UCC SATURN

UNIVERSAL COMMERCIAL CONTROLLER
User & Installer Manual

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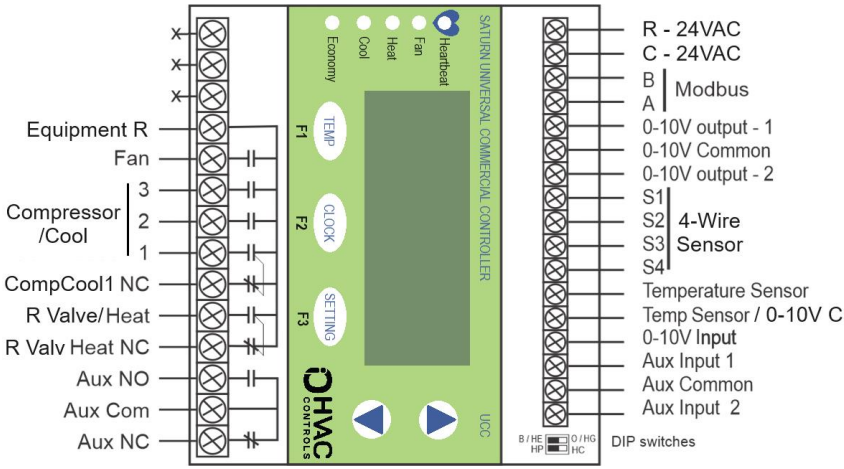
Installation

Wiring Overview

The Saturn is a designed to precisely control a wide selection of HVAC systems in commercial applications. A brief input / output explanation is provided below, further function specific detail is provided through this manual.



Function Buttons

The Saturn has 3 function buttons directly under the LCD. The text above the function buttons change dynamically to indicate the function of each button.

Equipment Connections

Equipment relays provided at the bottom of the Saturn shall be landed to your equipment terminals. Provided relays are as such Hot (R), Fan (G), Compressor/Cool (Y1, Y2, Y3), Reversing Valve/Heat (O/B or W).

A normally closed relay is provided for first stage heating and cooling respectively. All other relays are single pole normally open.

All relays are rated at up to 300V. The Fan relay is rated at 12Amps resistive; all other relays are rated at 5Amps resistive maximum. It is **strongly** recommended that an external fuse be used to protect the Saturn relays and the equipment being controlled. Exceeding current handling capacity of the relays may result in damage to the relays or the Saturn.

Communications Terminals

The Saturn comes with hardware and firmware to provide MODbus RTU communications capability. The “A” and “B” terminals are for communications.

The communications terminals “A” and “B” are close to the 24V input.
Take extreme care that 24V is not accidentally applied to the communications terminals or it may result in damage to the communications capability of the Saturn.

Auxiliary Outputs

Dry contact normally open and normally closed outputs are provided for an auxiliary relay that can be configured for a variety of functions in the Settings.

0-10V Outputs

2 x 0-10 Volt outputs (Z1, Z2) have been provided for a variety of functions that can be configured in the Settings. These may be where modulating dampers are wired depending on application.

0-10V Input

1 x 0-10 Volt input has been provided. This may be connected to an IAQ sensor that provides a 0-10V output. When IAQ Threshold is enabled for this input option, fresh air will not be introduced to the building if this input's value measures lower than the set value in the menu.

Temperature Sensor Input (2-wire)

The standard room temperature sensor provided with the Saturn wired up to the T terminals. It is recommended to use the 4-wire sensor if you have concerns about problems associated with long cable runs or interference in the sensor wiring. Since the 2-wire sensor is a digital sensor, shielded cable is required on all cable runs.

Auxiliary Inputs

The Saturn has two auxiliary inputs with selectable functions. A list of available functions for these inputs is provided in the Installer Menu section. These inputs are volt free (dry contact) and initiated by switching the auxiliary input to the auxiliary input common.

If two inputs contradict each other, input 1 has priority. Fire and fault inputs have priority over all other functions regardless of what input they are on.

These inputs accept DRY CONTACTS. Do NOT apply any external voltage to these Auxiliary input terminals or damage to the Saturn will result. This is NOT covered by warranty.

Setting the 2 DIP Switches Functions

There are 2 DIP switches that are used to set core function of the Saturn. A table outlining these functions is provided below. These switch functions may be set when the Saturn is unpowered.

Switch 1	Switch 2	Function
OFF	OFF	Heat Pump – Energize in Heat
OFF	ON	Heat Cool – Electric Heating
ON	OFF	Heat Pump – Energize in Cool
ON	ON	Heat Cool – Gas Heating

Sensor Wiring

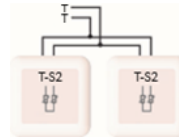
The Saturn will accept two types of temperature sensors: the 2-wire sensors (T-S1 and T-S2) and the proprietary 4-wire sensors (UCC-DTH, UCC-OTH, and UCC-TH).

2-Wire Sensors

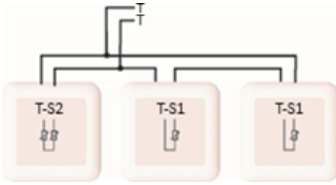
The standard 2-wire sensors are suitable for room temperature monitoring only. There are several types of 2-wires sensors available. 2-wire sensors connect to the T1 and T2 terminals next to it on the Saturn and are not polarity dependent.

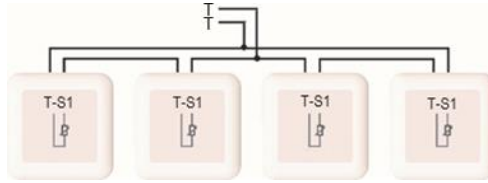
Averaging Room Sensors

When it is necessary to measure the room temperature in multiple locations the Saturn can use a network of room sensors and control the average of these temperatures with the 2-wire sensor.



Examples of averaging in 2, 3 and 4 locations are shown using a combination of 2-wire sensors.



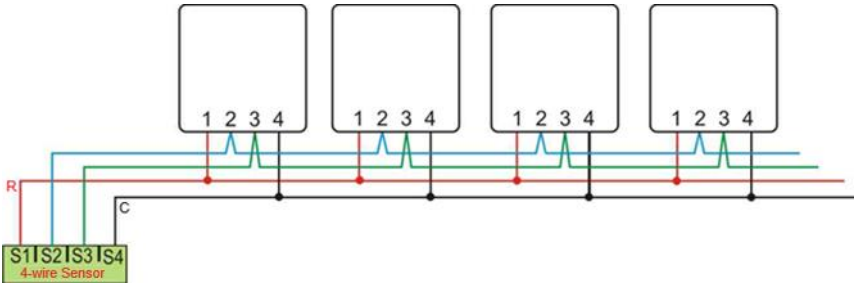


4-Wire Sensors

Terminals 1 & 4 power the proprietary 4-wire sensor (12v DC +/- 4v is normal) while terminals 2 & 3 communicate data between each sensor and the Saturn.

The sensors must be wired in **series** only. For further detailed set ups refer to the 4-wire sensor manual. Alternatively, if set under the Installer Menu option “Change Sensor Performance”, you can select High Heating & Low Cooling when using multiple 4-wire sensors.

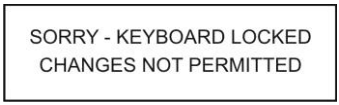
Note, when short of cabling you may power the 4-wire sensor locally from a 12VDC power supply and connect the Saturn to the smart sensor using terminals 2 & 3.



Setup

The PIN Prompt

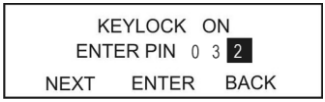
The Saturn has 3 main menus, some or all of which may be protected by a PIN. This PIN can be changed from the factory default of **"032**" by the installer. If the PIN has changed and the new PIN is not known by you, please contact us.



"Changes Not Permitted" window warns you that you must enter a PIN to proceed the menu being accessed. The PIN window will show up momentarily.

Pressing the **UP**/**DOWN** buttons will adjust the currently highlighted number. The first digit in the default PIN is "0" (Zero) so simply press the **[NEXT]** button to advance to the next digit. Adjust the second digit to "3" (Three) and again press the **[NEXT]** button to advance to the third digit. Adjust the third digit to "2" (Two). You should now have the PIN window showing "032".

If you have made an error, pressing the **[BACK]** button will permit you to adjust a previous digit.



Press the **[ENTER]** button to proceed. You may try again if you entered the wrong PIN.

