Electro-Magnetic Compatibility (EMC)
This product complies with Council Directive 2004/108/EC when installed and used in accordance with the relevant instructions.

Service and Technical Support
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User Guide

"SAM 400"
Speed-Area-Distance Meter

Calibration and Operation
Software Reference WZ200-0 rev. 6

Contents

Overview

The RDS *SAM 400 Speed-Area-Distance Meter* is a versatile, simple to use instrument. It displays to the vehicle operator,

?? Forward Speed (km/hr or miles/hr)

?? Partial and Total Area (hectares or acres)

?? Distance (km or miles)

?? Instantaneous Work Rate (Ha/hr or acres/hr)

?? Engine Hours

?? RPM (optional)

The displayed information can be converted from Metric to Imperial units at any time.

The instrument also has two programmable forward speed alarms that also operate two outputs that may be utilised to control (unspecifed) aspects of a machines operation.

The *SAM 400* can be programmed by the operator for implements of any practical width and for any sensing wheel size.

The *SAM 400* system comprises :

?? The Head Unit.

?? A Forward Speed Sensor kit.

?? An automatic cut-out switch to prevent area accumulation when turning on headlands etc.

?? A power supply kit.

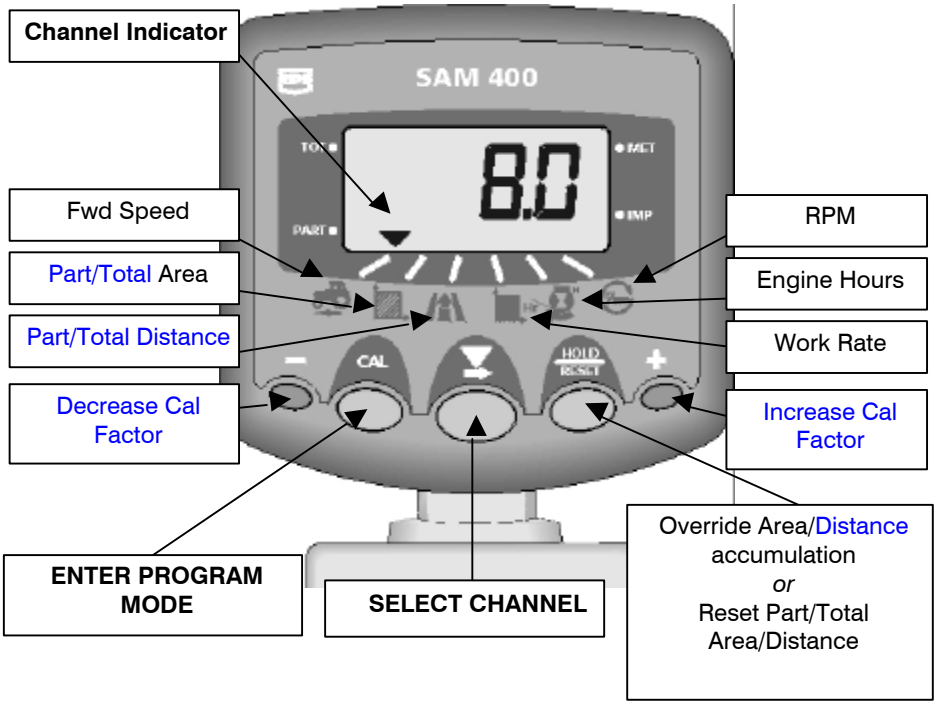
?? Shaft Speed Sensor (optional)

If the *SAM 400* is to be used on a number of vehicles, each vehicle can be equipped with a 'transfer kit' to enable the head unit only to be transferred simply between vehicles.

The *SAM 400* can also be used in conjunction with the RDS Area Compensation Interface (ACI) or Width Compensation Interface (WCI) to ensure accurate area monitoring when using partial implement width.

Operation

Figure 1



The instrument will normally be powered through the vehicle ignition system and will be on whenever the vehicle ignition is on. The display is permanently illuminated.

Channel Selection

Simply press the ▼ button to cycle through the six different channels that can be displayed.

