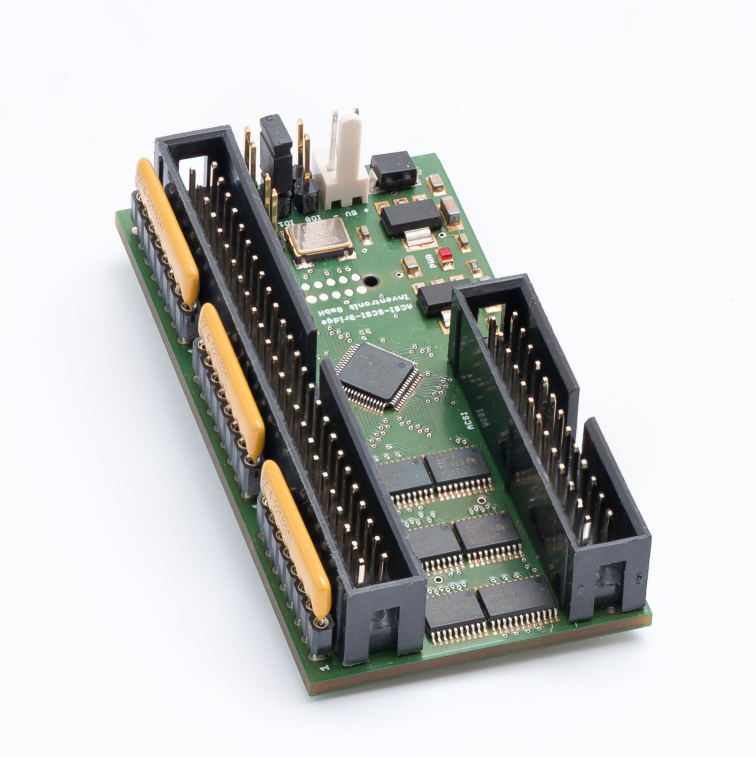
Inventronik GmbH

Suska ACSI-SCSI Adapter
Revision II



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Subject to change without notice.

J. Carroll, W. Förster

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Introduction

The Suska ACSI-SCSI adapter allows the operation of up to 7 Devices with parallel, non differential SCSI interface at the ACSI bus of Atari ST computers. The adapter supports bus parity and initiator identification. Thus, it is possible to connect SCSI-Components which meet the SCSI-1, SCSI-2 or SCSI-3 standard. Using appropriate hard disk drivers like the HDDRIVER in an actual version, furthermore it is possible to use SCSI commands of all SCSI command classes. This large command extension, which distinguishes the adapter from a simple ACSI interface, allows for example the use of big hard disc drives or removable media devices without any problem (if there is a driver software for the devices).
The hardware of the Suska ACSI-SCSI adapter is designed in a way, that the protocol translation is done in a modern CPLD (**C**omplex **P**rogrammable **L**ogic **D**evice) and the level shifting between the nowadays often used 3,3V technique and the 5V levels of the ST computers and the SCSI devices is realized using line drivers. the digital design is modelled synchronously and therefore robust against noise on the signals. The power supply for the CPLD and the clock source is located on the ACSI-SCSI adapter which only requires a single operating voltage of +5V.