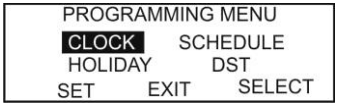
Setting the START Event or Run Temperatures

When the Saturn is running it will maintain the user-defined heating & cooling set temperatures. To set the START event temperatures press the **<F1>** (settings button). Use the **[SELECT]** button to select fan mode (if applicable) and the heating and cooling set points. Adjust with the **UP**/**DOWN** buttons to your desired value.

When the Saturn is running the STOP event, it will maintain the setback temperatures set in the Advanced Installer Menu.

Programming

The Saturn can automatically turn the HVAC system on and off based on its internal time clock and the user/installer defined schedule.



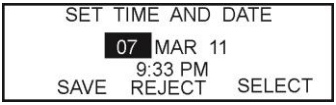
There are 4 options in the schedule menu that can be accessed with the **<F2>** menu. These are detailed below.

Setting the Clock - Will set the current time and date.
Setting the Daylight Savings Time – Used to set the daylight savings start and end date and time.
Setting the Program – Used to set the 7 day start and stop times.
Setting the Holiday – This sets the date the holiday schedules will start and end.

For Daylight Savings, 7 Days, and Holiday Scheduling, see the Scheduling Controls section.

Setting the Clock

Press the **<F2>** "Schedule" button. Depending on values set within the Saturn installer menu you will be presented with several options. Use the **[SELECT]** button to highlight the word "CLOCK" and then press the **[SET]** button.



Use the **[SELECT]** button to advance through the various parameters such as Date, Month, Year, Hour and Minute and then adjust these values with the **UP**/**DOWN** buttons to the desired value. (The Saturn will calculate the day of the week)

Press **[SAVE]** to save the new time parameters and exit the menu. The **[REJECT]** button will exit this menu discarding changes.

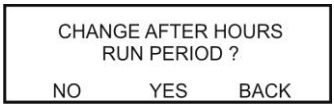
Setting Installer Preferences

The Saturn has a menu to adjust operational settings for the safe and effective operation of the HVAC equipment under control of the Saturn.

To enter the Installer menu, press **<F3>**. If the key lock is enabled, you will be given the option to enter your 3-digit PIN before advancing to the next step.

The Saturn has 3 function buttons directly under the LCD. The text above the buttons change dynamically to indicate the function of each button in that window at that time and in conjunction with other options selected elsewhere in the various Saturn menus.

A typical installer menu window is shown here.

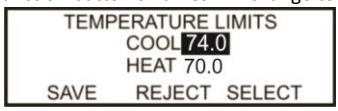


Selecting **[NO]** will move to the next option in the installer menu.

Selecting **[YES]** will permit you to edit the shown option, the “After-hours” run period in this example.

Selecting **[BACK]** will move you to the previous menu item or if you press and hold the **[BACK]** button for 3 seconds you will be “short-cut” exited from the installer menu.

As you navigate through the various windows, the 3 main function button’s names will change to indicate the button’s new function for the current window.

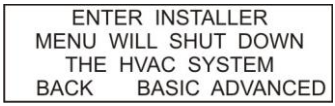


The **[SELECT]** button advances you through the various functions that can be adjusted as shown by the black box surrounding the menus, the cool set temperature in this example.

The **UP**/**DOWN** buttons will permit you to change the currently selected option.

The **[SAVE]** button will save the changes and exit this window.

The **[REJECT]** button will exit this window discarding any changes made.



Note - Entering the installer menu will shut down the HVAC system until you exit this menu. The HVAC system will then restart again after having waited for any set time delays to expire once you exit this menu.

A list of the Basic & Advanced Installer Menu with details of the options within each menu is provided below.

Installer Menu

Basic Menu	Advanced Menu
Change Programming Options? Change Auxiliary Relay Functions? Change Auxiliary Input Functions? Change 0-10V Output Settings? Change Economy Settings? Exit Installer Menu?	Change System PIN? Change Button Lock? Change Programming Options? Change Temperature Control Limits? Change Setback Temperature? Change After Hours Run Period? Change Sensor Performance? Change Compressor Staging Limits? Change Compressor Control Options? Change Compressor Timing Options? Change Room Sensor Functions? Change Auxiliary Relay Functions? Change Indoor Fan Options? Change Unoccupied Mode Settings? Change Auxiliary Input Functions? Change 0-10V Input Settings? Change 0-10V Output Settings? Change Display Settings? Change Economy Settings? Change Night Purge Settings? Change PI Settings? Change Network Override Settings? Edit Communications Settings? Enter Service Setting Menu? Exit Installer Menu?

The table provided below provides a detailed description of the various menu items, their functions and the range the values that can be set where appropriate.

1	**Change System Pin?**	**Default Value = 032**
The Saturn has a 3-digit PIN from 000 to 199 that is used to access various menu items if enabled by the installer. This menu lets you to see and change the current PIN. To change the PIN, you must enter it twice. If both PINs match, the new PIN is updated and must be used on all future PIN requests. *NOTE: If you change and then forget this PIN, please contact us.*		
2	**Change Button Lock?**	**Default = OFF**
This menu sets the security access for the various menus within the Saturn. **Options** **Off** – No menu items are PIN protected - Unrestricted access to all functions. **Set Temp Only** – The user can alter the Set Temperatures only without requiring a PIN. **Set & Program Only** – The user can edit the Set Temperature and Time Schedules menu but must use a PIN to enter the Installer Options menu. **Full Lock** – All menu items require a PIN to enter.		
3	**Change Programming Options?**	**Default = 7 Day 2 Event** **Optimised Start = OFF**
The Saturn can be operated as a programmable controller. It may instead be used as a manual controller, which requires an external time clock or switch to turn it on or off. **Options** **Always ON** –If selected the Saturn will turn on and run 24 hours per day, 7 days per week. This setting is to be used when using the RS-SSD to turn the Saturn ON and OFF manually. **Manual** – The Saturn will rely on an external signal to turn it on or off. This external signal is from the auxiliary inputs only or the built in After-hours Run function. Do NOT use this function if using the RS-SSD sensor ON/OFF Function. **7-Day 1 Event** – This option permits the Saturn to initiate the START event and STOP event automatically as set by the inbuilt time clock, once per day for the 7 weekly days. **7-Day 2 Event** – This option is like the 7-day 1 event as described above however you are permitted 2 START events and 2 STOP events per day. This is useful should you wish the air conditioning to be off for part of the day or when you wish the Saturn to start on one day, run past midnight and stop the next day. **365 Day 1 Event** – This option permits you to additionally set up to 30 holiday schedules in the Saturn that will override the normal 7-day 1 event program. Useful for pre-programming the Saturn to utilize START, STOP, or Unoccupied settings during holidays. **365 Day 2 Events** – This option is like the 365 Day 1 Event as described above however you are permitted 2 events per day. **Optimised Start** OFF / ON. ON will start the HVAC system before the programmed start time to ensure that it is at the set temperature **BY** the start time.		

4	Change Temperature Control Limits?	Default = Heat 120°F & Cool 42°F

If permitted, the user can have the ability to adjust the heating and cooling setpoints. The range of the user adjustment can be limited if desired by setting the values below.

Options

Heat – The highest heating setpoint that can be adjusted. (42°F to 120°F)
Cool – The lowest cooling setpoint that can be adjusted. (42°F to 120°F)

Regardless of where these set point limits are set, the Saturn will always ensure that the cooling setpoint is above the heating setpoint. If necessary, the Saturn will "push" set points apart to ensure the set points do not overlap.

5	Change Setback Temperature?	Default = Heat Off & Cool Off

Rather than shutting the heating and cooling system completely off during the STOP events, the Saturn can automatically maintain a more energy efficient setpoint during this time.

This value can also be used as a set temperature during Holiday events if desired. See "Setting Holiday Schedule" section.

The Fan will run in "Fan Auto" mode to maintain any setback temperatures that are set.

Options

Heat – The setback heating temperature. (Range Off –then 42°F to 120°F)
Cool – The setback cooling temperature. (Range 42°F to 120°F then OFF)

6	Change After Hours Run Period?	Default = OFF

The Saturn has a built-in after-hours timer that, when initiated will replace the current STOP or Holiday event set points with the START heating and cooling set points and Fan Mode. This override period is timed and at the conclusion of this timed period the Saturn will return to the programmed set points for the current date and time.

