



# Protocab

# NEWSLETTER

JANUARY 2016

THE NEWSLETTER OF ACC+ESS LIMITED-DESIGNERS AND MANUFACTURERS OF THE PROTOCAB WIRELESS MODEL RAILWAY CONTROL SYSTEM

## A VERY HAPPY NEW YEAR TO YOU AND YOURS!

### Where have we been?

#### A Review of 2015

Firstly, a Very Happy New Year and my apologies for not sending you a Club newsletter recently.

After nearly five years of development, we launched the Pilot Series in September comprising the 0201 Direct Controller, the 0502 Locomotive Control Unit (LCU), 9601 Plug Charging Unit (PCU) and two models of battery. Pre-orders have all been delivered and there has been a steady stream of new orders, several being taken at Scaleforum in September. We have also had repeat purchases of LCUs, PCUs and batteries as customers have tried the system on one loco to start with.

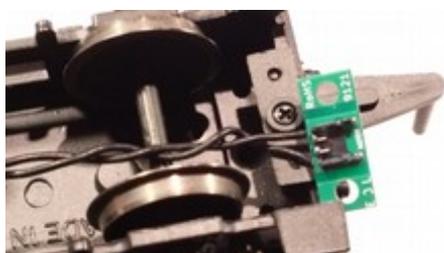
You'll be able to read some customer installation stories later in this newsletter, both demonstrating that even the current range of components will fit inside medium sized 4mm tank locos, something we didn't expect to see until we had introduced the smaller LCU this coming year.

#### Not all plain sailing

However, the launch has not been problem-free. In November, a customer, who had purchased the 0201 and several LCUs for predominantly ready to run locos, reported that, after a period of running, the locos would suddenly come to a stop. Our first reaction was to suggest that the loco motors were drawing too much current for the 0502 LCU which cuts out at 500mA to protect the circuit and

battery. Strangely, one of the units that had this effect was the Bachmann Class 108 DMMU, and we were very doubtful if the power draw would be enough to cause the LCU to reset and thus bring the loco to a sudden stop. We were able to refund the customer in full (although he wants the system back after we have remedied the problem), but shortly afterwards another customer reported a similar situation. We expected to hear that he also had RTR locos, except that his locos were fitted with Portescap motors and we know that these are very low current, high efficiency motors. We had never experienced this problem during the alpha or beta tests or during the EMC and radio certification tests so we had to try to reproduce the problem. As we started our researches, several other customers reported the same effect, all with a variety of motor types. After a while of varying the firmware on the 0502 LCU, it occurred to us that the problem might not be with the LCU, but rather with the 0201 Direct Controller. Try as we might, we couldn't reproduce the problem with the test 0201. Bearing in mind that all the products are individually thoroughly tested before despatch, we had to conclude that this was a phenomenon that would only occur in certain customer situations that we weren't able to reproduce in our environment.

*Continued on page 2*



The new 9121 LCU to Motor Extension Adaptor enables tenders to be separated from the loco when required. See page 3 for more details. The first conversion using this product, a Bachmann L&NER V2, is detailed on our new YouTube video (see next page)

### A Novel form of Update

#### 'OTA' Updates

A significant milestone was reached in the software development of Protocab when, in August, internal tests were completed on the ability to update the 0201's and 0502's firmware 'Over The Air'. Whilst we'd like to think that OTA updating will only be used to add new functions to your Protocab system, unfortunately it is unlikely that Protocab will be the world's first bug-free software system. So we will use the medium to be able to add bug fixes as and when they occur. Recently, OTA Updates have been used regularly to apply fixes for the 'stopping' problem described on this page.

To carry out OTA updates, firstly customers download the 9801 Management App for Windows from a new Protocab website specially assembled for firmware and other updates. The app is saved to their computers which should have internet access. They plug the 0201 to the USB port on their computer via the microUSB port on the 0201 using the 9956 cable. Click the update button on the app and whether you want to update the 0201 or the 0502 LCUs. If you select the LCUs, the 0201 will act as a 'pass through' and transmit the update to the respective LCU(s). To put the 0201 into update receive mode, you use the Management Modes selected through the Mode switch. All is explained in detail in the User Guide included with the 0201.

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## A Review of 2015, *continued*

Customers have been very patient and helped us immensely by letting us send them updates to their LCUs and controllers via the Over The Air update process and testing against these updates.

About a week before Christmas, having tested the different component stages of the 0201's circuit board, we concluded that the LCU was operating exactly as it is designed to do, i.e. when it loses radio communications with the 0201 controller, it tries a number of cycles before concluding that the 0201 is out of action and therefore stops current to the loco motor to prevent damage.

