Paladin Hot Water Diverter
User Guide

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Important Safety Information

All safety warnings give specific details of the potential danger/warning present and indicate how to reduce risk of injury, damage and electric shock resulting from improper use of the diverter. Carefully observe the following instructions:

- Installation and maintenance must be carried out by a competent person, in compliance with the manufacturer's instructions, the relevant wiring regulations and local safety regulations. If in any doubt, consult a qualified electrician.
- The diverter must be disconnected from the power supply before carrying out any installation work.
- The diverter must have adequate ventilation. The diverter must be installed in a vertical position.
- Regulations require that the diverter is earthed.
- Do not remove the diverter cover while the power supply is connected.
- Do not operate the diverter with the cover removed.
- Do not attempt to repair or replace any part of the diverter.
- Do not touch the diverter with any wet part of the body.
- All maintenance operations must be carried out by a qualified electrician.
- The diverter is not suitable for outdoor use.
- The manufacturer accepts no responsibility for any damage or injury caused by improper use or failure to comply with these instructions

Warranty & Disclaimer

Paladin has made every effort to ensure the accuracy of the content of this manual. However, it is possible that it may contain technical inaccuracies or typographical or other errors. Paladin will assume no liability for any inaccuracy found in this publication, nor for damages, direct, indirect, incidental, consequential or otherwise, that may result from such an inaccuracy. The information provided in this manual is subject to change without notice. Paladin reserves the right to alter product designs or specifications without notification.

Document Purpose

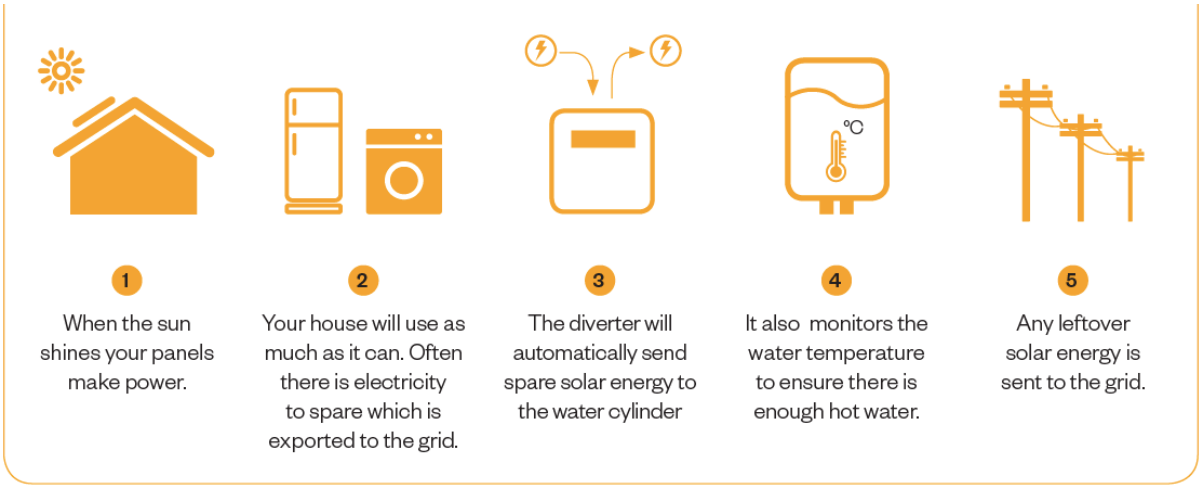
This document is intended to provide you, the end user, with an overview over the hot water diverter basic functioning and display settings and to summarise basic steps for in-home trouble shooting.

Background

The hot water diverter is designed to maximise the value of your solar system by capturing any excess solar power and diverting it to heat your hot water instead of exporting back to the grid.

The diverter watches the main power line on your home and instantaneously sends the exact amount of power that would have been exported, to your hot water cylinder using a solid-state relay. This allows power to be sent to the hot water cylinder at any rate from zero to the maximum rating of your cylinder element as opposed to the normal on/off that the hot water cylinder element would do. Essentially the diverter trickle feeds your hot water cylinder with electricity in direct proportion to the amount of excess solar power that is not being used by other appliances in your house.

Basic functioning of the hot water diverter



The hot water diverter is designed to re-direct solar power that would otherwise be exported to the grid into your hot water cylinder. This maximises the value of the power you generate through the solar system as you are using the hot water cylinder in a similar to a battery.

