



## SACO<sub>v2</sub>-240v

### CARPARK CO MONITOR / CONTROLLER

24v version also available

SACO is an ideal standalone wall mount Carbon Monoxide (CO) Controller that meets or exceeds AS1668.2-2012 requirements for

CO Measurement, Control, Fault monitoring & minimum Ventilation in enclosed small motor vehicle garages / lockups with poor or no natural ventilation not exceeding 25 meters sensing from the monitor. The SACO includes a system idle monitor / timer to automatically force on ventilation each day as required to satisfy minimum air turnover. The SACO is capable of direct control of On/Off fans up to 5 Amps or variable speed control of VSD or EC controlled fans. *For larger area systems we recommend our HCP7 controller with the required number of remote wall mounted HGSU-CO sensors as per the size of the carpark.*

### FEATURES

- ❖ Control of On/Off single speed fans direct (up to 5 amps) or variable speed fans.
- ❖ 0-10vDC modulating (P+I) output for control of VSD's or EC fans.
- ❖ Fail safe N/C Fan Start Relay...powered open when no call & system power on.
- ❖ Digital display of current CO ppm level, I/O status, internal & external faults.
- ❖ Automatic daily ventilation fan run timer as per AS1668 requirements.
- ❖ Inbuilt fault & high CO ppm alarm Siren, mutable by exposed mute push button.
- ❖ Test/Demo button to force I/O operation from ramped virtual 0-60-0 ppm CO.
- ❖ Lockable settings via 4 digit code.
- ❖ External interlock for forced fan run at programmable speed. i.e by thermostat or movement sensor etc & can be interlocked with an internal 7 day time switch.
- ❖ External fan fault input -N/O or N/C & choice to interlock with actual fan run call.
- ❖ Automatic zero ppm calibration + Manual calibration Software using Calibration gas.

# Keypad, Displays & Settings.

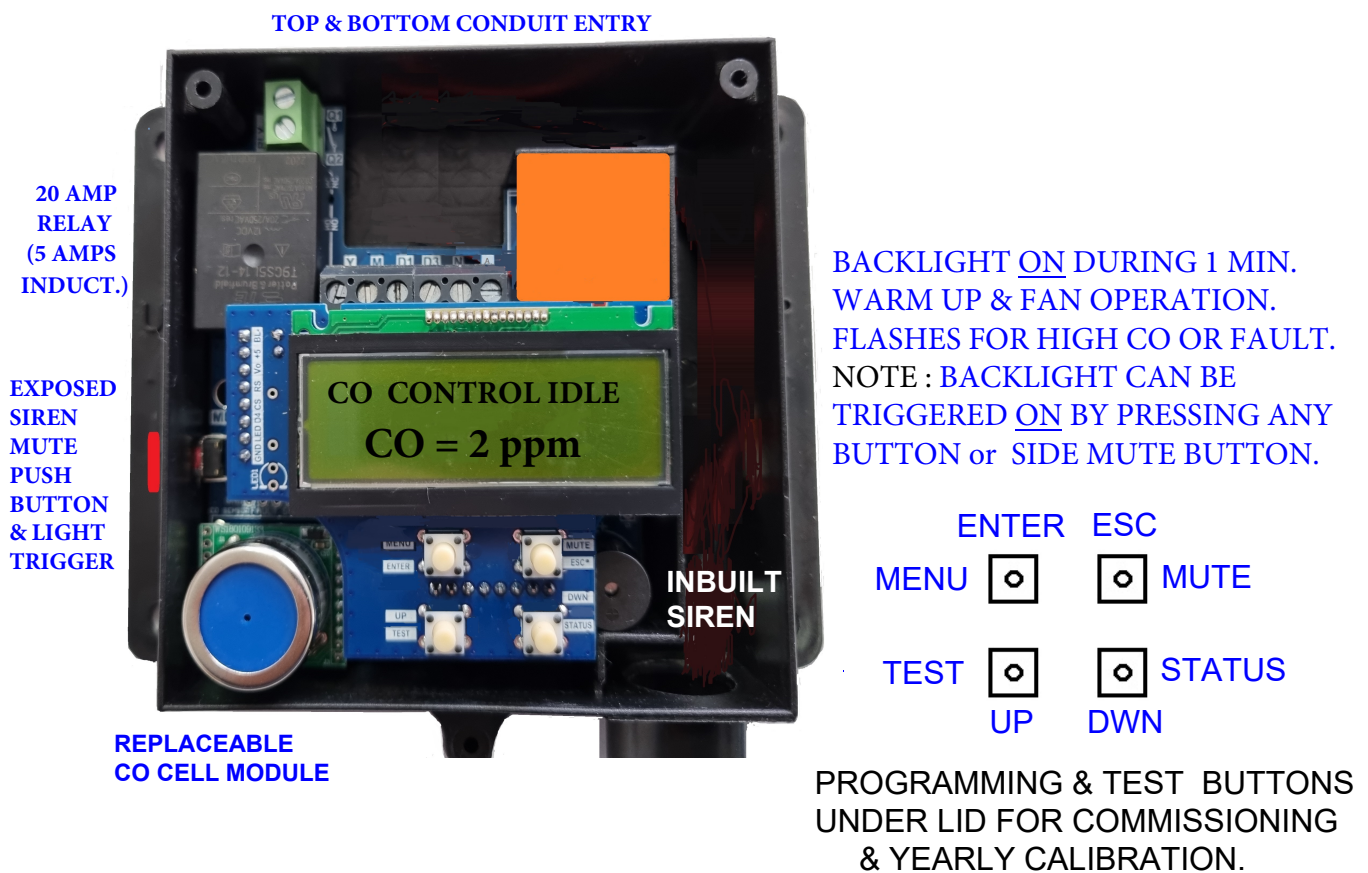
The PCB includes 4 push buttons & a 2x16 character LCD screen. + **additional mute button.**

