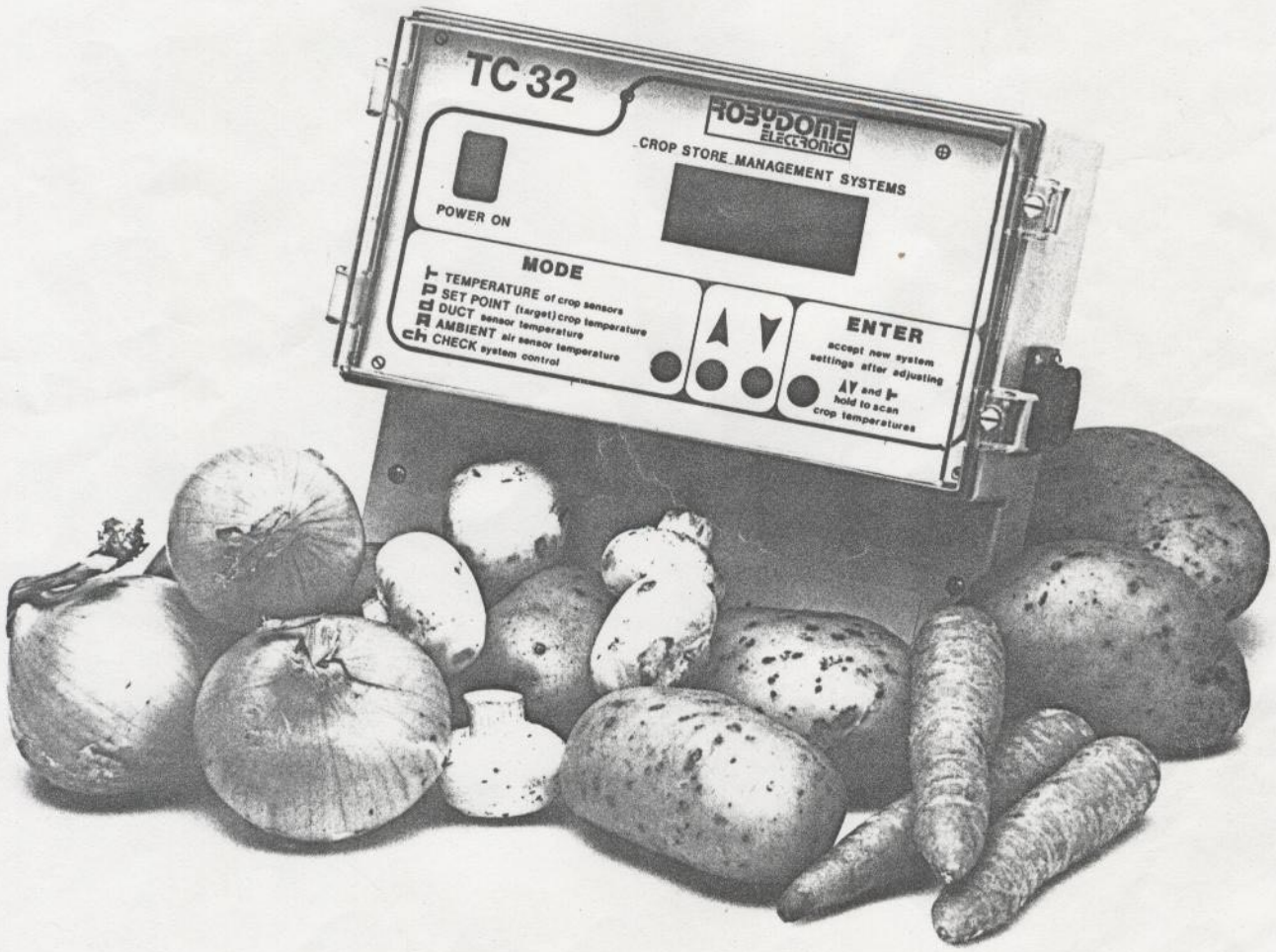
TC32

CROP STORE MANAGEMENT SYSTEMS



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SYSTEM FOR VEGETABLE STORE ENVIRONMENTAL CONTROL

System Overview

The TC32 control system will scan up to twelve crop sensors, measure ambient air and ventilating duct air temperature.

