



Kiln Operation Manual

INSTALLATION - POSITION AND SAFETY OF THE KILN

1. Adequate ventilations around the kiln is essential, make sure that the kiln is situated in an area where there is at least some natural ventilation to the outside of the building. If not, you may have to consider forced ventilation. Fumes from kilns can be unpleasant and are also corrosive and can badly damage any metal fittings in the room.
2. The Kiln ships with screw in plastic feet that screw into inserts in the feet. We strongly advise you install these feet as they provide the following benefits. By adjusting the screw for each feet you can level the kiln on uneven ground. Secondly the feet slide fairly easily across hard surfaces making the kiln easier to relocate should you need to access the rear of the kiln for servicing and the like.
3. Make sure that there are no combustible materials stored under, around or behind the kiln. ie: Timber, canvas, paper or chemicals etc...
4. Nothing at all should ever be stored on top of the kiln, EVER.
5. No unauthorized persons should be allowed near the kiln during the firing process. ie: to touch the hot kiln case (can reach well over 90 Deg C), or to look through the spyhole or change the control settings.
6. Always ensure adequate distance for ventilation purposes is left around your Kiln the minimum distance is at least **200mm from any wall** or structure. Please also ensure a minimum of **600mm above the Kiln**.
7. Please ensure that you do not install a Kiln on an electrical connection with an Earth Leakage System (RCD or Residual Current Device Breaker). These systems will often cause the kiln to trip out (as with stoves or ovens). A simple circuit breaker is more suitable. Should an Electrician have an issue with not installing an RCD then the kiln may need to be hardwired to the connection.

LOADING THE KILN

Loading a kiln is a delicate task. One misstep and your pottery can melt, shatter, under-fire or misfire. However, if properly loaded, your kiln can create beautiful ceramic or glass pieces. If you are 'not reaching temperature' please ensure that the kiln is packed as advised before blaming the kiln. Most under firings are caused by incorrect spacing around the thermocouple or the ware itself.

1. Before you begin ensure you have the correct safe working clothing to fire the kiln:
 - i. Mask – Class P1 minimum.
 - ii. Leather mittens or good quality garden gloves.
 - iii. Long sleeved loose fitting clothing non combustible.
 - iv. Safety glasses with infrared filters should be worn when viewing through spy holes at elevated temperatures.
2. Prepare your kiln. Make sure that any debris from previous firings has been removed, including any material used to prop your pieces. **Always place a shelf on the floor of the kiln** to begin loading. This helps protect the floor of the Kiln which can't be easily replaced like a shelf can. It's a good idea to vacuum out any residual dust regularly.
3. Inspect your pottery. Make sure the ceramic pieces you are about to load are dry. Check that the piece is in good condition with no visible fractures or cracks. One broken piece can ruin an entire kiln.
4. Make sure the kiln load is even. You can create multiple levels separated by Kiln Shelves (Batts made from cordierite or other kiln-safe material) and Props (support pillars) of varying heights. Choose pieces to load based on height. Load tall pieces on one level, and shorter pieces on another. If you have items of different sizes, split the shelves to maximize space. Always try and evenly load a Kiln, from side to side, top to bottom. This will help ensure the kiln provides an even firing.
5. **NOTE:** Ensure that the Thermocouple (the temperature probe that protrudes into the Kiln to enable the Digital controller to control the firing) is not too close to any pieces or too close to any shelf. As this is where the controller reads temperature from within the kiln we want to ensure that it accurately reflects the air temperature within the kiln and is not damaged in any way. Try to picture the end of the thermocouple probe at the center of a sphere the size of a tennis ball. You need at least 3-4cm from any item and especially a shelf. This way you avoid inaccurate readings caused by re-radiated heat from the ware or a shelf.
6. If your pieces are glazed, use a ceramic stilt to support your ceramics; setting it on a shelf will fuse the piece right to the shelf. For pieces with wider bases, use a wider stilt, which can prevent your piece from tipping. If your piece does not have a flat bottom, and

is not easily supported with a single stilt, use multipoint stilts for support. If you have an item that is not glazed on the bottom, set it directly on the shelf or use a triangle stilt to support your piece. Kiln wash can be used on shelves to stop them sticking but it's not a foolproof system.

