Signal Project

Overview

The signal system proposed will offer the dispatcher and train crews a measure of traffic control and safety. For the dispatcher the system offers monitoring of block occupancy and control of main line turnouts and signals. For the train crews it offers trackside signals for heads-up events. Our implementation will operate similar to the prototype in many ways but cannot exactly duplicate a prototype system. With this in mind, we will expect certain compromises and adapt our operating rules accordingly.

The members of the Signal Committee are Chairman Larry Denton, Signal Design & Construction Kevin Slade and System Engineer Smitty Nash.

Larry Denton's role is to mediate the committee's findings and bring them into the club as policies and recommendations. He is responsible for the operation of the signal system and the planning on how it is supposed to work as well as documenting the signal operations from the dispatcher's chair.

Kevin Slade's duties are to standardize the signal design. He is also in charge of standardizing the parts used in the construction as well as documenting the construction process.

Smitty Nash is charged with designing and building the control system to drive signals, control turnouts and detect trains using the input from Larry's operational plan and Kevin's signal designs. He is also to document the control systems and connections.

Nomenclature: A section of track between two signals is called a signal block. A block name can contain many signal blocks.

Phase I

Research

Choosing which system to use was derived from three main points.

- Operations and appearance
- Complexity of installation and maintenance
- Cost

Operations and appearance are important to the members for two reasons. First, it provides increased animation to the public's eye during open houses. Second, it increases realism when operating trains. Semaphore or lighted signals are available in almost any system allowing the most visually animated aspect of signaling to visitors and crews. The condition was it had to operate in an automated mode during open house without a dispatcher to set the signals and route trains. Control via LocoNet was optional but could be a dependency depending on the system chosen.

Complexity of the installation and maintenance of the system ranked number 2 simply because the finished product is what everyone will see thus the operational appearance at the top. Operational considerations determine how complex a system will be and determine the level of maintenance competency and frequency required for successful continued operations. After all, those who installed it may not be around when it needs repair. Signals and semaphores can also be handmade or purchased ready to install.

Cost was last as any signal system can be expensive. Time can be used to spread an expensive system across fiscal budget years to make the system more palatable. However, it can not be overstated you get what you pay for. Cheap parts or signal controls yield higher maintenance time and repair/replacement costs and in some cases a steeper or longer learning curve. How often do you want to repair a cheap system?

Phase II

Planning

Once the considerations were evaluated, Digitrax won out based on its simplified architecture. Both systems integrated with LocoNet and Team Digital's SIC24 will interface with the Digitrax SE8C to send it block occupancy messages with its own built in occupancy detection inputs. The architecture of the SIC-24 was more complex and offered fewer signal drivers per controller. The induction type current sensing block occupancy detectors available to trigger the block occupancy on the SE8C could not be used directly. This led to using a bank of relays to trigger the SE8C. Part for part, the SE8C has more features rolled into the one board that solved various problems at the outset.

To simplify the startup of developing a completely new signal system for the layout, the RV block was chosen as the starting point. It is a simple single main line with a single siding and a lot of traffic similar to the single main in the Austinville block with two sidings. Second, it will provide a live laboratory environment to develop procedures, techniques and policies that will be used to install other sections of the signal system.

Wiring isn't the only aspect that must be defined. Programming and control are two very important parts to make it come together. Once wired, it has to be programmed. Proper documentation for each connection and CV value is critical. After RV is certified, installation can spread from the RV block in both directions but how will it be accessed? A signal board addressing map will accompany the documentation for programming and troubleshooting. It will contain the address of the SE8C and associated signal number. A column for switch numbers will also make identification of the signal/switch relationship much easier.

Phase III

Infrastructure

Signals are nothing without the controls, so too are controls without signals. The infrastructure consists of the signal masts, dwarfs and switch control, any feedback hardware and of course the cables that connect everything. External switch controls and motor controls for switch machines are accessories. The signals will be installed to report block occupancy and react to switch position. This will communicate to the dispatcher and train crews a more realistic sense of what is ahead of a train.

Remember, a signal block is defined as the application of the signal system to the section of track between two turnouts or signals. A block name is defined as a group of signal blocks. This is important to note as the term "block" is not interchangeable. Thus it requires the use of either the prefix "signal" or "name" to properly identify the context of the word.

Phase IV

Control

The fourth phase consists of the signal controller and DCC power distribution. The rewiring of the block-name will have taken place by now along with installation of any PM4s and block detectors.

What is left is the signal control system itself. The SE8C has eight signal drivers or plants. So each SE8C can control four signal heads per driver or plant. The RV block uses five drivers or plants so only one signal controller is required. This leaves the extra plants for expansion such as a signal for a diamond.

Once the wiring is complete the programming takes over control of the system. A computer has been procured for this purpose. It will be configured for use as the control point of the signal system. The dispatcher will monitor blocks and operate main line switches and signals. Remote operation of trains is not practical without some kind of train reporting or transponder system and will not be implemented.

Milestones
December 2006
Signaling for RV was installed by Christmas of 2006 but wiring issues prevented it from working properly. A fix was found and the signals are working properly.

2007
Kingsport and half of Bessemer are completely signaled with two turnouts in RV and one in Kingsport having been motorized in a period of about ten months throughout 2007 due to availability of Smitty's time.

2008
January
Fontana is going through some track plan changes and a new detection system is being installed and tested. Once the new detection system is bug-free, work can commence at a much faster pace. Bessemer experienced some turnout trouble prompting an unplanned early start to the replacement of Seymour. Bessemer's track plan was changed as replacing one switch would have been more work than to reconfigure the track plan. Two crossovers were removed and track 2 is now a siding. Detection was already in place for tracks 1 and 2 so no changes are needed here. Additional detection will be needed and the signals installed by end of March.