märklin
digital

Entrance into Märklin Digital

the multi-train control system

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INTRODUCTION

What do you have from this book?
This book would like to help you to find a simple entrance into the world of the digital model path control. It addresses itself both at new risers and to „gestandene" model railroaders, which possess perhaps already for a long time a conventional model layout.

The book wants to show both groups of readers, how simple the structure and the operation of a Märklin digital layout is. It is to still possible to take an old model layout hare existing fears of contact and reservations against the new technology.

In beginners shows it „Train around course" the various possibilities of Märklin digital and DELTA. Straight one for a beginner was developed some time ago the DELTA Mehrzugsteuerung, which one can regard as the „smaller brother"of the digital-Systems. Therefore in this book, apart from the digital-System, also Märklin DELTA is in detail treated with all its components and possibilities. Many additional tips and reference offer in addition, eingefleischten digital fan new information and background. This book is to on the other hand also be on the one hand „Reading book ", „Nachschlagewerk ". Perhaps it can accompany you in such a way with your model course he career from the first steps - e.g. with an entrance packing - up to a large layout, which exhausts the possibilities of Märklin digital fully. In order to become fair also all a risers without technical or modellbahnerische previous knowledge, the front chapters begin consciously very simply and descriptive. In the further chapters for each digital equipment application type, connection and operation are then treated in detail.

You find a connection design, which was drawn as realistically as possible general for each individual equipment.

Arrangement
The book is arranged into three large parts, which are numbered with Roman numbers. Each of the three parts consists of several main chapters. The main chapters are sequentially consecutively numbered with Arabic numerals.

Part 1: Märklin digital - entering and driving
This part offers the entrance and the bases of the digital model path control. After the conception of the main advantages of a digital layout you can, if you want, a little over background yourselves of Märklin digital to inform. In a further main chapter it concerns then the concrete structure and the wiring of digital model railway facilities.

Part II: Everything over DELTA and digital devices
In this extensive part you become acquainted with all current devices of the DELTA and digital-Systems in detail. They find the correct connection, references to the operation and attitude and many tips approximately for each equipment around the model railway company. Therefore this part is reader and reference book at the same time.

Part III: Overviews and tables
This part is mainly meant as reference book. They do not only find here in clear tables all current digital and DELTA devices, but even all today no more did not produce Märklin of digital devices, for all track widths and track systems. The last chapter finally contains the address coding tables for all digital decoders and other devices. In addition you find to lists with the factory-installed stopped addresses of all until 1994 delivered digital here and DELTA Lokomotiven.

Guideline assistance
So that you get along easily in the book, there is to it some guideline assistance:
At the beginning of each main chapter you find a short summary of the main contents, so that you can decide quickly whether the chapter for you is for the moment interesting or not. On each side there is a footing line. On the left side you find the heading of the respective main chapter here apart from the page number, on the right side the heading of the current chapter. A detailed index at the end of the book gives you quick access to all article numbers and important terms. Also all tips are there registered.

Used symbols
- The grey small box marks an enumerating.

- You see a light blue small box everywhere, where you are to implement or know an activity.

Red writing is used for important notes, which should absolutely consider you.

Grey writing unu grey ba'ken aul the left side marks against it texts, which do not have to read a risers necessarily or which background more deeply on technical are received.

PART 1.

MÄRKLIN DIGITAL – ENTERING AND DRIVING

Entering and driving - is digital really so simple? We state: yes, and which we want to show you in this book. Märklin digital simplifies the necessary technology of a model course radically and multiplies at the same time its possibilities.

In main chapter 1 therefore as introduction and motivation the main advantages are presented of Märklin digital (and/or DELTA) compared with conventional model railway facilities.

Main chapter 2 gives answers to questions often posed in connection with the digital-Sy-stem. In the first chapters the basic principles of the digital-Systems are as easily as possible explained; in last two chapters 2,8 and 2,9 probably also digital professionals find still new information.

Main chapter 2 is not an obligation reading; They can use the remaining chapters also fully if you only partly did not read main chapter 2 or.

Into main chapter 3 it goes then to practice: first it of the possibilities and stages of development are a matter from small, middle and large digital layouts.

In a further chapter you learn to measure, how much achievement your model railway facility necessarily and like you must lay your current supply out. Last chapter 3.5 shows them many cheats and tips approximately around the wiring of a model railway facility, so that you can develop your layout problem-free and more uncomplicated to maintain.

1. Which advantages does Märklin digital offer?

What do you experience in this main chapter?

In this main chapter around the comparison between conventional model railway facilities on the one hand and to DELTA and digital layouts are on the other hand. The abilities of a multi-course control system are regarded, to switching from switches and signals and possibilities of flexible mechanism circuits. Quickly the many advantages of digital and DELTA become clear. In two additional sections you receive a first overview, which devices can need or use you for „Digital driving " and/or „Digital switching ".

1.1. Courses independently from each other steer

As long as in a model railway facility only one locomotive drives, it is no matter for most Modellbahner, in which kind this is steered a locomotive: in conventional, „konventionelle" way with a driving transformer or „digital" over a digital driving desk. As soon as however a second locomotive is added, will quickly the desire awake to be able to steer locomotives independently from each other. Because for a close-to-reality enterprise of a model railway facility is a substantial condition that the locomotives can be steered independently. This should be realizable however at if possible small expenditure. This were basic conditions for the development of the Märklin Digital-Systems.

Many courses at the same time do not steer a problem with Märklin digital

Conventional layout

With a conventional model railway facility the basic principle applies: All locomotives in the same electric circuit can be steered only together in speed and driving direction. Different locomotive types drive during same attitude of the driving automatic controller driving automatic controller differently quickly (dependent on motor type and transmission of the locomotive as well as the zuggewicht). But if the driving automatic controller is more highly turned, all locomotives drive more quickly, and after switching the driving direction all locomotives are switched (if voltage supply for it is sufficient). In an electric circuit thus only a very simple multi-course enterprise can be driven, usually on two independent struggle ringstrecken. A switchyard operation is so hardly realizable.

Also on a conventional layout locomotives can be steered independently. But in addition was and is necessary substantial expenditure. Electronics engineers and Tueftler let themselves be broken in always new circuits, in order to get the problem of the multi-course control system into the grasp. Tips for the setting up of conventional model railway facilities should not be the topic of this book; for this there is already a whole number of other publications, e.g. in the Märklin magazine. The examples in the next two sections are rather Schwiengkeiten a conventional multi-course control system compared with a digital solution to point out.

With disconnectible track sections - example marshalling yard

With a conventional layout each locomotive, which is to be steered independently of others, must be in its own electric circuit. In order to realize a marshalling yard at justifiable expenditure, one makes frequently the current supply for individual track sections disconnectible. Several rangiergleise are attached thereby with a spur track each parallel to a driving transformer; the current supply can and however for each track individually with control panels 7210 or 7211 be switched off. The disadvantages of such a solution are obvious: The operator must have a very good overview of the allocation of the electric circuits, in order to be able to serve the layout as desired. Guests can hardly play along thus without training. If several locomotives are to drive at the same time, several driving trafos must be used.

With overhead line - example double traction

A further possibility for multi-course enterprise on a conventional layout offers the overhead line. Thus at least second, completely independent electric circuit can be developed, which is available for electrical locomotives however only. The overhead line must be supplied by its own driving trafo. Also the overhead line can be divided in principle into several, electrically separated sections. With the double traction two locomotives draw together a heavy course. That looks in a larger model railway facility exactly the same impressing as with the genuine model. The double traction can be realized however on a conventional layout actually only in two kinds: either with two accurately identically constructed locomotives (same engines, transmission translations resemble), which drive both in the same electric circuit. Or a locomotive is operated over the neutral conductor, the other one over the overhead line; this locomotive must be then naturally a e-Lok.

DELTA layout

The Märklin DELTA system was brought 1992 on the market and has since then large success, because DELTA makes a flexible multi-course operation possible at small expenditure. With DELTA can be independently from each other steered up to four locomotives. In contrast to a conventional layout thereby all locomotives in the same electric circuit are. However this fact makes the DELTA system enormously convenient. Also the structure and the wiring of a layout are substantially facilitated. A locomotive becomes by a small electronic package in its inside a DELTA locomotive. DELTA locomotives cannot however only be used on a DELTA layout. They drive just as problem-free on a conventional, conventionally steered layout and likewise on a digital layout. Therefore these locomotives also universal locomotives are called. The electrical achievement of the DELTA system is particularly appropriate for smaller to middle model railway facilities. If your requirements and your model course in the course of the time grow, you know with one transferred to the „grosse" digital-System almost all DELTA components within the digital-Systems further to use.

As already said, with DELTA all locomotives drive in the same electric circuit. That has a further consequence: is also only one trafo necessary and possible. Nevertheless several locomotives can be steered independently! A contradiction? No, but the operational principle of Märklin DELTA.

There are at present two groups of DELTA Geraeten, which differ in the appearance and in their operating philosophy: The blue controller „DELTA control " is attached to a conventional driving transformer (power output to 30 VA). With a switch at the DELTA control selected, speed and driving direction of the selected locomotive will become then at the driving transformer adjusted the desired locomotive.

Additionally a further locomotive can be steered independently via hand an automatic controller „DELTA pilot ".

The new, white/black „DELTA station " can be supplied alternatively by a conventional or a digital transformer (power output to 52 VA). It needs to be adjusted at least one manual control device „DELTA mobile ", at which the desired DELTA locomotive is not only selected, but also equal their driving speed and driving direction. To the DELTA station can be attached up to four DELTA mobile, therefore this system is suitable ideally for common playing of several persons. As special bite the new devices DELTA station and DELTA mobile are suitable also for operation with the large Märklin track width, Märklin 1. The new „Maxi" locomotives are already appropriate ex-factory for multi-course operation with DELTA. More exact information about characteristics and operation of the devices experiences you in main chapters of 4 „DELTA controllers ".

The many advantages of a DELTA layout lead last to only one basic consideration: If there is an DELTA execution from a certain locomotive model or a starting packing, it is hardly still meaningful to buy the conventional execution. This applies, even if you already possess a conventional layout. Because DELTA is open toward both sides: it is on the one hand addition and extension of a conventional layout, on the other hand one it is an ideal starting point for a later transition to the digital-System.

Digital layout („Digital driving ")

On a digital layout is possible for multi-course enterprise nearly without borders. Up to 80 locomotives can drive independently on the layout. In order to apply the electrical achievement necessary for it, several transformers must be naturally used. But the allocation of the layout into electrical electric circuits

no more role plays for the course enterprise (nearly). The basic principle of Märklin digital corresponds from DELTA. Each locomotive is assigned a number, the so-called locomotive address. The number of the desired locomotive is typed easily on a digital control panel, and you already steer exactly this locomotive, completely independently of where on the layout them are straight. (here we presupposed that this locomotive not already on another control panel „ called " was.) At a control panel you can use digital control panels up to 10, i.e. you can have max. 10 locomotives at the same time in the access. All further locomotives drive on than „Streckenloks " with the speed stopped last. All locomotives can be naturally affected thereby by signal stopping distances. If the speed or the driving direction of one is to be changed „Streckenlok ", it can be called at any time on any control panel. Meanwhile last the locomotive called on this control panel drives on automatically with its previous speed. With several digital control panels are also so far complicated on gave like switchyard operation or Double traction no more problem, because for the operator all locomotives are apparently in the same electric circuit.

„Digital driving " offers however still further advantages: Nearly each digital locomotive has a remote controlled capable of being activated „Zusatzfunktion ". That can be the lighting of the locomotive, a controllable TELEX coupler or the smoke generator of a steam locomotive. This auxiliary function can be switched on and off with two keys at the digital control panel at will. With digital locomotives this auxiliary function is completely independent of the driving speed. Therefore the lighting of a digital locomotive can shine also while stationary. The newer control panels have still four further keys and/or pairs of keys, with which further special functions can be switched on or off. These special functions at present mainly assigned with „Funktionsmodellen " or with locomotives of the trace 1. With these locomotives can become up to five different functions of the control panel from remote controlled, e.g. light in front and in the back, locomotive whistle, smoke generator etc.. Detailed information to the working models finds you starting from page 121.

Which equipment do you need for „Digital driving "?

First naturally at least a digital or a DELTA locomotive (with DELTA locomotives there is however no adjustable auxiliary function). Besides you need digital central processing unit, supply transformer and at least one digital control panel.
UNIT the central processing unit with a control panel in low-priced equipment is combined for some time in the CONTROL. The CONTROL UNIT is thereby the ideal basis for the start into digital operation. Additionally then only a transformer is necessary. That can be for the beginning a conventional driving trafo. If one wants to use however the efficiency the CONTROL UNIT fully, one should use the TRANSFORMER developed particularly for the digital enterprise. Thus at least four HO locomotives can drive, all at the same time in the same electric circuit on the layout. Already with this basic equipment you can attach at any time further control panels to the CONTROL UNIT.

Further locomotives or several lit train sets need naturally more current. Then you do not need a further central processing unit, but only „BOOSTER " (digital achievement amplifier) with an additional TRANSFORMER. This supplied then an own electric circuit on the layout, the controlling of a locomotive remains however independent with a digital layout completely of the organization of the electric circuits. The same locomotive can be steered always on the same (any) control panel, no matter, in which electric circuit it is straight. Additionally there can be operated track sections on the layout also still conventionally.

1.2. Switches and signals switch

The second important range of a model railway facility apart from the controlling of the locomotives is switching the switches and signals. Switches, signals, uncoupling tracks etc. are summarized frequently under the term „Magnetartikel ", because they are operated by a solenoid coil.

Conventional layout

On a conventional layout magnet articles are usually switched with the control panel 7072. Sometimes on large layouts also gleisbildstellwerke are used. From each magnet article at least two blue cables go to the control panels. In the case of larger layouts results in quickly respectable wires, which must be laid very systematically, so that one can later still find and assign an individual cable.

Frequently one would like to switch several magnet articles, at the same time e.g. the switches of a „Fahr road " or several signals of a station range. Here the possibilities of a conventional layout push quite quickly to its borders. In principle one should not at the same time switch any more than two to max. three magnet articles. Otherwise the current on contact no more could not be sufficient to a safe manipulation, above all, if under it a magnet article somewhat difficult to operate is. Hooked up magnet articles can be operated normally only together. It is only with special circuit-cheats and a still higher wiring expenditure possible individually to operate alternatively also a switch or a signal.

For special tasks (e.g. route or shade station control system) many special circuits devised, which would usually serve also their purpose quite well. In these circuits relays were usually used or in recent time also switch transistors or triac (electronic construction units for switching from current) in larger number. However all had a disadvantage these circuits: for a change of the control or the drive nearly always changes of electronics were or at least the wiring necessary. That became since the development of the Märklin of digital-Systems differently.

DELTA layout

Märklin DELTA is a pure course control system; Magnet articles are conventionally switched, independently of the DELTA system.

Digital layout („Digital switching ")

In principle the functions are to a large extent independent „Digital driving " and „Digital switching " on a layout. They can leave therefore without further the existing wiring of a conventional layout and use only digital driving. Also the reverse possibility of driving and only digitally of switching conventionally, is conceivable, is however rather rarely used. Because who became acquainted with the advantages of the digi-tal-Systems once, digital driving and digital switching will want to combine both possibilities rather surely. The expenditure for reequipping an existing layout on digitally switching is smaller, than many believe, because all magnet articles and e.g. the wiring of signal stopping distances are invariably maintained. Which changes in the main, the wiring of the magnet articles is to the control panels - and the substantially larger flexibility. With a digital layout there are no more direct interwirings between control panel and the magnet articles. Rather are the magnet articles with short

Inter-wirings attached at „ Magnet articles Decoder ". These decode the digital signals of the central processing unit and prepare them in such a way that all conventional magnet articles can be headed for. The decoders are attached only with in each case two cables to the central processing unit or a booster. Thus the wiring expenditure of a digital layout is substantially reduced at the same time and the clarity is increased. Each magnet article decoder possesses four exits for up to four magnet articles. As the different magnet articles are attached correctly, detailed topic of the main chapter is 8,4 starting from page 136.

Because the magnet articles are attached to a decoder in their proximity, also the structure of „Modulanlagen is substantially simplified ". A module layout is a layout, which can be divided without large expenditure into small „ Individual parts " (modules) to be able to transport e.g. in order the layout problem-free.

Which equipment do you need for „Digital switching "?

The basic conditions are similar as when digitally driving: Basic module of a digital layout is always the central processing unit with a supply transformer. To the central processing unit at least one digital placing desk is attached. The standard placing desk in the digital-System is the **KEYBOARD**. It contains 16 pairs of keys, thus can one with a KEYBOARD up to 16 magnet articles switch. In each case four pairs of keys of a KEYBOARDs are assigned to one decoder each **k 83** or **k 84**. A KEYBOARD with four decoders k 83 corresponds thus to four conventional control panels 7072. In addition, with the KEYBOARD decoders k 84 can be addressed. The decoder k 84 is used for switching on and off lighting, engines or disconnectible track sections. Four pairs of keys of the KEYBOARDs and a k 84 correspond to the conventional control panel 7211 in the function mode. Beside the KEYBOARD there are further digital control panels, by which digitally switching becomes only so correctly comfortable:

With the **SWITCHBOARD** quite easily a digital track picture signal tower can be developed. On a track picture signal tower the process of the tracks is to be seen, and each switch and each signal are assigned directly the appropriate placing keys and indicator lights. Often additionally still another position display for the courses is inserted. Thus the courses can be steered e.g. in a station sbereich many more directly and more easily.

The **MEMORY** is a universal „ Routes Control Panel ". A route is a succession of switching commands for magnet articles. Once entered, a whole route with a push of a button is switched automatically. But the possibilities of the MEMORY are still by far more varied.

The **INTERFACE** is the connecting link between the model railway facility and a computer. For all usual computer types comfortable programs are available, with which all shifting processes and when desired also digitally driving can part-automatically or fully automatic be steered by the computer. Also the automatic control of subranges of the layout is naturally possible. For „Selbst programmers " the INTERFACE is the linkage between the two hobbies computers and model railway.

More over all these possibilities experience you in main chapter 9.

1.3. Courses automatically steer

Conventional layout

If one steered a model railway facility for a while in hand operation, frequently the desire arises to automate shifting processes. With large layouts this is often even inevitable, because one cannot at all keep all courses at the same time in the view. During all mechanism circuits switches, by the driving locomotives or courses, are switched signals etc. as soon as the respective locomotive over-drives a certain position. For releasing the switching impulse there are different possibilities: Reed contacts, switching tracks, contact tracks.

- Reed contacts (inert gas tubing contacts): applicable for all track systems; moment contacts are applicable, thus for switching from magnet articles; can depending upon assembly the driving direction differentiate.
- Switching tracks: only for Märklin HO tracks; Moment contacts; differentiate between the driving direction.
- Contact tracks: only for Märklin HO tracks; Continuous contacts, therefore on conventional layouts not for direct switching from magnet articles applicable; do not differentiate between the driving direction.

Moreover the function and the wiring of the different signal initiators find you starting from page 57.

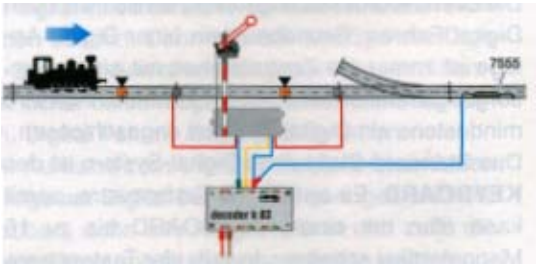
Magnet articles know both by signal initiators (switching track/reed contacts) and parallel by conventional control panels to be switched. Conventional mechanism circuits have some disadvantages in principle:

- They need a complex wiring (however admitted:
  - Draft and structure of such circuit mean a challenge, which makes already alone the model course hobby interesting) for some amateur handicraftsman.
  - More complex procedures, e.g. whole routes fully automatic to switch, often complicated electronics circuits require.
  - Changes in the expiration or at the function of the circuit require nearly always a change of the circuit or at least the wiring.
  - It is quite complex to also individually manually operate magnet articles which are merged into a conventional mechanism circuit with several magnet articles at the same time.

At all these points a digital layout brings clear advantages.

Digital layout

In the case of the conversion of a conventional layout to digital switching you know first all existing simple mechanism circuits maintained. They can be switched



simply parallel to the digital manipulation: You find this example detailed on page 148. However thereby naturally also all discussed disadvantages of conventional mechanism circuits remain existing. If switches and signals are operated by a conventional mechanism circuit, this becomes at the KEYBOARD and MEMORY does not register and not indicated.

Within the digital-Systems there are however substantially more flexible and simpler possibilities for mechanism circuits. They all use either the MEMORY or the INTERFACE, in each case in combination with one or more acknowledging modules of „Decoder s 88". To these acknowledging modules with the digital-System the different signal initiators are attached. An acknowledging module possesses altogether 16 entrances, which are somewhat differently used however with the MEMORY and with the INTERFACE. More to this topic find you in main chapter 9 starting from page 174. As signal initiators mentioned can be used, without restriction with the digital-System all in the section conventional layout (thus e.g. also a contact track for switching from magnet articles).

The large advantage of mechanism circuits in the digital-System is in their flexibility:

E.g. if route or another automatic operational sequence is to be changed, in addition the entire wiring can remain unchanged in all rule. To be changed only the succession of the instructions in the MEMORY or the program in the computer must.

The possibilities of mechanism circuits in the digital-System are extremely various. A detailed description would blow up the framework of this book. In main chapter 9 you find some basic informations for the connection and for the use of the devices mentioned. Large information and many example circuits to the advanced possibilities of Maerklin digital are the topic of a second volume.

Summary:

We summarize the main advantages of a digital model path control again briefly:

1. Multi-course control system: many courses independently steer, without separation of the electric circuits.
2. Magnet articles digitally switch: less wiring; comfortable and flexible route control, simply setting-up of track picture signal towers.
3. Flexible mechanism circuits: by the employment of special digital devices, like MEMORY or INTERFACE.

2. As actually functions Marklin Digital?

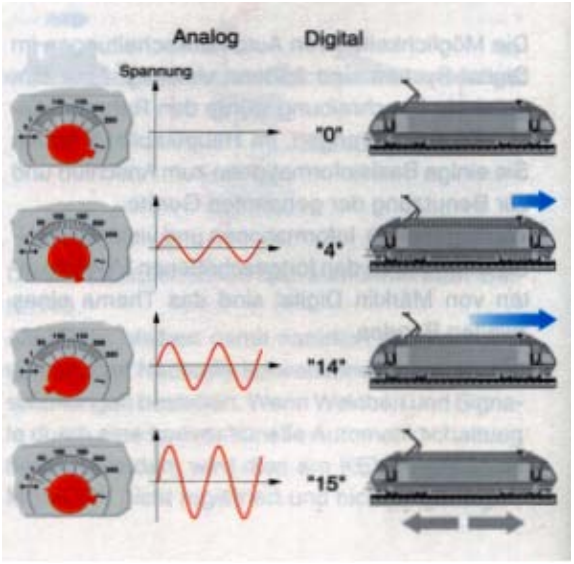
2.1. What means „digital"?

What do you experience in this main chapter?
This main chapter wants to describe you in simple way the basic principles of the digital-Systems. It is not necessary necessarily that you read completely this main chapter, but a fundamental understanding of the connections facilitates reliably the use of the digital-Systems for you. For technically more to a large extent interested readers chapter 2.9 is meant, in which special details of the digital-Systems are described. As more „Einsteiger " you can jump over this chapter.

The word „digital " means: Information with numbers represent. The other possibility of representing information is called similar. „Analog " means: accordingly, similarly. How this distinction is converted with the model course, we want to show by the example of the speed of a locomotive. The following representation of the function mode of the digital-Systems is strongly simplified; many details are only described in a later chapter.

„Analog "
the speed of a conventional locomotive is stopped at the rotary button of a driving transformer (,,conventional" meant: conventionally, thus not digitally). The inside one the trafos a Schleifer measures a different high alternating voltage depending upon the position of the driving automatic controller. This voltage is given directly to the track. The engine of a locomotive turns the more quickly, it supplied tension is the higher. If the driving automatic controller is set to zero, no tension lies close the track.

The speed of the locomotive is determined during the conventional model path control by the voltage at the track, with the digital-System by a number between "0', and '14".



„Digital "
differently with the digital-System:

Here each driving speed is represented by a certain number, with the Märklin digital-System by a number between 0 and 14. „0" meant thereby that the locomotive stands, „14" corresponds the highest speed, which can drive a locomotive. The number of „15" is used for the change-over of the driving direction.

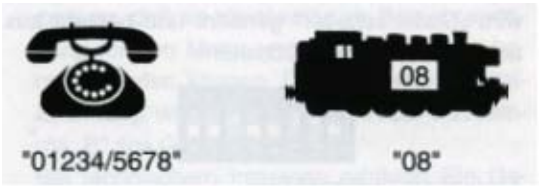
Perhaps now you say: Adjusted at a digital control panel however nevertheless the driving speed also with a turnable regulator, exactly as with a conventional driving trafo. This made, because on the one hand the operation of a rotary button is simpler and more descriptive than an entering of a number, on the other hand transferred in such a way in such a way of a conventional layout more easily falls. In the control panel however the position of the driving automatic controller is converted into a number, which corresponds to the adjusted driving speed. Calls this procedure one „digitalisieren " or „code". (code is called: information convert or code.)
The number, which corresponds to the adjusted driving speed, arrives from the control panel first into the central processing unit, from here at the track and finally into the locomotive, where it processes the locomotive decoder. This is more near explained in chapter 2.3.

Summary:
With the digital-System the driving speed does not become any more by the voltage, but when coded from the digital control panel to the locomotive transfer number.

So far is perhaps not yet clear you however, who advantages the apparently complex intermediate step offers Informationsuebertragung as digital signal. You experience this in the next chapter.

2.2. What is a digital address?

In the last chapter you saw, how the driving speed will digital transfer. The advantages of the digital-Systems arise however only as a result of the fact that additionally to the driving speed still another second information about the track will transfer: the „Digital address" of a locomotive.
What has it with this digital address on itself? One can compare the digital address of a locomotive with a telephone number. Each telephone has a certain number, under which it can be selected. If this telephone number is selected, only the telephone with



A telephone number as address Example of a digital adress

exactly this number rings. All other telephones „fuehlen themselves not addressed " and remain mute.

Similarly it behaves with the digital model course: each digital locomotive (and also each DELTA locomotive) has its own number. This number is called digital address. In order to change now the speed of a certain locomotive, apart from the speed the address of that locomotive is transferred to the track, for which the information is intended. And only this a locomotive finally changes its driving speed. In order to remain with our example: One could also introduce oneself, each locomotive has a radio telephone connection with a certain telephone number; over this number the driving service leader (operator of the central processing unit) can convey instructions by telephone to the engine driver (locomotive decoder).

Responding a locomotive over a certain digital address is thus the actual reason for the multi-course ability of the digital-Systems.

Summary:
Each locomotive in the digital-System possesses thus its own digital address (telephone number) and evaluates only the information, which is sent with this address. Thus each locomotive is individually controllable.

Attitude of the digital address
With distribution is adjusted each digital locomotive in a certain address, which you yourselves can change however at any time. Each locomotive address lies between the numbers 01 and 80.
It is adjusted at a 8 pole switch on the

Eight pole coding-switch.

digital locomotive decoder. This construction unit is called more „ Coding-switches " and consists of eight small slide switches.

One can switch everyone of these small switches either to ON or OFF . A certain locomotive address is specified by the combination of the eight switching positions. However all switching positions are not „ permits " for technical circuiting reasons; Detail in chapter 2.9 on page 32). Which switching positions must adjust you for a certain locomotive address, find into „Code table for digital locomotive addresses " on page 218. This table is contained also in the operating instructions of each digital locomotive.

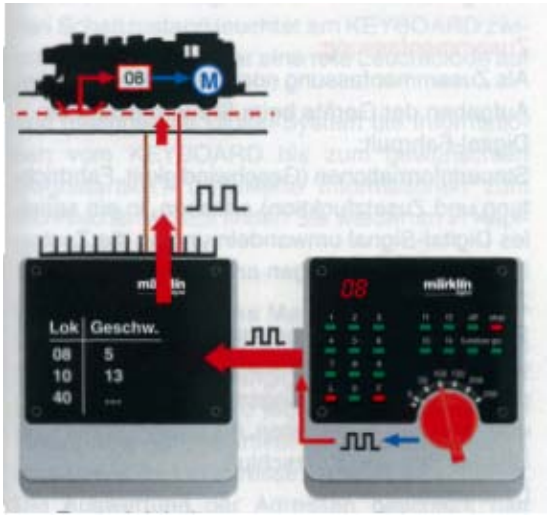
2.3. How is a locomotive in the digital-System steered?

For you as operators steering of a digital locomotive is very simple:
They enter the address of the desired locomotive on a digital driving desk, adjust at the driving automatic controller their speed and switch possibly still the light with the key „function": and the locomotive does exactly the wishing. All remaining locomotives remain completely uninfluenced of it. This chapter is to show you in a simple manner, how the information from the driving desk arrives at the digital locomotive. More detailed information for technical execution finds you in chapter 2.9 starting from page 29.

- In order to steer a certain locomotive, you enter the desired locomotive address first at the digital driving desk. The locomotive address is already a number, it can be passed on thus directly. However the driving desk examines before independently whether the entered address is at all valid, whether it lies thus in the range between 01 and 80. If not, the wrongly entered address flashes immediately in the announcement.
- With the driving automatic controller you adjust now a certain speed. The position of the driving automatic controller is „analogue " information, which is thus converted first in the control panel „digitised", into an appropriate number. In addition the value of the Auxiliary function (16 =, 0 = out) of this information is added.
- The microprocessor in the driving desk converts now both numbers, locomotive address and speed, into a consequence from 0 and 1-Values. This 0-und 1-value can be sent successively over only one line (+current back line, thus 2 cables). This more „ successively " one calls in the technician language „serial". (details see chapter 2.8 starting from page 27). The serial Infomation is then transferred over the lateral contact strip to the central processing unit.

- The central processing unit examines as the first whether if the desired locomotive is free, the desired locomotive changes is called on another control panel not perhaps already, because it is not possible at the same time to steer a locomotive of two control panels. If that is the case, the central processing unit sends a busy response to the calling control panel. This leaves thereupon the selected locomotive number in the announcement to flash, as reference to the fact that the locomotive is called on another control panel already. Easily effort of the operator „knocks" the control panel now and again with the center on, in order to inquire whether the locomotive could be steered meanwhile perhaps nevertheless. Possibly became in the meantime called on the other control panel another locomotive.

In reality the procedures with large speed, described here, run off, so that between typing for the locomotive address and flashing only a tiny instant is appropriate for the announcement.



Central processing unit **Control Panel**

Expiration of the information transfer when steering a locomotive (schematic). Blue arrows: similar currents, red arrows: Digital data

- The central internal data signal of the control panel into the Motorola data format over and sends the instructions to the track. The locomotive drives thereupon with the speed stopped at the control panel loosely. Afterwards the center sends back a confirmation to the control panel, and only thereupon the entered address lights up continuously at the control panel. As long as the locomotive is called on the control panel, each change of the speed, driving direction or auxiliary function is sent immediately on the way to the central processing unit and from here to the locomotive.
- The pure processing of the information in the control panel and in the central processing unit needs very little energy. In the central processing unit the digital informations must be strengthened, so that they can be used at the same time as operating voltage for the engine and the lighting. The intensified „Digital voltage" is given by the center over the clamp „B" to the track. With technical interest you experience more details in chapter 2.9.
- The Schleifer of the locomotive removes this digital tension then from the track. In the digital locomotive the voltage arrives however not directly at the engine, but first into the „Digital locomotive decoder ". Decoder comes from „Decodieren", i.e.: information decode.
- First the locomotive decoder examines whether the sent digital address agrees with its set address. If not, the sent information does not concern it, it worries thus about the following data, but does not maintain its values for speed and auxiliary function, stored so far. Only if the sent address corresponds more „ its " address (telephone number), the decoder evaluates the information for driving direction and speed and stores it in its inserted memory.

- Finally it steers the engine with the help of the parallel digital voltage according to the evaluated information „Driving speed". Likewise it, according to the new information, switches the auxiliary function in or out.
  ~ the new driving speed and auxiliary function remain held as number in its internal memory, until it receives again new information intended for its address. With the stored speed therefore the locomotive drives on, no matter whether it is called on a control panel still or not.

If the locomotive comes to a red signal, it continues, because it receives no more voltage in the signal stopping distance for the engine. The information about driving speed and auxiliary function remains also without outside power source further in the memory of their locomotive decoder stored. At least for a while, because electronics in the locomotive decoder uses likewise one, although very small, achievement. For older locomotive decoders this retention time was indicated as approx. two minutes, for newer versions can amount to it also several hours. So that the locomotive does not forget its stored information also with a longer signal stop, one can let a very small current flow into the actually switched off signal stopping distance. In addition must be built only no resistance into the wiring (see page 142). This small current is sufficient, in order to cover the tiny current consumption of the decoder. It is not enough naturally, in order to hold the engine or the lighting in course, which it also is not. In this way the decoder experiences entered changes even while signal stationary. It implements it immediately, as soon as the signal distance is again de-energised.

The locomotive decoders c 80 and c 81 can even recognize, if the locomotive on a conventional track section drives, where no digital tension is available. They switch automatically to this enterprise and can be steered then by a conventional trafo. In its memory the last „digital" driving speed remains further stored. As soon as they come again on a digitally supplied track range, they switch automatically to the stored speed and auxiliary function.

In addition, the center stores the last in each case information for all called locomotives (with small differences between the CONTROL UNIT and older central processing units). It repeats these information independently (without effort of the driving desks) in regular intervals, thereby also locomotives, which hear temporarily „bad" (e.g. because of bad current conduction at the Schleifer) up to date to remain.

Summary:
As summary again the most important tasks of the devices when steering a locomotive:
Digital control panel:
Control information (speed, driving direction and auxiliary function) seize, into a serial digital signal convert and to the center pass on; Announcements head for.
Central processing unit:
Sort, buffers and a repeating of the locomotive data; convert into the Motorola data format, with supply voltage link and to the track pass on. In addition protection from overloading and short-circuit.
Locomotive decoder:
Received one and adjusted address compare; if directly: Driving speed, driving direction and auxiliary function evaluate; Rectify the digital signal; Engine and auxiliary function head for; Locomotive data buffers.

2.4. How are switches and signals switched in the digital-System?

With a conventional layout, switches and signals (generic term „Magnetartikel ") are switched by means of the blue leads being connected by the control panel 7072, briefly with a press. How does this switching take place now in the digital-System? In principle the expirations are similar, as shown for the locomotive control system in the last chapter.

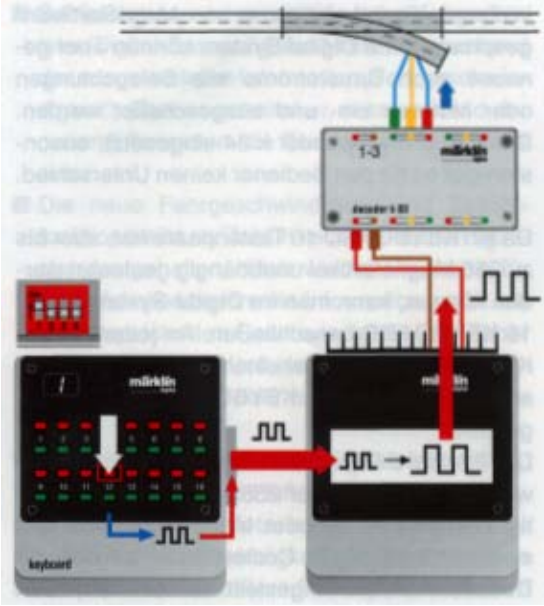
The KEYBOARD is the standard control panel in the digital-System. It has 16 pairs of keys for switching the magnet articles. Thus it fulfills the same tasks like four conventional control panels 7072, but it does clearly more. As operators you press on the desired key. Immediately the correct magnet article switches on the layout. As feedback over the switching status a red light emitting diode lights up or expires at the KEYBOARD between the pair of keys. How does the information from the KEY BOARD to the desired magnet article arrive in the digital-System? Detailed information for technical execution finds you again in chapter 2,9 starting from page 33.

Digital address of a magnet article
In the Märklin digital-System magnet articles can be operated independently up to 256. In addition each switch and each signal a magnet article address are assigned, similarly as the locomotive address with the locomotives. The evaluation of the addresses takes place here likewise over a decoder. There is (fortunately) no distinction of „Digital magnet articles " and conventional magnet articles, but the conventional switches and signals are attached easily over an upstream decoder. In this chapter always of „Magnetartikeln " one speaks. In the digital-System however just as also permanent currents can be switched on and off such as lighting or engines. But the decoder k 84 is used, otherwise there is no difference for the operator.

Since a KEYBOARD has 16 pairs of keys, but up to 256 to be steered independently to be able, one can attach magnet articles in the digital-System up to 16 KEYBOARDs. At everyone this KEYBOARDs is adjusted over a four pole coding-switch another KEYBOARD address. The standard decoders k 83 and/or k 84 have in each case 4 exits. For 256 magnet articles one needs thus 64 decoders. In each decoder there is (8 pole) a coding-switch, at which the decoder address must be stopped, because when switching magnet articles the address of a magnet article is passed on not directly, but the address of a decoder. In the control information for the decoder is then coded, which the exits this is to head for.

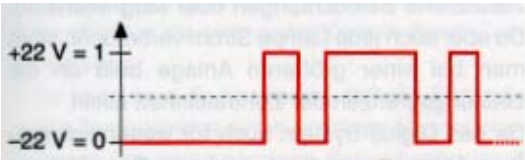
Expiration when switching a magnet article

- the operator presses a certain key at a certain KEYBOARD. The microprocessor in each KEYBOARD calculates the associated decoder address from the adjusted KEYBOARD address and the key number. This decoder address and the information, which decoder exit is to be switched on, are converted from the KEYBOARD into 0 -, 1- and passed on to the central processing unit.
- the central processing unit can work on in each case magnet article information at the same time. It converts the magnet article information from the control panel into the Motorola format, arranges it in the repetition cycle of the locomotive information, strengthens the digital signals and gives it on their exit. From here the information goes to the track and to the magnet article decoders attached over cables.



Data

Expiration of the information transfer when switching magnet articles (schematic). Blue arrows: similar currents, red arrows: Digital



- only thereafter sends back the center a confirmation message to the control panel. Thereupon the responsible KEY BOARD switches the associated light emitting diode in or out. In principle the digital data for locomotives and magnet articles are directly developed. So that they cannot disturb themselves mutually, they are transferred with different frequencies.
- all attached magnet article decoders compare constantly the addresses of all received information with their adjusted address. Only if both agree, they evaluate the following data division and connect the associated exit through. The attached blue cable is connected with mass, and the magnet article switches.

Since magnet articles may not be operated with permanent current, but only to need, the KEYBOARD a switching off instruction sends a short switching impulse to the center, as soon as the operator releases the pressed key again. This switching off instruction is treated in the same way as the switching command. Only after the switching off instruction the center can accept the next instruction for a magnet article, so that the digital-System is loaded in each case with the current on contact for only one magnet article.

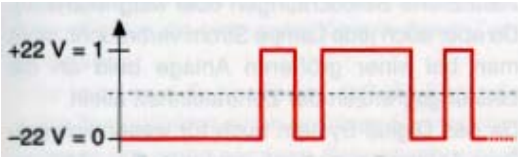
Beside the standard magnet article decoder k 83 with four exits there is for some time also an installation decoder k 73. The plate is intended to the direct installation in switches of the m-tracks; the decoder has therefore only one exit. With something fate it can be used in addition, for signals or other magnet articles (see in addition the tips on page 159/160). The installation decoder keeps its digital informations direct over the track. There is then thus no more cable connections necessary for such an magnet article.

Summary:
The most important tasks of the devices when switching magnet articles:
Digital control panel:
Pressed key issued, into a serial digital information convert and to the center pass on; Announcements head for.
Central processing unit:
Sort, a converting of the placing desk information into the Motorola format, an inserting into the repetition cycle of the locomotive data; link with supply voltage and to the track pass on. In addition protection from overloading and short-circuit.
Magnet article decoder: Received one and adjusted address compare; if same, decoder exit and switching direction evaluate; Rectify the digital signal, switch transistor (k 73, k 83) or relay (k 84) head for.

2.5. Why can the lighting shine also while stationary with a digital locomotive?

With conventional locomotives the brightness of the lighting depends on the adjusted driving speed: during quick travel it shines more brightly; with standing locomotive also the lighting expires. With digital locomotives the lighting can (or more generally: an auxiliary function) over the digital driving desk remote controlled be switched on and off. Switched on it shines with continuous brightness, completely independently of the driving speed; this applies even, if the locomotive stands. As we saw in chapter 2.1, the driving speed is not steered with digital via the height of the tension at the track.

Rather the digital voltage builds itself +22 V and -22 V up only from the two values. As long as the central processing unit does not send digital informations to the track, the quiescent level is with -22 V. Become information transferred, changes the tension between -22 V and +22V.



Quiescent levels Digital data
Principal appearance of the digital tension at the track

Quiescent level digital data

Appearance in principle of the digital tension at the track the river for the lighting of the locomotives or for the auxiliary function is won from the negative portion of the digital tension; this always outweighs the positive portion. Therefore the lighting can with each driving speed and also while stationary further-shine. However the brightness depends easily on straight data traffic running off over the track. This can become apparent sometimes through easy flickering of the lighting.

Summary:
The tension in the digital-System is independent of the driving speed of the locomotives. At each time always an average value of approx. 20 V is present, which is used for the supply of the engine. The lighting and other auxiliary functions are supplied from the negative portion of the digital tension (half-wave rectification).

2.6. What is the difference between Märklin digital and DELTA?

The answer reads, how often with questions of this kind: In principle there are none! The DELTA system is the smaller brother of the digital-Systems, which the equipment of the devices and the extensions possibilities concerns. That is however no deficiency, because you can transfer at any time from DELTA to digital. And nearly all DELTA devices can re-use you thereby without change and without restriction. That is possible, because the data signals of DELTA and equal to the digital.

Differences of the possibilities

There are naturally already some differences concerning the possibilities:

- in the DELTA system can be steered max. 5 locomotives independently, in the digital-System up to 80.
- digital locomotives have a remote controlled auxiliary function, which it with DELTA locomotive do not give.
- with DELTA locomotives depends the lighting on the driving speed. Even if the locomotive stands, the lighting expires.
- in the digital-System can be addressed beside the locomotive decoders still more „Functions decoder", with which four further functions (e.g. lighting or engines) can be switched off or on.
- only in the digital-System gives it to components for „Digital switching ". With DELTA, switches and signals must be switched over conventional control panels (e.g. 7072).
- in the digital-System can be attached over BOOSTER further electric circuits, with the DELTA system give it only one electric circuit.

Summary:
The electrical voltages and data formats are identical with digital and DELTA. DELTA is a system for multi-course control system for smaller layouts (and smaller purses), an ascent to the digital layout is at any time possible.

2.7. What is a „BOOSTER actually "?

„BOOSTER" (spoken more „buuster") auxiliary amplifier means. With the Märklin digital-System has this equipment a similar task as the devices of same name, which increase the achievement of car radios. Each locomotive and each lamp use a certain electrical achievement with the enterprise. This achievement must be made available by a transformer and processed by the central processing unit. Against a model railway facility high demands are made against electrical security. Therefore the power output of the devices may not be laid out of any size. In addition special preventive measures for the case of short-circuit are prescribed. The maximum power output of a central processing unit, those of a TRANSFORMER (art. NR. 6002), amount to approx. 45 Watts are supplied or, in the technician language, 45 VA (volt Ampere). That is sufficient, in order to operate about 5 small or 4 large HO digital locomotives (without additional lighting or magnet articles). Since in addition, each lamp uses current, one pushes with a larger layout soon to the power limits of the central processing unit alone. Since the digital-System was laid out also for substantially larger layouts, additional electrical achievement must be made available. Each digital layout needs however only one central processing unit; a co-operation of several central processing units is not intended. Therefore the BOOSTER was developed: a pure achievement amplifier, which contains all its information directly from the central processing unit. Further information receives you in chapter 5.5.

Summary:
A BOOSTER makes additional achievement available for a digital layout. Technically seen, a BOOSTER corresponds to a central processing unit without own data processing.

If necessary also several BOOSTERS can be used. Each BOOSTER must be

attached to its own TRANSFORMER and to its own electric circuit. Since the BOOSTER strengthens however only the digital informations from the central processing unit, the information is identical in all electric circuits of the layout. If a locomotive over-drives the transition of an electric circuit on the other hand, the locomotive decoder of it notices nothing. The user does not have to thus differentiate with the enterprise of the layout no more between the different electric circuits. A locomotive is steered continuous with the same driving desk under the same address, no matter, in which electric circuit it is straight.

Why do the electric circuits have to be from each other isolated also in the digital-System?

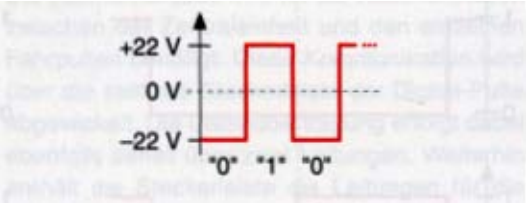
The BOOSTER has two power-output stages (one for the negative, the other one for the positive „ Impulse half waves ") as auxiliary amplifier like the central processing unit. Now transistors or integrated circuits, which are used in different devices, can be manufactured never completely identically. Above all they differ slightly in their time performance. So it can happen e.g. that the output stage of the central processing unit connects a positive pulsed voltage through later around a tiny fraction of a second than the output stage of a BOOSTERs. If the two electric circuits would be not from each other isolated then, for a very short moment very high balance stream between the two electric circuits to flow, limited only by the current limiting of the output stages. This is to be recognized among other things by a high whistling noise. Such mode of operation would be in the long term neither the output stages of the devices nor the working reliability of the layout beneficial.

Always pay attention therefore to a perfect isolation between the different electric circuits.

Consider in this connection also the referring in chapter 3.5 to page 61.

2.8. How„Numbers" transferred over the track?

„Digital " means: with numbers. The data communication to the locomotives and to the decoders for magnet articles is made by only 2 lines: Neutral conductor (red cable) and earth (brown cable). How however are numbers transferred over these two lines? The answer in principle is quite simple; about the details of the realization we will only worry in the next chapter. Figuratively spoken, the data communication takes place in „Indian file": an information unit one after the other, and „in clock always resembles always beautifully ". The technician calls this form of the data communication „serial" (successively). The other possibility of a data communication would be „parallel"; for this however several data lines would have to be used at the same time, which would be practically not possible in a model course. For a digital data processing a further characteristic is characteristic: one works only with two „Conditions": 0 or 1, „high " or „low ". The technical term for it is more „binary". A binary information unit („Bit ") can be thus either 0 or 1; there are not other values. The Märklin digital-System works exactly the same in principle. „1" corresponds to a tension by +22 V, „0" of a tension of -22 V, in each case to earth related.



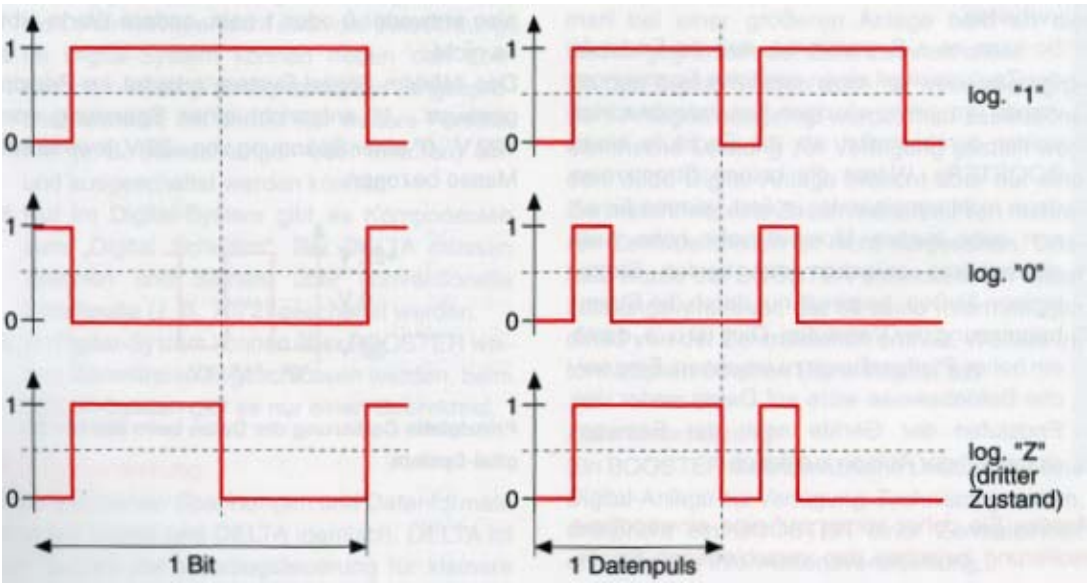
Coding in principle of the data with Märklin Digital-System

Any number can be represented as a consequence of 0 and 1. The more to differentiate, the more wants to use different numerical values one „Bits " must one for it. With 4 bits e.g. 16 different numbers can be represented (2^4= 16); with 8 bits already 256 different numbers (2^8= 256).

Summary:
All numbers will thus transfer with the digital-System as a consequence from bit values with voltages from +22 V and -22 V. But a line is sufficient plus return pipe.

The binary data communication has a further advantage: it is insensitive to disturbances. In principle one could transmit information e.g. also by 10 different voltage levels over a line. Here however a disturbance would produce much more easily a wrong value, as if one uses only two different voltage levels like +22 V and -22 V. The conversion of the the microprocessor in the digital driving desk settles original numerical values (e.g. the locomotive speed stopped at the driving automatic controller). The locomotive decoder as receivers must evaluate then the received bit sequence. In addition the receiver must naturally „ know ", how long a bit perseveres and exists like many bits a number. How long a bit is to last is specified, by an electronic circuit (clock producer). Of like many bits a number consists, by electronics or the control program in each decoder is specified.

„Trinaere coding"
With the Märklin digital-System gives it however still another special characteristic. During the conversion of the digital addresses not only two, but three different „ Conditions are used ": logically „1", logically „0" and logically „Z". The addresses for locomotives and magnet articles are thus not binary coded, but more „trinary". Only the two voltage levels +22 V and –22 V are used nevertheless. The technical conversion takes place in such a way that „Bit" into 2 parts one divides as it were again. Possible the in principle fourth condition (combination „0-1") is not used for reasons of data security.



The three conditions with the trinary coding: left: simplified representation - right: material process

Only with the coding of the addresses 3 conditions are differentiated, for which data only the two the conditions log 0 (combination „0-0 ") become and log 1 (combination „1-1 ") uses. The advantage of the tri eras data communication is mainly in a higher data security. Or differently seen, can be represented with the tri eras coding a larger number of possible values (related to „whole" bits of the binary notation): In the case of the tri eras coding only 2^4 = 16 can be coded addresses with 4 address,,Trinaerbits " 3^4 = 81 addresses, with binary coding only 2^4 =81 addresses are available.

All information in the digital-System becomes in packages in each case 9 „Entities" (bits is not quite correct because of the tri eras coding) or 18 „Informationspulsen" transferred. The allocation in addresses and data is however different for locomotive instructions and magnet articles, as is shown in the next chapter.

Thus a trinaere uses used electronic packages the Märklin digital-System, for the remaining data a binary coding for the addresses. This special data format is produced for the firm by special electronic packages (ICs = integrated circuits) „Motorola". The data format is also often called therefore Motorola data format or Motorola Track format. There are different integrated circuits for transmitters and receivers, which use however all the Motorola data format; they have the designation " MC 14502... ". As transmitter component the MC 145026 one uses. As receiver component in locomotive decoders a customized is used IC, which contains from space reasons apart from the functions of the receiver component MC 145029 a row of further electronic circuits. In the magnet article decoders a receiver component of the type MC 145027 is used.

2.9. How does the information transfer in the detail look? (for digital professionals)

In this chapter some „ Refinement" of the digital-Systems are described, therefore this chapter is more strongly technically oriented than all remaining chapters in this book.

So far schematically the basic concepts of the digital-Systems were shown. In the following sections it concerns their technical conversion. We differentiate a driving between the ranges „Digital" and „Digital switching ".

Digitally driving

Data communication between control panel and center

to switching on of the transformer of the central processing unit on are initialized automatically first all attached control panels. You recognize this by the fact that briefly on the control panels the number of 99 in the announcement lights up (technical term: „Power on RESET "). Afterwards all control panels are in a defined initial condition. During the initialization by the center an internal address is assigned to each driving desk, from the center to the right sequentially. For this reason no address needs to be adjusted at a digital control panel.

The internal address is needed for communication between the central processing unit and the individual control panels. This communication is completed over the lateral contact strip of the digital panels. The data communication is made thereby likewise serially by two lines. Further the contact strip contains the lines for the current supply of the digital desks and additional lines, e.g. for the instructions „stop " and „go ", so that these instructions to become at any time effective to be able.

Between the digital control panels and the central processing unit the following information is exchanged:

- (internal) receiver address for the instruction
- (internal) transmitter address
- locomotive address
- control information: Auxiliary function and drive position

After each information the respective receiver sends to the transmitter an acknowledgement message that the information arrived correct.

Exact operational sequence of a command transmission

As example is to become on a control panel CONTROL 80 F a locomotive with the address 08 gesteuerl. Central processing unit is a CONTROL UNIT.

1. The operator types a locomotive address at the control panel, e.g. „08 ". The control panel examines: Is the locomotive address valid (address between 01 and 80)? No: Announcement flashes, it goes no message to the center. Yes, address valid:
2. The control panel sends a message to the center: Receiver: CONTROL UNIT transmitter: Control panel No. 2 (control panel No. 1 is the internal control panel the CONTROL UNIT) locomotive address: 08 control information: Auxiliary function, drive position 5.
3. Central one examines: Is the locomotive free (it is not already called on other control panel?) If the locomotive is called at other control panel already, the center sends a „Occupies" message to the control panel. The control panel places thereupon the entered locomotive number in the announcement on flashing. As long as the announcement flashes, the control panel repeats regularly the inquiry to the center. Locomotive is free:
4. The central processing unit gives the locomotive address and the control information to the track. Afterwards the center sends an acknowledgement message to the control panels: Receiver: Control panel No. of 2 transmitters: CONTROL UNIT locomotive address: 08 control information: Auxiliary function, drive position 5.
5. The control panel lets the locomotive address only now light up continuously in its announcement.

Afterwards the control panel transmits only then again information to the central processing unit, if either the locomotive number, which driving speed, driving direction or auxiliary function of the locomotive are changed. The information sent last remains however in a memory of the central processing unit and additionally in a memory of the locomotive decoder. The central processing unit repeats independently in regular intervals the information from its memory.

Repetition of the locomotive data by the central processing unit

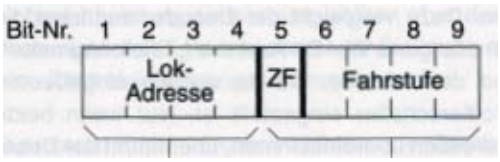
For reasons of the transmission reliability is accepted new information by a locomotive decoder only if the identical information reaches it twice successively. Otherwise the new instruction is rejected and the old information in the memory of the locomotive decoder is maintained. Therefore each control instruction is twice sent very briefly one behind the other by the central processing unit. Additionally the central processing unit in regular intervals repeats all locomotive information, which it in their internal memory has. This guarantees a safe information transfer in each operating situation.

The regular repetition of the instructions is to be represented most easily by an example: On a layout two digital control panels are installed and for four locomotives in operation with the addresses 01.08.22 and 78. The locomotives No. 08 and 78 are called at present on a control panel, locomotive No. 01 drive with constant speed as distance locomotive, locomotive Nr.22 are turned off straight, had however before been already once called. In the number and the occupation of the memory the new center CONTROL UNIT and the earlier central processing units differ.

The CONTROL UNIT arrange for each once called locomotive address an own memory (and additionally for each function address), altogether thus max. 2 x of 80 memory. Into locomotive memory the locomotive address, speed and auxiliary function are put down; into memory for the function decoders the position of the four function keys for the respective address.

With the CONTROL UNIT looks the recurrence rate thus in such a way: Locomotive 01, locomotive 01, break, locomotive 08, locomotive 08, break, locomotive 22, locomotive 22, break, locomotive 78, locomotive 78, break, locomotive 01, locomotive 01 all locomotives in the order of their address are thus repeated, even if they are called on a driving desk at present not or do not drive. In a driving desk if any attitude for a locomotive is changed, this information is several times one behind the other transmitted immediately more „ausser the row " to the track. Then the center registers the new values again into the associated memory, and the locomotive is incorporated again into the normal repetition cycle. By the way a complete repetition cycle takes few seconds also with 80 filled locomotive memory only.

The older central processing units CENTRAL UNIT and CENTRAL CONTROL had against it only 10 locomotive memory inserted, per one for each attached driving desk. Therefore here the repetition cycle looks somewhat differently: only the locomotives called on a driving desk are repeated. With the same example as looks before then in such a way: Locomotive 08, locomotive 08, break, locomotive 78, locomotive 78, break, locomotive 08, locomotive 08, break, which becomes information for the locomotives 01 and 22 here thus not repeated.



Evaluation trinary

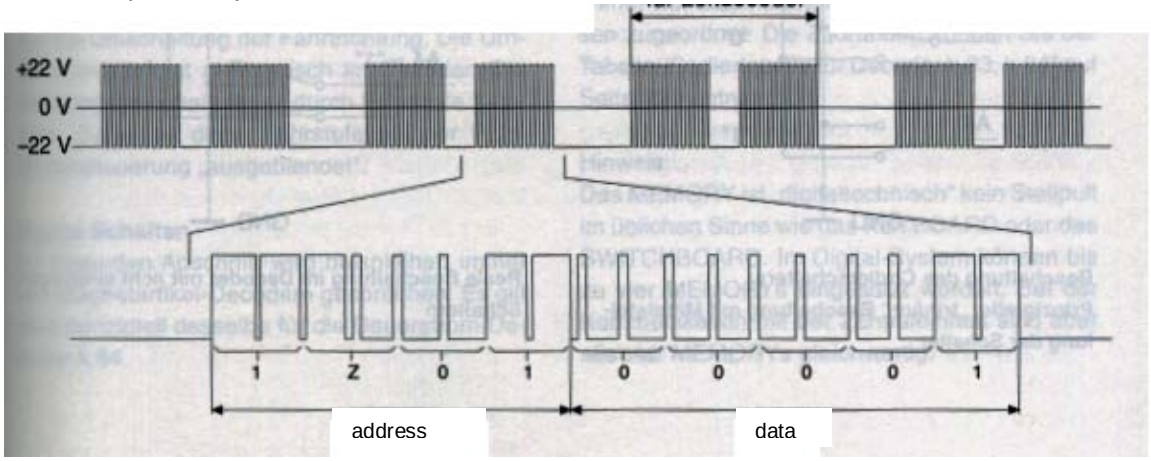
Evaluation binary

Coding of the locomotive data at the track

Coding (data format) of the locomotive data (ZF = aux. functlon)

Bit 1 - 4: Loco address in trinary coding.
Bit 5: Auxiliary function (1=on, 0 = off).
Bit 6 - 9: Drive position, binary codes.
Drive position 0: Locomotive stands (engine does not receive a tension),
Drive position 1: Change-over of the driving direction (engine receives no tension here likewise),
drive position 2: lowest driving speed,
drive position 15: highest driving speed.

Pair of impulses for locomotive decoders.



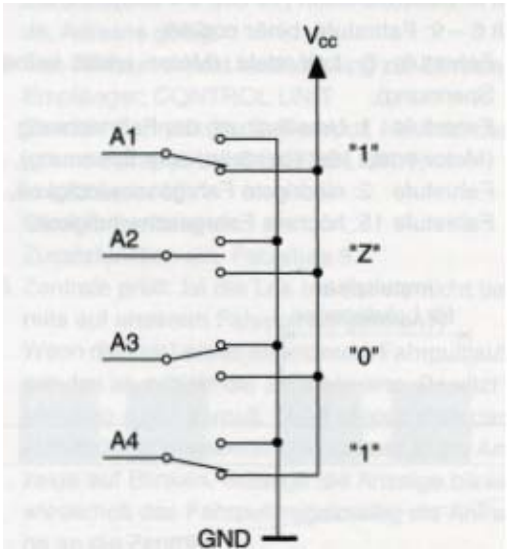
Timing diagram of the tension at the track (in the example represented: Locomotive address 34)

2.9. Wie sieht die Informationsübertragung im Detail aus?

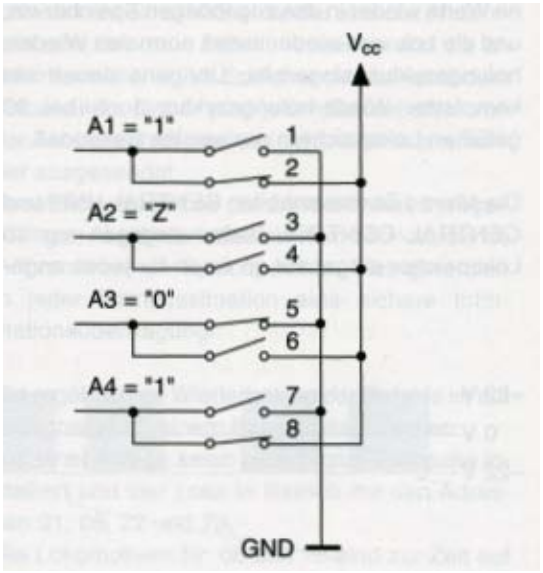
In each case 18 information pulses form a packet. Clearly visibly is sending two equal packets directly one behind the other. The locomotive data are transmitted with a frequency by approx. 4813 cycles per second.

Evaluation of the information in the locomotive decoder

In the locomotive decoder the special decodes the Motorola data format Marklin the chip. It converts the serial information again into parallel data, which represent the actual useful information. In addition the decoder compares first the received four-bit location (more,,Telefonnummer ") with the address, which is adjusted at its inserted coding-switch. Only if both addresses agree, the decoder transfers the following 5 bits data to an internal buffer. The data for speed and auxiliary function at the exit of the decoder remain however still the old. They are only updated if following second contains lmpulspaket accurately the same data as first. Thus in the Marklin digital-System a high data security is reached, because the probability that an impulse package is falsified twice in the same kind, is very small. The special coding of the addresses at the eight pole coding-switch of each locomotive decoder is connected with the tri eras coding. In each case two slide switches lying next to each other are switched to the same address entrance of the Motorola chip, whereby one with earth, other one is connected to which with ~. With two switches four in principle different conditions could be stopped. However if two matching switches are switched at the same time to ON, this corresponds to a short-circuit between mass and ~ with such an attitude the locomotive cannot be operated therefore. The remaining three attitudes correspond the tri eras to coding, as in the following design is to be seen.

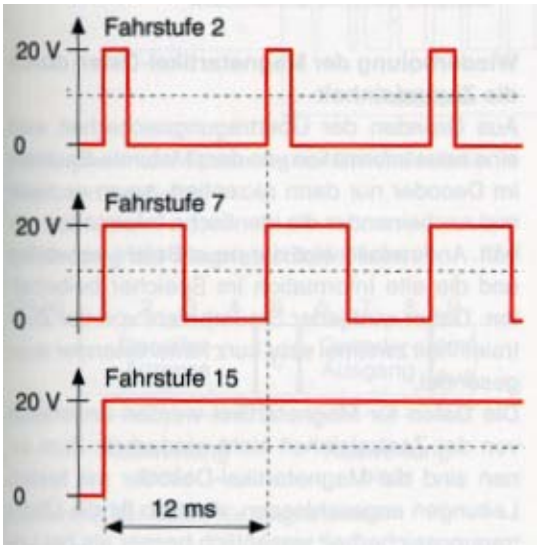


Wiring of the coding-switch: " wiring in principle and „trinaere with central position of the switches



Material wiring in the decoder with eight single-pole switches

Control of the engine
In the locomotive decoder becomes the digital tension of the track by a full-wave rectification parallelly. This tension is given according to the selected drive position for shorter or longer time on the engine (technical term: „ Pulsbreiten control"). Thus the engine with pulsating DC voltage



is steered. Because of the short period duration becomes outside however not apparent after. Tension at the engine according to the selected drive position

In the digital-System not the absolute driving direction forward or backwards, but only the change-over of the driving direction is coded. The change-over takes place electronically in the decoder. The direction change-over is coded by drive position 1. Therefore this drive position is „ausgeblendet during the controlcontrol control ".

Digitally switching
In the following section is exemplarily always spoken of magnet article decoders. It applies however in principle the same to the permanent current decoders k 84.

Data communication between Control panel and center
The digital control panel receive an automatic RESET likewise after switching on of the layout on like the driving desks. But, contrary to these, control panels do not keep an internal address assigned from the central processing unit. Instead the address for each digital control desk at a four pole coding-switch must be set by hand. Also several placing desks the same address can receive. For reasons of a safe achievement supply however nevertheless any more than altogether 16 placing desks should not be attached to a central processing unit.

Internal communication between the central processing unit and the placing desks is completed over the lateral contact strip of the digital desks. The data communication is made thereby serially by two lines. Between the digital Placing desks and the central processing unit and to be turned around the following information exchanged:

- a receiver address for the instruction
- transmitter address of the instruction
- control information: Decoder number and desired exit

The control information do not refer directly in a magnet article address, but they contain the address a decoder (range 1 to 64) and the desired decoder exit. Always four successive decoder addresses are assigned to a placing desk with 16 pairs of keys. The allocation you can infer from the table „Codiertabelle for decoders k 83, k 84 " on page 220.

Reference
The MEMORY is not „digitaltechnisch " Stellpult in the usual sense like the KEY BOARD or the SWITCH BOARD. In the digital-System can be used up to four MEMORYs. During communication with the central processing unit however all four MEMORYs are equivalent.

Exact operational sequence of a Befehisuebertragung

During the controlling of the magnet articles the duration of the switching impulse fixed by the length of depressing the key at the KEY BOARD or SWITCH BOARD. This length is transferred by the steep desk by the fact that the two procedures „Taste and „Taste pressed " released " as two separated instructions are sent. As example a switch with key No. 12 is to be placed on red on the KEY BOARD No. 1. The sequential decoder numbers 1 to 4 are assigned to the KEY BOARD No. 1; for key 12 decoder No. 3, exit No. 4 is responsible.

1. The operator presses the key " 12 red " at the KEY BOARD No. 1.
2. The KEY BOARD sends a message to the center: Receiver: CONTROL UNIT transmitter: Placing desk No. 1 control information: Decoder No. 3, exit 4 red switch on.
3. Central one examines: Does another Schaltanfoderung momentarily already exist for a magnet article address? Yes: Data bus for the Stellpulte goes on Busy, the new instruction is not accepted; the placing desk does not receive an acknowledgement message for the instruction. The instruction is repeated therefore so for a long time by the KEY BOARD, until it is accepted by the center. No, no other placing desk requirement:
4. Instruction for the magnet articles is inserted twice one behind the other at the naechstmaeglichen position into the transmission cycle of the driving desk instructions.
5. Afterwards the center sends an acknowledgement message to the steep desks: Receiver: Steep desk No. 1 transmitter: CONTROL UNIT control information: Decoder No. 3, exit 4 red
6. only now switches the KEY BOARD on the red light emitting diode with key No. 12.
7. The operator releases the KEYBOARD key again.
8. The KEY BOARD sends again a message to the center: Receiver: CONTROL UNIT transmitter: Placing desk No. 1 control information: Decoders No. 3, exit 4 red switch
9. off the center spend also this instruction twice one behind the other. Afterwards it can accept further Placing desk instructions.

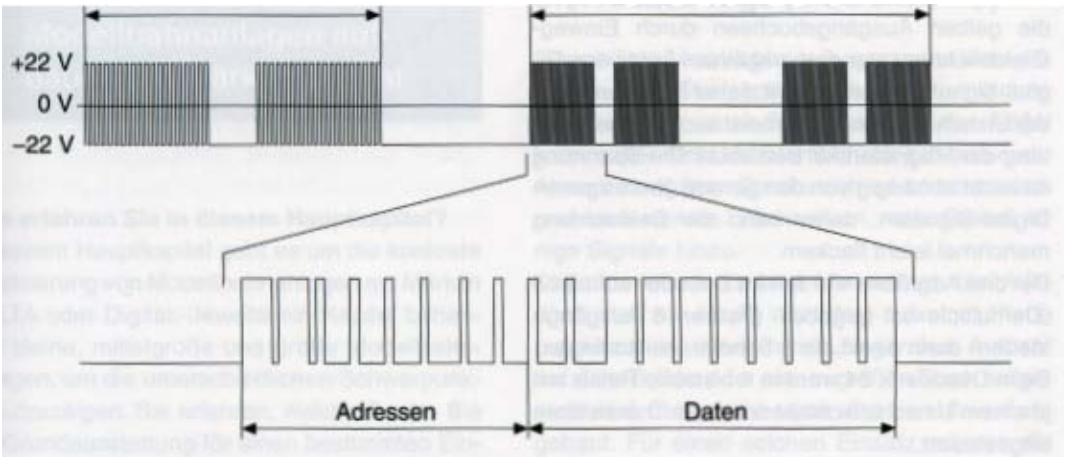
Repetition of the magnet article data by the

Coding of the data for magnet articles central processing unit for reasons of the transmission reliability is accepted new information by the Motorola component in the decoder only if it receives twice successively the identical information. Otherwise the new instruction is rejected and the old information in the memory is maintained. Therefore each control instruction is twice sent very briefly one behind the other by the central processing unit. The data for magnet articles are not repeated otherwise by the central processing unit. To the magnet article decoders with firm lines are attached, therefore the transmission reliability is substantially better than with locomotives. On the other hand the switching off impulse switches the exit off of the decoder again, because the magnet articles may not be operated with permanent current. A repetition of the information would be senseless therefore.

In each case 18 information pulses form a packet. Clearly visibly is sending two equal packets directly one behind the other. The magnet article data are transmitted with a frequency by approx. 9625 Hz (the double frequency of the locomotive data), so that the data for locomotive decoders and magnet articles do not affect each other mutually.

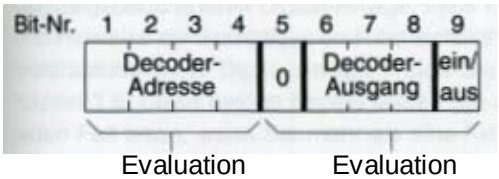
für Lokdecoder

für Decoder k 83, k 84



Timing diagram of the voltage at the track with a magnet article instruction

Coding of the magnet article data



Evaluation more trinaer

Evaluation binary

Bit 1 -4: Decoder address in trinaerer coding. The address coding is the same as with the locomotive addresses, but only 64 addresses are used.