7. Let your pottery breathe. In order for the heat to properly fire your ceramic pieces, make sure your pieces are around 3 - 5cm (2 inches) apart, and leave a few cm of room at the top of each level for the heat to pass evenly throughout the kiln.

KILN SHELVES OR BATTS

1. Most Shelves or Batts will ultimately bend – however the life of the batt can be increased by regular turning and insuring that the kiln does not spend too much time at the top end of its cycle. Flipping shelves will also help prolong their life so any bending offsets itself over time.
2. Cracking: Generally speaking a shelf should not crack. If a shelf does crack the cause should be sought and eliminated if possible. If the Kiln shelf has begun to bend and then ultimately a crack appears where it bends the shelf is nearing than end of its life. It's better to be proactive in replacing then as major damage can occur to insulation, elements and ware if a shelf fails during firing and thus collapses. Shelves don't last forever and will need replacing over time.

The following causes may be the reason for the cracking:

- a) THERMAL SHOCK - Too rapid cooling or firing particularly at the 20 > 250 C range. For thinner shelves a maximum Ramp Rate of 400°C is suggested as an upper limit. Never fire a damp shelf as the escaping moisture can cause it to crack.
- b) Uneven heating or cooling possibly due to poor circulation or uneven loading of ware.
- c) Bad propping - probably the most common cause.
 - i. Three props are better than four, being inherently more stable.
 - ii. If four props must be used, make sure that they all touch the underside of the bat above.
 - iii. Props should be placed in line vertically. Ensure that the end faces of the props are flat and parallel.

GENERAL IMPORTANT NOTES

1. Moisture levels – never fire pieces which are damp (you can feel the moisture in them – they feel slightly cool). This moisture gradually damages the refractories and elements in the kiln particularly if the kiln is fired fast. The more moisture you need to drive out of the ware the greater chance that the ware will explode in the kiln. If the moisture turns to steam before it can leave the ware the pressure will cause the ware to crack, pop or explode.
2. Do not place foreign materials in kiln. Do not introduce contaminants like camphor or wood chips (popular with professional potters) to create a reduction atmosphere as elements will be permanently damaged.
3. Do not allow paper or cloth to be burnt out after acting as support or stuffing – this can also Damage the kiln.
4. Metallic (electrically conductive) materials should never be put into the kiln whilst in operation. With exposed Elements this can be a serious safety risk.

NOTE: A Special mention for Paper Clay

With the increased popularity of paper clay in recent years we have had a number of people cause false fire alarms etc from the amount of smoke and fumes that are generated from the Kiln. Due to the paper content you must bare in mind there will be smoke as it fires. Even if the bungs are in this smoke will find its way out of the Kiln and can cause issues like fire alarms etc. If you wish to fire them you will need significant ventilation in the room. We would advise fitting of our External Ventilation System (Ventmaster) to help alleviate this problem. For schools they should check where their smoke detectors are etc before firing paper clay.

Bungs – Door and Roof

- i. For bisque firing – should be left out of the kiln until the kiln has reached around 250-400C. The bung can be removed if desired after the kiln has reached maximum temperature to accelerate the cooling cycle. (Always ensure that you wear protective clothing and gloves when operating on or near the Kiln when at temperature.) If you can't be there to put the bungs in, then fire with the bungs in from the start and ensure the ware is extra dry as the moisture will have trouble escaping the chamber and will result in reduced element life.

- ii. For firing glaze – bungs can be left in the kiln at the start providing there are no oils or burn out materials which need to be driven off during the early stages of firing eg: oils in gold lustres.

Note: remove the bung slowly

It is recommended that safety glasses with infrared filters be worn when viewing through spy holes at elevated temperatures.

Replacement Bungs are available and can be posted direct. Please measure the diameter of the bung hole before ringing so we can supply you the correct size.

