



# ACES 2 (Heating & Cooling) User Manual

ACES2002 | Issue No 2 | March 2020

## Important Safety Information

This manual may not be altered or reproduced in whole or in part by any means without the express written consent of Best Energy Saving Technology Ltd.

The information contained in this document is believed to be accurate at the time of publication, however, Best Energy Saving Technology Ltd assumes no responsibility for any errors which may appear here and reserves the right to make changes without notice.

Please read this manual carefully before installation, operation and maintenance of the ACES 2 unit. The following symbols in this manual are used to provide warning of danger or risk during the installation and operation of the unit.



Electric Shock Symbol: Carries information about procedures which must be followed to reduce the risk of electric shock and danger to personal health.



Safety Alert Symbol: Carries information about circumstances which if not considered may result in injury or death.

Installation and maintenance of the ACES 2 should only be performed by qualified, competent professionals who have received training and should have experience with current devices.

Best Energy Saving Technology Ltd shall not be responsible or liable for any damages caused by improper installation.

## Considerations When Installing the ACES 2

Installation of the ACES2 must be performed by qualified personnel only, who follow standard safety precautions through the installation procedures. Those personnel should have appropriate training and experience of Aircon systems and electrical systems. Appropriate safety gloves, safety glasses and protective clothing are highly recommended.

During normal operation the device uses DC voltage and low current draw, But DC voltage can still be dangerous and may appear on parts of the ACES2, including the exposed circuit boards (when unit open). AVOID contact with any current-carrying surfaces.

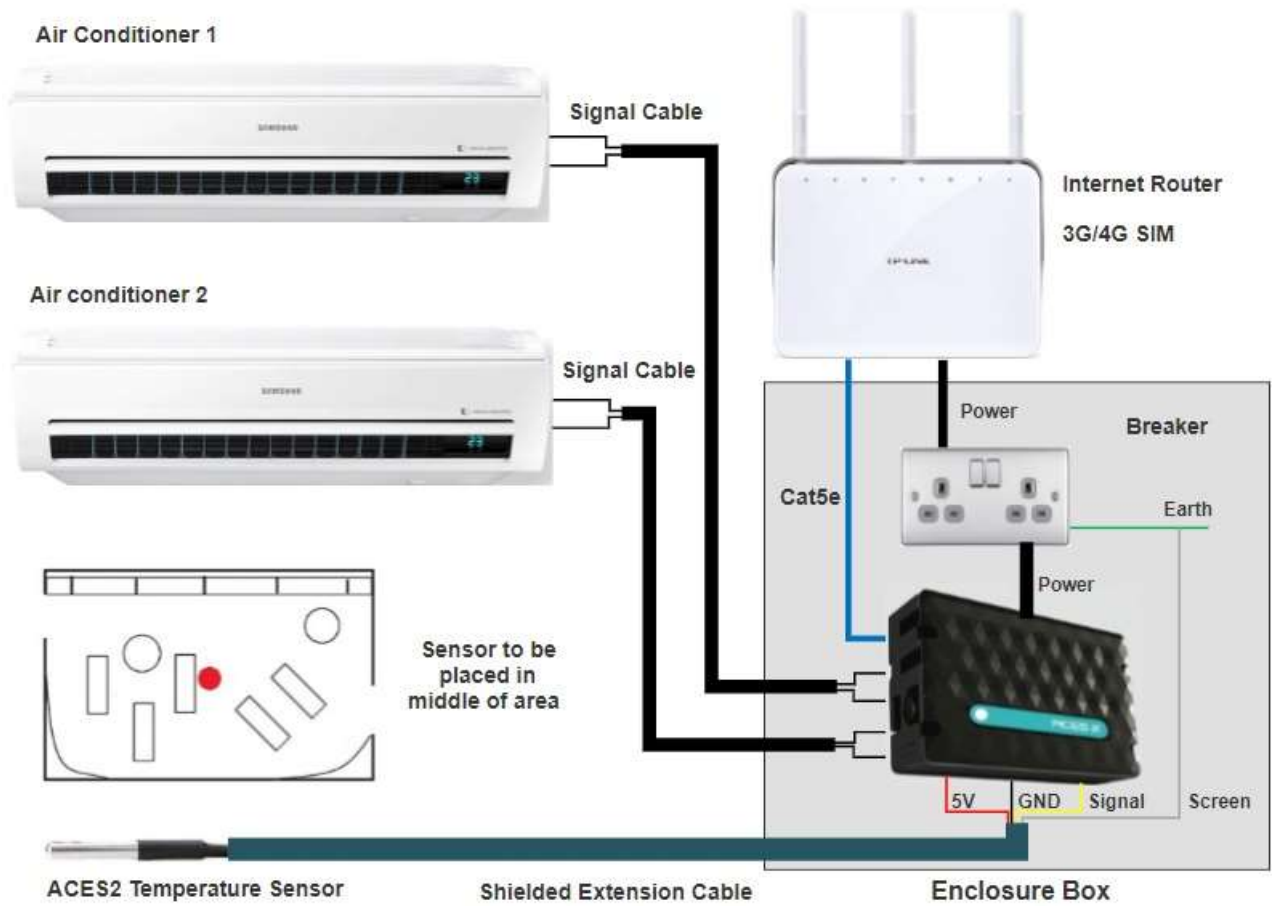
The ACES2 is NOT designed as primary protection devices and shall NOT be used as primary circuit protection or in an energy-limiting capacity. The ACES 2 can only be used as secondary protection. AVOID using under situations where failure of the ACES2 may cause injury or death. AVOID using the ACES2 for any application where risk of fire may occur.

Applying more than the maximum voltage to the ACES2 will permanently damage the unit. Please refer to the specifications for all devices before applying voltages.

- Best Energy Saving Technology Ltd recommends using a dry cloth to wipe the The device.

**Important Note: if the equipment is used in a manner not specified by the Manufacturer, the protection provided by the equipment may be impaired.**

# ACES2 Description



The ACES2 enhances your energy management with automated intelligence, by fixing your aircon temperature to desired value (no one can alter the settings via remote) and scheduling your multiple aircon systems on or off depending on the time of day or demand.

## The Hardware



ACES2 is a plug-and-play system, easily and safely installed by an electrician. It offers the chance to transform energy management in a facility with automated intelligence that switches your energy hungry Aircon systems equipment on and off automatically.

That functionality can work on the basis of logic controls; a set of rules which, if satisfied, ‘trigger’ the on or off function. Or you can control it manually, switching equipment off yourself when you see (with Eniscope’s analytics) that consumption is excessive or active out-of-hours, for example.

A single ACES2 unit can control up to 4 Aircon units, to switch your devices on or off and has the ability to monitor up to up to 6 temperature sensors.

## The Software

The ACES2 uses on-board software to display live input readings, and allow you to programme the logic controller and switch your output relays on or off manually.

You can also view your data remotely on temperature graphs dating back a month or in table format along with the recorded aircon states on our website, via MQTT.

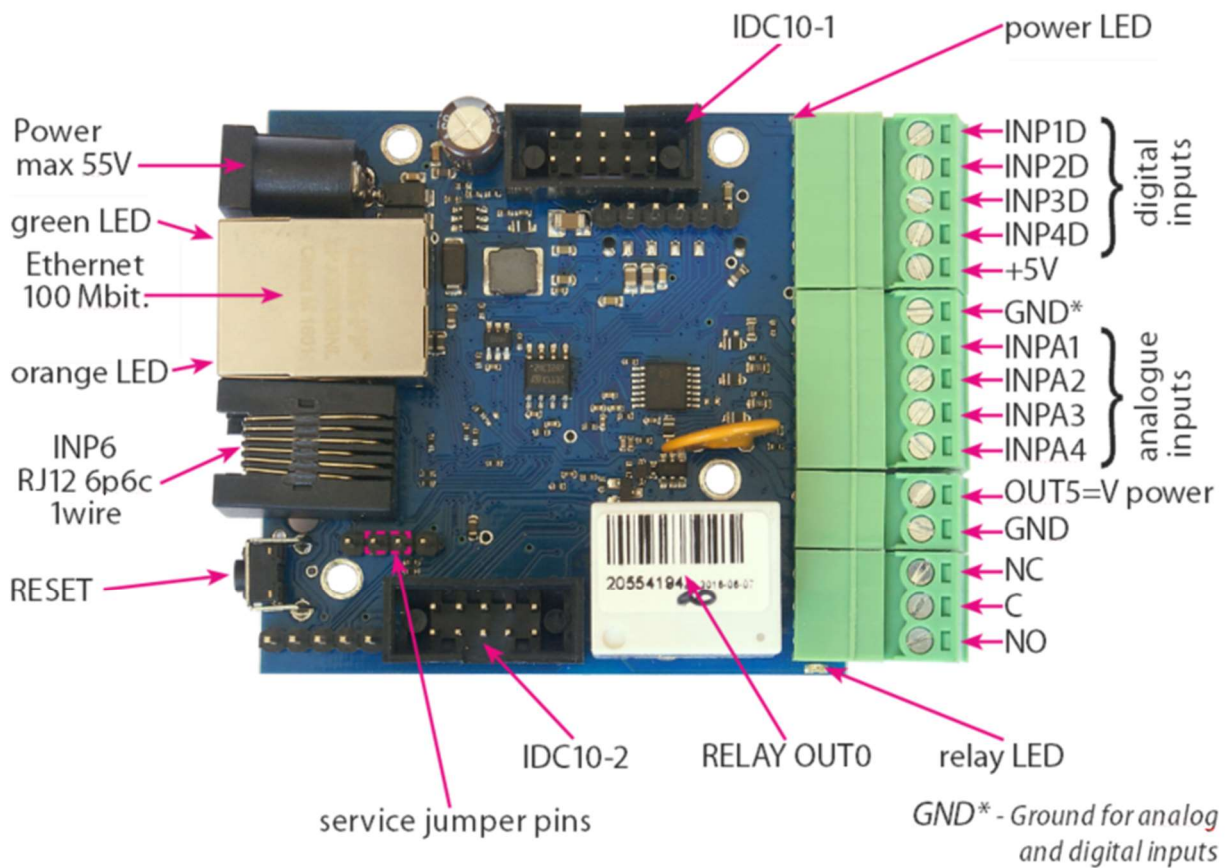


From this website you can setup remote scheduling for your aircon systems, such as ensuring they off outside of operating hours or scheduling multiple units to be all on at peak day heat, while operating just 1 aircon for the evening or overnight conditions.

