ATLplus, the sonorous engine decoders

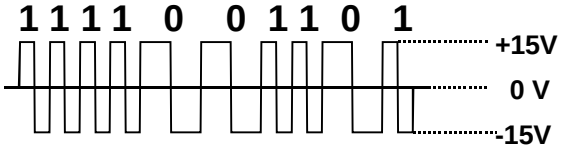
Introduction

The digital technology is replacing step by step the older analog solutions. This is valid for model railroads, too. The achievable functionality is impressing. All the same, many model railroaders have a bad feeling thinking on a replacement of their old good regulators by a personal computer. And how can 100 or even 10'000 addresses be an advantage, if nobody is able to control more than two or three trains simultaneously? The following article describes, how you can profit all the same from a digital control without loosing survey and contrarily having a lot of fun.

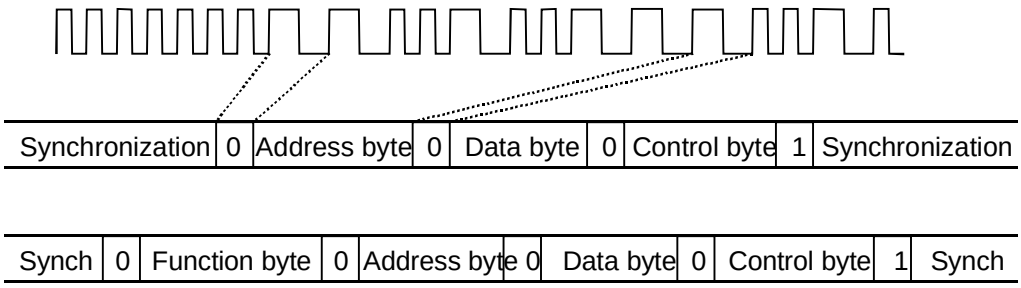
Standardization by NMRA

Standardizations are a nice tool allowing users to combine products of different manufacturers and extending the suitable assortment considerably. The fixed gauges (N, H0, 0, etc.) are a good exemple. Some years ago the model railroad suppliers even agreed on a common platform for a power bus (power supply with integrated remote control), which is now adopted by nearly all manufacturers worldwide. Unfortunately not all! Maerklin and Fleischmann still keep to their own proprietary protocols. The Maerklin solution was in fact the first digital control using the so called Motorola protocol, but there are some substantial disadvantages. All the same, Maerklin has a huge patronage, which leads to a de facto standardization, but restricting customers widely to Maerklin models .

All the other manufacturers however conform more and more to the international NMRA rules (National Model Railroader Association). In this case no single supplier dictates, what a customer has to buy and where. A very flexible remote protocol, which is the power supply at the same time, allows the comprehensing control and programming of engines, points (switches), signals, etc. with so called digital telegrams. A singular central unit and one or more signal amplifiers (boosters) are feeding the tracks. The polarity is no consideration at all and the digital voltage is symmetric, i.e. the positive and negative power pulses are balanced. Such a protocol is also the premise for the ATLplus system described from now on.



The NMRA power bus



The NMRA telegrams

Signal controlled trains

Digital installations are basically remote controls allowing to drive trains very realistically. This includes continuous acceleration and desceleration, adjustment of top speed and mass simulation.

Considering the fact that the simultaneous control of more than two or three engines is a hopeless undertaking (but with PC), it is reasonable to influence trains by signals most of the time. To get a train stopped in front of a red signal means to put somehow the signal information on the track in front of the signal. And that is exactly the weak point of nearly all available digital systems. Without having regard to just cutting the current with emergency stop and lights off (real passengers would kill you ...) there are three ways to get out of this:

- Special brake telegram by brake signal generator
- Continuous current instead of digital signal
- Marking of the digital signal (without changing the content of the telegrams)

All versions allow the smooth braking and acceleration, because there is always current available. All the same, there are significant differences.

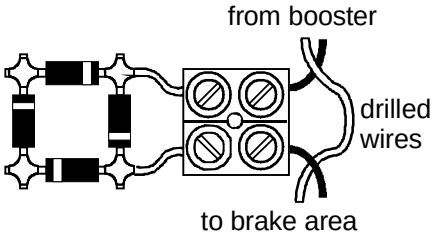
In the first case (e.g. Lenz DIGITALplus) you need at least one brake generator (kind of a little central unit with fixed telegrams), followed by one or more amplifiers, being a quite expensive solution. Moreover the signals must have change over switches. Trains passing the interrupted rails cause short circuits, which can properly be avoided with complex relay circuits only. Being a very annoying disadvantage trains cannot be controlled in front of red signals any more. Shunting drives are impossible therefore. Rather an impertinence than a solution, but working with all decoders.