The hot water cylinder temperature is monitored to ensure that it never drops below a pre-set temperature. By default, this is 40°C, but it can be changed. If the hot water cylinder temperature drops below 40°C then grid power will be used to bring the water temperature back to the minimum temperature. Once it has reached the pre-set minimum, it will stop using grid electricity and watch for export electricity and then divert to the cylinder up to the maximum set temperature.

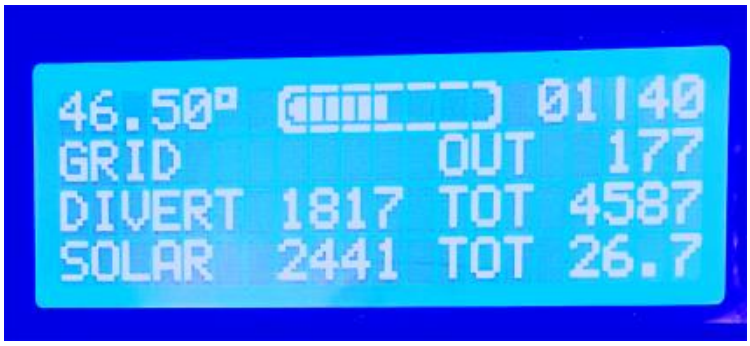
If you have a tempering valve in your plumbing system (which keeps the hot water coming out of your taps at a safe 55°C), the diverter will be pre-set to a maximum temperature of

78°C. If you don't have a tempering valve, the temperature will be set to 65°C. This level is required to ensure that Legionella bacteria does not grow in your cylinder. Additionally, all cylinders have an adjustable thermostat. At the time of installation, (if you have a tempering valve) your thermostat will be changed to an 80°C high temperature type and set to maximum. The thermostat is required as a mechanical backup to limit any over temperature situation that could damage the cylinder.

In general, the greater the difference between the minimum and maximum temperatures, the greater will be the savings, as this creates a wide margin for the diverter to operate within. However, this may not offer maximum comfort. For families with large hot water demands, especially in concentrated periods, setting the minimum temperature to a higher level, e.g., 50°C will likely yield better results. See *Minimum Temperature Settings* below…

Display explanations

The display for the diverter is not at all important for its correct operation, but there is a host of information there which can be useful.



Here is a brief summary of the display. The deeper explanation can be found below in the FAQs.

The overarching rules for this display are:

1. When there is nothing interesting to show, the associated line will be blank.
2. When there is no activity on that line, the line will show totals for the day so far if any.
3. There is no rounding or smoothing of data. Even the 'noise' is interesting (see FAQ).

The 4-line display can be best described line by line:

Line 1

To the left is the hot water tank temperature in degrees Celsius. If the Toggle Switch (see below) is in the left position the degree symbol is replaced by a + and if the Toggle switch is in the right position the degree symbol is replaced by a ^.

In the centre are terse words to indicate what is happening now apart from when the diverter is transferring excess solar, when this displays a 'throttle' graphic' to give sense of how hard the diverter is working. Other words that can be displayed in the centre of this line and their meanings are:

PALADIN	Diverter is in an idle state
SENSOR	Temp probe is faulty and not giving a valid reading
NO TEMP	Temperature probe is not fitted
ELEMENT*	Faulty cylinder element/thermostat or cylinder not reaching Minimum or Legionnaire's temperature during a grid top up cycle
MAXIMUM	Diverter has reached maximum temperature
TOP UP	Diverter is heating cylinder from Grid power
HEALTH	Diverter is doing a Legionnaire's top up from the grid
BOOST	Diverter is doing a night boost import from the grid
TO GRID	Power is being exported to the grid

* If ELEMENT is displayed, please see the ELEMENT is displayed in the top line section below.

On the right is the number of hours | minutes that more than 100W of transfer has taken place so far today.

Line 2

This is the Grid activity line. This line is always displayed and shows either GRID or GRIDIN and a number in Watts. If there is excess solar this will bounce between IN and OUT. Remember these are snapshots of what is happening 3200 times a second internally and the gross values of the numbers while bouncing are not actually what is passing through the meter. When there is no excess solar, it will always show GRIDIN. If your hot water is at maximum or you have solar in excess of your heater element, it will show OUT.

Line 3

This shows the Transfer of Solar to Hot water data. While there is active solar diversion the line shows 'DIVERT' and value in watts showing the instantaneous diversion and 'TOT' with a value for the total that has been diverted so far today in watthours. When diversion stops the line changes to 'X'FERED' with a value for the total diversion today in watthours and 'TOP' with a value showing how much has been topped up from the grid. This line is sampled every 5 seconds.