TC32 is designed to control a fan and air mixing louvres to maximize ventilation at every opportunity, even at extremely cold ambient air temperatures. Refrigeration plant can also be controlled when ambient air is unsuitable.

The console has a digital display which shows all measured temperatures and set target temperatures. Temperature checking and settings are achieved by only four push buttons on the front panel making for straight forward operation.

System design makes this unit suitable for all types of vegetable stores and particularly potato stores of up to 1200 tonnes capacity where automatic, precise environmental control is required.

Two set up options can be used.

a) EZISET only requires the operator to set in the TARGET CROP TEMPERATURE, most other variable settings are AUTOMATICALLY programmed in by the microprocessor. This feature makes for simple console operation, letting the machine do the work and hence eliminating operational errors.

b) STANDARD set up procedure allows the user complete flexibility to set all variable points including target duct temperature.

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TC32, CROP STORE MANAGEMENT SYSTEMS

INSTALLATION

Identify all components of the system. You should have at least the following:-

TC32 console.
Relay card or box.
Ambient and Duct temperature sensors.
At least 4 crop sensors (may be 8 or 12).
At least 1, 4 way junction box (may be 2 or 3)

1. Power Supply Requirements

1.1 The console operates from 220-240v a.c. 50 Hz.

1.2 Electricity is supplied via the 3 core mains lead.

BROWN	is LIVE
BLUE	is NEUTRAL
GREEN/YELLOW	is EARTH.

IMPORTANT - THE CONSOLE MUST BE EARTHED.

1.3 The console fuse, located on the left hand side, is rated at 2 AMP, type 1.25 inch quick blow.
Refer to diagram 1 for connections.

2. Installing the System

2.1 Locate the console in a convenient position on a wall not directly exposed to general climatic conditions. It is fixed by 3 points, one is located towards the top and centre of the enclosure, the other two are either side of the bottom, accessible by removing the connector cover fixed by two screws. DO NOT REMOVE THE CONSOLE FRONT PANEL.
Fixing centres are 197 x 140/150, refer to back panel of console.

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2.2 Fix the relay box or relay card adjacent to the console, (extension cables are available if required) four fixing points are located in each corner of the enclosure, access these by removing the cover.
Refer to the relay pcb fig 1 diagram for wiring instructions.
Please note:- **Relay cards must be housed in a suitable enclosure to prevent electric shock hazard.**

RELAY FUNCTIONS:-
Relay number 1 is Fan Control.
Relay number 2 is Louvre Control - CLOSED.
Relay number 3 is Louvre Control - OPEN.
Relay number 4 is Refrigeration Control.
Relay number 5 is Recirculation Control.

2.3 Sensors to sense DUCT and AMBIENT air plug into the console bottom panel (see diagram 1). Locate each sensor carefully.
AMBIENT SENSOR: Best located on a NORTH facing aspect and not exposed to exhaust air from the crop store.
DUCT SENSOR: Locate approximately 3m downstream of the main Fan in the centre of the air duct.
Note: Do not fix sensor directly to walls etc, they must sense air temperature only.

2.4 The crop sensor junction box is designed to be installed in the store. The lead supplied is 20m however, 10m and 20m extensions are available.

Fix the junction box by the mounting lugs, preferably in a vertical plane to allow any condensation to run off the enclosure. The actual location of the junction box is determined by the layout of the sensors within the store.
Refer to diagram 1 to locate junction box connector socket.

2.5 Crop sensors are best installed in the crop by inserting into plastic tubes approximately 15 to 20mm in diameter located in the crop. Sensor cables can be placed on top of the crop, but where they will not be walked upon. Use tyraps or clip cables when routed along building structure.
Suspending cables from the roof is another option.
Avoid running alongside heavy power cables.

3. <u>System Commissioning</u>

3.1 Ensure main FAN is isolated and cannot be run, then familiarise yourself with the controls, referring to the OPERATING INSTRUCTIONS on page 4.

3.2 Certain parameters have to be set up before normal operation can proceed. Read the SET UP instructions carefully to program the console ready for use.

3.3 Check the integrity of all connections and system operation, refer to the program FLOW CHART 5029-3 and operating instructions relating to checking system control.

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OPERATING INSTRUCTIONS

1. GETTING STARTED

1.1 Isolate the main fan to avoid unnecessary operation.

1.2 Switch the console power ON by the rocker switch on the left hand side of the front panel. The display will show the temperature of the first crop sensor (if connected).