We became suspicious about the OEM radio transceiver we use in the 0201

and investigated the manufacturer's support website. We found, after some digging, that they had issued a report in June 2015 of an intermittent fault on less than 1% of the modules and then described *exactly* the symptoms around a quarter of our customers had experienced. We have adjusted the firmware for the 0201 following the manufacturer's recommendations and this seems to have cured the problem.

As a result, we have now resumed sales of the system and we are sorry to our customers for the inconvenience that this has caused. On a positive note, it has shown the benefit of being able to update the firmware over the air. It has also enabled us to introduce some functional improvements.

## Our YouTube Channel

We've created our Acc+Ess Protocab channel on YouTube where we intend to provide a range of videos, starting with Customer Support tutorials. The first videos which are already available to view are:

*5B01 LCU adoption techniques*  
<https://www.youtube.com/watch?v=yk5UtaOA9tw>

*5B02 How to measure stall currents*  
<https://www.youtube.com/watch?v=GJINcDWQwPg>

*5C01 Installing Protocab in a Bachmann L&NER V2 class loco(2 parts)*  
<https://www.youtube.com/watch?v=jhBbmHioUc>

To view the videos type the URLs into your web browser or go to [www.youtube.co.uk](http://www.youtube.co.uk) and type 'protocab' into the search box.

Your comments about these and suggestions for future videos will be very welcome.

Email [club@protocab.com](mailto:club@protocab.com)

## Customer Installation Report

### Text and photos by David Bunyan

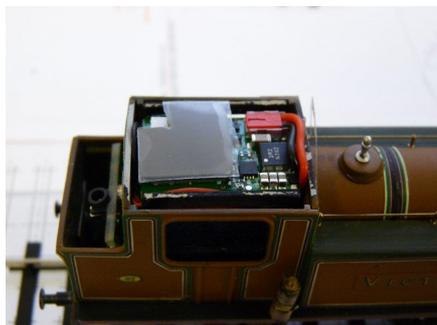
We are very grateful to customers who have kindly sent in details of their Protocab conversion exercise and given us permission to reproduce them in the Club Protocab Newsletter. If you have experience of installing Protocab and would like to share them with other modellers, we'd be delighted to hear from you.

In this first report, **David Bunyan** outlines his first conversion, remarkably into a medium sized tank loco.



David writes:

I would like to congratulate you on the success of the product, I have spent the last week installing them



into a 4mm 0-4-4 tank engine. As this was a retro fit there was insufficient space in the tank area as it is white metal. However by sacrificing the cab area I have been able to squeeze both the smaller battery and LCU onto the cab area while still keeping some day light. All I need is to make a non metal roof to finish. The plug charger unit fitted nicely into the bunker.

I have attached a couple of pictures which shows the LCU a perfect fit into the cab roof area. I have also attached another one showing the basic method, which was to build a

card framework, which housed the battery in the bottom and the LCU on top.

It was a "sloppy" fit to allow for the wires to fit round the outside of the card framework and be hidden from view once the superstructure was in place. This allowed the main cab superstructure to be slid over when everything was connected, except the battery. That is one of the reasons for no roof so I could attach the battery once everything was securely in place.

At present I have attached the copper pad inside of the tanks, as I was concerned that if I attached it to the underside of the roof it might touch something on the LCU as the tolerance were very tight.



As an added bonus it did show that the previous poor running was down to poor electrical pick up and dirty track, rather than my lack of engineering skills.

## Sales Channels

Although Acc+Ess operates a sales office and attends a number of exhibitions throughout the year, we want to extend our presence to bring Protocab to you, locally. Also, there are many other exhibitions that we would like to attend but simply we don't have the resources.

We are delighted, therefore, to let you know that we have signed agreements with two established model railway specialists to provide the additional channels for Protocab. They are to handle the marketing and sales for UK and France respectively and will be extending their current coverage to cover the Protocab range at exhibitions and through their own sales channels.

The United Kingdom Channel Manager is **Hubert Carr**, known to many through his Model Railway Developments (Emardee) company, and, formerly, for the Carrs range of solders, weathering powders

etc. Tony Hagon writes: "Hubert and I have known each other for nearly forty years and we were both heavily involved with the Protofour Society until its merger with the Scalefour Society. Hubert's extensive experience and contacts in the hobby as well as the commercial side of the hobby will be very important to Protocab's future".

