CONNECT

Scoring

KEY2ACT

Scoring Tools

Feedback vs Setpoint

The first scoring tool is the FB vs SP option.

This option compares the value of the Feedback object to the value of the Setpoint object

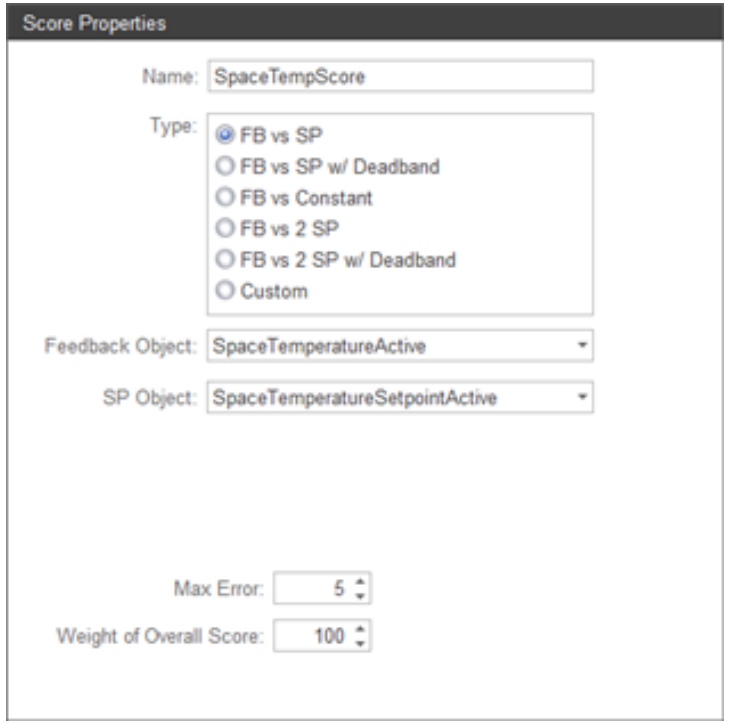
Calculates the difference between them.

Compares that difference to the Max Error.

Calculates the score based on the Weight of the Overall Score.

Example;
Space Temperature of 74 and Space Temperature Setpoint of 72 provides a difference of 2.

Max Error of 5 and a Weight of Overall Score of 100 equates to a 20% reduction in score for every 1 degree difference. 100/5 = 20
A 2 degree difference would produce a score of 60%. 100 – (2*(100/5)) = 60



	Space Temperature	Score
	65.0°F	0
	66.0°F	0
	67.0°F	20
	68.0°F	40
	69.0°F	60
	70.0°F	80
Space Effective Setpoint	71.0°F	100
	72.0°F	80
	73.0°F	60
	74.0°F	40
	75.0°F	20
	76.0°F	0
	77.0°F	0

Max Error of 5 deg.

Max Error of 5 deg.

Weight of Overall Score of 100.

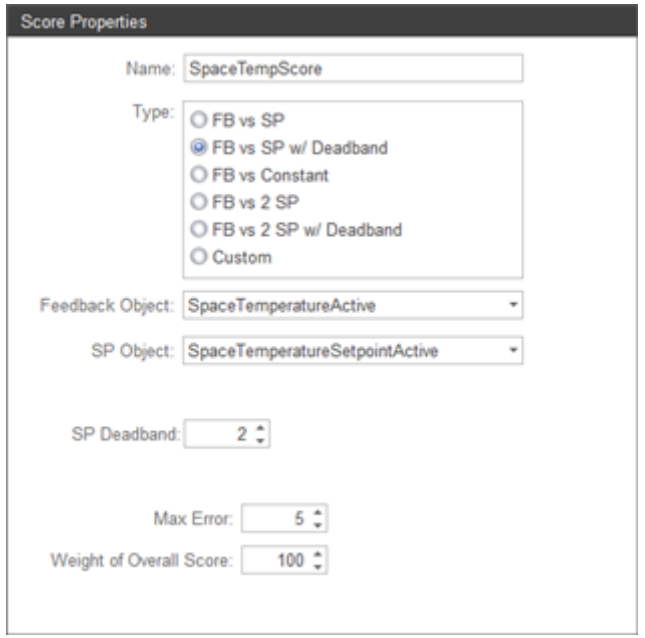
KEY2ACT

Scoring Tools

Feedback vs Setpoint w/Deadband

The next scoring tool is the FB vs SP with a deadband option.
This option applies the deadband above and below the Setpoint.
It compares the value of the Feedback object to the value of either Setpoint plus the deadband or Setpoint minus the deadband.
Calculates the difference above or below.
Compares that value to the Max Error.
Calculates the score based on the Weight of the Overall Score.

Example;
Space Temperature Setpoint of 72 and a deadband of 2. The Setpoint of the scoring tool is the range of 70 to 74. Scoring will begin to reduce from 100 when the Space Temperature values are more than 74 or less than 70.



	Space Temperature	Score
	65.0°F	0
	66.0°F	20
	67.0°F	40
	68.0°F	30
	69.0°F	80
	70.0°F	100
	71.0°F	100
Space Effective Setpoint	72.0°F	100
	73.0°F	100
	74.0°F	100
	75.0°F	80
	76.0°F	60
	77.0°F	40
	78.0°F	20
	80.0°F	0

Max Error of 5 deg.

Deadband of 2 deg. above and below.

Max Error of 5 deg.

Weight of Overall Score of 100.

KEY2ACT

Scoring Tools

Feedback vs Constant

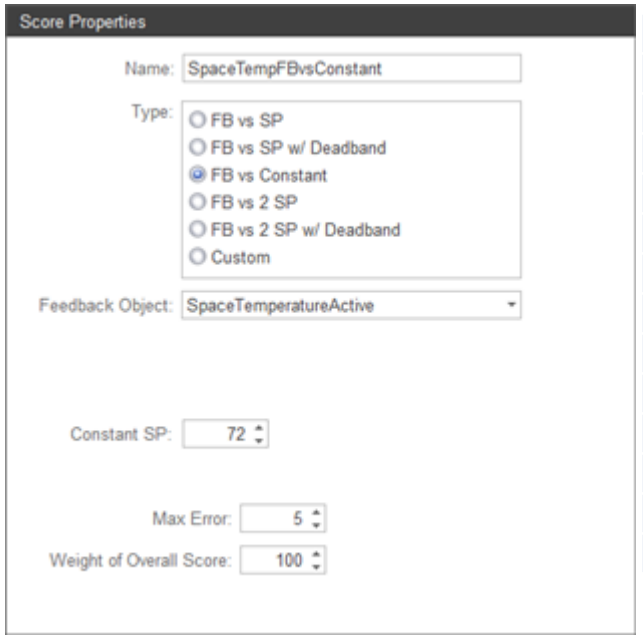
The next scoring tool is the FB vs Constant option.
This option applies a fixed constant value for a Setpoint.

It compares the value of the Feedback object to the value of the Constant SP.

Calculates the difference
.
Compares that value to the Max Error.

