# **Cellwatch Battery Monitoring System**

## **Technical Note**



# Tech20040115-1-2 Using C-Clamps or Similar Devices to Connect Cellwatch DCM's to Batteries

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NDSL Supply special tag connectors for connecting DCM's to batteries. These tags have to be fitted to the battery terminal posts. This is readily done at the time of installation of the battery system, but if Cellwatch is fitted to an existing system it means that the battery connections have to be undone to fit the tags. In some cases, it is highly undesirable to go through this process. It is technically feasible to use clamp-on connections (with tags fitted), to facilitate the connection of the Cellwatch DCM's. However, great care needs to be taken to ensure that the DCM readings are not adversely effected by these clamp connections.

This Technical Note discusses how, if necessary, this can be done to minimise the chance of erroneous readings. *This note is not intended to encourage the use of this type of connection method, nor does it promote the use of any particular clamp device.* 

#### 1. Safety Warning

DANGER

High voltages may be present on battery systems.

It is imperative that all necessary safety precautions are taken when making any connection to a battery system. Follow all local and National safety rules when working on batteries.

ALSO note, that the use of clamp-on fittings may result in uninsulated terminals being exposed, presenting a greater danger to personnel and plant.

This Technical Note addresses the impact on measurement accuracy and repeatability of using this type of connection method. The content of this note should not be construed as an endorsement by NDSL that the use of Clamp fittings is safe or advisable. An independent assessment should be made of the safety implications to any system where this system might be used.

#### 2. The Measurement Issues

The Cellwatch<sup>™</sup> DCM's determine the internal resistance of a battery by measuring the change in terminal voltage that results from a known current flow. To do this the DCM uses two leads to draw current from the battery whilst the other leads are used to make the voltage measurement. Connecting the leads in the wrong order will result in errors. Also, unreliable or high resistance connections to the battery terminals may result in poor repeatability or accuracy of these measurements. The voltage sensing leads are more tolerant of resistance in the connections, as the measurement circuitry is relatively high impedance. However, it is important that if there is resistance, the connections are made at points that minimise the effects of this resistance – this is especially important for the Red/Brown and the Blue/White lead pairs.

The normal method of connecting DCM's ensures reliable low resistance connections. A ring tag is fitted on the terminal post bolt as part of the normal inter-jar/bloc connection, which must be tightened to a defined torque to

ensure good battery system operation. The leads from the DCMs have push-on connectors that fit on to the blades of the ring tags and provide good, low resistance connections.

### **3. Using Clamp-on Fittings**

Any clamp-on device will inevitably introduce additional resistance, as they rely essentially on compressive contact. If this resistance is between the battery terminal and the point at which resistance is being measured, then the reported battery resistance will be in error.

To minimise any errors, the clamps and DCM leads need to be fitted in the correct way.

An example of a C Clamp fitting is shown in the photo below. It is a saddle that fits over the conductor and is clamped to it using the grub screw. A push-on connector is fitted to the top, which is used for connecting the DCM lead

If using such devices, great care should be taken during installation to ensure that they introduce as little resistance as possible.

- Make sure that the grub screw is tightened sufficiently to ensure the clamp is clamped tightly to the battery link producing a low resistance connection.
- Also make sure that the machine screw holding the ring tag on top, is tight and providing a good low resistance contact.
- During the lifetime of the installation, check the tightness of the grub screw and machine screw.
- It would be advisable to use electrical contact grease when assembling and fitting these devices, to reduce the risk of corrosion



Correct Positioning of Clamps and Connection of DCM Wires

The correct placement of the clamps and connection of DCM's is illustrated above in Figure 1.

Several points should be noted:-

- It is **very important** that, as shown, separate C Clamps are used for the brown & Red leads, and for the Blue & White leads.
- The Clamps for the Red, Brown, White & Blue Leads should not be touching.

Figure 2 (below) illustrates several ways in which the Clamps can be wrongly fitted, resulting in erroneous readings.



Some Possible Errors in Positioning of Clamps and Connection of DCM Wires

Another Likely Error is shown in the next diagram – The Two Clamps for Red/Brown and Blue/White Leads are in contact with Each Other



-----**3** 

All of the preceding fitting errors will lead to measurement problems – either in accuracy, repeatability or comparative readings from one DCM to another. Therefore great care needs to be exercised to ensure that all DCM's are connected as shown in Figure 1; this will ensure the best readings available using this connection method.

### 4. Concluding Remarks

This Technical Note has described a way of using C Clamp fittings for connecting Cellwatch DCM's to batteries that will give good measurement results. It has also highlighted a number of ways in which this connection method can be misapplied, resulting in measurement problems. The overall message is that YES, it can be done; but great care is required in ensuring that the clamps are installed in the recommended way, and that the DCM's are wired as described. In addition, this correct installation must be retained over the lifetime of the installation. Battery maintenance operations could of course disturb the required installation and produce problems.

Therefore the use of C Clamps (or similar methods) is not recommended and should only be chosen as a last resort.