Bit 5: = 0 firmly

Bits 6 - 8: Exit of the decoder (2 x of 4 = 8 exits = 2~possibilities)

Bit 9: Exit switch on or off

Evaluation of the information in the magnet article decoder

in the magnet article decoder (and likewise in the permanent current decoder k 84) decodes the special Märklin chip the Motorola data format. It converts the serial information again into parallel data, which represent the actual useful information. In addition the decoder compares first the received four-bit location with the address, which is adjusted at its inserted coding-switch. Only if both addresses agree, the decoder transfers the following 4 bits utilizable data to an internal buffer. The data at its exit remain however still the old. They are only updated if following second contains Impulspaket accurately the same data as first. Thus a high data security is reached, because the probability that an impulse package is falsified twice in the same kind, is very small. Since the address coding for magnet articles is and equal to locomotives, also the same wiring of the coding-switch is used. This was already shown for the locomotive decoders on page 32.

In the magnet article decoder the tension door the yellow exit hubs is won through one-wayequal direction from the negative portion of the digital signal. With this tension the switching magnet and also the lighting of the magnet articles are usually operation. The tension depends easily on the straight transferred digital signals, sometimes therefore the lighting can flicker easily. The three address bits are given in the decoder on more „Demultiplexer ". Its 8 exits head for then directly the 8 schalttransistoren. With the decoder k 84 4 bistabile relays are headed for with one two-way contact each by the transistors.
In the installation decoder k 73 against it not only 64 decoder addresses, but all 256 magnet article addresses are out-decoded. That is, that with the k 73 an individual address is selected, while a decoder k 83 is adjusted to a group by four following each other addresses. To 8 Laetflaechen with the decoder k 73 of 64 decoder addresses and over two further Laetflaechen a certain magnet article address (22=4 possibilities according to the 4 exits of a decoder k 83) is stopped. To situation of the soldering surfaces see page 158.

3. Model railway facilities develop with Märklin Digital

What do you experience in this main chapter?

In this main chapter it goes around the concrete realization from model railway facilities with Maerklin DELTA or digital. In each case a chapter treats small, medium sized and large model railway facilities, in order to point the different emphasis out. They experience, which devices need you as basic equipment for a certain targeted application and which Erweiterungs-und there are extension possibilities. To each plant size a concrete example is pointed. Chapter 3.4 helps you when measuring the power demand of a digital plant. Many tips and reference to the versatile and clear wiring of a digital plant find you in chapter 3.5. These two chapters should read you in any case, if you develop more than one small plant with only one electric circuit like-

3.1. Small Layout (1 current circle)

Most model railroaders start out quite small: with a starting packing with a simple track oval and a train set. Usually however quite soon the desire on after more alternation comes with the play enterprise: thus gradually further locomotives, more tracks, some signals are added.

Of a small plant it remains characteristic however that she is frequently not firmly developed on a plate, but with „fliegendem

structure " on the soil or a large table is set up. Accordingly often it is diminished and. For such an employment the tracks must be as durable as possible.

Therefore rather the sturdy metal track for ground-based systems (m-track) is recommended. Plants with plastic tracks (k-tracks) look true to nature, but the k-tracks are suitable nevertheless rather for a plant, which remains firmly developed on a plate. A further characteristic of the small plant: it has usually only one electric circuit, i.e. it is supplied from a transformer. The transformer is necessary, in order to produce from the high and dangerous mains voltage a harmless safe voltage, with which without risk a model railway facility can be operated.

With a transformer can be supplied, depending upon type, between two and five locomotives at the same time. Thus thus a multi-course enterprise is already meaningful with small plants. The large advantages of a multi-course control system already saw you in main chapter 1.

With small plants you have the option between a DELTA and a digital plant. Since a small plant is used frequently (also) by children, rather the simpler DELTA system as entrance, which in addition also more strongly supports, is recommended a common playing. Therefore there are at present only DELTA -, but no digital starting packings (and naturally still conventional starting packings, whose locomotives for multi-course enterprise must be however specially reequipped).

And fortunately Märklin DELTA is not a dead end, because a later transferred to the „grossen " digital-System is at any time possible, and which most DELTA components can do thereby without change are continued to use.

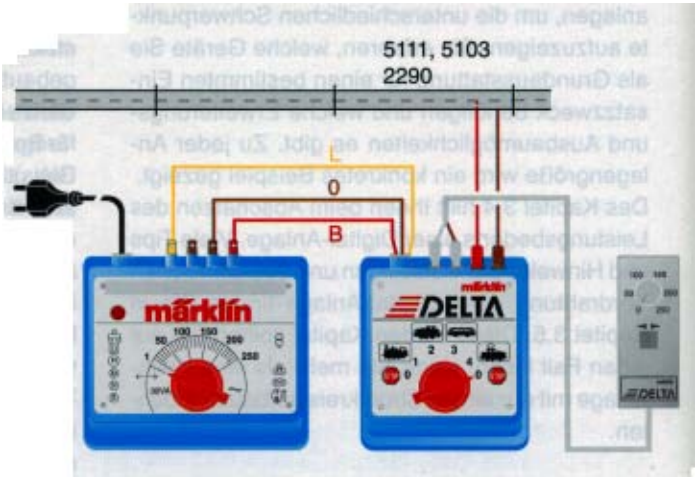
Further information:
The beautifully illustrated entrance guidance shows the possibilities of the starting packings and the extension packings: „Einsteigen and driving ", from which some picture examples were used also here. Further suggestions for the various organization possibilities of smaller layouts find you in the two Märklin brochures: „M railway tracks for a riser " (art. NR. 0710) „K railway tracks for a riser " (art. NR. 0720)

DELTA layout
With DELTA there are 94 two equipment families (on the one hand a DELTA control and a DELTA pilot, on the other hand DELTA station and
DELTA mobile) for the spring, which differ in the appearance, in the operating concept and in the possibilities something. Therefore the two families are separately presented here.

DELTA control (6604) and DELTA pilot (6605)

Basic equipment

Transformer (trafo):
Here you need a conventional driving transformer. A light licht-Trafo or a digital TRANSFORMER cannot be used for the DELTA control. An important characteristic of a trafos is its power output. It indicates, how much river or electrical achievement the trafo can supply, without it is overloaded. The more achievement it to supply can drive e.g. at the same time, the to more locomotives can on a layout. Borders are however on the other hand set by electrical security. For the DELTA station therefore best a driving fahrtrafo with approx. 30 VA is suitable, e.g. the 6631 (for the mains voltage 230 V; for other mains voltages variations in type are available). Driving fahrtrafos with only 10 VAoder 16 VA have a too small achievement for a multi-course enterprise.



Basic equipment and expandability (grey drawn in) with a DELTA layout

With a DELTA layout it is not possible to use more than the achievement of a trafos with a DELTA control thus for max. 30 VA.

CONTROLLER:
The controller is the DELTA control. It is attached easily between trafo and spur track (see page 70).
With it can be operated in principle up to 4 locomotives on a layout. The power output DELTA control and the trafos is sufficient, in order to let about three locomotives drive at the same time.
The operational principle DELTA control is very simple: At its selector switch a locomotive is selected, and this locomotive is then steered with the driving automatic controller of the trafos. The remaining locomotives continue to drive so for a long time with the speed stopped last, until they are selected again at the DELTA control. Switches and signals are conventionally switched independently of DELTA. They are attached to a conventional placing desk 7072.

Locomotives:

- DELTA locomotives contain the DELTA module ex factory. They are from the beginning adjusted to a suitable DELTA address (with the new DELTA module starting from spring 94 on the attitude for a conventional layout). DELTA locomotives can be used also without each change on a digital layout.
- digital locomotives can likewise drive on a DELTA layout. They must be adjusted however before to a valid DELTA address (see page 72). The lighting or the auxiliary function cannot be switched on.
- conventional locomotives drive on a DELTA layout, but its speed is not controllable. They can however later be converted with a DELTA module (or digital decoders).

Expandabilities:
To the DELTA control additionally a control quadrant DELTA pilot can be attached. With it, independently of the four locomotives at the DELTA control, an additional DELTA or digital locomotive can be steered. It must be adjusted for it in the digital address „80 " (see page 72).

Example (small layout):
Our taping layout is steered a small layout with two to three courses, with a DELTA control. For the startstart start the rotary switch at the DELTA control is turned by the position „0 " (STOP) on position „1 " (steam locomotive). The exit signal in the station for the passenger train is switched to „Green". At the drivingautomatic controllerautomatic controller driving automatic controller you increase now slowly the speed of the steam locomotive. If it achieved its desired distance speed, the rotary switch at the DELTA control is placed on position „2 " (diesel locomotive). Meanwhile the steam locomotive drives on steadfastly with the speed on its track, stopped last. The heavy goods train with the diesel locomotive BR 216 takes up now likewise slowly travel. As soon as it drove through the station range slowly, it accelerates on the free distance. Now can at the DELTA control again to the steam locomotive be shifted back, in order to let near-roll it slowly to a signal. Before a red signal the courses hold naturally automatically, if the stopping distance is accordingly wired. And all of this is possible in an electric circuit with only a driving fahrtrafo. If the layout is extended e.g. by or two rangier-gleise, a ranking locomotive could be steered by a second fellow player completely independently of the other two locomotives with the DELTA pilot.

Example of a small layout

DELTA station (6607) and DELTA mobile (6608)

Basic equipment

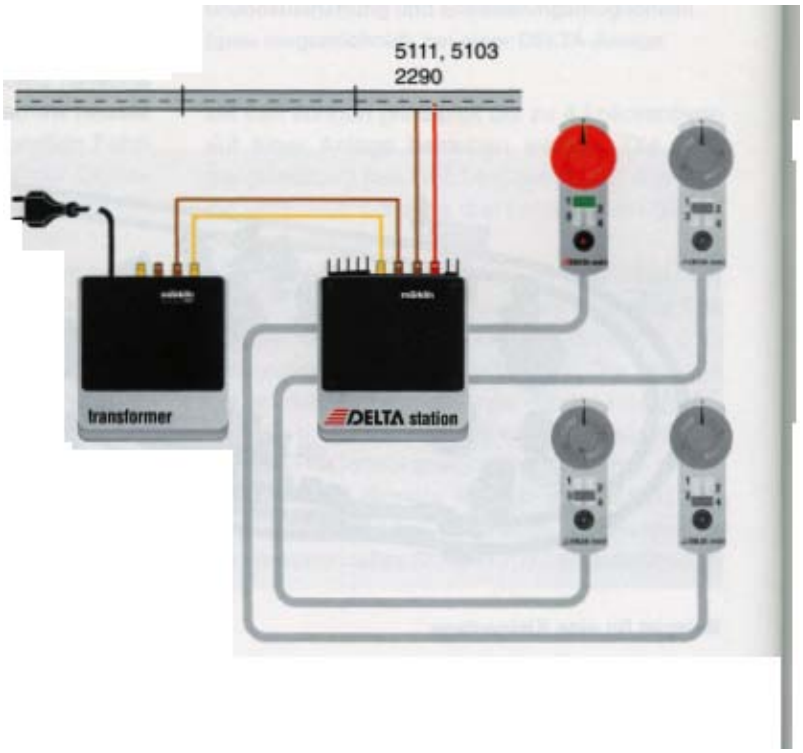
Transformer (trafo): For the DELTA station you can use any transformer, which has a power output of approx. 30 VA or more. It can thus alternatively be a driving fahrtrafo 6631, a light licht-Tra-fo or a digital TRANSFORMER. The DELTA station has larger power reserves than the DELTA control. Their full power output can be used only with a MOLDERMOLDER MOLDER, which can supply approx. 52 VA. With a DELTA layout it is not possible to use more than the achievement of a trafos; with a DELTA station thus max. 52 VA.

Controller:
The DELTA station does not have own control elements. It can be used only in connection with at least a manual control device DELTA mobile. A DELTA mobile is enclosed to each DELTA station therefore also. With the DELTA mobile one has a compact control desk for up to four locomotives in the hand. By its long lead one can steer the locomotives from the best in each case view position. At
the DELTA mobile you select one of four locomotives at a slide switch. Speed and driving direction of this locomotive can steer you then with the large rotary button. This has a characterized central position. With a pressure on the black emergency stop key you can stop the entire course enterprise. The light emitting diode built in the key informs at any time about the condition of the called locomotive and the entire layout (see page 79). The name „ Manual control device " for the DELTA mobile is thus not exaggerated. In addition the combination DELTA station and DELTA mobile can be used also for the enterprise of a Spur 1-Layout. Multi-course enterprise on „ Garden layout " is just as problem-free possible with it as with HO. Locomotives: As is the case for the DELTA control DELTA Loko motives, converted conventional locomotives as well as digital locomotives can be used.

Expandabilities

To the DELTA station can be attached up to four DELTA mobile. Already with two or three DELTA mobile one can play ideally too secondly or too third with a model railway facility. Each fellow player is responsible with its DELTA mobile for in or two locomotives. Finally varied model course situations can be copied such as switchyard operation, station sverkehr or double traction also together. Thus the DELTA station offers a quite new play passport with a smaller model railway facility.

Basic equipment and expandabilities (grey) with a DELTA station and DELTA mobile



Example

Also the delivery of a locomotive of a DELTA mobile on another is problem-free possible: Accepted, with that DELTA mobilely No. 1 will the straight express train with a e-Lok steered, the slide switch stands on „4 ". now is with this DELTA mobile steam locomotive by the siding to be driven. Thus easily the slide switch is placed e.g. on „1 ". One can let the ranking locomotive quite slow drive now with the large rotary button. The express train drives on meanwhile with the speed stopped last. Now if a second fellow player with DELTA mobilely No. would like to steer the 2, that places simply its slide switch on „4 ", and he is responsible already for the further travel of the express train. A goods train is during the whole time with constant speed on the way, although the locomotive on no DELTA mobile is selected. Thus model course driving now still more fun makes.

Digital layout

Also a small layout can be already operated with Märklin digital. This brings mainly two advantages:

- with a later extension all components can be invariably taken over.
- also with small layouts switches and signals can be switched digitally. This can „Bodenanlagen straight with " a crucial advantage to be.

If the layout with m-tracks is developed, an installation decoder k 73 can be built in each case into all switches (to installation also with signals 7039 possible, see page 160). Then you need to only attach the two leads red and brown the spur track to the digital center CONTROL UNIT. For the switches and signals is no outside wiring more

Example layout with m-tracks

necessarily, because they get their river and their switching information likewise over the track. Like that also a flying structure is very quickly and error free possible.

Tip: Switches with installation decoder mark each switch have by their decoder a certain number. So that you know after a change directly again, which switch is switched by which key at the KEY BOARD, you should note the number at the best to the track bed of the switch or on their lower surface.

Tip: Second spur track also the switches and the signals over the tracks attached, should use you in any case at least a further spur track, so that the tensions loss becomes not too large. The second spur track comes best on the first spur track facing the side or into a range, where there are several switches and signals. Attach the two spur tracks simply parallel to the central processing unit. You do not need an isolation of the neutral conductors naturally in this case.

Of course you can switch the magnet articles also with a digital layout conventionally with placing desks 7072.

Basic equipment and expandabilities
These are essentially identical as with a medium layout size. In order to avoid repetitions, please in following chapter 3.2 reread.

3.2. Medium sized layout (several electric circuits)

A „medium size " layout is a layout, as they developed many model railroadmen in the course of the time. The demarcation to a „big " layout is natural flowing. A medium sized layout is developed in all rule on a firm baseplate. It contains several electric circuits. With digital enterprise an electric circuit is supplied by the central processing unit, the others via a BOOSTER each with in each case its own TRANSFORMER. The digital control is usually used for digitally driving and also for digitally switching. Often mechanism control systems are already installed.

Reference works:
Track plans for middle and larger layouts: „Märklin HO railway tracks, K + M ". Suggestions and tips on the landscape design and for the setting up of model railway facilities: „Märklin course + landscape " and „Märklin course with whistle " around own track draft plans to try out or optimize, gives it „Gleisplanspiel ", in each case for m and k-tracks. There you find all Märklin of pieces of track as plastic parts to scale for plugging together. Different colors facilitate the overview of the different track radii.

Basic equipment
Transformer:
For the digital-System CAN they in principle each transformer use, which has a power output of approx. 30 VA or more. It can thus alternatively be a driving fahrtrafo 6631, a light licht-Tra-fo or a digital TRANSFORMER. The maximally possible power output of a digital central processing unit (approx. 47 VA) can be used however only with a TRANSFORMER, which can supply approx. 52 VA.

For larger layouts therefore a TRANSFORMER should be absolutely used. If the layout has several digital electric circuits, then BOOSTER and its own TRANSFORMER are necessary for each additional electric circuit.

Controller:
Principal item of each digital layout is the digital central processing unit. It settles data exchange with all attached control desks and strengthens the digital data. In the new central processing unit CONTROL UNIT (6021) is at the same time also a complete digital driving desk contained, so that the CONTROL UNIT represents a very favorable entrance in the digital-System. With the older central processing unit CENTRAL UNIT is necessary an additional digital driving desk. In the combined central processing unit CENTRAL CONTROL is likewise a driving desk contained, with which however only four determined locomotive addresses can be addressed (however all 80 locomotive addresses in connection with an additional driving desk).

Locomotives:
On a digital layout probably mainly digital locomotives will be used. There are different locomotive decoders, which offer different comfort possibilities.

- locomotives with the standard decoders c 80 or c 81 (art. NR. 36...)
- locomotives with the high-power engine 6090 with the decoder c 90 (art. NR. 37...).

This converted conventional locomotives can be also on digital enterprise. All digital locomotive decoders have from the driving desk a controllable „Zusatzfunktion ". With their e.g. the lighting or a smoke generator can be switched on and off a digital locomotive, even at any time if the locomotive stands. The high-power engine 6090 offers beyond that as comfortable possibilities as adjustable maximum speed, adjustable automatic starting and brake delay as well as speed control while driving downhill and mountain.
Each digital locomotive can be adjusted in any locomotive address between 1 and 80.

- also all DELTA locomotives can be used problem-free on a digital layout. They knew however no remote controlled auxiliary function and only in certain digital addresses to be adjusted (see page 219).
- conventional locomotives drive likewise on a digital layout, but its speed is not adjustable. They can however later be converted with a digital locomotive decoder.

If special conventional locomotives, for which a change is not possible or is out of the question, are to be continued using, should you a track range with a conventional electric circuit maintained. For this also an existing overhead line could be used. Which is to be considered thereby otherwise, experience on page 97.

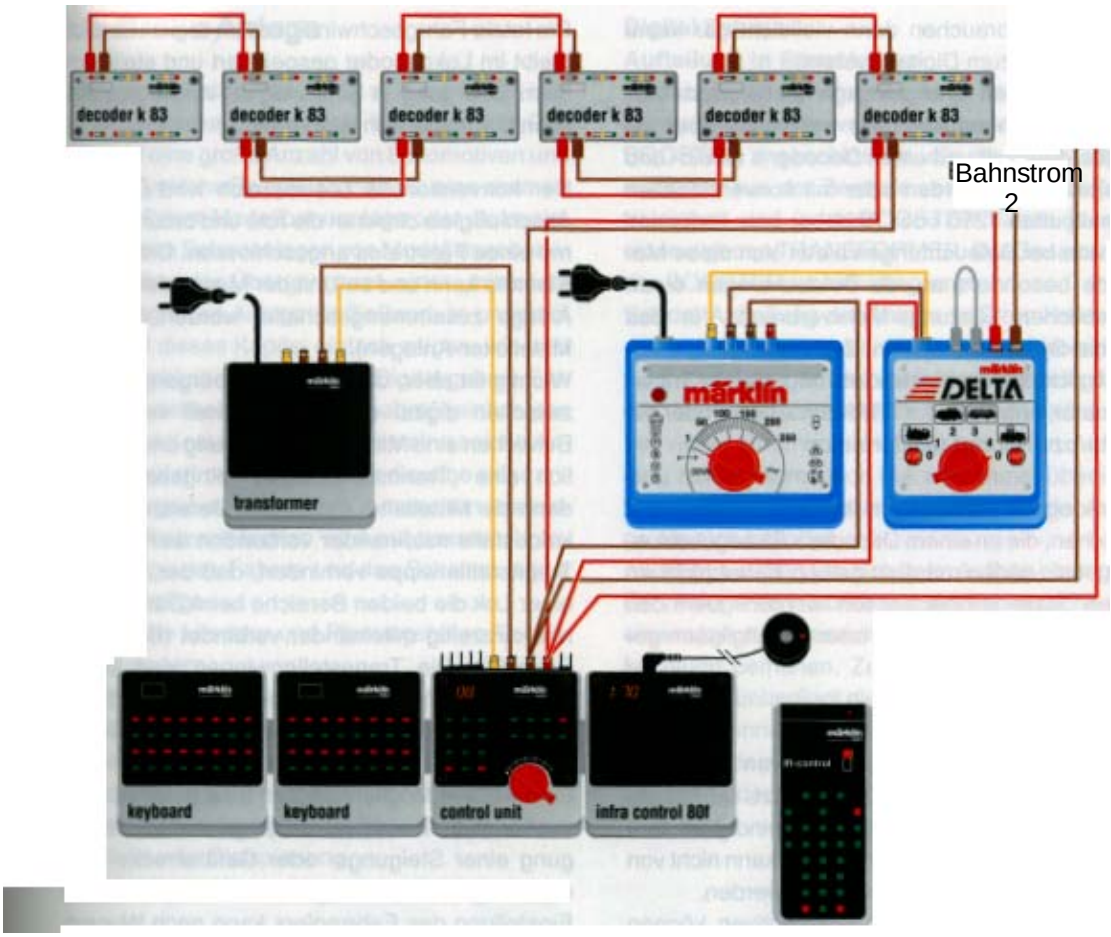
Expandabilities:
Digitally driving to each digital center further driving desks, e.g. CONTROL 80 F (6036) can be attached, (, even if only one electric circuit is present). If you have e.g. four or more locomotives on your layout, at least a further driving desk is recommendable; for some tasks it (e.g. double traction with arbitrary locomotive types) is even indispensable. Beside the standard driving desk CONTROL 80 F (6036) could be applicable for you perhaps also an infrared remote control IR CONTROL (6071) with the receiver station INFRA CONTROL 80 F (6070). Thus you can steer your locomotives of any point in the area out. With the IR CONTROL is even quick switching between four different locomotive addresses possible. To the speed attitude over the keys one can get accustomed quite quickly, however she is not operated „blind " like the travel automatic controller of a driving desk.

The earlier driving desk CONTROL 80 (6035) can be used naturally further with all central processing units, it is missing to it only the keys for the working models.

Expandabilities:
Digitally switching would like to switch you switches and signals likewise digitally, need you a digital placing desk and suitable magnet article decoders k 83(6093) or k 73 (6073). Basic equipment for digitally switching is a digital placing desk KEY BOARD (6040). It offers switching possibilities for magnet articles zweispulige up to 16. If you have more switches and signals on your layout, you can begin up to 16 KEYBOARDs. The magnet articles are usually attached with a firmly installed layout to decoder k 83, in each case 4 magnet articles to a decoder (somewhat low-priced and more universally than individual installation decoders k 73). The decoders are connected by one red and brown cable each directly with the central processing unit or a BOOSTER. Several decoders can be connected in series with a ring circuit. Exactly the same also decoders k 84 can be attached, with those lighting, engines or track sections over a KEY BOARD be switched on and off. You can reread the correct connection of the different magnet articles and permanent current consumers in chapter 8.4 starting from page 136. The extended possibilities when digitally switching are presented in chapter 3.3 „Grosse layout ".

Example layout
The shown layout is appropriate for operation with up to 4 courses. It is divided into two electric circuits. You find an exact Gleispian for this layout in the book by the way „K track lay close for a riser ", 5. 47 - 49. As central processing unit a CONTROL UNIT is used, which contains an adequate digital driving desk at the same time. As the further driving desk an IR CONTROL with a INFRA CONTROL 80 F is used, so that one can go when steering the courses also around the layout. Also the magnet articles on the layout are digitally switched, therefore two KEYBOARDs are installed (on the layout nevertheless 8 switches are and altogether 12 signals present, of it 3 „dreibegriffige signals " 7041). In order to head for these, 6 decoders k 83 are needed. For the reduction of the power absorption the lighting are developed with all not visible switches and signals.

Example of a medium sized layout



sized example layout

Allocation of the electric circuits:
The CONTROL UNIT supplies the station range and all magnet article decoders. As the second current supply unit a DELTA control with a conventional trafo 6631 is used here (see also page 73), which remained remaining still by an earlier DELTA layout. However here the load of the current supply comes depending upon distribution of the courses sometimes already to its border.

„Gemischte " layouts with digital and conventional components
It is problem-free possible with Märklin H0-Mittelleiter-Anlagen to operate apart from the digital also conventional components on the same layout.

Conventionally switching

- All magnet articles can be switched easily with conventional placing desks 7072. The current supply of the magnet articles is made then by the yellow clamp of a transformer. For this if a transformer is used, which supplies also a digital electric circuit, is to there naturally less achievement at the disposal. Therefore best a separate trafo should be used.
- It is also possible to switch a part of the magnet articles over digital layout and another part conventionally. This can be applicable, if some magnet articles are switched always automatically e.g. over switching tracks, contact tracks or reed contacts from the courses, e.g. railway barriers, signal lights

usw. These need then perhaps no connection to the digital-System. Lighting and other permanent current consumers can be switched on and off likewise alternatively over a digital placing desk and a decoder k 84 or with conventional operating desks 7210 or 7211. Straight one with lighting particularly offers itself this method, since lighting represent a substantial achievement increased consumption for the digital-System. For supply its own high performance transformer is recommended here, either a TRANSFORMER or a driving and/or a light transformer.

Warning with mixed enterprise: Switches, which are attached at a decoder k 83, may not be attached with the yellow cable to a trafo. Nevertheless they can be switched with that 7072 or switching tracks.

Conventionally assigned:
they drive a driving conventional locomotives directly on a digital electric circuit with relatively high constant speed. Their speed and driving direction cannot be affected by a digital driving desk. Nearly all conventional locomotives can be converted however with a digital decoder (see main chapter 6) and are then a digital locomotive completely equivalent.

In addition, one can supply a certain track range with a conventional driving fahrtrafo. Digital locomotives can drive on such a track section without further; their speed and driving direction can be steered even via the conventional trafo. The last driving speed within the digital range remains stored in the locomotive decoder and resets themselves with the transition to a digitally supplied section automatically.

The conventional track range is attached over a spur track directly to the red and brown clamp of a driving fahrtrafos. The brown clamp can be hooked up and is with the mass of the digital layout (with HO neutral conductor layouts). Important it is however that at all connectors between digital and a neutral conductor isolation and additionally a „Trennstellenwippe are inserted to conventionally supplied ranges ", because the neutral conductors of the two ranges may not be interconnected under any circumstances. The Trennsteltenwippe prevents that the Schleifer of a locomotive the two ranges Darueberfah ren with briefly interconnect (to picture see page 61). The interface jacks are as 5-Stueck-Packungen under the art. NR. 38,555 (for m-tracks) and 38,558 (for k-tracks) available.

A further possibility for the employment of a conventional trafos would be the separate supply upward gradient or pleasure gefaellstrecke or a general slow distance covered. With the attitude of the driving automatic controller a higher or lower speed can be selected according to desire, which applies then to all locomotives.

3.3. Große Anlage

3.3. Large layout

A „big layout " draws out by long track distances, very many switches and signals and a large number of locomotives and courses. Typical examples are e.g. a room-filling private-model railway facility or the impressing layoutlayout layouts of model railway clubs. But the transition of a „medium " to a large layout is flowing. In our book this chapter is to show easily, how far the possibilities go from Märklin digital. Individual Modellbahner will probably realize such a layout rarely from place and cost reasons completely, but or other building group is surely interesting for some. Of course on more „unserer " large layout driving and switching are digitally managed. Additional literature and planning aids for larger layouts:

- „Märklin HO railway tracks, M + K " 1
- Märklin electrical connection councellor
- track planning game m or k-track
- track plan notation templates
- track planning programs for the PC
- individual track planning.

You find details in the current Märklin catalog.

Digitally driving

Allocation into electric circuits

Also with large layouts there is in each case a central processing unit. All further electric circuits are attached to BOOSTERS, which strengthen the digital informations from the center. The central processing unit and each BOOSTER have in each case its own TRANSFORMER. The total number of the BOOSTERS is not limited. During the allocation of the layout into electric circuits it is to be only considered that in each electric circuit any more than four locomotives do not drive at the same time. That or the operators do not need to worry also with many electric circuits about their allocation. Each locomotive is always steered via its digital address, no matter, where up, the layout it is. However you should strive with the structure of a large layout regarding the error tracing around a as clear allocation and a wiring as possible. Absolutely draw into a layout plan the situation in of all spur tracks and interfaces. Use several spur tracks for electric circuits with long track distances or many branchings.

Example of a large layout

3.3. Große Anlage

If many driving and Stellpulte are installed (more than approx. 10), the central processing unit should not supply an outside electric circuit more. She takes over then only the supply of the digital desks and the BOOSTERS.

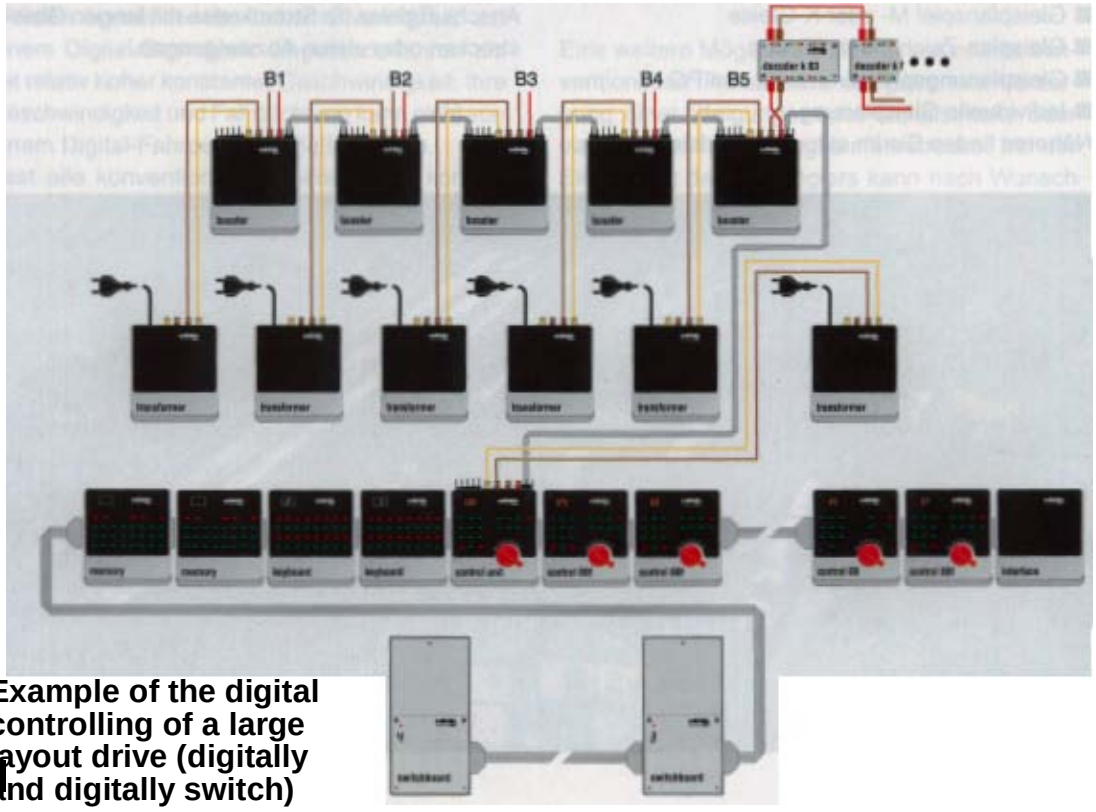
Employment of the driving desks

On a large digital layout altogether driving desks can be used up to 10. Since the CONTROL UNIT already contains a driving desk, here still 9 additional driving desks can be attached. Also the INFRA CONTROL counts 80 F and the INTERFACE in each case as driving desk.

With a large layout it is often favourable to develop two separate fahrstaende so that intensive components can be better seen. The connection between the fahrstaenden is made by the adaptor cables 6038/6039. The total number of the driving desks remains however limited to 10. Altogether courses can be assigned be steered independently up to 80 locomotive addresses, can thus up to 60 locomotives and. Straight one with large layouts is surely meaningful the employment of a computer over an INTERFACE. Appropriate computer programs can take over fully automatic or part-automatically a part of driving. By the use of reporting contacts and acknowledging modules precisely, course-steered operational sequence are possible, which would be realizable with manual control only with many „Lokfuehrern". This extensive group of topics would blow up however the framework of this book.

Working models

The employment of different working models makes itself very beautiful on a digital layout, e.g. a turntable, a sliding stage, a jib crane or a goliath crane. Details to the connection and enterprise find you on the pages 172/173. A computer control makes reality-faithful operational sequence possible also here.



Example of the digital controlling of a large layout drive (digitally and digitally switch)

Digitally switching

In the digital-System magnet articles can (or lamps, engines etc.. up to 256) independently to be switched. With maximum configuration for it decoders k 83 or k 84 are necessary up to 64. At a large-scale installation the decoders should be supplied by one or more BOOSTERS.

The magnet articles are then independent of driving and can be switched more surely. The power demand of the lighting plays thereby a crucial role. For ever about 30 lit switches or signals its own BOOSTER with in each case a TRANSFORMER must be used. However it can be more economical to separate the lighting of the magnet articles and to a its own to attach high performance lighting transformer.
Best you use a Märklin trafo likewise. With trafos of other manufacturers you yourselves must absolutely provide for a perfect electrical security (e.g. absolutely fuses with correct acceptable current load, execution slowly-acting, into the electric circuits insert!).
Also permanent current consumers, that are switched over decoder k 84, like engines or lighting, can be supplied and not loaded via own transformers then the digital layout (see circuits on page 164).
For the control of the magnet articles and remaining consumer can be inserted up to 16 KEYBOARDs. At each KEY BOARD an address must be stopped. Also several Stellpulte can be adjusted parallel in the same address, e.g. for separate fahr-staende. For achievement reasons nevertheless any more than altogether 16 digital placing desks should not be used.

An interesting alternative straight for larger layouts are surely place deskdesk placing desks, which are headed for over in or several SWITHBOARDs (see page 174). A place deskdesk placing desk makes particularly within station or ranking ranges a substantially better overview possible of the conditions of all switches and signals. There are to buy alternatively finished modules for place deskdesk placing desks in the trade (unfortunately relatively expensively), or you can with inexpensive construction units and something fate itself an individual gleisbildstellwerk construct itself. An interesting and inexpensive alternative are gleisbildstell-werke, which are simulated on a computer screen. Some programs for the use of the INTERFACE offer this possibility.

On many large layouts a „Schatten station is inserted ". That is a number of tracks next to one another, which are invisibly shifted under the layout usually (therefore it the name). Turned off on these tracks all courses, which do not drive at present on the layout, but always again to be used to be supposed. For greatest possible flexibility all tracks of a shade station should be at least as long as the longest assigned course. You can arrange the automatic control of a shade station in the digital-System very comfortably and flexibly with a MEMORY. The MEMORY is an automatic route placing desk. With a MEMORY you can automate very simply also different control problems, e.g. blocking block enterpriseblocking enterprise or the entry routes of a station, because the MEMORY is one of the most versatile devices in the digital-Sy-stem. For large layouts can be used to max. 4 MEMORYs. By a MEMORY can surely serve an individual operator still layout sizes, which would be still visible with hand enterprise hardly. Even an automatic bolting device can be stopped, those crossing routes recognizes and when desired prevented. Thus the MEMORY helps also very effectively to avoid course collisions. Also the magnet article control system offers extremely extensive possibilities by a computer with the help of the INTERFACE. The INTERFACE can be used at the same time for the controlling of the course enterprise and the magnet articles. These possibilities in detail to represent here, would exceed the framework of this book with far.

3.4. Power demand of a layout

Each engine and each lamp in a model railway facility need a certain electrical achievement. The entire achievement of all consumers switched on at the same time must be made available by the transformer and processed by the central processing unit. In this chapter you obtain appoximate values, in order to measure the power demand of the individual consumers. Thus you can determine whether the necessary achievement can be applied by the central processing unit alone or whether it additional achievement amplifiers (BOOSTERS) to need. In this case you must clarify the question, how many BOOSTERS them to need and how your layout is divided best into different electric circuits.

Power output of the transformers and central processing units

The electrical achievement of transformers is indicated in VA (volt Ampere). The equivalent unit Watt (W) is more well-known: 1 VA corresponds to 1 W.

Maximum power output of the transformers:

Designation	Art.-Nr.	Power output
TRANSFORMER	6000 (100 V)	50 VA
TRANSFORMER	6001 (110 V)	42 VA
TRANSFORMER	6002 (230 V)	52 VA
TRANSFORMER	6003 (240 V)	52 VA
Driving transformer	6631 (230 V)	30 VA
	6627 (110 V)	30 VA
	6647 (230 V)	32 VA
Driving transformer (no longer available)	6671 (230 V)	16 VA
	6667 (110V)	16 VA
Light transformer (no longer available)	6611 (230 V)	40 VA

Maximum power output of the central processing units and BOOSTERS:

Designation	Art.-Nr.	Exit - leistung
CONTROL UNIT	6021	ca. 47 VA
BOOSTER	6015	ca. 47 VA
CENTRAL UNIT	6020	ca. 47 VA
CENTRAL CONTROL		ca. 45 VA
DELTA-Control als Digital-Booster	6604	ca. 30 VA
DELTA-Station	6607	ca. 47 VA

Different achievement data partly result from different test provisions for different countries, e.g. with the type 6001. Each Märklin transformer contains a safety device, which switches the trafo off when to strong heating up. This thermal switch reacts however quite slowly-acting, so that usually the disconnection of the center takes place first.

The indicated power output of the central processing units applies to an input voltage of approx. 16V alternating voltage. All central processing units and BOOSTER have practically the same power output. In each central processing unit (and in each BOOSTER) an overcurrent protection is inserted, which limits output current to values of approx. 2.5 A. „Fordert " the layout over longer time (some seconds) a higher river, the overcurrent protection switches the output stages of the central processing unit and all BOOSTERS off. This prevents a damage of the digital devices and the locomotives and car on the layout. The achievement of the TRANSFORMERS is somewhat higher than those of the central processing units, since the central processing unit has a certain power consumption. The power outputs of the conventional transformers are clearly smaller against it. With conventional transformers thus the efficiency of the central processing unit or a BOOSTERs cannot be used fully. Also a more frequent disconnection is possible by thermal overloading of these transformers.

Equipment	Power absorption
Driving HO locomotive (einmotorig)	ca. 8 VA (5 bis 10 Vaje nach Motor u. Zuglast)
Driving trace 1-Lok	15 - 20 VA
Locomotive lighting	ca. 2 - 3 VA
Smoke generator	additionally ca. 5 VA
Lamp (car, houses, switches)	je ca. 1,2 VA
Switch a unbe shone magnet article (only for the moment switching)	ca. 5 - 10 VA
Turntable (without lighting)	ca. 10 VA
Crane	ca. 5 VA
Digital-Fahrpult	ca. 1 VA
Digital Fahrpult (on the average)	ca. 1 - 2 VA

Leistungsbedart of different consumers

The power demand of the individual consumers can be indicated only ansatzweise, since there are from equipment on the other hand substantial differences. For the computation of the total output you must add easily the number of the devices and lamps switched on presumably at the same time times their respective power absorption. In addition you find in chapter 12.11 eineTa belle, with which you can accomplish this computation directly (see page 222). Here you need to
register naturally only such consumers, that actually refer their river over the digital-Sy-stem. If lighting are supplied e.g. directly from their own lighting beleuchtungstrafo, they are not taken into account.

Remarkably: A course with 4 lit up cars necessarily about as much at all the lighting strike achievement as a driving locomotive quite substantially to book. During the capacity rating the power demand only one magnet article is to be along-considered in the switching moment, since in the digital-System only one magnet article can be always switched at the same time. Older, somewhat switches or signals difficult to operate need maximally up to 10 VA. are then at the same time four locomotives in the same electric circuit on the way, are not sufficient possibly the achievement of a tender unit any longer for clean switching magnet articles.

Allocation into separate electric circuits

Power demand of a layout

If you attached many digital control desks on a large plant, the central processing unit should supply if possible no own electric circuit more. It is then only responsible for the supply of the control desks, as in the example „Grosse plant " (see picture on

page 48).

Tip: Stromkreise „auf Reserve“

Even if you at present yet several traction current circles do not need: If you install a plant firmly, it is favourable, if you insert from advance some reserve interfaces with. Each range is supplied via its own spur track. First you attach then several spur tracks parallel to the same electric circuit. If necessary you have then several separate electric circuits available, without you must diminish their tracks again.

Leistung einsparen

If you are straight at considering whether you need still another further BOOSTER: There are also some possibilities of saving achievement or of not operating devices over the digital plant. Earliest for this lighting offer themselves:

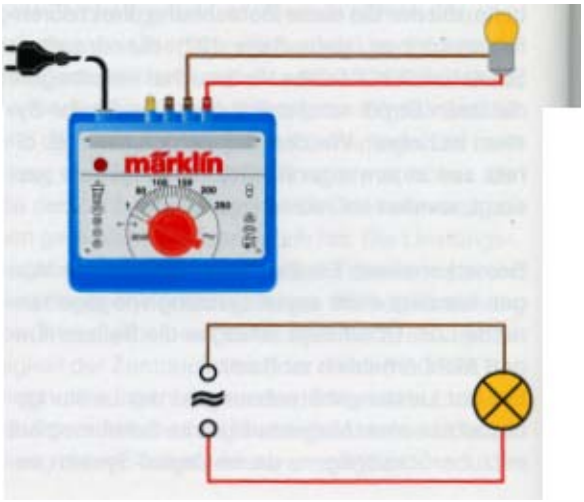
- with switches or signals within not observable ranges of the plant can develop you the lamps. The switching function is not impaired by it.
- of light signals have their own connection for the lighting.
- also with switches can be installed a separate connection for the lighting (see page 139). All these lighting can be attached directly to their own transformer. But also a conventional driving or light transformer can be used (see e.g. picture page 150). Importantly: Without change the yellow cables of the switches, which are attached at a decoder k 83, may be attached not to a separate supply versorgungstrafo!
- the lighting of houses, roads do not have to be supplied via the digital System. They can be attached easily also over a conventional operating desk 7210, 7211 or a decoder k 84 to a trafo (see picture page 164).

3.5. Effective wiring with digital

The range of the wiring with a digital plant is reduced noticeably in relation to a conventional plant; there are nevertheless some important points, which one should consider and.

Bases of the electrical connection with digital plants

They surely still know the sentence from the school: River can only flow, as long as an electric circuit is closed. So simply this sentence sounds, is so fundamental it for entire electro-technology and for functioning a model course. And when is an electric circuit closed? If an electrical connection of a power source to the consumer and a second line of the consumer lead again back to the power source. With the model course the inlet is called to the tracks „Bahnstrom " (abbreviation „B ") and to the lamps „Lichtstrom " (abbreviation „L"); the strom-rueckleitung is called „Masse " (abbreviation „0 "). With Maerklin H0-Modellbahnanlagen in principle alternating current is used. With a digital plant however the potential gradient is fundamentally different from that a conventional plant (closer see chapter 2.9).



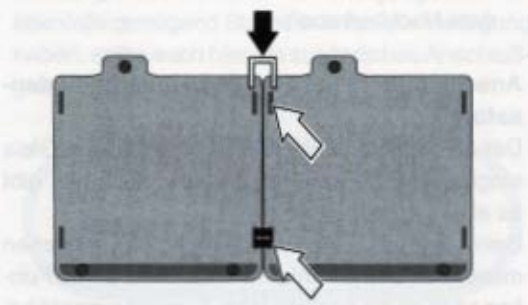
Principle sketch of a closed electric circuit, above material, down as wiring diagram represented

There are also model railways, which work with direct current, but those are not topic of our book. The tracks of each Märklin HO layout have the characteristic neutral conductor, across which the current inlet is led. The currentback line is made by the rails. The strom-eitung of a track to the next is made by the connection latches of the neutral conductor and the rails.

Since the household-usual alternating voltage for the enterprise of a model railway facility would be much too dangerous, this is „ down-transforms „ Mains voltage " first by a transformer to a harmless value ". With a digital layout the river does not go however directly from the trafo to the spur track, but the central processing unit links the digital informations with the tension and gives it then to the track and to the remaining consumers.

Each electrical consumer needs a certain achievement for his company whether it concerns now around the engine of a locomotive or a simple lamp. The transformer must supply at least so much achievement, how is used by all consumers in the model railway facility, switched on at the same time. Otherwise it switched itself off too strongly to warm up and after some time, because in all Märklin an overheating protection is inserted model course modell-bahntrafos. If a trafo cannot put alone to sufficient achievement at the disposal, the layout must be divided into several separate electric circuits, which are supplied in each case by their own trafo. That applies also in principle with the digital-System. Here there is a BOOSTER (achievement amplifier) apart from the central processing unit for each further electric circuit. It strengthens all information from the central processing unit; therefore the information is alike in all electric circuits on a digital layout. The operator of the layout does not need to worry thus any longer about the allocation of the electric circuits.
This was a quite short „ Overflight/flyover " over the most important bases of the model course electrical connection. We treat now however the individual points step for step.

Before attaching it stands in each guidance, but it is often surveyed nevertheless or forgotten:
Before you attach or remove any digital equipment, separate the associated transformer from the net.
The „ attach or remove " applies both to the lateral contact strips of the digital desks as well as for all interwirings. Always a damage does not have to develop, if you do not consider this reference, but in certain cases one can develop.



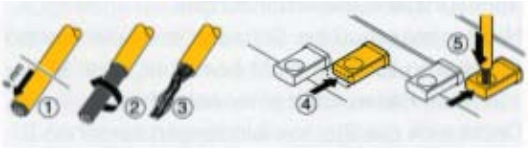
Patch cords of the digital desks by holding clasp fix

So that the patch cords between digital control desks do not separate unintentionally, you should clasp the devices in principle by each digital desk included with the plastic to interconnect. The clips are put into the recesses at the lower surface of the devices. They fit in only in the intended direction.
Thus the connection folds
Good Contacts are important
It applies in the daily life, it is also an important factor with the wiring of a model course. A matter of course? Actually already, but so some lengthy error tracing becomes necessary, because at stripping or attaching the cables carefully one did not work.

The most important points shortly:

- Cable ends strip the wire on a length of approx. 8 mm. If possible no kupferadern split (the maximum stress of the cable reduces).
- Kupferadern with one another twist. Ends do not solder (cable becomes too rigidly - larger danger of fracture).

Correct connection of the cables at connecting terminals



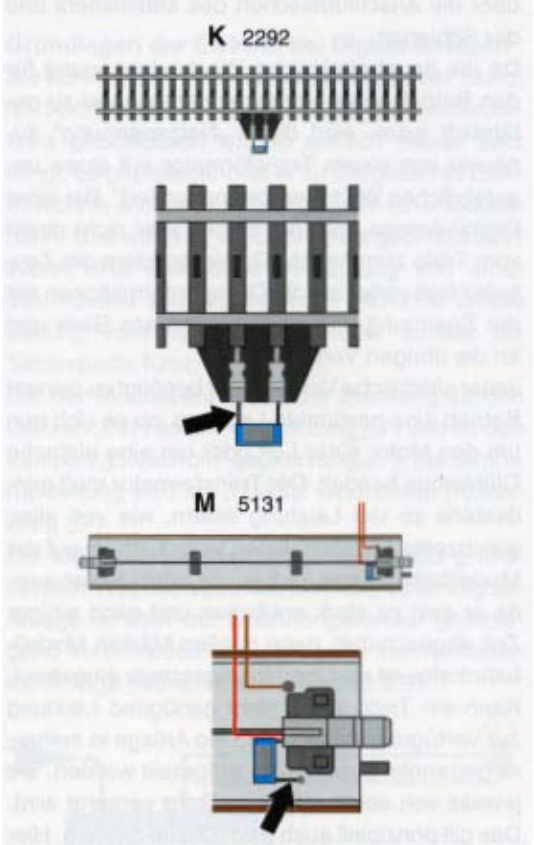
- Press from the rear on the connecting terminal, only stripped cable end into the hole in-lead, clamp release.

Importantly: Do not clamp the isolated part of the cable! Cable ends not too far down leave (risk of short circuit with the neighbour cable).

Spur tracks with or without capacitor

The river one feeds over a spur track into the track. So far, so well. In addition, it gives here to consider somewhat. With the enterprise of a model course locomotive sometimes small sparks in the collector develop. These sparks can „Funkstoerungen the notorious " with broadcast or cause television sets in the environment, if they spread over the tracks. So that the disturbances cannot spread over the tracks, a spur track with a capacitor must be used with a conventional layout in each electric circuit. All further spur tracks of the same electric circuit may not contain capacitor; this would reduce its effectiveness otherwise again. A DELTA or a digital layout may be never attached against it with spur tracks with capacitor. The condensers would work for the digital signals similarly as a continuing short-circuit. Interferences are already suppressed with DELTA and digital locomotives in the locomotive.

Situation of the entstoerkondensators in a k and/or a one conclusion track



Therefore: for digital and DELTA layouts only use the following spur tracks:
M-Gleise:
Art.-Nr. 5111 (gerade) oder 5103 (gebogen)
K-Gleise:
Art.-Nr. 2290 (gerade) oder
Anschlußklemmen 7500 (Masse) und 7504 (Mittelleiter) für Standard-K-Gleise.

A layout on digital enterprise, already developed, you change, must test over on capacitor wools you first determine whether in any spur track a condenser is built. With k-tracks you can check easily, because the condenser is from the outside clearly visible. With m-tracks it is somewhat more difficult, because the condenser, if available, is under the track bed installed. But they can without disassembly of the rails with

a simple test determine whether in an electric circuit a condenser is present or not. In addition a digital central processing unit with a transformer and a driving desk must already be attached.

- If you remove first all consumers from the track (locomotives, lit up car, other consumers, that are attached at the central processing unit directly).
- Separate the red line to the spur track.
- Close a normal model course lamp between them, as shown in the sketch down.

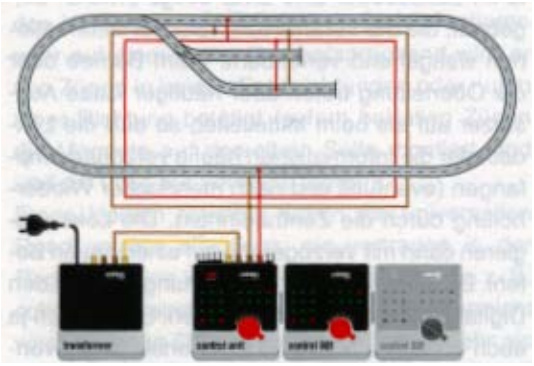
Test whether in the spur track a entstoerkondensator is present

- giving it at the digital driving desk the locomotive address „40 "; untwist then the driving automatic controller completely.
- if now the lamp does not shine, is everything correct: it is not missing a condenser in the spur track.
- lights up the lamp however, must look for you the spur track (with several spur tracks in an electric circuit only one would be allowed to do a capacitor contained). You remove the condenser, by at least splitting a connection leg with a small side cutter (pliers) (see arrows in the accompanying picture).
- of case on their layout several electric circuits are present, examine you all with this method!

Several spur tracks use

The current forwarding does not go over the connection latches of the tracks as „ smoothly " as in a cable. At each connector the river must overcome „ Transition resistances "; therefore it can be weakened after a longer track distance clearly (dependent also on the condition of the tracks). For this reason should be inserted with larger layouts after about in each case two to three meters track distance a furtherspur track, in order to refurbish the tension at the track again. If several spur tracks are present for an electric circuit, these become best to a ring circuit (ever a red and a brown cable!) attached, which proceeds from the center or a BOOSTER. It by the way is of advantage, if it really concerns thereby a closed ring circuit, which is attached thus „on two sides ".

So that the locomotives at upward gradient distances have likewise sufficient current reserves available, an additional spur track should be inserted also here.



Ringleltung and several spur tracks (schematic)

Magnet articles specially attach
Because of the tensions loss in the track also the magnet article ecoders should not be attached if possible at the track, as it was frequently shown in former times. The decoders should be attached rather over own leads red and brown directly to the central processing unit or a BOOSTER. For this is one (likewise closed!) Ring circuit particularly favourably. Even if you supply at present the decoders and a traction current circle from a common source, achieve a particularly clear and „zukunftssichere " wiring, if you install a completely separated ring circuit only for the decoders. Then you can supply the decoders from their own BOOSTER with later extensions without each change.

Overhead line for digital do not use
Since the digital pulses are comparatively short, already very short interruptions of the current feed can make the information unauswertbar. During the processing of the digital signals in the locomotive decoder are some „Tricks " inserted, which prevents the processing of wrong information to a large extent. With the enterprise over the overhead line however more frequently short misfires arise than with the neutral conductor, so that the locomotive decoders frequently retards the information received (possibly only after repeated repetition by the central processing unit). The locomotives react then with delay to a new instruction. Therefore an overhead line should not be used for the digital enterprise. They can steer also anyhow up to 80 locomotives independently from each other!

If you would like however an additional conventional electric circuit on your layout maintained, the overhead line is for it a good possibility, but unfortunately only for conventional e-Loks.

The mass macht's
By the central neutral conductor all Märklin H0-Modellbahnanlagen has a special advantage: there is a common mass potential, i.e., all ground wires can be interconnected problem-free. This applies even to mixed layouts with digital and conventional components. In the sense of a clear wiring a „zentrale mass should be installed " in the proximity of the trafos, similarly like the central mass rail in the junction box of a house electrical connection in a model railway facility. To this central mass the brown ground wires of all transformers, central processing units and BOOSTERS should be attached. For it one or more distributor plates 7209 are well suitable, to which 11 plugs can be attached in each case. It is expressly not recommended by Märklin by the way to lay a only one „dicke " mass ring circuit approximately around the layout and attach to it all earth cables. Better, because by far clearer, it is, to use for each electric circuit separated ground wires. Thus the probability of unwanted side effects is smaller. If an electric circuit is not correctly attached to the ground wire, it can come e.g. over the rails nevertheless to a careless bonding. In addition the error tracing is substantially facilitated (it to be able clearly to say: here a ground connection is missing and here).

Reference
The stromrueckleitung for the yellow cables is made frequently by the rails or the blue switching lines. Whether the electric circuit is correctly closed, is not always obvious thereby. This can cause errors, which are to be found often only with some consideration.

Masseanschtuss of the signals
Signals keep their ground connection usually direct over the metallic base plate from the track. This ground connection is responsible only for the lighting, the switching function of the signals is independent of it. If thus

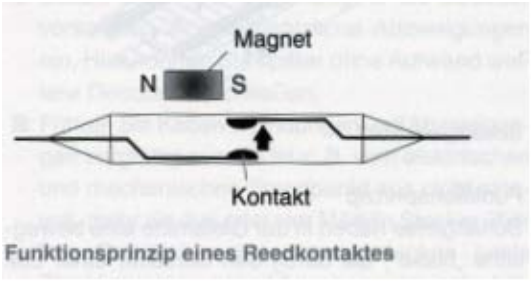
Signal lighting once does not burn, is missing with large probability the ground connection. The ground can be supplied also by way of a cable, if the base plates are not to be used or be able. With the wing signals in addition a socket is laterally intended at the signal; the light signals have a brown marked Connecting terminal. The provided base plates of the wing signals are intended for m-tracks, the plates of the light signals for k-tracks. As spare parts there are the suitable baseplates for that in each case different track system however for all signals. Further information to this topic finds you in the section „Ground connection the signals " on page 141.

Switch correctly - also with mechanism
For all mechanism circuits, all the same whether on a conventional layout or in the digital-System, it becomes signal initiators necessarily, which are operated by the driving courses. In the following sections function and employment of the most important signal initiators are discussed.

Reed contact (HO und Spur 1)
Reed contacts (admits also under the contraction „SRK " = inert gas tubing contacts) are independent of the track system and can be used therefore for practically all application purposes. Are from Märklin reed contacts for m and k-track under the art. NR. 7555 available.

Reed contact 7555 in m-track begin

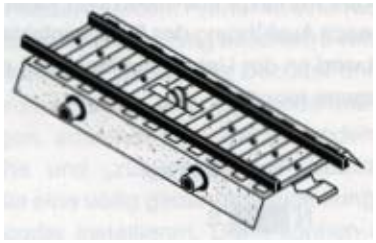
Two springy Metalizungen melted operational principle in a small glass tube,



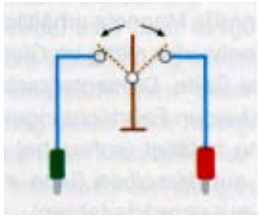
Funktionsprinzip eines Reedkontaktes

at whose ends contacts sit. The connections of the metal tongues are outward led as cables. Outside the glass tube if a small magnet is led past, then the metal tongues tighten, and the contacts close (or open, depending upon execution of the reed contact). The magnet is installed at the lower surface of a locomotive or a car. One must determine the correct distance between magnet and reed contact by trying out. For different distances differently large magnets are available. One can install the contact either centrically in the track or on a side. Accordingly it is operated by courses in both driving directions or only in a direction (if with all courses the magnets are installed onto the same side and the locomotives only forward to drive). The universal reed contacts have a small disadvantage however: they stand usually only a small current load, which is e.g. already reached by only one magnet article. If one wants to switch more than one magnet article at the same time over a reed contact, one must use electronic additional circuits with transistors or triacs with conventional layouts. If reed contacts are attached against it in the digital-System to an acknowledging module s 88 (see page 181), contact load does not play a role.

Switching track (only HO)
There are switching tracks only with the Märklin HO means leader system with the following article numbers:
5146 (M)/2299 (K): gerade 1/2 Länge;
5147 (M)/2229 (K): gebogen 1/2 Länge;
5213 (M)/2239 (K): gebogen 1/2 Länge, großer Kreisbogen.



Operational principle
Switching tracks have a mobile „Nase in the track center ", which is pressed downward by the Schleifer of a locomotive with the

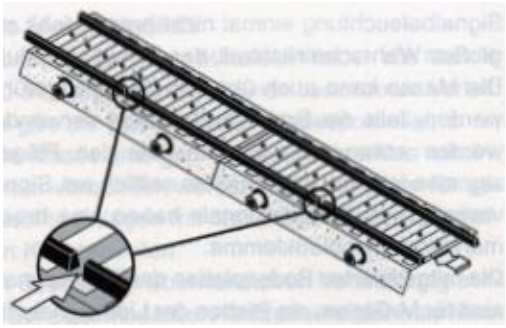


1- operational principle of a switching track

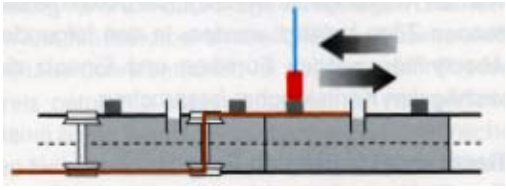
Darueberfahren. One of the two contacts is closed. With a switching track the driving direction of the courses can be differentiated surely, because for each driving direction its own contact is present. Switching tracks are from their principle moment contacts, because they close only for the moment the Darueberfahrens.

Contact tracks (only HO)
Art.-Nr.:
5145 (M)/2295 (K): 2 x gerade, 1/2 Länge;
5115 (M): Kontaktgleis-Verlängerung gerade, 1/1 Länge;
5116 (M): Kontaktgleis-Verlängerung gebogen, 1/1 Länge, großer Kreisbogen.

Operational principle



Contact track set 5145
With contact contacts one of the two rails is electrically isolated inserted (normally both rails have mass potential) with Maerklin HO tracks. Now if a locomotive drives or a car (with metal wheels, metal axles and - store) over a contact track, then by the wheel sets the isolated rail is connected with mass.



Picture: Operational principle of a contact track

Important note
Contact tracks must be installed, so always in pairs that the female connectors of both tracks are on the same side. In order to extend the contact range, isolated extension tracks are available. Contact tracks give so long contact, as a course drives over it or stands on it. They are thus continuous contact givers. For direct switching of magnet articles to conventional plants they are not suitable, since the coil in a magnet article „durchbren nen " can, if them receive current on contact over longer time. In conventional plants contact tracks are used therefore mainly for the position recognition. In the digital-System (at an s 88) contact tracks can be used also for switching from magnet articles, only the switching impulse are used there here.

3. Modellbahnanlagen aufbauen mit Märklin Digital

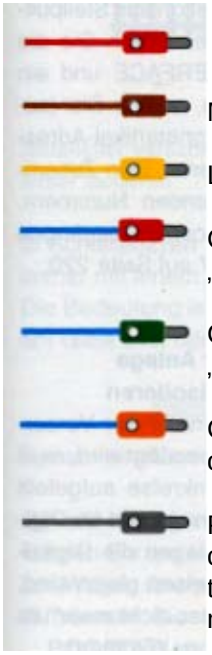
Clear wiring cable salad does not promote the well-being

Therefore: Cables clearly lay! Probably each experienced Modellbahner will agree this sentence with head nodding. But a view under many model railway facilities shows that the conversion is obviously not always quite so simple. A clear wiring at the beginning makes natural somewhat for more trouble, but you have which use of it, experience at the latest, if you must make yourselves on an intensive error tracing.

Märklin Colour Scheme

Use with larger layouts always uniform colors for the cables, plugs and sockets with the same function. In addition there is a given color pattern:

Kabel Stecker Bedeutung



Power
Bahnstrom (B)

Masse (0) Earth

Lichtstrom (L) Lights

Current on contact: Switch „curve", signal „Halt "

Current on contact: Switch „curve", signal „Proceed"

Current on contact: Switch or signal 3.

Position fixed, uses e.g. for connection of the contacts to acknowledging modules s 88

Also the following tips for clear wiring should consider you if possible with each model railway facility.

1. With small layouts with m-tracks you can get along with a minimum wiring with only 2 cables red and brown to the track, if you use their own installation decoder k 73 in each magnet article (see also tips on page 159/160).
2. Shifting it matching cables next to each other always in pairs; thus e.g. ever a separate red and a brown cable to the spur tracks and decoders.
3. Use separate ring circuits for each traction current circle and for the supply of the decoders. Implement these as closed ring circuits.
4. Insert into the ring circuit for the decoders as a precaution some additional branchings. Here you can later attach further decoders without expenditure.
5. Implement interwirings and branchings carefully. It is not meaningful e.g. from the electrical and mechanical point of view to plug more than three or four Märklin together plugs over their transverse holes (many plug contacts = high transition resistances '). Use with many leads better a distributor plate 7209.
6. Do not let the cables under the layout freely sag. Fix the cables with so-called „Krampen " or small kabelschellen.

Veneuerplatte **7209**

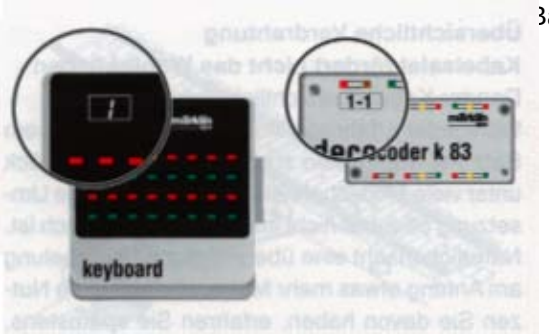
7. A module layout is to be able to be divided easily into smaller parts. It is much easier with Märklin digital to develop than with the thick wiring harnesses of a conventional magnet article control system. Only two lines each must actually be shifted by a module on the other hand red and brown for the decoders and for each traction current circle (plus possibly flat cables for the connection of SWITHBOARDs or acknowledging modules s 88).
8. If cables are connected with a plug and a clutch, provide the cables before the interface with a strain relief.

o making it itself a layout plan of your layout, into which you draw the situation in of all spur tracks and all neutral conductor interfaces. Write the numbers of the electric circuits beside it.
O marking it neutral conductor interfaces also directly on or beside the track, e.g. with a colored point in track bed.

Is the cable „ thick sufficient "?
(something over Kabeiquerschnitte) the usual Märklin model course cable has a cross section of 0,19 mm2 that is sufficient for all wirings on small and medium sized layouts. Only with large layouts (with cable lengths of more than approx. 6 meters) you for the stromversorgungskabel for the fasten-quiet and the ring circuits for the decoders cables with larger cross section should use, e.g. 0.5 mm2, so that the full achievement can arrive unhindered with the consumers. Remember to use for and the return pipe cable with same cross section because a thicker cable alone does not make a sense.

Numbers create overview

- Provide yourselves a numbering and an inscription pattern for your entire wiring.
- numbering it first the different electric circuits through. Mark your traction current circles e.g. with „B-1 " (red), „0(B)-1 " (brown); „B-2 ", „0(B)-2 ", the light-current circles e.g. with „L-1" (yellow), „0(L)-1 " (brown) etc.. Stick they small stickers on each cable below the layout (however you make sure as before as possible, whether the stickers keep also longer than a few days!).
- places it the addresses of its digital steep desks (KEY BOARD or SWITCH BOARD) if possible in sequential order. Stick stickers with the adjusted address into the address array left above on the housing.
- designating you your decoders at the best with a number, from which also equal the associated placing desk address follows, e.g. decoder 2-4 is the fourth decoder for the placing desk No. 2.



Adjusted addresses into the Adresstelder register

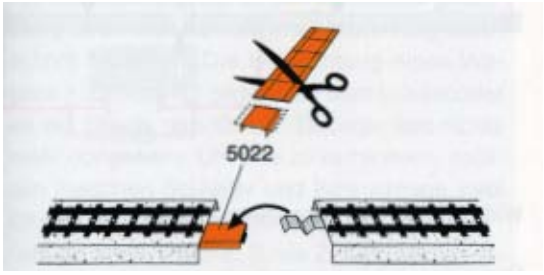
- noting it particularly with the decoders absolutely the adjusted address outside at the housing. In order to make it quite clear, you can write the assigned placing desk key number down at each decoder exit.
- numbering it the switches and signals on your layout through. Use for it best a clear combination of placing desk address and key number. If you steer the magnet articles over an INTERFACE and a computer program, you (additionally) should note the sequential magnet article address between 0 and 255. You find the connection between sequential numbers, KEYBOARD keys and decoder exits in the table 12.7 on page 220.

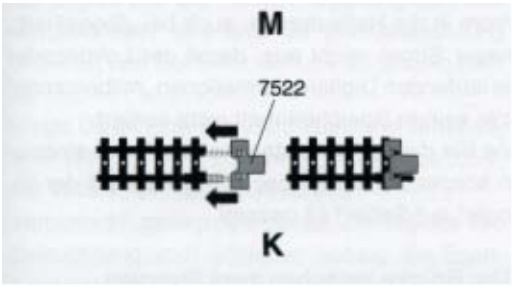
Several electric circuits on the layout

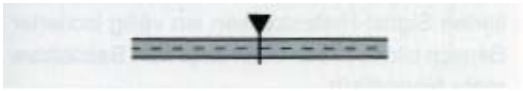
Electric circuits against each other isolate

As soon as more than one transformer for the supply of a model railway facility are needed, must the layout into separate electric circuits are divided. This applies to conventional and to digital layouts. Since with digital layouts the digital informations are alike in all electric circuits, the operator does not need to worry later any longer about the allocation of the electric circuits. Each electric circuit must be isolated at all connectors to other electric circuits. With a H0-Mittelleiter-Anlage it is enough out to isolate the neutral conductors against each other. For m-tracks there are in addition the insulating strips 5022, which are attached also to each wing signal. It goes

in addition, with a suitably into shape-cut piece of thicker paper.
For k-tracks there are the plastic more lsolier pieces 7522. An overhead line can be divided if necessary with the







Symbol for neutral conductor interface

piece of interruption of 7022 into different electric circuits.
Neutral conductors of different electric circuits against each other isolate.

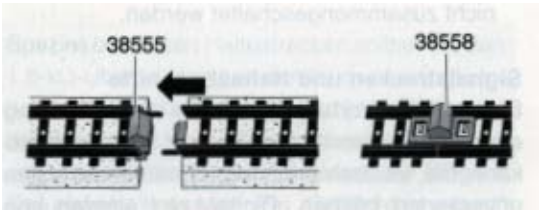
In wiring diagrams one is always represented neutral conductor lsolierung with a black triangle. The meaning is alike whether the Dreieick sits outside at the track or points to the neutral conductor.

Whether all connectors are correctly isolated, can examine you most easily with a lit car:

- separation it the red leads of all BOOSTERS and the central processing unit of the connecting terminal.
- latches it the red cable of a BOOSTER5 again on.
- driving it with the lit car over each interface of this electric circuit. Behind the interface the lighting must go out, otherwise the isolation is not correct.

Electric circuits meaningfully separate

In the digital-System the central processing unit can supply and a power output of approximately 47 VA to each BOOSTER with. This is sufficient, in order at the same time to operate maximally four to five HO locomotives. A large layout should be divided therefore in such a way into different electric circuits that with no more operating situation than 4 locomotives drive in an electric circuit. Intensive ranges such as stations or a locomotive shed with sliding stage must be divided therefore perhaps even into two electric circuits. Each electric circuit is supplied by a its own „ Tender unit ", thus of TRANSFORMER + central processing unit or TRANSFORMER + BOOSTERS.



Separate steuen whip for M and K-TRACK
Beside the digital also conventionally supplied electric circuit on the same layout can be operated. At all connectors between conventional and digital electric circuits additionally to „Trennstellenwippen " to be installed to that so-called must neutral conductor LSO lierungen.

The interface jacks prevent that over the Schleifer of a locomotive one, even if only brief one, can develop connection between digital and conventional electric circuit. Such connection would affect itself like a short-circuit and could lead quickly to a damage of the digital devices (output stages). Therefore also no locomotives with two electrically connected Schleifern may over-drive these interfaces, the locomotives 3045, e.g. not 3046, 3047 and their predecessor.

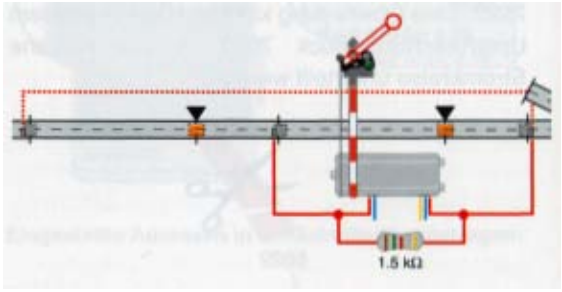
Important notes to current supply connections

- several transformers should be attached in principle over a multiple plug socket, if possible with switch, to the net. When putting the power supply plugs in you do not need to pay attention with digital layouts to same polarity of the trafos.
- the red connections of different trafos or different BOOSTERS may be connected never among themselves or with the central processing unit.
- the yellow and red connections of a central processing unit or a BOOSTERs may be never interconnected.
- the yellow cables of magnet articles, which are attached to a digital decoder, may not be connected with the yellow connection of a tra-fos or a central processing unit.
- the yellow cables of magnet articles may be united, as long as they are attached to the same decoder. The yellow cables for different decoders may not be hooked up.

