SIEMENS

ECOS

SRIF 2002

Operating Instructions

Edition 10/2003

Safety instructions

This document contains instructions you are strongly advised to observe in order to guarantee your personal safety and to avoid personal damages. The instructions are marked by a warning triangle and, depending on the degree of risk, are presented as follows:

Warning

means that death or serious physical injuries may be caused if you do not take the respective precautionary measures.

Caution

means that minor physical injuries may be caused if you do not take the respective precautionary measures.

Note

provides important information on the product, the product handling or the respective part of the documentation which requires special attention and whose observation is recommendable due to possible advantages.

Use in accordance with specification

Please observe the following:

Warning

The device may only be used for applications specified in the catalogue and the technical descriptions. It may further only be used in combination with non-Siemens devices and components which are recommended or approved by Siemens.

Faultless and safe operation is only ensured if the product is transported, stored, mounted and installed properly and if the operation and maintenance is carried out conscientiously.

Disclaimer of liability

Although we have carefully checked the contents of this publication for conformity with the hardware and software described, we cannot guarantee complete conformity since errors cannot be excluded. The information provided in this manual is checked at regular intervals and any corrections which might become necessary are included in the next editions. The contents of this manual are subject to change without prior notice. Any suggestions for improvement are welcome.

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General 1

1.1 Short description

The SRIF 2002 is a radio transmitter/receive module (transceiver) for half-duplex data transmission in the 5.8 GHz ISM range. It transmits digital data with a baud rate up to 115.2 kBaud. Depending on the antenna, the installation environment and the frequency band, the transmission range may be up to 15 m, 100 m as a maximum (comparable to free field).

127 different frequencies (radio channels) can be set and used in the 5.8 GHz ISM band.

1.2 Definition of terms

BA	Battery Adapter
ECOS	Electrical Check Out System
ECOS-i	Electrical Check Out System intelligent
FCC	Federal Communications Commission
FSK	Level Frequency Shift Keying
HT	Hand-held Terminal
ISM	Industrial, Scientific and Medical Applications
LSB	Least Significant Bit
MDA	Mobile Diagnosis Adapter
MMCX	Type: RF connector with latching element
MPS	Mobile Test Station
MSB	Most Significant Bit
RF	Radio Frequency
RSSI	Receive Signal Strength Indicator
SDA	Stationary Diagnosis Adapter
SMA	Type: RF connector with thread
SRIF	Serial Radio InterFace
TRX	Transmitter Receiver (product from the ECOS range)
UART	Universal Asynchronous Receiver Transmitter

1.3   Important instructions

1.3.1 General instructions

Transport

We recommend that you only transport the device in its original packaging (shock and impact protection).

Repairs

Repairing the device is not permitted. Considerable danger may result for the user if the device is opened without authorisation or repairs are carried out improperly.

ESD guidelines

Modules with ESD (electrostatically sensitive devices) may be marked by the following label:

If you use modules with ESD, you are urgently required to observe and follow the following guidelines:

●   Before you start to work with modules including ESD, you must discharge yourself electrostatically (e.g. by touching an earthed object).

●   All devices and tools used must be free of static charge.

●   Withdraw the power plug prior to plugging in or withdrawing modules with ESD.

●   Touch modules with ESD only on the edges.

●   Do not touch any terminal pins or conductors on a module with ESD.

●   Use only ESD-suitable packaging for shipping.

1.3.2 Certificates, guidelines and declarations

Notes on the CE certification

CE   The following applies for the product described in these operating instructions:

EC guideline R&TTE 1999/5/EC

The product meets the requirements of the EC guideline R&TTE 1999/5/EC (Radio Equipment and Telecommunications Terminal Equipment) and the corresponding harmonized European standards (EN) published in this context.

SRIF 2002 complies with national and international standards. Radio installations with the SRIF 2002 are ready for approval world-wide.

