ConsoliDator+

MasterClass

Week 9 – Advanced Configuration

Today's Key Topics

- How to Configure Duplex/Triplex Pump Controllers
- How to Configure Leak Detection
- How to Configure an "Annunciator Panel"
- Programming AND/OR Alarms (Boolean Logic)
- How to Configure Open Channel Flow Channels (with built-in formulas)

Configuring Duplex Pump Controllers

Since your "Level Channel" is already created, we can jump right to setting up our "Pumps"

For this type of application, I typically name my relays, "Pump 1", "Pump 2" etc.

The reason I name them that is because it looks much more slick on a "Screen" than if they were just "Relay 1"

6a : Relay Output

Display Tag: RY-1. | Pump 1
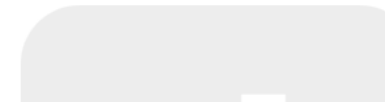Name for the relay output channel, 15 characters max.

Input: | 1. Level Channel

☐ **Enable Alternation**

| Set (On): | 80.0 | On Delay: | 0.0 | sec |
| Reset (Off): | 70.0 | Off Delay: | 0.0 | sec |

☐ **Pulse Output**

Break: | Relay Off ▼ | On Time: | 1.0 | sec
☐ Fail-Safe | Off Time: | 1.0 | sec

Configuring Duplex Pump Controllers

For this type of application, we want to make sure the "Enable Alternation" box is checked so that we can create a duplex pump controller

We then use this "chart" to program our set and reset points of our pumps!

6a : Relay Output

Display Tag: RY-1. Pump 1
Name for the relay output channel, 15 characters max.

Input: 1. Level Channel

☑ Enable Alternation   ☐ Alternation in Time: 00:00:00

	Set (On)	Reset (Off)
1	80.0	50.0

Insert
Remove
↑
↓
Edit

Break: Relay Off ▼   On Delay: 0.0 sec
☐ Fail-Safe   Off Delay: 0.0 sec

In this case, when our tank reaches 80% capacity, we want our pump to turn on and keep running until our tank empties to 50% capacity.

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Configuring Duplex Pump Controllers

In the event our pump cannot keep up with incoming material, we want to have a second setpoint which will turn BOTH pumps on to pump out the tank

To add a second set and reset point, we just need to press the "Insert" button

In this case, when our tank reaches 80% capacity, we want our pump to turn on and keep running until our tank empties to 50% capacity.

Unless our tank level continues to rise to 90% at which point our secondary pump will come on to help out

They will run simultaneously until our reset point (50%) is reached

6a : Relay Output

Display Tag: RY-1. Pump 1
Name for the relay output channel, 15 characters max.

Input: 1. Level Channel

☑ Enable Alternation   ☐ Alternation in Time: 00:00:00

	Set (On)	Reset (Off)
1	80.0	50.0
2	90.0	50.0

Insert
Remove
↑
↓
Edit

Break: Relay Off ▼   **On Delay:** 0.0 sec
☐ Fail-Safe   **Off Delay:** 0.0 sec

NOTE: *In real life, you would not want the pumps to switch off at the same point every time, but in this example, it's okay!*

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Configuring Duplex Pump Controllers

The ConsoliDator+ can alternate pumps based on level setpoint AND / OR elapsed pump run time!

This is an extremely useful feature which helps customers make sure their pumps are wearing evenly!

To enable this feature, simply check the "Alternation in Time" checkbox, and then enter in the desired time

In this example, if our first pump kicks on and it runs for 10 minutes without reaching our reset point (50%), the ConsoliDator+ will turn Pump 1 off and will allow Pump 2 to take over… and the process continues!

6a : Relay Output

Display Tag: RY-1. Pump 1
Name for the relay output channel, 15 characters max.

Input: 1. Level Channel

☑ **Enable Alternation**   ☑ **Alternation in Time:**   00:00:00

Set Time   eset (Off)

Insert	1	0.0
Remove	2	0.0

Hours   Minutes   Seconds
00   10   00

OK   Cancel

↑

↓

Edit

Break: Relay Off ▼   On Delay: 0.0 sec
☐ Fail-Safe   Off Delay: 0.0 sec

NOTE: *With this mode activated, the pumps will alternate based on setpoint and/or elapsed time, <u>whichever occurs first!</u>*

Configuring Duplex Pump Controllers

Now we need to go to the left of the software window again, find "Outputs" and then find the relay for our backup pump!

As you can see, since mine is clearly labeled, it's easy to spot ;)
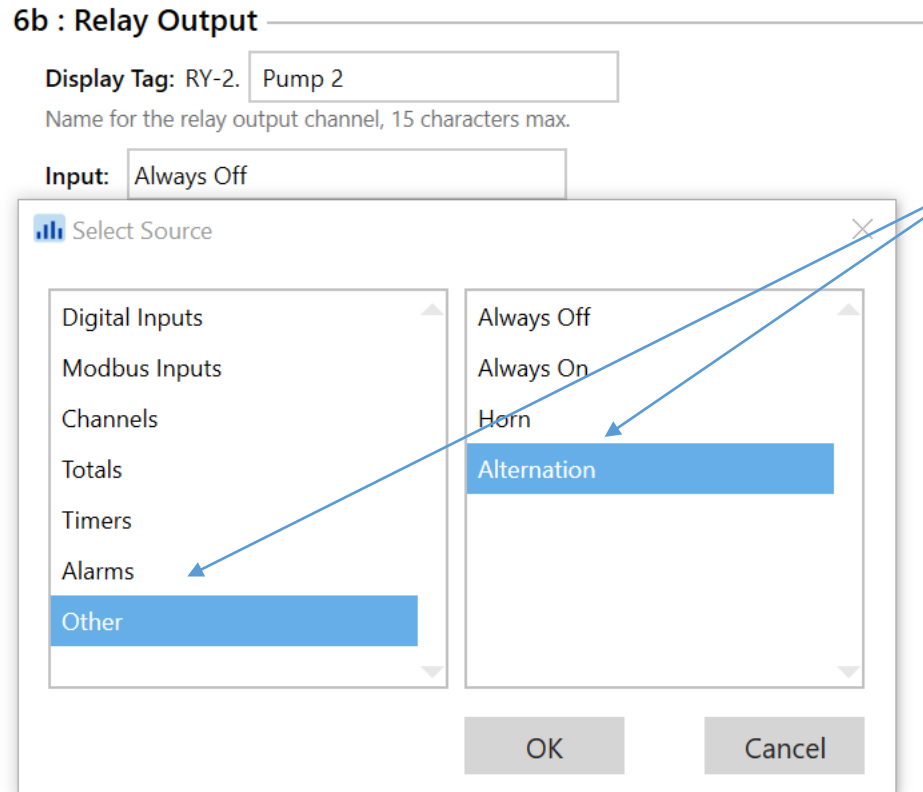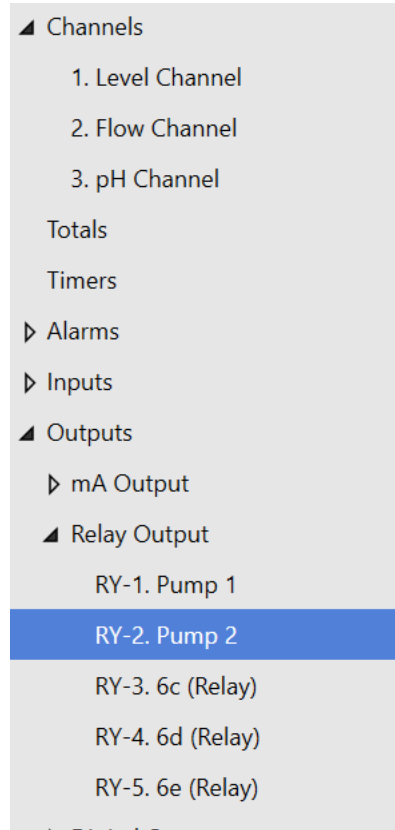
For this second relay, we want our "Input" to be "Alternation" which is actually located in the "Other" category!

