

3Minds Control



MCT₅₀ - Multi-Channel Immersion Heater Timer

Master Unit (3MF037_1) **Slave Unit** (3MF037_2) **Remote Boost Button** (3MF037_3)

1.	Product Summary	3
2.	Specification	4
3.	Installation	5
3.1.	Mounting	5
3.2.	Connections	6
3.2.1	Heater and Control Supply Connections	6
3.3.	Configuration	13
3.3.1.	Unit ID (<i>Slave</i> only)	13
3.3.2.	Economy Supply Sensor (<i>Master</i> only)	14
4.	Operating Instructions	15
4.1.	General Use	15
4.2.	General Functionality	15
4.2.1.	Boost Rundown Timer	16
4.2.2.	Remote Boost Button	17
4.2.3.	Over Temperature Trip	18
4.2.4.	Level Sensor	18
4.2.4.1.	Level Sensor Output	18
4.2.5.	Thermostat Inputs	19
4.3.	Configuration	19
4.3.1.	Setting Time Items	20
4.3.2.	Users Menu	20
4.3.2.1.	Run Mode	20
4.3.2.2.	Clock	21
4.3.2.3.	Boost Timer	21
4.3.2.4.	Exit	21
4.3.3.	Engineers Menu	23
4.3.3.1.	Presets	23
4.3.3.2.	Zones	24
4.3.3.3.	Controls	25
4.3.3.3.1.	Sequence	25
4.3.3.3.2.	Economy Preference	25
4.3.3.3.3.	RTS Meter Operation	25
4.3.3.4.	Tariff	26
4.3.3.5.	TimeBase	27
4.3.3.6.	Boost Timer	27
4.3.3.7.	EcoTmr 1 / EcoTmr 2 / EcoTmr 3	27
4.3.3.8.	Exit	27
5.	Diagnostics	29
5.1.	Status Information	29
5.2.	Communication	29
5.3.	Internal Operating Temperature	30
6.	Repair and Service	30

This product complies with the following EC Directives:
Electro-Magnetic Compatibility Directive.
(EMC) (89\336\EEC), (92\31\EEC)
Low Voltage Directive.
(LVD) (72\23\EEC), (93\68\EEC)



1. Product Summary

The MCT₅₀ has been designed to meet the wide and varying needs of an immersion heater based water heating system. The system comprises of a Master which provides all the control requirements for the system and a number of Slaves which give expansion capabilities to accommodate larger electric heating applications.

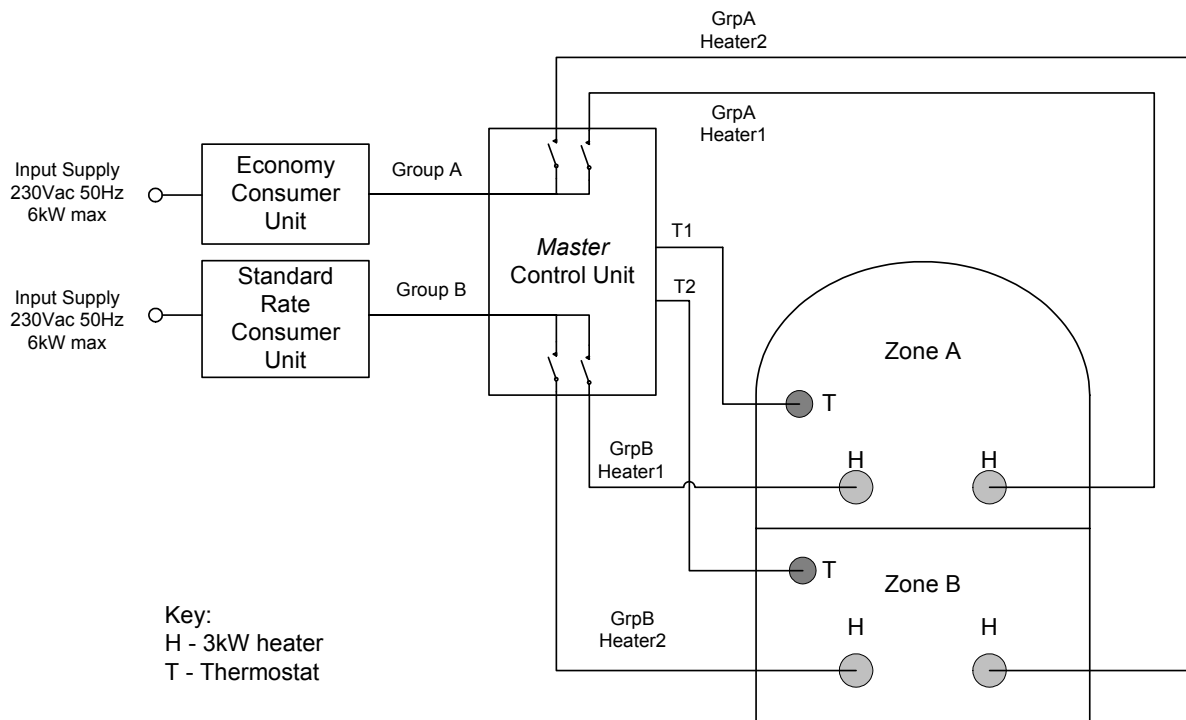
The *Master* provides connections for up to five 3kW immersion heaters. These are implemented as two isolated **groups** to allow for dual supply systems. The *Slave* has no integrated timer and is instead controlled by the *Master*. Each *Slave* provides connections for a further five 3kW immersion heaters arranged in two isolated **groups**. A maximum of three slave units can be used to create a system that can control up to 20 heaters.

The timer provides four programmable time periods over 24hrs, one for the *Boost* (standard tariff) heaters and three for the *Economy* (low tariff) heaters. A manual boost function provides selection of 30, 60 or 120 minutes duration for the *Boost* heaters.

The MCT₅₀ provides a great deal of flexibility in system configuration which may include the following functionality:

- Dual (Economy and Standard tariff) or single metered supplies.
- Economy Supply sensing in a remote tele-switch (RTS) meter setup.
- Intelligent heater control such that only one heater is turned on or off at a time, minimising large instantaneous loading of the input supplies.
- Over-heat thermostat input for tertiary level safety protection.
- One to three virtual heat **zones** within the cylinder.
- Water level input for low water level protection, including output contacts to control additional system components.
- Connection of a remote boost button (RBB).

The diagram below shows a typical small system configuration using a *Master* only. The cylinder is configured to have two virtual heat **zones**. It is a dual supply arrangement, with two 3kW immersion heaters on each:

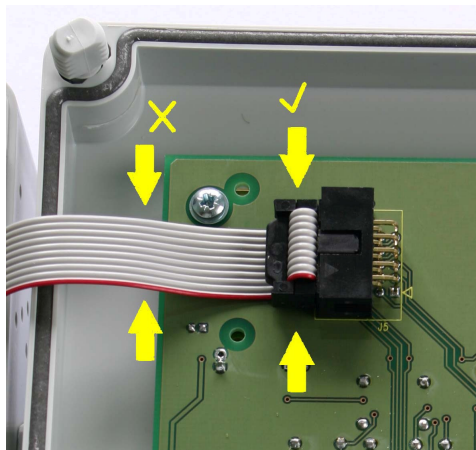


2. Specification

Purpose of control	: Sensing control
Classification	: Type 1.B Action, micro-disconnection on operation
Contact rating :	
-Heaters	: 230VAC Suitable for heating elements up to 3kW
-Level Sensor Output	: 230VAC 3A resistive / 3A inductive
Control power supply	: 230V AC 50Hz 4W
Load power supply	: 230V AC 50Hz 1 x 9kWmax and 1 x 6kWmax
Boost duration	: 30, 60 and 120 min
RBB duration	: 60 min
Operating temperature range	: 0°C to 40°C
Control pollution situation	: Pollution degree 2
Shock protection	: Class II
Rated impulse voltage	: 4000V
Ball pressure test	: 75°C
Enclosure protection	: IP30
Contacts	: Micro-disconnection
Construction	: Independently mounted control for surface mounting
Case material	: Flame retardant high impact Polystyrene (HIPS)
Weight	: Master 1.2 kg; Slave 1.0kg
Overall Dimensions	: Width 220mm (including cable glands) Height 254mm Depth 63mm
Mounting	: Surface mounting

