



Farm Electronics

Operator Instructions



Farm Electronics Ltd
Woodland Drive
Alma Park
Grantham
Lincs. NG31 9SR
Tel: 01476 591592 Fax: 01476 591188
email: info@farmelec.co.uk

Instruction Code:
Temp/CS16MC3/0202

CROPSCAN 16 mc3

OVERVIEW OF CONTROLS

The Cropscan 16mc3 (CS 16mc3) fascia has been designed to make the entering and retrieval of information as easy as possible.

All temperature settings are digital : i.e. what you see in the display is what you are setting.

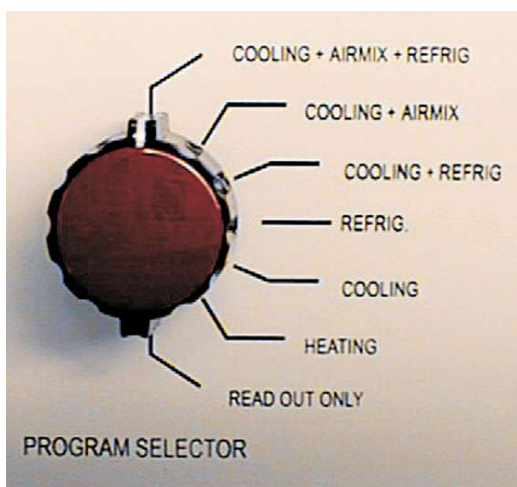
The CS16mc3 has two digital displays. The upper Red display (*figure 1*) shows actual temperatures and also control temperature settings. The lower multi line display (*figure 3*) shows status information and control parameters.

Associated with each digital display is a set of 3 controls. A short cut Display Switch which provides quick access to the parameters you require. An Adjust Settings knob which will alter the selected value and an Enter push button to both select and confirm all inputs made

(figure 1)



(figure 2)



The Program Selector knob (*figure 2*), centre left in the fascia, gives access to the six control programmes available on the CS16mc3

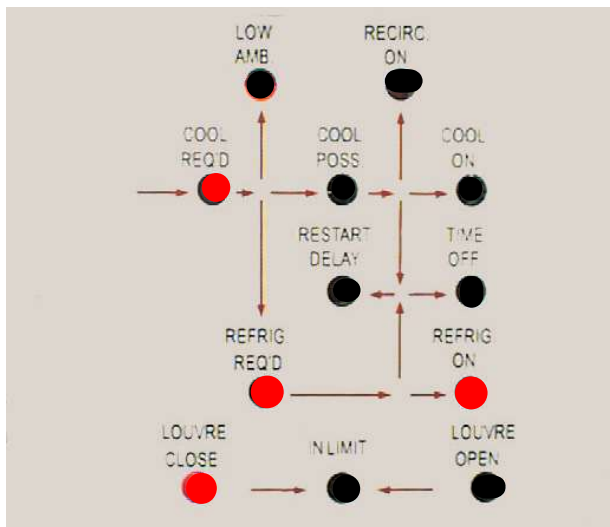
CROPSCAN 16 mc3

OVERVIEW OF CONTROLS

(figure 3)

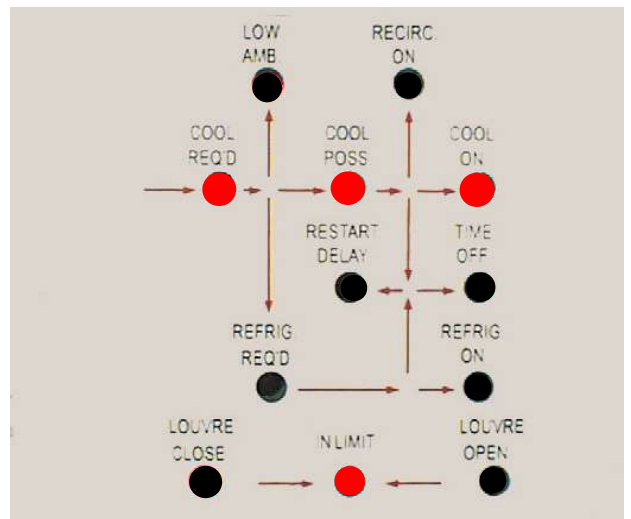


The LED Flow Diagram in the centre of the fascia shows the decision making process. By following the LED pattern it is possible to recognise the control status of the CS16mc3.



Example 1

In this example there is a **COOLING REQUIRED** demand.
Ambient cooling is not possible so **REFRIG REQUIRED** shows.
Refrig is actually **ON** and the louvres are **CLOSED**.



