Model Railway Computer Control Centre (MRCCC): Overview   JUL 2005

Introduction

Model Railway Computer Control Centre (MRCCC) is a Windows software application created to provide a user interface and interlocking for the model railway that closely replicates real modern UK signalling practice. MRCCC is designed to be the signal box – it does not attempt to control the trains or allocate controllers and traction power feeds. However, it is a flexible system and complex additional logic can be built up if required using any of the signalling states, which MRCCC knows about.

The software is freeware and can be downloaded from the Internet free of charge. The source code (MS Visual Basic .NET 2003) is also available.

MRCCC is not intended to be a commercial product and as such user instructions, help and support are limited. The software will only currently work with the MERG Remote Panel Control (RPC) hardware running in RS232 single-drop mode. However the structure of the code is such that it would not take much additional work to code alternative hardware platforms or communications protocols.

MRCCC looks and behaves like a real VDU (Visual Display Unit) based signalling control centre. Some simplifications have been made – overlaps, approach locking and sectional Route locking for example are not necessary for model railway use. Equally, details like point and signal identities are not required on the screen. The aim has been to recreate the appearance of a real system but without reliability, safety and availability features that are essential on the real railway.

This Technical Bulletin (TB) is intended to introduce MRCCC and outline the features available and give some background on the signalling terminology used throughout the application. A second Bulletin, TB G16/86 the User Guide, contains detailed guidance and advice on obtaining, installing, configuring and operating the software, and also a Signalling Glossary.

Current Features

- VDU control of Model Railway signalling on a PC.
- User Configurable screen layout and interlocking conditions. Configuration is via Windows dialog boxes, which should be understood with a little signalling knowledge, and not with any kind of scripting language requiring computing knowledge.
- Full and comprehensive validation of all user-configured data with feedback at each stage on exactly why a layout is invalid or what is wrong with an entry just made.
- Test Mode provided for offline testing (without connecting the layout) of the full interlocking including the ability to simulate user and layout inputs and monitor all states within the system.
- Entry-Exit (NX) Route setting by mouse, calling all points as required.
- Auto Working buttons.
- Full automatic aspect sequencing for 2-, 3- and 4-aspect colour light signalling (only basic sequencing provided, e.g. no flashing aspects).
- Point Keys.
- Call On/Shunt Exits buttons and position light aspects.
- Shunt Signals and permissive working.
- Facilities for Slots or Emergency Replacement controls.
- Real time display of track occupation, aspect and point position (detection not provided).
- Train Operated Route Release (simplified).
- Route Release (simplified).
- Full interlocking of conflicting Routes or occupied track circuits with comprehensive feedback to the signaller of why the interlocking has rejected a command.
- Multi-User support for large layouts.

Future Developments Planned

- Point Initialisation Feature to correspond all points to the RPC stack.
- External and Internal Event Driven Route Requests (to enable auto-terminal platform working, automated passing loops, external push buttons to request Routes such as in Fiddle Yards, Preset Shunt Route support).
- Train Describer (tracking an ID with trains using track circuit and signalling data).
- Pocket PC version of Client application available to enable wireless, handheld operation – ideal for shunting with!

Future Possibilities

- Full Sectional Route Release and Point locking.
- Limited Automatic Route Setting to allow pre-defined operating scenarios.
- Revised Graphics Set to allow Panel Style Indications and/or Mechanical Signals.
- Automatic Train Control utilising Train Describer and existing signalling data to evaluate target speeds and transmit them to trains via a DCC command station.
- **I'm open to suggestions! If it is going to be used and is feasible, I'll consider it.**

Hardware Requirements

The hardware requirements are fairly high, reflecting the powerful nature of the application and the modern development environment used. The limitation is on the requirement to install the Microsoft .NET Framework runtime. This is free, and links to the relevant installers on the Microsoft Website are on my site.

- 133MHz Intel Pentium or AMD Opertron, Athlon64 or better.
- 128MB RAM.
- 150MB Hard Disk space (including 40Mb during installation only).
- 800 x 600 screen resolution, 256 colour graphics.
- Mouse or compatible pointing device.
- MS Windows XP, 2000 SP 4, ME, 98, NT4: SP 6a or Server 2003 operating system.