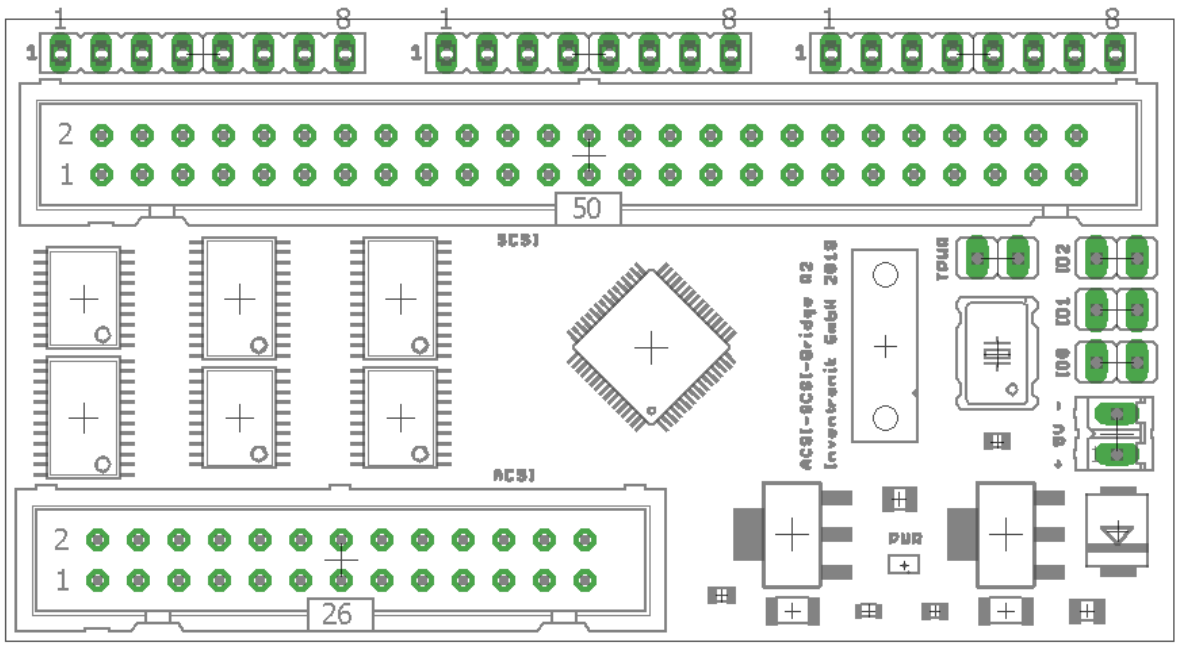

Figure 1: Top View of the ACSI-SCSI-II Adapter

Operation Preparations

The ACSI-SCSI adapter is connected via two connector for the buses and optional via a third power supply connector.

Installation of the ACSI Connector

On the ACSI side there is required a 26 pos. female header to connect the adapter with the ST series computers. In the annex there is a table with the pin description of this connector. It is arranged in a way, that a 19 pos. crimp technique D-SUB connector can be mounted, if the pin positions number 1 to 19 of the 26 pos. header are used and the pin positions 20 through 26 are left open or used in connection with the power supply (look ahead for more information). For internal use of the adapter within the ST computers it is required, that the ACSI cable is on the one hand mounted to a 26 pos. female header and on the other hand wired correctly to the respective main board. At this point, it is not possible to give a universal information how to connect the ACSI cable because there are too many different ST machine type and main board revisions. It is recommended to involve an expert in case of any doubts. If the adapter is used internally, it is furthermore recommended to use the computer power supply for the operation of the ACSI-SCSI adapter.

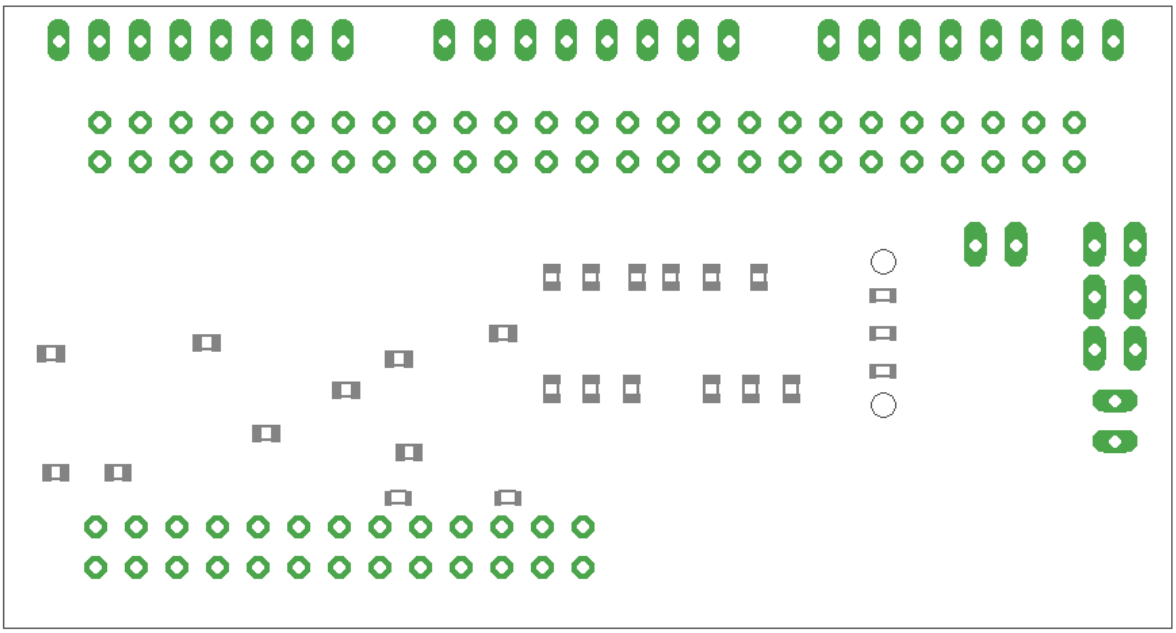

Figure 2: Bottom View of the ACSI-SCSI-II Adapter

Installation of the SCSI Connector

The connection of the SCSI devices with the ACSI-SCSI adapter is accomplished by using a standard 50 pos. flatband cable with female headers at each side. The pin description of this connector is described in the annex.