Example 2

In this example there is a **COOLING REQUIRED** demand and cooling is possible.
Cooling is actually **ON** and the Air Mix (Duct) temperature is **IN LIMIT**

Operator Instructions

Cropscan 16 mc3
Controls

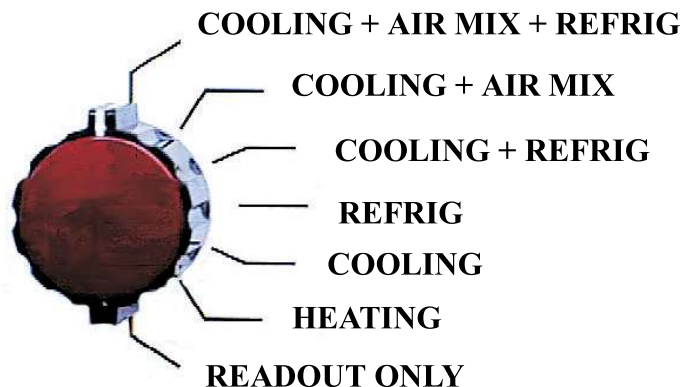
Program Selector

COOLING + AIR MIX + REFRIG - How the program operates

Operation is as for Cooling + Air Mix, except refrigeration will be initiated whenever a demand for cooling exists but ambient air is unavailable to cool. The demand for refrigeration is shown by the **Refrig Required** Red LED, which flashes when a crop sensor which requires cooling is scanned and the ambient air is too warm to cool with.

COOLING + AIR MIX - How the program operates

Operation is as for cooling, except the motorised louvres will be modulated during ventilation to maintain the duct, air cooling temp +/- 0.2C around the **Air Mix Set** temperature level. This is achieved using a variable timed pulse control of the motorised louvres i.e. if the tunnel temp is 0.1 to 0.3C above or below the **Air Mix Set** level, the louvres will pulse open for 1 second. Greater temperature differences will cause a 3 second pulse time.



COOLING + REFRIG -How the program operates

Operation is as for cooling except if cooling is still required but no suitable ambient air temperature differential exists, or there is a **Low Limit** condition the refrigeration plant will be initiated. It has a 12 mins minimum run timer reset by the **Refrig Required** demand Red LED.

REFRIG - How the program operates

When any crop sensor is found more than 0.1C above **Crop Set** refrigeration is initiated Demand for refrigeration will continue until all crop sensors are reduced to the objective.

COOLING - How the program operates

When any crop sensor is found more than 0.1C above **Crop Set** and the ambient is less than the highest crop sensor minus the Offset Value, cooling is initiated. Demand for cooling will continue until all crop sensors are reduced to the objective or the ambient conditions become unsuitable.

PROGRAM SELECTOR

HEATING - How the program operates.

When any crop sensor is found 0.1C below the **Crop Set** level the temperature is compared with ambient sensor temperature. If the Ambient temperature is greater than the lowest crop sensor plus "Offset Value" heating is initiated. Heating using Ambient Air will continue until this differential is reduced or the crop sensors are heated up to the **Crop Set** level. NB for heating, the offset should be set to a positive value i.e.. + 02.0C.

READOUT ONLY- How the program operates.

Crop temperatures and control parameters can now be displayed without any automatic control relay functions being activated. this can be used during manual control in order to monitor the sensors only. We recommend leaving the controller in this selection when the store is not in use.

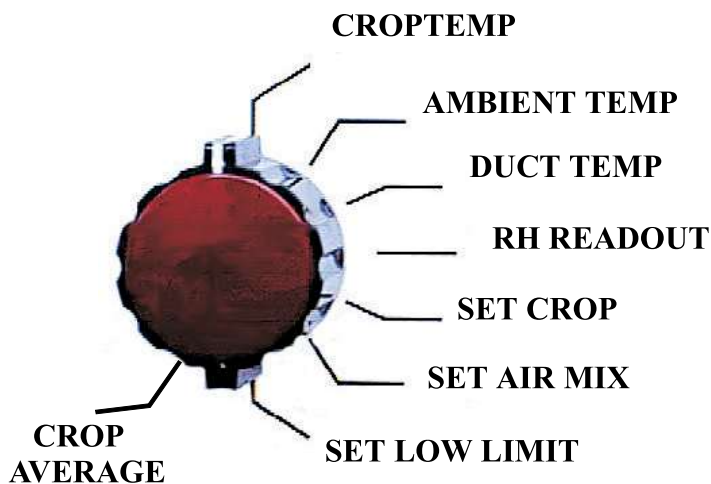
Operator Instructions

SETTINGS + READOUT SELECTOR

Cropscan 16 mc3 Controls

CROP TEMP - Displays the actual Crop Sensor temperatures in sequence as scanned by the CS16 mc3. The Zone and Sensor number identifies each sensor.

