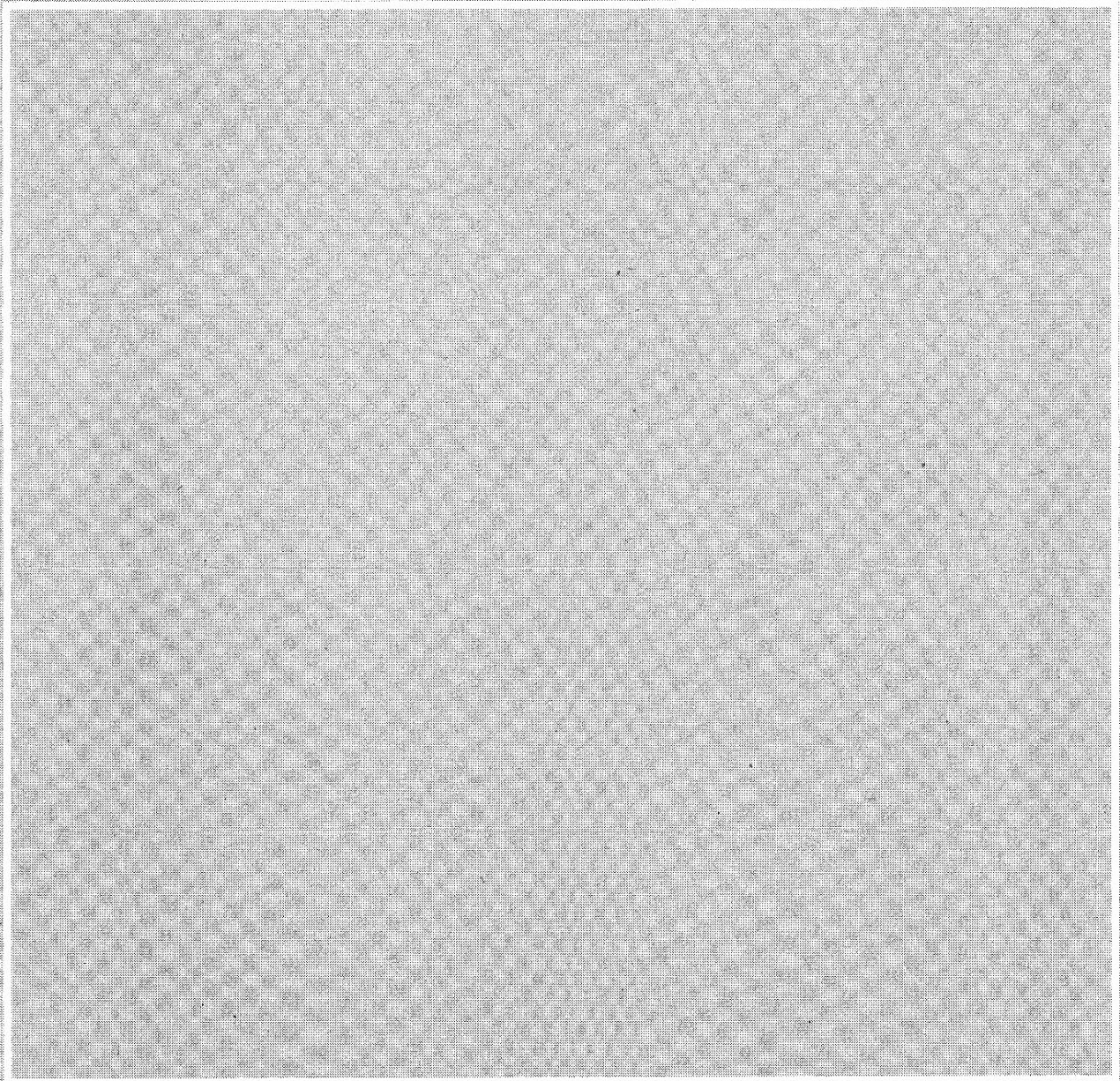


märklin
digital



interface

6051

Märklin Digital mit Computeranschluß

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1. General Information

The Interface is the link for controlling a Märklin digital layout with a computer. The following conditions must be met with the computer.