Line 4

This line only shows if you have a second CT fitted to measure Solar production. This is just 'info only' and has no effect on the diverter's operation. Most diverters installed do not have this second CT and so this line will not display. If you do have a solar CT, this line will show SOLAR and a value in watts for the instantaneous generation and TOT with a value in watthours for the total solar generation so far today

Auto/Manual Changeover switch

The diverter is installed with a 3-way changeover switch. This allows you to bypass the diverter in case the unit fails or needs to be turned off for maintenance.

Positions are as follows:

AUTO = Hot water diversion device controls the temperature in the hot water tank. The switch should be left in this position for normal operation. This position is as far as you can turn it anticlockwise.

OFF = The diversion device and the hot water tank will be completely off with no electricity passing through to either. This is the middle switch position.

MANUAL = The diverter device is entirely bypassed, and grid power will feed the hot water cylinder. This will return control of the hot water cylinder to the internally installed thermostat, as it was before the installation of the device. Note that in this mode the display on the Paladin diverter will flash on and off. This is normal when the switch is in the MANUAL position. This position is as far as you can turn it clockwise.

When turning the switch please do so slowly and wait for 5 seconds at each switch position to give the diverter enough time to respond to the new switch position.

Minimum temperature settings

The standard minimum temperature setting can be set to 10°C, 30°C, 40°C or 50°C. This is set by the installer at time of installation. The factory default is 40°C. 40°C is low enough to give a wide temperature band within which solar energy is used to raise the water temperature to its maximum, but also high enough to allow for a couple of showers if there is not enough sun to heat the water higher.

Every house has a different pattern of hot water use. Some houses use more hot water in the morning before the sun has a chance to heat the water and some houses use more hot water at night. Because of this, Paladin has a toggle switch that gives extra functionality.

Toggle switch operation

The toggle switch on the top of the diverter is used to change the minimum temperature.

This switch has 3 positions.
LEFT - OFF – RIGHT.
This is what it does:

OFF - NORMAL Centre position

Minimum temperature is set to what was set at installation, or to the default minimum set by the Windows app (see below), e.g., 40°C. This is the position recommended for normal operation, especially in the summer months when there is plenty of excess solar.

Night Boost = Left position

With the switch in the LEFT position the diverter will boost the water temperature to 60°C in the small hours of the morning, at the time of the daily reset. For the rest of the day the minimum temperature will be what was set at installation, or to the default minimum set by the Windows app (see below), e.g., 40°C. Depending upon the quality of your hot water cylinder insulation this early morning boost will leave your water temperature at around 58°C for morning showers etc, to avoid topping up on peak grid power. If the water is already above 60°C when the daily reset occurs, then nothing happens.

With the switch in the LEFT position the 'C' appending the displayed water temperature changes to '+'.

50°C NOW = Right position

Putting the switch RIGHT changes the minimum temperature setting to 50°C. If the water temperature is below 50°C then the diverter will start heating with grid power. With the switch in the RIGHT position the 'C' appending the displayed water temperature changes to '^'.

Either the LEFT position or the RIGHT position may be used when the user is not getting enough hot water. This may occur when:

- There are high losses from the system overnight (poor cylinder insulation).
- There is high morning hot water demand.

- A small solar system is installed.
- A three-phase solar system is installed with not enough generation on the phase to which the hot water cylinder is wired.
- During winter months when solar generation is lower.

Be sure to set the Toggle Switch position back to the centre when the above conditions do not apply. The Centre position maximises transfer and therefore allows the diverter to do what it is designed to do—i.e., minimise grid electricity use to heat hot water.

Diagnostic Display

Please be aware: If you (re)start the diverter with the Toggle Switch in the RIGHT position or if there is a power cut and the power returns while the switch is in the RIGHT position, then the display will change to the Diagnostic Mode. The diverter operates normally in the diagnostic mode, but the display is different. The diagnostic display is for factory use only for testing and tuning. However, if you see the Diagnostic Mode 'DON'T PANIC'. To exit from Diagnostic Mode, just move the Toggle Switch to any other position and then the display will revert to normal operation. Don't forget to put the Toggle Switch back to the RIGHT position if you want to keep the diverter in the 50ºC NOW mode.

For those that are technically minded, here is a decode and explanation of what can be seen in Diagnostic Mode.