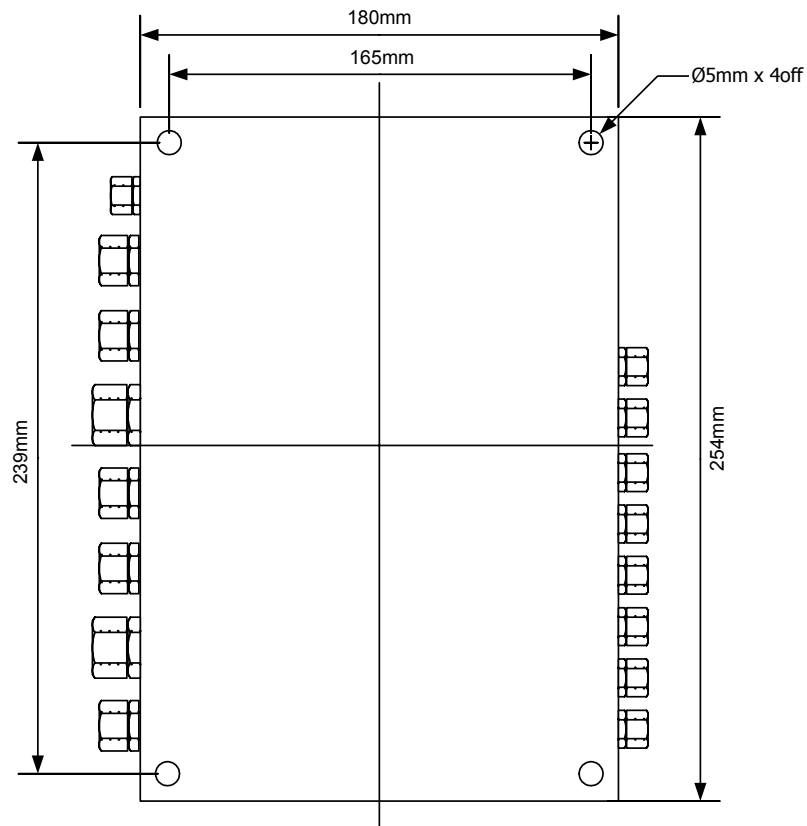
Warning - Installation and connection should only be carried out by a suitably qualified person and in accordance with the current edition of the IEE wiring regulations. Isolate all mains supplies before commencing installation or maintenance.

Caution – Installation and connection requires that the enclosure lid is removed (using a suitable tool). The *Master* lid is also attached via the Timer control cable, which may be disconnected at the printed circuit board (PCB). To disconnect, ensure the connector is pulled away by gripping the plastic housing and not the cable itself.



3. Installation

3.1. Mounting



Fix each unit securely in place using the 4 off 5mm dia. mounting holes in the enclosure. The mounting holes are located directly behind the enclosure lid screws. The drawing above shows the location and fixing centres of the holes.

The MCT₅₀ system components should be located in close proximity to the cylinder or thermal store in a position where it will remain dry. Each component should be mounted on a suitable solid surface (e.g. wall or metal plate), however ensure that:

- the mounting surface is flat to avoid distortion of the case.
- clearance is provided for mounting the enclosure and that there is sufficient access for wiring to the unit.
- ensure a minimum of 50mm free air space around each component (excluding the rear face). Do not mount directly to any heat source.
- avoid tight radius bends on all external cables to the unit.

3.2. Connections

3.2.1 Heater and Control Supply Connections

The connection of the *Master* and *Slave* heater supplies, to the power distribution equipment, is dependent on the required system configuration. As such it is the responsibility of the system designer and the installation engineer to ensure that the installation wiring and associated switchgear is arranged logically for the intended application. There are no requirements for any particular group of heaters to be connected to a specific supply (standard or economy).

The *Master* and *Slave* units utilise the same base PCB design. As such the input supplies and heater connections are the same on both products.

The heaters are divided into groups as shown below.

- *Master* Group A – 3 x 3kW heaters
 Group B – 2 x 3kW heaters

- *Slaves* Group C,E,G – 3 x 3kW heaters (per slave)
 Group D,F,H – 2 x 3kW heaters (per slave)

Each heater **group** in the MCT₅₀ system is electrically isolated. At the end of this section Fig1 and Fig2 show schematics of the group arrangement.

The supply circuit for each heater **group** should have an independent connection to the power distribution equipment and be protected by a suitably rated HRC fuse or circuit breaker. An appropriately rated isolation switch (minimum contact air gap of 3mm) should be used close to the control.

Three-core cable should be used for the 3kW heater connections, with a minimum conductor size of 1.5mm² for a 2KW heater or 2.5mm² for a 3KW heater. For 6kW and 9kW mains supplies, three core cables should be used, with a minimum conductor size of 4.0mm² and 6.0mm² respectively. All cables should pass through the cable glands provided and be secured on completion of wiring.

Note. All MCT₅₀ system components (Master and Slaves) must be powered from a single independently fused and switched supply which is not derived from the heater circuits. This will allow the controller(s) to operate during programming with the heater supplies switched off for safety. The supply must also always be present and cannot be powered by an externally switched economy supply.

Master and Slaves must be switched on simultaneously. This is important as the Master controller searches for the attached slaves at switch on. Failure to follow this procedure could cause communication problems between the MCT₅₀ system components.

Warning – each control unit is class II and as such has no provision for protective earth (PE). However provision is made within the units for common earth connections for earth continuity of each heater.

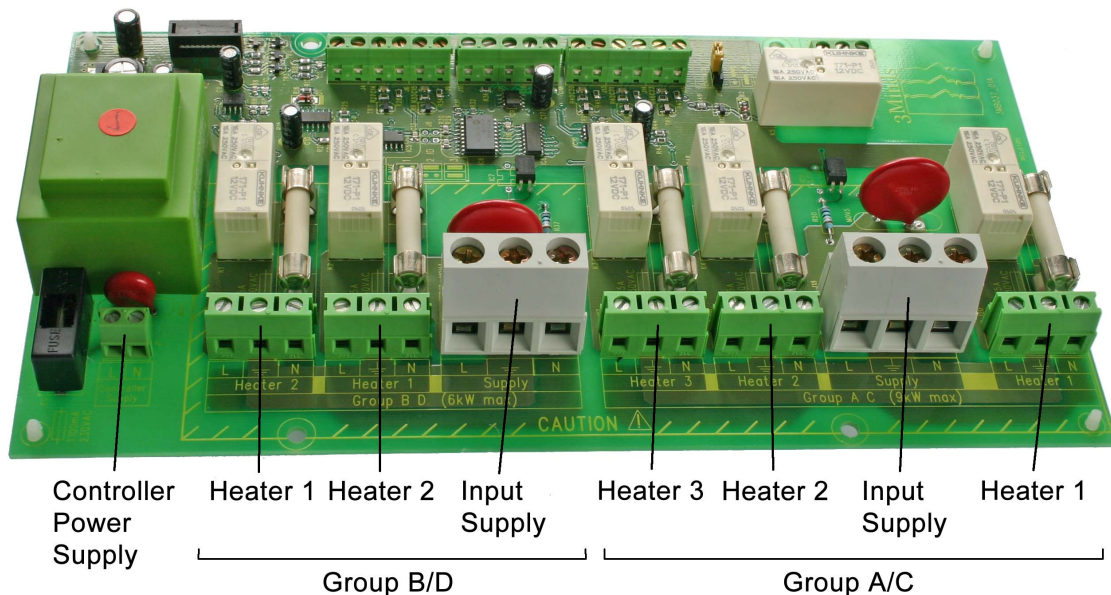
If a heater protective earth is joined through the control, the impedance of the PE conductor path must be tested during installation to ensure it does not exceed the specifications required.

The cables should be heat resistant to 85°C where applicable. The suggested conductor sizes provided should be checked by applying the relevant temperature de-rating factors for all cables used prior to selection and fitting.

Ensure all conductors are securely clamped in the connectors. Only a single cable must be used with each connector terminal. None of the terminals in the units are to be used as a wiring junction.

Poor cable connections can cause localised heating of the connectors and may result in damage to the unit.

Location of power connections inside *Master* and *Slave*:



Connections on Base Board (left hand side; top to bottom):

	PCB Connector	Fig1. Ref	Connection Description	Location
P w r	L	Lin1	Live IN terminal for Controller supply	J1 (Master & Slave)
	N	Nin1	Neutral IN terminal for Controller supply	
G r o u p B / D	Heater2 Lout	Lout2B	Live OUT terminal for Heater2 (Group B or D)	J3 (Master & Slave)
	Heater2 \perp	E2B	Common earth connection for earth continuity of Heater2 (Group B or D)	
	Heater2 N	Nout2B	Neutral OUT terminal for Heater2 (Group B or D)	
	Heater1 Lout	Lout1B	Live OUT terminal for Heater1 (Group B or D)	J5 (Master & Slave)
	Heater1 \perp	E1B	Common earth connection for earth continuity of Heater1 (Group B or D)	
	Heater1 N	Nout1B	Neutral OUT terminal for Heater1 (Group B or D)	
	Supply Lin	LinB	Live IN terminal for heater Group B or D – 6kW max	J7 (Master & Slave)
	Supply \perp	EB	Common earth connection for earth continuity of heater Group B or D	
	Supply N	NinB	Neutral IN terminal for heater Group B or D -	
G r o u p A / C	Heater3 Lout	Lout3A	Live OUT terminal for Heater3 (Group A or C)	J12 (Master & Slave)
	Heater3 \perp	E3A	Common earth connection for earth continuity of Heater3 (Group A or C)	
	Heater3 N	Nout3A	Neutral OUT terminal for Heater3 (Group A or C)	
	Heater2 Lout	Lout2A	Live OUT terminal for Heater2 (Group A or C)	J16 (Master & Slave)
	Heater2 \perp	E2A	Common earth connection for earth continuity of Heater2 (Group A or C)	
	Heater2 N	Nout2A	Neutral OUT terminal for Heater2 (Group A or C)	
	Supply Lin	LinA	Live IN terminal for heater Group A or C – 9kW max	J18 (Master & Slave)
	Supply \perp	EA	Common earth connection for earth continuity of heater Group A or C	
	Supply N	NinA	Neutral IN terminal for heater Group A or C -	
	Heater1 Lout	Lout1A	Live OUT terminal for Heater1 (Group A or C)	J20 (Master & Slave)
	Heater1 \perp	E1A	Common earth connection for earth continuity of Heater1 (Group A or C)	
	Heater1 N	Nout1A	Neutral OUT terminal for Heater1 (Group A or C)	

3.2.2 Control Sensors Connections

All control sensor connections are isolated from the mains and will exhibit a maximum of 12 volts DC on any terminal. The control cables should not be run in parallel with mains conductors which would increase the chances of inducing mains borne interference in the sensor circuits.

