When an alarm is activated, [**Vol. rate alarm**] or [**Tank alarm**] flashes for 3 seconds on the top line of the display.

6.0 MENUS

Menus are selected using the menu (top) key. 

The menus can be scrolled up/down with the arrow (center) keys. 

The upper line, in capital letters, displays the menu you are in.

The lower line, in lower case letters, displays the choices you have. When the desired menu is displayed, press the menu key again to open the menu.

When modifying a setting, prolonged pressure on the arrow key will generally cause the data shown on the display to change faster.

After the setting is modified, press the accept (bottom) key. 

The display then changes back to the previous display. Repeatedly press the accept key until the main display returns.

There are 2 menu systems, the operator menu for general use and an extended menu (Section 11.0) for initial set-up of the system. To access the extended menu, press both arrow keys at the same time until the menu changes.

6.1 General keystroke

Press  to open selection menu.

Press  to find desired menu.

Press  to enter displayed menu.

Press  to find desired sub-menu or edit setting.

Press  to continue in the menu if needed.

Press  to accept and exit the menu.

Press  Repeat to exit menus and go back to main display.

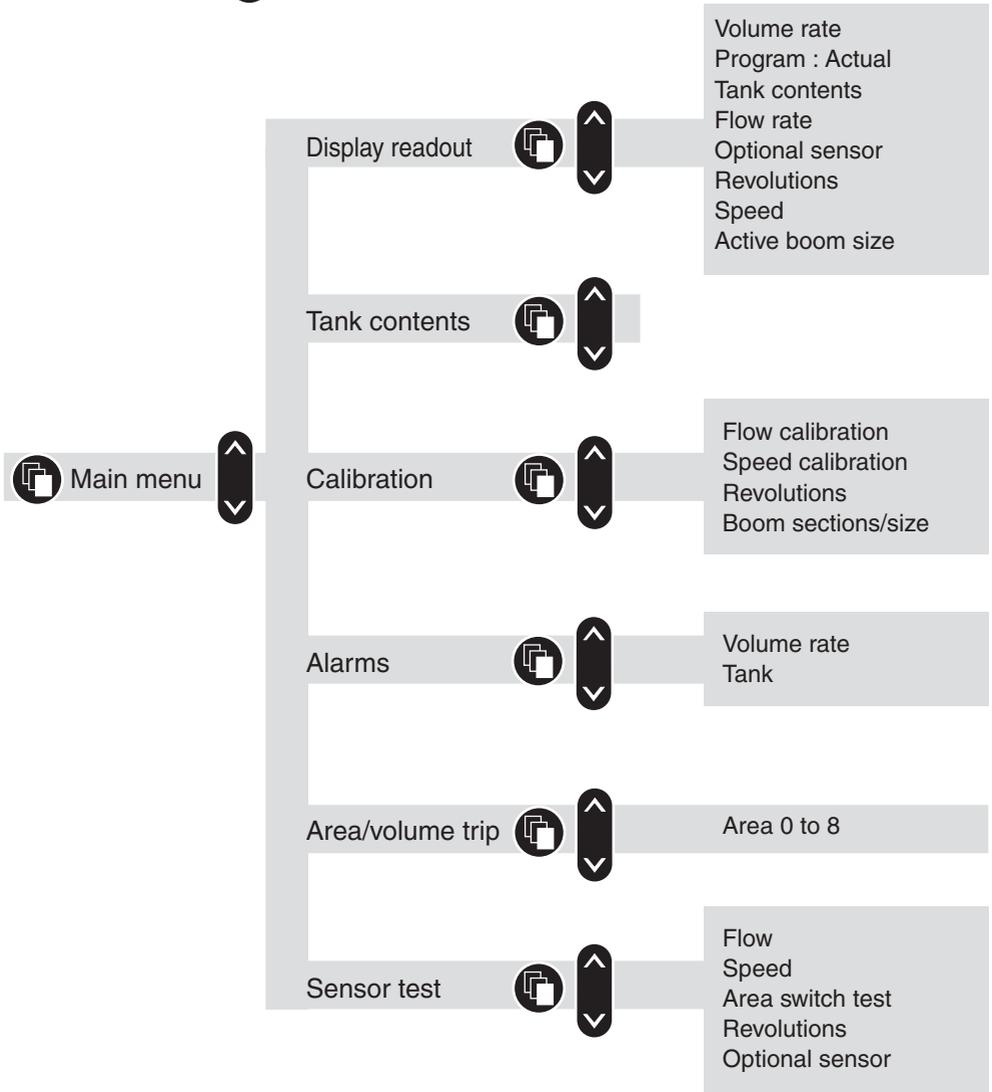




6.2 Keystroke menu tree chart

Press  to read (HM 1500) or alter (HC 2500) chosen volume rate.

