

Electro-Magnetic Compatibility (EMC)

This product complies with Council Directive 89/336/EEC when installed and used in accordance with the relevant instructions.



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User Guide

Athene 100 Belt Spreader Monitor/ Variable Rate Controller

Calibration

Software Reference WZ812-000 rev.2

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1 Overview

There are two aspects of calibration :- Calibration procedures/system settings made less frequently or only on installation, and the Product calibration procedure as part of everyday operation. In addition to the normal display / operating mode the instrument has 4 calibration modes.

On entering a Cal Mode the instrument defaults to the channel indicated by the ▼ symbol. Table 1 shows the various Cal. modes and functions. Note that the parameters required to ensure the correct application rate are

Table 1 highlighted.

| | Cal Mode 1 | Cal Mode 2 | Cal Mode 3 | Cal Mode 4 |
|---|--|---|--|--|
| | Press ▼ to select channel, then press and hold  | Press and hold the  button, power on and hold for 10 seconds | Press and hold the  button and power on | Press and hold the  button and power on. Instrument must be 'out of work' |
| Channel Selection | As above | Press  | Press  | Press  |
| Channel 1  | Speed Sensor factor (m/ 2 pulses) [sect. 2.1] | Gate Width (mm) [sect. 2.2.9] | Simulated forward speed (km/h) [sect. 4.4] | Response (0.000 - 0255) [sect. 2.2.5] |
| Channel 2  | Working Width (metres) [sect. 2.2.10] | Total Area (ha) [sect. 4.3] | Units (kg/ha or tonnes/ha) [sect. 4.5] | Start up PWM (4.0 - 96.0%) [sect. 2.2.2] |
| Channel 3  | Hopper Alarm Volume [sect. 4.1.5] | Max Hopper Volume [sect. 4.1.6] | Percentage Step (5, 10, 15, 20 or 25%) [sect. 4.6] | Min Duty Cycle (4.0 - 96.0%) [sect. 2.2.4] |
| Channel 4  | Target Application Rate [sect. 3.1.3] | mm/Belt Pulse [sect. 2.2.7] | Product Density (Kg/Litre) [sect. 3.1.1] | Max Duty Cycle (4.0 - 96.0%) [sect. 2.2.3] |
| Channel 5  | Under-speed alarm(rpm) [sect. 4.2.2] | PPR Shaft [sect. 4.2.1] | Gate Height (mm) [sect. 3.1.2] | Deadband (0 - 100) [sect. 2.2.6] |
| Channel 6  | Tank Contents/Alarm on-off [sect. 4.1.2] | Hopper Alarm from Volume/Sensor [sect. 4.1.1] | NudgeDensity [sect. 3.3.3] | Valve Auto Setup Routine [sect. 2.2.1] |

2 Calibration on Installation

After installation, first proceed to calibrate the forward speed sensor and the belt drive.

2.1 Forward Speed Sensor Setup

Cal Mode 1 – channel 1 *Default = 1.000m (39.38 inches)*



The instrument must be programmed with the correct Speed Sensor Factor (S.S.F.). This is the distance travelled per two pulses received from the sensor.

If a cal factor has previously been established for the vehicle, that factor can be manually programmed. If the factor is not known then it can be calculated automatically via the “Autocal” function as follows.

2.1.1 ‘Autocal’

1. Set two markers at 100 metres apart (328 feet). Choose a convenient reference point on the vehicle and position this point opposite the first marker.

2. Press and hold the  button until the cal factor is displayed
(*Default = 1.000 m /2 pulses*).

3. Continue holding the  button, and press the  button until the display shows "Auto" ready for the Autocal.

4. Drive the vehicle until the chosen reference point is opposite the second marker. The instrument counts and displays the sensor pulses received over the distance traveled.

NOTE: *If the count exceeds 9999 (as may occur if the forward speed signal comes from a radar sensor), then the instrument displays the first 4 digits i.e "1001" indicates between 10,010 and 10,019 pulses.*

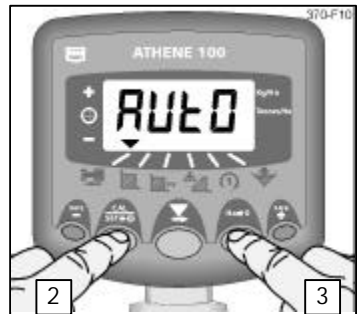







Figure 10: Start 'Autocal'

5. Press the  button again to complete the Autocal routine.
The calibration factor is automatically calculated and stored in memory.