Signaistrecken and retaining sections

An important preface: In the case of the conversion of a conventional layout to digital enterprise the wiring of the signal stopping
distances can remain unchanged. Digital locomotives are exactly the same affected by signal stopping distances like conventional locomotives, because the traction current switch in the signal interrupts the current feed in the retaining section with „Red" completely. Therefore normally also no digital informations would arrive into a switched off retaining section. A digital locomotive, which stands before a closed signal, „mitbe would not come it ", if in the driving desk its speed or driving direction were changed meanwhile. With a very long retaining break the locomotive decoder possibly even the last stored speed could „vergessen ": in this case the locomotive would not „Greenalso with " no more to drive on. Both can be avoided by a small circuit trick: They insert simply a resistance of approx. 1.5 k~ (1/4 Watt), parallel to the current supply of the stopping distance, which is switched over the switch in the signal.

Resistance in the signal stopping



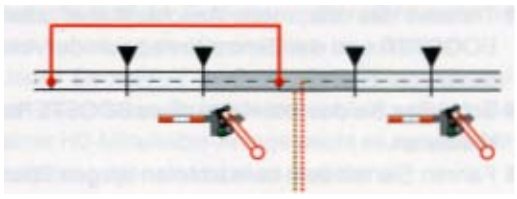
distance

Over the resistance a small river always flows into the stopping distance, also with „Signal stop". This river is sufficient, so that the locomotive decoder does not lose the current digital informations „receives" and/or its memory contents. How you can build this resistance in practice is shown, in the section „ Connection the signals " on page 143.

Tip: Bridge between two signals

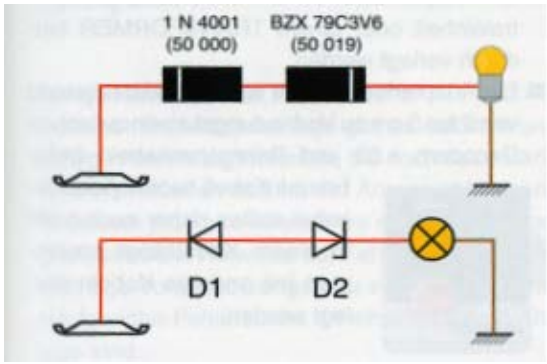
When the assembling of signals an error is made quite frequent: two signals are installed one behind the other on a distance. Even if both signals stand on „Green", the course in the track section between the signals continues. Why? Because in the center between the two isolated signal stopping distances a completely isolated range forms, into which at all no more traction current flows.
Remedy:
Install an additional spur track into the isolated section, or you pull a wire link from outside into this range.

Bridge between two signal retaining sections



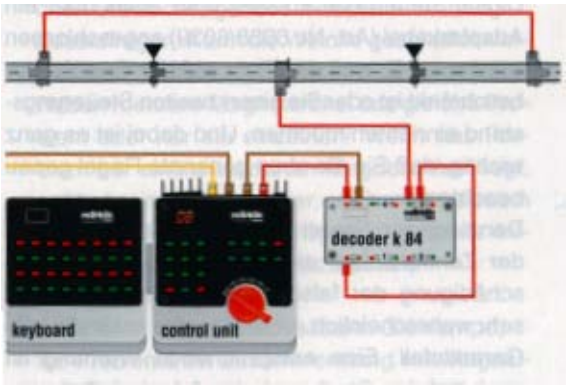
Booster, Zentrale

Tip:„Dioden gegen Gedächtnisverlust“
The locomotive decoder needs only a very small river for the processing of the information, as long as it does not have to head for the engine or the lighting of the locomotive. So that the circuit trick with the resistance functions, however no other power consumer may refer river from the switched off signal section at the same time. The lighting of a car e.g. needs so much river opposite the locomotive decoder that for the decoder nearly nothing more would remain. In order to prevent this, two diodes must be switched between Schleifer and lighting. That applies also, if e.g. as auxiliary function of a digital locomotive the TELEX clutch is switched on and off and the locomotive lighting is attached directly at the Schleifer of the locomotive. Diode DL is a standard rectifier diode, e.g. 1 N 4001 o. ae., D2 is a breakdown diode 3.6 V, 1/2 Watt, e.g. BZX 79C3V6 o. ae. Simplified said, separates the breakdown diode the lighting of the Schleifer, as soon as the tension at the neutral conductor becomes smaller than 3.6 V. The remaining tension is
sufficient the decoder for storage.



rotective circuit from two diodes prevents a memory loss of the notive decoder

Tip:Haltestrecken without signals
For not observable stopping distances, e.g. the tracks of an underground shade station, are signal masts unnecessary. You can furnish a disconnectible track distance also in other way, e.g. with a decoder k 84. With such a decoder can be switched up to four stopping distances.



Stopping distance with decoder k 84

Particularly with these stopping distances you should absolutely insert the 1 ,5-k Bypasses resisted, because here sometimes these distances turn off in not particularly well accessible ranges to usually rule and the locomotives even for longer time. „ Memory loss " would be here thus particularly annoying of a locomotive decoder. You can build the resistance simply together with the leads into the plugs at the k 84:

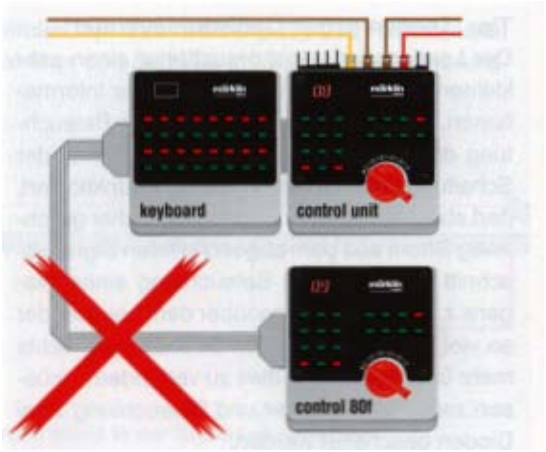
- cables and an end of the resistance in the plug bolt on.
- second cable and other end of the resistance into the second plug screw.
- connecting leads of the resistance only into shape-bend when putting the two plugs into the decoder.

Still more elegantly the resistance can be soldered inside in the decoder directly to the female connectors on.

Problems with Adapterkabein report

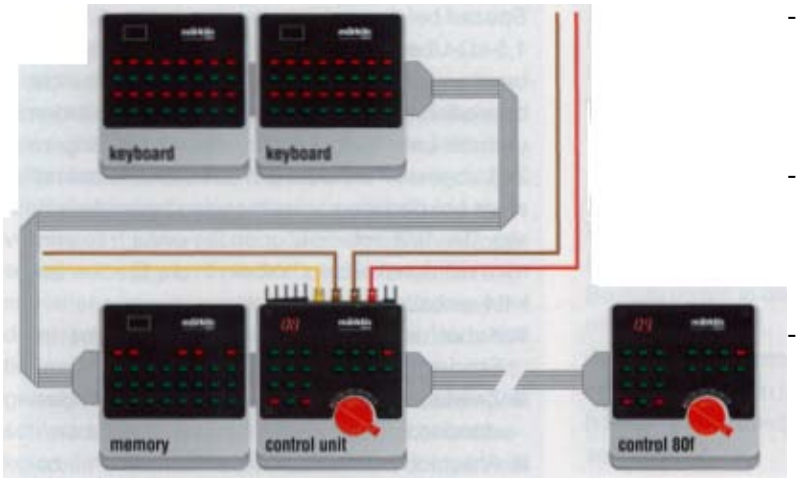
adapter 6038/6039

A digital driving desk must be stuck on always at the right side of the central processing unit, a digital Stellpult against it always at the left side. This is nearly natural, as long as you plug together the control desks directly over the lateral contact strips. Operate around it does not go actually at all. In addition, digital control desks can over an adaptor cable (art. NR. 6038/6039) to be attached, e.g. because the place is limited on the baseplate or you would like to furnish second control conditions. And it is quite important that you observe the rule specified above exactly.



So you may attach e.g. a digital driving desk in no case!

Because control desks are attached at the wrong side of the central processing unit, are very probable a damage of the wrongly attached desks. And that would be naturally no case of warranty. An appropriate warning is appropriate also on the plugs of each adaptor cable.



Like that it
Is correct!

When using adaptor cables you should consider additionally the following tips:

- in principle can be intercoupled several adapters. The overall length of all adaptor cables should not exceed however 6 m if possible.
- is necessary an adaptor cable longer than, should not be rolled up it, but not be laid out in a loop.
- An adaptor cable should not be laid under a central processing unit or through TRANSFORMER.
- an adaptor cable should have a minimum distance of 2 to 3 cm to cable connections between decoders s 88 and traction current cables (red / brown cables). Adaptor cables should not be laid therefore also in a troughing together with other cables.

Tip: Adaptor cables shield
If unexplainable disturbances arise to adaptor cables in the digital layout, and you again and again used, you should try to lay the adaptor cables differently (further away of other cables). Or you protect the adaptor cables off by taping with aluminum foil. Additionally the aluminum foil is connected by a „Krokodilklemme " with mass. Often a persistent problem can be eliminated by this simple measure.

Extension cords 6089
As lead between an acknowledging module of „Decoder s 88 " and a MEMORY or an INTERFACE or between mehrereren Deco that s among themselves 88 there is the extension cord 6089 with a length of 2 meters. Do not try to extend this cable or to use a itself-built longer cable. This could lead to problems with the transmission reliability. After in each case 2 m conduit length must be used a decoder s 88. This strengthens the signals before the forwarding. The leads of the contacts to the decoder entrances can be arbitrarily
long against it.

Some references to the error tracing
In a model railway facility there are naturally innumerable possibilities of error, which still depend in addition strongly on the individual structure of the layout. Within this framework we can give therefore only some fundamental references to the error tracing. Important conditions for a purposeful and successful error tracing at
a larger layout are:
- a clear wiring and
- a certain overview of the electrical operational sequence of a digital layout.

We hope both points with the preceding chapters something to have supported.
- error tracing step for step: Go out thereby with the power source (the central processing unit) and to try you to limit error location step for step. Divide in addition the layout systematically into ever smaller ranges. See example 1 further below.
- additional information for the containment of the error cause look for: The lamp of a switch is on not, compares you following example 2. Zusatzf rise up: Can the switch be switched or not? Do several magnet articles have the same problem or only individual? If the problem is with an individual magnet article, it goes pre+groping along usually more quickly, of this magnet article toward voltage supply (or better: to before-test).
- measuring and testing set: usually a normal model course lamp;
- for problems in connection with magnet articles best in a version with cables, how it is often used as house lighting;
- for problems on the track best a car with Schleifer and lighting is suitable for the error tracing.

The two mentioned examples are to weden now in the detail represented, in order to help you to come an error systematically more quickly on the trace.

Example 1
On a middle layout (3 traction current circles, a further electric circuit for the magnet articles) a short-circuit arose. It is not a course out of the rails jumped, first is thus no short-circuit cause recognizable.

- pressures it the key „go " on the central processing unit. After short time the operational status indicators of the center and the BOOSTER go out again, the short-circuit exist thus further. But, if you observe the operational status indicators exactly, see that the announcement on equipment (BOOSTER or central processing unit) becomes dark a short moment in former times as at the remaining. In this electric circuit therefore the short-circuit is to be looked for!
- we accept, with the BOOSTER, which supplies the magnet articles, become the announcement as the first darkly. Thus we continue to look for in this electric circuit.
- around our assumption to secure, we clamp the red cable at this BOOSTER. To the examination a renewed „go " at the center - the short-circuit actually does not arise.
- fortunately are all decoders attached at their own ring circuit. For the containment of the error we separate now the red cables of all decoders from the ring circuit. The red lead at the BOOSTER is again put in. The operational status indicator of the center and all BOOSTER should now still further-shine. now we connect a red to o after cable ander~n one again with the ring circuit. With a certain cable it will give a small spark, and all operational status indicators (BOOSTERS and center) are again out. now we already found the correct decoder to Aha!
- The red cable of this decoder is separated again from the ring circuit, but all remaining is again attached. Again „go " as control: there should be no more short-circuit! now we remove all yellow inlet cables for
- from our problem decoder and attach its red cable again at the ring circuit: if not the decoder itself causes the short-circuit, the operational status indicators remain on.
- In the same way as now a yellow cable is attached before after the other one again at the decoder. Assumed, with second it transmits again: thus we discovered an individual switch as a short-circuit cause. Counter proof: remaining the two again attach; „go " press: everything o.k.
- To the development of the defective switch the actual error cause points itself with exact Hinsehen: the yellow inlet cable had a chafed through place and therefore over the track bed connection with mass: that had to give a short-circuit!

Admitted, the error tracing reads itself quite complex. But how long you would have without systematic procedure and a clear wiring uses, in order to find such an error?

If a traction current circle would have been recognized as defective, the search would in a similar way have continued, only you would have had to separate starting from a certain point schienenverbindungen, in order to constitute the exact defective equipment. In this way you would have found, e.g. however after some time those to error cause a small, inconspicuous screw, which was appropriate for neutral conductors on the track and and mass had interconnected.

Example 2
The lamp of a switch is not on. Auxiliary observation: the switch does not switch also. These two error symptoms suggest rather surely an interruption of the current supply of the switch. By the way a lamp is many more rarely defective, than one often believes. In order to limit the error as quickly as possible, it should be still examined whether the magnet articles of neighbouring KEYBOARD keys can be switched or not. In our example here everything is correct. With such a case of an error it is advisable to further-search from the defective equipment backwards in direction power source. The three leads of the switch go to the entrance of a decoder k 83.
Easy pulling on all leads exposes here our error quickly:
the yellow cable of the switch was not firmly enough in the plug bolted and had therefore no more contact to the decoder. We hope however that you must go as rarely as possible with their layout on error tracing.

PART II.

EVERYTHING OVER DELTA-AND OF DIGITAL DEVICES

In the part of II of this book you become acquainted with in detail all current Märklin of DELTA and digital devices, which use the Motorola data format. (in the part of III you find an overview of all digital components produced so far.) Apart from the application type and the operation of the devices you find many tips and references, which help you to use the digital-System better. In order to facilitate for you the overview, we use a uniform representation method for the description of the devices as far as possible. Thus this part of the book can be used also as reference book. Over contents or the index you can find aimed certain equipment; there you find all necessary information then quick. For easier orientation nearly all chapters this part of II are subdivided additionally into the following main sections (there are further points of pass in some chapters):

In the introduction of each equipment you find a picture, a short description and the respective application type.

What knows the equipment?
Under this heading the most important characteristics and the technical data are described for each equipment.

Connection of the equipment
Only with correct connection equipment can function also correctly. Therefore we show you for each equipment the correct connection in word and picture.

Operation of the equipment
The references to the operation cannot replace the operating instructions. But you find here often useful tips, which not in the operating instructions.

Little technology –
under this heading technically interested readers find additional information about the technology and background the digital-Systems. These sections are characterized by grey writing and a grey bar. That does not mean however that these sections contain only grey theory, in the opposite. But you can jump over such sections easily; the understanding of the remaining sections is not impaired thereby.

Tip:
Tips and important notes from practice for your practice with Märklin digital recognize you immediately by the grey background surface.

4. DELTA- Controllers

4.1. Basic characteristics of the DELTA system

Problem-free multi-course enterprise the Märklin DELTA system carries out a long preserved desire of many model railroadmen: to steer in the same electric circuit several locomotives independently. The DELTA system is an inexpensive entrance into multi-course operation on small to middle layouts. It is as it were the „small" digital-System. With DELTA can be steered in principle up to 5 locomotives independently. As many locomotives can drive thereby actually at the same time, hangs of the power demand of the locomotives and from the used transformer.

In an electric circuit
The most important thereby: all locomotives are in the same electric circuit, a partitioning into electrically separated track sections are no longer necessary with the DELTA system.

A condition: the DELTA module
To operation with the DELTA system the locomotives must be equipped with a special „ Component ", the DELTA module. This DELTA module processes the signals of the DELTA controller and makes so the independent enterprise possible of several locomotives. A set of locomotives is already in a DELTA version available, with which the DELTA module is from the beginning inserted. With most conventional locomotives the DEL TA module can later be inserted by a Märklin specialist dealer. In addition you can operate also nearly all digital locomotives with DELTA. (there are some few digital locomotives, which inserted special decoders, with those the locomotive address or only in certain addresses to be adjusted cannot.)

More easily transferred to the digital-System
If with the time your requirements become larger, you can transfer problem-free from DELTA to the „grosse " digital-System. Nearly all components of your DELTA layout can use you thereby further as you will see during the description of the individual devices. Therefore a beginning of a „Modelleisenbahner career is " with Märklin DELTA in each case a future-safe entrance.

Now also usable for spur 1
The new DELTA devices are applicable not only for HO layouts, but also for spur 1. The new trace 1 „Maxi" locomotives contained likewise „ Multi-course ability ex factory ", because they inserted a special DELTA module.

4.2. DELTA-Control (6604)

The DELTA CONTROL is the first controller in the DELTA system. At its rotary switch one by four locomotives is selected, whose speed and driving direction steer you then with a conventional driving transformer. If another locomotive is selected, the remaining locomotives with their past speed drive on.

What knows the DELTA control?

- four to five locomotives at the same time in an electric circuit at the DELTA control can be steered in connection with a driving transformer up to four locomotives independently. A further, fifth locomotive can be steered additionally directly with the accessory equipment DELTA pilot.
- power output 30 VA the maximum power output DELTA control of approx. 30 VA (= 30 Watts) is sufficient, in order to let three locomotives with unlighted cars drive at the same time. With the fact a condition is natural that the used transformer makes this achievement available at least. If you would like to operate later once more than three courses at the same time, you can transfer problem-free to the „big" digital-System.
- inserted overload protection is switched off automatically the DELTA control once more achievement demanded, than it can supply, it by an overload protection for some time. That applies also in the case of a short-circuit on the

DELTA-Control (6604)

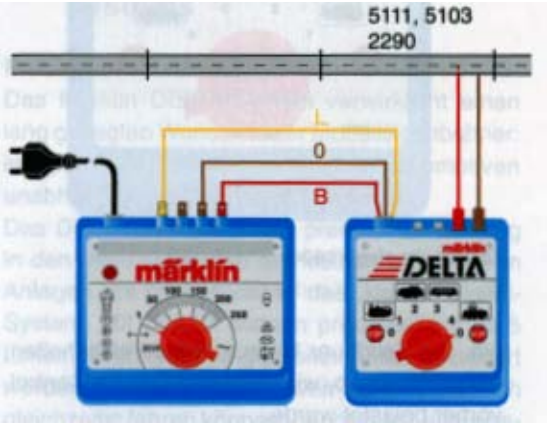
layout or if it becomes otherwise too warm the equipment. Approximately one minute later restarts itself it automatically. The length of time up to restarting depends on how strongly the DELTA control was loaded before. A similar overload protection is inserted by the way also in each Märklin transformer. Therefore also a trafo can switch off for some time, if too much achievement is demanded from it.

- a switching off of the tension to the track if you the rotary switch DELTA control on the position STOP (on the left of or right) turn, the tension to the track one switches off automatically. In this position you can set therefore it new courses on the track, without risking a short-circuit. The tension to the track is switched off automatically also if for all with o-Fahrregler DELTA Lokomotiven to speed of „0 " are adjusted.

Connection of the DELTA-Control

The DELTA control is switched easily between a conventional driving transformer and a spur track. Please you before generally consider:

Before attaching: Transformer from the net separate!



DELTA control between trafo and spur track

- connecting it the three firm leads DELTA control (red, brown, yellow) with the appropriate connecting terminals of the transformer:
  - red cable to red clamp „B " (B = traction current);
  - brown cable to brown clamp „0 " (0 = mass = stromrueckleitung);
  - yellow cable to yellow clamp „L " (L = light-current).

  Pay attention thereby to good contact. How you attach the cables reliable on electrical contacts, find in the section „ Effective wiring with Märklin digital " on page 54.

Older transformers have female connectors for the Märklin model clearing modellbahnstecker instead of connecting terminals still. If you still another such a transformer use:

- screws it the enclosed plugs to the three leads DELTA control.
- installing you suitable plugs to the red and brown cable of a spur track and connect you the cables with the red and brown socket at the DELTA control.
- putting it the power supply plug of the transformer.

Important note

For DELTA and digital layouts only spur tracks without inserted may be used Entstaer condenser: with m-tracks: Art. NR. 5111 or 5103, with k-tracks: Art. NR. 2290.

Have from an existing layout spur tracks with a entstoerkondensator (Art.-Nr.5131 oder2292),dann:

- separation it at least one connection of the condenser with small pliers off (see page 54).

Little technology - as the DELTA control functions?

The DELTA control measures the tension at the exit „B " of the transformer. The voltage level depends on the position of the driving automatic controller. The DELTA control produces now a digital signal, which corresponds to the voltage level and thus the position of the driving automatic controller at the trafo. This signal is linked with the address of the locomotive, to which the DELTA control is adjusted. The entire digital information is given to „L " of the transformer „verbun that " in the DEL TA control with the constant tension from the exit and to the track. The DELTA data format (the kind, like the speed and the address of the locomotive to be passed on) is alike as with the digital-Sy-stem. Therefore one can DELTA Lokomoti ven all also in the digital-System use and in reverse.

Operation of the DELTA-Control

A locomotive select:

Put the rotary button DELTA control on the suitable locomotive symbol:

1 steam locomotive

2 diesel locomotive

3 motor coach or ICE

4 electric locomotive

If you want to use a digital locomotive on a DELTA layout, you must adjust them before in the „richtige address ". How goes, experience in the main chapter 6 „DELTA and digital locomotives " on page 105.

Speed of the selected locomotive stop:

• Turn, exactly as with a conventional layout, the driving automatic controller of the transformer on the desired position.

Driving direction change:

• Turn the driving automatic controller of the transformer beyond the zero position up to the notice to the left.

Further locomotive to drive leave:

- places it the rotary button DELTA control on another locomotive symbol. The before selected locomotive drives on with the speed stopped last.
- places it speed and possibly driving direction of the new locomotive again with the driving automatic controller of the transformer.
- possible at the DELTA control on a third locomotive switch, etc..

Reference

After switching to another locomotive the DELTA control passes the speed attitude on on the trafo only after approximately two seconds to the new locomotive. Thus you can switch at the DELTA control e.g. from a steam locomotive (switching position 1) to an electrical locomotive (switching position 4), without the intermediate diesel locomotive or the motor coach changes its speed. Within these two seconds you can turn also the drivingautomatic controllerautomatic controller driving automatic controller into a suitable position for the new locomotive, in order to start e.g. the new locomotive from the conditions slowly.

All locomotives stop:

- Turn it the rotary button at the DELTA control on the nearest STOP position (on the left of or right).

Tip: All locomotives continue

If the rotary button at the DELTA control is reset from the STOP position to any locomotive, all before selected locomotives with the past speed drive off. With the following trick one knows however all locomotives on at the same time „c Driving speed 0 " to adjust:

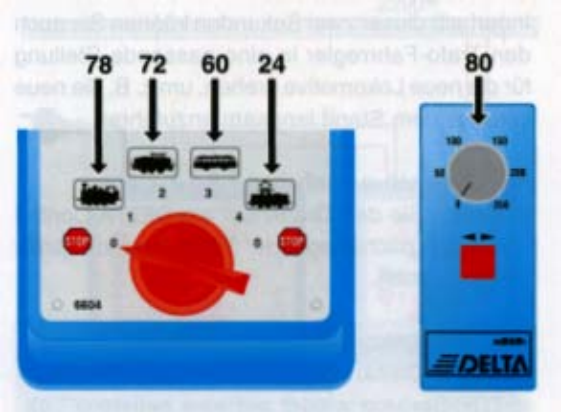
- places it the rotary button at the DELTA control on the left STOP position.
- switching it the driving direction at the trafo three times behind in and hintereinanderum (driving automatic controller to the left notice turn). Thus the driving information of all locomotives at the DELTA control is deleted.
- now you can again start again a locomotive after the other one.

Do not forget with end of operation:

- separation it the transformer of the net.

Digital addresses of the DELTA locomotives

A certain digital address is assigned to each DELTA or digital locomotive. (the meaning of the digital address is explained in detail in chapter 2,2 on page 19.) The data formats of DELTA and digital-System are alike. Therefore a certain digital address is assigned to each locomotive symbol on the DELTA control. In order to be able to steer a DELTA or a digital locomotive in the DEL TA system, it must be adjusted to one of the addresses 78, 72, 60.24 (or 80 for the DEL TA pilot). The accompanying table shows the appropriate attitudes of the coding-switches (or soldering surfaces with the past DELTA module). Important note: With DELTA locomotives with the new DELTA module (with coding-switch) all coding-switches are adjusted to 0FF with distribution; this is the attitude to the enterprise on a conventional layout. Further information in addition finds you in the section „Lokomotiven with the DELTA module " on page 91.



Digital-Adressen der DELTA-Lokomotiven

Lokomotive	Einstellung DELTA-Modul	Digital-Adresse	Einstellung Digital-Lokdecoder
		78	
		72	
		60	
		24	
		80	

Attitude of the DELTA addresses with the DELTA module (so far: Digital decoders

DELTA control as digital unit (booster)
With the DELTA control transferred meaningfully be continued using from DELTA to the „big" digital-System can. Together with a transformer it is used as additional current supply unit for the digital-System (booster). With a digital-System the central processing unit with the associated TRANSFORMER takes over „ Basic supply " with electricity. If the model railway facility needs more achievement, this must be made available by an auxiliary amplifier and a further transformer. Exactly this task can fulfill the DELTA control. This is possible with the following central processing units:

CONTROL UNIT (6021), CENT RAL UNIT (6020), CENT RAL CONTROL.
Thus is with transferred from DELTA on digital immediately to more achievement for digital locomotives or magnet articles at the disposal. Further information to this topic finds you in the chapter „ Lei stungsbedarf to a layout " on page 50.

The DELTA control must supply a its own, electrically isolated electric circuit of the digital layout.

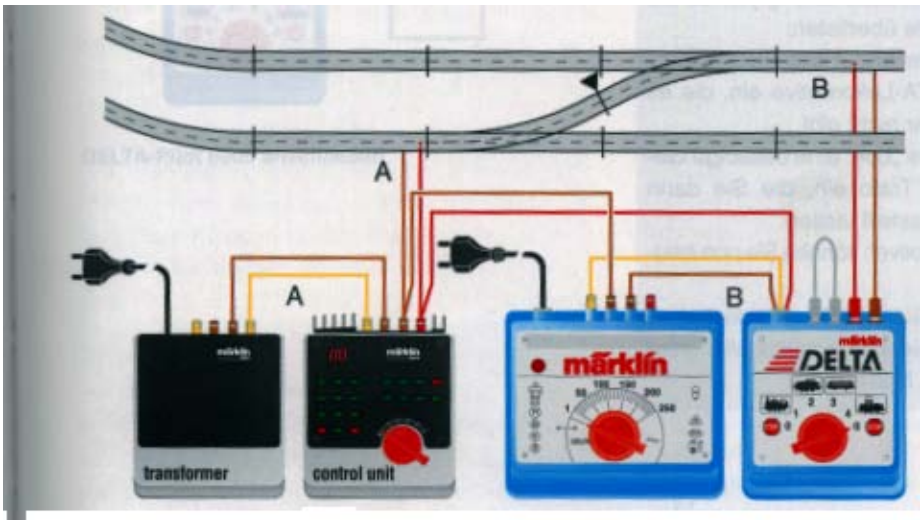
The digital informations are nevertheless in all electric circuits of a digital-Systems the same; for a driving locomotive therefore the transition of an electric circuit does not have any meaning on the other hand.

Connection DELTA control as additional digital current supply

Before attaching: All transformers of the net separate

- connecting it the red lead DELTA control with the red connecting terminal of the digital central processing unit.
- the brown and yellow lead remain connected with the transformer.
- connecting it additionally the brown clamps of driving transformer and central processing unit with one another.
- connecting it the two grey sockets at the DELTA control (to those the DELTA pilot is normally attached) by a cable link with one another.
- connecting it an additional spur track with the red and brown socket DELTA control. (a second electric circuit is attached to the digital central processing unit.)

Connection DELTA control as additional digital current



or:
central unit
central control
cu

Soldering surfaces, again: Coding-switch) and oeim uu

- isolating it the neutral conductors of the tracks at all connectors between the two electric circuits against each other (see also to section „Stromkreise meaningfully separating " on page 61).

- places it the rotary switch DELTA control on the right STOP position. The DELTA control works only in such a way as digital booster.
- connecting it all transformers again with the net. Use best a multiple plug socket.

Reference
The position of the driving automatic controller at the transformer DELTA control plays no more role with this mode of operation. All DELTA and digital locomotives are selected and steered over a digital driving desk.

Tip: Power cut to the track go around
As mentions before, the river is switched off automatically to the track, as soon as you set the driving automatic controller for all DELTA locomotives to zero. The last driving locomotive is hard braked, even if it concerns a digital locomotive with adjustable starting and brake delay. You can outwit the automatic power cut with the following method:

- places it the rotary button DELTA Con trol on a DELTA locomotive, which does not give it at all on your layout.
- places it for these „Lok " any speed at the trafo, which continuous adjusted you leave then.
- the remaining locomotives can steer you now as usual.

The tension at the track remains switched on, even if you „rea len the speed of all " locomotives to zero set.

4.3. DELTA-Pilot (6605)

The DELTA pilot is an additional control quadrant for the connection to the DELTA control (6604). With it a further DELTA or digital locomotive can be steered completely independently of the remaining locomotives. It is ideally suitable therefore in order serving to secondly a DELTA Modellbahnan situation. The enterprise e.g. a rangierlokomotive particularly makes much fun with the DELTA pilot!

DELTA-Pilot (6605)

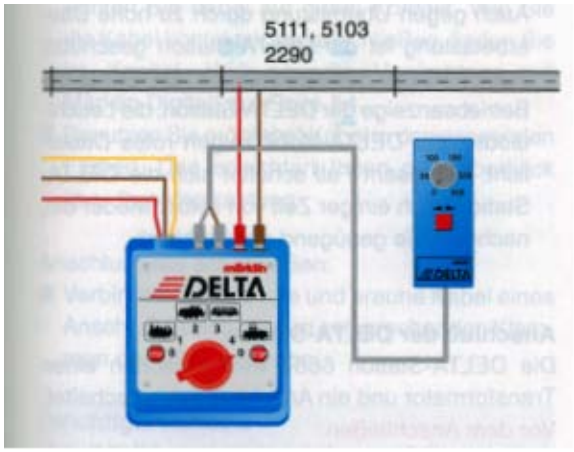
Which can of the DELTA-Pilot?

With the DELTA pilot a DELTA or a digital locomotive can be steered only if their digital address is adjusted to 80. References to it find you in the preceding section „Digital addresses to that DELTA Lokomo tiven " on page 72. A delivery of the locomotive of the DELTA pilot to the DELTA control did not turn around or possible.

Connection DELTA pilot

before attaching consider: Transformer from the net separate!

- putting it the two plugs DELTA pilot into the grey sockets at the back DELTA control.



Operation of the DELTA pilot

The controlling of a locomotive with the DELTA pilot is nearly still
simpler than with a conventional layout.
Speed stop:

- tricks it the rotary button on the desired position. Driving direction switch:
- pressures it the red key.

Tip: Extension cords for DELTA pilot the lead DELTA pilot can extend you problem-free with a home-made two-pole extension cord. The entire cable should not be longer however than 5 m, so that the transmission of the data remains safe.

4.4. DELTA-Station (6607)

The new DELTA controller DELTA station was developed for the employment with Märklin trace 1. In addition, it can be used with HO layouts. It resembles outward the earlier digital central processing unit cent RAL UNIT 6020. The DELTA Station can be used only in connection with at least one control quadrant DELTA mobile. A DELTA mobile is contained in the scope of supply.

DELTA-Station (6607)

Which can DELTA-Station?

- Applicable for trace 1 the new DELTA station makes the DELTA Multi-course enterprise also on trace for 1-Anlagen possible. Thus Märklin meets a long preserved desire of many to trace 1-Fans.
- Up to four locomotives independently from each other in the same electric circuit you can attach max. four control quadrants DELTA mobile to a DELTA station (four female connectors available). They can steer however also with only a DELTA mobile up to four locomotives independently.
- Open land-suited the DELTA station can be set up for the enterprise of a Märklin trace 1-Bahn also in the free one. The supply versorgungstrafo must remain however absolute in the house, because he may not come with humidity into contact.
- Power output approx. 45 VA the maximum power output of the DELTA station amounts to about 45 VA (= 45 Watts), if the used transformer this achievement at least makes available, e.g. the TRANSFORMER 6002. With this achievement smaller or two large trace 1-Lokomotiven can be driven at the same time up to three. The same power output by the way also the digital central processing units supply and the BOOSTERS. even two protective mechanisms are inserted to
- inserted overload protection in the DELTA station: In the case of a short-circuit on the track the DELTA station is completely switched off. The operational status indicator expires, the light emitting diodes of the manual control devices DELTA mobile shows red steady light. Also against overheating by to high continuous stress is protected the DELTA station: If this protective circuit addresses, the operational status indicator of the DELTA station, the light emitting diodes of the DELTA mobile flashes shows red steady light. In this case the DELTA station restarts itself after some time automatically, after it is sufficient cooled down.

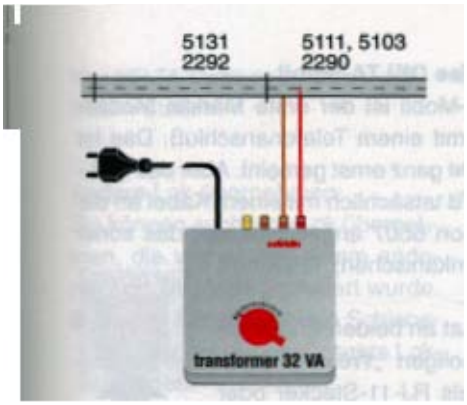
Connection of the DELTA station

The DELTA station 6607 is switched between a transformer and a spur track. Before attaching: Transformer from the net separate!

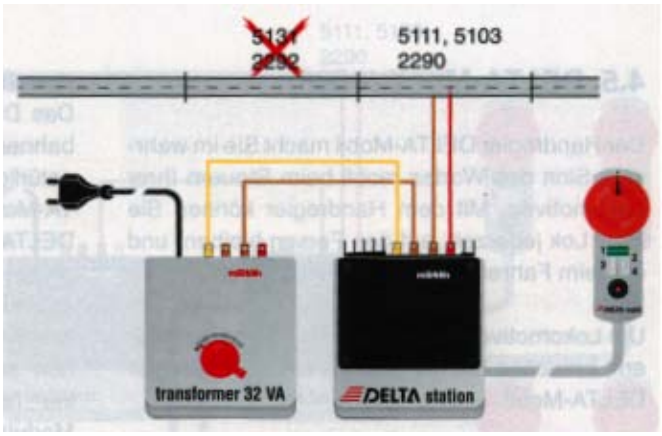
As transformer a conventional driving transformer or a digital TRANSFORMER can be used alternatively. But only with a digital TRANSFORMER (e.g. 6002) the full achievement of the DELTA station can be used.

Current supply attach:

Connect the yellow connecting terminal of the DELTA station with a yellow clamp at the transformer („L " = light-current).



Conventional track connection with one TRANSFORMER 32 VA



Connection of the DELTA station between trafo and spur track

- connecting it a brown clamp of DEL TA station and transformer (0 = mass = stromrueckleitung). Pay attention thereby to good contact. How you attach the cables reliable on electrical contacts, find in the chapter „ Effective one wiring with Märklin digital " on page 54.
- using it if possible cables in the suitable colors. Facilitates for you the overview of your wiring.

Spur track attach:

- Connect the red and brown cable of a spur track with the appropriate clamps of the DELTA station.

Important note

For DELTA and digital layouts only spur tracks **without** inserted entstoerkonden-sator may be used: with m-tracks: Art. NR. 5111 or 5103, with k-tracks: Art. NR. 2290.

Have from an existing layout still spur tracks with a entstoerkondensator (Art.-Nr. 5131 oder 2292):

- Separate at least one connection of the condenser with small pliers, as shown on page 54.

Operation of the DELTA station

The DELTA station does not contain own control elements. The controlling of the locomotives is described in the following section „DELTA mobile ".

Digital addresses of the DELTA locomotives

The DELTA station uses the same digital addresses as the DELTA control (78, 72, 60, 24; does not go to 80 here). The allocation to the DEL TA numbers is likewise alike. If you liked to operate a digital locomotive under DELTA, them must likewise be coded on one of these four digital addresses. Otherwise it cannot be addressed by the DELTA station. You find details in the chapter „DELTA control (6604) " on page 69.

Reference

If digital locomotives with a DELTA station are used, their auxiliary function is continuously switched on. Therefore you should not use DELTA Stati on digital locomotives, whose auxiliary function is switched to a TELEX clutch or a smoke generator with that (see also chapter 6,7 „Lok auxiliary function " on page 106).

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4.5. DELTA-Mobil (6608)

The control quadrant DELTA mobile makes you in true sten for sense of the word mobilely when steering your locomotives. With the control quadrant you can remain your locomotive „ on the heels " and look it at any time when driving „on the wheels ".

In order to steer locomotives with the DELTA station, you need one control

quadrant DELTA mobile at least.

DELTA-Mobil

(6608)

With two or three DELTA mobile common driving and playing with several locomotives naturally particularly makes much fun. So one can deliver correct rail running or solve together tricky tasks of ranking. Max. four DELTA mobile can be attached to the DEL TA station.

Which knows the DELTA mobil?

- at each DELTA mobile can be in each case selected one by four locomotives. This locomotive is steered with the DELTA mobile. The remaining locomotives drive on with the before stopped speed.
- Speed and driving direction are steered with only one rotary button.
- emergency stop key and operational status indicator are additionally in the control quadrant integrated.

Connection of the DELTA mobile

The DELTA mobile is the first Märklin model course article with a telephone connection. That is meant naturally not quite serious. But the DELTA mobile is actually attached with a cable to the DELTA station 6607, which is otherwise often to be found with (American) telephones. The cable has a sechspoligen at both ends „Western Stekmoreker " (also as RJ-11-Stecker or modular plug designates). This patch cord withstands a certain by an engaging also „ Tensile stress ", as it can occur in the rough model railway company already times.

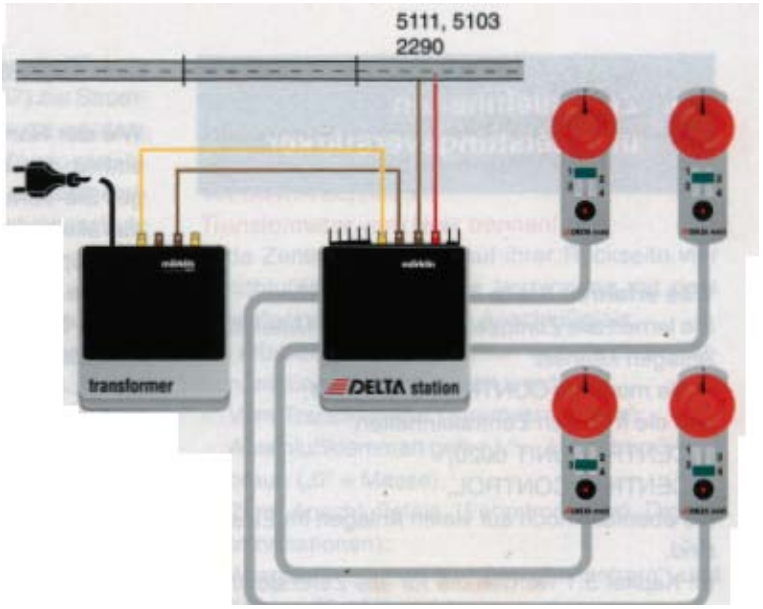
West Stecker and associated socket

Attach only the devices planned for it to the respective female connectors! Do not attach the DELTA station or the DELTA mobile to a telephone system!
The devices could be damaged by incorrect or toohigh tensions.

Operation of the DELTA mobile

Locomotive steer:
The controlling of a locomotive with the DELTA mobile is very simple:

- places it the green slide switch on the locomotive number, which you would like to steer. The light emitting diode in the center of the black key shines constantly green, as soon as you can steer the selected locomotive.
- selecting it speed and driving direction with the red driving automatic controller rotary button. In the center the zero position is marked.
- selecting it with the green slide switch another locomotive. The before selected locomotive drives on with its speed stopped last.



Four DELTA mobile at a DELTA station

Other locomotive take over:
They can take over also a locomotive, which was steered before by another DELTA mobile.

- Place simply the slide switch on the desired locomotive number.
- is selected this locomotive at present on no other DELTA mobile, receive you immediately the access (light emitting diode green steady light).
- If the same locomotive number is adjusted at another DELTA mobile, this DELTA mobile keeps first the access to the locomotive (light emitting diode flashes). Only if on the first DEL TA mobile another locomotive number is stopped, your DELTA mobile receives the access to the locomotive.

Emergency stop and release:

- with the black key release you an emergency stop: all locomotives stop immediately. The emergency stop key surely prevents some otherwise inevitable collision. The light emitting diode in the center of the key shines in the case of emergency stop red.
- pressures it again on the black key: all courses drive again loosely with their before stopped speed.

Colors of the light emitting diode:
The light emitting diode in the emergency stop key of the DELTA mobile supplies various information about the current condition of the layout:

- green duration: selected locomotive is steered by this DELTA mobile.
- green flashing: selected locomotive is called at another DELTA mobile.
- yellow duration: selected locomotive is free and can directly by this DELTA mobile be steered.
- red duration: " stop "; selected locomotive is steered by this DELTA mobile.
- red flashing: " stop "; selected loco is called at another DELTA mobile.

In the case of a short-circuit on that layout the light emitting diode of the DELTA mobile shines likewise red, the operational status indicator at the DELTA station is out.

- eliminating you first the short-circuit cause, press you then the black key.

Tip: Extension cord for DELTA mobile

As extension for the lead between DELTA mobile and DELTA station you can use an extensionextension extension, as them are offered e.g. in department stores and building markets. Important it is however that the extension cord is sechspolig (with telephone systems a vierpoliges cable is often used, which is not sufficient for our purpose). Also with an extension the entire cable length should not exceed however 25. The four sockets in the DELTA station are joined in parallel. Therefore one can attach also an extension cord to only one socket and to its end a distributor box with three or four west seriousness western-Steckern. In addition, more than four DELTA mobile at a DELTA station are not possible with such a combination!

5. Central processing units and achievement amplifiers

Which you experience in this chapter?
They become acquainted with all central processing units for H0-Mittelleiter-Anlagen:
- the modern CONTROL UNIT 6021; and the earlier central processing units
- CENTRAL UNIT 6020,
- CENTRAL CONTROL, which is likewise still on many layouts in use.

In chapter 5.1 the characteristics common for all central processing units are presented. Since the electrical connection for all central processing units takes place directly, it is likewise treated in chapter 5.1. Afterwards the individual descriptions of the different central processing units follow. Information for the connection of an achievement amplifier (BOOSTER) finds you in chapter 5.5 „BOOSTER (6015) " starting from page 87.

5.1. Common one of characteristics

Like the name already suggest, the central processing unit is the most important equipment of a digital layout. She administers and arranges the information from all attached driving and placing desks, links her with supply voltage and passes her on directly to the track or to the magnet article decoders. Each central processing unit coordinates the control of up to 80 digital locomotives and up to 256 magnet articles. At both sides of a central processing unit sunk contact strips are for the connection of digital control desks. At the right side only digital driving desks may, at which left side only digital placing desks are attached. Via the contact strips the control desks are supplied with river and the digital informations between the central processing unit and the control desks are exchanged. A socket contact at the back of the central processing unit serves for the connection of an achievement amplifier (BOOSTER).

Current supply

The central processing unit receives its electricity from a transformer. Their full achievement can furnish a central processing unit however only if it is supplied by a sufficient high performance transformer. Therefore particularly for the supply of the digital layouts of the Märklin TRANSFORMER was developed. It supplies a power output of max. 52 VA; on this achievement also the central processing units and BOOSTER are laid out.

Also in principle a conventional transformer (e.g. art. NR can. 6631 or 6647) for the current supply of a central processing unit to be used. If you drive at the same time then however with several courses on your layout, it can happen after some time that the overload protection (thermal switch) of the transformer releases because of overloading.

The transformer must be appropriate for the mains voltage existing in your household always. The TRANSFORMER 6002 is intended e.g. for the mains voltage of 230 V alternating current, usual in the German-speaking countries. All central processing units can supply a maximum output current of approx. 2.5 A, if the transformer is accordingly efficient. That corresponds to a power output of approximately 45 VA (thus 45 Watts). With this achievement you can let unlighted H0-Zuege drive up to five at the same time, if the central processing unit must supply magnet articles or lighting not at the same time. As operational status indicator a red light emitting diode serves. An electronic overload disconnection in the central processing unit switches the tension off with overloading or short conclusion to the track.

On each layout only one central processing unit should be used. An information transfer between several central processing units is not intended. With larger power demand of the layout additional achievement amplifiers (BOOSTERS) must be attached.

Connection of a central processing unit

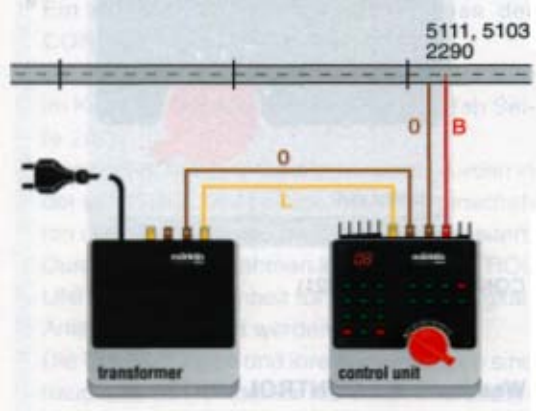
The connection at transformer and track is alike for all central processing units. It is shown by the example the CONTROL UNIT.

Before attaching: Transformer from the net separate!

Each central processing unit has four connecting terminals for the connection with the transformer and a spur track on its back. Clamps of the same colors must be interconnected in each case:

- of the transformer (current supply): Connecting terminals yellow („L " = „Lichtstrom ") and brown (,,0 " = mass).
- to the spur track (driving stream and digital informations): By the way connecting terminals red („B " = „Bahnstrom ") and brown (,,0 " = mass)

Are in each case connected equivalent clamps the inside one the devices, so that it does not play a role, to which brown or yellow clamp you a cable attach.



Connection the CONTROL UNIT as example of all central processing units

Never connect a yellow clamp of a transformer with the red clamp of a central processing unit or a BOOSTERs!

5.2. CONTROL UNIT (6021)

Since there is Märklin digital, several different central processing units were brought on the market. Meanwhile only the CONTROL UNIT is available. It is produced since 1993. The CONTROL UNIT replaces the earlier central processing unit CENTRAL UNIT within the HO neutral conductor range. Since spring 94 the CONTROL UNIT replaces also the special central processing unit for Märklin trace 1 (CENTRAL CONTROL 1). The CONTROL UNIT is thus now the universal central processing unit for the Märklin digital-System. It is however not only central processing unit, but it contains at the same time a complete digital driving desk.

CONTROL UNIT (6021)

Which knows the CONTROL UNIT?

The common characteristics of chapter 5.1 apply naturally also to the CONTROL UNIT. Here against it only special characteristics the CONTROL UNIT are specified:

- The CONTROL UNIT is suitable for the control of HO neutral conductor and trace 1-Anlagen.
- you has an own memory for the driving speed and the auxiliary function for each of the 80 Lokomotivadressen.
- a four pole coding-switch at the back serves for adjustment special characteristics of the digital signal.
- the CONTROL UNIT contains also a complete digital driving desk.
- all Lokomotivadressen from 01 to 80 can be called. The selected locomotive number is indicated in a two digit digital display.
- With operation with Märklin 1 is indicated the driving direction to the locomotive with two pfeilfaermigen light emitting diodes.
- Switching on and off one locomotive auxiliary function and four functions „f 1 " to „f4 " for function decoders.

Maße: 140 x 120 x 80 mm

Connection the CONTROL UNIT

The connection the CONTROL UNIT was already shown in the preceding chapter as example.

Important note for users of earlier central processing units: The lead to a BOOSTER must be put in at the CONTROL UNIT straight differently (cables upward!) as with all other central processing units and at the BOOSTERn themselves (to illustration see page 89).

Reference

If the transformer the CONTROL UNIT is separated from the net, the operational status indicator the CONTROL UNIT flashes still few times, in order to use up still existing residual energy.

Operation of the CONTROL UNIT

The central processing unit in the CONTROL UNIT does not need control elements. The driving desk the CONTROL UNIT corresponds exactly to the driving desk CONTROL 80 F. the operation is therefore directly as with a CONTROL 80 F and starting from page 111 is described.

Coding-switch of the CONTROL UNIT
With the vierpoligen coding-switch at the back the CONTROL UNIT some special characteristics of the digital signal are stopped. Märklin did not document and released however yet all positions and possibilities of this switch. With distribution all four slide switches are posed to the CONTROL UNIT on 0FF. You should not change this position for normal operation with HO neutral conductor layouts.

Attitude of the coding-switch for HO Mittellelter layouts

CONTROL UNIT as central processing unit for Märklin 1
The CONTROL UNIT can be used also as central processing unit for Märklin trace 1-Anlagen. In addition the coding-switch at the back must be changed over: Switches 1, 2 and 3 on ON, 4 on 0FF.

Attitude of the coding-switch for spur 1- layouts

During the attitude of the coding-switches 1, 2, 3 on ON the CONTROL UNIT apart from the locomotive address of one of two arrows lights up in the announcement, which indicates the driving direction to the locomotive. The announcement of the driving direction is inserted and by the CONTROL UNIT is then activated likewise by the way also in the driving desks CONTROL 80 F and INFRA CONTROL 80 F. If the CONTROL UNIT is used as trace 1-Zentraleir~-heit, must be used for single-engine trace 1 - locomotives of the locomotive decoders c 95. It replaces the locomotive decoder c 85 (6085) and has the same plug contacts as these, i.e. it is problem-free exchangeable. The past decoder c 85 is not usable with the CONTROL UNIT. The change of the locomotives takes place via its Märklin specialist dealer. For some special locomotives are available special trace 1-Decoder, which is suitable for operation with the CONTROL UNIT (see also chapter 6.9 „Digital decoders for Märklin 1-Lokomotiven " on page 108).

With the CONTROL UNIT as central processing unit the decoders k 83 (6083) must also for trace 1 for magnet articles and/or for lighting k 84 (6084) to be used. The earlier trace 1-Decoder k 86 and k 74 are not applicable with the CONTROL UNIT. Further information and a detailed table to this topic find you in the main chapter of 11 „Bisherige digital devices for trace 1 and H0-Zweileiter-Anlagen " starting from page 207.

Literature:
For the ring binder „Märklin 1-Handbuch (0323) " is immediately an auxiliary chapter available to the group of topics Märklin 1 and digital.

A Little Tecnnik - function mode the CONTROL UNIT

The basic functions of a central processing unit are in detail described in chapter 2.3 (starting from page 20). In relation to earlier central processing units in the CONTROL UNIT some internal characteristics and characteristics of the digital signal were extended. The CONTROL UNIT can be used by these measures as central processing unit for all Märklin digital layouts. The extensions and their effects are mainly important for more strongly technically interested readers. They are summarized therefore in special chapter 2.9.

5.3. CENTRAL UNIT (6020)

The centRAL UNIT is the predecessor of the central processing unit CONTROL UNIT (6021). It is not no more produced since 1993 and is not available meanwhile any longer.

CENTRAL UNIT (6020)

What knows the cent RAL UNIT?

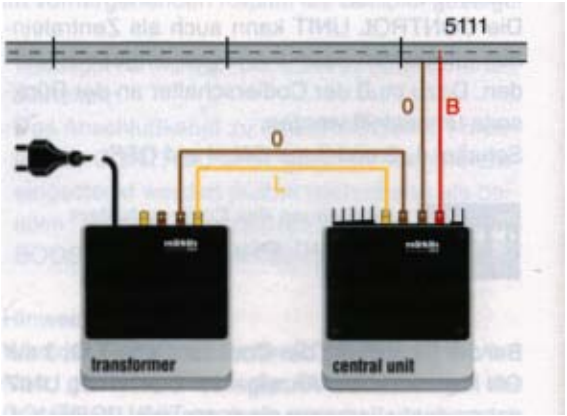
- Is exclusively suitable for the control of H0-Mittelleiter-Anlagen
- the centRAL UNIT. - to „Digital driving " at least one digital driving desk must be attached to the cent RAL UNIT.
- altogether 10 memory for locomotives has the cent RAL UNIT (for address, driving speed, auxiliary functions). Nevertheless can be driven also with the cent RAL UNIT up to 80 locomotives at the same time. For all locomotives up-to-date called at a driving desk the speeds of the central processing unit are constantly repeated (10 memory for max. 10 driving desks). All other locomotives keep its speed and driving direction in the memory of the respective locomotive decoder. If its speed is to be changed, the locomotive must be called before again on a driving desk.

Maße: l4Oxl2Ox8Omm

Connection of the cent RAL UNIT Der Connection of a central processing unit was already shown on page 81 by the example the CONTROL UNIT. The cent RAL UNIT exactly directly one attaches.

Operation of the cent RAL UNIT

The cent RAL UNIT is a pure central processing unit; it has therefore no control elements.



Connection of the cent RAL UNIT

5.4. CENTRAL CONTROL

The central processing unit cent RAL CONTROL was a component of the digital starting packings 2602, 2610 and 2620. It has therefore no own article number. Cent RAL the CONTROL becomes bar. No more produced and is not available any longer.

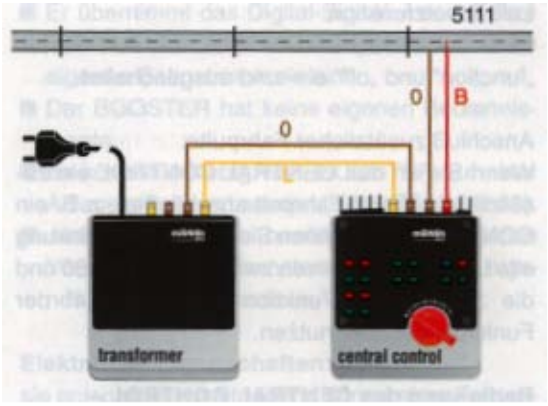
Which can CENTRAL CONTROL?

o The centRAL CONTROL contains a complete digital central processing unit. Their characteristics correspond to those cent RAL a UNIT (6020), see chapter 5.3 on page 84.

Darüber hinaus enthält das CENTRAL CONTROL
- a simplified digital driving desk with four firm locomotive addresses and
- a small digital digitalplace-desk-for-placing desk for four firm magnet article addresses.

Connection of the centRAL CONTROL

The connection of a central processing unit was already shown in detail starting from page 81 by the example the CONTROL



Connection of the cent RAL CONTROL

UNIT. CentRAL the CONTROL is exactly directly attached.

peration of the cent RAL CONTROL - inserted driving desk

Locomotive call: In each case a digital locomotive can be addressed through pressures of the green keys „1 " to „4 ". The locomotives must be coded thereby in the following digital addresses:

Taste	1	2	3	4
Lok-Adresse	10	20	30	40

If the light emitting diode over the called number shines constantly, the locomotive with the driving automatic controller at the cent RAL CONTROL can be steered. However if the light emitting diode flashes, then the locomotive is already called on another digital driving desk.

Reference

Only if a new locomotive is called (associated light emitting diode shines), the previous locomotive for use at another driving equipment released. After switching on on the locomotive No. 40 is „reserviert ", the associated light emitting diode is however still out. Meanwhile this locomotive cannot be selected however on another driving desk.

Locomotive Auxiliary function:
A locomotive auxiliary function is switched on and off with the keys „function " and „0ff".

Connection of additional driving desks:
If you attach to the centRAL CONTROL an additional digital driving desk, e.g. a CONTROL 80F, you can use it without restriction all Lokomotivadressen between 01 and 80 and the additional functions „f 1 " to „f4 " the function decoder.

Operation of the centRAL CONTROL - inserted placing desk

Keys and assigned addresses:
With the four red and four green keys on the centRAL CONTROL with the inscription „key board " „1 " to „4 " one can switch directly four magnet articles. The assigned magnet article addresses are firmly adjusted in the highest magnet article addresses in the digital-System: 253, 254.255 and 256.

Taste „keyboard“	1	2	3	4
Magnetartikel-Adresse	253	254	255	256
KEYBOARD Nr. 16	13	14	15	16

These addresses correspond to the keys No. 13 to 16 on a normal KEYBOARD, which is adjusted in the KEYBOARD address 16

The CENTRAL CONTROL is adjusted in the highest magnet article addresses, because the starting packing contained 2602 two digital switches also firmly inserted decoders, which were coded in the addresses 253 and 254. Under the art. NR. 2604 was two additional switches with the coding 255 and 256 available.

In addition, with the cent RAL CONTROL four normal switches or signals can be steered. In addition a magnet article decoder k 83 is necessary. At the eight pole coding-switch the inside one the decoder the highest decoder address must be stopped before:

Decoder-addresses to be adjusted:
Switches 2, 3 and 6 on ON. This corresponds to the magnet article addresses 253 to 256, to which centRAL is adjusted the CONTROL.

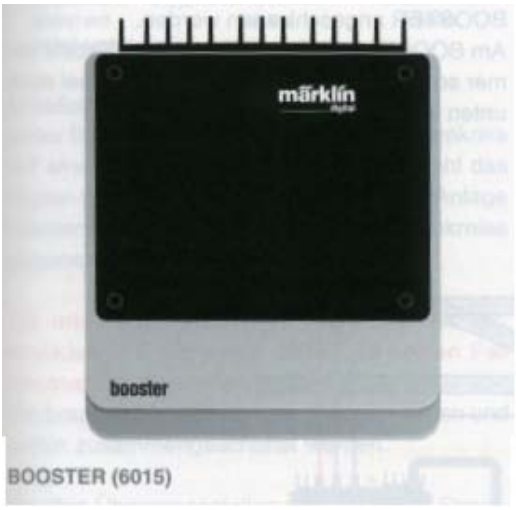
Attitude of the addresses 253... 256 to eight pole towards coding-switches in the decoder k 83/k 84

Announcements:
If one of the red keys is operated „keyboard" Field, a red light emitting diode lights up with the appropriate number. When pressing to a green key expires the associated Leuchtdiode.

Connection of additional placing desks: If you attach cent RAL to the CONTROL an additional digital placing desk, e.g. a KEY BOARD or also an INTERFACE, can use you without restriction all 256 magnet article addresses. The four addresses 253 to 256 are steered then parallel both by the placing desk No. 16, keys 13 to 16, and of the keys „1 " to „4 " at the cent RAL CONTROL.

5.5. BOOSTER (6015)

The BOOSTER is an achievement amplifier for the digital-System. It is needed, if on a plant more courses are to drive at the same time or more are present lit magnet articles, than the central processing unit and their TRANSFORMER can supply alone with river. For each BOOSTER an additional TRANSFORMER is necessary for the current supply. Whether the power demand of your plant is so large that you must use a BOOSTER (or even several), can measure you yourselves. The information in addition finds you in the chapter „ Power demand to a digital plant " on page 50.



BOOSTER (6015)

What can the BOOSTER?

- the BOOSTER (6015) can be attached to all central processing units for H0-Mittelleiter-Anlagen, thus to CONTROL UNIT, cent RAL UNIT and cent RAL CONTROL. In connection with a CONTROL UNIT becomes the BOOSTER (6015) also for Maerklin 1 - plants uses.
- it takes over the digital signal of the central processing unit, strengthens it and feeds it into its own traction current circle.
- the BOOSTER does not have own control elements.
- as many as desired BOOSTERS on a plant can be used (see picture page 89).
- each BOOSTER needs its own supply transformer and must an own, isolated electric circuit supply.

Electrical characteristics:
they correspond to a large extent to those a central processing unit:

- output current max. 2.5 A; according to a power output of approx. 47 VA (with a TRANSFORMER 6002 as supply transformer).
- automatic short-circuit and overload disconnection (independent of the central processing unit).
- red light emitting diode as operational status indicator.

Size: l4Oxl2Ox8Omm

Important note:
Now and then by foreign offerers boosters are offered, which can supply substantially higher achievements than the Maerklin BOOSTER. The firm Maerklin advises against however urgently to use such devices! Quite consciously into the Maerklin BOOSTER a current limiting with approx. 3 Ampere one built. Higher rivers can heat on the one hand the normal model course cables up so strongly that the isolation can melt or burn down. On the other hand so high rivers arise with a short-circuit that wheel sets or even tracks can punctually with one another to weld and become useless thus. Maerklin sets thus with full intention high safety standards before the technically feasible or more inexpensive solution, in order to protect under all circumstancecircumstance circumstances the health and the plant of the customer!

Connecting the BOOSTERS

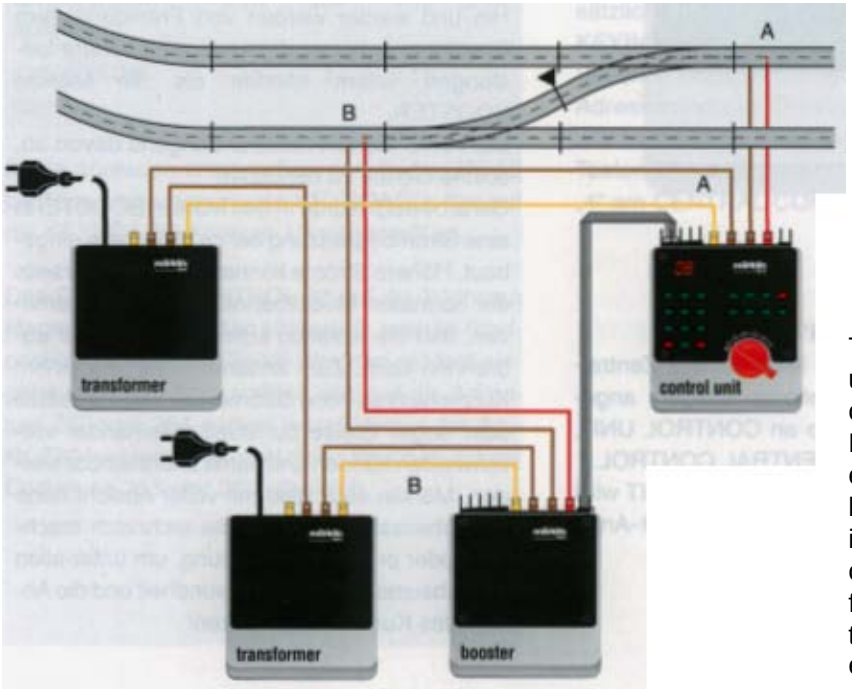
Before attaching: Transformers of the net separate!

The BOOSTER has on its back, just as a central processing unit, four-connecting terminals for the connection to the transformer and a spur track. The belonging together devices must be interconnected in each case by clamps of the same colors, as shown in the picture down.

- of the transformer (current supply): Connecting terminals yellow („L " = „Lichtstrom ") and brown (,,0 " = mass).
- to the spur track (driving stream and digital informations): Connecting terminals red („B " = „Bahnstrom ") and brown (,,0 " = mass).

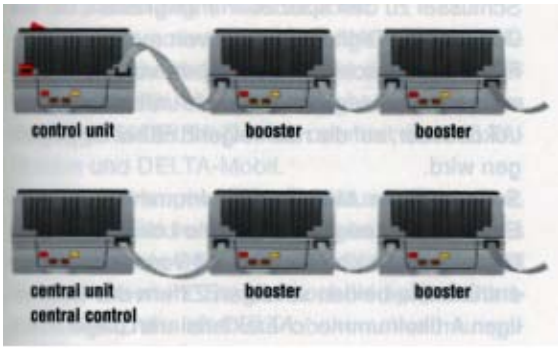
The full achievement supplies the BOOSTER only in connection with a TRANSFORMER. On its power output of 52 VA also the BOOSTER is laid out. Also in principle a conventional transformer (e.g. art. NR can. 6631 or 6647) for the current supply to be used. However the same restrictions apply, as specified in chapter 5.1 on page 81. The transformer must in any case for the mains voltage existing in your household be laid out and should about 16 V of alternating voltage deliver.

BOOSTERS with the central processing unit connect:
As connection to the BOOSTER a five conductor flat cable with two plugs is attached to. The BOOSTER has two equivalent sockets for this cable on its back: to the one socket the central processing unit is attached, to which others know if necessary further BOOSTERS are attached. At the BOOSTER the plug of the cable must be always put in in such a way that the cable runs downward.



The central processing unit supplies an electric circuit „A ", the BOOSTER the separate electric circuit „B ". between the switches is inserted a neutral conductor interface for the isolation of the two electric circuits.

At the different central processing units the cable must be differently plugged in:
- at the CONTROL UNIT (6021): Plugs in such a way put in that the cable runs upward.
- at the cent RAL UNIT (6020) and at the GENE TRAL CONTROL: Plugs in



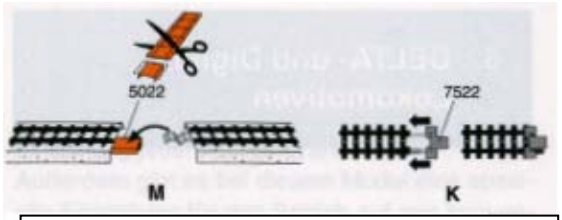
such a way put in that the cable runs downward.

Neutral conductors isolate:
Each BOOSTER must supply its own electric circuit on a digital plant. Although the digital signal is identical in all electric circuits of the plant, the individual electric circuits must be against each other isolated.

The red or yellow leads of the different electric circuits may be interconnected in no case.
The brown ground wires against it may be supposed and to be hooked up.

At all connectors between two electric circuits thus the neutral conductors of the tracks must be isolated against each other:
- setting it in addition insulators between the tracks:
  - with m-tracks: Paper isolations 5022
  - with k-tracks: plastic Isolierstuecke 7522.

Examine the effectiveness of the isolation best immediately after the assembly:
- pulling it the red cable of the spur track from the connecting terminal of a BOOSTERs. All other BOOSTERS and the central processing unit, as well



Isolation of the neutral conductors with m and k-tracks

- driving it with a lit car or a locomotive over all interfaces of this BOOSTER electric circuit. Behind the interface the car lighting must go out or stop the locomotive.
- is not that the case, must you the in any case interface again examine.
- examining it for the same kind an electric circuit after the other one.

Tip: Slow distance covered with BOOSTER

If you use a conventional driving transformer as current supply for a BOOSTER and the traction current circle attached to it, you can furnish thereby a slow distance covered.
- Connect in this special case exeptionally not the yellow connecting terminal „L ", but the red clamp „B " of the transformer with the yellow clamp of the BOOSTERs.
- Adjust at the driving automatic controller of the trafos the desired speed. The input voltage for the BOOSTER may amount to between 10 V and 18 V alternating voltage.

BOOSTER and Spur 1

In combination with the central processing unit CONTROL UNIT (6021) is used the BOOSTER (6015) also for trace 1-Anlagen. As achievement amplifier for the earlier trace 1-Zentraleinheit cent RAL CONTROL 1 (6030) gave it so far the BOOSTER to 1 (6018). This cannot be used with the CONTROL UNIT.

6. DELTA- and Digital-Locomotives

And which you experience in this main chapter?
In this main chapter the different digital locomotives and their decoders are introduced. Its own chapter is dedicated DELTA Modul. Also the installation of the DELTA module and all digital decoder are shown in conventional locomotives. Into chapter 6.9 we go on the new trace 1-Digital-Decoder for operation with the CONTROL UNIT (6021).

6.1. Overview of locomotives and decoders

DELTA and digital locomotives built inside a small electronic package in their. This component is called with the digital locomotives digital locomotive decoders and with the DELTA locomotives DELTA module. The component is the key to the special abilities, which distinguish the DELTA and digital locomotives. For the different types of locomotives and engines there are also different locomotive decoders, with which one deals in the following more in greater detail. Already at the Maerklin article number an inaugurating can recognize whether a locomotive is a digital locomotive and which kind of decoder contains it. The two front numbers of the article number four digit characterize this Loko motivklasse, while the two rear numbers designate in the following the respective model (with xx generalizes).

33xx/ Conventional locomotives without digital
34xx: Decoder.
Some newer 33r + 34r locomotives enthal ten already the DELTA module (see locomotive guidance and/or description in the catalog).
35xx: Locomotives with the conventional five-pole high speed engine.
This engine will not manufactured in the future no more, there its characteristics also at conventional operation of the digital high-power engine (6090) he is enough or to be exceeded.
36xx: Locomotives with the standard digital decoders c 80 or c 81.
37xx: Locomotives with the digital High-power engine c 90.

6.2. Locomotives with the DELTA-Module (6603)

Already in the chapter of „DELTA controllers " we called Maerklin DELTA the „small digital-System ". The DELTA module (6603) makes a DELTA Locomo tive from a normal locomotive. It corresponds to a simplified digital locomotive decoder in its functions. DELTA locomotives inserted ex factory a DELTA module. Thus they are the ideal starting point for a multi-course operation with the controller DELTA control or with the DELTA station and DELTA mobile. From each head Lokomotivgattung (steam locomotive, diesel locomotive, electrical locomotive, motor coach, ICE) there is one DELTA model at least. The selection is constantly extended. There are also complete starting packings, which are equipped with DELTA locomotives - a future-safe and inexpensive entrance into the world of the digitally steered model railway.

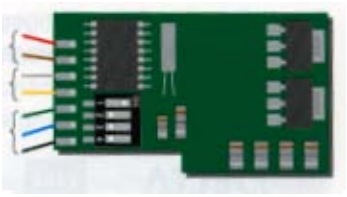
Characteristics of the DELTA module

- locomotives with DELTA module can be used not only on DELTA plants, but likewise on conventional plants and digital plants.
- the lighting of a DELTA locomotive changes with the driving direction. It is however to switch off contrary to the digital locomotive decoders, not separately. The brightness depends on the driving speed.
- it gives meanwhile two series of the DELTA module. They differ mainly by the kind of the address attitude from each other.

Maße: 36x21 x4mm

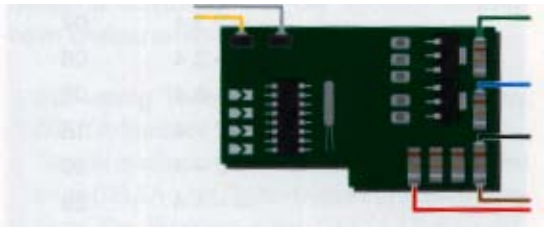
Address attitude with the DELTA module
With the newer DELTA module for adjustment a vierpoliger coding-switch is inserted to the DELTA address. Here you can change therefore the address attitude itself at any time. In addition there is a special attitude for the enterprise on purely conventional plants with this module.

Current supply light engine



New DELTA-Module (6603)

With the older DELTA module four rows with in each case two soldering surfaces serve directly on the electronics plate for the address attitude. In order to change the address of the locomotive here, small solder tacks must become put on on certain soldering surfaces (or removed for some addresses even). This tricky work you should leave better to a specialist dealer, which has for this the correct equipment.



