Instruction Manual

MPX15

MULTIPLEXER

Instruction Manual Version 1.4

November 2002

MPX15 Addendum

Wiring Details

Wiring details for the Parallel Twin mode have been changed since earlier versions of this manual were issued. New versions of figure 2-6, on pages 2-9 (for new PA5 frames) and C-3 (for old style PA5 frames) are shown in this manual. Wiring detail recommendations have also changed since white papers were issued in 2001 and 2002 concerning striping problems with the Parallel Twin mode.

Procedure For Checking Probe Configuration Wiring

You can easily check to see if you have the multiplex configurations wired and orientated correctly. Set the system up for taking your first measurement, with the frame and resistance meter in front of you. Press Enable Log and you will see a reading made with the first measurement pair, A1 / M1 if using a Twin array. Unplug the jumper lead for A1 and you should see an "HCR Open Cct" message (current probe). Reinsert that jumper lead and next unplug the jumper lead for M1 and you should see "Over-range" message (potential probe) or a reading that wanders up and down. Reinsert the jumper lead for M1. Next log a complete cycle and delete just the last reading using the DEL key so you are now measuring A2 and M2 (for 2 multiplex cycles). Again repeat the process described above but this time apply it to A2 and M2. If there are more than two multiplex cycles follow the same procedure and bear in mind you will be stepping back from the end of the cycle.

PA5 Probes

Probes for the PA5 system are now provided with a neoprene sleeve and rubber grommet to provide extra protection against moisture.

A 25mm length of neoprene tubing is provided for the top of each probe. The tube internal diameter is slightly less than the diameter of the plastic at the base of the handwheel so should form a tight seal at this point. At the other end it will compress against the beam or wing, enclosing the nylon and steel washers which have a diameter less than the internal diameter of the neoprene.

A rubber grommet is provided for the bottom of each probe. This slides down the probe until it pushes against the steel nut at the base of the probe. It will form a tight seal with the probe since its internal diameter is slightly less than that of the probe. It's diameter is about 25mm and thickness 8mm. When a white mud cap is pushed into place this presses against the grommet forming a seal.

Care and Maintainance

It is very important to look after and maintain the PA5 frame system to minimise measurement errors that can occur, especially in wet weather conditions. These errors are most noticable when making Parallel Twin measurements and take the form of striping in the data. This is discussed later on in the addendum. Please observe the following points :

- Always keep the system as clean and tidy as practicable since moisture and mud will inevitably cause current leakage problems and result in measurement errors. Dry equipment out thoroughly after use and do not store in damp conditions (in much the same way you should do if you want to keep a mountain bike in good condition).

- If soil conditions are very salty then consider washing down and drying equipment immediately after use. Soils heavy with salts may cause more leakage problems than "normal" soils, especially if caked on.

- The central beam should be treated with a mix of linseed oil and white spirits every 6-12 months, (or more often depending on circumstances) – this will help to repel water and prevent waterlogging of the central beam which can be a source of measurement errors.

- Always use the white mud caps and grommet to keep mud away from the probe mounting position under the beam or wing.

- Take special care to fit all the insulators as shown in the diagrams – if the metal probes conctact with the wooden or metal wings potential leakage current paths can be created which in turn can cause measurement errors, especially in wet weather.

- Touch up any scratching of paint on the wings to avoid any possible current tracking to or from exposed metal.

- Ensure the bolts securing the handle to the beam (located underneath the beam) are still encapsulated with plastic filler and rubberised sealant.

- When using wings ensure the nylon bush and washer kit that insulates the struts from the handle has not broken.

- If you experience striping problems with Parallel Twin data you may wish to follow the practice of some users who wrap heavy duty plastic sheeting around the beam system and seal it up with tape. This is reported to greatly reduce or eliminate striping problems, especially in older frames.

Striping Defects with the Parallel Twin Configuration

Even with good care and maintainance, striping can still occur with the Parallel Twin mode, usually in wet conditions. Normally, all will be well when the weather is fine but after a short period of working in rainy conditions or in long damp grass striping will start to occur. Typically this is a low level phenomenon, about 2 ohms in magnitude. Two example surveys illustrate this problem and show two different methods of dealing with the error should it arise.

