ConsoliDator+

MasterClass

Week 11 – Advanced Math Functions & Other!

Today's Key Topics

- Basic Arithmetic (addition/subtraction etc.)
- Trigonometry Functions
- Averaging – normal AND weighted
- Absolute Value

OTHER
- Select (A or B)
- Text (Percent)
- Capture

Basic Arithmetic (Addition)

This channel function allows you to add the values of multiple channels together.

You can also add a constant to one or more channels by using the "Constant" field

NOTE: *The units of each channel being added MUST have units which agree.*

Basic Arithmetic (Division)

You can also do some division between two channels. You can only divide with TWO channels.

If you need to divide this answer by something else, you can simply create a NEW division channel and use THIS channel as the "Input".

New Channel

Channel: 12. ▾

Display Tag: 12. | Division /
Name for the Channel, 15 characters max.

Color Scheme: ■ Default

Function: | Divide

☑ Bargraph   0% | 0.00
            100% | 100.00

Input: (A / B)

A: | 1. Tank 1

B: | 10. Tank 3

Units: | None

Decimals: | 2 + −
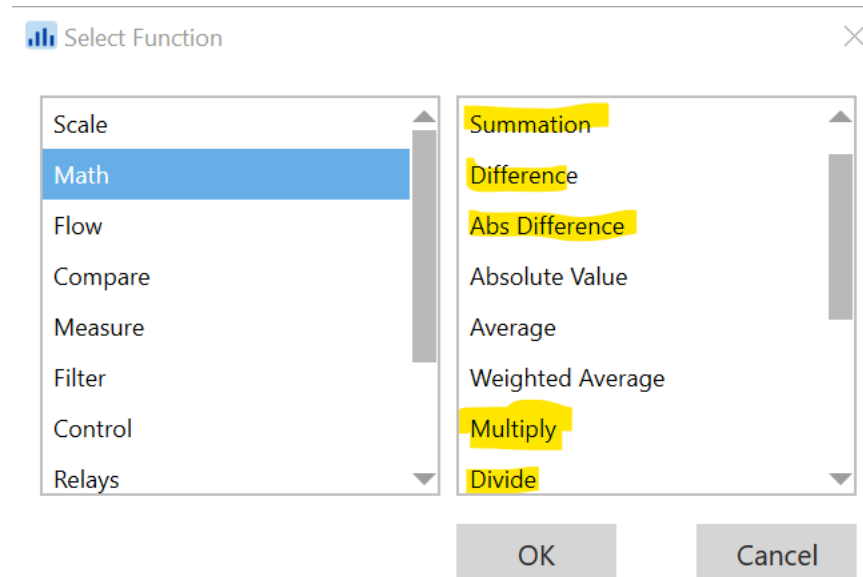
Save   Cancel

NOTE: *The units of each channel being divided MUST have units which agree.*

Basic Arithmetic (All Others)

Basically, you can find any math function one would typically find on an average calculator.

From addition and subtraction to multiplication and division, the ConsoliDator+ can do it all!

NOTE: *Multiple math channels can be combined together to really make some complex calculations. It can be as simple or complicated as you'd like.*

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Trigonometry Functions

Trig:

Sine, Cosine, Tangent, Arc sine, Arc cosine, Arc tangent, etc.

Angle:

Degrees, or Radians

NOTE: *Multiple math channels can be combined together to really make some complex calculations. It can be as simple or complicated as you'd like.*

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Averaging (Regular)

This function allows you to calculate the AVERAGE between 2 or more channels

However, each channel contributes equally to the average value!

Averaging (Weighted)

Rather than having all the included channels contribute to the average reading evenly, we can decide which channels are "weighted" more than others.

For example, let's say you "trust" your radar level sensor more than your ultrasonic sensor in regard to accuracy.

You can then allow the radar level sensor to contribute more to the average reading than the ultrasonic sensor does.

Then, the mA value from THIS channel can be used as the input to a regular level monitoring channel

Absolute Value

Absolute value simply means that you are guaranteed to NEVER display a negative number.

For example, let's say you do some math functions, and the answer is a negative value.

You can make that channel the input to an "Absolute Value" channel, and now the value is ALWAYS positive!

NOTE: *There is a separate "Absolute Difference" math function which will automatically make the difference a positive value without having to create this separate channel!*

OTHER…

The rest of these slides don't have a lot to do with mathematics.

