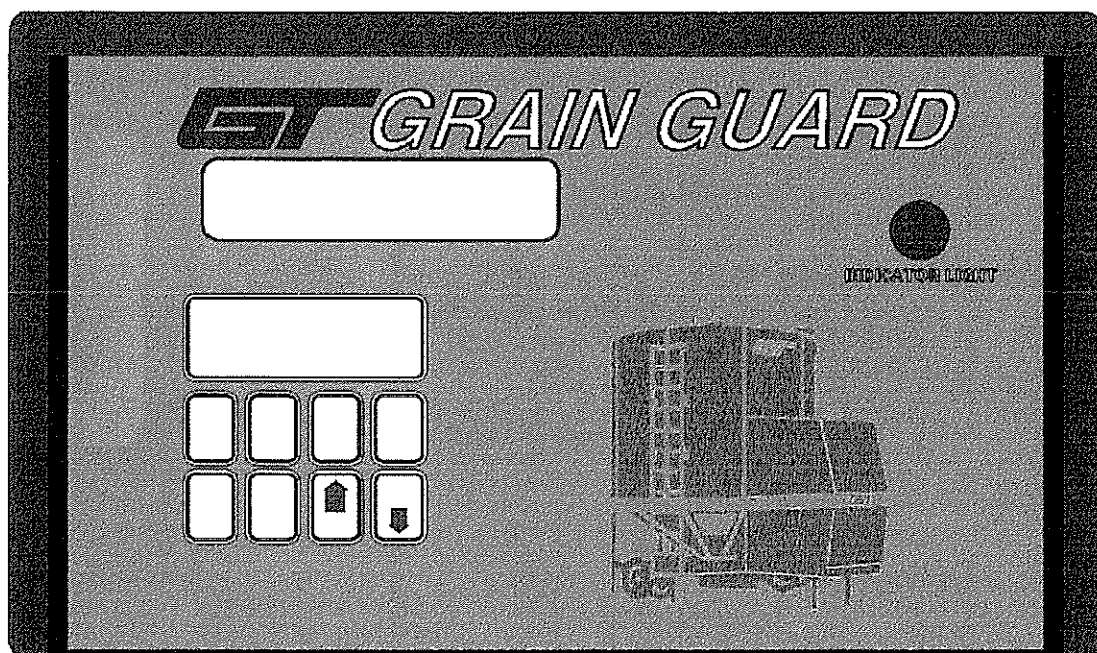


GT Mfg
Recirculating Single Batch
Grain Guard
Controller



Reference Manual

May 10, 2002

Quick Start for Single Batch Dryer

Note: *These instructions assume that the controller is set to the single batch mode and all sensors are working properly. It is also assumed that the dryer is full and all 12V connections have been made.*

1. With gas and 12V power to the dryer and manual valves open, press “ON” on the controller.
2. Press “MENU” key.

Set Drying Data?

Note: *If the Drying Data has been set and is correct, then precede from Step 2 to Step 7.*

3. Press “YES” key.
 - a. Press “UP” or “DOWN” to choose grain.
4. Press “YES” to set grain.
 - a. Select plenum temperature using “UP” or “DOWN” key.
5. Press “YES” to set plenum temperature,
 - a. Select grain temperature using “UP” or “DOWN” key.
6. Press “YES” to set grain temperature.
7. Press the “NO” key.

Batch Dry On?

8. Press the “YES” key.
9. Press the “STATUS” key.

The display will read “PURGING” and the dryer will operate until the set grain temperature is reached.

NOTE: Read Reference Manual for complete instructions.

Single Batch Detailed Dryer Controller Operation

4.1 Operating Assumptions - In this section it is assumed that the controller and the associated dryer are operating normally. Failures in the operation of either will be discussed in Section 6. The exception is certain "error" conditions that may reasonably be expected to occur, such as failure to fill because the grain source has been exhausted.