Method 1

An example of striping can be seen in the survey opposite, figure 1. The first image is the raw data, and the second shows the data after high pass filtering (X=10, Y=10, Wt=U) so the striping is clearer. The survey is an amalgam of surveys made with Single Twin and 2 Parallel Twin (3 probe), with the striping occurring only with the 2 Parallel Twin configuration.

The data can be corrected using standard Geoplot process routines applied to the complete composite. First the data must be despiked and saved. Then apply a low pass filter across the saved data with X=10, Y=0, Wt=Gaussian. Repeat the low pass filter 3 or 4 times and save this new data set. Low pass filtered data for the raw data above (not the high pass filtered data set) is shown in figure 2. This new data set has effectively had most archaeological features smoothed out and retains just the background geology and striping defect due to leakage.

Next subtract this new data set from the original despiked data set to effectively remove the striping defect. You can see from the results in figure 3 that all trace of the striping has been removed. Note also that the data has effectively been high pass filtered, though there are differences from the regular high pass filtered data in that localised features are more visible. Note that any archaeological features that are parallel with the traverse direction will be removed by this processing technique, so, depending on their importance, you may need to use the Cut and Combine function to temporarily store and preserve such features in a temporary composite and then repaste them back in their original positions after the above processing.

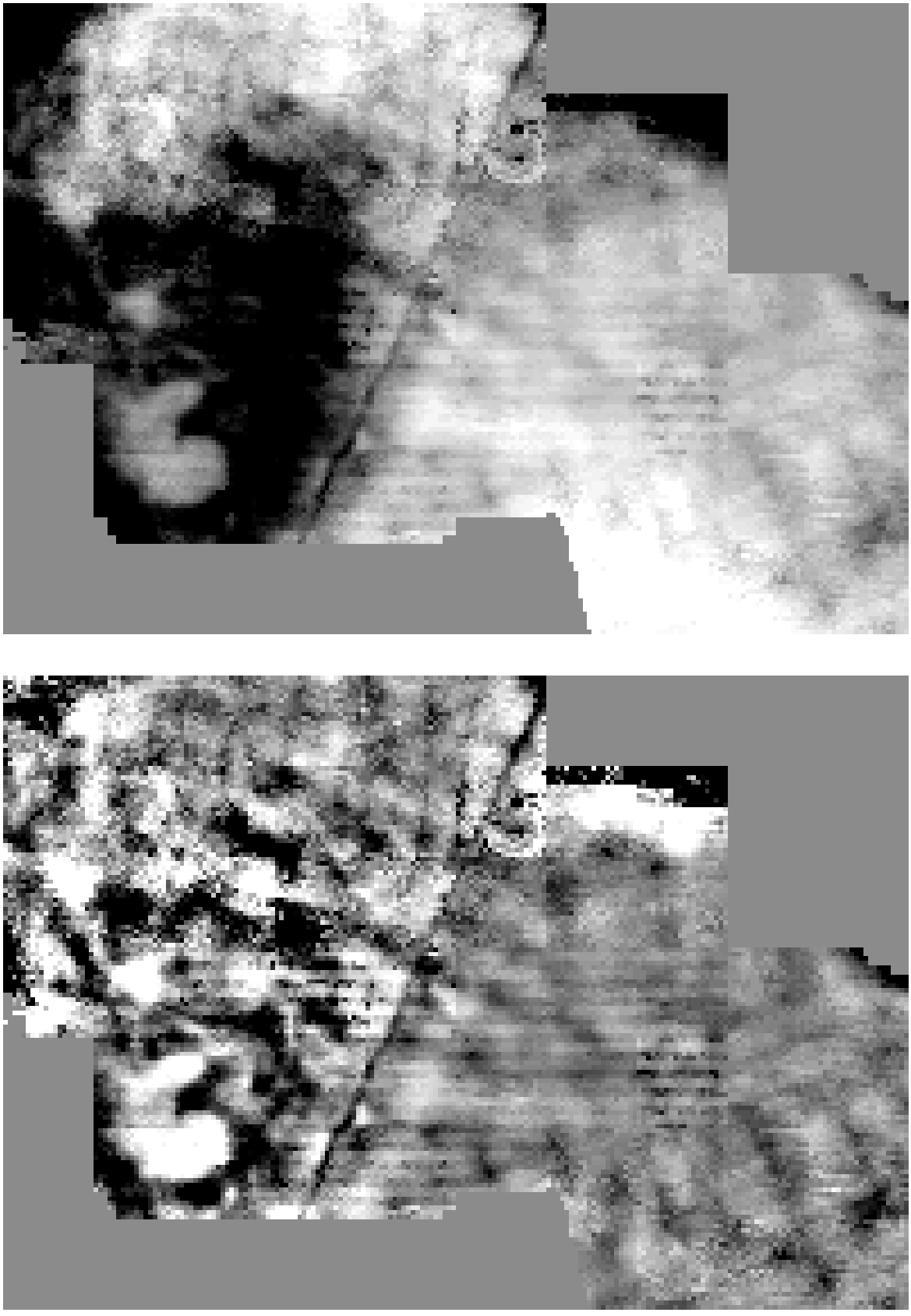


Figure 1. Striping Defect visible in raw and high pass filtered data.

Figure 2. Low pass filtered data used for correction of striping defect.

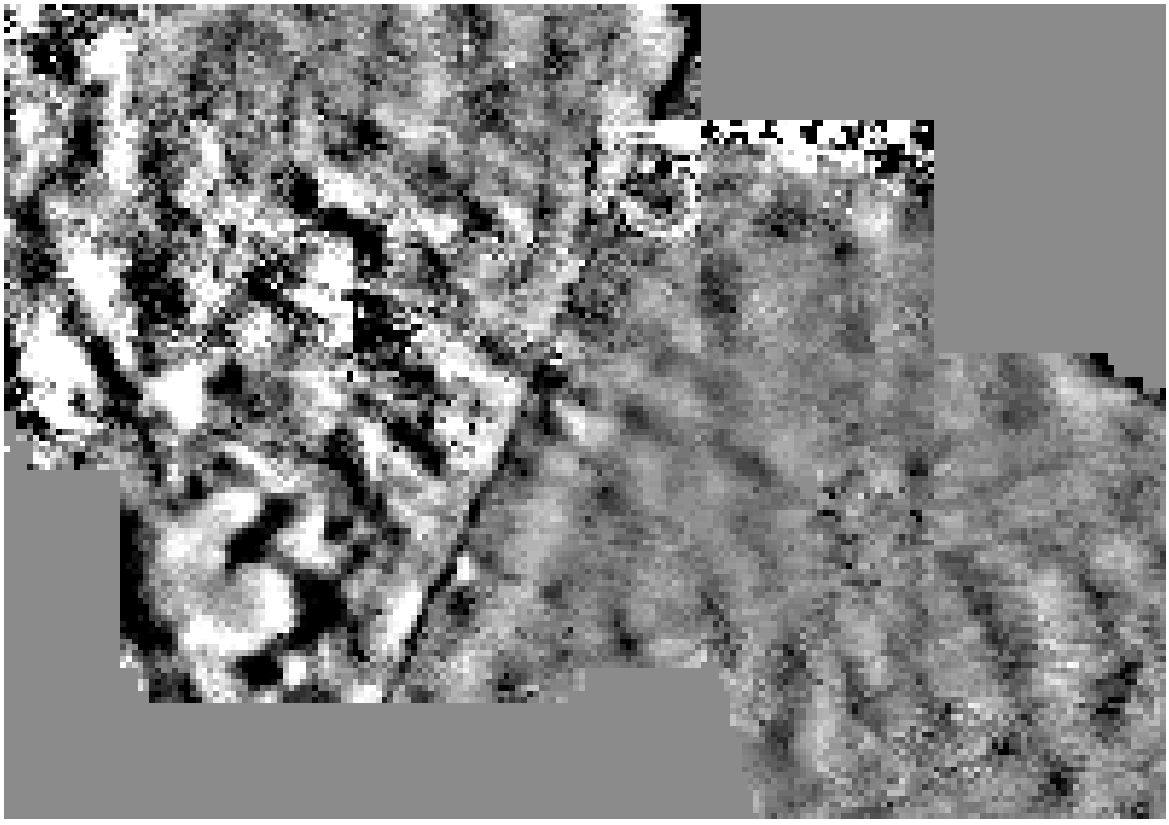
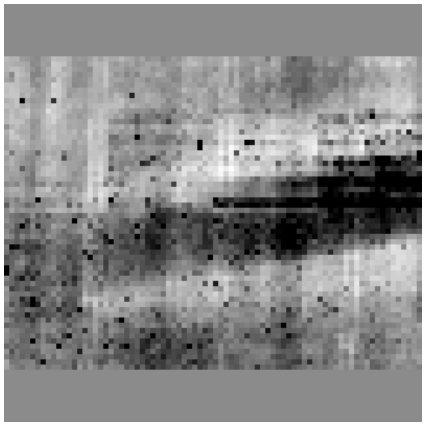