AMBIENT TEMP - Gives readout of actual ambient temperature.



DUCT TEMP - Gives readout of actual duct (air entry) temperature.

RH READOUT - Gives readout of RH Sensor in % RH (when fitted)

SET CROP - Gives readout of current Crop Temperature objective. To alter press ENTER SETTINGS button once. Change knob value using the ADJUST SETTINGS. Press ENTER SETTINGS button once again to store the new value.

SETTINGS + READOUT SELECTOR

SET AIR MIX - Gives readout of current (duct) Air Mix temperature objective. To alter follow instructions as per Set Crop.

SET LOW LIMIT - Gives readout of minimum acceptable Ambient temperature when using a cooling only program (no-air mix). To alter follow instructions as per Set Crop.

Operator Instructions

Menu Selector - Level 1

Cropscan 16 mc3 Controls

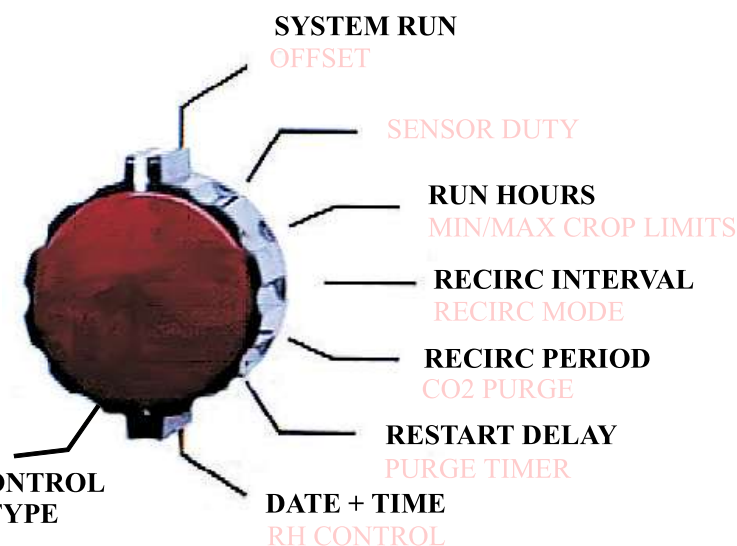
SYSTEM RUN - The selector should be left in this position once all the program options have been set. The display will show the correct DATE and TIME in addition to the CROPSET, AIRMIX SET and LOW LIMIT SET temperature values.

PRINT - If a dedicated local printer is fitted use this selection to initiate the printout. 3 Printouts are available, CURRENT TEMPS + SETTINGS, LAST 24HRs and ALL LOGGED DATA. To select printout - press ENTER SETTINGS button once. Select Print Out required using the ADJUST SETTINGS knob. Press ENTER SETTINGS button once more and the Print Out will occur.

RUN HOURS - Displays accumulated hours run times for AMBIENT COOLING HRS, REFRIG HRS and RECIRCULATION HRS
Note: Ambient hrs includes Recirc hrs.
Recirc Hrs is Recirc only.

RECIRC INTERVAL - The time interval between each Recirculation fans run. To set press ENTER SETTINGS button once. Alter time using the ADJUST SETTINGS knob. Press ENTER SETTINGS button once to store the new value. Range = 9hrs 55 mins (maximum).

RECIRC PERIOD - The actual fan run time for each Recirculation operation.
To set - follow instructions as per Recirc Interval.
Range = 55 mins (maximum).



MENU SELECTOR

LEVEL 1 & 2

RESTART DELAY - The delay time before a cooling operation will re-occur after the last one has stopped. To set - follow instructions as per Recirc Interval. Range = 9hrs 55 mins (maximum). This delay is useful when the store is down to temperature, to limit the number of cooling 'starts' per day.

DATE + TIME - Use to enter or alter the correct date and/or time To change - press the ENTER SETTINGS button once. To alter the number use the ADJUST SETTINGS knob. Press ENTER SETTINGS button once more to store the setting. To SKIP a setting if it is OK press the ENTER SETTINGS button to move on.

