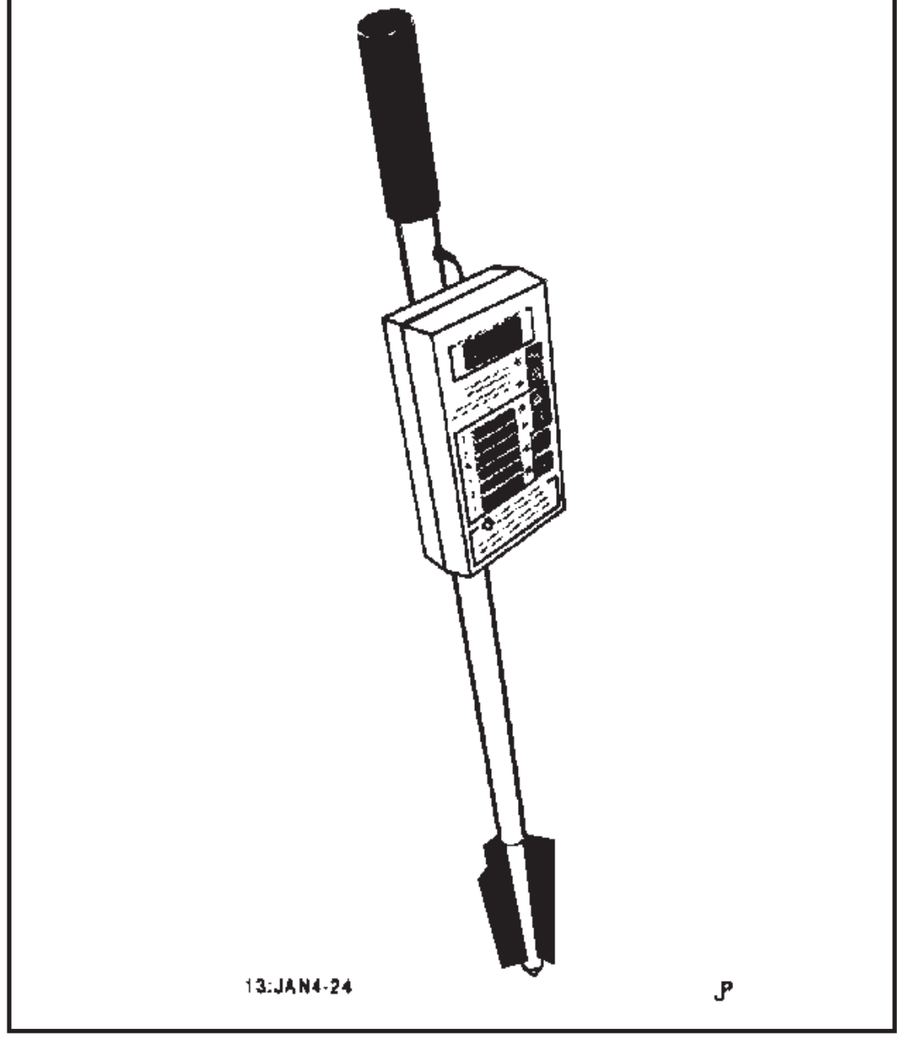
SINAR TECHNOLOGY

MANUAL



Sinar GrainSpear™ Users Manual

Contents

1. Introduction to GrainSpear™

The GrainSpear™ is an instrument for measuring the temperature and moisture of crops and other commodities in bulk. It provides these readings immediately at any point where the spear is immersed. This means that sampling and analysis away from the heap is not needed and, because the GrainSpear™ operation is so fast, allows the user to gain a picture of the whole store rather than just a sample.

Unpacking the GrainSpear™ - the Checklist

The instrument comes in a purpose-made box. This is an expensive item - do not throw it away. The box has been designed for use in storage and transport of the machine and should be kept for this purpose.

In the box you should find the following items:

1. User manual.

2. GrainSpear™

The GrainSpear™ comes wrapped in a protective cover to protect it from water or moisture ingress in storage and transit. Take the instrument out of the wrapping (which is best saved along with the box) and carefully lay it flat on a table or bench. It may decide to lay a little awkwardly if the cable at the back of the display unit is a bit stiff - this is O.K.