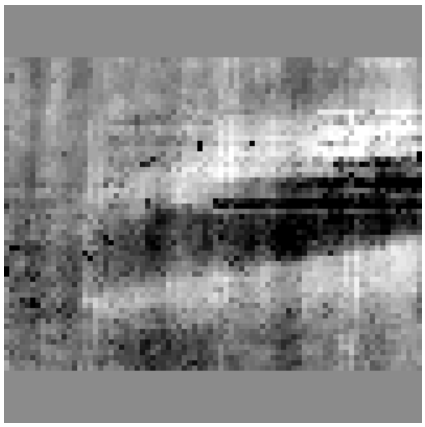
Figure 3. Data set with striping defect removed.

Method 2

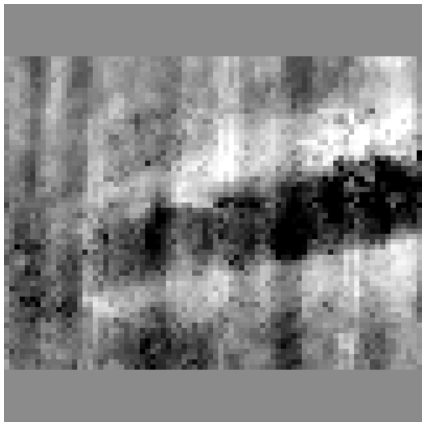
A second example of the striping defect can be seen in the survey below. Noise spikes and striping defects running from left to right are visible, the latter especially so in the high resistance area to the right. Mean is 57 ohms and standard deviation is 7.5 ohms.



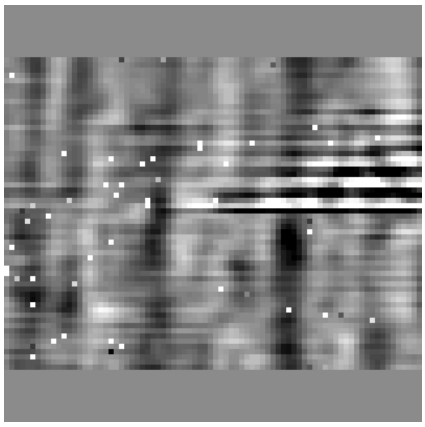
The data can be corrected using the following approach. Firstly, to remove most of the spikes use Despike with window radii of X=1, Y=1. A second Despike with X=2, Y=2 may help in some cases, as was the case here, together with use of the Add function to remove stubborn spikes. The results of this operation is shown below.



Secondly, to remove the striping, Low Pass Filter the data set using window radii of X=3, Y=3, weighting=Gaussian and save that data with a new file name. Reload the despiked data set and High Pass Filter the data set using window radii of X=10, Y=0 and weighting=Gaussian. This will remove the striping but also any large scale archaeological or geological background. To restore this, use the Cut and Combine function to add the earlier saved Low Pass Filtered data set. The result is shown below, together with further despiking.



The processing approach described above has succeeded in reducing the striping errors and noise spikes substantially. Subtracting the final data set from original shows the spikes and striping errors removed – see plot below.



You can see that the striping error changes in magnitude over the site and increases in magnitude over higher resistance areas - 1 ohm over most of the site but up to 10 ohms in the high resistance region. Even so, the processing approach has succeeded in removing the majority of this error. You can see from the difference plot that the restoration of the large scale background changes using addition may have over increased the magnitude of the linear features running from top to bottom. Changing the magnitude of the low pass filtered data set to between 70% and 100% before addition would help reduce this effect. Also, in some situations a wider low pass filter window may produce better results, especially where the background features are extensive.

Note that any archaeological features that are parallel with the traverse direction may be removed by this processing technique, so, depending on their importance, you may need to use the Cut and Combine function to temporarily store and preserve such features in a temporary composite and then repaste them back in their original positions after the above processing.