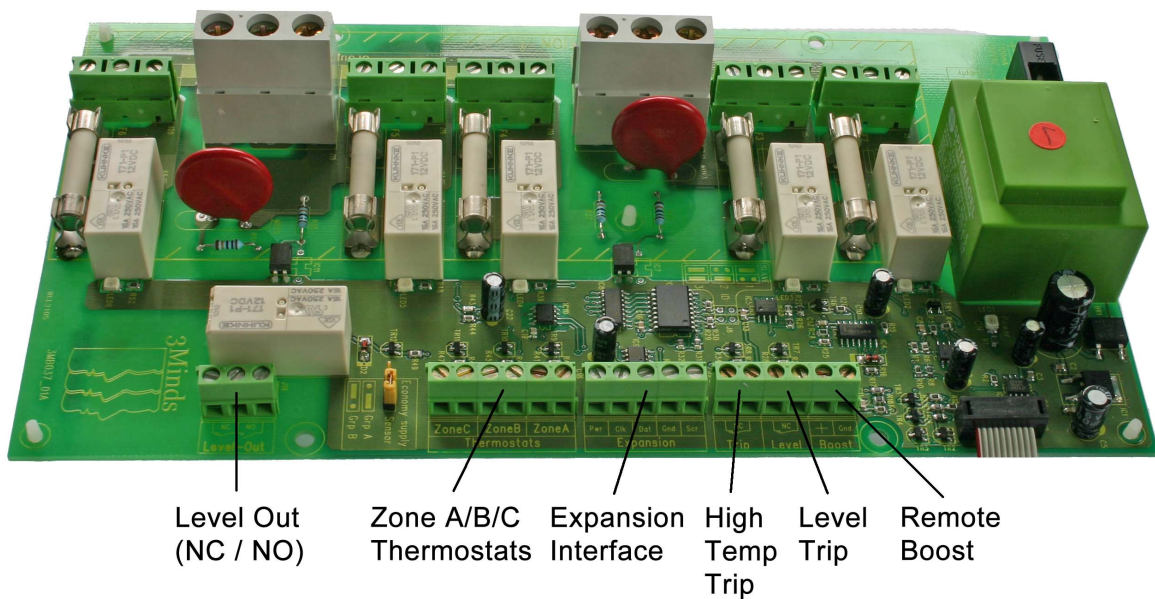
The Level trip device along with the zone and trip thermostats should have volt-free contacts and can be wired without considering any polarity.

The Remote Boost Button (RBB) should be connected using a two core cable. The polarity of the connections is very important for correct operation of the button's indicator. The RBB and Master PCB's have references to aid correct wiring. If the Boost switch cable is long it is important that it is run away from any mains cables to avoid false operation.

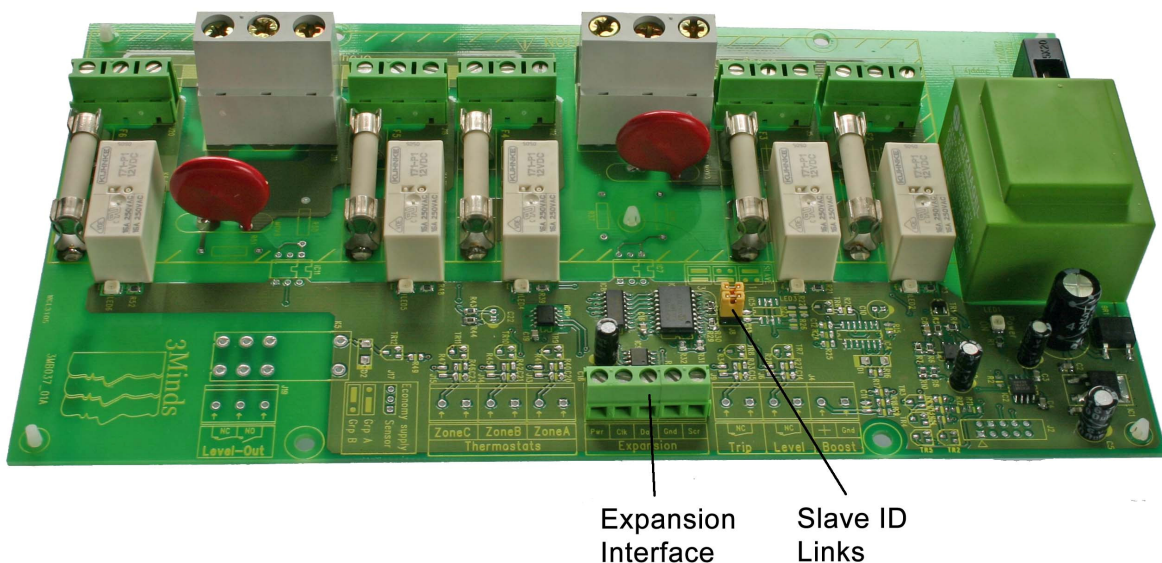
The *Slave* units have no sensor control connections (i.e. thermostats, remote boost button, level sensor or level output). They do have an expansion connector which provides communication with the *Master* unit.

Note: Four-core screened cable should be used for the interface between the *Master* and *Slave* units. A separate connector is provided to terminate the screen at the expansion connectors on each unit.

Location of control connections inside the *Master*:



Location of control connections inside the *Slave*:



Control Connections on Base Board (right hand side; top to bottom):

Note: The slave unit only has the Expansion connections fitted.

	PCB Connector	Fig1. Ref	Connection Description	Location
B o o s t	Gnd	R2	Remote boost switch Gnd return	J4 (Master Only)
	+	R1	Remote boost switch input. <i>Note this is only intended for use with dedicated Boost switch.</i>	
L e v e l	Level	L1	Level sensor input terminal pair (no polarity)	J6 (Master Only)
	Level	L1	<i>Level switch should have normally closed volt-free contacts.</i>	
T r i p	Trip	O1	Over temperature trip terminal pair (no polarity)	J9 (Master Only)
	Trip	O1	<i>Trip switch should have normally closed volt-free contacts.</i>	
E x p	Scr (Screen)	E5	Dedicated expansion interface between <i>Master</i> and <i>Slave</i> . (A screened 4 way cable should be used.)	J10/11 (Master & Slave)
	Gnd	E4		
	Dat	E3		
	Clk	E2		
	Pwr	E1	<i>Not used for a Master only system.</i>	
T S t a t s	ZoneA	T1	Zone A thermostat terminal pair (no polarity) <i>Stat should have normally closed volt-free contacts.</i>	J13 (Master Only)
	ZoneA	T1		
	ZoneB	T2	Zone B thermostat terminal pair (no polarity) <i>Stat should have normally closed volt-free contacts.</i>	J14 (Master Only)
	ZoneB	T2		
	ZoneC	T3	Zone C thermostat terminal pair (no polarity) <i>Stat should have normally closed volt-free contacts.</i>	J15 (Master Only)
	ZoneC	T3		
L O u t	NO	S2	Level sensor output, normally open contact	J19 (Master Only)
	Common	SC	Level sensor output, common contact	
	NC	S1	Level sensor output, normally closed contact	

