

Bit Masks

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“There are 10 types of people in the world. Those who understand bits and those who don’t”

Bit Masks are the implementation of binary math. Binary is the simplest form to represent a number. A “bit” of a number can only be 0 or 1. This is how digital computers work. They aren’t smart enough to handle numbers like 123.45, but they can handle 1s and 0s very fast. Fast enough to process complex large numbers into little “bits” and do it in a *very fast* process.

In most cases, people have problems with “bits” because we don’t think that simple. A “bit” is only, can only, and will only ever be 1 or 0. Nothing more, nothing less.

Control IQ uses “long” bit masking (aka 32 bits) in a number of areas to control what the users can View and Edit.

Think of “groups” of information in Control IQ. Very often we have:

- Air Handlers
- Chillers
- Boilers
- Irrigation Pumps
- Outside Lighting

Each of those groups contain many “points” in Control IQ, and different users have different needs to see those grouping of points, but in general, a user that can see one air handler can see ALL air handlers. A user that can see one part of the outside lighting can see ALL of the outside lighting. And a user that can see the irrigation pumps can see ALL of the Irrigation system. BUT a user that can see the Air Handlers, may not have any need to see any part of the Irrigation system. So we need a method to define that. Using bits, Control IQ can control or limit what “groups” of information a user sees.

As we define users, we need to define for each user what areas of information they have access to. We will turn a bit On or Off to present each of the groups a user sees.

Air Handlers would have a bit. Can this User see the Air handlers; Yes or No? 1 or 0
Chillers would have a bit. Can this User see the Chillers; Yes or No? 1 or 0
Boilers would have a bit. Can this User see the Boilers; Yes or No? 1 or 0

Etc.

A logical grouping of points (I.E. Chillers) would have a single bit. But a user would have multiple bits set based on what they could access.

In the Users table we *could* setup 32 fields that were Yes/No (1 or 0) to establish what a user can see, but we didn't. Since we have multiple masks that serve multiple purposes, this would add a lot to the database and a lot for GUI to process. For this reason we combined "like" bits together into one number.

It's like learning to drive a stick shift. Little tough to get used to, but once you get it, you got it.

If we combine the bits there has to be some method to access them separately. This is where binary numbers come in. Each "bit" is assigned a value based on its position. In our list above:

Air Handlers	is the 1 st bit	(referred to as "Bit 0")
Chillers	is the 2 nd bit	
Boilers	is the 3 rd bit	
Irrigation Pumps	is the 4 th bit	
Outside Lighting	is the 5 th bit	(referred to as "Bit 4")

Binary math dictates that the values have to double as you add them to the list to make everything unique. Trust me on this one. Ease out the clutch. We will assign a "weighting" for each bit.

Air Handlers	is the 1 st bit	whose weight is 1	
Chillers	is the 2 nd bit	whose weight is 2	← See how they double?
Boilers	is the 3 rd bit	whose weight is 4	
Irrigation Pumps	is the 4 th bit	whose weight is 8	
Outside Lighting	is the 5 th bit	whose weight is 16	

Since a bit can only be On or Off that means:

Air Handlers	is the 1 st bit	whose weight is 1	can only be 0 or 1
Chillers	is the 2 nd bit	whose weight is 2	can only be 0 or 2
Boilers	is the 3 rd bit	whose weight is 4	can only be 0 or 4
Irrigation Pumps	is the 4 th bit	whose weight is 8	can only be 0 or 8
Outside Lighting	is the 5 th bit	whose weight is 16	can only be 0 or 16

Clutch – Shift to 2nd gear. Not real comfortable yet?

ViewMask

ViewMask is used to allow, or disallow Groups (Tabdata) or Views to be accessible to the user as described above.

In the Users ViewMask we set a number that is the total of all bits they can see,

<u>ViewMask</u>	<u>Accessible Groups and Views for this User</u>
1	Air Handlers (only)
5	Air Handlers AND Boilers (1+4)
23	Everything EXCEPT Irrigation Pumps (1+2+4+16)
8	Irrigation Pump (only)
31	Everything (1+2+4+8+16)

As long as the Views/Groups ViewMask is fully contained in the User's ViewMask, the View / Group is accessible to the user.

Clutch – 3rd Gear. Almost home.

ViewMask

We may want to restrict what “some” users see from this group so they don't get overwhelmed with the amount of data (or perhaps we don't want to give some of them access to the Chiller set point). The User's Viewmask must line up with the Viewmask set for the Point. If the User Viewmask is “1” and the Point Viewmask is a “2” the user will not have access to that point. In this way you can “hide” points from a user.

If the User Viewmask is a 3 and the Point Viewmask is a 1. The User WILL have access to the Point because the “3” in the user has bit “1” and bit “2” set. Since “1” is set it will allow the Point to be accessed. But if the user Viewmask is a “1”, they would not have access to any points in the same group whose Viewmask is set to “2”.

EditMask

EditMask works exactly like Viewmask, but controls what Points a user can edit (change setpoints, override the Point etc) If the User's EditMask is aligned with the Points EditMask, the “notepad” Icon will appear next to the Point in TabData, and the point will be editable by the user.

So you would think a user that has access to all points would have all bits set; right? While it is most common to use just the first view bits, it is possible to set all 32 bits in a ViewMask, BitMask and EditMask. For this reason the SAI built in user has all bits set. (Exception made for Dillards)

In all cases, the User masks are the master. The ViewMask set in Views and Groups, and Points must be fully contained in the User's ViewMask or EditMask in the case of Points.

As of this writing, there are pre-define ViewMask setting. These were put in place to control a user's ability to use Mobile ControllQ

Remember the "1st Bit" is actually Bit 0

0	Site Specific	(Air Handlers in our example)
1	Site Specific	(Chillers in our example)
2	Site Specific	(Boiler in our example)
3	Site Specific	(Irrigation in our example)
4	Site Specific	
5	Site Specific	
6	Site Specific	
7	Site Specific	
8	Site Specific	
9	Site Specific	
10	Site Specific	
11	Site Specific	
12	Guest Room	Mobile – User has access to Guest Room Screen
13	Mobile local only	Mobile – User only has access from the local network
14	Mobile Access	Mobile – Is this user allowed mobile access
15	Mobile Dashboard	Mobile – Does this user have access to the Dashboard
16	Mobile LogEntry 16	Data Entry (Dominos)
17	Mobile LogEntry 17	Data Entry (Dominos)
18	Mobile LogEntry 18	Data Entry (Dominos)
19	Mobile LogEntry 19	Data Entry (Dominos)
20	Footer Buttons	Mobile – Does the user see Footers on Views
21	Allow Global	Dillard's – Global Setpoints / Schedules
22	Service Channel	Dillard's – Does the Link to SC show up
23	Mobile Edit Points	Mobile – Can this user edit points (new)

In views, there is a "Device" bit mask fields that controls what devices a view will be displayed on.

0	Phone (Less than 400 pixels wide)	(Value = 1)
1	Mini-Tablet (400 to 800 pixels wide)	(Value = 2)
2	Tablet (800-1200 pixels wide)	(Value = 4)
3	Desktop (>1200 pixels wide)	(Value = 8)

If a View is to be displayed on a Phone and Mini-Tablet then Device = 3

If a View is to be display on Desktop Only then Device=8

If a View is to be display on all devices then Device=15

You can copy/paste a Bitmask's Value into Calculator ('Programmer' sty) and it will show the individual bits.

Clutch, brake, neutral, parking brake, turn off the lights, turn off the key. We're done.
That wasn't so tough; was it?