Press  to read or reset area trip.



6.3 Main menu

The upper line will read [**MAIN MENU**].

The lower line displays the choices.

M A I N M E N U
D i s p l a y r e a d o u t

To choose what is to be displayed on screen.

T a n k c o n t e n t s

To change the indicated tank contents.

C a l i b r a t i o n

To access calibration menus.

A l a r m s

To set alarm parameters.

A r e a / v o l u m e t r i p

To select register to record or read area covered and volume sprayed.

S e n s o r t e s t

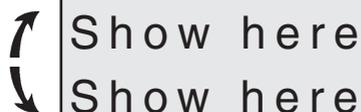
To test that the transducers function.





6.4 Display readout

It is possible to choose which function is to be shown on the upper or lower line of the display. When [**DISPLAY READOUT**] is selected from the main menu, you must first choose which line to refer to.



To choose where to show information.

Press arrow key to move [**Show here**] to the upper or lower line.

Press menu key to continue.

The upper line will read [**DISPLAY READOUT**].

The lower line displays the choices.

DISPLAY READOUT
Volume rate

To show the actual application rate.

Program:Actual

To show the programmed and actual application rate.

Tank contents

To show the tank contents.

If two or more tanks are used, the tank contents is the total contents of all tanks.

Flow rate

To show the flow rate.



Optional sensor

To show readout from an optional analog transducer.

Revolutions

To show revolutions (RPM) from an optional analog transducer.

Speed

To show driving speed.

Active boom size

To see the active boom size.

6.5 Tank contents

If the sprayer is partially refilled or refilled the tank contents can be adjusted.

See Extended menu (Section 11.0) to set the maximum tank size.

TANK CONTENTS
x x x x gal

Press menu key and use arrow keys to raise or lower value.



6.6 Calibration

It is necessary to set the correct boom width and calibrate the flow and speed transducer before using the system. Calibration of the optional RPM transducer is necessary if it is fitted.

6.6(a) Boom size

CALIBRATION
Boom size set

For setting the number of boom sections and their widths.

The correct working (spray) width for each boom section is necessary to calculate dosage and area covered.

Method

BOOM SIZE SET
Total sections x

1. Use the arrow key to set the number of boom sections and press the menu key. The maximum number of sections is 8. Press the menu key to continue. For vineyard and orchard sprayers, the number of sections is typically 2.

Sec. y Size xxxx”

2. Use the arrow key to increase or decrease the section spray width. Press the menu key to continue to next boom section. After the last section, press the accept key. The display will briefly show the total width.

6.6(b) Flow calibration

CALIBRATION
Flow calibration

The flow transducer can be calibrated theoretically or with two practical methods. For the sake of accuracy, the practical methods are preferred. If the exact amount in the tank is known (from fluid meter or weight difference, **NOT** sight gauge), the Flow Tank method is more accurate than the Flow Nozzle method.

When changing to nozzles with more than a 100% increase or decrease in output, it is recommended to re-calibrate the flow transducer.

IMPORTANT: Practical calibration is ALWAYS done with clean water.

Calibration is recommended to be carried out at least once during the spraying season.

Use the chart in Section 10.0 to record the values.



6.6(c) Flow calibration - Flow constant

FLOW CALIBRATION

Flow constant

To change the flow constant theoretically.

During theoretical flow calibration the number of pulses per unit is shown on the display.

For example, [455.0 PPU] indicates the number of pulses which theoretically come from the flow transducer while 1 gallon of liquid passes through. Approximate PPU values for different flow housings are as follows:

Housing	Code for Housing	Part #	Flow range g/min	PPU value	Orifice mm
EVC	1 groove	842191	2-30	455.0	13.5
ESC	1 groove	842021	2-30	400.0	13.5
ESC	2 grooves	842098	4-70	225.0	20.0
EC	White	842020	2-30	445.0	13.5
EC	Black	842088	4-70	225.0	20.0
EC S/67	1 groove	842081	2-30	485.0	13.5
EC S/67	no groove	842082	4-70	225.0	20.0
EC S/67	2 grooves	842228	4-160	475.0	36.0

FLOW CONSTANT

X X X . X PPU



6.6(d) Flow calibration - Nozzle method

FLOW CALIBRATION Nozzle method

During practical flow calibration, the individual nozzle output on the display is compared to the actual individual nozzle output. The displayed output is corrected **while spraying** to read the actual output. For correct calibration, it is necessary to know the number of nozzles on the boom.

Method

NOZZLE METHOD
Total Nozzles xxx

1. The number of nozzles is set with the arrow key to read the actual number of nozzles to spray. Press the menu key to continue.
2. Open all boom sections.
3. Turn the main ON/OFF valve on.
The display unit will then show the individual nozzle output per minute.

xxxx fl.oz/min

4. Using a calibration jug, check the actual nozzle output for one minute. It is recommended that an average of several nozzles be taken. A calibration kit is available from your HARDI® dealer (HARDI® ref. no. 818493:U.S./HARDI® ref. no. 818492:Metric).
5. **While still spraying under exact conditions during step 4**, correct the output shown on the display with the arrow key to read the average output measured with the calibration jug.
The display will briefly show the new calibration value PPU when returning to the main display picture.

6.6(e) Flow calibration - Tank method

FLOW CALIBRATION

Tank method

During practical flow calibration the tank is partly emptied through the nozzles. While emptying, the display calculates the quantity emptied on the basis of the actual calibration value (PPU). The displayed quantity is then compared with the actual quantity emptied.

IMPORTANT: The quantity emptied must be **accurately measured** either by weight difference of the sprayer before and after, or by using a fluid metering system. The tank level indicator (remote or liquid type) is not accurate enough for this calibration method.

The displayed quantity is then corrected to read the quantity actually emptied.

Method

1. Fill the tank with clean water until the tank level indicator reads at least 50% more than the amount to be emptied (e.g. Start with 75 gallons when emptying 50 gallons).
2. Accurately weigh the entire sprayer or reset fluid metering system.
3. Open all boom sections.
4. Open menu and turn the main ON/OFF valve on.

TANK METHOD

Sprayed xxxgal

The display unit will then begin to count the volume being emptied through the nozzles.

5. When the display shows the desired amount has been emptied (e.g. 50 gallons), turn the main ON/OFF valve off.
6. If using a fluid metering system, record the actual amount emptied. Otherwise, accurately weigh the entire sprayer again and subtract from the original weight. Divide the weight difference (in lbs.) by 8.346 to calculate the amount emptied (in gallons). For example, 460 lbs/8.346 = 55.1 gallons.
7. Correct the volume shown on the display with the arrow key to read the volume measured in step 6. The display will briefly show the new calibration value PPU when returning to the main display.





6.6(f) Speed calibration

CALIBRATION Speed Calibration

The speed transducer can be calibrated theoretically or practically. The practical method is recommended.

6.6(g) Speed calibration - Speed constant

SPEED CALIBRATION Speed constant

The theoretical speed constant, units per pulse (UPP), is the distance in feet on the circumference of the wheel between magnets.

For example, if the wheel circumference is 6.00 ft. and 4 magnets are fitted, UPP is 1.5000.



SPEED CONSTANT X . X X X X U P P

6.6(h) Speed calibration - Speed practical

SPEED CALIBRATION Practical

Practical calibration of speed is done by driving a measured distance and correcting the display so that the actual and the calculated distances are the same.



NOTE: Theoretical speed calibration should be carried out before practical speed calibration. Calibration should take place in the field with a half full tank and normal working tire pressure in order to obtain the wheel's real "working radius".

Method

1. Measure a distance of at least 250 ft (up to 999 ft.). The greater the measured distance, the more accurate the calibration.
2. Park the tractor at the start of the measured distance.
3. Open menu. When zero distance [0 feet] shows, drive the measured distance.

PRACTICAL
Measured xxx ft

4. Correct the distance shown on the display with the arrow key to read the actual distance. Repeat step 3 to confirm calibration.

Revolutions (RPM) calibration

CALIBRATION
Revolutions cal.

For calibration of revolutions transducer.

REVOLUTIONS CAL.
x . x PPR

The constant, pulse per revolution (PPR), is the number of pulses for one revolution.

For example, if one magnet is fitted, the PPR is 1.0.

6.7 Alarms

There are 2 alarms, a tank alarm for low tank contents and a volume rate alarm for over or under application. When outside the alarm settings, the relevant warning will flash. The built-in beeper can also be activated or turned off.

ALARMS
Tank alarm

Low tank contents alarm.





Activated at xx %

Suggested setting is 10%. For no alarm, set at 0 %.

Audio off

The beeper can be activated [**on**] or de-activated [**off**] by pressing the arrow key.

ALARMS

Vol. rate alarm

Volume rate alarm for over or under application for more than 20 seconds.

Activated at xx %

Suggested setting is 5%. For no alarm, set at 0 %.

Audio off

The beeper can be activated [**on**] or de-activated [**off**] by pressing the arrow key.

6.8 Area/volume trip

It is possible to choose up to 9 area trip meters (0 to 8). [**Area 0**] is a total for all areas treated. When any of the other areas are used, the treated area and volume will also be registered automatically in [**Area 0**].

AREA/VOLUME TRIP

Area x

To reset [**Area / Volume Trip**], see “Reading and reset of area trip” (Page 16 of Section 5.3).

6.9 Sensor test

All readouts are in accumulated counts, i.e. one signal gives one count, except for the optional (analog) transducer that is read in milli-ampere. Follow instructions on the display.

SENSOR TEST
Flow test

To test the flow sensor.

Spin rotor xxx

Remove transducer from flow housing and spin rotor. Every second magnet will give a count, indicating correct function. See also "Testing flow transducer".

SENSOR TEST
Speed test

To test the speed sensor.

Drive slowly xxx

Every magnet will give a count, indicating correct function. See also "Testing speed transducer".

SENSOR TEST
Revolutions test

To test the revolutions sensor

Turn slowly xxx

Every magnet will give a count, indicating correct function.





SENSOR TEST

Optional sensor

To test the optional transducer.

x.x mA

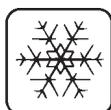
Gives a direct reading in mA from the sensor.



7.0 VINEYARD AND ORCHARD SPRAYERS

Points to note if the system is used on vineyard or orchard sprayers:

- Work width is the same as the spray width of the sprayer.
- Use the Tank method to calibrate the flow transducer.
- Blower fan revolutions can be read in the revolutions readout.
- The flow transducer is installed between the distribution valves and the pressure regulation valve (similar to EVC control).
- To mount the speed transducer to the axle of a trailed vineyard or orchard sprayer, use the Tandem Axle 8 Bolt kit (HARDI® ref. no. 83306003).



8.0 STORAGE

When the tractor and sprayer are parked, disconnect the power supply to the Scanbox. This will stop the system from using power.

The display and Scanbox should be protected from moisture and should be removed if the tractor does not have a cab.

9.0 TROUBLESHOOTING

9.1 EMERGENCY OPERATION: EC, EVC, ECP, ESC, ECPC, CB

The HM 1500 & HC 2500 do not require any wiring modifications to the electric control unit (EC, EVC, ECP, ESC, ECPC or CB). If a problem arises during operation, it is possible to continue spraying without the HM 1500 or HC 2500 by disconnecting the Scanbox from the control unit and reconnecting the cable from the control unit (EC, EVC, ECP, ESC, ECPC or CB) to the control box.

9.2 Fault finding

Fault	Cause	Remedy
No start-up.	Check polarization is correct. Check the fuse in the Scanbox.	Change fuse. (See section 4.3).
Blinking back-light. No "bip" sound at start-up.	Poor power supply.	Check battery, cabling and connections.
Displayed area larger than actual area.	Field was not rectangular. Overlapping spray.	Check spray width to ensure no overlapping occurs on turnarounds.
Displayed volume larger than actual volume.	Pressure equalization valve leaks.	Replace seals.

9.3 Fine tuning the flow constant - PPU

Calibration of the flow transducer is always carried out with clean water but small changes may occur when adding pesticides or fertilizer. This will affect the final readings. This is typically noted when the volume displayed on the display does not equal the actual measured volume (i.e. with fluid meter, **NOT** sight gauge) that was sprayed out. The formula below can be used to "fine tune" the flow transducer PPU.

$$\text{New PPU} = \frac{\text{Original PPU} \times \text{Displayed Volume}}{\text{Sprayed Volume}}$$

For example, 240 gallons of spray liquid is sprayed out (measured by fluid meter or weight difference, **NOT** sight gauge). And the display showed a total of 230 gallons. (Original PPU = 120.0)

$$\text{New PPU} = \frac{120.0 \text{ (Original PPU)} \times 230 \text{ (Displayed Volume)}}{240 \text{ (Sprayed Volume)}} = 115$$

Note the relation is inverse:

- To raise the displayed volume, the PPU is lowered.
- To lower the displayed volume, the PPU is raised.
- See section 6.6(c) to change PPU values.

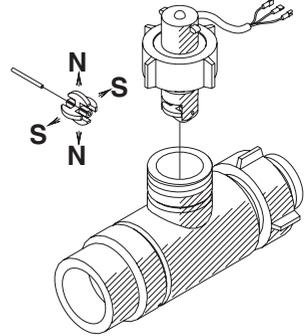




9.4 Testing the flow transducer (Ref. no. 728816)

Wire connections: BROWN wire to positive of 12V battery.
BLACK wire to negative.
BLUE wire to positive lead of multimeter.

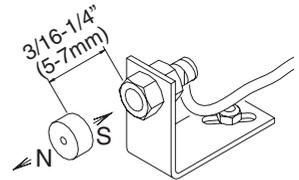
1. Make sure the rotor turns freely.
2. Each vane in the rotor has a magnet in it with the pole facing out. Check that the 4 magnets are in place.
3. Check that every second magnet has the same pole orientation so the rotor magnets are N - S - N - S.
4. Connect negative lead of multimeter to negative post of 12V battery.
5. Set multimeter to DC volt.
6. By turning the mill wheel slowly, this will register approx. 8.0 +/- 1 with the diode on and 0.3 +/- 0.1 volt with the diode off with every second magnet.



9.5 Testing the magnetic speed transducer (Ref. no. 72098400)

Wire connections: BROWN wire to positive of 12V battery.
BLACK wire to negative.
BLUE wire to positive lead of multimeter.

1. Connect negative lead of multimeter to negative post of 12V battery.
2. Set multimeter to DC volt.
3. Bringing the south pole of a magnet a distance of 3/16"-1/4" (5-7mm) from the transducer will register 0.3 +/- 0.1 volt.
4. Removing the magnet will register 7.0 +/- 1.0 volt.



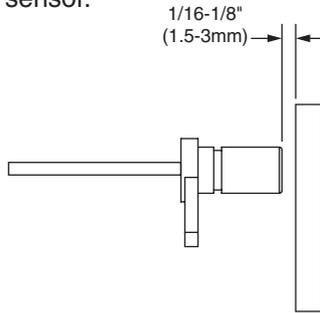
9.6 Testing the proximity speed transducer

(Ref. no. 26005503)

IMPORTANT: A speed sensor adapter with "pull-up" resistor (#26005703) is required when a proximity transducer is used.

Wire connections: BROWN wire to positive of 12V battery.
BLACK wire to negative.
BLUE wire to positive lead of multimeter.

1. Connect negative lead of multimeter to negative post of 12V battery.
2. Set multimeter to DC volt.
3. The transducer will register 0.5 +/- 0.1 volt when the transducer is within 1/8" (3mm) from a metal surface.
4. The transducer will register 12.0 +/- 1.0 volt when there is no metal directly in front of the sensor.



10.0 CHART FOR RECORDING VALUES

Menu	Function	1 - Values	2 - Values	3 - Values
	Nozzle /Color			
[Flow constant]	Flow PPU			
[Speed constant]	Speed UPP			





11.0 EXTENDED MENU

Access the extended menu by pressing both arrow keys at the same time until the menu changes.

The extended menu is written in English only.



IMPORTANT: Re-start the system after leaving the Extended menu.

Menu	Function [choices]
[Language]	To select language. [GB, DK, F, E, D, Cz, SF, NL, I, S]
[Unit]	To set unit of measurement. [Metric, USA]
[ON/OFF valve]	To change rotation of pressure reg. motor. [Present, not present]
[Pressure system]	To select pressure system. [Equalization, No equalization]
[Control box]	To indicate control box connection to Scanbox. [Lunch Box, Spray Box, Not connected]
[Tank volume max]	To pre-set tank volume indicated at start-up.
[Analog adjust]	To calibrate the optional transducer. [max., min., offset in mA]
[Analog unit text]	To choose the unit of measurement for optional transducer. [Bar, PSI, deg C, deg F, % R.H.]
[Regulation con.]	For the sensitivity of the pressure regulation valve.
[Min Press Duty]	To increase the power of pressure reg. Motor.
[Change SW ver.]	To permit change or update of software.
[Master reset]	For factory use only.
[Area totals]	To see total area covered and volume sprayed.
[Scanbox]	Troubleshooting/To set contrast.

Default setting

Text	For HC 2500	For HM 1500
[Language]	E	E
[Unit]	USA	USA
[ON/OFF valve]	Present	Present
[Pressure system]	Equalization	Equalization
[Control box]	Lunch Box	Lunch Box
[Tank size]	500 gal	500 gal
[Analog adjustment]	max. 10 min. 0 offset in mA 0 mA	max. 10 min. 0 offset in mA 0 mA
[Analog unit text]	PSI	PSI
[Regulation con.]	0%	0%
[Min Press Duty]	5%	5%
[Flow PPU]	120.0	120.0
[Speed UPP]	1.0000	1.0000

HM 1500 and HC 2500

Extended menu settings for EVC, ESC, ECPC or CB control units:

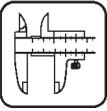
- [ON/OFF valve] to [Not present]
- [Control box] to [Lunchbox]

Extended menu settings for EC or ECP control units:

- [ON/OFF valve] to [Present]
- [Control box] to [Lunchbox]

IMPORTANT: Re-start the system after leaving the Extended menu.





12.0 TECHNICAL SPECIFICATIONS

Supply voltage	12 Volt DC
Minimum supply	11 Volt DC
Maximum supply	16 Volt DC
Maximum peak	20 Volt DC
Ambient temperature	15° F to 130° F (-10° C to +55° C)
Memory	Flash PROM non-volatile
Digital transducers	Square signal
Update frequency	4 times per second
Trigger high	5.0 to 12.0 Volt DC
Trigger low	0.0 to 0.5 Volt DC
Analog transducers	
Supply	Loop
Input	4 to 20 mA
Minimum speed for volume regulation	1.25 mph (2 km/h)

Flow ranges for the flow transducers:

Housing	Code for Housing	Part #	Flow range g/min	PPU value	Orifice mm
EVC	1 groove	842191	2-30	455.0	13.5
ESC	1 groove	842021	2-30	400.0	13.5
ESC	2 grooves	842098	4-70	225.0	20.0
EC	White	842020	2-30	445.0	13.5
EC	Black	842088	4-70	225.0	20.0
EC S/67	1 groove	842081	2-30	485.0	13.5
EC S/67	no groove	842082	4-70	225.0	20.0
EC S/67	2 grooves	842228	4-160	475.0	36.0

Pressure drop over 13.5 mm orifice is 14.5 PSI at 40 g/min.

Packaging information

Materials used for packaging are environmentally compatible. They can be safely scrapped or recycled.

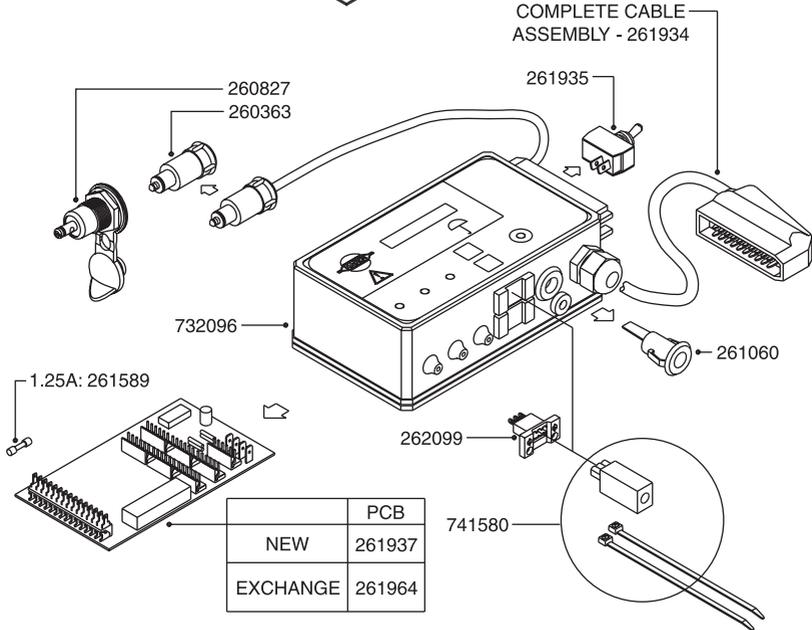
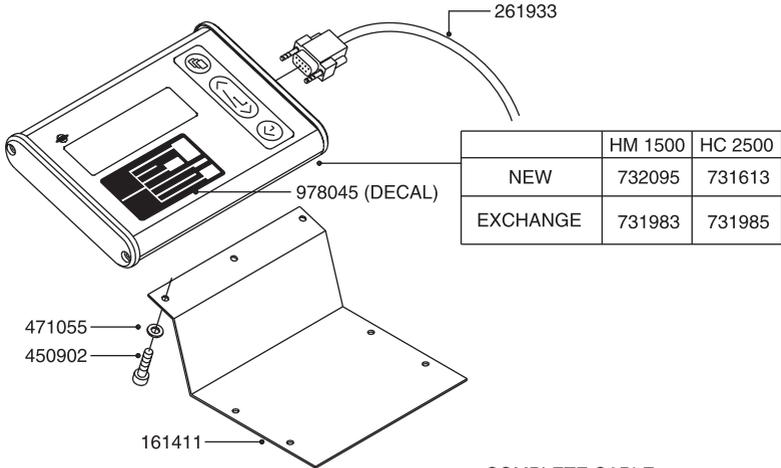
Recycling