We are also delighted to announce that **Nicolas Percebois** will be our agent for France. Nicolas first visited us at Scaleforum and his enthusiasm for Protocab has been infectious, not only here in the UK where he lives with his family, but in France where he and his father have many contacts in the hobby and the commercial side of the industry.

Hubert won't have the challenge that Nick has - to translate Protocab user guides and marketing material into French!

The Acc+Ess 'National Channel Managers', so far Hubert and Nick, are appointed to develop and handle all the sales channels in their respective country including accrediting local retailers, providing first line support to them and liaising with the model press. Already, Hubert and Nick have been in touch with various magazine editors and the first reports are beginning to appear.

Customers will be able to purchase Protocab through retailers, when appointed, and still through the Protocab website which has now been enhanced with a fully secured shopping cart.

We are hoping to bring you news of National Channel Manager appointments in other countries in future Club Protocab newsletters.

## The Pilot Series

Here is the current range of Acc+Ess Protocab products:

	<p><b>0201 Direct Controller</b> Battery and USB powered, 9 LCU selection buttons, simulation mode Price: £128</p>	<p>circuit and 9mm thick. With connector for 0502 LCU Price: £8.95</p>	<p>Price: Free to download and use</p>
	<p><b>0502 Locomotive Control Unit</b> for 12V motors, maximum stall current 500mA for 30 seconds, running current maximum 450mA at 10.8V output with Locoswitch fitted and including heatshrink tubing, 9949 LCU to motor leads (150mm), 9959 Heat Absorbing Pad and 9970 Motor Suppressor Price: £82.50</p>	 <p><b>9601 Plug Charging Unit (PCU)</b> including 9953 PCU to LCU cable assembly, installed in locomotive or tender to enable battery to be charged without being removed from the loco. Price: £18.99</p>	 <p><b>9901 UK Mains Adaptor to USB socket, output 1A</b> for use with 9950X EIAJ to USB cable and 9956 USB to microUSB cable, 1.8m long. Price: £9.99</p>
<b>Accessories</b>			
	<p><b>1902-653042 Lithium Ion Polymer battery 3.7V 820mAh</b> for use with the 0502 LCU in powering locomotive motors with a stall current maximum 500mA. Measures 30mm wide, 42mm long over protection circuit and 7mm thick. With connector for 0502 LCU Price: £8.95</p>	 <p><b>9121 LCU to Motor Extension Cable</b> to enable tender where Protocab LCU and PCU are installed, for example, to be disconnected from loco in which motor is installed. Price: £2.99</p>	 <p><b>9950-X EIAJ to USB cable</b> to charge the Protocab battery by plugging into the 9601 PCU. Use in conjunction with 9901 UK Mains Adaptor or plug into powered USB socket of a computer (min 500mA) Price: £6.75</p>
	<p><b>1902-902030 Lithium Ion Polymer battery 3.7V 500mAh</b> for use with the 0502 LCU in powering locomotive motors with a stall current maximum 500mA. Measures 20mm wide, 30mm long over protection</p>	<p><b>9801 Management App for Windows</b> The application used to update the firmware on the 0201 Direct Controller and 0502 LCUs. Also used to manage aspects of the 0201 and 0502 firmware including updating characteristics and provides a range of test routines. Requires the 9956 USB to microUSB cable and a suitable computer running the Microsoft Windows** operating system (version XP or later). ** Microsoft and Windows are trade marks of the Microsoft Corporation.</p>	 <p><b>9956 USB to microUSB cable</b> to charge the Protocab 0201 Direct Controller. Use in conjunction with 9901 UK Mains Adaptor or plug into powered USB socket of a computer, where it is also used to update the 0201 and 0502 LCUs when used with the 9801 Management App for Windows. Price: £6.75</p>
<p><b>9959 Heat Absorbing pad</b> A semi-tacky pad, 25mm x 16mm with high thermal absorption to act as a heat barrier between the 0502 LCU and other components Price: £1.99</p>			

Order online: [www.protocab.com](http://www.protocab.com) or by telephone 07831 231164

## Product Update

Several modellers have commented on the connection between the 0502 LCU and the motor. Up to now, the 9953 cable which is included with the 0502 LCU has a pair of bare wires to solder to the motor, the other end having a small connector to plug on to the 0502. The comment is that this makes it difficult to separate loco and tender if the 0502 is fitted in the tender (this, of course does not apply to a tank or diesel loco).