2.1.2 Programme Cal Factor manually

Calculate as follows;

- (i) **If a conventional wheel sensor with two magnets** is installed, the Speed Sensor Factor is half the effective rolling circumference of the wheel. Drive the vehicle forward in field conditions with the implement attached, for exactly **5** revolutions of the sensed wheel. Measure the distance travelled (metres) and divide by ten to find the Speed Sensor Factor.
- (ii) **If a prop shaft sensor with a single magnet is installed**, the distance traveled for two turns 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 (metres) and divide by five, to find the Speed Sensor Factor.
- (iii) **If an RDS Radar sensor is installed**, set the factor to **0.0016** (m / 2 pulses).




1. Press and hold the  button until the cal factor is displayed. Continue holding this button and...
2. QUICKLY PRESS and RELEASE the  button to select the digit or decimal point to change, or...
3. HOLD the  button to change the digit, or if selected move the decimal point.
4. Release the  button to return to the normal operating mode.

2.2 Belt/Gate Setup

2.2.1 Valve Autoselection Routine

Cal mode 4 - Channel 6 (ref. Table 1)

The valve auto-calibration routine establishes the startup PWM and maximum duty cycle for controlling the belt speed.

1. Ensure the instrument is switched 'out of work' (▼ is flashing) at the bottom of the display and then turn the instrument off.
2. Press and hold the  button and switch the instrument on to enter Cal mode 4.
3. Press the  button to select channel 6. The display shows "AUTO".
4. Press the  button to select the auto-calibration routine and then switch the system into work.

The display then alternates between "X" and "run" (X being the PWM value being sent to the valve) as it then establishes the Start up PWM and Max. Duty Cycle PWM values as follows.

5. Once the routine is complete the PWM output will be turned off, the instrument can be switch 'out of work' again and the Start Up PWM and Max Duty Cycle PWM will be saved accordingly.

2.2.2 Start up PWM

Cal mode 4 - Channel 2 (ref. Table 1)

Default: 4% (Display shows 0004)

Auto-calibration first establishes the Start up PWM value. This is the PWM output that enables a speed feedback signal to be received and from which point closed loop control can continue.

The PWM output is slowly ramped up from 0% until the system registers a slow but steady belt speed. The PWM value (typically around 20%) is then stored to channel 2.

It should not normally be necessary to program this value as it will be determined with an 'Autocal' (see section 2.2.1).

2.2.3 Maximum Duty Cycle

Cal mode 4 - Channel 4 (ref. Table 1) Range: 4 - 96%

Default: 96% (Display shows 0096)

After establishing the Start up PWM value, auto-calibration then establishes the Maximum Duty Cycle PWM value. This is the PWM output at which the belt is at maximum speed.

The PWM output continues ramping up until the belt speed no longer increases. The PWM value is then stored to channel 4. When this is completed the PWM output is switched off and the display shows "donE".

It should not normally be necessary to program this value as it will be determined with an 'Autocal' (see section 2.2.1).

2.2.4 Minimum Duty Cycle

Cal mode 4 - Channel 3 (ref. Table 1) Range: 4 - 96%

Default: 4% (Display shows 0004)

This the percentage duty cycle at which the valve does not enable oil to pass, and the hydraulic motor to rotate.

2.2.5 Response





Cal mode 4 - Channel 1 (ref. Table 1) Range: 0.000 - 0255

Default: 250 (Display shows 0250)

This factor affects how quickly the system will respond to a change in application rate.

If it is set too high then the system will respond quickly but may overshoot the target. This may result in the rate remaining unsettled and fluctuating about the target rate.

If it is set too low, then the system will not respond quickly enough and the system will take longer to reach the target rate.

1. Ensure the instrument is switched 'out of work' ( is flashing) at the bottom of the display and then turn the instrument off.
2. Press and hold the  button and switch the instrument on to enter Cal mode 4. On entry the instrument will automatically default to channel 1 showing the response factor programmed (default 0250).
3. QUICKLY PRESS and RELEASE the  button to select the digit or decimal point to change, or...
4. HOLD the  button to change the digit and release when the required number is shown.

NOTE: *It is possible to program a number greater than 0255 but when the instrument is turned OFF it will not be saved. Therefore ensure the number set does not exceed the maximum of 0255.*

2.2.6 Deadband

Cal mode 4 - Channel 5 (ref. Table 1) Range: 0 - 100

Default: 10 (Display shows 0010)

This setting sets a 'tolerance band' about the target rate. The control system will only adjust when the calculated application rate is outside of this band.





The lower the factor, the more accurate the system will be in trying to achieve the target. If you find that the system is constantly 'hunting' to meet the target then you should increase the factor.