Additional Information

Whilst in averaging mode a number of keys have been immobilised in order to protect the user from losing valuable information gained whilst averaging.
The CAL, the °C and the ON/OFF key are all immobilised whilst in averaging mode. In order to turn the Sinar GrainSpear™ off you must first exit the averaging mode.

(Press the % Key for 5 seconds).

NOTE

The information in this document is given in good faith.

Since the method of use and the care of the instrument are beyond the control of the manufacturers, they cannot accept responsibility for any loss consequential or otherwise resulting from or involving the use of the instruments.

If you have any comments or require further information please call or write to us at the following address:

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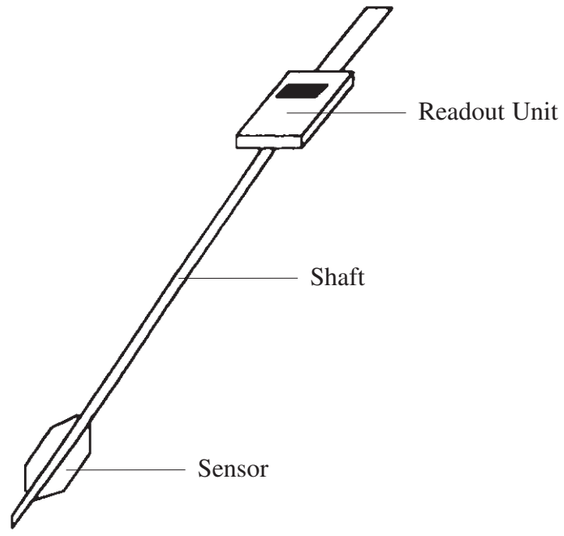
A first look at the GrainSpear™

The GrainSpear™ is made up of three basic components:

Sensor This is a unique patented moisture and temperature sensor. It can detect very small changes in moisture and temperature simply by insertion.

Shaft The shaft allows the warhead to be immersed deep into the bulk of the crop being measured.

Readout Unit This measures the signal from the sensor and using its built-in microprocessor calculates the temperature and moisture which is then displayed on the digital display.



Sorry - Batteries not included

Unfortunately we cannot provide batteries because of transit restrictions and the risk of deterioration damage when the instrument is stored for a long time.

The batteries are located under a small lid at the back of the readout unit. If you remove this lid you will see a battery cradle neatly tucked into the recess. Take the cradle out and unclip it from the battery clip.

You are going to need four AA-type batteries. We recommend you use the alkaline type such as Duracell, or equivalent - these last longest.

Place the batteries in the battery cradle, clip the connector on to the end and neatly pop it back into the recess, and replace the compartment lid.

Confirming the GrainSpear™ is O.K.

With the batteries successfully installed we can now look at the front panel of the readout unit. The purpose of the lights and switches on the front panel are explained in the next section, but for the moment we are just interested in the ON button.

To turn the GrainSpear™ on, simply press the ON button for about 1 second - you should then observe the following:

* A short continuous bleep followed by a series of shorter bleeps.

* At the same time, the red l.e.d.s will go through a pattern (starting from the bottom) to test they are all working.

* At the same time the LCD display will run through all the digits 0000 to 9999 to test they are all working.

* The instrument then briefly displays “HI”.

To select any one of these simply press either the up or down crop selection keys. The 3 factors are identified as follows:

i) Average moisture reading prefixed with A.
ii) Total number of samples prefixed with C.
iii) Current moisture reading - no prefix.

At this stage the average moisture reading will show A00.0 as no samples have yet been taken.

The current moisture reading will show the moisture reading at the point at which the sensor is inserted. Or if in free air the base reading of the spear. This reading is the same as if the Sinar GrainSpear™ was in standard operation.

5. To exit the averaging mode hold the % key down for 5 seconds. The double-beep will now discontinue to inform you that you are now back in standard operation.