The solution is a new accessory, the **9121 LCU to Motor Extension Adaptor**. One end connects to the 0502 LCU, the other end has a socket on a pcb that fixes somewhere convenient. For example, if the 0502 LCU is in the tender, the 9121 socket (which is 6mm x 5mm) can be located under the footplate of the tender. The 9953 cable included with the 0502 then connects to this socket.

The 9121 is priced at £2.99 including VAT and is available now (note 1).

The next new accessory provides two functions. It enables you to fit the 0502 LCU into your locomotive at the same time providing a degree of heat dissipation from the 0502 (it does not generate much heat and mainly when the locomotive motor is being worked hard).

The **9959 Heat Absorption Pad** feels like a very flexible blue tack, but cold to the touch. However, it's not as adhesive as blue tack. It can be cut and moulded to the shape of the 0502 and the locomotive body where the LCU is to be located. The 9959 is included with every LCU pack, and is also available as a separate accessory at £1.99 including VAT (note 1).

On the subject of connections, I want to apologise to one Club member who telephoned me and, in conversation, asked whether the NEMS connector used for DCC Ready or DCC connections to RTR locos could be used to connect the Protocab components to the locomotive. Without thinking about the implications, I told him that it wouldn't be possible because Protocab doesn't need the wheel pickups and the connector to a DCC decoder is different. What nonsense! The NEMS 8- or 21-pin connector is very suitable and, if we were to offer this option, we would simply not connect anything to the two pins used to connect to the loco pickups. The LCU to motor cables (part 9953) included with the 0502 LCU would then be soldered to the two pins of the connector that are linked to the loco motor. We might even be able to use the other pins of the larger connector in conjunction with our Auxiliary Control Units for lighting. We are thus investigating how we might be able to use the NEMS plug, and will report further in the next newsletter. And sorry to our Club member for decrying this excellent

suggestion!

One point to note. We have been asked whether the 9601 Plug Charging Unit can be purchased separately to provide charging facilities for non-Protocab batteries. We have had to say that the 9601 is designed to work in conjunction with the 050x and there are components on the 0502 that complete the power circuit including recharging, so the answer, unfortunately, has to be 'no'.

On the other hand we have been asked if the 190x series Protocab batteries can be bought separately to work with other systems and the answer is 'yes', but under the Royal Mail regulations outlined in the last newsletter, we cannot use their service to deliver a loose battery (they will only accept lithium ion batteries either connected to or delivered with the appliances they power). However, we have found a courier, *Collect Plus*, who will deliver loose lithium ion batteries. The downside is that we have to drop off consignments and our nearest point is ten miles away and our customers will have to travel to pick it up from their nearest point! Therefore we will offer three prices for this service (each price for a maximum of 4 batteries):

Within 14 days: £4.99

Within 5 days: £6.75

Two days: £9.50

We will, of course, be pleased to sell loose batteries at exhibitions we attend.

Note 1: Visit [protocab.com/shop](http://protocab.com/shop) for details of how to purchase these products, including cost of postage.

## To bind or to adopt?

Conventional radio control systems use a technique called 'binding' to associate the receiver to the controller, and this is often accomplished by pressing a button on both the devices, whereupon the binding has been achieved and the controller and receiver are permanently associated (until changed, if required). For Protocab we call this process 'adoption' and, with the first controller in the Protocab range, the 0201, the process is a little more complex. This is because the only interaction that the user has with the 0201 Direct Controller is the set of nine LCU

selection buttons, the mode switch and the control knob (plus, of course, the on/off switch). There is also the microUSB port of which more anon. Notably on the 0201 there is no information screen which might further simplify the operation that our customers want. Therefore, we need to use the buttons on the 0201 to enter the adoption commands that allocate an LCU to one of the nine LCU selection buttons.

The adoption process differs from most RC binding operations in ensuring that the LCU can only be adopted by the 0201 Direct Controller that the user selects.

Imagine the situation in, say, an exhibition, where several retailers are trying to adopt an LCU to an 0201 for a client at the same time, compounded by layout operators who want to readopt a different set of locos to the 0201. Given the range of the Protocab system that easily broadcasts to the entire exhibition hall or club room, if several unadopted LCUs were to be readied for adoption, how would the user of the 0201 know which LCU was being adopted to the 0201?