Line 1

Temperature (or DELTA_T value) / Messages and Graphic / Transfer Time

Line 2

Becomes three blocks of numerals. Grid I/O (Neg = Input) / Total In / Total Export

Line 3

This is likewise three blocks of numerals. Transfer Now / Total Transfer / Total Top Up

Line 4

As above (if Solar CT is fitted). Solar Now / Solar Total.

The last element of the 4th line (bottom right) displays different values depending upon the minute value of the internal clock. On the ODD minutes it will show the minimum temperature setting as adjusted by DELTA_T or the Toggle Switch (so in this case it will show (M)50). On EVEN minutes it shows the grid reads per second. This will range between 3000 and 4000 depending upon internal processes. Values below 3000 are indicative of a poor CPU timing crystal. (which is why it is there). You will also see a set of '00000's alternating with the above. This is the DELTA_T variance, but since use of the Toggle Switch in the

RIGHT position to activate this effectively disables DELTA_T for the duration of this 'boost', the values are zeros.

All this is of absolutely no interest at all to the end user and is provided just to satisfy the curious.

FAQ

Why do the numbers 'bounce' and the Solar Totals not match the Inverter?

The diverter is not designed to be a meter as its core task is to figure out what is happening at the grid entry point and divert every possible Watt of excess solar energy to the hot water cylinder. The dynamics of the electricity flow to and from a house are complex and chaotic, and depending upon the observation time frame the relationship between solar generation and house activity is either serene or very variable.

The diverter reads that electron stream as fast as possible to get an accurate sense of what is happening every mains cycle (one fiftieth of a second) and acts on that information in the same time scale. It also continuously changes internal values to cater for varying conditions. The diverter's short-term accuracy is high; long term 'metering', not so much - by design. With that in mind you will see the Grid values 'bouncing' since that number is updated once a second and it represents a snapshot of 1 second's worth of averaged activity. Hidden inside that 1 second number is another 50 cycles worth of activity and 3200+ grid reads. Likewise, any totals are just an approximation of what has happened since the last reset. These numbers are not absolutes and are provided for the user to get a sense of the day's progress, not as a substitute for a meter reading. Your electricity meter and solar inverter data are the correct place to look for absolute values. That said, there should not be a huge difference and any large deviations should be investigated as it could indicate a badly placed or defective CT clamp, or even some problem with the Diverter itself. But again, the diverter is extremely sensitive and often 'sees' effects that are not directly associated with pure household current flow, such as minute induced changes in the house and CT wiring caused by external influences. E.g., high values of solar radiation caused by Coronal Mass Ejections, induction from overhead power lines and such are typical suspects.

An aside on the subject of accuracy—a vacuum cleaner uses more power on the forward than on the backwards stroke. The diverter is so fast and accurate that it sees that and reacts accordingly. The reason is reasonably obvious once you think about it. Pushing forward, there is a downward component to the applied force, which in turn presses the cleaning head harder onto the floor; thus increasing the seal, and the effort required to spin the motor.

When do the Totals reset?

The diverter's internal clock is linked to solar activity, or more specifically to solar transfer. An hour is still an hour, but the day start time is internally 8 hours since the last solar transfer activity to the hot water cylinder. Nominally this will be around or just after midnight, but in the summer, may be as late as 4am. If the Toggle switch is set to the Night

Boost position, this is the time that the night time boost will occur. If you have cheap night time electricity rates, and the last transfer occurs after 3 pm, then the Night Boost will use cheap power to boost the cylinder temperature to 60°C. Cheap power starts at 11 pm. The Night Boost will take place 8 hours after last transfer to the cylinder on the previous day. Please be aware that if the cylinder reached the cut off temperature earlier than 3 pm on the previous day, then the Night Boost will occur before 11 pm and therefore will use more expensive electricity.

How does the diverter manage Legionnaire's Disease?

There is a health problem associated with accumulated 'nasties' that breed in water systems that run at temperatures below 50°C or so for prolonged periods. The effective recommended prevention technique is to ensure that the water temperature reaches 60°C at least every 72 hours. The diverter does exactly that. Whenever the water temperature reaches 60°C it resets an internal counter to zero. Every hour it adds one to that counter and if the counter reaches 72 the hot water is boosted to 60°C, at which point the whole cycle starts again. If you have excess solar then this activity will be rare, but there will be times when it happens - particularly in winter. Internally The diverter tries to anticipate this, and if it anticipates a potential 'health top up' occurring during day time peak hours it will forward schedule the temperature boost to 60°C in the early hours of the day, just after the totals reset.

