1 General

1.1 Introduction and Intended Use (Informative)

This standard describes an interface between a main module, hereinafter referred to as Host, and extension modules, hereinafter referred to as SUSI-Modules, installed in the model railway vehicles. These extension modules can be sound modules, extended function outputs or other function modules. The SUSI name is the abbreviation of: "Serial User Standard Interface".

The SUSI logo is a trademark of Dietz Elektronik GmbH & Co.KG. It can be used freely with compatible products.

1.2 References

This standard should be interpreted in the context of the following NMRA Standards, Technical Notes, and Technical Information.

1.2.1 Normative

When using the corresponding interface, the following standards must be complied:

- [S-9.1.1.5 / RCN-118] Next18 / Next18S - interface
- [S-9.1.1.3 / RCN-121] 121 21MTC – 21-pin interface
- [S-9.1.1.4 / RCN-122] PluX interface
- [S-9.4.3 / RCN-602] Configuration variables for SUSI

1.2.2 Informative

The standards and documents listed here are for information only and are not part of this standard.

- [RCN-212] DCC operating commands for vehicle decoders
- [S-9.2.1] DCC Extended Packet Formats
- [RCN-214] DCC configuration commands
- [RCN-226] DCC special values for configuration
- [S-9.2.1.1] DCC Adv Extended Packet Formats
- [S-9.2.2] DCC Configuration Variables
- [S-9.4.2 / RCN-601] SUSI bidirectional
- [S-9.2.2 Appendix A] Manufacturer ID codes as assigned by the NMRA.

1.3 Terminology

Term	Definition
HOST	Main module which generate the SUSI Clock
SUSI-Module	Extension module, controlled by the Host
Bit Character Definitions	The following characters are used to indicate the meaning of a bit: 0 Bit value 0 1 Bit value 1 D Data bit F Function enabled/Disabled bit L Binary states function bits (low byte) H Binary states function bits (high byte) X Direct command bits/ various bit values S Current byte bits R Direction bit G Normalized speed bits P Load state bits A Analog function value bits / Module address bits (high/low byte) B Module control byte bits V CV number bits K CV manipulation mode select bit

1.4 Requirements

To be compliant with this standard, all mentioned mechanical and electrical parameters as well as the defined commands must be respected (followed). It is not necessary to support all commands of the interface. This applies to both Host and SUSI-Modules. The description of the respective product should list the usable / necessary functions. A component tolerance of 10% is permissible for all resistance values mentioned.

2 Table of Contents

3 Document History

Date	Description
2025.06.25	First Draft

4 Mechanical properties

There are three different connector systems, which also differ in their electrical values.

Name	Plug Type	Load capacity
classicSUSI	JST *M04B-SRSS-TB	1000 mA
microSUSI	JST 04XSR-36S	200 mA
powerSUSI	WTB 2.0 5-pin version	2000 mA

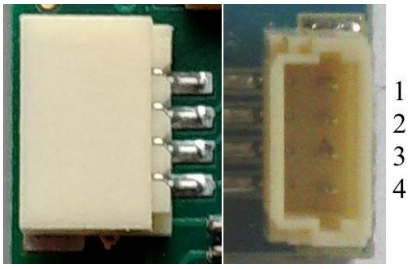
The "classicSUSI" interface is known since 2003, as it is mainly used for H0 models. The microSUSI interface is a smaller version introduced in 2017, e.g. for N size. The powerSUSI interface was added in 2018 for larger gauges and modules with higher current requirements. The three versions are described in more detail in the following sections. Alternatively, solder points instead of a connector can be provided for the connection. Additionally, it is also possible to connect a SUSI module to a second decoder interface in the vehicle according to [RCN-118] [RCN-121] or [RCN-122].

4.1 classicSUSI interface

The interface is using a 4-pin JST connector or compatible.

The recommended pin header on the Host side is "JST SM04B-SRSS-TB" (horizontal) or "JST BM04B-SRSS-TB" (vertical).

The matching cable connectors are "JST 04SR3S" or "JST SRH-04V-S-B". If the SUSI-Module also has a plug socket, the cabling is 1:1 (electrically symmetrical).