Fig1. Master Unit Wiring Schematic

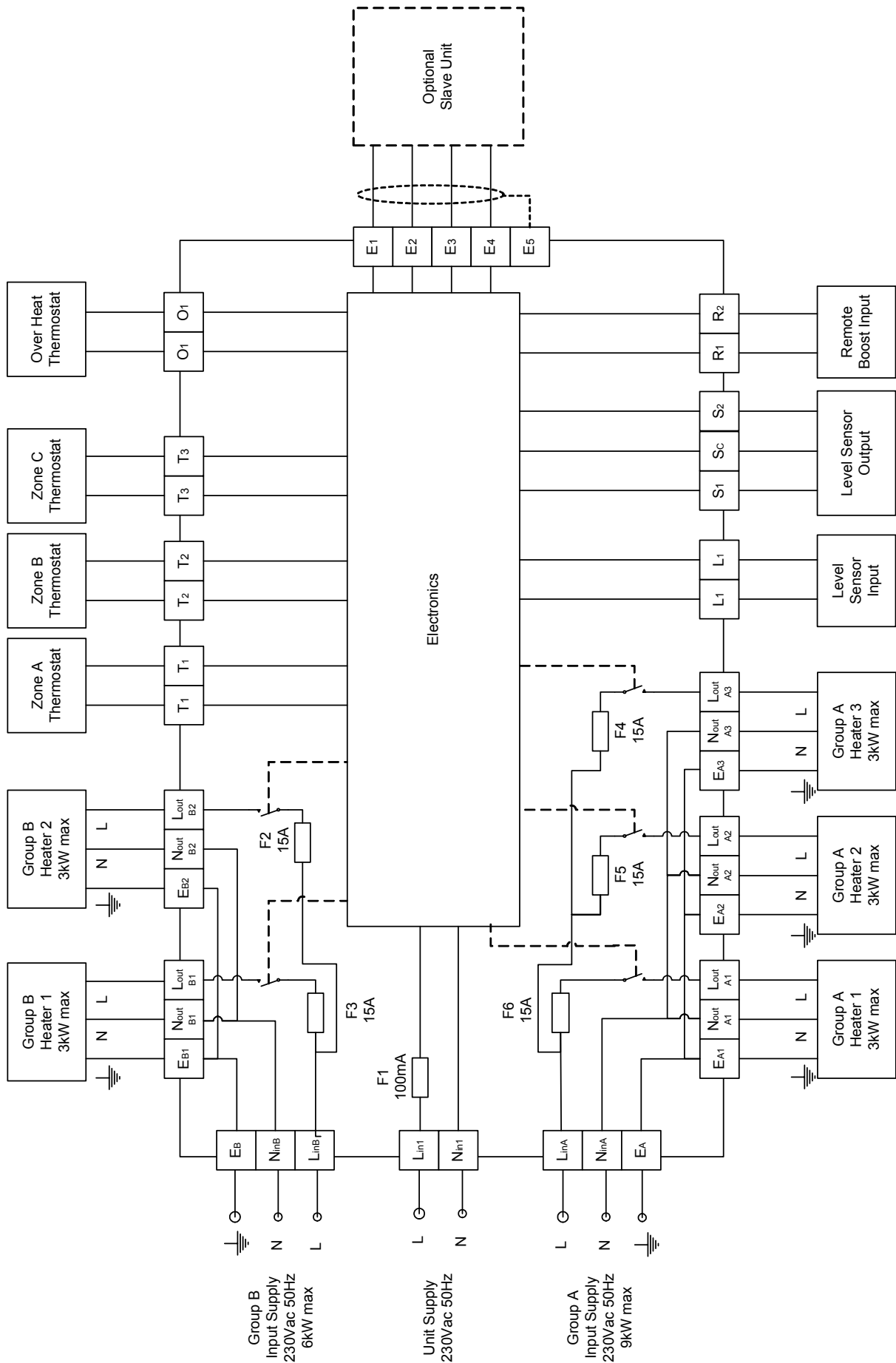
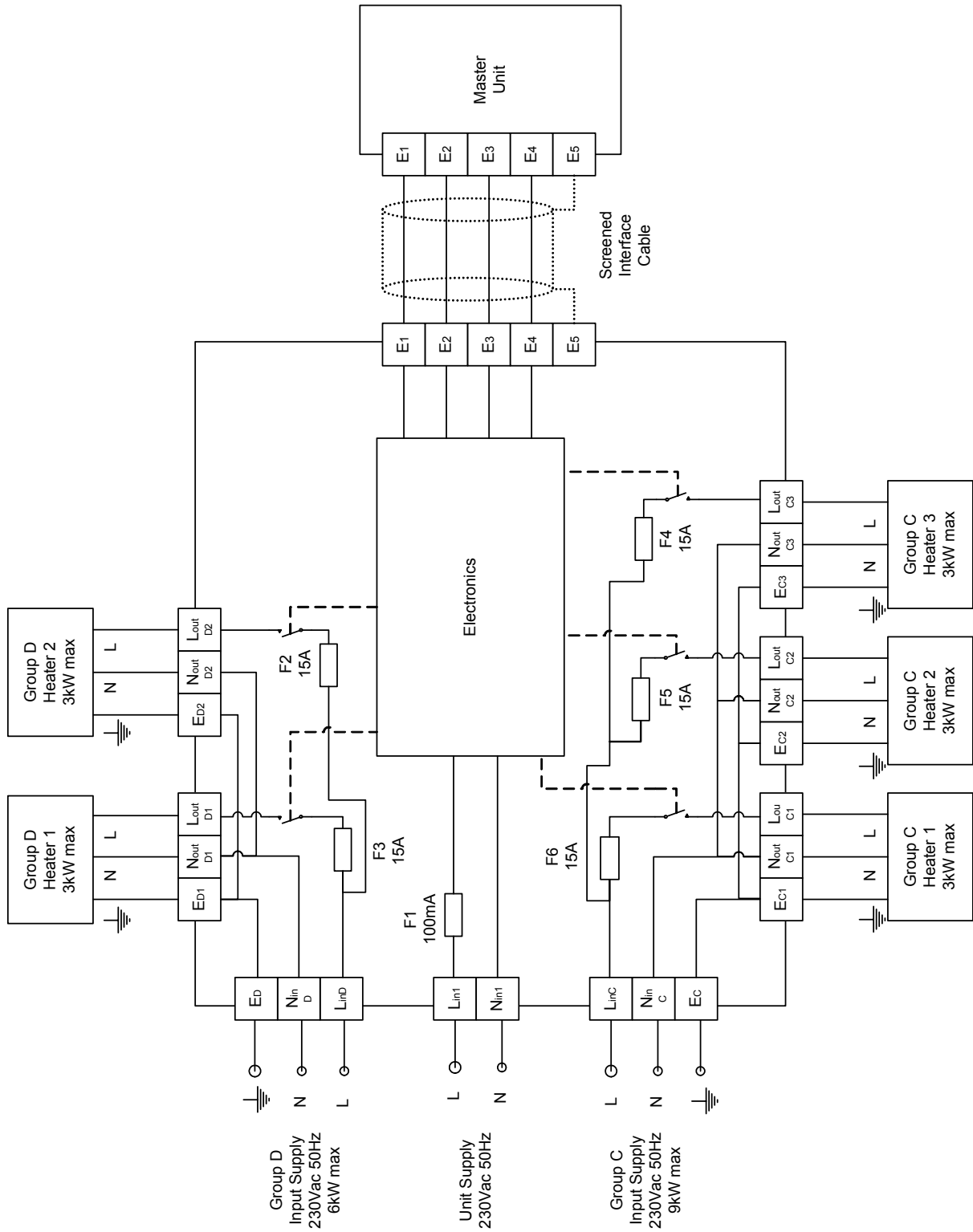
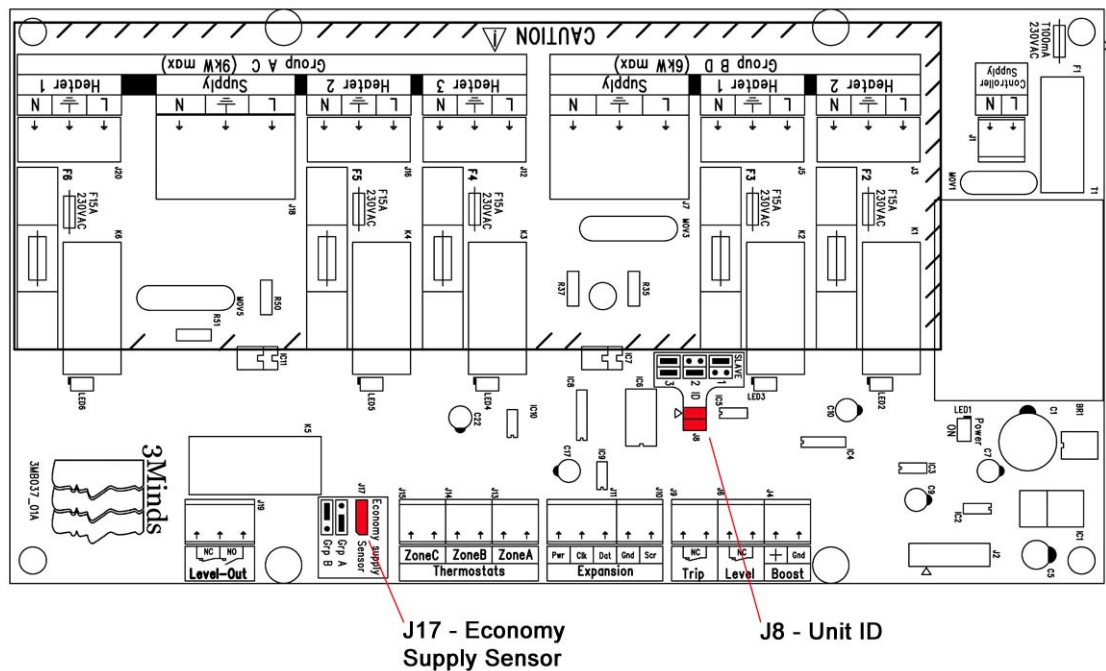


Fig2. Slave Unit Wiring Schematic



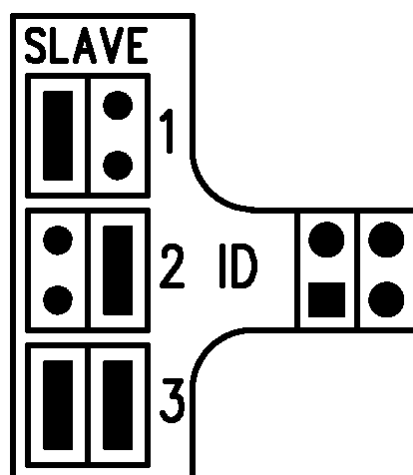
3.3. Configuration

The locations of the configuration links on the Controller PCB are shown below:



3.3.1. Unit ID (Slave only)

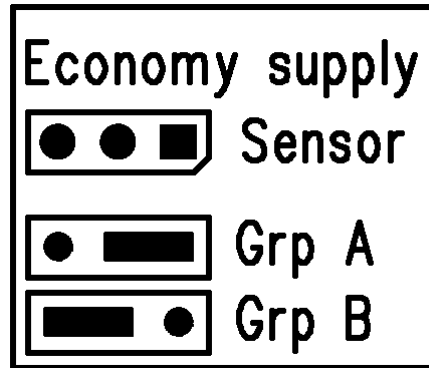
Each Slave in the MCT₅₀ systems must have a unique ID. The Slaves have two links for the ID configuration. The ID must always be set to lowest available ID, beginning at 1. ID's must be used consecutively for the Master to identify all Slaves correctly. E.g. If two slaves are being used ID's 1 and 2 must be used. The PCB has a key showing how to set the ID.