Experience has shown that the MRCCC application works best on a faster PC (2GHz or above with 256MB RAM) especially when a large layout is being operated at speed. Slower PCs, providing they can handle the .NET framework, are more than adequate for data preparation or use as MRCCC Clients.

The software supports up to 1280x1024 resolution layouts. It is easier to run layouts that fit wholly on the screen without having to scroll.

Obtaining the Software

To obtain the software, please visit my Website at http://www.bwwmrc.co.uk/mrccc or contact me by e-mail or at MERG meetings. Alternatively, I can supply the software on CD complete with the Microsoft .NET Framework components for the cost of postage and provision of a blank CD-R. Feel free to e-mail me through my Website for support. A sample layout in the form of Horton is supplied as part of the installation.

Disclaimer

I appreciate there is much more to railway signalling than that in this Bulletin. This is only intended to explain the basics to members not familiar with the terminology to assist them with planning their model signalling and applying MRCCC. I have of course made a number of simplifications, but if you realise this, you already know what you need to for MRCCC.

Modes of Operation

MRCCC has three distinct modes of operation:-

1. **Design Mode** allows the user to create and modify the track and signalling layout and interlocking conditions. Full validation is carried out at each step and errors reported to the user. Refer to TB G16/86 for Design Tips and the best place to start. MRCCC always starts up and closes from design mode (on exit, the mode change will be automatic if required).

   You cannot enter Test or Operate Mode if errors exist in the layout data. Use Interlocking Menu – Check Data if you find the Test and Operate Mode options are disabled on the Mode Menu.

2. **Test Mode** allows you to simulate the inputs of the layout. You can set Routes and operate the signalling as you would in operate mode and the interlocking will respond accordingly. You can simulate inputs by clicking on the elements – this includes track circuits by clicking on the Track Section devices created in Design Mode.

3. **Operate Mode** allows the user to control the layout. After selecting the Mode, choose the COM Port the layout is connected to and you are in control. It may take a few seconds for the layout states to update the display.

Main Screen

Everything is carried out using the Main Screen with dialogs to configure as required (see Fig. 1).
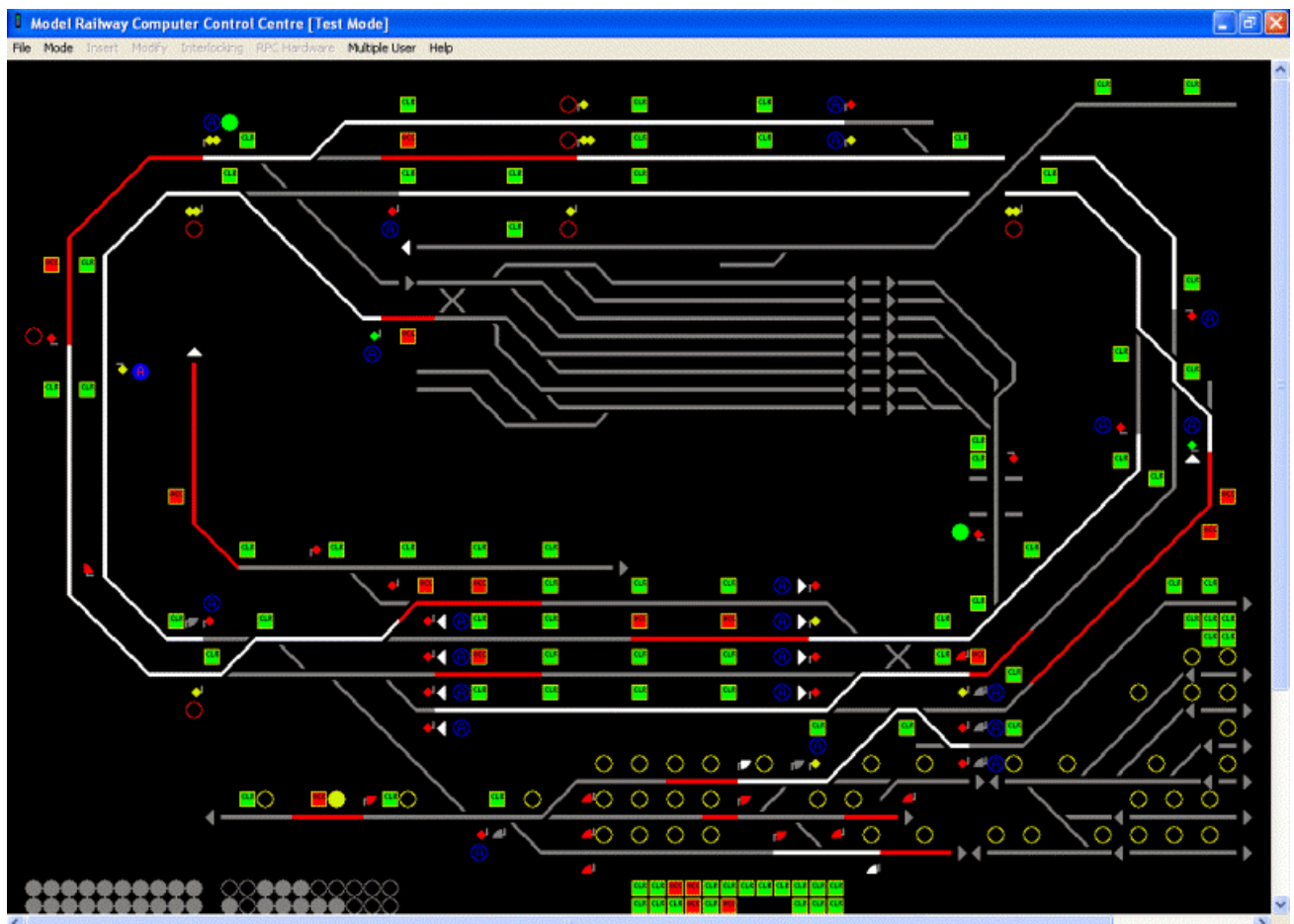