Earlier DELTA-Module (6603)

In the following table are specified all possible address attitudes on the DELTA module.

For the enterprise on a DELTA plant only the fat-printed attitudes can be used. The attitude in the 5. Line, digital address 80, can be used only with the DELTA control in connection with the DELTA pilot.

On a digital plant however all 15 addresses can be stopped and used from 02 to 80.

DELTA 6608	6604/6605	ON 6603	Digital-Fahrpult
1		1– – –	78
2		1 2 – –	72
3		1 – 3 –	60
4		1 – – 4	24
–		1 2 3 4	80
		– 2 3 4	02
		1 – 3 4	06
		– – 3 4	08
		1 2 – 4	18
		– 2 – 4	20
		– – – 4	26
		1 2 3 –	54
		– 2 3 –	56
		– – 3 –	62
		– 2 – –	74
		– – – –	–

Address attitudes on the DELTA module

The lowest attitude (all four switches on 0FF) applies only to the new DELTA module, if the locomotive on a purely conventional plant is to drive. With the earlier DELTA MODULE with solder joints there is not this attitude, the change-over on conventional enterprise took place automatically. All DELTA locomotives with the new DELTA module are delivered with this factory setting (all four switches on 0FF). To the enterprise on a DELTA plant first one of the DEL TA addresses (78, 72, 60, 24, 80) must be adjusted. A conventionally claimant distance section within a DELTA or a digital plant can be driven through against it with any address attitude. The locomotive can drive here however only if it received a digital driving instruction before. As soon as the locomotive is whole in a conventional section longer time without river, it forgets the driving instruction and stops.

Differences between DELTA module and digital decoders

- with the DELTA module one can select from 15 with the digital decoder from 80 possible addresses.
- the DELTA module does not possess an adjustable auxiliary function. The lighting depends on the driving speed. It does not shine with standing locomotive.

Installation of the DELTA module

The installation is alike for the old and new DELTA Module. An important note in front: The DELTA module should be inserted only by an authorized Maerklin specialist dealer, since Maerklin transfers only in this case a warranty for perfect functioning of DELTA Module and locomotive. In addition the specialist dealer has a special test equipment available, in order to examine the perfect function of the DELTA module before the installation. The DEL TA module should be inserted only on a antistatic job.

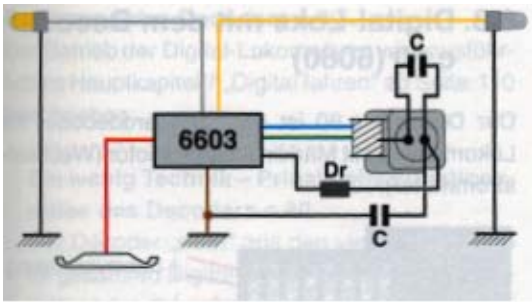


Diagram of connections
DELTA module (6603)

Preparations:
Before the change must be examined the motives for locomotive for perfect mechanical and electrical function. A mechanical or electronic direction of travel change over switch of a conventional locomotive must be removed before the installation of the DELTA module, because in the DELTA module an electronic direction of travel change over switch is contained.

Electrical connection: The red and the brown cable supply the current supply and the digital informations for the DELTA module. The red cable is soldered on directly at the Schleifer. It must remain long enough, so that it does not obstruct the movements of the rotary stand. The brown cable is soldered on to a central ground at the locomotive chassis. The grey and the yellow cable are responsible for the lighting. The grey cable receives tension, if the driving direction is adjusted to „vorwaerts " (preferred direction). It is attached to the front lighting (or possibly to another consumer, that should be active while driving forward); the yellow cable accordingly to the rear lighting. Each lighting exit receives tension with the DELTA module only if the driving automatic controller does not stand on zero. If the bulb sockets are isolated attached, a brown cable must be attached to the ground connection (locomotive chassis) as return pipe. The black lead of the DELTA module is soldered on to the existing throttle (a throttle is a special coil, it looks similar as a resistance). The other connection of the throttle is connected with a brush connection (engine sign). The blue and the green lead are soldered on to the field coil connections of the engine, so that the locomotive drives into forward direction, if the front lamp is on. Only then driving direction and lighting agree. If that is first not the case, must the blue and the green cable to be exchanged with one another.
Caution: The field coil connections are heat sensitive, them can at to long soldering duration be destroyed!

Noise suppression: For the noise suppression of the engine a entstoerkondensator is attached to the DEL TA module. It must between a brush connection (to the connection point of the throttle!) and the locomotive mass (connection point of the brown cable) to be soldered, if it is present not already in the locomotive. The connecting leads of the condenser must be kept as short as possible thereby. The other condenser (over the two brush connections) and the throttle must remain unchanged with the change.

Little technology - as the DELTA module functions?
The information and electrical signals are practically identical with the DELTA and digital-System. The function of a DELTA module corresponds therefore to a large extent the one digital locomotive decoder. The DELTA module decodes (decoded) the driving speed and the driving direction (more exactly said: the shift instruction) from the digital signal. It produces from it the driving tension for the engine. With the same tension also the lighting is supplied.
Closer explanations concerning it find you in main chapter 2, page 25.

Change possibilities
Most conventional locomotives can later be equipped with a DELTA module. Its Maerklin specialist dealer implements all changes gladly for you. From it you get also information over change possibilities and - praise.

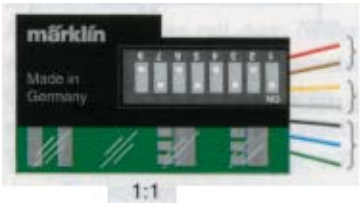
A change of a DELTA locomotive with the digital locomotive decoder c 80 (art. NR. is possible in principle for 6080, brings however only small advantages: - the lighting shines with a digital decoder with constant brightness, independently of the driving speed. It can be switched on and off remote controlled. - at the digital decoder one can adjust one of 80 addresses (opposite 15 possible addresses with the DELTA module).

A clear extension of the possibilities brings against it a change on the high-power engine 6090. More over its abilities can reread you in chapter 6.5 „Digital locomotives with high-power engine 6090 ".

Tip: High speed locomotive additionally
In view of not it is worth straight small costs of the change on the high-power engine 6090 a consideration whether you do not let better the DELTA locomotive unchanged and additionally a new 37er-Locomotive to purchase (or give to let?), those already inserted the high-power engine. For a small additional price you have then two adequately applicable digital locomotives.

63. Digital-Locos with the Decoder c 80 (6080)

The decoder c 80 is the standard decoder for locomotives with Maerklin universal motor (alternating-current motor).



Locomotlve decoder C 80(6080)

What can the Decoder c 80?
- Locomotives with decoder c 80 can be operated not only on digital plants, but also on conventional and DELTA plants (with a suitable address attitude). The change-over in the decoder takes place automatically.
- at an eight pole coding-switch a digital address can be stopped from 01 to 80 (see page 105). M the driving direction is switched electronically. M of the decoders contains an electronic memory for the speed and driving direction stopped last. The memory keeps for a while its contents also without voltage supply of the locomotive (between two minutes and hours unite). Is lost „Ge daechtnis to the locomotive ", the speed to zero and the driving direction are set on „vor waerts " (advantages driving direction). o of the decoders has a switching exit for an auxiliary function. It is operated with the
- keys „func tion " and „off " a digital driving desk. o the brightness of the lighting is independent of the driving speed. The lighting can further-shine with the digital-System even with standing locomotive.

- Maximum maximum stress of the decoder exits:
    - Engine: Duration 0.8 A, briefly 1.0 A.
    - Auxiliary function: 2 x 0.2 A (for in front and in the back).

Maße: 36 x 21 x 9 mm

Operation of the decoder c 80
The enterprise of the digital locomotives is described in detail in main chapter 7 „Digital to drive " starting from page 110.

Little technology - function mode in principle of the decoder c 80 the decoder „siebt " from the many data, which are contained in the entire digital signal, those o jenigen out, which is intended for the adjusted Loko motivadresse. From these data it wins the information, with which speed and in which direction locomotive the r is to drive. And according to these defaults it steers the engine of the locomotive and its auxiliary function.

„Memory“ of locomotive decoders
The electronic memory for the driving direction keeps with newer decoders much longer its „Gedaechtnis " than in former times (today up to some hours). Thus the locomotive also with a longer stop before a signal its stored speed and driving direction „vergisst ", cannot be bridged the signal distance with a resistance 1.5 k~ (see chapters „Magnetartikel attaching correctly " on page 142). With the employment of newer locomotives and the CONTROL UNIT than central processing unit is no longer absolutely necessary the resistance, because the information of the driving speed of all locomotives is constantly repeated by the CONTROL UNIT. However only the resistance guarantees that the locomotive maintains also its driving direction if the retention time is exceeded. If the locomotive has its information „vergessen ", it drives loosely into preferred direction (normally forward), as soon as the signal jumps on green.

Change of conventional locomotives with the decoder c 80
Most conventional locomotives can be equipped with a digital locomotive decoder c 80. More exact information keeps you direct from the parts catalog in the Maerklin catalog or with its Maerklin specialist dealer. A digital locomotive decoder should be inserted as only as possible by an authorized Maerklin specialist dealer, since Maerklin transfers a warranty for perfect functioning of decoder and locomotive only in this case. The specialist dealer has a special test equipment to the Veriuegung, in order to examine the perfect function of the decoder before the installation. In addition the decoder should be inserted only on a antistatic job.

Preparations:
Before the change the locomotive must be examined for perfect mechanical and electrical function. The mechanical or electronic direction of travel change over switch of a conventional locomotive (including connecting electronics built in some locomotives) must be removed before the installation of the decoder. At its place the decoder is usually inserted. In the decoder c 80 an electronic direction of travel change over switch is contained. The locomotive decoder is fastened with the settled adhesive strip in the locomotive.

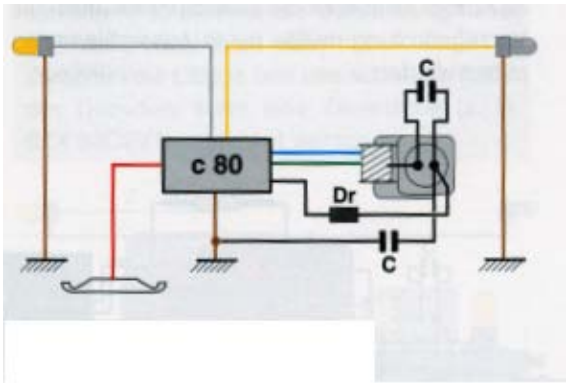


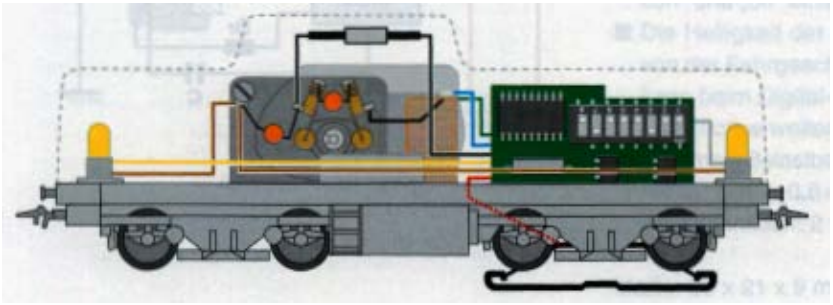
Diagram of connections locomotive decoder c 80

6.3. Digital-Loks mit dem Decoder c 80 (6080)

9
5

Electrical connection:
The red and the brown cable supply the current supply and the digital informations for the decoder. The red cable is soldered on directly at the Schleifer. It must remain long enough, so that it does not obstruct the movements of the rotary stand. The brown cable is soldered on to a central ground at the locomotive chassis. The grey and the yellow cable are the exits for the direction of traveldependent auxiliary function. To it can alternatively the lighting, which TELEX clutch, a smoke generator or e.g. a locomotive whistle is attached. The grey cable receives tension from the decoder, if the auxiliary function is adjusted switched on and the driving direction to „vorwaerts "; it marks the so-called preferred direction. The grey cable is attached to the front lighting (or to another consumer, that should be active while driving forward); the yellow cable is attached accordingly to the rear lighting. The bulb socket or the auxiliary function does not have a contact to the locomotive chassis, a brown cable must be attached to the ground connection (locomotive chassis) as return pipe. The grey and the yellow cable can be also hooked up, then the auxiliary function is independent of the driving direction, e.g. for a TELEX clutch or a smoke generator. Note: In older locomotive decoders c 80 both leads for the auxiliary function were yellow. The preferred direction had to be determined by trying out. The black lead of the decoder c 80 is soldered on to the existing throttle (a throttle is a special coil, it looks similar as a resistance). The other connection of the throttle is connected with a brush connection (engine sign). The blue and the green lead are soldered on to the field coil connections of the engine. They must be attached in such a way that the locomotive drives into forward direction, if the auxiliary function is active in „Vorzugsrichtung " (grey cable = front light). If the locomotive backs up first, while the auxiliary function is active „vorwaerts ", must the blue and the green cable to be exchanged with one another. Caution: The field coil connections are heat sensitive, them can at to long soldering duration be destroyed!

Noise suppression:
For the noise suppression of the engine a entstoerkondensator is attached to the decoder c 80. It must between a brush connection (to the connection point of the throttle!) and the locomotive mass (connection point of the brown cable) to be soldered, if it is present not already in the locomotive. The connecting leads of the condenser must be kept as short as possible thereby. The other condenser (over the two brush connections) and the throttle must remain unchanged with the change.



Locomotive decoder c 80, built into a locomotive of the series 212. The throttle sits in reality likewise on the height of the engine. It was so highly drawn in only to the better clarity.

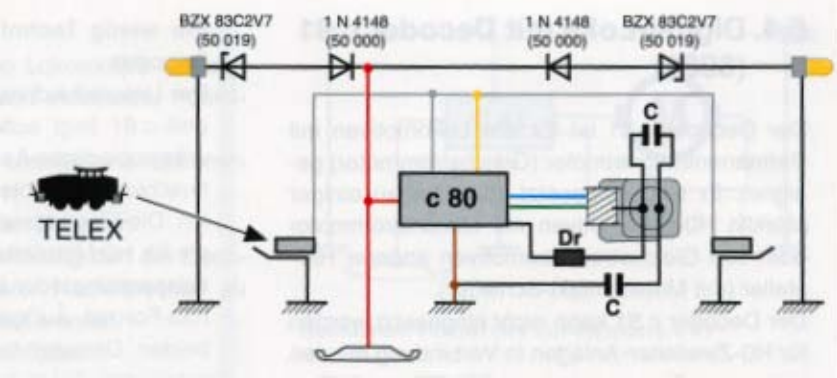


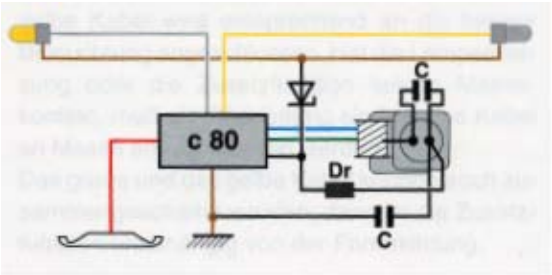
Diagram of connections locomotive decoder c 80: Auxiliary function switches TELEX clutches

Conclusion of the work
After the installation of the decoder still the desired locomotive address must be stopped (see page 105). After (hopefully successful) a test run of the locomotive the housing can be remounted: Make sure that you get caught thereby no cables!

Tip: Digital locomotives at the overhead line do not operate
In the decoder guidances is often shown to attach the red lead of the decoder with electric locomotives to the change over switch of overhead line and Schleifer. That is in principle correct, but nevertheless not recommendable. It, the red cable is better at the Schleifer of the locomotive directly festzulaeten. With digital enterprise should not be operated motives for locomotive if possible at the overhead line, because here the digital signal is substantially more frequently disturbed than during current feed over the Schleifer. In the digital-System actually also no more necessity exists to supply a locomotive via the overhead line it can up to 80 locomotives independently be operated anyway. For optical reasons the pantograph (more „ Schleifer " for the overhead line) can be set naturally nevertheless on the railway catenary.

Connection of other Auxiliary functions
With the standard wiring of a locomotive decoder, like in the picture on page 95, the auxiliary function switches the front and rear lighting of a locomotive according to the driving direction. In addition, with the auxiliary function other functions can be steered. The auxiliary function can steer e.g. one TELEX coupling. Further information to this topic finds you during the description of the high-power engine 6090 on page 103/104.

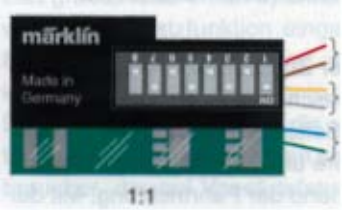
Tip: Flickerfree lighting with locomotives with the decoder c 80 (only with the c 80 possible)
The return pipe of the lamps (brown cable) not to a ground, but to the black cable (engine return pipe) is attached, then the lighting shines more brightly and flickers also not more. Between the lamp and the black cable of the decoder a breakdown diode (e.g. BZX 83C2V7) should be inserted.



Connection lighting at engine return pipe

6.4. Digital-Loks mit Decoder c 81 (6081)

The decoder c 81 is suitable for all locomotives with permanent magnet engine (direct current motor). It assigned for the change of some Maerklin HO locomotives with direct current motor or of direct current locomotives of other manufacturers (with Middle contact Schleifer)
.



The decoder c 81 cannot be used for H0-Zweileiter-Anlagen in connection with the past central processing units „CENTRAL UNIT = „ (6027) or „CENTRAL CONTROL = „.

What can the Decoder c 81?

The characteristics and the function mode of a decoder c 81 are practically identical to those of a c 80, see page 94. We do not need to repeat it here therefore.

A Little technology - distinction of the decoders the difference between the decoders c 80 and c 81 lies exclusively in the fact that they make different output voltages available for different motor types. The input voltage of both decoders is the alternating voltage or digital tension typical for H0-Mittelleiter-Anlagen in the Motorola format. Outwardly the two decoders differ only by an additional black cable of the decoder c 80. Whether in a locomotive a direct current motor (permanent magnet engine) or a universal motor is used, has mainly constructional reasons. Locomotive decoder c 81 (6081) with a permanent magnet engine is produced the magnetic field by a permanent magnet. The driving direction is switched by commutating the tension at the engine coil. With a Alistrommotor the magnetic field is produced by a field winding coil. The driving direction depends on which is flowed through by the two field winding coils of river (therefore also the additional black cable), wound opposite.

Change of conventional locomotives with the decoder c 81

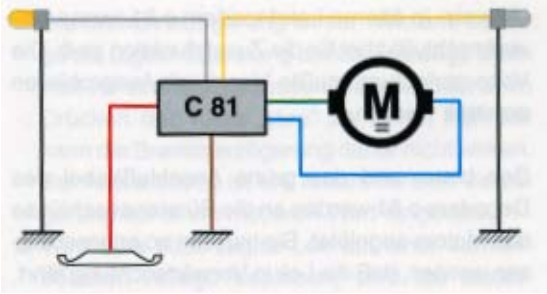
A digital locomotive decoder should be inserted as only as possible by an authorized Maerklin specialist dealer, since Maerklin transfers a warranty for perfect functioning of decoder and locomotive only in this case. The specialist dealer has a special test equipment available, in order to examine the perfect function of the decoder before the installation. In addition the decoder should be inserted only on a antistatic job.

Preparations:
Before the change the locomotive must be examined for perfect mechanical and electrical function. Conditions for the change of a locomotive with the decoder c 81:

- sufficiently place for the decoder: Because of the heat development the decoder may not be built in direct neighbourhood to plastic parts.
- engine connections floating:
  Before the installation of the decoder it must be absolutely examined with an ohm meter, whether the engine connections are floating, i.e. whether they do not have an electrical connection with the locomotive housing or the wheels. If such a connection exists with the locomotive of a foreign manufacturer, by some manufacturers isolated replacement parts are offered for the change.

The mechanical or electronic direction of travel change over switch of a conventional locomotive (including connecting electronics built in some locomotives) must be unsoldered and removed before the installation of the decoder. At its place the decoder is usually inserted. In the decoder c 81 an electronic direction of travel change over switch is contained.
All interwirings between engine, chassis, Radschleifern and lighting must be unsoldered. The locomotive decoder is fastened with the settled adhesive strip in the locomotive.

Electrical connection:
If yet available, does not have a Schleifer are inserted. It must have and with sufficient pressure strength on the neutral conductor spot contacts press sufficient place upward for bouncing. The red cable is soldered on directly at the Schleifer. It must remain long enough, so that it does not obstruct the movements of the rotary stand.
The brown cable is attached at a central ground at the
locomotive chassis.



Standard connection of the locomotive decoder c 81

Attention!
There are some locomotives of foreign manufacturers, which are supplied as alternating current version with Schleifer already installed, against their chassis however the potential of the neutral conductor rests! Check with the ohm meter! In this case the earth cable must be attached to an isolated ground. If such a locomotive does not have isolated connections for the light, then the light can be attached (cables yellow + grey), it however will relatively strongly flicker. In this case the lamps should be inserted isolated and be attached with a cable to mass.

The grey and the yellow cable are the exits for the direction of travel dependent auxiliary function. To it knows alternatively the lighting, the TELEX clutch, a Rauchgeneratoroderz. B. a locomotive whistle to be attached. The grey cable receives tension from the decoder, if with switched on auxiliary function the driving direction is adjusted to „vorwaerts ". The grey cable is attached to the front lighting (or to another consumer, that should be active while driving forward); the yellow cable is attached accordingly to the rear lighting. The bulb socket or the auxiliary function does not have a earth bar, a brown cable must be attached to mass as return pipe. The grey and the yellow cable can be also hooked up, then the auxiliary function is independent of the driving direction.

Note: In older locomotive decoders c 81 both leads for the auxiliary function were yellow. The preferred direction had to be determined here by trying out.

The blue and the green lead of the decoder c 81 are angelaetet to the brush connections of the engine. They must be attached in such a way that the locomotive drives into forward direction, if the auxiliary function is active in „Vorzugsrichtung " (grey cable). If the locomotive backs up first, while the auxiliary function is active „vorwaerts ", must the blue and the green cable to be exchanged with one another.

Caution: The engine connections are heat sensitive, them can at to long soldering duration be destroyed! Note: In older locomotive decoders both engine leads were blue. Conclusion of the work after the installation of the decoder must be stopped still the desired locomotive address (see page 105). After (hopefully successful) a test run of the locomotive the housing can be remounted: Get caught no cables!

Connection of other auxilliary functions with the exits of the auxiliary function also different functions can be switched instead of the lighting. In the picture down that connection of a smoke generator is Shown with a steam locomotive. Then the light is however not direction of travel dependent and not adjustable.

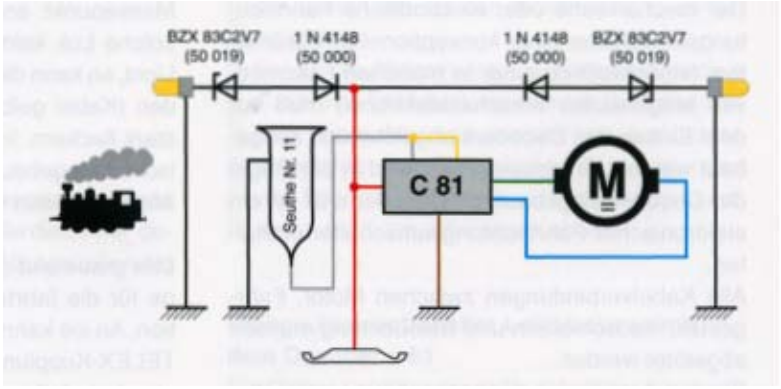


Diagram of connections locomotive decoder c 81: Auxiliary function switches smoke generator

6.5. Digital locomotives with the high-power engine c 90 (6090)

The high-power engine 6090 covers not only the decoder c 90, but also substantial parts of the engine. The electrical characteristics of the decoder c 90 are particularly co-ordinated with this engine.

Current supply

Auxiliary function

Engine connections

Locomotive decoder c 90 (6090)

Which can of the High-power engine 6090?

Locomotives with the High-power engine 6090 have particularly model-faithful characteristics:

- Adjustable maximum speed:
  The maximum speed (and thus the speed over the entire range of adjustment of the driving automatic controller) can be stopped according to the type of locomotive and the driving desires. With an express train locomotive one will stop for example a higher speed than with a ranking locomotive, which is to be regulated within the slow range particularly sensitivly. With distribution of the locomotives maximum maximum speed is adjusted at the decoder.
- load-sensitive regulation of the speed:
  The speed once stopped at the driving automatic controller remains to a large extent constantly, also at upward gradients or while driving downhill of a heavy course. With digital enterprise the regulation functions independently of the attitude of the maximum speed.
- Adjustable starting and brake delay:
  Thus the handling of heavy course federations can be copied. Also when quick changes at the driving automatic controller the courses start moving model-faithfully slowly or continue accordingly. The brake delay is only effective, as long as the digital tension rests against the track. With the stop before a closed signal or when pressing the key „stop " at a driving desk the brake delay cannot work therefore. With distribution the starting/brake delay is adjusted to a middle value.
- is operated a 6090-Digital-Lok on a conventional layout, is the load-sensitive speed control, the adjustable maximum speed and the starting delay likewise effective, but not quite as effective as with digital enterprise. As well the regulation can work during uphill drive, depends in analog operation also on the attitude of the maximum speed. If this is very highly adjusted, remains hardly still power reserve for the regulation.
- The locomotive address isadjustable with digital enterprise from 01 to 80 (see page 105).
- An auxiliary function can be switched on and off with digital enterprise at the driving desk.

Reference

It replaces the conventional five-radial engine of the past locomotives of the 35.-Serie to reference by the excellent characteristics of the high-power engine 6090 also with conventional enterprise. This motor type is not in the future any longer manufactured.

Change on the high-power engine 6090

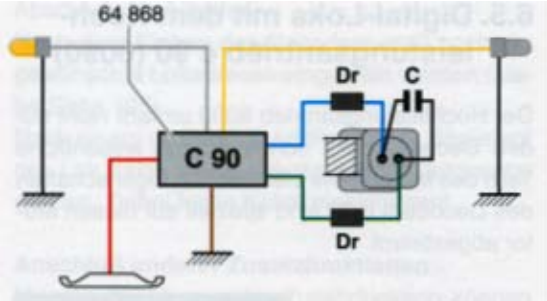
A change with the complete conversion kit 6090 is possible with locomotives with a drum commutator motor. Information for this gives the parts catalog in the catalog or your Märklin to specialist dealers. With this change the locomotive decoder c 90 will not only become as well as new five poliger anchors inserted, additionally also the field magnet, the engine sign and the pair of brushes of the engine begun. Therefore this change should be accomplished only by an authorized Märklin specialist dealer. The specialist dealer has a special test equipment available, in order to examine the perfect function of the decoder before the installation. In addition the decoder should be inserted only on a antistatic job.

Comparatively more inexpensive than the change of an existing locomotive the solution is, equivalent from the beginning the 37. - to buy execution, if from their „ Desire locomotive " such a model is available.

Preparations
Before the change the locomotive must be examined for perfect mechanical and electrical function. Before the installation of the high-power engine first the existing mechanical or electronic direction of travel change over switch or another digital locomotive decoder must be removed. In its place the decoder c 90 is used.

Mechanical change:
First the following parts of the engine must be removed: old UKW throttle, engine sign, anchor and field magnet. Then the new engine components are installed: the field magnet, the new five-pin anchor and the engine sign. At the engine sign a entstoerkondensator is already soldered over both brush connections. Afterwards the new pair of brushes (art. NR becomes. 60,146) assigned. The locomotive decoder is fastened with the settled adhesive strip in the locomotive

Electrical connection:
The red and the brown cable supply the current supply and the digital informations for the decoder. The red cable is soldered on directly at the Schleifer. It must remain long enough, so that it does not obstruct the movements of the rotary stand. The brown cable is attached at a central ground at the locomotive chassis. The grey and the yellow cable are the exits for the direction of traveldependent auxiliary function. To it can alternatively the lighting, which TELEX clutch, smoke generator or another consumer is attached.



The grey cable receives tension from the decoder, if the auxiliary function is adjusted switched on and the driving direction to „vorwaerts "; it marks the so-called preferred direction. Diagram of connections locomotive decoder c 90

The grey cable is attached to the front lighting (or to another consumer, that should be active while driving forward); the yellow cable accordingly to the rear lighting. The bulb socket or the auxiliary function does not have a earth bar, a brown cable must be attached to mass as return pipe. When desired the grey and the yellow cable can be also hooked up, then the auxiliary function is independent of the driving direction.

Into the blue and green lead of the decoder c 90 one throttle each is inserted for noise suppression (a throttle is a special coil, it looks similar as a resistance). The blue and the green cable are then soldered on to the connections of the engine. They must be attached in such a way that the locomotive drives into forward direction, if the auxiliary function is active in „Vorzugsrichtung " (grey cable). If the locomotive backs up first, while the auxiliary function is active „vorwaerts ", must the blue and the green cable to be exchanged with one another. Caution: The engine connections are heat sensitive, them can at to long soldering duration be destroyed!

Conclusion of the work:
After the installation of the decoder still the desired locomotive address must be topped (see page 105). After (hopefully successful) a test run of the locomotive the housing can be remounted: Get caught no cables!

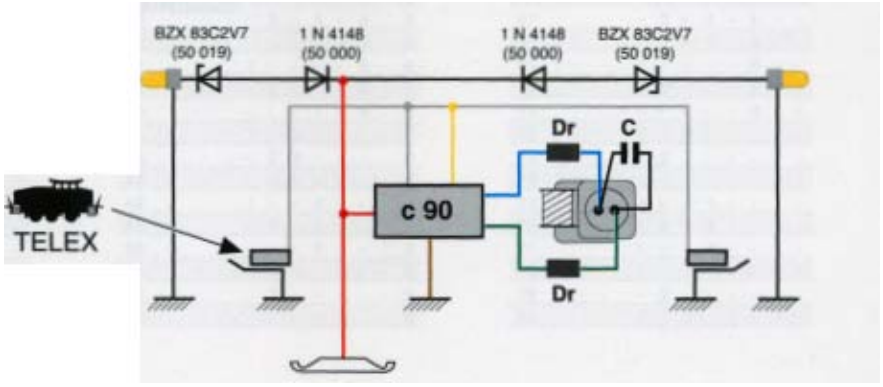
Tip: **Decoder c 90 with other engine**
In principle the decoder c 90 can be used also with another direct current motor. E.g. the disk commutator motor in some locomotives can be converted to a direct current motor. In addition the field coil is replaced by a „HAMO Feldmagnet ". The motor armature remains unchanged. However the rule characteristics will be surely less good then than with the particularly co-ordinated five-pin engine of the conversion kit 6090.
It cannot be ensured also that the decoder with each motor type co-operates. With unsuitable engines the installation of the decoder c 90 can lead to the destruction of the decoder or to damages at the engine.
There are authorized firms, which accomplish such changes from Märklin. Their addresses receive you from your specialist dealer.

Connection of other Auxilliary functions
Instead of the lighting can be switched on and off with the exits towards the auxiliary function also different consumers. The lighting is no longer adjustable in this case, but shines continuously (also with standing locomotive).
The connection of a TELEX clutch or a smoke generator is shown in the following pictures.

TELEX- Coupling

The TELEX clutch is a remote controlled clutch, with which cars at any point of the layout can be uncoupled. For rangierlokomotiven a TELEX clutch is ideal therefore. With the circuit variant shown the front and rear TELEX clutch is operated at the same time and independently of the driving direction, since the grey and the yellow cable are hooked up. One could naturally head for the two clutches also direction of traveldependently. The lighting is directly attached at the Schleifer. It shines continuously with constant brightness, independently of driving speed and driving direction.

The TELEX clutches are to be operated only briefly. They reach this, if you do not use 80 F on the digital driving desk CONTROL the key „function " for switching on of the auxiliary function on, but only for short time the key „0ff " press. Then the auxiliary function is only so for a long time operated, as you keep the key pressed „off".



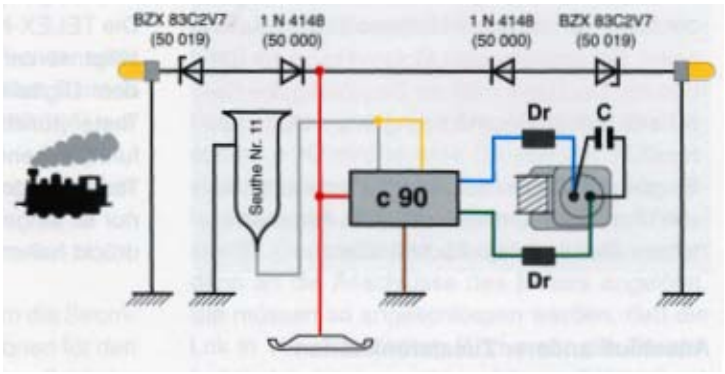
Auxiliary function TELEX clutch

Smoke generator
A smoke generator is a small heating cartridge, which heats up and to steaming brings a special steam oil. Thus a model course with steam loks becomes still more realistically.

Importantly: Use only the smoke generators of the firm Seuthe developed particularly for digital enterprise!
They are co-ordinated with the maximum output current of the Zusatztunktion (200 mA). With some locomotives the employment is intended by two smoke generators.
This is possible with the digital smoke generators of Seuthe. The yellow and the grey cable are connected during this circuit, so that the smoke generator can be operated with each driving direction.

The lighting is directly attached at the Schleifer. It shines continuously with constant brightness, independently of driving speed and driving direction.

Little technology - function of the diodes the two standard and breakdown diodes in the inlet of the lighting prevent that the digital decoder loses because of the comparatively high current consumption of the lighting in an isolated track section its „Gedaechtnis ". This auxiliary circuit is to be used with the digital-System generally, if beside the locomotive decoder still further consumers are within an isolated track section, e.g. a signal stopping distance. This could apply also to lit cars, whose Schlei fer is in the proximity of the locomotive (see also page 63).



Auxiliary function smoke generator

6.6. Attitude of the Lokomotivadresse

All standard Lokomotivdecoder inserted a achtpoligen coding-switch. With these eight miniaturschaltern the digital address of a locomotive can be stopped.

Eight pole coding-switches

The digital address is the „Telephone number " of a locomotive, under which it is addressed in the digital-System. This number must be entered at a digital driving desk, before the locomotive can be steered. You find an explanation in more detail of the digital address in chapter 2.2 „Was is a digital address? " on page 19. In the coding table for the Locomotive address you see, which of the eight small slide switches into the position „ON " to be brought to have, in order to stop the desired address. The position „ON " is always designated on the coding-switch itself. The small switches can change you over most surely with a narrow screwdriver or the special adjusting pin, which is attached to the decoder 6090. To the emergency is enough also tooth more stocher from wood. You find the same coding table also in the guidance of each digital locomotive.
There the factory-installed stopped address with a more strongly dyed bar is marked. With distribution another address is adjusted for each type of locomotive. So far possible, this address has a relationship with the serial number of the locomotive. You find a list of the factory-installed stopped addresses of all digital locomotives supplied so far in chapter 12.2, page 220.

Address	Switch ON	Address	Switch ON	Address	Switch ON
01	. 2 3 . 5 . 7 .	27	1 . 3 . 5 . . 8	54	1 . 3 . 5 . . .
02	. . 3 . 5 . 7 .	28	. 2 3 . 5 . . 8	55	. 2 3 . 5 . . .
03	1 . . 4 5 . 7 .	29	. . 3 . 5 . . 8	56	. . 3 . 5 . . .
04	. 2 . 4 5 . 7 .	30	1 . . 4 5 . . 8	57	1 . . 4 5 . . .
05	. . . 4 5 . 7 .	31	. 2 . 4 5 . . 8	58	. 2 . 4 5 . . .
06	1 . . . 5 . 7 .	32	. . . 4 5 . . 8	59	. . . 4 5 . . .
07	. 2 . . 5 . 7 .	33	1 . . . 5 . . 8	60	1 . . . 5 . . .
08	. . . . 5 . 7 .	34	. 2 . . 5 . . 8	61	. 2 . . 5 . . .
09	1 . 3 . . 6 7 .	35	. . . . 5 . . 8	62	. . . . 5 . . .
10	. 2 3 . . 6 7 .	36	1 . 3 . . 6 . 8	63	1 . 3 . . 6 . .
11	. . 3 . . 6 7 .	37	. 2 3 . . 6 . 8	64	. 2 3 . . 6 . .
12	1 . . 4 . 6 7 .	38	. . 3 . . 6 . 8	65	. . 3 . . 6 . .
13	. 2 . 4 . 6 7 .	39	1 . . 4 . 6 . 8	66	1 . . 4 . 6 . .
14	. . . 4 . 6 7 .	40	. 2 . 4 . 6 . 8	67	. 2 . 4 . 6 . .
15	1 . . . . 6 7 .	41	. . . 4 . 6 . 8	68	. . . 4 . 6 . .
16	. 2 . . . 6 7 .	42	1 . . . . 6 . 8	69	1 . . . . 6 . .
17	. . . . . 6 7 .	43	. 2 . . . 6 . 8	70	. 2 . . . 6 . .
18	1 . 3 . . . 7 .	44	. . . . . 6 . 8	71	. . . . . 6 . .
19	. 2 3 . . . 7 .	45	1 . 3 8	72	1 . 3 . . . . .
20	. . 3 . . . 7 .	46	. 2 3 8	73	. 2 3 . . . . .
21	1 . . 4 . . 7 .	47	. . 3 8	74	. . 3 . . . . .
22	. 2 . 4 . . 7 .	48	1 . . 4 . . . 8	75	1 . . 4 . . . .
23	. . . 4 . . 7 .	49	. 2 . 4 . . . 8	76	. 2 . 4 . . . .
24	1 . . . . . 7 .	50	. . . 4 . . . 8	77	. . . 4 . . . .
25	. 2 . . . . 7 .	51	1 8	78	1 . . . .
26	. . . . . . 7 .	52	. 2 8	79	. 2 . . . . . .
		53	 8	80	1 . 3 . 5 . 7 .

Locomotive address code table

5.7. Locomotive Zusatfunktion

In almost any digital locomotive there is an auxiliary function, which can be switched on and off from each digital driving desk remote controlled, if the locomotive at this driving desk is called.
Depending upon wiring the auxiliary function can become dependent on the driving direction of the locomotive angesteu erl. This is used e.g. with a direction of traveldependent lighting.

Which function with „Zusatzfunktion " is switched on and off, depends of the type of the locomotive and on its equipment:

- lighting direction of traveldependently in front or in the back
- light in front during driving direction „forwards" (e.g. with many steam locomotives)
- light in front, independently of the driving direction
- light changes red/white depending upon driving direction
- Swiss light change (in front: three stern lamps, in the back: only the left lower lamp)
- smoke generator (usually not direction of traveldependent)
- for TELEX clutch (short time manipulation, usually not direction of traveldependently)

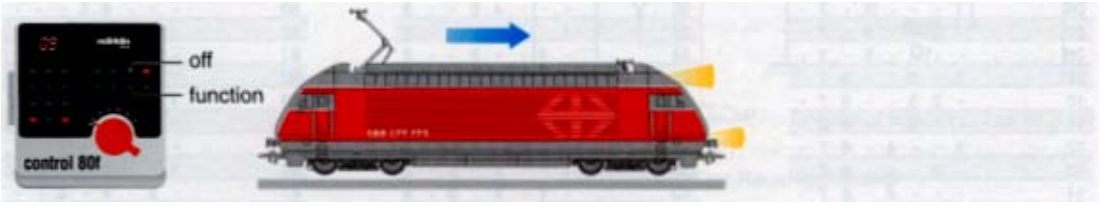
Operation at the digital driving desk
auxiliary function longer switch on (e.g. for lighting):

- switch on: Key „function " at the digital driving desk press;
- switch off: „0ff gropes " presses.

Auxiliary function briefly switch on
(e.g. for TELEX clutch):

- switch on: Key „off ' press; (only with the driving desks CONTROL 80 F and CONTROL UNIT)
- switch off: Key „off " release.

As long as the auxiliary function is switched on, also the light emitting diode shines with „function ".



Keys for the locomotive
auxiliary function

6.8. HO digital locomotives with special decoders

There are some few locomotives, which are equipped with standard decoders not or can be converted. This can be appropriate for on particularly close space conditions on the one hand in the locomotive, e.g. with „Glaskasten " 3686 or 3687.

On the other hand additional functions are inserted, approximately with the ICE 3370/3770 a direction of traveldependent loop loop circuitloop circuit in some locomotives or motor coaches. A change of the conventional remarks of these locomotives on digital enterprise is only directly possible with Märklin. Further details take you please from the spare part table in the Märklin catalog or the respective locomotive guidance.

There are also some few locomotive decoders, which do not contain a normal coding-switch from space reasons. Here the address can be changed over if necessary over solder joints. Turn to it please to its Märklin specialist dealer.

Locomotive 3686
„Glaskasten "

6.9.Digital-Decoder for Märklin 1-Locomotives

Decoder c 95 (6095)
the Decoder c 95 is the new Locomotive decoder for single-engine trace is 1-Locomotives in connection with the central processing unit CONTROL UNIT. It replaces the past decoder c 85 (6085). With the earlier trace 1-Zentraleinheit cent RAL CONTROL 1 cannot be used the decoder c 95! An employment with the cent RAL UNIT (6020) is not intended. Locomotives with the decoder c 95 can be steered with the following driving desks:

- CONTROL UNIT (6021),
- CONTROL 80 F (6036),
- INFRA CONTROL 80 F (6070) in connection with the hand transmitter IR CONTROL (6071),
- INTERFACE (6050). Also the functions „f 1 " to „f4 " of the decoder c 95 are accessible over the INTERFACE.

Which can the decoder c 95?

- adjustable in the addresses „01 " to „80 "
- adjustable maximum speed
- regulation of the speed while driving downhill and mountain and with extreme slow speed
- adjustable one starting and brake delay for the imitation of heavy courses
- all attitudes take place directly at the locomotive decoder. A special programming device is not necessarily
- with distribution of the locomotives is as follows adjusted the decoders:
  Maximum speed: maximally
  starting/brake delay: middle position
- control of up to 5 locomotive functions
- equal dimensions and same connections (plug-compatible) as past decoder c 85
- uses the Motorola Track format (closer information see chapter 10 on page 184)
- maximum load of the exits:
  Engine: 1.Ä
  functions: ever is alike 0.5

operation of the decoder c 95
the operation as with all other digital locomotives. It is described in detail in the chapter „Digital driving " on page 113.

Tip: Five adjustable function exits are already inserted use of the special functions in the decoder c 95. They are headed for over the keys „function"/,,off " as well as „f 1 " to „f4 " of a digital driving desk. So that all five functions react correctly, just be placed at the CONTROL UNIT the coding-switches 1, 2 and 3 on ON. The „L " - and the „F" address must be alike (this is the standard attitude with all driving desks with function keys).

Change on the decoder c 95
The change of conventional locomotives or of locomotives with the predecessor decoder c 85 takes place via a Märklin specialist dealer. For the change of the decoder c Märklin offers 85 on the c 95 temporally limited particularly favorable conditions on.

Decoder 86 095

This decoder is the replacement for the past digital decoders for twin-engine trace 1-Lokomotiven. It is, just like the decoders c 95, for the employment with the central processing unit CONTROL UNIT (6021) intended and finished likewise the Motorola data format. The decoder is not applicable with:

- „CENTRAL CONTROL 1 " (6030) or
- CENTRAL UNIT = „ (6027).

An employment with the central processing unit CENTRAL UNIT (6020) is likewise intended. Locomotives with the decoder 86095 (e.g. E 91, crocodile, V 100) can be steered with the following driving desks:

- CONTROL UNIT (6021),
- CONTROL 80 F (6036),
- INFRA CONTROL 80 F (6070) in connection with the hand transmitter IR CONTROL (6071),
- INTERFACE (6050/6051).

Decoder 66 152

The decoder 66 152 is the replacement for the past digital decoder for the trace 1-Dampf locomotive T 3 (art. NR. 5509). It is intended to operation with the central processing unit CONTROL UNIT (6021) and processes the Motorola data format. The decoder is not applicable with:

- „CENTRAL CONTROL 1(6030) or
- „CENTRAL UNIT = „ (6027).

An employment with the central processing unit CENTRAL UNIT (6020) is likewise intended. In all other respects applies already with the decoder 86 095 saying also to the decoder to 66 152.

Decoder 66 982

the decoder 66 982 is the replacement for the past digital decoder for the trace 1-Kleindiesel-lok, series 323 „Koef " (art. -No. 5574). It is intended to operation with the central processing unit CONTROL UNIT (6021) and processes the Motorola data format. The decoder is not applicable with:

- „CENTRAL CONTROL 1 " (6030) or
- „CENTRAL UNIT (6027).

An employment with the central processing unit CENTRAL UNIT (6020) is likewise intended. In all other respects applies also here already with the decoder 86 095 saying.

7.Digital Driving

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Which you experience in this main chapter?

In this main chapter you become acquainted with the different driving desks of the digital-Systems, and you experience, what working models are.

The possibility of being able to steer several locomotives independently from each other in the same electric circuit is reliably for many model railroadmen the most important reason to decide for a digital plant. This applies the more strongly, since with the introduction the CONTROL was brought to UNIT a universal central processing unit on the market, which already contains a complete driving desk. Additional digital driving desks apart from the central processing unit are nevertheless the most important components of a digital plant

7.1. Common characteristics of the digital driving desks

Digital driving desks must be always stuck on at the right side of the central processing unit. With the Maerklin digital-System altogether driving desks can be steered by the central processing unit up to 10.

There are 80 different locomotive addresses, i.e. can, in principle up to 80 locomotives independently from each other on a plant drive. On a driving desk the locomotive called last can be always steered concerning driving speed or driving direction. However several locomotives can drive at the same time on the plant with only one driving desk, whose speeds are then successively stopped.

A digital driving desk does not need a direct track connection, since it passes all information on to the central processing unit. The central processing unit prepares the information and sends it to the track. You find details in addition in chapter 2.3 „Wie a locomotive in the digital-System are steered " starting from page 20.

Connection of a digital driving desk

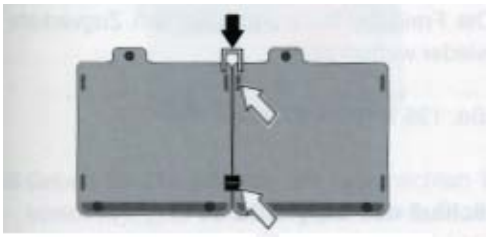
Before attaching: All transformers of the net separate!

A digital driving desk must be always stuck on on the right side of the central processing unit. This is particularly important, if you use adaptor cables (see next side).

In which order different driving desks are stuck on, no role plays. Only the INTERFACE must be quite right stuck on as last equipment, because it does not have a second contact strip, but the socket at the right side for the connection of the computer.

Altogether max. 10 driving desks can be served by a central processing unit. The inserted driving desk the CONTROL UNIT and a possibly attached INTERFACE must be taken into account.

So that the patch cords between the control desks cannot separate unintentionally, you should interconnect the devices in principle with the settled plastic clips. Put in addition the clips into the recesses at the lower surface of the



Devices with plastic clips interconnect devices.

Directly after switching on on briefly the number of „99 lights up " on each driving desk. That shows that the driving desk was recognized by the central processing unit and shifted into the initial state (,,automatic RESETS "). By the central processing unit an internal digital address is assigned to the driving desk. For this reason a driving desk does not possess coding-switches for adjusting an address.

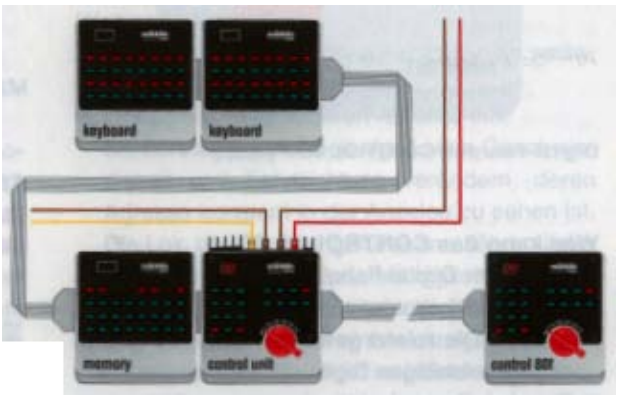
Connection over adaptor cables

If a larger plant is to be served by several persons, it offers itself to develop two spatially lying apart „ DRIVE CONDITIONS ". As connection between the control desks (driving desks or placing desks and central processing unit) then the adaptor cables serve 60 cm or 180 cm (6039/6038).

But do not forget please:

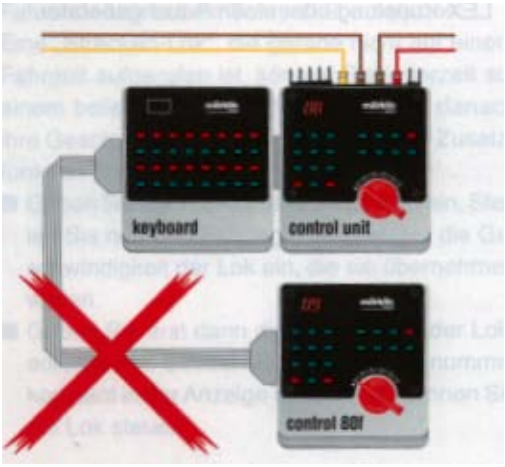
Digital driving desks always from the right side, digital placing desks from the left side to the central processing unit attach!

Read heretofore an attaching of the adaptor



Correct connection of driving and placing desks with adaptor cables

cables also the referring to page 64.



But SO in no case!

7.2. CONTROL 80 F (6036)

The standard driving desk in the digital-System is called CONTROL 80 F. It is for all Maerklin digital Plants and for all central processing units suitably

Digital-Control panel CONTROL 80 F (6036)

Which can CONTROL 80 F?

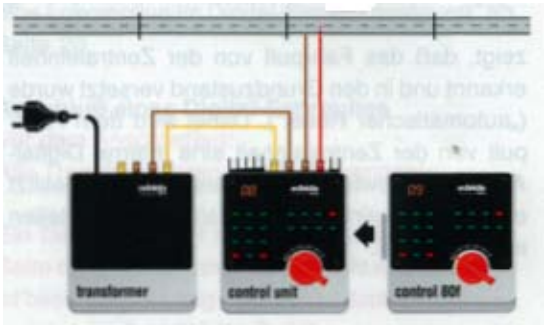
- With a digital driving desk can be driven (in principle) up to 80 locomotives at the same time. The address selected last is indicated on a two digit digital display.
- a locomotive auxiliary function can be switched on and off. The auxiliary function can switch, depending upon kind of the locomotive, different
- functions, e.g. the lighting, the TELEX clutch or smoke generator.
- with the CONTROL 80 F know, except the straight mentioned locomotive auxiliary function, four functions one Function decoder independently be switched on and off. Function decoders are inserted in working models or in Lo-komotiv-decoders (e.g. in trace 1 - decoders). Which functions thereby are actually steered, depends completely on the working model.
- with manipulation of the emergency stop key „stop " is switched off the output current of the central processing unit and all BOOSTER. The announcements and memory contents of all digital control desks remain however.
- the enter key „go " lets the train services further-roll again.

Maße: 135x120x80mm

Connecting the CONTROL 80 F

Before attaching: All transformers of the net separate!

5111, 5103
2290



The CONTROL 80 F is attached at the right side of the central processing unit

Bedienung eines CONTROL 80 F

Locomotive call:

If you want to call a new locomotive address, always the light emitting diode must shine with the key „L". Usually also the LED of the key „F“ shines. This indicates that the entered address is to apply both to locomotive and to function decoders.

- If you enter the address of the desired locomotive always in two digits, thus e.g. to „08 ". shine the entered locomotive address constantly in the announcement, the locomotive can be steered. If the locomotive address flashes against it, either the input was not correct or the desired locomotive is already called on another driving desk. Then the locomotive on the other driving desk must be released only, before you can steer the locomotive on your driving desk.

Speed adjust:

- Adjust the speed with the driving automatic controller. For different locomotives the actual speed can be different despite same attitude of the driving automatic controller. That depends on the engine and transmission of the locomotive, of the type of the digital decoder and on the zuggewicht.

Driving direction change over:

- Turn the driving control knob beyond the zero position to the left on the small triangle. Quiet clicking is to be heard in the driving desk. At a digital locomotive is not to be seen switching to no more or heard, because the change-over takes place electronically in the digital decoder of the locomotive. If the lighting of the locomotive is switched on, it is switched likewise with most locomotives with the driving direction. In which way, depends of the type of the locomotive (e.g. lamps shine either only in front or in the back or alternating red or white for etc..)

Further locomotive call:

If you on the same driving desk a further locomotive to call want:

- Type simply their address.
  They can in each case change that locomotive in speed and driving direction, whose address is to be seen constant in the announcement. The locomotive, which was called before, drives on with the speed stopped last. In this way you can in principle steer up to 80 digital locomotives with only one driving desk, in practice are it however admittedly quite with difficulty, more than two or three locomotives with a driving desk really „im grasp " to be kept.

  Driving locomotive on a driving desk take over:
  You can at any time call a „Strecken locomotive ", which is not called on a driving desk straight on any driving desk and, change afterwards their speed, driving direction or auxiliary function.
- Give the 1. Number of the locomotive address. Adjust now the driving automatic controller in approximately to the speed the locomotive, which they want to take over.
- giving it only then the second number of the locomotive address. As soon as the complete locomotive number lights up constantly in the announcement, you can steer the locomotive.

Auxiliary function switch on and off:
Almost any digital locomotive possesses an auxiliary function, which can be switched off with the keys „function " and „0ff " ein- und. In addition, with most locomotives the auxiliary function switches the lighting in or out, it can other functions thereby be switched, e.g. the smoke generator with a steam locomotive or the TELEX clutch with a ranking locomotive.

- auxiliary function longer operate (e.g. for lighting, smoke):

- switch on:
  Key „function " press;
- switch off:
  Key „off " press.

- Auxiliary function briefly actuators (e.g. for TELEX clutch):

  - switch on: Key „off " press;
  - ausschalten: Taste „0ff“ wieder loslassen.

As long as the auxiliary function of the called locomotive is in operation, the red light emitting diode shines with the signature „function".

Emergency stop release:

- Red key „stop " press.
  With it you release an immediate emergency stop of all courses. The current supply to the tracks (and to the magnet article decoders) is interrupted; this applies also to possibly attached BOOSTERS. The driving speeds of all locomotives remain however stored, since the control desks are supplied further by the central processing unit with river.

Drive on:

- key „go " press. All locomotives continue to drive with its before stopped speed and driving direction.

Reference
Digital locomotives can lose possibly after a longer emergency stop (several minutes) it „Ge daechtnis ", i.e., they forget their driving speed and driving direction stopped last. You will notice however mostly then only if a locomotive before the emergency stop were adjusted to reverse movement, because as digital information not the driving direction, but only the shift instruction is sent for it. The information for the driving speed repeated against it by the central processing unit regularly, particularly also after an „go" instruction, so that it does not play a role whether it is contained in the locomotive memory additionally or not. With the CONTROL UNIT is constantly repeated the digital information for all driving locomotives. With the other central processing units only instructions for the locomotives repeated, which are called on a driving desk, thus for max. 10 locomotives.

RESETS release:

- if you the two keys „stop " and „go " press, solve you at the same time a so-called „Reset " the central processing unit (6021) out: all driving locomotives are stopped and all information of the driving desks and the central processing unit are deleted. They reach thereby the same condition as after switching on of the plant on. However after one „go " the locomotives with the speed will drive on, which is still stored in each locomotive decoder.

Function keys use:
On the CONTROL there are 80 F still four further keys with the inscription „f 1 " to „f4". With these keys you can, beside which, four further „Funktionen switch locomotive auxiliary function ". By combinations of the four keys even more than four functions can be headed for with some working models. The CONTROL owes 80 F also the letter „F to these function keys " in its type designation. The function keys are needed e.g. for steering some special working models or trace 1-Lok-decoder (see page 108). The working models contain a function decoder, which works similarly in principle as a locomotive decoder.

- a pressure on one of the function keys switches the function on, next depressing the key switches off it again. As long as the function is switched on, a red light emitting diode over the respective function key shines.

Function decoder address enter:
The function keys work as desired even if a function decoder address is selected. As a check the red light emitting diode over the key „F must shine ". After switching on on or after a RESET the two light emitting diodes over „F " and „L " shine for the digital plant at the same time. That means it that the selected address applies at the same time to the locomotive and function decoder. In addition, it is possible to select the addresses of Lok-und function decoders independently:

- Press in addition the key „F ", and you enter the address of the function decoder in two digits.
- If you want to select another locomotive, press the key „L " and enter the new locomotive address likewise in two digits. The previous function decoder address remains simultaneous adjusted. They can even press the function keys, while the locomotive address in the announcement is to be seen. The function decoder address appears again with pressure on the key „F".

Little technology - as steering a locomotive functions?

In the driving desk CONTROL 80 F is inserted its own microprocessor. It steers and supervises all functions of the driving desk and data exchange with the central processing unit.

Driving desk: Locomotive address valid?
After entering a locomotive address the microprocessor examines whether it concerns a valid address. Otherwise, the announcement is placed immediately on „Blinken ", it goes no message to the central processing unit.

Central one: Locomotive address already „ occupies "?
If the address is valid, it, together with the driving speed and the auxiliary function, is passed on to the central processing unit. The central processing unit examines whether the requested locomotive address is called on another driving desk already. In this case a busy response is returned to the driving desk, the announcement at the driving desk begins to flash. The driving desk sends then in short time intervals the same requirement to the central processing unit; thus are enough, until either the requested address is released or on the driving desk another locomotive address is selected.

Central one: Locomotive address freely;
Driving desk: Locomotive steer.
If the requested locomotive address is not selected on another driving desk, the central processing unit registers locomotive address, speed and driving direction into an internal memory. Then it sends a confirmation to the driving desk, which thereupon the locomotive address shows constantly in the announcement. At the same time the central processing unit transmits the data several times one behind the other to the track. Only with a change of driving speed, driving direction or auxiliary function the new data will transfer from the driving desk to the central processing unit. In the meantime the central processing unit sends the data from its memory independently in regular intervals to the track.

The managing representation is something simplified; it does not consider some refinement of the data communication. But it shows quite clearly the expiration of the data communication and the basic concepts of the digital-Systems. Still more detailed information in addition finds you in chapter 2.9 „Wie looks the information transfer in the detail? " starting from page 29.

Operation with Maerklin 1-Locomotives

The locomotive decoders for trace 1-Locomotives can up to five functions head for: the locomotive auxiliary function and the functions f1 to f4. If the CONTROL UNIT is used as trace 1- Central processing unit with the new trace 1-Decodern 6095, 86,095, 66,152 and 66982 (see page 109), must be placed at the back the CONTROL UNIT the coding-switches 1, 2 and 3 on ON. Only then the function keys work „f 1 " to „f4 " as desired. With this attitude UNIT lights up as well as on each CONTROL 80 F or IN-FRA CONTROL 80 F a swept light emitting diode as direction indicator on the CONTROL. With the trace 1 - this announcement always indicates the material driving direction of the locomotive to decoders.

7.3. CONTROL 80(6035)

The digital driving desk CONTROL 80 is the predecessor CONTROL 80 F.
its functions is to a large extent directly as those CONTROL 80 F and
needs therefore not to be repeated here.
With the CONTROL 80 the possibilities for the controlling of the function decoders are only missing. The CONTROL 80 can be used on all Maerklin digital plants
and with all central processing units; also a mixed operation with
the CONTROL 80 F or other digital driving desks is easily possible.

Driving desk CONTROL 80(6035)

Connection and operation CONTROL 80

connection and operation are directly as with the CONTROL 80 F (see chapter 7.2). They are not repeated here therefore.

1

7.4. CONTROL UNIT (6021)

The CONTROL UNIT is not only central processing unit for all Maerklin digital plants, it contains also a complete digital driving desk. The functions and the operation correspond nearly completely to those of the driving desk CONTROL 80 F, see chapter 7.2.

The CONTROL UNIT is also a complete digital driving desk

Connection the CONTROL UNIT
The connection the CONTROL UNIT to the track and their characteristics as central processing unit are in the chapter „ Central processing units " starting from page 80 in detail described. At the right side the CONTROL UNIT further digital driving desks can be attached up to nine.

Tip: Locomotive speeds during „stop " change
A special characteristic for the CONTROL UNIT (not with the cent RAL UNIT 6020) can with a threatening Zusammenstoß nützlich sein:
In the CONTROL UNIT and each driving desk attached to her one can change the speeds also several locomotives during an operating interrupt through „stop " successively:

- pressures it the key „stop " on any driving desk.
- Enter the address of the first locomotive. Set the driving automatic controller to the desired value (e.g. zero).
- giving it the address of the second locomotive. Set the driving automatic controller to the new value, etc..

Immediately after restarting the tension to the track with the key „go " the new speeds are passed on to the locomotives. They continue to drive therefore possibly still some centimeters, before the new speed becomes effective. Switching of the driving direction is however only possible after the key was again pressed „go ". Reason: For switching the driving direction several instructions in a certain order must be sent (STOP - shift instruction - STOP). Such Instruction sequences can become in the CONTROL UNIT not buffered.

7.5. INFRA CONTROL 80 F (6070) and IR CONTROL (6071)

The INFRA CONTROL 80 F is a special driving desk within the digital-Systems. Together with a remote maintenance IR CONTROL makes possible it to steer the model railway facility practically from any point in the area. No annoying cable connection disturbs, and the range is even sufficient for large areas. The principle is the same as during the remote maintenance of a television set: the control signals will transfer 80 F by invisible infra-red light from the hand transmitter IR CONTROL for „Empfangs station " INFRA CONTROL. They are passed on from here to the central processing unit.

ranrpun INFRA CONTROL KUL 80 F (6070) mut Intrarot-Empfangssonde

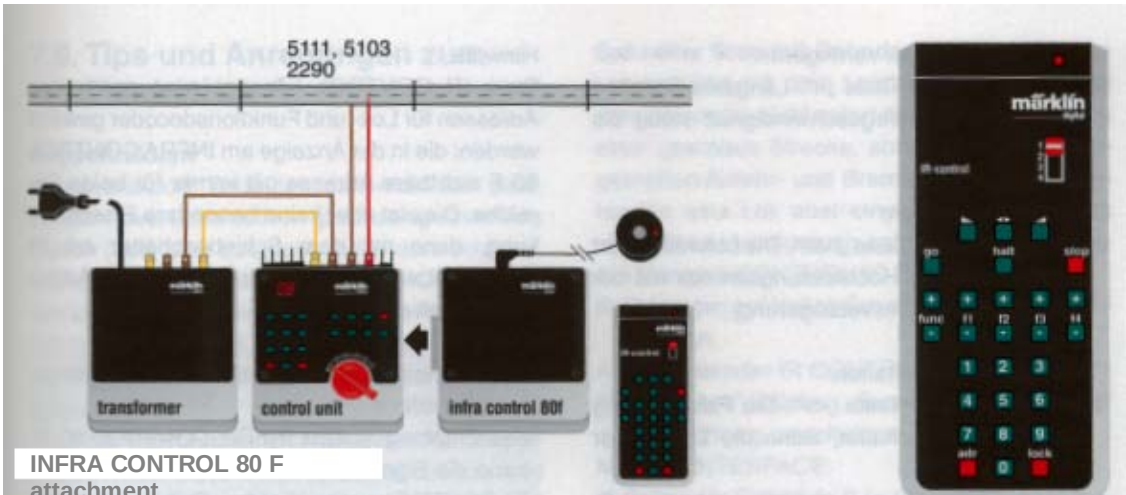
What knows the INFRA CONTROL 80 F?

- at least one hand transmitter IR CONTROL is necessary for the enterprise.
- A INFRA CONTROL 80 F can co-operate with up to four hand transmitters IR CONTROL.
- in the INFRA CONTROL 80 F is stored up to four locomotive addresses.
- instructions for the four different locomotive addresses can be received in arbitrary order, however not at the same time.
- the receipt probe is at 3.5 m is enough cable fastened. She can be installed thus at a favorable receiving place.
- a light emitting diode in the receipt probe blinks with each received instruction briefly.
- the INFRA CONTROL 80 F has the following announcements:
  a three-figure digital display for the current transmitter address and the pertinent locomotive address; two swept light emitting diodes for the announcement of the driving direction (only during appropriate attitude of the central processing unit CONTROL UNIT are activated); four light emitting diodes for the four functions of the function decoders; a light emitting diode for the locomotive auxiliary function, a further for the bolting device position „lock " IR CONTROL.

Maße: 135 x 120 x 80 mm

Connection of the INFRA CONTROL 80 F

The INFRA CONTROL 80 F is attached, like all digital driving desks, at the right side of the central processing unit. The sequence of the different driving desks plays thereby no role. However only a INFRA CONTROL 80 F on a plant may be used IR receivers to attach the cable of the receipt probe possesses a three pole 3,5-mm-Klinkenstecker, which is put in at the back of the INFRA CONTROL 80 F. Since the cable is long approx. 3.5 m, the probe at a particularly well visible position in the area can be installed, e.g. at the cover or



INFRA CONTROL 80 F attachment

at the rear wall of the plant. Only the middle field of the receipt probe must remain visible, the remainder can " become also „versteckt. The IR CONTROL does not have to be directed always directly toward the receipt probe. The receiver is so sensitively that he recognizes also such infrared signals reliably, at the space walls was already several times reflected.

For the cable of the receipt probe there is also a special, 3 m long extension cord under the art. NR. 6072. The Infrarot Empfangssonde is an active construction unit (it contains a small amplifier); for reasons of the transmission reliability however any more than two extension cords should not be connected in series.

Which can IR CONTROL?

- With the IR CONTROL nearly all functions of a " digital driving desk can „normalen, e.g. CONTROL 80 F, are steered.
- all locomotive addresses between 01 and 80 can be selected.
- Each hand transmitter can be adjusted with a slide switch to one of four transmitter addresses.
- with each switching position can be steered another locomotive.
- needs a 9-V-Blockbatterie for the enterprise.

Maße: 147x65x21 mm

Hand transmitters IR CONTROL (6071)

Operation of the IR CONTROL / INFRA CONTROL 80 F

Directly after switching on on none of the announcements of the INFRA CONTROL 80 F shines. Locomotive address at the IR CONTROL select:

- places it at the slide switch of the IR CONTROL a transmitter address (e.g. „4 ").
- Press the key „adr". With each input blinks the light emitting diode at the IR CONTROL quite briefly; the light emitting diode at the receipt probe of the INFRA CONTROL 80 F shows by short to flashes that the instruction arrived correct there.
- giving it the desired locomotive address in two digits, e.g. „08 ". In that-indicate the INFRACONTROL8O Fwird now indicated: „4 08 ". The locomotive can be steered, if the locomotive address lights up constantly.

Driving speed increase:
Since the IR CONTROL does not possess a driving automatic controller in the conventional sense, also the driving speed is stopped over keys.

- pressures you the key „ > „. you the key keep, the speed pressed so long are constantly increased. First the locomotive reacts very slowly, then however ever more quickly.

Driving speed reduce:
- pressures you the key „ < „. longer pressing constantly reduces the driving speed up to the stop.

Locomotive quickly stop:
- pressures you the key „halt ". The locomotive holds immediately on (with locomotives with high-power engine with the adjusted brake delay).

Driving direction switch:
- pressures it the Taste,,<> ". The driving direction is switched only if the locomotive stands before.

Emergency stop:
- if you the key „stop " press, by the central processing unit the tension to the track are switched off, all locomotives stop immediately. All adjusted locomotive addresses and driving speeds remain however.

Enterprise again take up:
- pressures it the key „go ": all locomotives drive off with its before stopped speed and driving direction again.

Address choice lock:
- Key „lock " press: then the locomotive address cannot be adjusted any longer, until again the key is pressed „adr ". At the CONTROL the light emitting diode shines for 80 F „lock " as reference. The bolting device applies only to the straight transmitter address stopped at the slide switch.

Functions operate:
The functions are switched with the pairs of keys „func ", „f 1 ", „f2 ", „f3 " and „f4 ".
- function switch on: appropriate key „ + " press.
- function switch off: appropriate key „-„ press. (a brief pressure is pressed only on the key „ - „ the function switches as for a long time in, as the key „ - „.) With switched on functioning the associated announcement on the INFRA CONTROL 80 F shines.

Reference
With the IR CONTROL no separate addresses for locomotive and function decoders can be selected; in the announcement to INFRACONTROL to 80 F visible address always applies to both ranges. This is however no special restriction, because with the slide switch at IR the CONTROL even four different addresses are quickly attainable

Tip: Common driving with several hand transmitters the slave station INFRA CONTROL 80 F can differentiate the signals from up to four hand transmitters IR CONTROL. Each hand transmitter must be adjusted in another transmitter address. However in each case a transmitter may send its instructions at the same time, otherwise the INFRA CONTROL cannot keep 80 F apart the different instructions.

Tip: Quick switching between different locomotive addresses with a hand transmitter the INFRA CONTROL 80 F can store another locomotive address under each of the four transmitter addresses. Thus one can switch CONTROL by switching the transmitter address at the slide switch of an IR very quickly between four locomotive addresses, without having to enter an address again.

By the way: Switching in another transmitter address is only Registered and indicated at the INFRA CONTROL 80 F, as soon as on the IR CONTROL any key is pressed. In this kind one can select also different addresses of locomotive and function decoders, if one needs this possibility nevertheless.

Example:
Position 1: Locomotive address 08
position 2: Function decoder address 20
position 3: Locomotive address 41

7.6. Tip and suggestions to driving

Double traction

„ Double traction “meant that not only pull one, but two locomotives at the same time a course (or a locomotive pulls, which pushes others). In former times double traction at larger upward gradients or with long goods trains was to be observed quite frequently in the genuine railway company. Therefore the double traction is also an interesting model course situation. On a conventional plant the double traction was not to be realized so easily, because both locomotives had to drive in the same electric circuit and by it with the same tensiontension tension. Therefore only two identically constructed locomotives could be used for this task (same transmission!); or a locomotive had to be steered via the overhead line and the other one via the neutral conductor contacts. With a digital plant however is substantially easier the double traction to convert. They need in addition only two digital driving desks. Thus you can adjust the two locomotives completely independently of their transmission translation to the same speed. And, if a locomotive is equipped with a TELEX clutch, also coupling is not before and uncoupling at the end of an upward gradient distance a problem, rather a very delightful termination of activities.

Reference
Operation with a thrust locomotive is recommendable in the model course only according to experience on straight distances; the use of two course locomotives is better.

Quick stop with Decoder 6090

Locomotives with the locomotive decoder 6090 continue normally notimmediately, but only after a certain distance, dependent on the adjusted starting and brake delay. Want you a locomotive however once as fast as possible without this delay to stop:

At the driving desk CONTROL 80 F:

- Driving automatic controllers to zero set and driving direction switch.

At the hand transmitter IR CONTROL:

- key „halt " press, then with the Taste,,<> " driving direction switch.

With the INTERFACE:

- instruction for drive position 0 (= 0) send, then instruction for change-over of the driving direction (= 15), between them at least 0.1 seconds of break.