- a. The computer must have a serial interface that can be set for the parameters given.
- b. The computer must use the MS-DOS operating system or a compatible operating system in order to be able to use the demo diskette included with the Interface.
- c. The computer must have a serial, 9-pin RS-232 port in order to make connections to the cable that comes with the Interface.

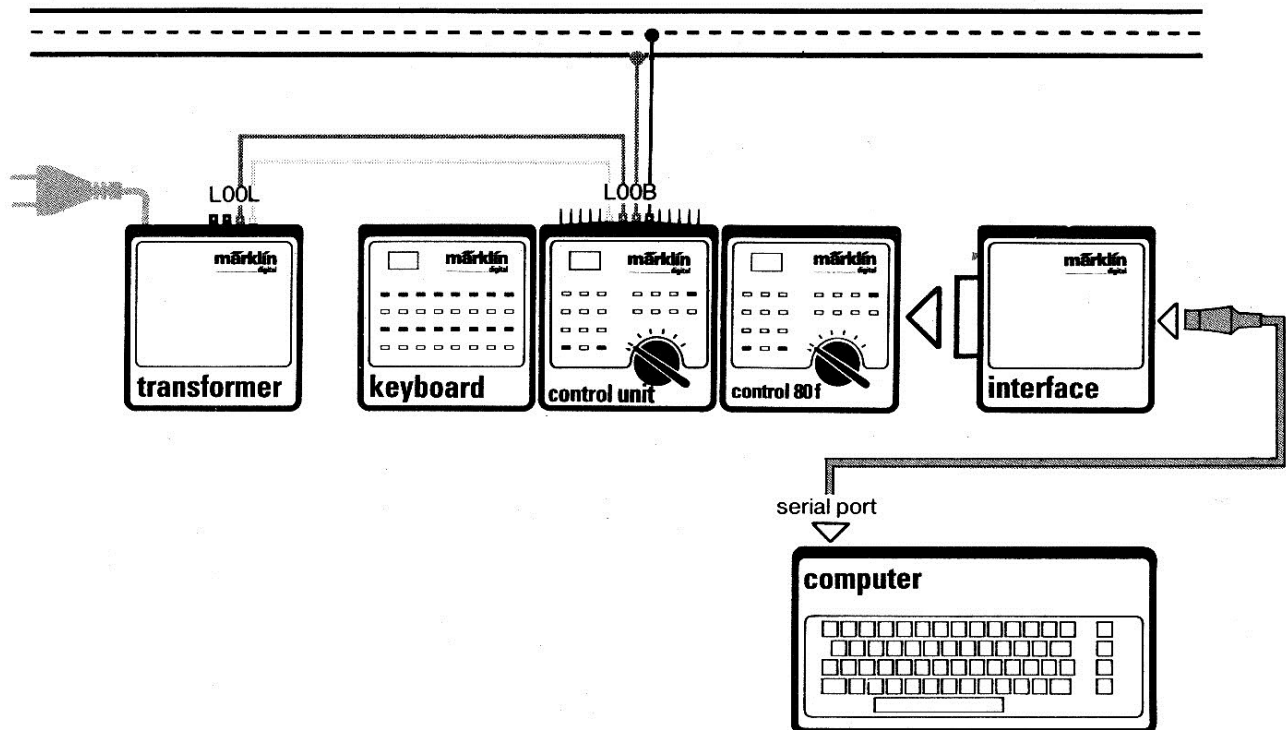
All 80 locomotive addresses, 256 accessory addresses can be controlled through the computer, and up to 496 contacts can be queried about their status (free/occupied). Four auxiliary functions on the 80 locomotives addresses can be switched on when using the 6021 Control Unit, the 6020 Central Unit or the Central Control from the 2601/2602 or the 2610/2612 sets. Additional control components are not required. It is advisable to have at least one control component with a Stop button, so that the digital layout can be halted in the event of a malfunction of the computer.