Forward Speed Display - Channel 1

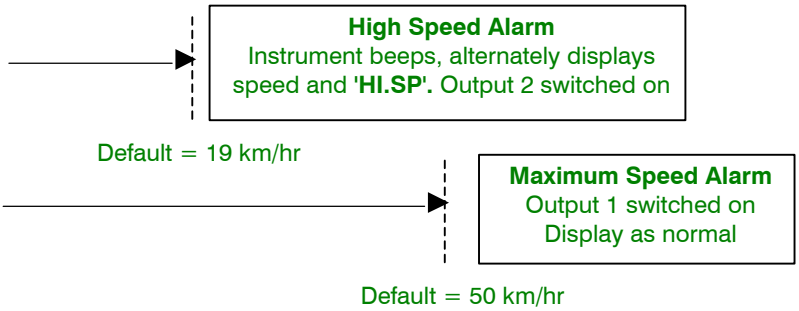
Channel 1 displays the current forward speed.

Forward speed is measured via a sensor suitably mounted to a wheel hub or a convenient location to the vehicle drivetrain. Speed is displayed either in miles/hr or km/hr according to the units selected in the CAL Mode.

NOTE: In order to display the correct speed and accumulate distance correctly, the instrument must be programmed with the correct Speed Sensor Factor (SSF).

Forward Speed Alarm Outputs

There are two programmable alarm thresholds - a 'Maximum Speed' alarm and a 'High Speed' Alarm. Each alarm also operates an output, to control some aspect of a machines function, e.g. 4-wheel steering, engine cutoff etc.



Refer to the Calibration section on how to set the alarm thesholds.

Area / Distance Measurement - Channel 2 and 3

View Area / Distance Totals

Channel 2 displays accumulated area and channel 3 displays distance travelled. Area is calculated from the distance travelled and the implement working width, and is displayed either in acres or hectares according to the units selected in the CAL Mode.

NOTE: The accuracy of these totals is dependent on correct speed sensor calibration, and programmed width.

For both area and distance there are two memory registers - a 'Part' total ("**tot.1**") and a 'Full' Total ("**tot.2**"), which can be independently reset. For example the part total register may be utilised for individual jobs, fields etc, whereas the 'full' total register may be the daily total.

The lefthand indicator indicates which total is currently displayed. To display the appropriate total, first select the area or distance channel. Then press the **CAL** button to toggle between "**tot.1**" (part total) and "**tot.2**" (full total).

Reset Area / Distance Totals

The full total ("**tot.2**") can only be reset with the security link in place on the instrument connector.

Select the appropriate total (as above) then press and hold the HOLD RESET button.

The lefthand indicator will flash and the instrument will beep for 5 seconds after which the total is reset to zero.

Figure 2: Reset Area Total

Area Override and Part Width operation

(i) On-Off Switch

As standard the system will have an on-off override switch installed. Depending on the particular application, this may be a simple manually operated switch, or it could operate automatically. The area/distance will stop accumulating when the implement is put out of work. The channel indicator will flash when area/distance accumulation is overridden and will be on permanently when area/distance is being recorded.

Area/distance accumulation can also be overridden at any time by pressing the HOLD RESET button.

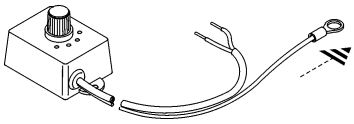
Whichever channel is selected, the display will then alternate between the channel readout and the message '**HeLd**'.

Press HOLD RESET to resume area/distance accumulation.

(ii) Optional Width Correction Interface

A Width Correction Interface (WCI) enables the operator to select a part width - 1/4, 1/2, 3/4, or full width as required.

When the WCI is switched to a part width, the display will alternate between the currently selected channel and **'1/4'**, **'1/2',** '**3/4**' or **'FULL**' corresponding to the switch position, and area accumulation is reduced accordingly.



Width Correction Interface

The WCI works in addition to the standard area override switch.

(iii) Area Compensation Interface

An Area Compensation Interface (ACI) connects between the SAM 400 and the sprayer switchbox. It detects which boom sections are on/off in order for the instrument to calculate the actual working width and apply the correct rate.

NOTE: The Nozzle spacing and No of nozzles per section are programmed for each section in turn, in the CAL mode.

