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User Guide

Athene 100 Belt Spreader Monitor/ Variable Rate Controller

Operation

Software Reference A810-000 rev.2

Contents

1	Overview _____	4
	<i>This Manual</i>	4
	<i>Application</i>	4
	<i>The Head Unit</i>	4
	<i>Calibration(Rate Controller)</i>	5
2	Switch functions in Normal Operating Mode _____	6
2.1	Work Status Indicator	7
2.2	Set Units	7
2.3	Channel Selection	7
3	Forward Speed Display _____	8
3.1	Low Speed Alarm	8
3.2	High Speed Alarm (Under-application)	8
4	Area Display _____	9
4.1	Select Area Total	9
4.2	Reset Area Total	9
5	Work Rate Display _____	10
6	Application Rate _____	11
6.1	Rate Control	11
6.2	Under-application (excessive speed)	11
6.3	Setting the Target Rate.....	11
6.4	Nudging the Target Rate	12
6.5	Work Monitoring (without Rate Control)	12
7	Product Calibration _____	13
7.1	Static Calibration	13
7.2	Dynamic Calibration	14
7.3	FAQ's about Calibration	15
	<i>There is a small discrepancy in the amount applied.</i>	15
	<i>There is a big discrepancy in the amount applied.</i>	15
	<i>The instrument beeps continuously during the calibration test</i>	15

7.4	Nudging the Calibration	16
7.4.1	Under-application.....	16
7.4.2	Over-application.....	16
7.4.3	Setting a Nudge Factor	16
7.4.4	Re-calculating the Calibration Factor	17
7.4.5	Adjusting the Calibration Factor	17
8	<i>RPM Display</i>	18
8.1	RPM Alarm	18
9	<i>Hopper Contents Display</i>	19
9.1	Low Level Alarm (using Hopper Level Sensor)	19
9.2	Weight display (Qty left in hopper/ Qty dispensed)	19
9.3	The “Quantity in Hopper” display	20
9.3.1	Set Alarm Quantity.....	20
9.3.2	Resetting the “Hopper Maximum Quantity” figure	20
9.3.3	Adjusting the “Hopper Maximum quantity” figure.....	21
“9.4	Quantity Dispensed” display.....	21
9.4.1	Resetting the “Quantity Dispensed” display to Zero.....	21

1 Overview

This Manual

This manual explains the everyday use of the instrument to the operator, including regular calibration e.g. for spreading different products. It describes both the basic work monitoring system (“monitor mode”) and separates the additional features of the full rate control system, should you have them installed on your machine.

Application

The *Athene 100* instrument is installed in one of two configurations. The basic configuration is a simple work measurement monitor for belt spreaders, but without controlling the application rate.

The full configuration uses a PWM (Pulse Width Modulated) output to also give variable rate control of moving-belt type fertiliser spreaders. When set up as a rate controller, you have on-the-move rate adjustment up to $\pm 50\%$ of the target rate. The rate is maintained as forward speed varies. The instrument also warns the operator when the application rate cannot be met, i.e. when the forward speed is too high.

The Head Unit

The head unit is ruggedly designed for maximum reliability in harsh environments, and is rated to IP67 (effectively waterproof). The instrument has a 4-digit back-lit LCD display with 6 display channels for different work measurement functions.

In the normal operating mode the following functions can be selected,

- ?? Forward Speed (km /hr)
- ?? Area Worked* (hectares)
- ?? Work Rate (hectares /hr)
- ?? Application Rate (kg/ha or tonnes/ha) or RPM depending on the application
- ?? Shaft Speed (normally PTO or Spinner speed)
- ?? Hopper Contents (kg or tonnes)

*There are two memory registers to record area worked. The area is accumulated to whichever total is selected on the display – ‘Total 1’ or ‘Total 2’.

The head unit is switched on/off by the switch on the back the instrument.

Area totals (and all calibration data) are automatically stored in memory when the instrument is powered off.

Calibration(Rate Controller)

The instrument must be initially calibrated to suit the implement being controlled. There are 4 programme modes for the various system settings to be altered as required. Most of these settings do not need to be accessed in normal use.

The instrument must be re-calibrated each time you change the product being applied. By setting a simulated speed, a static calibration test can be done in the yard. Alternatively, you can do a dynamic calibration test in the field.

2 Switch functions in Normal Operating Mode

The front panel has five buttons. On systems configured for rate control, the outer two buttons are used to adjust the application rate.

The diagram shows the front panel of the ATHENE 100 spreader rate controller. The display shows '800' with units 'Kg/Ha' and 'Tonnes/Ha'. Below the display are six buttons: RATE -, CAL SET, a central button with a downward arrow, Ha=0, and RATE +. Callouts point to these buttons and the display area.