To disable this function set this value to OFF

7	Change Sensor Performance?	Default = 0.0 & Nor& SS

Room - Room sensor
O/A - Outside air sensor

Options

Calibration – adjust this value of the selected sensor by +/- 6.0°F.
This is used mostly to offset any temperature accuracy errors caused by long cable runs with the 2 wire sensors. Adjusting any 4-sensor readings should NEVER be necessary.
Response Speed - The Saturn will permit you to select how rapidly it will respond to room temperature changes.
Options are **VFAST** / **Fast** / **Nor** (Normal) / **Slow** / **VSLOW**
High / Low select (only applicable with multiple indoor smart sensors)
SS = Standard HI = High Select LO= Low Select

8	Change Compressor Staging Limits?	Default = 2°F

The Saturn can control up to 4 stage heat pump system. You can select how far from setpoint each of the 4 stages turn on and how close to setpoint each stage will turn off. These are all set independently:
Stage X ON Value (How far from setpoint this stage turns on)
Stage X OFF Value (How far from setpoint this stage turns off)

Options

OFF to 10°F – When selecting OFF for any compressor, it and subsequent compressors are also turned to off.

Compressor 1 cannot be turned OFF.
To use compressor 4, you must also set the Aux Relay function to Compressor 4

9	Change Compressor Control Options?	Default = OFF & 5min % 30min

This menu item permits you to fine tune the Saturn's compressor control settings.

Options

Lead / Lag – Default = OFF. This option attempts to even the wear on air conditioning systems with multiple compressors. When all compressors are off (either due to the room temperature being in the dead band or via time clock turning the system off) the compressor numbers will rotate 1 value so that next time the system starts, a different compressor will start first.

Important – The Lead Lag Function will use all compressors under Saturn control as indicated in the Compressor Control Options menu as described above, so it is vital that the number of fitted compressors is correct.

Smart Upstaging – Default 5 mins. The Saturn does not simply measure the difference between the room temperature and set temperature to bring on various stages of heating or cooling. The Saturn will give a running compressor a chance to bring the room to temperature on its own before starting additional compressors to reduce energy consumption. The "Smart Staging" settings will determine the minimum time the Saturn will wait before bringing on additional compressors.
Timed Upstage – Default 30 mins. This setting will bring on additional compressors regardless of how close the room temperature and set temperature are to prevent a struggling compressor attempting to bring a room to set temperature on its own.

10	Change Compressor Timing Options?	Default = 3 mins & OFF

An adjustable compressor short cycle and minimum run timer has been provided to improve compressor protection.
The short cycle timer will prevent the compressor from restarting too soon after it has shut down and when the Saturn first powers up (soft starting).
The minimum run timer will keep the compressor running for a minimum period of time, again to prevent short cycling but more so to reduce long term energy consumption of the system.

Options

Short Cycle Delay – Adjust this from Off to 3, 4 or 5 mins (Default = 3 Minutes)
Minimum Run Time – Adjust this from Off to 2, 3, 4 or 6 mins (Default = OFF)

11	Change Room Sensor Functions?	Default = OFF

The room temperature sensor wiring can be used for additional functions other than just measuring the room temperature. When this sensor is open circuited or short circuited and seen as missing by the Saturn, additional functions can be performed.

Options

Force Off – When the room temperature sensor is absent, the Saturn will shut down.
Ventilation – When the room temperature sensor is absent the Saturn will keep the indoor fan running during the START event programmed time. There will be no heating or cooling.
Full Vent – When the room temperature sensor is absent the Saturn will keep the indoor fan running regardless of time or set schedules. There will be no heating or cooling – use this with caution.
Note: A fire or fault input will shut down both Full Vent and Ventilation Modes instantly.

12	Change Auxiliary Relay Functions?	Default = OFF

The Saturn is fitted with an auxiliary dry contact relay to which you can assign pre-set functions. Many of these functions have an additional setting associated with them, such as when selecting the high temperature alarm the Saturn permits you to set the alarm value.

Options

Off – This relay is not used.
Time & After Hours – the auxiliary relay will close when the Saturn is running the START program or when the after-hours timer is active. This may be used to make the Saturn a Master Time Clock.
After Hours Only – the auxiliary relay will close only when the after-hours timer is running. This can be used to pass the after-hours run information to additional devices.
Time Clock Only – The auxiliary relay will close when the Saturn time clock is running the START program. If the after- hours timer is initiated, this relay will remain inactive.
Compressor 4 – The auxiliary relay is assigned as compressor 4. Compressors 1 - 3 must be active for this function to operate.
Aux Heat – In this mode, the auxiliary relay is assigned as auxiliary heat relay, providing a heating call after all compressors have finished calling for heat or as a 2nd stage of heating in Heat Cool Mode (Sw 2 ON).
IAQ – The relay will energise whenever the 0-10V input is greater than 0.5v.
Fan – The Aux relay will turn on whenever the main fan relay is on.
MASTER – The Auxiliary relay will close whenever the Saturn is running and open when the Saturn stops. This considers any axillary input calls that may override the Saturn to Run or stop outside of programmed hours.
Heat and Cool – The auxiliary relay will close whenever the Saturn is calling for heating or cooling.
Cool – The auxiliary relay will close whenever the Saturn is calling for cooling.
Heat – The auxiliary relay will close whenever the Saturn is calling for heating.
Low Temp Alarm - The auxiliary relay will close when the room temperature falls below the low temperature alarm limit. It will auto reset when the room temp rises more than 3°F above the alarm set point. Note – if set, the Low Alarm will operate if the Saturn is powered, even when stopped or OFF.
Hi Temp Alarm – The auxiliary relay will close with the room temperature exceeds high temperature alarm limit. It will auto reset when the room temp falls more than 3°F below the alarm set point. Note – if set, the High Alarm will operate if the Saturn is powered, even when stopped or OFF.
Economy - The auxiliary relay will close whenever the Saturn calls for economy mode. The Fresh Air Damper Voltage can also be set that will energise the Aux relay).
Humidity - This permits the Saturn to control a humidifier if the indoor humidity becomes low. You can also set the alarm threshold.
Network – The auxiliary relay can be controlled (opened or closed) via Modbus only

13	Change Indoor Fan Options?	Default Unlocked & No Purge

The indoor fan in the Saturn can be controlled by the user if desired (permitted to select Auto Fan or Fan On Mode) or locked into On or Auto Mode as set by this menu.

Options

Unlocked – The user can select Fan Auto or Fan ON Mode for the START event without restrictions.

Locked Auto – The user cannot adjust the Fan Mode. When the START event is running the fan will be in Auto Mode where the fan will cycle on and off with the heating and cooling.

Locked ON – When the START event is running, the fan will be held on continuously regardless of the need for heating or cooling. The fan will turn off at the 'Stop' program.

Purge - A fan purge period of 0 (Off) to 10 minutes, in 1-minute steps, can be set. This will hold the fan on for a purge period of time after the set point has been reached and the heating and cooling has stopped.

14	Change Unoccupied Mode Settings?	Default Heat Off, Cool Off, A. Fan

The Saturn has an Unoccupied mode. When in Unoccupied mode, the current active setpoints and fan mode are replaced by the Heat, Cool and Fan settings in this menu. The Unoccupied mode can be initiated via the auxiliary inputs or via the Holidays function.

Options

Cool – The cooling set point to use during the unoccupied period. (Default OFF)

Heat– The heating set point to use during the unoccupied period. (Default OFF)

Fan– The Fan Mode to use during the unoccupied period. (Default Auto)

Caution* – *If you set the Fan Mode to "ON" in this menu and then use the unoccupied mode for a holiday event, then the fan will run continuously, 24 hours per day during that holiday event period regardless of the need for heating and cooling. See Holiday Programming for more detail.

15	Change Auxiliary Input Functions?	Default = OFF

Two auxiliary inputs have been provided. These are digital inputs and each of these 2 inputs has the same list of options. In the event of a conflict, auxiliary input 1 will have priority. A fire or fault input regardless of what input calls them has absolute priority over all Saturn inputs.

Options

OFF – This input is disabled.

Fire – Normally closed input. If this input is open the Saturn will shut down all functions, all relays will open and both 0-10V signals will be 0 volts. This is an instant shutdown; minimum run times and fan purge periods will be cancelled. The LCD will show "FIRE" to indicate this mode is active.

Occupancy – Initiating this function will cause the Saturn to replace the current set points with the installer set Occupancy set points and Fan Mode for as long as this input is active.

AH Initiate – A short ON/OFF signal (Pulse) on this input will initiate or cancel the Saturn's after hours run timer function. During the after-hours run time, the Saturn will use the START setpoints and Fan Mode for the timed after hours run period.

Force On – When this input is active, the Saturn will use the START program's temperatures and Fan Mode for as long as this input is active.

Delay Start – Initiating a Delay Start is like the Force ON Function described above except that rather than starting immediately the Saturn will wait a random period of time up to 90 seconds, before starting the A/C system. This is useful if you have multiple Saturn units running from a single time clock to protect the building's power system.

Fault NC – Opening this input will shut the Saturn down. The LCD will show "System Fault".

Fault NO – Closing this input will shut the Saturn down. The LCD will show "System Fault".