Power Supply

The power supply for the adapter can be realized in one of the three following ways:

1. The 26 pos. ACSI header carries out 4 dedicated pins for the +5V power supply connection; positions 23 through 26. Additionally The pins 20, 21 and 21 are connected to the adapter's ground.
2. There is a dedicated power supply header. The polarity is marked on the PCB (+ 5V -) See also Figure 1.
3. By the TermPower line of the SCSI connector. Using this possibility it is required, that the SCSI device is configured in a way, that the terminator power is driven by this device. To use this feature it is also required, that the jumper TPWR is closed, see Figure 1.

Important: it is not allowed to drive the power supply for the ACSI-SCSI adapter by two or more sources. Otherwise a proper operation is not guaranteed or there may result a damage to the hardware!

The LED mounted on the top of the printed circuit board indicates a correct powering of the adapter.

Configuration of the Initiator Identification Number

On the top side of the printed circuit board there are three configuration jumpers ID3 through ID0 (see Figure 1). Closing one ore more jumpers will result in different initiator IDs as described in the following table. The default setting for the jumpers ar all open which means ID7.

ID2	**ID1**	**ID0**	**SCSI-ID**	**ID2**	**ID1**	**ID0**	**SCSI-ID**
Open	Open	Open	**7**	Closed	Open	Open	**3**
Open	Open	Closed	**6**	Closed	Open	Closed	**2**
Open	Closed	Open	**5**	Closed	Closed	Open	**1**
Open	Closed	Closed	**4**	Closed	Closed	Closed	**0**

Bus Termination

A correct bus termination is the first requirement for a proper operation. The Suska ACSI-SCSI adapter features optional pluggable bus terminators which are intended to terminate the SCSI bus correctly. Further possibilities for bus termination are using external terminators. Please be aware, that in case of using more than one SCSI device on the bus, only the last device at the end of the cable may be terminated. All others should be configured with inactive terminators. There could also be successfully tested the configuration of the ACSI-SCSI adapter with only one SCSI device and a short cable terminated only by the device.

Limitiations

1. Due to a 'Race-Condition' in the Tos 2.06 operating system, not every connected drive is capable to boot from. Although the ACSI-SCSI adapter features a speed up management to avoid this effect, especially during operation of very old hard drives the boot sequence may fail. Nevertheless these drives can be used in a normal manner when an appropriate driver is loaded from the floppy drive or a hard disk connected to the IDE port.

Hardware Aspects of operating fast peripheral Devices at the ACSI Adapter

Introduction

The Atari ST Computers are equipped with an Atari Computer System Interface (ACSI) with Direct Memory Access (DMA). Thus it was possible to connect dedicated hard disk drives of the MegaFile series or kompatible equipment. The data transfer rate of 600kByte/s upto about 1,5MByte/s was considerable fast for that time. The ACSI interface is a reduced variant of the Small Computer System Interface (SCSI). With ACSI it is possible to transfer SCSI commands of the group 0 to the connected peripherals. The protocol defined in ACSI is a subset of the SCSI protocol. Hence it is not possible to transfer commands other than group 0 commands. For that reason, the variety of mass storage devices was rather modest. Beside the MegaFiles there were only a handful of other manufacturers of hard disk drives mostly with storage capabilities not more than 100Mbyte.

Limitations of the ACSI Interface and resulting technical Solutions

While the SCSI-I standard was enhanced to SCSI-II and later to SCSI-III in the 1990ties the development of the ACSI interface was finished due to the abandonment of Atari. More modern hard disk drives with more storage capacity and other storage media like JAZ, ZIP, DVD-ROM or DVD-RAM could not be connected to the ACSI interface and operated on it. To remove this drawback, some developments for adapters were established in the nineties, which were used to translate the protocol between the ACSI and the SCSI interface and vice versa. To mention in this context are the ICD LINK or the LINK96/97, which are not available on the market any more since a longer time. Common to all those adapters was a trick, which faciliates sending SCSI commands of the groups two to five to the connected peripheral devices and in this way, at least on the hardware side, to operate more modern devices. ICD compatibility has established as a term for this feature. The ACSI adapter of Inventronik covers the function of a protocol converter from ACSI to SCSI and vice versa. It is ICD compatible.