In the second case the brake area gets its digital supply voltage across a diode, which makes the decoder brake. This avoids the problem with the short circuits, but introduces a new one: Because only half of the supply voltage is available now, braking of heavy trains could become a problem. Moreover decoders react dependent from the polarity and will stop just in one direction.

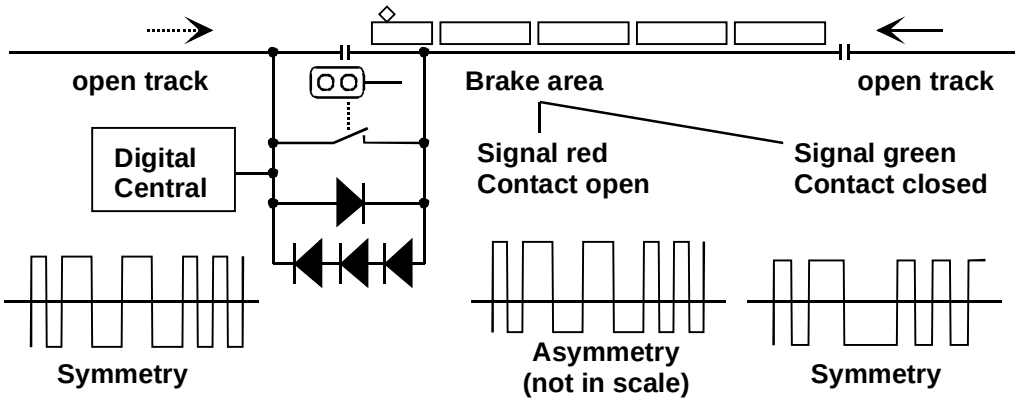
In the third case there are two systems available today. ZIMO offers a digital signal with short interruptions to mark a braking area, while ATLplus operates with a slightly shifted supply voltage using four cheap diodes. Both solutions need special engine decoders providing more or less the same result: a perfect control of every engine including shunting. Each engine can be switched between signal and remote control at any time. But only ATLplus does it at nearly zero costs on the infrastructure side.

The ATLplus system

In this system, that is set up with any digital central unit at NMRA standard and special engine modules, the brake area is marked with a slightly asymmetric supply voltage. Because there is a symmetric signal on the open track by the NMRA definition, the engine module may discriminate very easily an open track from a brake area. To provide this asymmetry we need only four simple diodes, soldered to a ring. Such diode packets are installed into the feeder line of every brake area (e.g. in parallel to the signal contacts), simplest with a two pole screw joint.



Wiring of brake diodes



Signal wiring with ATLplus

Due to the voltage drop and the different number of diodes in each current direction the digital voltage is slightly shifted automatically. Nevertheless, the telegram content is not affected at all. Therefore the remote access is always possible, even at closed signals.

To get the train depart it is sufficient to connect the brake area via signal contact with the open track. This is the same as the conventional installations with current interruptable areas in front of signals. The signal contact bridges at green the diode packet, whereby the supply voltage gets symmetric again. This makes believe, that a change from conventional installations to digital ATLplus is very simple and that existing relay controls can be adopted.

A very nice feature of this system is the symmetry of the brake area. Trains will stop inside the brake area in both directions without any switching. The polarity of voltage shift is no consideration. Signals with their contacts can be installed at both ends of the brake area, whereas the contacts "in the wrong direction" have to be open. For each brake area only one diode packet is needed.

Of course, to make this all working, special engine modules with the ATLplus functionality are necessary. Such units are offered from the companies *UMELEC* Engineering and ITELEC AG in Switzerland. The ATL principle, originally invented on alternate current base in 1983, was not patented on purpose, therefore it is open to other manufacturers, too. Possibly it will be introduced in the NMRA standardization.

The ATLplus principle can be combined with every NMRA compatible central unit. The parallel use of decoders from other manufacturers is possible without problems, though these do not react on brake diodes and go on telecontrolled. It is recommended to use such decoders already bought for shunting engines, which do not circulate in signal mode in general. Unfortunately a combination with the Maerklin system is not possible due to the lack of tele-

gram symmetry there. Central units capable to send out both formats must not send out other than NMRA compatible addresses, when diode brake areas are used.