Slow distance covered furnish

In order to furnish a generally valid slow distance covered, there are several possibilities in the digital-System. For each of these possibilities the neutral conductor at the beginning and at the end of the slow distance covered must be isolated from the remaining tracks. The driving stream is fed over its own spur track into the slow distance covered.

Possibility 1:
Insert a resistance into the red cable of the spur track (of conventional plants admits). The resistance is to have approx. 5 to 10, its maximum stress must at least 10 W (!) amount to. This possibility has a set of disadvantages: The resistance warms up with the enterprise strongly, it must at a well ventilated place be installed. And it uses naturally the output for heating of the central processing unit, which is not very economic. With a firm resistance the driving speed is not adjustable, an adjustable resistance (potentiometer) of this achievement is expensively, with difficulty available and possesses likewise all other disadvantages of this circuit. The effective load control of the high-power engine 6090 will to a large extent compensate even the spannungsverlust and thus the effect of the slow distance covered will destroyed make. Thus for digital enterprise no particularly recommendable possibility.

Possibility 2 is a better alternative:
Slow distance covered via a BOOSTER supply.
The BOOSTER however not to a MOLDERMOLDER MOLDER, but to the traction current clamp „B " (!) of a rule regeltrafos attach, e.g. a trafos 6631. Then can be adjusted with the driving automatic controller of the trafos, as slow the locomotives to become to be supposed. In addition, the normal supply voltage of a BOOSTERs amounts to approx. 16V, it still works with an input voltage of 12 V alternating voltage. If the tension is too far reduced however, the BOOSTER switches out.

Possibility 3:
Reduce supply voltage at the track. Hobby electronics engineers can reduce the tension at the track also by breakdown diodes. This reduction does not impair the digital signal. Even locomotives with the high-power engine 6090 become accordingly slower within such ranges. The breakdown diodes should have however an acceptable current load of at least 1 A.

Tip: Slow distance covered before signals

In the Maerklin magazine No. 4/93 with supplement in 5/93 was introduced a circuit, over for locomotives with the high-power engine 6090 before signals a reality-faithful to achieve slow course stop.

Turning loops automatlc for Märklin 1 with digital enterprise

With Märklin 1 as two-leader alternating current system star (no separate neutral conductor as with HO) the problem of a turning loop mechanism emerges again and again. Among them one understands the automatic commutating of the tension, if a course is within a turning loop. This is necessary, because at the end of the turning loop the tension of each rail has the straight reverse polarity as at the beginning. Beginning and end of the turning loop may not be hooked up therefore without special measures.

The circuit presented here uses the pole pole 8947, which originally originates from the Märklin mini club program. In addition, it stands problem-free the higher tensions of spur 1.

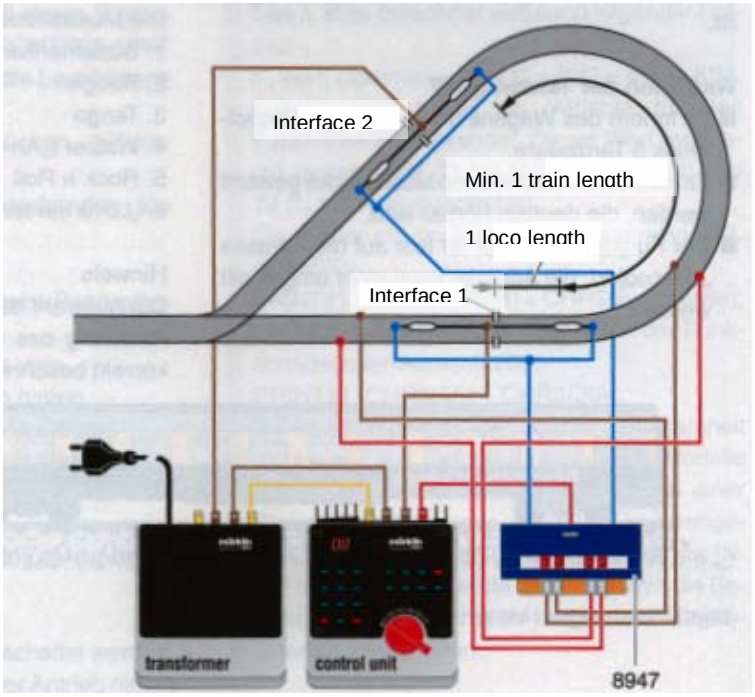
Within the turning loop two interfaces are installed. At least in each case 1 locomotive length before and behind the interface is installed a reed contact. At the locomotive a magnet must be installed, with the Darueberfahren the contacts within the reed contact operated.

Before and behind each interface two reed contacts joined in parallel are installed, so that will drive through the turning loop in both directions can. The reed contacts of the second interface commutate then the tension again, so that the tension has the same direction toward driving through the turning loop as at its beginning.

Notes:
The circuit can be used:
- for trace 1-Digital operation with the CONTROL UNIT 6021;
- for conventional alternating current operated.

It cannot be used:
- with two-leader Digital systems (6027, 6030) and
- with trace 1 - direct current enterprise.

The magnet should be installed at the locomotive. The distance of the two interfaces should be at least as large as the longest course up – the layout. The locomotive with the magnet may not stop on a reed contact; of the thus developing continuous contact could lead otherwise to a damage 8947.



Turning loop mechanism for Spur 1

7.7. Working models

Working models inserted a function decoder. A function decoder is headed for over the keys „f 1 " to „f4 " of a digital driving desk. In addition the following driving desks are suitable: CONTROL UNIT, CONTROL 80 F, INFRA CON-TROL8O find INTERFACE. The exits of a function decoder steer consumers in the working models, e.g. lighting or engines. A function decoder works similarly as a locomotive decoder: it is addressed under an „Funktionsdeco that address ". From the entire data stream it filters only the information intended for him.

Dance car (4998)
The car 4998 with inserted function decoder is called officially society car. It is a very beautiful example of the various a satzmaeglichkeit from function decoders. Therefore it is described here quite in detail, although it is available unfortunately already longer time no longer.

Which can the dance car?
- The inside one the car 5 tanzpaare turn on push of a button. o it can
- be selected 6 different music pieces, which are clearly audible. o of
- the function decoders is coded firmly in the address „20 ", the
- address can not be changed over.

Operation of the dance car
- giving it the address „20 " on a digital driving desk.
- with the driving desks CONTROL UNIT and CONTROL 80 F must shine thereby the light emitting diode with the key „F ".
- at lR the CONTROL: Key „adr " press, „20 " enter.
- at the INTERFACE: see section of „INTERFAE instructions for function decoders " on page 125.

The four function keys have the following meaning with the dance car:
f 1: Sky light in and out switch.
f2: 5 tanzpaare turn on the tanzflaeche or stop.
f3, f4 out: The current music piece abspielen.
f3 out, f4: Switch far to the next music piece. All 6 music pieces automatically successively play. Music switch off.

The music pieces are:
1. South American rhythm (,,La bamba“)
2. Boogie
3. Tango
4. Walzer (,,on the beautiful blue Danube “)
5. Rock‘n Roll
6. „Love me tender“

Reference
the selection of the music pieces is not quite correctly described in the original guidance of the society car.

Panorama car (4999)

The panorama car is a further HO car with inserted function decoder. Also it is not available unfortunately any longer.

Which can of the Panoramawagen?

- a waiter goes the inside one the car back and forth, it can at the tables and at the end of the course stop.
- The sky light and the lamps at the tables are be switched on and off separately.
- The function decoder in the panorama car is coded firmly in the address „10 ", the address can not be changed over.

Operation of the panorama car

Enter the address „10 " on a digital driving desk. With the driving desks CONTROL UNIT and CONTROL 80 F must shine thereby the light emitting diode with the key „F ". At the IR CONTROL: Key „adr " press, „10 " enter. At the INTERFACE: see accompanying section.

The four function keys have the following meaning with the panorama car:

f1, f2 out: Waiter runs forward.
F1 out, f2: Waiter runs to the rear.
F1, f2: Waiter stops immediately.
f1 from, f2: Waiter stops immediately.
f3: Table lighting switch on and off.
f4: Sky light switch on and off.

Reference

If fi and f2 are switched on at the same time, the waiter stops immediately. The drive does not take damage despite the apparently contradictory instructions.

Digital-Panorama-wagen (4999)

Function decoder and INTERFACES

Little technology of INTERFAE instructions for function decoders

The instructions for the function decoders can be spent also over the INTERFACE. These instructions were not yet specified in the earlier guidance of the INTERFACE 6050).

It concerns a two-byte instruction:

1. byte: Attitude of all 4 functions.
2. byte address of the function decoder

The 1. Byte computes itself using the following formula:

F_Wert (decimal) = 64+ f1 + 2*f2 + 4*f3 + 8*f4.

F_Wert is used thereby as variable for the function value. This value lies with it between 64 (f 1 to f4 switched off) and 79 (f 1 to f4 switched on).

The controlling of the functions reads thus e.g. in BASIC:

PRINT#1 , CHR$(F_WERT) + CHR$(F_ADRESSE);

Example: Function f2 switch on with the function decoder address 20:

PRINT#1, CHR$(66) + CHR$(20);

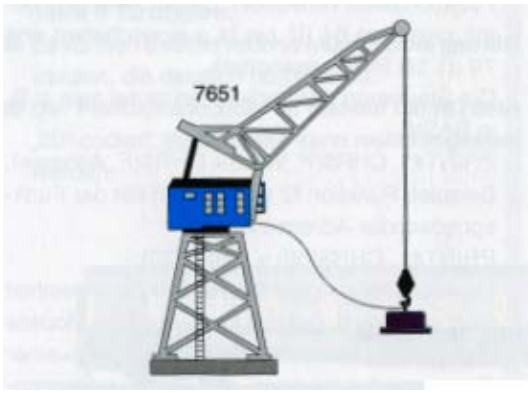
Function instructions are not repeated by the central processing unit. Instructions for mobile models (function cars) can be lost therefore with interruptions of circuit at the track. If you send function instructions over an INTERFACE, the program should repeat the instructions therefore if possible in certain time intervals.

Decoder instructions with Spur 1

The earlier trace 1 and Zweileiter-H0-Zentral-einheiten („CENTRAL UNIT = „ „CENTRAL CONTROL = „ „CENTRAL CONTROL 1 ") cannot head for a function decoder with the INTERFACE. Against it if a CONTROL UNIT (6021) is used as trace 1- Central processing unit, the function instructions are to be addressed via the INTERFACE correctly, if the coding-switches are placed 1, 2 and 3 at the CONTROL UNIT on ON.

Digital-Jib Crane (7651)

The digital jib crane is a working model with a special decoder. It unites the functions of a function decoder and a locomotive decoder. With the digital jib crane very realistic loading procedures in a model course can be copied. The electromagnet at the kranausleger cannot only hold loose iron splinters, but also different articles, hides a small iron core contained (e.g. crates, barrels, bundles of etc.). Very delightfully also the automatic control of the crane is parallel to the model railway company with a computer and the INTERFACE.



Digital Jib Crane (7651)

Which can the digital jib crane?

- With the digital jib crane lifting and lowering the load and
- the rotation of the structure can be controlled not only in the direction, but also in the speed.
- together with the electromagnet also the passenger lighting is switched on and off.
- the digital address can be stopped at a coding-switch in addresses possible of 16. The factory-installed stopped address is „30".
- with the lower floor panel conversion kit No. 7652 the entire drive of the crane can be shifted under the model construction plate. This approaches the original appearance and reduces also the noise of the crane noticeably

Adjust the digital address

- Adjust the desired digital address at the achtpoligen coding-switch under the base plate.

The following addresses can be stopped:
01,03,04,09, 10, 12, 13, 27, 28, 30, 31, 36, 37, 39, 40, 80
The attitude of the coding-switches is alike thereby as with the digital locomotive decoders c 80, c 90 etc.. You find the table of the locomotive addresses on page 218. In the address of the jib crane should be adjusted no motives for locomotive, since the jib crane decoder evaluates also locomotive instructions in this address.

Connecting the Digital Jib Crane
The connection is extremely simple with the digital jib crane: Since the decoder is built in the crane itself, a red and a brown cable are sufficient, which supply current supply and digital informations at the same time.

Operation of the digital jib crane
Address enter:
- giving it the selected address of the jib crane in two digits. With the driving desks CONTROL UNIT and CONTROL 80 F must shine thereby both light emitting diodes „L " and „F " at the same time (basic adjustment).

Crane turn:
- f1 switch on. Rotating speed steer with driving automatic controller. Direction of rotation switch:
- Switch exactly like driving direction of a locomotive: Driving automatic controllers up to the notice to the left turn.

Load lift or lower:
- f2 switch on (f 1 out). Speed steer with driving automatic controller. Switch between lifting and lowering:
- Driving automatic controllers up to the notice to the left turn. If fi and f2 are switched on at the same time, the crane does not react.

Electromagnet and lighting switch on and off:

Switch on:
- key „function " press. Switch off:
- key „off " press.

Connection of the digital jib crane 7651 to a central processing unit (or a BOOSTER) with only two leads

Tip: Conventional ones or digital jib crane select?
Beside the digital jib crane also further the conventional jib crane 7051 is available. If you liked to possibly steer a jib crane within a digital plant or with the INTERFACE, the digital jib crane 7651 the best solution is natural. For „Handbetrieb " (thus without computer price increase) the conventional jib crane 7051 with the pertinent placing desk in addition, is applicable. By decoders k 83 and k 84 can be steered also the jib crane 7051 digitally, however the operation is pedantic than with the provided control desk (see page 173). Advantages of the digital jib crane: Beside the simpler connection the rotating speed and the Geschwindigkteit are variable for lifting and lowering the load. For spring 1994 there is a conversion kit (art. NR. 7652), which makes a digital jib crane from the conventional jib crane 7051. The change takes place via your specialist dealer, afterwards the crane corresponds exactly to one digital jib crane 7651.

8. Digital Schalten

Which you experience in this main chapter?

The following main chapter „Digital switching " is one of the most extensive chapters in this book. They find here over

- the digital placing desk KEY BOARD,
- the magnet article decoders k 73 and k 83,
- the correct connection of all magnet articles to the digital-System,
- the decoder k 84 to information for switching from lighting and other permanent currents,
- circuits with the decoder k 84.

The special digital placing desks SWITCH BOARD and MEMORY as well as the INTERFACE are addressed briefly in following main chapter 9. Their various possibilities cannot be exhaustively treated however within this volume. These digital components are treated in detail therefore in a continuation volume.

8.1. Common characteristics of the digital placing desks

Digital placing desks must be always stuck on at the left side of the central processing unit. With the Maerklin digital-System altogether placing desks can be served by the central processing unit up to 16. At each digital placing desk with a vierpoligen coding-switch of 16 possible placing desk addresses one adjusts (differently than with the digital driving desks). There are altogether 256 addresses for magnet articles or permanent current consumers. Contrary to a conventional plant with a digital plant the magnet articles and permanent current consumer are not attached directly to a placing desk. Rather a so-called decoder must be inserted, which converts the digital signals into the conventional switching impulses, which need e.g. magnet articles. All decoders need to be connected only by a two-pole ring circuit with a digital electric circuit, thus the wiring expenditure is reduced clearly in relation to a conventional plant. Can be switched by inserting the decoders with a digital placing desk both magnet articles and permanent current consumers, e.g. lighting or engines.

8.2. KEYBOARD (6040)

The standard placing desk in the digital-System is the KEY BOARD. It is suitable for all Maerklin digital plants and for all central processing units.

Digital-Stellpult KEYBOARD (6040)

Which can KEYBOARD?

- the KEY BOARD contains 16 pairs of keys with in each case a red and a green key. With each pair of keys one of the 256 addresses is served. Over a decoder thereby (more zweispuliger) a magnet article or a permanent current consumer can be switched.
- each pair of keys is assigned a red light emitting diode (LED). It shines, if the associated red key were pressed.
- when switching off remains the last position of all magnet articles in the KEY BOARD stored.

Connecting the KEYBOARDs

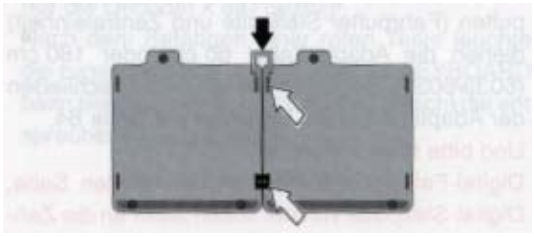
Before attaching: Transformer from the net separate!

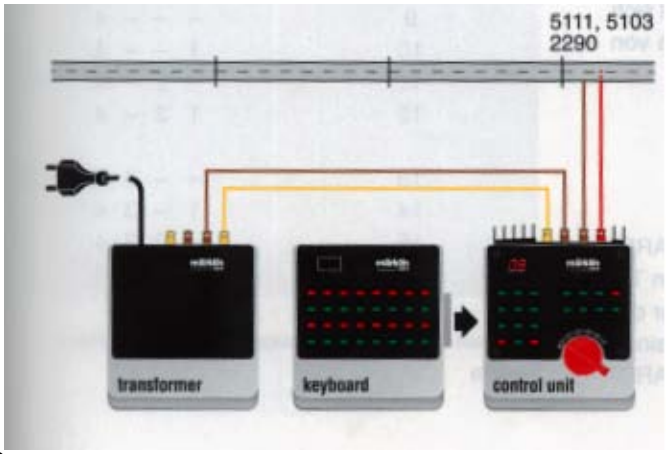
A digital placing desk must be always stuck on on the left side of the central processing unit. This is particularly important when using adaptor cables.

In which order the individual placing desks are stuck on, no role plays. However altogether any more than 16 placing desks are not to be attached to the central processing unit.

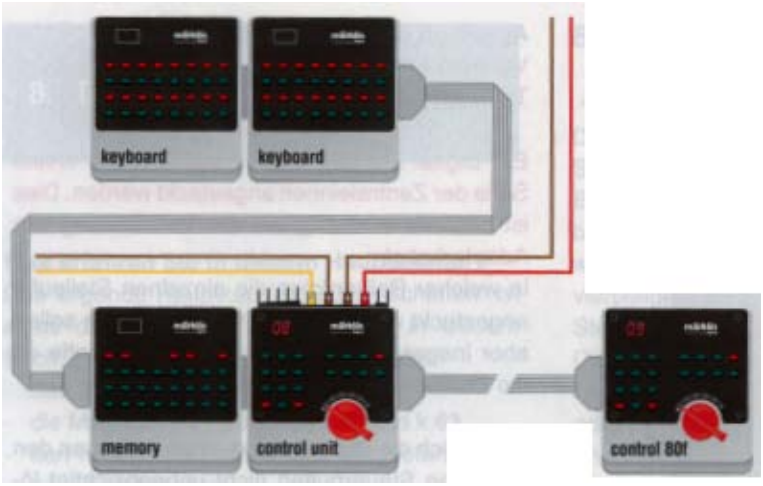
So that the patch cords between the individual control desks cannot separate unintentionally, you should clasp the devices with the settled plastic to interconnect:

- putting it in addition the clips into the recesses at the lower surface of the devices.





A KEY BOARD is attached from the left side to the central processing unit



If you the address of a KEYBOARDs during operation this conversion changes, becomes only effective after a RESET of the digital plant reference over (to RESETS see page 114)!

Correct connection of driving and placing desks with adaptor cables

Connection over adaptor cables
If a larger plant is to be served by several persons, it offers itself to develop two spatially lying apart „Fahrstaende ". As connection between the control desks (driving desks / placing desks and central processing unit) the adaptor cables serve 60 cm or 180 cm (6039/6038). Consider before attaching the adaptor cables the referring to page 64.

Please do not forget : Digital driving desks always from the right side, digital placing desks from the left side to the central processing unit attach!

Adjust the KEYBOARD address
In the digital-System can be attached up to 16 different KEYBOARDs. Since each KEY BOARD has 16 pairs of keys, 16 x 16 = 256 different addresses can be served. At the back of the KEYBOARDs is a four pole coding-switch, with which one of 16 addresses is adjusted.

o places you here the desired KEYBOARD

address according to the following table, into the recess left above over the keyboard of the KEYBOARDs can attach you a sticker with the adjusted KEYBOARD address.

Desk address	Code switch ON
1	– – – –
2	1 – – –
3	– 2 – –
4	1 2 – –
5	– – 3 –
6	1 – 3 –
7	– 2 3 –
8	1 2 3 –
9	– – – 4
10	1 – – 4
11	– 2 – 4
12	1 2 – 4
13	– – 3 4
14	1 – 3 4
15	– 2 3 4
16	1 2 3 4

Placing desk addresses and associated switching positions

The sequence, how the KEYBOARDs is attached to the central processing unit, is independent of the adjusted address. The used addresses must also not absolutely follow all one another. Four KEYBOARDs may be adjusted e.g. easily in the addresses „2 " - „1 " - „4 " - „2 ". However such a coding can become easily unclear.

Tip: Several placing desks in the same address adjust

They can adjust when desired also several digital placing desks in the same address, in order to develop e.g. two spatially separated fahrstaende. The placing desks are then joined in parallel without any auxiliary wiring, i.e., of each of these placing desks the same magnet articles can be switched, the light emitting diodes show on all placing desks the position of the magnet articles. In this way e.g. also a KEY BOARD and a place deskdesk placing desk attached over a SWITCH BOARD can be joined in parallel. Nevertheless the total number should not be exceeded by altogether max. 16 placing desks at the central processing unit for reasons of the supply achievement.

Decoders k 83 or k 84 can be addressed by each KEY BOARD up to four (also mixed). Also in each decoder one must be adjusted to the KEYBOARD address fitting decoder address (see also page 133 and 220).

Operation of the KEYBOARDs

The Operation of the KEYBOARDs is very simple; it corresponds also to a large extent to the operation of the conventional placing desks 7210, The keys correspond to the indicated functions only if the devices are attached in the correct way to the decoders. The correct connection of all devices is shown starting from page 136 (for the decoders k 83) and/or starting from page 163 (for the decoders k 84). After operation the associated red light emitting diode at the KEY BOARD, during the pressing of a green key shines for a red key expires the appropriate light emitting diode.

Equipment	**Red button**	**Green button**
Switch	abbiegend	Straight ahead
Signal	Stop	Go
Uncoupling track	does not use (or 2. Uncoupling track)	Uncouple
Lighting	aus	ein
Motor	aus	ein

Little technology - as functions switching a magnet article?

In each KEY BOARD its own microprocessor is inserted. It steers and supervises all functions of the KEYBOARDs and data exchange with the central processing unit. The following description describes as it were into more extremely „ Slow motion ", which runs off by electronic signal processing in reality within one instant between the components of a digital plant.

Inquiry: Button pressed?
The microprocessor of the KEYBOARDs examines constantly whether any key was pressed on the KEY BOARD. If, it passes a message on to the central processing unit.

KEY BOARD at center: Key pressed!
This message contains the number and the KEYBOARD address stopped at the coding-switch of the pressed key (e.g. key No. 8 red) (e.g. „from KEY BOARD No. 2 "). This information is sent only once to the central processing unit, as soon as a key was pressed. The center links this information with the driving tension and continues to give it then to the track and to all decoders (also to those, which are attached to BOOSTERn).

Central one at KEY BOARD:
Instruction spent only after execution of the instruction sends back the central processing unit a feedback to the KEY BOARD that the requested was implemented switchingon gift.

KEY BOARD: Lamps on
Thereupon the KEY BOARD switches the light emitting diode on belonging to the key (if a red key was pressed) or out (if a green key was pressed). If a second KEY BOARD or a SWITCH BOARD is adjusted in the same address, both receive the acknowledgement message of the center. Therefore both switch the associated light emitting diode in or out, although only on one of the two a key was pressed. Also the MEMEORY receives this message and updates its announcement of the routes.

Central one to placing desks:
Are employs the central processing unit stores internally the information, which key was pressed. Until the key is released, the central processing unit does not accept other instructions of placing desks. Therefore two different decoder exits can be switched only successively, but not accurately at the same time with the digital-System.

KEY BOARD at center: Key released
Is released now the key to KEYBOARD again, again sends the KEY BOARD a message to the central processing unit. This sends thereupon a switching off instruction for the addressed decoder exit. If a magnet article is steered over an INTERFACE, the computer program itself must send switching on on and the switching off instruction.

How the information in the decoder is processed, experience in next chapter 8.3 of „Decoder k 83 " starting from page 133. Still more detailed information to the data communication finds you in chapter 2.9 „Wie looks lnformationsuebertragung in the detail? " starting from page 29..

8.3. DECODER k 83 (6083)

The DECODER k 83 is necessary for switching the conventional magnet articles on a digital plant. It converts the digital informations of the central processing unit into the pulsed voltages, which need the magnet articles. A decoder k 83 has four exits, which are assigned to four pairs of keys next to one another on a KEY BOARD. With the 16 pairs of keys of a KEYBOARDs thus decoders can „ addressed " to become up to four. Each exit of the decoder has a red, a yellow and a green female connector, to which leads

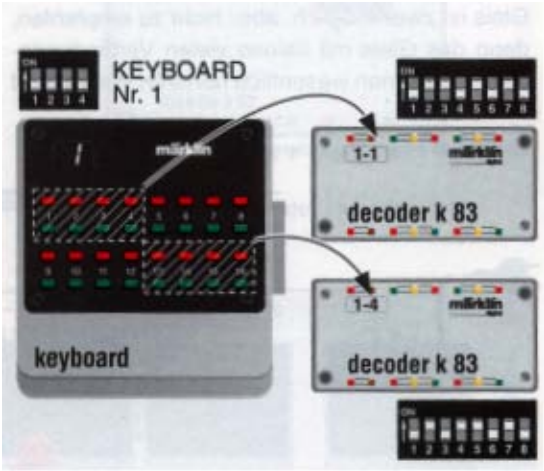
of a zweispuligen magnet article, thus e.g. a switch or a signal are attached. The decoder k 83 supplies a switching impulse only so long, as the appropriate key is pressed at a KEY BOARD. Magnet article decoder k 83. Left the eitght pole Coding-switches is suggested the inside one the decoder.

Adjust the decoder address thereby each decoder clearly the correct four pairs of keys of a certain KEYBOARDs to be assigned can, an address must be stopped also in the decoders. With the distribution each decoder is so adjusted that it is addressed via the first four pairs of keys of the KEY BOARDs No. 1. In the digital-System there are altogether 256 magnet article addresses. The four exits of a decoder occupy four successive addresses, therefore there are 64 different decoder addresses. The decoder address is stopped at a achtpoligen coding-switch the inside one the housing:

- tricks you the two screws at the decoder housing out and remove you the frame cover.
- places it at the coding-switch the desired address according to the following table, by placing the indicated slide switches on ON.
- latches it the housing again.

Tip: Left above you write decoder address
On the decoder a small recess on the decoder housing find. Into this address array you should absolutely note the adjusted decoder address. This avoids some unnecessary error tracing, if magnet articles are attached to a decoder with a „false" address.

Connection between KEY BOARD and decoder addresses
A decoder has four exits, a KEY BOARD however 16 pairs of keys. Each pair of keys is responsible for a decoder exit.



Connection between KEYBOARD keys and decoder addresses for KEYBOARD address 1

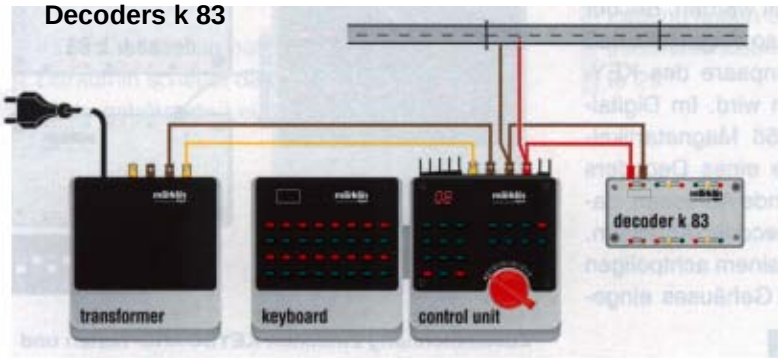
Thus four decoders can be headed for over a KEY BOARD. Each decoder is assigned to four on einanderf olgen that pairs of keys of a KEYBOARDs.

To the lighter overview the decoder address is usually not sequentially numbered consecutively, but referred in the associated KEYBOARD address: Thus e.g. decoder „1-4 " is the fourth decoder for the KEY BOARD with the address 1. Thus one knows also directly without conversion that for this decoder the KEYBOARD keys are responsible 13 to 16. There are max. 16 different KEYBOARD addresses, which can head for in each case four decoders in the digital-System. Thus there are 16 x 4 = 64 decoder addresses.

Connecting the Decoders k 83

Each decoder is attached with a brown and a red cable to the central processing unit or a BOOSTER. Over these two cables the decoder receives both the digital informations and its supply voltage. The red and brown cable supply however not only supply voltage for the decoder itself, but also for all magnet articles or other consumer attached to it. Therefore the decoders should over their own connection (red and brown cable!) directly with the central processing unit or a BOOSTER to be connected. Removing of supply voltage from the track is possible to recommend but not because the track with its many junction points has a substantially higher resistance than a cable. If then or two magnet articles are to be switched, the tension is not sufficient possibly any longer to a safe manipulation. At each decoder there are in each case two red and brown female connectors. To the second pair of sockets a further decoder can be attached.

Anschluß eines Decoders k 83



The connection of the different magnet articles to a decoder exit is shown in detail in following chapter 8.4.

A little Technology – How does a decoder k 83 function?

The decoder receives the digital signals from the central processing unit together with its supply voltage. The digital information is divided into two blocks. The first block contains the decoder address. The sent address is compared in the decoder with the address stopped at the coding-switch. If they are alike, the data are intended for this decoder and the data block is evaluated. The data block contains the number, the switching direction (,,rot " or „gruen ") and the information of the addressed decoder exit: „Ausgang switch on " or „Ausgang switch off ". According to these information one of the eight output transistors of the decoder is so for a long time connected through, until a switching off instruction arrives.

Little technology - exits of the Decoders k 83

The tension at the yellow exit of each decoder k 83 amounts to approx.. Minus 20 V of DC voltage. It is won through Half-wave rectification and smoothing of the digital tension in the decoder. Therefore a „ yellow " decoder exit may be never connected with the yellow connection of a transformer or a central unit.

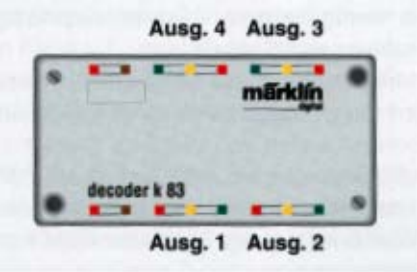
All yellow exits of a decoder are hooked up. If it is simpler for the wiring, one can summarize and to a yellow decoder connecting lead also the yellow cables of the magnet articles attached at a decoder together. Importantly: This applies only to magnet articles, which are attached at the same decoder. DC voltage can be measured by the yellow decoder exit also in principle for other purposes, z. 6th for the connection of light emitting diodes o a however mash sen you to be conscious that the necessary achievement »Versorgungseinheit " Decoders the k 83 (central processing unit or BOOSTER and associated supply versorgungstrafo) is taken and so that of them ringert otherwise available achievement en.

The decoder exits „rot " and „green" become by schalttransistoren for the duration one Switching impulse switched to mass potential. This corresponds to the function of the konventionel len placing desks 7072. For this reason a parallel manipulation of the same magnet article is over conventional and digital placing desks Z moglich in addition, then must the yellow cable of the magnet article to the decoder k 83 attached its.

Tip: Maximum stress of the exits

In former times the rule applied that per decoder exit only one magnet article could be attached. This is connected with the fact that with the in and particularly when switching off magnet articles (coils) briefly quite high tensions develop and also strong rivers can flow, which must bear the schalttransistoren of the decoders. All newer decoders k 83 are however in such a way laid out that they can switch also two magnet articles joined in parallel. This is e.g. important, if one wants to together switch a main and a pilot signal over the same decoder exit. They can recognize easily whether your decoder already belongs to the newer series, if you open the decoder housing. With the newer series the 8 schalttransistoren have a rectangular housing with a hole. With the older series the 8 switch transistors had a semicircular housing.

Connection between KEYBOARD keys and printer exits



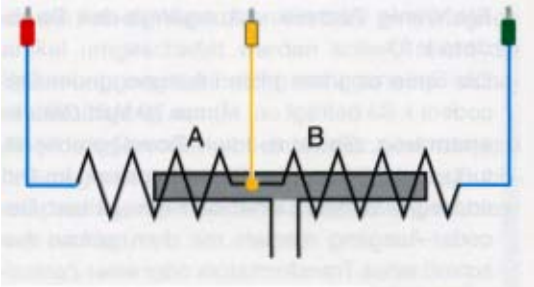
Allocation of the exits of the decoder k 83

Decoder exit	1	2	3	4
KEYBOARD	1	2	3	4
button	5	6	7	8
	9	10	11	12
	13	14	15	16

8,4 Magnet articles correctly attach

In this large chapter the correct connection of all Maerklin switches, signals, turntables, turning cranes and the sliding stage is shown to the digital-System. In the provided guidances of some devices always the connection is not shown to a digital plant. Therefore you find a connection diagram to each equipment. The connection diagrams are drawn as realistically as possible. They are to be understood however generally as examples. From space reasons and because of the better clarity the basic components of the digital-Sy-stems, thus, usually only on the first picture of a new section completely shown central processing unit, are MOLDERMOLDER MOLDER and KEY BOARD. In principle you can attach all conventional magnet articles without change to a digital plant. In addition you, beside a digital placing desk, need at least one magnet article decoder k 83. For some magnet articles also an installation decoder k 73 can be used instead of its, which is described in detail starting from page 157.

Little technology - operational principle of the switches and the signals switches and signals are actually quite conventional components of a digital plant. Nevertheless we want to deal here briefly with their operational principle. This knowledge facilitates the understanding for the connection and for some characteristics of some magnet articles for you. A coil in the inside „Magnetartikel " produces a magnetic field, as soon as river flows by the coil. By the magnetic field „An more ker " one tightens, which implements the desired action over a linkage. The most switches and signals have a so-called „Double reel propelled ".



Those are two coils next to one another, which are wound on a spool. In its inside an anchor is pulled either on the one or on the other side, ever after which coil is flowed through by river. Schaltschema euleD a Doppelspulenantrieds

A coil is attached over the blue cable with red plug, the other one over the blue cable with green plug. At the common connection of the two coils the yellow cable is attached. The current on contact flows therefore from the yellow cable by one of the two coils, as long as one of the blue cables is attached to mass (river can as well known only flow, so long an electric circuit is closed). The anchor in the coils is pulled already by a short current draw into its new position and stops also without current flow in this position. Therefore a short switching impulse is sufficient for switching a magnet article. The coil should not be flowed through in continuous operation of river, otherwise it warms up more and more and can even „durchbrennen after some minutes ".

If a magnet article has three blue leads, it contains also three coils, e.g. with the „dreibegriffigen " signals (signals with three different positions). Due to the ME-O chanischen construction the anchor cannot be moved however here from each position into every other position. Whereupon is to be respected when connecting these magnet articles.

Tip: Which plug color to which cable?

Each cable and plug color has with Maerklin model courses a clearly defined task. The different cable colors have which function, find in the chapter „ Effective one wiring with Maerklin digital " on page 59. A less experienced Maerklin friend however the question head can perhaps breaks to prepare after unpacking equipment: „Wel cher plug belongs now to which cable? " The answer to this question is quite simple with yellow, red and brown cables: they always receive plugs of the same color as the cable. With the blue cables the option is larger: they receive either a green or a red or an orange plug. How can one determine now, which plug color belongs to which blue cable? In addition there are two possibilities:

1. They look after with the diagram of connections of the equipment in this book. This possibility functioned always then, if the arrangement of the cables at equipment is clear, thus e.g. several blue cables from the same Öffnung do not come out.

2. The other possibility: Install the yellow plug to the yellow cable and put you it into the yellow marked female connector of a decoder k 83. The decoder must be connected with the central processing unit by a red and brown cable.
Now you keep in each case one of the blue cables alternating briefly by (attached) a rail or by a brown socket of the decoder (ground connection). If the magnet article functions correctly, it must switch alternating into the one and into the other position. If thereby a small electrical spark is to be seen: No fear, it is completely harmless. According to the determined switching direction you attach now the suitable plugs:

- with magnet articles with two blue cables:
  - **red** = switch curved, signal **red**
  - **green** = switch straight, signal **green**

  The „ Donkey bridge " with the same initial letters is to help you to note the position of the switches more easily.
- magnet articles with three blue cables:

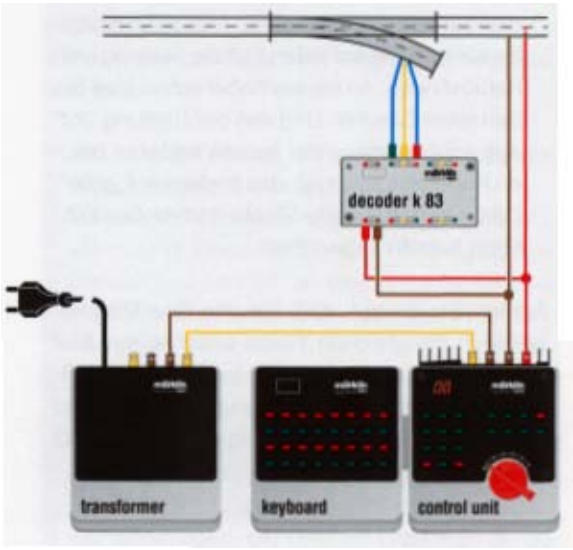
  With such an magnet article the sequence of the manipulation plays a role: With a „ three position " signal e.g. the position can „green " only from the position „red ", not however from the position „orange " to be reached. In this case the following proceeding helps:
  The position „red " can be attained from each position. Hold thus successively the three blue cables by a ground connection. So you can find out the in any case position „red ". To this cable you screw the red plug. And of the position „red " out one of the two other blue cables switches the other one to „orange ", to „green ". Thus you assigned all plug colors to the correct cables.

Make sure that you attach all your magnet articles in the same way. Only then on the one hand the allocation of the colors indicated in the connection diagrams and on the other hand the switching direction at the KEY BOARD with the key color is correct.

Basic connection of the switches (art. NR. 5137.5140.5202.2261.2267 and 2264, 2271 with el. Drive 7549)

In the Maerklin program gives it a whole number of different switches. The connection of all magnet articles with three leads to a decoder k 83 is however in principle alike: - yellow cable with yellow plug into the yellow marked socket, - blue cable with red plug into the red marked socket, - blue cable with green plug into the green marked socket.

Importantly with the digital-System the yellow plug of a magnet article must be put into the yellow socket of a decoder k 83. It may not be connected with the yellow socket of the supply transformer. That could entail the damage of a decoder exit.



Basic connection of the switches at decoder k 83

Usually it does not play a role, to which the four exits of a decoder k 83 equipment is attached. They should clarify however before the connection the order of the exits, so that you can assign the correct keys on the placing desk to the exit.

Tip: Avoid unnecessary error tracing

Test magnet articles in principle already before the connection to the digital-System! It is annoying, if one after some days or weeks on construction work at a model railway facility must already determine after some palpation jerks: somewhat does not go! The answer of the question however, why „es does not go, costs " sometimes many hours or nights of laborious search work. Make yourselves it general the habit to examine each magnet article before the connection to the digital plant with in the tip on page 137 described „Umschalttest ". Thus you recognize immediately whether a magnet article functions from the beginning correctly. If he does not work then after the connection to the digital-System as expected, the error with large security is because of a Kontakttehler of the wiring or a wrong address attitude of decoder or digital placing desk. Quite frequently when quick attaching is also forgotten to adjust the correct address at the placing desk and at the decoders.

Tip: Lighting with m-switches separately attach

With the switches of the metal tracks the switch lighting with the weichenantrieb is hooked up. The switch can be thus only switched, even if the switch lighting burns. If the lighting is attached additional lead against it over an own, has this two advantages:

- the plant becomes more realistically, because you can switch on or off the switch lighting when desired.
- the river for the lighting of the switches does not have to be applied no more by the central processing unit and its MOLDERMOLDER MOLDER. The lighting can be supplied by any transformer with 1 6-V-Ausgang, e.g. an older light or driving transformer.

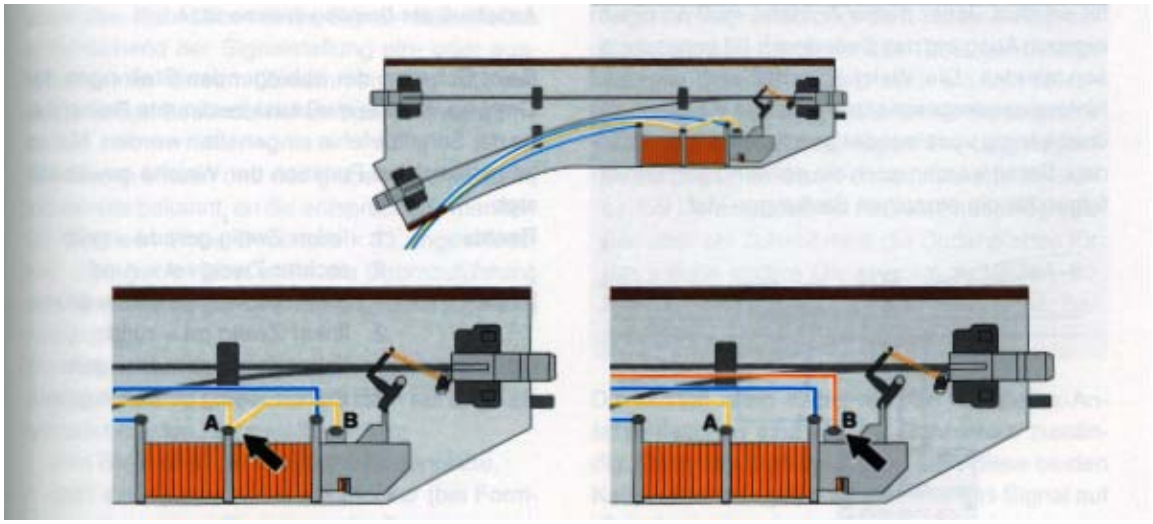
Each amateur handicraftsman, who can deal with a soldering iron, knows this change makes:

- Remove the base plate of the switch. (pull out then latches of the Base plate lever sheet metal at the side with a screwdriver carefully over the small holding pegs.)
- Split the yellow lead to the point „B " (lighting). At the point „A " (anchor) against it it remains attached.
- soldering you an additional lead at point „B " and lead you it outward. Use for it best an additional cable color with a yellow plug.
- The plugs of several converted switch lighting can connect you with a distributor plate 7209.

Switching of the switch lighting on and off:

- with the KEY BOARD over a decoder k 84 (see page 163),
- or over a decoder k 83 with a universal external switch 7245 (see page 148),
- or completely independently of the digital-System with one – perhaps still existing - conventional operating desk 7210 or 7211.

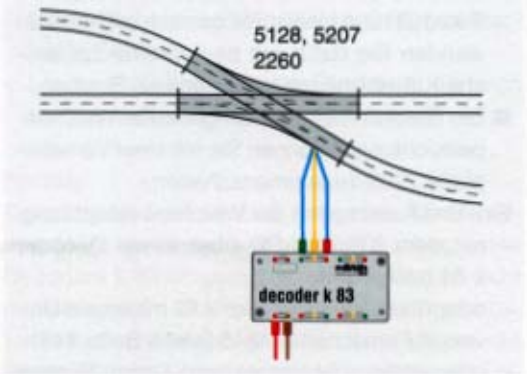
All switch lighting attached to a trafo can be switched over only one exit of the k 84 or 7210/7211.



Switch lighting separately attach

Crossing switch (5128, 5207, 2260)

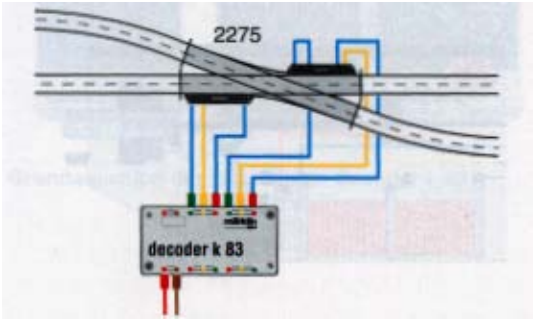
With these crossing switches both yield tongues are switched at the same time, therefore to have the switches of likewise only three leads. Accordingly they are also exactly the same attached like the standard device oaks: green = straight (crossing), red = curve (turning).



Connection of the crossing switches 5128 5207 and 2260

Double switch (2275 with two elect. Drives 7549)

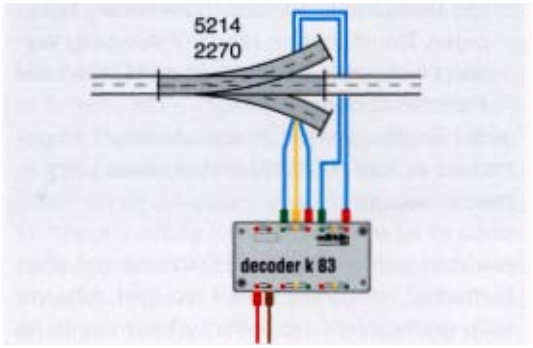
The k-track-crossing switch 2275 can be equipped with two electric drives 7549. Each of these drives must be attached at its own exit of the decoder k 83. The switch behaves like two connected in series simple switches, which can be switched independently. Thus also the necessary switching sequences for the individual positions become clear.



Connection of the crossing switch 2275

Three way switch (5214, 2270)

Also the two three-way switches 5214 (m-track) and 2270 (k-track) contain two drivedrive drives. Therefore they occupy also two exits of a decoder k 83. These switches one can imagine compound from a right and a left switch, whose middle track was folded up. Thus also the function of the two drives becomes more easily understandably. the connection of the switch 5214 is shown in the picture. With it



Connection of the three-way switch 5214

there is only a common yellow cable for both weichenantriebe. With the switch 2270 against it each drive has its own yellow cable from space reasons. When switching the bending positions of the three-way switch a certain sequence of the switching commands must be observed. Only like that a safe function of the switch is ensured.

Right:
1. left Branch straight = green
2. right Branch red = curve

Left:
1. right Branch straight = green
2. left Branch red = curve

Straight:
1. left Branch straight = green
2. **right branch straight** = green

Switches for Märklin 1

The trace 1-Weichen exactly the same to a magnet article decoder are attached like the switches of a HO plant.

If you use the CONTROL UNIT (6021) as central processing unit, use for it the Decoder k83.

Please you consider: The decoder k 86 is not usable with the central processing unit CONTROL UNIT, the k 83 not with the earlier central processing unit cent RAL CONTROL 1. Read to it also the references in main chapter 11 on page 207/208.

Basic connection of the form signals

An important point in front: If a conventional plant is later changed over to digital switching, the entire wiring of the signals and the retaining sections can remain unchanged.

To this section „ Basic connection " for all signals and pilot signals concrete connection diagrams are pointed. In addition we show you also the targeted application and all signalbilder of the different signals.

The form signals are attached in principle in the same kind to the digital decoders like the switches. Practically all hauptsignale can switch on or off also the traction current of a signal stopping distance according to the signalstellung. In this connection therefore some characteristics must be considered.

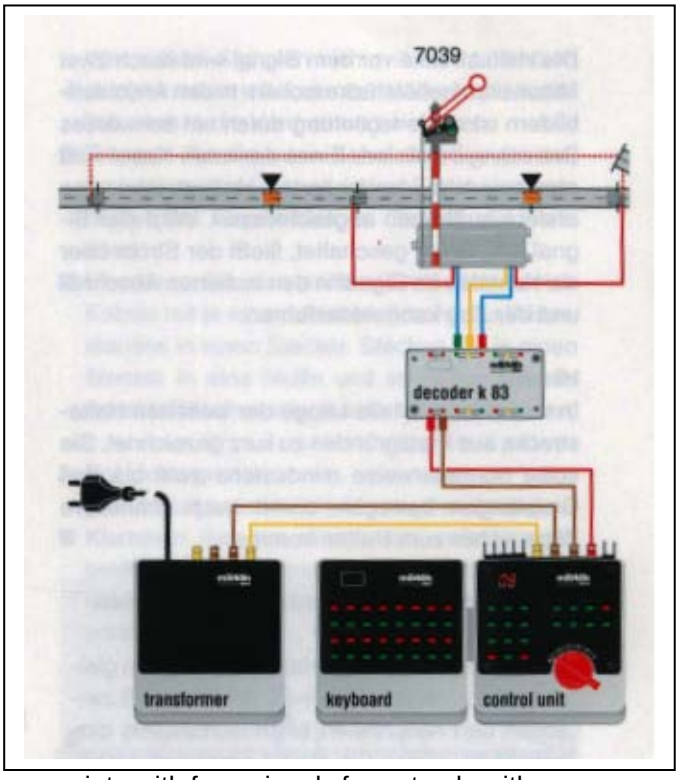
The two blue and the yellow cable, like already admits, attached to the accordingly marked sockets of a decoder k 83. The yellow cable is responsible for the current feed of the magnet drive and the signal lighting.

The lighting needs its own ground connection. The ground connection can be manufactured in three different kinds:

- of the track over the metallic base plate,
- over an own cable with plug (with form signals own socket at the side)
- over a bright connecting lead, which is pressed to a metal part of the signal

Tip: Signal Base plates

The ground connection of the signal lighting is normally made by the metallic signal base plates, which are pushed under the track. In addition, they can put an earth cable stripped far directly under the Bodenpiatte or the signal propelled. The settled base plates are



appropriate with form signals for m-track, with light signals for k-tracks. There are the base plates for that in each case different track system to buy however as accessories. Its Maerklin specialist dealer can procure surely it for you,

The two red cables with the averaging pus connection latches are responsible for the traction current. If the signal stands on „Red ", these two cables are electrically separate. If the signal switches to „Green ", the two cables are connected electrically with one another and switch the traction current into the signal stopping distance through.

The stopping distance before the signal is isolated by two neutral conductor insulators. In the connection diagrams this isolation is symbolized by a black triangle. One of the red cables is outside attached now within the isolated stopping distance, the other one. If the signal is switched to „Green ", the river flows over the contacts
in the signal into the isolated section and the course can drive on.

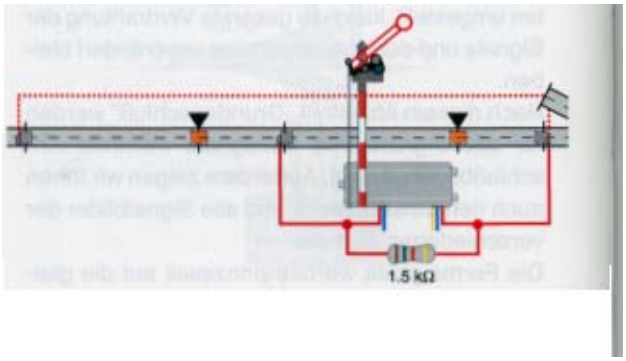
Reference in the pictures is too briefly drawn the length of the isolated stopping distance from space reasons. It should amount to normally at least two to three track lengths, so that also quicker courses come reliably to holding.

Tip: Bridge or spur track between two signals
couches several signal retaining sections in the same electric circuit one behind the other, without between the sections a spur track is inserted, may not forget you those red dashed drawn in „ Bridge ". Otherwise the track section between the signals remains because of the neutral conductor isolations dead. A spur track between the retaining sections serves the same purpose.

Bypasses resisted with signals

And digitally wired signals there is a small difference between conventional nevertheless, or at least there can be him. It is recommended by Maerklin to generally insert between the two red traction current connections of the signals a resistance of 1,5 kohms. Two of these resistances are attached to each decoder k 83.

The value of a resistance is usually indicated by colored rings. A resistance with 1,5 kOhm has the following colour rings: brown – green - red - (silver or gold). The in parentheses colour ring only indicates, like exactly the resistance value to the print corresponds



Bypasses resisted with a form signal (schematic)

.

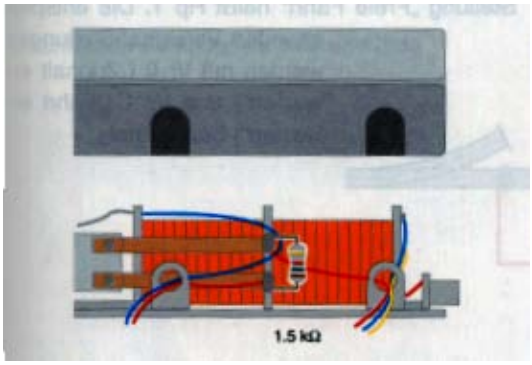
What has it now with this resistance on itself? By the resistance a small river flows into the stopping distance also with signal stop. This river is much too small, in order to hold the engine or the lighting of the locomotive in course. But it is sufficient, so that the decoder in the locomotive also with a signal stop the digital informations at the track „mithoeren " and evaluate can. Thus e.g. the driving direction of a locomotive can be even switched before a red signal. It is also prevented by the resistance that a locomotive decoder loses during a very long signal stop (e.g. in a shade station) its „Gedaechtnis ". However remains for a long time preserved with the modern digital locomotive decoders of these memory also without auxiliary current supply (several minutes until some hours).

With newer plants it is thus necessary resistances in the signal stopping distances only if you attach importance to the fact that locomotives can be switched also in the stopping distances and also with arbitrarily long stop (up to switching the plant off) their adjusted speed does not „vergessen ".

To DELTA plants the same applies: The resistance can be omitted, as long as it is not important to them that a locomotive is also before a closed signal the change-over of the driving direction received. In addition the adjusted speed remains also without resistance some time in the locomotive decoder stored and regularly by the DELTA station is repeated.

Assembly of the resistance the resistance can be installed onto different kinds:
1. With form signals: The most elegant method is here to solder on the resistance the inside one the signal direct with the switching contacts.

- Take the housing of the signalantriebs off.
  Caution: Housings with intuitive feeling and not by force decrease, otherwise quickly the sensitive linkage of the Signal drive is damaged.

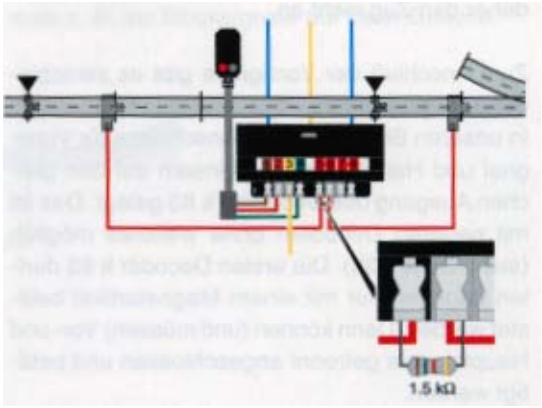


Connection of the form signals 7039 and 7036

- Solder the resistance on with short connecting leads as shown. Who does not want to step with the soldering iron too close to its signals, can the resistance naturally also into the wiring build:
- separation you the red cables of the signal up, and screw you to each end a red sleeve (the counterpart to the Maerklin plugs).
- Install the other end of each red cable with one connecting lead each of the resistance into a plug. Put one plug each into a sleeve and attach you the connection latches as used to the tracks.

2. With light signals: With light signals the assembly is simpler:

- clamps it the resistance between the two red marked connecting terminals, additionally to the cables for the neutral conductor connections. Connection of the upper bridging resistance with light signals



Resistance, soldered into a form signal. Left the traction current switch is to be seen, behind it the coil of the magnet drive

It has by the way no sense, the resistance to the two different, usually free, to attach red marked clamps. These two clamps are meant for switching a signal distance of the overhead line. The two switches in the signal for neutral conductors and overhead line are electrically completely from each other separated.

Reference
In the following connection diagrams the ueberbrueckungswiderstand is usually omitted. They can build it however into each signal having signal-Hattestrecke.

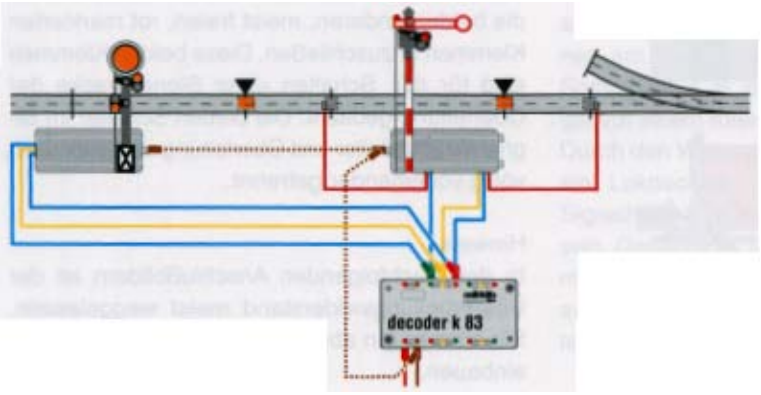
Home signal 7039 with distant signal 7036

Form signals (frequently also wing signals called) are not to be seen so frequent in the material railway company any longer. At the Federal Railroads they were replaced in the last years strengthened by light signals, since this have no mechanical manipulation and so that also less maintenance to need. In the model railway facility the popularity of the form signals is however still unbroken.

In the following connection diagrams in principle the connection of a hauptsignal and the associated pilot signal is shown. They can naturally also omit the pilot signal. The distance between hauptsignal and pilot signal should be selected, if place is present, more largely than on our designs. The Maerklin of pilot signals does not wear no traction current switch and to hold therefore the course.

For the connection of the pilot signals there are different possibilities: In our pictures the connections for pilot signal and hauptsignal are together put on the same exit of the decoder k 83. That is easily possible with newer decoders (see page 135). The first decoders k 83 could be loaded against it only with a magnet article. Then (and to have) pre and hauptsignale can be attached and operated separately.

The manipulation of separated attached 7036 7039 pre and hauptsignalen can be solved very elegantly over a route control with the MEMORY. As alternative also two decoders k 83 can be coded in the same address. To a decoder the haupt-

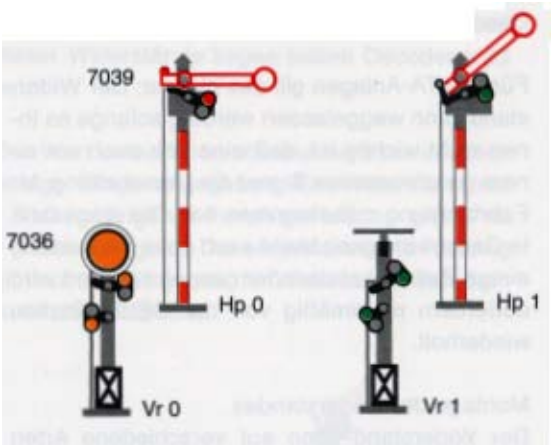


Connection of the form signals 7040 and 7038

signale are then attached, to the same exits of the second decoder the pilot signals.

Signalstellungen of the form signals 7039 and 7036

Targeted application and signalbilder

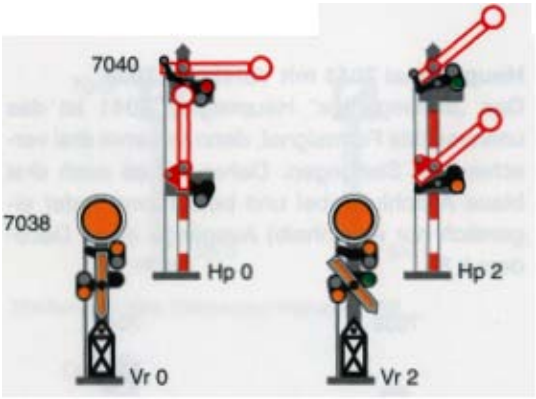


The einfluegelige hauptsignal 7039 and the pilot signal 7036 stand as interlocking signals on the free distance, as exit signals in small stations or as protection signals before leading into switches. They know only two signalstellungen. Since these signals do not know a position for creep speed, they cannot stand before a bending or crossing track process. The „Halt" position designated at the Federal Railroads with Hp 0 (Hp stands for „Halt point"), the position „ Free travel " is called Hp 1. The appropriate pilot signal positions become with Vr 0 („expect a halt signal") and Vr 1 (,,expect a go signal ") designates.

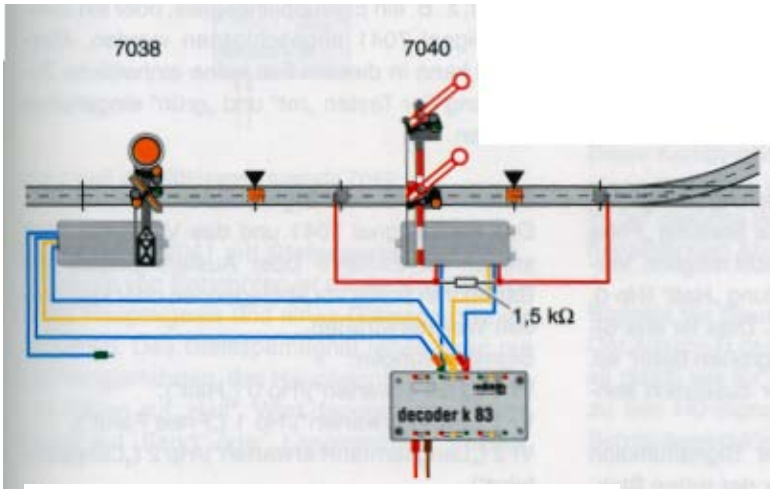
Hauptsignal 7040 mit Vorsignal 7038
The hauptsignal 7040 is directly attached as the signal 7039.

The hauptsignal 7040 has two coupled wings. Therefore it knows only the two positions „Halt " and „Proceed slowly " (marked with Hp 2), not however „Free travel " (Hp 1) like the signal 7041. To this signal there is no special pilot signal, so that the pilot signal 7038 should be used here, which however actually knows three positions. Since the position „Free travel cannot seem " with the hauptsignal to 7040 however, the blue cable with green plug of the pilot signal is left unbeschaltet.

Signalstellungen of the form signals 7040 and 7038



Targeted application and signalbilder the double swing hauptsignal 7040 and the pilot signal 7038 stand at the beginning of slow distances covered, thus e.g. before bending switches or entry tracks in stations. Since they do not possess position „Free travel ", they do not stand ever e.g. as interlocking signals on free distance.



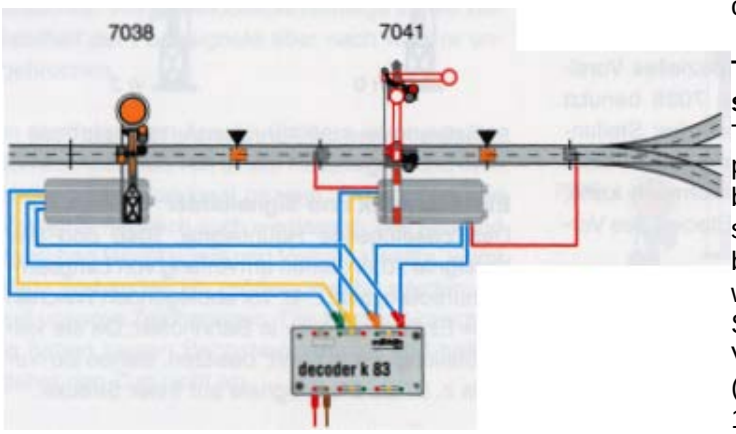
Connection of the Form signals 7040 and 7038

Hauptsignal 7041 with pilot signal 7038

The „dreibegriffige " hauptsignal 7041 is the most universal form signal, because it knows three different positions. Therefore it has also three blue leads and occupies two (or actually only one and a half) exits of a decoder k 83. Direct switching from position „Langsam do not drive " (Hp 2, plugs orange) for position „Freie travel " (Hp 1, plug green) is possible. Before must be switched absolutely to the position „Halt " (Hp 0, plugs red). This is for safety reasons also with the „big course " like that. With the Maerklin model for it additionally constructional reasons are responsible. In principle it would unimportant for the signal function whether or the green plug is put to the orange on the second exit of the decoder k 83.

This consideration becomes important however, if you liked to begin a MEMORY. Within a route on the MEMORY a red and a green cannot „Ta ste " the same exit to be operated. For the position „Slow speed " therefore always the combination of keys should be used „rot " „orange ". Therefore the signal should be attached in such a way, as shown on the picture.

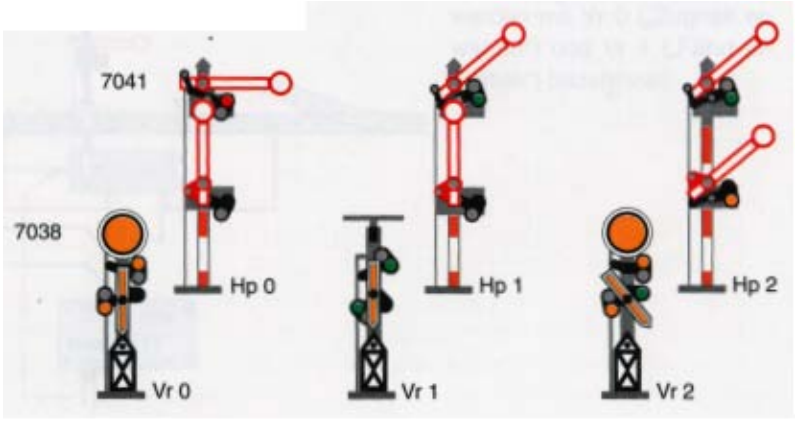
In principle can „halben to the " remained free decoder exit still another einspuliger magnet article, e.g. an uncoupling track, or a second signal 7041 to be attached. However no uniform allocation of the keys can „green„rot " and " to be kept in this case.



Connection of the form signals 7041 and 7038

Targeted application and signalbilder

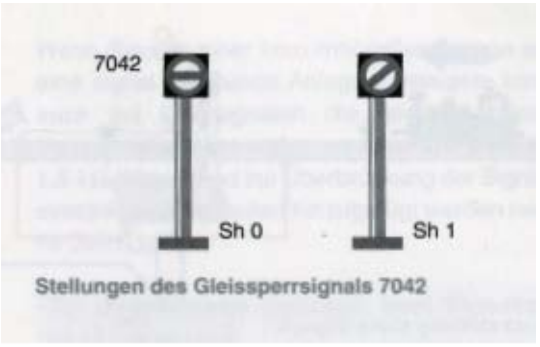
Th hauptsignal 7041 and the pilot signal 7038 stand at bringing in or exit tracks of stations as well as before bending or crossing weichenstrassen.
Signalstellungen:
Vr 0 (,,Halt erwarten")/Hp 0 (,,Halt "); Vr 1 (erwarten")/Hp 1 (,,Freie travel,,Fahrt "); Vr 2 (,,Langsamfahrt erwarten")/Hp 2 (,,Langsam drive ").



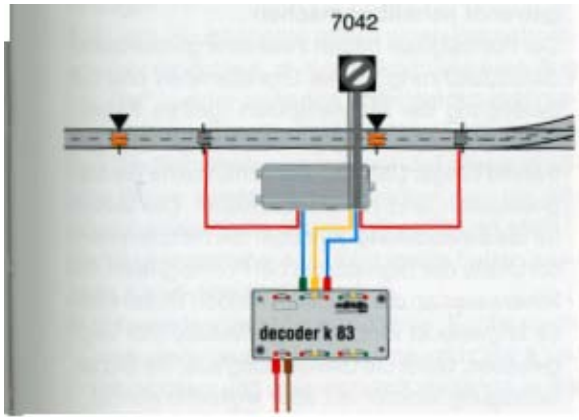
Signalstellungen „drei understood igen " signals 7041 and 7038

Gleissperrsignal 7042

The track inhibit signal 7042 is to be found on station and rangiergleisen. The Maerklin model has likewise a train control system (inserted traction current switch for a signal stopping distance). The track inhibit signal has two blue leads and knows two positions: Sh 0 meant „Halt ", Sh 1 is called „ Driving ban waived ".



Stellungen des Gleissperrsignals 7042

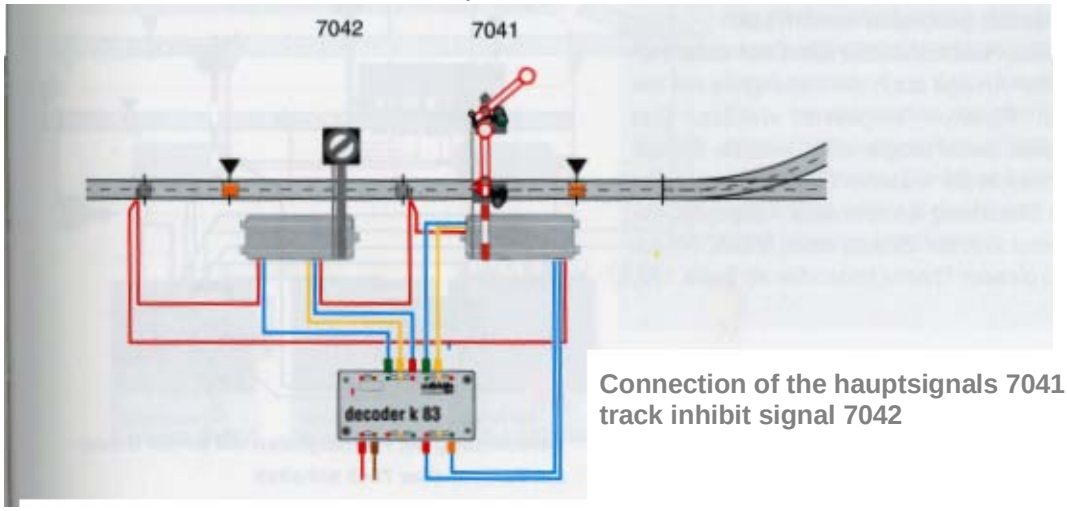


Hauptsignal 7041 with track inhibit signal 7042

Within stations the combination of a hauptsignals and a track inhibit signal is often to be seen. The track inhibit signal regulates then only the ranked ahrten, the hauptsignal remains in these cases on „Halt ". Against it the haupt-signal is placed on „Fahrt " or also the inhibit signal must indicate „Durchfahrt permitted ". Even if this demand is seriously taken in the model course, then it is sufficient to attach only the train control system of the track inhibit signal. If we do not take it however in the model course so strictly, then you can attach also the neutral conductor connections of both signals parallel. The retaining section receives river if the two signals on „Fahrt " one places. Like that also our circuit is drawn. This combination occupies already three exits of a decoder k 83. The signal 7041 is attached thereby in the same way as in the preceding section.

Signals for trace 1

the connection of the trace of logic 1 takes place in principle equal as for the H0-Signale. In contrast to the H0-Signalen the trace logic 1 of screw connections for the cables have.