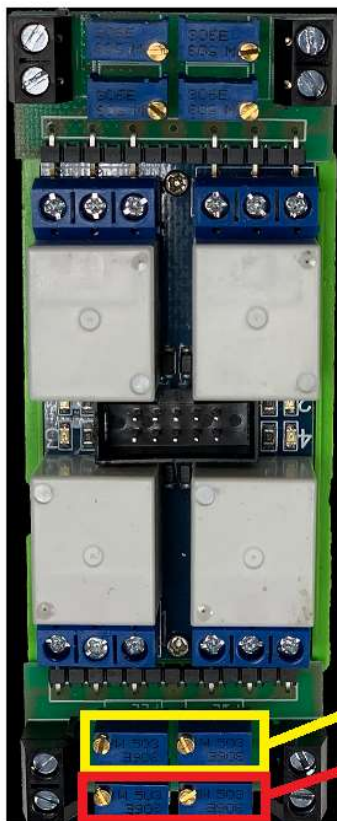
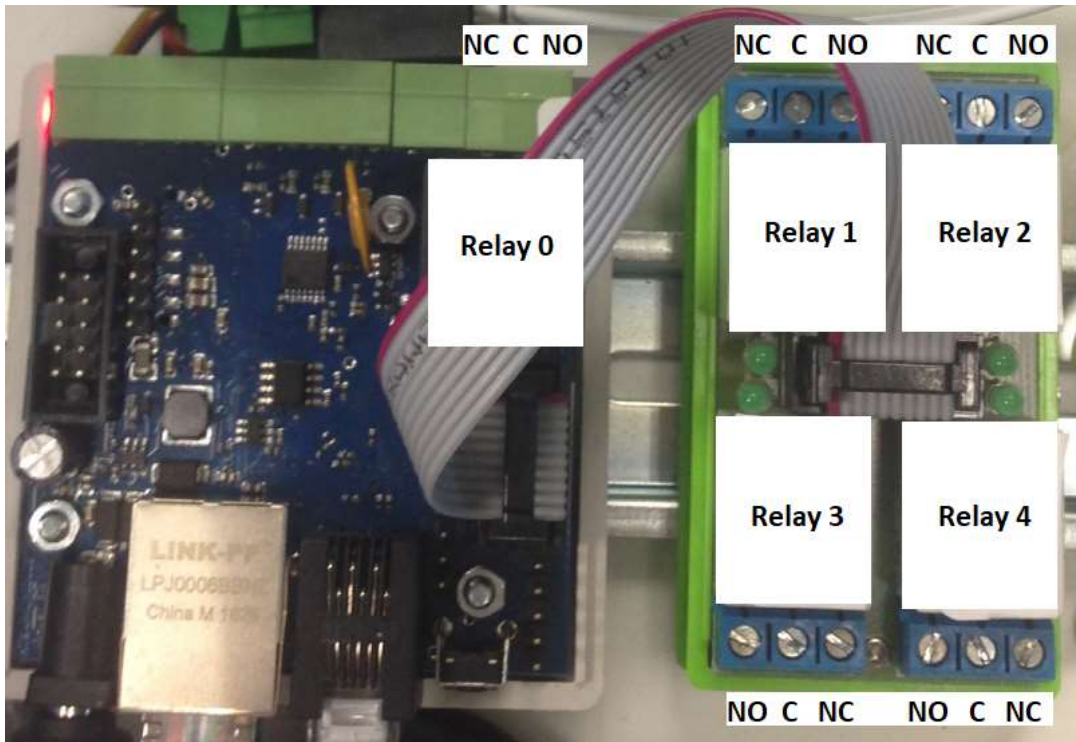
You can also setup instant email alerts if temperature goes outside desired range and even remotely increase the temperature without having to make another on site visit (or set different temperature ranges for different times of the day).

**Contact your Best Energy Saving Technology Distributor today to learn how your organisation can benefit from the ACES2 system.**

# ACES 2 Identification



PIN/Component	Description
Power	Power supply 8V ÷ 55V DC
power LED	LED indicator on – power on board
relay LED	LED indicator on – relay active
green LED	LED indicator on – eth link active
orange LED	LED indicator on – data transmitted
IDC10-1	Additional Inputs / Outputs PWM1 ÷ 3
IDC10-2	Additional outputs transistor OC standard, for example, relays
INP1D ÷ INP4D	Logical inputs Low=0~0,8V, High=0,8V~20V Also supports a pulse counter
+5V	For sensors supply
GND*	Ground for analog and digital inputs
INPA1 ÷ A4	Analog inputs
OUT5	Transistor output (+), voltage = power supply, max 1A
GND	Ground for transistor output (-)
NC	Relay OUT0, normally closed contact
C	Relay OUT0, common contact
NO	Relay OUT0, normally open contact



Note: The Relay circuit board has the numbers identification printed on the board.

NC = Cold Signal  
 NO = Hot Signal

# ACES2 Tools and Consumables

## Tools:



1) Screwdriver set including a 2mm flat head screwdriver.



2) Wire strippers



3) Wire cutters



4) RJ45 Crimpers



5) Multimeter (for resistance measurements 0 – 50k)



6) Drill and Masonry drill set





7) Ferrule crimping tool



8) Cat5 tester



9) Accurate/calibrated portable temperature probe

**Consumables:**



1) RJ45 connectors



2) CABLE - 2 wire 26AWG or larger signal cable for each aircon control.



3) CABLE - 3 wire SCREENED 26AWG or larger Cable for Temperature probe.



4) Screws and raw plugs for mounting ACES2 to wall.



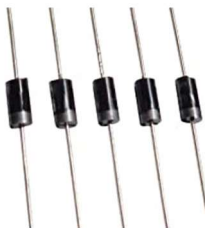
5) 0.5 (20 AWG, 0.5 mm<sup>2</sup>) and 0.25 (26 AWG, 0.25 mm<sup>2</sup>)



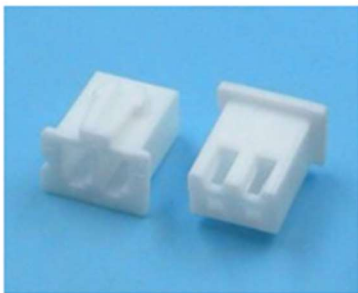
6) Electrical Tape



7) Terminal block (CH2 Spring Wire Connectors for instance)



8) Diode 1N5817



JST XHP-2 is a common connector

9) Optional: Connector Plug, Pins and crimper (Usually JST XHP-2, varies based on aircon model)

# SECTION 1

# INSTALLATION

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## Important Safety Notice

### SAFETY AT WORK



The owner, installer and user of this ACES2 device are responsible for its correct installation and use, and must ensure that;

- a) Only qualified persons install the unit.
- b) Isolate Power Supply before installation.
- c) The installation complies with the information contained in this publication.
- d) All units must be installed in accordance with the current National Electrical Code.

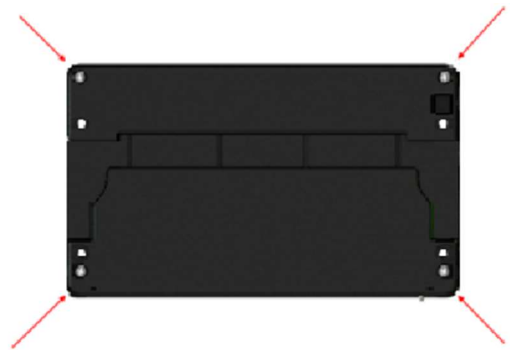
Best Energy Saving Technology Ltd, or their agents do not assume any liability, expressed or implied, for any consequences resulting from inappropriate, negligent or incorrect installation, application, use or adjustment of this device.

## A. Mounting the ACES2

### Opening the ACES2

There are 4 screws on the back of the ACES2 Enclosure, once removed the front lid will come off and you can see the boards inside.

Please note you will need to screw the lid down again before final mounting to the wall.

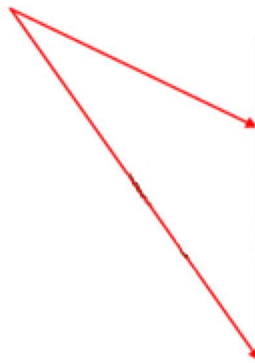


### Environmental

There are no specific ventilation requirements however, please check the environment, temperature and humidity to ensure the ACES2 is within the correct operating conditions. Also before you begin to mount the ACES2.

The ACES2 is Type 1, for indoor use only.

Mounting Holes



Mounting Holes



The ACES2 is designed to be mounted on a vertical surface within an electrical cabinet or wall mount, using the provided glands for incoming cables. ACES2 can be mounted using the corner mounting holes.

### Dimensions

**Height** 144 mm  
**Width** 236 mm  
**Depth** 60 mm



## B. Location

### ACES2 Location

You will need to consider the best location of the ACES2 unit to get all the connectivity options.

The ACES2 unit will need:

- Internet access via rj45
- An earthing point for the shielded cable
- Wall socket (100-240V) for power point
- 2 wire cable for each evaporator temperature sensor or thermostat to take control.
- 4 Wire screened cable for the temperature probe.

Normally we see partners installing the ACES2 unit near the Eniscope (So they can share the same network access point and use the Eniscope earth point).

### Temperature Probe Location

You need to decide the best locations for the temperature probe(s) and quantity needed, we recommend 1 per Aircon unit or at least 1 per 5m<sup>2</sup> floor area.



Obviously, you need to use your onsite observation for the best positions, but we recommend the sensor being placed in the middle of the area/room being covered and near the ceiling. If you have 1 sensor per aircon unit, then again position as such that it is near the aircon but away from the walls, corners or obstructions.

Other considerations of places **not** to put the temperature sensor include:

- In direct flow path of aircon unit (remember we want the average room temperature, not the evaporator air temperature like ACES1 use to).
- In the direct path of any fans installed on site.
- Above the ceiling tiles or ceiling of a room.
- Next to lights or heat sources.
- Keep away from doorways or windows (where you have temperature variation both sides).
- Keep the sensor out of direct sunlight.
- Touching metals, etc that could be hot or cold.