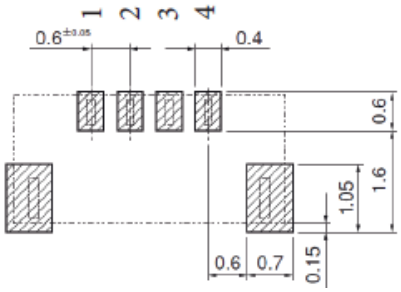


4.2 microSUSI interface

The interface is using a 4-pin JST connector or compatible.

The recommended pin header on the Host side is "JST SM04B-XSRS-ETB".

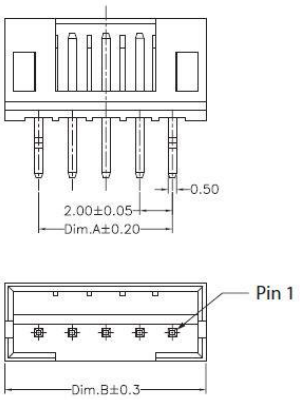
The matching cable connectors are "JST 04XSR-36S".

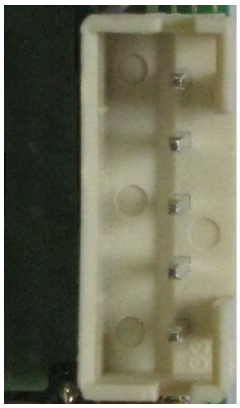


4.3 powerSUSI interface

The interface is using a 5-pin Würth Elektronik WR-WTB type connector or compatible, with 2.0 mm pitch. Plugs Types:

THT vertical	620 005 116 22
THT horizontal	620 005 117 22
SMT vertical	620 305 124 022
SMT horizontal	620 105 131 822





1 Trigger
2 GND
3 Data
4 Clock
5 V+

5 Electrical properties

5.1 classicSUSI interface

The maximum load of the classicSUSI interface is 1000 mA. The interface has four pins/poles:

1 Ground (decoder - after the bridge rectifier)

2 Data

3 Clock

4 V+ (decoder + after the bridge rectifier)

5.2 microSUSI interface

The maximum load of the microSUSI interface is 200 mA. The interface has four pin/poles:

1 Ground (decoder - after the bridge rectifier)

2 Data

3 Clock

4 V+ (decoder + after the bridge rectifier)

5.3 powerSUSI interface

The load capacity of the powerSUSI interface is a maximum of 2000 mA. The interface has five pins/poles:

1 Trigger (open collector signal or contact to ground for synchronization)

2 Ground (decoder - after the bridge rectifier)

3 Data

4 Clock

5 V+ (decoder + after the bridge rectifier)

With its higher load capacity, the powerSUSI interface is also suitable for steam generators. The additional trigger signal enables the steam bursts to be synchronized with the wheels without constantly sending trigger commands. The falling edge determines the sync point in time. The pull-up resistor for the open collector trigger signal is located on the SUSI module, it is connected to the V+ of the SUSI module and its value should be in the range of 4.7 kΩ to 22 kΩ.

5.4 Decoder interface

When using a second decoder interface in the vehicle to plug in a SUSI-module, the specifications in [RCN-118], [RCN-121] or [RCN-122] must be followed.

Signal	RCN-118 Next18 / Next18S	RCN-121 MTC21	RCN-122 PluX22
Ground	5 and 14	20	5
Data	13	6	4
Clock	4	5	3
V+	6 and 15	16	9

Only the four mentioned signals are connected directly to the decoder. In particular, the track connections are not connected when used as a SUSI interface. All other connections can be used for the functions of the SUSI module.