"**MENU/ENTER**" : To edit the controllers settings, press this button to enter the controllers menu list (some menus are password protected).

"**MUTE / ESC**" : Used to exit a menu or as a Siren Mute, (which can also be muted by an external push button connected between terminals M and D2).

"**TEST / UP**" : pressing the "TEST" button causes normal operation to stop and a 5 minute demo/test program to run that simulates CO levels increasing from 0ppm to 63ppm & returning to 0 to demonstrate the effect on outputs and displays at various CO levels, note normal delay times are bypassed or reduced.




"**STATUS / DOWN**" : pushing the "STATUS" button causes the display to show input and output status .Push the up or down buttons to see all pages of information.



## EX HEVAC SETTINGS, BUT USER ADJUSTABLE

| OUTPUT  | TRIGGER VALUES IN ppm            | DELAY SETTINGS                    |
|---|----------------------------------|-----------------------------------|
| FAN ENABLE RELAY  | ON > 15 ppm    OFF < 9ppm        | 1 Min. ON DELAY / 5 Min OFF DELAY |
| VSD RAMP 0-10vdc O/P                                      | Start at 20 ppm ~ 100% at 35 ppm | + Integral time = 60 Mins.        |
| LCD BACKLIGHT ((FLASHING))<br>As EARLY WARNING of High CO | ON > 55 ppm    OFF < 50ppm       | 30 sec. ON DELAY                  |
| BUZZER (SIREN)  | ON > 60 ppm    OFF < 50 ppm      | 4 Min. ON DELAY                   |

# MAIN MENU

**PRESS**  to open main menu to alter settings, Use  or  to scroll up or down through menus.

5 off main menu items in the following order

( menu item # 4 has 6 sub menus (a-f) for lockable controller configuration )

- 1.) Under menu called VIEW EVENT ON HISTORY VIEW PAST "ON" EVENTS  
UPTO 20 EVENTS RECORDED THAT OVER WRITE OLDEST RECORD
  
- 2.) Under menu called SENSOR CALIBRATION MANUAL FORCED SENSOR CALIBRATION USING TEST GAS  
Allows adjustment of zero & high level ppm  
matching calibration test gas bottles.
  
- 3.) Under menu called SET D3 FORCED  
RUN T/SW. INTERNAL 7 DAY TIME SWITCH for interlocking with  
the D3 terminal for forced fan run subject to this  
time switch settings.
  
- 4.) Under menu called CONFIGURE CONTROLLER  
**NOTE : this menu is password protected.**  
**P/W= 9562**
  - a.) EDIT OUTPUT SETPOINT TRIGGER VALUES
  - b.) EDIT OUTPUT DELAY TIMERS
  - c.) SET IDLE PERIOD AUTO FAN RUN TIMER
  - d.) SET D1 (fan) FAULT MODE & CONDITIONS
  - e.) SET D3 Y FORCED FAN SPEED
  - f.) RESTORE FACTORY DEFAULTS
  
- 5.) Under menu called SET CLOCK SET SYSTEM CLOCK, DATE & DAYLIGHT SAVING

# VIEW EVENT HISTORY

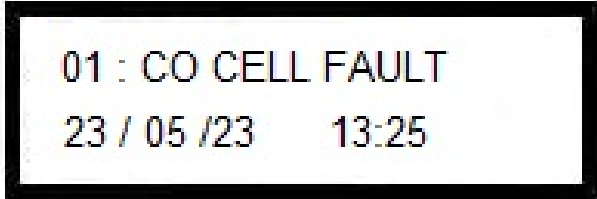
The controller has a basic 20 event data logger that records events that cause an output response to help diagnose alarm causes and system behavior.