Fresh Air – When this input is active and Economy Mode is enabled, the Saturn will open the fresh air damper and close the return air damper to introduce fresh air into the building. Typically, this input is connected to an indoor air quality monitor.

Auto – When Auto mode is used, the Saturn will run based on its time schedule only when this input is closed and stop when the input is open. This mode fits standard Mechanical Auto/ON/OFF switch logic.

16	Change 0-10v Input Settings?	Default = OFF

Off - This input is not used.
IAQ Threshold - The voltage seen at the 0-10V input below this value will not initiate any fresh air introduction into the building. This is the normal "background" level that is acceptable.
Range is the amount the fresh air damper will open when the 0-10V input measures 10V.
For example: if using a 0-2000ppm CO2 sensor where you want the damper to open to a maximum of 60% when full fresh air is required and want the damper closed when the indoor CO2 is below 500ppm. Set the threshold for 2.5V ((2000/500ppm) =4, 10V/4 = 2.5)) Set the range to 60%

17	Change Display Settings?	Default = Deg F & 12 Hour

This menu sets the default temperature and time format display for the Saturn.

Options
Display – Degree C or F format.
Clock – 12-hour (am/pm format), 24-hour format or Off.
(Note Setting the clock to OFF will force the Saturn into Manual Mode)

18	Change 0-10V Output Settings?	Default = OFF

The Saturn has two 0-10V outputs which can be assigned specific functions as detailed below. Each of the two 0-10V outputs has the same functions.

Options
OFF – The output is not used. Output is 0V.
H & C – By selecting this option this single output will modulate for both heating and cooling. This is mostly used by BMS systems for example to obtain feedback about how far the room is from set point for both heating and cooling modes.
Cool – This sets the 0-10V output to control a 0-10 cooling valve. When you select "Cool" you are then given the option to select the span for the cooling valve, i.e. how far above set point the 0-10V output is at 10V.
Heat – This sets the 0-10V output to control a 0-10 heating valve. When you select "Heat" you are then given the option to select the span for the heating valve, i.e. how far below set point the 0-10V output is at 10V.
As well as setting the 0-10V output span, you are also able to set how far from setpoint you wish the output to start. – Only applies to Heat, Cool and heat and cool settings)
Return Air – This assigns the 0-10V output to control the inside economy cycle damper. When economy is used, this damper will modulate closed as more outside air is used.
Fresh Air – This assigns the output to control the outside economy damper. Normally this is at 0V until economy air is used but can sit above 0V if the DVT function is set (see Change Economy Settings below). The outside damper is also used for the Night Purge Function as described below.
Type – 0-10V or 2-10V type valves. Note - This applies to BOTH 0-10V outputs.

19	Change Economy Settings?	Default = OFF

You must assign one of the 0-10V outputs as described above before being permitted to adjust the economy settings within this menu. The Saturn will automatically change this setting to "ON" when you assign at least one 0-10V output to Fresh or return air if you have the outside air sensor fitted.

When using outside air for free cooling (see Economy Control Section) the suitable temperature range of outside air can be defined.

Options

DVT- Off to 90%. The Day Ventilation Time Function will open the outside air damper by this fixed amount regardless of other economy function settings but only while the building is occupied. This is to introduce a fixed amount of fresh air into the building to keep the indoor air quality acceptable when the building is occupied. The damper will close when the building is unoccupied to prevent heat loss overnight.

Off - Economy cycle is not used.
On 2 Wire – In this mode, Economy Cycle is ready and using a 2-wire sensor for outside air temperature measurement. A 4-wire sensor must be used for indoor temperature measurement.
On 4 Wire – In this mode, Economy Cycle is ready and using a 4-wire sensor for outside air temperature and humidity measurement. You may use a 2-wire or a 4-wire sensor for indoor temperature measurement.
Test - Saturn will behave as if 100% outside air is required.
RH Limit – When an outside smart sensor is used, and the normal 2 wire sensor is used for room temperature measurement the Saturn will permit you to set a high outside relative humidity limit. When the outside air is above this level outside air will not be used for cooling.

If both inside and outside smart sensors are used, then the economy settings window will show "Enthalpy Based". There are no adjustments required as the Saturn will compare the inside and outside air enthalpy and base the use of outside air on these values.

Note: When the outside air cannot adequately cool the room, the Saturn will suspend the use of outside air and replace it with mechanical cooling.

20	Change Night Purge Settings?	Default = OFF

The Saturn can use outside air to cool a building at night when the air is cooler, to cool the building and prepare the building for the next day's use.

Options

Off / Fan / Aux – Turns the Night Purge Function on or off and sets which relay should close to draw in outside air during the night purge period. "Fan" will use the normal equipment fan. By selecting "Aux" the Saturn will use the auxiliary relay to control the night purge fan.
Temp – Sets the desired temperate to cool when night purge is operating.
RH Limit – Maximum outside RH level suitable for night purge. (requires smart outside sensor)
When - Sets the night purge start.
T0 - Sets the night purge stop time.
Note - night purge requires 1 0-10V output to be set for "Fresh Air Function".

21	Change PI Settings?	Default = P Only

The Saturn can apply integral action to its outputs if so desired. This action will alter the control output to bring the room to set temperature more quickly when using multistage equipment or equipment with variable capacity. PI control will not assist with a fixed capacity system.

Y1 Output, Y2 Output or multistage relay outputs can be given PI control. You have 99 degrees of proportional and integral action to choose from.

You will be given 2 settings when selecting PI control. The first digits are the "P" (proportional), the second digits are the "I" (Integral).

Unfortunately, there are no best "defaults" for this function. The settings should be made to suit the application, the size of the equipment and load will have great impact on how effective these settings will be. Trial and error will provide the best outcome.
P only – Proportional control only
P1 – Slight Proportional action. P 99 – Heavy Proportional integral action.
I 1 – Slight Integral action. P 99 – Heavy Integral action.

If in doubt - leave this setting as P only.

22	Change Network Override Settings?	Default = OFF & Auto

When connected to a MODbus master, many settings or control functions can be monitored or overridden. This menu permits resetting of critical control functions should the MODbus network fail.

Options

O/Ride OFF – the Saturn internal clock and schedule is in control.
Force ON – The BMS system is holding the Saturn on (in START Mode).
Force OFF – The BMS system is holding the Saturn off (in STOP Mode).

Relay Auto – The Saturn will control its 6 relays based on room and set temperature.
Network – the Saturn relays are being controlled via the controlling BMS.

23	Edit Communications Settings?	Default = 32 / 19.2k

The Saturn is fitted with integrated MODbus RTU communications drivers and firmware. This permits one or multiple Saturns to be controlled remotely via a PLC or BMS if required. Communications information is provided in a separate document.

Options

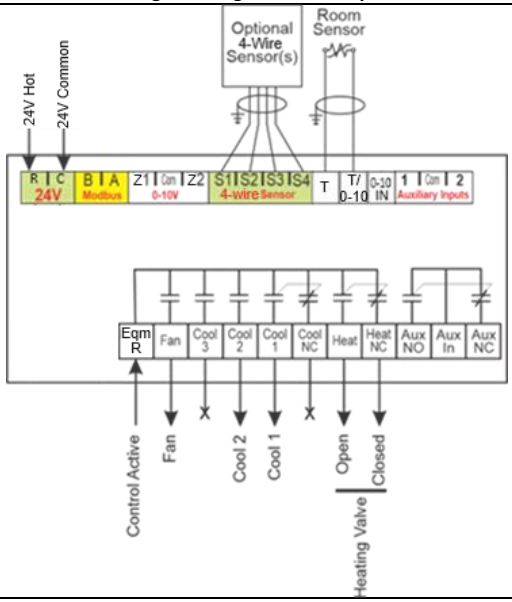
MODbus Address – This sets the unique address for "this" Saturn on the network. Every device on the network must have a unique network address. Range 0 - 255. Zero NOT recommended.
Baud Rate – This sets the communications speed. 4.8K, 9.6K or 19.2K 38.4 baud. All devices on the network must communicate at the same speed.