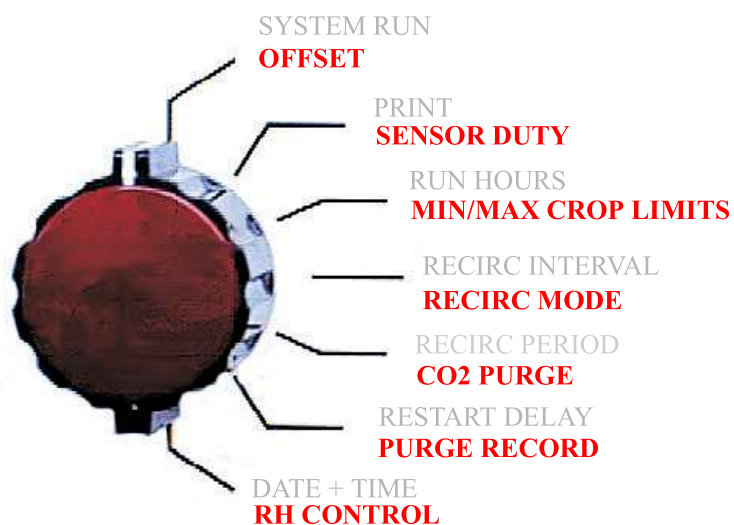
Operator Instructions

Cropscan 16 mc3 Controls

Menu Selector - Level 2

OFFSET - For efficient cooling the ambient air temperature must normally be 2C below the highest crop sensor temperature. This difference is the offset. Typically it is set at around -02.0C for Cooling or +02.0C for Heating purposes.

SENSOR DUTY - Individual Crop Sensors can be switched **Off Duty** for control purposes. All Zone 1 and Zone 2 sensors are displayed, with a **Y** to indicate **ON DUTY** and an **N** for **OFF DUTY**. The normal programming procedure is used to select / change the Y or N for each sensor. During the normal sensor-scan the green digital displays for zone and sensor number will flash for each **OFF DUTY** sensor.



MIN/MAX CROP LIMITS - These alarm points allow you to set up a minimum and maximum acceptable crop sensor limit. At the minimum level cooling will be switched off. At the maximum the sensor involved will not be able to initiate cooling. These alarms can be seen on the main Red LED readout, in the form of an **L** before a low sensor and an **H** before a high sensor.

RECIRC MODE - A choice of Recirc Methods can be selected. These are - Standard Recirc; Recirc Off; On During Timeclock Off; On During Refrig On; On During T/Clock + Refrig; To Select program required - press ENTER SETTINGS button once. Choose program using ADJUST SETTINGS knob. Press ENTER SETTINGS button once again to store new selection.

CO2 PURGE - Provides a timed fresh air change for the store to remove CO2 gas build up. Works similar to Recirc on an interval and period basis. Ambient is introduced using the air mix system to ensure safe temperatures. Set as per normal method. Interval 1-23hrs (maximum) Period 5-30mins (maximum)

MENU SELECTOR

LEVEL 1 & 2

PURGE RECORD - Shows the total number of CO2 purge fan runs that have occurred. This will verify that the purges have actually taken place.

RH CONTROL - Can be used (if RH sensor is fitted) to limit the RH level of the Ambient Air. The Hi and Lo RH setting can be used in 3 ways. If just the Lo setting is made cooling will be stopped, if the RH is below the Lo set. If just the Hi setting is made cooling will be stopped, if the RH is above the Hi set point. If both Hi and Lo are set cooling will occur only when the RH is between the set points. Set using the normal method. For no RH control set the Lo at 00% and the high at 99%.

Operator Instructions

SUMMARY OF TERMINOLOGY USED

Cropscan 16 mc3
Controls

<u>TERM (SETTINGS)</u>	<u>WHAT IT MEANS</u>
CROP TEMP	The temperature of individual crop sensors.
AMBIENT TEMP	The actual ambient (outside) temperature.
DUCT TEMP	The actual duct air temperature.
CROPSET	The desired storage temperature for the stored crop.
AIR MIX SET	The target duct cooling air temperature when cooling with ambient air.
LOW LIMIT SET	The lowest acceptable ambient air temperature for cooling without air mix.
OFF SET	The difference the ambient temperature needs to be below the highest crop temperature before ambient cooling can be initiated.
MIN/MAX CROP LIMITS	The set temperature levels that prevent over cooling of the crop. The MIN set is the temperature that the lowest crop sensor can fall below the Crop Set before cooling is prevented. (set in - degrees C below the CROP SET target temperature). This shows up as a L on the main temperature readout. The MAX set will ignore any crop sensor that is above this temperature for control purposes. (set in + degrees C above the CROP SET target temperature). This shows up as a H on the main temperature readout.
HEATING	The mc3 logic can be reversed in order to warm the crop. NB. This is only achievable if the ambient air is warmer than the CROP TEMP by more than the OFFSET value.
RECIRC MODE	The type of recirculation program required.
RECIRC PERIOD	The length of the fan run during recirculation.
RECIRC INTERVAL	The time elapse between RECIRC PERIOD fan runs.
SENSOR DUTY	Individual crop temperature sensors can be turned "OFF DUTY" for control purposes.
RESTART DELAY	The time to elapse after any fan or refrig operation, before the system can cool again.
CO2 PURGE	Optional air change system that will remove a CO2 gas build up by bringing in ambient fresh air on a timed basis.
READ OUT ONLY	Select if the controller is not in automatic use. It will continue to give readout information but no cooling will be initiated.