Note : After 20 events are recorded new events overwrite the oldest event.

To access the logger, press the ENTER button to open the menu system & using the DOWN button, scroll down or up through the menu until "VIEW EVENT "ON" HISTORY" is displayed. Press the ENTER button to open this menu & view the 1st (if any) ON event triggers. The LCD display shows the event # starting at 01, followed by the event description & the time and date that the triggered the event.

DISPLAYED SCREEN INDICATING  
A SENSOR FAULT HAS OCCURED

EVENT #      EVENT DESCRIPTION



01 : CO CELL FAULT  
23 / 05 /23      13:25

EVENT DATE & TIME


The 1st event is the newest, followed by older events up to a maximum of 20 events. To erase the event history scroll up from the 1st event and the LCD screen will display a message asking to "ERASE WHOLE HISTORY" ?, Press ENTER to delete history or press the ESC button to exit event history leaving history intact. Other sample event screens are shown below.

DISPLAYED SCREEN WHEN  
NO EVENTS HAVE BEEN  
RECORDED




**NO EVENT  
HISTORY**

DISPLAYED SCREEN INDICATING  
SYSTEM STARTED BY IDLE RUN  
TIMER (Automatic minimum  
ventilation forced fan run timer)



05      IDLE RUN TIMER  
23/05/2018      11:35

DISPLAYED SCREEN INDICATING  
INTERNAL TIME SWITCH & THE  
D3 + M LINK IS ENABLED FOR  
FORCED FAN RUN.



02 : T/Sw. + D3  
23/05/2018      09:00

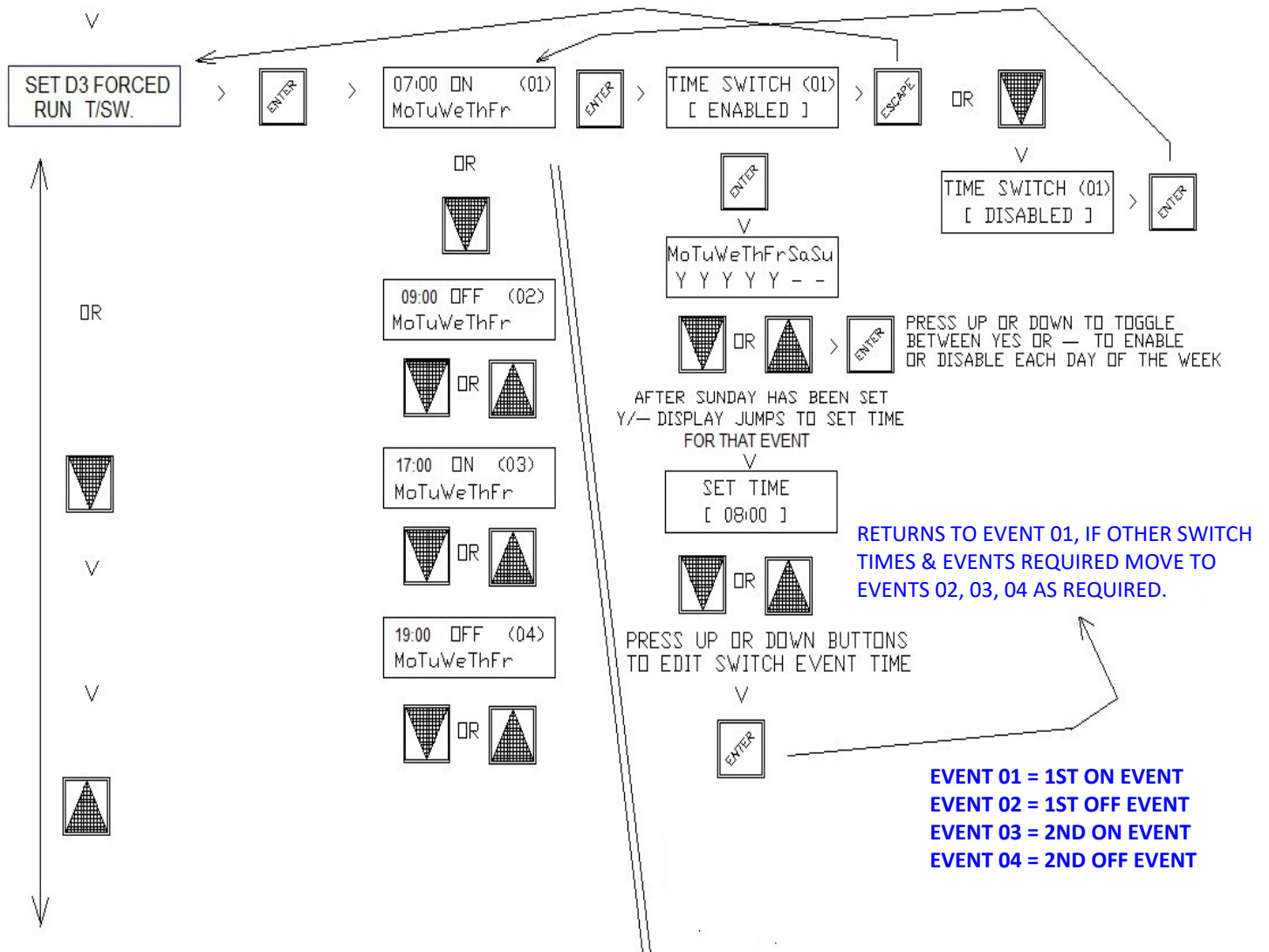
# SET D3 (terminal) FORCED (fan) RUN T/SWITCH