Target Rate Indicator

Channel / Work Status Indicator

Decrease Rate

Increase Rate

SELECT AREA TOTAL

Select the channel then press to switch between Area Total 1 and 2.

SET APPLICATION RATE

Select the channel then HOLD for 3 seconds.

If the existing rate set = the target rate, then the target rate is displayed and you can adjust it using the rate + and - buttons.

If the existing rate set is above or below the target rate, that rate is set as the new target rate.

Press and hold the button for 3 seconds to return to the normal display.

RESET

With “tot.1” or “tot.2” selected on channel 2, HOLD for ten beeps to reset the area register to zero

SELECT CHANNEL

- Ch.1 Forward Speed
- Ch.2 Area Total 1 or 2
- Ch.3 Work Rate
- Ch.4 Appl. Rate/RPM
- Ch.5 RPM - Shaft/Spinner
- Ch.6 Hopper Contents

2.1 Work Status Indicator

The ▼ indicator is used to indicate the channel to which the information on the display relates. It also shows the working status of the spreader.



The cursor flashes when the spreader is out of work (e.g on the headland) and the area accumulation stops.

The cursor is on continuously when the spreader is in work and area accumulation takes place.

Spreading is started and stopped via the separate Cutout Switch, not from the head unit.

2.2 Set Units

The application rate can be displayed in units of kg/ha or tonnes/ha.

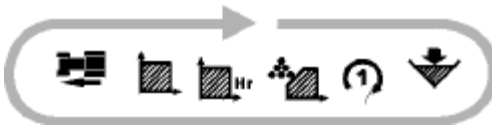
To check which is selected, select the  channel then press the  button (as for setting the target rate)

The dashes indicate the units set.



Figure 3: Check Units

2.3 Channel Selection



Simply press the ▼ button to cycle through the channels.

In the Work Monitor configuration only, the instrument will stay on the channel you have selected.

In the Rate Controller configuration, the instrument will always default to the application rate display 10 seconds after selecting any other channel (the exception to this is when there is an alarm condition).

3 **Forward Speed Display**



The forward speed is displayed in km/hr.

3.1 **Low Speed Alarm**

If the forward speed drops below 0.5 km/hr, the instrument defaults to a flashing forward speed display and the instrument beeps. **The belt drive will stop.**

The instrument will return to the application rate display when forward speed increases above 0.5 km/hr. **The belt drive will re-start.**

3.2 **High Speed Alarm (Under-application)**

If your forward speed exceeds the maximum beyond which the target application rate cannot be achieved, then the instrument defaults to a flashing forward speed display and beeps continuously.

The instrument will return to the application rate display when forward speed is reduced sufficiently for the target rate to be met.

4 Area Display



The area in hectares is derived from the forward speed (or the simulated speed for the calibration test) and the programmed implement width, and is accumulated to whichever total is selected on the display – Total 1 or Total 2. The two separate area totals can be independently reset to zero.

The master cutout when switched off, stops area accumulating. The channel indicator will flash when area accumulation is overridden and will be on permanently when area is being recorded.

4.1 Select Area Total

1. Select the  channel.
2. Press  to cycle between the two area totals.

The display will then show 'tot.1' or 'tot.2' before displaying the area accumulated since that total was last reset



Figure 4: Select Area Total

4.2 Reset Area Total




1. Select the  channel.
2. Press  to cycle between the two area totals.
3. Hold  for 5 seconds to zero that total.



Figure 5: Reset Total 1 / Total 2

5 Work Rate Display



The work rate is displayed in ha/hr. It is an instantaneous rate which is re-calculated every 3 seconds from the working width set and the current forward speed.

6 Application Rate

6.1 Rate Control



This channel displays the application rate (kg/ha or tonnes/ha), when controlling a moving belt type spreader.

With the system in work, if the actual application rate is within 10% of the target rate, the target rate is displayed,

At more than 10% from the target rate, the display shows the actual application rate.



Also, when in work and stationary, the target rate is displayed.

6.2 Under-application (excessive speed)




If your forward speed exceeds the maximum beyond which the target application rate cannot be achieved, then the instrument defaults to a flashing forward speed display and beeps continuously.

You must reduce your forward speed sufficiently for the target rate to be maintained, at which point the instrument will stop beeping and return to the application rate display.

6.3 Setting the Target Rate

Select the  channel then press and hold the  button for 3 seconds (in the meantime the bars indicate the units set).



If the existing target rate set = Target rate (i.e. you had not nudged it up or down – see next section), then the target rate will be displayed, at which point you can release the button.

