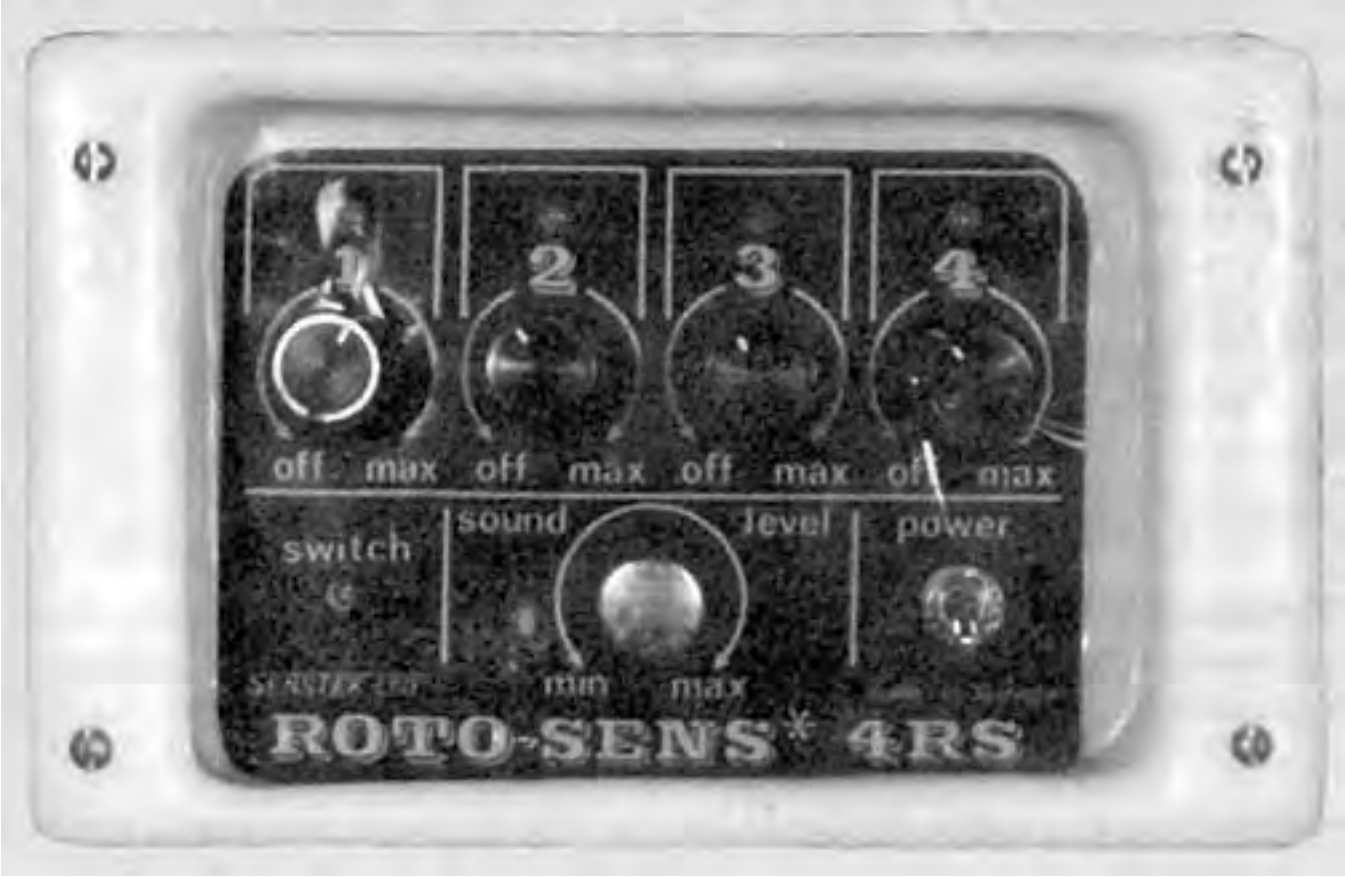
Evaluation Report No. E0277C
Printed: June, 1978
Tested at: Humboldt
ISSN 0383-3445

Evaluation Report 47



Roto-Sens 4Rs Model 477 Shaft Speed Monitor

A Co-operative Program Between
ALBERTA FARM MACHINERY RESEARCH CENTRE
PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

ROTO-SENS 4RS MODEL 477 SHAFT SPEED MONITOR

MANUFACTURER and DISTRIBUTOR:

Senstek Limited
125 - 105th Street
Saskatoon, Saskatchewan
S7N 1Z2

RETAIL PRICE:

$252.00 (June, 1978, f.o.b. Humboldt with four channel control box and optional pull-type wiring harness.)