With regard to water temperatures, it should be obvious that if your hot water cylinder main thermostat is defective, not set to maximum or in some other way not able to allow a temperature of at least 60°C then the health temperature sequence will effectively force the diverter to top up continuously and be totally ineffective.

Likewise, if the temperature probe is incorrectly positioned a similar situation will occur.

How accurately does the diverter transfer excess solar?

There are a couple of 'Ifs' associated with the answer. If your excess solar generation never exceeds your hot water heating element rating and you never reach 73°C water temperature or your tank thermostat limit then you can expect 90%, often 95% or sometimes even better. The 'even better' bit depends very much on the type of loads that occur in the house and the gross variability of the solar output itself. Typical 'difficult' loads for the diverter to manage are high wattage irons and Induction cookers. The diverter does manage these rather well, but the very rapid surges in load that they produce can cause small amounts of 'spillage'.
Once you produce excess solar over and above what your cylinder element can absorb, or you hit maximum temperature, excess solar energy will of course be exported.

DELTA_T Operation?

The diverter introduces a novel concept (for a device like this) of DELTA_T - that is rate of change of temperature over time. This is largely transparent in operation, but the more eagle eyed may see its effects. If the water temperature is dropping quickly towards minimum (40°C normally) the DELTA_T mechanism will see this well before the water

actually reaches 40°C and will start a top up sequence earlier than would be possible by just waiting for 40°C to be registered. This allows the diverter to head off most cold shower situations, subject to water use and heater size etc. Conversely, when topping up, if there is only a few degrees of temperature to change then DELTA_T will not activate the heater at full power.

The device will monitor that DELTA_T value, visible in the bottom right of the display, and uses that as an inverse analogue of your hot water use. Simply put, by watching DELTA_T, the device can anticipate if the tank temperature could fall below the minimum set point in the near future (the next hour). Then ensures that your tank maintains the minimum set point in a range of conditions.

The software then uses DELTA_T to anticipate the tank heater turn on point by changing the Minimum Water Temperature value every 12 seconds to adjust it for a decreasing or increasingly negative DELTA_T. If the tank temperature is above 50°C this creates a Minimum Tank Temperature increase equal to the negative DELTA_T. Below 50°C the DELTA_T influence is doubled. If you are watching your MAX | MIN values, you will see this happening. To avoid over doing this function if there is active Solar, this effect will be moderated if more than 500W of Solar activity is perceived. This will ensure that grid power is not wasted heating water that will be heated later by solar.

Why does the display look different to normal?

You may have restarted the diverter with the Toggle Switch in the RIGHT position or there may have been a power cut and the power returned while the switch was in the RIGHT position. If this happened, then the display will change to the Diagnostic Mode. The diverter operates normally in the diagnostic mode, but the display is different. The diagnostic display is for factory use only for testing and tuning. However, if you see the Diagnostic Mode 'DON'T PANIC'. To exit from Diagnostic Mode, just move the Toggle Switch to any other position and then the display will revert to normal operation. Don't forget to put the Toggle Switch back to the RIGHT position if you want to keep the diverter in the 50°C NOW mode.

Recommended system details?

There are some practical and basic limitations to Hot water cylinder setups that can take best advantage of the diverter's abilities:

1. A Hot water cylinder of at least 180 litres and a thermostat set above 73°C.
2. A tempering valve that will enable the cylinder water temperature thermostat to be set at more than 60°C. (The hotter the water the more power it can store, and the better the buffer for cloudy days).
3. A normal use of hot water. If you are not regularly drawing off hot water then the best that the diverter can manage is about 1.6 KWh of solar power diversion per day, as that is the magnitude of normal thermal losses (see below).

The average household consumes 8 to 12 kWh of electricity a day for hot water. The numbers are: (and individual mileage may vary)

A 180-liter hot water tank uses 3.15kWh of electricity to raise the water temperature by 15 degrees Celsius. A normally insulated 180L tank uses around 1.6kWh of energy per day in lost heat.

The situation is this: If you have a 1:1 FIT you really don't care when your hot water cylinder heater runs. You produce the power; you use the power - the time frame is not important. However, if you are buying power at 4 times the rate you can sell it for, then it makes perfect sense to use as much of your own power as possible at the exact moment you produce it. If the Grid doesn't want your power, then the Grid doesn't get it. Without a large battery, the only practical power storage you have in the average home is the hot water cylinder.

How?

This section is the slightly nerdy stuff that is definitely just 'nice to know', not 'need to know'.