However, they are extremely valuable features of the ConsoliDator+ that don't really fit into any one category, so I decided to add them to the end of this session!

We will go over how the ConsoliDator+ can choose which level sensor it should be using to display your level readings. Or, how the ConsoliDator+ can actually show you MESSAGES instead of, or in addition to, a numerical value!
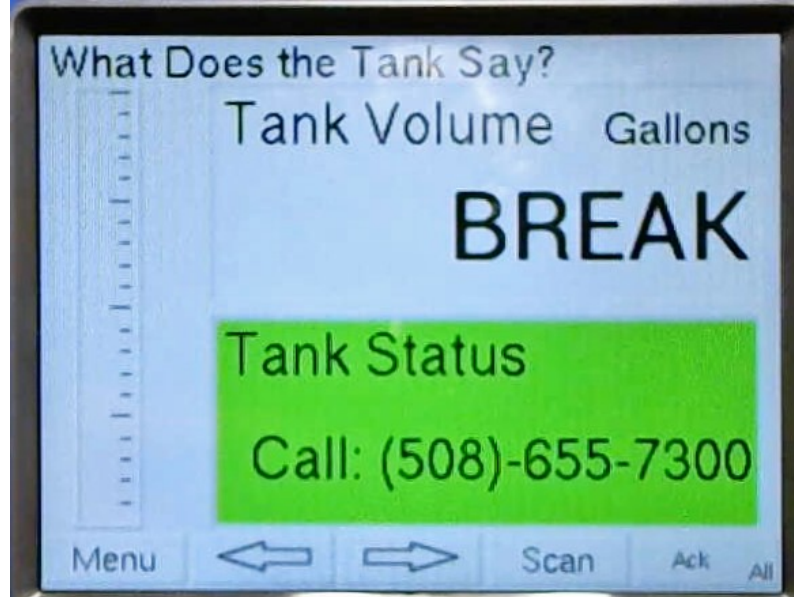
Select (A or B)

PROBLEM: Your customer monitors the level of their wet well with two separate technologies. Their primary sensor is a submersible pressure transducer, and the other is an ultrasonic sensor suspended from the top. However, sometimes the submersible transducer stops working, or the wires get cut, and then they don't have an easy way to maintain their level readings on the same device!!

SOLUTION: Using the "Select (A or B)" channel function will allow the ConsoliDator+ to choose which level sensor input it will use to display/control your level readings!

When the submersible pressure transducer breaks, the ConsoliDator+ will automatically switch over to the ultrasonic sensor until the primary sensor is restored. At which point, the ConsoliDator+ will automatically switch back over to the primary sensor!!

Select (A or B)

The FIRST thing to do is to make sure the submersible transmitter input can easily detect a "Break"

The Default "Break Below" is ".010 mA" which is FAR too low.

2b : mA Input

Display Tag: AI-2. Pressure Xmiter
Name for the mA input channel, 15 characters max.

Filter: WIN 8 sec ▼
Filter time window. If you need a more stable reading, select IIR 16 or 32 sec.

Bypass: 0.5   Percent of Full Scale
If the signal change is greater than the bypass value, the reading jumps to the actual value ± Bypass % of full scale.

☐ **Glitch Filter**
Eliminates short duration noise spikes

☑ **Break Below:** 4.000   mA
Set the mA value at which a sensor break is reported to the system

☐ **Disable Input Channel**
Turns off the power to the input.
This should only be used to save power on unused inputs.

Be sure the "Break Below" is CHECKED, and that the value is equal to "4 mA"

If not, the system won't detect a break until it is much too late!

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Select (A or B)

Next, create an alarm!

When our sensor breaks, we want this alarm to be triggered!

Set Point = 0 (because 0=off and we want this alarm to turn ON when our sensor is "off")

Reset = 1 (because 1=ON and we want this alarm to go away when our sensor is back "ON")

Alarm 1

Display Tag: A1.   Sensor Break
Name for the Alarm, 15 characters max.

Type: Single Source ▼

Input: 1. Pressure Xmit

Color Scheme: 🟥 Default

☐ Sound Horn
☐ Alert!
☑ Automatic
☑ Ack Anytime

Break: Alarm On ▼

Set Pt: 0.0   On Delay: 0.0
Reset: 1.0   Off Delay: 0.0

New   Copy   Delete

Break = ALARM ON

The default is to "stay as is" but this alarm is solely responsible for reporting a sensor break, so we want to make sure this value is "Alarm On"

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Select (A or B)

Then, create a new channel with the **"Function" = "Select (A or B)"**

The **"Input"** is going to be the alarm we just created

When the **ALARM** is "ON", (our sensor is broken), we want to use the Ultrasonic Sensor as our input

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Channel 2

Display Tag: 2. Sensor Select	**Color Scheme:** ▮ Default
Name for the Channel, 15 characters max.	

