



Tech 20180321-4-2

## DCM Wiring on Strings with a Jar count not Divisible by Four

### Introduction

Cellwatch™ DCMs each have four measurement channels. This works well for a majority of installations, as the number of jars is usually a multiple of four (32, 40, 60, etc). However, there are instances where the number of jars is not divisible by four and does not neatly match up with the number of available DCM channels. In these cases, it is necessary to use fewer than four channels on one or more DCMs. This application note describes several methods to install DCMs that use less than four channels.

Care should be taken to understand the terminal voltage (minimum anticipated voltage during a discharge event) that may be reached on the DCM when nulling DCM channels.

Installations should only be completed by a certified installer. A certified installer should review this entire Application Note before implementing Cellwatch on an odd sized string.

### Default Null Channel Method (Normal usage – VRLA jars)

Often the next to last DCM on the battery string is fitted across only one, two or three containers with the unused channels ignored (null) by Cellwatch. The DCM will be powered from a lower voltage than other DCMs. The DCM will function normally so long as the DCM's minimum operating voltage is maintained.

DCM VERSION	MIN VOLTS DC	MAX VOLTS DC
DCM5	4.5v	80v
DCM6-L	4v	12v
DCM6-H	12v	80v

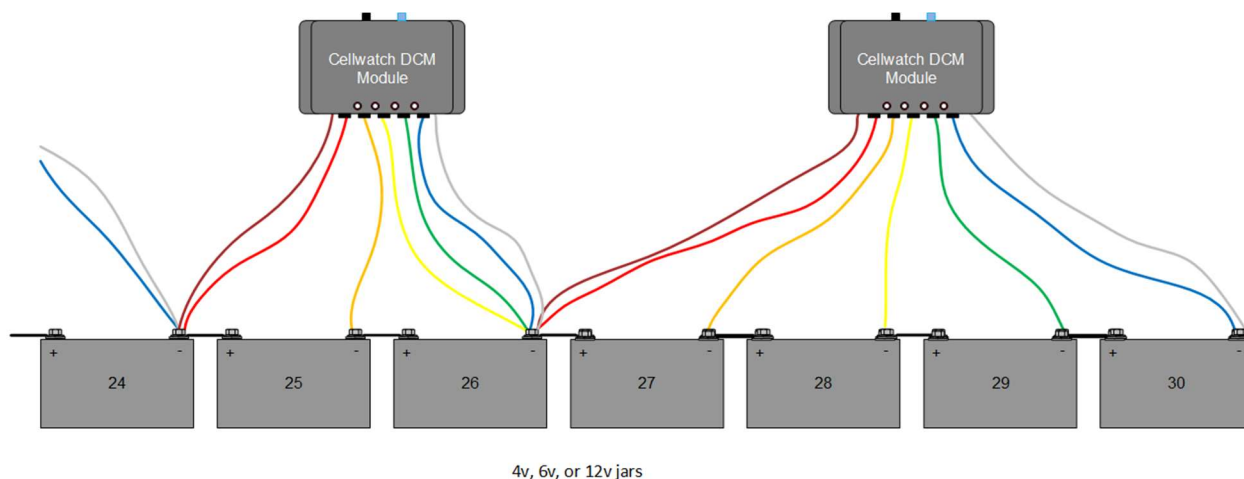
For systems where the minimum operating voltage will be too low, use the Alternate Null Method described below.

**The Default Null method is recommended under most circumstances because the Cellwatch Configuration Builder will automatically account for and null out channels as needed. As demonstrated below, in the wiring section the**



ConfigBuilder will by default always null out channels on the second to last DCM on the string.

### Wiring Arrangement



The image shows the next to last DCM has channels that are unused. The unused channels are connected to a common point. Due to nulling two channels as shown above, it may not be feasible to terminate six leads to a single terminal. The unused leads can be spread to other nearby terminals except for **Blue which must always be landed with the White lead**. The DCM takes measurements between the pairs of sense leads shown here:

- Channel 1, between the Red and Orange leads
- Channel 2, between the Orange and Yellow leads
- Channel 3, between the Yellow and Green leads (nulled above)
- Channel 4, between the Green and Blue leads (nulled above)

Note: The brown and white wires are the power wires for the DCM.