NOTE: Never fire the entire firing with the bungs out. (It can cause a fire risk due to the super heated air leaving the bungs at higher temps and also reduces the efficiency of the Kiln markedly)

PREVENTATIVE MAINTENANCE OF THE KILN

1. Refractory Walls and Floor

Brush or vacuum dust out of kiln after every few firings (you should use an approved mask for this so that you do not inhale the dust). Check that the element grooves are not broken leaving the element without adequate support. If there are broken sections and the problem is not attended to immediately then the element will curl out at the broken section and begin to droop down. The element will then need replacing. Repairing these grooves early will avoid a problem that is harder to fix if left unattended for too long. If a wall or floor begins to crack do not be alarmed. If however, this crack continues to grow or the insulation becomes loose please contact Woodrow to arrange a service for your Kiln.

2. Elements

Regularly check the condition of your elements. They should have a slightly grey colour. They should not be rough on surface. ie: they should not have a sandy appearance. The coils should be evenly stretched throughout their length (they should not be bunched together anywhere). If the coils are leaning over on each other they will need replacing soon. As the elements wear the kiln will become slower over time and worn elements can also affect how even the Kiln fires across its chamber. Please also ensure you

regularly check the electrical connection to your Kiln (le Plug and Lead) as well as the fuse/breakers for the Kiln circuit to ensure they are in good working order. NOTE: Before doing checking or doing any work at all on the electrical components of the Kiln please ensure you unplug the Kiln from the power point. If your Kiln is 'hardwired' always contact a licensed electrician to work on the Kiln. Should elements fall out of there groove they should be attended to as quickly as possible in order to try and save the element. You will need to heat the elements with a small blow torch until they are glowing before you try and bend them back into the groove. If you don't heat them they will easily break if you try and bend them. This is quiet tricky so it may be best to get an experience technician to do this.

3. Door Seals

If it becomes noticeable that heat is escaping from between the door sealing surfaces, action is necessary to avoid resultant prolonged and unnecessary firing time and searing of the painted metalwork around the door opening. We can send a replacement door seal kit with glue so you can repair your Kiln or we can arrange a service for your kiln. Also check the adjustable door latches to ensure they are working correctly as leaking seals can sometimes be caused by over tightened door latches that over compress the fiber door seal. A slight brown or black stain may occur around the door seal, this is caused by a buildup of fumes that slowly leak around the seal. This is normal and doesn't affect the kiln.

4. Thermocouples

The thermocouple is the white ceramic tube like sensor device which extends into the kiln chamber through the wall. The thermocouple will require replacement during the life of the kiln. If the thermocouple fails during a firing then the Automatic temperature controller will immediately turn the kiln off (fail safe). It will display a **tC** alarm. However, most Kiln faults, even those that appear to be the Controller are as a result of the Thermocouple being faulty. To check the Thermocouple first disconnect the Kiln from the power supply. Next unscrew the Thermocouple holder and remove the Thermocouple from the Kiln. Inspect the Thermocouple, if it appears damaged in any way contact Woodrow to organize a replacement. Generally you will be looking for excessive corrosion of the tip or a break in the wires inside the small white ceramic beads. We can usually express post a replacement to you within a few days. Before calling check the colour of the cable leading to the thermocouple as this will indicate what 'type' you need.

5. Replacement of Thermocouples

Thermocouples have two connections (+ and -).

If you are unsure of what 'Type' Thermocouple you have please note the colour of the cable coming from the Thermocouple and give us a ring. (Yellow wire is a Type K, Orange wire is a Type N, Green wire is either a Type S or Type R)

The Thermocouple used with the AF+ controller is either a TYPE K (Yellow) or post Jan 2014 a Type N (Orange)

CAUTION: It is important to note that the **negative (-) terminal** on both of these thermocouples is colour coded **RED**. **(THIS IS OPPOSITE TO CONVENTIONAL ELECTRICAL WIRING). The polarity of the wire is vitally important and must be correct at both ends. Reversed polarity will lead to inaccurate readings!**

6. Kiln Moisture and Kilns not used for an extended period

If your Kiln is not to be used for an extended period please ensure the door is kept closed to stop a moisture build up in the Kiln. We would also suggest that for the first firing you should initially allow the Kiln to 'dry' out by heating to around 150 Deg C to ensure any built up moisture in the refractory's has been allowed to burn off. This is only required if the Kiln has not been fired for a few months or in areas with a lot of moisture in the ambient air. Before firing touch the insulation if it has a slightly damp or cold feeling it may need to be dried.