Current Peripheral Hardware at the ACSI adapter of Inventronik

For the ACSI-SCSI adapter is still available since many years, the Atari hardware with its ACSI interface hase not changed in any way but of course the peripheral devices, it is important to have a look on some details to achieve a failureless operation. The following argumentation will be done for a fast SCSI-III hard disk drive, which represents all other fast SCSI mass storage devices. The hard disk drive plays the role of the target, the Atari is the SCSI initiator. The ACSI adapter is the link between initiator and target and has the task, as mentioned above, to take over the protocol conversion. The control of the target takes place via software from a suitable driver for example the HDDRIVER of U. Seimet.

The data transfer from or to the initiator will be achieved, sending a respective command to the target (Read, Write etc.). There shall not be explained any details at this point. Exact informationen can be found for example in the "WORKING X3T9.2 DRAFT Project 375D Revision 10L 7-SEP-93 Information technology - Small Computer System Interface - 2". During this phase of initialisation the initiator is the dominant part and takes the control over the communication to the

target. Once the target has received a valid command, it will take over the control of the further communication. in concrete this means, that it is up to now dependant on the target, how fast the data transfer will be established. In principle ST machines are able to process data with about 2Mbyte/s. The ACSI-SCSI_II adapter of Inventronik is in this case no limiting element. It can handle about 20Mbyte per second.

Consequences of the high Data transfer Rates from or to the Target

Because of the target controlled data transfer rate there result some consequences to the hardware, especially for the wiring and termination. In retrospect it can be experienced that SCSI hard drives of the first generation in conjunction with the initiator hardware, eventually used adapters and appropriate software drivers could not transfer much more than 1Mbyte per second of data. So the frequency of 1MHz on the bus was moderate. Because of this reason a simple ribbon cable in conjunction with crimped connections was sufficient to guarantee a safe operation.

This has changed with the introduction of more modern mass storage devices. Already in the nineties it was bvious, that the conventional wiring technique was not optimal to meet the requirements of a fast data transfer rate. Technical solutions came with differential signaling which was much more robust against noise. To connect such targets to the ACSI interface is not possible without the use of signal adapters which transfor the differential to a non differential signal. Contemporary the data transfer rate is significantly increased. Additionally the driver software HDDRIVER is maintenanced and developed for many years and optimized to achieve high data throughput. In summary there are multiple negative effects using such targets on the Atari ACSI interface: the data throughput will be increased which leads to higher frequencies on the data bus while the robust differential signals are converted to non differential ones.

Solutions for a save Operation

The effects as described in the preceding paragraph partially involve, that the operation of peripheral devices is not perfect on the ACSI interface. There result errors for example during formatting or sector tests. Writing big blocks of data to the media will result in errors.To avoid such negative impacts, it is recommended to plan have a carful look on the details during planing the peripheral system:

1. Connecting any peripheral devices randomly is not recommended.

2. It is not always the best solution to select the fastets ultrawide hard disk drives with signal adapters to the non differential bus.

3. The bus termination should be done carefully. It sometimes helps to terminate not only the ends of the bus but every peripheral device. 4. Use cables as short as possible.

5. Avoid driving too many targets on the SCSI-Bus with ACSI-Adapter.

6. Sometimes it is better to use only a small amount of targets with multiple ACSI adapters, hence use more ACSI-IDs.

7. Older targets, with non differential signaling often do their job better than modern targets.

Closing Words

There is a widely range of possibilities to adapt different peripheral devices with or without signal adapters to the ACSI interface of the Atari ST machines. Hence the explanations and argumentation above should be understood as a reference which points out the interaction between initiator, target, ACSI adapter, wiring, termination, operating system and last but not least the driver software. At least it should be clarified that higher bus frequencies lead to more noise and in this way to a more and more difficult operation. To eliminate or reduce such effects the peripheral system should be carefully designed with respect to the targets, the wiring and the bus termination.