4.2 Single Batch (SB) Dryer

4.2.1 Controller Options - The options provided the operator are shown in Figure 4-A.

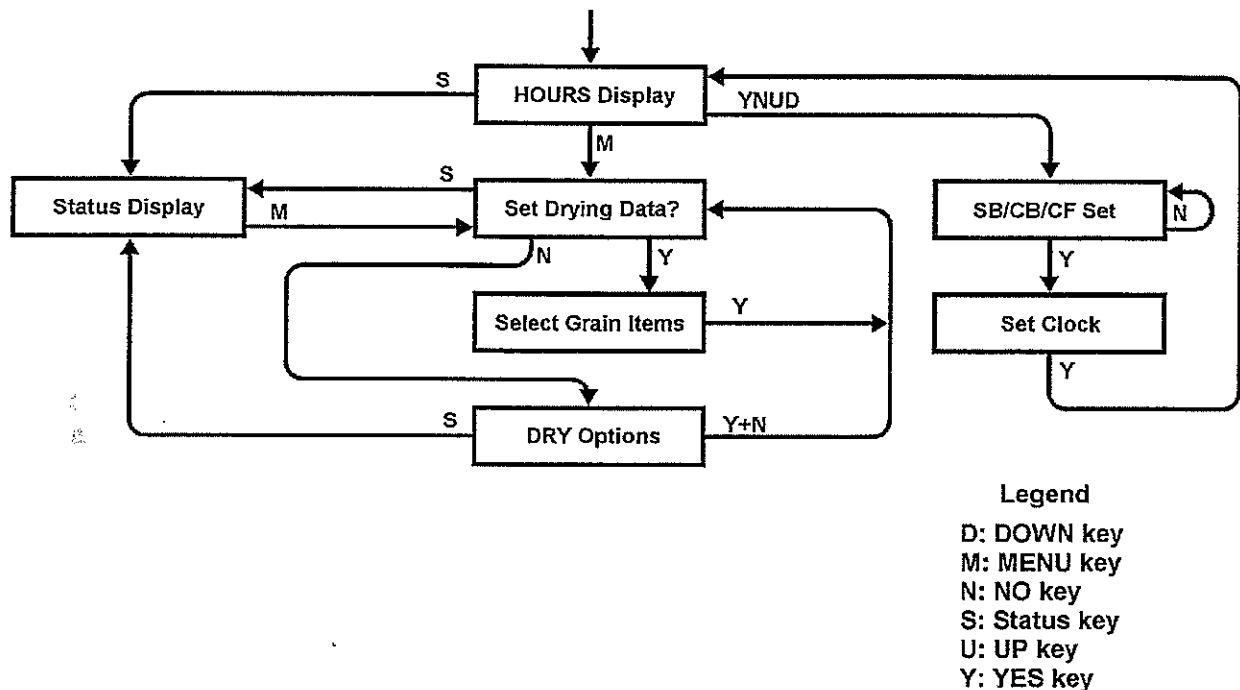


Figure 4-A Controller menu options available when the unit is set to operate in the SB mode.

4.2.2 Drying Operation

4.2.2.1 - Filling - The SB dryer is manually filled with the selected grain to be dried to whatever level is desired. This process does not involve the controller in any way. The controller may be left in the off condition during this operation.

4.2.2.2 Ready for Drying - The following steps will dry a load of grain.

4.2.2.2.1 Turning the Unit On - Press and release the **ON** key. The display will change from being blank to:

Hours xxxxx

where "xxxxx" will be a number between 000 and 25599. The number displayed will be the number of hours that the controller has been in the in the operating state.

4.2.2.2.2 Controller Status display - Press the **STATUS** key. The path to reach the **STATUS** display message is shown in Figure 4-B.

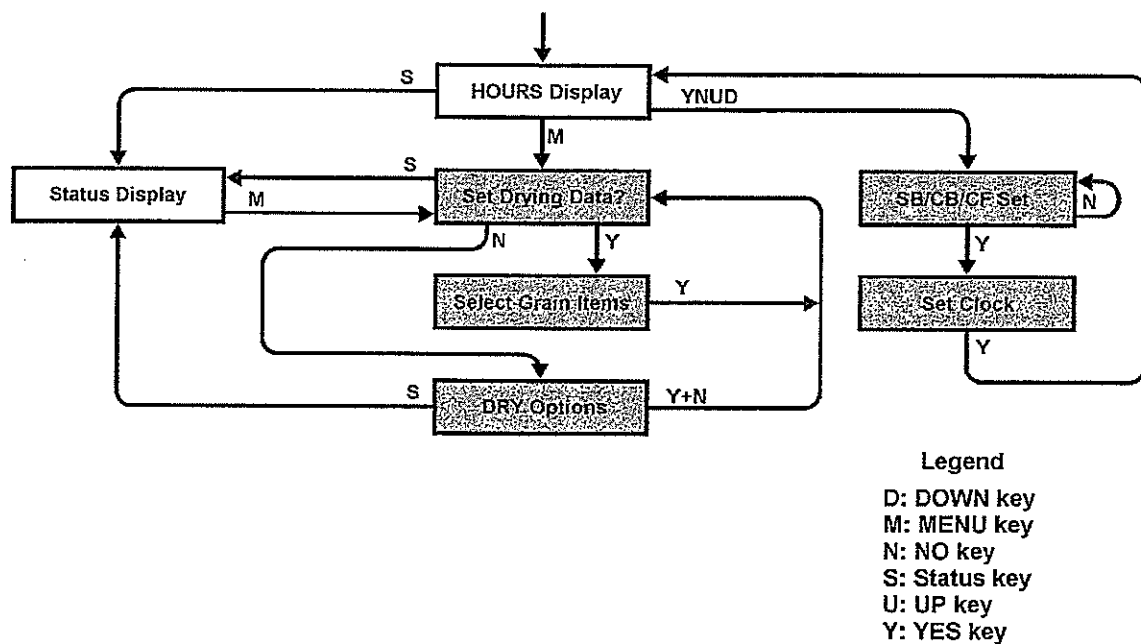


Figure 4-B Path from hours display to status display.