Operator Instructions

SUMMARY OF TERMINOLOGY USED

Cropscan 16 mc3 Controls

TERM (LED DISPLAY)

WHAT IT MEANS

LOW AMBIENT

Ambient (outside) air is below your LOW LIMIT SET.

RECIRC ON

Fan is running in a RECIRC PERIOD.

COOL REQ'D

The mc3 needs to cool a high crop sensor.
NB. Flashes on as that sensor is scanned.

COOL POSS

The ambient (outside) air is cold enough to cool using ambient air.

COOL ON

Ambient cooling is taking place.

RESTART DELAY

The unit is held "OFF" because the RESTART DELAY time has not elapsed yet.

TIME OFF

The unit is held "OFF" because the external timeclock is giving an "OFF" signal.

REFRIG REQ'D

The mc3 needs to cool a high crop sensor using Refrigerated air.
NB. Flashes on as that sensor is scanned.

REFRIG ON

Refrigeration is taking place.

LOUVRE CLOSE

The louvres need to PULSE CLOSE.
NB. LED will go out momentarily as louvres are pulsing.

IN LIMIT

The duct air temperature is satisfactory.

LOUVRE OPEN

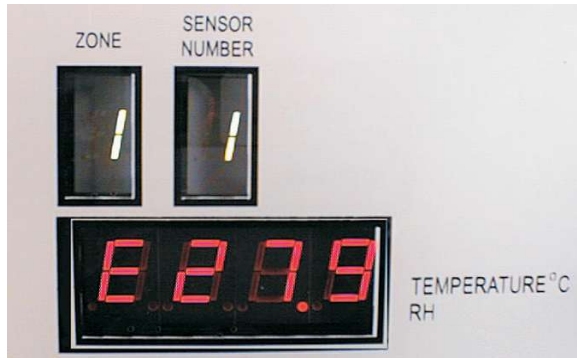
The louvres need to PULSE OPEN.
NB. LED will go out momentarily as louvres are pulsing.

Operator Instructions

UPPER RED DISPLAY ERROR CODES

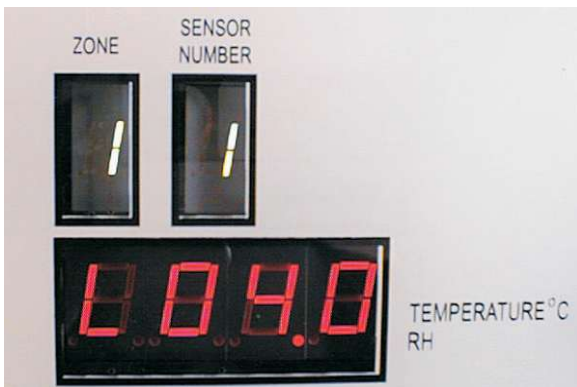
Cropscan 16 mc3 Controls

(figure 7)



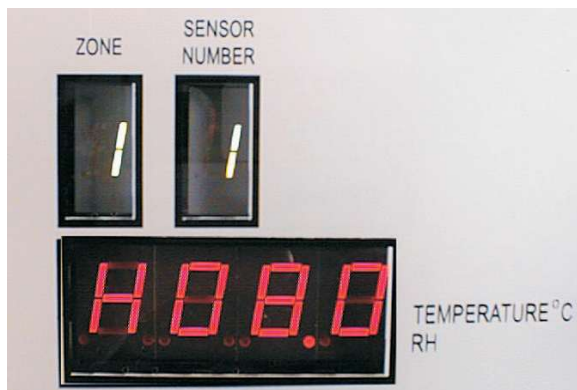
If a letter **E** appears before the temperature value the sensor is disconnected or faulty. See (figure 7)

(figure 8)



If the letter **L** appears before the temperature value this crop sensor is below your LO-ALARM setting. NB. If this occurs all cooling will be stopped. See (figure 8)