## C. Cables



### Power Cable

The unit comes with a UK plug end and a 110-240v supply, (The Smart Switch requires 8 to 55V DC supply) to plug into a wall socket, we recommend you use an existing wall socket point or create one from the Distribution board with a switch. If your country uses a different plug you can keep the power supply and just get a cable with figure 8 C7 adaptor or replace the plug directly.

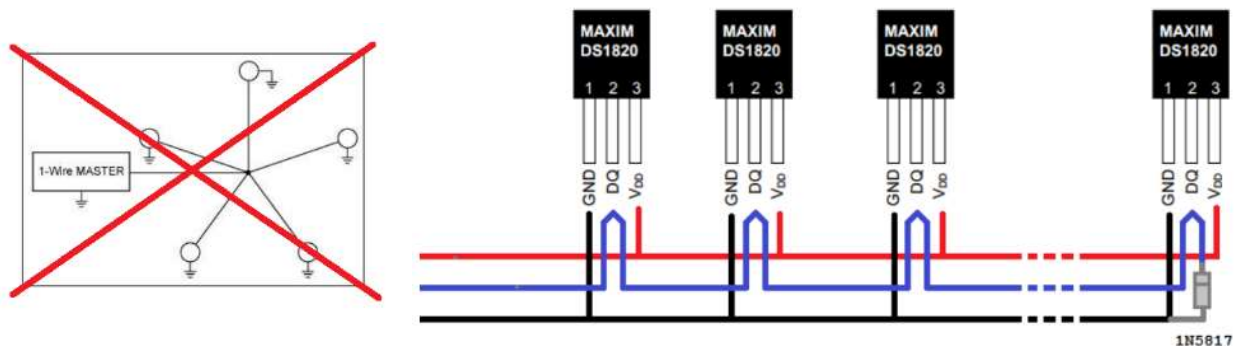
### Ethernet Cable

Run the Ethernet cable between your ACES2 unit and the nearest internet access router so data can be uploaded to the MQTT site and remote instructions can be sent to the unit.

### Temperature Probe Extension Cable

Extend the temperature probe(s) up to 50m maximum, by using a 3wire (or 2 pair) screened (shielded) signal cable (AWG26 or larger), connecting the temperature probe to the end via either soldered connection or terminal block and put in the diode. **Also ensure the screen is connected to earth otherwise noise will effect the temperature probe!**

**If having more than 1 sensor, you must connect them in 'daisy chain' or line bus format and not a star network. This means there only ever be 1 set of wires going to the ACES2 unit (rather than each sensor wires return to the ACES2 unit which would form a star network).**

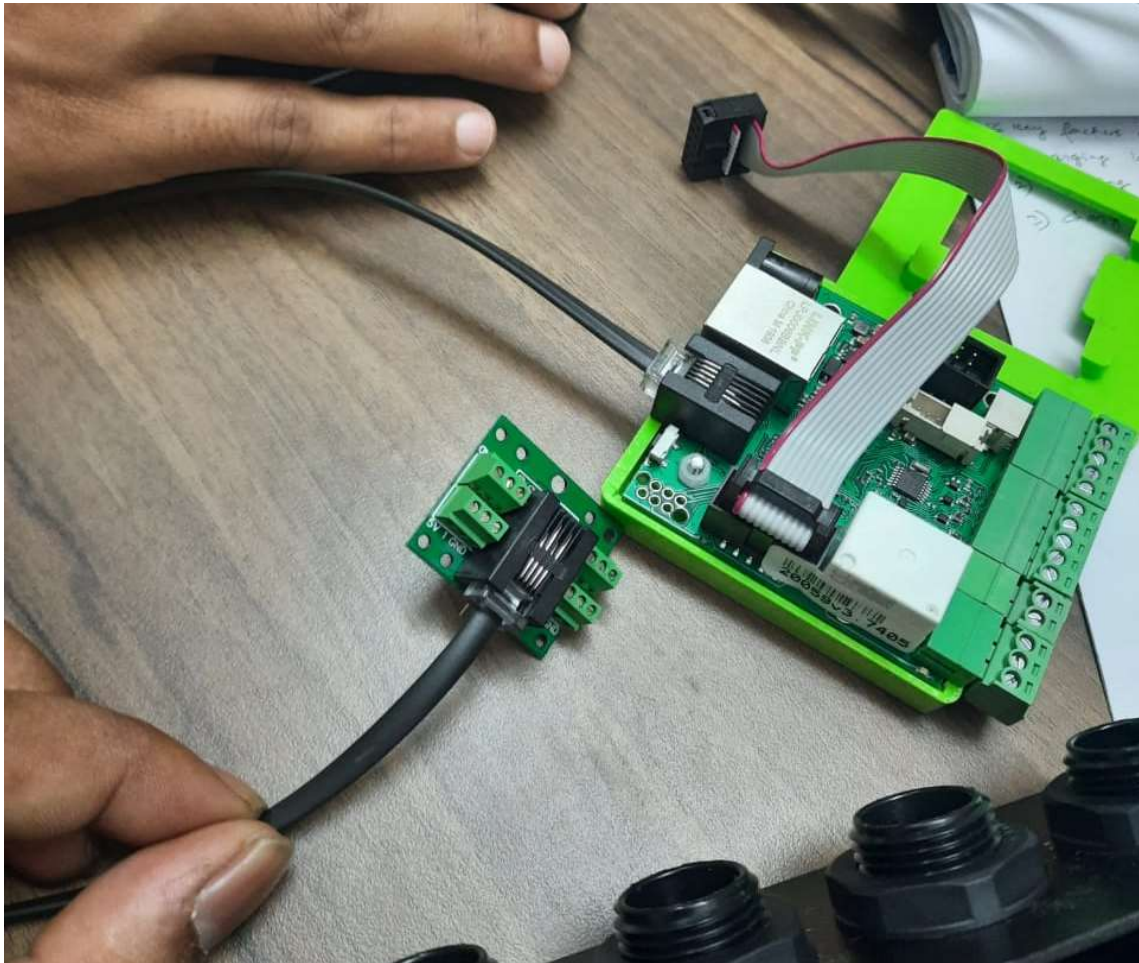


You can connect the screen to earth by connecting to the Distribution Board Earth bar or alternatively to the Eniscope Earth connector (but ensure the Eniscope itself is connected to the Earth bar in the DB).



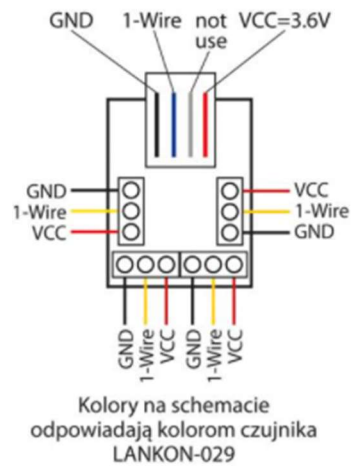
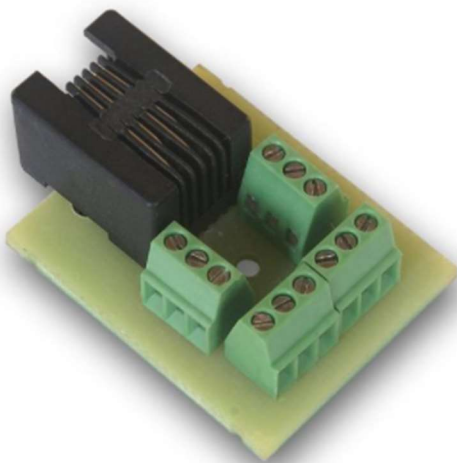
## Temperature Probe Wiring

Use the RJ12/RJ11 cable provided with your ACES2 and connect to the mainboard and the splitter like shown below:

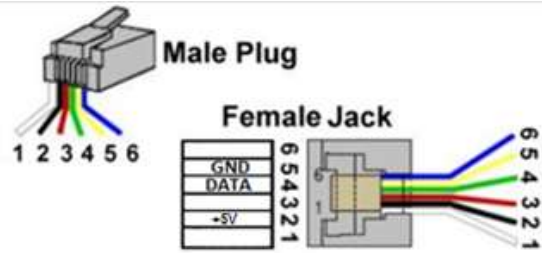


Below are the Splitter wiring details:

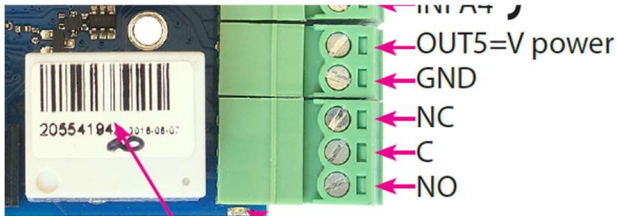
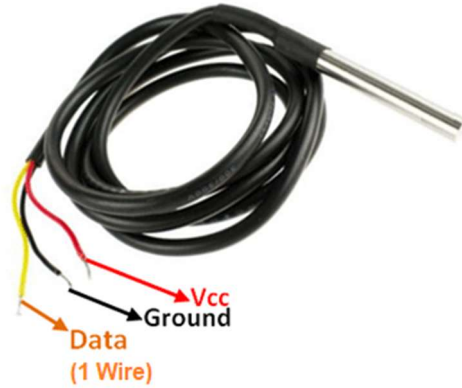
1-Wire input splitter (screw terminals) for Lan Controller, allowing connection of up to 4 DS18B20 temperature sensors.



If you decide not to use the splitter and you have cut the RJ12/RJ11 cable for direct connection, then pin2 (Vcc), pin4 (Data) and pin5 (ground).