Fig.1. Main Screen in Test Mode

Each device is referenced to a position on the screen that is split into 16x16 pixel cells up to a maximum size of 1280x1024 (80 x 64 cells). If the screen resolution is smaller, scroll bars are provided but operability is reduced. The design of a complex 32'x10' 'OO' layout, Horton fits comfortably. The only items not referenced to a position on the grid are the RPC module configuration (where users enter the modules they have available) and the Routes Table.

Sample Screen Shots

Point (turnout) form

Signal form

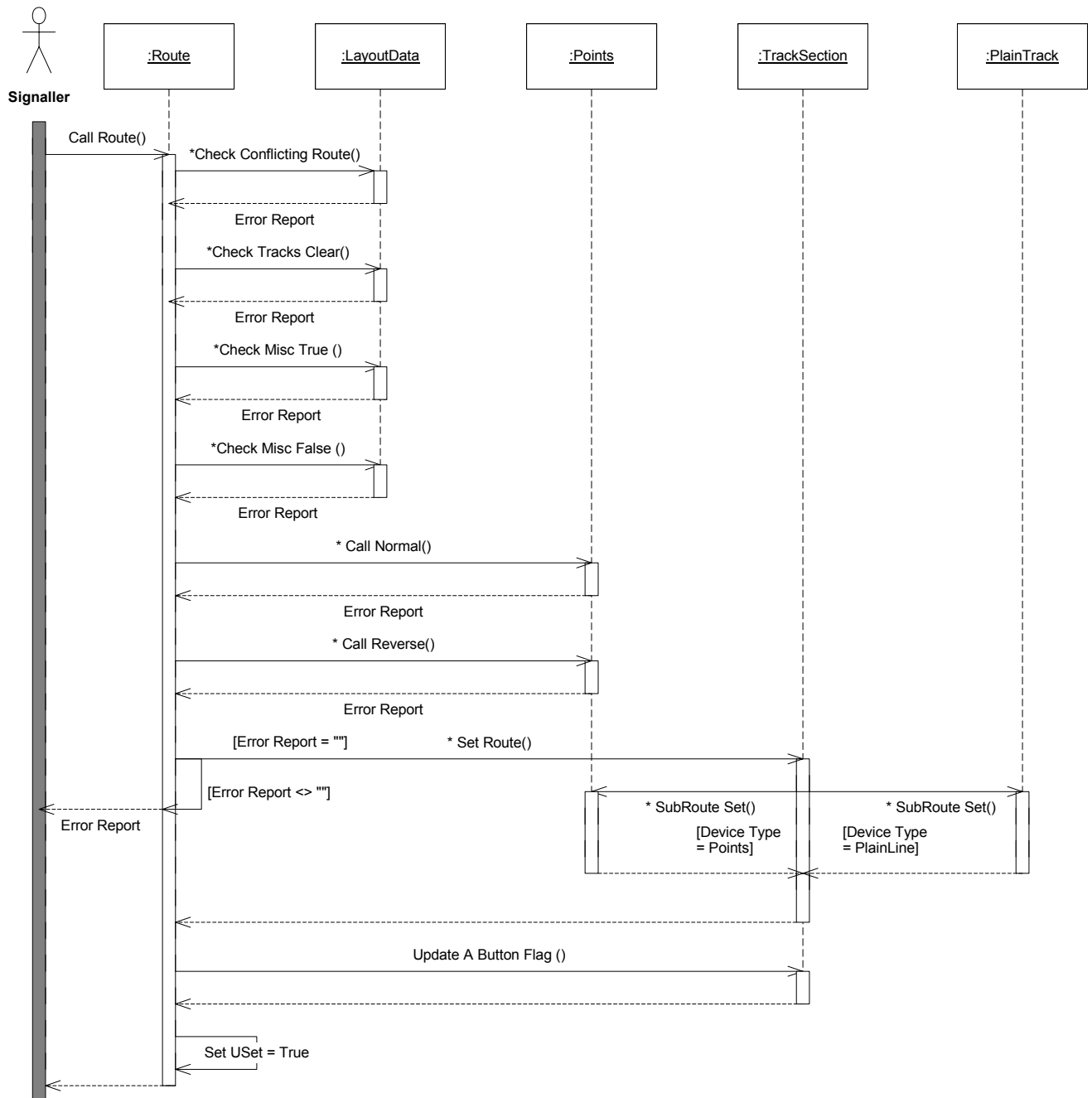**Aspect conditions form**

Route form

Routes

Routes underpin the interlocking that MRCCC implements. A Route is the path from one signal to the next on a given path; not necessarily Station A to Station B but signal to signal.

The Routes dialog consists of a list of points to move for the Route, together with track circuits that must be proved clear, and importantly, a list of all other Routes which conflict with this one. The software ensures that if Route 1 conflicts with Route 2, then Route 2 must conflict with Route 1. Once the Route is set, white lights illuminate on the screen along the path and signals reference the Routes which allow them to clear to better than red.

Sample Logic for Route Setting