2.2.7 Millimetres of belt per pulse

Cal mode 2 - Channel 4 (ref. Table 1) Range: 0.000 - 99.99

Default: 30.00 mm (Display shows 30.00)

This is the length the belt moves for every pulse from the belt drive encoder. It will need to be calculated mathematically for each different type of machine, and must take account of the overall gear reduction ratio between the encoder shaft and the belt drive roller.




1. To enter cal mode 2, press and hold the  button, power on and then hold for 10 seconds.
2. Press the  button to select channel 4.
3. Quickly PRESS and RELEASE the  button to select the digit or decimal point to change, or...
4. HOLD the  button to change the digit and release when the required digit is shown.


NOTE: *It is possible to program a number greater than 99.99 (by moving the decimal point) but if the factor required is greater than this suggested maximum we would advise that the device used to provide the speed signal (encoder or sensor) is relocated to provide a greater number of pulses. Having an installation requiring a factor greater than 99.99 will not enable the control system to work correctly.*

2.2.8 Setting "Monitor only" mode

Cal mode 2 - Channel 4 (ref. Table 1) Range: 0 - 99.99

Default: 30.00 mm (Display shows 30.00)

1. To enter cal mode 2, press and hold the  button, power on and then hold for 10 seconds.
2. Press the  button to select channel 4.
3. QUICKLY PRESS and RELEASE the  button to select the digit or decimal point to change, and...

4. HOLD the  button to cycle each digit to zero.




NOTE: When setting a value of 00.00 the instrument will revert to 'monitor only' mode. In the operating mode the instrument will not carry out proportional PWM control and the side indicator will not be seen. Programming mode 4 will not be selectable, and only channel 2 will be available in mode 3.

2.2.9 Gate Width

Cal mode 2 - Channel 1 (ref. Table 1)

Default: 300 mm (Display shows 0300)

This is the width of the gate (in milli--metres) at the rear of the machine. It is used along with other parameters in the software to calculate the theoretical volumetric discharge.



1. To enter cal mode 2, press and hold the  button, power on and then hold for 10 seconds. On entry the instrument will automatically default to channel 1 showing the current width programmed (default 0300).
2. QUICKLY PRESS and RELEASE the  button to select the digit or decimal point to change, or...
3. HOLD the  button to change the digit and release when the required number is shown.



2.2.10 Working Width

Cal mode 1 - Channel 2 (ref. Table 1)

Default: 4.000 m (Display shows 4.000)

As with the gate width setting the spread width setting is required along with other parameters in the software to calculate the theoretical volumetric discharge.

1. Select the  channel.
2. Press and hold  for 5 seconds to enter programming mode 1.

3. QUICKLY PRESS and RELEASE the  button to select the digit or decimal point to change, and...
4. HOLD the  button to cycle each digit to zero.
5. RELEASE both buttons and the instrument will then return to the normal display mode.

3 Product Calibration

Ensuring that the system applies the correct quantity of product is a simple matter of programming both the product density (kg/litre) and the appropriate gate height (mm) for the desired application rate (referring to the manufacturer's calibration chart).

3.1 Setting up for a given product/application rate

Simply perform the following steps,

3.1.1 Set Density

Cal mode 3 - Channel 4 (ref. Table 1) Default: 1.000 kg /m³






1. Select Cal Mode 3 by pressing the  button and switching the instrument on again (fig.6).
2. The instrument defaults to the UNITS channel. Press  to select the  channel.
3. Use the  or  button to adjust the density figure.



Figure 6: Select CAL Mode 3



NOTE: You can programme either



- (i) a "corrected" density (section 3.3.4) established previously or,
- (ii) the specified density for the product and a separate nudge factor (section 3.3) established previously.

3.1.2 Set Gate Height

Cal mode 3 - Channel 5 (ref. Table 1)

Default: 100 mm (Display shows 100)

4. Press  to select the  channel.




5. Use the  or  button to adjust the gate height (10mm to 750mm max.) for the desired application rate according to the manufacturer's calibration chart.

NOTE: *In the case of (ii) above, press  to select the  channel and programme the appropriate "Nudge Factor" (section 3.3), otherwise continue to section 3.1.3.*

3.1.3 Set Application rate (Target rate)

Cal mode 1 - Channel 4 (ref. Table 1)

Default: 100 kg/ha (Display shows 100.0)

6. Switch the instrument off then back on again. The instrument then defaults to the target rate channel.
7. Use the  or  button to adjust the application rate.
8. Press and hold the  button for 3 seconds to return to the normal application rate display.

NOTE: *The Target rate can subsequently be changed or nudged from the normal operating mode (see sections 6.3 and 6.4 in the Operation manual).*

3.2 FAQ's about Product Calibration

There is a small discrepancy in the amount applied.