Operation modes à la carte

Basically the ATLplus modules have two operation modes: signal or remote controlled. The mode is remotely selected using the function 0 resp. the headlights control button on the control box. Because the remote control is always and everywhere operative, the change of mode is possible at any time, for engines stopped or at any speed. In fact only that way real operation concepts are possible without a PC.

As an exemple, trains are generally circulating on a circular track with automatically operated signal blocks. If you find the time, you take over a train by addressing it and switch to remote control by button 0. You may do this at standstill or in full speed. Now it's up to you to drive the train, brake and stop it in front of red signals and then depart again. If the train enters a tunnel, just switch back to signal control and forget it. In the shunting yard a lot of remote controlled machines are waiting for you, the shunting master.

Another operation mode is a remote controlled station inserted in an automized circular track. There you take over a train as soon as it arrives at the stations entrance signal and drive it with varying speed via switches and platform to the red signal. You may depart manually or automatically as soon as the signal gets green again. In the meantime other trains wait for your attendance.

Another very interesting application is a header station. Let a train come in from the automatic circle and it will stop automatically near the end of the track. Switch to remote control and make the engine advance a little bit with uncoupling the waggons however. Then get a remote controlled engine from the shunting yard, move it to the new front end of the train and couple them. After heading change switch this engine to signal mode. It will leave the station as soon as the signal goes green. Now you just have to move the other engine back to the yard. A lot of railroad feeling is granted!

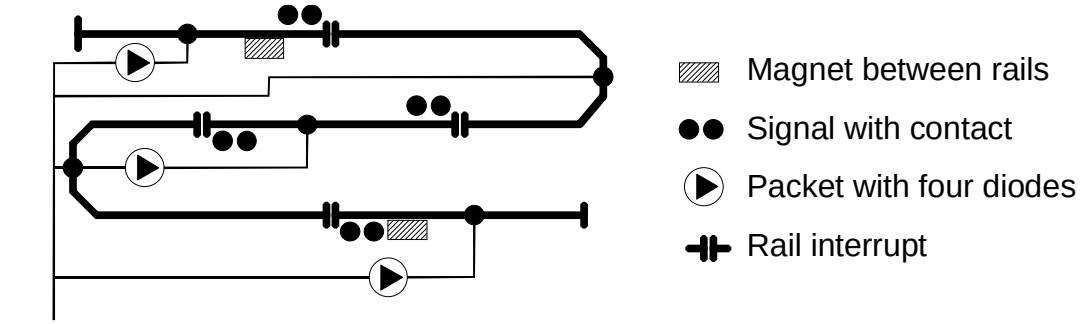
Shuttle operation

Automatic shuttle operation with digital controls is much more complex than with analog circuits, because the heading of an engine is defined by the centres telegram. If an engine has to be inversed at the end of a shuttle track automatically, an enormous effort is needed: quite a lot of rail contacts, interface and PC with corresponding software. This will inhibit most of the interested railroaders.

Unbelievable, but true: the ATLplus engine modules include this functionality. Of course, also the ATLplus modules have to take over the heading informations from the centre, in remote, but also in signal controlled mode. But it is possible to program any module to shuttle mode. From now on the heading is dependent from the centre only in remote mode. In signal mode the engine keeps control on the heading by itself. To toggle the direction, only a small Reed contact must be installed at the bottom of the engine and be connected to the module. Now the direction can easily be toggled with a magnet near to the contact (supply must be on). The heading remains stored, also at power-off. Automatic shuttling is now very easy.

At both ends of the track a magnet is put between the rails inside the brake area. When the engine is braking and passes the magnet, the module just stores the toggle command, but goes on braking the same way, until the engine has stopped. Now the toggle command is executed. The train will leave only when the signal is set to green again. That's simple, low cost, perfect!

It is no problem to insert station holds and take over resp. crossing areas with diodes in the track between. As long as the braking engine does not encounter magnets, it will stop and depart again without direction change. A typical narrow gauge mountain train can therefore easily be operated. Of course, each shuttle engine can be taken back to remote control at any time, for anticipated direction changes, e.g. If at a switch back to remote control the real direction does not coincidence with the controllers direction, a harmless emergency stop occurs. Therefore shuttling with ATLplus is very easy to handle.



Shuttle installation with ATLplus

Additional ATLplus functions

The ATLplus modules which are named intentionally not only decoders due to their wide functionality, offer still some other interesting features, which are described shortly as follows. For detailled information a system handbook is available.