Connection of the hauptsignals 7041 with the track inhibit signal 7042

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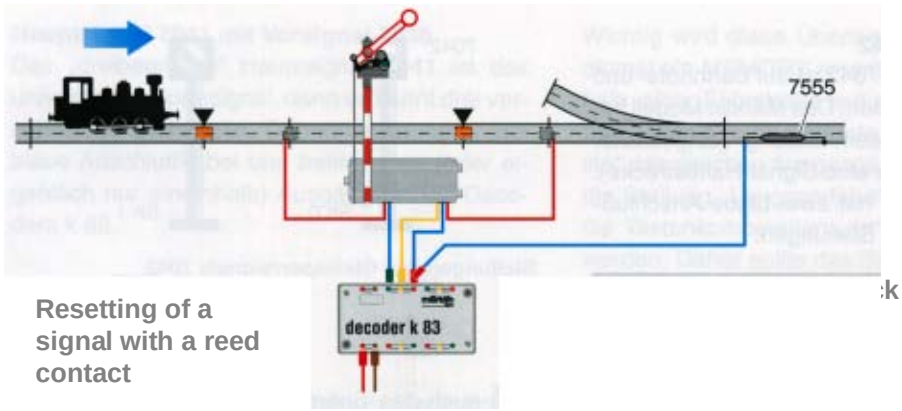


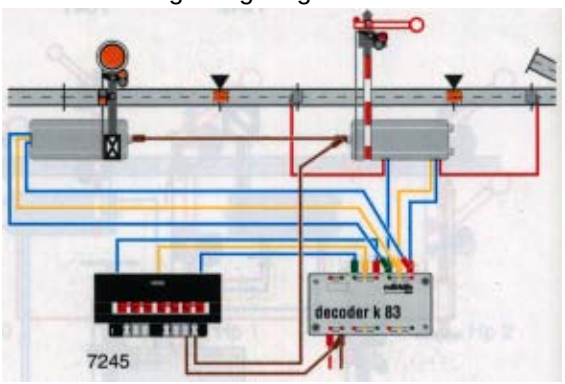
Resetting of a signal with a reed contact

Tip: Simple mechanism circuits in the digital-System

The electrical function of the decoder k 83 is similar as those of the placing desk 7072. Therefore simple mechanism circuits can be used also in the digital-System, as they are often to be found on conventional plants. The digital manipulation and the conventional manipulation are easily joined in parallel thereby. In our example the signal is switched from any digital placing desk to „Green". Under the locomotive a small magnet is installed. If the locomotive behind the switch drives over the reed contact (called in Modellbahner circle also often SRK = „ Inert gas pipe contact "), this contact switches the signal again to „Halt " back. Suitable reed contacts are available under the Maerklin article number 7555. Note that with a reed contact because of contact load no more than one magnet article is not to be switched. Instead of a reed contact also a switching track with the same function can be used on a HO neutral conductor plant. The switching track even offers a further switching possibility in the other driving direction. For the controlling of more complex automatic sequences the employment of a MEMORY offers itself. More to this topic find you starting from page 177.

Tip: Signal lighting with form signals separately adjustable make

The form signals have a common current feed for the signal lamps and the manipulation of the solenoid coils (yellow cable). The stromrueckleitung however is made by separate ways: The ground connections for the solenoid coils are the blue cables. The mass for the lighting goes over the metallic base plate of the signals, which is usually stuck on with form signals to the mass-prominent metal tracks. If the Metailplatte is omitted, the lighting is missing, the signal manipulation functioned however further normally. Thus you can make the lighting adjustable without interference into the signal: The ground connection is manufactured over a cable at the individual socket laterally at the signal. The bonding can be switched then with a decoder k 84 or with a universal external switch 7245 at a decoder k 83 (or with a conventional operating desk 7211). With day enterprise you can switch now when desired the signal lighting off.



Lighting with form signals with a universal external switch 7245 switch

Basic connection of the light signals

As previously mentioned is used, at the Federal Railroads of always frequent light signals. The Maerklin of light signals frequently used with k-GIei-sen. Therefore also the insulators in our connection diagrams (art. NR are. 7522) and neutral conductor connecting pieces for k-tracks (art. - No. 7504) drawn in. For the light signals there are however likewise base plates for the assembly to m-tracks.

All light Hauptsignale inserted a traction current switch, i.e., they can stop a course with „Red" in an isolated stopping distance automatically and „Green with " drive on to let. The signal lighting can be attached in differentiate iche way (see the pictures on this side, side 150 152 and 154). The magnet drives of the light signals have special cable connection clamps.

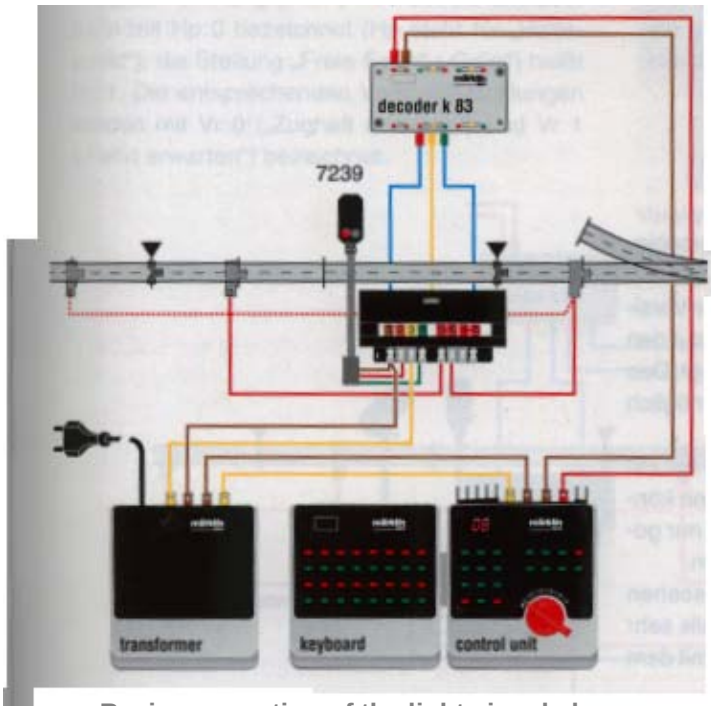
- Cable end carefully strip, kupferadern with one another twist, clamp easily down press and stripped cable end into the developing Öffnung put.

If you transfer from a conventional plant to a digitally steered plant, the entire track wiring can be taken over also with light signals. Only the 1 ,5-kO-Widerstand for the bypass of the signal distance can be added if necessary (see page 143).

Tip: Wire link between two signals do not forget

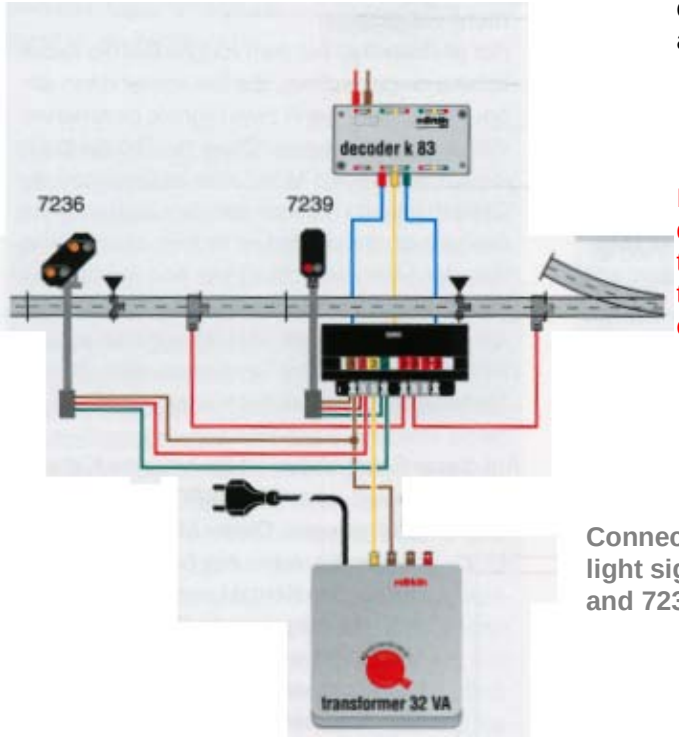
Red broken the wire link is drawn in in the previous picture, which you must insert whenever two signals are inserted one behind the other. Without the bridge the track section between the signals remains dead because of the two neutral conductor isolations (see also page 62). The bridge is drawn in for no more for reasons of clarity with the following connection sketches. As alternative possibility also an additional spur track can be inserted between the two signal distances.

On this wiring diagram a brown cable pulled as ground connection of the MOLDERMOLDER MOLDER to the signal. This ground connection is necessary, if the signal does not have a sufficient contact to the track, if e.g. the provided Bodenplatte is not used. The ground connection can be removed also from a brown connection of the decoder. Then however the lighting stream for the signal is fed by the central processing unit. It is still better to use for it its own trafo at which also other lighting can be attached. The mass (brown) of this trafos is connected with the mass of the digital-Systems.



Basic connection of the light signals by the example of a hauptsignals

Hauptsignal 7239 with pilot signal 7236
Also with the connection diagrams of the light signals in principle the connection of a haupt-signal and the associated pilot signal is shown. They can omit the pilot signal in addition. The distance between hauptsignal and pilot signal should be selected, if place is present, more largely than on our designs.



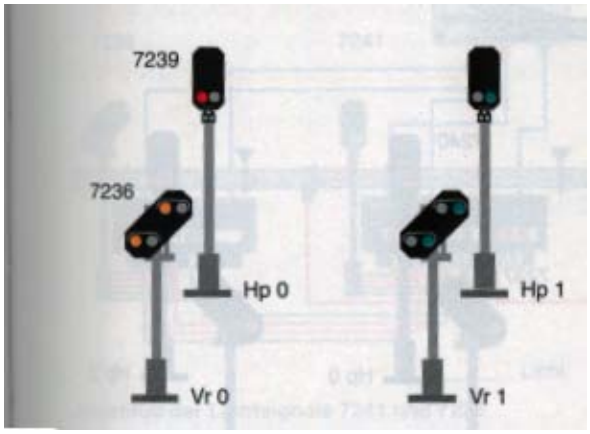
Connection of the light signals 7239 and 7236

For the connection of the pilot signals there are different possibilities: In our pictures are the connections for pilot signal (7238) and hauptsignal together put on the same exit of the decoder k 83. That is easily possible with newer decoders (see page 135).
The first decoders k 83 could be loaded against it only with a magnet article. Then (and to have) pre and hauptsignale can be attached and operated only separately. The manipulation of separated attached pre and hauptsignalen can be solved however likewise very elegantly over a route control with the MEMORY.

Tip: Separate light connection for light signals
With the light signals the current inlet for the manipulation of the magnet drive and for the lighting is separate. Therefore the light connection can be supplied via an additional transformer and loaded so not the central processing unit and their trafo. Do not forget: also the brown ground connection of the signal to the auxiliary zusatztrafo to attach (you know: River flows only with a closed electric circuit...). Become the yellow lines of the signals to the red connection „B " of a driving transformer (e.g. art. NR. attached 6631 or 6647, even the brightness of the lighting can be stopped with the driving automatic controller

Importantly! Do not operate the direction of travel change-over of the trafos with this connection way; the lamps could be destroyed otherwise by the higher tension.

Targeted application and signalbilder
The hauptsignal 7239 and the pilot signal

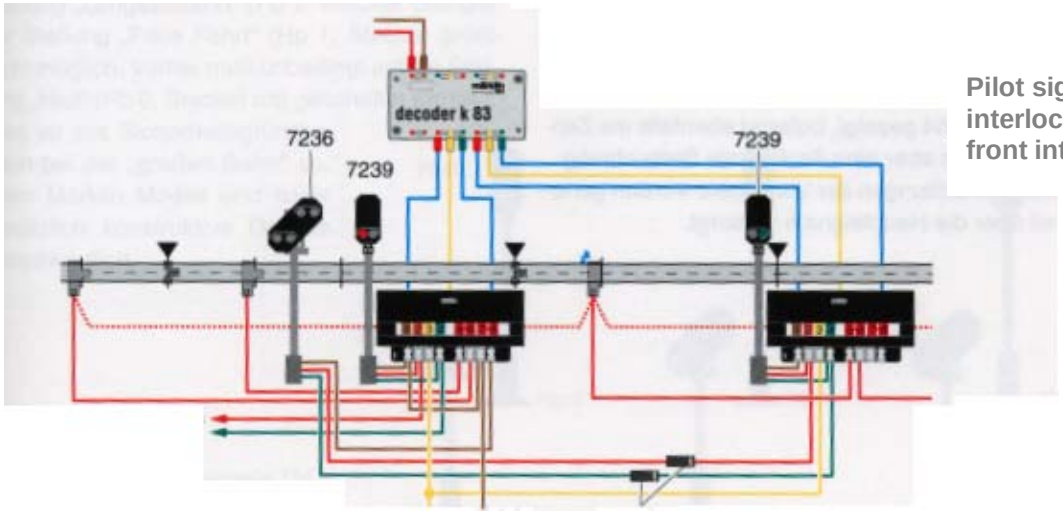


7236 stand as interlocking signals on the free distance, as exit signals in small stations or as protection signals before leading into switches. They know only two positions. Since this signals do not know a position for creep speed, they cannot stand before a bending or crossing track process.
Signalbilder der LichtsIgnale 7239 und 7236

The „Halt" position (,,Rot ") designated at the Federal Railroads with Hp 0 (Hp stands for „Halte point "), the position „Freie travel " (,,Gruen ") is called Hp 1. The appropriate pilot signal positions become with Vr 0 („Zughalt to expect ") and Vr 1 (,,Fahrt to expect ") designates.

Tip: Lighting of the pilot signal disconnectible

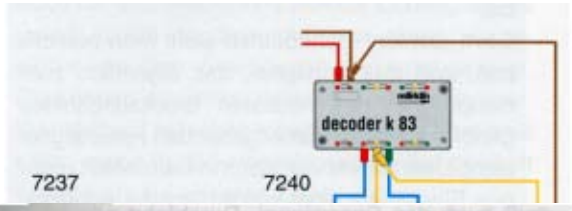
Sometimes with the „echten " railway company one sees that the pilot signal, which actually belongs to the hauptsignal of the next block section stands directly at the preceding hauptsignal. This occurs, if in stations several signals are located one behind the other on a short distance. If during such an arrangement the second hauptsignal and concomitantly its pilot signal „Gruen " show, which show first hauptsignal however „Rot ", could work for an engine driver under circumstances confusing. Therefore in this case the lighting of the pilot signal is switched off. This circuit can be copied without large expenditure also in the model course: The ground wire of the actually following pilot signal is switched over the overhead line traction current switch of the front signal. Only if the front hauptsignal „Gruen " shows, the lighting of the pilot signal shines. The two diodes must be switched in the installation direction shown (cathode to the hauptsignal) into the red and green inlet, so that the signal lighting in the switched off condition does not glow.

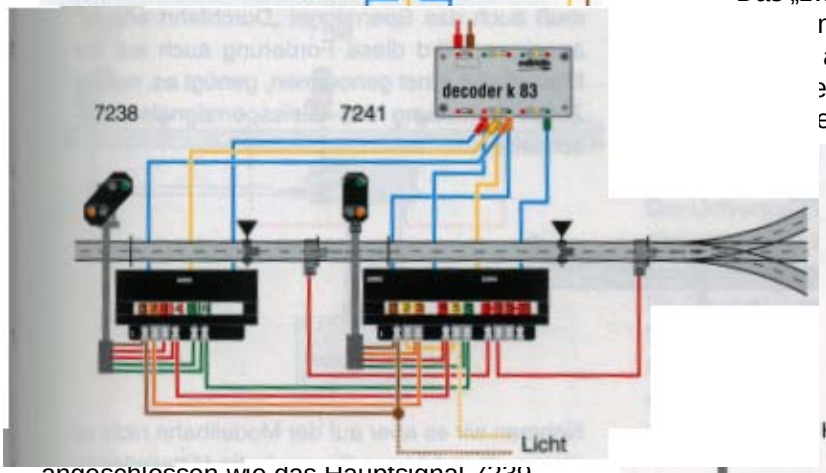


Pilot signal lighting of the second interlocking signal is switched by front interlocking signal

Vorsignal

Light connection diodes, e.g..1 N 4001





angeschlossen wie das Hauptsignal 7239.

Anschluß der Lichtsignale 7241 und 7238

Das Hauptsignal 7240 kennt nur die beiden Stellungen „Halt“ (Rot, Hp 0) und „Langsamfahrt“ (Grün/Gelb, Hp 2), nicht jedoch „Freie Fahrt“ (Hp 1) wie das Hauptsignal 7241.
Bei diesem Anschlußbild wird eine andere Möglichkeit für den Lichtanschluß gezeigt als in den Zeichnungen auf Seite 149 und 150: das gelbe und das braune Kabel werden am DECODER k 83 angeschlossen. Dieser Anschluß ist zwar mit weniger Verdrahtungsaufwand verknüpft, aber der Beleuchtungs
belastet die Zentraleinheit (oder
BOOSTER). Ein Anschluß wie au
154 gezeigt, belastet ebenfalls di

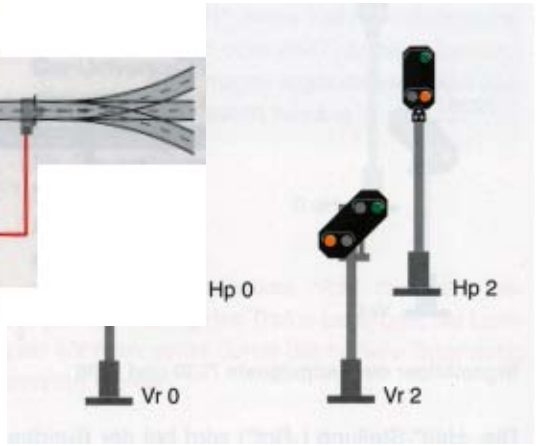
Hauptsignal 7241 mit Vorsignal 7238

Das „dreibegriffige“ Hauptsignal 7241 ist das universellste Lichtsignal, denn es kennt drei verschiedene Stellungen. Daher hat es auch drei blaue Anschlußkabel und belegt zwei (oder eigentlich nur eineinhalb) Ausgänge eines Decodersk83.
Das Vorsignal 7238 hat, im Gegensatz zu den anderen Licht-Vorsignalen, einen eigenen Signal-antrieb. Der Lichtanschluß kann wahlweise an einen separaten Trafo

liefert aber eine flackert reie Beleuchtung. Die Beleuchtungen der Vorsignale werden generell über die Hauptsignale versorgt.

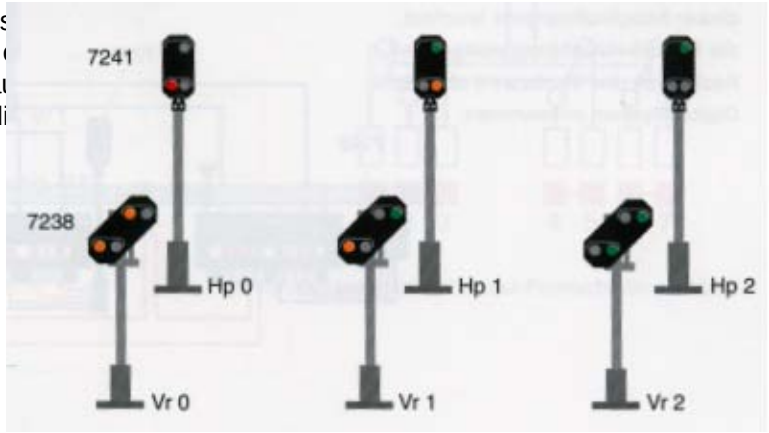
Einsatzzweck und Signalbilder

Das „zweibegriffige“ Hauptsignal
nd das Vorsignal 7237
am Anfang von Langsam-
ecken, also z. B. vor
enden Weichen oder



Signalbilder der Lichtsignale 7240 und 7237

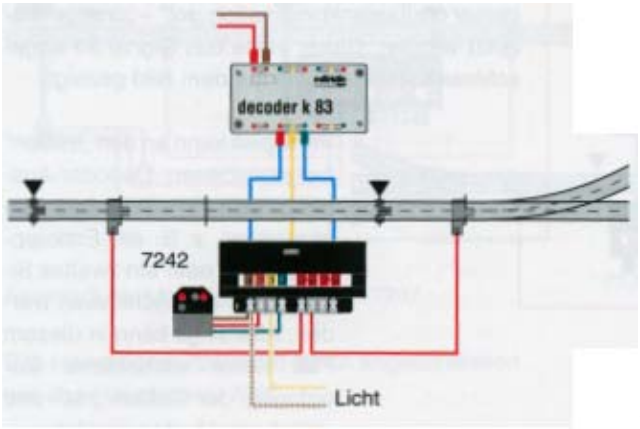
Einfahrtsgleisen in Bahnhöfen.
Da sie keine Stellung „Freie Fahrt“ besitzen, stehen sie niemals z. B. als Blocksignale auf freier Strecke.



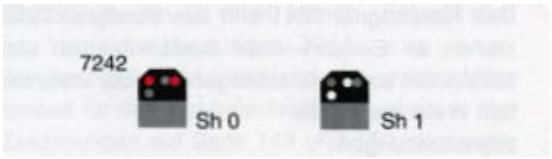
oder an den Decoder angeschlossen werden, wie auf den vorhergehenden Bildern gezeigt. Beim Signal 7241 ist das direkte Umschalten von Stellung „Langsamfahrt“ (Hp 2, Stecker orange) zur Stellung „Freie Fahrt“ (Hp 1, Stecker grün) nicht möglich. Vorher

1 5 3

muß unbedingt auf die Stellung „Halt“ (Hp 0, Stecker rot) geschaltet werden.
Dies ist aus Sicherheitsgründen auch bei der „großen Bahn“ so. Beim Märklin Modell sind dafür zusätzlich konstruktive Gründe verantwortlich.



Anschluß des Gleissperrsignals 7242



Stellungen des Gleissperrsignals 7242

Signalblider der Lichtsignale 7241 und 7238

Grundsätzlich wäre es für die Signalfunktion gleichgültig, ob der orange oder der grüne Stekker auf den zweiten Ausgang des Decoders k 83 gelegt wird. Wichtig wird diese Überlegung aber, wenn Sie einmal ein MEMORY einsetzen möchten. Innerhalb *einer* Fahrstraße auf dem MEMORY können nicht eine rote und eine grüne „Taste“ des gleichen Ausgangs betätigt werden. Für die Stellung „Langsamfahrt“ sollte deshalb immer die Tastenkombination „rot“ „orange“ benutzt werden. Daher sollte das Signal so angeschlossen werden, wie auf dem Bild gezeigt.

Prinzipiell kann an den „halben“ freigebliebenen Decoder-Ausgang noch ein einspuliger Magnetartikel, z. B. ein Entkupplungsgleis, oder ein zweites Signal 7241 angeschlossen werden. Allerdings kann in diesem Fall keine einheitliche Zuordnung der Tasten „rot“ und „grün“ eingehalten werden.

Einsatzzweck und Signalbilder

Das Hauptsignal 7241 und das Vorsignal 7238 stehen an Einfahrt- oder Ausfahrtgleisen von Bahnhöfen sowie vor abbiegenden oder kreuzenden Weichenstraßen.

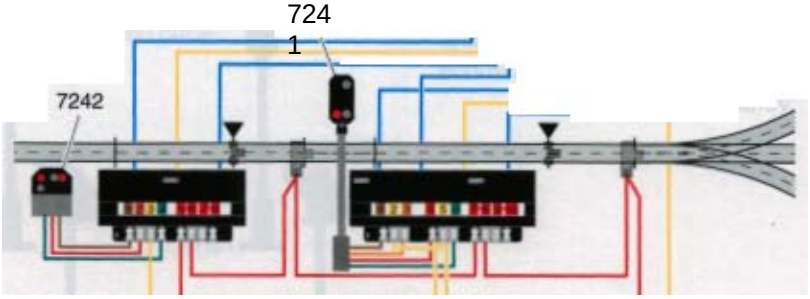
Signalstellungen:

Vr 0 („Halt erwarten“)/Hp 0 („Halt“);

Vr 1 („Fahrt erwarten“)/Hp 1 („Freie Fahrt“);

Vr 2 („Langsamfahrt erwarten“)/Hp 2 („Langsamfahrt“).

8.4. Magnetartikel richtig anschließen



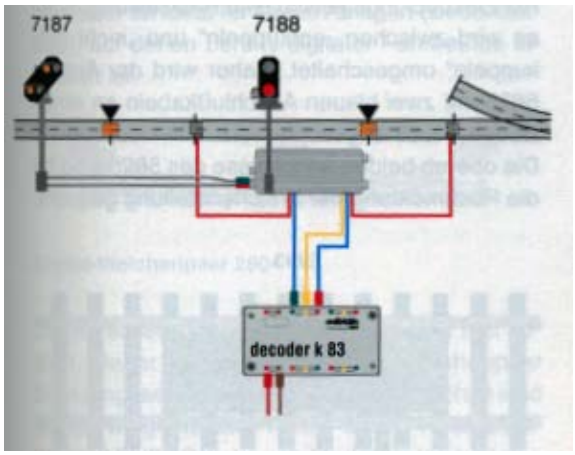
Gleissperrsignal 7242

Das Gleissperrsignal 7242 ist auf Bahnhofs- und Rangiergleisen zu finden. Das Märklin Modell hat ebenfalls eine Zugbeeinflussung (eingebauter Bahnstromschalter für eine Signal-Haltestrecke). Das Gleissperrsignal hat zwei blaue Anschlußkabel und kennt zwei Signalbilder: Sh 0 (Rot/Rot) bedeutet „Halt“, Sh 1 (Weiß! Weiß) heißt „Fahrverbot aufgehoben“.

Hauptsignal 7241 mit Gleissperrsignal **7242**

Innerhalb von Bahnhöfen ist oft die Kombination eines Hauptsignals und eines Gleissperrsignals zu sehen. Das Gleissperrsignal regelt dann nur die Rangierfahrten, das Hauptsignal bleibt in diesen Fällen auf „Halt“. Wird dagegen das Haupt-signal auf „Fahrt“ oder „Langsamfahrt“ gestellt, muß auch das Sperrsignal „Durchfahrt erlaubt“ anzeigen. Wird diese Forderung auch auf der Modellbahn ernst genommen, genügt es, nur die Zugbeeinflussung des Gleissperrsignals anzuschließen.

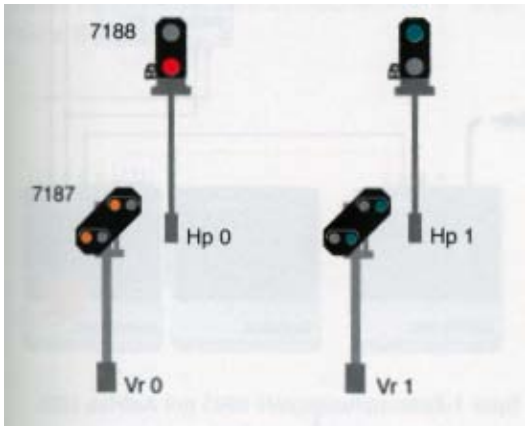
nicht so streng, dann können Sie auch die Mittelleiteranschlüsse beider Signale parallel anschließen. Der Halteabschnitt erhält dann Strom, wenn eines der beiden Signale auf „Fahrt“ gestellt wird. So ist auch unsere Schaltung gezeichnet.



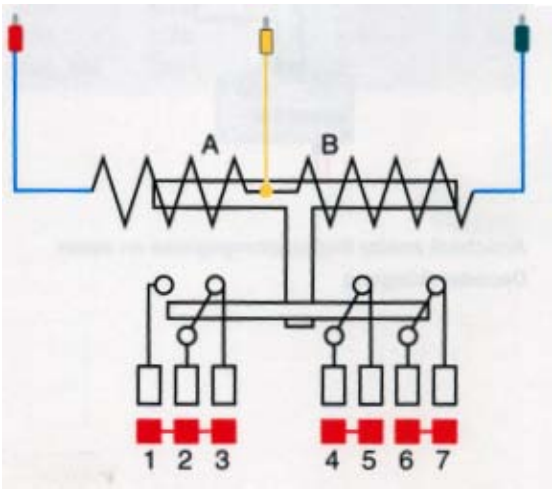
Anschluß der Lichtsignale 7188 und 7187

Diese Kombination belegt drei Ausgänge eines Decoders k 83. Das Signal 7241 ist dabei in der gleichen Weise angeschlossen wie im vorhergehenden Abschnitt.

Nehmen wir es aber auf der Modellbahn



Signalbilder der Lichtsignale 7188 und 7187



Schaktkizze eines Unlversal-Fernschalters 7245

Anschluß des Hauptsignals 7241

mit dem Gleissperrsignal 7242. Bei dieser Anschlußvariante leuchtet die Signalbeleuchtung weitgehend flackerfrei, der **Strom wird aber dem Digital-System entnommen.**

Hauptsignal 7188 mit Vorsignal 7187

Die einfachen Lichtsignale 7188 und 7187 sind für Metallgleise gedacht. Ihr Anschluß ist einfach. Das Vorsignal 7187 wird direkt an die farbig markierten Buchsen des Hauptsignals 7188 angeschlossen. Der Mast des Vorsignals muß an Masse angeschlossen werden.

Das Signalbild des F-lauptsignals weicht etwas von dem der übrigen Lichtsignale ab.

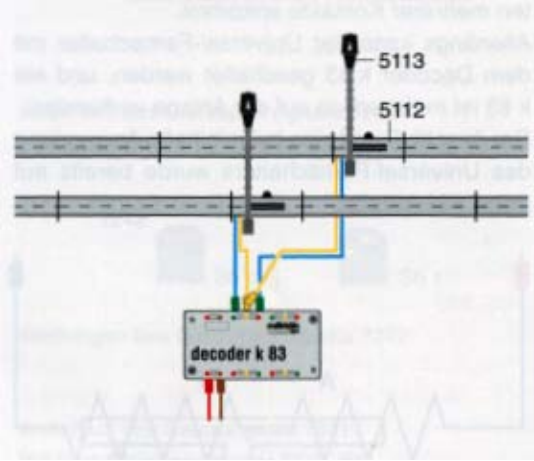
Universal-Fernschalter 7245

Der Universal-Fernschalter **7245** sieht aus wie der Antrieb eines Lichtsignals, und so ähnlich funktioniert er auch. Er wird genauso an einen Decoder k 83 angeschlossen wie die Standard-Licht-

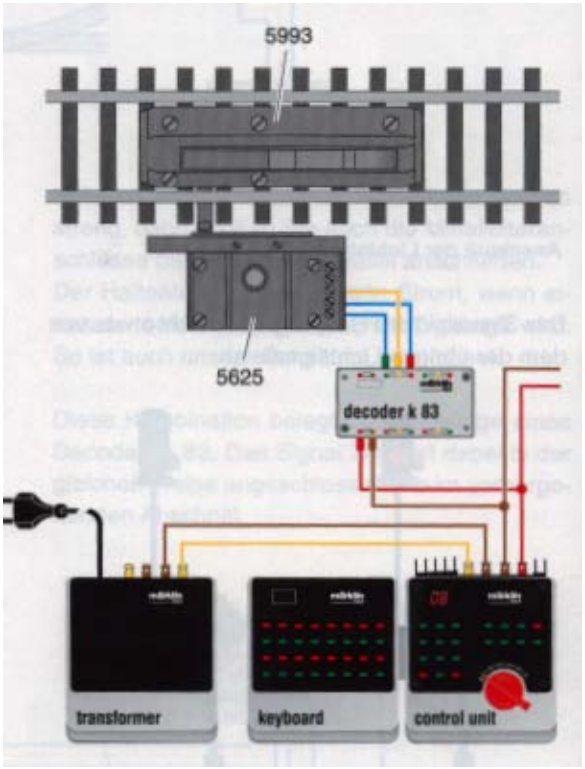
signale. Er enthält drei voneinander unabhängige Schaltkontakte für Dauerströme, die alle gleichzeitig betätigt werden. Einer der drei Kontakte (Nr. 1, 2, 3) ist ein Umschaltkontakt, die anderen beiden sind Ein-Aus-Kontakte. In Kürze wird der neue Universalfernschalter (7244) lieferbar sein, der dann 4 Umschaltkontakte enthält.

Der Universal-Fernschalter wird bei Digital-Anlagen nicht mehr so häufig gebraucht wie bei konventionellen Anlagen, weil es im Digital-System für Dauerstrom den Decoder k 84 gibt. Viele Schaltaufgaben eines Universal-Fernschalters können genauso gut mit dem k 84 bewältigt werden, wenn es nicht auf das gleichzeitige Umschalten mehrerer Kontakte ankommt.
Allerdings kann der Universal-Fernschalter mit dem Decoder k 83 geschaltet werden, und ein k 83 ist meist schon auf der Anlage vorhanden. Der Anschluß und eine beispielhafte Anwendung des Universal-Fernschalters wurde bereits auf Seite 148 gezeigt.

Entkupplungsgleis 5112, 2297
Ein Entkupplungsgleis dient dazu, die



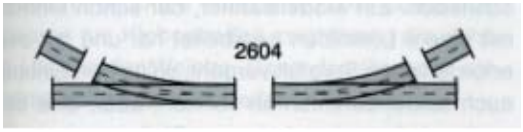
Anschluß zweier Entkupplungsglelse an einen **Decoder-Ausgang**
Kupplungen eines darüberfahrenden Zuges zu trennen. Es wird häufig in Rangierbahnhöfen und in Abstellgleise eingebaut.
Die HO-Entkupplungsgleise rasten nicht in der Entkupplungsstellung ein; sie werden nur aktiviert, solange die entsprechende Stellpult-Taste gedrückt ist.
Der Signalmast 5113 kann zusätzlich an das Entkupplungsgleis angesteckt werden. Seine Lampe leuchtet auf, solange das Entkupplungsgleis betätigt wird.
Ein Entkupplungsgleis enthält nur eine Magnetspule, daher benötigt es auch nur ein blaues Anschlußkabel. Somit können an einen Ausgang des Decoders k 83 zwei Entkupplungsgleise angeschlossen werden. Ein Entkupplungsgleis wird dann allerdings mit einer grünen, das andere mit der roten Taste bedient.



Spur 1-Entkupplungsgleis 5993 mit Antrieb 5625

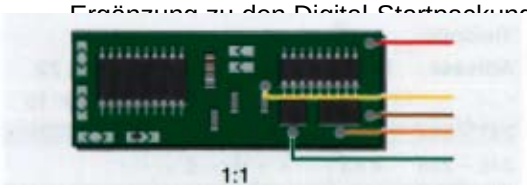
Spur 1-Entkupplungsgleis 5993 mit Antrieb 5625

Das Entkupplungsgleis für die Spur 1-Gleise kann (auch nachträglich) mit einem elektrischen Antrieb 5625 ausgerüstet werden. Es ist derselbe Antrieb wie für die Spur 1-Weichen.
Das Entkupplungsgleis hat im Gegensatz zu den HO-Entkupplungsgleisen eine Raststellung, d. h., es wird zwischen „entkuppeln“ und „nicht entkuppeln“ umgeschaltet. Daher wird der Antrieb 5625 mit *zwei* blauen Anschlußkabeln an einen Decoder k 83 angeschlossen.
Die oberen beiden Anschlüsse des 5625 sind für die Rückmeldung der Weichenstellung gedacht.



8.5. Digital-Weichenpaar 2604

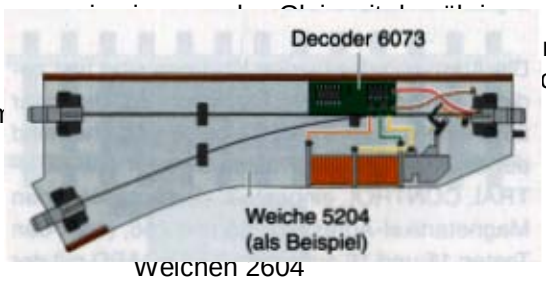
Das Digital-Weichenpaar 2604 entspricht einem Weichenpaar 5137 mit eingebauten Digital-Decoder. Es wurde entwickelt als Ergänzung zu den Digital-Startpackungen



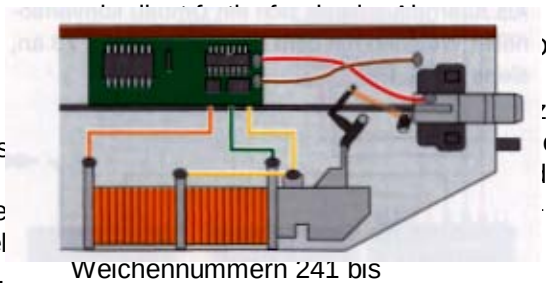
Digital-Weichenpaar **2604**

Die Adressen der beiden Weichen sind fest codiert. Daher kann nur 1 solches Weichenpaar 2604 eingesetzt werden. Die beiden Weichen sind auf die Magnetartikel Tasten 3 und 4 des CENTRAL CONTROL eingestellt; das entspricht den Magnetartikel-Adressen 255 und 256, (oder den Tasten 15 und 16 auf einem KEYBOARD mit der Adresse 16).
Als Alternative bietet sich ein Umbau konventioneller Weichen mit dem Einbaudecoder k 73 an, siehe Seite 158.

Anschluß der DIgital-Weichen 2604
Da der Digital-Decoder in diesen Weichen bereits eingebaut ist, werden sie nur noch



Weichen 2604
Die Adressen für die Decoder müssen nicht



Weichennummern 241 bis 254.

Einbaudecoder k 73 anschließen

Beispiel:

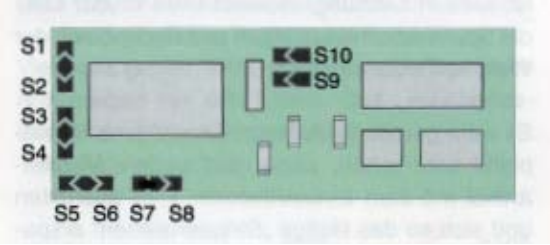
Adresse	Decoder	Einstellung k 83/k 8 12345678	41k 73 9 10
241—244	k83		
245—248	k83	...5 ...	
249—252	k84	1 .3 ..6 ..	
253	k73	-23-- 6--	910
254	k73	-23-- 6--	910
255, 256	2604	fest codiert	

8.6 Einbaudecoder k 73 (6073)

Der Einbaudecoder k 73 ist ein Decoder zum direkten Einbau in Weichen der M-Gleise. Er besitzt einen Ausgang für einen zweispuligen Magnetartikel. Seine besondere Stärke: Sowohl seine Spannungsversorgung als auch die Digital-Informationen erhält der k 73 direkt über den Gleisanschluß. Bei einer mit dem Einbaudecoder ausgestatteten Weiche entfällt also jegliche weitere Verkabelung. Die Weiche wird einfach mit den übrigen Gleisen zusammengesteckt und kann sofort

über ein KEYBOARD geschaltet werden. Das bedeutet eine enorme Vereinfachung gerade beim „fliegenden Aufbau“ oder häufigen Umbau einer Modellbahnanlage. Der einzige Wermutstropfen: Aus Platzgründen kann der Decoder nicht in alle Magnetartikel und speziell nicht in die Weichen der K-Gleise eingebaut werden.
Wichtig!
Der Einbaudecoder k 73 kann und darf nicht bei konventionellem Fahrbetrieb verwendet werden. Der Bahnstrom der Weiche (oder des Signals) muß „Digital-Strom“ sein.

Einbau des Decoders k 73
Der Decoder **k** 73 sollte normalerweise durch einen Fachhändler eingebaut werden. Nur dann besteht ein Garantieanspruch für Decoder und Einbau. Der Händler hat zum Einbau des Decoders



auch einen antistatischen Arbeitsplatz zur Verfügung, denn die integrierten Schaltkreise auf den Decodern können durch elektrostatische Entladungen zerstört werden.
Nachfolgend wird dennoch der Einbau genau beschrieben. Ein Modellbahner, der schon einmal mit einem Lötkolben gearbeitet hat und mit der erforderlichen Sorgfalt vorgeht, sollte den Einbau auch selbst durchführen können, aber, dies sei nochmals betont, auf eigenes Risiko.
Vorbereitungen
Vor dem Einbau sollte der Magnetartikel genau auf mechanische und elektrische Funktionsfähigkeit überprüft werden.
Der Einbau wird hier am Beispiel einer Standardweiche 5204 gezeigt. Für andere Weichen funktioniert er sehr ähnlich.

Nehmen Sie die Bodenpiatte der Weiche ab (Blech an der Seite vorsichtig über die kleinen Haltezapfen hebeln und unten herausziehen). Nach Abnehmen des Isolierstreifens sehen Sie den Weichenantrieb vor sich. Merken Sie sich möglichst, welches Kabel (welche Steckerfarbe!) wo angelötet ist. Dann werden die beiden blauen und das gelbe Anschlußkabel vom Weichenantrieb abgelötet.
Setzen Sie zunächst den beiliegenden Doppel-klebestreifen in die Weiche ein. Die kleine Aussparung am Klebestreifen zeigt Ihnen die richtige Lage in der Weiche. Dann den Decoder vorsichtig auf den Klebestreifen aufsetzen.

Kabel anschließen
Kürzen Sie die Anschlußkabel des Decoders auf die erforderliche Länge (etwas Spielraum lassen). Löten Sie die Anschlußkabel an, wie auf dem Bild gezeigt: das rote Kabel (Stromversorgung) an die Mittelleiter-Anschlußlasche der Weiche, das braune Kabel (Masse) direkt an das Blech des Gleiskörpers.
Das grüne Kabel kommt an die Seite des Doppelspulen-Antriebs, wo vorher das blaue Kabel mit dem grünen Stecker angelötet war. Wenn Sie nun doch nicht mehr genau wissen, wo das war: Sie können es durch Umstellen der Weiche von Hand leicht feststellen: Stellen Sie die Weiche auf „geradeaus“. Der Anker (das „Innenteil“ der Spule) liegt dann näher bei der Seite, wo der grüne Draht angeschlossen werden muß.
Das orange Kabel (entspricht dem bisherigen blauen Kabel mit rotem Stecker)

kommt an die gegenüberliegende Spulenseite, und das gelbe Kabel geht zur Spuienmitte oder an den damit verbundenen Anschlußpunkt.

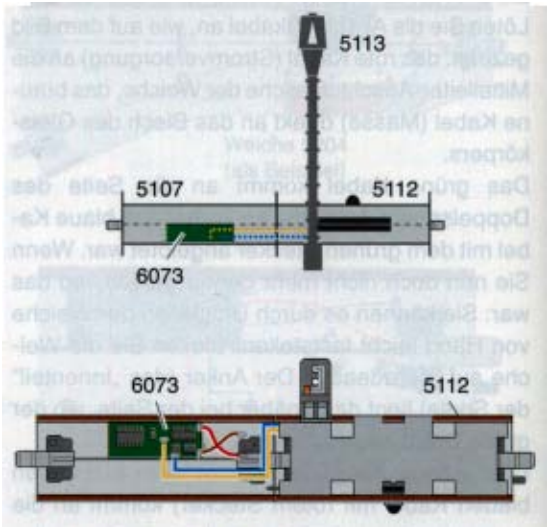
Adresse einstellen
Zuletzt müssen Sie die richtige Adresse des Decoders einstellen. Dies ist wahrscheinlich die kniffligste Arbeit des ganzen Einbaus.
Da wegen der geringen Höhe kein normaler Codierschalter eingebaut werden konnte, sind auf der Platine insgesamt 10 Lötflächen vorhanden.
Je nach gewünschter Adresse müssen Sie die richtigen Flächen mit einem kleinen Lötklecks miteinander verbinden (aber wirklich nur die richtigen!). Für die Lötflächen S1 bis S8 gelten die gleichen Einstellungen wie für die Decoder k 83/ k 84. Schalter auf ON entspricht hier „Lötfläche überbrückt“ (Tabelle siehe Seite 220/221).
Adreßeinstellung beim k 73 mit 10 Lötbrückenfeldern

Mit den Lötflächen 9 und 10 muß der Einbaudecoder auf eine bestimmte KEYBOARD-Taste eingestellt werden, da er, im Gegensatz zu einem Decoder k 83, nur einen einzigen Magnet-artikel schaltet.

Taste	Stellpult	Lötflächen	überbrückt
1,	5, 9, 13	9	10
2,	6, 10,14	–	10
3,	7, 11,15		9
4,	8, 12, 16		

Adreßcodierung beim Einbaudecoder k 73

Test
Kontrollieren Sie am Schluß nochmals alle Lötstellen: sind sie sauber und glänzend? Sind auch keine unbeabsichtigten Verbindungen entstanden? Wenn soweit alles gut aussieht, trennen Sie den Transformator vom Netz und schließen Sie testweise die Weiche an ein Anschlußgleis an. Verbinden Sie ein KEYBOARD (oder ein anderes Digital-Stellpult) mit der Zentraleinheit. Stellen Sie am Stellpult die richtige Adresse ein (siehe Seite 130).



Entkupplungsgleis mit Einbaudecoder k 73

Verbinden Sie nun den Transformator mit dem Netz. Die Beleuchtung der Weiche sollte auf leuchten. Wenn die Adreßeinstellung korrekt war und alle Kabel richtig angeschlossen sind, müßte die Weiche beim Druck auf die richtige grüne Taste auf „geradeaus“, beim Druck auf die rote Taste auf „rund“ = abbiegend schalten. Ist alles in Ordnung, Isolierstreifen wieder über die Spulenanschlüsse legen und Bodenblech der Weiche wieder aufsetzen.

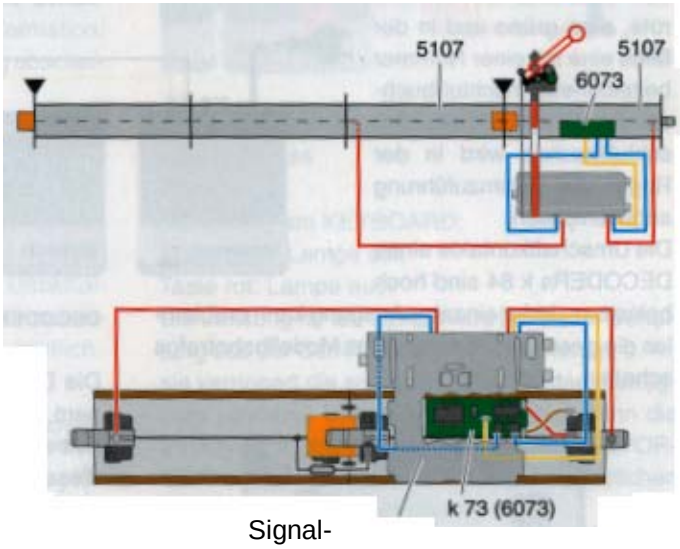
Es wäre gerade für Anlagen ohne eigene Grundplatte sehr schön, wenn man weitere Magnet-artikel mit dem Einbaudecoder k 73 ausrüsten und sich so das lästige „Strippenziehen“ ersparen könnte. Da unter einem Entkupplungsgleis oder einem Signal kaum Platz für den Decoder vorhanden ist, bietet sich die Möglichkeit an, den Decoder unter ein zusätzliches Gleisstück zu montieren. Dazu die beiden folgenden Tips:

Tip: Entkupplungsgleis mit Einbaudecoder k 73
Ein Entkupplungsgleis 5112 wird fest mit einem geraden Gleisstück 5107 verbunden: am sichersten durch zwei

Lötbrücken auf beiden Seiten des Gleisbettes der beiden Gleisstücke. Statt des Gleises 5107 kann natürlich jedes Gleis mit ausreichend Platz für den Decoder verwendet werden.

- Nehmen Sie die Bodenplatte des 5112 ab:
  Laschen des Gleisbetts auf der Seite des Anschlußkabels mit einem Schraubendreher anheben, Bodenplatte schräg nach oben herausziehen.
- Ziehen Sie die Anschlußkabel des 5112 nach innen durch und führen Sie sie ins zweite Gleis.
- Setzen Sie die Bodenplatte des 5112 wieder an (sie rastet wieder in ihre alte Stellung ein).
- Setzen Sie den Decoder k 73 ein, wie vorher beschrieben.

Für ein Entkupplungsgleis wird nur ein Anschluß des Decoders (grünes oder orangefarbenes Kabel) benötigt. Gelbes, rotes und braunes Kabel werden angeschlossen, wie auf dem Bild gezeFgt.



Signal-Grundplatte

8. Digital Schalten

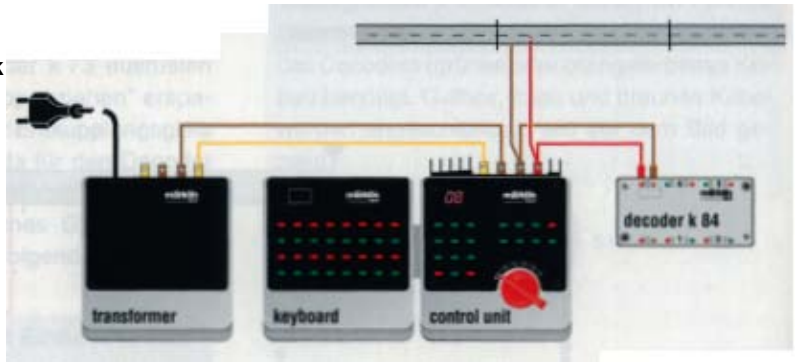
Tip: Signal mit Einbaudecoder k 73

Auch in Formsignale kann der Einbaudecoder k 73 nicht direkt eingebaut werden. Aber warum nicht aus der (Platz-)Not eine Tugend machen und mit zwei „halben“ Gleisen 5107 eine kompakte Signaleinheit aufbauen?

Die Bahnstromanschlüsse werden direkt an die Mittelleiter angelötet (Laschen der Kabel vorher abtrennen). Auch der Widerstand und eine Mittelleiter-Isolierung können direkt miteingebaut werden. Die zweite Mitteilleiter-Isolierung sollte in etwas größerem Abstand eingesetzt werden, damit die Länge der Haltestrecke vor dem Signal ausreicht. Auch diese Einheit kann ohne irgendeine zusätzliche Verkabelung in eine Anlage eingebaut werden. Das ist ein enormer Vorteil gegenüber dem herkömmlichen, doch recht aufwendigen Einbau eines Signals.
Die Verdrahtung sollte aus dem Bild und der Einbau-Beschreibung zum Decoder k 73 klar sein.

Vielleicht geben Ihnen diese beiden Tips auch Anregungen für den Einbau des „Weichendecoders“ in weitere Magnetartikel.

Signal-Glelseinheit mit **Einbaudecoder k 73,** anschlußfertlg vormontiert



DECODER K **anschliessen**

8.7. DECODER k 84(6084)

Der DECODER k 84 wird benötigt zum Ein- und Ausschalten von Beleuchtungen, Motoren und anderen Dauerstrom-Verbrauchern auf einer Digital-Anlage. Der Decoder k 84 enthält vier

unabhängige Umschalter, die jeweils aus einem Relais mit einem Umschaltkontakt bestehen. Von der Funktion her entspricht ein DECODER k 84 einem herkömmlichen Schaltpult 7211.
Die vier Umschaltkontakte des DECODERs sind vier nebeneinanderliegenden Tastenpaaren auf einem KEYBOARD zugeordnet. Jeder Ausgang des DECODERs hat eine rote, eine grüne und in der Mitte eine mit einer Nummer bezeichnete Anschlußbuchse. An diese mittlere Anschlußbuchse wird in der Regel die Stromzuführung angeschlossen.
Die Umschaltkontakte eines DECODERs k 84 sind hoch belastbar: Jeder einzelne Ausgang kann problemlos die gesamte Leistung eines Modellbahntrafos schalten.
Dauerstrom-Decoder k 84. Links ist **der** achtpolige Codierschalter im Innern des Decoders angedeutet.

Einstellen **der Decoder-Adresse**

Die Decoder-Adresse muß an dem achtpoligen Codierschalter im Innern des k 84 eingestellt werden. Dies ist beim DECODER k 83 auf Seite 133 beschrieben. Die Tabelle mit allen Adressen finden Sie im Kapitel 12.6 auf Seite 220.
Nicht vergessen: Eingestellte Decoder-Adresse im Adreßfeld an der Gehäuse-Oberseite notieren!

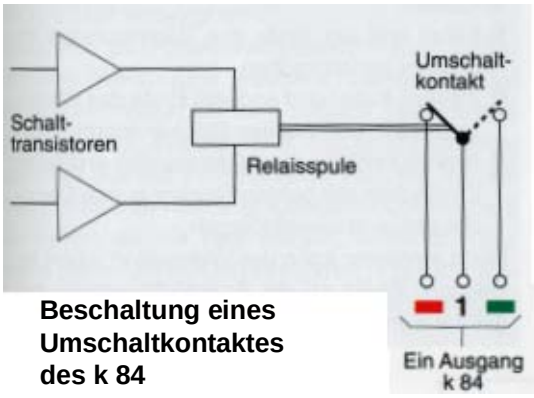
Anschluß des DECODERs k 84

Die DECODER werden mit einem roten und einem braunen Anschlußkabel an die Zentraleinheit oder einen BOOSTER angeschlossen. Über diesen Anschluß erhält der DECODER die Digital-Informationen und die Stromversorgung für seine Elektronik. An das zweite Buchsenpaar rot und braun können weitere DECODER angeschlossen werden. Die Stromversorgung für die angeschlossenen Verbraucher kann ebenfalls von hier oder völlig getrennt zugeführt werden. Der Anschluß unterschiedlicher Verbraucher wird auf den folgenden Seiten gezeigt.

U. Digital Schalten

Ein wenig Technik – Wie funktioniert ein DECODER k 84?

Der Decoder empfängt die Digital-Signale von der Zentraleinheit gemeinsam mit seiner Versorgungsspannung. Die Digital-Information ist in zwei Blöcke aufgeteilt: einen Adreßblock und einen Datenblock. Der Adreßblock enthält die Decoder-Adresse. Die gesendete Adresse wird im Decoder mit der am Codierschalter eingestellten



Beschaltung eines Umschaltkontaktes des k 84

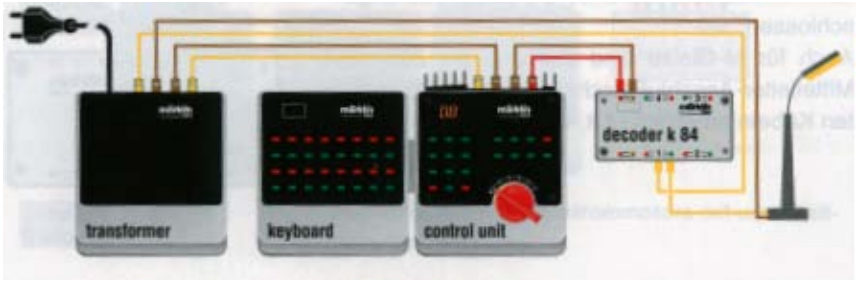
Standardanschluß einer Beleuchtung an den DECODER k 84

eines der vier Relais des Decoders geschaltet. Der Umschaltkontakt bleibt in jeder der beiden Stellungen stehen, auch wenn die Schaltspannung wieder weggenommen wird („bistabiles Relais“). Daher ist jederAusgang eines k 84 ein Umschalter für Dauerstrom. Die Funktion der Umschaltkontakte wird aus folgender Skizze deutlich:

8.8. Anschlußschaltungen mit dem DECODER k 84

Straßen- und Häuserbeleuchtungen

Der Standardanschluß einer Beleuchtung an einen k 84 ist im nachfolgenden Bild gezeigt. Die Stromzuführung geht jeweils an den



Stromversorgung aus Digital-TRANSFORMER

Adresse verglichen. Nur wenn beide gleich sind, sind die Daten für diesen Decoder bestimmt und der Datenblock wird ausgewertet. Der Datenblock enthält die Nummer des angesprochenen Decoder-Ausgangs, die Schalt-richtung („rot“ oder „grün“) und die Information: „Ausgang einschalten“ oder „Ausgang abschalten“.

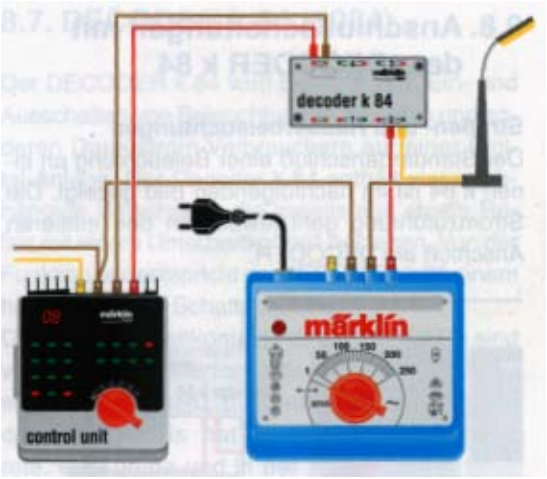
Entsprechend diesen Informationen wird

mittleren Anschluß am DECODER.

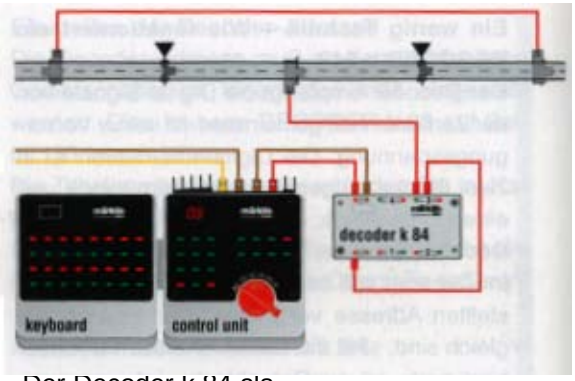
Bedienung am KEYBOARD:

Taste grün: Lampe ein, Taste rot: Lampe aus.

Die Leistung für die Lampe wird bei dieser Schaltung aus der CONTROL UNIT entnommen, d. h., sie verringert die sonst



im Digital-System verfügbare Leistung. Um dies zu vermeiden, kann die Stromversorgung direkt dem Digital-TRANSFORMER oder noch besser aus einem zusätzlichen Transformator entnommen werden.



Der Decoder k 84 als Signalersatz

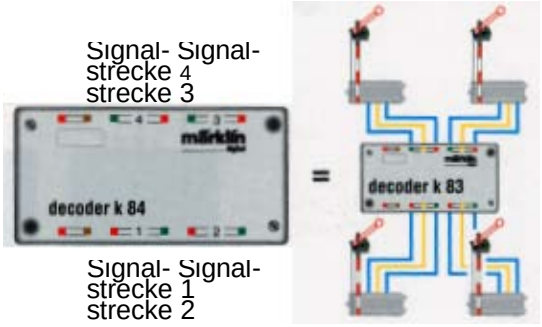
Für eine klare und übersichtliche Verdrahtung sollte unbedingt auch der Masseanschluß an den gleichen Transformator geführt werden, auch wenn sich dabei etwas längere Kabellängen ergeben.

Stromversorgung aus getrenntem Transformator, Anschluß an Klemme B

Wird als Stromversorgung der rote „B"-Anschluß benutzt, kann die Helligkeit der Lampe mit dem Fahrregler eingestellt werden. Allerdings darf dann die Fahrtrichtungsumschaltung nicht betätigt werden, die Lampen könnten durch die Überspannung schnell durchbrennen. Vergessen Sie auch nicht, die Masse der verschiedenen Transformatoren miteinander zu verbinden.

Hinweis
Trafo-Anschlüsse mit gleicher Farbe sind innerhalb der Geräte miteinander verbunden, z. B. beim 6631 oder 6647 beide Masseklemmen, oder beim 6002 beide Masse- und beide Lichtstrom-klemmen.

Fahrstrom schalten
Der Decoder k 84 kann auch als Ersatz für ein Signal eingesetzt werden. Als „Verbraucher" ist dann einfach ein isolierter Gleisabschnitt angeschlossen.
Auch für M-Gleise sind übrigens als Zubehör Mittelleiter-Anschlußlaschen mit angeläteten roten Kabeln erhältlich (Art.-Nr. 5004).
Tip: Brücke und Widerstand nicht vergessen Vergessen Sie bei dieser Anwendung nicht die Überbrückungskabel zwischen aufeinanderfolgenden isolierten Gleisabschnitten (siehe Seite 62/142) und den 1 ,5-kO-Widerstand zur sicheren Versorgung der Lokdecoder im isolierten Gleisabschnitt. Die Verdrahtung entspricht genau der normalen Verdrahtung einer Signal-strecke.
Den Widerstand können Sie einfach

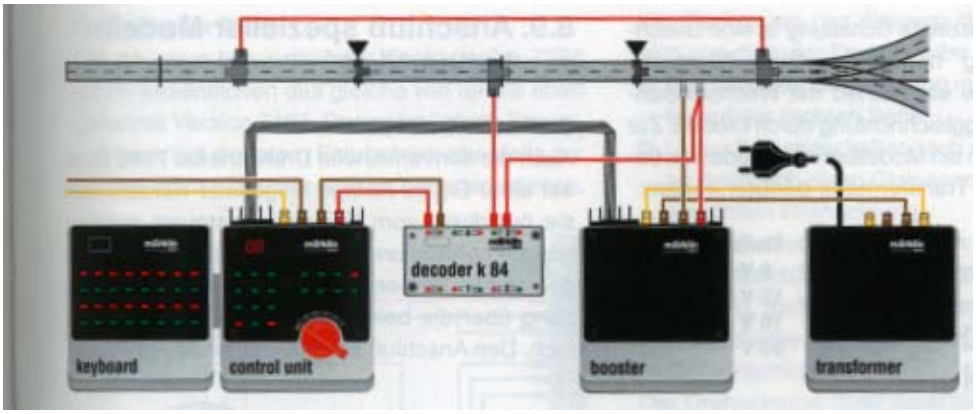


Ein DECODER k 84 kann einen k 83 und vier Signale ersetzen zusammen mit den Anschlußkabeln in die Stecker am k 84 einbauen:

Kabel und ein Ende des Widerstandes im Stecker festschrauben.

Zweites Kabel und anderes Ende des Widerstandes in den zweiten Stecker schrauben.

Anschlußdrähte des Widerstandes erst



beim Einstecken der beiden Stecker in

Trennung verschiedener Versorgungsbereiche

den Decoder passend zurechtbiegen.

Noch eleganter kann der Widerstand innen im Decoder direkt an die Anschlußbuchsen an-gelötet werden.

Hinweis:Stromkreise auseinanderh alten

Achten Sie darauf, daß Sie verschiedene Bahn-stromkreise konsequent auseinanderhalten. Liegt der abschaltbare Gleisabschnitt z. B. im Versorgungsbereich eines BOOSTERs, sollte unbedingt auch seine Stromversorgung aus dem BOOSTER erfolgen, selbst wenn der Decoder k 84 von der Zentraleinheit oder einem anderen BOOSTER versorgt wird.

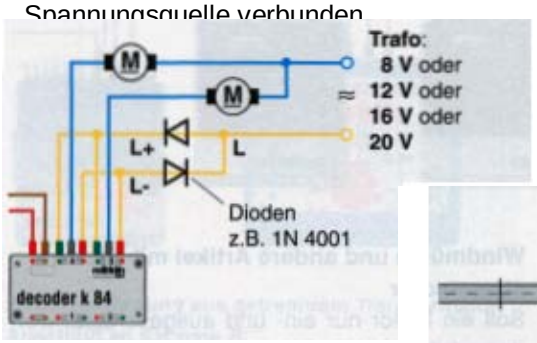
Zwar sind die Digital-Informationen in allen Stromkreisen gleich. Eine „saubere“ Verdrahtung ist aber im Hinblick auf eine spätere Fehlersuche sehr wichtig. Würden z. B. mehrere Signalabschnitte aus der Zentraleinheit versorgt, könnte beim Anfahren mehrerer Loks eine Überlastung auftreten, die nur sehr schwer

ıluß eines Gleichstrommotors mit umschaltbarer Drehrichtung nachvollziehbar wäre (denn die BOOSTER waren ja gerade eingebaut worden, um eine solche Überlastung zu vermeiden).

Windmühle und andere Artikel mit Gleich-strommotor

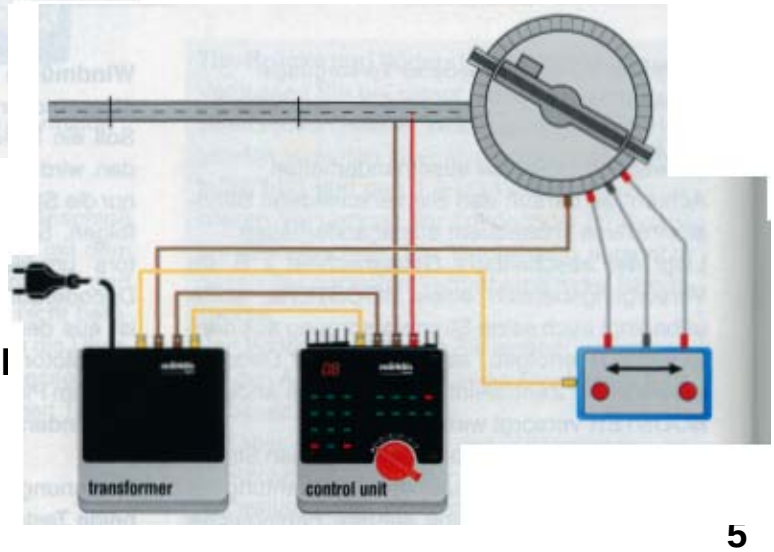
Soll ein Motor nur ein- und ausgeschaltet werden, wird er angeschlossen wie eine Beleuchtung, nur die Stromversorgung muß mit Gleichstrom erfolgen. Soll dagegen die Drehrichtung des Motors umgeschaltet

werden, sind dafür zwei Decoderausgänge erforderlich. Die Beschaltung ist aus dem folgenden Bild ersichtlich. Die beiden Motoranschlüsse werden so wechselweise mit dem Plus- und Minuspol der Spannungsquelle verbunden.



Bedienung am KEYBOARD:
beide Tasten grün = Rechtslauf beide Tasten rot = Linkslauf
Tasten rot/grün oder grün/rot: Motor steht

8.8. Anschl 84



5

Für die gerade gezeigte Schaltung ist eine Gleich-Stromversorgung notwendig. Eine Alternativ-möglichkeit wäre ein Betrieb mit Wechselspannung und Einweggleichrichtung durch Dioden. Zur Versorgung kann ein Modellbahntrafo oder ein beliebiger anderer Transformator benutzt werden:
Anschluß von Gleichstrommotoren direkt an die Wechseispannung eines Transformators

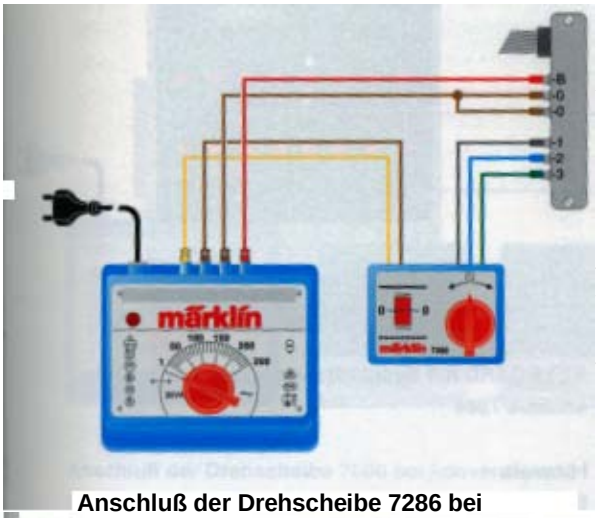
1 A.

Wichtig: Eine solche Beschaltung ist nur möglich, wenn die Motoren eine eingebaute Endabschaltung besitzen (wie z. B. motorische Weichen-antriebe) und der Motorhersteller einen „Halbwellenbetrieb“ zuläßt. Die Trafospannung wird entsprechend der Angabe des Motorherstellers ausgewählt.

Im Bild werden sogar zwei Motoren mit der gleichen Spannung versorgt. Es dürfen aber maximal so viele Motoren angeschlossen werden, daß die Dioden nicht überlastet werden. Die Typen 1 N4001 z. B. erlauben einen Strom von max.

8.9. Anschluß spezieller Modellbahnartikel

Drehscheibe 7186
Auch die konventionelle Drehscheibe 7186 kann auf einer Digital-Anlage eingesetzt werden. Soll sie nur direkt vom Bediener gesteuert werden, ist es empfehlenswert, sie weiterhin mit dem mitgelieferten Steuerpult zu bedienen. Die Bedienung über die beiden Drucktasten ist sehr einfach. Den Anschluß zeigt die folgende Abbildung.



Anschluß der Drehscheibe 7186 mit eigenem Steuerpult

Die Gleise der Drehscheibe können beim Digital-System direkt an die Bahnstromversorgung angeschlossen werden. Auf diese Weise können auf Wunsch die Beleuchtungen der stehenden Lokomotiven weiterleuchten.
Soll die Drehscheibe dagegen über ein MEMORY oder einen Computer mit INTERFACE gesteuert werden, muß sie über einen Decoder k 84 angeschlossen werden. Die entsprechende Schaltung finden Sie in der Anleitung zum Decoder k 84. Die Bedienung über das KEYBOARD ist mit dieser Variante etwas umständlicher als mit dem mitgelieferten Steuerpult.

Anschluß der Drehscheibe 7286 bei konventionellem Fahrbetrieb

Anschluß der Drehscheibe 7286 bei digitalem Fahrbetrieb

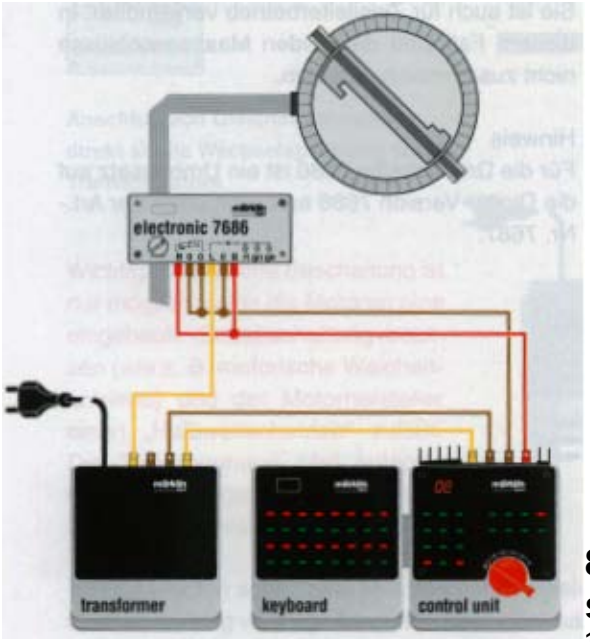
Drehscheibe 7286

Für die neue konventionelle Drehscheibe 7286 gilt im wesentlichen das gleiche wie für die eben genannte Version 7186. Das mitgelieferte Steuerpult kann bei digitalem Fahrbetrieb ebenfalls zur Steuerung der Drehscheibe beibehalten werden.
Die Bedienung des Steuerpultes unterscheidet sich von dem der Drehscheibe 7186:

- Einstellen der Drehrichtung mit dem Drehschalter auf der rechten Seite.
- Linker Schiebeschalter nach unten: Drehscheibe dreht sich einen Gleisanschluß weiter in der gewählten Drehrichtung.
- Linker Schiebeschalter nach oben: Drehscheibe dreht sich stetig weiter in der gewählten Dreh-richtung, bis der Schalter losgelassen wird; die Drehscheibe hält dann am nächstfolgenden Gleisanschluß.