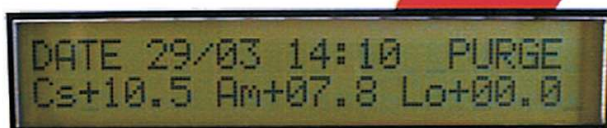
(figure 9)



If a letter **H** appears before the temperature value this crop sensor is above your HI-ALARM setting. NB. Any sensor which displays this will not initiate cooling. See (figure 9)

CO 2 PURGE SYSTEM

(figure 10)



If the word **PURGE** is seen on the right hand side of the lower LCD display, the fans and louvres are operating during a PURGE air change operation. See (figure 10)

Operator Instructions

Cropscan 16 mc3 Controls

GENERAL POINTS FOR THE SUCCESSFUL OPERATION OF THE UNIT

Ensure all **Crop Temperature Sensors** that are in use, are always in the crop.

Unplug any Crop Sensors that cannot be placed in the stored crop. These un-plugged sensors will be ignored for control purposes. Alternatively turn unused sensors "OFF DUTY" by using the SENSOR DUTY program on the mc3 menu level 2.

At the end of storage season always coil up crop sensors and store in a safe dry place.

Do not skewer potatoes etc. with sensors.

Either drop the Crop Sensor down pre-positioned tubes in the stack (bulk storage) or bury sensor under the crop 150mm to 200mm (box storage).

It is a good idea to record fan hours run daily or weekly on record sheets (available on request) or in a note book to see what operations are taking place. NB. This may not be deemed necessary if the Datalog files are downloaded to a PC. **Remember** the Cropscan 16 mc3 is a very useful management aid which will make best use of cooling air when available. It should never however be left in sole control of a store without regular inspections to see the store condition and monitor operations.

Always leave control unit switched on even when not in use. This will maintain electronics in a sound, dry condition. Switch to "**Readout Only**" to eliminate control outputs.

During normal auto operation after the parameters have been set for control program you have selected the Display Selector switch would normally be left in the "**Croptemp**" position. This will show a continuous readout of all the Crop Temperature sensors as they are scanned in turn. The Cropscan locks onto each sensor for approximately 5 seconds in turn.

Operator Instructions

Datalogging

Cropscan 16 mc3 Controls

The Cropscan 16 mc3 has an automatic inbuilt datalogging function. This records all temperature and most primary setting values every 4 hours. The memory will hold a maximum of 2 weeks of recorded data after which time the oldest data will be discarded. Each mc3 has its own unique 3 digit identity number which enables its data to be identified. (see figure 6)

This data can be utilised by using the Farm Electronics mc3 Comms and mc3 Graphing software packages. These programs will run on any PC using Windows 95, 98, ME or XP operating systems.

Connection to the Cropscan 16 mc3 is made via the inbuilt RS232 port in the side panel of each unit. (see figure 4) If using a Laptop computer a simple short wire lead can be used. For remote sites various methods can be employed, such as fixed hard wiring, landline or GSM modems. (see figure 5) Multiple Cropscans can accessed from one modem using an optional RS485 network interface system.

When a connection system is in place the computer can be used to collect the long term data at any time but in addition can download current temperatures, equipment run times, system fault status and settings. It can also be used to reprogram the key setting parameters of the mc3 if required. The graphing software builds a complete season graph for the store which can be analysed at any time on the PC. From this data a greater understanding can be gained on the operation of the ventilation system throughout the long term storage period. Print outs can be made from several of the download options.

For operation of any of the above systems refer to the information supplied with the download option supplied.



Identity Number = 080



GSM Modem Unit

FAULT TROUBLESHOOTING

The Cropscan range of store controllers have proved to be very reliable in operation.

Most problems when they do occur are usually associated with the external temperature sensors or junction boxes. This is either due to physical damage by mishandling or rodents or possibly an individual sensor failure. (see figures 11, 12, 13)

An open circuit (or broken wire) sensor failure is easy to spot as the readout will register approx. E27.7C.

A short circuit (wires touching) sensor can be more difficult to find as its effect can sometimes be seen on undamaged sensor values. The best approach to locate this type of fault is to unplug all the Crop Sensors at the 8 way junction box. Then proceed by plugging in each sensor in turn. Look at the Cropscan 16 mc3 readout after each sensor is replaced. When you plug in the sensor causing the error the effect on the other sensors can usually be seen.

