

Summary: This study guide will serve as a supporting document for the “Flow Applications” session of the ConsoliDator+ MasterClass. This will go over the exact same topics we reviewed but will go a bit deeper into the significance of each feature and why they make the ConsoliDator+ such a unique accessory for any flow application!

For visual guidance, please refer to the corresponding sections of the slide show that was included in the email you received immediately after the session ended.

Basic Flow Display: This screen is to demonstrate a couple different things. It shows you how large the numbers and letters of each channel appear when there are only two channels on a screen. It also shows what the screens look like when the bar graphs are turned off completely.

Now, you could choose to have bar graphs on the screen, and they can be assigned to either the rate or the total, but bar graphs are not typically used in flow applications, in my experience with Precision Digital.

Moving on from the display portion of the screen, this slide is also demonstrating a really useful feature that is **ONLY** on the ConsoliDator+ (in the Precision Digital product line). That one feature is **automatic unit conversions!**

You will notice how the flow rate (on top) is reading in GPM which is standard. But the total is being read out in mL which is a **MUCH** smaller unit of measure. As long as the two units of measure are in the same “category” (in this case, volume) the ConsoliDator+ will automatically convert the readings from GPM to mL without the user having to do anything but select their desired units!

Lastly, just like on the level screens we saw last week, we can program “Soft Keys” to execute various functions! In this particular scenario, the “F4” soft key is programmed to reset the total.

Now, to avoid any accidental total resets in the field, this particular screen is programmed to have the operator **CONFIRM** their decision before the ConsoliDator+ will actually reset the total.

Open Channel Flow Display: One of the most useful features found on our [ProVu totalizers](#) is the ability to calculate a flow rate in an open channel based on a signal from a level sensor (typically ultrasonic). Not only can it take in a level signal, condition it for a flow input, and then output that conditioned signal, but it also powers the level sensor to make for a great compact open channel flow system.

However, the ConsoliDator+ takes us to the next level and gives us much more flexibility over the types of weirs and flumes we can use, and the programming is actually much simpler!

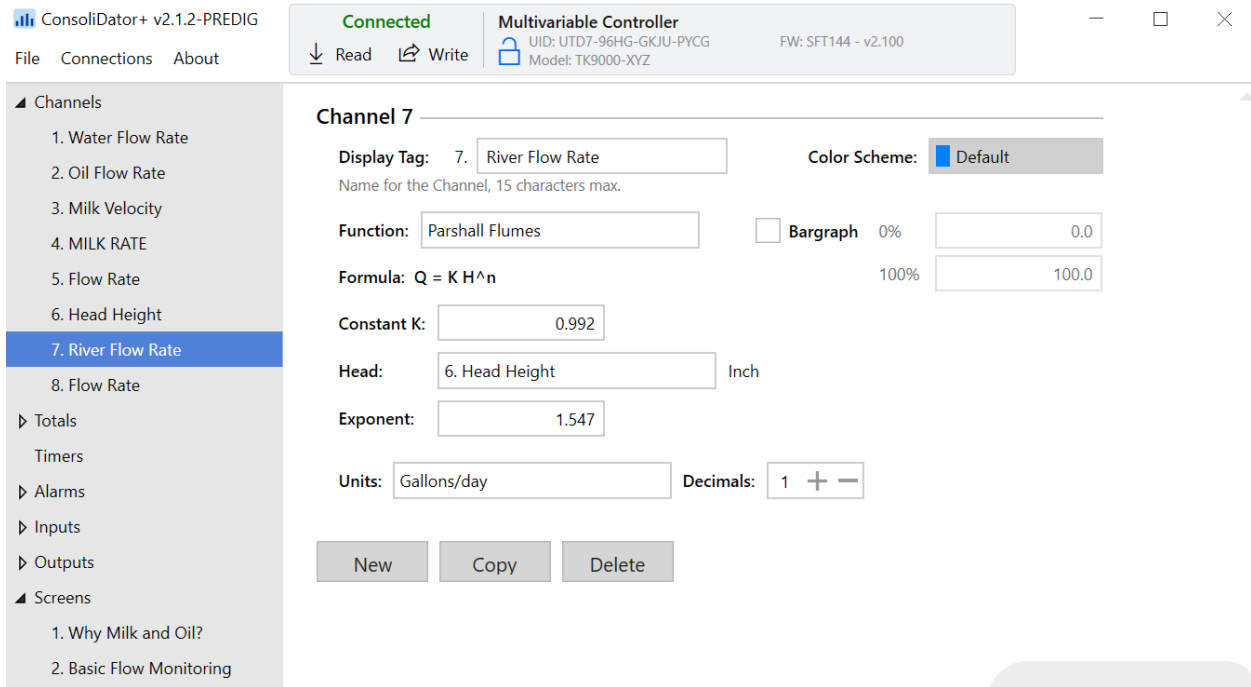
First, let’s take a look at the display on slide 4 of the slide deck.