Die Drehscheibe 7286 kann bis auf maximal 48 Gleisanschlüsse ausgebaut werden.
Sie ist auch für Zweileiterbetrieb verwendbar. In diesem Fall sind die beiden Masseanschlüsse nicht zusammenzuschalten.

Hinweis
Für die Drehscheibe 7286 ist ein Umbausatz auf
die Digital-Version 7686 erhältlich unter der Art.Nr. 7687.



8.9. Anschluß spezieller Modellbahnartikel

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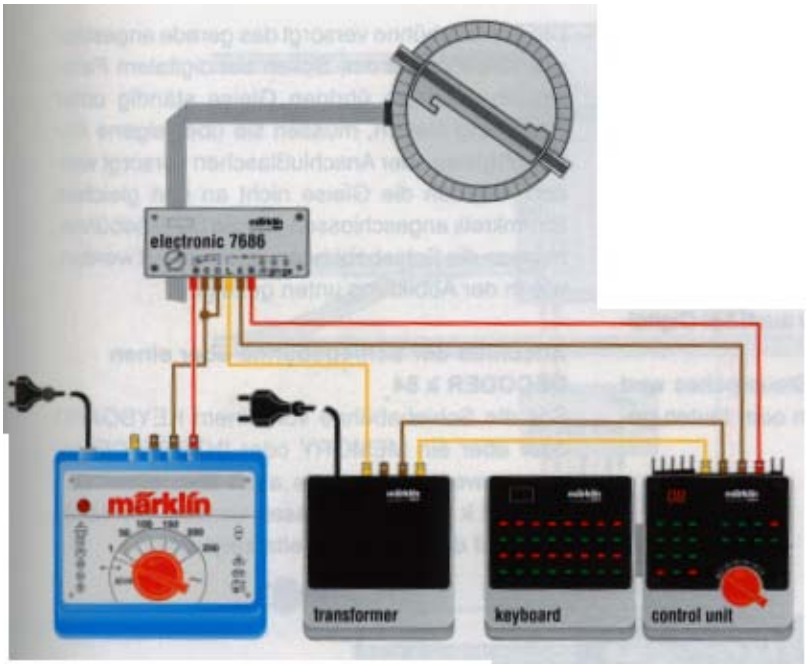
Anschluß der Drehscheibe 7686
bei digitalem **Fahrbetrieb**

Digital-Drehscheibe (7686)

Die Digital-Drehscheibe 7686 bietet besonderen Bedienungskomfort: sie kann ebenfalls bis auf maximal 48 Gleisanschlüsse ausgebaut werden. Jedes Gleis kann über das KEYBOARD direkt angesteuert werden (mit vorwählbarer Drehrichtung). Eine automatische 180°-Drehung ist von jedem Gleis aus möglich. Die Standardfunktionen „Einzelschritt ritt“ und „Dauerbetrieb“ in beiden Richtungen sind natürlich ebenfalls eingebaut.
Die Drehscheibe 7686 wird über einen mitgelieferten speziellen Digital-Decoder angeschlossen, wie im folgenden Bild gezeigt.
Zusätzlich wird ein KEYBOARD benötigt, das auf die KEYBOARD-Adresse 15 eingestellt werden muß. Das KEYBOARD gehört nicht zum Lieferumfang der Drehscheibe, aber eine spezielle Tastenschablone, die die Beschriftung für die Bedienung der Drehscheibe anpaßt.
KEYBOARD mit Beschrlftungsschablone für Drehscheibe 7686

Hinweis
Sollen auf einer großen Anlage zwei Digital-Dreh-scheiben eingesetzt werden, kann der Drehscheiben-Decoder im Werk so umgestellt werden, daß er durch ein KEYBOARD mit der Adresse 14 angesteuert werden kann.

Tip: **KEYBOARD** ausnutzen
Mit den 16 Tastenpaaren auf dem KEYBOARD können bis zu 24 Positionen (also insgesamt 48 Gleise) der Drehscheibe direkt angewählt werden. Wenn Sie nicht so viele Gleisanschlüsse benutzen - was wohl die Regel ist -, können

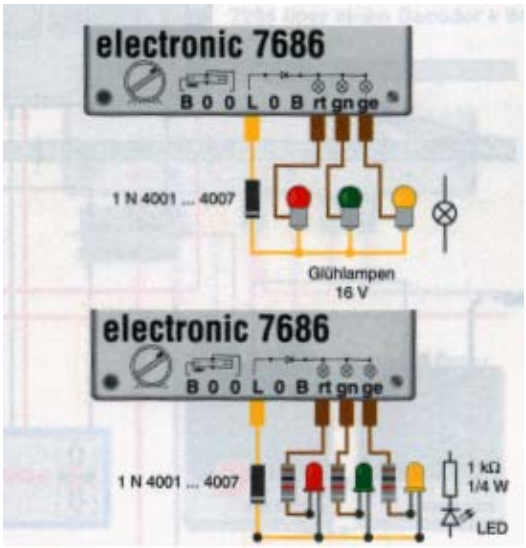


hluß der Drehscheibe 7686 bei konventionellem Fahrbetrieb

Tip: Drehscheibe ohne **KEYBOARD** steuern Die Drehscheibe kann natürlich auch mit einem MEMORY oder einem INTERFACE mit Computer gesteuert werden. In beiden Fällen ist für den Betrieb der Drehscheibe kein eigenes KEYBOARD mehr erforderlich. Nur für die Einrichtung der „Fahrstraßen“ (der Steuerungsbefehle für die Drehscheibe) auf dem MEMORY muß einmal ein beliebiges KEYBOARD auf die Adresse 15 eingestellt werden. Es kann danach wieder mit einer anderen Adresse für Weichen und Signale benutzt werden.

Damit die einzelnen Gleisanschlüsse von der Drehscheibe gezielt angesteuert werden können, muß die Lage der Gleise sowie die definierte Position 1 einmal programmiert werden. Die Einstellungen bleiben natürlich auch nach dem Abschalten der Anlage erhalten.
Die Drehscheibe versorgt jeweils das angefahrene Gleis mit Strom, die übrigen Gleise sind abgeschaltet. Sollen alle Gleise bei Digital-Betrieb kontinuierlich unter Spannung stehen, müssen sie über eigene Anschlußgleise oder Anschlußlaschen aus dem gleichen Bahnstromkreis wie die Drehscheibe versorgt werden.
Die Digital-Drehscheibe kann auch auf einer Anlage mit konventionellem Fahrbetrieb eingesetzt werden. Eine Digital-Zentraleinheit und ein KEYBOARD zur Steuerung sind dann aber trotzdem erforderlich.

Sie die übrigen Tasten auf dem KEYBOARD ganz normal zur Steuerung von Magnetartikeln verwenden. Sie müssen dann nur die DECODER k 83, k 84 oder k 73 auf die passenden Adressen (KEYBOARD-Adresse 15!) einstellen. Bei 8 Gleisanschlüssen (4 Positionen) können Sie z. B. noch 10 Weichen anschließen, bei 16 Gleisanschlüssen noch 4 Weichen usw.



Leuchtdioden mit Vorwiderstand

Anschluß der Kontrolleuchten

Zur Kontrolle der Programmierung und der Bedienung sollten am Steuerpult 7686 drei farbige Lampen oder Leuchtdioden angeschlossen werden. Die drei Anzeigelampen zeigen durch unterschiedliche Kombinationen von Dauerleuchten und Blinken alle Betriebszustände der Drehscheibe an.
Die gleichen Anschlüsse können auch zur Erfassung des Betriebszustandes der Drehscheibe über ein Rückmeldemodul s 88 benutzt werden (für Computersteuerung).

Anschluß der Kontrolleuchten am Steuerpult 7686, oben mit Glühlampen, unten mit Leuchtdioden.

Hier muß vor jede LED ein Vorwiderstand mit ca. **1** kO eingesetzt werden.

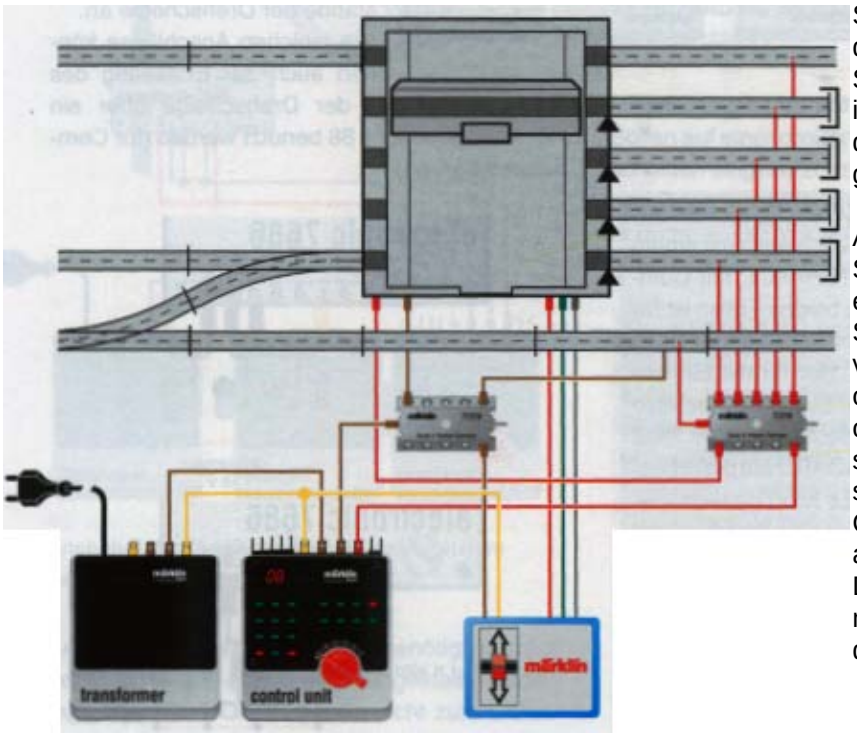
Schiebebühne 7294

Die Schiebebühne 7294 braucht auf einer Anlage weniger Platz als eine Drehscheibe. Sie läßt sich gut mit dem geraden (Durchfahr-)Lokschuppen 7289 kombinieren. Außerdem ist für die Schiebebühne eine Oberleitungsgarnitur erhältlich (Art.-Nr. 7295).

Die Schiebebühne wird standardmäßig ebenfalls mit einem speziellen Steuerpult bedient, und zwar sowohl bei konventionellem wie auch bei Digital-Betrieb.

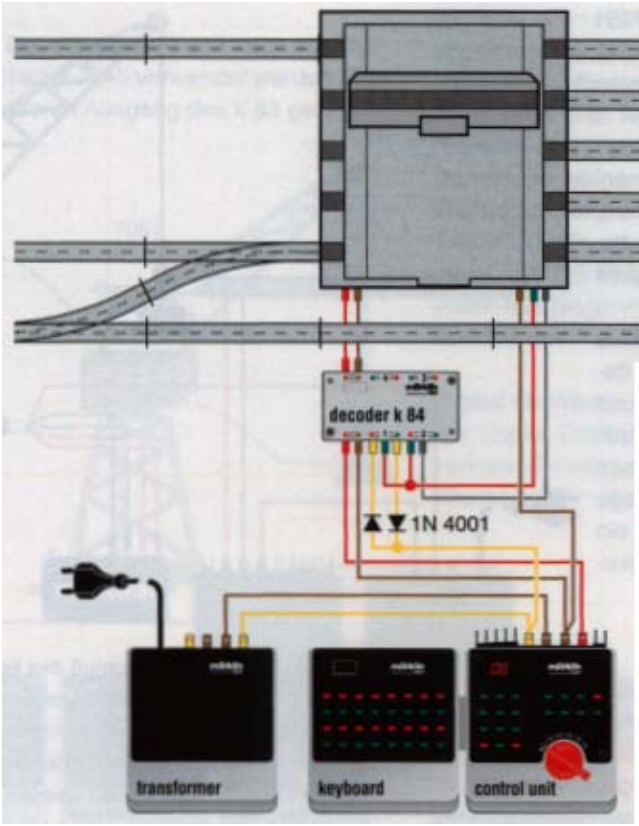
Mit dem Schiebeschalter des Steuerpultes wird die Bühne wahlweise nach vorn oder hinten gefahren.

Die Schiebebühne versorgt das gerade angesteueile Gleis mit Strom. Sollen bei digitalem Fahr-betrieb auch die übrigen Gleise ständig unter Spannung stehen, müssen sie über eigene Anschlußgleise oderAnschlußlaschen versorgt werden. Werden die Gleise nicht an den gleichen Stromkreis angeschlossen wie die Schiebebühne, müssen die Schiebebühnengleise isoliert werden, wie in der Abbildung unten gezeigt.



Anschluß der Schiebebühne über einen DECODER k 84

Soll die Schiebebühne von einem KEYBOARD oder über ein MEMORY oder INTERFACE ge-steuert werden, kann sie auch über einen DE-CODER k 84 angeschlossen werden. Die Abbildung auf der nächsten Seite zeigt dies.



Anschluß der Schiebebühne 7294 über einen Decoder k 84

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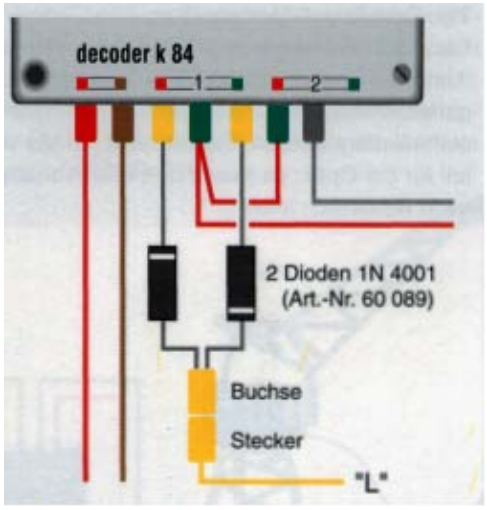
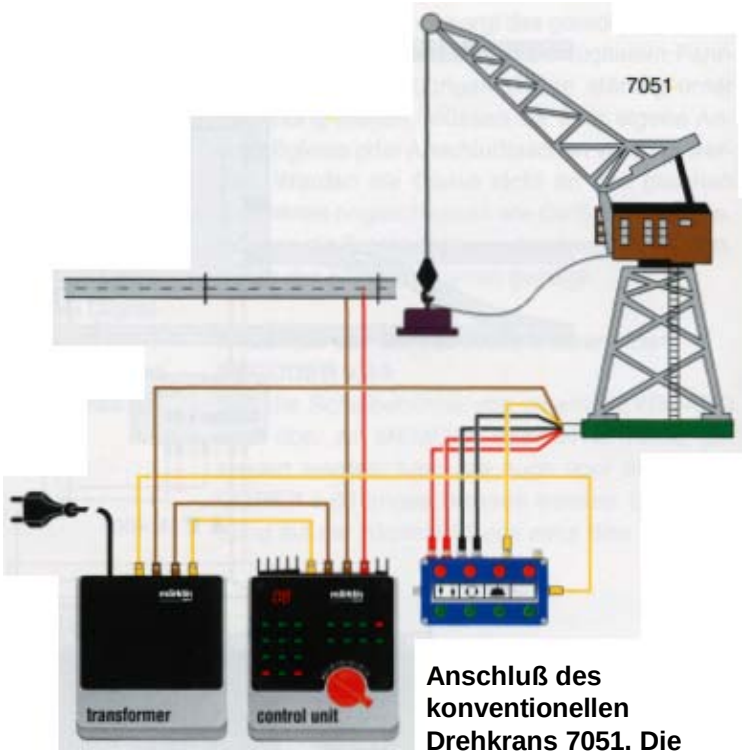
Anschluß der Schiebebühne 7294 mit dem mitgelieferten Steuerpult



Anschlußmöglichkeit der Dioden für die Schiebebühne

8. Digital Schalten



Anschluß des konventionellen Drehkrans 7051. Die Stromversorgung kann wahl-

Die Schiebebühne wird durch einen Gleichstrom-motor angetrieben. Die Änderung der Fahrtrichtung erfolgt durch Umpolen des Motorstroms. Aus diesem Grund sind bei dieser Schaltung die beiden Dioden erforderlich. Die Dioden können auf einfache Weise über eine Märklin Muffe am Decoder k 84 angeschlossen werden. Alternativ könnte statt der beiden Dioden auch ein Brückengleichrichter benutzt werden.

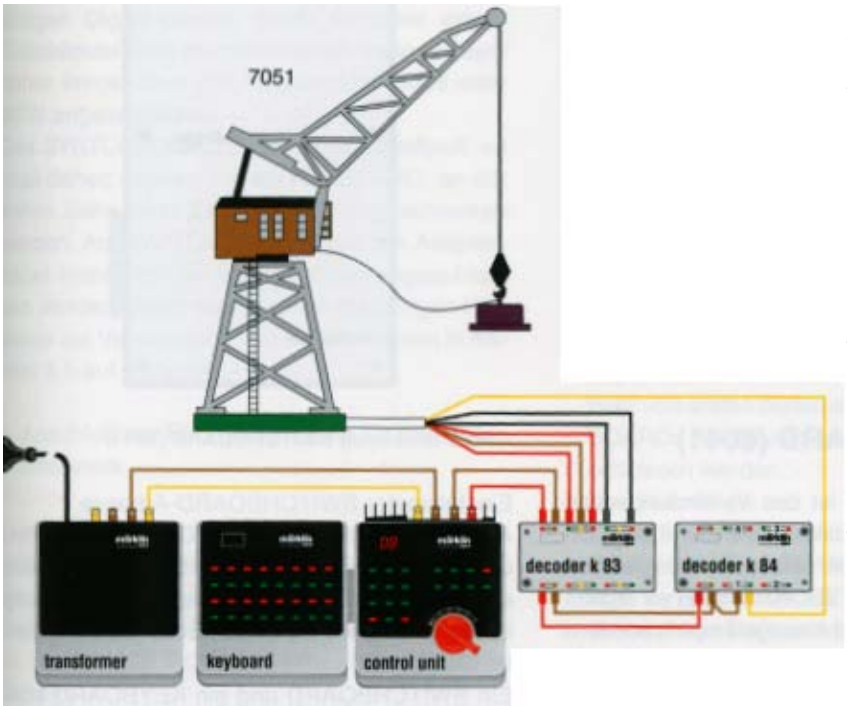
Bedienung am KEYBOARD:
Welche Tasten am KEYBOARD zuständig sind, hängt immer von der Belegung der Decoder-Ausgänge und der eingestellten Decoder-Adresse ab. Taste 1 (oder 5, 9,13) rot: Fahrtrichtung nach vorn. Taste 1 grün: Fahrtrichtung nach hinten.
Taste 2 (5,10,14) rot: Schiebebühne starten.
Danach muß Taste 2 grün gedrückt werden:
Startimpuls „aus“.

Konventioneller Drehkran 7051
Mit einem Drehkran können auf einer Modellbahn realistische Be- und Entladevorgänge nachgespielt werden. Der Drehkran 7051 wird von zwei Alistrom-motoren angetrieben, von denen der eine für die Drehung des Krans, der andere für Heben und Senken des Hubmagneten zu-ständig ist. Die Geschwindigkeit der Motoren ist konstant. Dem Drehkran liegt ein spezielles Steuerpult bei. Es handelt sich dabei um ein kombiniertes Stell- und Schaltpult. Dieses Pult sollte auch verwendet werden, wenn man den Kran auf einer Digital-Anlage nur manuell, aber nicht über ein MEMORY oder INTERFACE steu-ern will.

Achtung!
Das Kranstellpult darf bei dieser Beschaltung nicht die seitlichen Anschlüsse von Weichenstellpulten 7072 berühren, das gäbe einen Kurzschluß!

Tip: **Drehkran leiser** machen
Für den Drehkran ist unter der Art.-Nr. 7054 ein „Unterflur-Zurüstsatz“ erhältlich. Damit kann der ganze Antrieb des Drehkrans unter die Grundplatte verlegt werden. Dies ist nicht nur ein Vorteil für die Optik, es macht den Kran vor allem auch wesentlich leiser.

weise einem separaten Trafo oder dem DigitalTRANSFORMER entnommen werden.



Digitale Steuerung des konventionellen Drehkrans 7051

Soll der Kran dagegen innerhalb des Digital-Systems, also von einem KEYBOARD, MEMORY oder INTERFACE, gesteuert werden, kann er auch über einen Decoder k 83 und k 84 angeschlossen werden, wie in der nachfolgenden Abbildung gezeigt.

Achtung!
Bei dieser Schaltung wird das braune Kabel des Krans an die gelbe Buchse des Decoders k 83 angeschlossen. Somit liegt positives Potential am Gehäuse des Krans. Er darf daher keine masse-führenden Teile wie Gleisbett oder Oberleitungsmasten berühren, sonst gibt es einen Kurzschluß.
Über den Dauerstromdecoder k 84 werden der Hubmagnet und die Kranbeleuchtung ein- und ausgeschaltet.
Achten Sie auf die richtige Einstellung der Decoder-Adressen, damit die Tasten für die Bedienung des Krans auf dem KEYBOARD nebeneinander liegen.

Hinweis
Anstelle des Decoders k 84 kann auch ein Universal-Fernschalter 7245 verwendet werden, der über einen weiteren Ausgang des k 83 geschaltet wird.

Tip: **Umrüstung auf Digital**

Der Drehkran 7051 kann mit dem Umrüstsatz 7652 zu einem Digital-Drehkran umgebaut werden, der vollkommen dem Modell 7651 entspricht. Diese Umrüstung wird von Ihrem Fachhändler durchgeführt.

Bedienung am KEYBOARD:
Taste 3 rot: Ausleger heben
Taste 3 grün: Ausleger senken
Taste 4 rot: Kran nach rechts drehen
Taste 4 grün: Kran nach links drehen
Taste 5 grün: Magnet und Licht einschalten
Taste 5 rot: Magnet und Licht ausschalten.
Welche Tasten am KEYBOARD zuständig sind,
hängt natürlich immer von der Belegung der Decoder-Ausgänge und der eingestellten DecoderAdresse ab.

Digital-Drehkran 7651

Der Digital-Drehkran 7651 benötigt keinen **ge**trennten Decoder und auch kein KEYBOARD zur Steuerung. Er enthält einen kombinierten Lok-

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Informationen finden Sie im Kapitel „Funktionsmodelle“ auf Seite 126. Der Anschluß des Digital-Drehkrans ist sehr einfach: er wird mit nur zwei Kabeln an die Zentrale oder einen BOOSTER angeschlossen.

9. Digital-Geräte für besondere Anwendungen

Was erfahren Sie in diesem Hauptkapitel?

In diesem Hauptkapitel werden kurz die Digital-Geräte für speziellere Aufgaben vorgestellt:
SWITCHBOARD, MEMORY, INTERFACE und
Rückmeldemodul s 88. Es würde aber den Rahmen dieses Buches sprengen, ausführlich auf die vielfältigen Möglichkeiten dieser Geräte einzugehen. Sie werden daher Thema eines zweiten Bandes sein.

8.9
Modellbahnartikel

9.1. SWITCHBOARD (6041)

Das SWITCHBOARD ist das Verbindungsglied zwischen einem Gleisbildstellwerk und dem Digital-System. Es erfüllt prinzipiell die gleichen Funktionen wie ein KEYBOARD, aber es enthält selbst keine Tasten und Anzeigelampen, sondern nur die Anschlußbuchsen dafür. Die Tasten und Lampen sind dann auf dem Gleisbildstellwerk neben Symbolen für Weichen und Signale eingebaut. Auf einem Gleisbildstellwerk ist sozusagen der gesamte Gleisverlauf eines bestimmten Anlagenteils oder der gesamten Anlage nachgebildet. Ein Gleisbildstellwerk ist daher leichter zu bedienen und gibt eine wesentlich bessere Übersicht über die Stellungen der Magnetartikel. Zusätzlich kann auch eine

Anschluß des Digital-Drehkrans 7651

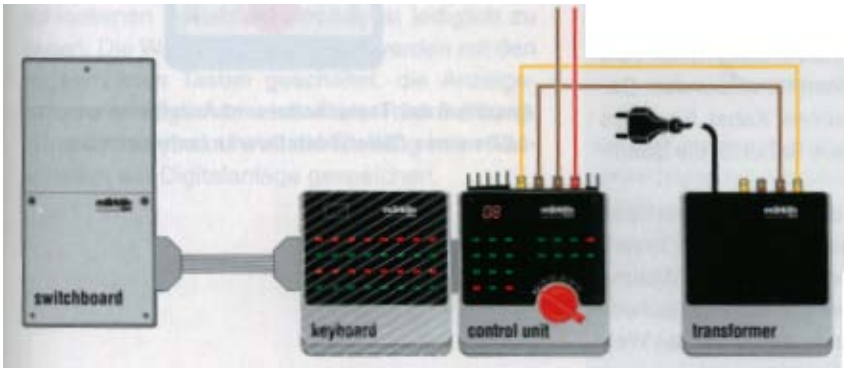
Anschluß spezieller

Zugpositionsmeldung installiert werden (die jedoch nicht durch das SWITCHBOARD gesteuert wird).
Gleisbildstellpult SWITCHBOARD (6041)

Einstellen der SWITCHBOARD-Adresse
An der Vorderseite des SWITCHBOARDs befindet sich ein vierpoliger Codierschalter. Hier wird eine von 16 Adressen eingestellt. Die Codierung ist die gleiche wie beim KEYBOARD, siehe Seite 130.
Ein SWITCHBOARD und ein KEYBOARD können auch auf die gleiche Adresse eingestellt werden. Das SWITCHBOARD „hört“ beim Datenaustausch zwischen der Zentraleinheit und anderen Stellpulten mit der gleichen Adresse immer „mit“, so daß die Anzeigen eines Gleisbildstellwerks auch dann korrekt sind, wenn Weichen oder Signale über ein KEYBOARD, ein MEMORY oder ein INTERFACE geschaltet werden. Aus Leistungsgründen sollten nicht mehr als insgesamt 16 SWITCHBOARDs und KEYBOARDs angeschlossen werden.

Anschluß des SWITCHBOARDs
1. Digital-Anschluß
Vor dem Anschließen:
Anlage vom Netz trennen!
Das SWITCHBOARD ist flacher gebaut als die übrigen Digital-Geräte, damit es unter einem Gleisbildstellwerk montiert werden kann. Es wird daher immer über ein Adapterkabel 6038 oder 6039 angeschlossen.
Das SWITCHBOARD ist ein Digital-Stellpult: es muß daher, ebenso wie ein KEYBOARD, an der linken Seite einer Zentraleinheit angeschlossen werden. Am SWITCHBOARD muß das Adapterkabel immer an der rechten Seite angeschlossen werden. Beachten Sie auch die übrigen Hinweise zur Verwendung von Adapterkabeln in Kapitel 3.5 auf Seite 64.

2. Anschluß der Stromversorgung für das Gleisbildstellwerk



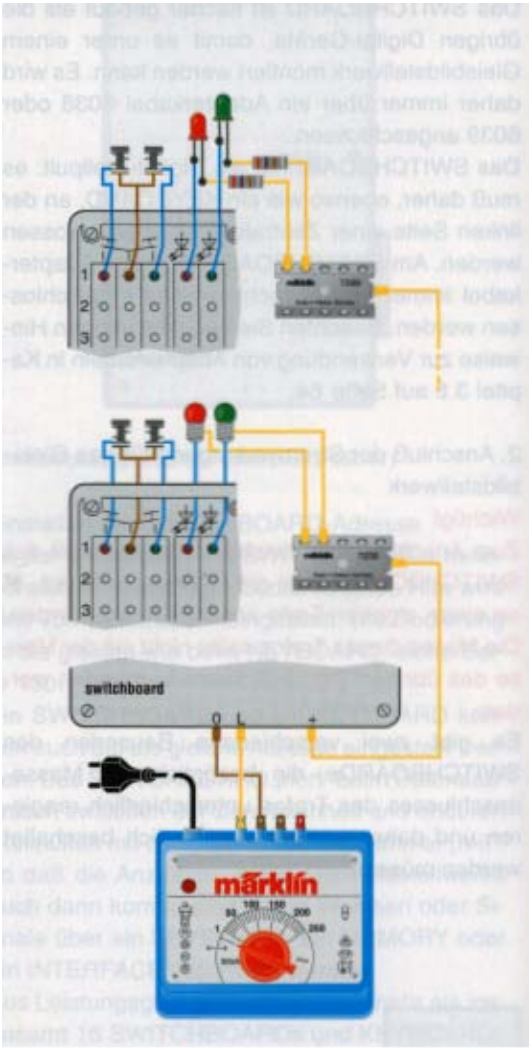
Digital-Anschluß des SWITCHBOARDs über **Adapterkabel**

Wichtig!
Zum Anschluß des Gleisbildstellwerks muß das SWITCHBOARD über die Buchsen „0“ und „L“ an einen eigenen Trafo angeschlossen werden. Die Masse dieses Trafos sollte nicht mit der Masse des übrigen Digital-Systems verbunden werden.
Es gibt zwei verschiedene Bauserien des SWITCHBOARDs, die bezüglich des Masse-anschlusses des Trafos unterschiedlich reagieren und daher auch unterschiedlich beschaltet werden müssen.

Es gibt eine einfache Testmöglichkeit, um festzustellen, zu welcher Bauserie Ihr SWITCHBOARD gehört:
Das SWITCHBOARD muß bereits mit dem Adapterkabel angeschlossen sein.
Trafo für das SWITCHBOARD noch nicht anschließen.
Trafo der Zentraleinheit ans Netz anschließen.

Die Betriebsanzeige-Leuchtdiode am SWITCHBOARD verhält sich nun je nach Bauserie anders:
Leuchtdiode aus:
SWITCHBOARD gehört zu Serie 1. Hier ist ein eigener Trafo erforderlich, der mit keinem anderen Trafo irgendeine Verbindung haben darf.
Falls vorhanden dürfen aber mehrere SWITCHBOARDs der Bauserie 1 an diesen Trafo angeschlossen werden.
Leuchtdiode an:
SWITCHBOARD gehört zu Serie II. Der Trafo darf mit der Masse der restlichen Anlage verbunden sein. Es kann unter Umständen auch ein Trafo verwendet werden, der noch andere Stromkreise auf der Anlage versorgt.
SWITCHBOARDs unterschiedlicher Bauserien dürfen nicht an denselben Transformator angeschlossen werden!

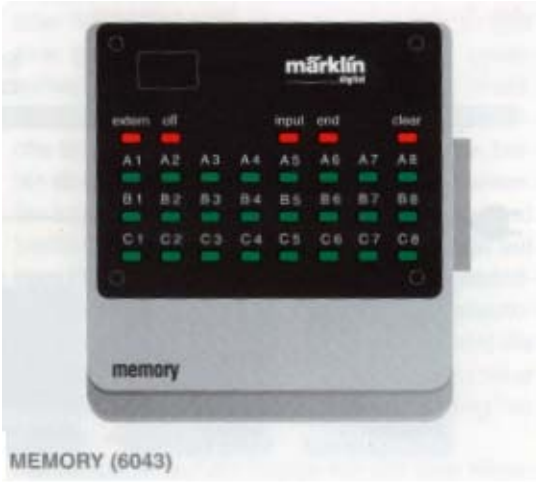
Hinweis
Der zusätzliche Transformator ist nur für den Anschluß der Anzeigelampen der Magnetartikel zuständig. Werden nur die Tasten des SWITCHBOARDs angeschlossen, kann der Zusatztrafo weggelassen werden.



Anschluß der Tastschalter und Anzeigelampen bzw. -LEDs eines Gleisbildstellwerks (schematisch)

3. Anschluß des Gleisbildstellwerks
Zum Aufbau des eigentlichen Gleisbildstellwerks können Sie fertige Module im Handel kaufen, die Sie beliebig aneinanderreihen können.
Sie können aber auch mit wenigen einfachen Bauteilen selbst ein Gleisbildstellpult nach Ihren eigenen Vorstellungen aufbauen. Sie brauchen dazu nur Taster (möglichst in den Farben Rot und Grün) sowie eine entsprechende Anzahl von Glühlampen oder Leuchtdioden. Diese Bauteile bekommen Sie in jedem Elektronik-Fachgeschäft oder über den einschlägigen Versandhandel.
Wenn Sie die obere Abdeckplatte des SWITCHBOARDs abschrauben, finden Sie eine ganze Reihe von Anschlußbuchsen für die Taster und Leuchten des Gleisbildstellwerks. Für jeweils zwei Taster gibt es drei Buchsen, sowie jeweils eine Buchse für die beiden Anzeigeleuchten rot und grün. Somit sind also insgesamt 16 x 5 = 80 Anschlußbuchsen vorhanden. Es müssen aber nicht unbedingt ebenso viele Kabel zum Gleisbildstellwerk verlaufen. Der Anschluß der Taster und Anzeigelampen des Gleisbildstellwerks kann entweder mit einzelnen Kabeln oder mit Flachbandkabeln erfolgen.
Die beiden Taster haben eine gemeinsame Masse, die an die mittlere Buchse angeschlossen wird.

tasten sollten zweipolige Taster



MEMORY (6043)

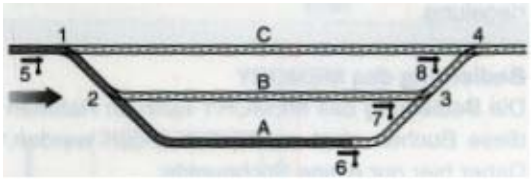
verwendet werden, über die die beiden Zuleitungen rot und grün geschaltet werden (jeweils getrennt für die Gruppen 1 . 8 und 9 . 16).

Tip: Anzahl der Kabel reduzieren
Von jedem Tasterpaar muß nur der braune Anschluß als eigenes Kabel vom Gleisbildstellwerk zum SWITCHBOARD gezogen werden. Die roten und grünen Anschlußbuchsen jeweils einer untereinanderliegenden Reihe (also Taster 1 bis 8 und 9 bis 16) sind miteinander verbunden. Daher reicht ein gemeinsames Kabel für jedes Tasterpaar plus vier weitere Kabel für die Strom-zuführung der Taster.
Bei Gleisbildstellwerken der „echten“ Bahn müssen aus Sicherheitsgründen immer zwei Tasten gleichzeitig gedrückt werden, um eine Weiche oder ein Signal zu schalten: eine „Weichengruppentaste“ und die Taste der einzelnen Weiche. Auch eine solche Schaltung ist mit dem SWITCHBOARD möglich. Als Weichengruppen

An der Abdeckung des SWITCHBOARDs sind zweimal acht Aussparungen angebracht, entsprechend der Anzahl der schaltbaren Magnetartikel. Somit ist eine eindeutige Zuordnung der Kabel zu den jeweiligen Buchsen gewährleistet.
Als Richtungsanzeigen können wahlweise Glühlampen oder Leuchtdioden verwendet werden. Leuchtdioden zur Stellungsanzeige verbrauchen weniger Strom und haben eine längere Lebensdauer als Glühlampen. Bei einer Eingangsspannung des SWITCHBOARD-Trafos von 16 Volt müssen Standard-Leuchtdioden über einen Vorwiderstand von 330 ₀ je 1/4 W angeschlossen werden (siehe Bild).
Die Stromversorgung für die Anzeigelampen ist durch das SWITCHBOARD abgesichert. Leuchten zu viele Glühlampen gleichzeitig (je nach Spannung und Lampentyp zwischen 20 und 50), schaltet das SWITCHBOARD die Stromversorgung aller Ausgänge ab.

Tip: **Elektrische Probleme vermeiden**
Die Kabel vom SWITCHBOARD zum Gleisbildstellwerk sind relativ anfällig gegen elektrische Einstreuungen. Kreuzungen dieser Verbindungskabel mit Bahnstromleitungen oder Adapterkabeln sollten daher möglichst vermieden werden. Falls dies nicht möglich ist, sollten Sie zwischen den kreuzenden Kabeln unbedingt einen Mindestabstand von 20 bis 25 mm einhalten.

Bedienung des SWITCHBOARDs
Zur Bedienung des am SWITCHBOARD



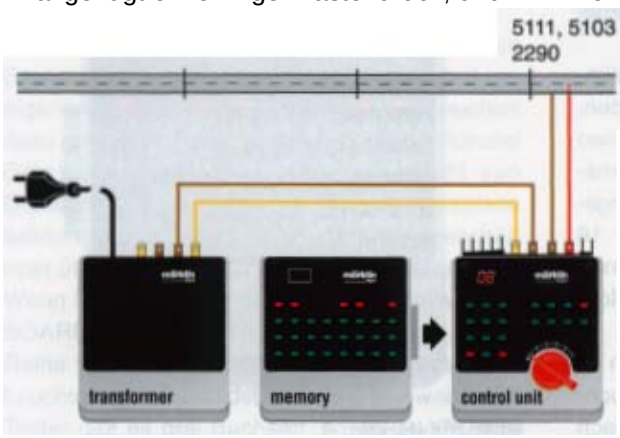
›iel einer einfachen Fahrstraße: die Einfahrt eines Zuges auf das Glels A wird durch einen Tastendruck gestellt.

angeschlossenen Gleisbildstellpultes ist lediglich zu sagen: Die Weichen und Signale werden mit den zugeordneten Tasten geschaltet, die Anzeige-lampen ermöglichen eine klare Rückmeldung. Wie beim Keyboard wird die Stellung beim Ausschalten der Digitalanlage gespeichert.

9.2. MEMORY (6043)

Das MEMORY ist das Fahrstraßenstellpult im Digital-System. Eine Fahrstraße ist eine Abfolge von Schaltbefehlen für Magnetartikel. Diese Abfolge wird ein einziges Mal in der richtigen Reihenfolge von Hand geschaltet. Dabei zeichnet das

MEMORY die Befehle auf. Beim nächsten Mal genügt ein einziger Tastendruck, und die gesamte Fahrstraße wird automatisch vom MEMORY geschaltet. Auf einem MEMORY können bis zu 24 Fahrstraßen eingerichtet werden. Jede Fahrstraße kann bis zu 20 Befehle enthalten. Eine Fahr-straße kann aber auch eine weitere aufrufen, so daß die Anzahl der Schaltbefehle fast beliebig groß sein kann.



)RY von der linken Seite an die Zentraleinheit anschließen

Anschluß des MEMORY
Vor dem Anschließen:
Alle Transformatoren vom Netz trennen!
Das MEMORY wird, wie alle Digital-Stellpulte, auf der linken Seite einer Zentraleinheit angeschlossen. Das MEMORY kann mit allen Zentralem heiten und für alle Gleissysteme eingesetzt werden. Es können bis zu vier MEMORYs angeschlossen werden. Die Reihenfolge spielt dabei keine Rolle. Es können auch MEMORYs und KEYBOARDs gemischt angeschlossen werden.
Am vierpoligen Codierschalter auf der Rückseite des MEMORY wird mit den Schaltern 1 und 2 eine von vier MEMORY-Adressen eingestellt. Die Schalter 3 und 4 dienen zur Einstellung der Verriegelung.

Bedienung des MEMORY

Die Bedienung des MEMORY kann im Rahmen diese Buches nicht ausführlich erklärt werden. Daher hier nur einige Stichpunkte:
Fahrstraßen können einfach eingegeben werden, indem die gewünschten Magnetartikel an einem beliebigen Digital-Stellpult geschaltet werden. Zur Ausführung einer Fahrstraße genügt dann ein Ta-stendruck auf dem MEMORY. Die ursprünglichen Eingabe-Stellpulte brauchen übrigens später nicht mehr vorhanden zu sein.

Jede Fahrstraße kann auch nachträglich einfach geändert oder erweitert werden. Damit Sie jederzeit den Überblick über Ihre eingegebenen Fahr-straßen behalten, sind dem MEMORY einige „Programmierbogen“ beigelegt, auf denen Sie Ihre Fahrstraßen übersichtlich eintragen können.
Für jeden Magnetartikel kann einzeln die Umschaltzeit festgelegt werden, so daß auch ältere Magnetartikel sicher schalten. Außerdem sind auch Pausen variabler Länge zwischen den einzelnen Schalt-befehlen möglich.
Es gibt einen Verriegelungsmodus, der kreuzende Fahrstraßen erkennen und auf Wunsch verhindern kann. Kreuzende Fahrstraßen enthalten denselben Ma-gnetartikel in unterschiedlichen Schaltrichtungen. Mit Verriegelung wird der Betrieb von größeren Anlagen wesentlich sicherer.

Jede Fahrstraße kann auch durch einen Gleiskontakt (über ein Rückmeldemodul s 88) ausgelöst werden. Damit können sehr eindrucksvolle Automatik-Abläufe auf einer Anlage eingerichtet werden. Dennoch bleiben alle Magnetartikel auch weiterhin einzeln und unabhängig voneinander schaltbar – ein großer Fortschritt gegenüber konventionellen Automatiksteuerungen. Die Möglichkeiten der Automatikschaltungen reichen aber viel weiter, als hier gezeigt werden kann.

Weitere Informationen
Im „märklin magazin“ Nr. 4/90 bis 1/91 wurde eine Artikelserie veröffentlicht über Automatikschaltungen mit dem MEMORY.

9. Digital-Geräte für besondere Anwendungen

9.3. INTERFACE (6050/6051)

Das INTERFACE ist das Verbindungsglied zwischen der Modellbahnanlage und einem Computer. Dazu kann prinzipiell jeder Computer verwendet werden, der eine serielle Schnittstelle besitzt. Das INTERFACE unter der Artikelnummer 6051 ist übrigens das gleiche Gerät wie unter der Nummer 6050. Einziger

INTERFACE (6050/6051)

Unterschied: dem 6051 liegt ein fertiges Anschlußkabel für einen PC-kompatiblen Computer bei, sowie eine PC-Diskette mit Demo-Programmen und Erläuterungen zum INTERFACE. (Beim 6050 war nur der Anschluß-stecker zum INTERFACE mitgeliefert.)

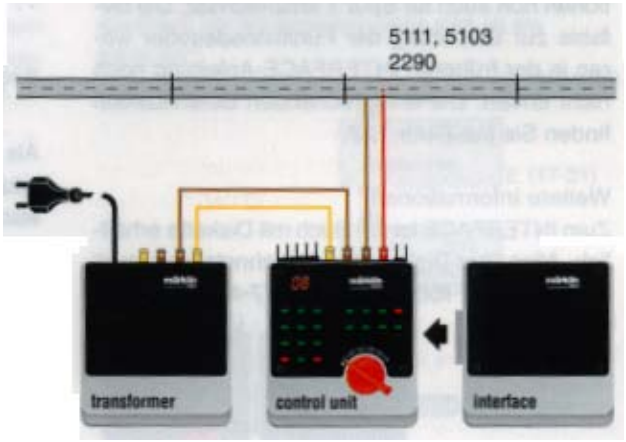
Was **kann das INTERFACE?**
Über eine serielle Schnittstelle (RS-232C, V-24) werden die Informationen von der Modellbahnanlage zum Computer übertragen und umgekehrt. Dabei wird eine Über-tragungsgeschwindigkeit von 2400 Baud (bit/s) benutzt. Über ein INTERFACE kann sowohl das Digital Fahren als auch Digital Schalten gesteuert werden, und zwar mit allen Möglichkeiten, die das Digital-System bietet. Somit kann ein INTERFACE Digital-Fahrpulte und Digital-Stellpulte ersetzen.

Die dazu nötigen Programme können Sie entweder selbst schreiben, falls Sie mit einer beliebigen Programmiersprache arbeiten können, oder Sie kaufen sich fertige Programme. Es gibt eine ganze Reihe von Programmen für unterschiedliche Computersysteme auf dem Markt. Verschiedene Programme haben unterschiedliche Schwerpunkte und Bedienungskonzepte, bieten aber teilweise sehr ausgeteilte Möglichkeiten. So zeigen manche Programme ein genaues und bedienbares Abbild der Fahr- und Stellpulte auf dem Bildschirm. Einige bieten ein Gleisbildstellwerk auf dem Bildschirm, andere einen vollauto-matischen Fahrplanbetrieb usw. Somit bietet die Computersteuerung einer Modellbahn ganz neue Möglichkeiten, die mit einer „Handsteuerung“ so niemals möglich wären.

ontaktgeber auf der Anlage können über Rück-meldemodule s 88 an ein INTERFACE angeschlossen werden.

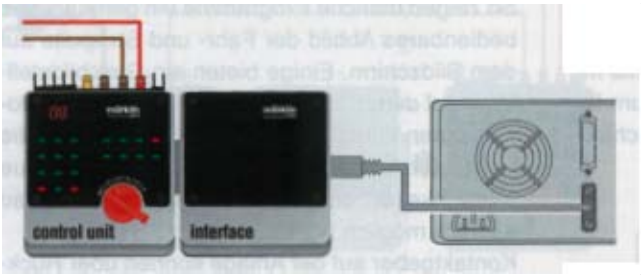
Anschluß des INTERFACE

or dem Anschließen:
RANSFORMER vom Netz trennen!



INTERFACE an Zentraleinheit anschließen

Das INTERFACE wird wie ein Digital-Fahrpult an der rechten Seite der Zentraleinheit angeschlossen. Es muß als letztes Gerät ganz rechts angeschlossen werden, da es auf seiner rechten Seite keine Anschlußbuchse für weitere Digital-Fahrpulte hat, sondern die Anschlußbuchse für den Anschluß des Computers.



INTERFACE an Computer anschließen

Beim INTERFACE 6051 ist ein Anschlußkabel (9 pin SUB-D) für einen PC-kompatiblen Computer mitgeliefert. Anschlußkabel für andere Computertypen können Sie nach der INTERFACE-Anleitung entweder selbst herstellen oder über die Firma „modellplan“ in Göppingen beziehen. Der Stecker zum INTERFACE ist ein sechspoliger DIN-Stecker.

Bedienung des INTERFACE

Das INTERFACE selbst hat keine Bedienelemente. Die Bedienung ist daher ausschließlich von dem benutzten Computerprogramm abhängig.

Mit Hilfe des INTERFACE sind die Sonderfunktionen fi bis f4 über alle Zentraleinheiten steuerbar, mit Ausnahme der „CENTRAL UNIT=“ (6027) und der „CENTRAL CONTROL 1“ (6030). Mit der CONTROL UNIT (6021) sind alle Funktionen nun auch für Spur 1 ansprechbar. Die Befehle zur Steuerung der Funktionsdecoder waren in der früheren INTERFACE-Anleitung noch nicht erklärt. Die entsprechenden Befehlszeilen finden Sie auf Seite 122.

Weitere Informationen

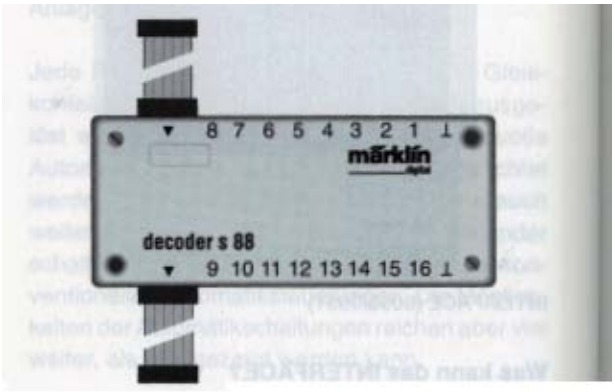
Zum INTERFACE ist ein Buch mit Diskette erhältlich „Alles über Digital – Modellbahnsteuerungen“ (Chip Spezial, ISBN 3-8023-0977-4).

9.4. Rückmeldemodul s 88 (6088)

Das Rückmeldemodul ist kein eigenständiges Digital-Gerät, sondern es wird grundsätzlich in Kombination mit einem MEMORY oder einem INTERFACE benutzt.

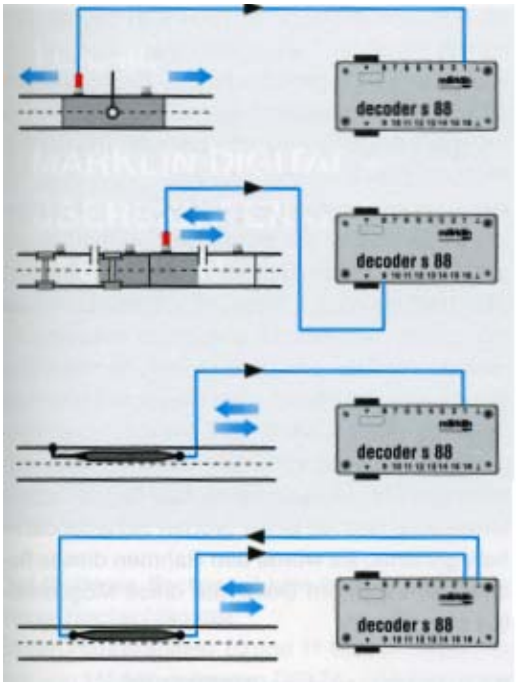
Was kann das Rückmeldemodul?

Trotz seines Namens ist das Rückmeldemodul „DECODER s 88“ eigentlich kein Decoder im üblichen Sinne; es hat auch eine völlig andere Funktion als z. B. die Decoder k 83 oder k 84. Es wird benutzt, um die analogen Spannungen von verschiedenen Kontaktgebern in ein Digital-Signal umzusetzen und ans Digital-System weiterzuleiten. Diese Funktion bezeichnet man in der Elektronik oft als „Encoder“.



Rückmeldemodul s 88 (6088)

Als Kontaktgeber können wahlweise Reedkontakte (SRK), Schaltgleise, Kontaktgleise oder auch mechanische Schalter benutzt werden. Mit einem s 88 muß also nicht mehr zwischen Momentkontaktgebern (Reedkontakte, Schalt-gleise) und Dauerkontaktgebern (Kontaktgleise) unterschieden werden. Die Funktionsweise der verschiedenen Kontaktgeber können Sie in Kapitel 3.5 auf Seite 57/58 nachlesen. Der Anschluß der Kontaktgeber ist aus folgendem Bild abzulesen:



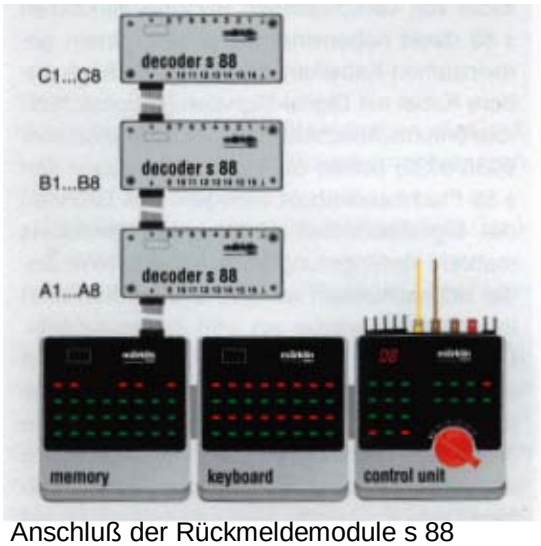
Anschluß verschiedener Kontaktgeber an ein
Rückmeldemodul s 88. Von oben: Schaltgleis (nur Märklin HO-Mittelleiter), Kontaktgleis (nur Märklin HO-Mittelleiter), Reedkontakt beim HO-Mittelleiter-System, Reedkontakt allgemein.

Die Pfeile deuten an, ob der jeweilige Kontakt die Fahrtrichtung unterscheidet oder nicht. Beim Reedkontakt ist dies von der Einbaulage der Kontakte und der Betätigungsmagnete abhängig.

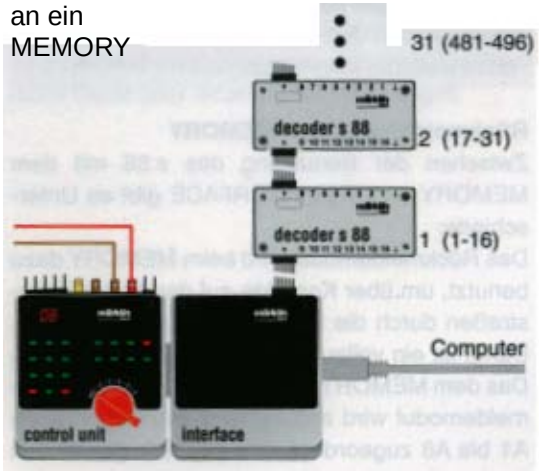
Elektrische Daten s 88
Als Eingangsspannung verträgt jeder Eingang des Rückmeldemoduls s 88 alles, was an Spannungen im Modellbahnbereich üblich ist:

Eingangsspannung: ±40 V
Spannungsschwelle: ÷2,5 V
Spannungen <2,5 V: Kontakt betätigt
Spannungen > 2,5 V: Kontakt nicht betätigt
Empfindlichkeit: Eingangswiderstand ca. 50 kO gegen Masse

Anschluß **des Rückmeldemoduls s 88** Das Rückmeldemodul wird entweder an ein MEMORY oder ein INTERFACE angeschlossen. Dazu liegt dem Rückmeldemodul ein Flachbandkabel bei, das in die sechspolige Buchse an der Rückseite von MEMORY oder INTERFACE eingesteckt wird (Kabel vom Stecker aus nach unten verlaufend). Am s 88 muß das Kabel immer so eingesteckt werden, daß der schwarze Pfeil in Richtung auf das MEMORY oder INTERFACE zeigt. An die



Anschluß der Rückmeldemodule s 88 an ein
MEMORY



Anschluß der Rückmeldemodule s 88 an ein
RFACE

gegenüberliegende Buchse am s 88 können weitere Rückmeldemodule angeschlossen werden: beim MEMORY maximal drei s 88; beim INTERFACE maximal 31 s 88.

Verlängerungskabel
Unter der Art.-Nr. 6089 ist ein zwei Meter langes Verlängerungskabel zum Anschluß eines Rückmeldemoduls erhältlich.

Tip: Signalsicherheit **beim s 88**
Über das Anschlußkabel des s 88 wird neben den Digital-Daten auch ein „Rechteck-Signal“ übertragen (für Insider: das Taktsignal für die Schieberegister). Um unerwünschte und schwer auffindbare Beeinflussungen der beiden Signale zu vermeiden, sollten Sie folgende Hinweise beachten.
Vermeiden Sie nach Möglichkeit, zwei Anschlußkabel von verschiedenen Rückmeldemodulen s 88 direkt nebeneinander oder in einem gemeinsamen Kabelkanal zu verlegen. Auch andere Kabel mit Digital-Signalen (hauptsächlich rote/braune Anschlußkabel und Adapterkabel 6038/6039) sollten Sie nicht direkt neben den s 88-Flachbandkabeln verlegen. Aus Gründen der Signalsicherheit dürfen auch keinesfalls mehrere Verlängerungskabel 6089 hintereinander angeschlossen werden. Dazwischen muß in jedem Fall wieder ein s 88 eingebaut sein. Der Selbstbau von Verlängerungskabeln ist ebenfalls nicht zu empfehlen; in speziellen Fällen müßten Kabel mit einzeln abgeschirmten Adern und Masseanschluß der Abschirmung verwendet werden. Der maximale Abstand von zwei Metern zwischen zwei s 88 sollte auch auf großen Anlagen ausreichen, denn die Anschluß-leitungen von den Kontakten zum s 88 können ohne weiteres länger sein.

Rückmeldemodul am MEMORY
Zwischen der Benutzung des s 88 mit dem MEMORY und dem INTERFACE gibt es Unterschiede:
Das Rückmeldemodul wird beim MEMORY dazu benutzt, um über Kontakte auf der Anlage Fahr-straßen durch die fahrenden Züge auszulösen. Damit ist ein vollautomatischer Betrieb möglich. Das dem MEMORY am nächsten liegende Rückmeldemodul wird automatisch den Fahrstraßen Al bis A8 zugeordnet, das nächstfolgende den Fahrstraßen Bi bis B8, und das dritte Cl bis C8.
Mit den „Stell-Eingängen“ (Buchsen 1 bis 8) werden die jeweiligen Fahrstraßen geschaltet, mit den Freigabe-Eingängen (Buchsen 9 bis 16) werden geschaltete Fahrstraßen wieder freigegeben. Die Freigabe-Eingänge werden aber nur mit der Betriebsart „Verriegelung“ benötigt.
Alle Kontakte werden vom MEMORY nur ausgewertet, wenn hier die Betriebsart „extern“ eingeschaltet ist (durch Drücken der Taste „extern“, Abschaltung mit der Taste „oft“). Somit kann man mit einem Tastendruck zwischen vollautomatischem Betrieb und manueller Fahrstraßen-steuerung umschalten. Erst dieser vollautomatische Betrieb des MEMORY erlaubt die vielfältigen Möglichkeiten zur Steuerung komplexer Betriebsabläufe. Als Beispiel sei hier nur der vollautomatische Betrieb eines großen Schattenbahnhofs genannt. Es würde den Rahmen dieses Buches sprengen, im Detail auf diese Möglichkeiten einzugehen.

Rückmeldemodul am INTERFACE
Bei der Steuerung der Modellbahn mit einem Computer über das INTERFACE kommt den Rückmeldemodulen eine besondere Bedeutung zu. Sie sind die einzige Möglichkeit, wie der Computer eine „Rückmeldung“ über die Abläufe auf der Anlage erhalten kann. Die Position der Züge kann er z. B. durch Kontaktgleise oder Reedkontakte erkennen, die an ein Rückmeldemodul s 88 angeschlossen sind. In Kombination mit einem INTERFACE sind alle 16 Eingänge des Rückmeldemoduls s 88 gleichwertig. Es können ebenfalls beliebige Kontakt-geber an sie angeschlossen werden. An das INTERFACE können bis maximal 31 s 88 hintereinandergeschaltet und dadurch bis zu 496 Kontakte überwacht werden. Der Computer bekommt die Informationen des Rückmeldemoduls nicht automatisch geliefert, das Computerprogramm muß vielmehr von sich aus die Rückmeldemodule in regelmäßigen Abständen „abfragen“, um das Schalten eines Kontaktes zu erkennen. Welche Reaktion der Computer daraufhin ausführt, hängt ausschließlich von dem Computerprogramm ab. Die Möglichkeiten sind beliebig vielfältig. Auch dieses Thema wird vertieft in einem Folgeband dargestellt.

TEIL III

MÄRKLIN DIGITAL . ÜBERSICHTEN UND TABELLEN

Teil III dieses Buches ist kein Lese-, sondern ein reiner Nachschlageteil.
In den Hauptkapiteln 10 und 11 finden Sie alle bisher von Märklin gebauten DELTA- und Digital-Geräte, jeweils sortiert nach aufsteigenden Artikel-nummern.
In Hauptkapitel 10 sind alle Geräte und Decoder aufgelistet, die das „Motorola-Datenformat“ benutzen. Dies sind:

- alle Geräte und Decoder für H0-Mittellleiter-An-lagen (DELTA und Digital),
- alle Geräte, die für alle Gleissysteme benutzt werden können (Digital-Fahr- und Stellpulte),
- sowie die neuen Decoder für Märklin Spur 1-Lokomotiven.

Im Hauptkapitel 11 finden Sie hingegen alle Geräte, die nicht das Motorola-Datenformat benutzen. Dies sind:

- die bisherigen (nicht mehr produzierten) Geräte und Decoder für Spur 1
- sowie die speziellen Geräte für H0-Zweileiter-Anlagen.

Eine Übersichtstabelle in Kapitel 11.1 zeigt den Zusammenhang zwischen bisherigen und neuen Spur 1-Komponenten.
Hauptkapitel 12 enthält als Zusammenfassung alle Adreßcodiertabellen aus diesem Buch sowie Tabellen mit den werksseitig eingestellten Adressen für alle Digital- und DELTA-Lokomotiven. Ein ausführliches Stichwortverzeichnis in Kapitel 13 schließlich ermöglicht einen gezielten Zugriff auf jedes Gerät oder einen bestimmten Begriff.

10. Digital-Geräte mit MotorolaDatenformat

Was erfahren Sie in diesem Hauptkapitel?

In diesem Hauptkapitel werden alle Geräte und Decoder stichwortartig aufgelistet, die das „Motorola-Datenformat“ benutzen.

Das Motorola-Datenformat ist eine bestimmte Art der Datenübertragung, die von der Haibleiterfirma „Motorola“entwickelt wurde. Dieses Datenformat zeichnet sich durch eine besonders hohe Übertragungssicherheit aus, was gerade bei der Datenübertragung auf einer Modellbahn über den Schleifer und die Räder besonders wichtig ist.

Nähere Informationen zu diesem Verfahren finden Sie in den Kapiteln 2.8 und 2.9.

Wesentlich ist aber folgendes:

Schon bisher wurde das Motorola-Datenformat für alle Zentraleinheiten und Decoder im HO-Mittelleiter-System mit großem Erfolg verwendet. Durch die Vereinheitlichung der Digital-Produktpalette ab dem Frühjahr 1994 benutzen nun auch alle neuen Märklin 1-Komponenten dieses Motorola-Format. Damit können jetzt die gleichen Zentralemheiten, BOOSTER, DELTA-Steuergeräte und Magnetartikeldecoder sowohl für HO-Mittellleiterwie auch für Spur 1-Anlagen verwendet werden. Weitere Informationen dazu finden Sie in Haupt-kapitel 11.

In den nachfolgenden Übersichten sind übrigens auch alle Geräte aufgelistet, die nicht mehr erhältlich sind, weil viele Märklin Freunde häufig auch konkrete Informationen zu solchen älteren Gerä
ten suchen.

Zeichenerklärung für nebenstehende Tabefle:

- Digital-Komponente kann ohne Einschrän kung eingesetzt werden.
- x Digital-Komponente kann eingesetzt werden, ist aber nicht mehr lieferbar.
- Digital-Komponente kann nicht eingesetzt werden.
- © Nachfolgemodell, sofern vorhanden.

Nachfolgemodell mit Motorola Gleisformat, nur einsetzbar mit Zentraleinheit 6021

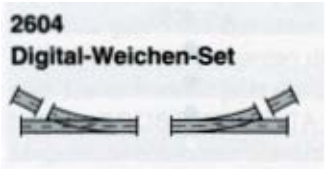
1U.4. Funktionsmodelle

10.1. Überblick (über alle Komponenten mit Motorola~Datenformat)

	DigitaI-Komponente	HO-MIttelleiter (Wechselstrom)	MarKnn 1 (Wechselstrom)
260 2	Startpackung M	x	
260 4	Weichen-Set	•	
261 0	Startpackung K	x	
262 0	Einstiegspackung	x	
499 8	Tanzwagen	x	
499 9	Panoramawagen	x	–
600 0	TRANSFORMER 100 V	•	•
600 1	TRANSFORMER11OV	•	•
600 2	TRANSFORMER 220 V	**1**	**1**
600 3	TRANSFORMER 240 V	•	•
601 5	BOOSTER	•	
602 0	CENTRAL UNIT	x 6021	–
	CENTRAL CONTROL	x 6021	–
602 1	CONTROLUNIT	•	**1**
603 5	CONTROL 80	x 6036	x 6036
603 6	CONTROL 80 F	1	•
603 8	ADAPTER 180	•	•
603 9	ADAPTER 60	**1**	**1**
604 0	KEYBOARD	**1**	•
604 1	SWITCHBOARD	•	•
604 3	MEMORY	•	•
605 0	INTERFACE	x~6051	x~6051
605 1	INTERFACE	**1**	•
607 0	INFRA CONTROL 80 F	**1**	•
607 1	IR CONTROL	**1**	•
607 3	DECODER k 73	•	
608 0	DECODER c 80	**1**	II (max. 800 mA)
608 1	DECODER c 81	•	(max. 800 mA)
608 3	DECODER k 83		
608 4	DECODER k 84	**1**	

1U.4. Funktionsmodelle

6088	DECODER s 88		
6089	ADAPTER s 88		•



6090	DECODER c 90		(max. 800 mA)
6095	DECODER c 95		n
6603	DELTA-Modul		
6604	DELTA-Control	**1**	–
6605	DELTA-Pilot	•	–
6607	DELTA-Station	•	1
6608	DELTA-Mobil	**1**	**1**
7651	Digital-Drehkran		–
7686	Digital-Drehscheibe		–

Art.-Nr.
Bezeichnung Beschreibung

Digital-Startpackung für M-Gleise

Inhalt:

- Digital-Zentraleinheit CENTRAL

1U.4. Funktionsmodelle

CONTROL
- TRANSFORMER
- Digital-Rangierlok BR 260 mit TELEX-Kupplung

- Digital-Tenderlok BR 89
- diverse Güterwagen
- diverse M-Gleise

1 1 Bogenweichenpaar 5140 mit eingebautem Digital-Decoder
Magnetartikel-Adressen (fest): 253, 254
beim CENTRAL CONTROL, Tasten: „1 „ „2“
beim KEYBOARD Nr. 16, Tasten: 13, 14

- 1 Entkupplungsgleis 180 mm mit eingebautem Digital-Decoder

Magnetartikel-Adresse (fest): 255
beim CENTRAL CONTROL, Taste: „3“
beim KEYBOARD Nr. 16, Taste: 15

Produktion eingestellt. Nicht mehr lieferbar. Digital-

Weichenpaar M-Gleis

Zur Ergänzung der Digital-Startpackung. Wie konventionelle Weichen 5137, mit fest eingebautem Digital-Decoder.
Magnetartikel-Adressen (fest): 255, 256
beim CENTRAL CONTROL, Tasten: „3“, „4“
beim KEYBOARD Nr. 16, Tasten: 15, 16

186 10. Digital-Geräte mit Motorola-Datenformat

Art.-Nr.
Bezeichnung **Beschreibung**

Digital-Startpackung für K-Gleise

Inhalt:
R Digital-Zentraleinheit CENTRAL CONTROL

1U.4. Funktionsmodelle

* TRANSFORMER
• Digital-Diesellok BR 216
* diverse Güterwagen
• 1 Weichenpaar 2271
• 2 elektrische Weichenantriebe 7549
• 1 Decoderk83
(Kodierung: 2 3 6 für Magnetartikel-Adressen 253 256)
• diverse K-Gleise

Produktion eingestellt. Nicht mehr lieferbar.

Digital-Staripackung

Zur Umrüstung konventioneller Anlagen auf Digital-Betrieb.

Inhalt:

* Digital-Zentraleinheit CENTRAL CONTROL
• Digital-Rangierlok BR 260 mit TELEX-Kupplungen
* 1 Decoderk83
(Kodierung: 2 3 6 für Magnetartikel-Adressen 253 256)

Produktion eingestellt. Nicht mehr lieferbar.

1U.4. Funktionsmodelle

Art.-Nr.
Bezeichnung **Beschreibung**

36xx **HO-Digital-Lokomotiven mit Standard-Decoder**
Seite 94/98

Digital-Lokomotiven Für H0-Mittelleiter-Anlagen.

Das „xx“ in der Typenbezeichnung steht für das jeweilige Modell.
Empfängt Motorola-Gleisformat.
Einsetzbar auf

***** konventionellen Anlagen (Wechselstrom),
• DELTA-Anlagen,
• Digital-Anlagen,
(mit Zentraleinheiten 6020, 6021, CENTRAL CONTROL,
nicht mit: 6027, CENTRAL CONTROL =).

• Lokdecoder: c 80 oder c 81, je nach Motortyp.
• Meist eine schaltbare Zusatzfunktion, fahrtrichtungsabhängig.
Zusatzfunktion je nach Loktyp (siehe Gebrauchsanleitung):
Beleuchtung, fahrtrichtungsabhängig;
TELEX-Kupplung;
Rauchgenerator.

37xx **HO-Digital-Lokomotiven**
Seite 101

Digital-Lokomotiven **mit Hochleistungsantrieb 6090**
Für H0-Mittelleiter-Anlagen.

Das „xx“ in der Typenbezeichnung steht für das jeweilige Modell.
Empfängt Motorola-Gleisformat.
Einsetzbar auf

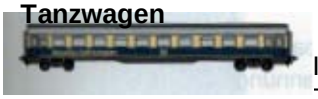
• konventionellen Anlagen (Wechselstrom),
• DELTA-Anlagen,
* Digital-Anlagen,
(mit Zentraleinheiten 6020, 6021, CENTRAL CONTROL,
nicht mit: 6027, CENTRAL CONTROL =).

• Motor: spezieller fünf poliger Trommelkollektor-Motor.
• Lokdecoder: c 90:
Einstellbare Höchstgeschwindigkeit.
Einstellbare Anfahr- und Bremsverzögerung.
Lastabhängige Geschwindigkeitsregelung.
• Meist eine schaltbare Zusatzfunktion, fahrtrichtungsabhängig.
Zusatzfunktion je nach Loktyp (siehe Gebrauchsanleitung):
Beleuchtung, fahrtrichtungsabhängig;
TELEX-Kupplung;
Rauchgenerator.

Motorola-Datenformat

Art.-Nr.
Bezeichnung **Beschreibung**

4998 **Wagen mit eingebautem**
Digital- **Funktionsdecoder** **Seite 124**
Tanzwagen Für H0-Mittelleiter-Anlagen.



Im Innern des Wagens drehen sich fünf Tanzpaare auf der Tanzfläche, dazu wird ein Musikstück gespielt. Auswahl aus sechs Musikstücken möglich.

- Gesteuert über ein Digital-Fahrpult mit Funktionstasten: CONTROL UNIT, CONTROL 80 F, INFRA CONTROL 80 F, INTERFACE.
- Adresse Funktionsdecoder (F-Adresse): 20 (fest codiert).
- Funktionen:

f 2: Tanzpaare drehen sich auf der Tanzfläche.
f3 ein, f4 aus: aktuelles Musikstück abspielen.
f3 aus, f4 ein: zum nächsten Musikstück weiterschalten.
f3ein,f4ein: alle sechs Musikstücke nacheinander spielen.
f3 aus, f4 aus: Musik aus.
fi Deckenbeleuchtung ein- und ausschalten. Fünf

Produktion eingestellt. Nicht mehr lieferbar.

4999
Digital-
Panoramawagen
Wagen mit eingebautem Funktionsdecoder
Für HO-Mittelleiter-Anlagen.
Seite 125

Im Panoramawagen bewegt sich ein Kellner den Gang entlang, er kann an den Tischen stehenbleiben. Tisch- und Deckenbeleuchtung sind getrennt schaltbar.

- Gesteuert über ein Digital-Fahrpult mit Funktionstasten: CONTROL UNIT, CONTROL 80 F, INFRA CONTROL 80 F, INTERFACE.
- Adresse Funktionsdecoder (F-Adresse): 10 (fest codiert).
- Funktionen:

fi aus, f2 aus: Kellner steht am Ende des Ganges.
fi ein, f2 aus: Kellner läuft nach vorn.
fi aus, f2 ein: Kellner läuft nach hinten.
fi ein, f2 ein: Kellner bleibt sofort stehen.
f 3: Tischbeleuchtung ein- und ausschalten.
f 4: Deckenbeleuchtung ein- und ausschalten.
Produktion eingestellt. Nicht mehr lieferbar.