Work Rate - Channel 4

This is the instantaneous work rate displayed in either hectares per hour or acres per hour, depending on the units set in the Cal mode.

If a WCI switch or an ACI is installed, the work rate is automatically recalculated based on the implement part width in operation.

Engine Hours - Channel 5

The instrument displays either the total engine hours, or the total hours that the instrument is powered on, depending on the setting in the CAL mode.

Reset Engine / Ignition Hours

The "Engine Hours" channel can be reset in the same way as the "Partial Area" and "Total Area" channels, however, the security link wire must be connected from the terminal labeled “Security Link" on the AMP connector, to 0V.

Select the  channel then press and hold the HOLD RESET button.

The display will flash for 5 seconds before the total is reset to zero.

RPM - Channel 6

Channel 6 typically displays the spinner speed, PTO speed or Engine speed, but it can be for any other rotating shaft depending on your particular application.

Calibration

The instrument has two calibration modes. In calibration mode 1 you can view and change the Forward Speed Sensor Factor, Implement Width/Nozzle spacing, No. of nozzles per section (if ACI installed), Units, and RPM Sensor Factor.

In calibration mode 2 you can set the forward speed alarm thresholds.

To allow entry to the CAL Modes, the Security Link Wire must be connected to 0V.

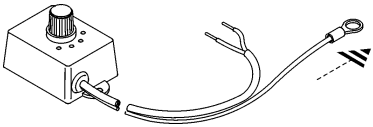
View Working Width

Press and hold the **right outermost** switch.

After a two-second delay, the display will show one of the following,

(i) *If a standard on-off override switch is fitted,* the display will show '**FuLL**' when the machine is in work and '**ZErO**' when the machine is out of work (or the hold button is pressed).

(ii) *If a Width Compensation Interface (WCI) is fitted* the display will show '**FuLL**', '**3**/**4**', '**1**/**2**', or '**1**/**4**' corresponding to the switch position on the WCI.



Width Compensation Interface

(iii) *If an Area Compensation Interface (ACI) is fitted on a sprayer*, the display will show the number of nozzles for the boom sections that are currently switched on.

E.g. An ACI is fitted on a 24 metre sprayer with 5 boom sections. The nozzle spacing is 0.5 metres and there are 10, 10, 8, 10, and 10 nozzles respectively on each section, giving 48 nozzles in total.

If the instrument has been programmed with an implement width of 0.5 metres, when all boom sections are on, the ACI will signal the instrument that there are 48 nozzles in use, e.g. the display will show **48**,

(48 x 0.5 m = 24 metre full width).

Figure 3: View No of Nozzles

Set Implement Width/Nozzle spacing

The factor to be programmed is the full, effective working width of the implement.

NOTE: If an ACI is connected on a sprayer, the implement width is equal to the nozzle spacing, e.g. 0.5 metres, You must then programme the ACI input (number of nozzles per section).

1. Press and hold the **CAL** button while switching the instrument on.
2. Select the  channel.
3. Use the small left and right buttons to set the width/nozzle spacing in metres or inches as appropriate.

ACI Input - Set No. of Nozzles per Section

1. Press and hold the **CAL** button while switching the instrument on.
2. Select the  channel.

NOTE: For single section sprayers fitted with a simple cutout switch, the number should be the total no. of nozzles for the boom.

If none or more than one section is switched on, the display will show "**- - - -**" and you can't programme the no. of nozzles.

3. If connecting an ACI module into the sprayer switchbox, switch on one section at a time.
4. Using the small left and right buttons, set the number of nozzles for that section.
5. Repeat for each section in turn.

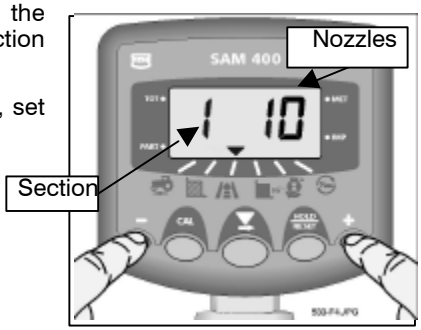


Figure 4: Set Nozzles per section

Metric/Imperial Selection

1. Press and hold the **CAL** button while switching the instrument on.
2. Select the  channel.

   4 indicator bars will appear showing the units currently selected (fig. 5).
3. Use the small left and right buttons to select the units.