The following UML (Unified Modelling Language) extract demonstrates the Route setting logic used by the software:-

Route Release

Routes in MRCCC release in three ways:-

1. **Train Operated Route Release (TORR)**

   As trains traverse the Route, the Route lights clear behind the train. This occurs unless the Auto Button has been operated. In this case, the Route from the signal in question would not release and once the tracks were clear, the signal would clear to a proceed aspect again, allowing a further train (or perhaps the same one on a circular layout) to take the same Route without further operator action. Due to sectional Route locking not being implemented, the Route remains locked until the train clears the last track in the Route or one of the following two options occur. With a model railway with faster trains and compressed track layouts, a train will clear a Route much faster than in reality, and the additional operational flexibility of sectional Route release wouldn't warrant the additional logic! Perhaps more importantly, this simplification allows the interlocking to be developed by modellers with less detailed knowledge of railway signalling – this was an important factor in the design.
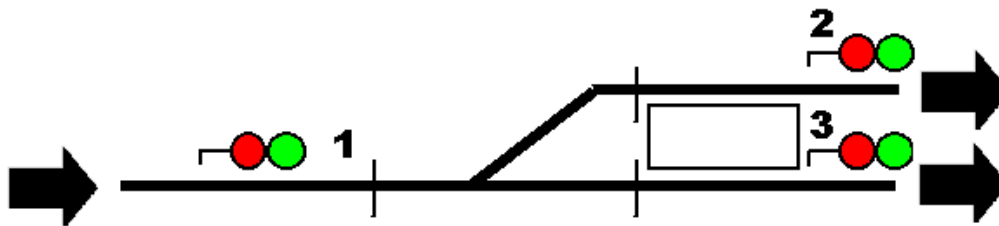
2. **Route Cancel**