To edit these settings, from the normal running screen, Press the "ENTER" button. Scroll down through the menu tree with the arrow buttons until "SET D3 FORCED RUN T/SW." is displayed. Press the "ENTER" button to open this menu for editing.

When terminal "D3" is connected to "M" either by a link wire or by an external switching device (i.e thermostat or movement sensor), the fan can be forced ON (relay on) and the 0-10vDC Y output forced to a user adjustable value (this forced signal level for the Y output is set under the menu "CONFIG CONTROLLER" / "SET FORCED FAN SPEED").





The user in this menu is prompted to be enable or disable each of the 4 time switch events + their individual switching times & days of the week. Event 01 is the 1st enable ON time, Event 02 is the 1st OFF (disable) time, Event 03 is the 2nd ON enable time & event 04 is the 2nd OFF (disable) time. This time switch can be used without external switching interlocks to force on the ventilation system during morning & evening peak traffic conditions ie 07:00-09:00 & 17:00-19:00 rather than relying on the actual CO levels to operate the system, in this use, a link wire would be fitted to terminals D3 & M so only the time switch causes the forced run.



If the D3 input is required to be able to force ON fan operation 24/7 (ie whenever the D3 / M interlock is made), only enable event 01, and leave other events disabled.. **This the default ex factory setting.**



# CONFIGURE CONTROLLER

To alter the SACO configuration , scroll through the main menu until "CONFIGURE CONTROLLER" is displayed &



press  The SACO will request a 4 digit password which is "9562" , use  or  buttons to set & press 


Press  or  buttons to then scroll through the sub menus to the menu item requiring editing.



- press  to edit
- EDIT OUTPUT SETPOINTS > Adjust output turn on & off trigger points etc.
  - EDIT OUTPUT DELAY TIMERS > Adjust Delay On & Run-On timer settings per relay
  - SET IDLE PERIOD FAN RUN TIMER > Idle period Time gap & fan Run duration
  - SET D1 FAULT MODE STATE > Set fan fault input as N/O or N/C
  - SET D3 Y FORCED FAN SPEED > Speed setting for forced fan run override
  - RESTORE FACTORY DEFAULTS > Clear user changes & return to factory defaults


## -EDIT OUTPUT SETPOINTS



To enter "EDIT OUTPUT ON/OFF VALUES" menu Press 


Edit " FAN OFF " using the  or  buttons to alter the FAN turn OFF point in ppm CO.



Press  to accept & jump to edit screen "FAN ON"


Edit "FAN ON" using the  or  buttons to alter the FAN turn ON point in ppm CO.

Press  to accept & jump to edit screen "VSD RAMP START"


Edit "VSD RAMP START" using the  or  buttons to alter the VSD RAMP start point in ppm CO.

Press  to accept & jump to edit screen "VSD RAMP P BAND"




Edit "VSD RAMP P-BAND" using the  or  buttons to alter the VSD RAMP Proportional BAND in ppm CO.

Press  to accept & jump to edit screen "VSD RAMP I-TIME"

Edit "VSD RAMP I-TIME" using the  or  buttons to alter the VSD RAMP Integral TIME in Minutes.

Press  to accept & jump to edit screen "VSD MIN O/P LEVEL"


Edit "VSD MIN O/P LEVEL" using the  or  buttons to alter the VSD Minimum Output level.

Press  To display & Edit "LCD FLASH OFF" (Hi level warning using lcd backlight) using the  or  buttons.

Press  To display & Edit "LCD FLASH ON" using the  or  buttons

Press  To display & Edit "SIREN OFF" using the  or  buttons.

Press  To display & Edit "SIREN ON" using the  or  buttons

Press  to accept & return to this sub menu.