Any emitted interferences in the transmit and receive mode comply with EN 300 440 (09.2001).

Note on the Declaration of Conformity

In accordance with the above mentioned EC guideline, the EC conformity declarations and the accompanying documentation are available for the responsible authorities at:

SIEMENS AG
Automation and Drives
A & D PT 34
P.O. Box 4848
D – 90327 Nuremberg

Tel.: +49 911 895 3490
Fax.: +49 911 895 3699

FCC approval

FCC   FCC ID:LDS-SRIF2002

The product meets the requirements of FCC guideline CFR47 Part15 chapter 249.

Caution:

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Observe installation guidelines

The installation and safety guidelines listed in these Operating Instructions must be observed for commissioning and operation.

DIN ISO 9001 certificate

The quality management system of our complete product generation process (development, production and distribution) complies with the DIN ISO 9001 requirements (corresponds to EN29001: 1987).
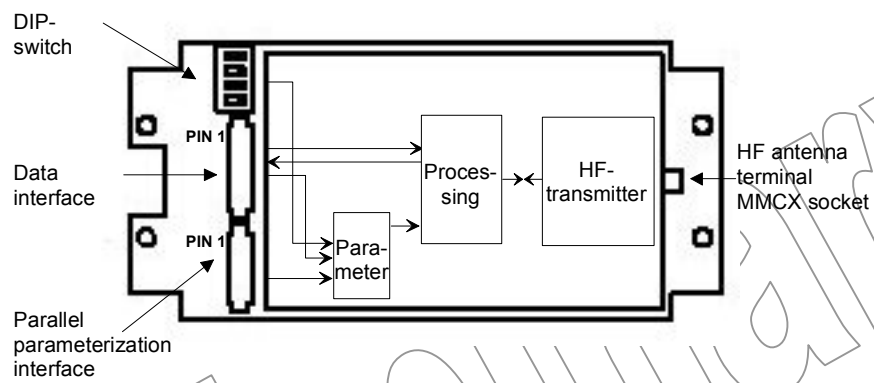
Block Diagram

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Figure 1: Block diagram of the SRIF 2002

Functional Description

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3.1   Radio transmission

The SRIF 2002 comprises all necessary functions for the transmission of digital data in the 5.8 GHz range in transmit and receive mode. It is possible to set 127 frequencies (channels) independent of each other. The channels can either be programmed via an additional asynchronous interface (UART protocol: 4800 Baud; 8N1) or set via 7 binary-coded parallel control lines. The parallel setting always has priority, i.e. a serial programming is only possible if the parallel interface is disconnected or the word "0" is set at the parallel interface (all switches open). The SRIF 2002 supplies an analog RSSI signal.

The SRIF 2002 operates in the half duplex mode. The SRIF 2002 is in the receive mode as a standard. As soon as any transmission data are applied to the data input (TXD) and the control signal pin2 is set to TX, the module switches to the transmit mode and transmits the data.
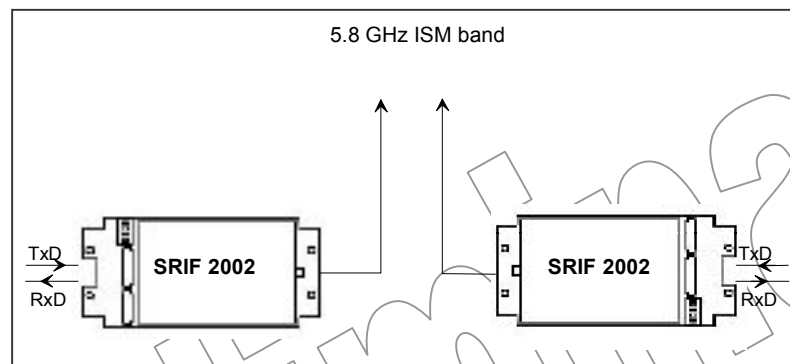
Figure 2: Schematic representation of the radio transmission

Operating modes of the SRIF2002:

- Receive mode

  The receive mode is the normal operating state of the module.