1.3 Familiarize yourself with the front panel layout.
NOTE: The console only has FOUR push buttons or keys, making operation straightforward.

1.4 Use the MODE key to get acquainted with the symbols on the front panel. Each press of the key will bring a new symbol up on the display.

2. HOW TO USE THE CONSOLE - FIRST STEPS

2.1 MODE is the most important function, used in conjunction with the other 3 keys.

2.2 The console scans all sensors continuously but displays their temperature individually. If not showing in the display, press MODE to select the t symbol on the display. PRESS ENTER, to read which sensor is reading (1 to 12), releasing ENTER shows that sensor's temperature in °C.

TC32 CROP STORE MANAGEMENT SYSTEM

OPERATING INSTRUCTIONS CONTINUED.

2.3 The ARROW keys, UP and DOWN adjust settings and readings by incrementing and decrementing the display.

2.4 ENTER key is also used to allow the console to accept new settings, press ENTER after any alteration.
With MODE selecting the t symbol, hold ENTER and use ARROW KEYS to manually scan crop sensor temperatures, 12 is maximum.

MODE SYMBOLS

3.1 t, (small T) is the ACTUAL CROP TEMPERATURE. To scan temperatures and sensor numbers use ENTER and ARROW keys as per section 2.4.
Use the MODE key to sequentially scan the other mode features and settings.

3.2 P is the TARGET or SET POINT CROP TEMPERATURE. It is the only adjustable temperature in the EZISET mode.
Refer to FLOW CHART and BOX 2.
The console will compare SET POINT P with ACTUAL crop temperature, if this is exceeded then ventilation is required to COOL the crop. The system is designed to keep temperatures at or below this setting (see also L in SET UP).
Use the arrow keys to adjust the P value , use ENTER to accept.

3.3 d (small D) is the ACTUAL DUCT TEMPERATURE. This is a reading NOT an adjustable set point.

3.4 A is the ACTUAL AMBIENT AIR TEMPERATURE. This is a reading only, NOT adjustable.

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OPERATING INSTRUCTIONS CONTINUED.

3.5 ch, Use this CHECK feature to follow the console control sequence. Refer to the FLOW CHART, numbers in the display relate to the FLOW CHART BOXES or STAGES. They allow the user to check on system operation and to verify changes in set or variable conditions. Use the arrow UP key to step the program ON in WAIT stages,, ie. BOX 4. "Wait 2 minutes".

3.6 Pr, Normally reading 0, it is to allow you to print instantaneously when a PR40 printer is connected. Press the ENTER key to initiate a print, display will show 1 during the process.

3.7 h, Real time clock display, use the arrow keys to change the time, press ENTER to accept new time after adjustment.

3.8 This display shows the day, the flashing colon and then the month, eg. 02.12 is the 2nd of December. Use the arrow keys to change , use ENTER to accept changes.

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SET UP INSTRUCTIONS

1.0 Ensure that the OPERATING INSTRUCTIONS notes have been fully reviewed and the operation of the keys is familiar.

2.0 SET UP mode needs a special key sequence before it can be entered.

2.1 Switch console OFF, wait 5 seconds, hold the MODE key in and at the same time switch power ON.
Release the mode key after 2 seconds, display will show Sd.

2.2 Once in the SET UP mode it is easy to revert to normal operation.
Either switch off and on again after 5 seconds or by NOT using any key the console will go back to the normal mode automatically after a delay of 10 seconds.

3.0 The following paragraphs explain the meaning and use of the various symbols and features in the SET UP mode.
REMEMBER TO USE ENTER AFTER CHANGING SETTINGS.

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SET UP INSTRUCTIONS CONTINUED.

3.1 Sd, SET DUCT, this value is preset within the EZISET feature and will always be 3 ° C lower than the crop TARGET (P) setting . See BOX 5.
It is possible to change this setting using the arrow keys, however it will revert to the EZISET value if P is changed in normal mode.

3.2 Ad, AMBIENT/CROP temperature DIFFERENTIAL, ventilation will only be allowed if any one crop sensor is higher than the ambient air by the set value.

Example 1 :-	Crop sensor	=	8 ° C.
	Ambient sensor	=	7 ° C.
	Ad	=	2 ° C.