3.3.2. Economy Supply Sensor (*Master only*)

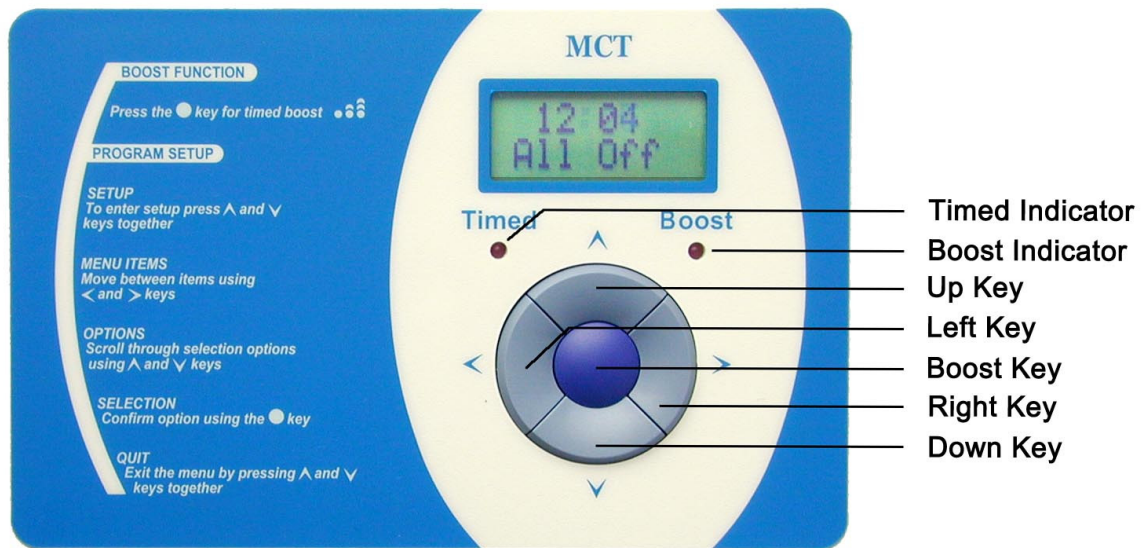
When the system is used with a remote tele-switch (RTS) meter, the 3-pin economy supply sensor link is used to determine which input power supply (Group A or B) is monitored for economy supply detection.

The PCB has a key showing how to select which supply is monitored.



The Economy Select link is only functional when the **RTSmeter** item in the **Engineers** Menu is set to **yes**.

4. Operating Instructions



4.1. General Use

The *Master* provides a 2 line by 8 character display and two LED's to show system status. The display is used to show the operating status of the controller in **Status** display mode and is also used to show configuration information whilst in either the **Users Menu** or **Engineers Menu**.

Five keys are also provided below the display. Left and Right keys are used to traverse menu items. Up and Down keys scroll through selection options and a Boost key which is used to select items and provide the boost function.

The *Master* has three display modes:

Mode	Description
Status display	Standard display mode
Users Menu	Used to configure the basic settings generally required by the user
Engineers Menu	Used to configure system settings, generally only done by the engineer during installation of the controller

4.2. General Functionality

The *Master* normally operates in **Status** display mode. In this mode the first line of the display shows the current time, whilst the second line displays status messages.

The following table lists the status messages that the *Master* may display:

Status	Display	Description
Boost Status	BoostOff	Boost heaters off
	Boost On	Boost Timer active
	BoostXXX	Manual Boost on for 'xxx' remaining minutes
Economy Timers Status	All Off	Run mode is set to All Off
	Econ Off	All economy timers are off
	Econ On	One or more economy timers are on
Day	Saturday	Current day
Date	1st Jan	Current date

Note: **Run** mode is set in the **Users Menu**.

Under certain conditions both display lines will be used to inform the user of the controller's status:

Condition	Display	Description
Setting Boost period	Boost! OFF	HW Boost heater off
	Boost! ON 30	HW Boost heater on for 30 minutes
	Boost! ON 60	HW Boost heater on for 60 minutes
	Boost! ON 120	HW Boost heater on for 120 minutes
Boost timer active	Timed Boost on	Boost timer is on. Boost button is disabled.
Economy preference on	Economy Active!	Economy timer is on and Boost heaters are disabled.
Level sensor tripped	WARNING! Level . sens. tripped.	Level sensor tripped. Water level has fallen below minimum level.
Over Temp tripped	WARNING! Over . temp. tripped.	Safety thermostat tripped. Water temperature exceeds safe level.
Communication fault	WARNING! Comms. error. Reset?	Temporary communication fault, will restart automatically after 30s.
Control fault	WARNING! Fault! . cycl e. power .	A system fault requires a power cycle of the <i>Master/Slaves</i> .
High ambient temperature	WARNING! Hi gh. Ambent. Reset?	Ambient temperature has exceeded safety limit.

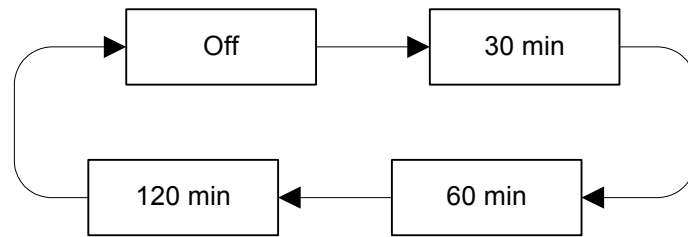
In addition to the display, two LEDs labelled 'Timed' and 'Boost' provide status information. The 'Timed' LED is on when any of the Economy timers are on. The 'Boost' LED is on when the Boost timer or the manual boost is on.

4.2.1. Boost Rundown Timer

The Boost heater/s may be turned on for a number of fixed time periods using the Boost button. The controller's **Run Mode** must be set to either Economy (**EconOnly**) or Economy & Boost (**Econ+Bst**) to use the Boost function. The Boost button is disabled whilst the daily Boost Timer is on.

To set the Boost duration:-

Each press of the Boost Button will change the time period to the next available setting as shown below.



After each Boost key-press the display will briefly show the duration period set. The display will then revert back to showing the standard status messages. The boost function can be cleared at a later time by a single press of the Boost button.

During the rundown period the *Master* will display the time remaining, in minutes, before the Boost heaters are turned off. If the optional Remote Boost Button is connected it will also be illuminated to indicate an active manual boost period.

4.2.2. Remote Boost Button



In addition to the front panel Boost control, the *Master* also allows the connection of a dedicated Remote Boost Button (RBB).

The RBB can be mounted in a more convenient position away from the MCT₅₀ system and uses a simple 2-wire cable (low voltage).

The RBB turns on the Boost heater/s for a fixed time period of 60 minutes. Whilst the manual boost is active the RBB will be illuminated and pressing the button will cancel the boost period. The boost period may also be cancelled using the Boost control on the *Master* unit.

The RBB will flash to indicate fault conditions e.g. Over temperature or Level sensor trip. Note also that the button is faintly lit when the manual boost is not set which shows the RBB has been installed correctly and can be useful in locating it in low light conditions.

4.2.3. Over Temperature Trip

The *Master* has provision for an Over temperature trip input. This may be used as a tertiary level safety feature to prevent the water temperature in the cylinder from exceeding a maximum level.

In an Over temperature condition the Controller will turn off all the heaters until the fault condition has been resolved. A status message is displayed and both LEDs will flash alternately during the fault condition. The RBB will also flash to help draw attention to the fault condition.

When the fault condition is removed, any timers (Economy or Boost) still active will have their heaters turned back on. However a manual boost period active at the time of the fault will be cleared.

Note: The Over temperature sensor must have volt-free contacts which are closed during normal conditions. If no sensor is fitted then the input terminals (O₁) must be linked together.

4.2.4. Level Sensor

The *Master* has provision for a Level sensor input. This may be used as a safety feature to prevent the heaters operating while the water level in the cylinder is below a minimum level.