Possible Cause: Variable factors such as field conditions, nature of product etc.

Remedy: You can “nudge” the density figure (3.3).

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.

Programmed density or gate height is incorrect.

Remedy: Set correct gate height and/or density.

The instrument beeps continuously

The beeping indicates that the PWM control parameters have been exceeded, and so the application rate set 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.

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

Reduce forward speed.

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

3.3 Nudging the Product calibration

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

- (i) leave the existing user-programmed density figure as it is and adjust the calibration by setting a “Nudge Factor” (a % change to the programmed density).
- (ii) Calculate a “corrected” density factor using a simple formula (3.3.4) and re-programme it.

The user-programmed density factor can be nudged up to $\pm 50\%$ in 1% steps.

3.3.1 Under-application

If the weight displayed on the instrument is more than the actual weight dispensed, the density 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 density factor to ensure that 10% more product will be dispensed, which will then ensure the application rate is correct.

3.3.2 Over-application







If the weight displayed on the instrument is less than the actual weight dispensed, the density 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 density factor to ensure that 15% less product will be dispensed.

3.3.3 Nudging the density

Cal mode 3 - Channel 6 (ref. Table 1)

Default: 100 (Display shows 100)

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.

3.3.4 Re-calculating a Density Factor

A “corrected” density factor can also be determined by a simple calculation using the actual weight and the displayed weight as follows :

$$\text{Corrected density} = \text{Programmed density} \times \frac{\text{Actual weight}}{\text{Displayed weight}}$$

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

The density needs to be set as $1.500 \times (1000/780) = \mathbf{1.923}$

Refer to section 3.1.1 to re-programme the density.

NOTE: *Each time the density is re-programmed, any existing “Nudge Factor” is cancelled i.e. it returns to 100.*

4 Other Calibration Settings

4.1 Hopper Setup

4.1.1 Level Sensor Configuration




Cal mode 2 - Channel 6 (ref. Table 1)

Default: "Sensor" (Display shows 'SenS')

Depending on the installation, level measurement is by one of two methods -

- (i) A capacitive sensor is fitted in the side of the hopper to give a low level signal. The setting should be set to "**Sens**". When this setting is made, channel 2 in cal modes 1 and 2 ("Tank Alarm Volume" and "Max Tank Volume") have no function.

- (ii) There is no level sensor. The setting should be set to "**tHEO**". Volumetric information will then be displayed on channel 6 in the normal operating mode. This information and the level alarm is based on the application rate and the area covered.




1. Select the  channel.
2. Hold the  button to enter programme mode 1. Continue holding the button and...
3. PRESS  to change the selection on the display between "**Sens**" (sensor) and "**tHEO**" (theoretical).
4. Release both buttons when the desired option is shown. The instrument will then return to the normal display mode.

4.1.2 Alarm On-Off

Cal mode 1 - Channel 6 (ref. Table 1)

Default: "on" (Display shows "1")

If in "SenS" mode (see above) the alarm function can be enabled/disabled. Set to "0" to disable.

1. Select the  channel.
2. Hold  to enter programme mode 1. Continue holding the button and...
3. PRESS  to select **0** (Off) / **1** (On).

The display will stay blank on this channel when the alarm is disabled.

4. Release both buttons when the desired option is shown. The instrument will then return to the normal display mode.






NOTE: If the "Hopper Max. Volume" setting (see next section) is zero, the alarm function no longer applies as the Hopper Volume display will then count up in the normal operating mode

4.1.3 Set Hopper Current Volume

Cal mode 1 - Channel 6 (ref. Table 1)




NOTE: This is also in the Operation manual section 8.3.3)

If the instrument is set in volumetric mode ("iHEO" - see under "Level Sensor Configuration"), then this channel is used to alter the current hopper volume. (e.g. if starting a job with a part loaded hopper).

1. After selecting channel 6, press and hold the  button for 5 seconds. The calculated current volume will then flash on the display.
2. Release the  button.
3. Adjust the volume using the  or  buttons.
4. Press the  button again for 3 seconds to revert to the normal operating display.

4.1.4 Reset Hopper Current Volume to Maximum Volume







Cal mode 1 - Channel 6 (ref. Table 1)

1. Select the  channel.
2. Press and hold the  to reset the current figure to the maximum hopper volume. The display will flash and the instrument will beep.
3. When the maximum is shown the  button can be released.

4.1.5 Set Hopper Alarm Volume

Cal mode 1 - Channel 3 (ref. Table 1)


NOTE: This is also in the Operation manual section 8.3.3)





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.