## -EDIT OUTPUT DELAY TIMERS

USE THIS MENU TO ADJUST THE DELAY ON AND RUN ON TIME DELAYS FOR EACH RELAY OUTPUT

Edit "FAN ON DELAY" using the ▲ or ▼ buttons to alter the ON time delay in mins & secs.

Press  to accept & jump to edit screen "FAN RUN ON TIMER"

Edit "FAN RUN-ON" using the ▼ or ▲ buttons to alter the run ON time delay in mins & secs.

Press  to accept & jump to edit screen "LCD FLASH ON DELAY"

Edit "LCD ON DELAY" using the ▲ or ▼ buttons to alter the ON delay in mins & secs.

Press  to accept & jump to edit screen "SIREN ON DELAY"

Edit "SIREN ON DELAY" using the ▲ or ▼ buttons to alter the ON delay in mins & secs.

Press  to accept & and return to this main sub menu.

Press the ▲ or ▼ buttons to scroll to other main sub menus or press  to exit programming

## -SET IDLE PERIOD FAN RUN TIMER

USE THIS MENU TO SET THE IDLE PERIOD AFTER WHICH THE FAN WILL AUTOMATICALLY START AND THE AMOUNT OF TIME THE FAN THEN RUNS FOR TO PROVIDE MINIMUM VENTILATION AIR TURNOVER REQUIREMENTS

Press  to edit settings in the menu "SET IDLE PERIOD FAN RUN TIMER"

Edit "IDLE PERIOD RUN DELAY" using the ▲ or ▼ buttons to set the time gap that triggers the fan after an idle period.

Press  to accept & jump to edit screen "RUN FOR TIME" screen.

Edit "RUN FOR TIME" using the ▲ or ▼ buttons to set the length of time that the fan then runs for in minutes.

Press  to accept & jump to edit screen "INHIBIT IDLE RUN FROM" screen.

Edit "INHIBIT IDLE RUN FROM" using the ▲ or ▼ buttons to set start lockout time, to inhibit idle fan run start.

Press  to accept & jump to edit screen "INHIBIT IDLE RUN UNTIL" screen.

Edit "INHIBIT IDLE RUN UNTIL" using the ▲ or ▼ buttons to set finish lockout time, to allow idle fan run start.

Press  to accept and return to this sub menu

Press the ▲ or ▼ buttons to scroll to other main sub menus or press  to exit programmi

## -SET D1 (fan) FAULT (or RUN) MODE STATE

**NOTE : To meet code, fan run or fault status is required to be monitored and cause an alarm if fan fails to operate. Terminals D1 & M are used for this requirement & must be used.**

USE THIS MENU TO SET THE SACO'S RESPONSE TO A FAN FAULT CAUSED BY AN OPENING OR CLOSING CONTACT ON D1 & M

Press  to edit settings in the menu "SET D1 FAULT MODE STATE"

Display shows existing state (factory default is close on fault)

Edit "D1 FAULT MODE STATE" using the ▲ or ▼ buttons to select [ CLOSE ] or [ OPEN ] on fault

Answer the next screen question as to whether you require the D1 fan fault input to be only read when the fan enable relay (R1) is enabled (this suits the use of N/C fan fault inputs so as not to cause faults during system idle. (factory default is NO.)

INTERLOCK WITH FAN CALL ? press ▲ or ▼ to select [ NO ] or [ YES ]

Press  to accept and return to this sub menu

Press the ▲ or ▼ buttons to scroll to other main sub menus or press  to exit programming

# SET D3 Y FORCED FAN SPEED

USE THIS MENU TO SET THE VARIABLE FAN SPEED (IF AVAILABLE) USED DURING FORCED **ON** OPERATION DUE TO THE INTERNAL TIME SWITCH / D3 OR IDLE RUN TIMER OPERATION.

Press **ENTER** to edit settings in the menu "SET D3 Y FORCED FAN SPEED "

Edit "FORCED RUN FAN SPEED" using the **▲** or **▼** buttons to set VSD speed 0-100% during forced run operation