In order for the second relay to be tied to the logic of the first relay, this input must be chosen!

Channels
- 1. Level Channel
- 2. Flow Channel
- 3. pH Channel

Totals

Timers

▷ Alarms

▷ Inputs

▲ Outputs
- ▷ mA Output
- ▲ Relay Output
  - RY-1. Pump 1
  - RY-2. Pump 2
  - RY-3. 6c (Relay)
  - RY-4. 6d (Relay)
  - RY-5. 6e (Relay)

6b : Relay Output

Display Tag: RY-2. Pump 2

Name for the relay output channel, 15 characters max.

Input: Always Off

Select Source

Digital Inputs	Always Off
Modbus Inputs	Always On
Channels	Horn
Totals	Alternation
Timers	
Alarms	
Other	

OK   Cancel

NOTE: *The pump alternation feature will NOT work properly if you make the "Input" of this relay the "Level Channel".*

Configuring Duplex Pump Controllers

Once you select "Alternation" as your "Input", you simply choose which relay (or pump) you want to alternate with.

If you have TWO duplex pump controllers on the same unit (which is possible) then it is important to make sure you are pairing with correct relay/system!
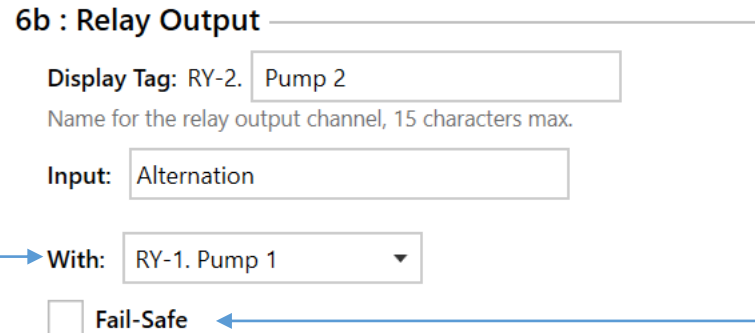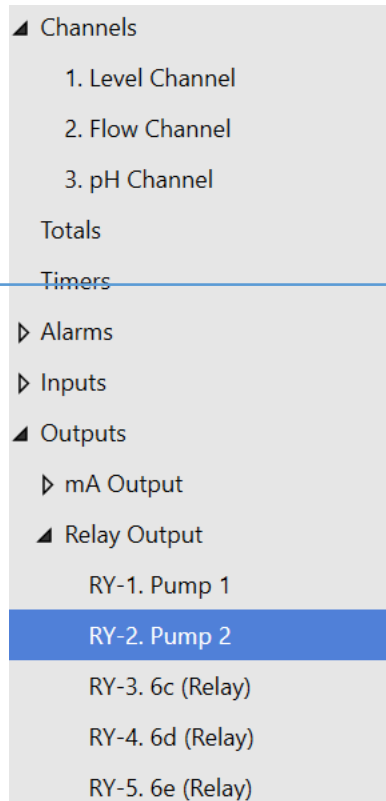
Notice how this relay has its own "Fail-Safe" box

That means that the "Fail-Safe" on the first relay we programmed is NOT tied to all alternating relays

Each relay has its own setting!

NOTE: *The pump alternation feature will NOT work properly if you make the "Input" of this relay the "Level Channel".*

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Configuring a TRIPLEX / QUADRAPLEX Pump Controller

So, what if you needed to add a third, or fourth pump to this system?!

You simply find your "Pump 3" relay, and follow the same exact process that we did for the second pump!
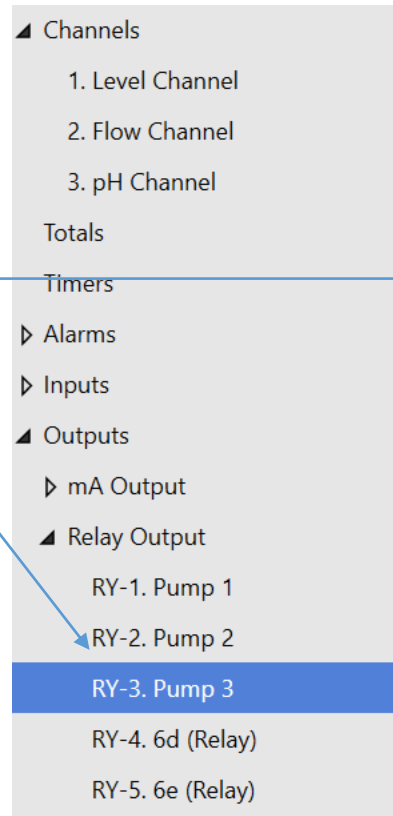
Notice how all the "logic" is built into the main relay we chose.

The other relays we add to this alternation cycle simply take direction from that main relay (or.. Pump)

Channels menu:
- ◢ Channels
  - 1. Level Channel
  - 2. Flow Channel
  - 3. pH Channel
- Totals
- Timers
- ▷ Alarms
- ▷ Inputs
- ◢ Outputs
  - ▷ mA Output
  - ◢ Relay Output
    - RY-1. Pump 1
    - RY-2. Pump 2
    - **RY-3. Pump 3**
    - RY-4. 6d (Relay)
    - RY-5. 6e (Relay)

6c : Relay Output

Display Tag: RY-3. [Pump 3]
Name for the relay output channel, 15 characters max.