- Transmit mode

  The module automatically changes into the transmit mode when a valid signal has been received via the UART and after the completion of a just received block via the radio path.

- Stand-by mode

  The stand-by mode is activated at wrong parameterization.

The SRIF 2002 communicates via a serial asynchronous interface (UART protocol). The transfer rate has to be preset by the user. Transfer rates of 9600, 19200, 38400, 57600 and 115200 can be set via the quadruple DIP switch of the SRIF 2002 (see Figure 1, page 11). Data communication is always 8E1 (8 data bits, even parity, 1 stop bit).

3.2   Parameterization via the parallel interface

The SRIF 2002 has to be parameterized via the parallel interface, for example if it is used in the battery adapter (BA) / ammeter or in the TRX245 of the ECOS range.

This presetting can be overwritten with the help of the additional asynchronous serial interface (UART protocol: 4800 baud; 8N1 (see Chapter 3.3 Serial parameterization, page 17).

The following settings have to be carried out:

Baud rate setting

The SRIF 2002 carries out the setting of the DIP switch after every power-on reset.

See Chapter 4 Settings, page 23, for a table listing of the settings.

Channel setting

8-pole plug-in connector Molex 53261-0890

Connector B Pin	Description
GND (Pin 1)	Reference potential
A0,..., A6 (Pin 2,..., Pin8)	Digital inputs for the parallel channel setting 4V CMOS level binary-coded A0 = 2^0 and A6 = 2^6

(for channel numbers, see Chapter 7 Appendix, page 31; for Pin numbering, see Chapter 2 Block Diagram, page 11)

7 parallel inputs (A0 = LSB, A6 = MSB) and one reference line (GND) are used. The address lines are equipped with internal pull-up resistances at the radio link module.

The coding switch to be connected short-circuits the selected address lines with the reference line (inverse logic !).

Due to the missing eighth address line, the settings on the coding switch starting from 8x are interpreted as entries starting from 0x.

3.3   Serial parameterization

For the use of the SRIF 2002 radio link module in the MPS, hand-held terminal, and MDA devices of the ECOS range, the channel number is set via the serial interface.

The serial programming is carried out via the additional asynchronous serial interface (UART protocol: 4800 baud; 8N1) and offers the following options for setting or polling the SRIF 2002:

- Version and setting inquiry
- Channel setting
- Overwriting the baud rate setting
- Connecting and disconnecting the RSSI extension

The meaning of the settings is explained in the following.

The transmission of the data via the serial interface is carried out in the form of a string consisting of 4 characters. The first three characters encode the command (numeric characters only), the fourth character is always "#". If a valid command has been detected, the SRIF 2002 responses - unless it is a version inquiry - with the string sent via the RxD line (pin 4). The response is also carried out with the UART protocol 4800 baud, 8N1.

Note

Communication via the additional asynchronous serial interface is only possible if the parallel interface is disconnected or the word "0" is set at the parallel interface (all switches open).

With the "serial parameterization", the SRIF 2002 starts in the stand-by mode after a power-on and waits for a serial channel setting. The SRIF 2002 only changes into the receive mode after a successful parameterization.

Channel setting

The SRIF 2002 operates with a frequency pattern of 1,173.23 kHz. For optimum use of the released ISM band (5.725 up to 5.875 GHz), the frequency of 5,726.0866 MHz was set for channel 1.

Example: Setting for channel 04 (hex); corresponds to a frequency of
            5,729.6063 MHz: 035#
            for the frequency table, see Chapter 7 Appendix, page 31).

Baud rate setting

Setting the transfer rate:

Transfer rate (baud)	Data string
9,600	991#
19,200	992#
38,400	993#
57,600	994#
115,200	995#

RSSI voltage / RSSI extension

The SRIF 2002 offers two settings for the output of RSSI voltage. With the "RSSI extension" activated in the delivery state, the SRIF 2002 always raises the RSSI voltage to a level of approx. 4V if received data are output at pin 4 (RxD).