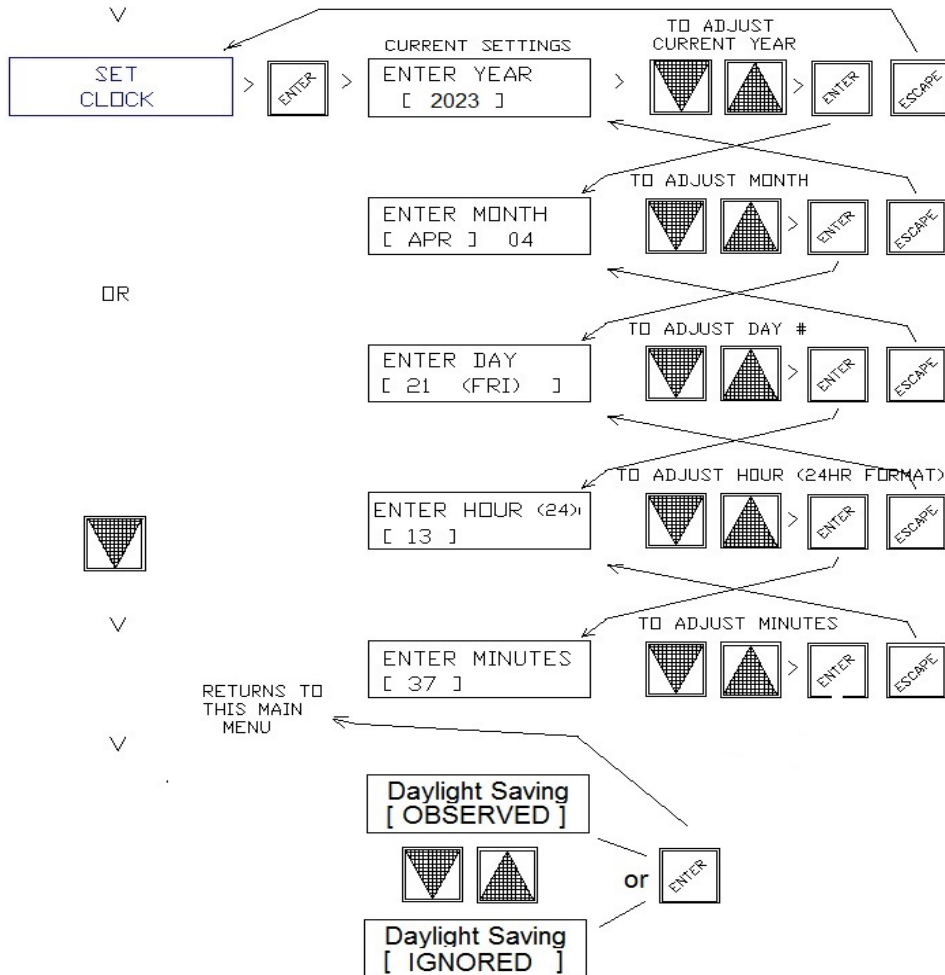
Press **ENTER** to accept and return to this main menu

Press the **▲** or **▼** buttons to scroll to other main sub menus or press **ESC** to exit programming

**RELAY COMES ON IN FORCED RUN MODE + Y output at settable value.**

# SET CLOCK (factory preset with eastern standard +daylight saving trigger dates)

From the running screen press the **ENTER** button to display the 1st main sub menu "SET CLOCK" to check or edit the controllers time, date and day light saving enable or disable settings. Daylight saving (if enabled) starts on the 1<sup>st</sup> Sunday in October (at 2am) and finish on the 1<sup>st</sup> Sunday in April (3am)



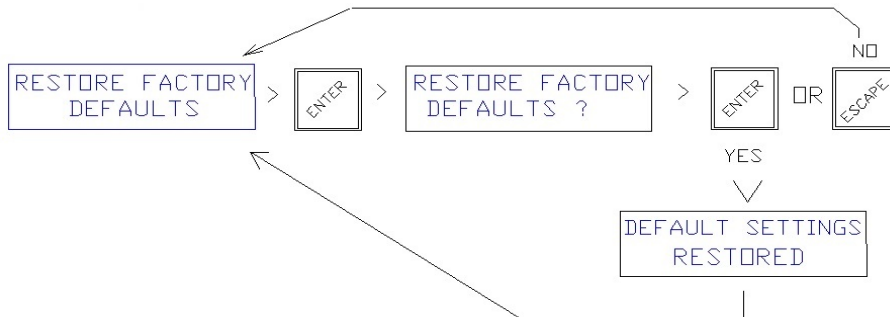


## -RESTORE FACTORY DEFAULTS

Press **ENTER** to access the choice of restoring settings to original factory defaults

To restore factory defaults select [YES] using the **▲** or **▼** buttons, then press **ENTER**

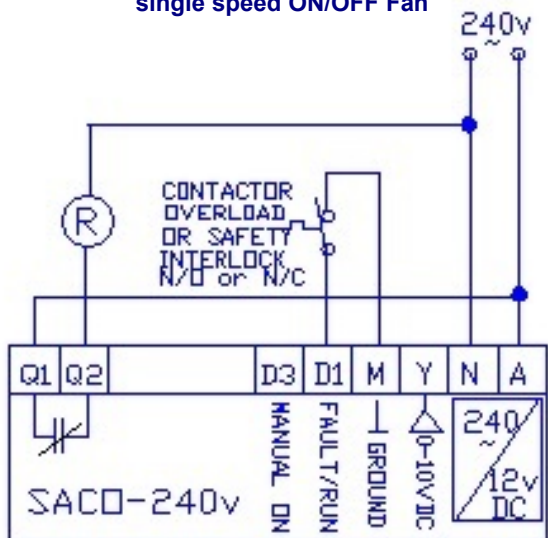
Press **ESC** to exit programming & return to normal operation & running display