   The indicator will switch between "MET" for metric units and "IMP" for Imperial units.

Figure 5: Set Units

Imperial	**Metric**
Miles/hr	Km/hr
Acres	hectares
Inches	Metres (Speed Sensor Factor)

Speed Sensor Setup

In order to display the correct speed and accumulate distance correctly, the instrument must be programmed with the correct Speed Sensor Factor (SSF). This is the distance travelled between pulses received from the sensor.

The factory default setting is 2.000 m (78.78").

The S.S.F. can be calculated theoretically and then manually programmed, or the instrument can automatically calculate it via the “Autocal” function. Carry out the calibration whenever soil conditions or wheel sizes change.

NOTE: An ‘Autocal’ is simpler to perform and is more accurate in field conditions

'*AutoCal*'

For maximum accuracy, perform an auto-calibration in field conditions.

1. Set two markers at 100 metres apart (328 feet). Choose a convenient reference point on the tractor/implement and position this point opposite the first marker.
2. Press and hold the **CAL** button while switching the instrument on.
3. Pressing the  key will toggle the display between "AUTO" and "SSF" .

NOTE: Selecting "SSF", enables you to adjust the speed sensor factor manually using the two outer keys.

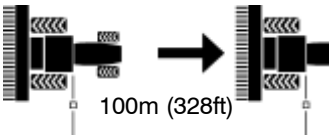
.

The display will show '**Auto**' for 2 seconds, and then show the number of received pulses.

3. Drive the vehicle until the chosen reference point on the tractor/implement is opposite the second marker.

   The instrument counts and displays the sensor pulses received over the distance travelled.

4. Press the **CAL** button to end the autocal. The new factor is then displayed.



Autocal' distance

Manually calculating the Factor

The smaller the speed sensor factor the better the speed update will be. Aim for a factor less than 2.000 m (78.78").

NOTE: Perform the following calculations in inches or metres depending on whether the instrument is set for Imperial or Metric units. If you calculate the factor using any other unit of measurement e.g. feet or centimetres, the forward speed display will be incorrect.

(i) ***If a single magnet is installed (as with a standard RDS Propshaft Sensor kit),*** the distance travelled for each turn of the prop shaft must be determined. To determine this distance, drive the vehicle forwards for exactly **10** revolutions of the prop shaft. Measure this distance (in inches or metres) and divide by **10**, to find the Speed Sensor Factor.

(ii) ***If 2 magnets are installed (as with a standard RDS Wheel Sensor kit)***, the distance is 1/2 the effective rolling circumference of the wheel. To determine this circumference, drive the vehicle forward in field conditions (with the implement attached if applicable), for exactly **10** revolutions of the sensed wheel. Measure this distance (in inches or metres) and divide by **20** to find the Speed Sensor Factor.

(iii) ***If 4 wheel magnets are installed***, the distance is 1/4 the effective rolling circumference of the wheel. To determine this circumference, drive the vehicle forward in field conditions (with the implement attached if applicable), for exactly **10** revolutions of the sensed wheel. Measure this distance (metres) and divide by **40** to find the Speed Sensor Factor.

Carry out this test whenever soil conditions or wheel sizes change.

(iv) ***If an RDS Radar sensor is installed,*** the Speed Sensor Factor is **0.008** m (or **0.312** inches).

If the calibration factor works out at over 2.000 m (78.78 inches), consider fitting additional magnets. Extra magnets are recommended if the vehicle has large diameter wheels or is slow-moving. In extreme circumstances you can find that the speed keeps going to zero as it times out before the next pulse arrives.

Number of Sensor magnets

The table gives the number of magnets required to enable a speed update of approximately once per second or faster on the display.

Tyre diameter	Typical speed in normal operation:		
	up to 5mph (8km/hr)	6 to 9 mph (9 to 15 km/hr)	10mph (16 km/hr) or over
12" (0.3m)	1	1	1
24" (0.6m)	1	1	1
36" (0.9m)	2	2	1
48" (1.2m)	4	2	2
60" (1.5m)	4	4	2
72" (1.8m)	4	4	2

Example Calculation 1

The tractor is fitted with a single-magnet propshaft sensor. The measured distance for 10 rotations of the propshaft is 17'-6".