Happily, everyone now has a smart meter installed. All smart-meters work in essentially the same way. They have (conceptually), a 1Wh or 3600 joule 'power bucket' that keeps track of the energy flow. When the 'bucket' fills, for either import or export, the light flashes and the appropriate power counter goes up by 1 unit - usually 1000 units to the kWh.

If we monitor the mains feed to the house and collect data fast enough, we can accurately model the state of that 'bucket' and we can leverage that data to switch the hot water cylinder heater on and off just enough to stop the bucket filling, and consequently ticking over the meter. The key here is speed, and you can only practically switch the heater on and off on the crossing phase of the mains cycle, which is 50 times a second.

The 1Wh 'bucket' capacity is a real bonus in this sense. 1Wh doesn't sound a lot, but in other units it is 3600 Joules. This is just another, larger number. However, think about a 1kW heater running for 1 hour. In that time, it uses 1kWh (1000Wh) of energy, give or take. What about each minute? That would be 1000/60 = 16.6Wh. What about every second? That will be 1000/3600 = 0.278Wh. There might be 2 light bulbs above your head at this point? One will be for the 3600, which is, not by coincidence, the number of seconds in an hour and also the number of Joules in a Watt. The second, and most important, is that the power use on a 1kW heater every second is a fraction of the 1Wh of the 'bucket'. Even a large 3kW hot water cylinder element uses less than 1 Watt per second. How convenient is that?

The diverter can control your element on and off up to 50 times per second (Hz), at the mains frequency. Additionally, it is monitoring the mains flow, over 60 times per mains cycle - which is >3000 times per second.

So, a simple metaphor for the diverter's operation would be a water tank, filled by your solar at a variable rate dependant on the panel output, and emptied by the amount of

power use in the home. At the bottom of the tank is a large tap that represents your hot water cylinder element. The diverter watches, calculates and waits until the tank is half full, it then opens the tap to the element. Depending upon the rate of input flow, the tank either begins to empty or continues to fill. If the tank starts to empty, then the tap gets turned off. Otherwise, it stays on for another cycle. If the solar input exceeds the tank capacity and the flow to the element then it will eventually fill, and you will just have to export that Watt of power, and the cycle starts again.

In practice, if you have a solar array that is significantly larger than your heater and not much power use in the house in the middle of a summer's day, you are going to export power. But only the remainder, and it is unavoidable. The good news is that this doesn't happen that often because of the shape of the solar curve. You will also be forced to export if your tank temperature reaches maximum, obviously.

At this point, just to stay a little nerdy, it is well to mention that the diverter is not perfect. Despite a very high sampling rate and high-quality sensors, the vagaries of inductive loads, such as the motors / compressors on refrigerators and freezers, power tools and heat exchangers etc, do cause the diverter to miss the odd Watt here and there. In practice, this can be around 5% of excess solar energy per day in unintended export, it depends on your household use, the variability of the sunshine and the quality of your house wiring.

But to put that in perspective on the same day you will have diverted all the rest to your hot water cylinder element.

Temperature probe

Should the temperature probe be damaged, incorrectly wired or just not fitted, there is a self-check mechanism built into the start-up sequence. If your probe is correct and sending valid temperatures, then you will NOT see the following:

If the probe is not fitted or not working, the start-up sequence will be protracted whilst a full check is carried out. This takes about 20 seconds, and the screen indicates marching '>>>'. A failure puts the diverter into a NO TEMP mode. In this mode:

- No temperature readings are taken or displayed.
- The auto-boost to 40^{o}C or 50^{o}C does not occur. I.e., grid power is not used to keep the temperature at these minimums.
- The Toggle Switch 60^{o}C night time top up does not occur.
- The Legionaries disease Health top-up does not occur every 72 hours.
- The DELTA_T functionality does not work.
- The words 'NT MODE' replaces 'PALADIN' top centre during zero transfer.
- All other display and diverter functions work correctly and excess solar is transferred to the hot water cylinder element as per normal during the day time. The water will heat until the cylinder thermostat switches off.

It is quite safe to use the diverter in this mode for a few days pending repairs or replacement.

No hot water?

If you discover no hot water, please check the display of the diverter. If it does not appear to be displaying correctly or it is blank, please reset your diverter. This is done by switching the rotary AUTO-MANUAL Changeover switch clockwise from the AUTO position to the OFF position (then waiting 5 seconds) and anticlockwise back to AUTO again. Check that the diverter starts up and the usual display is showing.