4.1.6 Set Maximum Tank Volume

Cal mode 2 - Channel 3 (ref. Table 1)

Default = 0000kg (Display shows 0000)

1. Switch the instrument off.
2. Select Cal Mode 2 by pressing the  button and switching the instrument on again. Hold for 10 seconds to access Mode 2.

3. Press the  button to select the  channel.
4. PRESS and RELEASE the  button to select the digit or decimal point to change, or...
5. HOLD the  button to change the digit or move the decimal point.
6. Switch the instrument off then back on again to resume the normal operating mode.

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






4.2 RPM Sensor Setup

4.2.1 PPR - Shaft

Cal mode 2 - Channel 5 (ref. Table 1)

Default = 1.000 pulses per rev (Display shows 1.000)

This channel is for calibrating the shaft speed sensor for the RPM display function. The default setting is for a sensor and single magnet installation. For very slow shaft speeds, a 3-magnet or 8-magnet carrier can be used. Accordingly the factor would then be set at 3.000 or 8.000

1. Switch the instrument off.
2. Select Cal Mode 2 by pressing the  button and switching the instrument on again. Hold for 10 seconds to access Mode 2.
3. Press the  button to select the  channel.
4. PRESS and RELEASE the  button to select the digit or decimal point to change, or...
5. HOLD the  button to change the digit or move the decimal point.
6. Switch the instrument off then back on again to resume the normal operating mode.







NOTE: If the factor is set to zero, the RPM channel cannot be selected in the normal operating mode.

4.2.2 Under-speed Alarm

Cal mode 1 - Channel 5 (ref. Table 1) :

Default = 2700 rpm (Display shows 2700)

Normally it will be the PTO shaft speed or Spinner speed being measured, but can be any other rotating shaft depending on the application.

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

NOTE: *The PWM output to operate the belt will be inhibited unless the shaft speed is above the under speed alarm programmed.*




If the alarm threshold is set to zero then the alarm function is disabled. The PWM output will NOT be switched off when the shaft speed drops to zero.

4.3 Total Area

Cal mode 2 - Channel 2 (ref. Table 1)

This channel displays the total area worked in hectares and is independent from the resettable area registers in the normal operating mode.

It is not normally resettable. It will however, reset to zero if you perform a "Power-on Reset" (which resets ALL calibration settings to their factory default value).

1. Switch the instrument off.
2. Select Cal Mode 2 by pressing the  button and switching the instrument on again. Hold for 10 seconds to access Mode 2.
3. Press the  button to select the  channel.








4.4 Simulated Forward Speed

Cal mode 3 - Channel 1 (ref. Table 1)

Default = 8km/hr (Display shows 8.000)

In the event that the forward speed sensor signal is lost for whatever reason (broken wire, faulty sensor etc), you can initiate a simulated speed signal to enable the control system to continue spreading.

This channel shows the simulated speed that will take effect.

1. Switch the instrument off.
2. Select Cal Mode 3 by pressing the  button and switching the instrument on again. The instrument will default to the  channel.
3. Press the  button to select the  channel.
4. PRESS and RELEASE the  button to select the digit or decimal point to change, or...
5. HOLD the  button to change the digit or move the decimal point.
6. With the required speed programmed, press the  to initiate the simulated speed.
7. The instrument will automatically revert to normal operating mode.

NOTE: *You must drive at the simulated speed. Driving slower or faster will result in an incorrect application rate!*

The simulated speed is cancelled when a pulse is received from the speed sensor or the instrument is switched off and on again.




4.5 Units

Cal mode 3 - Channel 2 (ref. Table 1) :

Default = Kg/Ha (Display shows "----")

This channel shows the currently selected units - either Kg/Ha or Tonnes/Ha.



The selected units are indicated by the top row of segments for Kg/Ha, or the middle row for Tonnes/Ha.






1. Switch the instrument off.
2. Select Cal Mode 3 by pressing the  button and switching the instrument on again. The instrument will default to the  channel.
3. Toggle the setting using the  button.

4.6 Percentage Step

Cal mode 3 - Channel 3 (ref. Table 1) : Range = 5 - 25%

Default = 5% (Display shows 5)

This channel sets the percentage step size that the  and  buttons adjust the target rate in the normal operating mode.

1. Switch the instrument off.
2. Select Cal Mode 3 by pressing the  button and switching the instrument on again. The instrument will default to the  channel.
3. Press the  button to select the  channel.
4. Cycle through 5 options - 5%, 10%, 15%, 20% and 25% using the  button.

ATHENE 100 – SPREADER RATE CONTROLLER

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