Input: [Alternation]

With: [RY-1. Pump 1 ▼]

☐ Fail-Safe

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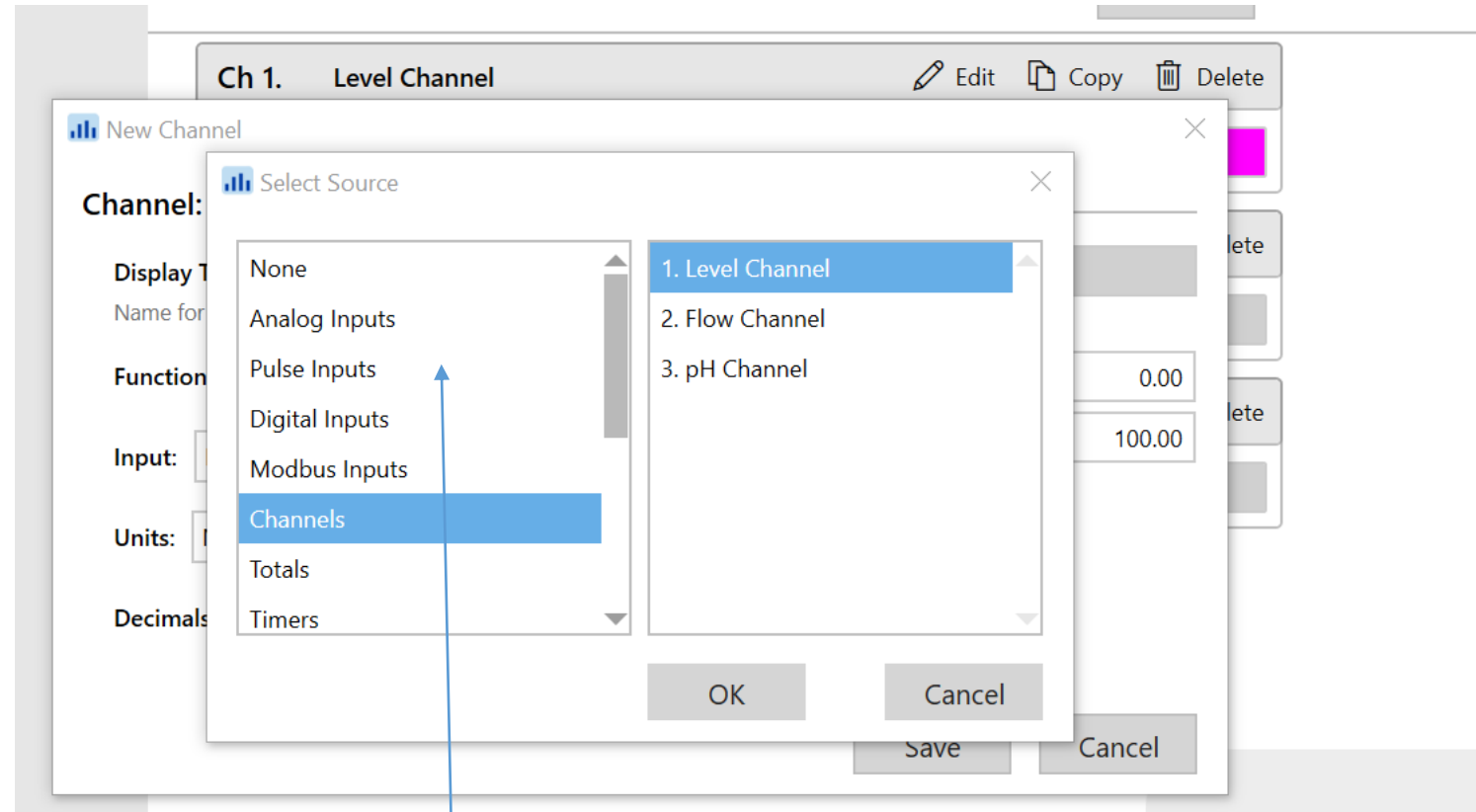# Configuring Leak Detection Alarms

Create an entirely new channel, name it whatever you'd like (this object does not NEED to appear on a screen, so the name is not too important) and then for the "Function" of the channel, we want to select the "Measure" category, and then find the "Rate of Change" function

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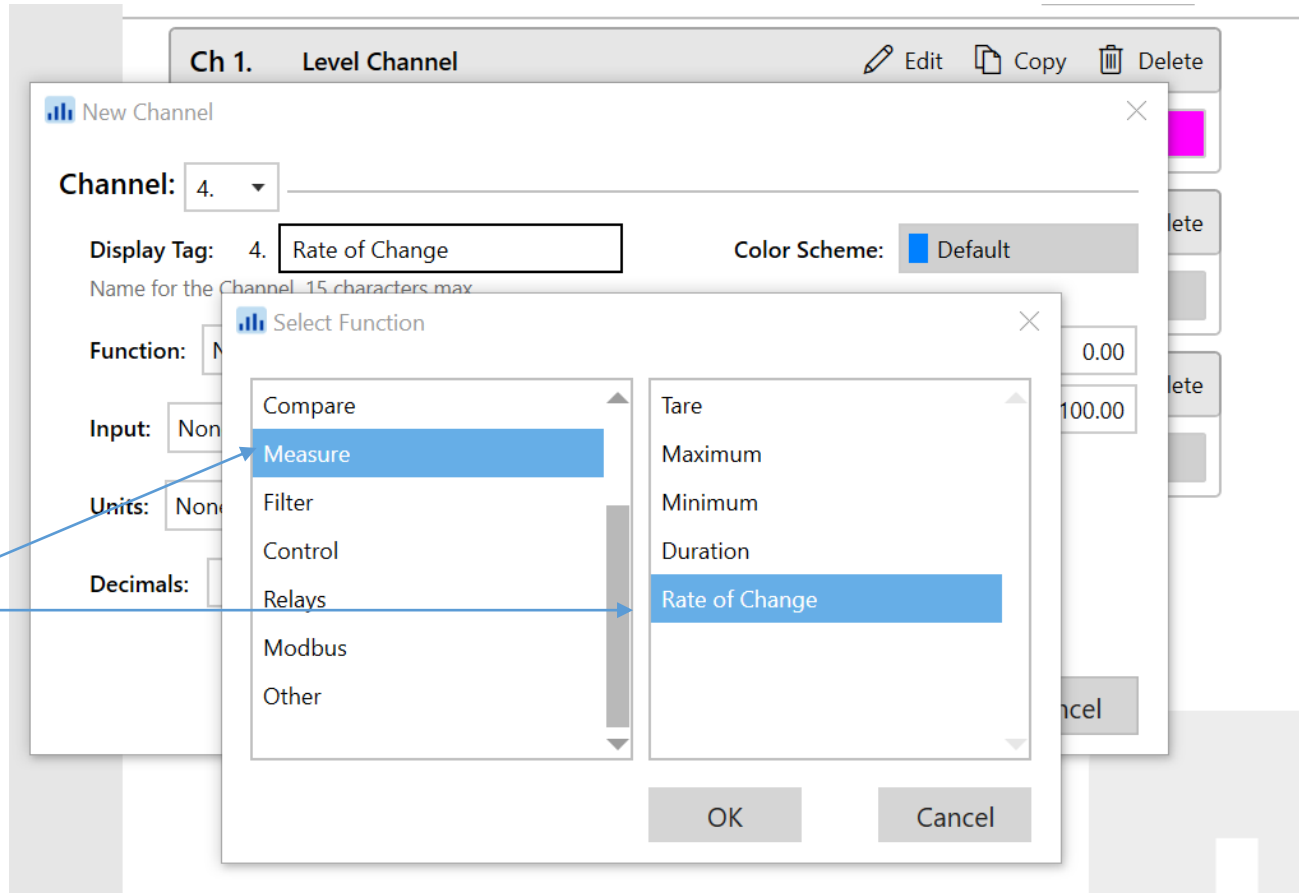
Configuring Leak Detection Alarms

For the "Input" of this channel, we want our "Level Channel" to be the input

Usually, we configure channels from a process signal input, but in this particular case, we want the input to be a channel we have already created!