The fan will not run with those readings.

Example 2:-	Crop sensor	=	8 ° C
	Ambient sensor	=	5 ° C
	Ad	=	2 ° C

Fan will now operate if other settings are satisfied.
See Box 30.

If P is changed in normal mode this value is reset to the EZISET value of 2.5.

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SET UP INSTRUCTIONS CONTINUED.

3.3 F, FROST or low temperature setting, designed to check incoming air downstream of the fan.

The duct sensor is checked against the F setting to ensure the temperature of the ventilating air is above this absolute minimum value.
See BOX 8.

The F number (1 to 5 in ° C) is SUBTRACTED from the DUCT setting Sd and is therefore always below duct value.

Example: Sd, duct set point = 4 ° C.
f, frost setting. = 1.5 ° C.

Therefore the actual value for FROST protection is 2.5 ° C

3.4 r, LOUVRE OPERATING RATE in seconds, used to fine tune the air mixing facility of the recirculating and ambient louvres.

3.5 L, SET POINT LOW difference, the value set here is taken away from the TARGET (P) crop temperature setting to create set point LOW. This set point checks that all sensors in the crop are cooled to that level and therefore ventilation can stop.
See Box 9.

Example, target P = 8 ° C
L = 2 ° C

Therefore ventilation will stop when all crop sensors are at or below 6 ° C
This setting is automatically adjusted by the EZISET feature to 1 ° C.
Anytime P is changed L will change to 1 ° C and therefore ventilation will stop when all crop sensors are cool below 1 ° C of the TARGET P.

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SET UP INSTRUCTIONS CONTINUED.

3.6 n, TOTAL NUMBER OF CROP SENSORS, adjustable from 1 to 12, for example setting to 4 will only allow a maximum of 4 sensors (1 to 4) to be read by the console.

3.7 rn, SENSOR MONITOR/CONTROL, normally set to 0, use this setting to de-select crop sensors for control purposes. The range is 1 to 4.

For example, assuming the system has 8 crop sensors:-
rn = 2
Sensors 1 through 6 are used by the system for control.
Sensors 7 and 8 can be read but are ignored by the console.

3.8 Pt, SET INITIAL PRINT TIME, the reading is in hours, the printer will print after the elapsed set time.

Example; Pt = 2
Actual time is 12.00 hrs. The first print will occur at 14.00 hrs.

3.9 Pi, SET PRINT INTERVAL, once the initial print has occurred this setting will control the interval of future printouts in hours.
Setting this interval to 0 will prevent printing.

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SET UP INSTRUCTIONS CONTINUED

4.0 Pn, NEXT PRINT TIME, use this to check how long it will be (in hours) before the console will print.

4.1 EF, SELECT REFRIGERATION OPTION, set to 0 will disable this feature and the ventilating sequence will be for using ambient air only.
Set to 1 to enable the refrigeration plant in the event of warm ambient conditions.
See BOX 3 and 11.

4.2 rc, RECIRCULATION PERIOD, in the event of long periods of high ambient temperatures automatic recirculation will take place.
The reading represents fan run time in minutes and this will take place every 24 hours.
See BOXES 12A, 12B, 12C.