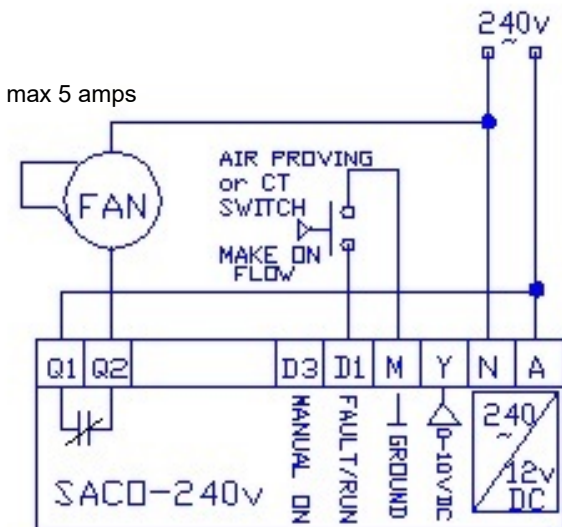
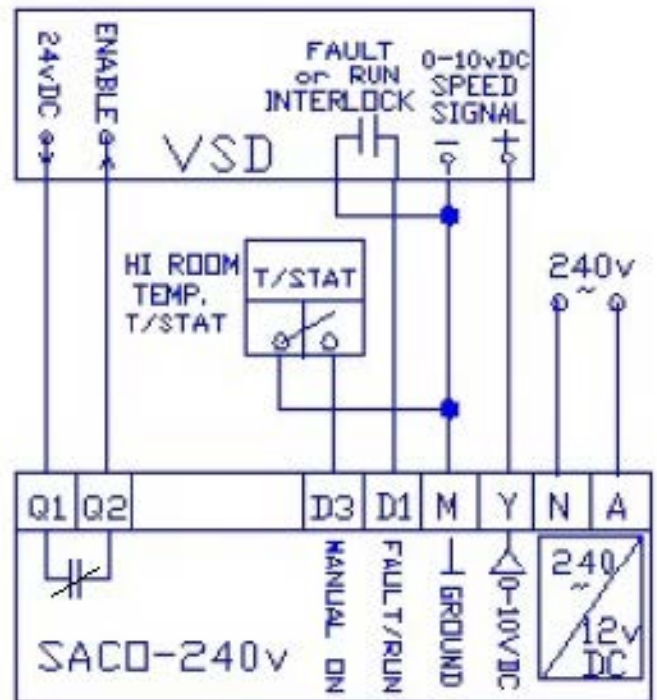
## WIRING EXAMPLES

Application Examples : CO Control using single speed ON/OFF Fan

**NOTE : TO MEET CODE, FAN FAULT MONITORING IS REQUIRED, USE TERMINALS D1 & M FOR THIS PURPOSE.**



Application Example : CO CONTROL WITH MODULATING VSD OUTPUT + HI-TEMP. T/STAT FOR FORCED START.



**NOTE : FAN RELAY N/C ..OPEN WITH POWER & NO FAN CALL**

## TESTING OPERATION

The SACO sensor / controller has a very handy Test/Demo software routine to help commission & test the ventilation system it controls. Under the SACO's lid & below the LCD screen is 4 user buttons for Menu access, Siren Mute and a Test /Demo button.

Pressing the Test/Demo button will cause automatic CO control to cease and trigger a 3 minute demo of the controllers outputs using a virtually generated CO ppm to ramp up & than down to cause outputs to trigger on & off at programmed levels to demonstrate the control & response action of this device to CO levels. It is highly recommended to use this feature to check for correct system operation.

## FAULT DIAGNOSIS

1.) If the VSD or ON/OFF Fan doesn't energise during the test routine, 1st check that the VSD or Fan is receiving enable power from the SACO's ON/OFF relay output (which is a voltage free contact for switching the fans enable power supply circuit).

2.) If controlling a VSD or EC fan, whilst the controller is producing a 0-10vDC (0-100%) output signal during the test routine (refer to the SACO display) meant to increase the VSD speed relative per this signal, and the VSD doesn't ramp up, verify that the controller is producing a 0-10vdc signal on its "Y" output terminal, if it reads 0v, try removing the field wire from the Y terminal & measure again. If without the field wire it does produce 10v than the fault must be in the connections to the vsd. Check the field wiring between the SACO's "Y" output to the VSD "+" signal input, and the SACO's "M" (or 24v neutral) to VSD signal ground. Also check the settings in the VSD, ie that it is set to a voltage signal input not 4~20mA current input which is a common error.