We are taking a look at the flow rate of a small river in gallons per day. This flow rate is based off a typical 4-20 mA signal that is measuring between 0 – 10” of “head height” (that channel is not visible on this screen). So, the “River Flow Rate” channel is converting that level signal into a flow rate using the open channel flow formula for a Parshall Flume which is pre-programmed into the device itself.

The “River Total” is being measured in “Mega Gallons” (or, millions of gallons) which is a unit of measure used to express large amounts of water in a flow application. Although it is a common unit of measure, I actually had to make a “Custom Unit” which is quite simple to do on this device.

Now, if I setup my custom unit properly (more on that in later sessions), the ConsoliDator+ can also do automatic unit conversions with your custom units!

Lastly, our “F4” soft key is configured to reset the “River Total” on this screen.



Above is a screen shot of what it looks like when you setup an open channel flow channel using the [ConsoliDator+ Configuration Software](#). You will notice my “Function” is Parshall Flumes and that will automatically generate the “Formula” you can see below.

To finish the setup, you just need to adjust any of the appropriate variables. The “Constant K” and the “Exponent” are automatically given to you but you CAN adjust them if need be.

The only thing the user MUST change is the “Head”. The Head is going to be a completely unique channel that is setup separately from this channel. On the left-hand side of the above screenshot, you’ll notice that channel number 6 (right above the highlighted channel) is called “Head Height”. That means I created that channel, and then used that scaling (0 – 10”) for the “Head” in the open channel flow setup!

But what if you need to output your open channel flow signal?

The good news is, you can output the “River Flow Rate” or “River Total” without having to do any fancy programming or added steps like you see above. We will go into HOW this is all set up in future sessions, but for now just know that you can output your open channel flow readings with any of the analog outputs available on the ConsoliDator+ unit in just a few simple steps!

1 Rate 3 Totals: When we looked at some of the level examples in the previous session, we looked at how you could have just ONE tank represented by a process signal, but can have that tank level scaled in multiple different engineering units at the same time.

Well, the exact same thing can be done with flow signals as well! One of the unique features of the ConsoliDator+ is the ability to configure multiple totals for ONE flow rate channel.

There are a couple reasons why this may be useful for a user. One reason could be to keep track of total flow of multiple shifts. Let’s say at the end of the day, whoever is in charge of monitoring the flow in that

section of the plant must record their totals, and then start off fresh the next day. Well, being able to have multiple totals for different shifts in the plant could be beneficial.

Or, another reason this could be helpful is because one of those totals could be used as a “Grand Total”. That way, no matter how many times a regular total is reset, the grand total will keep track of the total flow!

Regardless of WHY it is useful, something else to keep in mind when talking about multiple totals per flow rate channel is the automatic unit conversion! You will notice on the corresponding slide, the rate is in fl oz/min, but the totals are in BBL (beer barrels), mL (milliliters), IGAL (Imperial Gallons) which are all found pre-programmed in the Consolidator’s unit library!

