MERG Model Electronic Railway Group
TECHNICAL BULLETIN G16/3
Issue 1
Gordon Hopkins M328

RPC System Overview **March, 1996**

Introduction.

One of the many difficulties in operating large, complex layouts at exhibitions is, as on the prototype, staff shortages. This is particularly true during lunchtimes, where operators have been known to disappear for hours at a time. It was mainly for this reason that the Remote Panel Control (RPC) system was originally devised, although it could be used for a multitude of other purposes not necessarily connected with railway modelling.

The system allows either partial or complete remote control of layout accessories such as points, signals, section switches etc. This makes such things as Interlocking.Timetables and Route Selection relatively easy to implement, as it is all controlled by Software. Similarly, layout modifications are also handled more easily than conventional Hard-Wired Interlocking systems.

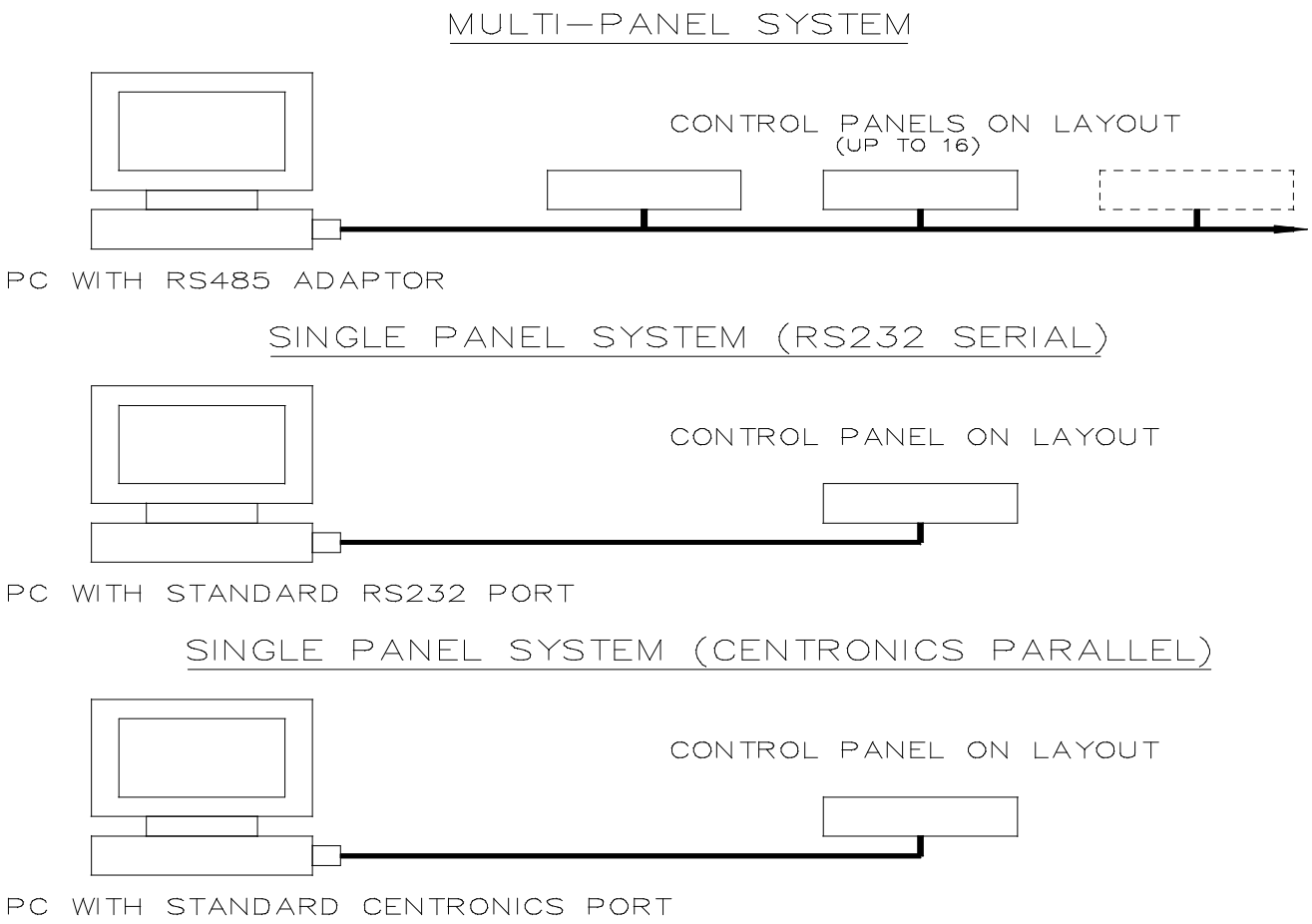
It has become clear, since this system was originally proposed, that user requirements vary considerably. Most applications will not require the full Multi-Panel system as implemented on 'Carstairs', the Nottingham (Bulwell) MRS layout which is the system 'Test Bed'. Therefore, simpler versions are also proposed for single panel layouts.