The temperature sensor will come with 3 wires:  
 Red = Vcc (5v)  
 Black = Ground  
 Yellow = Data (1 Wire)

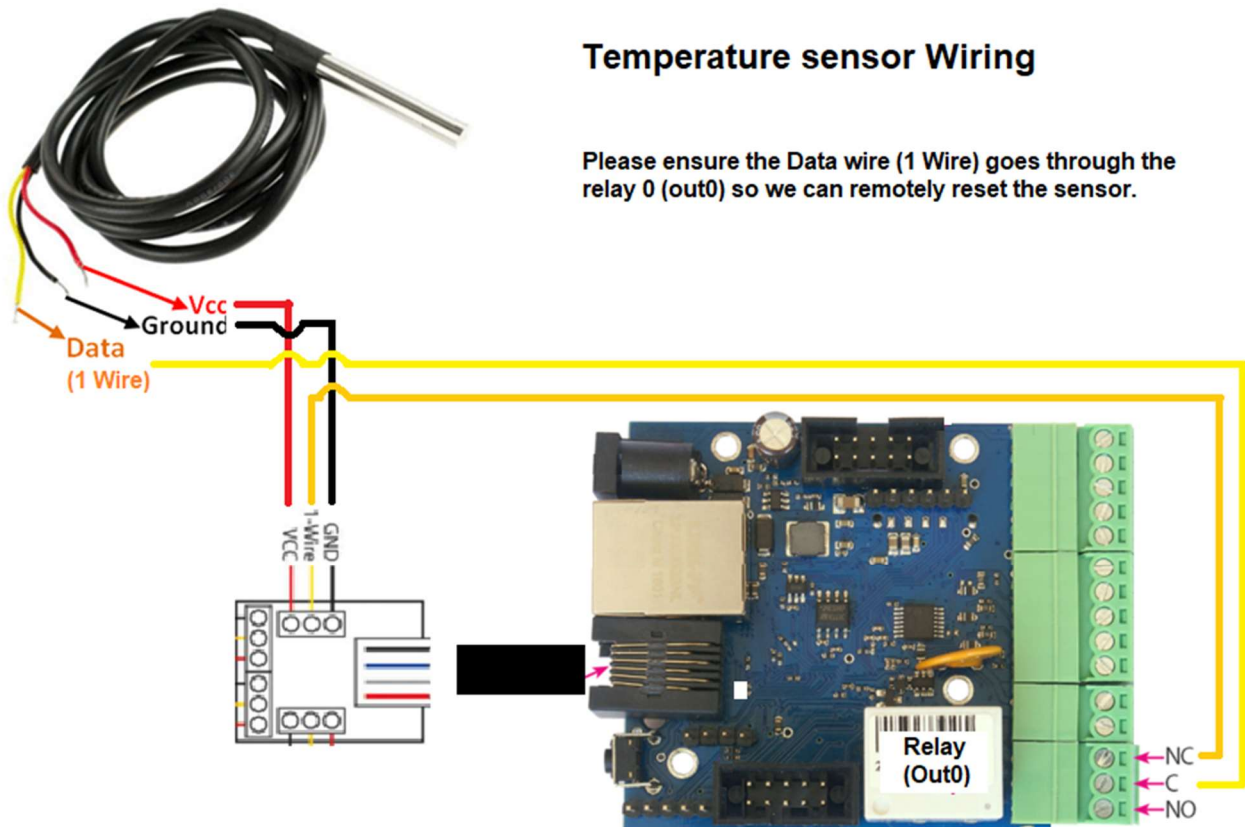


The sensor Data wire should be routed through the relay0 NC (normally closed) and C (common) pins using the green connector provided. This will allow us to remotely reset the sensor by operating the relay.

The final wiring should look like:

### Temperature sensor Wiring

Please ensure the Data wire (1 Wire) goes through the relay 0 (out0) so we can remotely reset the sensor.





## Aircon Signal cables

Please use 26AWG 2 wire (1 pair) or larger, you will need 1 cable per aircon system and all cables must lead back to the ACES2 unit.

Your first step is to open the Aircon Evaporators and identify the air temperature sensors. Please note we want the room air sensor, not the coil temperature sensor.



Example of the common sensor

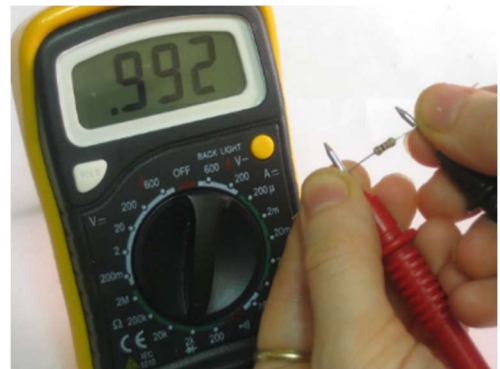
Next unplug the temperature sensors from the aircon control board (do not remove, keep fixed in unit so can be plugged in again in future) and make note of the connector types, you will then need to order the connectors and the pins to put onto your control wire (along with the crimping tool if needed). Or otherwise obtain permission to cut the sensor wire in the middle and join onto the existing wire with terminal connector.



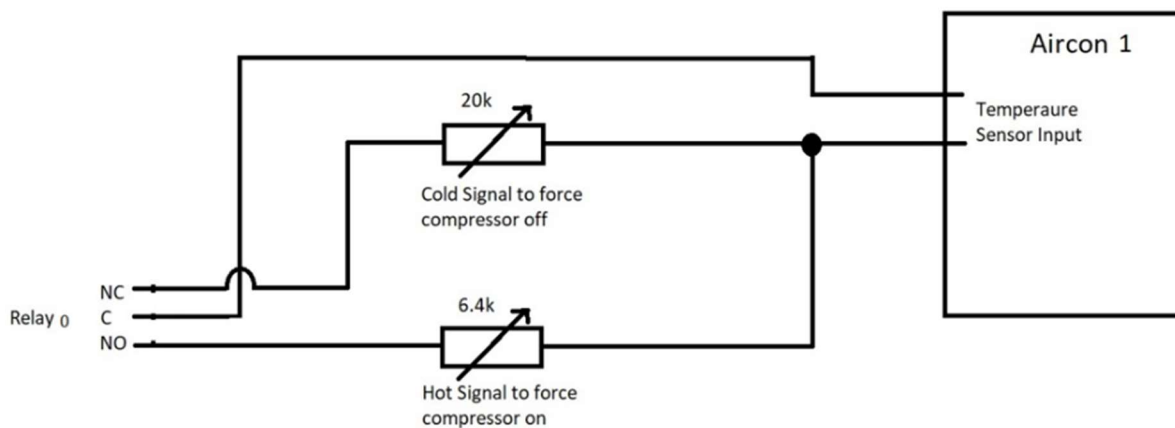
JST XHP-2 is a common connector

Now you need a warm and cold signal resistance value to record for ACES2 settings, to do this connect a multimeter set to resistance to the end of the temperature sensor and place the sensor inside a fridge for 1 minute, then record the resistance (usual values are around 16-19KOhms).

Next place the sensor on a hot source, such as hold tightly in the palm of your hand for 2-3 mins until the value settles (usually values are 4 to 8kOhms). Write these values down onto the commissioning sheet as will be needed later.



Finally you can connect the end of your signal cable directly to the Aircon control board and close the unit.



**Note:** Remember a cold signal is used to bring heating system on (0) and hot signal is used to bring cooling system on (1).

Now for terminating the signal cables to the ACES2 unit, pass the up to 4 signal cables (up to 4 Aircon control) through the glands and wire to the black terminals of the relay outputs.

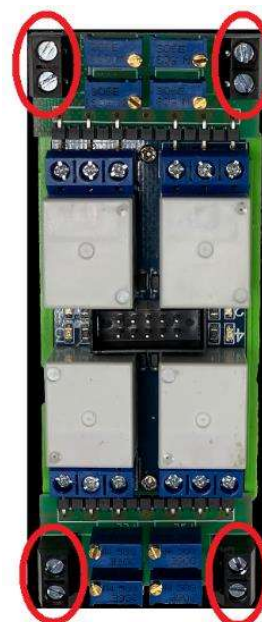
For a heating & cooling system, we want:

**out?=0 to be Heating on mode**

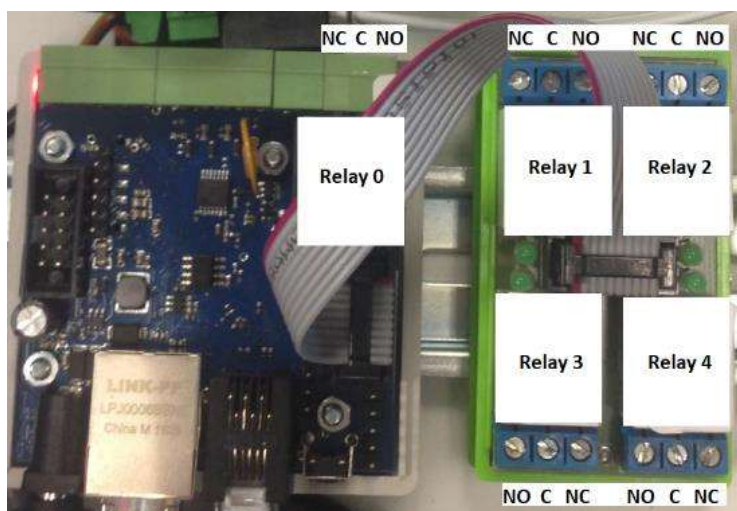
**out?=1 to be Cooling on mode**

**No off position?**

Normally we need a 3 point system (Heating, Off, Cooling), but what we actually are using is a 2 point system (heating or cooling), but we know there is a transition time the systems uses to protect itself (commonly around 15-20min) to switch from heating to cooling and vice versa... we can use this “off band” to our advantage as an off state. For scheduling off this means we will toggle the system every 10mins between the 2 state to lock the system off until we want to resume with normal temperature control.



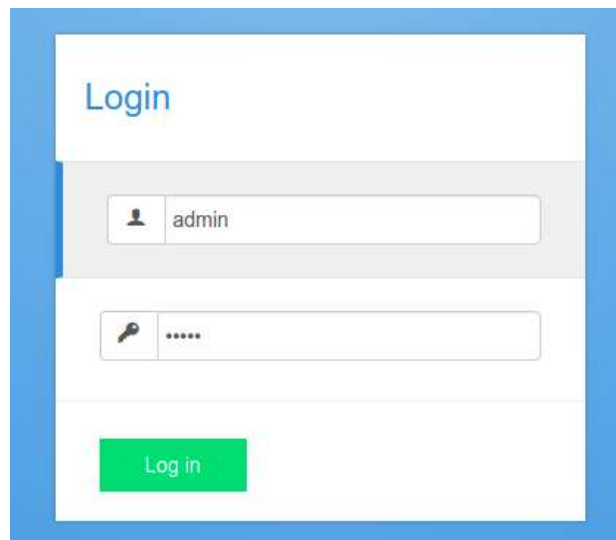
Note that Relay 0 is on the Microcontroller board and then Relay 1 to Relay 4 are on the separate relay board (you do not wire the aircon signal cables to relay 0, start at relay 1). The numbering can be seen on the circuit board also.