Sampling and Averaging

1. Firstly plan your sampling procedure to gain representative samples from the whole of the bulk. Use a grid pattern over the store if this helps.
2. Enter averaging mode as described opposite.
3. Once inserted into the grain a sample reading can be taken by simply pressing the % key. A single bleep will sound to confirm a sample has been taken and entered into the average. A moisture reading will only be entered into the averaging equation when the % key is pressed. Up to 999 samples can be averaged.
4. At any time you can view one of the three factors as described i.e.

   - the average reading, shown prefixed with an A.
   - the total No of samples taken.
   - the current moisture reading, NO prefix.

To select the above simply press either the up or down crop selection.

8. Averager Module

NOTE

Before attempting to use this averaging facility please read fully the complete Sinar GrainSpear™ Owners Manual supplied with your machine. This will enable you to become familiar with the standard operational procedures before moving into this further stage of operation.

Introduction to the Averager

The averager option fitted to the Sinar GrainSpear™ gives the user a calculated average reading of a number of sample results. It also displays the number of sample measurements included in the average and the current moisture reading.

This facility is ideal for the overall assessment of stores and loads etc where a single representative moisture figure is needed.

For the average result to be meaningful the method of acquiring the moisture reading is important. The user should therefore take care to ensure that the sample moisture readings are representative of the bulk being averaged. An excessive number of readings in one location will bias the average result to that location.

Averager Operation

1. Follow the start up procedure as shown in the Sinar GrainSpear™ Owners Manual.
2. Select moisture and crop calibration to be tested/averaged.
3. To enter averaging mode press the % key for 2 seconds. The display will now show A00.0 You will also hear a double-bleep every 3 seconds to inform you that you have entered averaging mode.
4. Whilst in averaging mode the Sinar GrainSpear™ display can show one of three results:
   - i) The average moisture of samples taken.
   - ii) The total number of samples taken.
   - iii) The current moisture content reading.

The sequence finishes by displaying two lit l.e.d.s, one next to TEMPERATURE and the other next to the first crop. The display should now be showing the temperature at the sensor and, if the GrainSpear™ is sat in a room, this is the room temperature!

You can do one final check. Press the % button; the l.e.d should switch to MOISTURE. Now put your hand between two fins on the warhead so that you are actually touching the fins. You should see a change in the display reading indicating the sensor has sensed the presence of your hand. This moisture test is by no means conclusive but it does confirm that the signals are getting through to the processor and things are going well; however there may be reasons (a special program, for instance) why the display could not change, but this is likely to be an exception.

2. The Front Panel

The GrainSpear™ has a specially designed membrane front panel. It is durable and gives protection against moisture and dirt ingress.

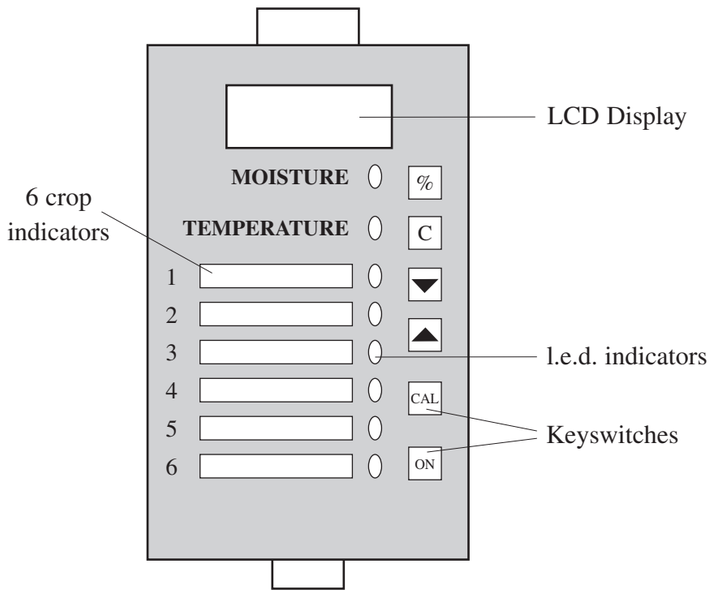
The panel has a very simple layout. There are six key switches, eight lights, and a window to view the LCD display. Lets look at each of these individually.