In the tripped condition the Controller will turn off all the heaters until the fault condition has been resolved. A status message is displayed and both LEDs will flash simultaneously during the fault condition. The RBB will also flash to help draw attention to the fault condition.

When the fault condition is removed, any timers (Economy or Boost) still active will have their heaters turned back on. However a manual boost period active at the time of the fault will be cleared.

Note: The Level sensor must have volt-free contacts which are closed during normal conditions. If no sensor is fitted then the input terminals (L₁) must be linked together.

4.2.4.1. Level Sensor Output

The Level Sensor output follows the Level sensor input status and provides a set of volt-free contacts suitable for use with external auxiliary equipment.

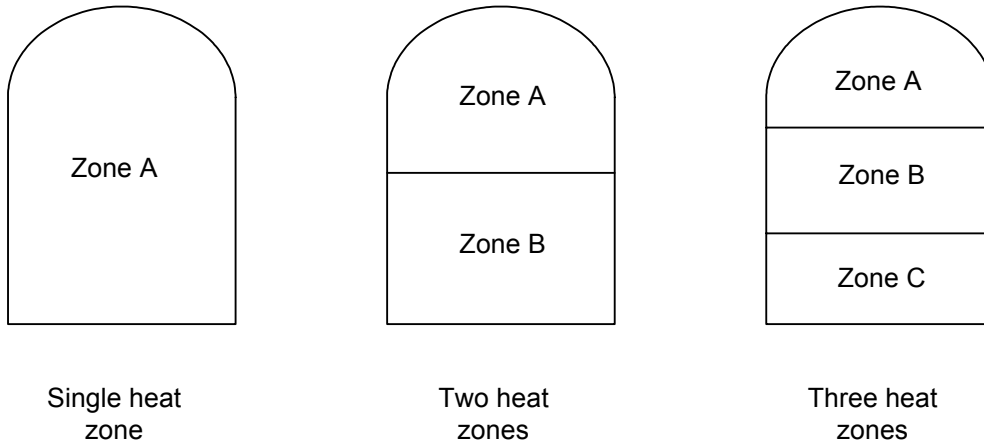
The circuit is rated at 3A resistive / 3A inductive 230VAC.

The Level Sensor output provides a set of changeover contacts:

PCB reference	Description
NC	Normally closed contacts whilst water level OK
NO	Normally open contacts whilst water level OK

4.2.5. Thermostat Inputs

The *Master* has provision for 3 thermostat inputs (Zone A, B and C), which enable the cylinder to be divided virtually into 1, 2 or 3 **heat zones**:



The functionality of the **zone** thermostats is determined by the **Sequence** item in the **Engineers Menu**.

When in normal mode each zone is controlled independently by its **zone** thermostat. In sequence mode only one **zone** is active at a time, with A having the highest priority followed by B and then C. When the zone A thermostat is satisfied, zone B will become active. Similarly when the zone B thermostat is satisfied, zone C will become active. Sequence mode is enabled by setting the **Sequence** item in the **Engineers Menu** to **Yes**

Note: Each of the Zone thermostats must have contacts which are normally closed when calling for heat. For unused zones the thermostat input terminals must be linked together.

4.3. Configuration

The system settings which determine operation are configured using the menus; **Users Menu** and **Engineers Menu**. Once in either of these menus, the four cursor keys together with the Boost key are used to review and revise the settings.

The left and right cursor keys are used to traverse across the menu items and sub-menu items (where applicable).

The Boost key is used to view a menu item and it is also used to select sub-menus (where applicable).

When a menu item is viewed the current option setting will appear, flashing on the first line of the display. The second line of the display will show descriptive text for the item. The up and down cursor keys are used to scroll through the selection options available.

To select an option, press the Boost key. After selecting an option, the next item in the menu or sub-menu will be displayed.

At any time whilst viewing the menus, pressing the up and down cursor keys simultaneously will exit the menu, and place the controller back in **Status** display mode. Any changes made to options prior to exiting will be implemented.

Whilst in either of the menus, if no keys are used for a period of approximately 30 seconds, the menu will automatically exit back to **Status** display mode. Again any changes made to options prior to exiting will be implemented.

4.3.1. Setting Time Items

Within the **User** and **Engineer** Menus several items require a 'time' to be entered instead of scrolling through selection options. The same procedure is used for setting the **Clock** time and the On and Off times for the Boost timer and Economy timers.

On selecting a specific time setting from the menu with the Boost key, the display shows the current time setting on the first line. The hour digits will be flashing to show they are the current item. The second line will indicate this by displaying 'Hrs'.

The Up and Down cursor keys are used to increment or decrement the digits. N.B. holding either key down will cause the numbers to autoscroll.

Use the Left and Right cursor keys to select between the hours and minutes. When the minutes are the selected item, the minute digits will be flashing. The second line will indicate this by displaying 'Mins'.

To confirm the entered time setting, press the Boost key. Once confirmed the next item in the menu or sub-menu will be displayed.

At any time pressing the up and down cursor keys simultaneously will exit from the menu and place the controller back in **Status** display mode. Any changes made to the time setting will **not** be saved.

4.3.2. Users Menu

The **Users Menu** is used to configure the settings that may require changing by the end user. The items contained in this menu are as follows:

Item	Description
Run Mode	Determines which timers will be operational
Clock	To set the current date and time
BoostTmr	To set the Boost timer ON period
Exit	Exit Users menu and place controller back in Status mode

Refer to Fig3. for the complete structure of the **Users Menu**.

To enter the **Users Menu**, press the up and down cursor keys simultaneously.

4.3.2.1. Run Mode

Run Mode determines which timers are operational:

Run Mode	Description
All Off	Disables all the timers
EconOnly	Only the Economy timers (Timer 1, 2 and 3) are functional
Econ+Bst	All timers are functional (Economy and Boost)

4.3.2.2. Clock

The item **Clock** is used to set the controller's date and time.

The item **Set Date** is used to set the calendar (date, month and year). The controller automatically switches between GMT and BST at the appropriate date and time, and also automatically compensates for leap-years up to the year 2099.

The item **Set Time** is used to set the controller's clock.

4.3.2.3. Boost Timer

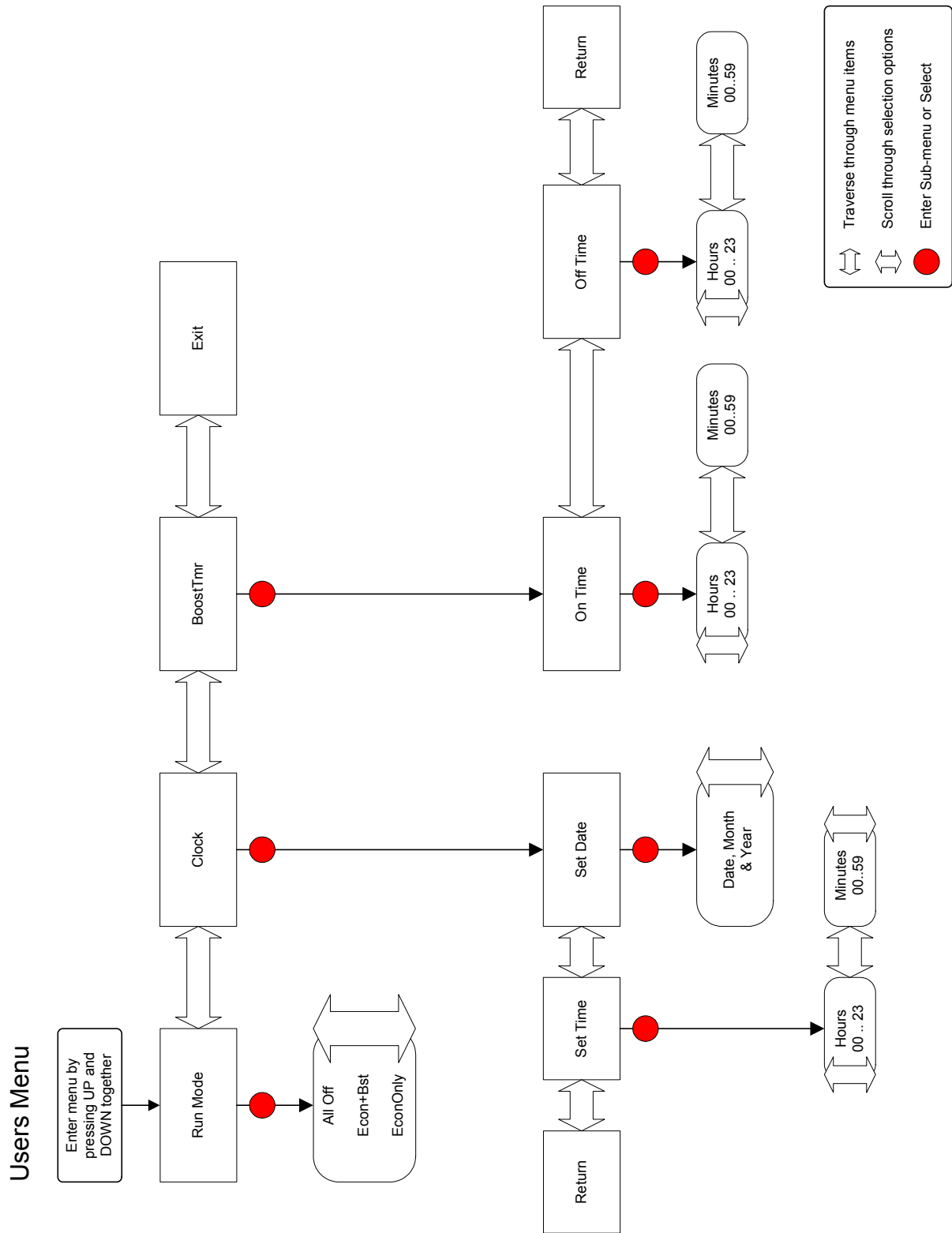
The item **BoostTmr** is used to set the on period for the Boost timer. The on period is defined by setting the **On Time** and **Off Time**. The heaters controlled by the Boost timer (and also the manual boost buttons) are determined by the item **Zones -> Boost** in the *Engineers Menu*.