ALWAYS REMOVE ANY SENSORS FOUND DAMAGED OR SUSPECT IN THIS WAY from the store and return to Farm Electronics for testing or repair

While the Cropscan can work satisfactorily on a reduced number of Crop Sensors the Ambient and Duct (air mix) sensors must always be working. If either of these sensors fails a Crop Sensor can be substituted temporarily until a repair can be made.

When reporting any suspected malfunction to the service department always try and have a note of which Function LED's were illuminated at the time. (I.e. Cooling Required, Cooling Possible, Low Ambient Etc.) This will enable us to interpret possible control situations much more easily.

On a microprocessor based controller, electrical interference is a potential problem. The mc3 is well protected against power failures but in some instances partial corruption of the unit may occur. To correct this simply turn the mains supply to the Cropscan off for 5 seconds and then on again. This will give a clean master reset. If this fails to sort it out contact Farm Electronics Service Department.

TYPICAL SENSOR DAMAGE

(figure 11)

Crushed Wire



(figure 12)

Broken Wire



(figure 13)

Rodent Damaged



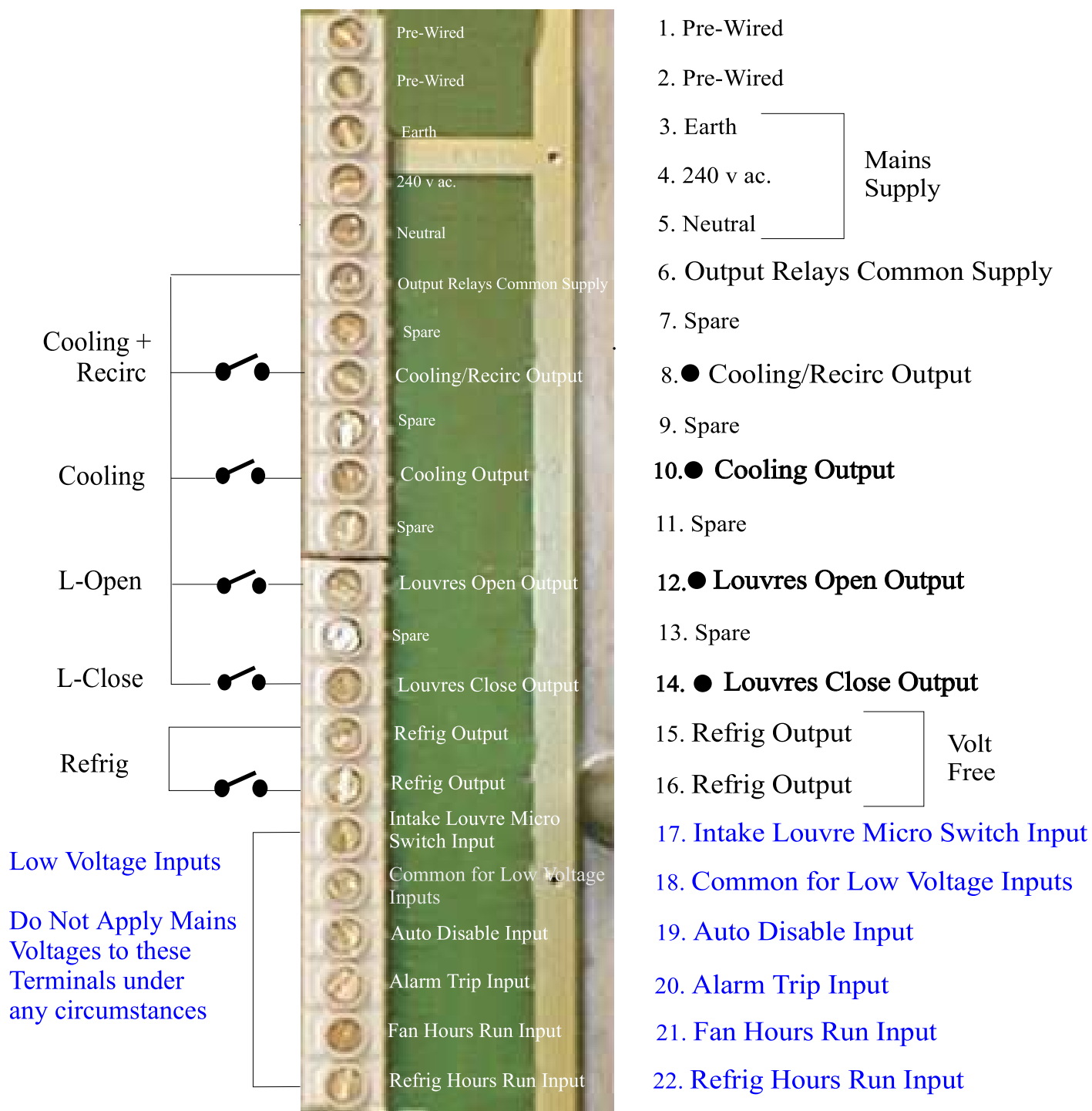
Installation Instructions

Cropscan 16 mc3 Controls

13

Cropscan 16
MC3 P/Supply
(single outputs)

NB. Do not apply MAINS VOLTAGES to terminals 17 - 22



Installation Instructions

Single Live Output Version

Cropscan 16 mc3 Controls

Screw unit to a firm surface using external black brackets on casing.

