

IMPORTANT

This is a supplement to the full Apricus MFC-1 Controller Manual provided available from the www.apricus.com website.

Refer to the full manual for full safety and operating instructions.

The controller must be set for USER menu once the system is commissioned. The end USER may only access and make changes to those settings contained in the USER menu. TECHNICIAN settings may only be changed by qualified persons.

Incorrect settings may result in unsafe system operation.

1. SOFTWARE PACK OVERVIEW

This software pack provides a set of standard functions suitable for most domestic and commercial solar thermal systems.

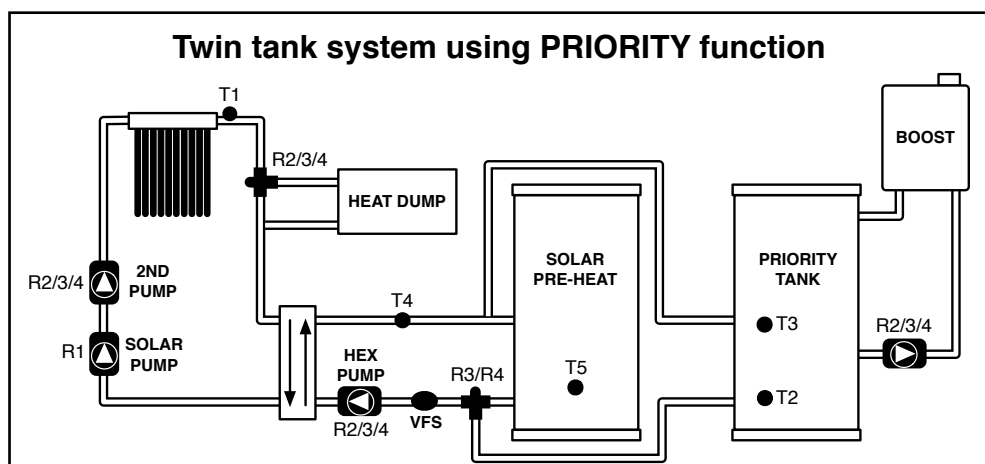
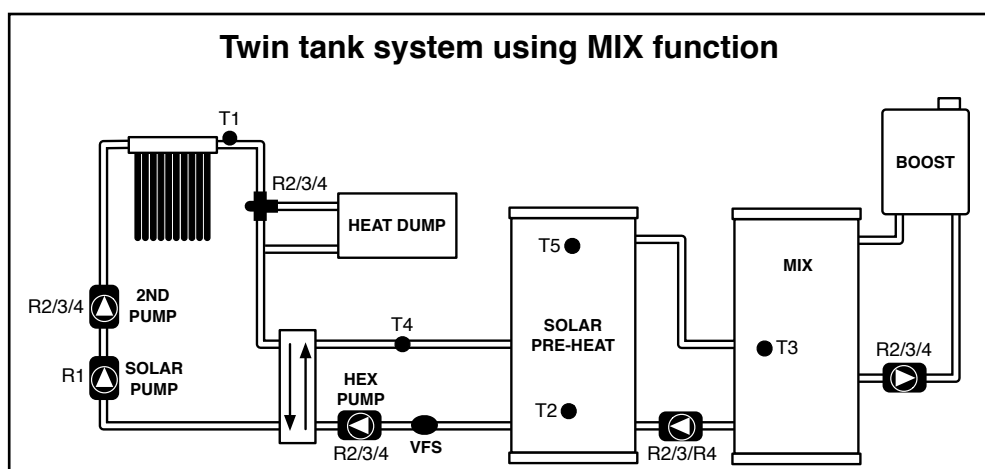
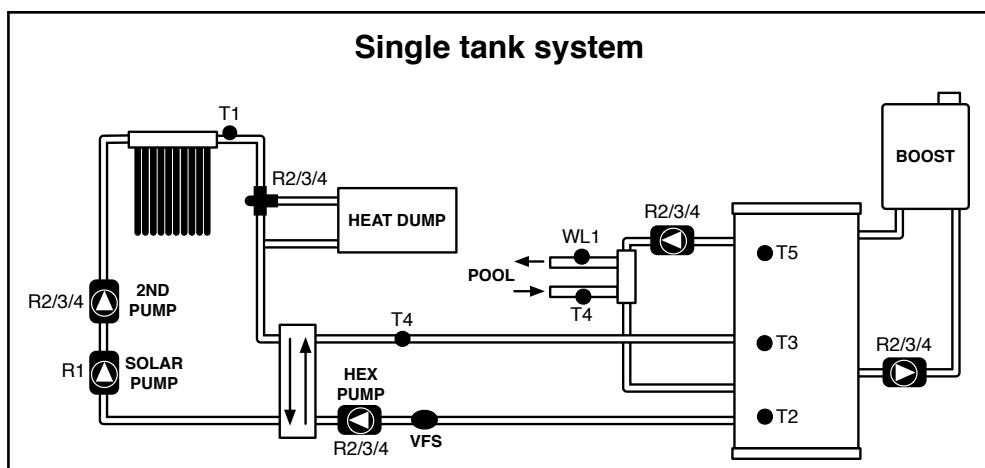
Relay 1 (R1) is dedicated to the solar pump operation. The additional 3 relays (R2, 3 & 4) can be used to operate a number of additional pumps or valves using the following function selections:

- **BOOST:** Runs pump for heating tank from auxiliary heat source.
- **DUMP:** Powers 3 way valve to divert flow through heat dissipator.
- **2ND:** Runs 2nd solar pump for extra head pressure.
- **EX-HEX:** Runs pump if using external HEX for solar loop.
- **PRIORITY:** Powers 3 way valve for priority heating of two tanks.
- **MIX:** Runs pump for mixing two tanks.
- **POOL:** Runs pump for pool/hot-tub heating.
- **TIME:** Control relays simply based on timer settings

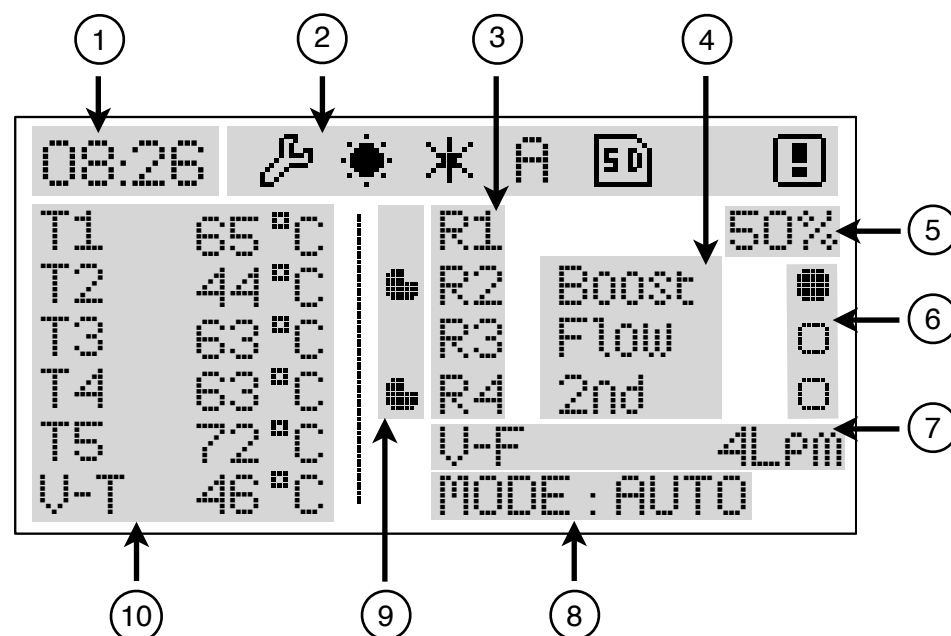
2. SYSTEM DIAGRAMS

The following diagrams show the various configurations that can be achieved. The complexity of the system is limited by the 5 sensors and 4 output relays.

Certain functions cannot be used concurrently due to conflicting requirements for sensor placement (Eg. POOL and SOLAR IQ).



3. MAIN DISPLAY OVERVIEW



1. Current Time

2. Icons

3. Relays

4. Relay 2,3 & 4 function

5. Relay R1 % speed

6. Relay 2,3 & 4 ON/OFF status

7. Flow rate (VFS or calculated)

8. Operation mode

9. Relay timer status

10. Temp sensor readings

A or M Auto or Manual Boost Mode

Freeze protection active

Timer active for relay

Solar energy available

Error(s) have occurred

Technician menu active

SD card inserted

4. INFORMATION SCREENS

Scroll through information screens by pressing ↑ or ↓ buttons.