1. Convert the distance to inches :- (17' x 12")+6" = 210"
2. Divide by 10 (magnet pulses) to give the calibration factor:- 210" / 10 = 21"
3. Programme the factor '021.0' as described overleaf.

Example Calculation 2

A vehicle with row crop wheels is fitted with 4 magnets. It is found to move 144 feet for 10 rotations of the sensed wheel.

Converting the distance to inches and dividing by 40 gives a calibration factor of (144' x 12") / 40 =43.2".

Manually setting the Factor

1. Press and hold the **CAL** button while switching the instrument on.
2. Press the  key to toggle the display to "SSF" .
3. Use the small left and right buttons to adjust the factor as required.

Set Forward Speed Alarm Thresholds

1. Press and hold the  button while switching the instrument on.
2. The  channel (1) displays the Maximum speed alarm threshold (Output 2). The default is 50 (km/hr).
3. Pressing the centre key selects the  channel (2). This displays the High speed alarm threshold (Output 1). The default is 19 (km/hr).
4. Use the small left and right buttons to adjust the setting.

Select Engine / Ignition Hours

When "**IGN**" is programmed, the instrument will accumulate hours whenever the instrument is powered on.

You can select "**ENG**" hours if the RPM channel is measuring engine speed (e.g. using the Alternator RPM Sensor kit). Hours will then only accumulate when the engine is running.

1. Press and hold the **CAL** button while switching the instrument on.
2. Select the  channel.
3. Press either outermost button to select '**iGn**' or '**EnG**'.
4. Switch the instrument off and then on again to resume the normal operating mode.

RPM Sensor Factor

The RPM Sensor Factor is equal to the number of pulses received by the instrument per revolution of the sensed shaft, e.g. for measuring Engine RPM, PTO Speed, Shaft Speed, Fan Speed etc depending on the particular installation. The default setting is 1 pulse per rev (p.p.r), which is OK in the case of a magnetic sensor with a single magnet on the sensed shaft.

In other cases, perform the following calibration procedure.

1. Run the sensed component at a known speed. If necessary measure this speed using a hand-held tachometer.
2. At the same time have someone note the RPM displayed on the instrument.
3. Calculate the new calibration factor,

$$= \text{Initial Factor} \times \frac{\text{Displayed Speed}}{\text{Actual Speed}}$$

Changing the RPM Sensor Factor

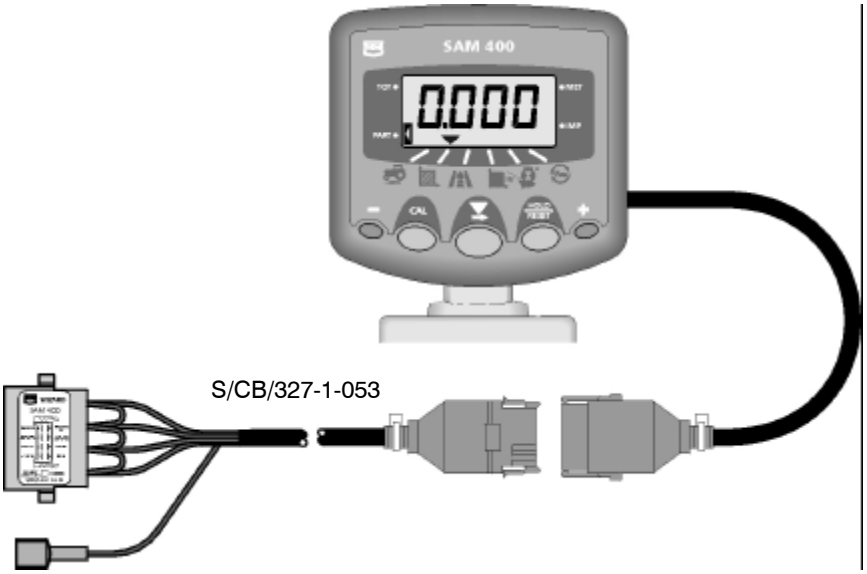
1. Select the **RPM** channel ( ).
2. Press and hold the **CAL** button while switching the instrument on until the instrument displays 'CAL.1'.
3. Press the centre button to select channel 6.
4. Use the '+' and '-' buttons to programme the new factor.