5.5 General electrical properties

Recommended cable colors for the 4-pin interfaces:

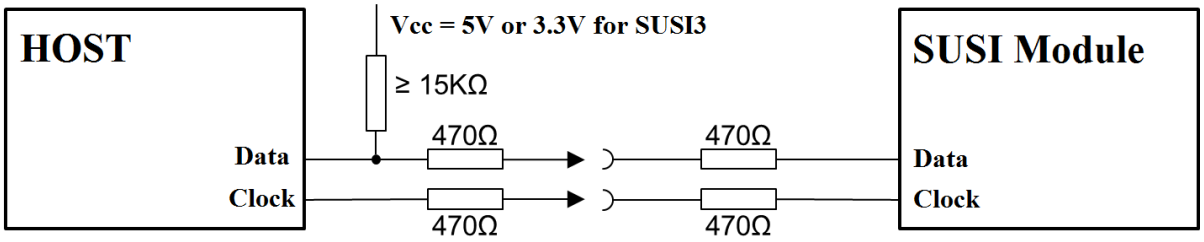
1 Ground	Black
2 Data	Gray
3 Clock	Blue
4 V+	Red

Up to 3 SUSI-Modules can be connected to one Host. The SUSI-Modules are all connected in parallel. For this purpose, corresponding adapter cables or distribution modules are required.

As concerns the load capacity, the following applies to all versions: If the load capacity of the Host is lower, this must be specified. At each SUSI-Module the maximum current consumption which flows over the bus connection must be defined. If more current is required in a SUSI-Module, this must be supplied with separate power supply. When connecting several SUSI-Modules to a Host, its total load capacity must not be exceeded.

A reverse polarity protection diode should be installed in series at the positive connection of the SUSI-Module to prevent a defect in case of reverse polarity.

A high logic level must not fall below the value of 0.7 × Vcc. Both lines contain series resistors of 470 Ω each at the Host and the SUSI-Module. The data line is pulled up with a resistor of ≥ 15 kΩ to Vcc on the Host.



5.6 Logic level at the interface

Levels corresponding to Vcc = 5V and Vcc = 3.3V are allowed. The following rules apply:

The supported levels must be specified in the instructions/manual.

Every SUSI-Module must tolerate 5V levels.

A SUSI-Module for microSUSI must also accept 3.3V levels.

A SUSI-Module that also accepts 3.3V levels can be labeled "SUSI3".

A Host that only supplies 3.3V level must be marked with "SUSI3". The only exceptions to this are hosts with a microSUSI socket.

For the user this means that only SUSI-Modules with "SUSI3" marking can be operated safely at a Host with "SUSI3" marking. If Host and SUSI-Modules with micoSUSI socket and plug are used, the compatibility is also ensured. If a Host with Vcc = 3.3 V should still deliver 5V levels, to be universally usable, a level shifter circuit is required. A suggestion can be found in Appendix E: Circuit example for decoders with Vcc = 3.3V.

6 Protocol

The data transmission is a synchronous unidirectional or half-duplex connection.

All packets are two times - or in exceptional cases three times - 8-bits. The clock is low in the inactive state. Data is sent on the rising edge of the clock and must be valid on the falling edge. Data must be read with the falling edge of the clock.

Future extensions may generally only be 2-byte packets. The mentioned exceptions are the commands that begin with the command code 0111-xxxx. These are the programming commands for CV manipulation with 3 bytes, adopted directly (1:1) from the DCC protocol.

The high or low period of the clock pulse must be at least 10 µs, the total period for a bit may only be a maximum of 500 µs. When reading a CV bank using SUSI BiDi commands, the total period for a bit may only be a maximum of 100 µs. The Host always supplies the clock pulse for data transmission. The first bit transmitted is the LSB (bit 0).

Since a single interference/perturbation pulse on the clock line leads to permanent shifting of the data during synchronous transmission, a special timing is used for synchronization.

At 8ms ±1 ms after a complete byte has arrived, all previously arrived bits are deleted, and the SUSI-Module is reset. This applies both within and outside a command sequence.

Individual bytes of a command must follow each other within 7 ms. Further commands can be sent seamlessly, i.e. without a time gap, if they follow the last byte of the previous command faster than 7 ms. Otherwise, the next command may not begin until 9 ms after the last transmitted byte.

For synchronization, the Host must insert a clock gap of at least 9 ms after every 20 commands. When reading a CV bank using SUSI BiDi commands, up to 50 commands can be transmitted without a pause.