Calculates the score based on the Weight of the Overall Score.

Example;
Space Temperature Setpoint of 72 and a Constant SP of 70.
Scoring will begin to reduce from 100 when the Space Temperature value is more than or less than 70.



	Space Temperature	Score
	78.0°F	0
	77.0°F	0
	76.0°F	20
	75.0°F	40
	74.0°F	60
	73.0°F	80
Constant Setpoint	72.0°F	100
	71.0°F	80
	70.0°F	60
	69.0°F	40
	68.0°F	20
	67.0°F	0
	66.0°F	0

Max Error of 5 deg.

Max Error of 5 deg.

Weight of Overall Score of 100.

KEY2ACT

Scoring Tools

Feedback vs 2 Setpoints

Some controllers do not provide a single effective setpoint value that can be easily compared to the Space Temperature via the FB vs SP scoring tool.

Instead they provide 2 setpoints such as Occupied Cooling and Occupied Heating. The actual operating setpoint will be one or the other depending on the heat cool mode at the time.

The scoring tool option of FB vs 2 SP is one option to handle this scenario. This option uses the value centered between the 2 setpoints.
For example;
An Occupied Cooling Setpoint of 72.0°F.
An Occupied Heating Setpoint of 70.0°F.
The centered value is 71.0°F and scoring would be calculated from the difference between 71.0°F and the Space Temperature.

	Space Temperature	Score
	65.0°F	0
	66.0°F	0
	67.0°F	20
	68.0°F	40
	69.0°F	60
Occupied Heating Setpoint	70.0°F	80
Centered Value	71.0°F	100
Occupied Cooling Setpoint	72.0°F	80
	73.0°F	60
	74.0°F	40
	75.0°F	20
	76.0°F	0
	77.0°F	0

Max Error of 5 deg.

Max Error of 5 deg.

Weight of Overall Score of 100.

KEY2ACT

Scoring Tools

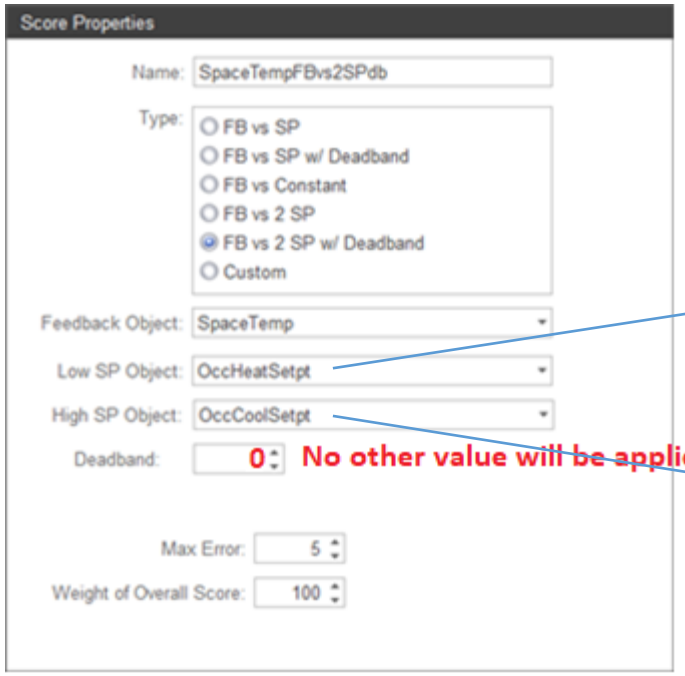
Feedback vs 2 Setpoints w/Deadband

The scoring tool option of FB vs 2 SP with a deadband is another option when 2 setpoints are used.

This option maintains the 100% score between the two setpoints plus or minus the value of the deadband.

For example;
An Occupied Cooling Setpoint of 74.0°F.
An Occupied Heating Setpoint of 70.0°F.
A Deadband of 2.0°F.

The score returned anytime the Feedback is between 76 and 68 will be 100.
This is desirable because the control loop is satisfied when the Feedback is between the High and Low Setpoint..



	Space Temp	Score	
	63.0°F	0	
	64.0°F	0	
	65.0°F	0	Max Error of 5 deg.
	66.0°F	20	
	67.0°F	40	
	68.0°F	60	
	69.0°F	80	
Occupied Heating Setpoint	70.0°F	100	
	71.0°F	100	
	72.0°F	100	No Deadband .
	73.0°F	100	
Occupied Cooling Setpoint	74.0°F	100	
	75.0°F	80	
	76.0°F	60	
	77.0°F	40	Max Error of 5 deg.
	78.0°F	20	
	79.0°F	0	
	80.0°F	0	
	81.0°F	0	

KEY2ACT

Scoring Tools

Custom

The Custom Scoring tool provides for scenarios which do not fit the other scoring calculation methods.

The table illustrates a situation where the controller's Effect Set Pt object does not change to the appropriate Unoccupied setpoint when the Occupancy changes.

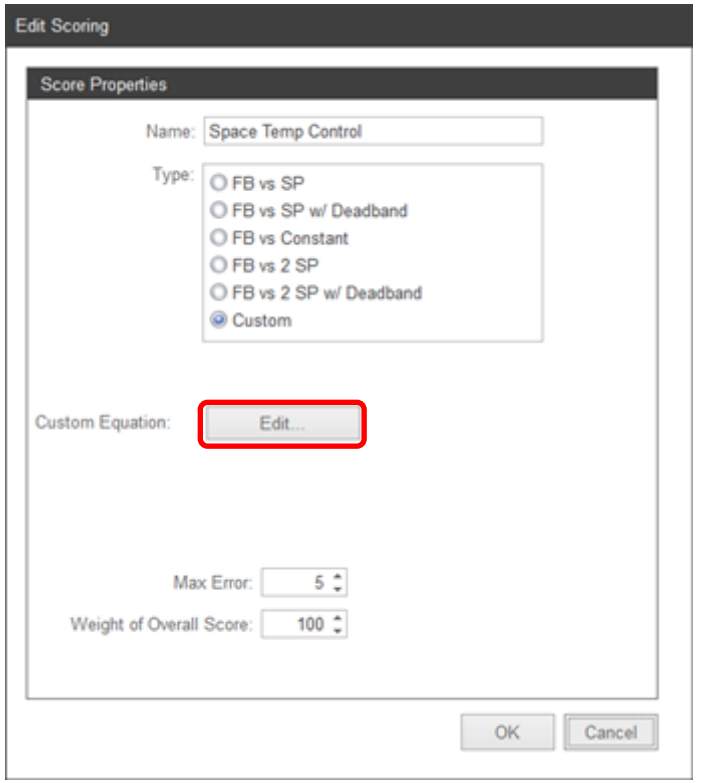
Date Time Stamp	Effect Set Pt	Occupied Cool	Occupied Heat	Unoccupied Cool	Unoccupied Heat	Effect Occ
6/17/2018 11:45:00 PM	73	73	71	80	60	0
6/17/2018 11:50:00 PM	73	73	71	80	60	0
6/17/2018 11:55:00 PM	73	73	71	80	60	0
6/18/2018 12:00:00 AM	73	73	71	80	60	0
6/18/2018 12:05:00 AM	73	73	71	80	60	1
6/18/2018 12:10:00 AM	73	73	71	80	60	1
6/18/2018 12:15:00 AM	73	73	71	80	60	1
6/18/2018 12:20:00 AM	73	73	71	80	60	1

This is an example of where the scoring is applied to one setpoint under one condition, "Occupied" and another set of setpoints is applied under another condition, "Unoccupied".