## D. ACES2 Access and Network Setup

### Login

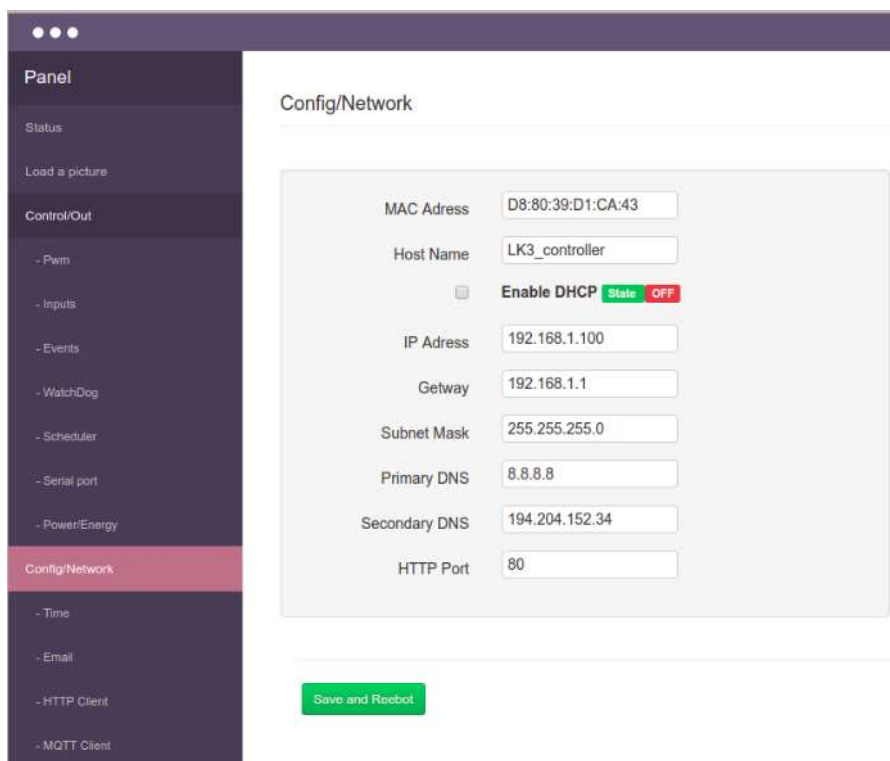
Login using the default IP 192.168.1.100 and user admin, password admin. You can login by typing the IP into the browser like with Eniscope (but do not need /admin).



You will find it best to connect to the ACES2 unit with a direct cat5 cable from your laptop (bypass any router for now).

### Setting the IP Address

Click 'Config/Network', Change the IP settings to the required static IP, do not use DHCP.



Now press 'Save and reboot' option, please remember to login in again on the new IP address. Remember that it is important to put in the correct IP range, gateway and DNS settings that match your router. After the settings are correct, you can connect both your ACES2 unit and your laptop to the router.

## Set the Time

Click the 'time' menu option and select the NTP option (or set the time manually) and save. Also click the 'set time in RTC' to save to controller. Also you can select your timezone.

Panel

- Status
- Load a picture
- Control/Out
  - Pwm
  - Inputs
  - Events
  - WatchDog
  - Scheduler
  - Serial port
  - Power/Energy
- Config/Network
  - Time
  - Email

### Time

Current time: 2018-10-15;12:47:58 Set time in RTC

NTP

Set manual: 1970-01-01;01:01:32

NTP Servers: pool.ntp.org

Port: 123

Time interval: 600

Time zone: 1

Automatic daylight saving time:

Save

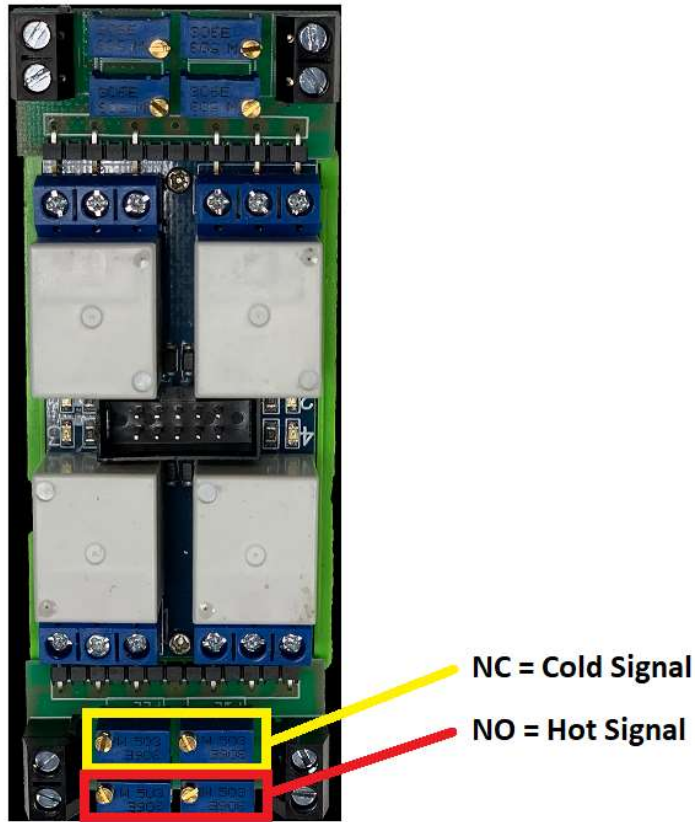
To check the operation is successful go to the 'status' screen and check the date and time displayed up top.

### Status

UpTime 46 sec, 14 min, 0 hour, 0 day ... 2018-11-15;10:33:02    Version: 1.49b1    VCC SUPPLY = 12.2 V    Temperature = 32 C

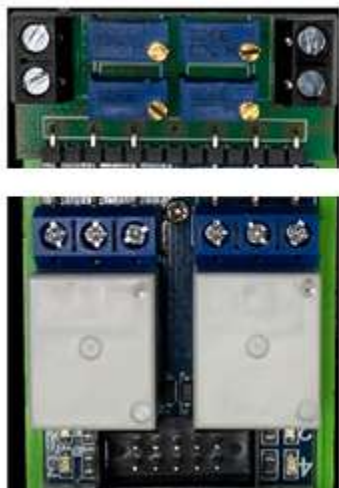
## E. Set the Potentiometers and test

Now all the wiring is in place it is time to set the potentiometers to the values you recorded from testing the AC sensors, do this using a multimeter set to resistance and set the pots shown below.



Note that you should disconnect 1 wire while setting the pots and manually change the state of the relay to set the 2 values, once set reconnect the wire.

If your aircon unit is controlled by a thermostat instead of a temperature sensor in the evaporator unit. Please remove the small circuit with the potentiometers and wire the control wires directly to the common © and Normally open (NO) terminals of the relay as a resistance value is not needed.





### Temperature sensor checks:

Also check you can see your temperature sensor reading under the DS1 to DS8 selection on the status screen. To move the sensor reading to DS1 or assign a missing sensor go to the 1 wire option.

Temperature sensor

Read ID DS18 ID = 28:FF:AF:52:45:16:3:6B

Save to  Position

DS18-1 ID = 0:0:0:0:0:0:0:0

DS18-2 ID = 0:0:0:0:0:0:0:0

DS18-3 ID = 0:0:0:0:0:0:0:0

DS18-4 ID = 28:FF:AF:52:45:16:3:6B

DS18-5 ID = 0:0:0:0:0:0:0:0

DS18-6 ID = 0:0:0:0:0:0:0:0

DS18-7 ID = 0:0:0:0:0:0:0:0

DS18-8 ID = 0:0:0:0:0:0:0:0

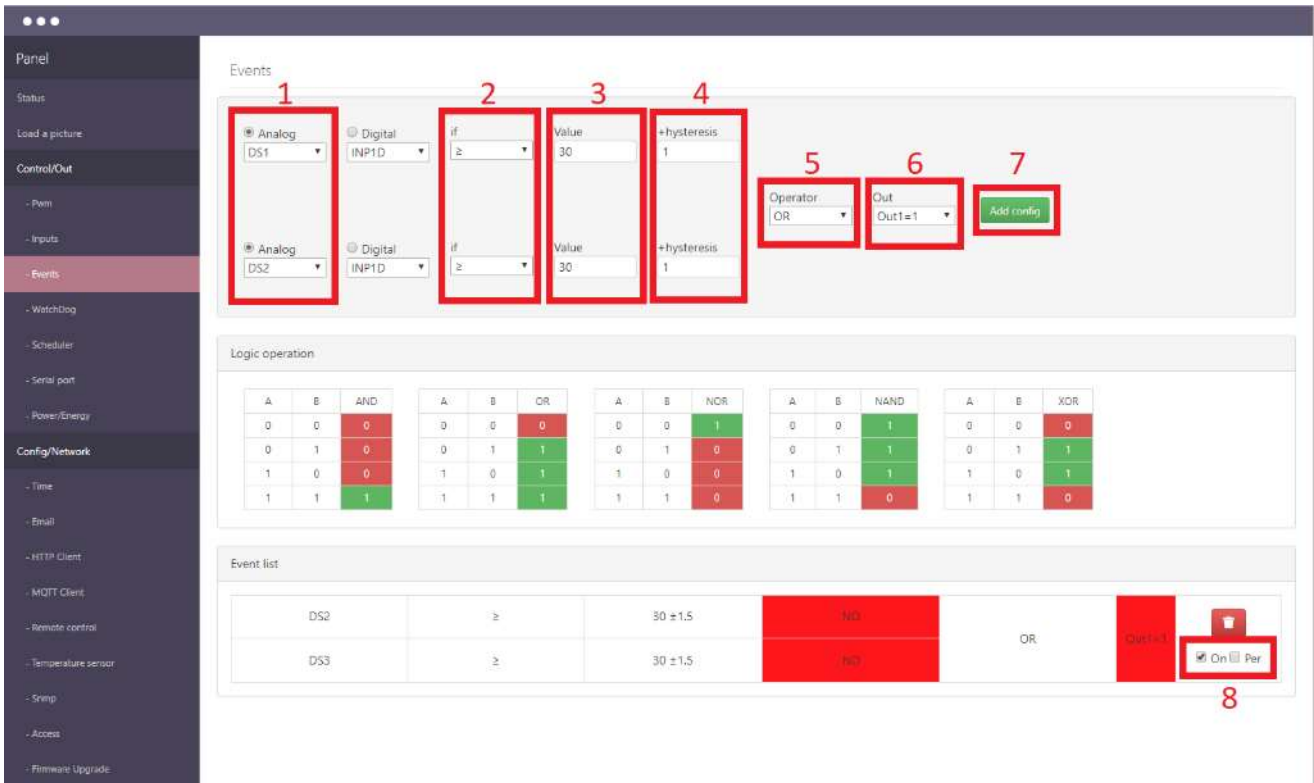
From the 1 wire option menu click the Read ID (it should produce a unique MAC number) and then save to position 1-6.