Commands that expects a response must be confirmed by the SUSI-Module with an acknowledge ("ACK") if the response is positive by pulling the data line via the 470 Ω to ground. The acknowledge

must be at least 1 ms and maximum 2 ms long and must be completed at the latest 20 ms after the falling clock edge of the last bit. After 20 ms without a completed acknowledge, the Host may abort the command with a negative response. A Host must accept acknowledge pulses of 0.5 to 7 ms as valid. Shorter pulses should be considered invalid to suppress interference.

When accessing CVs 897 to 899 and 1020 to 1024, multiple SUSI-Modules may respond with an acknowledge. Therefore, in this case, the Host must always wait the full 20 ms and must not send the next byte immediately after a successfully received acknowledge.

Error detection and error correction is not implemented because the signal lines are generally very short. It is recommended to implement them with a maximum length of 20 cm between the Host and the SUSI-Module.

If SUSI-Modules do not receive valid commands within 100 ms after reset, they can automatically start in an alternative mode without SUSI command control.

7 Commands

The data bytes are basically derived from the DCC commands of the [RCN-212] and [RCN-214]. This allows a very simple forwarding of DCC commands to the SUSI-Modules. The [RCN-212] and [RCN-214] contain more detailed descriptions of the individual bits of the commands. The commands are sent to the SUSI-Modules on demand e.g. when the data is currently received in the Host. Every active function or speed command should be repeated at least every 200 ms, even without new data reception, to enable safe operation even in the event of faults. If the Host does not receive any external data (DCC), it can also generate commands independently based on specified operating states (e.g. in analog mode).

Function group 1 (2-byte):

0110-0000 (0x60 = 96) 0 0 0 F0 - F4 F3 F2 F1

Note: Over the SUSI interface the light function F0 is always sent in FG1.

Function group 2 (2-byte):

0110-0001 (0x61 = 97) F12 F11 F10 F9 - F8 F7 F6 F5

Note: Over the SUSI interface the DCC function groups F5-F8 and F9-F12 are combined in one single command.

Function group 3 (2-byte):

0110-0010 (0x62 = 98) F20 F19 F18 F17 - F16 F15 F14 F13

Function group 4 (2-byte):

0110-0011 (0x63 = 99) F28 F27 F26 F25 - F24 F23 F22 F21

Function group 5 (2-byte):

0110-0100 (0x64 = 100) F36 F35 F34 F33 - F32 F31 F30 F29

Function group 6 (2-byte):

0110-0101 (0x65 = 101) F44 F43 F42 F41 - F40 F39 F38 F37

Function group 7 (2-byte):

0110-0110 (0x66 = 102) F52 F51 F50 F49 - F48 F47 F46 F45

Function group 8 (2-byte):

0110-0111 (0x67 = 103) F60 F59 F58 F57 - F56 F55 F54 F53

Function group 9 (2-byte):

0110-1000 (0x68 = 104) F68 F67 F66 F65 - F64 F63 F62 F61

Binary states short form (2-byte):

0110-1101 (0x6D = 109) D L6 L5 L4 - L3 L2 L1 L0

Note: D = 0 means function L switched off, D = 1 switched on

L = function number 1 ... 127

L = 0 (broadcast) switches all functions 1 to 127 off (D = 0) or on (D = 1)

Binary states long form low byte (2-byte):

0110-1110 (0x6E = 110) D L6 L5 L4 - L3 L2 L1 L0

Note: The Binary states long form commands are always sent as a pair. This command is sent before the binary state long form high byte. If the two commands do not follow each other directly, they must be ignored.

D = 0 means binary state L switched off, D = 1 "switched on"

L = low-order bits of binary state number 1 ... 32767

Binary states long form high byte (2-byte):

0110-1111 (0x6F = 111) H7 H6 H5 H4 - H3 H2 H1 H0

Note: The Binary states long form commands are always sent as a pair. This command is sent after the binary state long form low byte. If the two commands do not follow each other directly, they must be ignored. Only this command leads to the execution of the complete command.

H = high-order bits of the binary state number high 1 ... 32767

Note: H and L = 0 (broadcast) switches all 32767 available binary states off (D = 0) or on (D = 1)

Direct command 1 (2-byte):

0100-0000 (0x40 = 64) X8 X7 X6 X5 - X4 X3 X2 X1

Note: The direct commands are used for direct control of outputs and other functions after interpreting the function (mapping) table in the Host. A bit = 1 means the corresponding output is switched on.