Providing that no error conditions exist, the display will switch to one of the messages shown below. Each message will remain for 2 seconds. After each has been displayed once, the pattern will repeat. The *Dry pp sdd* message will only be present if the optional moisture sensing module is attached.

	<i>Idle</i>	
or	<i>Grain ttt</i>	<i>sdddS</i>
or	<i>Dry pp</i>	<i>sdd%</i>

The *Idle* indication is the state of the controller and the dryer i.e. no action in regard to drying is under way.

The *Grain* message tells the operator that the numbers to the right are for the temperature of the grain in the bin. *ttt* is the temperature of the grain. *sddd* is the temperature difference between the grain set point and the current temperature (*ttt*). *s* is the sign of the difference and will be + to indicate that the grain in the bin is above the set point and - to indicate that it is below. *S* is the temperature system being used and will be *F* for Fahrenheit and *C* for Celsius.

The *Dry pp sdd%* message will only be present if moisture sensing has been installed. *Dry* informs the operator that the information which follows is the moisture level of the grain in the bin. *pp* is the current moisture percentage. *sdd* is the percentage difference between the grain set point and the current moisture percentage (*pp*), with the *s* being the sign of the difference. A + sign means the moisture level is above the set point and a - sign means it is below.

4.2.2.2.3 Establishing Drying Conditions - Press and release the **MENU** key. The path taken by the controller to reach the grain parameter setting display is shown in Figure 4-C.

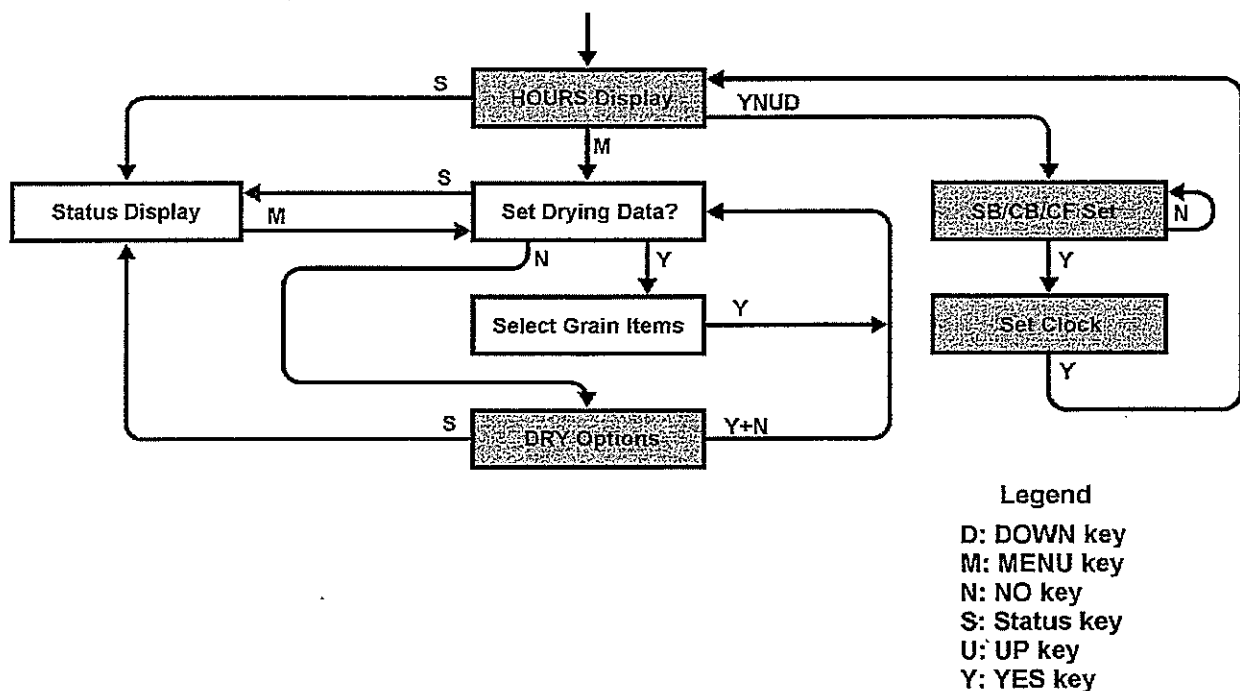


Figure 4-C Path followed by controller from the status display to setting grain drying parameters.

Providing that no error conditions exist, the display will switch to the messages shown below.

Set Drying Data?

The menu routine has only two main areas for an SB dryer: grain parameter setting and activating/deactivating drying. If it is desired to set or adjust the grain parameters, press **YES**. If the current settings are acceptable, press **NO** and the controller will move to the condition described in Section 4.2.2.2.4.