Then you then can adjust the rate up or down using the  or  button. Press and hold the  button for 3 seconds to return to the normal rate display mode.

NOTE: *If the existing rate had been nudged up or down from the target rate, then after holding the button for 3 seconds, instead of you being able to adjust the rate as above, the nudged rate is set as a new target rate.*

6.4 Nudging the Target Rate

You can adjust the application rate up to 50% above or below the target rate whilst in work.

Press the  or  button to nudge the rate up or down by a pre-programmed % (5% by default).

The bar on the left side of the display indicates when you are above or below the target rate e.g.,



Similarly, use the  or  to return to the target rate.

When nudged above or below the target rate the application rate display will flash, alternating between the application rate and the the % nudge e.g, if a target rate of 500 kg/ha is nudged minus 5%, the display will then alternate between '475' (kg/ha) and '-5'.

The instrument will also beep every 30 seconds reminding that you are still applying above or below the target rate

6.5 Work Monitoring (without Rate Control)

On the basic system without PWM (Pulse Width Modulated) rate control, this channel is simply programmed with the application rate that you intend applying at, so that the instrument can calculate and display the hopper contents correctly.

7 Product Calibration



The PWM control system must be correctly calibrated after installation (as described in the Installation and Calibration manual) before attempting to calibrate the instrument for individual products as described here.

If you are going to spread a product for the first time you need to establish an initial calibration factor for that product. The calibration factor is the quantity of product dispensed per revolution of the metering shaft encoder. There are two possible options for calibrating the spreader. The choice of method may depend on the nature of the product in use e.g. ease of handling, value etc.

?? A static calibration test in the yard using a simulated forward speed (7.1).

?? A dynamic calibration test on the field (7.2). A dynamic test should prove more accurate as it accounts for normal operating conditions.

Once you have established factors for the various products, you should note them in the back of this manual for future reference, so that the calibration test does not have to be repeated.

If you are changing to another product and you have already established a reliable calibration factor, then you simply need to re-programme the existing calibration factor accordingly (7.4.5). The calibration factor must be re-programmed each time a different product is applied.


7.1 Static Calibration

NOTE: Whenever possible, the system should be calibrated at the application rate that you are going to apply.

1. **Check the spread width and Target Rate** is correctly set.
2. **Set the gate opening** for the product and application rate according to the manufacturer's chart.
3. **Load the hopper.** For the test, you need to establish the weight of product dispensed. You can, depending on the circumstances and the type of product, either,
 - (i) Load bagged product of known weight, and dispense all for the test.
 - (ii) Weigh the product as you load the hopper, and dispense all for the test.
 - (iii) Collect and weigh the quantity dispensed.
 - (iii) Weigh the entire vehicle before and after the test to calculate the weight dispensed during the test.

Position the machine to discharge where convenient.

4. Switch the instrument off

5. Select Cal Mode 3 by pressing the button and switching the instrument on again (fig.6). The instrument defaults to the  channel.


(Speed simulation - On/Off)

6. Start forward speed simulation (8km/hr) by pressing the  button (fig.7a).

7. Switch the spreader on.



The belt speed is based on the current calibration factor, application rate and simulated forward speed. The instrument then displays the theoretical area accumulating.


8. Switch the spreader off as soon as the hopper is empty (or you have dispensed an intended quantity).

The instrument then defaults to the  channel and displays the theoretical weight it has calculated as being dispensed, based on the current calibration factor.

NOTE: *If at this stage the instrument is switched off for any reason, when switched on again it will default to this display. You must adjust and confirm the actual weight before you can resume normal operation.*

9. Enter the actual weight dispensed.

Use the  or  button to adjust the displayed figure.

Press the  button to confirm the figure. The display shows “done”.

The calibration factor is then re-calculated and stored in memory. The new factor displays for 5 seconds before the instrument defaults to normal operating mode. If the previous calibration had been “nudged”(7.4), the nudge factor is “cancelled” and automatically resets to 100%.

7.2 Dynamic Calibration

Proceed as for a Static Calibration procedure except please ignore Step 5 to switch on the simulated speed (the factory default setting is “OFF”).

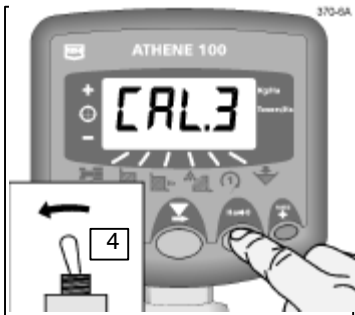


Figure 6: Select CAL Mode 3



Figure 7a: Start Speed Simulation

7.3 **FAQ's about Calibration**

There is a small discrepancy in the amount applied.