   The operator can cancel any Route at any time by right clicking the entrance signal. This is the VDU equivalent of 'pulling up' a Route with the entrance button on an N-X (Entrance-Exit) panel. Unlike a real interlocking, approach release is not provided (our trains generally stop as soon as you remove the power), and as such you do not have to wait for the locking to time off before re-routing your train or setting another Route over the junction.

3. **'Early Release'**

   This is an MRCCC feature to compensate for the lack of sectional Route release and provide most of the benefit that modellers need in a simpler format.

   Consider the layout below:-

   The train enters the loop and comes to a stand at the platform. The Route would not release until the train has occupied and cleared every section, including the track in the platform, as the Route has proved the line clear to the next signal, 2. However, if the train is now to wait and be overtaken, the Route would remain locked and the Route past the train via the main line would be locked. As a result, MRCCC allows an 'Early Release' to be configured to release the Route early on occupation or clearance of a track section. In this case, when the train clears the track section on the point, this track section clearing could be configured to release the Route, allowing the second train to pass by.

Multi-User (Networking) Support

Having operated Horton at exhibitions, it became apparent that there was a need on complex layouts to devolve some control to other operators. In our case, the yard shunting was being hampered by the fact that the main panel was so busy with the mainline that requests for points and shunt signals to be operated for shunting were getting ignored. We also found that it was useful for the public to be given a better view of the operating screen to appreciate what the PC was doing and to add interest.

As a result, further development work was undertaken to create a Client version of MRCCC known as MRCCC Workstation. The normal application is run on a single PC that connects to the RPC system and on which design, test and operation are carried out. However, in Test or Operate modes, PCs connected to the MRCCC Server by a standard Windows LAN (either wired or wireless), can connect to the MRCCC Server. The MRCCC Server then sends every screen change to connected Clients, ensuring their screens are identical to the Servers. The Clients can operate the layout as they would on the Server PC and their requests are transmitted to the Server to queue and action. Any feedback messages are routed back to the originating Client.

The Client has two modes: a Signaller Mode that operates as described, and also a Supervisor Mode in which user actions are ignored. This is provided to drive additional displays to the public. In theory the client could connect across the Internet to control the layout, although whether this is of any practical benefit is questionable!

A further development which is planned (to aid our shunter) is the porting of the Client application to the Pocket PC platform to allow wireless, handheld control of the layout on PDAs communicating over a Wireless LAN with the Server. This could be used to allow drivers to set their own Routes and dispense with the signaller if this method of operation was required.

Advice

For the most accurate representation of the signallers display, realistic operation and the best operational performance, the layout must be provided with sufficient track circuits for the track layout. Saving a few pounds on less wire and modules could really restrict operations once you apply a proper signalling interlocking. Read up on the theory, get an expert in or study real signalling plans for how to position section breaks.

A list of references and suggested reading is shown overleaf.

Acknowledgments

MRCCC wouldn't be possible without Gordon Hopkins whose excellent RPC hardware system allows the PC to communicate with the layout. Gordon's help and advice have been essential.

Graham Plowman's Solid State Interlocker (SSI) showed what could be done with computer control, proved all my hardware and gave me the idea of using three modes of operation.

The Beckenham and West Wickham MRC for allowing me to develop Horton with RPC and computer control.

GE Transportation for providing me with access to many real signalling centres and technical standards together with professional signalling training.

References and suggested reading

Websites:-

Beckenham and West Wickham Model Railway Club
  http://www.bwwmrc.org.uk

FreeVBCode.com – Code samples and VB.NET RS232 Interface
  http://www.freevbcode.com

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Visual Basic .NET Serialization Handbook
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