Note: if you are using multiple sensors, you will need to have only 1 sensor at a time connected to the ACES2 to read ID and assign a position. Once done you can then connect all sensors to ACES2.

If you want to remove a sensor from a position, disconnect all sensors (unclip the white ribbon cable), click read ID and it will produce 0. Now save the ID to position you wish to blank. Reattach the sensors when finished.

# F. Setting the Programmable Logic

## Understanding the Events Screen



On the Events screen we can see the programmable logic for setting our relay outputs based on the temperature or digital/analogue inputs thresholds.

1. Select the temperature sensor(s) or digital/analogue input you wish to monitor.
2. Select if the relay switching should be when temperature is equal to or greater than or below option (i.e. switch when equal to or above 30 degrees, switch when below 20 degrees).
3. Set the temperature threshold for switching (i.e. 30 degrees).
4. Set the hysteresis or leave as default 1. This will mean the for example if threshold is 30, that the relay will switch on at 31 degrees (with hysteresis set to 1), then switch off again at 29 degrees.
5. Select your Logic operation, if in doubt, keep to an 'OR' for most applications. Examples are displayed on screen.
6. Select the Relay outputs (output 0-4 and 1 for on, 0 for off). Don't select Auto as this is a continuous toggle on/off.
7. Once the configuration is complete hit the 'add config' to save.
8. To turn the configuration on select the On tick box.

Now you understand the interface please set the below logic for the 2 or 3 Aircons:



## Finding your temperature threshold

Before setting the events you need to work out the temperature difference between your sensor position (usually in the roof which warmer than room below) and the temperature of the room at chest height. Use a digital thermometer like shown below and measure in the centre of the room around waist-chest height. Compare this to the sensor reading you get in ACES2 to find the difference. Now add this difference to 24 to get your threshold setting for the events (replace the 24 you see in the event settings below)



i.e. your digital thermometer says 25.2degs. The ACES2 says 27.2degs. The difference is 2degs.

Therefore on the events you see the threshold as  $24 + 2 = 26$ degs.

## Temperature offset Test

For this test we want to manually switch on the aircon compressors until the room temperature (via your handheld thermometer in the middle of the room) reaches 22 degrees. Now turn off the aircon units with their remote controls or power switches. Take readings every 2mins of the ACES2 temperature sensor and your handheld thermometer readings until the room reaches 26 degrees. Write the results in the commissioning report.

Now compare the figures of the ACES2 temperature sensor readings and your hand held thermometer readings from the middle of the store and see what the difference is over the range. Check that the threshold difference you set in the events is correct or if it needs adjustment.

Example:

Handheld thermometer	ACES2 Sensor	Offset
22	24.2	2.2
23.2	25.5	2.3
24.5	26.7	2.2
26	28.1	2.1

Then with a desired room temperature of 24 our events setting between 26 and 26.2 would be correct.

## Setting the Events

### Single Unit Example:

See below example of a single unit setup, we will now break down to explain.

Event list

#	Source	If	Value	State	Operator	Action	
1	OUT0	=	1	No	AND	EVENT5=1	 <input checked="" type="checkbox"/> On <input checked="" type="checkbox"/> Per
	OUT5	=	1	No			
2	DS2	≥	19 ±0.2	Yes	AND	EVENT6=1	 <input checked="" type="checkbox"/> On <input checked="" type="checkbox"/> Per
	OUT5	=	0	Yes			
3	EVENT6	=	1	Yes	OR	Out1=1	 <input checked="" type="checkbox"/> On <input checked="" type="checkbox"/> Per
	EVENT5	=	1	No			

Event list

#	Source	If	Value	State	Operator	Action
1	OUT0	=	1	No	AND	EVENT5=1
	OUT5	=	1	No		
2	DS2	≥	19 ±0.2	Yes	AND	EVENT6=1
	OUT5	=	0	Yes		
3	EVENT6	=	1	Yes	OR	Out1=1
	EVENT5	=	1	No		

- 1) **Out0** is physically wired to break the digital sensors circuit when in a state of 1 and allow readings when 0 (used for reset), be we can also use it as a trigger in events to put system in override mode. In combination with **out5** (which has no physical relay, is virtual switch) we can create in the events that when **out0=1 and out5=1 we can force aircon on** all the time (ignoring temperature readings). While if we have **out0=1 and out5=0 we can force heating mode on** all the time (since disconnected sensor reads as -60). This give us manual override options.
- 2) **DS2** here we are setting the temperature threshold for switching between heating and cooling mode. We are going with a default of **19 degrees +/- 0.2** (meaning 18.7 heating mode, 19.3 cooling mode). We then remotely from the MQTT server able to move this threshold point up (currently using 20 degrees for example).

Also note this event line can be cloned to look at other sensors also and trigger different units depending on number of sensors used.

**Please note to not set this value to high! As we can go up remotely but not down!**

Also if there is a difference between the room temperature and the sensor position please build the correction in here (refer to the manual for more detail).

**Out5** when system is not in override mode can be used for the remote MQTT site to adjust the temperature threshold up as will see in the settings explained later.

- 3) Finally if **Event 6 or Event 5** (or both) have concluded in cooling mode required, it will switch out1 relay on (1) to trigger cooling. Note this command line can be cloned multiple times peer system connected (see below example for 4 system control with 1 sensor).

Below is an example of a 4 system setup:

Event list

#	Source	If	Value	State	Operator	Action
1	OUT0	=	1	No	AND	EVENT5=1
	OUT5	=	1	Yes		
2	DS1	≥	19 ±0.2	Yes	AND	EVENT6=1
	OUT5	=	0	No		
3	EVENT6	=	1	No	OR	Out1=1
	EVENT5	=	1	No		
4	EVENT6	=	1	No	OR	Out2=1
	EVENT5	=	1	No		
5	EVENT6	=	1	No	OR	Out3=1
	EVENT5	=	1	No		
6	EVENT6	=	1	No	OR	Out4=1
	EVENT5	=	1	No		

**Events control Tests**

**Temperature Rise ACES2 Test**

Please untick the events (deactivate) on the ACES2 panel and switch all systems connected to 1. **If the system has a Cooling mode, it should now be on.**

Let the temperature drop to **at least 2 degrees below** the required level and then tick the events and ensure the MQTT settings are active.

Leave the system in this state until the temperature rises back up to the desired level. Once there wait 20mins to ensure it maintains the temperature at desired range correctly.

Note: If the system can provide heating and cooling, the system (depending on model) can take 20-30mins on average to switch to the opposite mode before coming on. Do not count this transition in the test time.

**Temperature drop ACES2 Test**

Please untick the events (deactivate) on the ACES2 panel and switch all systems connected to 0.

**If the system has a Heating mode, it should now be on.**

Let the temperature Rise to **at least 2 degrees above** the required level and then tick the events and ensure the MQTT settings are active.

Leave the system in this state until the temperature drops back to the desired level. Once there wait 20mins to ensure it maintains the temperature at desired range correctly.

Note: If the system can provide heating and cooling, the system (depending on model) can take 20-30mins on average to switch to the opposite mode before coming on. Do not count this transition in the test time.

## Setting up the cloud connection

Select the 'MQTT Client' in the ACES2 to set up communications and then in a browser type: [aces2.enscope.com](http://aces2.enscope.com)

Login to your account, if you don't have an account yet then please contact BEST for one.

Now enter a name for the ACES2 and choose the LK3 option. Click add device.

To add a new device: (click to see more)

Name

Type

Redirect afterwards

You will now be asked to tick the 'active' box for the parameters you wish to see on the mobile app.

To begin with tick all outputs (out0-5) and the temperature sensors DS1 up that are in use.

Click save series settings when done.

<input checked="" type="checkbox"/>	n05c0b/a59/out0	OUT0	<input type="checkbox"/>
<input checked="" type="checkbox"/>	n05c0b/a59/out1	OUT1	<input type="checkbox"/>
<input checked="" type="checkbox"/>	n05c0b/a59/out2	OUT2	<input type="checkbox"/>
<input checked="" type="checkbox"/>	n05c0b/a59/out3	OUT3	<input type="checkbox"/>
<input checked="" type="checkbox"/>	n05c0b/a59/out4	OUT4	<input type="checkbox"/>

Now on the left hand menu select 'quick configuration' (note this will only work if your computer is on the same local network as the ACES2). Type in the IP address of the unit and click 'Perform Quick Configuration'.

Series group **Smart Switch 2** (with device)

**Name change** If your LK3 is in the same network as you are (you can access it in your browser), then you can quickly configure its MQTT client without need to edit its settings manually.

**Quick Configuration** Simply choose series you want to monitor in Series settings, then go back here and enter address of your LK3 in the field below and confirm with button next to it.

**Series settings** **Note:** In case you have already enabled authentication on your LK3, type in field below also your login credentials to device (they will not be stored or even sent to server, but used just once to access your LK directly from your browser). Generally it should be in following format:

**Chart settings** login:password@LK3address

**Manage databases**

In case you would like to use old edit page go here. However new version offers better load times and hopefully better division of content.

You can now return to the ACES2 web menu and refresh the 'MQTT Client' menu. You should find that the MQTT is Connected (top left in green background) and that the connection settings have been filled in for you.