Possible Cause: Variable factors such as field conditions, nature of product etc. A dynamic calibration in the field is likely to be more accurate than a static calibration test.

Remedy: You can “nudge” the calibration factor (7.4).

There is a big discrepancy in the amount applied.

Possible Cause: The gate opening is altered.

The product is changed.

(Certain machines) The speed ratio between the shaft onto which the encoder is fitted and the belt drive shaft (e.g. according to the application rate you require) is changed.

Product weight incorrectly calculated or entered in calibration test.

Remedy: Perform the calibration test again.

The instrument beeps continuously during the calibration test

The beeping indicates that the PWM control parameters have been exceeded, and so the application rate set for the calibration test cannot be met. As a result the actual quantity dispensed will be less than it should be.

Possible Cause: Gate opening incorrect.

Forward speed too high (Dynamic Calibration)

The initial (current) calibration factor set, is not close enough to the required factor (e.g. if you have a large change in product density/application rate between one calibration test and the next).

Remedy: Check the gate opening is correct according to the manufacturer's chart*.

Reduce forward speed during the test.

Programme a larger initial calibration factor and repeat the test.

*The control system should be capable of metering over the same range of application rates for a given product and gate setting. Larger gate openings should not normally be necessary.

In the event custom gate settings need to be established, they can be noted in the back of this manual for future reference.

7.4 Nudging the Calibration

If you find a consistent discrepancy between the instrument weight reading and the actual weight dispensed, you can either,

- (i) Leave the existing Calibration Factor as it is and adjust the calibration by setting a “Nudge Factor” (a % change). The calibration factor can be nudged up to $\pm 50\%$ in 1% steps.
- (ii) Calculate a new Calibration Factor using a simple formula (7.4.4) and re-programme it.

7.4.1 Under-application

If the weight displayed on the instrument is more than the actual weight dispensed, the calibration factor must be *decreased*.







E.g. If the weight reading is 10% high, then set the nudge figure to “90” (indicating the system is only applying 90% of what it should be). This value will then nudge the current calibration factor to ensure that 10% more product will be dispensed, which will then ensure the application rate is correct.

7.4.2 Over-application

If the weight displayed on the instrument is less than the actual weight dispensed, the calibration factor must be *increased*.

E.g. If the weight reading is 15% low, then set the nudge figure to “115” (indicating the system is applying 15% more than it should be). This value will then nudge the current calibration factor to ensure that 15% less product will be dispensed.

7.4.3 Setting a Nudge Factor

1. Switch the instrument off.
2. Select Cal Mode 3 by pressing the  button and switching the instrument on again. The instrument defaults to the  channel.
3. Press the  button to select the  channel.
4. Press the  or  button to set the nudge factor.
5. Switch the instrument off then back on again to resume the normal operating mode.

7.4.4 Re-calculating the Calibration Factor

The actual calibration factor can also be determined by a simple calculation using the actual weight and the displayed weight as follows :

$$\text{Correct factor} = \text{Existing factor} \times \frac{\text{Actual weight}}{\text{Displayed weight}}$$

For example: The existing calibration factor is 1.500. The displayed weight was 780 kg but the actual weight dispensed was 1000kg.

The correct factor is $1.500 \times (1000/780) = 1.923$

7.4.5 Adjusting the Calibration Factor

NOTE: The factory default Calibration Factor = 1.000







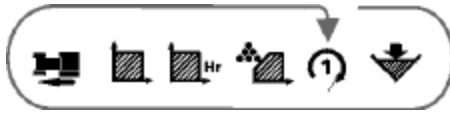
1. Select Cal Mode 3 by pressing the  button and switching the instrument on again (fig.6). The instrument defaults to the  channel.
2. Press the  button to select the  channel.
The calibration factor is displayed and the first digit will be flashing (fig.7b).
3. PRESS and RELEASE the  button to select the digit or decimal point to change.
4. HOLD the  button to change the digit or move the decimal point.
5. Switch the instrument off then back on again to resume the normal operating mode.



Figure 7b: Adjust Cal. Factor

8 RPM Display



This channel will normally display the PTO speed or the spinner speed, but can be another rotating shaft depending on your particular application.

8.1 RPM Alarm

The RPM channel has an under-speed alarm.

The low speed alarm is programmable in the calibration mode (refer to Installation/Calibration manual).

Default setting: Low Speed Alarm - 2700rpm

The RPM alarm does not function when the forward speed is less than 2km/hr.

If the RPM falls below the programmed threshold, the display will default to this channel and flash the actual RPM and the instrument will beep 5 times.