Modularity has been one of the main aims of the design, both in Hardware and Software. It should be pointed out that the system is not aimed at absolute beginners. Users must still decide what track switching, signals, block sectioning etc.are required for their application. Software application programs to generate some of this information are under development, in particular by John Down (M001), and it may be possible to use proprietary programs such as Andy Micklethwaites 'Interlocker' to similar effect. Thereafter, appropriate modules can be chosen from the range available to achieve the desired effect. The range of modules will be increased as and when new requirements arise.

The principle here is to create a Computer controlled version of a 'Conventionally Wired' Control Panel, allowing manual override if necessary (an essential feature on Exhibition Layouts). It should be possible to incorporate Proprietary DCC (Digital Command Control) Systems with the RPC Hardware. This would probably only be of use for train speed control, as the RPC Hardware performs all the switching and train detection required (and will undoubtedly be cheaper than a full DCC System with Accessory Modules).

Main System Requirements

- **Computer Interface** Industry standard — RS-232C for single panel systems. RS-485 for multi panel systems. Centronics Parallel for single panel systems.
- **Simple Commands** The computer communicates using simple command messages consisting of standard ASCII characters and numbers. (Not applicable to parallel systems)
- **Modularity** Control Panel Modules to be usable in any combination.
- **Layout Accessories** To be Open Collector Drive compatible to allow manual override.
- **Switching** Relays providing isolated, uncommitted switching for track, block sections, controllers etc.
- **Control Outputs** Open Collector Drive for layout accessories such as signals, point motors etc. to allow manual override with conventional switches.
- **Train Detection** Continuous Track Circuiting to detect presence of Trains in any Block Section for Signalling and Interlocking purposes.
- **Control Inputs** Open Collector Drive compatible for feedback of data such as point correspondence.



SYSTEM ARRANGEMENTS

System Limitations.

The alternative System arrangements shown above each have certain characteristics which should be considered for each application. The RS485 system allows for up to 16 Control Panels on the same pair of wires, and can, according to the EIA specification, be operated at up to 4km distance (!). The RS232 system is limited in distance by the EIA specification to around 15m (2500pF line capacitance). Parallel systems are rather more restricted in operating distance unless specialised line drivers and receivers are used. A maximum range of only a few metres is desirable to maintain reliability, depending on the data transfer rate.

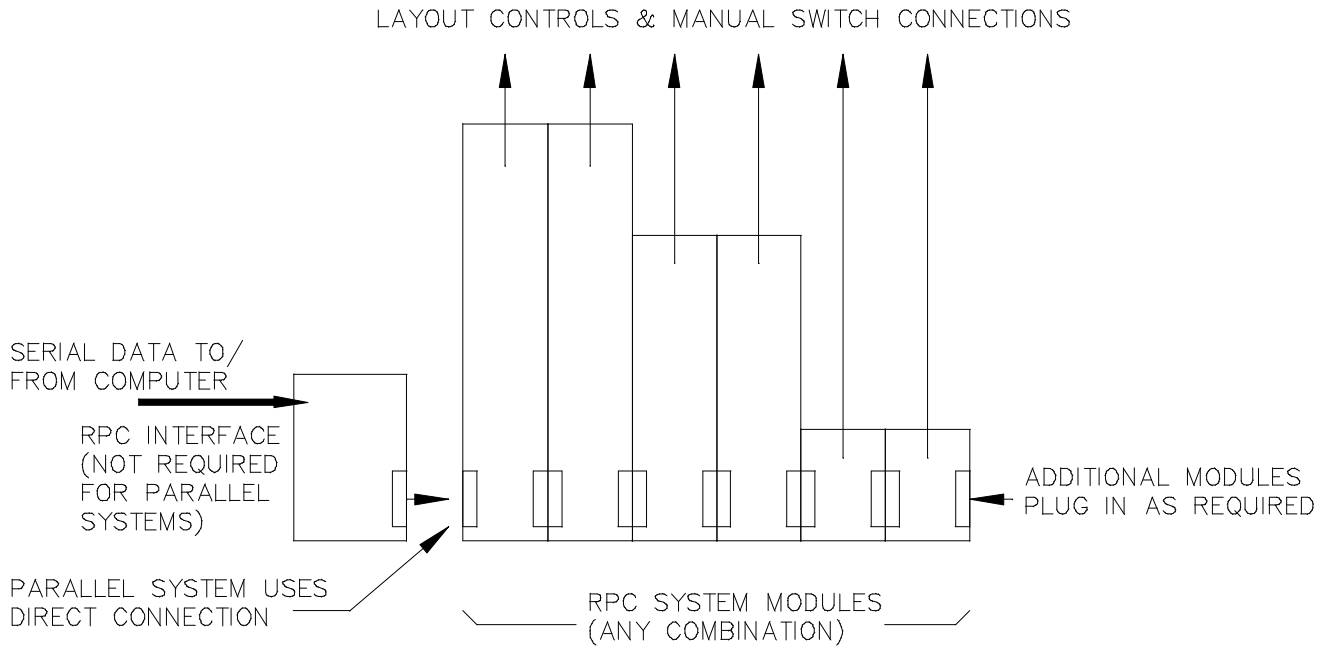
The communication protocols for the serial systems are almost identical :-