4.2.2.2.3.1 Select Grain - Press and release the **YES** key. The display will now change to:

Gggggggg?

where *Gggggggg?* represents one of the grains in the controller's library. The selected grain from the library will always be the one last selected. So, if the grain selected for drying during the previous dryer use was *CORN?*, that is what the dryer will initially display. This recall of the previously set parameters is true for all of the settings in this sub-menu. This allows the operator to turn the unit off and return later to dry another batch without having to remember the previous settings.

The appearance of a ? in any controller message prompts the user to the fact that he must make a selection.

If the grain displayed is not the one desired, use the ↑ (**UP**) and ↓ (**DOWN**) keys to step through the alphabetized table until the desired grain is reached. It should be noted that once these keys are used, even if the same grain is then selected, all previously set grain parameters will be replaced by those suggested values in the controller's library and those set by the previous operator will be lost.

The only way the controller can exit the grain parameter selection sub-menu is to press **YES**.

4.2.2.2.3.2 Select Temperature System - Once the desired grain is displayed, press **YES**. The display will now change to:

Degrees S?

S will either be *C* or *F*, indicating that the current temperature displaying system is Celsius (*C*) or Fahrenheit (*F*). A "no" response will switch the display to the other system while another "no" will return it to the original. This sub-menu may only be left by answering with a **YES** key depression and the last displayed system will be the one set.

4.2.2.2.3.3 Set the Plenum Temperature - Depressing and releasing the **YES** key will cause the display to change to:

Plenum? ttt sdddS

The *Plenum* indicates that the current plenum temperature set point conditions are being displayed. The ?, as with all controller displays, shows that the value may be adjusted. The *ttt sdddS* format is very similar to the one previously introduced in **Section 4.2.2.2.2**. *ttt* is the desired plenum temperature during drying, rather than the actual temperature. *sddd* is again the sign and the difference, but this difference is between *ttt* and the suggested value found in the controller's library. This allows the operator to see how far the suggested set point he has deviated. *S*, as before, is the temperature system being used and will be *F* for Fahrenheit and *C* for Celsius.

If the plenum set point displayed is not the one desired, the ↑ (**UP**) and ↓ (**DOWN**) keys may be used to step through the values until the desired point is reached. One depression will raise or lower - depending on which key is used - the set point one degree. If either key is depressed and held, the temperatures will increment or decrement at the rate of once per second until the key is released or

a limiting value is reached.

The library contains limiting values, above which the plenum may not be set. Attempting to lower the plenum temperature below the grain set point is not allowed either. This sub-menu may only be left by answering with a "yes" response, setting the last displayed value as the desired one.

4.2.2.2.3.4 Select the Grain Temperature - Pressing the "yes" key will cause the display to change to:

Grain? ttt sdddS

The **Grain** indicates that the current grain temperature set point conditions are being displayed. The ? shows that the value may be adjusted. The *ttt sdddS* format is very similar to the one previously introduced in **Section 4.2.2.2.3.3**. *ttt* is the desired or maximum grain temperature during drying rather than the actual temperature. *sddd* is the sign and the difference between *ttt* and the suggested value in the controller's library for the selected grain. This latter value allows the operator to see how far the set point has deviated from the suggested setting. *S* is the temperature system and will be *F* for Fahrenheit and *C* for Celsius.

The grain set point value has a different meaning depending upon whether the moisture sensing module is installed. Without moisture control, the grain set point determines when grain drying will be considered to have been completed and the heat source turned off. If the module is installed, then this parameter represents a maximum value not to be exceeded during the drying process. In this way it acts as sort of a fail-safe control. But the point where the grain will be considered to be dry, providing it doesn't reach the limit, will be determined by the dry setting. The grain set point will then only serve as a safety limiting value.

If the grain set point displayed is not the one desired, use the ↑ (**UP**) and ↓ (**DOWN**) keys until the desired value is reached. One depression will raise or lower - depending on which key is used - the set point one degree. If either key is depressed and held, the temperatures will increment or decrement at the rate of once per second until the key is released or a limiting value is reached.

The library also contains values above which the grain may not be set. Attempting to raise the grain temperature above the plenum set point is not allowed either. The grain temperature may not be set to freezing or below. This sub-menu may only be left by depressing the **YES**. The last displayed value will be the one set.

4.2.2.2.3.5 Selection of the Moisture Level - The display and the setting mode the controller will move to with the previous **YES** depression depends upon whether the moisture module is installed. If it is not, the controller skips directly to the condition shown in **Section 4.2.2.2.3.6**. If the moisture unit is present, the display will become:

Dry? pp sdd%

The **Dry** indicates that the grain moisture set point condition are being displayed. The ? prompts the operator to the fact that the value may be adjusted. The *pp sdd%* format is very similar to the one

previously introduced in **Section 4.2.2.2.3.4**. *pp* is the desired grain moisture percentage desired at the end of drying. *sdd* is the sign and the difference between *pp* and the reference value in the controller's library. The latter allows the operator to see how far the setting is from the suggested value.