Direct command 2 (2-byte):

0100-0001 (0x41 = 65) X16 X15 X14 X13 - X12 X11 X10 X9

Direct command 3 (2-byte):

0100-0010 (0x42 = 66) X24 X23 X22 X21 – X20 X19 X18 X17

Direct command 4 (2-byte):

0100-0011 (0x43 = 67) X32 X31 X30 X29 - X28 X27 X26 X25

Trigger pulse (2-byte):

0010-0001 (0x21 = 33) 0 0 0 0 - 0 0 0 1

Note: The command is used for synchronization of a steam impulse. It is sent once per steam pulse. Bits 1 to 7 are reserved for future applications.

Current (2-byte):

0010-0011 (0x23 = 35) S7 S6 S5 S4 - S3 S2 S1 S0

Note: Current consumed by the motor. The value has a range from -128 to 127, is transmitted in 2's complement and is calibrated by a manufacturer specific CV in the locomotive decoder. Negative values mean regeneration as it is possible with modern electric locomotives.

Locomotive actual speed step (2-byte):

0010-0100 (0x24 = 36) R G6 G5 G4 - G3 G2 G1 G0

Note: The speed step and direction correspond to the real state of the motor. The transmitted G value is the Vmax of the model normalized to 0…127 l. G = 0 means the locomotive is stationary, G = 1 ... 127 is the normalized speed, R = direction of travel with R = 0 for reverse and R = 1 for forward.

This and the following command are not recommended for new implementations. SUSI-Modules should evaluate commands 0x50 to 0x52 if possible. Hosts that use deviating and/or different implementations for commands 0x24 and 0x25 for compatibility with existing products are compliant with the standard

Locomotive target speed step (2-byte): **(**not recommended for new implementations**)**

0010-0101 (0x25 = 37) R G6 G5 G4 - G3 G2 G1 G0

Note: Received speed level of the "Host" normalized to 127 speed levels. G = 0 means locomotive should stop, G = 1 ... 127 is the normalized speed R = direction of travel with R = 0 for reverse and R = 1 for forward.

Load control (2-byte): **(**not recommended for new implementations)

0010-0110 (0x26 = 38) P7 P6 P5 P4 - P3 P2 P1 P0

Note: The load state can be detected by motor voltage, current or power. 0 = no load, 127 = maximum load. Negative values are also possible, which are transmitted in 2's complement. This mean less load than driving on flat surface.

Locomotive actual speed (2-byte):

0101-0000 (0x50 = 80) R G6 G5 G4 - G3 G2 G1 G0

Note: The speed and direction correspond to the real condition of the motor. This is a control value in relation to the "set" speed, i.e. that after following the speed characteristic, the actual and set speed should be the same (compensated state). The transmitted G value is the Vmax of the model normalized to 0…127. G = 0 means the locomotive is stationary, G = 1 ... 127 is the normalized speed, R = direction of travel with R = 0 for reverse and R = 1 for forward.

Locomotive target speed (2-byte):

0101-0001 (0x51 = 81) R G6 G5 G4 - G3 G2 G1 G0

Note: Internal speed level of the "Host" normalized to 127 speed levels according to the received speed level converted via the characteristic curve (CVs 67 to 94, CVs 2, 6 and 5) and other CVs determining the speed of the vehicle. I.e. the highest value that can be reached due to CVs 94 and/or CV5 or other corresponding CVs is normalized to 127. CVs for acceleration and braking like CVs 3, 4, 23 and 24 are not included in the calculation. G = 0 means locomotive should stop, G = 1 ... 127 is the speed R = direction of travel with R = 0 for backward and R = 1 for forward. Since the decoders use different methods to determine the maximum speed, there may be slightly different implementations here. The most important thing is that the commands for actual and target speed behave the same way.

DCC speed step (2-byte):

0101-0010 (0x52 = 82) R G6 G5 G4 - G3 G2 G1 G0

Note: This value is only normalized from 14 or 28 speed steps to 127 speed steps if necessary. There is no adjustment by any CVs.