If the "RSSI extension" is switched off, the RSSI level is not raised to 4 Volt during the data output.

RSSI extension	Data string
ON	997#
OFF	996#

Version and setting inquiry

The SRIF 2002 responds to the command 990# (version inquiry) with its soft- and hardware-dependent version number and its current settings for channel, transfer rate, status of the RSSI extension. The "Special Channels" switch (SRIF 2000: 998/999) is also output to ensure compatibility with the SRIF2000. This switch has no function for the SRIF2002.

The version number lies within the range of 200 and 299. The individual pieces of information are separated from each other by "," and are contained in the response string in the above mentioned sequence (202,035,994,997,998#.)

Example response:	Data string
Version number 202 = SRIF2002 / V02	202
Channel 4,	035
Transfer rate 57,600,	994
RSSI extension "ON"	997
Special channels "OFF":	998#

3.4 Serial data interface

Pin assignment 10-pole plug-in connector Molex 53261-1090:

Connector A Pin	Type	Description
RSSI (Pin 1)	Output analog / digital	Receive Signal Strength Indicator
Rx / Tx (Pin 2)	Input digital	Test mode switchover
SerIN (Pin 3)	Input digital	Asynchronous serial programming interface
RxD (Pin 4)	Output digital	Received data Output of the received data in the receive mode
PWR (Pin 5)	Input digital	Control of the transmitting power
TxD (Pin 6)	Input digital	Transmission data
Mode (Pin 7)	Input digital	Test mode activation
+ 5V (DC IN) (Pin 8)	Input	Supply voltage
LDI (Pin 9)	Output digital	Status output of the PLL frequency synthesizer
GND (Pin 10)		Reference potential

For pin numbering in the connector, see Chapter 2 Block Diagram, page 11.

3.5   Notes on the radio operation

Conditions for the radio path

A radio path usually exists between a stationary unit (e.g. SDA or TRX245) and a mobile unit (e.g. MPS, HT, MDA, BA).

Various physical quantities influence the signal propagation on the radio path. In order to achieve a radio transmission which is as interference-free as possible, the total of all of the physical parameters should be as good as possible. If the individual conditions become worse, this does not immediately result in faulty radio traffic. However, if several negative influences add up, this could result in increased interferences in the radio transmission or it could completely collapse.

Parameters of a radio path:

- Selection of the antennas:
  The type of antenna is specified for the respective device used .
  If it is necessary to optimize a radio path, it is possible to improve it by selecting a high-quality antenna. Nevertheless, the fact has to be taken into account that interfering frequencies might also be increased. An exact examination and measurement of the radio path is necessary for each application.

- Arrangement of the antenna:
  With stationary units, the antenna should be installed in such a way that an "obstacle-free" radio path can be set up, i.e. there are no fixed and, if possible, no moving obstacles in the direct radio path.

- Arrangement of several antennas:
  Different antennas with different radio paths should be installed as far away from each other as possible, otherwise interferences could occur. The same is true regarding the selection of the frequencies. The greater the distance between the frequencies is, the less interferences occur.

- Radio link modules and frequencies:
  When using different radio link modules or radio systems, you should make sure that they do not send on the same or a similar frequency, but that different frequency ranges are used; otherwise they could influence each other.

- Radio path:
  The radio path in open space is the most optimal one.
  Stationary obstacles (e.g. walls or metallic objects) limit the transmission range
  and movable or smaller objects (also humans) also influence the radio path.
  Since the radio transmission in this frequency range is not only carried out
  directly, but also via reflexions, other paths are also possible (multipath
  propagation).

Settings

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4.1 Settings for the DIP switch

The SRIF 2002 communicates via an asynchronous serial interface (UART interface). The transfer rate has to be preset by the user.