Art.-Nr.
Bezeichnung **Beschreibung**
6000 **Transformator zur Stromversorgung** **Seite 50/80**

1U.4. Funktionsmodelle

TRANSFORMER

Wie TRANSFORMER 6002, aber:
- Eingangsspannung: 100 V, 50 Hz (Japan)
- Ausgangsspannung: l6VWechselspannung
- Ausgangsleistung: 50 VA
- Maße: 135x120x80mm

6001 Transformator zur Stromversorgung TRANSFORMER Seite 50/80

Wie TRANSFORMER 6002, aber:
- Eingangsspannung: 110V, 60 Hz (USA)
- Ausgangsspannung: 16 V Wechselspannung
- Ausgangsleistung: 42 VA
- Maße: 135x120x80mm

6002 **TRANSFORMER** Transformator Für alle Märklin Digital-Anlagen. Seite 50/80

Zur Stromversorgung aller Digital-Zentraleinheiten und BOOSTER, oder zur Versorgung von Lichtstromkreisen auf Digitalanlagen oder konventionellen Anlagen.

- Eingangsspannung: 230 V, 50 Hz (Europa)
- Ausgangsspannung: l6VWechselspannung
- Ausgangsleistung: 52 VA
- Betriebsanzeige: rote Leuchtdiode (LED)
- Eingebaute Überlast-Abschaltung
- Maße: 135 x 120 x 80 mm

6003 TRANSFORMER Transformator zur Stromversorgung Seite ***50/80***

Wie TRANSFORMER 6002, aber:
- Eingangsspannung: 240 V, 50 Hz (Großbritannien, Australien)
- Ausgangsspannung: l6VWechselspannung
- Ausgangsleistung: 52 VA
- Maße: 135x120x80mm

Art.-Nr.
Bezeichnung

6015
BOOSTER
6020
CENTRAL UNIT
Beschreibung
Digital-Leistungsverstärker
Zum Einsatz
mit den Digital-Zentraleinheit

en: CONTROL UNIT (6021), CENTRAL UNIT (6020) und CENTRAL CONTROL.
Nicht geeignet für: »CENTRAL UNIT «(6027), „CENTRAL CONTROL «CENTRAL CONTROL 1 (6030).

Einen oder mehrere BOOSTER brauchen Sie immer dann, wenn die
Ausgangsleistung der Zentraleinheit zur Versorgung Ihrer Anlage nicht
(mehr) ausreicht.
Jeder BOOSTER muß einen eigenen, isolierten Stromkreis versorgen!
Die Digital-Informationen in allen Stromkreisen sind aber dennoch identisch.

Seite 87

- Anschluß: an Zentraleinheit über mitgeliefertes Kabel. Anschlußbuchse für weiteren BOOSTER.
- Stromversorgung: durch TRANSFORMER

1U.4. Funktionsmodelle

an Anschlußkl

6021 CONTROL UNIT

emmen gelb und braun.

$ Anschlußkle mmen rot und braun: zum Anschlußgleis .

- Betriebsanzeige: rote Leuchtdiode (LED)
- Ausgangsstrom: ca. 2,5 A
- Ausgangsleistung: ca. 45 VA
- Eingebaute Überlast-Abschaltung
- Maße: l4Oxl2Ox8Omm

Digital-Zentraleinheit
Für H0-Mittelleiter-Anlagen.
Seite 84
Koordiniert die Steuerung von bis zu 80 Digital-Lokomotiven und bis zu 256 Magnetartikeln.

1 Erzeugt Motorola Gleisformat.

- Anschluß: an beiden Seiten Steckbuchsen zum Anschluß von Digital-Stell- oder -Fahrpulten.
- Anschlußbuchse für BOOSTER.
- Stromversorgung: durch TRANSFORMER an Anschlußklemmen gelb und braun.
- Anschlußklemmen rot und braun: zum Anschlußgleis.

$ Betriebsanzeige: rote Leuchtdiode (LED)

- Ausgangsstrom: ca. 2,5 A
- Ausgangsleistung: ca. 45 VA
- Eingebaute Überlast-Abschaltung
- Maße: l4Oxl2Ox8Omm

Produktion eingestellt. Nachfolgemodell ist CONTROL UNIT 6021.

Art.-Nr.
Bezeichnung Beschreibung
Digital-Zentraleinheit Seite 821117
Für alle Märklin Digital-Anlagen.

Zusätzlich vollständiges Digital-Fahrpult.

Zentraleinheit:

- Koordiniert die Steuerung von bis zu 80 Digital-Lokomotiven und bis zu 256 Magnetartikeln.
- Erzeugt Motorola-Gleisformat.
- Betriebsanzeige: rote Leuchtdiode (LED).
- Anschluß: an beiden Seiten Steckbuchsen zum Anschluß von Digital-Stell- oder -Fahrpulten.
- Anschlußbuchse für BOOSTER.
- Stromversorgung: durch TRANSFORMER an Anschlußklemmen gelb und braun.
- Anschlußklemmen rot und braun: zum Anschlußgleis.
- Ausgangsstrom: ca. 2,5 A
- Ausgangsleistung: ca. 45 VA
- Eingebaute Überlast-Abschaltung.

Fahrpult:

- Zugriff auf Lokadressen 01 bis 80.
- Aktuelle Lokadresse: wird auf zweistelliger Digital-Anzeige angezeigt.
- Ein- und Ausschalten einer Lok-Zusatzfunktion.
- Vier Funktionen von Funktionsdecodern zusätzlich schaltbar.
- Nothalt- und Freigabetaste.

• Maße: 140x120x80 mm

CENTRAL CONTROL **Digital-Zentraleinheit** **Seite 85**

Für H0-Mittelleiter-Anlagen.

Zusätzlich eingebautes Digital-Fahrpult und -Stellpult.
Enthalten in den Digital-Startpackungen 2604, 2610, 2620.
Einzeln nicht erhältlich.

Zentraleinheit:

- Koordiniert die Steuerung von bis zu 80 Digital-Lokomotiven und bis zu 256 Magnetartikeln.
- Erzeugt Motorola-Gleisformat.
- Anschluß: an beiden Seiten Steckbuchsen zum Anschluß von Digital-Stell- oder -Fahrpulten.
- Anschlußbuchse für BOOSTER.
- Stromversorgung: durch TRANSFORMER an Anschlußklemmen gelb und braun.

Art.-Nr.
Bezeichnung **Beschreibung**

CENTRAL CONTROL • Anschlußklemmen **rot und braun für Anschlußgleis.** (Fortsetzung) • Betriebsanzeige: rote Leuchtdiode (LED).

- Ausgangsstrom: ca. 2,5 A
- Ausgangsleistung: ca. 45 VA
- Eingebaute Überlast-Abschaltung.

CENTRAL CONTROL-i

Fahrpult:
• Lok wählen: mit Tasten „1“, „2“, „3“, „4“.
• Zugeordnete Lokadressen: 10, 20, 30, 40.

- Anzeige: rote Leuchtdiode bei jeweiliger Taste.
- Mit zusätzlichen Fahrpulten: Lokadressen 01 –80 wählbar.
- Lok-Zusatzfunktion: ein- und ausschalten.
- Tasten für Nothalt („stop“) und Freigabe („go“).

Stellpult:

- Magnetartikel schalten:

mit Tastenpaaren rot/grün „keyboard“ „1“ „2“, „3“, „4“.

- Zugeordnete Magnetartikel-Adressen: 253, 254, 255, 256.
- Mit zusätzlichen Stellpulten: alle Magnetartikel-Adressen von 1 –256 wählbar.

1 Maße: l4Oxl2Ox8Omm

Produktion eingestellt. Nicht mehr lieferbar. Nachfolgemodell ist CONTROL UNIT 6021.

Digital-Zentraleinheit

Für H0-Mittelleiter-Anlagen.

Zusätzlich eingebautes Digital-Fahrpult und -Stellpult. Nur für Export verfügbar.

- Erzeugt Motorola-Gleisformat.

Funktionen ähnlich wie CENTRAL CONTROL, aber:
Stellpult:

- Magnetartikel schalten:
  mit Tastenpaaren rot/grün „keyboard“ „1“ „2“, „3“, „4“.

1U.4. Funktionsmodelle

- Zugeordnete Magnetartikel-Adressen: 1, 2, 3, 4.

Bezeichnung

- Mit zusätzlichen Stellpulten: alle Magnetartikel-Adressen von 1 – 256 wählbar.
- Zusätzlich: eingebautes modifiziertes Interface zum Anschluß an Computer (serielle Schnittstelle RS 232-C).

6038 Adapterkabel 180

- Maße: 140 x 120 x 80 mm

Produktion eingestellt. Nicht mehr lieferbar.

.10.5. Digital-Geräte und Decoder 193

Art.-Nr. **Bezeichnung** **Beschreibung**

TRAIN-ING Lehr- und Demonstrationssystem

Für HO-Mittelleiter-Anlagen.

6039 Adapterkabel 60 **Anschlußkabel**

Nur für den Ausbildungsbereich.

Kombinierte Zentraleinheit:
Funktionen ähnlich wie CENTRAL CONTROL-i, Seite 193.

- Erzeugt Motorola-Gleisformat.
- Zusätzlich: eingebautes modifiziertes Interface zum Anschluß an Computer (serielle Schnittstelle RS 232-C).

Inhalt des TRAIN-ING-Koffers:

6040 KEYBOARD

- Zentraleinheit TRAIN-ING (mit durchsichtigem Kunststoff-Gehäuse),
- Digital-Lokomotive,
- Digital-Weichenpaar,
- Gleismaterial M,
- Ausführliches Lehrmaterial.

Produktion eingestellt. Nicht mehr lieferbar.

6035 **CONTROL 80** Digital-Fahrpult Für alle Märklin Digital-Anlagen. Seite 116

- Anschluß: an der rechten Seite der Zentraleinheit.
- Lokadressen: 01 bis 80. Aktuelle Lokadresse wird auf zweistelliger Digital-Anzeige angezeigt.
- Lok-Zusatzfunktion: ein- und ausschalten (Tasten „function“, „0ff“).
- Tasten für Nothalt („stop“) und Freigabe („go“).
- Maße: 135 x 120 x 80 mm

Produktion eingestellt. Nachfolgemodell ist CONTROL 80 F (6036).

6036 **CONTROL** 80 F Digital-Fahrpult Für alle Märklin Digital-Anlagen. Seite 111

- Anschluß: an der rechten Seite der Zentraleinheit.
- Lokadressen: 01 bis 80. Aktuelle Lokadresse wird auf zweistelliger Digital-Anzeige angezeigt.
- Lok-Zusatzfunktion: ein- und ausschalten (Tasten „function“, „off“).
- 4 Funktionen von Funktionsdecodern zusätzlich schaltbar (Tasten „f 1“ bis „f4“).
- Adressen von Lok- und Funktionsdecoder unabhängig voneinander wählbar.
- Tasten für Nothalt („stop“) und Freigabe („go“).
- Maße: 135 x 120 x 80 mm

1O~5. Digital-Geräte und Decoder 197

1U.4. Funktionsmodelle

Beschreibung
Anschlußkabel **Seite 64**

Für **alle** Märklin Digital-Anlagen.

6041
SWITCHB
OARD

Zum Anschluß eines Digital-Fahrpultes oder -Stellpultes in größerem
Abstand von der Zentraleinheit oder anderen Steuerpulten.
R Länge: 180cm

Wichtig: Fahrpulte immer an der rechten Seite, Stellpulte immer an der linken Seite der Zentraleinheit anschließen!

Seite 64

Wie Adapterkabel 6038, aber:
- Länge: 60 cm

Wichtig:Fahrpulte immer an der rechten Seite, Stellpulte immer an der linken Seite der Zentraleinheit anschließen!

Seite 129

6043
MEMORY

Umschalten von bis zu 16 Weichen, Signalen oder anderen Magnet-artikeln.

Anschluß: an der linken Seite der

Tasten: 16 rote und 16 grüne Tasten

rtikel.

Anzeige: eine rote Leuchtdiode bei aktuelle Stellung des Magnetartikels an.

- Anschlußmöglichkeit: bis zu 16 Digital-Stellpulte können an eine Zentraleinheit angeschlossen werden.
- Einstellen der Adresse: mit vierpoligem Codierschalter auf der Rückseite.
- Beim Abschalten: letzte Stellung der Weichen und Signale bleibt gespeichert.
- Maße: 135 x 120 x 80 mm

10.5. Digital-Geräte und Decoder 195

Digital-Stellpult
Für alle Märklin Digital-Anlagen.
Art.-Nr.
Bezeichnung Beschreibung
Digital-Stellpult Seite 174
Für alle Märklin Digital-Anlagen.

Zum Anschließen eines Gleisbildstellwerks für bis zu 16 Magnetartikel.

- Anschluß: mit Adapterkabel 6038 oder 6039 an der linken Seite der Zentraleinheit.
- Tasten: keine.

N Betriebsanzeige: rote Leuchtdiode (LED).

- Steckbuchsen: 3 x 16 Buchsen für Taster; 2 x 16 Buchsen für rote und grüne Anzeigelampen oder LED5. Die Lampen werden über einen getrennten Eingang mit Strom versorgt.
- Anschlußmöglichkeit: bis zu 16 Digital-Stellpulte können an eine Zentraleinheit angeschlossen werden.

- Einstellen der Adresse: mit vierpoligem Codierschalter an der Vorderseite. Es können auch mehrere SWITCHBOARDs und KEYBOARDs auf die gleiche Digital-Adresse eingestellt werden.
- Beim Abschalten: letzte Stellung der Weichen und Signale bleibt gespeichert.
- Maße: 210x110x32 mm

Fahrstraßenstellpult **Seite 177**

Für alle Märklin Digital-Anlagen.

Eine Fahrstraße ist eine Folge von Schaltbefehlen für beliebige Magnet-artikel. Eine solche Fahrstraße wird mit dem MEMORY mit einem Tastendruck geschaltet.

- Pro Fahrstraße bis zu 20 Schaltbefehle.
- Mehrere Fahrstraßen können miteinander verknüpft werden.
- Anschluß: an der linken Seite der Zentraleinheit.
- Auf einem Memory: bis zu 24 Fahrstraßen speicherbar.
- Anzeige der Fahrstraßen: eine rote Leuchtdiode pro Fahrstraße.
- Bis zu vier MEMORYs können an eine Zentraleinheit angeschlossen werden.

6070
INFRA CONTROL 80 F

* Eingabe der Fahrstraßen: über KEYBOARD, SWITCHBOARD oder INTERFACE.

- Betrieb mit Verriegelung: gegenseitiger Schutz der Fahrstraßen.
- Automatikbetrieb: mit Rückmeldemodulen DECODER s 88 und Kontakten an den Gleisen.

$ Beim Abschalten: Programmierung der Fahrstraßen und zuletzt eingestellter Zustand bleiben gespeichert.
$ Maße: 135x120x80mm

Art.-Nr.
Bezeichnung

nanlage mit einem **Seite 179**
Computer
Für alle Märklin Digital-Anlagen.

6050/6051
INTERFACE
Beschreibung
Zur Steuerung einer Modellbah

Über das INTERFACE können bis zu 80 Digital-Lokomotiven und bis zu 256 Magnetartikel über den Computer gesteuert werden. Alle Funktionen der Lok- und Funktionsdecoder sind ebenfalls ansteuerbar. Der Computer wird über eine serielle Schnittstelle RS 232-C angeschlossen.

- Anschluß: an der rechten Seite der Zentraleinheit als letztes Gerät ganz außen.
- Anschlußkabel zum Computer:

Art.-Nr. 6050: nur Stecker zum INTERFACE im Lieferumfang.

1U.4. Funktionsmodelle

Art.-Nr. 6051: komplett

- Programme: fertig zu kaufen für alle gängigen Computersysteme oder Selbstprogrammierung.
- Maße: 135x120x80mm

es Anschlußkabel für IBM-kompatible Rechner (neunpolig) im Lieferumfang.

Art.-Nr. 6051 und 6050 sind baugleich, nur Lieferumfang unterschiedlich (6051 mit Anschlußkabel und Diskette).

Digital-Fahrpult **Seite 118**

Für alle Märklin Digital-Anlagen.

Einsetzbar nur in Verbindung mit Infrarot-Handsender IR CONTROL 6071. Kann die Befehle von bis zu vier Handsendern IR CONTROL auswerten.

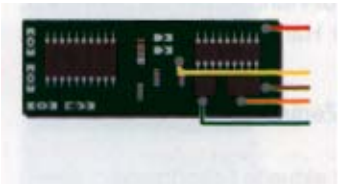
- Anschluß: an der rechten Seite der Zentraleinheit.
- Lokadressen: 01 bis 80.

1 Anzeige: 2stellige Digital-Anzeige für aktuelle Lokadresse.

1 Fünf Leuchtdioden für Zustand der Lok-Zusatzfunktion und Funktionen der Funktionsdecoder „fl“ bis „f4“.

- Infrarot-Empfangssonde: getrennt zum Einbau an gut sichtbarem Standort auf oder über der Anlage.

1 Maße: 135x120x80mm



Art.-Nr.
Bezeichnung

6071
IR CONTROL
6072
Verlängerungskabel

Zum Steuern von Lokomotiven in Verbindung mit dem Empfangsgerät
INFRA CONTROL 80 F. Bis zu 4 IR CONTROL können von einem
INFRA CONTROL 80 F ausgewertet werden.

- Lokadresse: 01 bis 80.
- Alle Funktionen eines Fahrpultes CONTROL 80 F sind steuerbar.
- Senderadresse des IR CONTROL: Umschaltung an Schiebeschalter **(1-4).**
- Reichweite in Innenräumen: mindestens 6 m.
- Spannungsversorgung: 9-V-Blockbatterie.
- Maße: 147x65x21 mm

Verlängerungskabel **Seite 119**

Für alle Märklin Digital-Anlagen.

Zum Anbringen der Empfangssonde des INFRA CONTROL 80 F in größerem Abstand.

6073
DECODERk73
Beschreibung
Infrarot-Handsender
Für alle Märklin Digital-Anlagen.

• Anschluß: Klinkenstecker und -buchse 3,5 mm, dreipolig. 1
Länge: 3 m

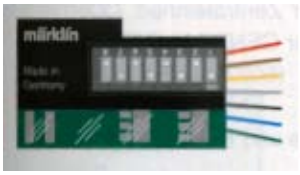
Einbaudecoder **Seite** 158

Seite 119

Für Märklin H0-Mittelleiter-Anlagen.
Zum direkten Einbau in Weichen der H0-Metallgleise.

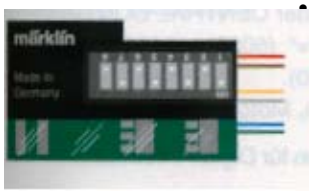
- Ein Schaltausgang für zweispulige Magnetartikel.

- Anschluß: erhält Stromversorgung und Digital-Informationen direkt über die Stromanschlüsse des Gleises, daher keine zusätzlichen Kabelanschlüsse mehr nötig.
- Einstellen der Adresse: über Lötbrücken.
- Einstellbare Adressen: 1 – 256.
- Maße: 42x15x5mm



10. Digital-Geräte mit Motorola-Datenformat

Art.-Nr.
Bezeichnung



6080
Lokdecoder c 80
6081
Lokdecoder c 81
Beschreibung
Seite 94
Digital-Lokdecoder
Für **HO-Lokomotiven** mit Alistrom-Motor („Wechselstrom-Motor“). Empfängt Motorola-Gleisformat. Einsetzbar auf

- konventionellen Anlagen (Wechselstrom),
- DELTA-Anlagen,
- Digital-Anlagen (mit Zentraleinheiten 6020, 6021, CENTRAL CONTROL, nicht mit: 6027, CENTRAL CONTROL =).

Umschaltung auf konventionellen Betrieb: automatisch.
Elektronische Umschaltung der Fahrtrichtung.

- Einstellen der Lokadresse: an achtpoligem Codierschalter.
- Einstellbare Adressen: 01 – 80.
- Eine schaltbare Zusatzfunktion, fahrtrichtungsabhängig.
- Belastbarkeit der Ausgänge:
  Motor: 0,8 A Zusatzfunktion: 2 x 0,2 A
- Maße: 36 x 21 x 9 mm

Digital-Lokdecoder **Seite 98**
Für HO-Lokomotiven mit Permanentmagnet-Motor („GleichstromMotor“).

Empfängt Motorola-Gleisformat.
Einsetzbar auf

- konventionellen Anlagen (Wechselstrom),
- DELTA-Anlagen,
- Digital-Anlagen (mit Zentraleinheiten 6020, 6021, CENTRAL CONTROL, nicht mit: 6027, CENTRAL CONTROL =).

- Umschaltung auf konventionellen Betrieb: automatisch. 1 9 9
- Elektronische Umschaltung der Fahrtrichtung.
- Einstellen der Lokadresse: an achtpoligem Codierschalter.
- Einstellbare Adressen: 1 – 80.
- Eine schaltbare Zusatzfunktion, fahrtrichtungsabhängig.

1U.4. Funktionsmodelle

- Belastbarkeit der Ausgänge:
  Motor: 0,8 A Zusatzfunktion: 2 x 0,2 A
- Maße: 36 x 21 x 9 mm

1 O~5. Digital-Geräte und Decoder

Art.-Nr.
Bezeichnung

CONTROL = CENTRAL CONTROL 1 (6030).
Vier Schaltausgänge für Weichen, Signale und Entkupplungsgleise.

6083
DECODER k 83
6084
DECODERk8

4
Beschreibung

- Anschluß: Steckbuchsen rot und braun für Digital-Informationen und Stromversorgung.
- Schaltbefehle: von einem Digital-Stellpult KEYBOARD, SWITCHBOARD, MEMORY oder INTERFACE.
- Einstellung der Adresse: an achtpoligem Codierschalter.
- Einstellbare Adressen: 1 – 64 (jeder Decoder ist zuständig für vier Magnetartikel mit vier aufeinanderfolgenden Magnetartikel-Adressen).
- Belastbarkeit: pro Ausgang maximal zwei Magnetartikel.
- Maße: 100x54x22mm

Digital-Decoder zum Schalten von Magnetartikeln
Seite 133

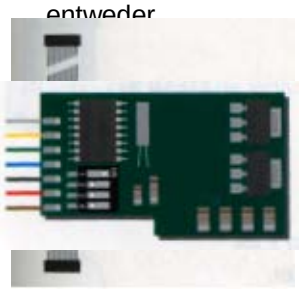
Digital-Decoder zum Schalten von Dauerströmen
Seite 162
Für alle Märklin Digital-Anlagen mit der Zentraleinheit: CONTROL
UNIT (6021), CENTRAL UNIT (6020) oder CENTRAL CONTROL.
Nicht geeignet für: „CENTRAL UNIT = (6027), „CENTRAL CONTROL = CENTRAL CONTROL 1 (6030).
Vier Schaltausgänge für Beleuchtungen, Motoren oder Bahnstrom.

Für **alle** Märklin Digital-Anlagen mit einer Zentraleinheit: CONTROL UNIT (6021), CENTRAL UNIT (6020) oder CENTRAL CONTROL. Nicht geeignet für: „CENTRAL UNIT = (6027), „CENTRAL

- Anschluß: Steckbuchsen rot und braun für Digital-Informationen und Stromversorgung.
- Schaltbefehle: von einem Digital-Stellpult KEYBOARD, SWITCHBOARD, MEMORY oder INTERFACE.
- Einstellung der Adresse: an achtpoligem Codierschalter.
- Einstellbare Adressen: 1 – 64.
- Art der Ausgänge: potentialfreier Umschalter:

mittlere, numerierte Anschlußbuchse ist entweder mit der roten oder mit der grünen Buchse verbunden.

- Belastbarkeit: jeder Ausgang kann die gesamte Leistung eines Modellbahntrafos schalten.
- Maße: 100x54x22mm



Art.-Nr.

Bezeichnung

6088 DECODER $ 88

MEMORY oder INTERFACE. **a** Anschluß: mit beiliegendem Flachbandkabel an MEMORY oder INTERFACE.

- Buchse zum Anschluß weiterer s 88.
- Anschlußmöglichkeit:

am MEMORY maximal drei DECODER s 88,
am INTERFACE maximal 31 DECODER s 88.

- Eingänge: 16 Buchsen für Kontakte.
- Kontaktgeber: Schaltgleise, Kontaktgleise oder Reedkontakte. Kontakte dürfen bis zu 6 m vom Decoder entfernt sein.

$ Beim MEMORY werden unterschieden:
Stell-Eingänge: 1 – 8, Freigabe-Eingänge: 9 – 16.

* Beim INTERFACE: allel6 Eingänge sind gleichwertig.

- Maße: 124x54x23mm

6089 **Adapter s 88**

Verlängerungskabel Seite 182

Beschreibung

Zum Anschluß eines Rückmeldemoduls s 88.

- Länge: 2 m

Digital-Lokdecoder und Hochleistungsantrieb **Seite 101**

Vorgesehen für HO-Lokomotiven mit speziellem Trommelkollektor(Permanentmagnet-)Motor.

Empfängt Motorola-Gleisformat. Einsetzbar auf

- konventionellen Anlagen (Wechselstrom),
- DELTA-Anlagen,
- Digital-Anlagen (mit Zentraleinheiten 6020, 6021, CENTRAL CONTROL, nicht mit: 6027, CENTRAL CONTROL =**).**

Rückmeldemodul

Für alle Märklin Digital-Anlagen.

* Umschaltung auf konventionellen Betrieb: automatisch.

- Elektronische Umschaltung der Fahrtrichtung.

* Einstellbare Höchstgeschwindigkeit.

- Einstellbare Anfahr- und Bremsverzögerung.
- Geschwindigkeitsregelung bei Berg- und Talfahrt. Seite 180

* Einstellen der Lokadresse: an achtpoligem Codierschalter.

Zum Anschluß von Kontaktgebern an

* Einstellbare Adressen: 1 – 80.

- 1 schaltbare Zusatzfunktion, fahrtrichtungsabhängig.

* Belastbarkeit der Ausgänge: Motor: 0,8 A; Zusatzfunktion: 2 x 0,2 A

* Maße (Decoder): 36 x 21 x 9 mm

1U.4. Funktionsmodelle
10.6. DELTA-Geräte

Art.-Nr.
Bezeichnung Beschreibung
6603 DELTA-Modul Seite 91

DELTA-Modul Für HO-Mittelleiter-Lokomotiven.

Loks mit dem DELTA-Modul 6604 können auf konventionellen, DELTA- und Digital-Anlagen fahren.

R Empfängt Motorola-Gleisformat.
- Einstellung der Adresse:

alte Bauserle: vier Lötbrücken.
neue Bauserie: vierpoliger Codierschalter.
- Adreßbereich: 16 Adressen, siehe Tabelle in Kapitel 6.2
- Elektronische Fahrtrichtungsumschaltung.
- Beleuchtung wechselt mit der Fahrtrichtung; Helligkeit ist abhängig von der Fahrgeschwindigkeit.
- Maße:36x21x4mm

6604 DELTA-Steuerpult Seite 69
DELTA-Control Für HO-Mittelleiter-Anlagen.

Ermöglicht den unabhängigen Betrieb von bis zu vier DELTA- oder Digital-Lokomotiven in einem Stromkreis (in Kombination mit dem DELTA-Pilot 6605 sogar bis zu fünf Loks).

- Erzeugt Motorola-Gleisformat.
- Stromversorgung: durch konventionellen Fahrtransformator.
- Ausgangsleistung: ca. 30 VA, ausreichend für bis zu drei Lokomotiven gleichzeitig.
- Eingebaute Überlast-Abschaltung.
- Lok auswählen: am DELTA-Control.
- Geschwindigkeit und Fahrtrichtung steuern: mit Fahrregler am Transformator.
- Umstieg auf das Digital-System: DELTA-Control ist einsetzbar als Digital-Zusatzverstärker (BOOSTER).
- Maße: 125 x 135 x 55 mm

Art.-Nr.
Bezeichnung Beschreibung
6605 Handregler Seite 74
DELTA-Pilot zum Anschluß an das DELTA-Control 6604

Steuerung von Geschwindigkeit und Fahrtrichtung einer zusätzlichen DELTA- oder Digital-Lokomotive direkt am DELTA-Pilot.

- Lok-Adresse für DELTA-Pilot: 80.
- Maße: lOOx4Ox3gmm

DELTA-Steuerpult Seite 76
Einsetzbar für Spur 1 und HO.

Zum unabhängigen Betrieb von maximal 4 DELTA- oder Digital-Lokomotiven. Benötigt Handregler DELTA-Mobil.

- Erzeugt Motorola-Gleisformat.
- Anschließbar: bis zu vier DELTA-Mobil.
- Stromversorgung: durch konventionellen Fahr- oder Licht-Transformator oder

durch Digital-TRANSFORMER.

- Ausgangsleistung: ca. 45 VA, ausreichend für zwei bis drei Spur 1-Lokomotiven oder bis zu vier HO-Lokomotiven gleichzeitig.
- Eingebaute Überlast-Abschaltung.
- Lok auswählen: mit Schiebeschalter am DELTA-Mobil.
- Geschwindigkeit und Fahrtrichtung steuern: mit Drehknopf am DELTA-Mobil.
- Maße: 135 x 120 x 80 mm

6608 Handregler Seite 78

DELTA-Mobil zum Anschluß an die DELTA-Station 6608

Einsetzbar für Spur 1 und **HO.**

Bis zu vier DELTA- oder Digital-Lokomotiven steuerbar mit einem DELTA-Mobil.

- Lok auswählen: mit Schiebeschalter am DELTA-Mobil.
- Die Lokomotiven müssen auf eine der vier DELTA-Adressen codiert sein (zugeordnete Digitaladressen: 78, 72, 60, 24).
- Geschwindigkeit und Fahrtrichtung steuern: mit Drehknopf am DELTA-Mobil.
- Taste für Nothalt.
- Leuchtdiode grün/rot für Betriebszustand.
- Maße: 140x40x25mm

Art.-Nr.
Bezeichnung Beschreibung
7651 Digital-Drehkran mit eingebautem speziellem Seite 126
Digital-Drehkran Funktionsdecoder
Für alle Märklin HO-Digital-Anlagen.

Enthält eine Kombination aus Lok- und Funktionsdecoder.

- Empfängt Motorola-Gleisformat.
- Gesteuert über ein Digital-Fahrpult mit Funktionstasten: CONTROL UNIT, CONTROL 80 F, INFRA CONTROL 80 F oder INTERFACE.
- Adresse einstellen (L- und F-Adresse): an achtpoligem Codierschalter.
- Wählbare Adressen: 01, 03, 04, 09, 10, 12, 13, 27 28, 30 (Standard-Einstellung), 31, 36, 37, 39, 40, 80.

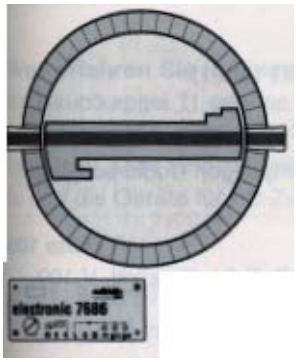
Funktionen:

- fi ein, f2 aus: Kran drehen
  Drehgeschwindigkeit steuern: mit Fahrregler.
  Umschalten der Drehrichtung: Fahrregler an linken Anschlag drehen.
  1 fi aus, f2 ein: Last heben/senken
  Hebegeschwindigkeit steuern: mit Fahrregler.
  Umschalten zwischen Heben und Senken: Fahrregler an linken Anschlag drehen.
- fl aus, f2 aus: keine Funktion
- fi ein, f2 ein: keine Funktion
- Elektromagnet und Beleuchtung ein- und ausschalten: mit Tasten für Zusatzfunktion: „function“/,,off“.

1U.4. Funktionsmodelle

- Höhe: 240 bis 310 mm
- Schwenkbereich: 360°
- Grundfläche: 90 x 90 mm

Art.-Nr.
Bezeichnung



7686
Digital-Drehscheibe
Beschreibung

Drehscheibe mit mitgeliefertem Spezial-Decoder Seite 168 Für alle Märklin HO-Digital-Anlagen.

Für digitalen oder konventionellen Fahrbetrieb.

•

Empfängt

Motorola-Gleisformat.

- Gleisanschluß: zum direkten Anschluß an K-Gleise, mit Übergangs-stück auch an M-Gleise. Sechs Anschlußgleise mitgeliefert zum Einbau an beliebiger Position.
- Ausbaubar auf max. 48 Gleisanschlüsse im Winkel 7,50~
- Position der Gleisanschlüsse ist programmierbar.
- Außenschienen der Drehbühne elektrisch voneinander getrennt einsetzbar zur Gleisbesetzt-Meldung.
- Schaltbefehle: von einem Digital-Stellpult KEYBOARD, SWITCHBOARD oder INTERFACE.

Für das KEYBOARD: spezielle Beschriftungsschablone mitgeliefert.

Funktionen:

- Bühne drehen nach rechts oder links: im Einzelschrittbetrieb zum nächsten Gleis oder mit Dauerfunktion.
- Bühne wenden (180°).
- Gezieltes Anfahren eines bestimmten Gleisanschlusses. Bis zu 24 Positionen können direkt angefahren werden durch Tasten am Keyboard.

Werden weniger als 24 Positionen genutzt, so können die übrigen Tasten des KEYBOARDs für Weichen genutzt werden:

z. B.: 24 Positionen keine Weiche
22 Positionen + 1 Weiche
8 Positionen + 8 Weichen

- Beim Abschalten: Festlegung der Einbau-Position der Gleise und aktuelle Position der Drehscheibe bleiben gespeichert.

- Bühnenlänge: 310 mm
- Außendurchmesser: 386 mm

10.8. Neue Digital-Decoder für Märklin 1

Art.-Nr.
Bezeichnung

6095
Spur 1 -
206 Lokdecoder c
95

86095
Spur 1-Lokdecoder
Beschreibung

Digital-Lokdecoder
Für einmotorige Märklin 1 -Lokomotiven.
Seite 108

- Einsatz mit Zentraleinheit: CONTROL UNIT (6021).
- Fünf Lokfunktionen.
- Empfängt Motorola-Datenformat.

1U.4. Funktionsmodelle

- Märklin 1 -Lokomotiven, z. B. E 91, Krokodil, V **100.**

Loka
dressen: 1 – 80, einstellbar durch achtpoligen Codierschalter.

- Einsatz mit Zentraleinheit: CONTROL UNIT (6021).
- Fünf Lokfunktionen.
- Empfängt Motorola-Datenformat.
- Lokadressen: 1 – 80, einstellbar durch achtpoligen Codierschalter.

Digital-Lokdecoder
Für zweimotorige

Seite 109

66 152 Spur 1 - Lokdecoder
Digital-Lokdecoder
Für Märklin 1-Lokomotive T3 (Art.-Nr. 5504).

- Einsatz mit Zentraleinheit: CONTROL UNIT (6021).
- Eine Lokfunktion.
- Empfängt Motorola-Datenformat.
- Lokadressen: 1 – 80, einstellbar durch achtpoligen Codierschalter.

Seite 109

66 982 Spur 1-Lokdecoder

Digital-Lokdecoder
Für Märklin 1-Lokomotive Baureihe 323 **„Köf".**

- Einsatz mit Zentraleinheit: CONTROL UNIT (6021).
- Eine Lokfunktion.
- Empfängt Motorola-Datenformat.
- Lokadressen: 1 – 80, einstellbar durch achtpoligen Codierschalter.

Seite 109

10. Digital-Geräte mit Motorola-Datenformat

11. Bisherige Digital-Geräte für Spur 1- und HO-ZweileiterAnlagen

Was erfahren Sie in **diesem Hauptkapitel?**

Im Hauptkapitel 11 geht es um alle Märklin Digital-Geräte, die nicht das Motorola-Gleisformat benutzen. Dies sind die bisherigen Spur 1 -Geräte und die Geräte für HO-Zweileiter-Anlagen.

11.1. Märklin Spur 1 – bisherige und neue Digital-Geräte

Frühere Situation
Bisher gab es für HO-Wechselspannung, HO-Zweileiter-Gleichspannung und Spur 1 jeweils unterschiedliche Zentraleinheiten, Leistungsverstärker und Digital-Decoder. Auf die speziellen DigitalKomponenten von Spur 1- und HO-Zweileiter-SySternen wird sonst in diesem Buch nicht eingegangen. Die verschiedenen Zentraleinheiten benutzten unterschiedliche Digital-Datenformate, die nicht zueinander kompatibel (austauschbar) waren. Für Spur 1-Anlagen wurde bisher ein Digital-System mit frequenzmoduliertem Datenformat verwendet.

Neue Situation
Zum Zeitpunkt der Herausgabe dieses Buches (Frühjahr 1994) wurden alle Spezialkomponenten für Spur 1-Digital-Systeme aus dem Märklin-Programm herausgenommen. Ersatzteile sind jedoch weiterhin erhältlich. Die Spezialkomponenten werden ersetzt durch einheitliche Komponenten für alle Anlagen, soweit technisch machbar. (Für Lokomotiven der Spur 1 gibt es z. B. weiterhin andere Lokdecoder als für HO-Lokomotiven.)
Durch die Vereinheitlichung gibt es aber in Zukunft nur noch *ein* Digital-Datenformat für alle Spurweiten und Systeme. Es handelt sich um das sogenannte „Motorola-Datenformat“, das bisher bereits für alle HO-Mittelleiter-Komponenten eingesetzt wurde.
Der gemischte Betrieb von Geräten mit frequenzmoduliertem Format und Motorala-Format ist nicht möglich.
Wenn Sie auf die Geräte mit Motorola-Format umsteigen möchten, kann Ihnen Ihr Fachhändler befristet ein besonders günstiges Angebot unterbreiten.

Vorteile der neuen Digital-Komponenten
Durch die Vereinheitlichung des Datenformats wird die gesamte Energie für Neu- und Weiterentwicklungen auf ein einziges System konzentriert. Dadurch können auch die Freunde der Spur 1-Digital-Anlagen alle Vorteile neuer Produkte und Möglichkeiten von Märklin Digital voll nutzen.
Eine gemeinsame Nutzung von Digital-Komponenten, z. B. in Vereinen, wird auch bei unterschiedlichen Gleissystemen möglich. Außerdem wird die Übersicht für jeden Anwender erleichtert.
Durch den Umstieg auf das Motorola-Datenformat ergeben sich zusätzlich folgende Vorteile:

~ Auf der gesamten Modellbahnanlage wird mit einer gemeinsamen Masse gearbeitet.

• Diese Masse kann verwendet werden, um Weichen direkt zu schalten. Ebenso wird diese Masse für Rückmeldekontakte von MEMORY und INTERFACE eingesetzt.

$ Jetzt sind auch die zusätzlichen Funktionen der Loks in Spur 1 über das INTERFACE an-steuerbar.

Übersicht: Bisherige und neue Digital-Komponenten für Spur 1
In der Tabelle auf der nächsten Seite sind die bisherigen und die neuen Komponenten für Märklin 1 einander gegenübergestellt. Die Eigenschaften der bisherigen Komponenten finden Sie in der darauffolgenden Übersicht ab Seite 209, sortiert nach aufsteigenden Artikel-nummern.

1U.4. Funktionsmodelle

Bisherige Geräte mit frequenzmoduliertem	Datenformat	Neue mit M	Geräte otorola-Datenformal	
5650 Einstiegspackung 1	x			–
6000 TRANSFORMER 100V	•			•
6001 TRANSFORMER11OV	•			•
6002 TRANSFORMER 220 V	•			•
6003 TRANSFORMER 240 V	•			•
6016 BOOSTER =	x (geringe Leistung)			
6018 BOOSTER 1	x	6015	BOOSTER	
6027 CENTRAL UNIT =	x (geringe Leistung)	6021	CONTROL UNIT	
CENTRAL CONTROL =	x (geringe Leistung)	6021	CONTROL UNIT	
6030 CENTRAL CONTROL 1	x	6021	CONTROL UNIT	
6032 PROGRAMMER	x			
6035 CONTROL 80	x ,- 6036			x , 6036
6036 CONTROL 80 F	•			•
6038 ADAPTER 180				•
6039 ADAPTER 60	•			
6040 KEYBOARD				•
6041 SWITCHBOARD				•
6043 MEMORY				
6050 INTERFACE	x (eingeschränkt)			x ~ 6051 (voll einsetzbar)
6051 INTERFACE	• (eingeschränkt)			• (voll einsetzbar)
6070 INFRA CONTROL 80 F	•			•
6071 IR CONTROL				•
6074 DECODER k 74	x	6084	DECODER k 84	
6085 DECODER c 85	x	6095	DECODER c 95	(und DELTA-Station)
6086 DECODER k 86	x	6083	DECODER k 83	
6088 DECODER s 88	• (eingeschränkt)			• (voll einsetzbar)
6089 ADAPTER s 88	•	6607	DELTA-Station	• (•
		6608	DELTA-Mobil	• nur mit DELTA-Station)

Zeichenerklärung:

- • Digital-Komponente kann ohne Einschränkung eingesetzt werden.
- x Digital-Komponente kann eingesetzt werden, ist aber nicht mehr lieferbar.
- – Digital-Komponente kann nicht eingesetzt werden.

,- Nachfolgemodell.

Nachfolgemodell mit Motorola-Gleisformat, nur einsetzbar mit CENTRAL UNIT (6021).

11.1. Märklin Spur 1 – bisherige und neue Digital-Geräte

208

11. Bisherige Spur 1- und HO-Zweileiter-Geräte

11.2. Frühere Digital-Komponenten für Märklin 1

Bisherige Komponente Beschreibung	Ersetzt durch	
 5650 Digital-	Grundanlage Digital-Einstiegspackung für Spur 1 Inhalt: • Ein CENTRAL CONTROL 1 (6030) • Ein TRANSFORMER (6002) • Anschlußgleis • Verbindungskabel • Gleismaterial Spur 1	Produktion eingestellt. Nicht mehr lieferbar.
 6018 BOOSTER 1	(6030), weitere BOOSTER 1 (6018). • Maße: 140x l2Ox8Omm	BOOSTER 4 Anschluß: über Adapterkabel an: CONTROL UNIT (6021), weitere BOOSTER (6015).
6030 CENTRAL CONTROL 1 Digital-Leistungsverstärker Nur für Märklin Spur 1. • Anschluß: über Adapterkabel an: CENTRAL CONTROL 1	Zentraleinheit mit eingebautem Fahrpult Nur für Märklin Spur 1. • Anschlußmöglichkeiten: BOOSTER 1 (6018), alle Digitat-Fahrpulte, alle Digital-Stellpulte. • Maße: l4Oxl2Ox8Omm	6021 CONTROL UNIT • Anschlußmöglichkeiten: BOOSTER (6015), alle Digital-Fahrpulte, alle Digital-Stellpulte.
6015		

bisherige Komponente	Beschreibung	Ersetzt durch
	11.2. FrUhere Digital-Komponenten für Märklin 1	
6074 **DECODER k 74**	209	
	8O F.	
6032 **PROGRAMMER Programmier- und Lesegerät**	• Taste zum Auslesen der Lokdaten. 1 Maße: 135x120x80mm	Entsprechende Einstellmöglichkeiten sind direkt am Lok-decoder vorhanden wie beim H0-Mittelleiter-System.
Für Spur 1 - Loks mit Decoder c 85 (6085).	**Digital-Decoder zum Schalten von Dauerströmen** Für Märklin Spur 1- oder H0-Zweileiter-Anlagen.	6084 **DECODER k 84**
~	Vier Schaltausgänge für Beleuchtungen oder Motoren.	Vier Schaltausgänge für Beleuchtungen oder Motoren.
Codier möglichkeiten: Lokadresse, Anfahrspannung, Anfahr- und Bremsverzögerung.	**1** Einsatz mit Zentraleinheit: CENTRAL CONTROL 1 (6030), CENTRAL UNIT = (6027), CENTRAL CONTROL • Schaltbefehle: von einem beliebigen Digital-Stellpult.	• Einsatz mit Zentraleinheit: CONTROL UNIT (6021). • Schaltbefehle: von einem beliebigen Digital-Stellpult.
• Eingabe der Lokdaten über Fahrpult CONTROL	• Einstellen der Adresse: mit Programmiertaste am k 74 und KEYBOARD. • Adreßbereich: 1 . 64 • Maße: 100x54x25mm	• Einstellen der Adresse: an achtpoligem Codier-schalter. • Adreßbereich: 1 . 64
	Entfällt	

11. Bisherige Spur 1- und HO-Zweileiter-Geräte

1 Bisherige Komponente	Beschreibung	Ersetzt durch
6085 Lokdecoder c 85 Digital-Lokdecoder Für einmotorige Märklin 1-Lokomotive n.	Einsatz mit Zentraleinheit: CENTRAL CONTROL 1 (6030). **a** Fünf Lokfunktionen. 1 Ansteuerbar durch: CENTRAL CONTROL 1 (6030), CONTROL 80 F (6036), INFRA CONTROL 80 F (6070/6071), INTERFACE (6050/51): bisher nur eingeschränkt nutzbar.	Einsatz mit Zentraleinheit: CONTROL UNIT (6021). 1 Fünf Lokfunktionen. 1 Ansteuerbar durch: CONTROL UNIT (6021), CONTROL 80 F (6036), INFRA CONTROL 80 F (6070/6071), INTERFACE (6050/51): voll nutzbar.
6095 Lokdecoder c 95  Für einmotorige Märklin 1-Lokomotiven.	• Einstellen der Lokadressen: ferngesteuert mit PROGRAMMER (6032). • Adrel3bereich: 01 . **99** • Maße:6lx5Ox5mm	• Einstellen der Lokadressen: direkt an achtpoligern Codierschalter. 1 Adreßbereich: 01 . 80
6086 DECODER k 86 Digital-Decoder zum Schalten von Magnetartike In bei Spur 1 Für Märklin Spur 1-Anlagen. Vier Ausgänge für	zweispulige Magnet-artikel (Weichen, Signale, Entkupp-lungsgleise). • Einsatz mit Zentraleinheit: CENTRAL CONTROL 1 (6030). • Schaltbefehle: von einem beliebigen Digital-Stellpult. • Einstellen der Adresse: mit Programmiertaste am k 86 und KEYBOARD. • Adreßbereich: 1 . 64 • Maße: 100 x 54 x 25 mm	**6083 DECODERk83** Vier Ausgänge für zweispulige Magnetartikel. $ Einsatz mit Zentraleinheit: CONTROL UNIT (6021). • Schaltbefehle: von einem beliebigen Digital-Stellpult. • Einstellen der

1 Bisherige Komponente	Beschreibung	Ersetzt durch
Adresse: an achtpoligem	Codierschalter. • Adreßbereich: 1 .64, für 256	Magnetartikel

11.3. Digital components for HO Zweileiter layouts

Art.-Nr.
Designation

2627
Digital entrance packing

6016
BOOSTER =
Description

Digital entrance packing
Only for H0-Zweileiter-Anlagen.

Contents:
o a CENTRAL CONTROL = (central processing unit with inserted driving desk),
o a Tenderlok BR 86 with TELEX clutches. Digital achievement amplifier only for H0-Zweileiter-Anlagen.
o connection: over adaptor cables at cent RAL UNIT = (6027) or CENTRAL CONTROL = , further BOOSTERS = (6016).
o mass: 140 x 120 x 80 mm

6027
CENTRAL UNIT =

Digital central processing unit
Only for HO Zweileiter layouts.

o Anschlussmaeglichkeiten: BOOSTER = (6016), all digital driving desks, all digital placing desks.
o mass: lÔxlÒx8Omm

11. Bisherige Spur 1- und HO-Zweileiter-Geräte

Art.-Nr.

Designatio

desk

Only for H0-Zweileiter-Anlagen.

From two-leader starting packing. Individually not available.

- Anschlussmaeglichkeiten: BOOSTER = (6016), all digital driving desks, all digital Stellpulte.
- o mass: lÔxlÒx8Omm

6032

PROGRAMM ER

n

Programming and reader for H0-Zweileiter-Lokomotiven with locomotive decoder c 82 (6082).

o Codiermaeglichkeiten: Locomotive address, starting tension, starting and Bremsverzaegerung.
o input of the locomotive data over driving desk CONTROL 80 F.
o key for the selection of the locomotive data.
o mass: 135 x 120 x 80 mm

6074

DECODER k 74

CENTRAL CONTROL = Description

Digital-Decoder zum Schalten von Dauerströmen Für H0-Zweileiter- und Märklin Spur-1-Anlagen.

Vier Schaltausgänge für Beleuchtungen oder Motoren.

- Einsatz mit Zentraleinheit: CENTRAL UNIT = (6027), CENTRAL CONTROL = oder CENTRAL CONTROL 1 (6030).
- Schaltbefehle: von einem beliebigen Digital-Stellpult.
- Einstellen der Adresse: mit Programmiertaste am k 74 und KEYBOARD.
- Adreßbereich: 1 . 64
- Maße: 100x54x25mm

Central processing unit with inserted driving

Art.-Nr.
Designation

6082
Lokdecoder c 82

6087

1 Bisherige Komponente	Beschreibung	Ersetzt durch
DECODER k 87 Description	o a locomotive auxiliary function. o controllable through: arbitrary digital driving desk. o adjusting the locomotive address: remote controlled with PROGRAMMER (6032). o address range: 1 - 99 o mass: 36 x 21 x 9 mm	
Digital-Lokdecoder Für HO-Lokomotiven mit Gleichstrommotor.	Digital decoder for switching from magnet articles for H0-Zweileiter-Anlagen. Four exits for zweispulige magnet articles (switches, signals, uncoupling tracks).	
o employment with central processing unit: CENTRAL UNIT = (6027) or CENTRAL CONTROL	o employment with central processing unit: CentRAL UNIT = (6027) or CENTRAL CONTROL o of switching commands: of any digital placing desk o adjusting the address: with programming branch at the k 87 and KEYBOARD. o address range: 1 - 64 o mass: 100 x 54 x 25 mm	

12. Tables

12.1. Standard coding of the HO digital locomotives

In this list the novelties are contained already 1994.

Art Nr	Baureihe	Adresse	Codierschalter ON	Funktion
2602	89	20	3 ___7_	Beleuchtung ein-aus
2602	260	10	2 3 __6 7_	Telex
2610	216	20	3 ___7_	Change light
2620	260	10	2 3 __6 7_	Telex
2647	schw. Güterzug	70	2 __6__	Change light
2660	Bayernzug	52	2 8	Change light
2662	Neue Farben	15	1 __6 7_	Change light
2663	Autozug	70	2 __6__	Change light
2664	Lollo	22	2 4 __7_	Change light
2665	Reichsb.	75	1 4____	Change light
2666	Junkers-Zug	80	1 3 _5_7_	Change light
2667	LH Airport	17	6 7_	Change light
2668	LI-1 Airport	15	1 __6 7_	Change light
2670	SJ-Holzzug	04	2 4 5_7_	Change light
2680	König Ludwig	77	fest codiert	Change light
2690	Post-Zug	26	7_	Change light
3600	03	03	1 4 5_7_	Change light
3600	86	08	_5_7_	Change light
3600	E 04	04	2 4 5_7_	Change light
3602	53	07	2 _5_7_	Change light
3603	Micheline	08	fest codiert	Interior lighting
3604	80	80	1 3 _5_7_	Change light
3605	RBe 2/4	24	1 7_	Beleuchtung ein-aus
3607	T 18	19	2 3 ___7_	Change light
3608	Posttriebwagen	30	1 4 5__8	ges. Beleuchtung
3609	T 18	18	1 3 ___7_	Change light
3610	012	01	2 3 _5_7_	Rauch÷Lichtwechsel
3611	C	02	3 _5_7_	Licht ein-aus
3614	C schwarz	03	1 4 5_7_	Licht ein-aus
3615	50	06	1 _5_7_	Rauch÷Licht ein-aus
3618	18.4	09	1 3 __6 7_	Rauch+Licht ein-aus
3623	Re 4/4	44	6_8	Change light
3624	Micheline	62	fest codiert	Interior lighting
3625	7200	72	1 3	Change light
3628	E 91	28	2 3 _5__8	Change light
3629	191	19	2 3 ___7_	Change light
3630	Re 4/4	45	1 3 ____8	Change light

1 Bisherige Komponente		Beschreibung								Ersetzt durch
3631	361	61	–	2	–		–	5	– – –	Telex
3634	BB 26 000	26						7	–	Change light
3636	Ae 6/6 rot	66	1	–	–		4	– 6	–	Change light
3638	Ae 6/6 grün	38	–	–	3	–	–	6	– 8	Change light
3640	110	11	–	–	3	–	–	6	7 –	Change light
3642	111	11	–	–	3		– –	6	7	Change light
3646	236	23	–	–	–			4	– – 7 –	Lighting in-out
3647	212	20	–	–	3		– – –	7		Change light
3649	F 7	07	–	2	–			– 5	– 7 –	Change light
3650	Ae 6/6	66	1	–	–			4	– 6 – –	Change light
3652	Ce 6/8	69	1	–	–			– –	6 – –	Change light
3653	120	12	1	–	–			4	– 6 7 –	Change light
3654	120.1	14	–	–	–			4	– 6 7 –	Change light
3655	111	13	–	2	–			4	– 6 7 –	Change light
3656	Ce 6/8	67	–	2	–			4	– 6 – –	Change light
3657	103	10	–	2	3			– –	6 7 –	Change light
3658	103	16	–	2	–			– –	6 7 –	Change light
3660	111	17				6	7	–		Change light
3662	F 7 3fach	07	–	2	–			– 5	– 7 –	Change light
3663	F 7 3fach	07	–	2	–			– 5	– 7 –	Change light
3664	260	26				7	–			Telex
3665	260	10	–	2	3			– –	6 7 –	Telex
3667	E 18 bl/be	67	–	2	–			4	– 6 – –	Change light
3667	E 18 metall	67	–	2	–			4	– 6 – –	Change light
3670	D 109	04	–	2	–			4 5	– 7 –	Change light
3671	ICE	41	–	–	–			4	– 6 – 8	Change light
3672	212	21	1	–	–			4	– – 7 –	Change light
3674	216	20	–	–	3			– – –	7 –	Change light
3676	VT628	62	–	–	–			– 5	– – –	Interior lighting
3679	Lollo Ep. 4	22	–	2	–			4	– – 7 –	Change light
3680	Köf	59				fest codiert				Flight compartment lighting
3681	V221 blau	22	–	2	–	4	– –	7		Change light
3682	V221 rot IV	21	1	–	–	4	– –	7		Change light
3682	V221 rot III	21	1	–	–	4	– –	7		Change light
3683	LAG	79				fest codiert				Light in-out
3684	050	05	–	–	–		4 5	– 7 –		Smoke-light in out
3685	PTT	30	1	–	–	4	5	– –	8	ges. Lighting
3686	98.3 gr.	76				fest codiert				Light in-out
3687	98.3	77				fest codiert				Light in-out
3688	DHG	70	–	2	–			– –	6 – –	Change light
3689	Posttriebw.	30	1	–	–		4 5	– –	8	ges. Lighting
3690	01.10	01	–	2	3			– 5	– 7 –	Change light
3696	086	08	–	–	–			– 5	– 7 –	Telex
3700	ICE Amtrak	70	–	2	–	–	–	6	–	Change light Innenbeleuchtung
3703	78	18	1	–	3	–	– –	7		Change light

1 Bisherige Komponente **Beschreibung** **Ersetzt durch**

Art Nr	R~tirp~h~~	Adrc~~~	C'nd	~r	r'haltør ON	Funktinn
3704	80	80	1	3	5 7	Change light
3709	85	08			5 7	Telex
3710	012	01	2	3	5 7	Smoke+Light
3715	52	52	2	8		Change light
3722	E 194 DB	19	2	3	7	Change light
3736	Ae 6/6	66	1		4 6	Change light
3737	Ae 6/6	65		3	6	Change light
3739	Ae 6/6	65		3	6	Change light
3742	212 (112)	20		3	7	Change light
3743	BR 243/1 43	43	2		6 8	Change light
3748	E 70 DB	70	2		6	Change light
3756	CE 6/8 II	68			4 6	Change light
3760	RE 4/4 VI	46	2	3	8	Change light
3763	465 BLS	46	2	3	8	Change light
3767	E18 grün	18	1	3	7	Change light
3768	E18 blau	18	1	3	7	Change light
3769	E 19 DRG	19	2	3	7	Change light
3770	ICE	70	2		6	Change light / Interior lighting
3776	VT 610	61	2		5	Change light'Interior lighting
3780	220	22	2		4 7	Change light
3782	221	21	1		4 7	Change light
3789	03.10	03	1		4 5 7	Change light
3790	01	01	2	3	5 7	Change light
3791	03.10 DRG	31	2		4 5 8	Change light
3792	41	41			4 6 8	Change light
3793	52	52	2	8		Change light
3795	003	03	1		4 5 7	Change light
3796	96	09	1	3	6 7	Change light
3797	B VI Bayern	70	2		6	Change light
4998	Dance Car	20			firmly codes	Music, Tanzpaare etc.
4999	Waiter cars	10			firmly codes	Waiter, Light etc.
7651	Jib Crane	30	1		4 5 8	Tricks, Lift etc.

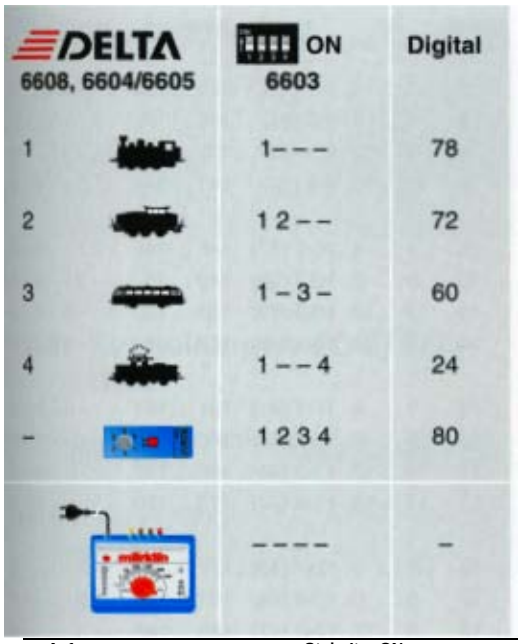
12.2. Standard coding of the Märklin 1-Lokomotiven (Motorola format)

Art.-Nr.	Baureihe	Adresse	C	er	c	te	O	Betriebsart	Funktion
85504	RAG-Loco	80	1		5		7	AC	Lighting
5558	Ranking crocodile	68			4		6 AC		Lighting
5571	218	18	1	3			7	AC	Lighting

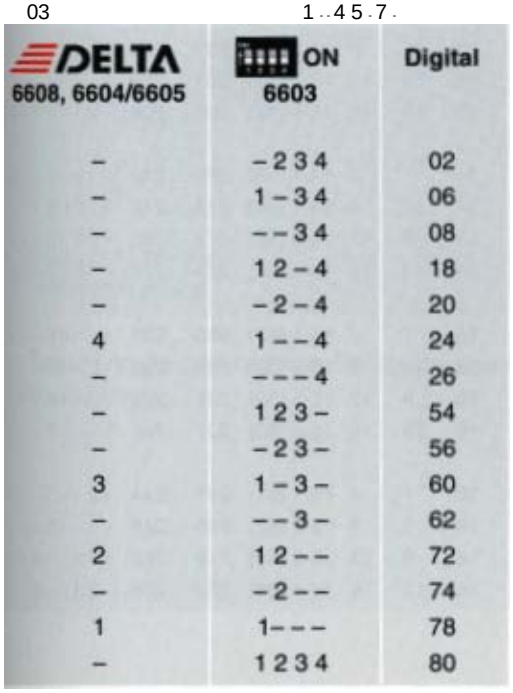
To all locomotives with 6090/6095 the following work basic adjustments apply: Maximum speed: maximally start /Bremsverzaegerung: middle position

12.2. Coding of the Märklin 1- Locomotives 217

12.3. Coding table digital locomotive addresses



Ac1r~s~~	St~h~lt~r ON
01	.2 3 .5 .7 .
02	..3 .5 .7 .
03	1 ..4 5 .7 .



04	.2 .4 5 .7 .
05	...4 5 .7 .
06	1 ...5 .7 .
07	.2 ..5 .7 .
08	....5 .7 .
09	1 .3 ..6 7 .
10	.2 3 ..6 7 .
11	..3 ..6 7 .
12	1 ..4 .6 7 .
13	.2 .4 .6 7 .
14	...4 .6 7 .
15	1 ....6 7 .

Kind NR series address coding	
16	.2 ...6 7 .
17	6 7 .
18	1 .3 ...7 .
19	.2 3 ...7 .
20	..3 ...7 .
21	1 ..4 ..7 .
22	.2 .4 ..7 .
23	...4 ..7 .
24	1 7 .
25	.2 ....7 .
26	7 .
27	1 .3 .5 ..8
28	.2 3 .5 ..8
29	..3 .5 ..8
30	1 ..4 5 ..8
31	.2 .4 5 ..8
32	...4 5 ..8
33	1 ...5 ..8
34	-2-- 5- -8
35	----5-- 8
36	1 .3 ..6 .8
37	.2 3 ..6 .8
38	..3 ..6 .8
39	1 ..4 .6 .8
40	.2 .4 .6 .8

Adr~s~P	Sr~h~lt~r ON
41	...4 .6 .8
42	1 ....6 .8
43	.2 ...6 .8
44	6 .8
45	1 .3 8
46	.2 3 8
47	--3---- 8
48	1 ..4 ...8
49	.2 .4 ...8
50	...4 ...8
51	1 8
52	.2 8
53	8
54	1 .3 .5 ...
55	.2 3 .5 ...
56	..3 .5 ...
57	1 ..4 5 ...
58	.2 .4 5 ...
59	...4 5 ...
60	1 ...5 ...
61	.2 ..5 ...
62	....5 ...
63	1 .3 ..6 ..
64	.2 3 ..6 ..
65	..3 ..6 ..
66	1 ..4 .6 ..
67	.2 .4 .6 ..
68	...4 .6 ..
69	1 ....6 ..
70	.2 ...6 ..
71	6 ..
72	1 .3
73	.2 3
74	..3
75	1 ..4 ....
76	.2 .4 ....
77	...4 ....
78	1
79	.2
80	1 .3 .5 .7 .

1 Bisherige Komponente Beschreibung Ersetzt durch

12.5. Standard coding of the DELTA locomotives

291 5	89	78	1	–	–	–	
291 6	89	78	1	–	–	–	
296 3	81	78	1	–	–	–	
297 4	RE4/4	24	1	–	–	4	
297 7	ICE	60	1	–	3	–	
298 3	216	72	1	2	–	–	
298 6	ICE	60	1	–	3	–	
333 1	140	24	1	–	–	4	
337 4	216	72	1	2	–	–	
339 5	03	80	1	2	3	4	
339 6	86	78	1		–	–	
342 8	515	60	1	–	3	–	
343 0	RE4/4	24	1	–	–	4	
345 9	8OSNCB	72	1	2	–	–	
346 4	260	72	1	2	–	–	

Attitudes for DELTA or digital enterprise

All DELTA locomotives are equipped starting from production 03/94 with a DELTA module, which is delivered in position „ Alternating current, conventionally " (all four switches in position „0FF ").

Art.-Nr.	Baureitle
3326	1700
3351	Ae3/6‘
3393	52 DRG
3404	80
3413	131TA
3415	52
3423	T141
3424	1100
3441	143
3442	212
3446	236
3458	1043

Art.~Nr.	Baureihe
3467	S.55
3468	1800
3469	E19

Attitude only for digital enterprise

3473	211
3474	133
3476	610
3489	0310
3496	96
83307	T18
83443	143
83463	460
83496	96

1 Bisherige Komponente **Beschreibung** **Ersetzt durch**

12.6. Coding table for DECODER k 83, k 84, (k 73)

Stellpult Nr.	Tasten Nr.	Decoder Nr.	fortlaufende Address	Code switch ON
1	1... 4	1-1(1)	1.. 4	-23-5-7-
1	5... 8	1-2(2)	5... 8	--3-5-7-
1	9.12	1-3(3)	9... 12	1--45-7-
1	13...16	1-4(4)	13... 16	-2-45-7-
2	1... 4	2-1 (5)	17... 20	..-45-7-
2	5... 8	2-2(6)	21... 24	1---5-7-
2	9...12	2-3(7)	25... 28	-2- -5-7-
2	13...16	2-4(8)	29... 32	----5-7-
3	1 ... 4	3-1 (9)	33... 36	1-3- -67-
3	5... 8	3-2(10)	37... 40	-23- -67-
3	9.12	3-3(11)	41... 44	--3--67-
3	13.16	3-4(12)	45... 48	1- -4-67-
4	1... 4	4-1(13)	49... 52	-2-4-67-
4	5... 8	4-2(14)	53... 56	..-4-67-
4	9 ... 12	4-3 (15)	57 ... 60	1 ....67 -
4	13.16	4-4(16)	61... 64	-2-- -67-
5	1... 4	5-1 (17)	65... 68	67-
5	5... 8	5-2(18)	69... 72	1-3---7-
5	9...12	5-3(19)	73... 76	-23-- -7-
5	13 ... 16	5-4 (20)	77 ... 80	.-3- .. 7-
6	1... 4	6-1(21)	81... 84	1--4--7-
6	5... 8	6-2(22)	85... 88	-2-4--7-
6	9 ... 12	6-3 (23)	89 ... 92	...4 ..7 -
6	13 ... 16	6-4 (24)	93 ... 96	1 7 -
7	1 ... 4	7-1 (25)	97 ... 100	- 2 ....7 -
7	5... 8	7-2(26)	101 ...104	7-
7	9.12	7-3(27)	105...108	1-3-5--8
7	13... 16	7-4(28)	109...112	-23-5- -8
8	1... 4	8-1(29)	113.116	--3-5--8
8	5 ... 8	8-2 (30)	117 ... 120	1 ..45 ..8
8	9.12	8-3(31)	121...124	-2-45--8
8	13... 16	8-4(32)	125.128	---45- -8

Stellpult Nr.	Keys Nr.	Decoder Nr.	Sequential Addresses	Code switches ON
9	1 ... 4	9-1 (33)	129...132	1-- -5- -8
9	5... 8	9-2(34)	133.136	-2- -5- -8
9	9 ... 12	9-3 (35)	137 ... 140	....5 ..8
9	13...16	9-4(36)	141.144	1-3--6-8
10	1 ... 4	10-1 (37)	145.148	-23- -6-8
10	5 ... 8	10-2 (38)	149 ... 152	..3 ..6 .8
10	9...12	10-3(39)	153...156	1--4-6-8
10	13.16	10-4(40)	157...160	-2-4-6-8
11	1... 4	11-1 (41)	161 ...164	---4-6-8
11	5... 8	11-2(42)	165.168	1----6-8
11	9.12	11-3(43)	169.172	-2-- -6-8
11	13.16	11-4(44)	173...176	6-8
12	1... 4	12-1 (45)	177.180	1-3- ---8
12	5... 8	12-2(46)	181 ...184	-23--- -8
12	9 ... 12	12-3 (47)	185 ... 188	..3 8
12	13...16	12-4(48)	189...192	1- -4-- -8
13	1 ... 4	13-1 (49)	193.196	-2-4-- -8
13	5 ... 8	13-2 (50)	197 ...200	...4 ...8
13	9 ... 12	13-3 (51)	201 ... 204	1 8 - 2 8
13	13 ... 16	13-4 (52)	205 ..208	
14	1 ... 4	14-1 (53)	209...212	8
14	5... 8	14-2(54)	213...216	1-3-5---
14	9... 12	14-3(55)	217...220	-23-5- ..
14	13 ... 16	14-4 (56)	221 ...224	.-3- 5 ...
15	1 ... 4	15-1 (57)	225...228	1- -45---
15	5... 8	15-2(58)	229...232	-2-45- ..
15	9...12	15-3(59)	233...236	---45---
15	13 ... 16	15-4 (60)	237 ...240	1 ...5 ...
16	1 ... 4	16-1 (61)	241 ...244	-2- -5---
16	5 ... 8	16-2 (62)	245 ...248	....5 ...
16	9... 12	16-3(63)	249...252	1-3- -6--
16	13 ... 16	16-4 (64)	253 ... 256	.23 ..6 ..

12.7. Auxiliary coding with the installation decoder k 73

Tas	ten	Stellpult	Soldering surfaces	bridges
1,	5, 9, 13		9	10
2,	6, 10, 14		¯	10
3,	7, 11, 15		9	¯
4,	8, 12, 16		¯	¯

12.8. Attitudes CONTROL UNIT

Enterprise on	Coding scarf	1er ON
H0- Neutral conductor layout	¯ ¯¯	¯
Spur 1- layout	1 2 3	¯

12.9. Coding table MEMORY

Memory Nr.	Code switches ON
1	¯ —xx
2	1 —xx
3	¯ 2xx
4	1 2xx
without bolting device	x x ¯¯
with bolting device	x x 3 4

x: Switching position is for this attitude without meaning

12.1O. Coding table KEYBOARD/ SWITCHBOARD

Control panel Nr.	Code	switch ON
2	1	¯¯
3	¯	2——
4	1	2——
5	¯	—3—
6	1	—3—
7	¯	23—
8	1	23—
9		——4
10	1	——4
11	¯	2—4
12	1	2—4
13	¯	—34
14	1	—34
15	¯	234
16	1	234

1 Bisherige Komponente **Beschreibung** **Ersetzt durch**

13. Stichwortverzeichnis

12.11 . Table capacity rating

On the basis the following tables you can calculate the power demand of your layout. Details you find in chapter 3.4, „ Power demand to a layout " starting from page 50. You make yourselves before filling out the table a copy best.

l2,
64,
111,
64,
111,

Gerät	**Anzahl**	**Durchschnitts-verbrauch**	**Anzahl x Durch-schnittsverbrauch**
At the same time driving locomotives		x **10 VA**	**VA**
Smoke generator		x 5 VA	= VA
Lit up car: òder3 lamps		x 3—4,5VA	= VA
House lighting		x 1,5 VA je Lampe	= VA
Lit up switches and signals		x 1,5 VA	= VA
Switch in the Switching moment (1 per magnet article electric circuit)		x 8 VA	= VA
CONTROL 80 F		x 0,3 VA	= VA
CONTROL 80		x 0,8 VA	= VA
INTERFACE		x 1,5VA	= VA
KEYBOARD		x 1 VA	= VA

),
90,
102,
124,
125,

SWITCHBOARD		x 1,5VA	= VA
MEMORY		x 0,3VA	= VA
Acknowledging modules s 88		x 0,1 VA	= VA
Turntable		x 1OVA	= VA
Jib crane		x 5VA	= VA
Other engines		x	= VA
	Sums total consumption		= **VA**

The number of necessary BOOSTERS results from the following calculation:

87, 89,
191,

Total consumption	Achievement one BOOSTERs	Number BOOSTER
VA	:47VA	=

Total consumption divided by the power output of a BOOSTERs results in an odd number. This number rounded off supplies the number of BOOSTERS

Art.-Nr. Seite

1 Bisherige Komponente	Beschreibung		Ersetzt durch
		6035	116, 194
		6036	113, 115, 194
		6038	130, 175, 195
Art.-Nr.	Seite	6039	130, 175, 195
0710	38	6040	129, 131, 195
0720	38	6041	174, 196
2260	140	6043	177, 196
2261	138	6050	179, 197
2264	138	6051	179, 197
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1 Bisherige Komponente **Beschreibung** **Ersetzt durch**

1 Bisherige Komponente	Beschreibung	Ersetzt durch