A good alternative to SCSI mass storage devices like hard disk drives, JAZ, ZIP, DVD-RAM etc. is the GigaFile SD card drive from Inventronik, which features native ACSI and SCSI operation, fast data throughput, Windows operating system compatibility when used with HDDRIVER, noiseless operation, very low energy consumption and a nice and compact design. It works as a removable disc and allows in this way data backup to different SD cards.

Annex

Pin Description of the 26 pos. ACSI Connector

Pin No.	Function
1	ACSI Data Bus Bit D0
2	GND
3	ACSI Data Bus Bit D1
4	ACSI-RESETn
5	ACSI Data Bus Bit D2
6	GND
7	ACSI Data Bus Bit D3
8	ACSI-HDACKn
9	ACSI Data Bus Bit D4
10	GND
11	ACSI Data Bus Bit D5
12	ACSI-CA1
13	ACSI Data Bus Bit D6
14	GND
15	ACSI Data Bus Bit D7
16	ACSI-CR/Wn
17	ACSI-HDCSn
18	ACSI-HDRQn
19	ACSI-HDINTn
20	GND
21	GND
22	GND
23	+5V
24	+5V
25	+5V
26	+5V

Pin Description of the 19 pos. ST Type ACSI Connector

Pin No.	**Function**
1	ACSI Data Bus Bit D0
2	ACSI Data Bus Bit D1
3	ACSI Data Bus Bit D2
4	ACSI Data Bus Bit D3
5	ACSI Data Bus Bit D4
6	ACSI Data Bus Bit D5
7	ACSI Data Bus Bit D6
8	ACSI Data Bus Bit D7
9	ACSI-HDCSn
10	ACSI-HDINTn
11	GND
12	ACSI-RESETn
13	GND
14	ACSI-HDACKn
15	GND
16	ACSI-CA1
17	GND
18	ACSI-CR/Wn
19	ACSI-HDRQn

Note: The pin numbers are normally marked on the D-SUB type connectors. Otherwise be careful using the correct numbering. In comparision to the pin headers' numbering, the pins are not arranged alternating; the correct numbering is row by row.

Pin Description of the 50 pos. SCSI Connector

Pin No.	**Function**	**Pin No.**	**Function**
2	/SCSI-D0	1	GND
4	/SCSI-D1	3	GND
6	/SCSI-D2	5	GND
8	/SCSI-D3	7	GND
10	/SCSI-D4	9	GND
12	/SCSI-D5	11	GND
14	/SCSI-D6	13	GND
16	/SCSI-D7	15	GND
18	/SCSI-PARITY	17	GND
20	GND	19	GND
22	GND	21	GND
24	GND	23	GND
26	TermPower	25	-
28	GND	27	GND
30	GND	29	GND
32	/ATN	31	GND
34	-	33	GND
36	/BSY	35	GND
38	/ACK	37	GND
40	/RESET	39	GND
42	/MSG	41	GND
44	/SEL	43	GND
46	/C_D	45	GND
48	/REQ	47	GND
50	/I_O	49	GND

Cable Assembly 50 pos Pin Header to D-SUB 25

D-SUB 25	**Function**	**50 pos. Pin Header**
1	/REQ	48
2	/MSG	42
3	I/O	50
4	/RST	40
5	/ACK	38
6	BSY	36
7	GND	20
8	DB0	2
9	GND	22
10	DB3	8
11	DB5	12
12	DB6	14
13	DB7	16
14	GND	24
15	C/D	46
16	GND	28
17	/ATN	32
18	GND	30
19	/SEL	44
20	PAR	18
21	DB1	4
22	DB2	6
23	DB4	10
24	GND	34
25	TRMPWR	26

Cable Assembly 26 pos Pin Header to D-SUB 19 and HD-SUB 26

26 pos. Header	Function	ACSI D-SUB 19	ACSI HD-SUB 26
1	D0	1	15
2	GND	11	2
3	D1	2	13
4	/RST	12	23
5	D2	3	11
6	GND	13	6
7	D3	4	9
8	/ACK	14	20
9	D4	5	7
10	GND	15	16
11	D5	6	5
12	CA1	16	24
13	D6	7	3
14	GND	17	14
15	D7	8	1
16	CR/W	18	26
17	/HDCS	9	22
18	/HDRQ	19	21
19	/HDINT	10	25
20	GND		8
21	GND		12
22	GND		
23	+5V		19
24	+5V		
25	+5V		
26	+5V		

Contact

lnventronik GmbH, Finkenstraße 48, 70199 Stuttgart.

Internet: www.inventronik.de; www.experiment-s.de.

Email: info@inventronik.de