Transfer rates of 9,600, 19,200, 38,400, 57,600 and 115,200 baud can be set via the quadruple DIP switch of the SRIF 2002. Data communication is always 8E1 (8 data bits, even parity, 1 stop bit).

The SRIF 2002 carries out the setting of the DIP switch after every power-on reset.

Transfer rate (baud)	Switch position			
	S4	S3	S2	S1
9,600	X	OFF	OFF	OFF
19,200	X	OFF	OFF	ON
38,400	X	OFF	ON	OFF
57,600	X	OFF	ON	ON
115,200	X	ON	X	X

(X: Switch position irrelevant)

The typical setting / factory setting is the baud rate 57,600.

Note

This presetting can be overwritten with the help of the additional asynchronous serial interface (UART protocol: 4800 baud; 8N1). The procedure is described in Chapter 3.3, page 17).

ECOS products such as the MPS, the hand-held terminal, or similar products use the serial parameterization to overwrite this switch setting.

The transmitting power of the radio module can be reduced via the S4 switch.

Transmitting power	S4 switch
Full transmitting power	**OFF**
Reduced transmitting power	**ON**

Please refer to Technical Data in Chapter 6, page 29, for the corresponding transmitting power.

The typical setting or factory setting is "Full transmitting power".

4.2 Settings for the operation in the MDA / SDA

For the operation in the MDA / SDA, both an organization channel (plus stand-by channel) and a data channel are required. The organization channel is the same for all MDA /SDA within one spacial area.

The following channel numbers are the standard / factory settings for the SRIF 2002 module:

Organization channel: **68**
Stand-by organization channel: **41**

Note

No settings can be carried out on the SRIF! The information given above is only relevant for MDA applications.

Due to the increased power consumption of the SRIF 2002 module, the increased power consumption is set for new MDAs in the operating mode "Constant current control = ON" (MDA 5 = 280 mA and MDA6 = 300 mA).

Please contact your contact partner for more information.

4.3 Settings for the operation in the hand-held terminal

Depending on the version and the equipped firmware in the hand-held terminal, it is possible that not all of the radio channels can be set and thus used.

Limitations of the radio channels between 1 and 33 and 41 to 73 might occur. This has to be taken into account when planning the installation.

In the case of older firmware versions, the possible HEX-coded channels cannot be set either.

The increased power consumption of the SRIF 2002 modules reduces the service life of the battery-operated handheld terminal.

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Maintenance and Care   5

The SRIF 2002 does not require any maintenance or care.

Technical Data

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● Transmit / receive frequency	5,726.0866 MHz up to 5,873.9134 MHz
	also see the frequency table (Chapter 7, page 31).
● Transmitting power PWR = open PWR = GND	+7 dBm up to +13 dBm –9 dBm up to –2 dBm
● Signal band width	normally: 1100 kHz
● FSK frequency shift	normally: 120 kHz
● Input sensitivity	–96 dBm
● Channel separation	1,173.23 kHz
● Operating voltage	4.5 V up to 5.5 V
● Current consumption in operation in stand-by	145 mA up to 210 mA 17 mA up to 23 mA
● Voltage at Rx/Tx, SerIN, TxD, mode	-0. 3 V up to +6.5 V
● Voltage at A0..A6, PWR	-0.3 V up to +4.5 V
● Operating temperature range	-10 °C up to +65 °C
● Storage temperature range	-40 °C up to +85 °C
● Size	100 x 47 x 11 mm

Subject to technical changes.