The scoring comparison will also need to change as follows;
During Occupied mode the Space Temperature may be compared to the Effect Set Pt value.
During Unoccupied mode the Space Temperature may be compared to above the Unoccupied Cool Setpoint and below the Unoccupied Heat setpoint.

Therefore in order for conditional scoring to take place, a Custom scoring expression will be required.

Click *Edit.*



KEY2ACT

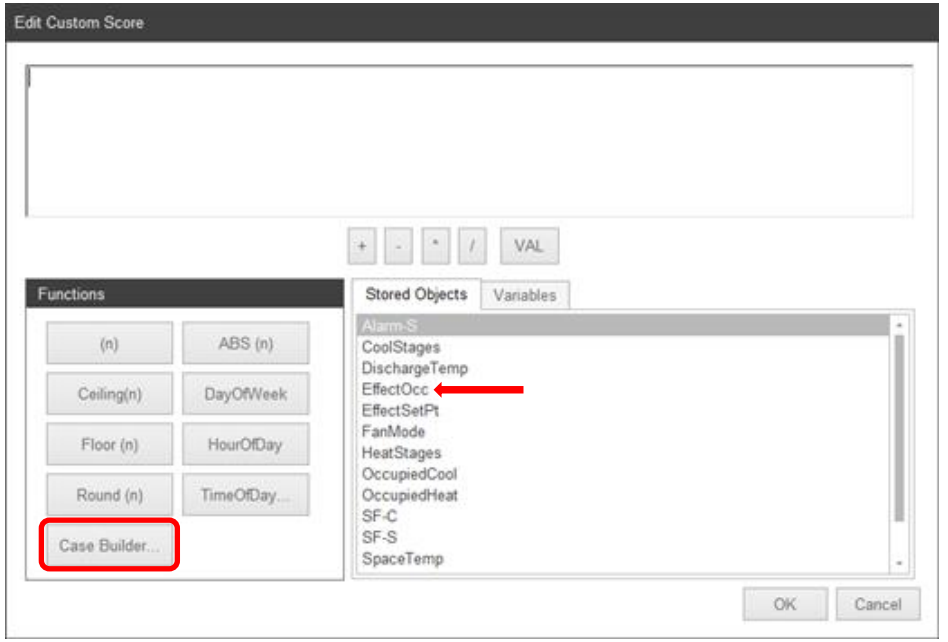
Scoring Tools

Custom

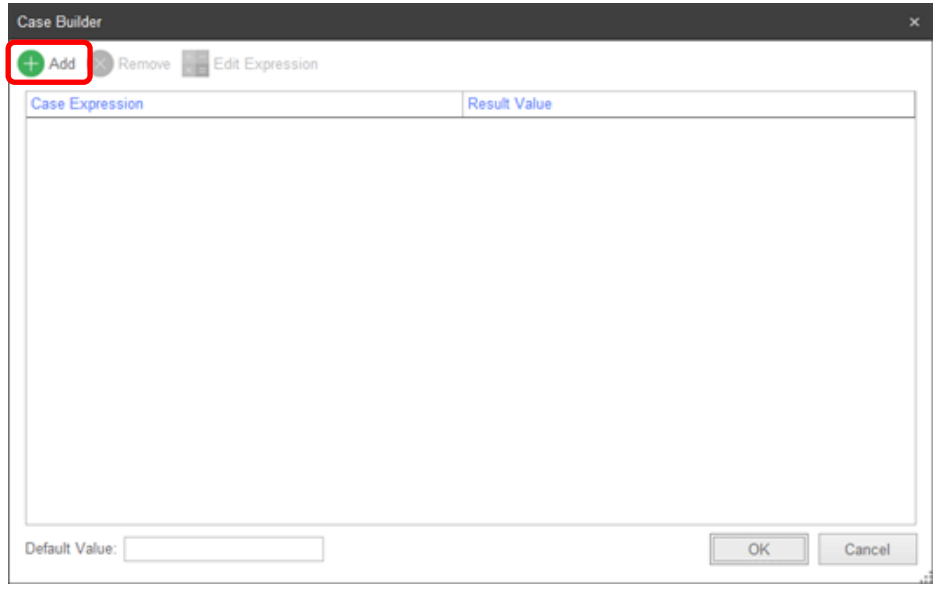
Occupied and Unoccupied mode is identified by the {EffectOcc} object. Changes in this object value will trigger changes in the scoring calculation.

A Case Builder will be required to provide one calculation when {EffectOcc} is returning a value of 1 “Occupied” and a different calculation when {EffectOcc} is returning a value of 0 “Unoccupied”.