On installations with many trains controlled by signals an automatic speed regulation is a must. Therefore all the ATLplus modules offer speed control. One version operates with EMF (electro motive force) measurement, as other manufacturers offer, too. On the other hand there are special ATLplus modules with infrared reflector barrier. These are needed for AC motors (Maerklin, HAG, Hermann, etc.). Indeed, the assembly asks for some more skills than the EMF solution.

The speed control together with the programmable top speed and brake rate in signal mode result in another, most welcome effect: the stop position of a braking engine always remains the same. Therefore it is possible to operate quite long trains without the annoying blocking of switches and signal blocks over and over again.

Moreover, the ATLplus modules offer an integrated sound generation! On one hand there is a remarkable steam puffing, which can be converted by configuration to a rumbling Diesel sound. Notabene, these sounds are provided from the module itself and do not need separate generators. Nevertheless, a small amplifier is needed to drive the loudspeaker.

Steam exhaust is dependent from speed and is synchronized to wheel rotations by programming. That is almost perfect with the light barrier module, but also quite good with EMF measuring modules. Most interesting: when the engine is braking, the exhaust is stopped and only a low fizzling is heard as at standstill. It is in fact a nonsense, that a braking steam engine exhausts with full power, until it stops, as separate sound generators do. The Diesel sound goes to max. speed in some steps and falls back to idle sound, when the engine brakes. Very attractive!

Moreover a train whistle is programmable and controlled by function button 3 or optionally via Reed contact (track dependent triggering with magnets). The preprogrammed 3-tone horn is

quite good, meanwhile one tone whistles sound rather synthetically. Here the limits of the used microprocessor get audible. But a DSP (digital signal processor) would drive the module price significantly higher, whereas the ATLplus solution may be called really balanced.

By the way a new separate whistle module will be available from *UMELEC* Engineering, which allows to record and replay real whistle sequences from an audio or video tape. Some problems with volume have still to be solved. Interested people should ask *UMELEC* directly.

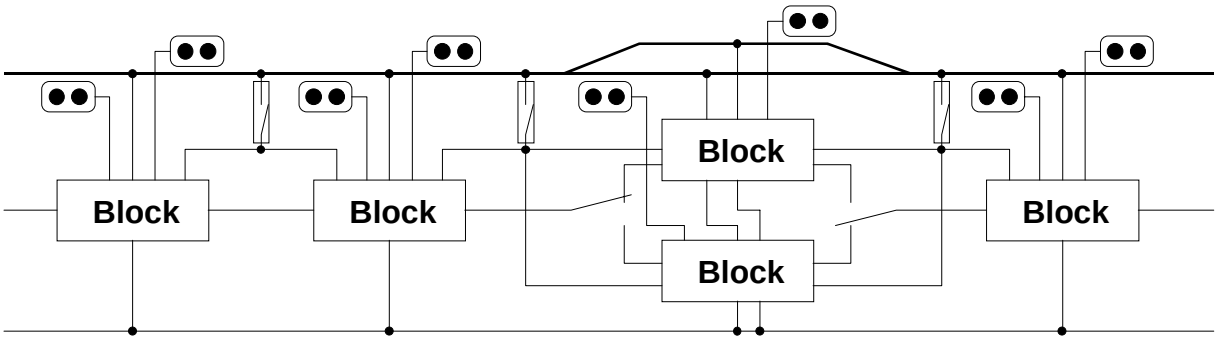
With regard to additional functions the user of ATLplus modules is served at best, too. Apart from the whistle on F3 the engine may be switched off by F4. This main switch turns off the lights and sound (idling Diesel!). Drive commands are without effect. The functions F1 and F2 can be taken from the module and may drive train illumination, clutches, smoke generators, etc. They may be assigned to every function bit from the centre i.e. the controller buttons. Most interesting for US engine drivers: these outputs may be coupled to a programmable flashing/blinking generator!

ATLplus modules, which can deliver up to 1.5 A, are quite small (25 x 12 x 5 mm) and may be installed from H0m (BEMO) upwards. For 0 and larger gauges bigger modules for 3A and 6A are available. More informations are available directly from *UMELEC* Engineering.

The future with ATLplus

The described ATLplus principle with digital central unit, intelligent engine modules and diode brake areas solves already a lot of important requirements at lowest costs. All the same, we invested some brainstorming how to get another big step nearer to realism. In doing so we found a very interesting comprehensive concept. Let's call it the ATLplus three layer model. As a definition, what we have described up to here, belongs to layer one.

For the second layer we need another element, namely the digital signal block. This provides in a simple manner the security of trains and drives the signal lamps. For each block on your installation one module is needed (including station tracks).