7. Safety Door Switch.

If the Kiln doesn't heat up at all when you begin firing please make sure you check that the safety door switch is working correctly. The switch is inside the right side of the Kiln controller box under the kiln. A small probe that is attached to the base of the door enters into the control box and triggers the safety door switch. The probe can be bumped and become un-aligned to the hole in the control box. If this happens adjust the probe to align it correctly. When the probe enters the hole you should be able to hear a small click as the door switch engages. The switch isolates the power to the elements when the door is opened to protect you from live elements inside the chamber.

OPERATION OF THE KILN

8. **POWER** - does your kiln “plug into” a power outlet or is it directly wired into the wall.
9. Check that the power is ON at the outlet and turn Kiln OFF then ON (This ensures the controller resets).
10. If no lights come on, then check supply fuses or circuit breaker.
11. If the Kiln will not start, check the kiln door is properly closed. Woodrow kilns are wired so that the control circuit power goes through a safety door switch. Unless the door is closed the kiln will not start. This may need slight adjustment over time.
12. The AF+ Controller should beep and flash between **Idle** and the ambient temperature reading. ie the Temp inside the Kiln.
13. Please select a Program or enter a New Program to begin firing (Please refer to Woodrow AF+ Instruction Manual)

FIRING RECOMMENDATIONS

Much like a recipe for an oven, a Kiln Firing Profile / Cycle is something that you need to learn and adjust over time. We can provide you with a starting point but as Clay's, Glazes etc differ, just like ingredients do, you will need to determine what cycle works best for your particular circumstance.

NOTE: Always follow the firing temperature recommendations of the glaze or clay manufacturer. Their recommendations should always be followed in preference of our suggestions.

Please find a table with suggested firing Temperatures, Ramp Rates and Soak at the back of this manual.

HELP

If you require any help with firing your Woodrow Kiln please feel free to contact us.

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This guide will show you how to use your AF + digital temperature controller.

The Guide is divided into three chapters.

Firstly, we will look at the theory of how the controller works and describe the basic principles that you should learn that will help you better understand using this versatile controller.

Secondly, we will demonstrate how we enter the program into the controller and generally how to use the controller. Last we will look at some additional features of the controller.

If this is your first time using a digital controller don't be daunted. Once you have used the controller just a few times you will get the hang of using it and will wonder how you did without it in the past.

Chapter 1 – The Key Principles of the AF+ controller

Getting to know your controller:



Let me describe the controller and how it thinks.

Firstly, the AF+ Controller has 9 available programs. What this means is that it has 9 available memory slots to remember different programs.

So if you do a few different types of firings, once programmed, you won't need to adjust them each time but simply select which one you would like to run and select start.

Each time you adjust a *STAGE* in one of these programs the controller automatically saves the setting in its memory for next time. There are 8 *STAGES* available in each program, each with its own ramp, temperature and soak.

Each of these 8 *STAGES* has 3 separate *STEPS* that you will need to enter:

The *STEPS* are:

1. **RATE**: how fast you want to go in degrees per hour.
2. **DEG C**: what temperature you want to go to.
3. **HOLD**: how many hours and mins you want to soak for.

Let's explain *STEP 1 RATE* or ramp rate in greater detail.

RATE refers to how fast you wish the Kiln to rise or fall in degrees C per hour.

You don't have to tell it to be +ve for heating and -ve for cooling as the controller works out that by itself.

Below is an illustrative example to help explain the concepts, it is not a recommended firing cycle.