Speaking of flow totals, there are several NEW types of totals we have introduced with this Consolidator+ product! We’ll take a look at those after we discuss a clever way to prevent a screen from becoming too busy for an operator to intuitively read.

Color Coding Totals: With so much information displayed on one screen, things have the potential of looking a bit cluttered, especially if the screen is maxed out with 8 “objects” on it.

One feature that can help keep things organized on a busy screen is color coding totals with flow rates on a screen!

You will see this screen is labeled, “Why Milk and Oil?”. The reason for this is to simply demonstrate that the screens can be labeled quite literally ANYTHING a user wants them to be labeled. They can even ask a silly rhetorical question!

This screen is showing the flow rates and total of Water, Oil, and Milk and they are color coded blue, black, and white respectively (notice how the text on the darker channels is white instead of the default, black. This is up to the user to remember! – be mindful of your color choices).

Now, you will notice how the rate and total for each product have matching color schemes.

Right, but the channel numbers are shown on each product, so it can be easily matched up that way! And, the channels are right next to each other, so it’s rather obvious which totals go with which flow rates, yeah?

Well, take a look at the next slide to see what happens if the screen is not configured “correctly”.

I purposely made sure the channels on the first screen were added in the correct order so that they would appear correctly on the screen. But, that won’t always happen, so to make things as simple as possible for the customer, it’s a great idea to color code your totals and flow rates if you have multiple parameters on a single screen!

Bonus Question: “Do you know WHY there would be an alarm for high flow velocity of milk?”

From what I have heard, and please feel free to correct me if I’m wrong, milk will actually curdle if the flow velocity in a pipe becomes too high. I believe this is due to the heat from friction caused by the turbulent flow at a high flow velocity.

Either way, the point of this was to demonstrate we can program alarms for either a flow rate, a flow total, or both!

Types of Totals: On our legacy flow products, like the [PD6830](#) or [PD6622 Loop Leader Series](#), your options for “types of totals” is very limited. Those products allow you to have a total, and a grand total – that’s it!

On some of the legacy products, you can have a non-resettable grand total, and that is about the extent of it!

With the ConsoliDator+, we have a handful of totals from which we can choose, and they each serve a very specific function. We can even create a total based on another total! And yes, that first total can be based on yet ANOTHER total. The whole thing can get TOTALLY wild... get it?

Let's take a look at the three different totals I have set up on the "Niagara Falls!" screen. What you are seeing is the flow rate of Niagara Falls (approximately 680K gallons/sec according to "History's Greatest Mysteries" on the History Channel), the total flow in "Megagal", something called a "Previous Total" and a third total called "Grand Total" – again, reading in Megagal.

The "Falls Total" is rather straight forward. It's just totalizing the flow rate of the falls in millions of gallons, again, a custom unit, to avoid having such giant numbers on the screen.

The "Previous Total" is a bit more unique than just a regular totalizer. On slide number 10, you see that "Previous Total" says "None". That is simply because I have yet to reset the "Falls Total", and therefore, there is no previous total to display!

If and when I press the "F4" button (programmed to reset "Falls Total") the "Falls Total" will reset to zero and begin counting up. Whichever number was being displayed in the "Falls Total" before I pressed F4 will now be displayed in the "Previous Total" channel as you can see on slide 11.

Lastly, we have the "Grand Total" which is NOT counting up continuously...

Rather, its "source" is the "Previous Total".

What does that mean?

Well, every time the "Previous Total" is updated, its previous number will get added to the "Grand Total" to represent ALL the water that has flowed over the falls – hence GRAND total. The other thing to add about the "Grand Total" is that it is **NON-RESETTABLE**. That's right, the Grand Total CANNOT be reset once it has been configured as a non-resettable total (more on how that's done in later sessions).

So, how would this feature be helpful to anyone?

Well, let's say an operator wants to know how much water has flowed over the falls so far today, would like to see the total that flowed the previous day, and the total flow for all week.