Wiring of digital signal block

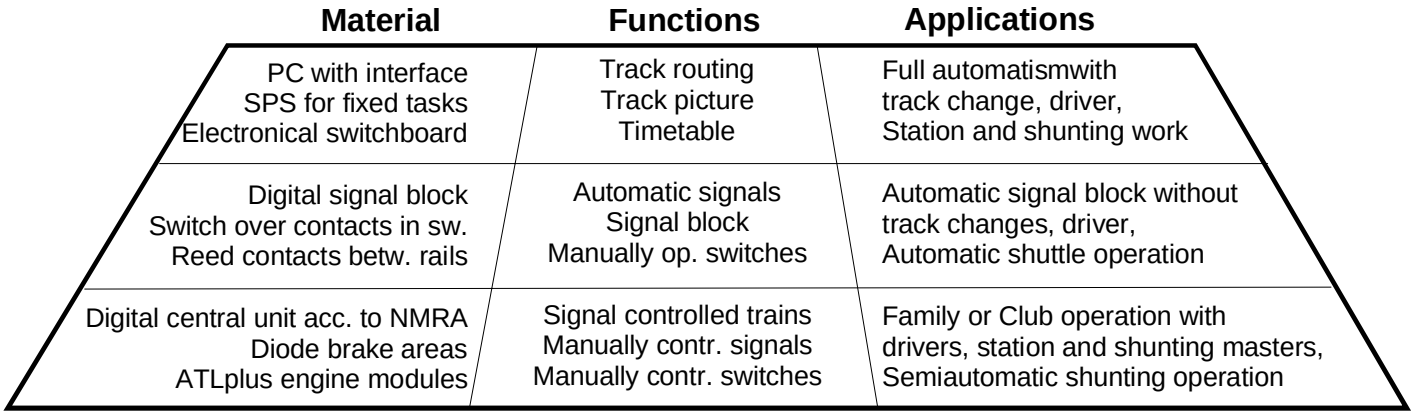
The following functions are covered with it:

- Fully compatible to NMRA control systems
- Integrated brake area control
- Remote control by manual controller for occupation, reset, anticipated green, etc.
- Fully automatic track survey, independent from PC
- Status: free, reserved, occupied, controlled by counter, driven by Reed contacts
- Vehicle or wheel counter (Reed or light barrier)
- Works in both directions
- Minimal wiring, 1 switch over needed for each branching

- Control of signal lamps or LEDs in both directions
- Dazzling change from red to green and vice versa
- Programmable waiting time for station blocks
- Drive-in command function, directed, for station entrance blocks
- Shuttle function, with waiting time

The digital signal block is actually in development and will be available from March 2000. Prototypes have been shown at the exhibition in Lucerne 1999. We will tell you the details in another article coming soon.

Finally the third layer deals with switch control (i.e. track routing) and time. Here you have the choice: manual control of each switch, diode matrices for fixed routes, electronically programmable switch controllers (e.g. LW100 from Lenz), track picture desk and as highlight, PC-controlled track display with touch-screen interoperation and timetable programming. And because todays managers need always pyramides for explanations .... here we go!



ATLplus 3-layer pyramide

Did you realise? Only in the third layer computers are mentionned. There is a good reason for. If all the subsidiary functions as acceleration, braking, track security, reading of track contacts, lamp control, etc. are transferred to the computer, the poor machine will break down in shortest time. That is the bad experience of many PC-freaks controlling more than two or three trains. By delegating such functions as far as possible to lower layers (i.e. engine module, block module), the danger of loosing control is reduced to a minimum. Now the PC can do things, it is predestinated for (e.g. track routing with screen display, control of underground stations, timetable dependent operation).

Let's explain this by an exemple. If you read the train positions by Reed contacts, each contact must be scanned once in a period of 10 ms. Having 100 contacts on an installation (rather realistic), driving 10 trains by acceleration and desceleration, controlling 30 signals and operating 20 switches, the collapse is preprogrammed. May be it's not the PC and its program, but the interface will do it for sure being the real bottleneck. Our three layer model bypasses all these problems with elegance. Moreover, each user decides himself, how far he wants to go realising the pyramide. Already the lowest layer offers most attractive conditions to drive trains with a lot of pleasure. And that's the essential!

If you would like to know more about ATLplus, read our information about the digital block provided in a short time and/or contact *UMELEC* Engineering directly to get the system handbook. We are on the WEB with our own homepage www.netwings.ch/umelec and can be reached by email, too: umelec@netwings.ch