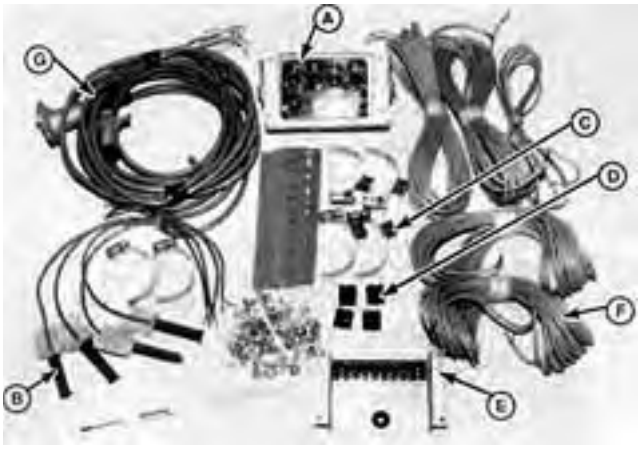


FIGURE 1. Senstek 4RS Shaft Speed Monitor: (A) control box, (B) detectors, (C) magnets, (D) terminal blocks, (E) terminal plates, (F) standard wire harness, (G) optional pull-type extension.

FIGURE 2. Control Box: (A) channel warning lights, (B) speed adjustment dials, (C) power switch, (D) buzzer sound level adjustment, (E) alarm switch light.

SUMMARY AND CONCLUSIONS

The Roto-Sens 4RS model 477 shaft speed monitor was suitable for monitoring both slow and high speed shafts on agricultural machines and for signalling the operator that machine components had stopped or were operating below the desired speed. It was suitable for monitoring slow speed components such as grain drill seed metering shafts and high speed components, such as combine straw chopper shafts.

The control box lights were bright enough to signal the operator providing the control panel was not in direct sunlight. The channel alarm buzzer could be adjusted to be clearly heard above tractor or combine noise.

The Roto-Sens 4RS could be successfully used for any shaft speed below 4000 rpm. System sensitivity was adequate for all applications and was somewhat dependent upon the operator's skill at adjusting the dials. It was found most suitable to adjust the sensitivity to cause the operator alarm to be triggered with a 20% drop in component speed. Response time was adequate for all applications.

The monitoring system could be installed in about 3.5 hours on a pull-type combine. Alignment of the detectors was fairly easy due to the large detector faces and the long adjustable brackets.

The operator's manual clearly outlined installation, operation and adjustment of the monitor.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

Since test results did not indicate the need for any modifications, no recommendations are given.

Chief Engineer -- E. O. Nyborg
Senior Engineer -- L. G. Smith
Project Engineer -- G. E. Frehlich

GENERAL DESCRIPTION

The Roto-Sens 4RS model 477 shaft speed monitor is designed to monitor the rotation of slow speed shafts, such as grain drill seed metering shafts and high speed shafts such as on combine straw choppers. It can be set to warn an operator that shafts have stopped or are turning slower than desired. It is powered by the tractor or combine electrical system and will operate on either positive or negative ground circuits. The control box will monitor up to four shafts.

The Roto-Sens 4RS consists of a control box which mounts at the operator's station, magnets, detectors, wiring harness and the necessary mounting hardware and instructions. The detectors are small magnetic switches that are activated by magnets attached to a rotating shaft. An optional wiring extension is included for use with pull-type combines and multi-unit drills.

Detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The Roto-Sens 4RS was used for 114 hours on a pull-type combine. It was evaluated for ease of installation, ease of operation and adjustment, quality of work and suitability of the operator's manual.

RESULTS AND DISCUSSION

EASE OF INSTALLATION

Installation Time: Installation of the Roto-Sens 4RS model 477 was easy, but fairly lengthy. It took about 3.5 hours to install the system on a pull-type combine. Installation instructions were clear and adequate.

Control Box: The control box (FIGURE 2) is mounted at a suitable location in the tractor or combine cab. The control box face should not be positioned in direct sunlight to provide clear viewing of the channel lights. The control box attaches with two bolts and is wired directly into the vehicle electrical system. When using more than one monitor system, control boxes may be bolted together. The tractor mounted control box may be used for monitoring either drills or combines providing each machine is equipped with a pull-apart connector for the detector leads.

Installation on Grain Drills: Installing the detector system on a grain drill is fairly simple. Hose clamp magnetic pickups are attached to the end of each seed metering shaft. A detector has to be installed adjacent to each magnet. Detectors are installed by drilling a hole in the plastic detector base at an appropriate location and attaching it to a frame member or the mounting bracket. The detector must be positioned within 6 mm (0.25 in) of the magnet, with the magnet notch perpendicular to the length of the detector as shown in FIGURE 3.

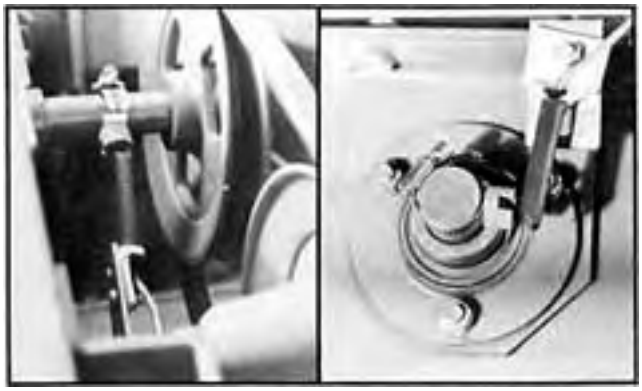


FIGURE 3. Detector and Magnet Installation on a Pull-Type Combine.