Click on *Case Builder.*



The Case Builder window opens. Click on *Add.*



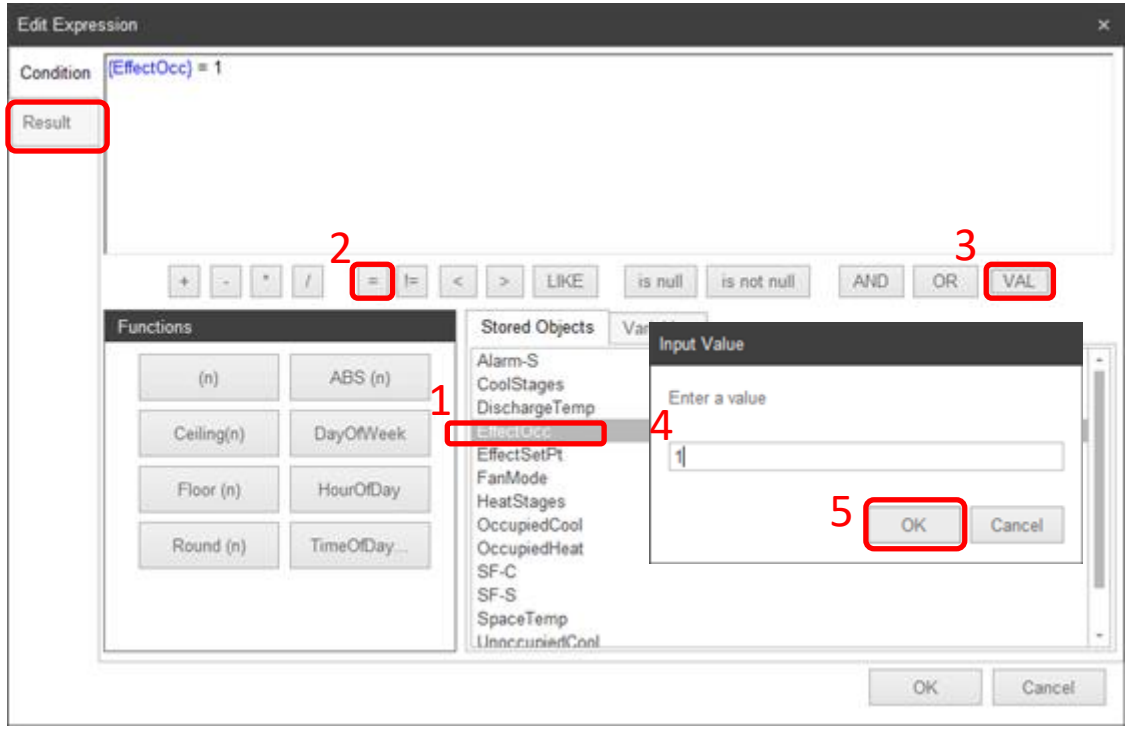
KEY2ACT

Scoring Tools

Custom

The Edit Expression window opens.
1. Double Click on EffectOcc to add it to the upper workspace.
2. Then click on the = button.
3. Then click on the *VAL* button
4. Type in the number 1
5. Click *OK*.

The expression {EffectOcc} = 1 should be visible in the upper workspace.
This will define the condition of when occupied.
6. Click on *Result*.



Note; Sometimes an Occupancy object uses a Text Data Type instead of a Double Precision. In some of those cases the Occupancy object Text Data Type may not have a Point Conversion applied in the Profile. In those cases the expression must contain the “LIKE” operator and the exact text that represents the desired condition.
An example is; {EffectiveOccupancy} LIKE ‘True’.

Use the Dynamic Explorer to identify these situations and the exact text required.

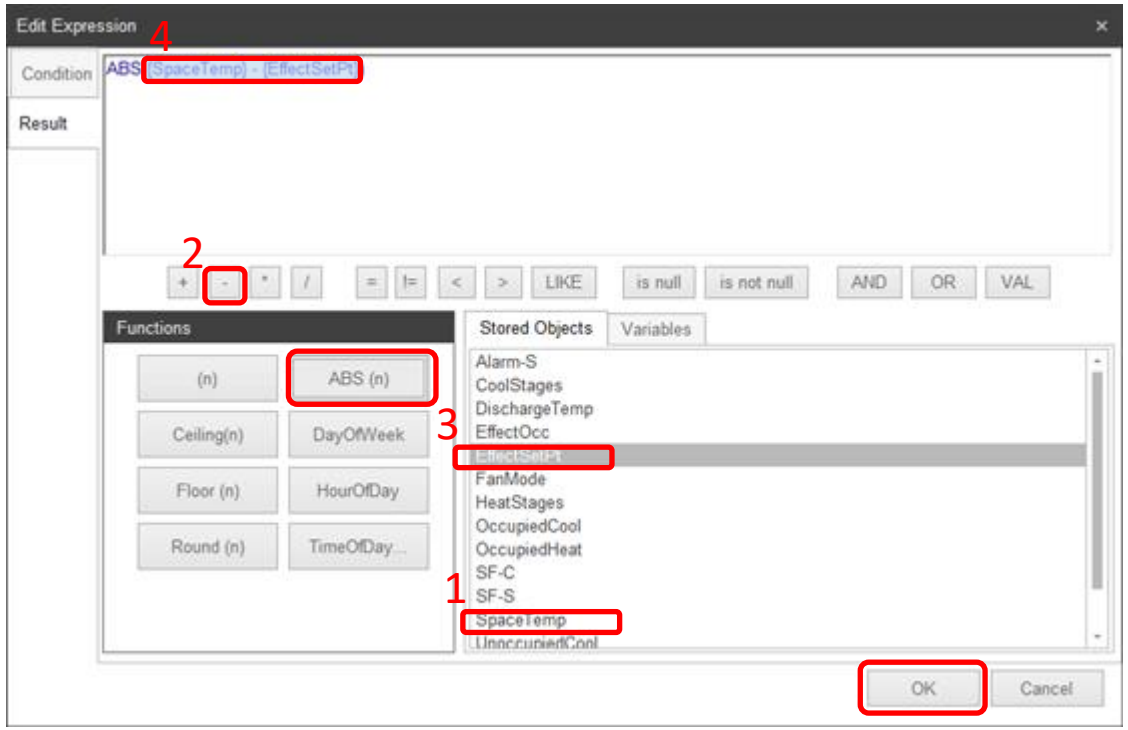
KEY2ACT

Scoring Tools

Custom

The Edit Custom Score window opens. The goal is to define an expression that produces the difference between the active space setpoint and the space temperature.

1. Double Click on {SpaceTemp} to add it to the upper workspace.
2. Then click on the - button.
3. Double Click on {EffectSetpt} to add it to the upper workspace.
4. Swipe over {SpaceTemp} – {EffectSetPt} to highlight that text.
5. Click on ABS(n) to apply the Absolute function to the highlighted expression
6. Click *OK*.



The expression ABS({SpaceTemp} – {EffectSetPt}) should be visible in the upper workspace.

This will calculate the absolute difference between the Space Temperature and the Effective Setpoint. Absolute was selected so that the difference between {SpaceTemp} and {EffectSetPt} will always return a positive value regardless of whether {SpaceTemp} is greater than or less than {EffectSetPt}.

A negative error value will always score the max range value. In this case 100%.

Click *Ok*.

KEY2ACT

Scoring Tools

Custom

The Case Builder window opens. Click on *Add.*
The Configuration Tab Edit Expression window opens.