2. Installing the Interface

2.1 Hooking up the unit

The Interface is plugged into the right side of the Control Unit, The Central Unit or a locomotive controller connected the aforementioned units. There is no multi-pin connection on the right side of the Interface for additional control components. For that reason the Interface must always be the last component connected on the right side.

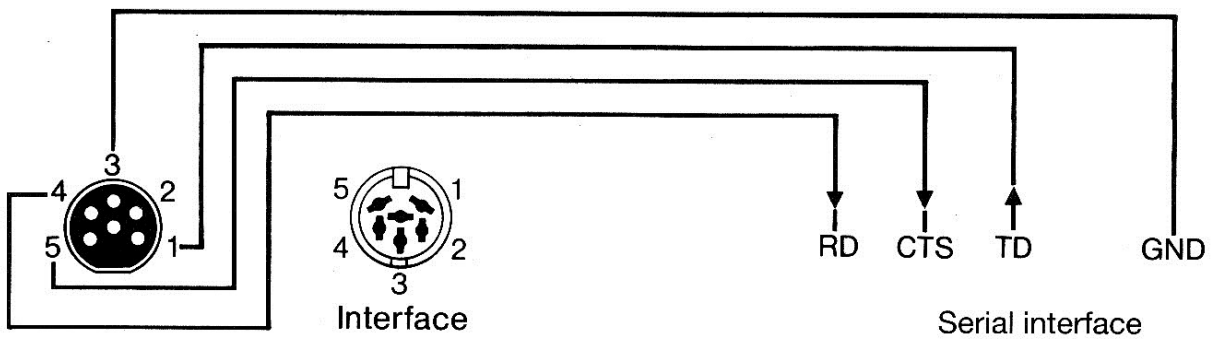
Tip:
The Interface may be connected only to the right side of the Control Unit. If the Interface is connected, for example, with an extension cable to the left side (Keyboard connection), this will lead to damage in all of the digital components connected to the control panel.



2.2 Hooking up the connecting cable

Included with the Interface is a serial connecting cable to the computer. Plug the 6-pin DIN plug into the socket on the right side of the Interface.

The other end of the connecting cable has a 9-pin plug for an RS-232 C Interface connection in the computer.

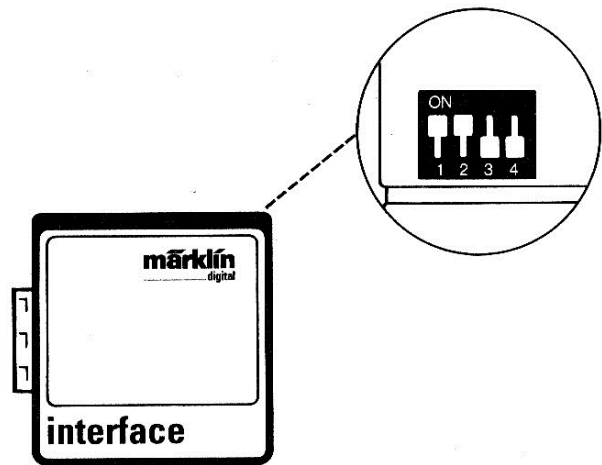


Contact no.	Designation	Function	
1	TD	TRANSMIT DATA	- Data line from computer to Interface
2	--	not used	
3	GND	GROUND	
4	RD	RECEIVE DATA	- Data line from Interface to computer
5	CTS	CLEAR TO SEND	- Control line for Interface readiness to receive data

2.3 Setting the Interface parameters

Four coding switches are located on the back of the Interface for setting several Interface parameters on the computer.