*Continued page 5*

## Essential testing

A few days before going to the ElectroMagnetic Compatibility (EMC) tests, we re-read the various standards and European Directives under which we must certify compliance. Although we had been told that our radio systems were already compliant and would only need documentation, as we say up here 'I had me doots' and as the manufacturers of Protocab, the onus is on us to ensure that we comply with the Directives. We know that the 0201 Controller is already pre-approved for the standards covered by this Directive, but we have built the RF circuit of the 0502 LCU ourselves and asked for it to be tested for radio emissions - covered, we thought, by the EMC tests. We had asked three test houses for their opinions on whether the tests we had in mind would cover this Directive and the best advice was to document the manufacturers' own approvals for the individual components we had used. So, we decided that simply documenting that the individual components on the 0502 are compliant is not enough. We booked further tests under the ETSI EN (EuroNorm) 300 328 standard in order to comply with the R&TTE Directive. Needless to say, Protocab passed the R&TTE tests with ease!

*Why is this ETSI EN 300 328 standard important to Acc+Ess and our customers?*

Another aspect is the way that the 0502 communicates with the 0201 Direct Controller. As you may know, we adopted the IEEE 802.15.4 standard for a number of reasons both for today's products and for future expansion. This, and similar standards at the network layer (e.g. Bluetooth, Wi-Fi) operate over the 2.45GHz Industrial, Scientific and Medical (ISM) waveband, and even without the imminent deluge of new devices, also forecast to be using this waveband, it is highly congested. Each standard using the 2.45GHz band divides the band into a number of separate "channels" depending on how much bandwidth it requires. The 0502 and 0201 work by setting up a communications link between them

over one of 16 channels, and the 802.15.4 standard provides for the devices to scan each channel and select the quietest. Between them they decide on the channel and carry out the 'pairing' process (not to be confused with 'adoption', which is the persistent association of the LCU with a button on the 0201). In congested areas, such as city

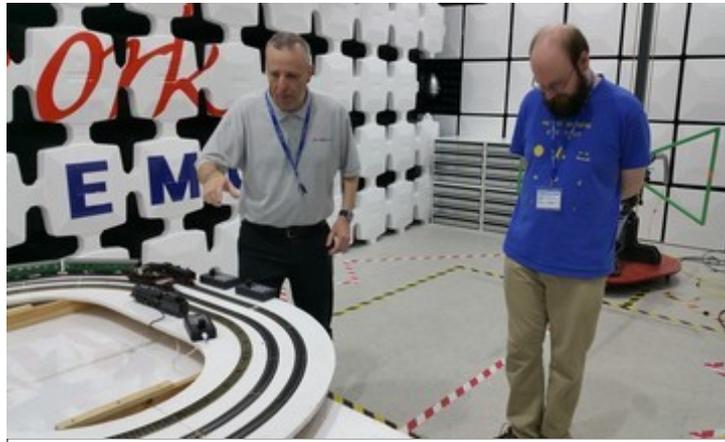
using the 2.45GHz band to retest all their devices. This has created quite a problem for suppliers of radio control devices, where some transmission protocols in devices sold prior to this year could not be compliant with the new standard.

In one respect we are lucky that we have not had to revise our designs, had we tested against 1.7.1. But we went a step further and tested against version 1.9.1 which is due to come into force in 2018, with manufacturers being advised to test against this standard from now. Getting this certification is not cheap and the expense has put our plans to expand Protocab to the USA on hold - the cost of getting the equivalent certification from the Federal Communications Commission (FCC) runs into many thousands of pounds.

We have been recommended to consider going abroad for our testing where the costs of the tests are somewhat less. But we consider that the time we spent with the test house, being able to quiz the specialists so

that we understood the process, to be very valuable and enable us to sign the Declaration of Conformity with confidence.

Although being in the north of Scotland has its own advantages of fresh air and great open spaces, the most likely radio congestion in the 2.45GHz band is likely to be in towns and cities. So we have been very fortunate to have the system tested by our beta testers, some of whom are town based and to all of whom we are very grateful.



*Could this be the most boring Model Railway Exhibition ever? One layout, no scenery and very few visitors.... No, it's Protocab undergoing (and passing with flying colours!) its EMC testing inside the Fully Anechoic Room (FAR) at York EMC's premises in Grangemouth, Scotland in July 2015. Dan, on the right, isn't asleep or being zapped by the high frequency antenna behind him, honest! The tests took two days and covered a wide range of compliance routines throughout the frequency spectrum. Zapping the Protocab components with 8,000 volts to make sure they continued to work was 'interesting'!*

*Photo: Tony Hagon*

centres, a pair of devices will be competing for channels with many other device pairs. If the devices themselves were to keep to their channels and only transmit a certain amount of radio power, all would, in theory, be fine. The problem arises where a device is broadcasting not only excessive power, but transmitting spuriously beyond the channel it was designed to stay within. For this reason, the European Union created the R&TTE Directive. It empowered an organisation known as ETSI to arrive at test standards whose results would provide the proof than manufacturers would need to demonstrate compliance with the Directive.