If the grain moisture set point displayed is not the one desired, use the ↑ (**UP**) and ↓ (**DOWN**) keys to step through the values until the desired one is reached. One depression will raise or lower - depending on which key is used - the set point one degree. If either key is depressed and held, the temperatures will increment or decrement at the rate of once per second until the key is released.

The library contains limiting values, below which the grain moisture percentage may not be set. The values are limited to values below approximately 70%

For moisture percentages below 20, the percentage is displayed as two digits and a single decimal digit. For values of 20 and greater, only the units and tens digits are present.

This sub-menu may only be left by answering with a **YES** key depression and the last displayed value will be the one set.

4.2.2.2.3.6 Exit from Grain Parameter Set - Figure 4-D illustrates the options available after setting the drying temperature information. A single depression of **YES** will return the unit to the condition described **Section 4.2.2.2.3** with the display being: *Set Drying Data?* If **YES** is again pressed, the grain parameter setting sub-menus will again become active. Pressing **NO** moved the controller on to the drying option.

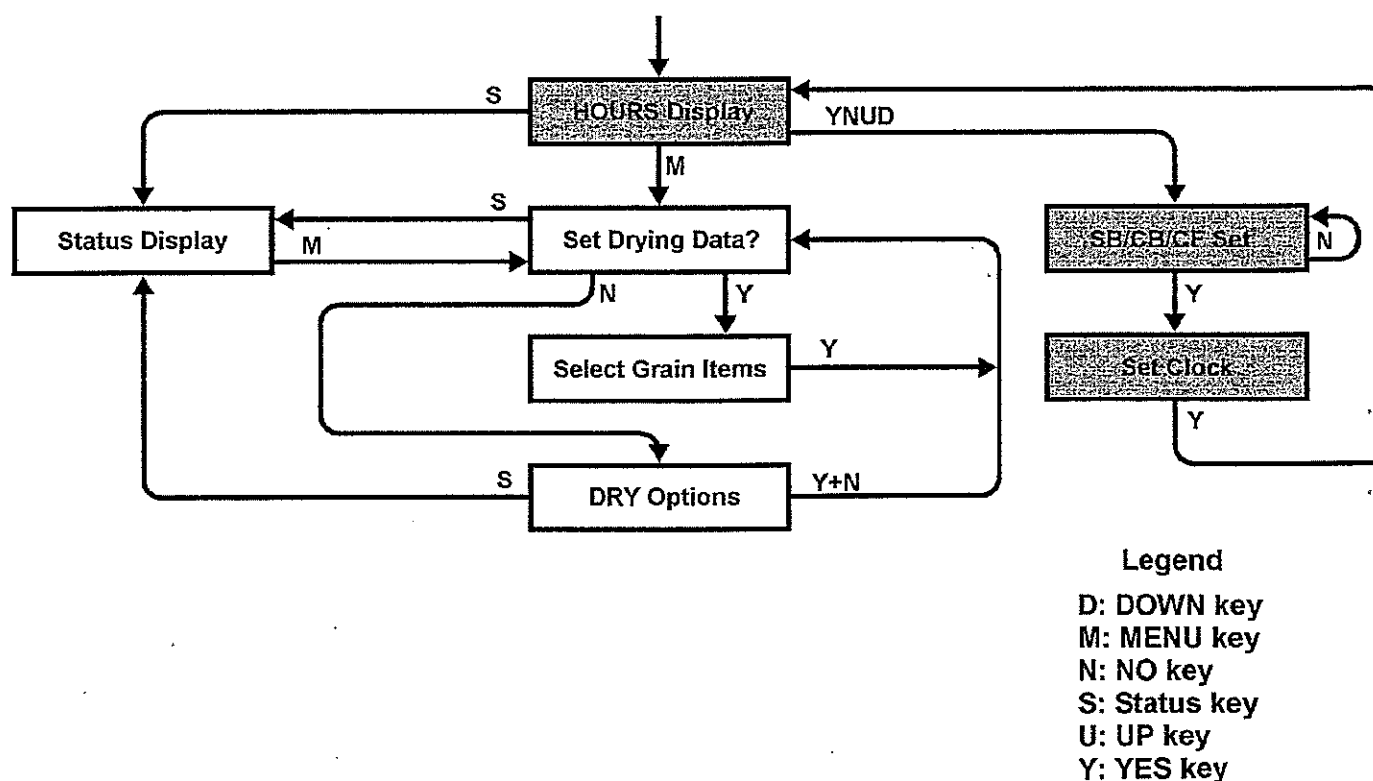


Figure 4-D Options available after the temperature information has been set.