You can temporarily ignore the low speed alarm by selecting another channel, however the instrument beeps and return to this display after 30 seconds. This will occur until the RPM increases above the threshold.

With a low speed alarm threshold programmed, if the RPM drops to zero, the PWM output (for variable rate control) is inhibited and the belt drive will stop.

If the alarm threshold is set to zero, then the alarm is disabled and PWM output is unaffected.

9 Hopper Contents Display



This channel gives either a simple low level alarm or displays the hopper contents, depending on how the system is configured.

9.1 Low Level Alarm (using Hopper Level Sensor)

If the hopper is fitted with a level sensor, when you select this channel it will briefly display “1” to indicate that the alarm is enabled

NOTE: *This is the default setting. If “0” is displayed then the alarm is disabled.*

When the hopper contents fall below the sensor, the display will default to this channel and flash “Alar”, and the instrument will beep 5 times. You can temporarily ignore the alarm by selecting another channel, however the instrument beeps and returns to this display after 30 seconds.

The hopper level alarm does not function when the forward speed is less than 2km/hr.

9.2 Weight display (Qty left in hopper/ Qty dispensed)

The instrument must already be set the calibration mode for “Volumetric” hopper contents (if necessary, refer to the Installation/Calibration manual).

The system calculates the theoretical quantity in the hopper, displaying either the total weight dispensed or the quantity remaining in the hopper, depending on how the instrument is configured in the calibration mode.

If kg units are selected, the units are kgs up to “9999” thereafter the decimal point indicating the readout is in tonnes (to the nearest 10kg) e.g. 10.10 tonnes.



NOTE: *On systems with rate control, the weight calculation is based on the belt speed and the area covered. The simpler system without rate control calculates from the programmed application rate and area covered. Therefore, the accuracy of the hopper contents display is dependent on the programmed rate figure matching the actual rate being applied.*




9.3 The “Quantity in Hopper” display

If the Hopper Maximum Quantity is set to a value above zero in the calibration mode (refer to the Installation/Calibration Manual to set this), the display will *count down from the maximum figure*, showing the quantity of product remaining in the hopper.

When the calculated weight reaches the pre-programmed hopper alarm-weight, the instrument will alarm in the same manner as described above.

9.3.1 Set Alarm Quantity

1. Select the  channel then press and hold the  button for 5 seconds
The current alarm quantity appears (fig 8a). The factory default setting is 500kg (0500).

2. Continue holding the  button.
3. PRESS and RELEASE the  button to select the digit or decimal point to change, or...
4. HOLD the  button to change the digit or move the decimal point.

Remember, setting a decimal point sets the units as tonnes. If no decimal point is set, the units are in kgs.

5. Release the  button to return to the normal operating mode.





Figure 8a: View Alarm Quantity



Figure 8b: Set Alarm Quantity

9.3.2 Resetting the “Hopper Maximum Quantity” figure







Select the  channel, then press and hold the  button. The instrument will give 10 beeps then resets to the default figure.

The factory default setting is 2000kg.

9.3.3 Adjusting the “Hopper Maximum quantity” figure

The meaningfulness of the display is reliant on the Hopper Maximum Quantity being correctly programmed for the actual quantity of product in the hopper at the start.

You may well want to adjust the default figure (e.g. for a part-loaded hopper, different density material etc)

1. With the  channel selected, press and hold the  button for 5 seconds
The quantity then appears with the first digit flashing (fig.9).
2. You can now release the  button.
3. Then you then can adjust the value up or down using the  or  button.
5. Press and hold the  button for 3 seconds to return to the normal operating mode.

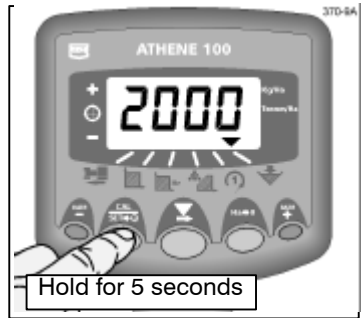


Figure 9: View Hopper Maximum Quantity



When the spreader is put into work, the display will then continue counting down from the figure that has been entered above.

“9.4 Quantity Dispensed” display

If the Hopper Maximum Quantity is set to zero in the calibration mode, the alarm function is disabled and the display will *count up from zero*, indicating the quantity of product dispensed.

9.4.1 Resetting the “Quantity Dispensed” display to Zero

You can reset to zero, e.g. if logging individual hopper loads, field totals, daily totals etc. Please note however, that aside from this channel total there is no independent “grand total” that stays in the instrument’s memory.

Select the  channel, then press and hold the  button. The instrument will give 10 beeps then resets to zero.

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