Up to the beginning of this year, the EN 300 328 standard assumed compliance on the part of manufacturers. The last version of this standard, version 1.7.1, was revised in 2012 to version 1.8.1, effective 1/1/15. It was no longer acceptable to carry out tests for the additional parts of the standard included in 1.8.1, it became *mandatory* for any manufacturer

### *Scottish EDGE*

We couldn't have carried out the EU Directive tests had it not been for the Scottish EDGE scheme (EDGE standing for Encouraging Dynamic Growth Entrepreneurs) which has been running in Scotland for several years funded by leading Scottish entrepreneurs, bankers and public sector supporter. We were awarded a cash prize under the Wild Card EDGE scheme and this funded the external testing.

# Customer Installation Report

Text and photos by Steven Atkins



Attached photographs show installation of components in Hornby WC. tender. It all needs tidying up but works well. The battery is supported at a slight angle by blue tack. The 9601 Plug Charging Unit is a slide fit between strips of plasticard 2mm x 3mm fitted to the tender sides. It sits on a block 26mm



long x 8mm wide x 7mm deep. The top two outer "lands" of the board were removed to allow it to fit flush with the inside of the tender so that the socket fits in a 4mm hole drilled where the water filler cap was. This was carefully removed and then made to pivot on a 0.45mm dia. piece of wire. The 0502 LCU is fitted to the inside of the tender top under the location of the vacuum reservoir cylinders. A 9959 Heat Absorbing Pad

was used to do this. The Locoswitch pad was cut down slightly and fixed to the inside of the tender side. The loco runs very smoothly. I

even managed to reverse the motor polarity using the Characterising options! Now for the Hymek!

(Ed: A couple of notes: The copper pad used for the Locoswitch can be cut down from the 25mm square delivered with the 0502 LCU. Naturally, this reduces the target area where you can touch it to switch on the LCU, but we find that it is acceptable to trim to around 10mm square if required. I replied to Steven that I would urge caution about using the 0502 inside the Heljan Hymek with the existing Beulah motor. We found that the current draw was over one amp at stall, way beyond the limit of the 0502, which is why I remotored with a Mashima 1624 which provides quite enough power in my opinion. Steven has written to say that he has taken up my recommendation! We look forward to a further report from him on the Hymek conversion - I bet it will be a lot better than mine! - TH).



## BRIGHTON PROGRESS

75A

Work proceeds apace on the Brighton MPD demo layout.

All thirteen shed roads are now laid and twenty six of the twenty eight turnouts are built and twenty two of them laid. This photo was taken in November, before the paving inside the shed roads was laid

The biggest workload in the last few months has been the laying of the inspection pits on the thirteen roads and outside the shed. The wagon is on the wheeldrop road, the wheeldrop housing yet to be built. Next project is to assemble the large water tower on the right. *Photo Tony Hagon*

## To Bind or to Adopt?

*Continued from page 3*

The answer is that we use the address of the 0201 and the address of the 0502 LCU to marry one to the other. Because the long addresses of these devices would be tedious to enter using only the buttons of the 0201, we have introduced a shortened 'passcode' comprising four digits. This passcode is tapped on the Locoswitch of the 0502 LCU being adopted to ensure that it and only it can be adopted to the chosen button on the user's 0201. With a unique combination of 255 passcode variations, we think that the chances of two passcodes attempting to be

entered at the same time is fairly low!

You might say, with complete justification, that this wouldn't matter to you because you are not likely to be anywhere near another Protocab user in radio range when you adopt your LCU to your 0201, so security to prevent another LCU being adopted or your LCU being adopted to the wrong controller is not relevant. However, we suggest that it might become an issue in circumstances that might be, as yet, unforeseen, for example, where you are lending your loco to a fellow modeller to adopt to his/her controller rather than them using yours. The adoption might take place

in an exhibition with several Protocab systems. We hope that the Customer Support Video '5B01 LCU Adoption Techniques' (see page 2) will help you with your LCU adoption - remember, you only need to go through the process once until you want to reassign the LCU to a different 0201 or LCU Selection button.

We will be investigating ways in which the 9801 Management App can be used in the adoption process, particularly in connection with the development of the Concentrator, currently on hold but about to be restarted.

As always, any suggestions or comments are very welcome!