24	Enter Service Settings Menu?	Default = Off (All)
This menu permits you to perform some minor maintenance and testing on the Saturn, as well as permits you to quickly commission the A/C system under Saturn control. **Options** **Relay Test –** Selecting **[YES]** will cycle all Saturn relays (and LEDs) to verify correct operation. It is recommended that this test is not performed while connected to an A/C system as this may stress the A/C system. **Service Mode –** Enabling this function will reduce (or eliminate) all of the Saturn's short cycle time delays, minimum run timers and other protective delays. Selecting "15 min" will automatically turn the Service Mode off after 15 minutes. Selecting "ON" will leave this menu on until manually deactivated. The LCD will show when the Service Mode is on. **Factory Reset –** Selecting **[YES]** and then again in the confirmation window to reset the Saturn back to the factory default settings. This will erase all programs, holiday schedules and all other values. The Saturn will return to the "out-of-box" state.		
25	**Exit Installer Menu?**	
Selecting "YES" will exit the service menu. Selecting "NO" will bring you to the first option of the service menu "PIN NUMBER SELECT". Note: If no buttons are pressed after 30 seconds the installer menu is exited automatically. If you press and hold the **[BACK]** button in any main menu window you can exit from the installer menu.		

Typical Wiring Diagrams

Several wiring diagrams are provided below; they do not represent all possible wiring combinations, nor all control options provided by the Saturn. They are to be used in conjunction with the documentation provided by the Original Equipment Manufacturer as well as other diagrams within this manual.

2 Stage Cooling with Drive Open Drive Closed Hot Water Valve

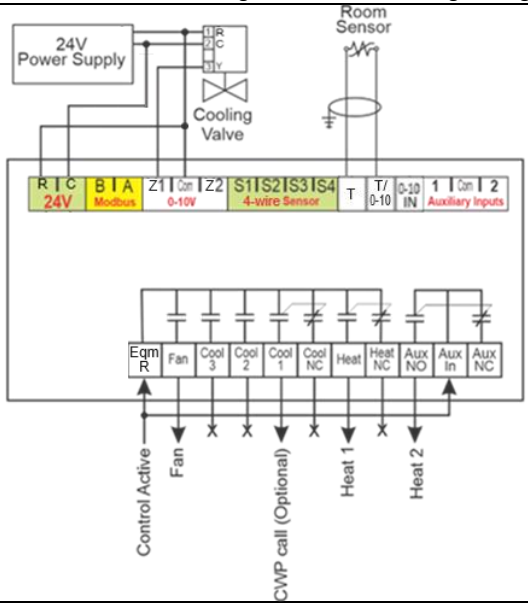


The first stage heating and cooling relays in the Saturn are changeover types, permitting you to drive a heating and/or cooling valve open and/or closed.

DIP Switch Settings
Sw1 Off – Fan on with heat
Sw2 On – HC Mode

Installer Options
None required.

2 Stage Heat with Modulating Cooling Control

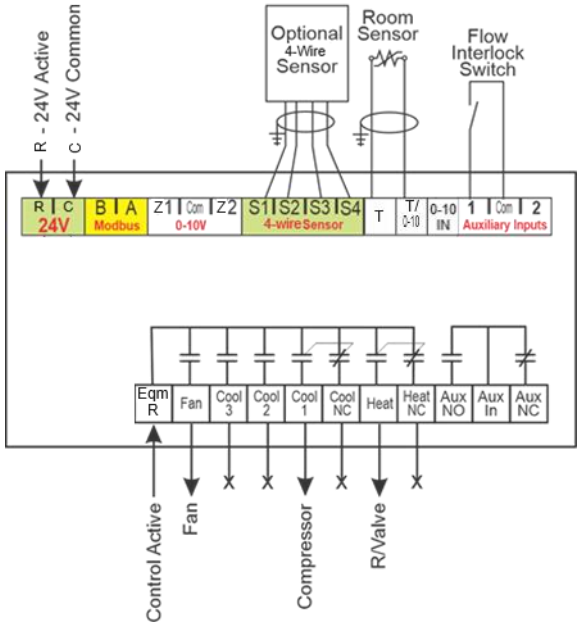


In Valve Mode both the relays and 0-10V outputs work in tandem, permitting the Saturn to modulate the 0-10V valve and call for the circulating water pump on a cooling demand if required.

DIP Switch Settings
Sw1 Off – Fan on with heat
Sw2 On – HC Mode

Installer Options
Set Aux relay = Aux heat
Set Z1= Cool

Single Stage Water Sourced Heat Pump



This is similar to a standard single stage heat pump except that the auxiliary input is set to shut the Saturn down on loss of water, thereby protecting the system.

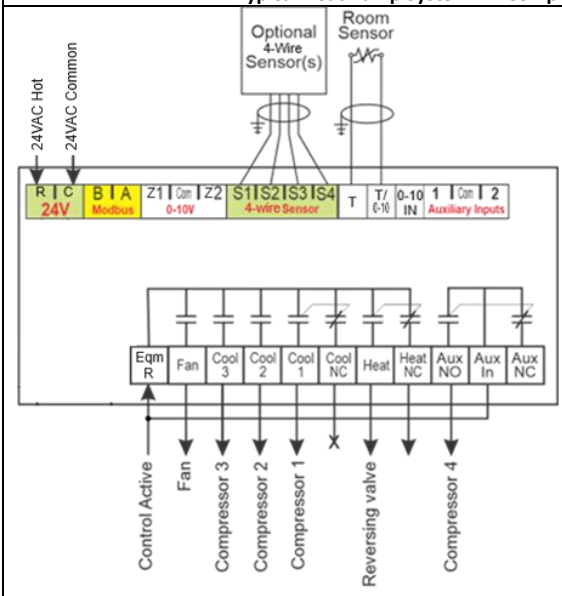
This fault input can be used as a phase fail input or any other safety interlock.

The Saturn LCD will indicate when a fault (low water) is detected.

DIP Switch Settings
Sw1 Off – Rev in heat
On – Rev in cool
Sw2 Off – HP Mode

Installer Options
Set AUX input 1 to Fault.

Typical Heat Pump System – 4 Compressors



In this example the Saturn is running a heat pump system with 4 compressors providing 4 stages of heating and 4 stages of cooling.

DIP Switch Settings
Sw1 Off – Rev in Heat
On – Rev in Cool
Sw2 Off – HP Mode

Installer Options
For 4 compressor systems Set Aux relay = Comp 4

Scheduling Controls

Setting Daily Schedules

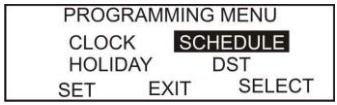
The Saturn has 7-day scheduling with up to 2 START and 2 STOP events per day.

When the Saturn is in START Mode it will use the START program as in the Setup section. When in the STOP program Mode, it will use the Setback set temperatures as defined in the Installer Menu. This provides around the clock temperature control.

Additionally, the Saturn has an "after hours" run timer that can be manually initiated where the STOP program temperatures are temporarily replaced with the START program temperatures for a period set by the installer in the Installer Menu; defaulted to 2 hours.

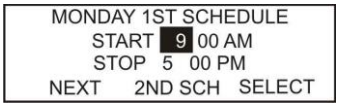
Note: Each daily schedule must start and end on the same day. You cannot set a schedule to start at 2pm Wednesday and end at 3am Thursday. To program an overnight event, set the end time for that event to be on 11:59pm on that day and a new event start time on 12:00am on the next day.

Setting a START schedule time and STOP schedule time at the same time will cancel the schedule for that day, i.e. 8:00am START and STOP.

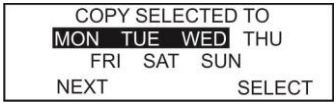


Press the **<F2>** "Schedule" button for 1 second. You may be prompted to enter a PIN, see The PIN Prompt section for more information. Depending on values set within the Saturn installer menu you will be presented with a few options. Use the **[SELECT]** button to highlight the word "Schedule" and then press the **[SET]** button to enter the 7-day programming menu.

You will be presented with the option to start / edit the program on Monday or select another day using the **UP**/**DOWN** buttons then press **[NEXT]** to proceed.



Set the START hour and minutes and the STOP hour and minutes for the day previously selected, Monday in this example. If you have 2 schedules per day you are given the option to swap back and forth between the 1st and 2nd daily START & STOP by selecting **[2ND SCH]**. Press **[NEXT]** to proceed.



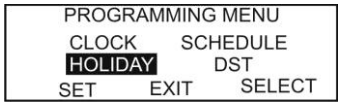
You can now copy the previously selected day's program, Monday in this example, to the other days by using the **[SELECT]** button to choose the day you wish to copy to and then press the **[NEXT]** button to begin the copying process. The Saturn will show "COPYING" and then permit you to re-enter the programming menu to program other days or exit to the main menu.

Set Holiday Schedules

Up to 30 holiday events can be scheduled into the Saturn. These holiday events will override the time and temperature settings of the usual 7-day programs events as described above and replace it with the holiday programs.

A holiday event can be used just once and then expire or be a “perpetual” event that occurs at the same time every year until cancelled manually.

Press the **<F2>** “Schedule” button. You may be prompted to enter a PIN, see The PIN Prompt section for more information. Depending on values set within the Saturn installer menu you will be presented with a few options. Use the **[SELECT]** button to highlight the word “Holiday” and then press the **[SET]** button.