Function: Select (A or B)   ☐ Bargraph   0%   0.000
                                                     100%   100.000

Input: A1. Sensor Break

Select A (ON): AI-1. Ultrasonic Xmit

Select B (OFF): AI-2. Pressure Xmiter

Units: mA

Decimals: 3 + −

[New]   [Copy]   [Delete]

When the **ALARM** is "OFF", (our sensor is working again) we want to use the Pressure Transmitter as our input to the level channel

Select (A or B)

Lastly, we need to create our "Level Channel"!

All you need to do is setup a regular channel just as you normally would.

Except, instead of using a physical analog input as the "Input" to this channel, you want to use the "Select (A or B)" channel that we just created!

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Text (Percent)

THE PROBLEM: Although the ConsoliDator+ can express the level of a vessel in practically any engineering unit, sometimes it would be best to also give operators some written instruction. In fact, I have seen folks using labels on the panels housing our ProVu panel meters that will tell an operator what to do at certain level readings (like to fill the tank, empty it, etc.)

However, we don't want your customer to have to put a bunch of labels and stickers on their new ConsoliDator+!

THE SOLUTION: The ConsoliDator+ can be programmed to show "messages" or short "instructions" instead of OR in addition to a volumetric level reading! It's actually quite simple, and really clever!

In fact, there's even a ***"hidden feature"*** *that will make the ConsoliDator+ your best friend!*

Text (Percent)

First, let's create a new channel with the Scale "Function" of "Text (Percent)"

This is different than the "Percent (Bargraph)" option, so do not choose that!

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Text (Percent)

Once you choose the correct function, let's make the **"Input"** the actual analog input from a level sensor.

Be sure that the **"Use Percentage from Input Bargraph"** box is checked!!!

If you will be displaying the tank's volumetric reading on the same screen, use the bargraph from THAT channel instead.

Make sure this **"Bargraph"** box is <u>UNCHECKED</u>

Channel 5

Display Tag: 5. Water Tank
Name for the Channel, 15 characters max.

Color Scheme: GREEN

Function: Text (Percent)

☐ Bargraph   0%   0.00
             100%   100.00

Input: AI-1. Ultrasonic Xmit

☑ Use Percentage from Input Bargraph

Inputs:

Insert	0%	TOTALLY EMPTY!
Remove	10%	Critical Low Level
↑	25%	Tank Needs Filling!
	50%	Level is Okay
↓	75%	Tank is Full
Edit	85%	CRITICAL HIGH LEVEL!
	100%	Get Out the Buckets!

Below 0%: Check Xmitter Output

☑ Break: Check Xmitter Output

New   Copy   Delete

Text (Percent)

To edit these messages, you simply press "Insert" and enter in the Value (in percentage of your 4-20 mA signal) and the message you'd like the ConsoliDator+ to display!

You will notice that instead of discrete values, we are giving the ConsoliDator+ a range

For example, between 10% and 25% the message will read "Critical Low Level" regardless if the tank is filling or emptying

Channel 5

Display Tag: 5. Water Tank
Name for the Channel, 15 characters max.

Color Scheme: GREEN

Function: Text (Percent)

Bargraph 0% 0.00
100% 100.00

Input: AI-1. Ultrasonic Xmit

✔ Use Percentage from Input Bargraph

Inputs:

Insert		
Remove	0%	TOTALLY EMPTY!
↑	10%	Critical Low Level
↓	25%	Tank Needs Filling!
	50%	Level is Okay
	75%	Tank is Full
Edit	85%	CRITICAL HIGH LEVEL!
	100%	Get Out the Buckets!

Below 0% Check Xmitter Output

✔ **Break:** Check Xmitter Output

New   Copy   Delete

Text (Percent)

If for some reason your mA value goes below 0% (or, below 4 mA, really) you can also have the ConsoliDator+ display a message that may tell the customer to check the transmitter output!

The same can be done if the ConsoliDator+ reports a "Break" condition on the analog input…

However…

I found a clever message you may like a lot

Channel 5

Display Tag: 5.   Water Tank   Color Scheme: GREEN

Name for the Channel, 15 characters max.