Appendix: Channel / Frequency Table 7

The table shows the channel assignment and the commands for the serial programming:

C. No. (hex)	Frequency (MHz)	Progr. serial	C. No. (hex)	Frequency (MHz)	Progr. serial	C. No. (hex)	Frequency (MHz)	Progr. serial
01	5,726.0866	005#	2B	5,775.3622	137#	55	5,824.6378	150#
02	5,727.2598	015#	2C	5,776.5354	147#	56	5,825.8110	160#
03	5,728.4330	025#	2D	5,777.7086	157#	57	5,826.9842	170#
04	5,729.6063	035#	2E	5,778.8818	167#	58	5,828.1574	180#
05	5,730.7795	045#	2F	5,780.0551	177#	59	5,829.3307	190#
06	5,731.9527	055#	30	5,781.2283	295#	5A	5,830.5039	062#
07	5,733.1259	065#	31	5,782.4015	305#	5B	5,831.6771	072#
08	5,734.2992	075#	32	5,783.5748	315#	5C	5,832.8504	082#
09	5,735.4724	085#	33	5,784.7480	325#	5D	5,834.0236	092#
0A	5,736.6456	007#	34	5,785.9212	335#	5E	5,835.1968	102#
0B	5,737.8189	017#	35	5,787.0944	345#	5F	5,836.3700	112#
0C	5,738.9921	027#	36	5,788.2677	355#	60	5,837.5433	200#
0D	5,740.1653	037#	37	5,789.4409	365#	61	5,838.7165	210#
0E	5,741.3385	047#	38	5,790.6141	375#	62	5,839.8897	220#
0F	5,742.5118	057#	39	5,791.7874	385#	63	5,841.0629	230#
10	5,743.6850	095#	3A	5,792.9606	187#	64	5,842.2362	240#
11	5,744.8582	105#	3B	5,794.1338	197#	65	5,843.4094	250#
12	5,746.0315	115#	3C	5,795.3070	207#	66	5,844.5826	260#
13	5,747.2047	125#	3D	5,796.4803	217#	67	5,845.7559	270#
14	5,748.3779	135#	3E	5,797.6535	227#	68	5,846.9291	280#
15	5,749.5511	145#	3F	5,798.8267	237#	69	5,848.1023	290#
16	5,750.7244	155#	40	5,800.0000	395#	6A	5,849.2755	122#
17	5,751.8976	165#	41	5,801.1732	010#	6B	5,850.4488	132#
18	5,753.0708	175#	42	5,802.3465	020#	6C	5,851.6220	142#
19	5,754.2441	185#	43	5,803.5196	030#	6D	5,852.7952	152#
1A	5,755.4173	067#	44	5,804.6929	040#	6E	5,853.9685	162#
1B	5,756.5905	077#	45	5,805.8661	050#	6F	5,855.1417	172#
1C	5,757.7637	087#	46	5,807.0393	060#	70	5,856.3149	300#
1D	5,758.9370	097#	47	5,808.2126	070#	71	5,857.4881	310#
1E	5,760.1102	107#	48	5,809.3858	080#	72	5,858.6614	320#
1F	5,761.2834	117#	49	5,810.5590	090#	73	5,859.8346	330#
20	5,762.4567	195#	4A	5,811.7322	002#	74	5,861.0078	340#
21	5,763.6299	205#	4B	5,812.9055	012#	75	5,862.1811	350#
22	5,764.8031	215#	4C	5,814.0787	022#	76	5,863.3543	360#
23	5,765.9763	225#	4D	5,815.2519	032#	77	5,864.5275	370#
24	5,767.1496	235#	4E	5,816.4252	042#	78	5,865.7007	380#
25	5,768.3228	245#	4F	5,817.5984	052#	79	5,866.8740	390#
26	5,769.4960	255#	50	5,818.7716	100#	7A	5,868.0472	182#
27	5,770.6692	265#	51	5,819.9448	110#	7B	5,869.2204	192#
28	5,771.8425	275#	52	5,821.1181	120#	7C	5,870.3937	202#
29	5,773.0157	285#	53	5,822.2913	130#	7D	5,871.5669	212#
2A	5,774.1889	127#	54	5,823.4645	140#	7E	5,872.7402	222#
						7F	5,873.9134	232#

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