Use the **UP**/**DOWN** buttons to choose one of the 30 available holiday event placeholders. The holiday event placeholders will show either “Empty” if no holiday event is set in this placeholder or it will give the starting date of an existing holiday event. Press **[SELECT]** to enter the desired holiday event placeholder.

If the holiday event placeholder shows “DDMMYY”, it indicates an expired event. You must delete this expired event before proceeding by selecting **[DELETE]**.

Use the **[SELECT]** button to highlight the desired option and use the **UP**/**DOWN** buttons to adjust to the desired value.

You are given an option to select a single day for this event or a range of consecutive days. This example shows a date range.

As each holiday event can be for different lengths of time and can occur at various times of the year, further the Saturn will permit you to choose from a few heating and cooling set points that will apply for the selected holiday event. In this example “OFF” has been selected.

The available options are:
OFF – The heating and cooling system will be off during this event.
SB – Setback: The Saturn will use the current Setback temperatures for the duration of the holiday event. The fan will cycle with the heating and cooling i.e. Auto Mode.
OCC – Unoccupied: The Saturn will use the current “unoccupied” set temperatures and Fan Mode for the duration of the holiday event.

Caution - The fan will obey the Fan Mode settings in the unoccupied set point menu, so if “Fan On” Mode is selected in this menu then the fan will run 24 hours per day for the duration of this holiday event.

To set the event duration, use the **[SELECT]** button advance through FROM and TO then adjust the dates with the **UP**/**DOWN** buttons.

To select a self-expiring one-off event, choose the current or a select a future year for this holiday event. The Saturn will show this year in the setting. When this event has passed the Saturn will delete this event automatically.

To set an event that occurs at the same time every year until manually cancelled, attempt to set a year prior to the current year as shown by the real time clock, the year number will change to a "P" to indicate this event is perpetual or permanent holiday event. A perpetual event will need to be manually deleted as they don't expire automatically.

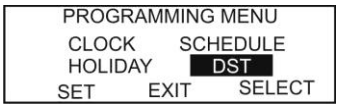
Press **[SAVE]** to save the new time parameters and exit the menu. The **[BACK]** button will exit this menu discarding changes.

Note:

- All holiday events start and stop at midnight on the day(s) selected.
- The after-hours run timer will operate during a holiday event if initiated and will use the normal Start Mode temperatures. (Not the "holiday" Heat / cool or fan setting).
- The fault or fire inputs will cancel any holiday event for the duration of the fault or fire event.
- All advanced functions such as economy cycle, fan purges and compressor control options operate during the holiday events to maintain any set temperatures programmed.

Setting Daylight Savings Times

The Saturn can automatically change its clock time based on the current daylight savings parameters set in this menu.



Press the **<F2>** "Schedule" button. If you are prompted to enter a PIN, see The PIN Prompt section. Depending on values set within the Saturn installer menu you will be presented with a few options. Use the **[SELECT]** button to highlight the text "DST" and then press the **[SET]** button.

Use the **[SELECT]** button to advance through the various parameters, such as the start day and month, the end day and month, what time to change the clock and whether you want the DST function on or off. Adjust the highlighted values with the **UP**/**DOWN** buttons to the desired value. Press **[SAVE]** to save the new time parameters and exit the menu. The **[BACK]** button will exit this menu discarding changes.

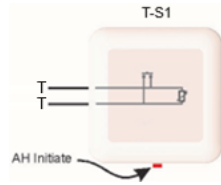
After Hours Timer

The Saturn has an Auto Off timer that is typically used as an after-hours timer. It can also be used in Manual Mode as an auto off run timer. Placing a normally open momentary push button on the Saturn's room sensor input will activate or cancel this timer.

"Anti-Bounce" logic is built into the Saturn so that a single or multiple presses of the button (within a 10 second window) are seen by the Saturn as a single call to start (or stop) the after-hours timer.

After Hours Timer Logic in Manual Mode

If the Saturn is set to "Manual Mode" then the Saturn will start and run for the duration of the after-hours timer period and then automatically turn off again. This is useful for training rooms for example that are used intermittently. Simply manually start the run timer when the training room is in use knowing that after the pre-programmed time the Saturn will shut down the HVAC system automatically.

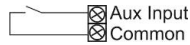


After hours Timer logic in Programmable Mode

If the Saturn is set to one of the programmable modes, the Saturn will automatically alternate between the START and STOP programs based on the pre-programmed times. If during the STOP program the building becomes occupied, simply initiate the after-hours timer and the START program temperatures are temporarily used for the present after-hours timer period (default 2 hours).

Initiating / Cancelling the After Hours Timer

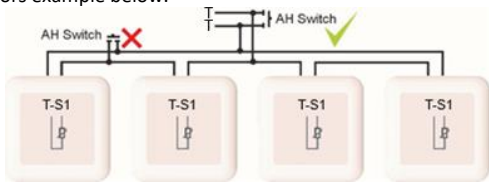
The Saturn room temperature sensor can be fitted with a normally open switch across the contacts. Pressing this switch for 1 or 2 seconds will temporarily "short" the temperature sensor, starting or stopping the after-hours timer. The Saturn is also provided with a digital auxiliary input; again, placing a normally open momentary switch across this input will start or cancel the after-hours timer. See the Installer Menu section for more information on this function.



After Hours Sensor Wiring

A normally open momentary press button is fitted to the sensor that will initiate or cancel the afterhours run function. Alternatively, you can add a switch across the 2 wires between the wall sensor and the Saturn to initiate or cancel after hours calls.

To use the "After-hours" function with averaging sensors, the after-hours switch must be wired so that it affects the entire sensor input on the Saturn and not just one sensor. See the diagram for the 4 averaging sensors example below.



Multistage Controls

Four Compressor Support

The Saturn can support up to 4 stage compressors for heat pump systems, by setting the Auxiliary Relay function to Compressor 4. Furthermore, on and off value between each stage can be set independently.

Smart Staging

The Saturn will give a running compressor a chance to bring the room to temperature on its own before starting additional compressors to reduce energy consumption. The settings will determine the minimum time the Saturn will wait before bringing on additional compressors. The default is 5 minutes.

Timed Upstaging

Timed Upstaging brings on additional compressors regardless of how close the room temperature and set temperature are to prevent a struggling compressor attempting to bring a room to set temperature on its own. The default is 30 minutes.

Compressor Lead Lag

When controlling systems with multiple compressors, the Saturn can attempt to even compressor wear by advancing the compressor numbers each time all compressors are off. So, for a 3-compressor system, first start will call compressor 1 as stage 1, compressor 2 as stage 2 and compressor 3 as stage 3. When set point is reached and all compressors are off, next time the system starts, compressor 2 will be stage 1, compressor 3 will be stage 2 and compressor 1 will be stage 3.

It is important that the Lead Lag Function is set correctly for the number of compressors for the HVAC system. Do this by turning off the additional unused compressor outputs from the compressor control options in the Advance Installer menu, so that the Saturn does not call for absent compressors.

Auxiliary Relay

The Saturn has an auxiliary output relay that can be installer set to multiple tasks such as providing an additional stage of heating (Aux Heat Mode), an additional compressor for a heat pump system (Compressor 4 Mode).

A useful function is to use this relay to indicate the Saturn status or to control auxiliary device such as bathroom exhaust extraction fans, access control or lighting based on the current Saturn status.

Economizer Controls

Economy Cycle

A typical economy cycle wiring diagram has been provided below. In this example the Saturn is controlling a single stage heat pump. Other control configurations could also take advantage of the economy cycle mode of the Saturn.

For the economy cycle to operate you must assign at least one of the 0-10V outputs for economy cycle function in the Installer Menu; either as Fresh Air damper, economy Return Air damper or both. You must also set economy cycle parameters in the Installer Menu. Further as economy cycle relies on outside air temperature (and humidity if using a 4-wire sensor outside) values being available to the Saturn you must use an outside sensor.