Function: Text (Percent)   ☐ Bargraph   0%   0.00
                                                100%   100.00
Input: AI-1. Ultrasonic Xmit

☑ Use Percentage from Input Bargraph

Inputs:

0%	TOTALLY EMPTY!
10%	Critical Low Level
25%	Tank Needs Filling!
50%	Level is Okay
75%	Tank is Full
85%	**CRITICAL HIGH LEVEL!**
100%	Get Out the Buckets!

Insert
Remove
↑
↓
Edit

Below 0%   Check Xmitter Output

☑ Break: Check Xmitter Output

New   Copy   Delete

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Text (Percent)

It just so happens that the messages on this type of channel are JUST long enough to fit this AWESOME tank message which can tell your customer to call YOU for help!
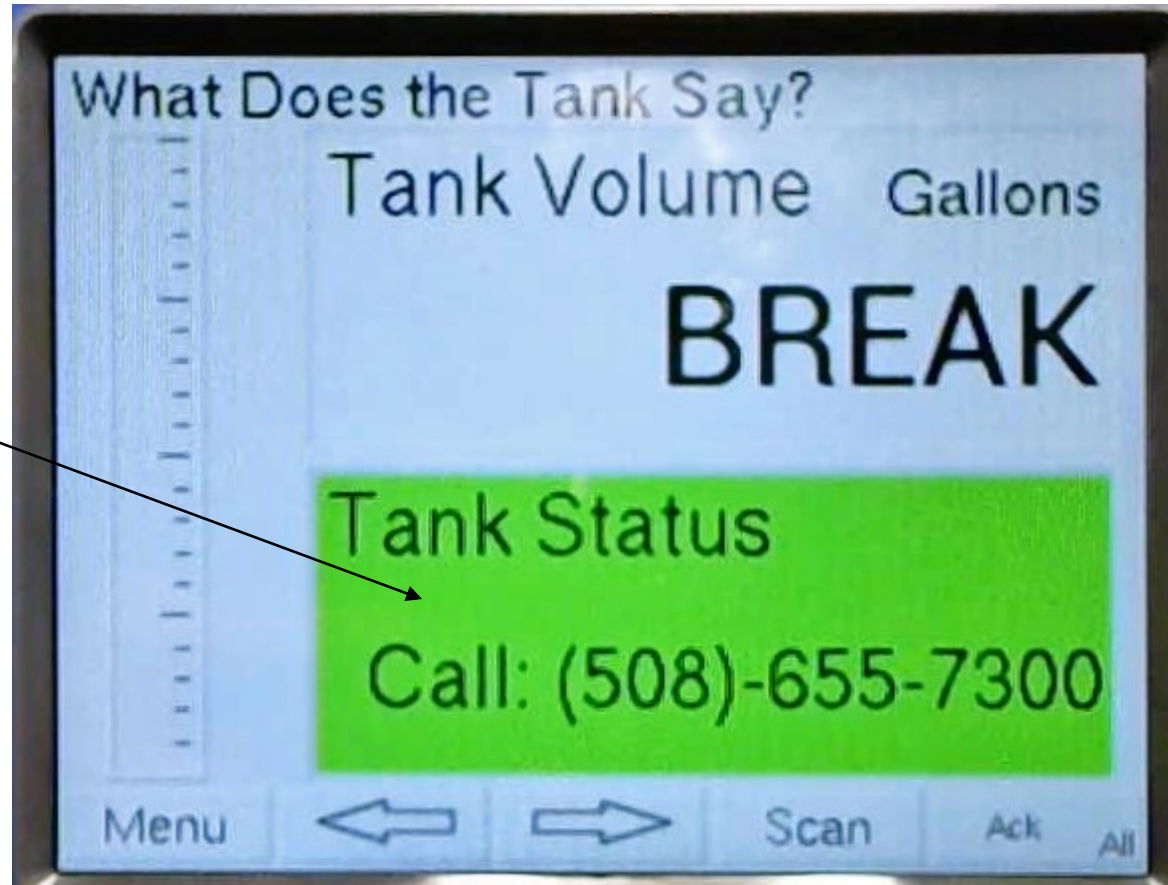
Now, you can see how flexible this is, and how easily it would be for you to put these types of messages on basically any screen!

If something goes wrong, you want your customer to call YOU, right?!