Sometimes the diverter may suffer a software glitch and this reset is usually all that is required to reset it. If the display remains off, even after you have used a torch to check for a failed backlight, then move the Changeover Switch to the MANUAL position. This will bypass the diverter completely and your hot water cylinder will operate with grid power as it used to do before the diverter was installed. If this happens, please contact McNae Electrical Solutions to investigate.

Occasionally the backlight in the display may not work. If this is the case, shine a torch onto the display. If you see the normal numbers and operation, then the display has lost its backlighting. In this case the diverter is still operating normally and there will be another reason why you don't have hot water. It could be that the element in the hot water cylinder has failed. In either case you should contact McNae Electrical Solutions who will come and either replace the element or fix the display backlighting.

Another reason for no hot water could be due to the hot water cylinder thermostat being tripped due to excessive water temperature. This can occur when the hot water cylinder is also heated by a wetback. A good way to determine if the cylinder element or thermostat is the cause of the problem is to do the following:

1. Take note of the cylinder temperature. This is displayed in the upper left corner of the Paladin diverter screen.
2. Turn the rotary AUTO-MANUAL Changeover switch slowly clockwise to the OFF position (then wait 5 seconds) then continue turning slowly clockwise as far as it will go to the MANUAL position. This will switch off the diverter and bypass it. Grid power will then be connected directly to the cylinder. Note: the diverter display will flash intermittently – which is normal when the diverter is bypassed.
3. Leave the cylinder to heat for 30-60 minutes.
4. Slowly turn the AUTO-MANUAL Changeover switch anticlockwise to the OFF position (then wait 5 seconds) then continue turning slowly anticlockwise as far as it will go to the AUTO position.
5. Wait for the diverter to boot up and check the temperature again. If the temperature has not risen, then either the cylinder element or the thermostat is faulty or the thermostat has tripped out due to over-temperature. If this is the case, then an electrician will be required to reset the overload or replace the element or replace the thermostat.

ELEMENT is displayed in the top line[1]

If you see this, it indicates that the electrical circuit from the diverter to the cylinder element is interrupted. ELEMENT is only displayed if the circuit is interrupted during a grid top up to the minimum set temperature e.g., 40°C or a Legionnaire's top up to 60°C.

If the ELEMENT display is triggered this stops the Paladin diverter operation until the unit is reset by turning the rotary AUTO-MANUAL Changeover switch slowly clockwise from the AUTO position to the OFF position (then waiting 5 seconds) and slowly turning it anticlockwise back to AUTO again. If ELEMENT is displayed, this also gives cold water in the cylinder because the diverter will not operate until the user resets it by doing a power cycle.

This feature is included to alert the user to the fact that the grid top up to the minimum set temperature or that the Legionnaire's cycle has not completed successfully and as such is a safety feature to protect the user's health from the potential growth of Legionnaire's bacteria.