4.1. MODE SCREEN:

- Choose from OFF, AUTO or MANUAL modes of operation.
- The controller will always start in OFF mode after a SOFTWARE UPDATE or SOFTWARE DEFAULT reset.
- Change to AUTO mode for normal controller operation.
- Use MANUAL mode to control relays and check variable speed pump operation.
- Always select EXIT and press SET to return to normal operation.

4.2. ERROR SCREEN:

- To review errors, press SET then ↑ or ↓ to scroll. If an error has occurred it will show the most recent occurrence date & time and total occurrences.
- To clear all errors, scroll to CLEAR ALL ERRORS, press SET, select YES then SET to confirm.
- To leave the ERRORS screen, scroll to the bottom and select EXIT.

4.3. RELAY, TEMP & ENERGY SCREENS:

These screens provide basic summary of the system operation. To reset the information choose RESET DATA in the SETUP menu.

08:26	Freeze protection active	* A	SD	!
T1 65°C	R1 50%			
T2 44°C	R2 Boost			
T3 63°C	R3 Flow			
T4 63°C	R4 2nd			
T5 72°C	U-F 4LPM			
U-T 46°C	MODE: AUTO			

MODE: MANUAL			
T1 140°F	R1 50%		
T2 120°F	R2 On		
T3 125°F	R3 Off		
T4 138°F	R4 Off		
T5 150°F	U-F 1.8GPM		
U-T 138°F	EXIT		

ERRORS			
E10: NONE			
E11: 05/03/2012 10:24 02			
CLEAR ALL ERRORS			

RELAY ACTIVITY			
R1	1hour	24hour	Total
R2	25m	4h	290h
R3	15m	2h	45h
R4	5m	8h	90h
R4	0m	0h	0h

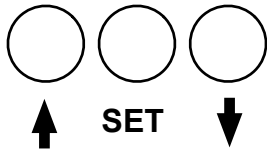
AVERAGE TEMPS			
T1	1hour	24hour	Total
T1	140°F	110°F	115°F
T2	120°F	120°F	120°F
T3	125°F	125°F	125°F
T4	138°F	138°F	138°F
T5	150°F	150°F	150°F

ENERGY OUTPUT	
Today	11kWh
7 days	65kWh
30 days	320kWh
Day Average	7.2kWh
Operating	55days

5. CONTROLLER OPERATION

5.1. CHANGING SETTINGS

- Press SET to enter function menu
- Press ↑ or ↓ to navigate menus
- Press SET to enter sub-menu
 - Press SET to edit setting
 - Press ↑ or ↓ to change value
 - Press SET to confirm
- Some functions can be turned OFF by exceeding the upper or lower range. They are identified by (↑↓) after the range.
- Press ↑ and ↓ together to **QUICK EXIT** to main screen



6. USER vs TECHNICIAN menus

USER menu allows the viewing and editing of **only basic** functions. TECHNICIAN menu allows the viewing and editing of **all** functions.

- To change status, hold ↑ and ↓ together for 10 seconds
- ⚙ icon displayed on Main Screen for TECHNICIAN menu.
- Always return to USER menu when finished editing settings.

6.1. USER MENU

The following items are available in the USER menu.

6.1.1. **TIME SET:** 24hour format. Set hours then minutes

6.2.2. **DATE SET:** Select date format, then set date.

6.2.3. **RESET DATA:** Reset quick display records (not SD card data).

6.2.4. **DATA INTERVAL:** Set data recording interval (30sec - 60min).

6.2.5. **BOOST:** Set AUTO or MANUAL boost operation.

- Can also be toggled between AUTO or MANUAL settings by holding ↓ button for 5 seconds when at HOME screen.
- Top of HOME scree shows A = Auto or M = Manual icon to indicate boost status.
- To complete a single boost (or toggle ON/OFF) press and hold ↑ button for 5 seconds. Single boost will active the relay and turn off once the BOOST OFF temperature setting has been reached.
- Set to MANUAL boost mode when on holidays to avoid daily automatic boosting. SAFE BOOST and TANK MIN boosting will still operate in MANUAL mode.

6.2.6. **BOOST TIME:** Only available if BOOST function configured.

- Choose TIMER to set up to 2 daily timer periods for the BOOST operation. Only applicable when in AUTO boost mode.
- Choose NOT SET to allow normal operation of the BOOST function.
- Single Boost can be activated outside of set timer periods. It will run until BOOST OFF temperature is reached.