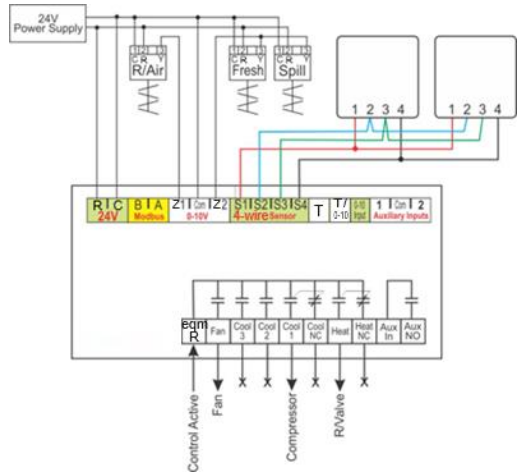
The Saturn can accomplish economy cycle in 3 ways. This is set up in the Installer Menu:

1. 4-wire sensor for both room and outside temperature and humidity. This mode provides full enthalpy-based Economy Control.
2. 4-wire sensor for outside air temperature and humidity control and the 2-wire sensor used for room temperature measurement. This method allows for a high outside RH limit to be set.
3. 2-wire sensor for outside temperature measurement and 4-wire sensor for inside temperature and humidity measurement. This method allows for an advanced indoor sensor for additional user control.

The example drawing below shows damper actuators using the same 24V supply that is powering the Saturn. Other power combinations are also possible.

Free Cooling Status
Using 100% fresh air
Outside Temp 17.7
Outside RH 78%

As some brands of dampers cannot easily operate in reverse (close at 10V) the Saturn provides two 0-10V outputs, one forward acting and one reverse acting. These are shown as Fresh Air and Return Air in the 0-10V output menu. The sum of both 0-10V outputs is generally 10V unless the daytime ventilation function is set where the Return Air damper may rest at a fixed voltage while the building is running. (Intended to introduce fresh air to maintain acceptable indoor air quality)



The example provided below shows the Saturn using both 0-10V outputs. You can also use one output and set one damper for reverse action.

The Saturn provides you with information on the status of the economy cycle from the main information screen. Simply press one of the **UP**/**DOWN** buttons to advance to the Economy Mode status window shown above.

Economy Checklist.

1. Wire the fresh, return and relief / spill dampers to the Saturn 0-10V outputs. Note which output is controlling which damper. For example, 0-10V output 1 can be set to control the return air damper while 0-10V output 2 may be set to control the fresh air & spill damper (as shown in the example above).

2. Wire the room and outside temperature sensor to the Saturn, one of which must be a 4-wire sensor. **Set all 4 DIP switches in the outside 4-wire sensor to ON** (This will define the sensor function as outside air sensing). See the manual supplied with the 4-wire sensor for more details on switch settings and other functions of the 4-wire sensor.

3. Enter the installer menu and set up the 0-10V outputs in the Saturn to match the damper wiring. Enter the menu "Change 0-10V Output Settings?" menu in the installer and Set AO1 = Return, Set AO2 = Fresh. Press **<F2>** Save. Installer Menu section details the 0-10V output settings within the Saturn.

4. In the installer menu enter the "Change Economy Settings?" menu. Confirm Economy = ON. Press **<F2>** Save.

5. Press & Hold the Back button **<F3>** to exit the installer menu to setup Economy cycle.

To test correct damper operation – Enter the Economy mode in the installer menu "Change Economy Settings? Change Economy ON to TEST. Exit the installer menu. The Economy LED will be on, and the LCD will show "Economy Test". The fresh air damper will be held at 10V, and the return air damper will be held at 0V.

You must exit economy mode test mode manually by setting economy mode back to Economy = ON. (If you forget the Saturn will automatically exit economy test menu after 1 hour).

Economy Logic

The economy cycle of the Saturn is used before stage 1 cooling is required and starts 0.1°C above the cooling set point if the outside air is suitable. If the indoor fan is in Auto Mode (Cyclic fan) and not running when the Economy Function is required, the Saturn will automatically start the indoor fan.

If after some time the desired room temperature is not reached or becomes warmer, the Saturn will automatically suspend the outside air function and replace it with normal A/C cooling to bring the room to set point. Economy Cycle function will be suspended. *(In these cases, the Economy LED will flash to indicate the outside air on its own is not capable of maintaining the target temperature.)*

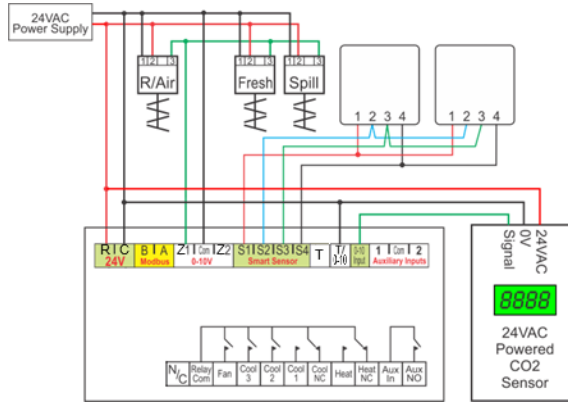
Night Purge

The Saturn can use outside air to cool a building at night when the air is cooler, to cool the building and prepare the building for the next day's use.

Advanced Features

CO2 input

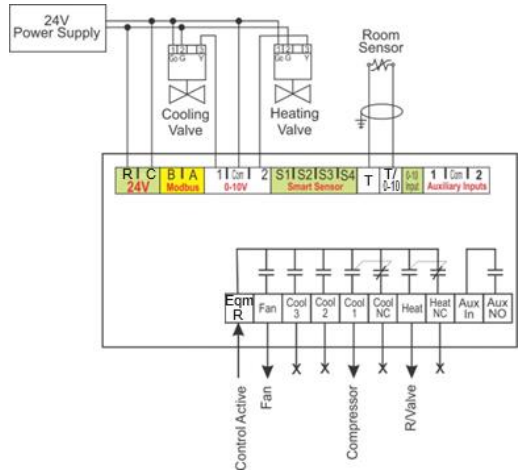
The Saturn permits you to additionally add a 0-10VDC CO2 sensor that regulates the introduction of outside air based on the indoor air quality of the building. An authorised distributor can provide a 0-2,000 ppm CO2 sensor with infrared sensor and LCD.



As the standard economy dampers are used, the Indoor air quality setting in the Saturn can limit the maximum amount of fresh air introduced into the building. See the Installer Menu option “Change 0-10V input settings” for setting the Indoor air quality settings.

Valve Control

The Saturn can control heating and/or cooling valves via a 0-10 or 2-10V signal. The span of the valves can also be individually set. The heating valve can be fully open (at 10V) when 3°C from set point while the cooling valve can be set to be fully open (at 10V) 1°C from set point.



The Saturn will also switch the heating and cooling relays when in Valve Mode. This permits the Saturn to additionally control a circulating water pump or some other device when heating or cooling is needed.

You will need to assign the 0-10V outputs to Valve function by selecting heating or cooling mode for the 0-10V output of the Saturn. See Installer Menu for setting the 0-10V output function.

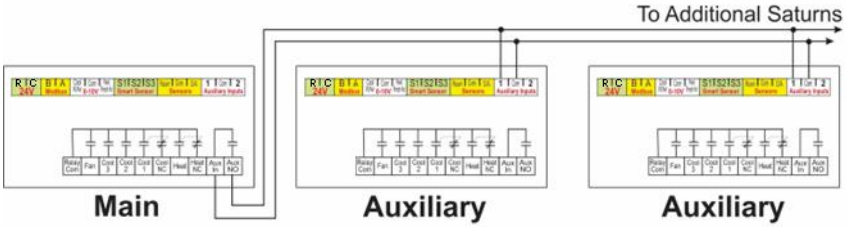
Setting the 1 Master Time Clock Saturn

Large buildings often have multiple A/C units. Having each A/C unit on a separate time clock can often be troublesome and time consuming to program and setup.

Using 1 Saturn as a master time clock and the balance of Saturns as auxiliary controller with the random delay start function active on all of the auxiliary Saturns thereby preventing all A/C systems waking up at exactly the same time (preventing potential damage to the building's electrical supply or incurring high peak demand power loading charges).

One Saturn is the clock and holds the programs and schedules, all other Saturns monitor the status of the main Saturn and when a start command is received, each Saturn will choose a random time from 0 to 90 seconds to wait before it starts.

The wiring diagram below shows how to wire this control network.



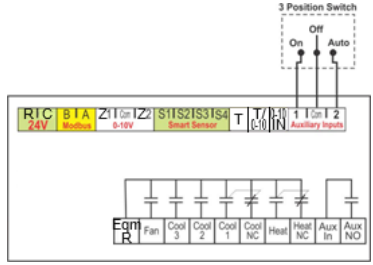
Main – Set Aux Relay Function to "Master" Mode in the installer menu. This will close the Aux Relay whenever the master Saturn is running Should the Saturn receive a call to run outside scheduled hours.

Auxiliary – Set program mode to Manual Mode (Installer Menu Options, "Change Programming Options") and set Aux input to delay start. (Installer Menu Options - "Change Axillary Input Options").

Note: If all Saturns are powered from the same 24V supply, ensure all auxiliary input commons are wired together as shown in the above example or feedback loops may occur.