Switch	for	Setting on	Setting off
1	TD	negative logic	positive logic
2	RD	negative logic	positive logic
3	CTS	negative logic	positive logic
4	GND	TTL level	RS 232 level (+/- 5 volts)



The correct setting for a computer with a standard RS 232 Interface is:

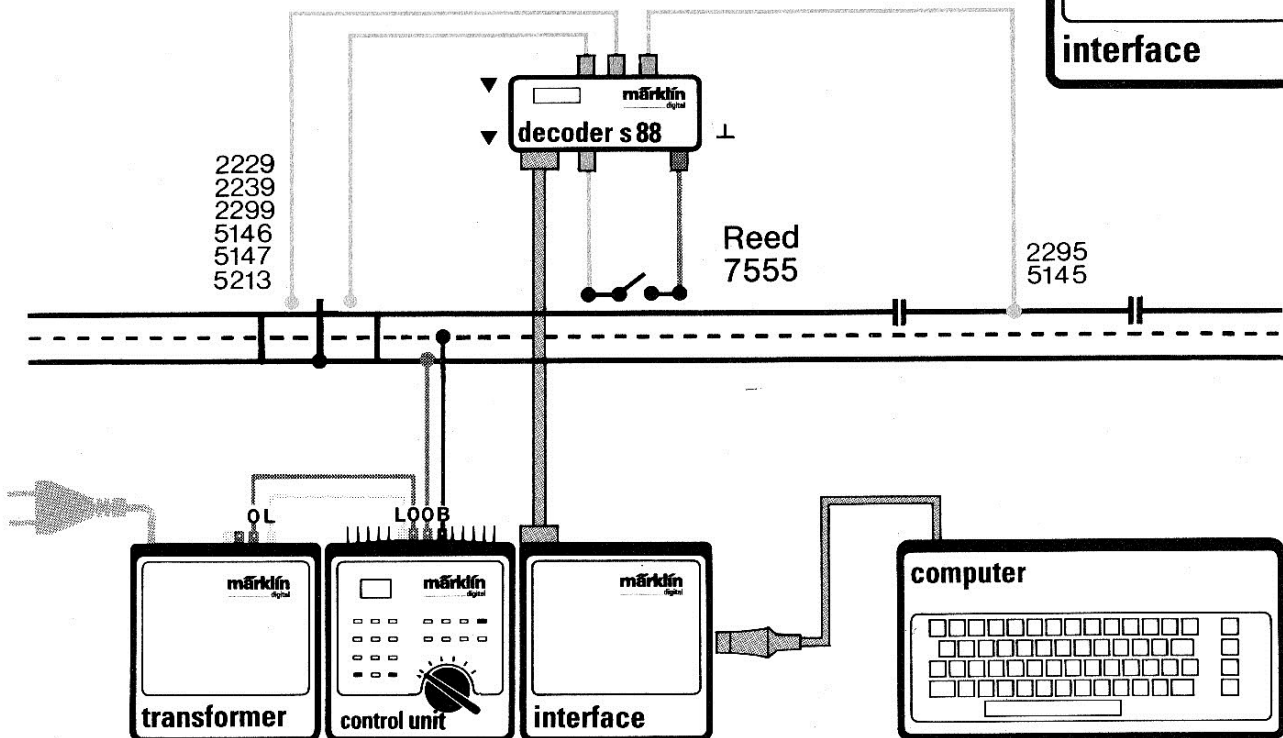
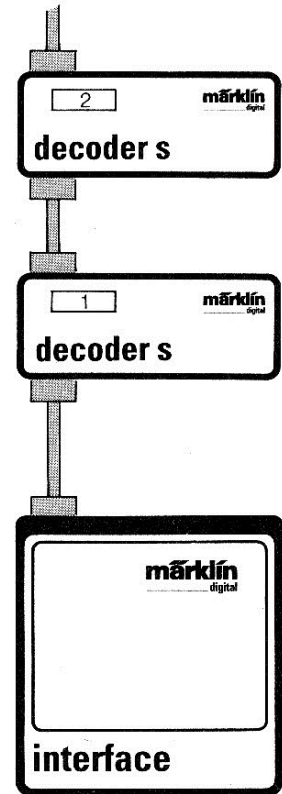
Switch	Setting
1	on
2	on
3	off
4	off

2.4 Connections for an s88 feedback module

The s88 feedback module (6088) has 16 contact inputs, each of whose status (contact occupied or free) can be reported back to the computer via the Interface. Up to 31 s88 feedback modules can be connected to an Interface. They are thereby numbered automatically in succession starting from the Interface.