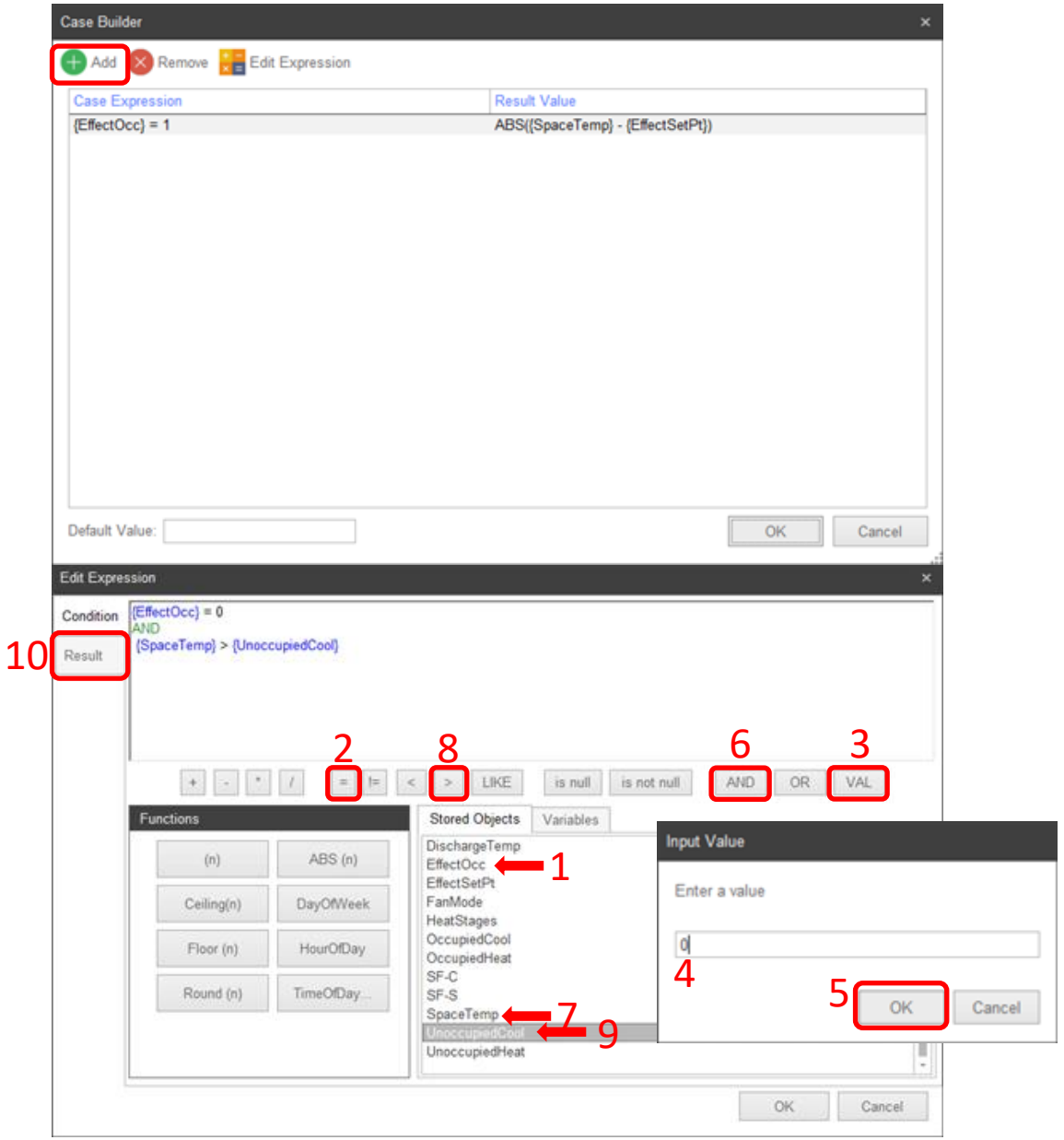
The goal is to create an expression that will return a true when the device is Unoccupied and the Space temperature is greater than the Unoccupied Cool setpoint.

1. Double click on *{EffecOcc}* to add it to the upper workspace.
2. Click on the = button.
3. Click on the *VAL* button.
4. The Input Value pop up opens. Enter a *0*.
5. Click *OK* on the Input Value pop up.
6. Click on the *AND* button.
7. Double click on *{SpaceTemp}* to add it to the upper workspace.
8. Click on the > button.
9. Double click on *{UnoccupiedCool}* to add it to the upper workspace.

Verify the expression is {EffecOcc} =0 AND {SpaceTemp} > {UnoccupiedCool}

Using {SpaceTemp} greater than {UnoccupiedCool} insures that only positive error values are produced.

10. Click on the *Result* tab.



KEY2ACT

Scoring Tools

Custom

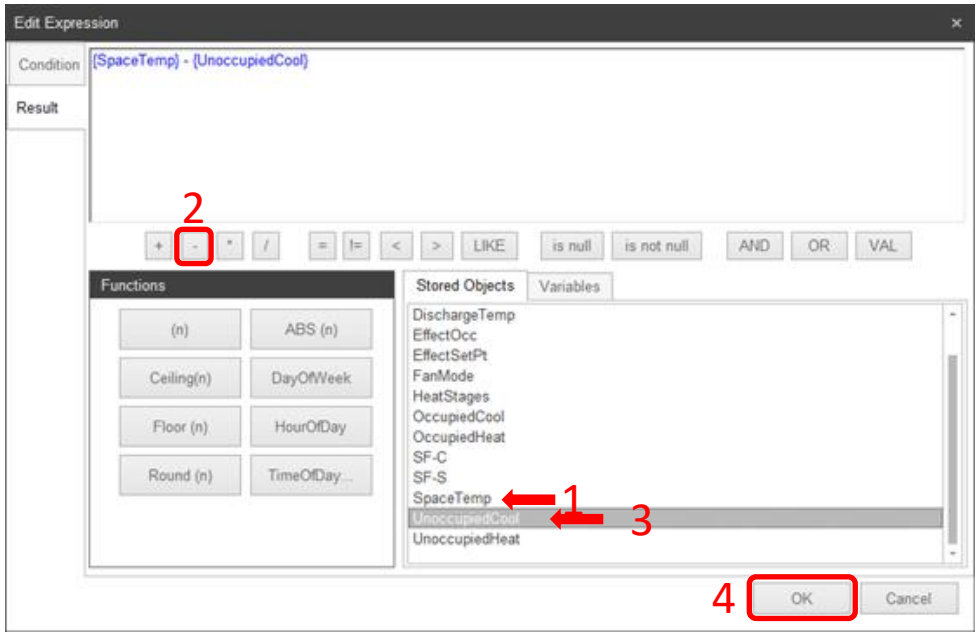
The Result Tab Edit Expression window opens.

The goal is to create an expression that will calculate the difference between the Space Temperature and the Unoccupied Cool Setpoint that produces a positive number when the Space Temperature is greater than the Unoccupied Cool Setpoint.

1. Double click on *{SpaceTemp}* to add it to the upper workspace.
2. Click on the - button.
3. Double click on *{UnoccupiedCool}* to add it to the upper workspace.

Verify the expression is {SpaceTemp} - {UnoccupiedCool}

4. Click on *OK*.



The Absolute Function is not desired in this case because when the {SpaceTemp} is less than {UnoccupiedCool} a negative error value is produced. This provides a max range score, in this case 100%. Which is the desired score at that condition for this expression.
As the {SpaceTemp} rises above {UnoccupiedCool} the error rises above 0 reducing the score.

KEY2ACT

Scoring Tools

Custom

The Case Builder window opens.
The two previous Case When expressions are visible. Click on *Add.*
The Configuration Tab Edit Expression window opens.