Installation on Combines: Installation of the system on a combine is identical to installation on a grain drill. The hose clamp magnets are attached to selected rotating shafts. The magnets may also be removed from the clamps and attached to other machine components such as rocker arms or pulleys. The brackets supplied for mounting the detectors were strong enough to resist machine vibration and provided numerous detector mounting positions.

The large hose clamp magnets could not be mounted on the end of most return or grain elevator shafts without interference from the end bearing mounting bolts.

Wiring Harness: The wiring harness included plastic hold down clips and ties for securing cables away from pinch points and moving components. A sufficient number of screws and clips were provided but there was a shortage of cable ties. Connections at the detector terminal blocks, terminal plate and control box contain screw terminals. Cables were attached by inserting the bare wire ends into the connectors and tightening the screws.

With the standard wiring harness for self-propelled combines, cables are routed directly from the detector terminal boxes to the control box. With the optional pull-type combine wiring harness, the detector cables pass from the detector terminal boxes to a main terminal plate and through a pull-apart wiring extension to the control box.

EASE OF OPERATION AND ADJUSTMENT

Only occasional minor adjustments were required once the detectors had been properly installed. Occasional checks were needed to ensure that cables were properly attached and clear of moving parts.

Each channel on the control box was equipped with a dial for setting the desired alarm speed. The dial position set the shaft speed at which a flashing channel light and buzzer would be activated to signal the operator. Channel lights were quite visible as long as the control box face was not in direct sunlight. The warning buzzer sound level could be adjusted to be clearly heard above the tractor and combine noise.

The large useable surface area of the detectors and the numerous slotted holes in the detector mounting brackets aided in the mounting and final adjusting of the detectors.

QUALITY OF WORK

Operating Range: The detectors were capable of monitoring shaft speeds from 4 to over 4000 rpm with one magnet attached to the shaft. Slower shaft speeds, especially on drills, could be monitored by attaching more magnets to each shaft clamp.

Sensitivity: The amount of shaft speed reduction necessary to activate the alarm was adjustable. The minimum speed reduction required to trigger the alarm varied from 1 to 12% of the shaft speed. The sensitivity obtainable was largely dependent upon the skill of the operator in adjusting the dials. The sensitivity of the monitor increased as the speed of the shaft being monitored increased.

For most applications it was suitable to set the sensitivity so that a 20% reduction in shaft speed would trigger the alarm. In this way, slipping belts or malfunctioning components could be detected before damage or blockage occurred but minor normal speed variations would not be detected.

Response Time: The time required for the indicator to detect a shaft speed reduction depended upon the shaft speed, the number of pickups on each shaft and the control box settings. Since the monitor compared the time between consecutive on-off pulses, response time was longer for slowly turning shafts than for high speed shafts. It took about 20 seconds to activate the alarm on very slow shafts while activation was virtually instantaneous on high speed shafts.

Environmental Effects: The detectors were well sealed and were not affected by rain or moisture. The chaff and dust common to normal combine operation did not hamper detector performance.

OPERATOR'S MANUAL

The operator's manual presented fairly comprehensive installation, operating and adjustment instructions.

POWER REQUIREMENTS

The Roto-Sens shaft speed monitor drew a maximum current of 0.15 A and could be attached to a 12 volt electrical system with either a positive or negative ground.

DURABILITY RESULTS

The Roto-Sens 4RS shaft speed monitor was operated in the field for 114 hours. The intent of the test was functional performance and an extended durability evaluation was not conducted. No durability problems occurred during field use, however, a faulty detector cable was encountered during installation. The detector lead was broken beneath the protective sheathing.

APPENDIX I
SPECIFICATIONS

MAKE:	Roto-Sens 4RS Shaft Speed Monitor
MODEL:	477
SERIAL NUMBER:	248
ELECTRICAL POWER REQUIREMENTS:	12 V-DC
CONTROL BOX:	
-- size	152 x 99 x 89 mm (6 x 3.9 x 3.5 in)
-- number of channels	4
-- alarm system	buzzer and warning light
-- controls	on-off power switch, shaft speed adjustment dials.
CONNECTORS:	screw type wire squeeze connectors, pull-apart connector with the optional pull-type wiring extension.
DETECTORS:	
-- type	magnetic reed switch detectors
-- number	4
OPTIONS:	pull-type wiring extension, hopper level indicators.

APPENDIX II
METRIC UNITS

In keeping with the Canadian metric conversion program, this report has been prepared in S.I. units. For comparative purposes, the following conversions may be used.

1 metre (m) = 1000 millimetres (mm) = 39.37 inches (in)

ALBERTA FARM MACHINERY RESEARCH CENTRE

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

Prairie Agricultural Machinery Institute
Head Office: P.O. Box 1900, Humboldt, Saskatchewan, Canada S0K 2A0
Telephone: (306) 682-2555

Test Stations:
P.O. Box 1060
Portage la Prairie, Manitoba, Canada R1N 3C5
Telephone: (204) 239-5445
Fax: (204) 239-7124

P.O. Box 1150
Humboldt, Saskatchewan, Canada S0K 2A0
Telephone: (306) 682-5033
Fax: (306) 682-5080