The feedback module is suitable for direct connection with Märklin circuit tracks, reed contacts, and contact tracks.

The feedback module is connected to a special socket on the rear of the Interface with a special cable (included with the feedback module). The arrow imprinted on the feedback module must point in the direction of the Interface. When several feedback modules are used, they are connected one behind the other.



3. Control with a computer

The computer needs a program for control of the digital layout. In addition to the programs on the demo diskette, various vendors offer complete programs that can be used directly without a knowledge of programming. The programs are installed on the computer and then started by following the instructions provided by the vendors. Whoever wants to program his own software will find the appropriate control commands below.

3.1 Initialization

The serial interface on the computer must be set to the following parameters:

boud rate : 2400 bits/second
number of start bits : 1
number of stop bits : 2
number of data bits : 8
parity check : none

Example of initialization in Q Basic on a computer with MS-DOS:

```
OPEN "COM1: 2400,N,8,2,CS10000,DS" AS#1
```

Tip:

COM1 = serial interface 1
CS10000 = CTS is checked a maximum of every 10 seconds
AS#1 = input and output channel 1

3.2 Emergency stop

Sending the ASCII character (97) activates the emergency stop on the digital layout (corresponds to pressing the STOP button on the Control 80 f).

```
Q Basic: PRINT#1, CHR$(97);
```

Tip:

The semicolon must always be at the end of a print instruction, as otherwise the computer automatically sends the ASCII character (13) which is interpreted by the Interface as the start of a new command!

3.3 Release

Sending the ASCII character (96) activates the release on the digital layout (corresponds to pressing the GO button on the Control 80 f).

```
Basic: PRINT#1, CHR$(96);
```

Tip:

The release command is then also processed by the Interface, while the CTS line is switched to busy. Before the release command is sent, the CTS query shall be turned off in the computer.

3.4 The locomotive command

Two byte are sent one after the other as ASCII characters to change the direction of travel or speed of a locomotive or to turn on the auxiliary function.

First, an ASCII character (0 to 31) is sent, which contains the operating data. Second, an ASCII character (1 to 80) is sent with the address data.

The first character consists of the operating data and the switching data:

operating data = 0	: locomotive remains stopped
operating data = 1 to 14	: locomotive travels at speed 1 to 14
operating data = 15	: reverse direction command
switching data = 0	: auxiliary function is turned off
switching data = 16	: auxiliary function is turned on

Example:

A locomotive (address 23) is to operate at speed level 10 and the auxiliary function is to be turned on:

information character = $10 + 16 = 26$
address = 23

The ASCII characters (26) and (23) are sent one after the other.

Q Basic: PRINT#1, CHR\$(26)+CHR\$(23);

3.5 Switching special functions

The four additional functions on the Control 80 f locomotive controller can also be turned on from the computer. An information character and an address character are sent for this purpose in the same manner as a locomotive command.

The information character is calculated according to the following formula:

info character = $1*f1 + 2*f2 + 4*f3 + 8*f4 + 64$

f1, f2, f3, f4 = 1 when turned on
f1, f2, f3, f4 = 0 when turned off

Example:

Functions 2 and 3 are to be turned on a 1 Gauge locomotive (address 38).

info character = $1*0 + 2*1 + 4*1 + 8*0 + 64 = 70$
address = 38

The ASCII characters (70) and (38) are sent one after the other.

Q Basic: PRINT#1, CHR\$(70)+CHR\$(38);

3.6 Switching accessories

A data character and an address character are send out to control accessories.

information character = 34 : accessory is switched to branch/red

information character = 33 : accessory is switched to straight/green

address
= 0 to 255 :

accessory address.
The first Keyboard has
the addresses 1 to 16,
the second 17 to 32, etc.
The last address on the
sixteenth Keyboard is
not (256) but rather (0)
[The ASCII code only
goes to (255). Therefore,
the previously unneeded
value (0) is used for the
address (256).]