6.2. TECHNICIAN MENU

Following items (7 - 12) are only available in the TECHNICIAN menus.

7. SETUP

Software packs are available that provide different function sets allowing a wider variety of system configurations. All software packs share the following standard SETUP functions:

7.1. **TIME SET:** 24 hour format. Set hours then minutes

7.2. **DATE SET:** Select date format, then set date.

7.3. **UNITS:** Select Metric (°C & Lpm) or US units (°F & Gpm).

7.4. **ENERGY:** Select kWh or kBtu for energy recording.

7.5. **SOFTWARE DEFAULT:** Reset controller to default settings.

7.6. **RESET DATA:** Reset quick display records (not SD card data).

7.7. **DATA INTERVAL:** Set frequency for data recording (5sec - 60min).

7.8. **UPDATE SOFTWARE:** Upgrade to new/different software pack.

7.9. **VER:** Displays the current installed software pack name.

8. SYSTEM - Relay function selection

8.1. **RELAY 1:** Select YES if solar pump is installed.

8.2. **R1 TYPE:** Select FIXED or VARIABLE speed pump control.

8.3. **R1 SPEED:** Circulation pump speed based on R1 TYPE setting.

- If VARIABLE, set minimum speed: Default: 50%, Range: 30~100%
- If FIXED, set constant speed. Default: 100%

8.4. **R1 FLOW:** Used to calculate solar energy output if no VFS is installed.

- If VARIABLE, set Minimum and Maximum flow rates.
- If FIXED, set constant flow rate.

8.5. **R1 LIQUID:** Select from WATER or OTHER. For OTHER liquids, such as glycol/water mixes, set an adjustment factor for the calculation of energy. The table below provides % values for glycol based liquids, refer to the full installation manual for more information.

- If OTHER set % value. Range: 50~100%

Glycol %	Adjustment %	Glycol %	Adjustment %
0% (plain water)	100%	30% glycol	95%
10% glycol	99%	40% glycol	92%
20% glycol	98%	50% glycol	89%

8.6. **R1 TIMER:** Set up to 2 daily operating periods (24hr time format).

8.7. **RELAY 2,3,4:** Select use for each relay from BOOST, 2ND, EX-HEX, DUMP, MIX, PRIO, POOL, TIME or NO (NO means no function selected)

8.8. **R2,3,4 TIMER:** Set up to 2 daily operating periods (24hr time format) for each relay.

8.9. **VFS:** Select VFS (Grundfos VFS flow meter) or NO.

- Select VFS model: 1-12, 2-40, 5-100, 10-200, 20-400

*Note on Relay TIMERS: Normal operation will **only** occur during timer periods. To disable timers, choose NOT SET.*

9. SOLAR - Settings to control solar collector circulation.

9.1. **SOLAR:** Settings to manage solar collector circulation. ☀ icon will be displayed on the HOME screen once START TEMP is exceeded.

- **START:** If solar collector (T1) is above setting, monitor SOLAR-ON.
 - Default: 30°C / 86°F, Range: 20~80°C / 68~176°F (↑↓)
- **ON:** If T1-T2 ΔT is above setting, turn R1 solar pump ON.
 - Default: 8°C / 14°F, Range: 5~50°C / 9~90°F (↑↓)
- **OFF:** If T1-T2 ΔT is below setting, turn R1 solar pump OFF
 - Default: 2°C / 4°F, Range: 2~40°C / 4~72°F (↑↓)

9.2. **SOLAR IQ:** Switches from reading collector temperature (T1) to return line (T4) for SOLAR ON/OFF operation after set period of solar pump (R1) operation.

- Set time delay to switch from T1-T2 to T4-T2 ΔT measurement.
 - Default: OFF, Range: 30~180 sec (↑↓)

Note: T4 must be installed close to tank on return (collector to tank) line. Not available if POOL function is used.

9.3. **FREEZE:** Circulates the solar pump to keep collector warm.

- **ON:** If T1 is below setting, turn R1 solar pump ON
 - Default: OFF, Range: -20~4°C / -4~41°F (↑↓)
- **OFF:** If T1 is above setting, turn R1 solar pump OFF.
 - Default: OFF, Range: -10~20°C / 14~68°F (↑↓)

9.4. **2ND PUMP:** Runs 2nd pump for set time period each time SOLAR ON activates R1 (For drain back systems)

- Set 2nd pump run time after R1 turns on.
 - Default: OFF, Range: 30~180sec

Note: If variable speed is active, 2nd pump will continue beyond run time if R1 is still at 100%, as siphon has not yet been achieved.

