

User Manual KUNBUS-IC PROFIBUS

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1 General information

1.1 Disclaimer

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1.2 Notes regarding this user manual

This user manual provides important technical information that can enable you, as a user, to efficient, safe and convenient integration of the IC-Module into your applications and systems. It is intended for trained, qualified personnel, whose sound knowledge in the field of electronic circuits and expertise of PROFIBUS is assumed.

As an integral part of the module, the information provided here should be kept and made available to the user.

1.3 Validity

This document describes the application of the KUNBUS IC-Moduls with the product number:

- PR100037, Release 01

1.4 Limitation of Liability

Warranty and liability claims will lapse if:

- the product has been used incorrectly,
- damage is due to non-observance of the operating manual,
- damage is caused by inadequately qualified personnel,
- damage is caused by technical modification to the product (e.g. soldering).

1.5 Customer Service

If you have any questions or suggestions concerning this product, please do not hesitate to contact us:

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support@kunbus.de

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2 Safety Guidelines

2.1 User

The Modul may only be assembled, installed and put into operation by trained, qualified personnel. Before assembly, it is absolutely essential that this documentation has been read carefully and understood. Expertise in the following fields is assumed:

- Electronic circuits,
- Basic knowledge of PROFIBUS,
- work in electrostatic protected areas,
- Locally applicable rules and regulations for occupational safety.

2.2 Symbols

The symbols used have the following meaning:

DANGER

Hazard

Observe this information without fail!

There is a safety hazard that can lead to serious injuries and death.

CAUTION

Caution

There is a safety hazard that can result in minor injuries and material damage.

NOTICE

Note

Here you will find important information without a safety hazard.

2.3 General Safety Guidelines

DANGER

Danger of electric shock

If unsuitable power supply is used, this can cause an electric shock.

- This can cause death, serious injuries and material damage to your systems and modules.
- ➔ Only use a power supply that complies with the regulations for safety extra-low voltage (SELV) or protective extra-low voltage (PELV).

CAUTION

Fault due to mechanical load

A continuous mechanical load of over 5 G or shock loads of over 15 G can cause faults on your modules.

- ➔ Comply with these load limits and avoid any unnecessary loads.

CAUTION

Damage due to subsequent processing

Avoid subsequent processing of the IC-Modul.

- Soldering can cause components to become detached and thus damage or destroy the module.
- Please note that the warranty shall become invalid if the products are changed technically.
- ➔ Speak to your contact person at the KUNBUS GmbH about customised solutions.

2.4 Environmental Conditions

Operate the IC-Modul only in an environment that complies with the operating conditions in order to prevent any damage.

Suitable Environmental Conditions:

Operating temperature	0 °C to +60 °C
Humidity	0% not 95%, non-condensing

3 Overview

3.1 Introduction

With the KUNBUS IC-Modul you can make a sensor or actuator fieldbus-capable. To do this, simply insert the module into your application and connect it to the fieldbus.

The IC-Modul thereby saves you time-consuming in-house developments.

3.2 Application Interface

The main board is connected to the device controller via a 32-pin connector strip. Thus, you have the option to plug the module directly into your DIL socket.

NOTICE

If the module is plugged in and unplugged frequently, mechanical stresses may damage the module.

Use a zero insertion force socket to prevent damage.

You can find detailed information on this topic in section "Installation [► 35]".

3.3 Status LEDs

You have the option to integrate additional LEDs into your application. These LEDs can be activated using the shift register.

- ✓ To do this, configure the first output shift register
 - In register 0x0025 or
 - in CDI menu "2.3 SSC Communication"

The signals have the following meaning:

Bit	Designation	Signal	Meaning
0	Operating Mode	off	Module not running
		flashes	At least one part of the system has not yet finished the initialisation.
		on	All systems are running perfectly
1	Module Error	off	No Error
		flashes	At least one system component is not running due to a configuration error
		on	An internal system error has occurred
2	Script Run	flashes	Script deactivated or not loaded
		on	Script is running
3	Script Error	off	No Error
		on	Error in Script
4	PROFIBUS Run	off	No cyclical data exchange
		on	Cyclical data exchange
		flashes	Standby Mode Master has sent "Clear Data". This happens e.g. when changing the control from "RUN" to "STOP"
5	PROFIBUS Stop	on	Bus Offline
		off	No Error

4 Components

4.1 Module Components

The module is divided into independent components to ensure a high level of flexibility in the application.

The following pages describe the individual components:

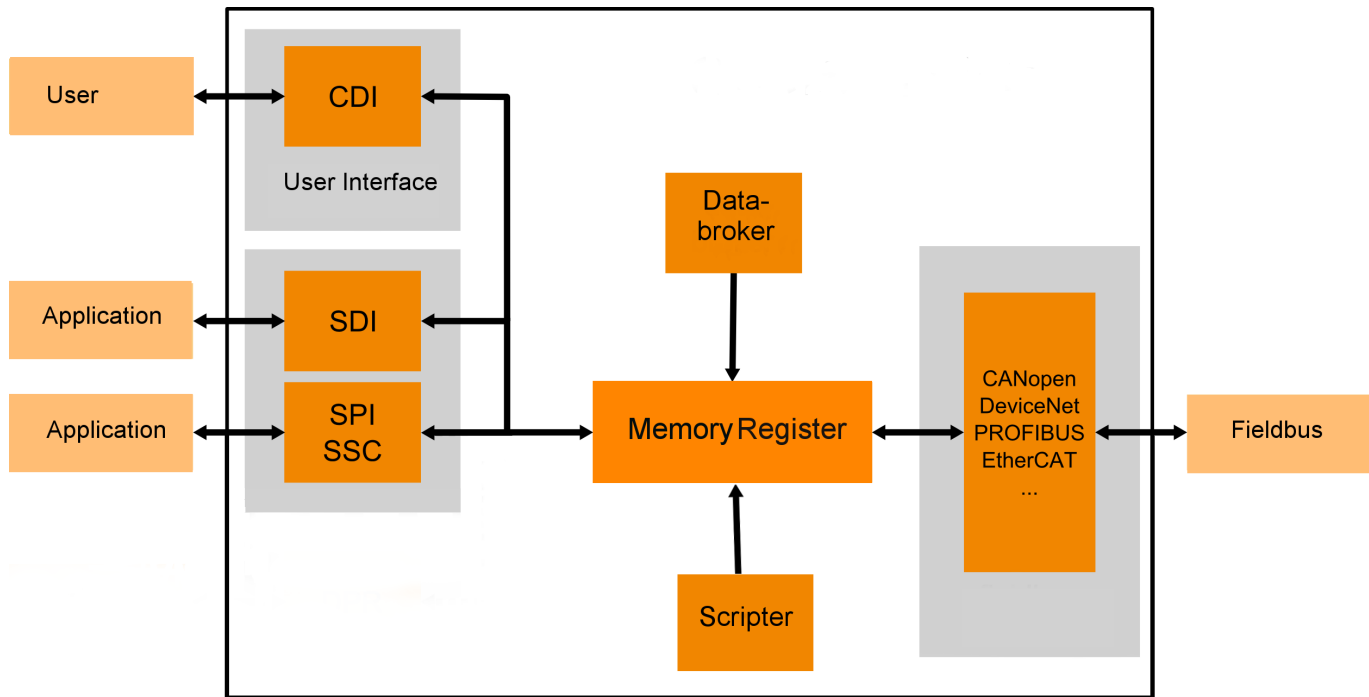


Illustration 1: Components

4.2 Storage Unit

The storage unit is the central component for all functions of the IC-Module. It is subdivided into individual Memory Register with a width of 16 bits each. In these Memory registers the following information is stored:

- Input and output data
- Configuration settings
- Module Status
- Error states

The functionality of the addressing was incorporated from Modbus. The register assignment depends on the application and is not specified by the Modbus specification. A Memory Register according to this specification has a register number between 1 (0x0001) and a maximum of 65536 (0x10000), of which the module only uses a small part, however.

With 8-bit values, 1 byte remains unused. 32-bit values are stored in 2 registers.

The 16-bit values are stored internally in the memory in Little Endian order. This must be taken into account when you access data via the fieldbus interface, SDI or SSC.

NOTICE! In the description of the individual memory registers and CDI, the memory registers are also referred to as Modbus registers.

In section Overview of the Memory Register [► 44] we have compiled a detailed overview of registers for you.

4.3 Data Broker

The Data Broker decouples individual components from each other and distributes the data streams between the interfaces. The targeted forwarding of the data ensures a high level of functionality between the data sources and data sinks of the module.

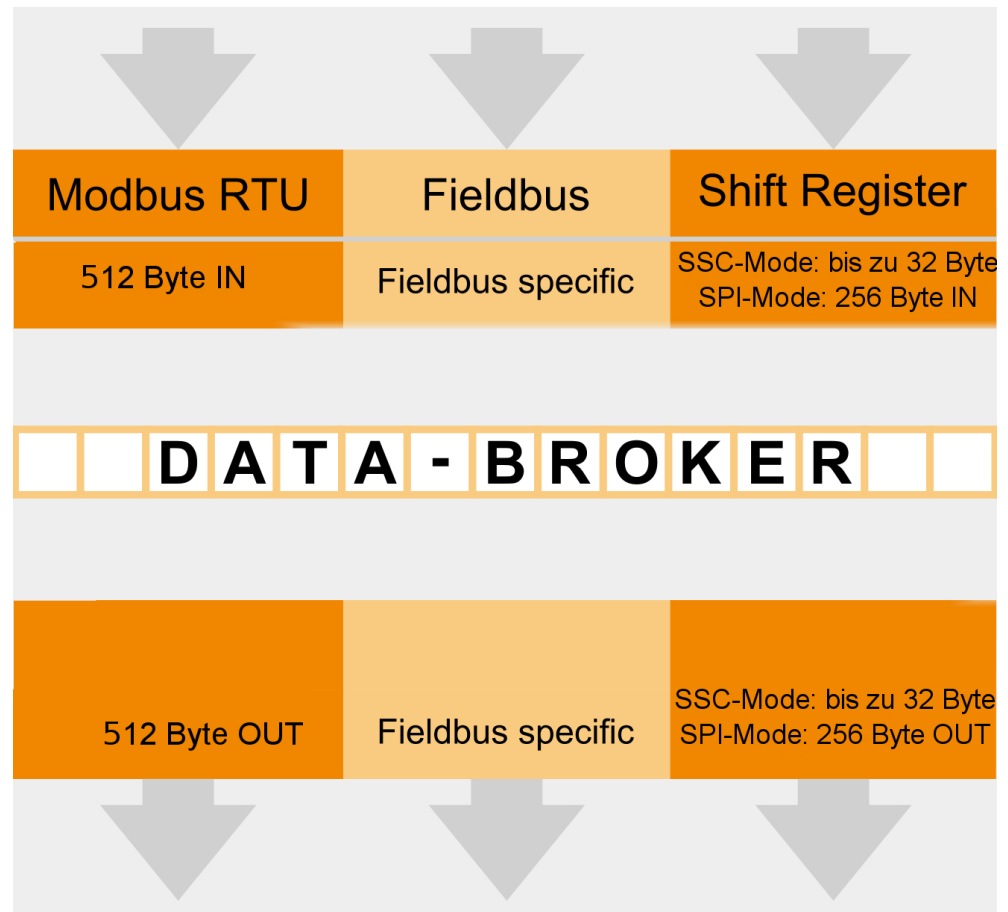


Illustration 2: Internal mapping by the Data Broker

Mapping

You have the option to define the allocation (mapping) yourself. This allows you to define which input register the Data Broker should accept data from and which output register it should transfer data to. You can define up to 8 register areas with freely definable lengths in the respective output register area for each of the interfaces. Any register area of the same length is assigned to the output register areas from one of the input register areas of all interfaces. Here, the 8 target areas are always on consecutive output register positions, starting with the lowest register address for the respective interface.

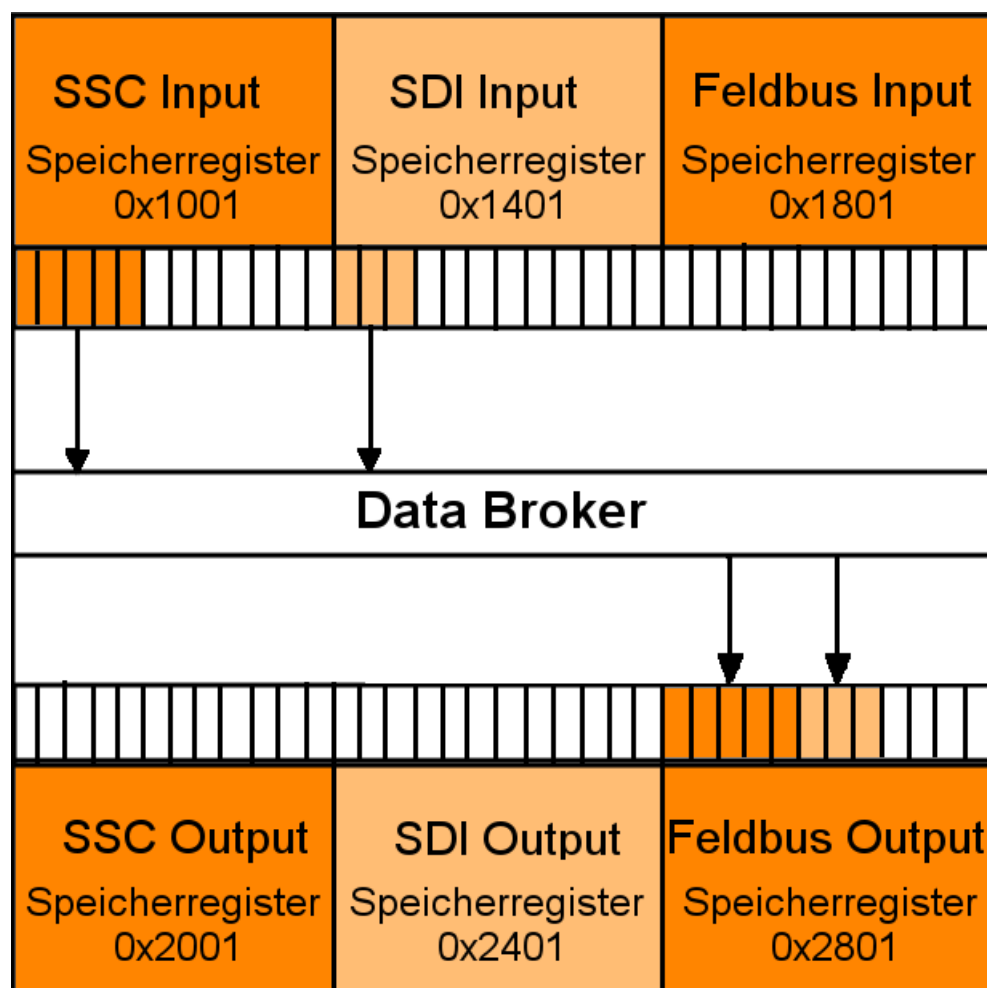


Illustration 3: Mapping

NOTICE

Viewpoint

Please note that the description of the input and output values is written from the perspective of the module and not from the perspective of the overall system or controller.

- ➔ Output: Values that the module sends to the fieldbus or application.
- ➔ Input: Values that the module receives from the fieldbus or application.

You can configure standard values that the Data Broker writes in the relevant output register instead of an input register in the event of a failure of a data provider. That has the advantage that the data processing cannot abort uncontrollably.

The module uses the Little Endian byte order for the internal processing. You can also configure the Data Broker so that it exchanges the high and low byte when copying if necessary. To do this, add the value 0x8000 or 32768 for the required mapping area (see details below).

Extended Mapping

Some applications work with data that is viewed bit by bit. To make the mapping for such applications even more flexible, an "Extended Mapping" is provided. This mapping basically works in the same way as the mapping described above:

Individual areas of the output Memory Register are assigned from areas of the input Memory registers. In Extended Mapping you define such assignments for up to 16 areas. When doing so, enter a number of consecutive bits for each of these areas.

The limit of a register must not be exceeded: The area may be up to 1024 bits long. Unlike the simple mapping described above, however, the 16 target areas do not necessarily have to be at consecutive addresses. You are totally free to define the position of the first bit of the target area by entering an output register address and the corresponding bit position (0 to 15). The source area is also defined by entering the input register and a start bit position.

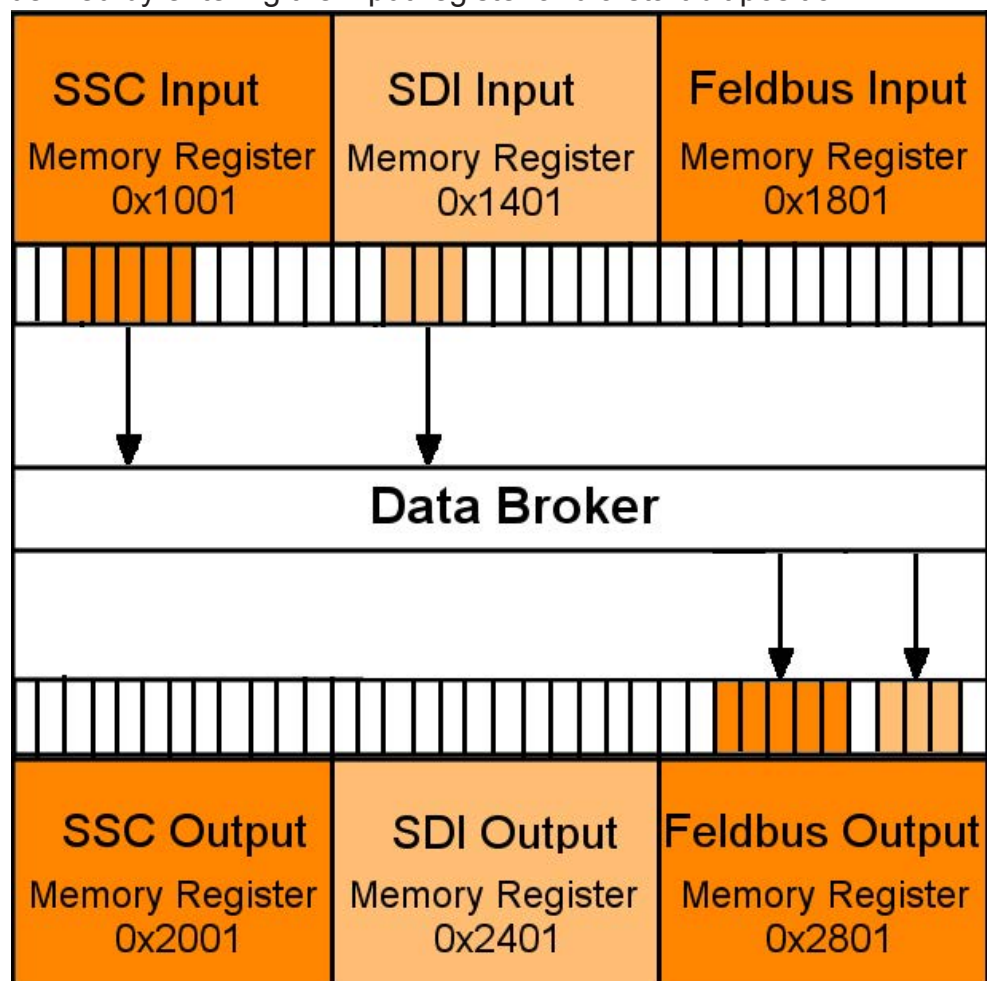


Illustration 4: Extended Mapping

All mapping areas are processed sequentially. The Data Broker first copies all simple mapping areas cyclically. After that, it executes the Extended Mapping. In the course of this, it is quite possible to intentionally overwrite a target area by several sources of data.

NOTICE

It is possible that bits are overwritten unintentionally by various input sources.

Make sure that the target areas do not overlap unintentionally.

Validity period of the process data

Data sources that write data to the input area of the central memory are called producers because they produce process data. The Data Broker collects this data and copies it into the output area of the central memory. From there, the data is sent to its target, the so-called consumer, via the corresponding interfaces.

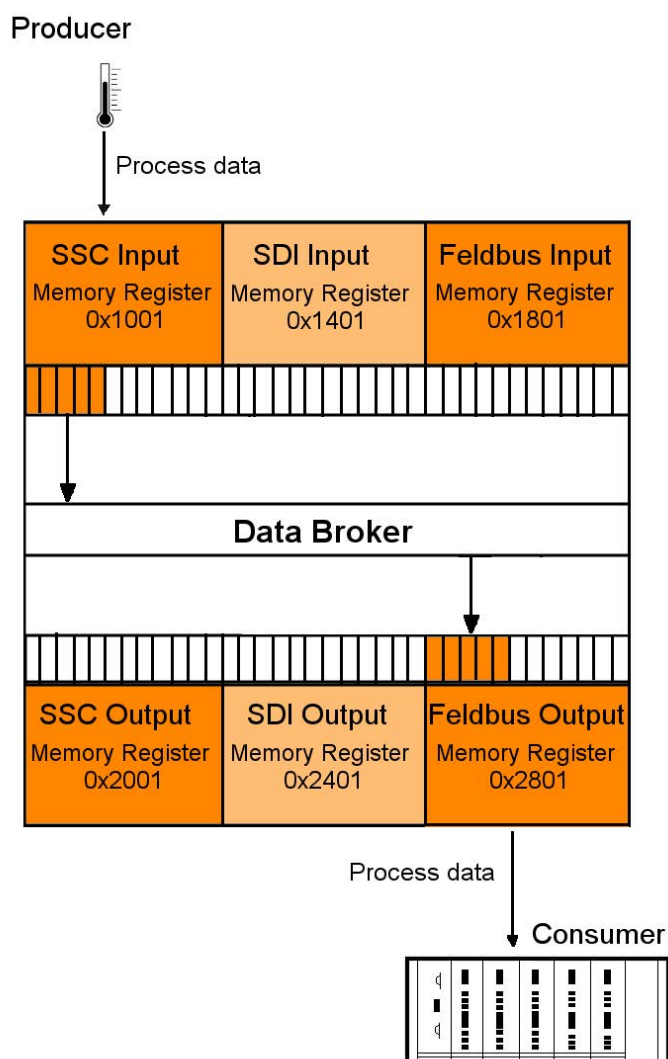


Illustration 5: Distribution to producers/consumers

Process data is normally exchanged cyclically between producers and consumers. If a producer fails (e.g. a connector is removed or a cable is broken), the consumer must be able to deal with this situation appropriately. For this reason, you can define in advance which values the producer will receive in exchange for the failed process data.

The IC-Module allow a separate validity period to be defined for each producer (SDI, SSC, PROFIBUS). When a producer supplies new process data, a stopwatch is started. If the producer does not supply any new process data before the predefined validity period expires, then the old data is invalid after this time.

Each consumer predefines which data he is to receive from the Data Broker in such a case:

- All bytes at 0
- All bytes at 1
- retain the last valid data

The set validity periods from IC-Modul are saved permanently in the Memory registers. They are also available after a restart. Likewise, the rule defined for a consumer, as to how to proceed if the validity period is exceeded. The respective time values of the validity period must be adapted, of course, to the cycle time of the interface concerned.

- For PROFIBUS this cycle time is determined by parameters of the master.
- For SSC interface the time is determined from the shift register chain length, the cycle frequency, and for short or fast register chains, it is determined by the cycle time of the IC module.
- During SPI slave mode and SDI transfer, the master determines the cycle time of the respective interface.

Example of a Mapping

The following example explains, step-by-step, how to map the first three SDI input registers and the first five SSC input registers to the field output register.

If you would like to participate in this example, you will need a functional CDI connection. Section "Setting up a Serial Connection [► 89]" explains how this works.

Input options in the CDI menu:

You can enter hexadecimal (with prefixed 0x) or decimal numbers in the CDI menu.

[Esc]	Go back one level
[Enter]	Confirm input/selection
[b]	Value is displayed in binary code
[h]	Value is displayed in hexadecimal code
[d]	Value is displayed in decimal code

- Open the main menu of the CDI as described in the Appendix "Setting up a serial connection using PuTTY".

Main Menu

The main menu is your access point for operating the module using the CDI. After a reset, the module transmits this main menu to the terminal.

```
-----
KUNBUS-IC - Main Menu
-----
1 - Module Information
2 - Interface Configuration
3 - Monitor Communication
4 - Module Status
-----
>
```

Configuration menu

- In the main menu enter [2]+[Return].
⇒ You will be taken to the configuration menu "2-Interface Configuration"

In this menu you have the option to set the mapping for the data broker and the operational parameters for the different interfaces.

- Select "Fieldbus Output Mapping" to define the data source for the fieldbus output register.

```
-----
KUNBUS-IC - Interface Configuration
-----
```

```
1 - SDI Communication
2 - CDI Communication
3 - SSC Communication
4 - SDI Output mapping
5 - SSC Output mapping
6 - Fieldbus Output mapping
7 - Fieldbus Specific
8 - Set Arbitrary Register
9 - Reset Module
10 - Extended Databroker
11 - Script Interpreter
12 - Reset to Factory Settings
-----
>
```

- Enter [1] + [Return].
 - Specify the first 3 registers of the SDI input register as data source (start address 0x1401).
 - Confirm your entry with [Return]
- ⇒ After confirming, you will return automatically to the "Fieldbus Output Mapping" menu

You can find an overview of the start addresses in the section "Overview of the Memory Register [► 44]".

```
-----
KUNBUS-IC - Edit one map entry
-----
```

```
Source Register: 0x1401
Number of Registers: 3
```

- Create another mapping at the next free position
- Select the first 5 registers of the SSC input register as data source (start address 0x1001)

```
-----
KUNBUS-IC - Edit one map entry
-----
```

```
Source Register: 0x1001
Number of Registers: 5
```

In the menu for fieldbus outputmapping, you can see the finished mapping.

```
-----
KUNBUS-IC - Fieldbus Outputmapping
-----
```

```
Src Register Number
```

```
1 - 1521 (0x1401) | 3
```

```
2 - 4097 (0x1001) | 5
```

```
3 - 1 (0x0001) | 0
```

```
4 - 1 (0x0001) | 0
```

```
5 - Default Data: all zero
```

```
6 - Valid Time: disabled
-----
>
```

The new mapping becomes active after a restart of the module. To perform a restart, you have the following options:

1. Switch the module off and on again.
2. [Esc] takes you to the CDI menu [2] "Interface Configuration". Here, enter [14] + [Return].

In CDI menu [2] "Interface Configuration" under menu item "Set Arbitrary Register" you now have the option to write the values in the SDI-In data area. The registers 0x1401 - 0x1500 are available to you for this purpose.

In menu [3] "Monitor Communication", under menu item "Arbitrary Register" you can view the fieldbus output register from address 0x2801.

NOTICE

Fault due to fine settings

Some settings lead to malfunctioning of the module.

If you already want to test some settings now, read section CDI MenusCDI Menus [► 91].

Also see about this

- 📖 Register for the Mapping [► 70]
- 📖 Setting up a Serial Connection [► 89]

4.4 Fieldbus Interface

The fieldbus interface connects the Modul to PROFIBUS. This also enables access to the fieldbus data areas FBS IN/Out.

Also see about this

- 📖 Overview of the Memory Register [► 44]

4.5 CDI - Configuration and Debug Interface

At the application interface, serial cables are available (RS232 interface with 3.3 V logic levels). You can connect these cables to a terminal or PC with terminal simulation (e.g. PuTTY) using an interface IC on the main board (see the application sample circuit diagram, Appendix 2). You can read and change parameters using structured menus. The CDI is also used for downloading scripts and firmware updates.

The CDI is suitable for configuration during the development and for diagnostic purposes. To configure several modules automatically, we recommend performing the settings with "Modpoll". "Modpoll" is freely-available software. You can find an introduction and example of this in the Appendix Configuration via Modpoll [► 128].

The serial interface is located at the application interface. The respective cables are provided there with 3.3 V logic levels. To connect these cables, you have the following options:

- Connect the cables directly with the UART inputs of the microprocessor on the main board
- Convert the cables to standardised levels using level converters or interface ICs. Afterwards, place the converted levels onto connectors for connecting a PC or terminal.

We deliver the Modul to you with the following default settings to enable access via the CDI :

- 115200 bit/s
- 8 data bits
- 1 stop bit
- Even parity (Even)

In section CDI Menus, we have compiled a detailed description of the menus for you.

4.6 SDI - Serial Data Interface

The serial data interface allows the application to access the individual Memory Register via the Modbus-RTU protocol. This allows you to configure the IC-Modul automatically and to write productive data in the input registers or to read it from the output registers.

The serial data interface is located at the application interface. The respective cables are provided there with 3.3 V logic levels. To connect these cables, you have the following options:

- Connect the cables directly with the UART inputs of the microprocessor on the main board
- Convert the cables to standardised levels using level converters or interface ICs. Afterwards, place the converted levels onto connectors for connecting a PC or terminal.

We deliver the Modul to you with the following default settings to enable access via the SDI :

- automatic baudrate detection
- 8 data bits
- 1 stop bit
- Even parity (Even)

Automatic bitrate detection means that the module tests the following bitrates until it has received a correct Modbus-RTU telegram:

- 2400 bit/s
- 4800 bit/s
- 9600 bit/s
- 19200 bit/s
- 38400 bit/s
- 57600 bit/s
- 115200 bit/s

NOTICE! During automatic bitrate detection the module does not send a reply to the master until the correct bitrate has been detected. This procedure can require up to 40 polls of the master.

TIP: Set a fixed bitrate if the automatic bitrate detection lasts too long for you.

You can make the settings optionally using the CDI or in the memory register 0x0005 [► 51].

4.7 Synchronous serial interface

A synchronous serial interface is available to you on the application interface. The synchronous serial interface can be used in 2 operating modes. You can select the operating mode in the CDI menu or in the memory registers:

- CDI Menu 2.3 [► 95]
- Memory Register 0x0017 [► 57]

Output data from the Data Broker is written to the SSC output register area and input data is read from the SSC input register area in both operating modes. The SPI Slave operating mode also allows an SPI Master write and read access to all other Memory Register that are enabled for this. This section describes how this functions in detail.

Operating mode as SPI Slave

In SPI Slave mode, the transmission of the process data between an SPI Master and the SSC Input or Output registers takes place in data blocks, which, in addition to the actual process data, also contain metadata (e.g. for indicating the register addresses for source and target areas). Such data blocks are transmitted with a hardware handshake. The actual data transmission lines MOSI, MISO and Clock are used with 3.3 V logic in the usual manner, as described below in the document S12SPIV4 "SPI Block Guide" von Motorola / Freescale®. Here, you can freely select the normally alterable parameters CPOL (Clock polarity) and CPHA (Clock Phase) in IC-Modul and define these permanently via the CDI Menu [► 98] or memory register [► 58]. The bit sequence (MSB first or MSB last) is fixed for IC modules, the module always starts the transmission with the MSB (bit of highest value) of a byte. All bytes belonging to a block are transmitted in a continuous sequence.

The clock signal required is input externally from the Master.

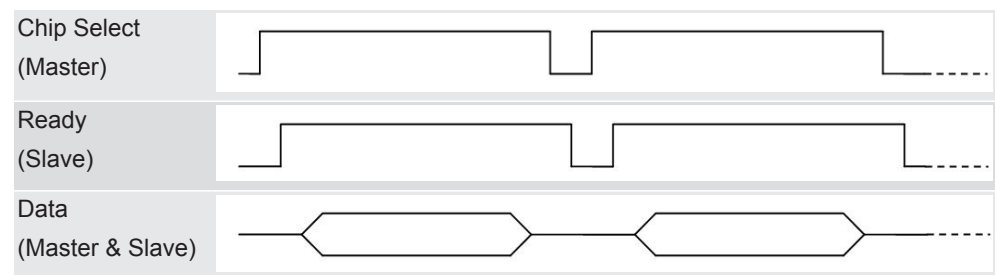
The IC-Modul can process maximum clock frequencies of 20 MHz.

Handshaking

The handshaking lines ensure that a Master first sends the subsequent transmission block after the module has processed the block that was received previously.

The module indicates by the "low" level on the SPI ready line that a transmission cycle has been completed, the status of the last transmission is waiting to be retrieved and the Master can trigger the next cycle. The Master starts this cycle by setting the SSC Chip

Select line to "high" to indicate to the module that data is ready for transmission and the following data block is meant for the module (theoretically, a master can address several modules). Once the module is now ready for this data transmission, it sets the SPI ready line to "high" and the Master can start transmission of the block immediately. A maximum delay between setting the CS signal and releasing by the ready signal of the module is 10 ms. All bytes of a data block are now transmitted directly in succession at the rate preset by the Master. After the last bit of the data block has been transmitted, the Master indicates the end of the transmission by resetting the SPI Chip Select line to "low". The module responds to this by resetting the SPI Ready line to "low". This happens at the earliest, however (maximum 10 ms after resetting CS), when the data has been processed insofar as the status was determined and is ready in the SPI output buffer so that the next transmission can start. This must first be requested, however, by the Master (as described above) by setting the SPI Chip Select line to "high".



Protocol

KUNBUS has defined a separate protocol for the data exchange via the synchronous serial interface. This protocol allows you to perform various read and write access operations. Here, the Master first always sends a transmission block with at least 5 bytes. The first 3 to 5 bytes of this transmission block consist of meta data (target address, etc.). Depending on the access type, another transmission block of variable data length follows the first block. Write and read access to the memory register of the module is performed. Only memory registers that have been enabled can be written or read, of course. The following areas cannot be written:

Input data areas:

- Fieldbus
- SDI

Output data areas:

- Fieldbus
- SSC

– SDI

When writing to the SSC input data area, the time monitoring is reset for this area (see Valid Time, Section "Data Broker [► 12]").

The various access types are explained below.

Writing 1 byte

This access type is used if 1 byte is written to a memory register of the module by the Master.

The Master first sends a transmission block with a fixed length of 5 bytes, which have the following content:

Transmission block with fixed length				
Command code (1 byte)	Address area (2 bytes)	Data area (1 byte)	Mask area (1 byte)	Description
0x01	0x0000-0xFFFF	0x00-0xFF	0x00-0xFF	WRITE_LOW_BYTE
0x02	0x0000-0xFFFF	0x00-0xFF	0x00-0xFF	WRITE_HIGH_BYTE
0x00	0XXXXX	0xFF	0xFF	NO_OPERATION*

Theoretically, you could use all memory register addresses between 0 and 0xFFFF. In practice, however, the write access is limited to registers that are enabled for this purpose. The byte can be written to the high or low byte position of the 16-bit wide register by selecting the associated command code. The mask byte only makes it possible to write single bits to the target register. Thereby, only bits that are set to "1" in the mask are transferred from the data byte (i.e. these bits are set to the value as found in the data byte). All other bits are left unchanged in the register.

During transmission of this first block, the module sends the status of the previous data transmission. The module first returns the status for the previous access when sending the next transmission block. If, however, no further write or read operation should follow the write access, then the Master must send another transmission block with the command code 0 ("NO_OPERATION") for retrieving the status, in which the module returns the status for the last write access operation.

The status response from the module is structured as follows for all write access types:

Transmission block with fixed length			
Status code (1 byte)	Error code (2 bytes)	Not used (2 bytes)	Description
0x00	0XXXXX	0XXXXX	NO_PREVIOUS_OPERATION
0x01	0x0000	0XXXXX	WRITE_SUCCESS
0x02	ERROR_CODE ¹	0XXXXX	WRITE_FAILURE

¹ See Table "ErrorCode"

The first byte returns the status. If it is set to "0", the Master then indicates that it cannot return any current status information since there was no previous operation (this is usually the response to the very first block transmission). A "1" indicates the successful completion of the previous transmission. In the case of a 2, the module sends the error code of an error in the subsequent byte, which occurred during the previous block transmission. The possible error codes are listed at the end of this subsection.

Writing 2 bytes (Word)

This access type basically proceeds as when writing 1 byte. It differs in the following points:

- Instead of a mask byte, the second byte of the 16-bit wide user data is transmitted with the data block. Access to individual bits in the target register is not possible with this access type.
- The 16-bit wide register content to be written must be prepared by the Master in such a way that the higher-value byte is transmitted as the 4th byte and the lower-value byte is transmitted as the 5th byte ("Big-Endian" or "Motorola format").

Transmission block with fixed length

Command code (1 byte)	Address area (2 bytes)	Data area (2 byte)	Description
0x04	0x0000-0xFFFF	0x0000-0xFFFF	WRITE_WORD
0x00	0XXXXX	0XXXXX	NO_OPERATION*

The status response has the same structure and meaning as write access with 1 byte

Writing more than 2 bytes with one access (bulk-write)

This access type is suitable for larger volumes of data. The number of target registers to be written and start address are transmitted with the first transmission block. As with the previous access types, the first transmission block also has a fixed length of 5 bytes here. After this block with metadata, the user data follows in a separate transmission block with variable length. The maximum permitted number of target registers to be written depends on the target area: A maximum of 128 registers (each 16-bit = 1 word) are permitted for writing to the SSC input register area. A maximum of 16 registers per block is to be written for all other target areas.

All 16-bit wide register contents to be written must be prepared by the Master in such a way that the higher-value byte is transmitted as the first byte and the lower-value byte is transmitted as the second byte ("Big-Endian" or "Motorola format"). The register contents must be sent in ascending address order, i.e. the start address first.

Transmission block with fixed length

Command code (1 byte)	Address area (2 bytes)	Data length (2 bytes)	Description
0x08	0x0000-0xFFFF	1-16/128	WRITE_BULK
0x00	0XXXXX	0XXXXX	NO_OPERATION*

NOTICE

The maximum data length for writing in the SSC input data area is 128 registers (256 bytes).

If this value is exceeded, errors in the data communication will result.

In the case of a transmission block of variable length, the module sends bytes with the value 0 to the master.

The status response has almost the same structure and meaning as write access with 1 byte. In the event of an error, a 16-bit wide register address is at position 4 and 5 for this transmission type, at which the first error occurred. The status is transmitted in the first transmission block that follows the data block with variable length.

Transmission block with fixed length

Status code (1 byte)	Error code (2 bytes)	Address area** (2 bytes)	Description
0x00	0XXXXX	0XXXXX	NO_PREVIOUS_OPERATION
0x01	0x0000	0XXXXX	WRITE_SUCCESS
0x02	ERROR_CODE ¹	0x0000-0xFFFF	WRITE_FAILURE

¹ See Table "ErrorCode"

** Address where an error occurs

Reading 2 bytes (Word)

This access type is used if just 1 register is to be read from a memory register of the module by the Master. The Master first sends a data block with a fixed length of 5 bytes, which have the following content:

Transmission block with fixed length

Command code (1 byte)	Address area (2 bytes)	Not used (2 bytes)	Description
0x10	0x0000-0xFFFF	0XXXXX	READ_WORD
0x00	0XXXXX	0XXXXX	NO_OPERATION*

* This command allows the master to request the status of a read request without an additional read or write request having to be executed.

Theoretically, you could use all memory register addresses between 0 and 0xFFFF. In practice, however, the write access is limited to registers that are enabled for this purpose.

During transmission of the first data block, the module sends the status of the previous data transmission. The module first returns the data to be read when sending the next data block. If, however, no further write or read operation should follow the read access, then the Master must send another data block with the command code 0 ("NO_OPERATION") for retrieving the data to be read, in which the module returns the status for the last write access operation.

The response from the module is structured as follows for all read access operations:

Transmission block with fixed length			
Status code (1 byte)	Error code (2 bytes)	Data area (2 byte)	Description
0x00	0xFFFF	0xFFFF	NO_PREVIOUS_OPERATION
0x01	0x0000	0x0000-0xFFFF	READ_SUCCESS
0x02	ERROR_CODE ¹	0xFFFF	READ_FAILURE

¹ See Table "ErrorCode"

The first byte returns the status. If it is set to "0", the Master then indicates that it cannot return any current status information since there was no previous operation (this is usually the response to the very first block transmission). A "1" indicates the successful completion of the previous transmission. In the case of a 2, the module sends the error code of an error in the subsequent byte, which occurred during the previous block transmission.

If the status is "1", the 2 bytes after that at position 4 and 5 contain the content of the memory register to be read at the address that was transmitted at the last block with the read command. The 16-bit wide register content read is prepared by the module in such a way that the higher-value byte is transmitted as the 4th byte and the lower-value byte is transmitted as the 5th byte ("Big-Endian" or "Motorola format").

In the case of status "0" or "2", both data bytes at position 4 and 5 are invalid and must be discarded by the Master.

In this access type, the number of source registers to be read as well as the start address are transmitted with the first transmission block that has a fixed length of 5 bytes. After this block with metadata, the transmission of the read data follows in a separate transmission block with variable length. Therefore, this access type is suitable

Reading more than 2 bytes
(Bulk-Read)

primarily for larger volumes of data. The maximum permitted number of source registers to be read depends on the source area: A maximum of 128 registers (each 16-bit = 1 word) are permitted for reading from the SSC output register area. A maximum of 16 registers per block is to be read for all other source areas. Byte order:

All 16-bit wide register contents read are prepared by the module in such a way that the higher-value byte is transmitted as the first byte and the lower-value byte is transmitted as the second byte ("Big-Endian" or "Motorola format"). The register contents are sent in ascending address order, i.e. the start address first.

Transmission block with fixed length

Command code (1 byte)	Address area (2 bytes)	Data length (2 bytes)	Description
0x20	0x0000-0xFFFF	1-16/128/256	READ_BULK
0x00	0XXXXX	0XXXXX	NO_OPERATION*

The Master sends a block of variable length with 0 bytes to the module.

The status response has almost the same structure and meaning as read access with 1 byte. In the event of an error, a 16-bit wide register address is at position 4 and 5 for this transmission type, at which the first error occurred. The status is transmitted in the first transmission block that follows the data block with variable length.

In the event of an error during bulk access (status "2"), the data transmitted by the module from the data block with variable length is invalid and must be discarded by the Master.

Transmission block with fixed length

Status code (1 byte)	Error code (2 bytes)	Address area (2 bytes)	Description
0x00	0XXXXX	0XXXXX	NO_PREVIOUS_OPERATION
0x01	0x0000	0XXXXX	READ_SUCCESS
0x02	ERROR_CODE ¹	0x0000-0xFFFF	READ_FAILURE

¹See Table "Error code"

** Address where an error occurs

Transmission block with variable length (1-16/128 words)

Data area
0x0000-0xFFFF"

Simultaneous reading and writing of more than 2 bytes with one access (bulk read/write)

In this access type, the number of source registers to be read or target registers to be written are transmitted with the first transmission block that has a fixed length of 5 bytes. After this block with metadata, the transmission of the read data follows in a separate transmission block with variable length. Unlike with Bulk-Read or Bulk-Write, no random start address can be defined for this access type. The start address for the block to be read is preset with 0x2001 (SSC input register) and with 0x1001 (SSC output register) for the block to be written. Byte order:

All 16-bit wide register contents to be read or written are prepared by the module in such a way that the higher-value byte is transmitted as the first byte and the lower-value byte is transmitted as the second byte ("Big-Endian" or "Motorola format"). The register contents are sent in ascending address order, i.e. the start address first.

Transmission block with fixed length

Command code (1 byte)	Not used (2 bytes)	Data length (2 bytes)	Description
0x40	0XXXXX	1-128	READ_WRITE_BULK
0x00	0XXXXX	0XXXXX	NO_OPERATION*

Transmission block with variable length (1-16/128 words)

Data area

0x0000-0xFFFF"

The status response has almost the same structure and meaning as read access with 1 byte. In the event of an error, a 16-bit wide register address is at position 4 and 5 for this transmission type, at which the first error occurred when reading or writing. The status is transmitted in the first transmission block that follows the data block with variable length.

Transmission block with fixed length

Status code (1 byte)	Error code (2 bytes)	Not used (2 bytes)	Description
0x00	0XXXXX	0XXXXX	NO_PREVIOUS_OPERATION
0x10	0x0000	0XXXXX	READ_WRITE_SUCCESS
0x20	ERROR_CODE ¹	0XXXXX	READ_WRITE_FAILURE

In the event of an error during bulk access (status "2"), the data transmitted by the module from the data block with variable length is invalid and must be discarded by the Master.

Error Codes

Error code	Designation	Description
0x01	INVALID_DATA_ADDRESS	Invalid data address The master tries to access an invalid address. The slave ignores the instruction.
0x02	INVALID_DATA_LENGTH	Invalid data length The data length predefined by the master is too great. The slave ignores the instruction.
0x04	INVALID_DATA	Invalid data The master tries to write data containing values outside a valid range. The slave ignores the instruction.
0x08	INVALID_ACCESS	Invalid access The master tries to access an invalid area or a valid address. The slave ignores the instruction.
0x10	INVALID_RANGE	Invalid range The master tries to write beyond the limits of an SSC input data area or to write beyond the limits of an SSC, SDI or FBS output data area. The slave ignores the instruction.
0x20	UNDEFINED_ERROR	Undefined error An undefined error has occurred. The slave ignores the instruction.

Table 1: Error Code

SSC Master Operating Mode

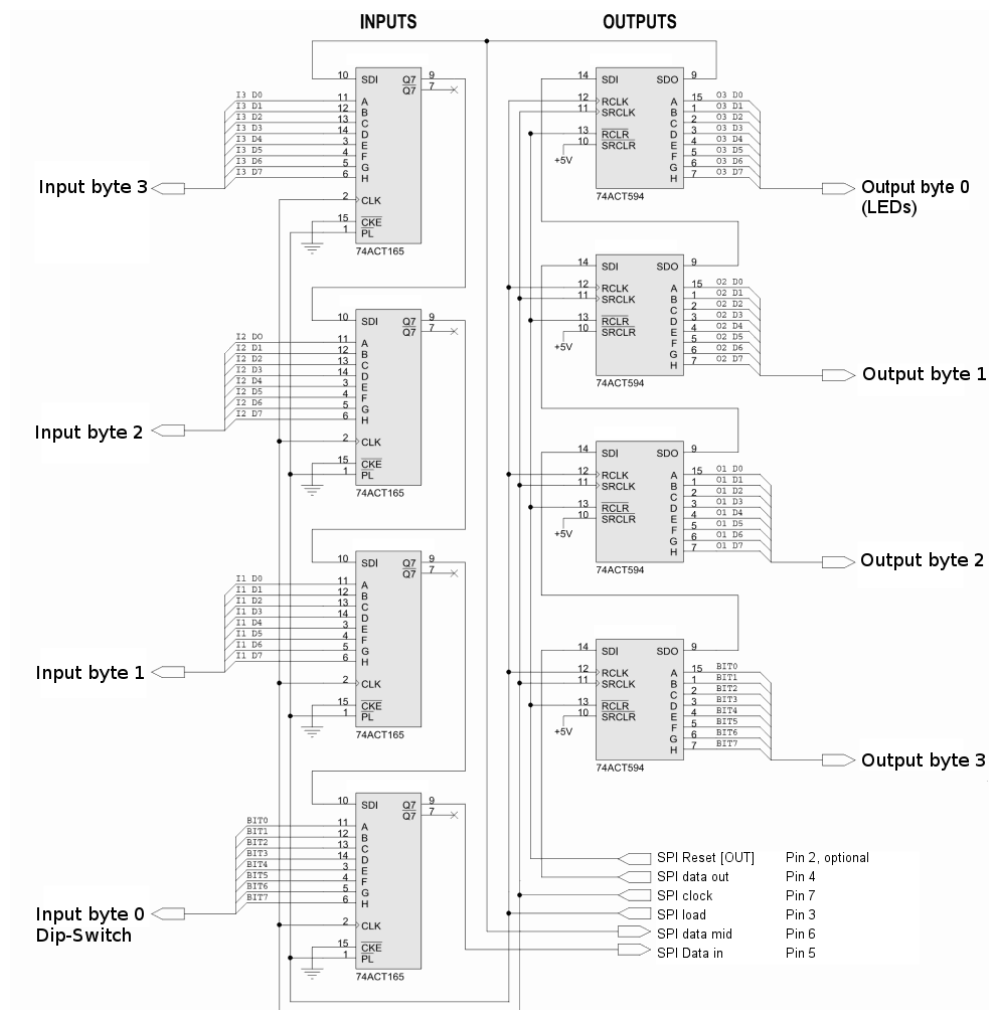


Illustration 6: Hardware shift register chain, example with 4 inputs and outputs

The advantage of such an interface is the possibility of forwarding input and output signals to the fieldbus without the need of microprocessor controlled application circuitry. Switches, contacts, relay coils or solenoid valves, for example, can therefore be connected directly via PROFIBUS without using a microprocessor.

The IC-Modul with its clock clocks the output data into the input register of the chain via the MOSI line, where it is shifted bit by bit until the end. At the same time, the input data is shifted bit by bit via the MISO line into the IC-Modul with the same clock pulse. Prior to each such shift procedure, the module sets the LOAD line to high. In this way, the parallel outputs of all shift register modules receive the data from the input buffers in the previous cycle. The input shift registers, on the other hand, utilise the positive edges from the LOAD signal to copy all parallel input values simultaneously to their output buffers. From there, they are shifted bit by bit to the SSC input register area of the IC-Modul during the current cycle.

The clock rates of the IC-Moduls can be adapted manually or automatically in 3 levels and are about 300, 1200 or 4800 Kbit/s. The load impulse is between 5 and 15 μ s long (active low). The delay between the load edge (positive edge of the load impulse) and the first clock edge (from high to low) is between 1 and 2 μ s. These values are completely uncritical when using the shift register modules 74HC165 (Input) and 74HC594 (Output).

An optional SSC RESET line initialises the shift register modules during the starting process of the IC-Moduls (i.e. also during each reset of the module).

With an arrangement of the output and input shift register as shown in this example, all registers are switched in series so that the IC-Modul has its own output data shifted back into the input register again for checking purposes. A test sample shifted through the complete chain without a LOAD signal allows the IC-Modul to detect how long the entire chain is by means of the necessary clock signals for such a shifting procedure. A centre pickoff between the output and input modules allows the IC-Modul to also detect the corresponding number of inputs and outputs of the shift register modules during this run of a test sample. If bit errors occur, the clock rate is reduced in automatic mode by one level. Hence, with such a structure the IC-Modul can find the right setting for the chain lengths and maximum possible transmission rate independently. It is also possible, however, to assign the lengths and clock rates manually via the CDI menu. In this case, the centre pickoff can also be omitted (it is only needed for determining the allocation between inputs and outputs of the shift register modules). The entire chain length is monitored constantly during ongoing operation and must match the configured length. If the module detects a difference, then it shuts down the SSC communication and reports an error status via its status register.

The IC-Modul can operate a maximum of 32 shift registers. You can use them as output or/and input shift registers.

Note on cycle time: The cycle time of the shift register interface is normally independent of its chain length since the IC-Modul in its work cycle only starts the transmission of a shift procedure. The shift procedure itself then takes place independently of the work cycle of the IC-Moduls. Its length is determined by the number of cycles as well as the clock rate. After completion of a shift procedure, the next

shift cycle starts with the next work cycle of the module. The maximum delay between the completion and start of a shift cycle is 10 ms.

Note ! If the shift procedure is longer than a work cycle of the module, the cycle time is determined by the length and speed of the shift register chain.

4.8 Scripter

The IC-Modul includes a software component that allows you to set up customer-specific data exchange protocols for SDI or CDI serial interfaces. If, for example, the module is to communicate in an application with a serial-controlled servomotor, this servomotor expects a preset protocol to be processed in order to receive the actuator values or to return sensor values. With the aid of the Scripter you can load small executable program sequences into the module that are then executed there cyclically. With the appropriate data exchange protocol the module can receive such actuator values e.g. via PROFIBUS and transmit these via the serial interface of the module (SDI or CDI) to the servomotor. The program sequences required are loaded once into the module in the form of a script via the CDI interface of the module and then always executed there cyclically. KUNBUS provides you with a PC tool for creating and testing such scripts. You can read all the necessary details in the separate manual on the Scripter.

NOTICE! Please note that when using the Scripter and activating a script the interface (CDI or SDI) selected for its communication is always assigned for the Scripter. If you choose the CDI interface, you can then no longer use this interface to check and enter module parameters ("CDI menus" are then no longer available). If you choose the SDI interface as a serial communication channel for the Scripter, you can then no longer process any Modbus protocol with access to the memory register via this interface.

5 Commissioning

5.1 Installation

The main board is connected to the device controller via a 32-pin connector strip. Thus, you have the option to plug the module directly into your DIL socket.

NOTICE

If the module is plugged in and unplugged frequently, mechanical stresses may damage the module.

Use a zero insertion force socket to prevent damage.

Pin assignment on the application interface

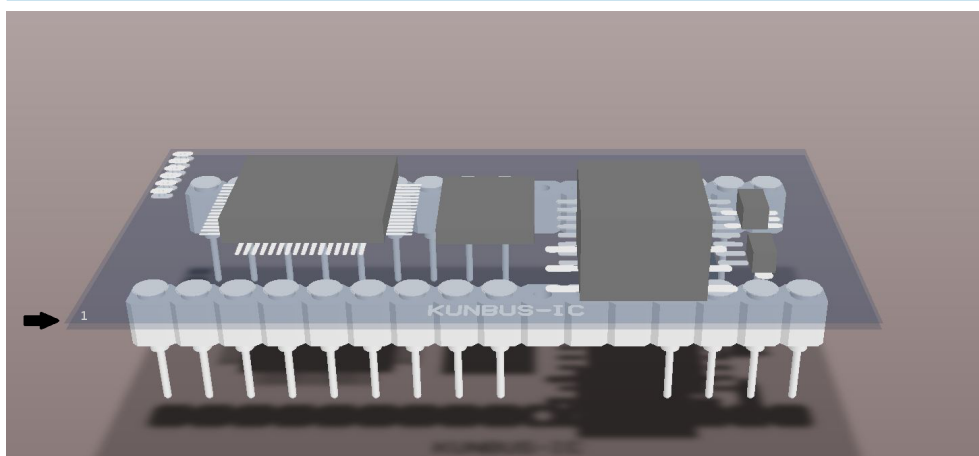


Illustration 7: Start point view

When you view your module from above, you will find a printed 1 in one corner.

The counting of the pins starts with the underlying pin which is then continued U-shaped and ends with the allocation 32 at the opposite pin.

1	32
2	31
3	30
4	29
5	28
6	27
7	26
8	25
9	24
10	23
11	22
12	21
13	20
14	19
15	18
16	17

Illustration 8: Pin Assignment

In the table below, we have compiled the pin assignment on the application interface for you.

SSC Master Mode

PIN	Application side	Direction	Electrical specifications			Temperature range (-40 C to 85 C)
			Min.	Typical	Max.	Tolerance:
1 ⁽¹⁾	VCC 5.0 V	[IN]	4.75 V	5.0 V	5.25 V	I _{max} = 150mA
	VCC 3.3 V	[IN]	3.15 V	3.3 V	3.45 V	I _{max} = 200mA
2	SPI Reset	[OUT]	-	-	3.3 V, 4 mA	-
3	SPI Load	[OUT]	-	-	3.3 V, 4 mA	-
4	SPI data out	[OUT]	-	-	3.3 V, 4 mA	-
5	SPI data in	[IN]	-0.1 V	2.0 V ⁽²⁾	5 V	-
6	SPI data mid	[IN]	-0.1 V	2.0 V ⁽²⁾	5 V	-
7	SPI clock	[OUT]	-	-	3.3 V, 4 mA	-
8	Module Reset	[IN]	-0.1 V	-	5 V	-
9	VC DC Converter 5.0 V	[IN]	4.75 V	5.0 V	5.25 V	-
	VC DC Converter 3.3 V	[IN]	3.15 V	3.3 V	3.45 V	-
10-12	Reserved			Do not connect!		
13	Profibus A	(3)	(3)	(3)	(3)	(3)
14	Profibus B	(3)	(3)	(3)	(3)	(3)
15	Profibus RTS ⁽⁴⁾	-	-	-	-	-
16-18	Reserved			Do not connect!		
19	GND (isolated for bus connection)	-	-	-	-	-
20	+ 5 V (isolated for bus connection)	-	-	-	-	-
21-23	Reserved			Do not connect!		
24	GND	[IN]	-	-	-	-
25	LED Profibus Online Status	[OUT]	-	-	3.3 V, 4 mA	-
26	Reserved	[IN]	-	-	-	-
27	CDI (UART) TX	[OUT]	-	-	3.3 V, 4 mA	-
28	CDI (UART) RX	[IN]	-0.1 V	2 V ⁽²⁾	5 V	-
29	SDI (UART) RX	[IN]	-0.1 V	2 V ⁽²⁾	5 V	-
30	SDI (UART) TX	[OUT]	-	-	3.3 V, 4 mA	-
31	RS-485 TX en	[OUT]	-	-	3.3 V, 4 mA	-
32	GND	[IN]	-	-	-	-

(1) The module is available optionally with 5 volt or 3.3 volt.

(2) A logical High is detected from 2 Volts.

(3) According to ISO1189-2

(4) Only necessary with external driver.

SPI Slave Mode (Activation via Modbus Register)

PIN	Application side	Direction	Electrical specifications			Temperature range (-40 C to 85 C)
			Min.	Typical	Max.	Tolerance:
1 ⁽¹⁾	VCC 5.0 V	[IN]	4.75 V	5.0 V	5.25 V	I _{max} = 150 mA
	VCC 3.3 V	[IN]	3.15 V	3.3 V	3.45 V	I _{max} = 200 mA
2	Reserved			Do not connect!		
3	SPI Slave Ready	[OUT]	-	-	3.3 V, 4 mA	-
4	SPI data in	[IN]	-0.1 V	2.0 V ⁽²⁾	5 V	-
5	SPI data out	[OUT]	-	-	3.3 V, 4 mA	-
6	SPI Slave Select	[IN]	-0.1 V	2.0 V ⁽²⁾	5 V	-
7	SPI clock	[IN]	-0.1 V	2.0 V ⁽²⁾	5 V	-
8	Module Reset	[IN]	-0.1 V	-	5 V	-
9	VC DC Converter 5.0 V	[IN]	4.75 V	5.0 V	5.25 V	-
	VC DC Converter 3.3 V	[IN]	3.15 V	3.3 V	3.45 V	-
10-12	Reserved			Do not connect!		
13	Profibus A	[IN/OUT]	(3)	(3)	(3)	(3)
14	Profibus B	[IN/OUT]	(3)	(3)	(3)	(3)
15	Profibus RTS ⁽⁴⁾	-	-	-	-	-
16-18	Reserved			Do not connect!		
19	GND (isolated for bus connection)	-	-	-	-	-
20	+ 5 V (isolated for bus connection)	-	-	-	-	-
21-23	Reserved			Do not connect!		
24	GND	[IN]	-	-	-	-
25	LED Profibus Online Status	[OUT]	-	-	3.3 V, 4 mA	-
26	Reserved	[IN]	-0.1 V	2 V ⁽²⁾	5 V	-
27	CDI (UART) TX	[OUT]	-	-	3.3 V, 4 mA	-
28	CDI (UART) RX	[IN]	-0.1 V	2 V ⁽²⁾	5 V	-
29	SDI (UART) RX	[IN]	-0.1 V	2 V ⁽²⁾	5 V	-
30	SDI (UART) TX	[OUT]	-	-	3.3 V, 4 mA	-
31	RS-485 TX en	[OUT]	-	-	3.3 V, 4 mA	-
32	GND	[IN]	-	-	-	-

(1) The module is available optionally with 5 volt or 3.3 volt.

(2) A logical High is detected from 2 Volts.

(3) According to ISO1189-2

(4) Only necessary with external driver.

Function

- PIN 9: Profibus prescribes an isolated voltage of 5 V for standardised connectors. To achieve this, there is a DC-DC converter with galvanic isolation. The supply voltage for this converter is supplied separately via PIN 9 and must be identical to the general supply voltage from PIN 1.
- PIN 25: You can connect an LED to this PIN. This LED indicates the Profibus RUN status.

- PIN 26: This PIN is a reserved digital input. Place this on GND with a 1 kOhm resistor.

NOTICE

An example of the connection options can be found in Appendix 2.

Connection options to the SDI interface

You can establish the connection to the SDI in RS232 or RS485 mode:

You need an RS232 level converter for operating in RS232 mode.

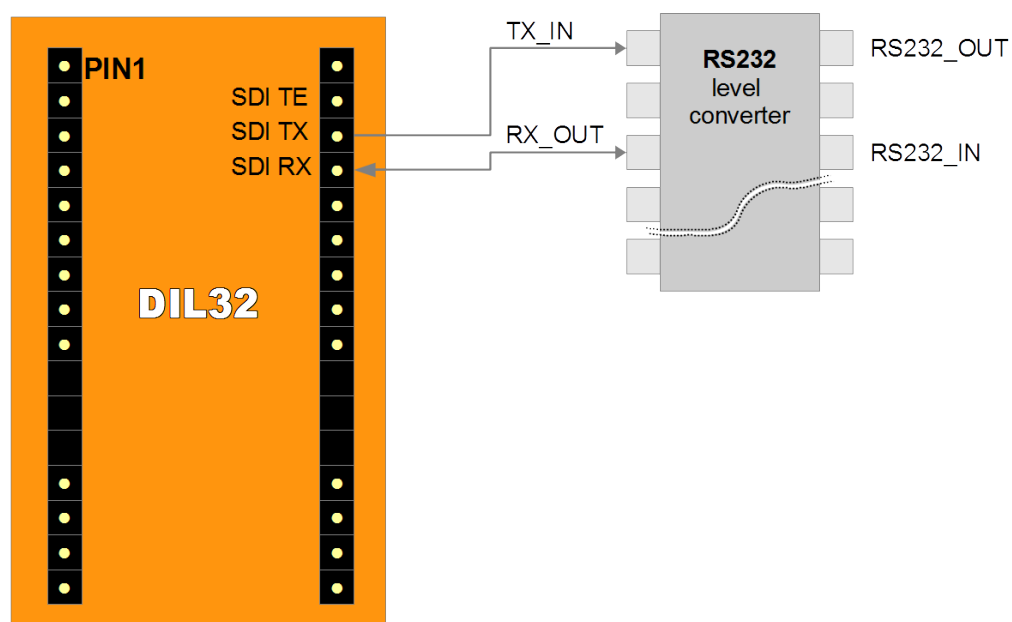


Illustration 9: Connection for the SDI via RS 232

The TX PIN is not used with this connection.

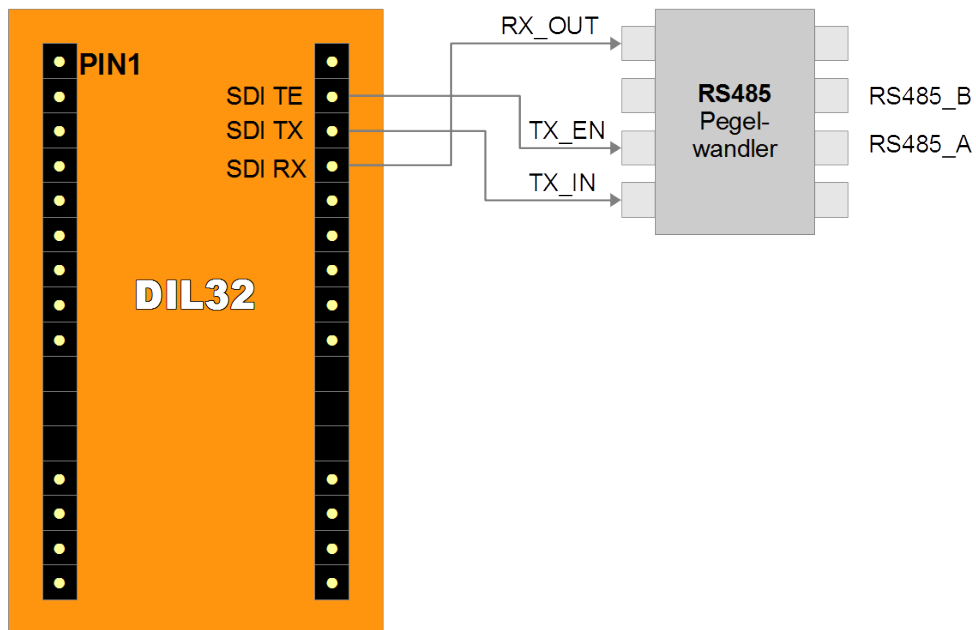


Illustration 10: Connection option for the SDI using RS485

You need an RS485 level converter for operating in RS485 mode.

Connection options to the
CDI interface

You can establish the connection to the CDI in RS232 mode:

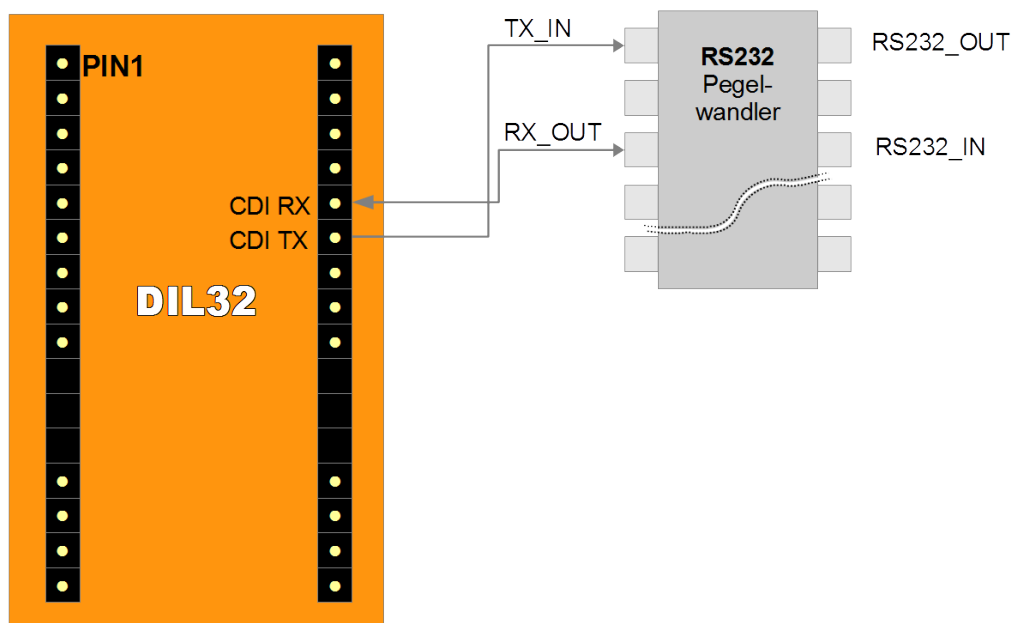


Illustration 11: Connection option for the CDI

5.2 Configuration

This section describes how to configure the module and associated components and applications.

NOTICE

- The module has no undo function.
- ➔ Changes are applied after a reset or start of the operating mode without any further confirmation.
- ⇒ If you want to reset all values, use the function "Reset to factory settings". [▶ 113] Please note that all previous settings made will be lost.

Configuration using the CDI

To configure the Modul and put it into operation using the CDI, you need a PC or notebook with a serial interface (RS-232) or USB/serial adapter. Make sure that the adapter drivers are installed.

Communication with the CDI (Configuration and Debug Interface) of the module takes place using a terminal program (e.g. PuTTY for Microsoft Windows®).

TIPPI!: Das CDI is suitable for configuration during the development and for diagnostic purposes. To configure several modules automatically, we recommend performing the settings with Modpoll. You can find an introduction and example of this in the Appendix Configuration via Modpoll [▶ 128].

Configuration using the SDI

The IC-Modul has a UART interface with 3.3 V logic levels. Your main board must convert these lines to standardised RS-485 signals so that Modbus/RTU devices can access these. Conversion to standardised RS-232 signals is generally necessary for communication with a PC. The base board of the evaluation board has both interfaces that can each be selected via jumpers.

Configuration using the SDI requires a Modbus master device.

One of the following devices is suitable for this:

- Master computer,
- Control panel,
- Programming device,
- SPS with the possibility of Modbus-RTU communication.

To communicate with the SDI of the module using a PC, you need Modbus software (e.g. Modpoll).

5.3 Address Assignment

PROFIBUS station address

Your module can be detected in the PROFIBUS network by the assignment of a station address. This also allows communication with other network subscribers.

You can perform the configuration of the station address optionally using the CDI, Memory Register or SSC register.

Since you always have the possibility to store another station address on each setting option, you must specify which settings you want to use in the Memory registers 0x4011-0x4012.

You have the following options for configuring the station address:

Configuration via the memory register

In memory register 0x400d you have the option to assign the station address. To use this address, you have to set the value "0" in the Memory registers 0x4011-0x4012.

If you set the value 126 in the memory register 0x400d, the module uses the default setting 126 (0x007e) automatically. As a result, the setting of the address source in register 0x4012 is ignored and the address assignment via Set Slave Address (SSA) is used as the source instead.

Address Assignment via Set Slave Address (SSA)

Your module supports automatic address configuration via the "Set Slave Address" telegram of the PROFIBUS Master.

The PROFIBUS master sends SSA telegrams to the special station address 126. At the same time, a manufacturer identity number is also transmitted in addition to the station address. The manufacturer identity number is specific to a particular product. It can be obtained from the file name of the GSD file of the device. This ensures that only one device with the address 126, which has a particular ID, changes the address.

The master can also determine in the telegram that the executing slave does not accept any further SSA telegrams. The IC-Modul processes this address lock and saves it permanently in the Memory Register 0x4102 ab. A set address block only affects address changes by SSA, however. If you set the rotary switch in register 0x4012 as source, then the address can be changed with the rotary switches even after a successful SSA lock.

You have three options for activating this function:

- Set the value "2" in the memory register 0x4012
- Set a value that is greater than 125 in the memory register 0x400d.
- Select the automatic address configuration in the CDI menu:

```
"2 - Interface Configuration > 7 - Fieldbus
Specific > 1 - Node Address > 3 - Auto Address
Assign from Profibus Master"
```

NOTICE! While this setting is active, all other address configurations (e.g. using the memory registers or coding switches) are ignored.

Also see about this

 [▶ 104](#)

5.4 Bitrate

The bitrate for the Profibus transmission is preset by the Master. The module has automatic bitrate detection and adjusts itself automatically to the selected bitrate. You can see these bitrates:

- in the memory register 0x400f
- in CDI Menu "4 - Module Status > 5 - Fieldbus Status > Bitrate"

A conversion in IC-Modul is not possible.

5.5 Firmware Update

If a firmware update is required, please contact our support (support@kunbus.de). We will be delighted to provide you with all the information you need for your product.

6 Memory Register

6.1 Overview of the Memory Register

The storage unit is the central component for all functions of the IC-Module. It is subdivided into individual Memory Register with a width of 16 bits each. In these Memory registers the following information is stored:

- Input and output data
- Configuration settings
- Module Status
- Error states

The functionality of the addressing was incorporated from Modbus. The register assignment depends on the application and is not specified by the Modbus specification. A Memory Register according to this specification has a register number between 1 (0x0001) and a maximum of 65536 (0x10000), of which the module only uses a small part, however.

With 8-bit values, 1 byte remains unused. 32-bit values are stored in 2 registers.

The 16-bit values are stored internally in the memory in Little Endian order. This must be taken into account when you access data via the fieldbus interface, SDI or SSC.

NOTICE! In the description of the individual memory registers and CDI, the memory registers are also referred to as Modbus registers.

Bitwise access to input and output data

Optionally, you can address input and output data areas bitwise. The functions 01 Read Coil Status, 02 Read Input Status and 05 Force Single Coil are defined in Modbus for this purpose. Since each bit has a separate address, they are assigned to the bits in the registers as follows: Coil 0x0001 corresponds to the lowest value bit 0 of register 0x0001, Coil 0x0002 corresponds to bit 1, etc. coil 0x11 is the bit 0 from register 0x0001 etc.

The table below shows the start addresses of the data areas:

Area	Memory Register	Coil/Input Address
Input SSC	0x1001 - 0x1080	0x0001 – 0x0800
Input SDI	0x1401 – 0x1500	0x2001 – 0x4000
Input DPR	0x1c01 ...	0x6001 ...
Output SSC	0x2001 – 0x2080	0x8001 – 0x8800
Output SDI	0x2401 – 0x2500	0xa001 – 0xb000
Output FBS	0x2801 - 0x2880	0xc001 – 0xe001

Register assignment of the memory area

The following table contains a brief overview of the register assignment of the general memory area. You can find a detailed overview of the individual registers on the following pages.


Register number	Assignment	Description
0x0001 – 0x0100 [48]	General Device Parameters	e.g. Setting of the bitrates, mailbox sizes etc.
0x0101 – 0x0e00	Reserved	-
0x0e01 – 0x0ea0	Register for mapping the output data	Each channel occupies 2 x 8 registers
0x0f01 – 0x0xf40 [71]	Register for mapping of the extended Data Broker	16 mappings occupy 4 registers each
0x1001 – 0x2000 [72]	Input memory of the communication channels	Each communication channel has a preallocated memory area of 128 - 256 registers.
0x2001 – 0x3000 [73]	Output memory of the communication channels	Each communication channel has a preallocated memory area of 128 - 256 registers.
0x3001 – 0x4000	Reserved	-
0x4001 – 0x5000	Fieldbus-specific (s. following table)	See the description of the individual fieldbus variants
0x5001 – 0x10000	Reserved	-

The following table contains a brief overview of the register assignment of the memory area for PROFIBUS. You can find a detailed overview of the individual registers on the following pages.

Register assignment of the memory area for configurations from PROFIBUS

Register	Description	Access
0x4001 [▶ 75]	Fieldbus Status	Read Only
0x4002 [▶ 75]	Module Status	Read Only
0x4003 -0x4004 [▶ 76]	Profibus device ID	Read/Write
0x4005 -0x4006	Reserved	-
0x4007 -0x4008 [▶ 76]	Fieldbus Version	Read Only
0x4009 [▶ 76]	Firmware Version	Read Only
0x400a -0x400b [▶ 77]	Serial number	Read/Write
0x400c [▶ 77]	current station address	Read Only
0x400d [▶ 78]	Configured station address	Read/Write
0x400f [▶ 79]	current Fieldbus Bitrate	Read Only
0x4010	Reserved	-
0x4011 -0x4012	Fieldbus configuration	Read/Write
0x4013-0x4015	Reserved	-
0x4016-0x4035 [▶ 81]	Product Name	Read/Write
0x4036 [▶ 81]	Size of input image	Read Only
0x4037 [▶ 82]	Size of output image	Read Only
0x4101 [▶ 82]	SSA Station address	Read Only
0x4102-0x4110	Reserved	-
0x4111 [▶ 83]	Number of Profibus parameters	Read/Write
0x4112 [▶ 84]	System parameter strobe	Read/Write
0x4113 [▶ 84]	Number of user-specific parameters	Read/Write
0x4114 [▶ 85]	Strobe user-specific parameters	Read/Write
0x4133 [▶ 85]	Length of the error diagnosis data	Read/Write
0x4134 [▶ 85]	Length of the info diagnosis data	Read/Write
0x4135 [▶ 86]	User diagnosis strobe signal	Read/Write
0x4201.-0x420A [▶ 86]	PROFIBUS Default Parameter	Read Only
0x4211 -0x424b [▶ 87]	PROFIBUS User Parameter	Read Only
0x4411 -0x4420 [▶ 87]	Error diagnosis register	Read/Write
0x4421 -0x4440 [▶ 88]	Info diagnosis register	Read/Write

Also see about this

 [▶ 70\]](#)

 [▶ 78\]](#)

6.2 General Device Parameters

0x0001 Set operating mode

In this memory register you have the option, the operating mode to set

Modbus Register	0x0001
Value Range	0x0000-0x0003
Default Value	0x0000
Number of bytes available	2
Permanently stored	No
Access	Read/Write
Meaning	
0x0000 or 0x0001	Operation Cyclical data exchange takes place.
0x0002	Restoring default settings (Factory Reset) Resetting of all permanent parameters to their original respective settings. A module reset takes place automatically and does not have to be done manually here.
0x0003	Reset Implementing a reset. Your settings can first be applied after a reset.

0x0002-0x0003 Current module status

In these memory registers you will find information for the current module status.

Bit 5 indicates whether there is an error in the configuration of the SSC Master mode. It is only set, however, during the initialisation of the module. If an error occurs during ongoing operation, this is not displayed here.

Memory Register 0x0002 (bit 0-15) contains the Low Word, Memory Register 0x0003 (bit 16-31) contains the High Word.

Modbus Register	0x0002-0x0003
Value Range	-
Initial value	-
Number of bytes available	2
Permanently stored	No
Access	Read Only
Meaning	
Bit 0	Fieldbus Run State 1: The field bus is in cyclical data exchange 0: The cyclical data connection is interrupted
Bit 1	SSC SSR Master Run State 1: The synchronous serial interface is in SSC mode and is exchanging data cyclically 0: No cyclical data exchange takes place.
Bit 2	SSC Mapping Configuration Error State 1: Configuration error in the mapping of the SCC interface. 0: Configuration is ok.
Bit 3	SDI Mapping Configuration Error 1: Configuration error in the mapping for the SDI. 0: Configuration is ok.
Bit 4	Fieldbus Communication Mapping Configuration Error 1: Configuration Error in the Mapping for the Fieldbus Interface. 0: Configuration is ok.
Bit 5	SSC SSR Master Configuration Error State 1: General Configuration Error in the SSC SSR Master Mode 0: Configuration is ok.

Bit 6	SDI Configuration Error 1: General Configuration Error of the SDI Interface. 0: Configuration is ok.
Bit 7	Fieldbus Communication Configuration Error 1: General configuration error of the FBS interface 0: Configuration is ok.
Bit 8-13	Reserved
Bit 14	Extended Mapping Error 1: Configuration error in the mapping 0: Configuration is ok
Bit 15	Script Run Status 1: Script was loaded successfully and is running cyclically. 0: Script is stopped
Bit 16	Script Error State 1: An error has occurred during execution of the script 0: Script runs without errors

0x0004 Set device address for the SDI interface

In this memory register you have the option, to set a unique device address for communication via the SDI interface (Modbus)

A Modbus network (RS485) can consist of several modules. Therefore, the Modbus protocol provides the unique addressing via device addresses. If you want to access the IC-Modul with a Modbus Master (e.g. PC with Modpoll), the Master must use the device address set in this register as the first byte in the send telegram.

The new settings are applied after a reset (Power Off/On or write Memory Register 0x0001 with value 0x0003).

Modbus Register	0x0004
Value Range	0x01-0xF7
Default Value	0x01
Number of available bytes	1
Permanently stored	Yes
Access	Read/Write

0x0005 Set bitrate for the SDI interface

In this memory register you have the option, to define with which bitrate the SDI interface should communicate.

Automatic bitrate detection means that the module tests the following bitrates until it has received a correct Modbus-RTU telegram:

- 2400 bit/s
- 4800 bit/s
- 9600 bit/s
- 19200 bit/s
- 38400 bit/s
- 57600 bit/s
- 115200 bit/s

NOTICE! During automatic bitrate detection the module does not send a reply to the master until the correct bitrate has been detected. This procedure can require up to 40 polls of the master.

TIP: Set a fixed bitrate if the automatic bitrate detection lasts too long for you.

The new settings are applied after a reset (Power Off/On or write Memory Register 0x0001 with value 0x0003).

Modbus Register	0x0005
Value Range	0x00-0x07
Default Value	0x00
Number of available bytes	1
Permanently stored	Yes
Access	Read/Write
Meaning	
0x00	Automatic bitrate detection
0x01	2400 bit/s
0x02	4800 bit/s
0x03	9600 bit/s
0x04	19200 bit/s
0x05	38400 bit/s
0x06	56700 bit/s
0x07	115200 bit/s

0x0006 Set parity bits for the SDI interface

In this memory register you have the option, to set the parity bit for the data transmission of the SDI interface.

The number of stop bits is adjusted automatically to the parity to ensure that a transmission always contains the same number of bits.

The new settings are applied after a reset (Power Off/On or write Memory Register 0x0001 with value 0x0003).

Modbus Register	0x0006
Value Range	0x00-0x02
Default Value	0x00 (Even Parity)
Number of available bytes	1
Permanently stored	Yes
Access	Read/Write
Meaning	
0x0000	Even Parity, 1 Stop-Bit
0x0001	Odd Parity, 1 Stop-Bit
0x0002	No Parity, (2 Stop-Bits)

0x0007 Current bitrate of the SDI interface

In this memory register you will find information about the currently used bitrate of the SDI interface.

Modbus Register	0x0007
Value Range	0x0000-0x0007
Initial value	-
Number of bytes available	1
Permanently stored	No
Access	Read Only
Meaning	
0x0000	The bitrate is unknown or has not yet been determined by the automatic bitrate detection.
0x0001	2400 bit/s
0x0002	4800 bit/s
0x0003	9600 bit/s
0x0004	19200 bit/s
0x0005	38400 bit/s
0x0006	57600 bit/s
0x0007	115200 bit/s

0x0012 Set bitrate for the CDI interface

In this memory register you have the option, to set the Bitrate for the CDI

The new settings are applied after a reset (Power Off/On or write Memory Register 0x0001 with value 0x0003).

Modbus Register	0x0012
Value Range	0x01-0x07
Default Value	0x07 (115200 bit/s)
Number of bytes available	1
Permanently stored	Yes
Access	Read/Write
Meaning	
0x01	2400 bit/s
0x02	4800 bit/s
0x03	9600 bit/s
0x04	19200 bit/s
0x05	38400 bit/s
0x06	56700 bit/s
0x07	115200 bit/s

NOTICE

Automatic bitrate detection with the CDI is not possible.

- If the configuration that was entered is invalid, the corresponding registers use the following settings in order not to block the interface by incorrect data:
- ➔ 115200 bit/s, 1 stop bit, even parity

0x0013 Set transmission format for the CDI interface

In this memory register you have the option, to set the format of the data transmission for the CDI interface

Modbus Register	0x0013
Value Range	0x00-0x07
Default Value	1
Number of bytes available	1
Permanently stored	Yes
Access	Read/Write
Meaning	
Bit 0	Parity Enable (PEN) 1: Activate parity check 0: Do not activate parity check
Bit 1	Even or Odd (EOP) Only relevant if parity check is activated. 1: Odd Parity 0: Even Parity
Bit 2	Stop Bit (STB) 1: Use synchronisation with 2 stop bits 0: Use synchronisation with 1 stop bit.

Example: The value "0x05" ("00000_101b") means:

- Bit 0: (1) Activate parity check.
- Bit 1: (0) Set Even Parity.
- Bit 2: (1) Use synchronisation with 2 stop bits.

Bit order:

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
													SBT	EOP	PEN

0x0014 Current bitrate of the CDI

In this memory register you will find information about the currently used bitrate for the CDI interface.

The new settings are applied after a reset (Power Off/On or write Memory Register 0x0001 with value 0x0003).

Modbus Register	0x0014
Value Range	0x01-0x07
Number of bytes available	1
Permanently stored	No
Access	Read Only
Meaning	
0x01	2400 bit/s
0x02	4800 bit/s
0x03	9600 bit/s
0x04	19200 bit/s
0x05	38400 bit/s
0x06	57600 bit/s
0x07	115200 bit/s

0x0015 Current data transmission format of the CDI interface

In this memory register you will find information about the current format of a data byte for the CDI .

Modbus Register	0x0015
Value Range	0x00-0x07
Number of bytes available	1
Permanently stored	No
Access	Read Only
Meaning	
Bit 0	Parity Enable (PEN) 1: Activate parity control 0: Do not activate parity control
Bit 1	Even or Odd (EOP) Only relevant if parity control is activated. 1: Odd Parity 0: Even Parity
Bit 2	Stop Bit (STB) 1: Use synchronisation with 2 stop bits 0: Use synchronisation with 1 stop bit.

Example: The value "0x05" ("00000_101b") means:

- Bit 0: (1) Parity control activated.
- Bit 1: (0) Even Parity Control set.
- Bit 2: (1) Synchronisation with 2 stop bits used.

Bit order:

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
														SBT	EOP PEN

0x0016 Configure SSC mode

In this memory register you have the option, to set the SSC mode of the module

You can operate the module in slave mode or master mode.

Modbus Register	0x0016
Value Range	0x0000-0x0003
Default Value	0x01
Number of bytes available	1
Permanently stored	Yes
Access	Read/Write
Meaning	
0x00	SSC SSR Master Mode deactivated
0x01	SSC SSR Master Mode (shift register, automatic detection)
0x02	SSC SSR Mode (slide register, manual configuration)
0x03	SSC SPI Slave Mode

0x0017 Current SSC Mode

In this memory register you will find information on the current SPI/SSC mode of the module.

You can find further information on this topic in section "Synchronous serial interface [► 22]".

Modbus Register	0x0017
Value Range	0x0000-0x0003
Initial value	0x01
Number of bytes available	1
Permanently stored	No
Access	Read Only
Meaning	
0x00	SSC SSR Master Mode deactivated
0x01	SSC SSR Master Mode (shift register, automatic detection)
0x02	SSC SSR Mode (shift register, manual configuration)
0x03	SSC SPI Slave Mode
0x04	SSC SSR Master Mode Error Status

0x0018 Configure SPI mode

In this memory register you have the option, Clock and data level for the SPI interface to set

This setting is only used in the SPI slave mode. In SSC Master Mode the SPI Controller always uses setting 4: "lagging edge, CLK high, MSB first" (see also Synchronous serial interface [► 22])

Modbus Register	0x0018
Value Range	0x0001-0x0004
Default Value	4
Number of bytes available	1
Permanently stored	Yes
Access	Read/Write
Meaning	
0x0001	Leading edge (CPHA=0, CLK low (CPOL=0), MSB first
0x0002	Leading edge (CPHA=0, CLK high (CPOL=1), MSB first
0x0003	Lagging edge (CPHA=1, CLK low (CPOL=0), MSB first
0x0004	Lagging edge (CPHA=1, CLK high (CPOL=1), MSB first

0x0019 Current configuration of the SPI controller

In this memory register you will find information about the current configuration of the clock and data level of the SPI controller.

Modbus Register	0x0019
Value Range	0x0000-0x0004
Number of bytes available	2
Permanently stored	No
Access	Read Only
Meaning	
0x0000	SSC/SPI deactivated
0x0001	Leading edge (CPHA=0, CLK low (CPOL=0), MSB first
0x0002	Leading edge (CPHA=0, CLK high (CPOL=1), MSB first
0x0003	Lagging edge (CPHA=1, CLK low (CPOL=0), MSB first
0x0004	Lagging edge (CPHA=1, CLK high (CPOL=1), MSB first

0x001a Set bitrate on the SSC interface

In this memory register you have the option, to set the bitrate on the SPI controller

Modbus Register	0x001a
Value Range	0x00-0x03
Default Value	0x01
Number of bytes available	1
Permanently stored	Yes
Access	Read/Write
Meaning	
0x00	Deactivated
0x01	~300kbit
0x02	~1200 Kbit/s
0x03	~4800 Kbit/s

0x001b Current bitrate on the SSC interface

In this memory register you will find information about the current bitrate of the SSC interface.

These values are only significant if you operate the module in slave mode. In slave mode the PROFIBUS-Master determines the bitrate.

Modbus Register	0x001b
Value Range	0x00-0x03
Default Value	-
Number of bytes available	2
Permanently stored	No
Access	Read Only
Meaning	
0x00	Bitrate not set or invalid
0x01	~300kbit
0x02	~1200 kbit/s
0x03	~4800 kbit/s

0x001c Configure number of SSC Outputs

Prerequisite: You have activated the Master Mode

In this memory register you have the option, to set the number of output shift register modules for the cyclical data exchange. The size of each shift register module is 8 bits.

When you carry out a manual configuration here, you must make sure that the automatic register detection is not set, since these values are given priority. If the number of connected shift register modules does not match this register, the SSC interface switches to error state.

Modbus Register	0x001c
Value Range	0-32
Default Value	0
Number of bytes available	1
Permanently stored	Yes
Access	Read/Write
Meaning	
0x00	0 Shift registers
0x01	1 Shift registers
0x02 – 0x1F
0x20	32 Shift registers

0x001d Current number of output shift register modules

Prerequisite: You have activated the Master Mode.

In this memory register you will find information about the current number of output shift register modules for the cyclical data exchange on the SSC interface.

Modbus Register	0x001d
Value Range	0-32
Number of bytes available	2
Permanently stored	No
Access	Read Only
Meaning	
0x00	0 Shift registers
0x01	1 Shift registers
0x02 – 0x0F	...
0x20	32 Shift registers

0x001e Configure number of input shift register modules

Prerequisite: You have activated the Master Mode

In this memory register you have the option, to set the number of input shift register modules for the cyclical data exchange. The size of each shift register module is 8 bits.

When you carry out a manual configuration here, you must make sure that the automatic register detection is not set, since these values are given priority. If the number of connected shift register modules does not match this register, the SSC interface switches to error state.

Modbus Register	0x001e
Value Range	0-32
Default Value	0
Number of bytes available	1
Permanently stored	Yes
Access	Read/Write
Meaning	
0x00	0 Shift registers
0x01	1 Shift registers
0x02-0x1F	...
0x20	32 Shift registers

0x001f Current number of input shift register modules

Prerequisite: You have activated the Master Mode.

In this memory register you will find information about the current number of output shift register modules for the cyclical data exchange on the SSC interface.

Modbus Register	0x001f
Value Range	0-32
Default Value	-
Number of bytes available	2
Permanently stored	No
Access	Read Only
Meaning	
0x00	0 Shift registers
0x01	1 Shift registers
0x02-0x1F	...
0x20	32 Shift registers

0x0020 Module type

This register contains the unique identification number for the module type of the KUNBUS-IC modules. This module type provides information regarding which product type it is and which fieldbus the module is used for.

Modbus Register	0x0020
Value Range	0x00-0xff
Initial value	4
Number of bytes available	1
Permanently stored	Yes
Access	Read Only
Meaning	
4	IC-Modul for PROFIBUS

0x0021 Default values in the data communication configure

In this memory register you have the option, to specify the behaviour of the memory register in case no data from outside is received anymore on the SSC Modbus RTU or fieldbus interface.

Modbus Register	0x0021
Value Range	0x00-0x3f
Default Value	0x00
Number of bytes available	1
Permanently stored	Yes
Access	Read/Write
Meaning	
Bit 1, Bit 0:	SS1 and SS0 (SSC interface) 00: Output data is set to 0 (default value) 01: Output data is set to 1 10: The data last written is retained
Bit 3, Bit 2:	FB1 and FB0 (fieldbus interface) 00: Output data is set to 0 (default value) 01: Output data is set to 1 10: The data last written is retained
Bit 5, Bit 4:	SS1 and SS0 (SDI interface) 00: Output data is set to 0 (default value) 01: Output data is set to 1 10: The data last written is retained

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
										SD	SD	FB	FB	SS	SS

0x0022 Validity period of the process data on the SSC interface

In this memory register you have the option, to set the validity period of the process data on the SSC interface

The next production must take place within the specified period, otherwise the input data is marked as invalid. Output registers that are supplied with process data via the Data Broker from this input area then adjust themselves to the preselected safe values. You set these values in the Memory Register 0x0021.

You can find detailed information on this topic in section "Data Broker [► 12]".

Modbus Register	0x0022
Value Range	0-255
Default Value	0x00
Number of bytes available	1
Permanently stored	Yes
Access	Read/Write
Meaning	
0	The data is valid indefinitely in acyclic operation.
1-255	Validity period in milliseconds (ms) The next production must follow within this time

0x0023 Validity period of the process data on the SDI interface

In this memory register you have the option, to define the validity period of the process data on the SDI interface.

The next production must take place within the specified period, otherwise the input data is marked as invalid. Output registers that are supplied with process data via the Data Broker from this input area then adjust themselves to the preselected safe values. You set these values in the Memory Register 0x0021.

You can find detailed information on this topic in section "Data Broker [► 12]".

Modbus Register	0x0023
Value Range	0-255
Default Value	0x00
Number of bytes available	1
Permanently stored	Yes
Access	Read/Write
Meaning	
0	The data is valid indefinitely in acyclic operation.
1-255	Validity period in milliseconds (ms) The next production must follow within this time

0x0024 Validity period of the process data on the PROFIBUS interface

In this memory register you have the option, to define the validity period of the process data on the PROFIBUS interface.

The next production must take place within the specified period, otherwise the input data is marked as invalid. Output registers that are supplied with process data via the Data Broker from this input area then adjust themselves to the preselected safe values. You set these values in the Memory Register 0x0021.

You can find detailed information on this topic in section "Data Broker [► 12]".

Modbus Register	0x0024
Value Range	0-255
Default Value	0x00
Number of bytes available	1
Permanently stored	Yes
Access	Read/Write
Meaning	
0	The data is valid indefinitely in acyclic operation.
1-255	Validity period in milliseconds (ms) The next production must follow within this time

0x0025 Configure shift chain

In this memory register you have the option, to use the first input and output register of the shift chain for connecting additional components (e.g. Status LEDs, Switches). If you do not want to use any further components, all registers can be used for the data transmission.

Modbus Register	0x0025
Value Range	0x00 – 0x07
Default Value	0x03
Number of bytes available	1
Permanently stored	Yes
Access	Read/Write
Meaning	
Bit 2, Bit 1	Input register of the shift chain 00: all registers are used for the data transmission. 01: Input register 0 is used for fieldbus switches. 10: Input register 0 and 1 are used for fieldbus switches.
Bit 0	Output register of the shift chain 0: all output registers are used for the data transmission. 1: Output register 0 is used for the status LEDs.

0x0026 Current assignment of the shift chain

In this memory register you will find information about using the first input and output register of the shift chain. You can detect whether additional components (e. g. status LEDs, switches) are used or whether all registers are used for the data transmission.

Modbus Register	0x0026
Value Range	0x00 – 0x07
Number of bytes available	1
Permanently stored	Yes
Access	Read/Write
Meaning	
Bit 0	Output register of the shift chain 0: all output registers are used for the data transmission. 1: Output register 0 is used for the status LEDs.
Bit 1, Bit 2	Input register of the shift chain 00: all registers are used for the data transmission. 01: Input register 0 is used for fieldbus switches. 10: Input register 0 and 1 are used for fieldbus switches.

0x0032 Script Enable Register

In this register you have the option to activate or to deactivate the execution of a script.

You will find information about creating a script in the "KUNBUS-Scripter" documentation supplied.

Modbus Register	0x0032
Value Range	0x00 - 0xff
Default Value	0x00
Number of bytes available	1
Permanently stored	Yes
Access	Read/Write
Meaning	
0	Deactivated
1	Activated

0x0033 Script Port Register

In this register you have the option to select the interface by which the script should communicate.

NOTICE

Please note that activation of a script influences the individual port.

E.g.: If the CDI port is used by the script, the CDI menu can no longer be used until you have deactivated the script.

If the CDI port is used by the script, you can only deactivate the script by writing the value 0 in the memory register 0x0032. You must restart the module to apply the deactivation.

Modbus Register	0x0033
Value Range	0x00-0x01
Default Value	0x01
Number of bytes available	1
Permanently stored	Yes
Access	Read/Write
Meaning	
0	CDI Interface
1	SDI Interface

0x0034 Script Status Register

In this register you will find information about the current status of the scripts.

Modbus Register	0x0034
Value Range	0x00-0xff
Default Value	0x00
Number of bytes available	1
Permanently stored	No
Access	Read Only
Meaning	
0	The running script is in the initialisation phase
1	The script is running cyclically
2	The running script is waiting for data input or for a waiting period to elapse
3	The script was stopped or no script for running is loaded or running script is deactivated
4	Script cannot run due to a serious error

0x0035 Script Loop Register

In this register you have the option to monitor whether your script is running. During each run of the script, the value in the register is incremented.

Modbus Register	0x0035
Value Range	0x0000- 0xffff
Initial value	0
Number of bytes available	2
Permanently stored	No
Access	Read Only

0x0036 SSC Error Register

In this memory register you will find information about possible errors that have occurred when connecting the module to an external shift register chain.

Modbus Register	0x0036
Value Range	0x00-0x05
Default Value	-
Number of bytes available	1
Permanently stored	No
Access	Read Only
Meaning	
0	No Error
1	Centre tap is not receiving any data, line defective
2	Data In is not receiving any data
3	Number of input registers is not as expected
4	Number of output registers is not as expected
5	General error, e.g. electrical faults

6.3 Register for the Mapping

In the following Memory registers you have the option to define the data mapping of the Data Broker for the input and output areas of the interfaces.

For each consumer (target register) there is a register area, in which all sources ("producers") are listed from which it obtains data. The data of the source areas is stored in the target area continuously in succession ("consumer") as well as the entries for this consumer. A maximum of 8 entries per consumer are possible. Each entry occupies 2 Memory Register. In the first Memory Register you can specify the base number of the Memory Register from which the data is copied. In the second Memory Register you determine the number of values you want to copy. Here, you can also exchange the High Byte and Low Byte (swap).

In the event of an invalid mapping, an error message flag is set in the status register 0x0002.

In section " Data Broker [► 12]" we will explain how a mapping works. You will also find an example of a mapping.

0x0e01-0x0e08 Output Data Mapping SSC

Modbus Register	0x0e01 – 0x0e08
Value Range	-
Default Value	0x00
Number of bytes available	16
Permanently stored	Yes
Access	Read/Write

0x0e21-0x0e28 Output Data Mapping SDI

Modbus Register	0x0e21 – 0x0e28
Value Range	-
Default Value	0x00
Number of bytes available	16
Permanently stored	Yes
Access	Read/Write

0x0e41-0x0e48 Output Data Mapping Fieldbus

Modbus Register	0x0e41 – 0x0e48
Value Range	-
Default Value	0x00
Number of bytes available	16
Permanently stored	Yes
Access	Read/Write

0x0f01-0xf40 Extended Output Mapping

In these memory registers have the option, to define a bit-accurate mapping. Individual bits can be mapped from any input data area to the output data area of your choice.

You can create a total of 16 different mappings.

Please note that a bit-accurate mapping requires very much run-time performance. Only use this function if you really need it.

To define a bit-accurate mapping, 4 registers must be defined in each case:

- In memory register 0xf01 enter the input memory register from which your data should originate.
- In memory register 0xf02 enter the output memory register in which you require the data.
- In memory register 0xf03 enter the source and target position of the bits that you want to map.
 - Define the source position via bit 0-3.
 - Define the target position via bit 4-7.
- In the memory register 0xf04 define the number of memory registers that you want to copy.
 - With bit 15 you can optionally swap the High Byte and Low Byte.

Modbus Register	0x0f01 – 0xf40
Value Range	-
Default Value	0x00
Number of bytes available	128
Permanently stored	Yes
Access	Read/Write
Meaning	
Register 0, 4, 6, 8,..., 60	Source register number
Register 1, 5, 9,..., 61	Target register number
Register 2, 6, 10, ..., 62	Bit 0-3: Source bit position Bit 4-7: Target bit position
Register 3, 7, 11,..., 63	Bit 0-14: Number of registers to be copied. Bit 15: generated when setting a change from high and low byte (swap)

6.4 Memory of the Communication Channels

The following memory registers contain the input and output data of the communication channels. Cyclical process data is written there or read from there.

The Data Broker distributes this data cyclically according to the Mapping entries. At the same time, the input data of the producers is assigned to the output data of the consumers.

The data can be read from the input registers at any time via the Modbus protocol. It is only possible to write to input registers via the respective communication channels (only in the case of SDI is this the Modbus communication itself, of course). The initial value in the input registers is 0 until a register is written with process data.

Output registers that are not written by the Data Broker also contain the initial value 0 regardless of the setting for the drop-off value in the event of validity periods of the source data being exceeded. Output registers can solely be written by the Data Broker. Read access is not possible via Modbus, however.

0x1001 Input SSC

Modbus Register	0x1001-0x1080
Coil Address	0x0001 – 0x0800
Value Range	-
Initial value	0x00
Number of bytes available	256
Permanently stored	No
Access	Read Only

0x1401 Input SDI

Modbus Register	0x1401-0x1480
Coil Address	0x2001 – 0x4000
Value Range	0x00-0xff
Initial value	0x00
Number of bytes available	256
Permanently stored	No
Access	Read/Write

0x1801 Input Fieldbus

Bear in mind that the 256 bytes represent a general upper limit for the IC-Modul. The maximum size that can be used with PROFIBUS is predefined by the GSD file as well as the maximum size of the Data Exchange telegrams and is 244 bytes.

A IC-Modul reacts like a modular PROFIBUS slave. This means that the amount of process data available in the respective application depends on the configuration that the PROFIBUS Master in the ChkConfig telegram requests prior to the cyclical data exchange with the slave.

Modbus Register	0x1801-0x1880
Coil Address	0x4001 – 0x6001
Value Range	-
Initial value	0x00
Number of bytes available	256
Permanently stored	No
Access	Read Only

0x2001 Output SSC

Modbus Register	0x2001-0x2080
Value Range	-
Coil Address	0x8001 – 0x8800
Initial value	0x00
Number of bytes available	256
Permanently stored	No
Access	Read Only

0x2401 Output SDI

Modbus Register	0x2401-0x2480
Coil Address	0xa001 – 0xb000
Value Range	-
Default Value	0x00
Number of bytes available	256
Permanently stored	No
Access	Read Only

0x2801 Output Fieldbus

Bear in mind that the 256 bytes represent a general upper limit for the IC-Modul. The maximum size that can be used with PROFIBUS is predefined by the GSD file as well as the maximum size of the Data Exchange telegrams and is 244 bytes.

A IC-Modul reacts like a modular PROFIBUS slave. This means that the amount of process data available in the respective application depends on the configuration that the PROFIBUS Master in the ChkConfig telegram requests prior to the cyclical data exchange with the slave.

Modbus Register	0x2801-0x2880
Coil Address	0xb001 – 0xe001
Value Range	-
Initial value	0x00
Number of bytes available	256
Permanently stored	No
Access	Read Only

6.5 Fieldbus specific Registers

0x4001 Fieldbus Status

In this memory register you will find information about the current communication status of the fieldbus interface.

Modbus Register	0x4001
Value Range	0-5
Number of bytes available	2
Permanently stored	No
Access	Read Only
Meaning	
0	Status is undefined
1	Bus in operation
2	Bus off error
3	Invalid station address or invalid bitrate
4	Bus offline

0x4002 Module Status

In this memory register you will find information about the PROFIBUS state of the module.

Modbus Register	0x4002
Value Range	0-4
Number of bytes available	2
Permanently stored	No
Access	Read Only
Meaning	
0	Initialisation
1	Error State
2	Fieldbus is stopped
3	Start-up phase
4	Operation

0x4003-0x4004 PROFIBUS Device ID

These Memory registers contain the PROFIBUS device ID. The device ID is an identification number assigned by the user organization PNO. If you want to change the device ID for your application, you can request a new device ID from PNO.

The Memory Register 0x4003 contains the High Word, Memory Register 0x4004 das Low Word of the device address.

Modbus Register	0x4003 - 0x4004
Value Range	-
Default Value	0x0CB5
Number of bytes available	4
Permanently stored	Yes
Access	Read/Write

0x4007-0x4008 Fieldbus Version

In this memory register you will find information about the fieldbus version.

The Memory Register 0x4007 contains the High Word, Memory Register 0x4008 contains the Low Word of the fieldbus version.

Modbus Register	0x4007 - 0x4008
Value Range	0x00000000 - 0xffffffff
Constant value	2
Number of bytes available	4
Permanently stored	Yes
Access	Read Only

0x4009 Firmware Version

In this memory register you will find information for the firmware version.

Modbus Register	0x4009
Value Range	0x0000 - 0xffff
Default Value	-
Number of bytes available	2
Permanently stored	Constant
Access	Read Only

0x400a-0x400b Serial Number

In these memory registers have the option, to change the serial number of the IC-Moduls.

In the delivered condition the KUNBUS serial number is stored.

The Memory Register 0x400a contains the High Word, register 0x400b contains the Low Word of the serial number.

Modbus Register	0x400a-0x400b
Value Range	0x00000000 - 0xffffffff
Default Value	KUNBUS Serial number
Number of bytes available	4
Permanently stored	Yes
Access	Read/Write

0x400c Current Station address

In this memory register you will find information about the Station address, with which the IC-Modul currently registers on the fieldbus.

Modbus Register	0x400c
Value Range	0 - 126 (0x0000 - 0x007e)
Default Value	-
Number of bytes available	2
Permanently stored	No
Access	Read Only
Meaning	
1-125	Station address (freely configurable)
126	Module accepts the address assignment via an SSA telegram from the Master.

0x400d configure Station address

In this memory register you have the option, to store the required Station address. Whether this Station address is used depends on the selection you make in the Memory registers 0x4011-0x4012.

The value range for the manual configuration is 0 – 125. If you set 126, the Station address is assigned automatically from the Master.

Modbus Register	0x400d
Value Range	0 - 126
Default Value	126
Number of bytes available	2
Permanently stored	Yes
Access	Read/Write
Meaning	
1-125	Station address (freely configurable)
>125	Module accepts an address assignment via an SSA telegram from the PROFIBUS Master.

0x400e Configuration of the device address via SSC

Prerequisite: You have connected the address switch.

This Memory Register reads the first two input bytes from the SSC channel. You can use these bytes as part of the Station address if you make the appropriate settings in register 0x4012.

Tip!: In Appendix 2 you will find an example for the connection of an address switch.

Modbus Register	0x400e
Value Range	0 - 126
Default Value	-
Number of bytes available	2
Permanently stored	No
Access	Read Only

0x400f Current Fieldbus Bitrate

In this memory register you will find information about the currently set fieldbus bitrate of the module.

The bitrate for data transmission to the fieldbus is preset by the Master. The module has automatic bitrate detection and adjusts itself automatically to the selected bitrate. A conversion in IC-Modul is not possible.

Modbus Register	0x400f
Value Range	0-9, 15
Default Value	-
Number of bytes available	2
Permanently stored	No
Access	Read Only
Meaning	
0	12 Mbit/s
1	6 Mbit/s
2	3 Mbit/s
3	1.5 Mbit/s
4	500 Kbit/s
5	187.5 Kbit/s
6	93.75 Kbit/s
7	45.45 Kbit/s
8	19.2 Kbit/s
9	9.6 Kbit/s
10-14	Not available
15	Bitrate not yet known (after reset)

In these registers you can define how the IC-Modul receives its device address.

Modbus Register	0x4011 - 0x4012
Value Range	
Default Value	0x00000003
Number of bytes available	4
Permanently stored	Yes
Access	Read/Write
Meaning	
Bit 1 , Bit 0	Station address 00: Modbus register 0x400b determines the station address 01: SSC determines station address (default value) 10: Station address is assigned automatically from the PROFIBUS Master 11: invalid
Bit 2	Address Format and Bitrate Settings Requires 1 input shift register 0: SSC Input register, binary format - 7 Bit length, bit 8 without function - 0 .. 125: Address of the module - 126: Address assignment by the Master - 127: invalid - Automatic bitrate detection 1: SSC Input register, BCD format - 8-Bit length - Bits 7-4 determine the tens digit - Bits 4-0 determine the single digit - 0 .. 99: Address of the module - Automatic bitrate detection

0x4014-0x4015 Product Code In this memory register you will find information about the product number of the module. The product code of KUNBUS is stored in the delivered condition. You have the option to change the product code. The Memory Register 0x4014 contains the High Word, Memory Register 0x4015 contains the Low Word of the product number.

Modbus Register	0x4014-0x4015
Value Range	0x00000000 - 0xffffffff
Default Value	-
Number of bytes available	24
Permanently stored	Yes
Access	Read/Write
Meaning	The default value is the KUNBUS product number of the IC-Moduls .

0x4016-0x4035 Product Name In this memory register you have the option, to change the product name. The product name of the module assigned by KUNBUS is stored In the delivered condition. You have up to 32 characters available in ASCII format for the name assignment.

NOTICE

If your product name is shorter than 32 characters, you have to fill up the remaining characters with the value "0".

Modbus Register	0x4016-0x4035
Value Range	32-Byte-String
Default Value	"KUNBUS IC PROFIBUS–DP V2.0"
Number of bytes available	32
Permanently stored	Yes
Access	Read/Write

0x4036 Size of Input Image In this memory register you will find information about the number of bytes the Data Broker can receive via PROFIBUS. You define this value using the configuration parameters by the master.

Modbus Register	0x4036
Value Range	0 - 244
Number of bytes available	1
Permanently stored	No
Access	Read Only

0x4037 Size of Output Image In this register you will find information about the number of bytes the Data Broker can transmit as user data of a telegram via PROFIBUS. You define this value using the configuration parameters by the master.

Modbus Register	0x4037
Value Range	0-244
Number of bytes available	1
Permanently stored	No
Access	Read Only

0x4101 SSA Station address This Memory Register contains the Station address that was last assigned from the Master.

This memory register has write and read access. The write access is used for writing from the master by SSA telegram. For this reason, do not enter any values using the memory register.

Prerequisite: You have configured the module so that the station address is assigned from the PROFINET-Master:

- For this purpose, write register 0x400d with the value 126
- ⇒ The module accepts the transmitted station address immediately. You do not have to perform a restart.

Modbus Register	0x4101
Value Range	0-126
Initial value	126
Number of bytes available	1
Permanently stored	Yes
Access	Read/Write

0x4102 SSA Lock

In this memory register you can see whether the PROFIBUS-Master has set an SSA lock.

In the SSA telegram the PROFIBUS Master can determine that the address transmitted with the telegram can no longer be changed. If this change lock is set, additional SSA telegrams are no longer processed by the slave and the transmitted address is preserved. There are 2 ways to change this state:

- by SDI transmission
- by a reset of the module to the delivered condition

If the module is reset, the SSA lock is reset to 0. As a result, the SSA telegrams will be processed again. Bear in mind that after resetting the module to the delivered condition, any settings already made will be lost again.

Modbus Register	0x4102
Value Range	0-1
Number of bytes available	2
Permanently stored	Yes
Access	Read/Write
Meaning	
0	The assignment of an address by SSA telegram is not locked from the Master.
1	The assignment of an address by SSA telegram was locked by the Master.

0x4111 Number of PROFIBUS Parameters

In this memory register you will find information about the number of parameters sent from the Master.

The number is set by the module as soon as parameters are available from a parameter telegram sent from the Master. This value includes all parameter bytes. These are made up as follows:

- 7-byte standard parameter
- Possibly user parameter including 3 DP-V1 specific parameters

Modbus Register	0x4111
Value Range	0-128
Number of bytes available	1
Permanently stored	No
Access	Read Only

0x4112 PROFIBUS Parameters received

This Memory Register indicates that parameters from the PROFIBUS-Master have been received.

After reading the parameters, this register is reset to 0 by the application.

Modbus Register	0x4112
Value Range	0-1
Default Value	0
Number of bytes available	1
Permanently stored	No
Access	Read/Write
Meaning	
0	No new information
1	New information available

0x4113 Number of PROFIBUS User Parameters

In this memory register you will find information about the number of user parameters sent from the Master.

The number is set by the module as soon as parameters are available from a parameter telegram sent from the Master. This value only includes the user parameters. The additional 3 bytes for DPV1 specific parameters are ignored here.

Modbus Register	0x4113
Value Range	0 - 118
Default Value	-
Number of bytes available	1
Permanently stored	No
Access	Read / Write
Meaning	
0x001	Parameter received from the master

0x4114 PROFIBUS User Parameter received

This Memory Register indicates that parameters from the PROFIBUS-Master have been received.

After reading the parameters, this register is reset to 0 by the application.

Modbus Register	0x4114
Value Range	0 - 1
Default Value	0
Number of bytes available	1
Permanently stored	No
Access	Read/Write
Meaning	
0	No new information
1	New information available

0x4133 Amount of Error Diagnosis Data

In this memory register you have the option, to define the amount of error diagnosis data that should be transmitted to the Master.

Set this value to "0" if no extended diagnosis data should be transmitted.

Modbus Register	0x4133
Value Range	0 - 32
Default Value	0
Number of bytes available	1
Permanently stored	No
Access	Read/Write

0x4134 Amount of User Diagnosis Data

In this memory register you have the option, to define the amount of user diagnosis data that should be transmitted to the Master.

Set this value to "0" if no extended diagnosis data should be transmitted.

Modbus Register	0x4134
Value Range	0 - 62
Default Value	0
Number of bytes available	1
Permanently stored	No
Access	Read/Write

0x4135 User Diagnosis Strobe Signal

In this memory register you have the option, to set the signal for releasing the transmission of extended diagnosis blocks.

Once you set the value here to "1", the module sends all current entries from the Error Diagnosis and Info Diagnosis memory register areas to the PROFIBUS Master with the next diagnosis telegram that the Master requests.

If the memory area for diagnosis error data contains at least one value that is not equal 0, then the "Ext_Diag" bit is set in the diagnosis telegram when sending and thereby triggers error handling on the PROFIBUS Master.

The module resets this value to "0" automatically once all transmitted data has been copied to the PROFIBUS-Protocol Chip.

Modbus Register	0x4135
Value Range	0 - 1
Default Value	0
Number of bytes available	1
Permanently stored	No
Access	Read/Write
Meaning	
1	Signal was sent to the Master
0	Signal not sent

0x4201-0x4205 Default Parameters

In this memory register you will find information about the default parameters that the PROFIBUS master last transmitted to the module in the parametrisation telegram.

The area includes the 7 bytes of the standard parameter telegram and possibly the first (DPV1 specific) bytes from user parameters, if these were transmitted from the Master.

The default parameters comply with the PROFIBUS standard.

Modbus Register	0x4201 - 0x4205
Value Range	-
Default Value	-
Number of bytes available	7 - 10
Permanently stored	No
Access	Read Only

0x4211 - 0x4285 PROFIBUS User Parameters

In these memory registers you will find information about the user parameters sent from the PROFIBUS Master.

This value does not include the first 3 DPV1-specific bytes that must always be set to 0 for DPV0.

NOTICE! These register contents cannot be distributed via the Data Broker.

Modbus Register	0x4211 - 0x42485
Value Range	-
Default Value	-
Number of bytes available	117
Permanently stored	No
Access	Read Only

0x4411 - 0x4420 Extended Diagnosis of the Error Data

This Memory Register contains the data sent in the first diagnosis block to the Master.

If the memory area for diagnosis error data contains at least one value that is not equal 0, then the "Ext_Diag" bit is set in the diagnosis telegram when sending and thereby triggers error handling on the Profibus Master.

Prerequisite: Before data can be transmitted to the PROFIBUS Master, you must specify the amount of error data in the Memory Register 0x4133 to be transmitted. This value must not be "0". This data will be transmitted together with the info data if you set the value "1" in the Memory Register 0x4135 for releasing the data.

NOTICE! These register contents cannot be distributed via the Data Broker.

Modbus Register	0x4411 - 0x4420
Value Range	-
Default Value	-
Number of bytes available	32
Permanently stored	No
Access	Read/Write

0x4421-0x443f Extended Diagnosis of the Error Data

This Memory Register contains the data sent in the second diagnosis block to the Master.

Prerequisite: Before data can be transmitted to the PROFIBUS Master, you must specify the amount of info diagnosis data in the Memory Register 00x4134 to be transmitted. This value must not be "0".

This data will be transmitted together with the error data if you set the value "1" in the Memory Register 0x4135 for releasing the data.

Modbus Register	0x4421 - 0x443f
Value Range	-
Default Value	-
Number of bytes available	62
Permanently stored	No
Access	Read/Write

7 CDI

7.1 Setting up a Serial Connection

The CDI interface of the IC-Module is a UART interface (asynchronous serial interface) with 3.3V CMOS signal level.

If you connect a switch with level converter (e.g. "EXAR - SP3232EUEY") to the application connector via the RX and TX connections of this interface, an RS232 interface is available to you for connecting a terminal (you can find details from our sample circuit diagram under "RS232 Interface for CDI" in the Appendix).

You can connect the serial COMx interface of a PC to such a terminal interface (or a serial USB converter) and then access the CDI menus using a terminal emulation. We provide you with PuTTY as a terminal emulation on our support webpage.

How to start PuTTY:

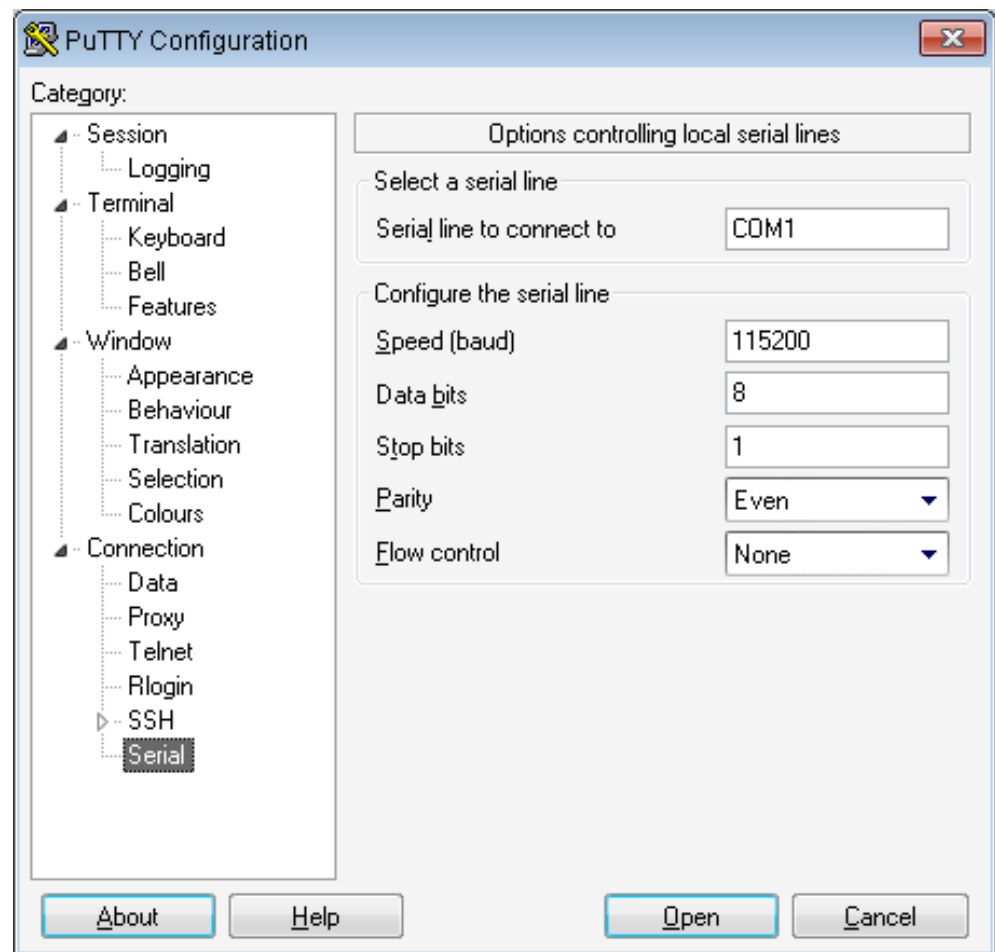


Illustration 12: Putty Serial

- Change to the "Connection > Serial" view
 - Select the serial interface that you want to access the CDI with (here: COM1)
 - Configure the interface with the default settings of the CDI interface (for values see Fig above). Deactivate the dataflow control as well.
 - Change to the "Session" view.
 - Activate "Serial" as connection type. The "Serial line" and "Speed" fields are already preallocated with the settings you specified beforehand.
 - Assign a name under "Saved Sessions" to save these settings.
 - Click on "Save".
 - Click on "Open".
- ⇒ The main menu will open in the terminal window.

NOTICE! If the terminal window remains black, click on the [ESC] key to start the data transmission via the CDI.

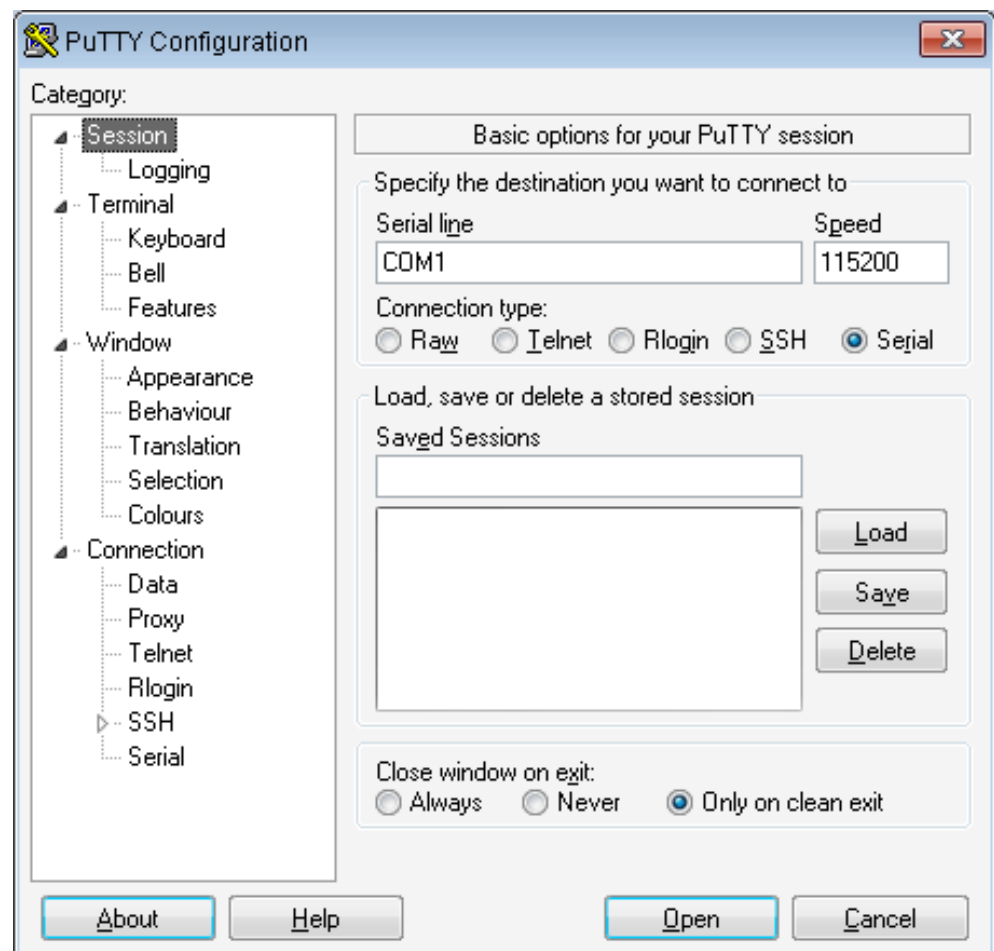


Illustration 13: Putty Session

7.2 CDI Menu

Main Menu

The main menu is your access point for operating the module using the CDI. After a reset, the module transmits this main menu to the terminal.

```
-----  
KUNBUS-IC - Main Menu  
-----  
1 - Module Information  
2 - Interface Configuration  
3 - Monitor Communication  
4 - Module Status  
-----  
>
```

Menu 1 – "Module Information"

1.Module Information

In this menu you will find general information about the module:

- Software revision
- Checksum of the firmware
- Serial number of the module
- