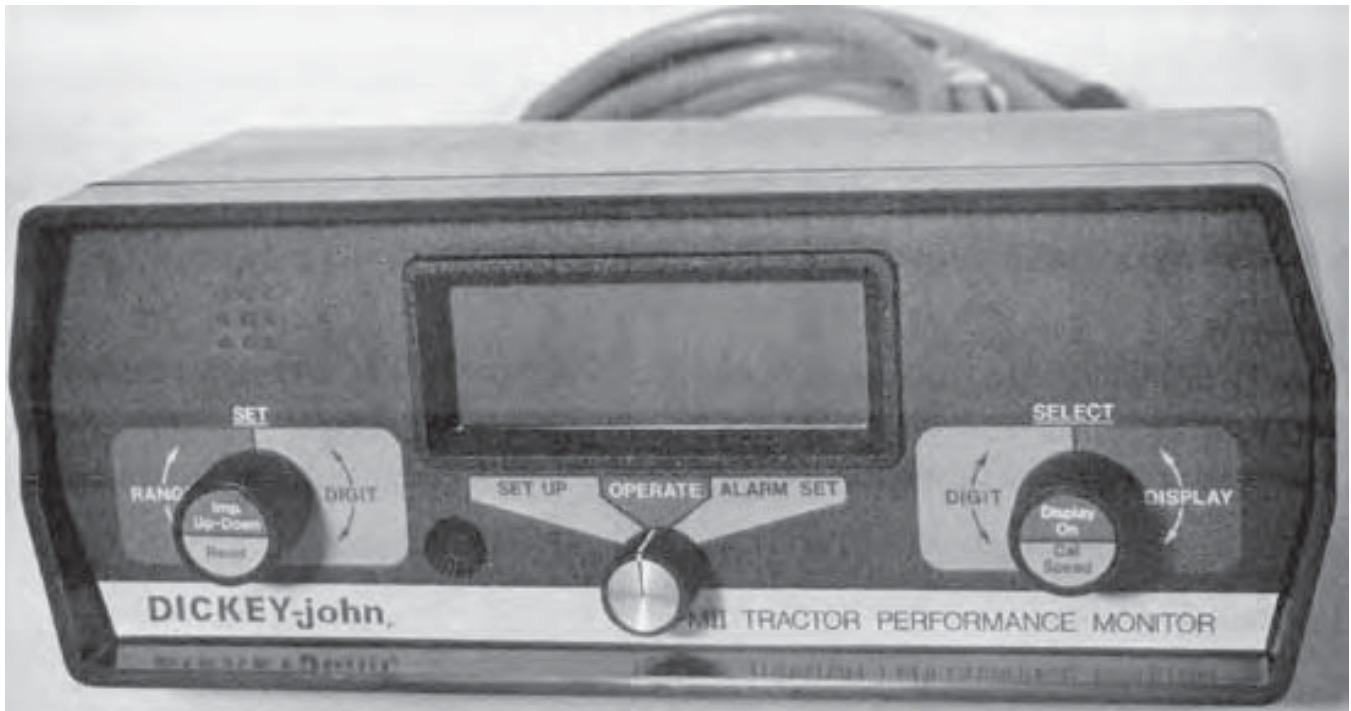


Evaluation Report

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Dickey-John TPM II Tractor Performance Monitor

DICKEY-JOHN TPM II TRACTOR PERFORMANCE MONITOR

MANUFACTURER:

Dickey-john Corporation
P.O. Box 10
Auburn, Illinois 62615
U.S.A.

DISTRIBUTOR:

Dickey-john Canada Inc.
700 Campbell Street
Cornwall, Ontario
K6H 6C9

RETAIL PRICE:

\$2,099.00 (May, 1985, f.o.b. Humboldt, Saskatchewan).

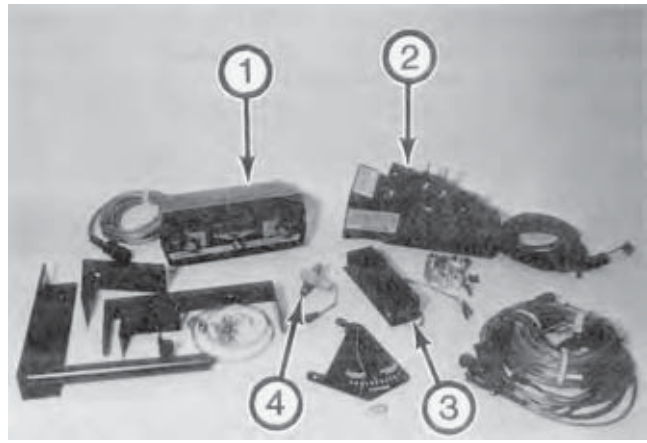


FIGURE 1. Dickey john Tractor Performance Monitor. (1) Control Console, (2) Radar Ground Speed Sensor, (3) Implement Status Switch, (4) Engine RPM Sensor.

SUMMARY AND CONCLUSIONS

Quality of Work: The Dickey-john TPM II tractor performance monitor was very useful in providing the operator with information on tractor operation.

Accuracy of the ground speed measurements was very good. Error was less than 1% if the monitor was properly calibrated for each field condition.

Accuracy of the wheel slip measurement was very good. Wheel slip was accurately displayed in 1% increments.

Accuracy of the area and workrate calculations was also very good. However, these values continued to increase in windy fields on windy days, even though the tractor was stationary.

Ease of Installation: Ease of installation was very good. It took one man about four hours to install the Dickey-john TPM II. Installation instructions were clear and descriptive. The sensors were easily installed on the test tractor.

Ease of Operation and Adjustment: Ease of operating the Dickey-john TPM II was good after some operator experience had been gained.

Readability of the liquid crystal display was very good, but was reduced by glare from direct sunlight.

Ease of calibrating the monitor was good. However, the procedure was time-consuming since many calibration steps were required.

Electrical Power Requirements: The monitor drew a maximum 0.5 A when operating, Memory loss occurred if the tractor battery was disconnected or voltage dropped below 4 V.

Safety: Safety decals were provided to warn the operator against looking directly into the radar ground speed sensor.

Operator's Manual: The operator's manual was very good and was well illustrated.

Mechanical History: No mechanical problems occurred during the test.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Modifications to prevent plant movement from increasing distance and area totals when the tractor is stationary.

Senior Engineer: G.E. Frehlich

Project Engineer: H.D. Kydd

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. The radar velocity sensor has been designated to be extremely sensitive so that it can obtain the high accuracy found by PAMI in their tests. When the tractor is moving, the radar velocity sensor detects only the ground movement because it produces a stronger signal than the plants waving in the wind. However when the tractor is stationary, the sensor detects the plant movement and this causes the raise accumulation of area and distance. To prevent this, the operator can raise the implement to activate the implement status switch or he can push the set control push button on the console. For specific applications, customers should contact Dickey-john Customer Services directly.

GENERAL DESCRIPTION

The Dickey-john TPM II tractor performance monitor consists of a control console, a radar ground speed sensor, an engine RPM sensor, and an implement status switch, A wheel speed sensor is provided for four wheel drive tractors, The digital monitor displays engine RPM, ground speed, wheel slip, distance travelled, field area, total area, and workrate in English units, A monitor that displays SI units is available.

The control console mounts in the tractor cab, The radar ground speed sensor mounts under the tractor to measure ground speed for two and four wheel drive tractors. The engine RPM sensor attaches to the tractor tachometer cable while the implement status switch mounts on the implement to stop the area count when the implement is raised. The wheel speed sensor mounts near the drive shaft and measures the speed of the drive shaft to determine wheel slip on a four wheel drive tractor.

The Dickey-john TPM II is powered by a 12 V DC electrical system and will operate on either a positive or negative ground. Detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The Dickey-john TPM II tractor performance monitor was operated on a Case 4690 four wheel drive tractor for 66 hours of typical tillage. It was evaluated for quality of work, ease of installation, ease of operation and adjustment, safety, and suitability of the operator's manual.

RESULTS AND DISCUSSION

QUALITY OF WORK

Ground Speed Measurement: Accuracy of the Dickey-john monitor for measuring ground speed was very good. When properly calibrated for each field condition, monitor error was less than 1%. However, when not calibrated for each different field condition, monitor error was as high as 3%.

In weedy fields or standing trash on windy days, the monitor indicated speeds up to 2.9 km/h (1.8 mph) when the tractor was stationary. However, weeds and trash did not affect accuracy of ground speed measurement when the tractor was moving.

Monitor readings were not affected by Citizen Band radio operation. However, electronic interference is possible with all monitors, and high performance radio systems are available which may increase the possibility of interference. Proper installation of the monitor and other electronic equipment should prevent possible interference.

Slip Measurement: The amount of slip encountered depends on field conditions; tire pressure, configuration and type; ballast; draft; tractor speed and weight; and many other factors. Tests have shown that optimum tractor performance can be obtained when slip is maintained between 8 and 15%.

The Dickey-john TPM II was a very good indicator of wheel slip. When properly calibrated, wheel slip was accurately displayed in 1% increments. Error was less than one increment for a wheel slip range of 0 to 20%.

Area and Workrate Calculations: Accuracy of the monitor in calculating distance travelled, field area, total area, and the work rate was very good, providing the monitor was properly calibrated for ground speed and implement width.

It was important to raise the implement when the tractor was stationary in weedy fields to prevent the weed movement from increasing the distance, area, and workrate totals. It is recommended that the manufacturer consider modifications to prevent increases in these totals when the tractor is stationary in weedy fields.

EASE OF INSTALLATION

Installation Time: Ease of installation was very good. It took one man about four hours to install the monitor using common tools found in most farm shops. Sufficient brackets and mounting hardware were provided. Installation instructions were clear and descriptive.

Control Console: The control console (FIGURE 2) was easily mounted in the tractor cab using the mounting brackets provided. The control console should be located in a normal line of sight, away from direct sunlight.

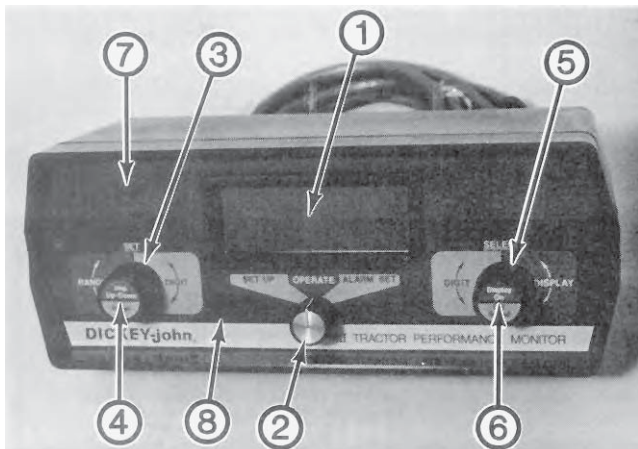


FIGURE 2. Control Console: (1) Display Screen, (2) Mode Selector Dial, (3) Set Control Dial, (4) Set Control Push Button, (5) Select Control Dial, (6) Select Control PushButton, (7) Alarm, (8) Alarm Volume Control.

Radar Ground Speed Sensor: The ground speed sensor was mounted underneath the tractor, facing rearwards (FIGURE 3) with an unobstructed view of the ground. It had to be mounted high enough to protect it from stubble and debris. When mounted, the sensor was set at the correct angle using the plumb bob template provided.



FIGURE 3. Typical Radar Ground Speed Sensor Mounting.

Wheel Speed Sensor: The wheel speed sensor was mounted on the differential housing using the brackets provided, while the sensor disk bolted to the differential U-joint yoke (FIGURE 4). The clearance between the sensor and target bolts was easily set at 0.08 in (2 mm) using the gauge provided by the manufacturer.

On two wheel drive tractors, a wheel speed sensor is not used because the drive shaft is not accessible.

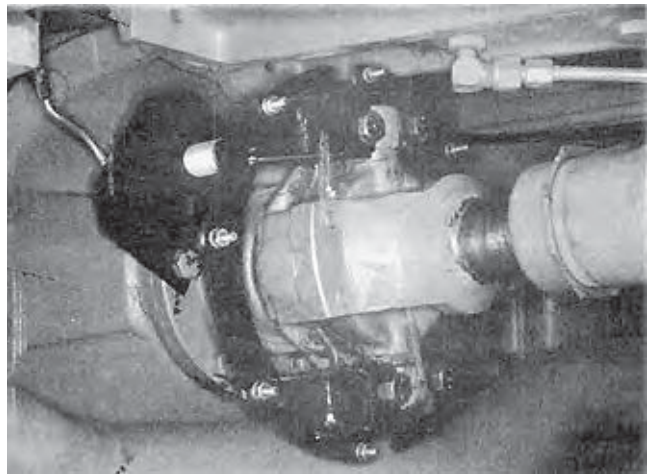


FIGURE 4. Typical Wheel Speed Sensor Mounting.

Engine RPM Sensor: The engine RPM sensor was easily mounted in the existing mechanical tachometer drive using hardware supplied by the manufacturer. Care was required to properly align all drive pins to avoid drive pin damage. Special connecting cables were supplied for tractors with electronic digital tachometers.

Implement Status Switch: The implement status switch was easily mounted on the test cultivator using the mounting hardware provided.

Wiring Harness: The control console was easily connected to the sensors and to the tractor power source using the wire and hardware provided. A quick coupler for the work switch facilitated unhitching. Special care was required to route cables to prevent mechanical damage.

EASE OF OPERATION AND ADJUSTMENT

Monitor Operation: Ease of operating the Dickey-john monitor was good after some operator experience had been gained.

The functions provided by the monitor controls are listed in TABLE 1. The function dials and push buttons were convenient to operate. Calibration numbers were easily entered into the monitor.

Display Readability: The readability of the liquid crystal display was very good during the day and at night. However, glare from direct sunlight reduced daytime visibility if the control console was located in direct sunlight.

Calibration: Ease of calibrating the Dickey-john TPM II was good. However, the procedure was time-consuming since many calibration steps were required.

TABLE 1. Monitor Controls and Functions

MODE SELECTOR DIAL POSITION	IDENTIFICATION	OPERATION	FUNCTION
OPERATE (Used during normal operation)	SELECT-DISPLAY	Dial	-Selects the desired display function
	SELECT-DISPLAY-ON	Push Button	-Turns on display message and silences the alarm
	SET-RANGE	Dial	-Selects the gear range on tractors that do not use the wheel speed sensor. It has no function on tractors that use a wheel speed sensor or a digital tachometer.
	SET-IMP UP-DOWN	Push Button	- Controls the implement UP-DOWN function which stops area and distance accumulation.
SETUP (Used to set up the various functions)	SELECT-DIGIT	Dial	- Positions the digit marker above the digit to be changed.
	SELECT-CALIB SPEED	Push Button	- Starts and stops the speed calibration.
	SET-DIGIT	Dial	- Sets the digit marked to the desired value
	SET-RESET	Push Button	- Zeros the four digit display.
ALARM SET (Used to set alarm points for speed, slip, and RPM)	SELECT-DIGIT	Dial	- Positions the digit marker over the digit to be changed.
	SELECT-CALIB SPEED	Push Button	- Has no function
	SET-DIGIT	Dial	- Sets the digit selected to the desired value.
	SET-RESET	Push Button	- Zeros the four digit display.

Constants for engine RPM and ground speed, and the effective width of the implement had to be determined and entered into the monitor. This was followed by zeroing total area, field area, and distance and setting the alarm points for wheel slip, engine RPM, and ground speed.

Ground speed was calibrated by driving a distance of 400 ft (121.9 m) and entering the calibration number shown on the display into the monitor.

Calibrating procedure for zero slip varied depending on whether the monitor was used on a four wheel or a two wheel drive tractor. For a four wheel drive tractor, the zero slip condition had to be calibrated only once for the particular field condition, since the speed of the drive wheels was measured by the wheel speed sensor. However, since the wheel speed sensor could not be mounted on two wheel drive tractors, the zero slip condition had to be calibrated for each tractor gear. The console had memory locations for eight different gears. Calibration for each zero slip condition consisted of driving a short distance in the field at normal field speed and pressing the set control push button to zero the slip.

POWER REQUIREMENTS

The Dickey-john required 6 W on a 12 V DC power supply. The monitor drew up to 0.5 A when operating.

The monitor functioned well with a supply voltage above 8 V. When supply voltage dropped below 8 V, the display went blank but reappeared when voltage returned to above 8 V. If voltage dropped below 4 V or the tractor battery was disconnected, the memory was lost and the monitor had to be recalibrated.

SAFETY

The radar ground speed sensor of the Dickey-john monitor emits a low intensity microwave signal. The manufacturer warns operators, in the operator's manual and on a decal on the side of the radar ground speed sensor, not to look directly into the front face of the sensor while operating, to avoid possible eye damage.

Caution was required when making electrical connections to the tractor battery.

OPERATOR'S MANUAL

The operator's manual was very good and well illustrated. Along with other literature, it provided detailed information on installation, set up, calibration, operation, and troubleshooting.

MECHANICAL HISTORY

The Dickey-john monitor was operated for 68 hours. The intent of the test was functional evaluation and an extended durability test was not conducted. Special care was required to prevent damage to the wiring harness. No mechanical problems occurred during the functional testing.

APPENDIX I	
SPECIFICATIONS	
MAKE:	Dickey-john Tractor Performance Monitor
MODEL:	TPM II
MANUFACTURER:	Dickey-john Corporation P.O. Box 10 Auburn, Illinois 62615 USA
CONTROL CONSOLE:	
- serial number	0632-10817
- size	11.75 x 5.5 x 4.0 in (298 x 140 x 102 mm)
- controls	alarm volume control, three rotary control dials and two push button switches
- alarm	wheel slip, speed and rpm
- display	multi digit LCD
SENSORS:	
- radar ground speed	
-- type	radar
-- size	rectangular - 11.5 m long, 48 m wide, 5.75 in high (292 x 122 x 146 mm)
- engine RPM	
-- type	electronic
- wheel speed	
-- type	magnetic pickup
- implement status switch	
-- type	mechanical switch
OPTIONS:	implement status switch extension cable

APPENDIX II	
MACHINE RATINGS	
The following rating scale is used in Machinery Institute Evaluation reports:	
excellent	fair
very good	poor
good	unsatisfactory

SUMMARY CHART DICKEY-JOHN TPM II TRACTOR PERFORMANCE MONITOR	
RETAIL PRICE	\$2,099.00 (May, 1985, f.o.b. Humboldt, Sask.)
QUALITY OF WORK	
Ground Speed Measurement	Very Good; best accuracy when calibrated for each field condition
Slip Measurement	Very Good; when properly calibrated
Area and Workrate Calculations	Very Good
EASE OF INSTALLATION	Very Good; approximately 4 hours to install
EASE OF OPERATION AND ADJUSTMENT	
Monitor Operation	Good; required some operator experience
Display Readability	Very Good; if positioned to prevent glare from sun
Calibration	Good; considerable time required
POWER REQUIREMENTS	12 V DC negative or positive ground
SAFETY	Safety decals provided
OPERATOR'S MANUAL	Very Good
MECHANICAL HISTORY	No mechanical problems occurred

 <p>ALBERTA FARM MACHINERY RESEARCH CENTRE</p>	<p>Prairie Agricultural Machinery Institute Head Office: P.O. Box 1900, Humboldt, Saskatchewan, Canada S0K 2A0 Telephone: (306) 682-2555</p>
<p>3000 College Drive South Lethbridge, Alberta, Canada T1K 1L6 Telephone: (403) 329-1212 FAX: (403) 329-5562 http://www.agric.gov.ab.ca/navigation/engineering/afmrc/index.html</p>	<p>Test Stations: P.O. Box 1060 Portage la Prairie, Manitoba, Canada R1N 3C5 Telephone: (204) 239-5445 Fax: (204) 239-7124</p> <p>P.O. Box 1150 Humboldt, Saskatchewan, Canada S0K 2A0 Telephone: (306) 682-5033 Fax: (306) 682-5080</p>