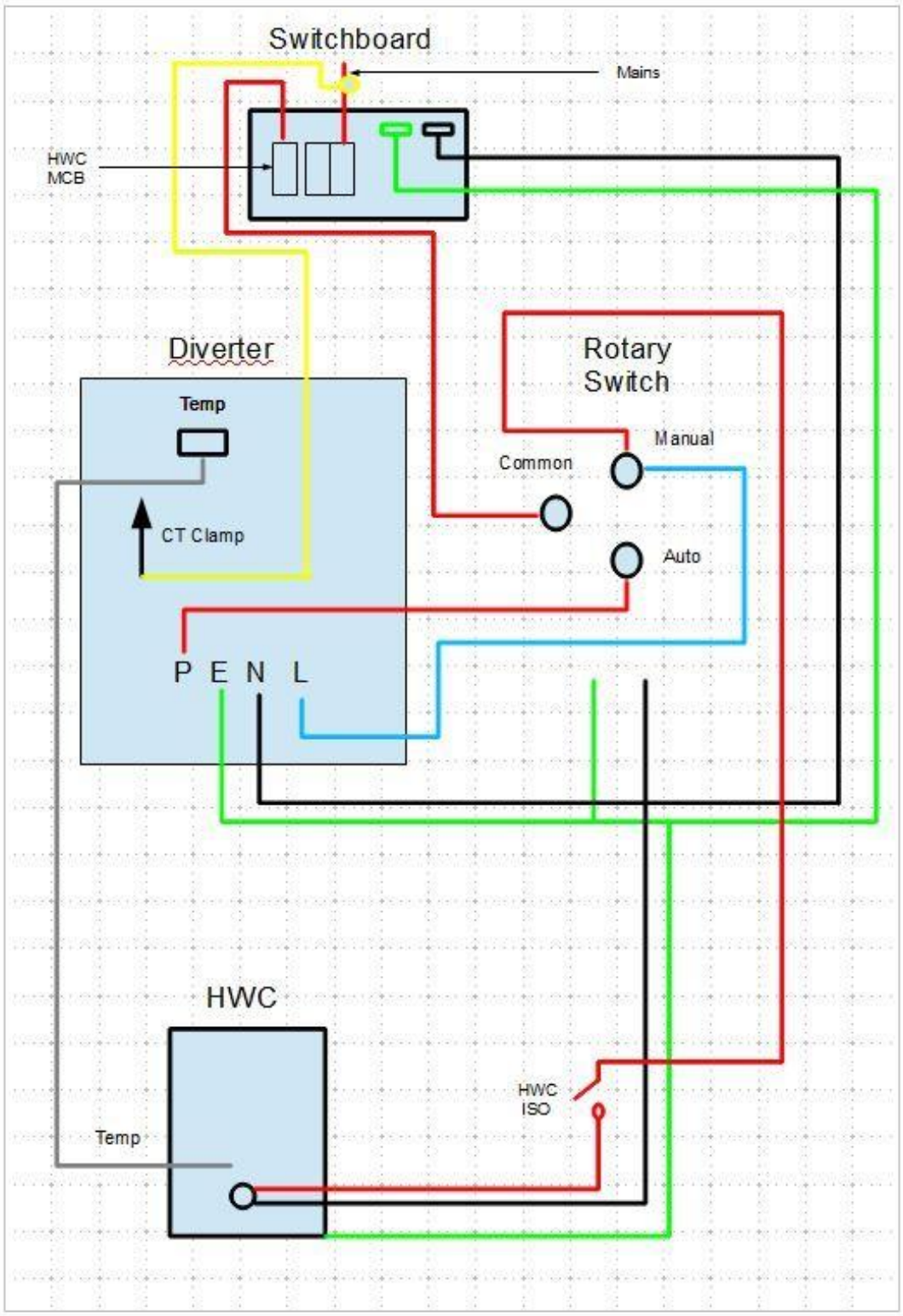
If ELEMENT is displayed, please do the following test:

1. Turn the rotary AUTO-MANUAL Changeover switch slowly clockwise from the AUTO position to the OFF position (then wait 5 seconds) and then turn it slowly anticlockwise back to AUTO again. This will reset the diverter. If the ELEMENT message goes away, then this will have fixed the problem (i.e., a software glitch in the diverter).
2. If ELEMENT is still displayed, slowly turn the rotary switch clockwise from the AUTO position to OFF (then wait 5 seconds) then continue turning it slowly clockwise as far as it will go to the MANUAL position. This will bypass the diverter and allow the hot water cylinder to heat from the grid. (Please note that the display may flash intermittently in this position but that is normal). If the water heats normally, then this proves that the cylinder electrical circuit is fine, but the diverter is faulty. Please contact McNae Electrical Solutions as this will require a replacement. Please note that if you then put the rotary switch back to the AUTO position, and the water is already hot, the diverter will appear to be working fine (i.e., the ELEMENT message will have disappeared from the display, but it won't heat up from excess solar energy.
3. If the water does ***not*** heat with the rotary switch in the MANUAL position, this proves that the fault is with the cylinder i.e., one of the following:
    - blown cylinder element or,
    - faulty cylinder thermostat, or
    - tripped overheat cut out device (particularly common with wetback cylinders).

    If this is the case, please contact an electrician to check your cylinder for one of the above issues.

[1] The ELEMENT feature in the display was introduced with Firmware Version 640. If your diverter has an earlier version of the firmware, this feature will not be present. The firmware version is displayed on the screen immediately after the diverter is turned on or reset.

Installation Wiring Diagram



Technical Specifications

Diversion Current | 20 Amps
Rated AC Voltage | 230 VAC
Frequency AC | 50 Hz
Max Continuous Power | 3 kW
Power Source | Single Phase
Weight | 920 Grams (2.12lbs)
Probe Cable | 3 Meters
Display | 4-Line Backlight
Enclosure (cm) | 20 x 12 x 12
Enclosure IP Rating | None
Warranty | 3 Years
Environment Temp Range | 0-50^{o}C
Environment Humidity | 95%
Environment Pollution Class | 2
Protection | Resettable Fuse
Cooling | External Heatsink
Standards: AS/NZS 4417.2