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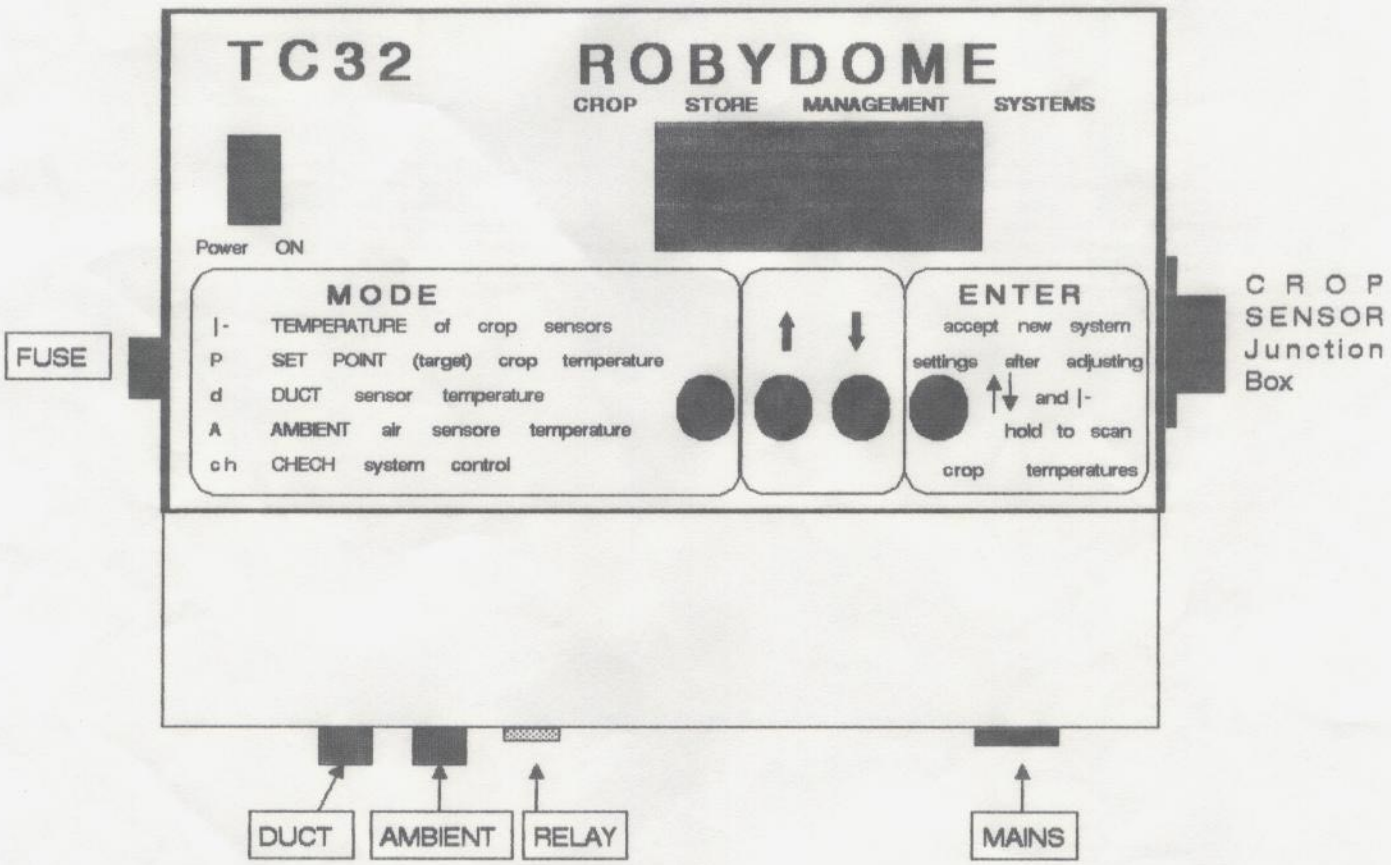
Diagram 1

