

MANUAL



SOHARD
EMBEDDED SYSTEMS

SH FARC-H3/5

SH FARC-E3

ARCNET - Card for ISA Bus

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1 Introduction

The product SH FARC-H3/5 is an ARCNET[®] plug-in card for PCs with an ISA bus. The chip COM 20022 [1] is used as a controller. The card has an 8 bit data bus. Two ARCNET[®] interfaces are available which, however, cannot be operated simultaneously. The integrated HUB function allows to connect up to three further interface modules (optical waveguide, Coax, RS485) via the plugs X3, X4 or X5.

The SH FARC-H3/5 or SH FARC-E3 is available in several variants:

Order Designation	Hub	Timer	RS485	2.5 Mbps Coax	5/10 Mbps Coax
SH FARC-E3		x	x	x	
SH FARC-E3-10		x	x		x
SH FARC-E3-K				x	
SH FARC-E3-K10					x
SH FARC-H3/5	x		x	x	
SH FARC-H3/5-10	x		x		x

The various functions are described hereinafter.

2 Performance Features at a Glance

ISA bus

- 16 bit IBM-AT compatible card, 8 bit data bus width
- IRQs 2/9, 3, 4, 5, 6, 7, 10, 11, 12, 14, 15 selectable via jumpers
- displaying of the COM 20022 register in the I/O address range of the PC

RS485 interface

- 9 pin Sub D plug connector
- optically decoupled
- bit-rate 156 kBit/s - 10 Mbit/s
- integrated termination to be activated via DIP switch
- protective circuit

Coaxial interface

- BNC socket
- suitable for RG 62 Coax cables (93 ohms of impedance)
- bit-rate 2.5 Mbit/s (optional up to 10 Mbit/s)
- protective circuit
- protection of the coaxial transceiver from erroneous control

ARCNET

- COM20022 controller
- LED for Coax interface active/inactive
- LED for activity on ARCNET[®] receiving channel
- LED for activity on ARCNET[®] transmitting channel
- LED for display of host accesses
- automatic switchover between RS485 and coaxial interface
- CE conformal for industrial environment (1)

HUB Function, optional see also (2)

- Bit-rate 156 kBit/s - 10 Mbit/s
- 3 interface modules connectable via flat conductor cables
- complete regeneration of received ARCNET[®] signals
- setting of the default bit-rate via DIP switch
- setting of the bit-rate automatically on initialisation of the ARCNET[®] controller COM20022

Timer

- optional (2): timer module with 82 C54[2], clocked with 6 MHz.

- (1) on installing in PCs conformal to the CE standard and on use of slot mechanics suitable for EMC purposes
- (2) not provided with all variants. See also table in chapter 1.

3 Function

3.1 Setting of Network Interfaces

The switchover between the RS485 and coax interface on the card is effected automatically.

However, only one interface can be used at one time. If both interfaces receive data simultaneously, there will be disturbances in the network operation.

3.1.1 Coax Interface

No manual settings are required. The interface is only activated if both a valid bit-rate (2.5 -- 10 Mbit/s) is set and the controller COM 20022 is operated in the non-backplane mode [1]. The interface is intended for being operated at a coaxial cable RG62. **If the HUB function is equipped (see also table in chapter 1), the controller COM20022 can also be operated in the backplane mode.**

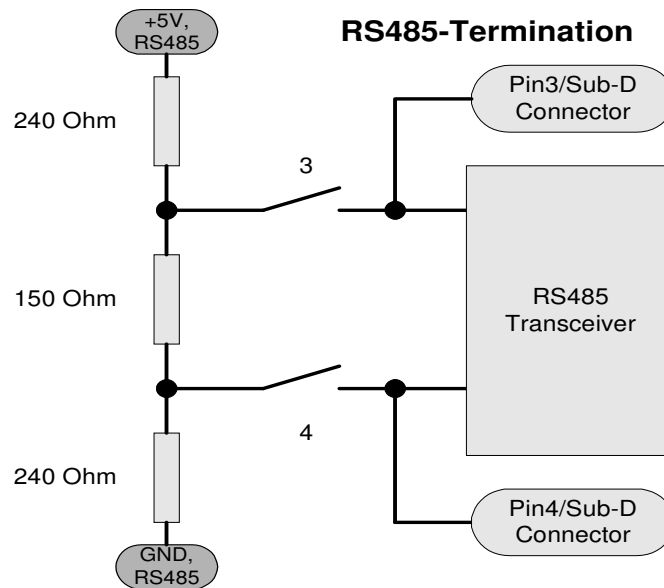
3.1.2 RS485 Interface

The termination can be turned on or off by means of the DIP switch S3/S3,4 at the slot metal. On delivery, the connection is terminated with an effective resistance of approx. 115 ohm. The impedance of the used cable should correspond to that value as closely as possible in order to avoid any reflections.