The LCD Display

The GrainSpear™ display is alphanumeric - that is, it can display some alphabetical characters as well as digits. In normal operation the user will see just a numerical display, but there are occasions when words, or abbreviations of words will appear - such as ‘bAtt’, indicating that the battery is beginning to fail. In some cases you will notice capitals mixed in with lower case letters which might look a little strange; this is because we have to make the best of the limited number of letters that can be shown with this type of display.

The keyswitches

Each key has a symbol or word indicating its primary function; the keys also have other functions which will be introduced in other sections.



GrainSpear™ Readout Unit

Just concerning ourselves with the basic operation, the basic purpose of each keyswitch is as follows:

% Press to display moisture content

°C Press to display temperature

▼▲ Press to select one of crops 1 - 6

CAL Press in conjunction with another key to enter one of the many calibration modes. N.B. Do not use this key unless you are familiar with the particular calibration feature. Pressing CAL on its own will have no effect.

2. Once you are in calibration mode you can press CAL at any time to get back to normal display

EXAMPLE

You've noticed that the GrainSpear™ is reading consistently high. When the moisture is more like 14.3% the GrainSpear™ reads 15.0% and is out by the same amount at around 18.0%. You therefore want to bias the moisture down a bit.

First calculate how much you need to reduce the reading by. Well, its 14.3 from 15.0 so the decrease is 0.7%. Make a note of the moisture reading before you calibrate, even if the machine is just laid on the bench.
Now for calibration.

Moisture for the crop in question should be selected.

Press CAL and % together for at least 3 seconds.

Press the down arrow key till you reach minus 0.7%. Remember it has to be minus 0.7% because it is to be subtracted from the 15.0%. If we were adding an amount you would use the up arrow key for a plus figure.

Press the ON button to blow into memory.

Press CAL to quit the calibration mode.

Now look at the moisture display, it should be reduced by 0.7%.

NB. Remember temperature also effects the moisture reading as well so try and keep the temperature constant when checking to see if the reading has changed.

7. Adjusting the Moisture Results

This facility allows you to shift the moisture readings up or down by a selected amount. For instance, lets say the instrument is reading consistently high on a particular crop by about 0.5%. This facility allows you to reduce that particular crop by 0.5%.

The procedure is extremely simple.

Calibration Procedure

First work out how much you want to change the reading by.

1. Set the display top moisture on the crop you want to change.

2. Now press the CAL and % keys together and hold them for at least 3 seconds. You will hear a blip and the moisture and crop lights will start flashing together - this means you're in Calibration Mode.

3. Press the up arrow key to increase and the down arrow to decrease the reading by the required amount.

4. Press ON to blow the calibration into permanent memory. You will hear two blips to indicate it has done this.

5. You will notice that the lights are still flashing which means you are still in calibration mode and can change the offset figure again if you like. If you are happy with the figure you have put in then just press CAL again.

6. The calibration is now complete. The display will return to the moisture figure for that particular crop but it should be changed by the amount you've entered.

NOTE

1. If you don't press the ON key to blow the figure into memory, the GrainSpear™ will use the offset figure you've entered whilst the power is left on. If you then turn the machine off you will lose this figure.

Lights

Each l.e.d. light indicates which particular reading is being observed on the display. There is a light to indicate moisture and one to indicate temperature. The other lights identify which one of the six crops is being measured.

Operating the keypad

When the GrainSpear™ is first turned on, it goes through the start-up test routine described earlier and settles on TEMPERATURE and CROP 1. Try the following exercises:

- Press the down arrow key. You will notice the crop light change to CROP 2. Press again and it will change to CROP 3 - and so on. When you get to CROP 6, press the down arrow key and you will notice we go back to CROP 1 - this is known as "rollover"

- Try the same exercise using the up arrow key.

- You will notice that the top function set to TEMPERATURE the display does not change when the crop changes. Temperature is not dependant on the crop being measured.