Note that the ON time period is disabled by setting the **On Time** and **Off Time** to exactly the same time.

4.3.2.4. Exit

The item **Exit** returns the controller back to **Status** display mode.

Fig3. Users Menu Structure:



4.3.3. Engineers Menu

The **Engineers Menu** is used to configure settings that are generally changed during installation of the system. The items contained in this menu are as follows:

Item	Description
Presets	Allows selection of 8 pre-defined configurations.
Zones	Used to allocate heaters to each of the Economy and Boost heat zones
Control s	Used to set the control options (Sequence , EconPref and RTSmeter)
Tari ff	Used to preset the settings of the Economy timers
Ti meBase	Sets time zone settings for the Economy timers
EconTmr 1	Sets the Economy Timer 1 on period
EconTmr 2	Sets the Economy Timer 2 on period
EconTmr 3	Sets the Economy Timer 3 on period
BoostTmr	Sets the Boost timer on period
Exi t	Exit Engineers menu and place controller back in Status mode

Refer to Fig4. for the complete structure of the **Engineers Menu**.

To enter the **Engineers Menu**, press and hold the left and right cursor keys simultaneously until the display changes and shows the controller's software version. Pressing the Boost key immediately will then bring up the menu.

Note On entering the **Engineers Menu** the **Run Mode** is set to **AI I Off**, which disables all the timers and ensures no heaters are unintentionally turned on whilst the unit is being configured. On exit from the **Engineers Menu** the **Run Mode** will remain set to **AI I Off**.

Note If the item **RTSmeter** is set to **yes** menu items **EcoTmr 1**, **2** and **3** are not available as they no longer affect the operation of the **Economy** heaters.

4.3.3.1. Presets

The **Presets** item may be used within the **Engineers Menu** to quickly set up all the controller settings to known base values.

Once the general controller items have been set using **Presets**, any item may be revised using the specific item menu.

On re-entry into the **Presets** item after any of the individual controller setting are modified the display will show **Custom** to indicate settings have been changed. Selection of a preset (**Config1 - Config7** or **Custom**) will once again reset all the controller settings back to known values.

The controller settings for the 8 presets available are as follows:

Setting		Preset							
		Custom	Config1	Config2	Config3	Config4	Config5	Config6	Config7
Zones: Economy (Economy timers)	Zone A	-	A1	-	-	-	-	A1	A1
	Zone B	-	A2	A1	A1,A2, A3	A1,A2	A1,A2	A2,A3	A2
	Zone C	-	-	-	-	-	-	-	A3
Zones: Boost (Boost timers)	Zone A	-	A1	B1,B2	B1	B1,B2	B1,B2	B1,B2	A1
	Zone B	-	A2	-	-	-	-	-	A2
	Zone C	-	-	-	-	-	-	-	A3
Sequenece	yes	yes	no	no	no	no	no	no	yes
EconPref	yes	yes	no	no	no	no	no	no	yes
RTSmeter	no	no	no	yes	no	yes	yes	yes	no
Tari ff	none	E7	E7	none	E7	none	none	none	E7
Ti meBase	GMT	GMT	GMT	GMT	GMT	GMT	GMT	GMT	GMT

4.3.3.2. Zones

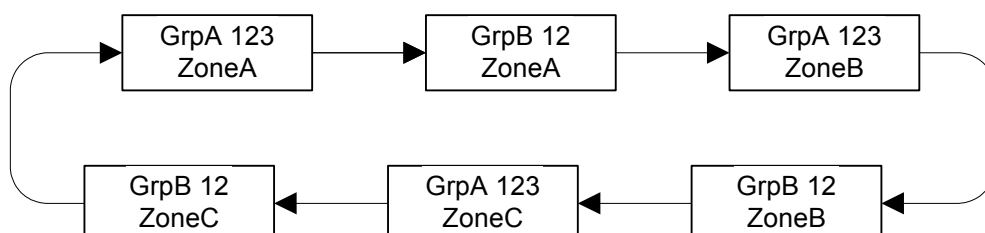
Within the **Engineers** Menu the **Zones** item allows both Economy and Boost zones to be setup. The items **Economy** and **Boost** allow heaters to be allocated to each of the heat zones (Zone A, B and C).

The heaters are selected from all of the available **groups**. For a *Master* only system this would be Group A and B, and for a *Master* and 1 *Slave* this would be Groups A – D.

On selecting either **Economy** or **Boost**, the first line of the display shows the **group** from which the heaters are being selected. The heater1 digit will be flashing to show it is the current item. The second display line will indicate the current Zone.

The Up and Down keys are used to select a heater (indicated by the heater number) or clear the heater (indicated by '-').

Use the Left and Right keys to move between each of the heaters. As each heater becomes the current item, the digit will be flashing. The second line will continue to display the current Zone. Using the Left and Right keys also moves between each subsequent heater Group available. Shown below is the order of Groups for a Master only system:



Once the required combination of heaters has been selected, the settings are confirmed by pressing the Boost key. Once confirmed the next item in the menu appears.

At any time whilst in a zone setting, pressing the up and down keys simultaneously will exit from the menu, and place the controller back in **Status** mode.

4.3.3.3. Controls

Within the **Engineers** Menu the **Controls** item is used to configure three items; **Sequence**, **EconPref** and **RTSmeter** which are used to determine how the input power supplies, heaters and zone thermostats interact.

4.3.3.3.1. Sequence

The item **Sequence** determines the functionality of the Zone thermostats:

Sequence	Description
No	Each Zone thermostat controls the heaters allocated to its zone, with all the heat zones operating independently.
Yes (default)	Only one zone of heaters can be on at any instance.

Note The priority of the Zone thermostats is A > B > C when **Sequence** item is set to **Yes**

4.3.3.3.2. Economy Preference

The item **EconPref** determines the interaction of the Economy timers and Boost timer (and the manual boost):

EconPref	Description
No	The Economy and Boost timers operate independently. Heaters allocated to Economy and Boost zones may be on at the same time.
Yes (default)	An Economy timer has preference over a Boost timer (or manual boost period). Heaters allocated to Economy and Boost zones can not be on at the same time.

Note When **EconPref** item is set to **Yes** the Boost timer will be temporarily disabled whilst any Economy timer is on. When all Economy timers are off the Boost timer will be re-enabled.

If the manual Boost period is active when an Economy timer is turned on, the Boost will be cancelled.

4.3.3.3.3. RTS Meter Operation

The item **RTSmeter** is used for system configurations where a remote tele-switch (RTS) meter is used to provide the Economy supplies. In this situation the Economy timers are not used, instead the economy heaters are on whenever the Economy power supply is present.

RTSmeter	Description
No (default)	The Economy timers are used to determine when Economy heaters are on.
Yes	Economy heaters are on whenever Economy power supply is present.

Note that if the item **RTSmeter** is set to **yes**, the controller's Economy timers are not used, and the items **EcoTmr 1**, **EcoTmr 2** & **EcoTmr 3** are not shown in the **Engineers Menu**.

RTS sensing circuitry is only available on a *Master*. If the system uses a RTS meter, at least **group A** or **B** must be connected to the Economy supply.

4.3.3.4. Tariff

The item **Tariff** determines which set of pre-configured timer settings are used for the Economy timers. When an option is selected the Economy Timers 1, 2 and 3 will be set with the time periods shown in the following table:

Tariff	Timer	On Time	Off Time
Custom	Timer 1	00:00	00:00
	Timer 2	00:00	00:00
	Timer 3	00:00	00:00
Econ 7	Timer 1	00:00	07:00
	Timer 2	00:00	00:00
	Timer 3	00:00	00:00
Econ 10	Timer 1	00:00	05:00
	Timer 2	13:00	16:00
	Timer 3	20:00	22:00
Econ 10L *	Timer 1	02:30	07:30
	Timer 2	14:00	16:00
	Timer 3	19:30	22:30
Econ 10S **	Timer 1	04:30	07:30
	Timer 2	13:00	16:00
	Timer 3	20:30	00:30

* **Econ 10L** – London Electricity

** **Econ 10S** – Scottish Hydro.

Once the ON periods have been set using **Tariff**, the specific on and off times of any of the Timers may be revised using the specific Economy timer menu item.

On re-entry into the **Tariff** item after any of the individual Economy timers are modified the display will show **Custom** to indicate timers have been changed.. Selection of a **Tariff** will once again set the Economy timers to the pre-configured settings.