Cardboard: Can recycle up to 99% and should therefore be taken to a recycling center.

Polyethylene: Can be recycled.

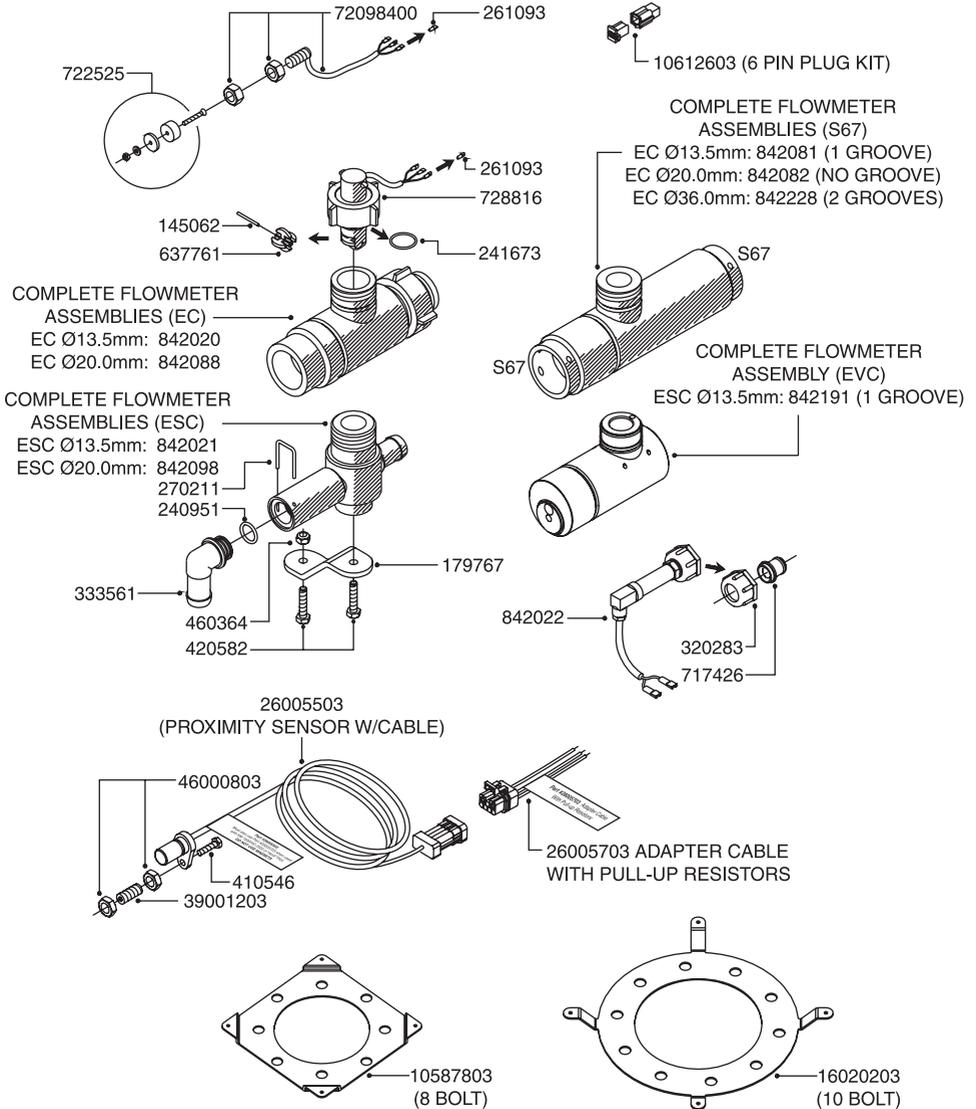
13.0 PARTS DRAWINGS

Major Components





Transducers and Accessories



14.0 SERVICE POLICY

Fault finding to verify a failure is to be done by an authorized HARDI® Service Dealer or by the owner of the HARDI® Monitor 1500 or HARDI® Controller 2500.