4.2.2.3 Begin Drying - Press and Release NO. The controller will move from the grain parameter setting mode to the dry option state.

The display will now show the following message:

Batch Dry On?

A “yes” response will initiate a drying cycle. A “no” will return the unit to the grain parameter setting mode. The **STATUS** key will return the unit to showing the status messages as described in **Section 4.2.2.2.2.**

4.2.2.3.1 Grain Bin Purge - Depress and Release YES. The display will revert to:

Set Drying Data?

Because the display is in the data entry mode, it does not give any indication that the dryer has begun a drying cycle. In fact, answering with a **YES** key depression at this time will once again bring up the grain menu. Instead, press and release the **STATUS** key. The display will change to the following:

Purge

Unless some problem occurs, this message will remain for 16 seconds as the fan is clearing the plenum of any fuel fumes that might otherwise cause an explosion during ignition. After the purge time has passed, the display will change to:

Ignite

In this phase the fuel volume is set to a low level and the electric ignitor will be activated. This state will last until the flame detector senses that a flame is present or until 90 seconds has passed, this latter time being the limit for allowing ignition. The dryer will return to idle in the event that the flame fails to light.

After ignition is detected, the ignitor is turned off and the display will change to:

Heat

This is a 30 second period during which the burner is allowed to warm the fuel heater, if present, while the flame remains at a low setting.

After the heating phase has passed, three or four displays will occur in a repeating sequence, each lasting 2 seconds. They are:

<i>Dry</i>		
<i>Plenum</i>	<i>ttt</i>	<i>sdddS</i>
<i>Grain</i>	<i>ttt</i>	<i>sdddS</i>
<i>Dry</i>	<i>pp</i>	<i>sdd%</i>

The first of these messages indicate that drying is under way. The second and third give the current plenum and grain temperatures where *ttt* is the current temperature and *sdddS* is the difference between the current temperature and the set point temperature, not the library temperature.

The last message will only be present if the controller has the moisture sensing module installed. *pp* is the present grain moisture and *sdd%* is the difference between that value and the set point.

If the dryer has not been in operation for a few minutes or more, at the same time the display changes from *Heat* to the cycling display, the burner will switch to the high-output mode. It will remain in that state until the plenum *sdddS* reaches 0 or +1 i.e. the plenum setpoint temperature and the actual temperature are equal. At that time, the burner will revert to the low output state until the plenum temperature decreases to the point where it is one or two degrees below the setpoint. At that time it will once again revert to the high-output state. This cycling will continue as long as the drying process is required to reduce the grain moisture to the desired point.

4.2.2.4 - Options During Drying - While the grain is being dried, the operator may press the **MENU** key and again gain access to both the grain parameter setting routine and the drying options. These routines operate exactly as they did before with two exceptions:

1. The previously selected grain is not displayed and cannot be changed while the burner is in operation.
2. Instead of the *Batch Dry On?* message, the display will show *Dry Off?* Answering **NO** will return the *Set Drying Data?* option while a **YES** depression will cause the dryer to immediately return to the idle state, turning off the burner. The *Set Drying Data?* display will again be shown, but the **STATUS** key will verify that the controller has returned to the idle state.

4.2.2.5 - End of Drying - The dryer operation may be halted in one of three ways:

1. A problem is detected.
2. Manually by the operator as indicated in **Section 4.2.2.4**.
3. The grain reaches the set point condition.

In all cases, the gas valves are closed and the ignition turned off if the dryer was in the *Ignite* phase of start up. In cases 1 and 3, the display will have a message indicating what condition stopped dryer operation. *Grain* is the display provided for normal completion of drying. All others indicate an abnormal conclusion to the drying process.

If the moisture module is not installed, the grain will be considered to be dry when its temperature reaches the grain set point temperature. If the moisture module is installed, drying is considered to be completed when the moisture reading equals the set point moisture value.

With one exception, the, the indicator lamp on the front panel will be lit whenever a stop occurs by any other means than operator intervention. That one condition is over-Voltage, as the high Voltage could burn out the lamp.

In the event of either a case 1 or 3 stop, the indicator lamp may be extinguished and the normal idle operation display restored by pressing any front panel key except OFF, which will turn the controller off.

6. Failures and Exceptional Condition Processing

6.1 Failsafe Operation - The circuitry of the controller and the associated dryer have been designed so single failures will not cause unsafe conditions to develop. For example: should the controller fail with the fuel valves open and the burner operating, the plenum temperature would eventually reach the point where the plenum temperature limit switch would open. This would open the fuel valve electrical supply, shutting off the fuel supply to the burner.

This is not to say that problems cannot occur which might result in loss. If, for example, the operator attempts to dry a load to a very low moisture content or to dry the grain very quickly, a fire can be started in the grain bin. Unless the operator takes appropriate steps to extinguish the fire, grain destruction and damage to the dryer could occur.