Analog function group (2-byte):

0010-1xxx (0x28 = 40 to 0x2F = 47) A7 A6 A5 A4 - A3 A2 A1 A0

Note: The eight commands of this group allow the transmission of eight different analog values in digital mode.

Direct command 1 for analog operation (2-byte):

0011-0000 (0x30 = 48) D7 D6 D5 D4 - D3 D2 D1 D0

Note: Setting of basic functions in analog mode bypassing a function assignment.

Bit 0: Sound on/off

Bit 1: Up/break

Bit 2-6: Reserved

Bit 7: Reduced volume

Direct command 2 for analog mode (2-byte):

0011-0000 (0x31 = 49) D7 D6 D5 D4 - D3 D2 D1 D0

Note: Setting of basic functions in analog mode will bypass/overwrite a function assignment.

Bit 0: Front light

Bit 1: Rear light

Bit 2: Parking light

Bit 3-7: Reserved

No Operation (2-byte):

0000-0000 (0x00 = 0) X X X X - X X X X

Note: The command does not cause any action in the SUSI-Module. The data can have any value. The command can be used as a gap filler or for test purposes.

Module address low (2-byte):

0101-1110 (0x5E = 94) A7 A6 A5 A4 - A3 A2 A1 A0

Note: Transmits the least significant bits of the active digital address of the "Host" when it is in a digital operating mode. The command is always sent in pairs before the address high byte. If the two commands do not follow each other directly, they are to be ignored.

Module address high (2-byte):

0101-1111 (0x5F = 95) A15 A14 A13 A12 - A11 A10 A9 A8

Note: Transmits the high-order bits of the active digital address of the "Host" when it is in a digital operating mode. The command is always sent in pairs after the address low byte. If the two commands do not follow each other directly, they are to be ignored.

Module control byte (2-byte):

0110-1100 (0x6C = 108) B7 B6 B5 B4 - B3 B2 B1 B0

Note: Bit 0 = Buffer Control: 0 = Buffer off, 1 = Buffer on

Bit 1 = Reset function: 0 = set all functions to "Off", 1 = normal operation

All other bits reserved by the RailCommunity.

If implemented, bits 0 and 1 must be set to 1 in the SUSI-Module after a reset.

CV manipulation - check byte (3-byte):

0111-0111 (0x77 = 119) 1 V6 V5 V4 - V3 V2 V1 V0 D7 D6 D5 D4 - D3 D2 D1 D0

Note: DCC command for byte check in service and operation mode

V = CV number 897 ... 1024 (value 0 = CV 897, value 127 = CV 1024)

D = comparison value for checking. If D corresponds to the stored CV value, the SUSI-Module responds with an acknowledge.

Note This and the following two commands are the 3-byte packets mentioned in section 4 according to [RCN-214].

CV manipulation - bit manipulation (3-byte):

0111-1011 (0x7B = 123) 1 V6 V5 V4 - V3 V2 V1 V0 1 1 1 K - D B2 B1 B0

Note: DCC command bit manipulate in service and operation mode V = CV number 897 ... 1024 (value 0 = CV 897, value 127 = CV 1024)

K = 0: Check bit. If D matches the bit state at bit position B of the CV, the SUSI-Module responds with an acknowledge.

K = 1: Bit Write. D is written to bit position B of the CV. The SUSI-Module confirms the writing with an acknowledge.

CV manipulation - write byte (3-byte):

0111-1111 (0x7F = 127) 1 V6 V5 V4 - V3 V2 V1 V0 D7 D6 D5 D4 - D3 D2 D1 D0

Note: DCC command byte write in service and operation mode

V = CV number 897 ... 1024 (value 0 = CV 897, value 127 = CV 1024)

D = value to write into the CV. The SUSI-Module confirms the writing with an acknowledge.

The commands 0x01 to 0x0F, 0x80 to 0x8F and 0xE0 to 0xFF are defined in [RCN-601] and reserved for BiDi.