Dip Switch S3

Switch 3	Switch 4	Function	Remark
ON	ON	Line termination activated for RS485	pre-setting
OFF	OFF	no line termination activated for RS485	
ON	OFF	invalid	
OFF	ON	invalid	

S1 and S2 are not used.



The interface can work with all transmission rates.

Essential note: in order to maintain CE conformity, the cable connected to the SUB-D plug/socket must have a shield which should be connected to the plug housing at low-impedance.

3.2 Access

The SH FARC-H3/5 can be addressed via the I/O area. Access is exclusively performed on a byte by byte basis.

3.2.1 Address Setting

Switch S1 is used for setting the I/O address under which the SH FARC-H3/5 can be addressed. The assignment of single switches to addresses is indicated on the board. There the switch position ON means 0 for the corresponding address line.

Address 120 H would have to be set as follows:

address line	A11	A10	A09	A08	A07	A06	A05	A04
switch position	ON	ON	ON	OFF	ON	ON	OFF	ON
status (120 H)	0	0	0	1	0	0	1	0

120 hex = 0001 0010 0000 binary

By means of the address lines A00-A03, single registers are addressed on the card.

3.2.2 Memory Occupancy

The COM 20022 occupies 8 bytes of ongoing addressable storage as of the set base address . The timer module covers a further four bytes as of the base address in addition to 8 bytes for the COM 20022.

IO address	Module	Register
IO base +0	COM20022	Status/Interrupt Mask
IO base +1	COM20022	Diagnostic/Command
IO base +2	COM20022	ADDRESS PTR HIGH
IO base +3	COM20022	ADDRESS PTR LOW
IO base +4	COM20022	DATA
IO base +5	COM20022	RESERVED
IO base +6	COM20022	Configuration
IO base +7	COM20022	TENTID/NODEID/SETUP
IO base +8	Timer 82 C54	Counter 0
IO base +9	Timer 82 C54	Counter 1
IO base +10	Timer 82 C54	Counter 2
IO base +11	Timer 82 C54	Control Word Register
IO base +12		Reserved
IO base +13		Reserved
IO base +14		Reserved
IO base +15		Reserved

The function of the register can be taken from the data sheets of COM20022 [1] or 82 C54 [2].

3.3 Interrupt Setting

The interrupt to be used is selected via the jumper panel. The assignment of single jumpers to the interrupts is indicated on the card. Please make sure that this interrupt is not used by another card within the PC since this might cause malfunctions and a damage to the SH FARC-H3/5.

3.4 Timer (optional)

The card optionally disposes of (see also table in chapter 1) a timer module type 82C54 [2] which has three counters. Counter 1 is timed with 6 MHz. The output of counter 1 controls the clock input of counter 2. The output of counter 2 controls the clock input of counter 3. All ENABLE inputs of the counters ("GATE") are enabled. For further information on the programming of the module, please see data sheet [2].

3.5 HUB (optional)

The card optionally has a HUB module (see also table in chapter 1). This allows the connection of up to five channels, two of which are used for the controller COM20022 and the Coax/RS485 interface which are on the card. By means of the three plugs X3-5 up to three interface modules can be connected via flat conductor cables. The HUB regenerates the received signals completely and allows both wider extensions of the network and the use of different transmission mediums such as optical waveguides, coaxial cable or twisted pair cables with RS485. The default rate is settable via the DIP switch S2 after switching on or reset. This bit-rate is automatically overlaid if the COM20022 is initialised with the bit-rate.

At present, interface modules for optical waveguides (SMA and ST connection, multi-mode-fibres), RS485 and Coax are available. Should you require any other modules, please contact MCS (contact information see also appendix).

3.5.1 Switch S2, Bit-rate Setting

Bit-rate of the HUB after switching on or reset

S1	S2	S3	Bit-rate
ON	ON	ON	156 kBit/s
OFF	ON	ON	312.5 kBit/s
ON	OFF	ON	625 kBit/s
OFF	OFF	ON	1.25 Mbit/s
ON	ON	OFF	2.5 Mbit/s (default)
OFF	ON	OFF	5 Mbit/s
ON	OFF	OFF	invalid
OFF	OFF	OFF	10 Mbit/s

3.6 COM20022 Configuration

The COM20022 [1] is to be initialized as follows:

3.6.1 Set-up Register

Bit name	Bit Nr.	Wert	Remark
Slow Arbitration Bit	0	0 for bit-rate \leq 2.5 Mbit/s 1 for bit-rate \geq 5 Mbit/s	
Pulse1 Mode	1	1	Push-pull driver activated in the backplane mode