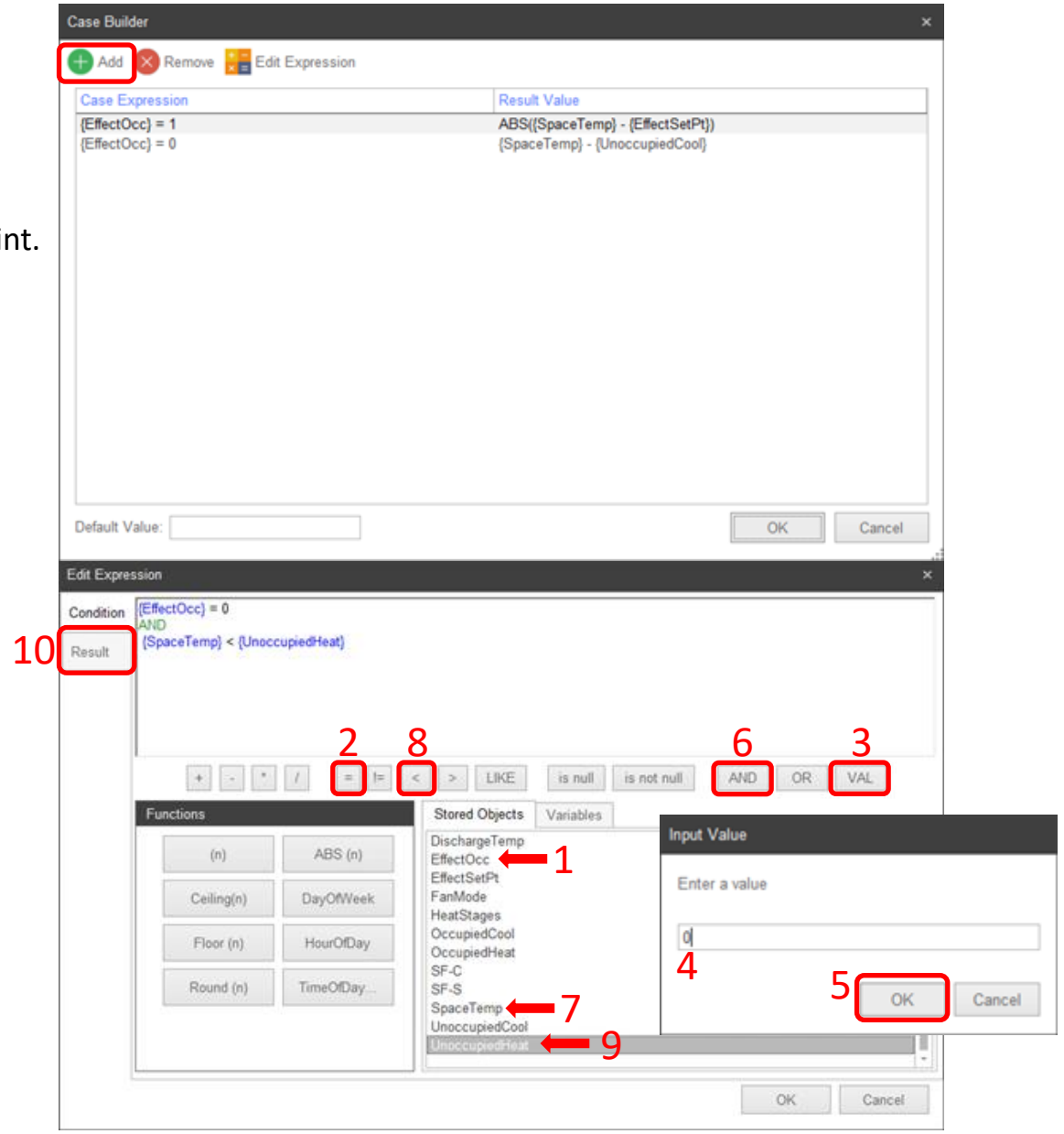
The goal is to create an expression that will return a true when the device is Unoccupied and the Space temperature is less than the Unoccupied Heat setpoint.

1. Double click on *{EffecOcc}* to add it to the upper workspace.
2. Click on the = button.
3. Click on the *VAL* button.
4. The Input Value pop up opens. Enter a *0*.
5. Click *OK* on the Input Value pop up.
6. Click on the *AND* button.
7. Double click on *{SpaceTemp}* to add it to the upper workspace.
8. Click on the < button.
9. Double click on *{UnoccupiedHeat}* to add it to the upper workspace.

Verify the expression is {EffecOcc} =0 AND {SpaceTemp} < {UnoccupiedHeat}

Using {SpaceTemp} less than {UnoccupiedHeat} insures that only positive error values are produced.

10. Click on the *Result* tab.



KEY2ACT

Scoring Tools

Custom

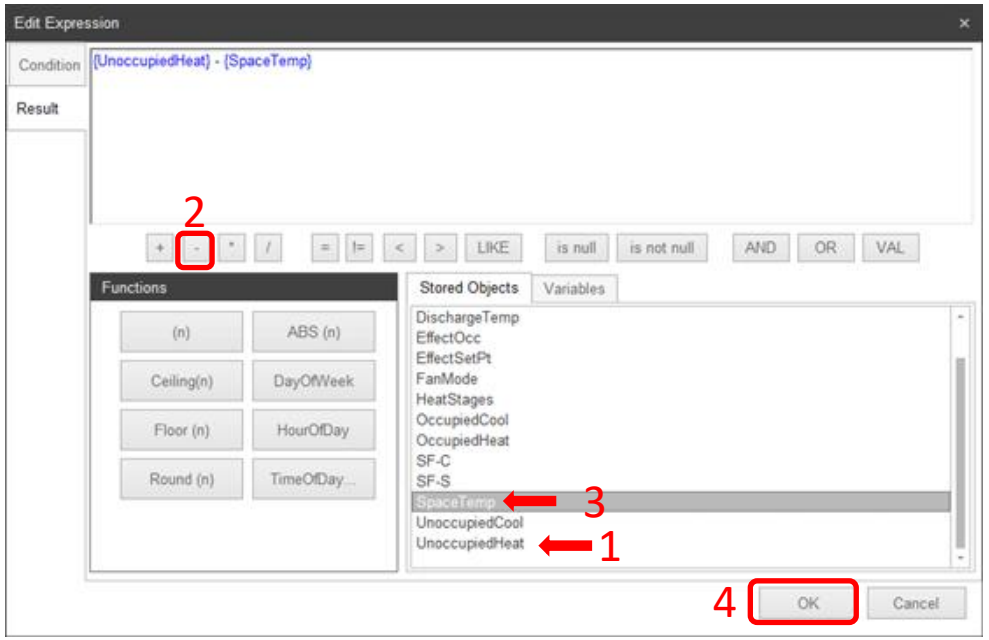
The Result Tab Edit Expression window opens.

The goal is to create an expression that will calculate the difference between the Space Temperature and the Unoccupied Heat setpoint that produces a positive number when the Space Temperature is less than the Unoccupied Heat Setpoint.

1. Double click on *{UnoccupiedHeat}* to add it to the upper workspace.
2. Click on the - button.
3. Double click on *{SpaceTemp}* to add it to the upper workspace.

Verify the expression is {UnoccupiedHeat} - {SpaceTemp}

4. Click on *OK*.



The Absolute Function is not desired in this case because when the {SpaceTemp} is greater than {UnoccupiedHeat} a negative error value is produced. This provides a max range score, in this case 100%. Which is the desired score in that condition for this expression.

As the {SpaceTemp} drops below {UnoccupiedHeat} the error rises above 0 reducing the score.