6.2 Monitored Variables - Table 6A lists the various items monitored by the controller.

Item

DC Supply Voltage level
Grain Bin Full
Grain Bin Empty
Agitator Rotation
Auger Rotation
Plenum Over-Temp Switch
Plenum Temperature
Air Flow
Flame Detector
Grain Temperature

Table 6A Sensor inputs utilized by the controller.

6.3 What Constitutes a Failures and the Controller's Response - Section 4 describes how to operate the controller, assuming that the dryer-controller combination functions in the intended manner. But if the controller detects some undesired or exceptional condition, it will generally take four actions. These are:

1. **Lit Indicator Lamp** - The front-panel **INDICATOR LIGHT** will be lit.
2. **Return to Idle** - The controller returns to the *Idle* state if it is not in that state. This will involve halting all dryer motors, closing all fuel valves and stopping the ignitor.
3. **Failure Message** - The Display will provide information that will allow the operator to determine the failure or condition which caused the dryer to halt.

6.4 Error Code Recording - The controller contains a memory device whose contents are preserved even when the power is removed. Whenever a special condition is detected, the controller records all of the machine data available in this memory device. See **Section 5** on how this information may be recovered and **Appendix B** on how to interpret the data.

When a failure occurs, the general goal is to return the unit to a safe condition so that no destruction may result from the failure and to draw the operator's attention to the failure. But some expected conditions have the same goal. When a single batch of grain is finished drying, it would be appropriate to halt all dryer operations and alert the operator. Due to the similarity in actions required of the controller in cases such as these, the controller treats both of these situations the same i.e. as if they were failures.

Table 6B lists all possible error messages and their meanings.

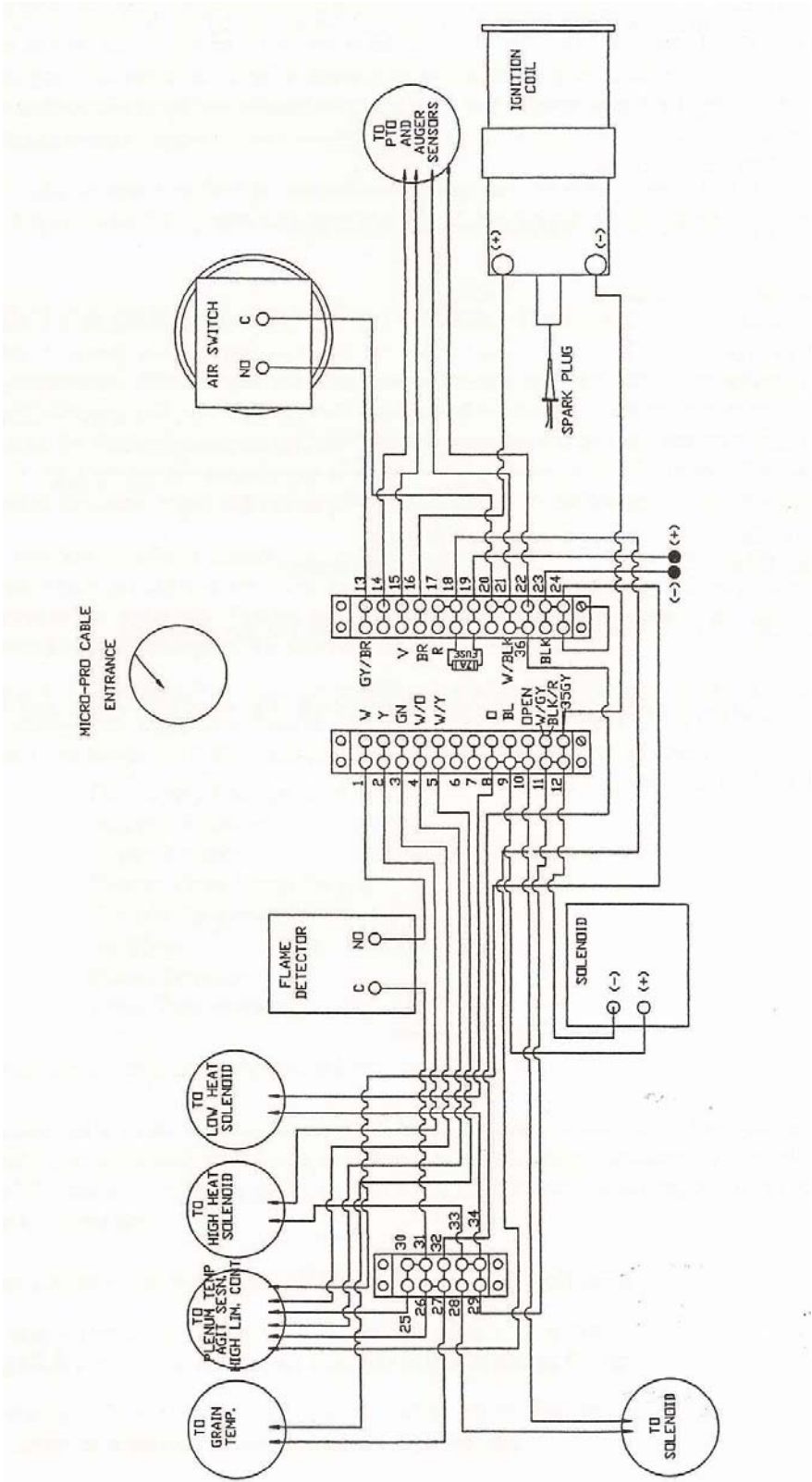
<u>Message</u>	<u>Priority</u>	<u>Meaning</u>
<i>Voltage Low</i>	7	The 12 Volt DC supply is lower than about 9.5 Volts
<i>Voltage High</i>	7	The 12 Volt DC supply is higher than about 17 Volts
<i>Plenum Hot</i>	6	Plenum switch or sensor found a high plenum temperature
<i>Air Low</i>	6	Air flow switch is open, indicating inadequate air flow
<i>No Flame</i>	5	Flame is absent when it should be present
<i>Flame On</i>	5	Flame switch is closed when it should be open
<i>No Fill</i>	4	Grain bin did not fill within allotted 30 minutes
<i>Fill Done</i>	4	Requested bin fill was completed normally
<i>No Unload</i>	3	Grain bin did not empty within allotted 30 minutes
<i>Unload Done</i>	3	Requested bin unload was completed normally
<i>Agitator Slow</i>	2	Agitator rotational rate is too low
<i>Auger Slow</i>	2	Auger stopped
<i>Grain Done</i>	1	Grain drying completed