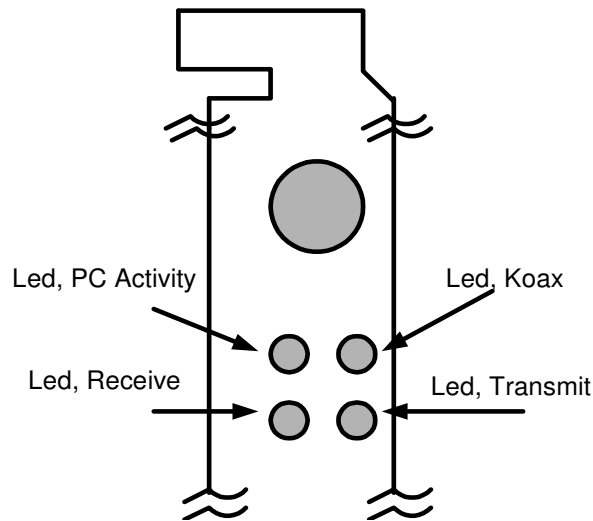
The right setting of pulse 1 mode is particularly recommended for use of the RS485 interface at high bit-rates.

3.6.2 Access Mode

The COM20022 is operated in the non-multiplexed mode . The switchover to this mode is effected by some dummy accesses[1] after reset. As a rule, the correct setting is already effected by accesses to the PC to other I/O units such as graphics card or serial interfaces. **We nevertheless recommend to carry out these accesses in the driver software.**

The COM20022 must be operated in the 8 bit mode (corresponds to COM20020).

3.7 LED Displays



LED (red):

The LED reports any write/read accesses by the host PC to the SH-FARC card. Every access is prolonged and thus made visible by means of a digitally monostable multivibrator (time constant approx. 1 msec).

LED (green):

The LED is activated if the ARCNET[®] controller is configured for a bit rate of 2.5 Mbit/s - 10 Mbit/s valid for the coax interface. If there is no HUB function on the FARC H3/5, the controller is to be operated in the non-backplane mode in addition. If the LED is off, the coax interface is not addressed.

LED (yellow):

The LED reports any activity on the ARCNET[®] receiving channel. The signal is prolonged and thus made visible by means of a digitally monostable multivibrator. As both the Coax and the RS485 interface receive the sent signal, too, the LED is also activated by the transmitting signal. If the ARCNET[®] runs in a stable state, the LED is continuously active. If reconfigurations [1] appear, the LED flickers periodically.

LED (yellow):

The LED reports activity on the ARCNET[®] transmitting channel. The signal is prolonged and thus made visible by means of a digitally monostable multivibrator. The brightness of the LED depends on the bit-rate set, the length of the transmitted packages as well as on the number of nodes in the ARCNET[®].

4 Interfaces

4.1 Coax Interface

Plug type: BNC socket, isolated

Pin Assignment:

PIN	Name	Meaning
1	Shield	outer conductor coaxial cable
2	Center	inside conductor coaxial cable

4.2 RS485 Network Interface (9 pin socket)

This occupancy is upward compatible to the FARC E3 card by MCS

Plug type: SUB-D socket 9 pin

Pin Assignment:

PIN	Name	Meaning
1	GND_RS	data reference potential, ground supply voltage
2	nc	reserved
3	Data A	data line A (in the quiescent state more positive than DATA B)
4	Data-B	data line B (in the quiescent state more negative than DATA A)
5	GND_RS	data reference potential, ground supply voltage
6	nc	reserved
7	nc	reserved
8	nc	reserved
9	+5 V_RS	dc decoupled 5 volts for RS485 interface. The peak voltage may not exceed 25 mA.
shield	PE	shield or system-unit cover potential

PE is the slot metal or system-unit cover potential. GND_RS is the ground of the dc decoupled RS485 circuitry element.

5 Technical data

5.1 General:

power supply:	+5 V, -5 V (max. 0.3 A) without external interface modules
power consumption:	< 10 W (without external interface modules)
operating temperature range:	0 C to +55 C
storage temperature range:	-20 C to +85 C
ISA bus, functionality:	PC ISA bus AT of IBM
interrupts:	interrupt IRQ 9 (2), 3, 4, 5, 6, 7, 10, 11, 12, 14, 15
dimensions without connectors:	breadth 120 mm, height 20 mm, depth 160 mm
weight:	max. 0.5 kg, packing included

5.2 HUB (optional):

type:	TMC2005 [3]
channel:	5, 3 of which for interface modules, 2 internal
transmission rate:	156 kBit/s -- 10 Mbit/s, automatic setting by means of the initialisation of the COM20022. Default bit-rate via DIP switch
permissible jitter of the input signal:	max. +- 25% of the bit length (100 ns at 2.5 Mbit/s)
max. transmission delay:	2 bit

5.3 Timer (optional):

type:	82 C54 of Intel
clock frequency:	6 MHz
allocation:	Out0→Clk1, Out1→Clk2, 6 MHz time gates enabled