   Check the calibration again to ensure the RPM display is now reading correctly.

Figure 6: Set RPM Cal Factor

Wiring Connections – SAM 400 (without WCI/ACI)

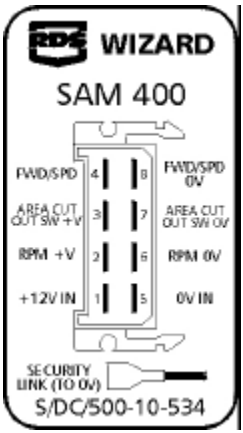
A 12-way Qikmate to 8-way AMP interconnection cable Pt No. S/CB/327-1-053 is supplied to connect to the sensors, power supply etc.



Please refer to the "Work measurement Installation" manual S/DC/500-10-261 for details on power supply, fitting sensors / cutout switches etc.

The AMP connector accepts the standard ¼" female crimp terminals. The wiring label (S/DC/500-10-534) identifies the wiring connections as shown.

NOTE: Connecting the security link wire to 0V to allows the area total 2 , distance total 2 and engine hours total to be reset in the normal operating mode.



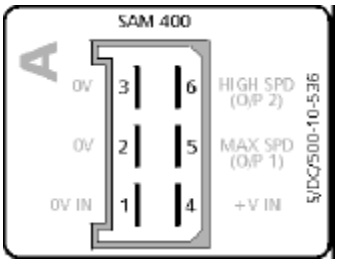
Wiring Connections – SAM 400 (With WCI / ACI)

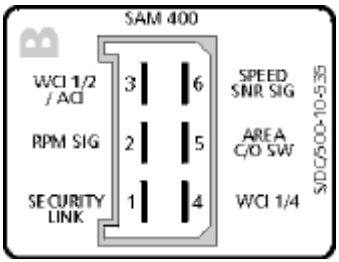
You will require the following cable in order to connect a WCI switch, ACI switch, or to utilise Outputs 1 and 2.

Pt No. S/CB/327-1-**063** (2 x 6-way AMP)

Please refer to the “Work measurement Installation” manual S/DC/500-10-261 for details on power supply, fitting sensors / cutout switches etc. The ACI has it's own installation and wiring instructions.

The AMP connector accepts the standard ¼” female crimp terminals. The wiring labels (S/DC/500-10-535 and S/DC500-10-536) identify the wiring connections as shown.





Connections for Cable S/CB/327-1-063

CONNECTOR – A			
TERMINAL	**KEY**	**COLOUR**	**FUNCTION**
1	0V	BLACK	POWER SUPPLY 0V
2	0V	BLACK	SENSOR 0V
3	0V	BLACK	SENSOR 0V
4	+V	RED	POWER SUPPLY +V
5	O/P 1	TURQUOISE	HIGH SPEED OUTPUT
6	O/P 2	ORANGE	MAX. SPEED OUTPUT

CONNECTOR – B			
TERMINAL	**KEY**	**COLOUR**	**FUNCTION**
1	I/P 1	GREEN	SECURITY LINK +V (CONNECT TO GROUND)
2	I/P 2	YELLOW	RPM +V
3	I/P 3	VIOLET	WCI 1/2 WIDTH (BLUE) / ACI SIGNAL
4	I/P 4	BROWN	WCI 1/4 WIDTH (BROWN)
5	I/P 5	BLUE	AREA CUTOUT SWITCH
6	I/P 6	WHITE	FORWARD SPEED +V

Issue 1	20/12/05	Original Issue
Issue 2	27/3/06	p.6 - added note ref. Security Link Wire p.15 - correction ref. Labels
Issue 3:	31/5/06	Changes to cover S/W WZ200-000 rev.6 p.15, 16 - Label A changed to show O/P 1 and 2
Issue 4	6/7/07	Correction p.5, p15