9.5. **EX-HEX:** After a set time delay turns ON tank side circulation pump for external HEX each time SOLAR ON activates R1.

- Set time delay before activating EX-HEX pump.
 - Default: OFF, Range: 5~60sec

9.6. **COL MAX:** Sets maximum operating temperature for solar loop. (Set below boiling temperature for drain back systems)

- If solar collector (T1) is above setting, turn solar operation OFF.
 - Default: 95°C / 203°F, Range: 80~160°C / 176~320°F (↑↓)

10. TANK - Settings to control storage tank operation

10.1. **TANK MAX:** Solar input stops once this temperature is reached.

- If bottom of tank (T2) is above setting, turn solar operation OFF.
 - Default: 75°C / 167°F, Range: 65~85°C / 149~185°F (↑↓)
 - Rule: TANK MAX > BOOST OFF.

10.2. **TANK MIN:** Activates BOOST to prevent tank from freezing.

- If mid tank (T3) is below setting, BOOST ON.
 - Default: 10°C / 50°F, Range: 2~40°C / 35~104°F (↑↓)

Note: Operates even outside TIMER periods and when MANUAL boost mode is active. Turns OFF once BOOST OFF setting is reached.

10.3. **BOOST:** External heat source boosting of storage tank.

- Choose from MANUAL or AUTO.
 - **MANUAL:** Only boosts by manual operation, refer to USER menu overview on page 1 for more details.
 - **AUTO:** Follows BOOST ON/OFF temperature settings.
- **ON:** If T3 below setting turn BOOST pump ON.
 - Default: 55°C / 131°F, Range: 40~70°C / 105~160°F
- **OFF:** If T3 active setting turn BOOST pump OFF.
 - Default: 65°C / 149°F, Range: 50~80°C / 120~180°F

10.4. SAFE BOOST: Activates BOOST ON if mid tank (T3) has not exceeded temp setting for specified time period. Helps prevent legionella bacteria growth.

- PERIOD: Number of days
 - Default: 3 days, Range: 1~30days
- TIME: Time of Day for Boost
 - Default: 02:00 using 24 hour format

Note: Operates even when MANUAL boost mode is active. Turns OFF once BOOST OFF setting is reached.

10.5. MIX: Mixes hot water from solar pre-heat tank into main tank.

- START: If T5 above setting, monitor MIX ON
 - Default: 40°C / 104°F, Range: 20~80°C / 68~176°F
- ON: If T5-T3 ΔT is above setting, turn MIX pump ON.
 - Default: 10°C / 18°F, Range: 6~40°C / 10~72°F
- OFF: If T5-T3 ΔT is below setting, turn MIX pump OFF.
 - Default: 2°C / 5°F, Range: 2~38°C / 4~69°F

10.6. HEAT DUMP: Activates pump or solenoid valve to dump or dissipate excess solar heat output.

- If T2 is above setting, turn relay (valve/pump) ON.
- Set OFF value of 5°C / 9°F lower than ON setting.
 - Default: 70°C / 158°F, Range: 25~90°C / 68~194°F

Note: If heat dump requires solar pump operation, value must be set below TANK MAX.

10.7. PRIORITY: Allows priority solar heating of main tank before switching solar flow to solar pre-heat tank.

- If T2 is above setting, turn relay (valve) ON.
- Set OFF value of 5°C / 9°F lower than ON setting.
 - Default: 60°C / 140°F, Range: 25~90°C / 68~194°F

Note: When PRIORITY is active, all SOLAR, HEAT DUMP & COOL & TANK MAX functions switch to monitoring T5 instead of T2.

10.8. COOL: Uses solar panel to cool tank down at night.

- START: If T2 is above setting, monitor COOL ON.
 - Default: OFF, Range: 20~80°C / 68~176°F (↑↓)
- ON: If T2-T1 ΔT is above setting, turn COOL pump ON.
 - Default: OFF, Range: 5~50°C / 9~90°F
- OFF: If T2-T1 ΔT is below setting, turn COOL pump OFF.
 - Default: OFF, Range: 2~40°C / 4~72°F

Note: Should not be used with drainback systems.