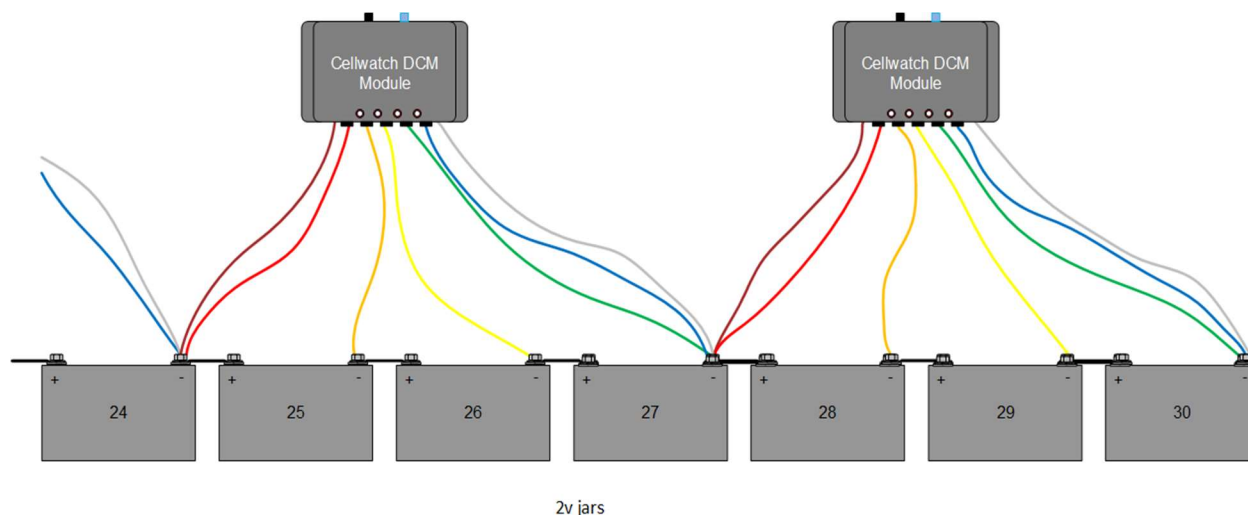
It is important that both leads of an active measurement channel be placed correctly. In the example above Channel 1 and 2 are in use. Therefore, the Red, Orange, and Yellow sense leads must be placed on the Negative terminal of jars 24, 25, and 26 respectively. **Blue should always be landed with the White lead** but Green can be terminated to another post as needed.

**Note: Never cut DCM leads or leave them loose.**

### Alternate Null Method (2V cells)



There will be situations where the default null method is not suitable, particularly for 2V configurations. If, for example, the previous 30 jar string were made up of 2V cells the default method would leave the second to last DCM under the minimum operating voltage. To maintain a usable operating voltage the final two DCMs will be wired across three jars each as shown in the image below. This method does require an extra step in the configuration process detailed in the next section.



## Configuration File

The system can be forced to ignore DCM channels by not assigning cells to those channels. This is done automatically by Cellwatch™ Configuration Builder when the number of containers in a string is not divisible by four as noted in the Default Null Method.

For a 1-channel null, channel 4 is ignored

For a 2-channel null, channels 3 & 4 are ignored

For a 3-channel null, channels 2, 3 and 4 are ignored.

Channel 1 is always used.

As shown in Figure 1, the two null channels from the original 30 jar example are easily verified as being null in the “View Configuration” window.