NOTE: *Notice how many other configurable "Objects" can be the input to a channel!!*

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Configuring Leak Detection Alarms

Now, since this is technically a "Rate" channel, our units must be "%/time" (percent over time) since the units for our "Level Channel" is in percent (if it were in gallons, the units for this rate channel would be gallons/time)
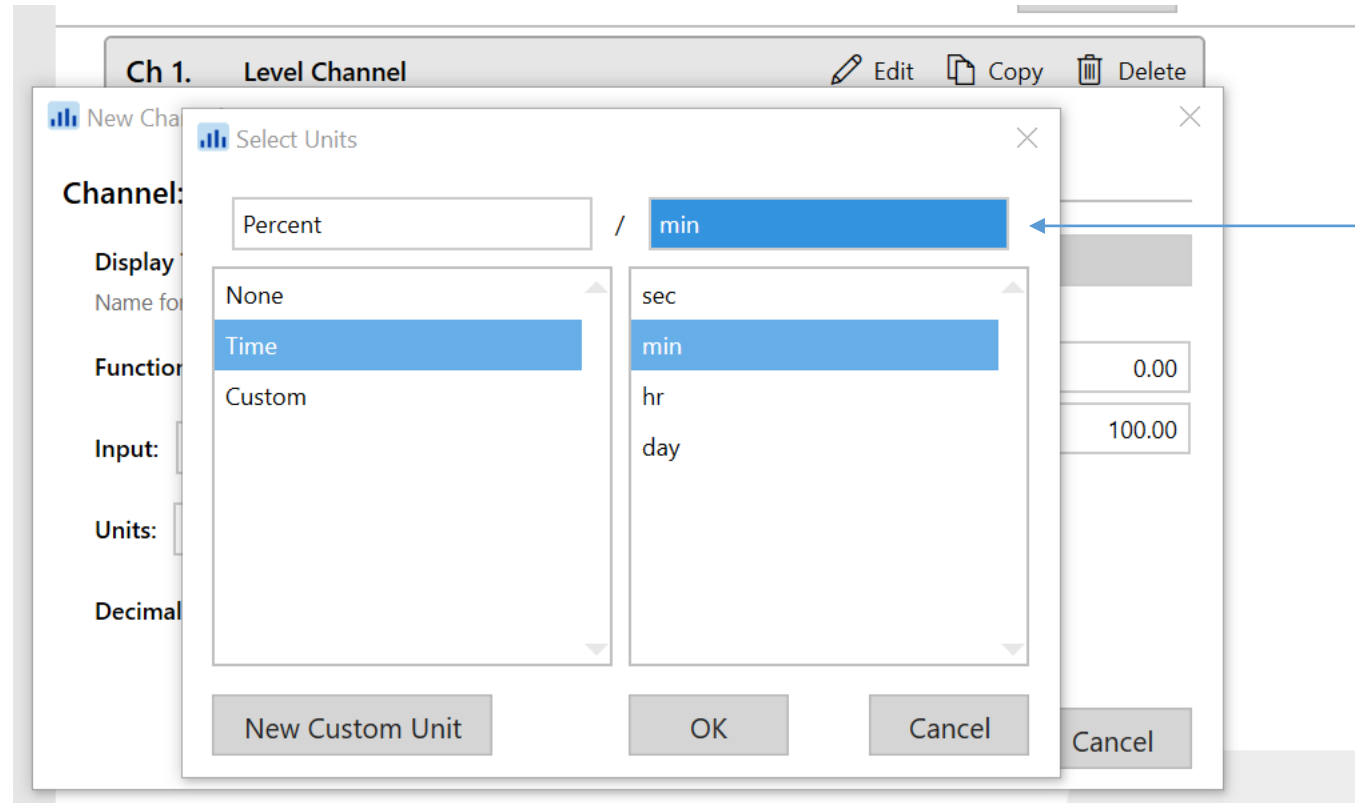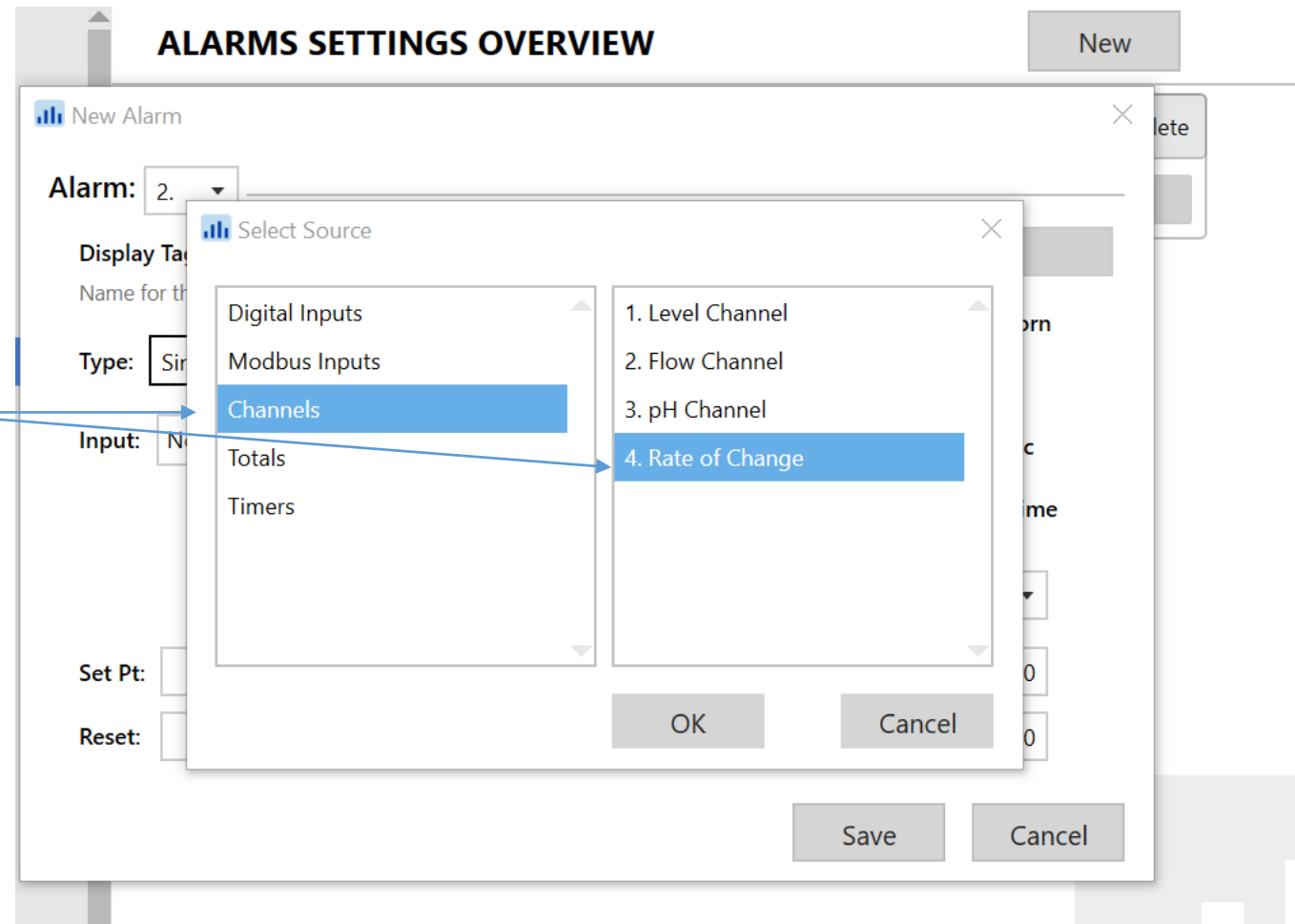