The RS485 half-duplex version necessitates the inclusion of an address as part of the data to determine which panel is to respond, as well as switching of the COM port RTS (Request to Send) line to control the data direction.

The RS232 version operates in full duplex mode, i.e. both directions are always available, so no switching is necessary. As only one panel is connected, no address information need be included.

In each case, the RPC interface board handles the RPC Module shift registers automatically, according to the message sent to it. Parallel systems however, require direct operation of individual bits on the LPT (Centronics) port (or any other Parallel I/O port you may care to use e.g. BBC User Port) to correctly control the RPC Module shift registers by clocking and strobing the data in the manner prescribed by the device data sheets (4094 & 4021).

Different communication software routines are required for each version, but none of them should be particularly difficult or complicated. It would be possible to operate several panels with the parallel system if enough bits are available on your port, but this could be rather cumbersome from a software point of view.



.

CONTROL PANEL INTERNAL ARRANGEMENT

Once it has been decided which modules are required for the application, they are stacked together as shown above. Each module uses one or more 8 bit shift registers, either serial in/parallel out (SIPO) for output modules or parallel in/serial out (PISO) for input modules. The order and combination of modules must be noted, as this information is essential for correct operation with the Computer software, which needs to know where each function resides. This data usually takes the form of a Bit Function table, to which the software refers.

Power supply rails vary from module to module, the only standard requirement being a +5V supply for the logic devices. In serial systems, this is derived from the RPC Interface module, which has an on-board +5V regulator. Parallel systems require a separate feed into the relevant pins on the connector stack.

Normally, the RPC Modules are fixed to the baseplate of the Control Panel, along with any power distribution tag strips, etc. for wiring convenience. Personally, I prefer to take the RPC module output connections via the manual override switches, then to the external layout connectors, as it is usually easier to connect multiple wires at the switches rather than at the RPC module connectors which are quite small.

Documentation of the system as (or preferably before) it is constructed is highly recommended. Noting down the wire colours, connector numbering etc. makes life much easier for fault finding if anything fails, especially at exhibitions. The panels fitted to ‘Carstairs’ all have complete point-to-point wiring lists and Bit Function tables so that any problems or modifications are easily dealt with. Planning also helps keep wiring neat and tidy, a feature which lets down many layouts seen on the exhibition circuit.

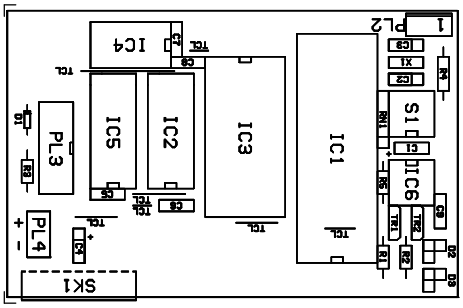
The Modules produced so far make possible a fairly comprehensive selection of functions, but they only represent those which I required for my own purposes. I welcome suggestions for additional Modules which could be used for applications which I have not considered so far.

Finally, overleaf is shown a small selection from a typical wiring document produced for one of the ‘Carstairs’ panels as an example of my current standard. The RPC Module drawings are directly imported into the document from the PCB drawing package, and some of the abbreviations used are specific to the layout itself. (TCR = Track Common Return, TAG refers to the tag strip used for some common connections, IPL1 refers to ‘Interface Plug 1’ which connects to the layout etc).