11. POOL - Settings to control POOL heating (if assigned to relay)

11.1. POOL: Settings to control heating of pool. Required flow switch (pool flow) input to WL1 to start any pump activity. ~30sec delay before ON.

- START: If mid tank (T3) is above setting monitor POOL ON.
 - Default: 60°C / 140°F, Range: 40~70°C / 104~158°F
- ON: If pool flow (T4) is below setting, turn pump ON.
 - Default: 25°C / 86°F, Range: 20~45°C / 68~113°F
- OFF: If pool flow (T4) is above setting, turn pump OFF.
 - Default: 27°C / 80°F, Range: 22~50°C / 71~122°F

12. ERRORS - System error management

12.1. DISABLING ERRORS: Errors can be turned OFF if not used or not installed (i.e. Sensors T4 and T5 not used);

- E1-E6 have ON/OFF selection
- E7-E10 can be turned OFF by exceed the range temperatures.

12.2. ERROR OVERVIEW:

- **E1,2,3,4,5:** Failure of sensors T1,2,3,4,5 respectively, System Shutdown will occur & error recorded.
- **E6:** Failure of VFS input, System Shutdown will occur & E6 recorded.
- **E7 (TANK HIGH):** If tank (T2, T3 or T5) is above setting System Shutdown will occur and E7 recorded.
 - Default: 90°C / 194°F, Range: 65~95°C / 149~203°F
- **E8 (TANK LOW):** If mid tank (T3) is below setting E8 recorded.
 - Default: 10°C / 50°F, Range: 2~39°C / 36~102°F
- **E9 (COL HIGH):** If collector (T1) is above setting E9 recorded.
 - Default: OFF, Range: 90~180°C / 194~356°F
- **E10 (COL LOW):** If collector (T1) is below setting E10 recorded.
 - Default: OFF, Range: 0~20°C / 32~68 °F

12.3. SYSTEM SHUTDOWN (SS): During System Shutdown all relay activity is stopped, the controller sounds an audible alarm for ~30seconds, an error message is displayed and the screen continually flashes. To return to normal operation all errors must be cleared in the Error Screen menu.

IMPORTANT NOTICE

SYSTEM HAS BEEN SHUTDOWN
PLEASE CHECK ERRORS
PRESS SET TO EXIT

ERRORS

E9 : NONE
E10 : 05/03/2012 10:24 01
CLEAR ALL ERRORS

FUNCTION SETTINGS RECORD (FILL IN VALUES)

R1 TYPE		SOLAR START		COOL START	
R1 SPEED		SOLAR ON		COOL ON	
R1 FLOW (FIXED)		SOLAR OFF		COOL OFF	
R1 FLOW (MIN)		SOLAR IQ		POOL START	
R1 FLOW (MAX)		FREEZE ON		POOL ON	
R1 LIQUID		FREEZE OFF		POOL OFF	
% IF OTHER		2ND PUMP		ERROR 1 (T1 FAIL)	
R1 TIMER 1 (ON-OFF)		EX-HEX		ERROR 2 (T2 FAIL)	
R1 TIMER 2 (ON-OFF)		COL-MAX		ERROR 3 (T3 FAIL)	
R2 RELAY USE		TANK MAX		ERROR 4 (T4 FAIL)	
R2 TIMER 1 (ON-OFF)		TANK MIN		ERROR 5 (T5 FAIL)	
R2 TIMER 2 (ON-OFF)		BOOST (AUTO/MANUAL)		ERROR 6 (VFS FAIL)	
R3 RELAY USE		BOOST ON		ERROR 7 (TANK HIGH)	
R3 TIMER 1 (ON-OFF)		BOOST OFF		ERROR 8 (TANK LOW)	
R3 TIMER 2 (ON-OFF)		SAFE BOOST PERIOD		ERROR 9 (COL HIGH)	
R4 RELAY USE		SAFE BOOST TIME		ERROR 10 (COL LOW)	
R4 TIMER 1 (ON-OFF)		MIX START		CALIBRATE T1	
R4 TIMER 2 (ON-OFF)		MIX ON		CALIBRATE T2	
VFS USE		MIX OFF		CALIBRATE T3	
VFS MODEL		HEAT DUMP		CALIBRATE T4	
		PRIORITY		CALIBRATE T5	