Table 6B Error messages the controller can deliver and their meaning.

In some cases it might be possible for two or more failures to occur at the same time. For example: if the motor which drives the auger and agitator would fail to start, both auger and agitator failures would occur. In the event of simultaneous failure conditions, only one is displayed and that will be the one with the higher priority as indicated in Table 6B.

MICRO CONTROL (GRAIN GUARD) LPG DRYERS

2001 ->



GRAIN GUARD TERMINAL BLOCK KEY

POSITIVE (+) TERMINALS	COMMON (-) TERMINALS
1. Flame Detector (Norm.Open) - Black	12. Liquid Solenoid - Blue
2. High Heat Solenoid - Black	20. Air Switch (Common) -White
3. Agitator Sensor - White/Blue	21. PTO Sensor - White
4. Plenum Temp. Sensor - White/Orange	22. Auger Sensor - Black
5. Grain Temp. Sensor - White/Orange	23. Battery (Negative 12 VDC)
6. Open Terminal	24. High Limit Switch - White/Black
7. Open Terminal	25. Agitator Sensor - White/Black
8. Low Heat Solenoid - Black	26. Plenum Temp. Sensor -White/Black
9. Liquid Solenoid - Black	27. Grain Temp. Sensor -White/Black
10. Liquid Solenoid - Black (N/A to UK)	28. Liquid Solenoid - Blue (N/A to UK)
11. Terminal Post 29 - White	29. Terminal Post 11 - White
13. Air Switch (Norm.Open) - Black	30. Open Terminal
14. PTO Sensor –Brown	31. Flame Detector (Common) - White
15. Auger Sensor –Yellow	32. Terminal Post 36 - White/Black
16. Ignition Coil (Positive) - Black	33. High Heat Solenoid - Blue or Red
17. Open Terminal	34. Low Heat Solenoid - Blue or Red
18. High Limit Switch - Orange	35. Ignition Coil (Negative) - White
19. Battery (Positive 12 VDC)	36. Terminal Post 32 - White/Black

GRAIN GUARD CABLE DETAILS, PROPANE GAS BURNER:

GRAIN GUARD PLUG Pin Number	Wire	Colour	Function	Control Box Terminal No.
1	BLK	Black	Ground (-)	23
2	R	Red	12 Volt DC (+)	17
3	GY	Grey	12 Volt DC (+) switched	35
5	BR	Brown	Ignition coil	16
6	O	Orange	Low heat solenoid	8
7	BL	Blue	Liquid solenoid	9
8	Y	Yellow	High heat solenoid	2
12	GN	Green	Agitator Sensor	3
13	V	Violet	Auger Sensor	15
23	W/GY	White/Grey	Ground (-) Coils	11
24	BLK/R	Black/Red	Ground (-) Coils	11
26	W	White	Flame Detector	1
27	GY/BR	Grey/Brown	Air Switch	13
29	W/BK	White/Black	Common for Sensors	21
30	W/O	White/Orange	Plenum Temperature	4
31	W/Y	White/Yellow	Grain Temperature	5
4,9,15,28,34,35,36,37	-	Open	-	-
14,20,21,22,25,32,33	-	Moisture control	-	-
10,11,16,17,18,19	-	Auto dryers	-	-