Robydome TC32 Standard Front Panel. 20/08/90



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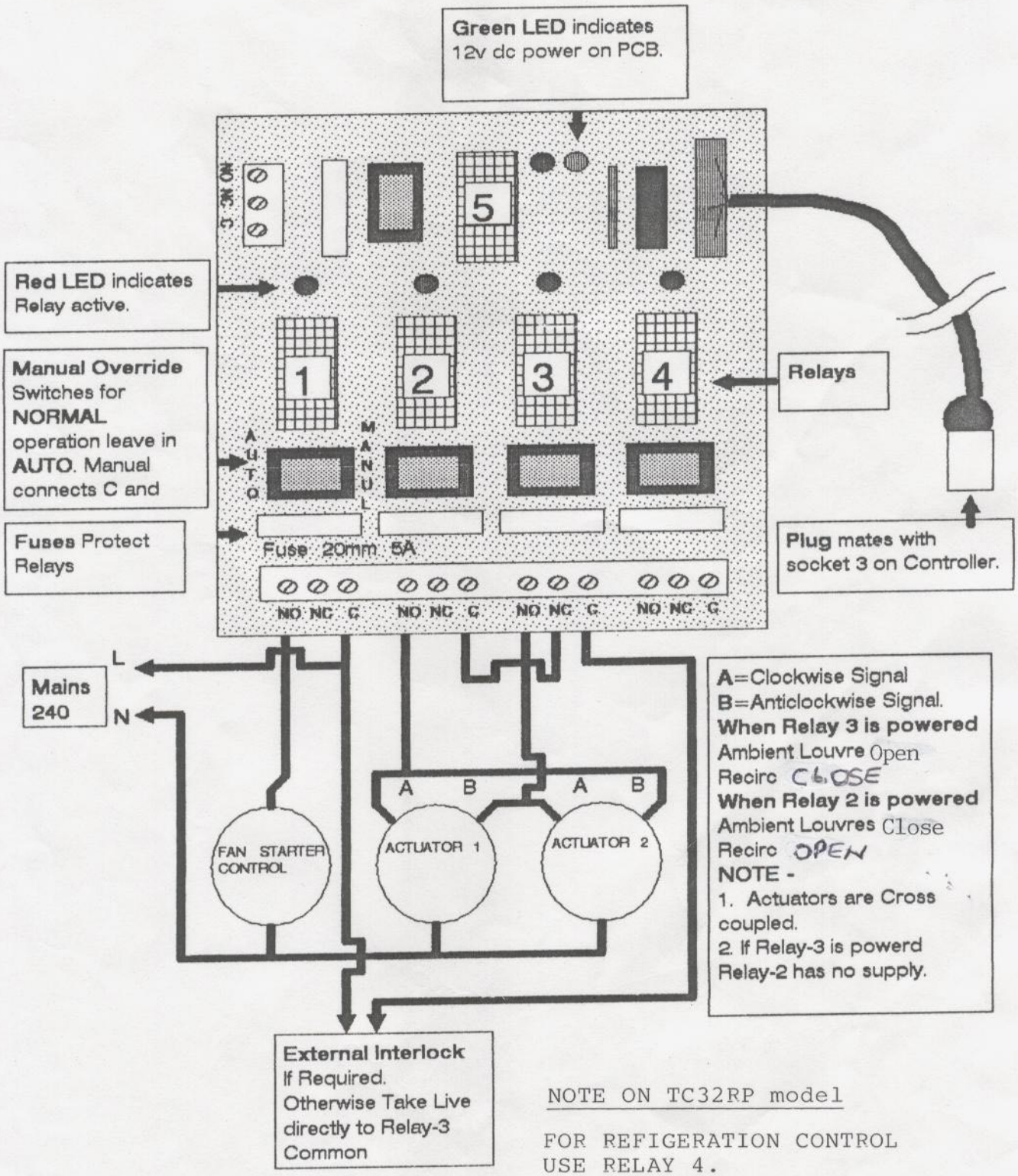
Installation Notes. Relay PCB Fig 1

Connection of Fan and Louvre Actuators to Relay PCB.