- Press the % key and you will see the light change to MOISTURE. This time when you press the arrow keys you may notice the display changes with the crop. This is because each crop can be programmed with different scales and ranges for moisture; a scale suitable for one crop may be completely different to that needed for another - hence the facility to hold six different scales in the GrainSpear™, for six different crops.

- Pressing the °C key brings you back to TEMPERATURE.

- Pressing the ON key turns the whole machine off. Press ON again and the GrainSpear™ comes back to life. Because of the nature of the on/off mechanism you may find that trying to turn the machine on and off rapidly may not always work. After pressing the ON key you generally have to wait about 7 or 8 seconds to use it again.

3. Alarms and Warning

The GrainSpear™ continually monitors its own health to ensure it is working correctly. To inform the user of any danger conditions it generates the following alarms and warnings:

“COn” - Connector Fail

The electrical connections between the GrainSpear™ and the sensor are monitored to ensure there is no break. In the event of a break the display will show “COn” and the bleeper will sound every half-second. Press CAL to clear the display. If the condition still exists the message will reappear.

“bAAt” - Battery Failing

The voltage from the battery pack is continuously monitored by the microprocessor. If the battery voltage starts to fall below a certain level, the alarm is raised. You can clear the alarm by pressing the CAL button, but you have been warned - its time to change the battery!

“dEAd” - Battery Dead

The voltage from the battery is detected as dangerously low. The GrainSpear™ cannot operate securely and so all its functions are shut down. The only way to clear this alarm is to change the battery.

“E002 & E003” Systems Alarms

These alarms are very unlikely to occur but indicate a serious error has occurred in the microprocessor itself. Contact Sinar if these alarms are observed.

conditions, often hundreds of tons left for long periods. The sensor penetrates the crop but doesn’t disturb the stability, so the machine calibrations are based on stable bulk densities established through uniform compaction. That’s why you can go back to the same location in a heap and get the same reading every time.

The user should therefore be cautious when using the GrainSpear™ on a crop that has recently been moved, where stable heap conditions are not yet established. The difference in compaction between a new and stable heap could lead to erroneous readings. However, users who have used the GrainSpear™ in fresh heaps have been able to obtain useful results by adopting a more judicial approach.

Calibration Changes

To get the best out of the GrainSpear™ it is essential that the instrument is calibrated to accurately suit the crop and the conditions being measured. The GrainSpear™ has been designed to allow the user to make changes to calibrations and to generally get involved with the instruments performance. If anything is to run at its best, it nearly always needs fine tuning. There are a number of facilities in the GrainSpear™ that allow you to program the machine to suit your particular application.

- Moisture results can be biased to match up with other references.
- The whole calibration can be changed*
- A new crop calibration can be added*

* For further information please contact your dealer or call Sinar Technology.

effect is a feature of all electrical moisture measurement devices - some you have to compensate manually, others are automatic.

The GrainSpear™ is automatically temperature compensated. The important thing for the user to remember is that for the temperature compensation to have full effect the sensor temperature must be close to the crop temperature, so it's worth checking that the temperature display is not changing rapidly. In many cases you will find that a crop heap has a fairly uniform temperature throughout, so once the sensor has acquired this temperature it is not necessary to wait and you can take instant readings. An occasional flick back to temperature is worthwhile just to keep an eye on things.

TIP: A rule of thumb for temperature compensation is that for every degree of temperature higher, the moisture content is about 0.1% lower*. For example, the temperature display is showing 17 deg C but the crop temperature is really 15 deg C. If the moisture display is showing 14.7% at 17 deg C it will then show 14.9% at 15 deg C. This gives you an idea of how accurate you need to be with the temperature reading.

* This is a rule of thumb only and really depends on the crop.

Compaction

Nearly every moisture measurement application requires the moisture figure to be given in % by mass. Most moisture measurement sensors give an output of moisture by volume and the mass reading is obtained by measuring the sample weight or compressing the sample so that it occupies a specific volume. The GrainSpear™ neither compresses or weighs, but relies on a particular principle called steady state conditions.