Y	Bat N	Str Id	Cell H	Bat No	Str No	Bk Fr	Bk To	Ver	RV	LV	HZ	LZ	HT	LT
	Univers	Upper Str	4	1	4			02.20	14	4	12	6	1	B
	Univers	Upper Str	5	1	5			02.20	14	4	12	6	1	B
	Univers	Upper Str	6	1	6			02.20	14	4	12	6	1	B
	Univers	Upper Str	7	1	7			02.20	14	4	12	6	1	B
	Univers	Upper Str	8	1	8			02.20	14	4	12	6	1	B
	Univers	Upper Str	9	1	9			02.20	14	4	12	6	1	B
	Univers	Upper Str	10	1	10			02.20	14	4	12	6	1	B
	Univers	Upper Str	11	1	11			02.20	14	4	12	6	1	B
	Univers	Upper Str	12	1	12			02.20	14	4	12	6	1	B
	Univers	Upper Str	13	1	13			02.20	14	4	12	6	1	B
	Univers	Upper Str	14	1	14			02.20	14	4	12	6	1	B
	Univers	Upper Str	15	1	15			02.20	14	4	12	6	1	B
	Univers	Upper Str	16	1	16			02.20	14	4	12	6	1	B
	Univers	Upper Str	17	1	17			02.20	14	4	12	6	1	B
	Univers	Upper Str	18	1	18			02.20	14	4	12	6	1	B
	Univers	Upper Str	19	1	19			02.20	14	4	12	6	1	B
	Univers	Upper Str	20	1	20			02.20	14	4	12	6	1	B
	Univers	Upper Str	21	1	21			02.20	14	4	12	6	1	B
	Univers	Upper Str	22	1	22			02.20	14	4	12	6	1	B
	Univers	Upper Str	23	1	23			02.20	14	4	12	6	1	B
	Univers	Upper Str	24	1	24			02.20	14	4	12	6	1	B
	Univers	Upper Str	25	1	25			02.20	14	4	12	6	1	B
	Univers	Upper Str	26	1	26			02.20	14	4	12	6	1	B
	Univers	Upper Str						02.20						
	Univers	Upper Str						02.20						
	Univers	Upper Str	27	1	27			02.20	14	4	12	6	1	B
	Univers	Upper Str	28	1	28			02.20	14	4	12	6	1	B
	Univers	Upper Str	29	1	29			02.20	14	4	12	6	1	B
	Univers	Upper Str	30	1	30			02.20	14	4	12	6	1	B

Figure 1: Two null channels on DCM #7 in a 30-jar system



## Multiple Null Channels

An extra step is needed when building a configuration where null channels need to be assigned on more than one DCM or in rare cases where the default selection of the second to last DCM cannot be used.

On the String Label page of the ConfigBuilder wizard (Walk-through Mode) there is the option to manually configure “sub-strings”. For this purpose, every DCM is considered to be a sub-string. Using a 30 2V container example there will be eight DCMs and therefore eight sub-strings. This allows the user to manually tell Cellwatch how many channels each DCM will use. If the final two DCMs are wired across three jars apiece sub-string 1-6 would have 4 channels and sub-string 7 and 8 would have 3 channels. Cellwatch will null out channel 4 on both of those DCMs. The unused Blue lead should be terminated to the same post as White and Green.

Another commonly seen example is 30 16V containers on a string. DCM 5s have a 60V maximum and can not be wired to four 16V containers. This configuration will require 10 DCMs, each wired to three containers. “Has sub-strings” will be selected in the ConfigBuilder and each of the ten sub-strings (DCMs) will have three channels.

The screenshot shows three steps of the ConfigBuilder wizard:

- Label for string #1**: A checkbox labeled "Has sub-strings" is checked. Below it are "Go back" and "Next >>" buttons, and a text field labeled "String:" containing "A1".
- Number of sub-strings in A1**: Below "Go back" and "Next >>" buttons is a numeric spinner set to "8".
- String: 1, sub-string 1: number of channels?**: Below "Go back" and "Next >>" buttons is a numeric spinner set to "4".

Figure 2: Configuring sub-strings in Cellwatch ConfigBuilder