**MQTT CONNECTED**

Your device number 910F00

Enable Mqtt

Enable log/pass auth

Server address

Port

Login

Password

Prefix

Time

Ping Time

INPA1  INPA2  INPA3  INPA4  INPA5  INPA6  INPA1R  INPA2R   
 INPA3R  INPA4R  INPA5R  INPA6R  DS1  DS2  DS3  DS4   
 DS5  DS6  DS7  DS8  VCC  TEMP  T1  H1  DIFF1   
 DIFF2  INPID1  INPID2  INPID3  INPID4  OUT0  OUT1  OUT2   
 OUT3  OUT4  OUT5  POWER1  POWER2  POWER3  POWER4   
 ENERGY1  ENERGY2  ENERGY3  ENERGY4  PM2.5  PM10  P1   
 CO2

If you have trouble with the quick configuration you can also set the MQTT connection manually, to do this go back to Devices menu


Now click on the blue banner titled 'to add a new device' and follow the instructions.

**To add a new device:** (click to hide)

1. Complete the form below.
2. Confirm with button **Add device** and wait until you are redirected and are shown results (success or errors message).
3. Choose data/series that interest you in **Series settings** inside **Edit** section.
4. Configure your device's **MQTT client** settings. There are 2 ways to do it for LK3.
  - A. **Recommended for LK3** Use **Quick Configuration** from **Edit** section (details on its page).
  - B. Manually enter data in form in LK3's **MQTT Client** tab:
 

<b>Enable Mqtt</b>	select it
<b>Enable log/pass auth</b>	select it
<b>Server address</b>	copy and paste <b>mqtt.ats.pl</b>
<b>Port</b>	copy and paste <b>1883</b>
<b>Login</b>	copy and paste <b>david.bowers</b>
<b>Password</b>	copy and paste <b>0ce7f26c2c</b>
<b>Prefix</b>	copy value of prefix generated for chosen device
<b>Time</b>	leave the default value or enter 300
<b>Ping Time</b>	leave the default value

Select at least one checkbox so LK3 will be actually sending data.  
Approve changes by clicking **Save**.

 **The picture showing valid configuration of LK3.**

# SECTION 2

## COMMISSIONING OPTIONS

m
Devices
Series groups
Config panel
MQTT Client
Docs
Contact
Account ▾

↓ Save changes
🗑 Discard changes

Services 250
▾

Reactions 1063
▾

Tasks 940
▴

➕ Add a new task

**Filter by name**

**Filter by topic**

**Number of shown results**

4 of 4 matches

Name	Topic	Message	Send on	Edit/Delete
447_AC1_ON	a3469d/cfc/cmd	out4=0	07:00:00 Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday	<span style="color: blue;">✉</span> <span style="color: red;">✕</span>
447_AC1_OFF	a3469d/cfc/cmd	out4=1	19:00:00 Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday	<span style="color: blue;">✉</span> <span style="color: red;">✕</span>
447_AC2_ON	a3469d/cfc/cmd	out5=0	19:00:00 Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday	<span style="color: blue;">✉</span> <span style="color: red;">✕</span>
447_AC2_OFF	a3469d/cfc/cmd	out5=1	07:00:00 Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday	<span style="color: blue;">✉</span> <span style="color: red;">✕</span>

# A. The Remote options

## Device Menu

Name	Prefix	Edit	Chart	Table
LK3 Office_RD	a3469d/6ff	Edit	Chart	Table
LK3 7 Eleven 447	a3469d/cfc	Edit	Chart	Table
LK3 7 Eleven 0211	a3469d/3e7	Edit	Chart	Table
LK3 7 Eleven 1411	a3469d/a0c	Edit	Chart	Table

Under the Device menu selection, you can see your ACES2 listed and besides them is a chart and table option.

## Temperature Chart



Selecting the chart option, you can see data for the last month for the ACES2 temperature sensor, if setup correctly you should see a reasonable controlled tight formation like the above example. If your temperature varies to much, you can scroll to a specific time or day with the sliders at the bottom of the graph to analyse.

## Temperature Table

Table for 7 Eleven 1411

[Click here to see information about CSV export](#)

[Download data in CSV format](#)

Date	DS1	OUT0	OUT1	OUT2	OUT3	OUT4	OUT5
2019-08-08 14:30:00	26.4	0	0	0	0	0	0
2019-08-08 14:25:00	26.5	0	0	0	0	0	0
2019-08-08 14:20:00	26.1	0	0	0	0	0	0
2019-08-08 14:15:00	26.6	0	1	1	1	0	0
2019-08-08 14:10:00	26.8	0	0	0	0	0	0
2019-08-08 14:05:00	26.5	0	0	0	0	0	0
2019-08-08 14:00:00	26.3	0	0	0	0	0	0
2019-08-08 13:55:00	26.2	0	0	0	0	0	0
2019-08-08 13:50:00	26.7	0	1	1	1	0	0
2019-08-08 13:45:00	26.8	0	0	0	0	0	0

Showing 1 to 10 of 20214 rows  rows per page      ...

Here you can analyse your ACES2 system more closely than the chart and compare the various output states against the temperature reading to check if the unit is triggering on the correct logic.

Table for 7 Eleven 1411

[Click here to see information about CSV export](#)

[Download data in CSV format](#)

Choose date format	DS1
ISO	26.4
UNIX	26.5
locale-native	26.1
locale-moment	26.1
standard	26.6

Also on the top of the Table screen you have the ability to download the data in a CSV format.



## Control Panel menu

### Services

Services <span>250</span>			
+ Add a new service configuration			
Name	Service	Value	Edit/Delete
Email_Alert	✉ smtp	retes.whisper@gmail.com	
Office_RD	🔊 mqttpub	a3469d/6ff/cmd	
7Eleven_447	🔊 mqttpub	a3469d/cfc/cmd	
7Eleven_211	🔊 mqttpub	a3469d/3e7/cmd	

This section is where you set the address of the items we want to communicate with, in this case we use the smtp service to publish a message to an email and the mqttpub service to point to the CMD (command console) of a particular ACES2 unit we wish to control.

### Reactions

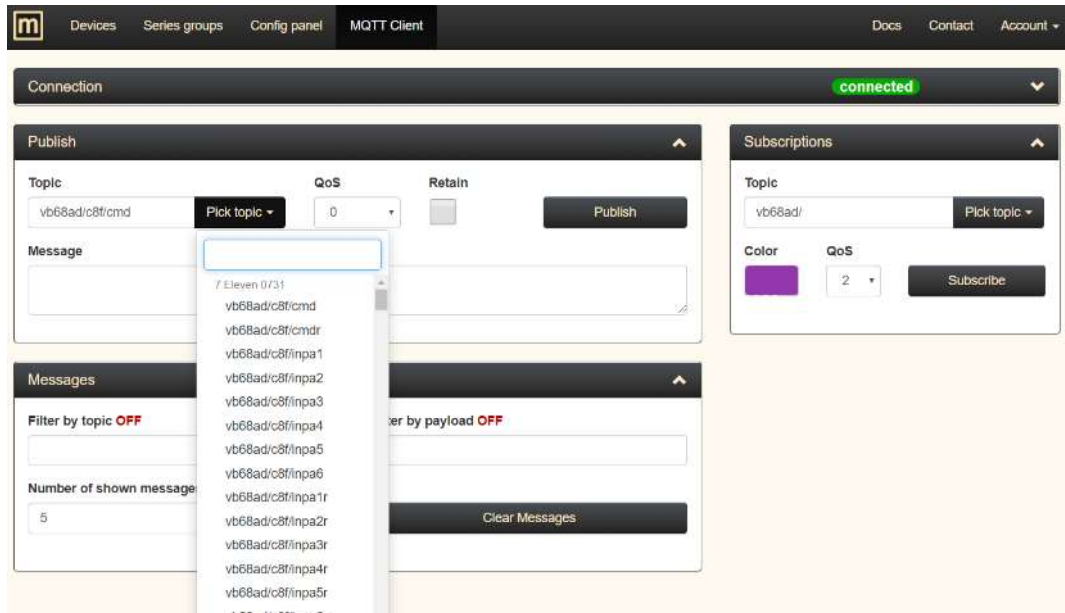
1	KFC_BRACKNELL_D...	w8529e/38b/ds1	V: >28 or <18	The temperature in Bra...	smtp>Email_Alert	
2	KFC_BRACKNELL_D...	w8529e/38b/ds1	V: >40 or <10 S: 500	out0=1	mqttpub:Bracknell_downstairs	
3	KFC_BRACKNELL_D...	w8529e/38b/out0	V: >0 T: 09:00:00 - 23:55:00	out0=0	mqttpub:Bracknell_downstairs	
4	KFC_BRACKNELL_D...	w8529e/38b/ds1	V: >20 T: 09:00:00 - 23:55:00	out5=0	mqttpub:Bracknell_downstairs	
5	KFC_BRACKNELL_D...	w8529e/38b/ds1	V: ≤20 T: 09:00:00 - 23:55:00	out5=1	mqttpub:Bracknell_downstairs	
6	KFC_BRACKNELL_D...	w8529e/38b/ds1	V: <100 T: 00:00:00 - 08:55:00	out0=1	mqttpub:Bracknell_downstairs	
7	KFC_BRACKNELL_D...	w8529e/38b/ds1	V: <100 T: 08:55:00 - 09:00:00	out0=0	mqttpub:Bracknell_downstairs	
8	KFC_BRACKNELL_D...	w8529e/38b/ds1	V: <100 T: 00:00:00 - 08:55:00 S: 840	out5=0	mqttpub:Bracknell_downstairs	
9	KFC_BRACKNELL_D...	w8529e/38b/out5	V: <1 T: 00:00:00 - 08:55:00	out5=1	mqttpub:Bracknell_downstairs	
10	KFC_BRACKNELL_D...	w8529e/38b/ds1	V: <100 T: 08:55:00 - 09:00:00	out5=0	mqttpub:Bracknell_downstairs	

Reactions section has a large variety of usage, we can set alerts so that when a sensor goes outside a set range it send an email alert. We can also set an auto trigger to disconnect and reconnect a sensor when failed and remotely adjust the temperature threshold up for the compressor trigger. For the Heating and cooling mode we will also be using this section for scheduling instead of tasks.

## Tasks (Not used for Heating and Cooling)

For the Heating and Cooling Mode we will be doing scheduling via the reactions and therefore do not use this section.