If the failure is related to a cable or fuse, repair is to be undertaken by an authorized HARDI® Service Dealer.

If the failure is related to hardware, the defective component is to be removed and forwarded to the applicable HARDI® Branch (Davenport, IA - London, Ont. - Visalia, CA). Any return to the HARDI® Branch must be handled through an authorized HARDI® Service Dealer.

Components for the HARDI® Monitor 1500 and HARDI® Controller 2500 that are out of warranty can be replaced with reconditioned exchange components if available. These reconditioned exchange components will be available through your authorized HARDI® Service Dealer.





15.0 WARRANTY POLICY AND CONDITIONS

HARDI® INC. , 1500 West 76th Street, Davenport, Iowa, USA; 8550 W. Roosevelt Avenue, Visalia, California, USA and 290 Sovereign Road, London, Ontario, Canada hereinafter called "HARDI®", offers the following limited warranty in accordance with the provisions below to each original retail purchaser of HARDI® new equipment of its own manufacturer, from an authorized HARDI® dealer, that such equipment is at the time of delivery to such purchaser, free from defects in material and workmanship and that such equipment will be warranted for a period of one year from the date of delivery to the end user providing the machine is used and serviced in accordance with the recommendations in the Operator's Manual and is operated under normal farm conditions.

1. This limited warranty is subject to the following exceptions:
 - a) This warranty will be withdrawn if any equipment has been used for purposes other than for which it was intended or if it has been misused, neglected, or damaged by accident, let out on hire or furnished by a rental agency. Nor can claims be accepted if parts other than those manufactured by HARDI® have been incorporated in any of our equipment. Further, HARDI® shall not be responsible for damage in transit or handling by any common carrier and under no circumstances within or without the warranty period will HARDI® be liable for damages of loss of use, or damages resulting from delay or any consequential damage.
2. We cannot be held responsible for loss of livestock, loss of crops, loss because of delays in harvesting or any expense or loss incurred for labor, supplies, substitute machinery, rental for any other reason, or for injuries either to the owner or to a third party, nor can we be called upon to be responsible for labor charges, other than originally agreed, incurred in the removal or replacement of components.
3. The customer will be responsible for and bear the costs of:
 - a) Normal maintenance such as greasing, maintenance of oil levels, minor adjustments, etc.
 - b) Transportation of any HARDI® product to and from where the warranty work is performed.
 - c) Dealer travel time to and from the machine or to deliver and return the machine from the service workshop for repair.
 - d) Dealer traveling costs.
4. This warranty will not apply to any product which is altered or modified without the express written permission of HARDI® and/or repaired by anyone other than an Authorized Service Dealer.
5. Warranty is dependent upon the strict observance by the purchaser of the following provisions:
 - a) That this warranty may not be assigned or transferred to anyone.
 - b) That the Warranty Registration Certificate has been correctly completed by dealer and purchaser with their names and addresses, dated, signed and returned to the appropriate address as given on the Warranty Registration Certificate.
 - c) That all safety instructions in the operator's manual shall be followed and all safety guards regularly inspected and replaced where necessary.
6. No warranty is given on second-hand products and none is to be implied.
7. HARDI® reserves the right to incorporate any change in design in its products without obligation to make such changes on units previously manufactured.
8. The judgement of HARDI® in all cases of claims under this warranty shall be final and conclusive and the purchaser agrees to accept its decisions on all questions as to defect and to the exchange of any part or parts.
9. No employee or representative is authorized to change this warranty in any way or grant any other warranty unless such change is made in writing and signed by an officer of HARDI® at its head office.

10. Any warranty work performed which will exceed \$400.00 MUST be approved IN ADVANCE by the Service Manager.
11. Claims under this policy must be filed with HARDI® within thirty (30) days of work performed or warranty shall be void.
12. Parts requested must be returned prepaid within thirty (30) days for warranty settlement.
13. Warranty claims must be COMPLETELY filled out properly or will be returned.

DISCLAIMER OF FURTHER WARRANTY

THERE ARE NO WARRANTIES, EXPRESSED OR IMPLIED, EXCEPT AS SET FORTH ABOVE. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION OF THE PRODUCT CONTAINED HEREIN. IN NO EVENT SHALL THE COMPANY BE LIABLE FOR INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES (SUCH AS LOSS OF ANTICIPATED PROFITS) IN CONNECTION WITH THE RETAIL PURCHASER'S USE OF THE PRODUCT.