So let's say we wanted to go to 800 degrees in 2 hours. That would mean the **RATE** is $400 = 800 \div 2$

This one step is what most people find most difficult to get their head around.

(So let's show another example. Let's say we were already at 600 degrees C and we wanted to go to 850 degrees in 30minutes. That would be calculated by $(850-600) \div 0.5$. So $250 \div 0.5$ thus = 500 degrees per hour.)

If you are still a little confused by this don't worry just have a read through a few more of the explanations at the back on you instruction manual under Ramp RATE Examples.

Alright, the next *STEP* is no 2: DEG C

This is the temperature you are aiming to get to at the end of that *STAGE*.

So if you wanted to go to 800 then the DEG C would be: 800.

STEP 3 is **HOLD**: Hold is the time in hours and minutes you wish to stay at that temperature. This is often referred to as the soak time and is most often used when firing glass for example.

So if we wished to stay at 800 degree for 15mins we would enter: 00:15

So for the first *STAGE* of this program we would enter:

RATE: rA1: 0400
DEG C: O C1: 0800
HOLD: HLd1: 0015

Ok now for the second *STAGE*:

Now we want the Kiln to drop back down to 600 in 2 hours.

So that would mean that **RATE 2** is: $(800-600) \div 2 = 100$

So *STAGE 2* would read:

RATE: rA2: 0100
DEG C: O C2: 0600
HOLD: HLd2: 0000

STAGE 3 we want to drop back to room temperature in 10 hours

Cool down stages are optional and are normally only programmed for certain glaze types. A typical bisque or glaze fire would not have a cool down step but would stop after reaching max temperature and the kiln would then cool at its maximum rate.

IMPORTANT NOTE: when you want to bring the kiln back down to room temperature you must set that temperature at a realistic temperature. The kiln will never be able to drop below the room's ambient temperature. You probably should aim for a temperature a little higher than what the normal room temperature might be. Say 30 degrees. This will allow the kiln to get down to a realistic temperature. NOTE: if firing in summer or in hot climates you may aim for a temperature a little higher say 40 degrees.

So Rate 3 is: $(600-30) \div 10 = 57$

So *STAGE 3* would be:

RATE: rA3: 0057
DEG C: O C3: 0030
HOLD: HLd3: 0000

If we had a more complex firing schedule we may well have had more *STAGES* in this program but for this example we have come to our end.

So the controller knows we are finished we must program in one more *STEP* for the next *STAGE*.

That is to tell the controller we want the **RATE** to be 0. That is no change in temperature.

So *STAGE 4* is:

RATE: rA4: 0000

That's all we need to enter for this program.

Once we have entered that value the controller will display StRt. i.e. asking if you want to Start the program?

Right, now take a breath. Congratulations you have learned all you need to know to successfully program this controller.

Now I know you are thinking that was all a bit too much and a little confusing.

Trust me once you have done it one or two times you will get the hang of it.

Just take a second and read over your notes until you are satisfied that you understand the **RATE** or ramp rate. As this is the area that people take a while to fully understand.

Once you are comfortable we will move on and show you how to enter values into your controller.

Chapter 2 – Entering the Setting in the Controller

When you turn on your Kiln and Controller, all the lights will light up and you will hear a beep. The controller will then enter into its start up routine.



Within 10 seconds the controller will display Idle and cycle between it and the current kiln temperature. (Say 0020 or so)



The controller is now ready for you to select one of the 9 available programs discussed in the previous chapter.

To begin press the Start Button once.

The controller will now display Pr 01. Meaning Program No 1. You can select a different program number by pressing the Up button, **NOTE: You must only use the UP button** to cycle through the Programs up to 9 then back to 1. Don't use the down button as this will initiate the Preview function . This will move through the Programs one at a time i.e. Pr01, Pr02 , Pr03.....Pr09.



Please press the buttons up so that Pr01 is showing.

Now press the **Start** button this will open up the Program and take us to the first *STAGE* and First *STEP* so we can enter our desired cycle.