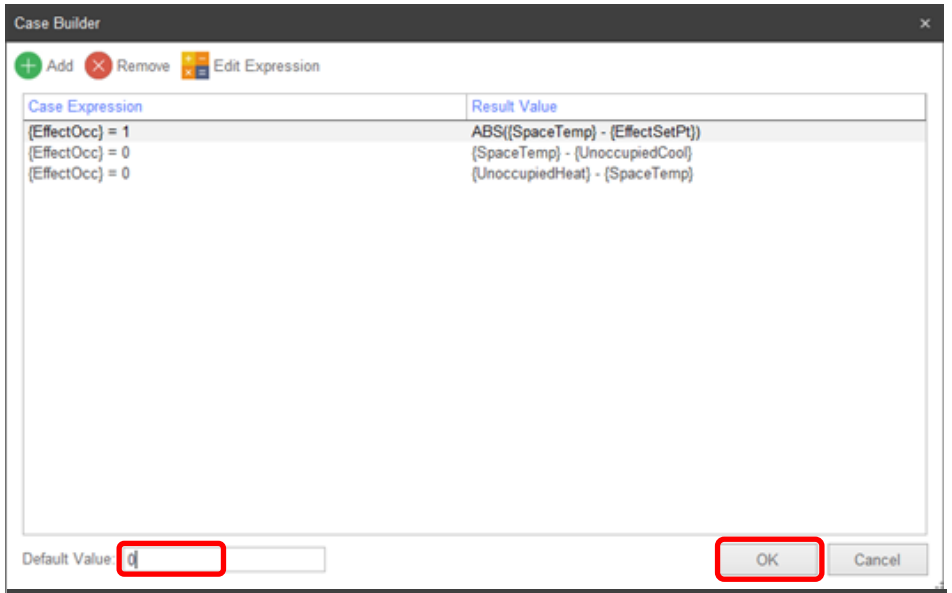
Scoring Tools

Custom

The Case Builder window opens.
The three previous Case When expressions are visible.

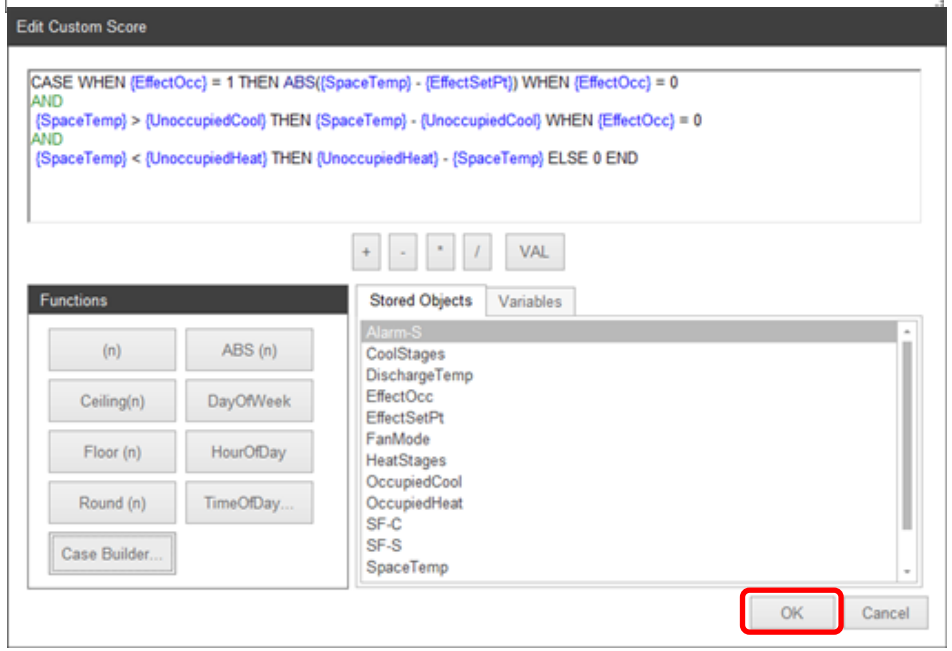
The goal is to provide a 100% score when {EffectOcc} is Unoccupied and the Space Temperature is between the Unoccupied Heat Setpoint and the Unoccupied Cool Setpoint.

Click in the Default Value window and type in the value *0*.
Click on *OK*.



Verify the completed expression is;
CASE WHEN {EffecOcc} = 1 THEN ABS({SpaceTemp} – {EffectSetPt})
WHEN {EffecOcc} =0 AND {SpaceTemp} > {UnoccupiedCool} THEN
{SpaceTemp} - {UnoccupiedCool}
WHEN {EffecOcc} =0 AND {SpaceTemp} < {UnoccupiedHeat} THEN
{UnoccupiedHeat} - {SpaceTemp}
ELSE 0 END

Click on *OK*.



KEY2ACT

Scoring Tools

Custom

The Edit Scoring window opens.

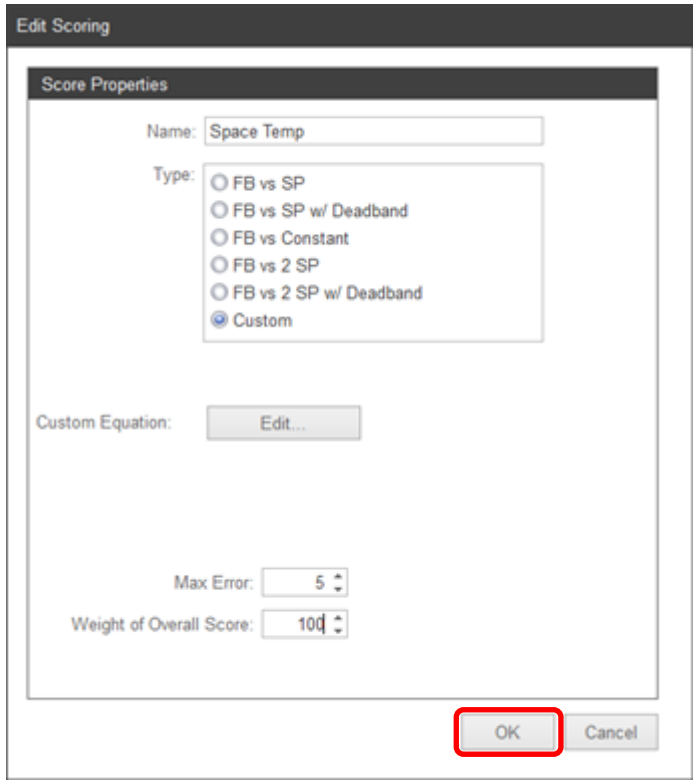
Set the Max Error and Weight of Overall Score to scale scoring as desired.

Max Error of 5 and a Weight of Overall Score of 100 equates to a 20% reduction in score for every 1 degree difference. 100/5 = 20

A 2 degree difference would produce a score of 60%. 100 – (2*(100/5)) = 60

Click *Ok*.

Note; A user may Copy/Paste the completed expression to Excel or Word etc.. to provide a library for future use where minimal editing is needed.



{EffectOcc} = 1	Space Temperature	Score	
	65.0°F	0	Max Error of 5 deg.
	66.0°F	0	
	67.0°F	20	
	68.0°F	40	
	69.0°F	60	
	70.0°F	80	
Space Effective Setpoint	71.0°F	100	
	72.0°F	80	Max Error of 5 deg.
	73.0°F	60	
	74.0°F	40	
	75.0°F	20	
	76.0°F	0	
	77.0°F	0	

{EffectOcc} = 0	Space Temperature	Score	
	87	0	Max Error of 5 deg.
	86	20	
	85	40	
	84	60	
	83	80	
Unoccupied Cool Setpoint	82	100	Deadband between Unocc setpoints.
	All values between	100	
Unoccupied Heat Setpoint	65	100	
	64	80	Max Error of 5 deg.
	63	60	
	62	40	
	61	20	
	60	0	

KEY2ACT

Scoring Tools

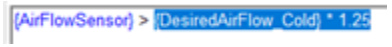
Custom - Functions

The (n) Function.

This Function allow the user to place a parenthesis outside a highlighted section of an expression.

Expression.

Highlight the desired section.

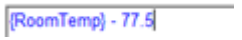


Click on *(n)*.

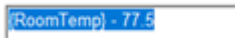
The ABS(n) Function.

This Function converts the product of a highlighted section of an expression to a positive value.

Expression.



Highlight the desired section.



Click on ABS*(n)*.

Date Time Stamp	77.5	Room Temp	ABS
6/24/2018 6:15:00 AM	77.5	76.8	0.7
6/24/2018 6:30:00 AM	77.5	76.9	0.6
6/24/2018 6:45:00 AM	77.5	77.1	0.4
6/24/2018 7:00:00 AM	77.5	77.6	0.1
6/24/2018 7:15:00 AM	77.5	77.8	0.3
6/24/2018 7:30:00 AM	77.5	78	0.5
6/24/2018 7:45:00 AM	77.5	78.6	1.1

The Ceiling(n) Function.

This Function returns a whole integer value “no decimal” product of the highlighted object or expression. The integer will be the next whole integer. For example 75.3 will return 76.

Expression.

Highlight the desired section.

Click on Ceiling*(n)*.

Date Time Stamp	Room Temp	Ceiling
6/24/2018 7:15:00 AM	77.8	78
6/24/2018 7:30:00 AM	78	78
6/24/2018 7:45:00 AM	78.6	79
6/24/2018 8:00:00 AM	79	79
6/24/2018 8:15:00 AM	79.4	80
6/24/2018 8:30:00 AM	79.4	80

Scoring Tools

Custom - Functions

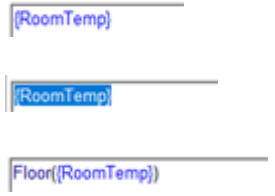
The Floor(n) Function.

This Function returns a whole integer value “no decimal” product of the highlighted object or expression. The integer will be the whole integer. For example 75.3 will return 75.

Expression.

Highlight the desired section.

Click on Floor*(n).*



Date Time Stamp	Room Temp	Floor
6/24/2018 6:00:00 AM	77	77
6/24/2018 6:15:00 AM	76.8	76
6/24/2018 6:30:00 AM	76.9	76
6/24/2018 6:45:00 AM	77.1	77
6/24/2018 7:00:00 AM	77.6	77
6/24/2018 7:15:00 AM	77.8	77
6/24/2018 7:30:00 AM	78	78
6/24/2018 7:45:00 AM	78.6	78

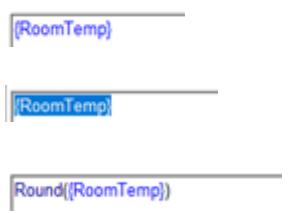
The Round(n) Function.

This Function returns a whole integer value “no decimal” product of the highlighted object or expression. The integer will be the next higher whole integer when the decimal is greater than .5 and the whole integer when the decimal is .5 or less. For example 75.5001 will return 76, 75.5000 will return 75 and 75.4999 will return 75.

Expression.

Highlight the desired section.

Click on Round*(n).*



Date Time Stamp	Room Temp	Round
6/24/2018 1:00:00 AM	76.5	76
6/24/2018 1:15:00 AM	76.3	76
6/24/2018 1:30:00 AM	76.2	76
6/24/2018 1:45:00 AM	76.7	77
6/24/2018 2:00:00 AM	76.7	77
6/24/2018 2:15:00 AM	76.6	77

The DayOfWeek(n) Function.

This Function returns a whole integer value representing the Day of the week. Sunday = 0, Wednesday = 3, Saturday = 6

Expression.

Click on DayOfWeek(n).

Date Time Stamp	DOW
6/24/2018 11:15:00 PM	0
6/24/2018 11:30:00 PM	0
6/24/2018 11:45:00 PM	0
6/25/2018 12:00:00 AM	1
6/25/2018 12:15:00 AM	1
6/25/2018 12:30:00 AM	1

Sunday

Monday

KEY2ACT

Scoring Tools

Custom - Functions

The HourOfDay(n) Function.

This Function returns a whole integer value representing the Hour of the Day. 12 AM = 0, 12 Noon = 12, 11PM = 23.

Expression.

Click on HourOfDay(n).

```
HourOfDay(datetime)
```

Date Time Stamp	HOD	
6/24/2018 12:00:00 AM	0	12 AM
6/24/2018 12:15:00 AM	0	
6/24/2018 12:30:00 AM	0	
6/24/2018 12:45:00 AM	0	
6/24/2018 1:00:00 AM	1	1 AM
6/24/2018 1:15:00 AM	1	
6/24/2018 1:30:00 AM	1	
6/24/2018 1:45:00 AM	1	
6/24/2018 2:00:00 AM	2	2 AM
6/24/2018 2:15:00 AM	2	
6/24/2018 2:30:00 AM	2	

The TimeOfDay(n) Function.

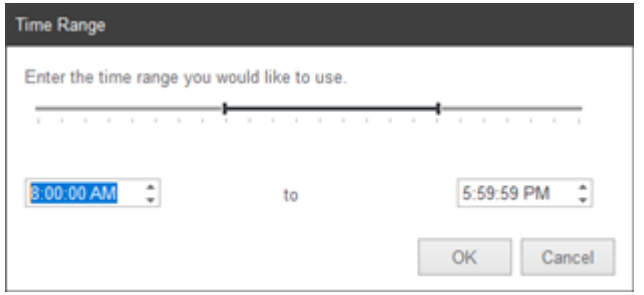
This Function provides a true/false value representing the result of a TimeRange selector tool.

Expression.

Click on TimeOfDay(n).

Select the desired Time Range.

```
TimeOfDay BETWEEN '08:00:00' AND '17:59:59'
```



Date Time Stamp	TOD
6/24/2018 7:30:00 AM	☐
6/24/2018 7:45:00 AM	☐
6/24/2018 8:00:00 AM	☑
6/24/2018 8:15:00 AM	☑

Thank you !!

KEY2ACT

THANK YOU