8 Appendix A: Command overview

Hex code	Command	Notes
0x00	NOP / Blank command	
0x01 – 0x0F	BiDi Host calls	See [S-9.4.2 / RCN-601] (from SUSI version 1.1.)
0x10 – 0x20	Reserved	
0x21	Trigger pulse	(from SUSI version 1.2)
0x22	Reserved	
0x23	Current	(from SUSI version 1.2)
0x24	Locomotive actual speed step	Note 1
0x25	Locomotive target speed step	Note 1
0x26	Load control	Note 1
0x27	Reserved	
0x28 – 0x2F	Analog function group	(from SUSI version 1.2)
0x30	Direct command 1 for analog operation	(from SUSI version 1.2)
0x31	Direct command 2 for analog operation	(from SUSI version 1.2)
0x40	Direct command 1 for outputs 1 to 8	(from SUSI version 1.3)
0x41	Direct command 2 for outputs 9 to 16	(from SUSI version 1.3)
0x42	Direct command 3 for outputs 17 to 24	(from SUSI version 1.3)
0x43	Direct command 4 for outputs 25 to 32	(from SUSI version 1.3)
0x44 – 0x4F	Reserved	
0x50	Locomotive actual speed	(from SUSI version 1.3)
0x51	Locomotive target speed	(from SUSI version 1.3)
0x52	DCC speed step	(from SUSI version 1.3)
0x53 – 0x5D	Reserved	
0x5E / 0x5F	Module address	(from RCN-600)
0x60	Function group 1	
0x61	Function group 2	
0x62	Function group 3	
0x63	Function group 4	

Hex code	Command	Notes
0x64	Function group 5	(from SUSI version 1.2)
0x65	Function group 6	(from SUSI version 1.2)
0x66	Function group 7	(from SUSI version 1.2)
0x67	Function group 8	(from SUSI version 1.2)
0x68	Function group 9	(from SUSI version 1.2)
0x69 – 0x6B	Reserved	
0x6C	Module control byte	(from RCN-600)
0x6D	Binary state short form	
0x6E / 0x6F	Binary state long form	
0x70 – 0x72	Restricted range	See appendix D.5 (CVs < 896) 3-byte commands
0x73	Reserved	Service mode extension (CC=00) if necessary - 3-byte command
0x74 – 0x76	Restricted range	See appendix D.5 (CVs < 896) 3-byte commands
0x77	CV manipulation - check byte	3-byte command
0x78 – 0x7A	Locked range	See appendix D.5 (CVs < 896) 3-byte commands
0x7B	CV manipulation - bit manipulate	3-byte command
0x7C	CV manipulation - bit manipulate	Only CV8 for reset function (appendix D.5) 3-byte command
0x7D / 0x7E	Restricted range	See appendix D.5 (CVs < 896) 3-byte commands
0x7F	CV manipulation - write byte	3-byte command
0x80 – 0x8F	BiDi SUSI-Module responses	See [S-9.4.2 / RCN-601]
0x90 – 0x9F	Reserved	No specific use yet
0xA0 – 0xAF	Reserved for update and sound programming	Manufacturer specific use; Not allowed in model operation
0xB0 – 0xDF	Reserved	
0xE0 – 0xFF	BiDi commands	Still in development phase

475 Note 1 - not recommended for new implementations

9 Appendix B: Identified problems with incompatibility to the standard

D.1 Data transmission rate

There are SUSI-Modules that cannot process data packets that follow each other quickly. It turned out that sometimes pauses of several 10 ms between packets are necessary. To control these SUSI-Modules, the Host may be switched to a slow mode, which sends the data in fixed time windows, contrary to the standard.

D.2 Data signal level in idle mode

According to the standard, the signal level is not fixed after data transmission ends and the last signal state may be maintained on the data line. However, there are SUSI-Modules that always require a high level in the idle state. A Host that behaves accordingly is compliant with the standard.

D.3 Synchronization of the data transfer

In earlier standard versions of DIETZ and NMRA, there were no or different time limits for automatic resetting of the SUSI-Modules, so data loss can occur in mixed operation between older and compliant modules.