You should now see the controller display: rA1 (the First Ramp RATE)



From the Wall chart we will show how we enter the first firing example (a normal Bisque firing)
 Step 1 show a **RATE** of 60. So we will hold the **Up** button down and watch it cycle up to 0060.
 Please hold the button down and you will notice that the scroll rate will increase much like setting an alarm clock or the like.



Once you have rA 1 then 0060 flashing on the controller, you can accept the value by pressing the **ENTER** button again. You should hear a beep.

Now the controller should be displaying O C1 which is (Degrees Celsius).



From our table we want to enter 250 so again hold the up button till 0250 is displayed. (You can always hit the **Down** button if you go too far)



Again to accept the value press the **ENTER** Button. (**Beep**)

Now the controller will be flashing HLd1 then 00.00



This is the hold/soak time. We don't want a soak for the first step so we enter: 00.00



Again press **ENTER** to accept. (Beep)



You will now See rA2: which we will enter as 0100



Again press **ENTER** to accept. (Beep)



Now O C2: we will enter 0880



Again press **ENTER** to accept. (Beep)



HLd2: we will leave as 00.00



Again press **ENTER** to accept. (Beep)



You will now See rA3: which we will enter as 0060



Again press **ENTER** to accept. (Beep)



Now O C3: we will enter 0980



Again press **ENTER** to accept. (Beep)



HLd3: we will enter as 00.10. Entered as Hours:Mins



Again press **ENTER** to accept. (Beep)

Now to tell the controller we are finished we enter the next **RATE** as 0.



So RA4 will be 0000



Press **ENTER** to accept (Beep)

The controller will now display STRT.



Press **ENTER** again and the controller will begin to run the program. The controller will display ON and the small **RUN** light will now blink.



When the controller is running it will display the temperature that is currently in the Kiln.

If at any time you wish to Stop the program simply Press **ENTER** and **STOP** will display on the controller



Press **ENTER** once again to stop the Kiln from running.

Quick start of an existing program using Review feature.

Once Idle is showing, press **UP or DOWN** button and select which Program number eg PR01 you wish to run. While PR01 is showing press the **DOWN** button. The controller will now flash each step one by one (this is the Review Mode). Once **Strt** is displayed you can now press **ENTER** button at any time to begin running the program.

Chapter 3 – Additional Features of the Controller

Feature 1: Delayed Start.

You can pre-program a delay before the Kiln begins to run. This allows you to start the Kiln at night when power may be cheaper or control the time the Kiln will be ready to open.

You program the delay start just before you start the program.

When the controller shows **Strt**:



Press the **DOWN** button and you will see Delay Mode dELA.



Now use the UP and DOWN keys to enter the desired delay time in HOURS:MINS.

Press the **ENTER** button to confirm your delay time and then press **ENTER** once more to Start the program. You will now see the Run light flashing and the controller will display a countdown timer before the Kiln cycle will start.

Feature 2: Change Settings While Running

To Skip a Step.

While program is running press the UP button once. Skip step SStP will show.



Press the **ENTER** button to accept Skip mode. The Display will now show the current step the Kiln is up to. Press **ENTER** again. This will Skip the step and begin firing as normal again.

To Add Hold/Soak Time.

While Program is running press the UP button twice. Hold Time will show HLdt.



Press the **ENTER** button to accept Hold Time Add feature. Now press the UP button to add 5 minute increments to the original hold time.

To Change a Set Temperature Value.

While the Program is running press the UP button Three times. This will show the Change time feature CH6t.



Press the **ENTER** button to enter the Change Temp Feature. Use the up and down buttons to adjust the temp then press **ENTER** again to return to normal firing.

TROUBLE SHOOTING

The most common error that can occur with your kiln will display the following errors:



Thermocouple Failure

This means that your thermocouple has either loose wires, or is faulty and needs to be replaced. The expected life of a thermocouple is 3-5 years.

The other shows FTL (fired too long) this could indicate an issue with the elements, please call.

HELP

If you require any help with firing your Woodrow Kiln please feel free to contact us.



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