## MQTT Client



The MQTT client can be used to send instant manual commands remotely, firstly check for the green connected symbol in top right corner. Next select topic and choose the cmd (command console) of your device. Now type the output you wish to switch the state of and hit Publish.

i.e. out0=1

**Note: the system is capital lock sensitive, so use lower case.**

## B. Setting up the Standard 1 Sensor Remote Logic

MQTT Remote setup Example:

1	KFC_BRACKNELL_D...	w8529e/38b/ds1	V: >28 or <18	The temperature in Bra...	smtp:Email_Alert
2	KFC_BRACKNELL_D...	w8529e/38b/ds1	V: >40 or <10 S: 500	out0=1	mqttpub:Bracknell_downstairs
3	KFC_BRACKNELL_D...	w8529e/38b/out0	V: >0 T: 09:00:00 - 23:55:00	out0=0	mqttpub:Bracknell_downstairs
4	KFC_BRACKNELL_D...	w8529e/38b/ds1	V: >20 T: 09:00:00 - 23:55:00	out5=0	mqttpub:Bracknell_downstairs
5	KFC_BRACKNELL_D...	w8529e/38b/ds1	V: ≤20 T: 09:00:00 - 23:55:00	out5=1	mqttpub:Bracknell_downstairs
6	KFC_BRACKNELL_D...	w8529e/38b/ds1	V: <100 T: 00:00:00 - 08:55:00	out0=1	mqttpub:Bracknell_downstairs
7	KFC_BRACKNELL_D...	w8529e/38b/ds1	V: <100 T: 08:55:00 - 09:00:00	out0=0	mqttpub:Bracknell_downstairs
8	KFC_BRACKNELL_D...	w8529e/38b/ds1	V: <100 T: 00:00:00 - 08:55:00 S: 840	out5=0	mqttpub:Bracknell_downstairs
9	KFC_BRACKNELL_D...	w8529e/38b/out5	V: <1 T: 00:00:00 - 08:55:00	out5=1	mqttpub:Bracknell_downstairs
10	KFC_BRACKNELL_D...	w8529e/38b/ds1	V: <100 T: 08:55:00 - 09:00:00	out5=0	mqttpub:Bracknell_downstairs

### ALERT

KFC_BRACKNELL_D...	w8529e/38b/ds1	V: >28 or <18	The temperature in Bra...	smtp:Email_Alert
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- 1) This line is to provide an email alert if the temperature sensor in store goes above 28 degrees or below 18 degrees. It will send the message ever 5mins and state the store name and temperature.

### Automatic Sensor Reset

KFC_BRACKNELL_D...	w8529e/38b/ds1	V: >40 or <10 S: 500	out0=1	mqttpub:Bracknell_downstairs
KFC_BRACKNELL_D...	w8529e/38b/out0	V: >0 T: 09:00:00 - 23:55:00	out0=0	mqttpub:Bracknell_downstairs

- 2) These lines are to detect if the temperature sensor goes to 85 deg or -60 (error). If so it will set out0=1 to break sensor wire (this command can only act every 500 seconds)
- 3) 2nd line allows 5mins later to return out0=0 and bring sensor back online automatically but only during the normal operating hours (9am to midnight).

## Temperature Adjustment

KFC_BRACKNELL_D...	w8529e/38b/ds1	V: >20 T: 09:00:00 - 23:55:00	out5=0	mqttpub:Bracknell_downstairs
KFC_BRACKNELL_D...	w8529e/38b/ds1	V: ≤20 T: 09:00:00 - 23:55:00	out5=1	mqttpub:Bracknell_downstairs

- 4) First line adjust the onboard events temperature threshold up from 19 to 20 degrees for cooling.
- 5) Second line adjust the onboard events temperature threshold up from 19 to 20 degrees for heating. Note both lines only apply during the operating hours (9a, to midnight).

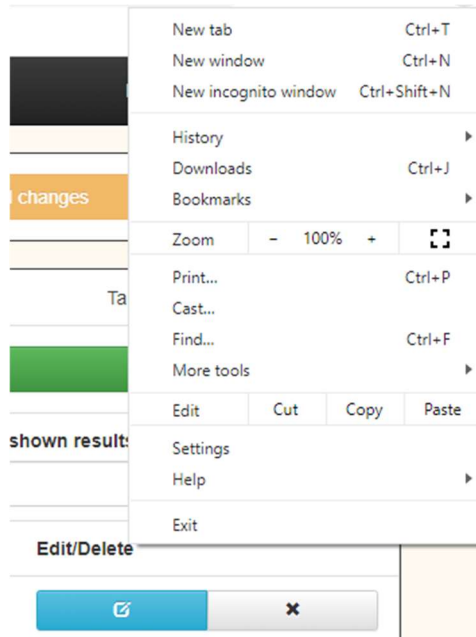
## Schedule Control

KFC_BRACKNELL_D...	w8529e/38b/ds1	V: <100 T: 00:00:00 - 08:55:00	out0=1	mqttpub:Bracknell_downstairs
KFC_BRACKNELL_D...	w8529e/38b/ds1	V: <100 T: 08:55:00 - 09:00:00	out0=0	mqttpub:Bracknell_downstairs
KFC_BRACKNELL_D...	w8529e/38b/ds1	V: <100 T: 00:00:00 - 08:55:00 S: 840	out5=0	mqttpub:Bracknell_downstairs
KFC_BRACKNELL_D...	w8529e/38b/out5	V: <1 T: 00:00:00 - 08:55:00	out5=1	mqttpub:Bracknell_downstairs
KFC_BRACKNELL_D...	w8529e/38b/ds1	V: <100 T: 08:55:00 - 09:00:00	out5=0	mqttpub:Bracknell_downstairs

- 6) First line forces the system into override mode (midnight to 9am) while 2<sup>nd</sup> line returns the system to normal temperature control by 9am.
- 7) Lines 3 and 4 are used to toggle the system between heating and cooling mode (creating an off state). This only operates between midnight to 9am.
- 8) The final line just returns the system to heating mode before temperature control resumes.

## C. Making Edits in ACES2.Eniscope.com

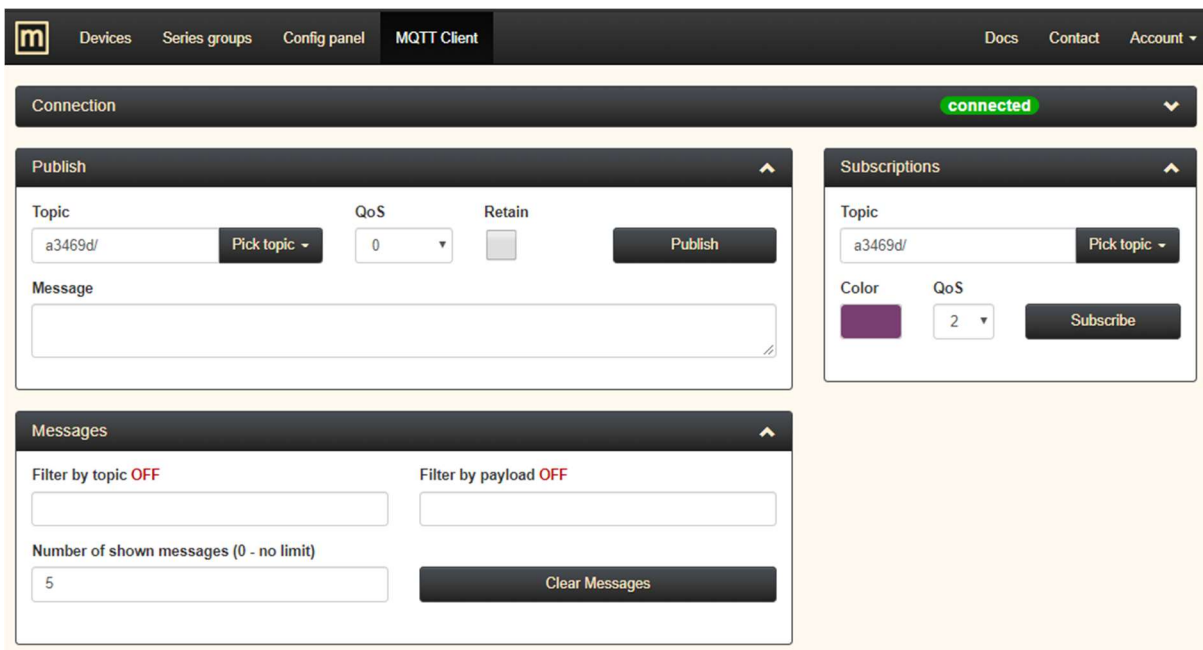
When you want to add new commands to Reactions, Tasks or MQTT Client you need to login via incognito window. This ensure no one can accidentally change setting while viewing.



All major browsers have a incognito mode and above is an example for google chrome.



If the mode is working correctly you will see the MQTT On in the bottom left corner.



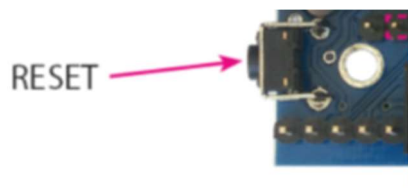
Or you will see the Connected sign for the MQTT Client

# SECTION 3

## TROUBLESHOOTING

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### A. Factory Reset



Pressing the reset button for about 0.5 seconds to change state relays, and hold for longer (up to five seconds) will change all settings (both network and configuration) on the factory reset.

Confirmation of the settings is fast switching on and off the relay.

# SECTION 4

## SPECIFICATIONS

---

Supply voltage: 8 to 55 V DC  
Power consumption: 0.5W  
Interface: Ethernet 100 Mbit/s  
Relay: 255 V AC 10 A  
Operating temperature: -20 to +85 °C

### INPUT / OUTPUT:

4 Analogue Inputs INPA1 to INPA4 with amplifier  
2 input voltage ranges:

The scope of of measured voltage for a range of 3.3 V  
gain=1 from 0 to 3300 mV  
gain=10 from 0 to 330 mV  
gain=50 from 0 to 60 mV

The scope of of measured voltage for a range of 33 V

gain=1 from 0 to 33000 mV  
gain=10 from 0 to 3300 mV  
gain=50 from 0 to 600 mV

for voltages between 0 to 5 mV, the measurement is not sure.

2 Analogue Input without gain INPA5 & INPA6:  
range of measured voltage of 0.1 to 3.3 V

1 Digital Input in standard 1-WIRE and I2C (connector 6P6C RJ12):  
measurement 6 temperature probes DS18B20.

4 Logic Input:  
VLow - max 1,1 V  
VHigh - min 1,5 V, max 12 V

RELAY:  
10 A / 240 V AC, 15 A / 24 V DC