NOTE ON TC32RP model

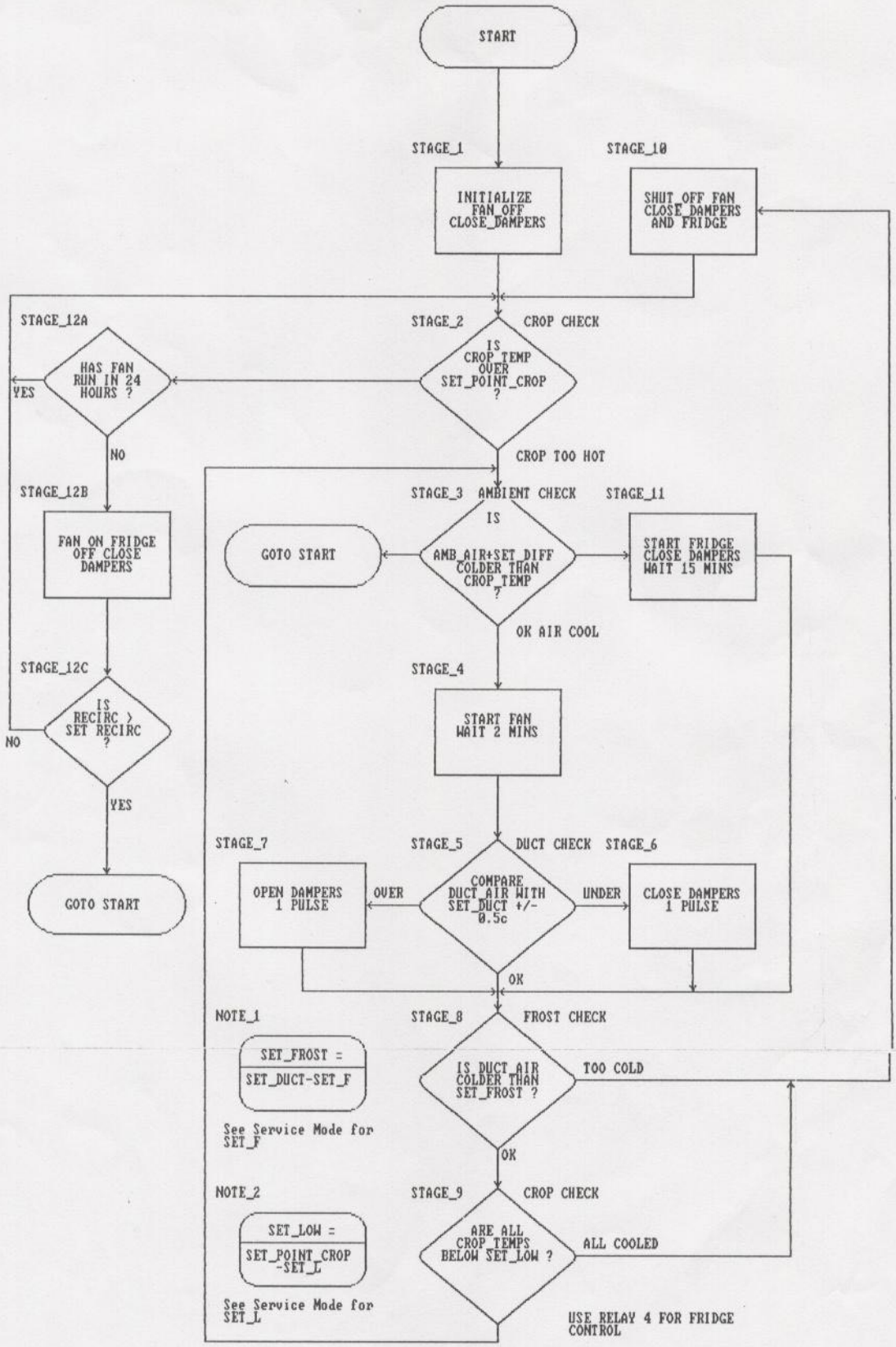
FOR REFIGERATION CONTROL USE RELAY 4.

FOR RECIRCULATING CONTROL USE RELAY 5.

ROBYDOME ELECTRONICS SUDBURY SUFFOLK 0787 310163

TC32 Standard Program COOLING + FRIDGE

ROBYDOME FLOW CHART NO. 5029-3 DATE:15/01/93



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TC32RP

Temperature controller
8th August 1995

Summary of Settings

IMPORTANT - USE ONLY IN CONJUNCTION WITH MANUAL.

Manual: TC32 Summ sam

Normal function mode			
Symbol	**Function**	**Type**	**Check box N°.**
t	Actual crop temperature	Reading	2,3&9
P	Set point or target crop temperature	Setting	2
d	Actual duct temperature	Reading	5&8
A	Actual ambient temperature	Reading	3
ch	Check controller functions, refer to flow chart box numbers.		
Pr	Use ENTER key for printout	Setting	----
13.39h	Time in 24 hour format	Setting	----
27.09c	Calendar in day and month format	Setting	----

Set-up mode (hold MODE key & switch ON to access)			
Symbol	**Function**	**Type**	**Check box N°.**
Sd	Set duct temperature (if required to override EZISET)	Setting	5 & 8
Ad	Set ambient air / crop differential	Setting	3
F	Set frost protection temperature, (Subtract from Sd for actual value).	Setting	8
r	Louver operating time in seconds	Setting	6 & 7
L	Set crop temperature low point, (Subtract from P).	Setting	9
n	Set total number of crop sensors	Setting	----
rn	Set number of crop sensors not used for control	Setting	----
Pt	Set print time	Setting	----
Pi	Set print time intervals in hours	Setting	----
Pn	Check time of next print	Setting	----
EF	Select refrigeration control on / off	Setting	3 & 11
rc	Set recirculation time period in minutes	Setting	----