Selection of **Custom** for the **Tariff** item will clear all the timers.

4.3.3.5. TimeBase

TimeBase determines how the entries in the Economy timers are interpreted with respect to the current time-zone (BST or GMT). The time-zone is calculated automatically from the controller's calendar.

TimeBase	Description
GMT only	The ON periods for the Economy timers will always operate with respect to GMT regardless of whether the clock is set to GMT or BST
Clock	The ON periods for the Economy timers will always be with respect to the current clock time

Note that the Boost timer settings are unaffected by the **TimeBase** and will always be with respect to the current clock time.

4.3.3.6. Boost Timer

The item **BoostTmr** is used to change the ON period for the Boost timer. The ON period is defined by setting the **On Time** and **Off Time**. The heaters controlled by the Boost timer are determined by the item **Zones -> Boost** in the **Engineers Menu**.

The factory default settings for this ON period are:

Boost Timer	On Time	Off Time
Factory default	14:00	19:00

Note that the on time period is disabled by setting the **On Time** and **Off Time** to exactly the same time.

This menu item is identical to **Boost Tmr** in the **User Menu**.

4.3.3.7. EcoTmr 1 / EcoTmr 2 / EcoTmr 3

EcoTmr 1, 2 and 3 determine the three independent on and off times for the Economy timers.

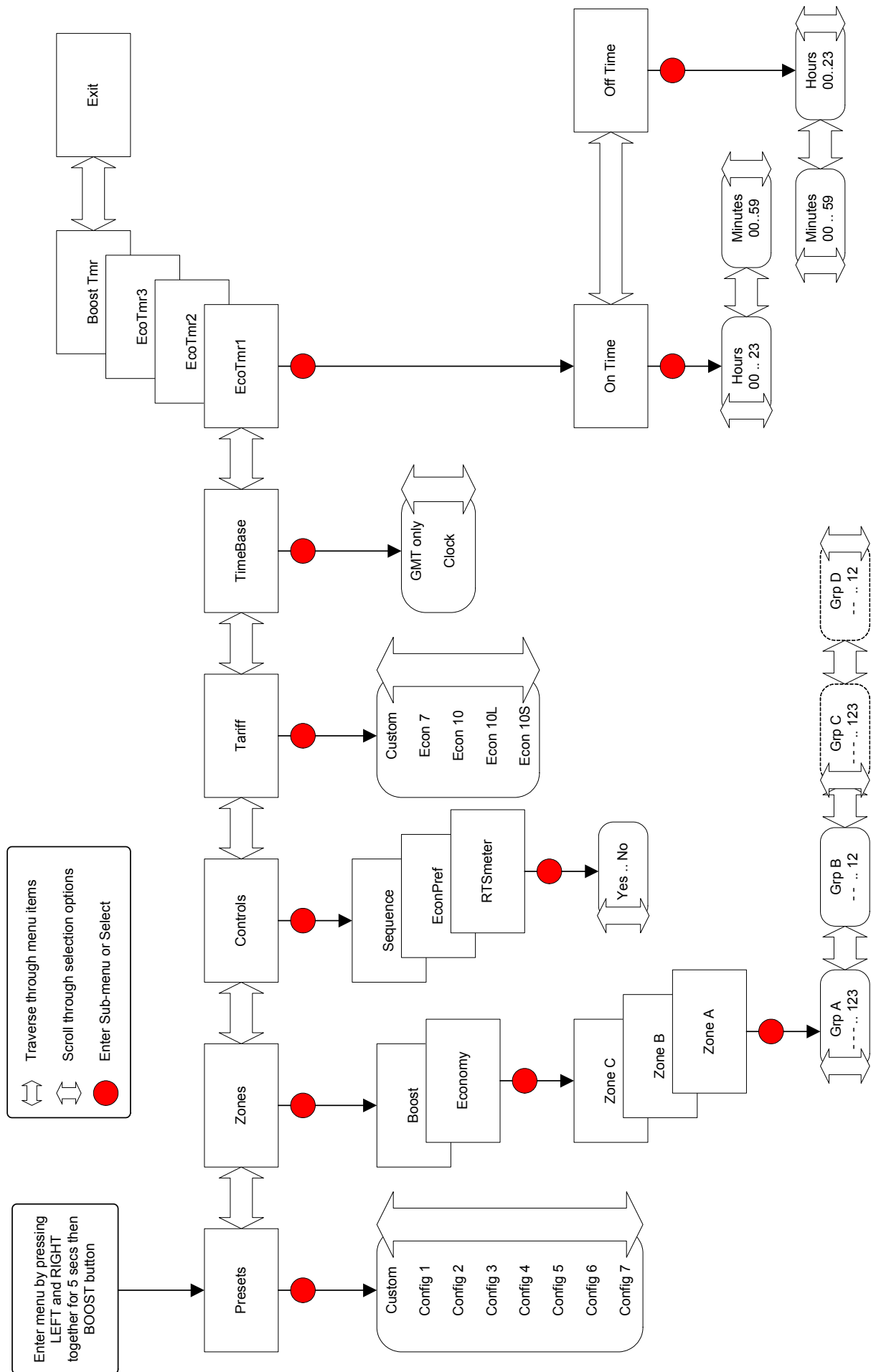
The on and off times for each Timer are preset when **EconMode** is used to select one of the default options, but can be adjusted to suit specific system requirements. The on period is defined by setting the **On Time** and **Off Time**. The heaters controlled by the timers are determined by the item **Zones -> Economy** in the **Engineers Menu**.

Note that the on time period for any particular timer is disabled by setting the **On Time** and **Off Time** to exactly the same time.

4.3.3.8. Exit

The item **Exit** returns the controller back to **Status** display mode.

Fig4. Engineers Menu Structure:



5. Diagnostics

Diagnostic features have been incorporated into the controller to help with the installation and configuration of a complete system.

5.1. Status Information

Whilst the Master unit is in **Status** display mode, system information may be accessed by pressing each of the cursor keys. When each key is held down the display will show the following information:

Key	Display	Description
Up	Master Temp 30c	The display will cycle, showing the internal temperature of each unit.
Right	Control s OT: LS: ES	Displays the status of the three control inputs: OT – Overtemp LS – Level sensor ES – Economy supply sensor
Down	Master A123 B12	The display will cycle, showing the output status of each heater in the system
Left	Tstat zA: zB: zC	Displays the status of the three thermostat inputs: zA – Zone A zB – Zone B zC – Zone C

5.2. Communication

In a Communication fault condition the Controller will turn off all the heaters until the fault condition has been resolved. The 'communication fault' status message is displayed and both LED's will flash alternately during the fault condition. The RBB will also flash to help draw attention to the fault.

If the fault is temporary, the controller will clear the communication fault itself and restore normal operation. The heaters will return to their previous state.

If the communication fault cannot be resolved, the 'control error' message is displayed and both LED's will continue to flash alternately. A system fault requires a power cycle of the Master/Slave units.

Provided the control units are installed and configured correctly, a communication fault should never occur. Possible reasons that may cause the fault are:

- Communications cable between Master and Slaves maybe damaged or incorrectly wired.
- Excessive levels of ambient electromagnetic interference, possibly due to non-compliant equipment in close proximity.

5.3. Internal Operating Temperature

If a high ambient temperature fault condition occurs, the *Master* will turn off all the heaters until the fault condition has been resolved. The 'high ambient temperature fault' status message is displayed and both LED's will flash alternately during the fault condition. The RBB will also flash to help draw attention to the fault.

The controller will not clear a high ambient temperature fault itself. To return to normal operation requires the Boost key to be pressed. This ensures that the fault has been witnessed by an operator. The fault can also only be cleared once the ambient temperature has returned to a safe lower level.

Provided the control units are installed and configured correctly, a high ambient temperature fault should never occur. Possible reasons that could cause the fault are:

- The system is being operated in an ambient temperature that is above the maximum specified.
- The unit is incorrectly mounted. The unit and or its ventilation holes are covered.
- The unit has been incorrectly or badly installed. Check that all wiring is correctly specified and that all cables are secure in connectors.

6. Repair and Service

The controller is NOT user serviceable.

Do not dismantle the controller.

In the unlikely event of a fault developing please contact your installer or qualified electrician.

The control unit is protected by an internal 100mA fuse. Under abnormal load conditions the fuse will blow and need replacing (230VAC T100mA).

The immersion heaters are protected by internal 15A fast acting ceramic fuses. In the event that one of these fuses blows, the reason should be investigated as an underlying problem may be overlooked. If the immersion heater is found to be in good working order and the wiring shows no sign of damage the fuse should be replaced with a new, identically rated, device. (230VAC F15A)

Notes:

Copyright © 2005 3Minds Limited.
All rights reserved.



3Minds Limited.
10 Ravensdale Close, 01922 626321
Walsall, 0870 706 2659
West Midlands, sales@3minds.co.uk
WS5 3PY. U.K. www.3mindscontrol.co.uk

CONTROLLING THE ELEMENTS, BY DESIGN.	IMMERSION HEATER TIMERS	IMMERSION HEATER CONTROLLERS	WATER FLOW CONTROLLERS
---	----------------------------	---------------------------------	---------------------------