5.4 ARCNET® Functionality:

compatibility:	ANSI/ATA 878.1 [4]
transmission rates:	156/312,5/625 kbps, 1,25/2,5/5/10 Mbit/s

5.5 Coax Network Interface

transmission rate: 2.5 Mbps (optional 5/10 Mbit/s)
input impedance: ≥ 1 kOhm (at $f = 5$ MHz)
output voltage: min. 16 Vss at terminated 93 ohms line
form of output pulse: sine dipulse 200 ns to ANSI/ATA 878.1
(50 ns at 10 Mbit/s)
wiring: RG62 with $Z = 93$ ohms is recommend
connection: isolated BNC socket

5.6 RS485 Network Interface (9 pin socket)

transmission rate: 156 kBit/s to 10 MBit/s
input level threshold: ± 200 mVs
polarity quiescent level: positive
input impedance: settable via DIP switch approx. 120 ohms
(with DC biasing)
DC biasing: settable via DIP switch 240 ohms
 $+5$ V/240 ohms 0 V
transmission level: min ± 3.0 V
connection: SUB-D plug 9 pin

6 What to do in case of problems?

- **Card fails to respond**

Possible causes:

- wrongly set I/O address
- overlapping with other ISA bus cards

remedy: set the I/O address correctly

- **Card responds but no Interrupts are generated**

Possible causes:

- wrong IRQ set
- the IRQ line is already used by another card

remedy: check the IRQ settings and correct them

- **LED reports reception activity to reconfigurations**

Possible causes:

- there is only one node in the network
- the network is not terminated correctly
- DATA-A and DATA-B are mixed up at RS485 connections

- **Green LED is not active**

Possible causes:

- the COM20022 works with a bit-rate that is smaller than 2.5 Mbit/s
- the COM20022 is in the backplane mode (HUB function is not equipped)

- **HUB function fails to work after switching on the PC**

Possible causes:

- If the optional HUB chip is equipped, the default bit-rate (DIP switch S2) is set after reset or switching on the PC. This is overlaid if the ARCNET[®] controller is initialised by the software. If the two bit-rates are different, the HUB only works as soon as the ARCNET[®] controller has been initialised.

remedy: set default bit-rate correctly

- **Card responds but no data traffic takes place**

Possible causes:

- DATA-A and DATA-B are mixed up at RS485 connections or termination is not correctly set
- the optical transmit power is too low or too high (overdriving) at connections with optical waveguides.

remedy: adapt transmit power to path attenuation

- **Everything seems to work but wrong data are transmitted**

Possible cause:

- The COM20022 is operated in the 16 bit mode [1]. Since the SH FARC-H3/5 has an 8 bit data bus, every second byte is transferred wrongly in this case.

remedy: operate the COM20022 in the 8 bit mode.

7 CE Declaration of Conformity

EC Declaration of Conformity



EC Declaration of Conformity
in accordance with Annex IV of Directive 2004/108/EC

Name of Supplier: **SOHARD
Embedded Systems GmbH**

Address of Supplier: **Würzburger Str. 197
D-90766 Fürth
Germany**

declares that the present product

Product name: **SH FARC-xx**

of one of the following types


Product types: **SH FARC-E3
SH FARC-H3/5**

meets the requirements of Directive 2004/108/EG of the European Parliament and of the Council as specified in Annex I of the said Directive. In accordance with Article 6 of the said Directive this Declaration is based on the following harmonized Standards

Safety: **EN60950: 1992
+ A1: 1993 + A2: 1993
+ A3: 1995 + A4: 1997**

EMC: **EN 50081-2: 1994-03
EN 50082-2: 1997-11**

Fürth, 13.06.2008


(Sebastian Schnitzenbaumer, Managing Director)

8 Support

Should you have any problems with the inauguration of the card, please check your settings again before contacting us. Please note down all your settings exactly.

8.1 Contact Addresses

SOHARD Embedded Systems GmbH
Würzburger Str. 197
90766 Fürth
Deutschland

Tel: +49 (0)911 97341 - 0 (Switch board)
- 522 (Technical support)

Fax: +49 (0)911 97341- 510

eMail: arcnet@sohard.de

Latest manuals and technical information to this product are available under <http://www.sohard.de>.

9 Literature

Reference	Document
[1]	Data Sheet COM20022B, SMSC (http://www.smsc.com)
[2]	Data Sheet 82 C54, Intel (http://www.intel.com)
[3]	Data Sheet TMC2005, SMSC (http://www.smsc.com)
[4]	ANSI/ATA 878.1 Local Area Network: Token bus (2.5 Mbps) ATA 1992

10 Warranty

Warranty is granted by SOHARD Embedded Systems GmbH according to our General Terms and Conditions.