3.) If the SACO is reporting a FAN FAULT error message, this is caused by a ground feed from [ M (or N for 24v systems) ] into terminal "D1" which can be set as a N/O (default) or as a N/C input, check the state & programming of this input is correct. Normally a system will be set up with N/O fault input so if this message appears and removing the wire from D1 the fault disappears, this indicates the fault mode is generated by the external fan fault interlock device.

4.) If the SACO is reporting a CO CELL fault message, check the removeable CO CELL module (bottom left) hasnt come loose & is correctly plugged into its pcb mounting sockets. Also try cycling power to the SACO. If the fault persists try recalibrating the SACO with test gas. If the message remains the CO CELL might be past its life time use (minimum 5 years) or the SACO is faulty & will need to be replaced.

5.) Forced fan operation from external switching device doesnt operate fan...check the connection into terminal D3 is connected to ground and that the internal time switch is in an enable period, if the D3 input is to work 24/7 - only time switch event 01 should be enabled.

## SENSOR CALIBRATION

**Initial & yearly calibration tests are required for this product to comply with AS1668.2 using calibrated gas by experienced service personal. NOTE : The CO cell in this device also utilizes the ABC automatic zero calibration algorithm to track true zero ppm over its life time. After a power cycle or start up during a higher than zero CO environment, the cell will automatically re-tune as the CO level returns to low levels to establish a correct zero reference.**

### To Manually Calibrate this device follow the steps below.

Press the ENTER button and then using the DOWN button scroll to the 2nd menu item. "SENSOR CALIBRATION" will be displayed

Press ENTER.

"CAL. ZERO ppm"  
"VALUE = [ ### ppm ]" current ZERO value will be displayed

Apply zero ppm calibrated air directly to the sensor cell via a suitable calibration kit & note the displayed value, press the UP button than the DOWN button to establish & adjust a true ZERO ppm level. (Note : A common practice amongst service techs is, unless obvious CO fumes exist, that the current background air is accepted as being 0 ppm & they don't actually use calibrated zero air for this adjustment plus as this device automatically tracks 0 ppm anyway (based on long term low readings) this approach is generally acceptable if the displayed initial reading is near or at zero, if in any doubt use a 0 ppm test bottle to set 0ppm.

Press ENTER

"SET CAL. GAS"  
"USED =[100] ppm" will be displayed

Using the UP or DOWN arrow buttons, adjust this value to match the calibration gas bottle being used for sensor calibration (default = 100ppm), but other typical values are 50 150 & 200 ppm.

Press ENTER

"APPLY CAL. GAS"  
"RECAL. = [ ### ppm ]" Current background CO is displayed,  
Increasing after applying test gas.

Apply calibrated gas (ie 100ppm) directly to the sensor cell via a suitable calibration gas kit and note the displayed actual value reading (allow at least 2 & 1/2 minutes to reach maximum value). If not displaying the value matching the calibration gas bottle, use the UP or DOWN buttons to adjust the value to the required ppm, +/- 2ppm is an exceptable value. Press ENTER

After locking in this new calibration value the display will return to the Calibration Menu, press the UP or DOWN buttons to move to another menu, or press the ESC button to exit programming and return to the normal running display for automatic CO monitoring & control.



**Control Agencies**

**EX FACTORY CALIBRATION CERTIFICATE**

**SENSOR MODEL NUMBER :** **SACO**

**SENSOR SERIAL NUMBER :** \_\_\_\_\_

**INTERNAL POWER SUPPLIES** \_\_\_\_\_

**SIREN MUTE CAPABILITY** \_\_\_\_\_

**PASSED TEST/DEMO TEST** \_\_\_\_\_

**OUTPUT TRIGGER LEVELS** \_\_\_\_\_

**0ppm CALIBRATION "AIR" BOTTLE WITHIN USE BY DATE** \_\_\_\_\_

**100ppm CALIBRATION "CO" BOTTLE WITHIN USE BY DATE** \_\_\_\_\_

**FACTORY CALIBRATION DATE :** \_\_\_\_\_

**CALIBRATION TECHNICIAN :** \_\_\_\_\_

**THIS IS TO CERTIFY THAT THIS SENSOR HAS BEEN CALIBRATED IN ACCORDANCE WITH AUSTRALIAN STANDARDS AS1668.2 , AND IS REQUIRED TO BE SITE CALIBRATED IN 12 MONTHS FROM THE ABOVE DATE BY QUALIFIED PERSONAL USING CALIBRATED TEST GAS.**