Example:

The turnout with the address (18) is to be
set for the straight side.

information character = 33
address = 18

The ASCII characters (33) and (18) are sent
one after the other.

Q Basic: PRINT#1, CHR\$(33)+CHR\$(18);

About 150 milliseconds (min. 80 – max.
10,000) later the switching procedure must
be ended by sending the character (32).
Example: Ending a switching procedure

information character = 32

The ASCII character (32) is sent.

Q Basic: PRINT#1, CHR\$(32);

3.7 Reading in feedback modules

In order to evaluate the feedback module,
an appropriate command stating what
data are required must first be communi-
cated to the Interface. The Interface then
sends the appropriate data in code to the
computer where they must be evaluated
correspondingly.

The command for reading in a particular
feedback module is calculated according
to the following formula:

ASCII character = $192 + x$

x = number of the feedback module to be
read in (1 to 31)

Example:

The third feedback module connected to
the system is to be read in.

The ASCII character to be sent is $(192 + 3)$.

Q-Basic: PRINT#1, CHR\$(195);
DO
LOOP UNTIL LOF(1) = 512

The command for reading several feed-
back modules is calculated according to
the following formula:

ASCII character = $128 + x$

x = number of the feedback modules
(1 to 31) to be read in

Example:

The first 4 feedback modules are to be
read in.

The ASCII character to be sent is (128 + 4).

```
Q-Basic: PRINT#1, CHR$(132);  
          DO  
          LOOP UNTIL LOF(1) = 512
```

For each feedback module 2 values are sent as ASCII code from the Interface to the computer. The first value gives the occupation of contacts 1 to 8, the second value give the occupaiton of contacts 9 to 16.

The ASCII value received must be changed into an eight digit base 2 number in order to receive the status of the individual contacts.

Example:

1. received value = 245

```
245 : 2 = 122 rest 1 : contact 1 = occupied  
122 : 2 = 61 rest 0 : contact 2 = free  
61 : 2 = 30 rest 1 : contact 3 = occupied  
30 : 2 = 15 rest 0 : contact 4 = free  
15 : 2 = 7 rest 1 : contact 5 = occupied  
7 : 2 = 3 rest 1 : contact 6 = occupied  
3 : 2 = 1 rest 1 : contact 7 = occupied  
1 : 2 = 0 rest 1 : contact 8 = occupied
```

2. received value = 24

```
24 : 2 = 12 rest 0 : contact 9 = free  
12 : 2 = 6 rest 0 : contact 10 = free  
6 : 2 = 3 rest 0 : contact 11 = free  
3 : 2 = 1 rest 1 : contact 12 = occupied  
1 : 2 = 0 rest 1 : contact 13 = occupied  
0 : 2 = 0 rest 0 : contact 14 = free  
0 : 2 = 0 rest 0 : contact 15 = free  
0 : 2 = 0 rest 0 : contact 16 = free
```

Sample programs can be found on the diskette included with the unit.