D.4 Acknowledge duration

There are Hosts, which do not react immediately to an acknowledge after data transmission end, but they will react delayed with up to 0.5 ms. If a SUSI-Module will send a pulse with a length of only 1ms immediately after the data transmission end, this may be not recognized by the Host. To avoid this, SUSI-Modules that issue the acknowledge immediately after receiving data should then issue pulses with a minimum length of 1.5 ms.

D.5 Access to CVs under 897

The SUSI standards before the RCN-600 did not explicitly exclude the possibility that access to CVs are passed from the Host to the SUSI-Modules, i.e. in the commands 0x7# the bits 1 and 0 in the first command byte as well as bit 7 in the second command byte are the high-order bits of the CV address. However, it was pointed out in the text that only the value range 896 to 1023 is valid for CVs 897 to 1024. So, the three mentioned bits are always set to 1 as described in the RCN-600.

However, it was partly the reset of the decoder by writing CV8, as described in [RCN-226] in section 2, forwarded to the SUSI module and used there to reset the module. This is the only access to a CV in the range below CV 897 that is tolerated by this standard. The corresponding command is 0x7C, 0x07, 0x08. = 0111-1100 0000-0111 0000-1000.

D.6 Known protocol incompatibility

Some SUSI-Modules respond to commands not defined in this standard or use reserved bits in defined commands:

Command 0x16 clears the sound memory of some modules

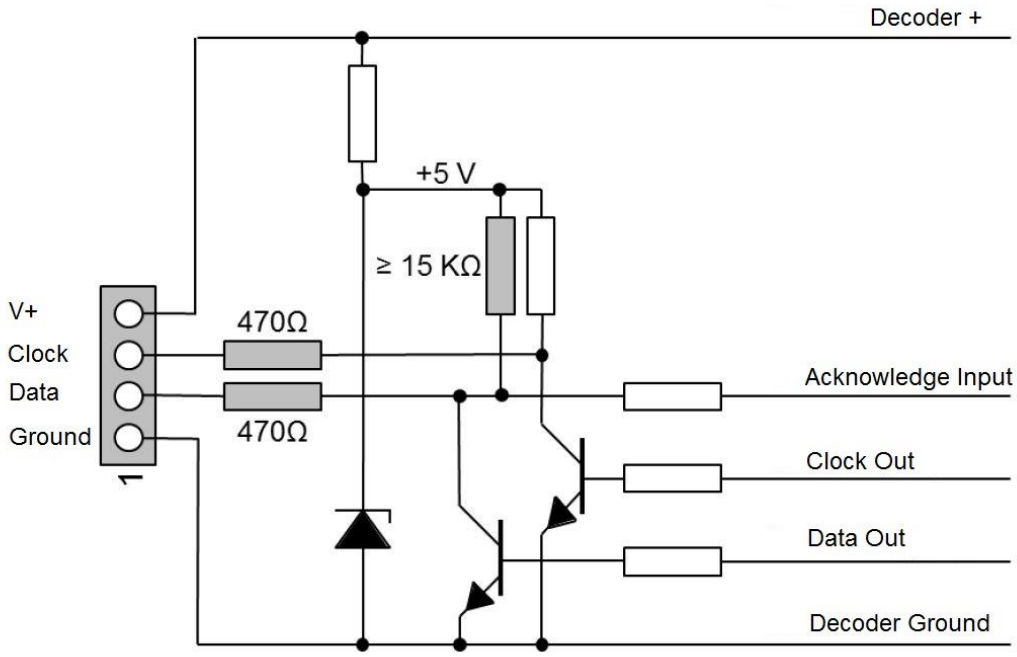
Command 0x27 is partially used for unknown applications in analog mode

In command 0x60 the three upper data bits (bits 7 to 5) are used deviating from this standard.

10 Appendix C: Circuit example for decoders with Vcc = 3.3V

For Hosts with Vcc = 3.3 V or lower (except for microSUSI) a voltage adaptation circuit is required, if compatibility to SUSI-Modules requiring 5V level is desired. The figure below shows a possible circuit. The gray filled components are the always required components of the standard circuit.

Since practically all controllers have protection diodes at the I/O terminals, in most cases it is not enough to program the output only to open collector or to switch between 0-level and high impedance. The protection diode would prevent the voltage from rising above approx. 3.8V.



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