Auto/On/Off Wiring

Many buildings require an Auto/On/Off switch in their switchboard to control their HVAC systems. The Saturn can accommodate this in several ways, one example is shown here.



Use the installer menu to set Aux input 1 as forced ON and Aux input 2 as Auto (see Installer Menu "Change Auxiliary Input Options")

In the Auto position the Saturn will run its normal 7 day or 365-day schedule. In the ON position the Saturn will use the START program temperatures and fan mode for as long as this switch is closed. In the OFF position the Saturn will shut down.

If one of the Auxiliary inputs is needed for another function, such as an occupancy input, then the Saturn can also be shut down by open circuiting the room temperature sensor for example.

Communications Functions

The Saturn has a powerful RS-485 driver chip with MODbus RTU communications drivers. In theory up to 247 Saturns can be connected on a single network node, however due to a number of real-world limitations each node should be limited to no more than 100 or 150 Saturns and only in ideal conditions with good quality shielded cable.

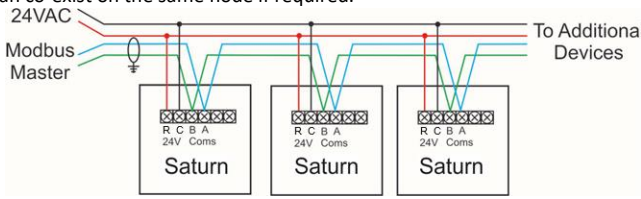
This permits all Saturns to be controlled from a central location or via the internet if connected to a suitably equipped master.

An animated icon will be displayed on the Saturn LCD whenever a remote device is communicating with the Saturn.

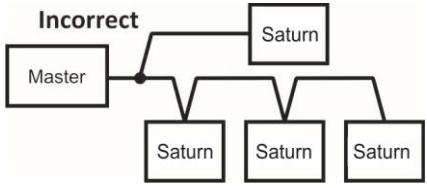
It is essential that high quality 0.2m screened, single pair cable is used when wiring the Saturn for communications particularly on long cable runs or where some electrical noise may be present. The screen drain should be earthed in a single location. The quality of the communications relies on good cable and wiring practices.

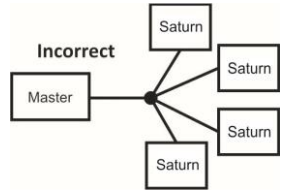
Each device on a network node must have unique network addresses and all communicate at the same Baud rate and parity. These parameters are set in the installer menu. Each device must have a unique network address and operate at the same baud rate as other devices on the node. The last device in the node may need the communications End Of Line (EOL) resistor in place.

The diagram below shows a typical MODbus RTU network showing 3 Saturns all being powered from the same 24VAC supply. Other Modbus devices sharing the same Baud rate and with different addresses can co-exist on the same node if required.



Some simple rules apply with Communications wiring; all devices MUST be in series No “T” branches or “star” wiring will be tolerated as this will seriously degrade or stop communications.



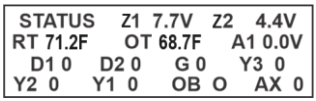


For full details on applying the Saturn to network use, for the points lists and other necessary information on networking the Saturn please refer to the Saturn communications addendum document available on our website.

Troubleshooting and Known Issues

Info Window

Press and hold both the **UP**/**DOWN** buttons together to open the status window. This window gives an overview of the Saturn functions showing the status of all the Inputs and outputs.



Z1 & Z2	The two 0-10V output values shown in volts.
RT & OT	The current room temp and outside air temp shown in relevant units (Deg C or F)
A1	0-10V Input voltage seen by the Saturn.
D1 & D2	Two digital input status. 0= input open. 1= Input closed.
G	Fan relay Status. 0= relay off (open) 1= relay on (closed).
Y3, Y2 & Y1	Cooling or Compressor relays status. 0= relay off (open) 1= relay on (closed).
OB	Heat or reversing Valve relay Status. 0= relay off (open) 1= relay on (closed).
Ax	Auxiliary relay status. 0= relay off (open) 1= relay on (closed).

Service Override

Pressing both the <F1> and <F3> buttons together for 2 seconds bring up the service override shortcut. This will permit you to lock the Saturn OFF when you wish to temporarily suspend control functions. Use the **UP**/**DOWN** buttons to select either “Enable” or “Disable”.

This function is NOT intended to replace electrical isolation.

Service Mode

Service mode suspends all short cycle and minimum run timers built into the Saturn. You can activate service mode so that it turns off automatically in 15 mins or stays on until manually turned off again. The Saturn will flash “Service Mode” on the LCD when this mode is active to warn you that the function is active.

Relay Test Mode

Use the relay test mode with caution. The relay test will cycle all Saturn relays and illuminates the LED displays to prove relay operation. The Saturn should NOT be connected to the AC equipment when performing this test or damage to the AC system may be caused.

Economy Test Mode

Should you wish to test correct damper operation in Economy mode, enter the installer menu and in the “Change Economy Settings?” menu select Economy = TEST. Exit the installer menu. The Economy LED will be on, and the LCD will show “Economy Test”. The fresh air damper will be held at 10V, and the return air damper will be held at 0V.

If the cooling set point and room temperature are far apart as would be the case of setting a very low cool set point for testing, then economy will NOT be used as the Saturn will immediately call for electric cooling, bypassing the economy call. Economy is used for stage 1 cooling only.

Problems	Solutions
Saturn will not show any information other than room temperature on the display. The <F2> button does not work.	Saturn clock is set to “0” in installer menu so Saturn is locked into Manual mode. See “Change Display Settings”.
Real Time Clock loses its time when power is removed.	A small lithium battery designed to maintain the real time clock during power outages may require replacing once every 3 to 5 years. (Part number CR1220 or equivalent). This is on the main Saturn printed circuit board and requires the removal of the plastic enclosure to replace.
Economy function is not working	The economy function requires configuring to meet the needs of the project before it can function. See Economy Cycle section.
How can I test the economy function is working?	In the economy menu, set Economy mode from “ON” to “TEST” using the up/down buttons then select save.
The red heat LED or blue cool LED is flashing - there is no heating or cooling output.	The Heating and Cooling LEDs will flash when heating or cooling is required but the Saturn cannot satisfy the demand until the compressor anti cycle delay timer has expired. “WAITING” is normally displayed in the LCD during this timeout period.
The Saturn is running at night when you believe it should be stopped.	Check the real time clock is set correctly paying special attention the AM/PM setting. Check the schedule by using the <F2> button. Ensure the start program event time is earlier than the stop program event time. Check to see if any setback temperatures are set. Check the Auxiliary input settings as there may be a time clock “override” wired into this input.

Specifications

Input Voltage	Low Voltage Input 24 +/- 15% 50/60 Hz
	High Voltage Input 100 to 270 VAC 50/60 Hz
Operating Temperature	32°F - 130°F
Operating RH	0-95% (Non-Condensing)
Storage Temperature	32°F - 170°F
Size	4.33” x 4.33” x 2.50”
	4.33” x 7.08” x 2.50” with Terminal Covers Fitted
Control Range	41°F - 122°F
Maximum Equipment Stages	4 Compressors (HC Mode = 2 Heat 3 Cool)
Anti-Cycle Timer	Off, 2, 3, 4 or 5 Minutes (Installer Adjustable)
After Hours Timer	Off To 12 Hours (Installer Adjustable)
Memory Type	Non-Volatile 256K
Clock	12/24 Hour 7 Day with Calendar
	Backup Battery for Clock (CR1220)
Backup Battery Life	8 Years typically under external power (1 ~3 years unpowered)
Holiday Events	30 (Perpetual and/or Self-Expiring)
LCD	32 x 132 Graphical - LED Backlight
Relays	Fan 12A Resistive 240V Max - Volt Free
	All Others 5A Resistive 240Vac Max - Volt Free
0-10V Output	10mA Max
0-10V Input	100k Impedance
Room & Outside Air Sensor	10K NTC Type II (2 Wire Screened)
Communicating Sensor	4 Wire - 400m Maximum with Control Function
	10K NTC type II / RH 10~98% RH 2%.
Optional RF Sensor	2xAAA Batteries 18 Month Life 10K NTC Type II
	Range- 150m Open Air (40M Indoors Typical)
	Frequency 433 MHz - 2 Way with Error Checking
Communications	Modbus Baud Rate 4.8 / 9.6 / 19.2K
	Address Range 0 –255
	Parity Odd / Even / None
Warranty	36 Months RTB

Date Installed	
Installed By	

Due to ongoing product improvement iO HVAC Controls reserves the right to change the specifications of the Saturn (or its components) without notice.

Io-06-1348-110624