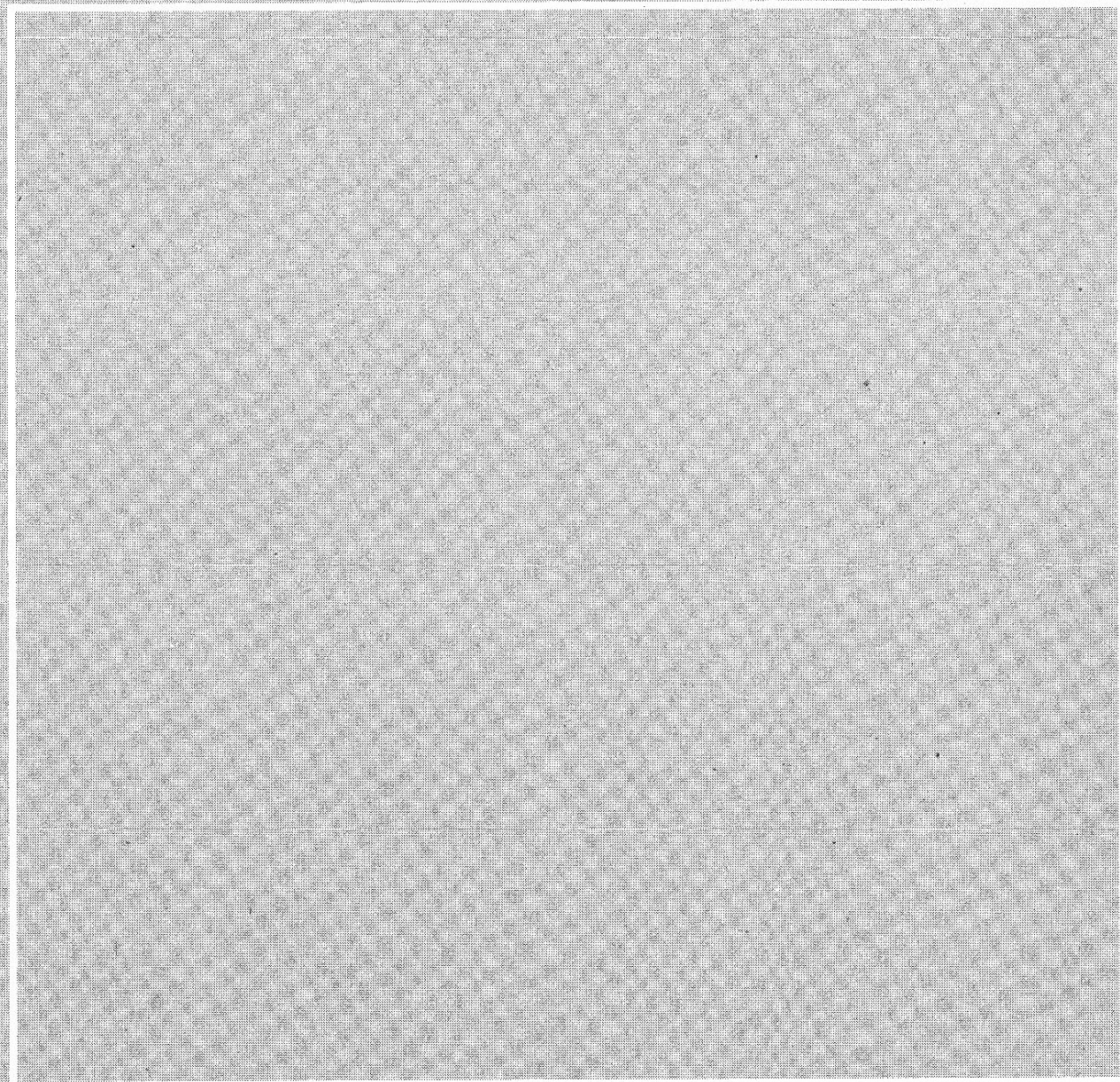
Radio Frequency Emission Notice

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. It is understood that the user may desire to supplement this product with additional equipment. The user should recognize that it is not possible to test all configurations of this product with all additional equipment. It is certain, however, that the supplementation of this product with additional digital equipment will increase the radiation of radio frequency energy. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Caution:

Changes or modifications of this product not expressly approved by Märklin, Inc. could void the user's authority to operate this product. The use of this product in accordance with the manufacturer's instructions has never been associated with harmful interference with electronic medical devices. However, because this product does emit radio frequency energy, its use in close proximity to an electronic medical device has the potential to result in irregular operation of the medical device. In the event that radio frequency interference with a medical device is suspected, the user should immediately cease operation of this product by removing the power source plug from the electrical outlet, and the individual using the medical device should contact his or her physician.



Gebr. Märklin & Cie. GmbH
Postfach 860
D-73008 Göppingen

662150 0297 se
Printed in Germany
Imprimé en Allemagne
Änderungen vorbehalten

Gedruckt auf 100 % Recycling-Papier