If a bulk of a particular crop (in a sack, bin, or on a floor) is left for a period it assumes a predictable bulk density: if you remove a sample from the bulk and pour it into a vessel, then that sample will probably have a different density. The change in density is because the heap was stable and settled (steady state) whereas the sample has been removed and is therefore unsettled of unstable - its density is unpredictable and therefore needs to be weighed or treated in some way.

In most cases with the GrainSpear™ we are looking at steady state

4. Care of the GrainSpear™

The GrainSpear™ is a precision measuring instrument using advanced microprocessor technology. Every step has been taken to design the machine to be robust and provide long service with minimum maintenance.

In order to obtain maximum benefit and use from the instrument the following points of care must be considered - remember the Guarantee does not cover neglect by the user:

1. Always keep in a clean, dry place when not in use - preferably in the box provided.

2. Keep the sensor clean with a dry cloth. Any residual material attached to the fins could give erroneous readings. You might find that after some use the paint on the sensor may come off - this will not affect the performance of the instrument.

3. Avoid leaving in vulnerable places e.g. laid on the floor. The sensor fins are made from a fibre laminate; they are strong yet flexible so that the sensor head retains its precise shape even after experiencing strong twisting movements. However the fins could break under extreme force.

4. Do not immerse in fluid.

5. Do not expose to temperatures greater than 45 °C for any prolonged period.

6. Avoid leaving in humid locations.

7. Remove battery when not in use for prolonged periods.

5. Measuring Temperature

When you turn on the GrainSpear™ the machine runs through its start-up routine and eventually settles on TEMPERATURE.

If the sensor is not immersed in any material than the display actually shows the temperature of the surrounding air. Of course the real power of the GrainSpear™ is in the measurement of crops at depth, so its this application that's now considered

Operation for Temperature

This couldn't be simpler. With the readout unit set to temperature push the GrainSpear™, sensor first, into the heap to be measured. Use the butt of the shaft to apply the downward pressure rather than the box which is likely to slip and strain the cable. When the instrument has been inserted to the required depth the temperature in deg C can be read from the display.

With all insertion operations you should remember:

- **don't twist the warhead.**
- **don't use the shaft as a lever; the forces at the sensor connection are enormous and could cause a fracture.**
- **always apply any force to the shaft - not the readout unit.**

Important Considerations - Temperature Measurement

If the material being measured is at a considerably different temperature to the air temperature then there will be a period of time needed for the sensor to reach the bulk temperature. The time needed for the GrainSpear™ to reach the bulk temperature depends on the difference, but the large fin area of the sensor allows this process to take place swiftly. You can judge when you are nearly there by monitoring the rate at which the temperature display rises of falls. Most of the waiting period will be for the last few fractions of a degree, so you should ask yourself how accurate you really want the reading to be.

6. Measuring Moisture

What makes the GrainSpear™ really special is its astonishing simplicity when it comes to moisture measurement. It is designed so that all you have to do is turn it on and go. But its simplicity can be deceptive, so there are a number of things you should consider when taking the reading to reduce the possibility of error; being aware of these considerations is just as important as knowing how to operate the machine.

Operation for Moisture

Having turned the GrainSpear™ on the readout will be showing temperature. Press the % key and the display will change to MOISTURE. You must also select the crop to be measured using the up and down arrow keys. With the readout unit set to moisture push the GrainSpear™, sensor first, into the heap to be measured. Use the butt of the shaft to apply the downward pressure, rather than the box which is likely to slip and strain the cable. When the instrument has been inserted to the required depth the % moisture content can be read from the display.

With all insertion operations you should remember:

- **don't twist the warhead.**
- **Don't use the shaft as a lever; the forces at the sensor connection are enormous and could cause a fracture.**
- **Always apply any force to the shaft - not the readout unit.**

Important Considerations - Moisture Measurement

Temperature Compensation

The measurement of moisture content at the sensor is effected by the temperature of the crop in the following way:

Say you had a heap of a particular crop which you knew was of constant moisture content throughout but had places of different temperature, If you measured the moisture content in different places in the heap without considering temperature you would actually see different moisture readings; we know the moisture is the same throughout the heap so what we are really seeing is the temperature effect. The temperature