Let's also say this operator is forgetful, and won't remember to reset the "Falls Total" at the end of every shift! Without that, this entire screen is useless to them!

That is precisely why a real-time clock was built into the device. Our operator never has to remember anything! They can just setup a "Schedule Channel" to reset the total (or any total, really) at a specific time of day. It can be scheduled for certain days, just weekdays, and everything in between.

We will discuss the scheduling features and timers in more detail in a later session. For now, just be aware that we can program the ConsoliDator+ to reset totals based on day and time!

Flow Status / Flow Switches: Precision Digital still manufactures our [Vigilante II](#) annunciator panel meter, but obvious it has its limitations. The annunciator has static status messages that are printed onto the meter itself, and it can only accept a maximum of 8 inputs!

However, the ConsoliDator+ can act similarly to our classic Vigilante annunciator panel but with a lot more flexibility, and a TON more inputs!

But wait a second, the data sheet says the ConsoliDator+ only has 5 digital (discrete) inputs. That's less inputs than a Vigilante II!

Well...

TOP SECRET FEATURE: *It is true that the ConsoliDator+ only comes with 5 digital inputs, but in reality we can actually have way more than 5 if we use our [Pulse Input Cards](#)!*

Although the Pulse Input Cards are typically used to accept common pulse signals from various flow meters, they can just as easily be used as digital (discrete) inputs!

So, if you fill all 7 slots of the ConsoliDator+ with a Pulse Input Card (4 inputs per card), add the 5 digital inputs that come standard with the product, the ConsoliDator+ can actually accept AND DISPLAY up to 33 digital signals from various flow switches!

So, now that we know we can have up to 33 digital inputs, what else makes the ConsoliDator+ unique for flow switch applications?

Well, the first feature is the fact that we can add totally custom status messages to each channel! For example, if you look at the status in “Upper Level” on slide 13, you’ll see that the channel is GREEN, and it says “Flowing”. We can assume this means that there is flow in the upper level, and the green color indicates that is the desired status.

Now, if for some reason conditions change in the “Upper Level” and there is no more flow when there should be, the ConsoliDator+ will show a message like, “No Flow” and the channel will turn RED and start flashing to draw the operator’s attention to the fact that there is no flow in the “Upper Level”.

[So, how could this feature be of value to a customer?](#)

Let’s say you want to use a button on the ConsoliDator+ to start a pump. So, you program a soft key to trip a relay, and you even have the pump status on the ConsoliDator+ screen. The channel says “On” to indicate that the pump is on.

Well, hold on a second. That status is only telling you that the RELAY is active, which SHOULD mean that the pump is turned on, but we all know that isn’t always the case.

However, if the customer were to have put a flow switch somewhere downstream from the pump, and that switch isn’t being triggered, then the operator could take a look at the FLOW STATUS screen, and they can determine that the pump should be on, but for some reason there is no flow happening!

[Can YOU Think of any other uses for this particular screen setup?](#)

As with the level sessions, there are certainly more features on the ConsoliDator+ that make it a great a flow accessory, but we will take a dive into those features as the class continues. For example, data logging is a HUGE benefit in the flow world, and we didn’t go over that in detail here. For one reason, we just had a webinar on that, and a lot of the folks in the MasterClass attended that, so I didn’t want to be too repetitive.

If you haven’t seen the [“ConsoliDator+ Data Logging Webinar”](#) hosted by Joe Ryan, I strongly suggest you take a few minutes and watch the YouTube video.

Some other flow features we will explore in future sessions include:

1. Timers
2. Scheduling (for total reset, and more)
3. Data logging flow rates and totals (even total resets)
4. Modbus TCP/IP capability
5. AND/OR Alarming for added logic control... and more

Week 3 will continue with a similar theme, but we will take a closer look at some ways the Consolidator+ can be used in Gas Detection applications! Bring your gas masks!!

Sincerely,

“Professor” Devin Gates

Cell: (508) 683-9034

Email: dgates@prediq.com