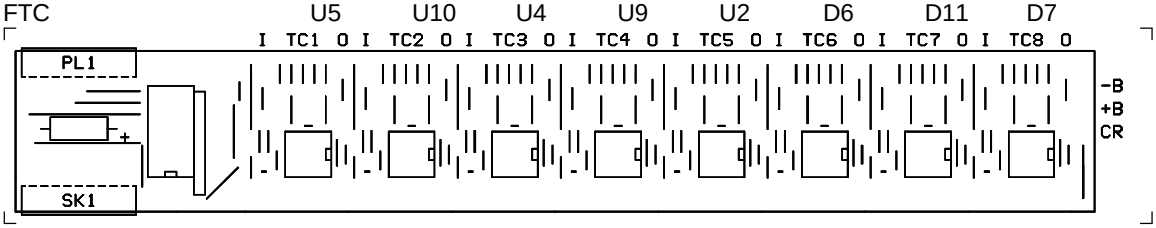
Ther are no hard and fast rules to follow for this type of documentation, as long as it suits the purpose. Users must decide for themselves how to approach this aspect of the design, although Word Processing clearly offer many advantages.

LAW JUNCTION RPC LAYOUT

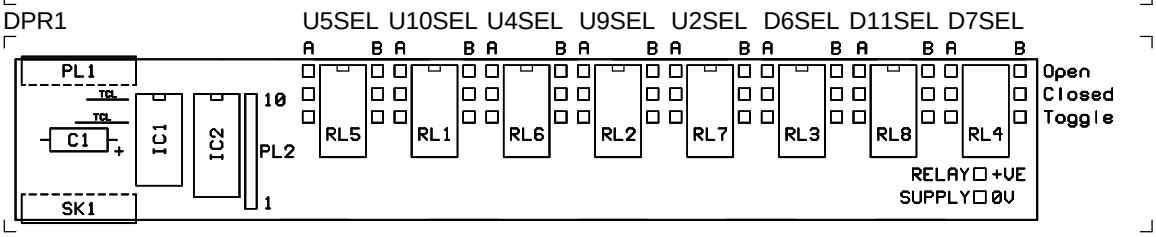
RPC



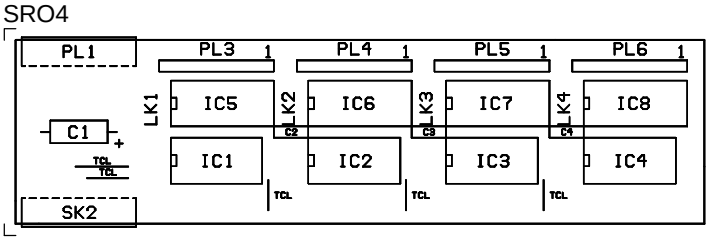
FTC



DPR1



SRO4



	LAW JUNCTION PANEL WIRING								
WIRE	**FROM**			**TO**			**FUNCTION**		
NUMBER	**UNIT**	**ITEM**	**TERM**	**UNIT**	**ITEM**	**TERM**	**COLOUR**	**ITEM**	
TCR	DPR3	RL1	CA	TAG		6	BK		
274	DPR3	RL1	OA	DPR3	RL1	OB	GN		
275	DPR3	RL1	TB	DPR3	RL5	CB	W		
TCR	DPR3	RL2	CA	TAG		6	BK		
257	DPR3	RL2	TA	DPR3	RL2	OB	O		
TCR	DPR3	RL3	CB	TAG		6	BK		
TCR	DPR3	RL3	OA	DPR3	RL3	CB	BK		
271	DPR3	RL3	OB	DPR3	RL7	CA	R		
254	DPR3	RL3	TA	DPR3	RL4	CA	Y		
253	DPR3	RL3	TB	DPR3	RL4	OA	BN		
TCR	DPR3	RL5	CA	DPR3	RL5	OB	BK		
275	DPR3	RL5	OA	DPR3	RL5	CB	W		
TCR	DPR3	RL5	OB	TAG		6	BK		
U9	DPR3	RL6	CA	DPR3	RL6	CB	GN		
TCR	DPR3	RL6	OA	TAG		6	BK		
274	DPR3	RL6	TB	DPR3	RL1	OA	GN		
TCR	DPR3	RL7	CB	TAG		6	BK		
U4	IPL1		46	FTC	TC3	O	R	U4SW	
D11	IPL1		47	FTC	TC7	O	GY	D11SW	
U9	IPL1		48	FTC	TC4	O	GN	U9SW	