Try and ensure unit is at operator eye-line height to give ease of viewing readouts.

The unit requires a 240 volt AC 50 HZ power supply fused at 5 amp (max). Output connections depend on the complexity of the installation. (see terminal list).

In principal however cooling, recirc, louvres open, louvres close give a single live output when the controller wishes to activate these functions. The common of these relays can be linked to any voltage required (normally 240 volt AC 50 Hz).

Refrigeration control is via a normally open voltage free contact.

On air mix systems, a micro switch is required to show when the air intake louver is fully closed. This is linked to the controller and is wired normally open when the louvres are open (unpressed). The switch contact should make when the louvres are closed (switch pressed).

An external **"Cut Out"** contact is provided (low voltage). This can be utilised to provide shut down of the Automatic outputs in conjunction with a Timeclock or remote Froststat etc. The terminal is marked "AMB DISABLE". When an external cut out is active the **"Time Off"** Red LED will illuminate.

Low voltage input terminals are provided for signals from auxiliary contacts on the FAN and COMPRESSOR starters. This will provide Hours Run information which the Cropscan 16 mc3 records.

Under no circumstances must an external voltage be applied to any of these terminals. Serious Damage will be caused to the Cropscan 16 mc3 if this is done.

Up to 16 crop temperature sensors can be connected to the controller.

This is via a two-way splitter box which plugs into the 25 way dee socket on the unit. One or two, 8-way sensor junction boxes can be plugged into this.

On units with only 8 crop sensors a single 8-way junction box will plug directly into the Cropscan 16 mc3 via the 25 way Dee socket marked **Crop**.

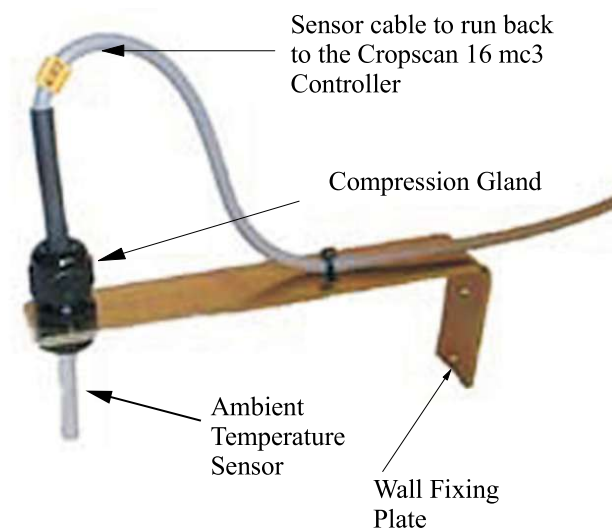
Installation Instructions

Single Live Output Version (Continued)

Cropscan 16 mc3 Controls

The Ambient sensor plugs into its own blue socket "Marked Ambient" on the side of the cropscan. The external sensor is positioned near the air intake on the stand off bracket provided. This bracket spaces the sensor off the wall fabric of the store helping to obtain a more accurate ambient air temperature reading. It is recommended that this sensor is put on a North facing wall if possible. When fitted on a system with refrigeration, keep the sensor well away from the outside refig condenser unit as this gives off warm air.

Mounting of Ambient Temperature Sensor Bracket



The Air Mix (duct) sensor is positioned after the fans (usually part way down the air duct) to detect cooling air temperature. This plugs into the blue socket on the side of the Cropscan marked Air Mix.

Mount at least 3m from the cooling fans if possible.

An optional RH sensor can be connected to the controller if required. This plugs into the blue socket on the side of the Cropscan marked RH.

Important Note: Avoid running all sensor cables and multicore cables close to a mains cable as electrical interference can be induced in the cables in extreme cases. If positioned on a cable tray, space away from mains cables by 50mm.

A remote printer (Epson FX protocol) can plug into the 25 way Dee socket marked Printer.

The datalog Download Comms RS232 socket is a 25 way MALE DEE socket marked COMMS.