NOTE: *Before you try calling, that is the main number for Precision Digital... call and say hello!*

Capture

THE PROBLEM: Your customer is using the ConsoliDator+ to monitor quite a few process conditions, and they are viewing them on multiple screens. However, there is one particular alarm that is absolutely critical and the "Alerts! Screen" isn't going to be enough for them… not quick enough.

They would want the ConsoliDator+ to AUTOMATICALLY jump directly to the screen that is causing an alarm without having to press any buttons.

THE SOLUTION: the ConsoliDator+ can actually perform this type of "meter function" without any type of human intervention (pressing a button, acknowledging an alarm, etc.). There are plenty of meter functions it can perform, but the main benefit of this "Capture" feature is that the meter function will be executed based on PROCESS CONDITIONS instead of a day/time, or from some other input to the device.

Works VERY similarly to the "Soft Keys" we've learned so much about!

Capture

The first thing to do is to create a new "Channel" with the "Function" of "Capture" which can be found right in the "Control" category!

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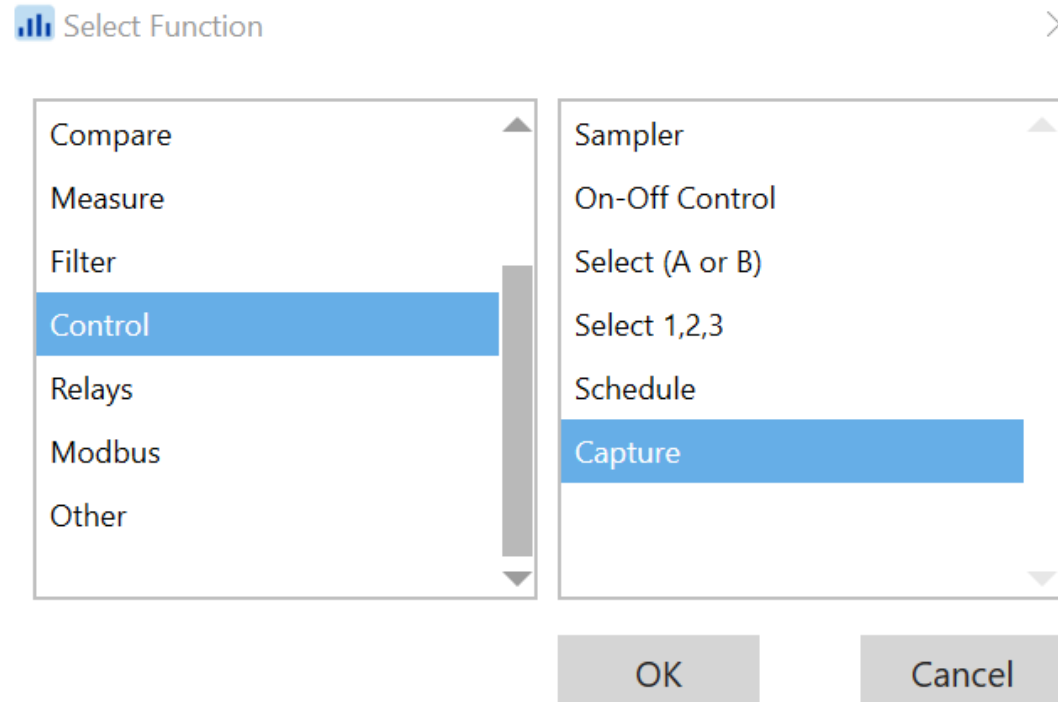
Capture

For this particular usage of the "Capture" function, we don't really need any type of input.

Also, since we aren't going to be displaying this on a screen, you can also ignore the units and decimal places!

For this particular scenario, the only things that are really important for us are the "Trigger" and the "Capture" settings!

New Channel

Channel: 7.

Display Tag: 7. Screen Switch
Name for the Channel, 15 characters max.

Color Scheme: Default

Function: Capture

☑ **Bargraph** 0% 0.0
100% 100.0

Input: None

Units: None

Decimals: 1 + −

Trigger: A1. Sensor Break Rising/Falling

On Capture: Do Nothing

Save Cancel

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Capture

Trigger: This is going to be an "object" that you have created (alarms, channels, outputs, inputs, etc.)

In this case, we have a sensor break alarm as our trigger. So, when this alarm is true, that will trigger this "Capture" function.

On Capture: this is the meter function you want to perform when this alarm is true.

The options are identical to what the "Soft Keys" can be programmed to do

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