To select the different "Time" options, you simply click on the box and then select which time base you want.

When I configure these channels for customers, I typically use "minutes" and that has worked just fine before!

NOTE: *Again, this channel does NOT need to appear on a screen to work, so we can consider this channel complete!*

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Configuring Leak Detection Alarms

Create a new SINGLE SOURCE "Alarm" with our newly configured "Rate of Change" channel

ALARMS SETTINGS OVERVIEW

New

New Alarm

Alarm: 2.

Display Ta
Name for th

Type: Sir

Input: N

Select Source

Digital Inputs
Modbus Inputs
Channels
Totals
Timers

1. Level Channel
2. Flow Channel
3. pH Channel
4. Rate of Change

OK   Cancel

Set Pt:

Reset:

Save   Cancel

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Configuring Leak Detection Alarms

Since we want to alarm when our tank is LOSING material, we want our "Set Point" to be a negative value – that makes sense, right?

For the reset value, we want to use "0" rather than a positive integer.

Why?

Well, we want the alarm to stop when the leak stops. If the reset were a positive number, the alarm wouldn't go away until the tank is being filled at a specific rate.

For the most part, the reset point is going to be ZERO!

New Alarm

Alarm: 2.

Display Tag: A2. Leak Detected?!
Name for the Alarm, 15 characters max.

Type: Single Source

Input: 4. Rate of Change

Color Scheme: Default

☑ Sound Horn
☑ Alert!
☑ Automatic
☑ Ack Anytime

Break: Alarm Off

Set Pt: -5.0
Reset: 0.0

On Delay: 0.0
Off Delay: 0.0

Save   Cancel

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Configuring Leak Detection Alarms

This next step is not REQUIRED for this to work, but it really makes the ConsoliDator+ shine.

Create a new "Channel" and name it a question, such as, "Leak Present?"

Make the "Input" to this channel that leak detection alarm we just created

Now, for your units, select the "YES" and "NO" units which can be found in the "Logic" category

That is so when there is no leak, the channel will say "NO" and when there is a leak, it will say "YES"

TURN THE BARGRAPH OFF!

NOTE: *The only thing we want this channel to do is tell us if our "Leak Alarm" is active, so we don't need a "Function". Leave that as "None"*

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Configuring Leak Detection Alarms

The last step is to assign a relay to the "Leak Detected" alarm so that when that alarm triggers, a relay will energize and throw an external alarm – if need be

After that, you simply want to create a new "Screen" and add the "Level Channel" and "Leak Present?" Channel we just created.

This screen will now show the tank level with a bargraph, and will also show you the leak detection status (YES/NO).

NOTE: *Neither of these objects MUST be on the screen for them to detect a leak in the tank, but again, having that leak detection status displayed on the screen is a crowd pleaser!*

Configuring "Annunciator Panel" Screens

When I say "Annunciator Panel Screens", this is what I mean.

These screens are simply providing us discrete status of a process.

In this particular case, the "Zone" can either be "Safe" or "WARNING"

Creating these screens is going to be VERY similar to the "Leak Detected" Alarm Channel we just made...
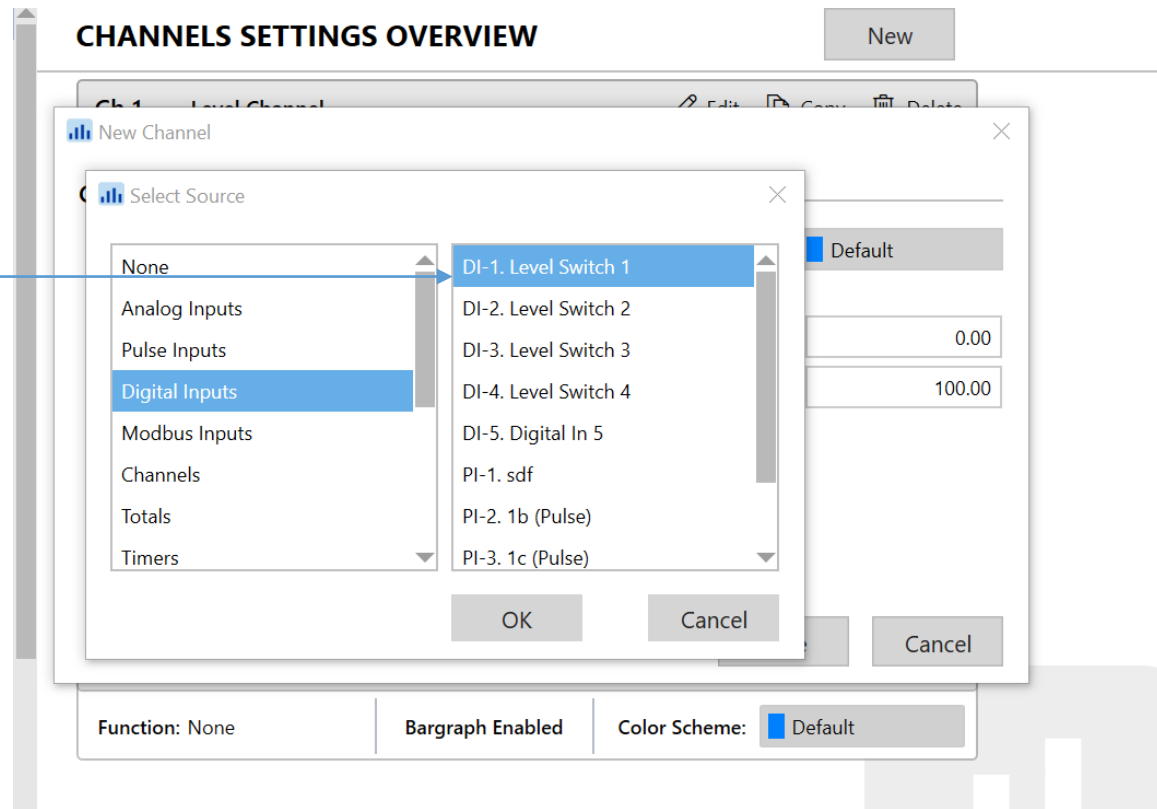
Almost EXACTLY like it...

QUESTION: *Is there better terminology I can use for this type of screen?!*

Configuring "Annunciator Panel" Screens

Create a new "Channel" with any of your digital inputs as the "Input"

I labeled my inputs as Level Switch 1-4 to make it easier to find them when making these channels!

CHANNELS SETTINGS OVERVIEW | New

Ch 1   Level Channel   Edit   Copy   Delete

New Channel ✕

Select Source ✕

None	DI-1. Level Switch 1
Analog Inputs	DI-2. Level Switch 2
Pulse Inputs	DI-3. Level Switch 3
Digital Inputs	DI-4. Level Switch 4
Modbus Inputs	DI-5. Digital In 5
Channels	PI-1. sdf
Totals	PI-2. 1b (Pulse)
Timers	PI-3. 1c (Pulse)

OK   Cancel

Default

0.00

100.00

Cancel

**Function:** None | **Bargraph Enabled** | **Color Scheme:** Default

NOTE: *Pulse Inputs can ALSO be used as digital inputs for this type of screen. The ConsoliDator+ can have a maximum of 33 "discrete" inputs*

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Configuring "Annunciator Panel" Screens

Select whichever "Units" you want to be shown on the "Annunciator Screen"

Or, you could think of them as "messages"

In this example, our "messages" are... "OKAY" and "WARNING"
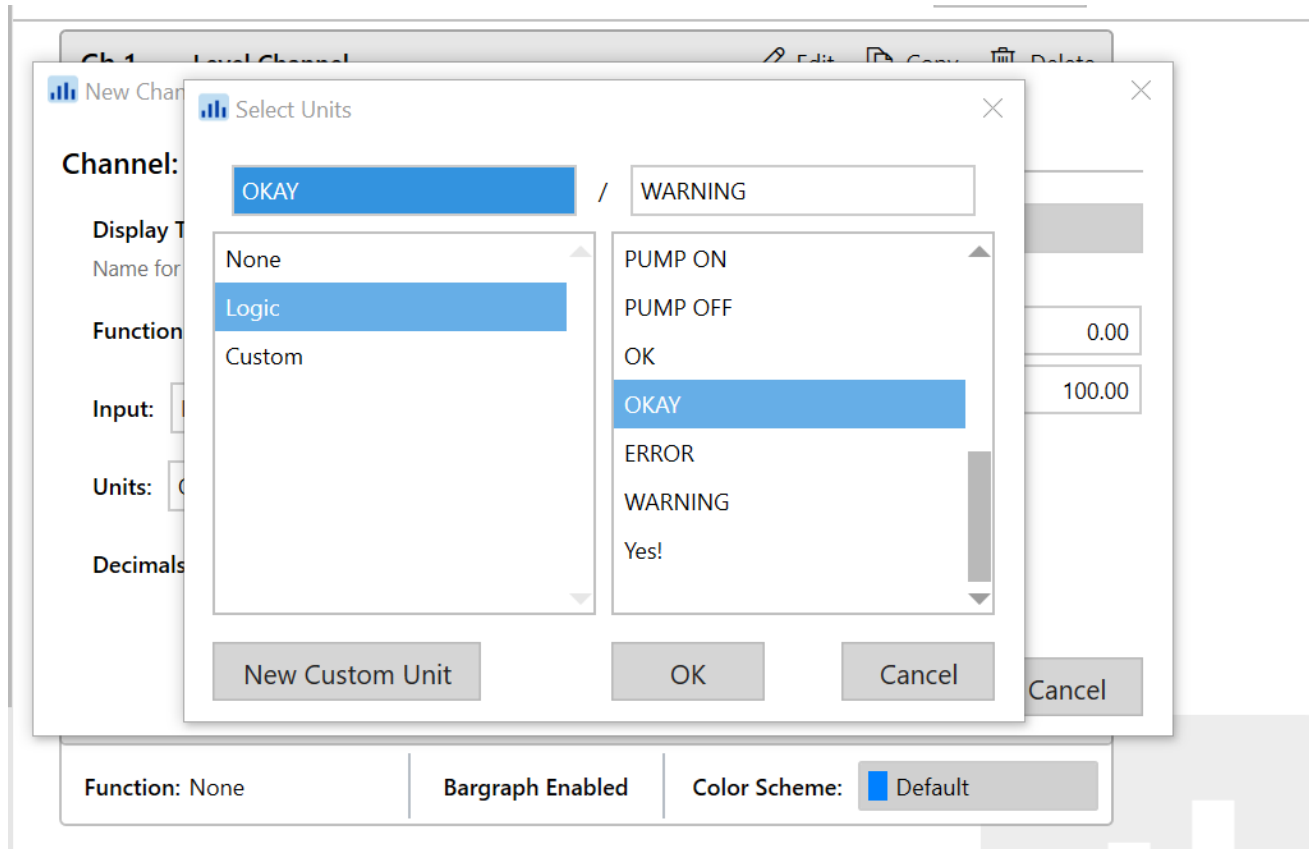
Keep in mind that you can create your own custom "messages" with a limitation of 8 characters

So, you could make a message which says, "Too Full" or "Empty Me" or something clever like that!

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Configuring "Annunciator Panel" Screens

Since we are **NOT** displaying any numerical values with this channel, we **DO NOT** need to worry about the decimals.

You are still able to "edit" that field, but it won't actually do anything to the channel itself

To really make these screens POP, be sure to change the "Color Scheme" of this channel to something with **BLACK** text and a **GREEN** background

Lastly, because this is just giving us a discrete reading, a bargraph would be totally useless to us, so be sure that the bargraph is turned OFF!

CHANNELS SETTINGS OVERVIEW   New

Ch 1   Level Channel   Edit Copy Delete

New Channel   ✕

Channel: 6. ▼

Display Tag: 6. Tank 1

Name for the Channel, 15 characters max.

Color Scheme: ■ GREEN

Function: None

☐ Bargraph   0%   0.00

100%   100.00

Input: DI-1. Level Switch 1

Units: OKAY/WARNING

Decimals: 2 + −

Save   Cancel

Function: None | Bargraph Enabled | Color Scheme: ■ Default

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Configuring "Annunciator Panel" Screens

Lastly, add all of the "Annunciator" channels that you created on a screen!

Remember, a maximum of EIGHT channels can be on a single screen.

However, in my personal opinion, it looks best with either 4 or 6 channels!

To ensure this screen looks as clean and slick as possible, let's utilize some of these checkboxes.

Make sure the "Show Channel #" box is **unchecked**

Also, if you forgot to turn the bargraphs off on the channels, don't worry! You can remove ALL of them from here!

NOTE: *Don't forget... the "soft keys" on the screen can be programmed to jump to a specific screen, look at channel details, or acknowledge alarms!*

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Configuring "AND/OR Alarms" (Common Alarms)

THE STORY: For this example, let's imagine we have TWO tanks that are of the same dimensions. Each tank has a "Single Source" alarm which will be active when the corresponding tank reaches 80% capacity. The alarm will become inactive when the corresponding tank empties to 50% capacity.

THE CHALLENGE: Your customer only has ONE relay available on the ConsoliDator+ but they want to have an external horn go off if EITHER of their tanks gets to 80% capacity

CHALLENGE ACCEPTED…

Configuring "AND/OR Alarms" (Common Alarms)

Create a NEW alarm, and for the "Type", we want to select, "Alarms OR"

The other options for "Type" are:

Single Source
Multi-Source
Interval
Alarms OR
Alarms AND
Day & Time

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Configuring "AND/OR Alarms" (Common Alarms)

Now our next step is to "Insert" the "Single Source" alarms that we would like to combine into a single alarm output

New Alarm ✕

Alarm: 3. ▾

Display Tag: A3. | OR Alarm |
Name for the Alarm, 15 characters max.

Color Scheme: ▮ Default

Type: Alarms OR ▾

☑ Sound Horn

☑ Alert!

Input:
| A1. Tank 1 High |
| A2. Tank 2 High |

☑ Automatic

☑ Ack Anytime

Insert

Remove

Not

Break: Alarm Off ▾

On Delay: 0.0

Off Delay: 0.0

Save   Cancel

You can think of this alarm as a conditional statement

Here is what we are "telling" the ConsoliDator+

"**IF** Tank 1 **OR** Tank 2 reach 80% capacity, **THEN** trigger this alarm"

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Configuring "AND/OR Alarms" (Common Alarms)

You'll notice that there is a button on this screen we have yet to use

What's this "NOT" button all about?!

Well, it's a way for us to edit the "Conditional Statement" we are trying to communicate with the ConsoliDator+

You can think of this as a "Modifier"

So, how does that "NOT" button change our "Conditional Statement"?!

Now our statement says:

"**IF** Tank 1 reaches 80% capacity **OR** Tank 2 is **NOT** at 80% capacity, **THEN** trigger this alarm"

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Configuring "AND/OR Alarms" (Common Alarms)

Here we have an "AND" alarm which I commonly refer to as, "*Common Alarms*"

These are configured exactly the same as an "OR" alarm, the only difference is that the "Conditional Statement" we communicate to the ConsoliDator+ is completely different.

New Alarm

Alarm: 3.

Display Tag: A3. | OR Alarm
Name for the Alarm, 15 characters max.

Color Scheme: ■ Default

Type: Alarms AND

☑ Sound Horn
☑ Alert!
☑ Automatic
☑ Ack Anytime

Input:
A1. Tank 1 High
A2. Tank 2 High

Insert
Remove
Not

Break: Alarm Off

On Delay: 0.0
Off Delay: 0.0

Save   Cancel

With an "AND" alarm, how does our conditional statement differ from that of an "OR" alarm?!

See our new statement:

"**IF** Tank 1 **AND** Tank 2 reach 80% capacity, **THEN** trigger alarm"

NOTE: *Unlike the "OR" Alarm, in this case, BOTH tanks MUST be at 80% capacity (or higher) for this "AND" Alarm to trigger*

Configuring "AND/OR Alarms" (Common Alarms)

<mark>The "Study Guide" for this week helps explain the conditional statements in greater detail</mark>, but hopefully you get the idea.

By thinking about ANY of these alarms as conditional statements, it will help you when trying to configure the ConsoliDator+ for more complex applications.

You saw how we use "AND/OR" Alarms to combine multiple "Single Source" Alarms. However, they can ALSO be used to combine other "AND/OR" Alarms which can be linked together to accomplish just about any type of logic needed for a complex control application.

Configuring Open Channel Flow

The first step here is to create a "Channel" which is going to be used as the "Head Height" of your weir/flume.

It is **VERY important** to make sure this channel is scaled in FEET!! (*not inches, cm, mm, or anything other than FEET*)

Channel 1

Display Tag: 1. Head Height
Name for the Channel, 15 characters max.

Function: Scale Linear 2-Pt

Input: AI-1. Level Sensor A

Units: Feet

Decimals: 2 + −

Scale:	Input (mA)	Output (Feet)
1.	4.000	0.00
2.	20.000	3.00

☐ **Cutoff:** 0.00 Feet

New | Copy | Delete

Color Scheme: ▉ Default

☑ Bargraph 0% 0.00
100% 3.00

This channel does NOT need to appear on any screen, so it's completely up to the end user if they want a bar graph and color scheme for this channel

NOTE: *Unlike the "OR" Alarm, in this case, BOTH tanks MUST be at 80% capacity (or higher) for this "AND" Alarm to trigger*

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Configuring Open Channel Flow

The next step is to create another channel for our flow rate!

This channel will be used to convert our level signal into a flow rate signal!

For "Function", you want to use the "Flow" category, and then find which open channel item you want to configure!
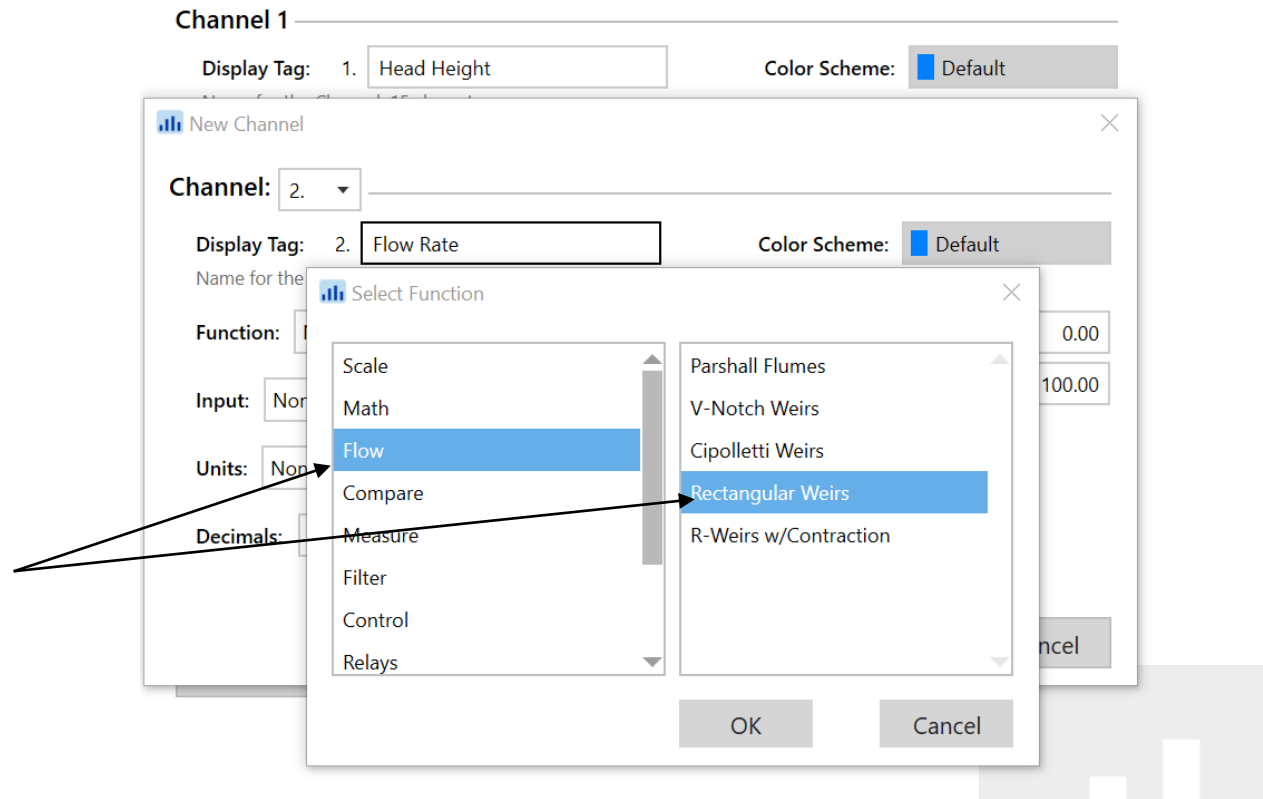
For this particular example, we will use "Rectangular Weir" simply because that's the kind with which I'm most familiar!

NOTE: *If you do NOT see the option you need here, give me a call right away!*

Configuring Open Channel Flow

Once you select the weir you need, you will notice that the ConsoliDator+ automatically fills out a few things for you.

Formula

Constant K

Length

Units

Channel 1

Display Tag: 1.   Head Height   Color Scheme: ◼ Default

Name for the Channel, 15 characters max.

New Channel   ✕

Channel: 2. ▾

Display Tag: 2.   Flow Rate   Color Scheme: ◼ Default

Name for the Channel, 15 characters max.

Function: Rectangular Weirs   ☑ Bargraph   0%   0.00

Formula: Q = K L H^1.5   100%   100.00

Constant K: 3.33

Length: 1.00   Feet

Head: 1. Head Height   Feet

Units: cuFt/sec   Decimals: 2 + −

Save   Cancel

IT IS VERY IMPORTANT THAT YOU DO NOT CHANGE THE CONSTANT K OR THE UNITS AT THIS POINT!!

NOTE: *The software does all the math and conversions for you, so do not touch the "Constant K" at all!*

Configuring Open Channel Flow

Now let's make sure the "Length" field has the correct length for the rectangular weir you are using – it **is VERY important** that your units of measure all agree!

You will notice that the Length, Head Height, and "Units" are all in FEET.

When filling in the length of your weir, be sure to express it in FEET

In this scenario, we are just going to use a 3-foot-long rectangular weir to keep everything simple!

Name for the Channel, 15 characters max.

New Channel ✕

Channel: 2.

Display Tag: 2. Flow Rate
Name for the Channel, 15 characters max.

Color Scheme: ■ Default

Function: Rectangular Weirs

☑ **Bargraph** 0% 0.00
100% 100.00

Formula: Q = K L H^1.5

Constant K: 3.33

Length: 3.00 Feet

Head: 1. Head Height Feet

Units: cuFt/sec **Decimals:** 2 + −

Save Cancel

Configuring Open Channel Flow

The last step here is to select the correct engineering units in which you want to measure your flow rate.

You see, the software defaults to "Cubic Feet per Second" as the rate. This is because that is the default rate unit if you were to look in the ISCO handbook

This "Constant K" is actually based off the "Cubic Feet per Second" unit.

However, we are going to keep the constant the same. The ConsoliDator+ is going to calculate your flow rate based on the default engineering unit.

When we change the "Unit", the ConsoliDator+ will automatically do the unit conversion for you, so you don't have to change ANYTHING in the math here!

New Channel

Name for the Channel, 15 characters max.

Channel: 2.

Display Tag: 2. Flow Rate
Name for the Channel, 15 characters max.

Color Scheme: Default

Function: Rectangular Weirs

☑ **Bargraph** 0% 0.00

Formula: Q = K L H^1.5

100% 100.00

Constant K: 3.33

Length: 3.00 Feet

Head: 1. Head Height Feet

Units: cuFt/sec **Decimals:** 2 + −

Save Cancel

Configuring Open Channel Flow

The last step here is to select the correct engineering units in which you want to measure your flow rate.

You see, the software defaults to "Cubic Feet per Second" as the rate. This is because that is the default rate unit if you were to look in the ISCO handbook

This "Constant K" is actually based off the "Cubic Feet per Second" unit.

However, we are going to keep the constant the same. The ConsoliDator+ is going to calculate your flow rate based on the default engineering unit.

When we change the "Unit", the ConsoliDator+ will automatically do the unit conversion for you, so you don't have to change ANYTHING in the math here!

New Channel

Name for the Channel, 15 characters max.

Channel: 2.

Display Tag: 2. Flow Rate   Color Scheme: Default
Name for the Channel, 15 characters max.

Function: Rectangular Weirs   ✔ Bargraph   0%   0.00
                                              100%   100.00
Formula: Q = K L H^1.5

Constant K: 3.33

Length: 3.00 Feet

Head: 1. Head Height   Feet

Units: cuFt/sec   Decimals: 2 + −

Save   Cancel

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Configuring Open Channel Flow

With the rate portion completed, the very last thing to do is create a totalizer for your open channel flow application!

Find the "Totals" on the left side of the software window, and then create a "New" Total

Be sure that your "Input" is the open channel flow rate we just created and **NOT** the head height!

From there, you have several other checkboxes to use to customize this totalizer, and they are rather self explanatory.

You can "Count Down", "Allow Negative" values, and can even make the totalizer "Non-Resettable"!

TOTALS SETTINGS OVERVIEW

New

- Channels
- **Totals**
- Timers
- Alarms
- ▷ Inputs
- ▷ Outputs
- ▷ Screens
- ▷ System
- Production
- Sales

New Total

Total: 1.

Display Tag: T1. Flow Total
Name for the Total, 15 characters max.

Color Scheme: Default

Input: 2. Flow Rate

☑ Bargraph 0% 0.0
100% 10000.0

Units: Gallons

Decimals: 1 + −

☐ Count Down
☐ Allow Negative
☐ Preset Value: 0.0 Gallons
☐ Roll-Over: 0.0 Gallons
☐ Non-Resettable

Save Cancel

NOTE: *Our legacy products allowed for a total "Count Down", but this is our first product which allows negative flow total values!*

PRECISION DIGITAL ⬧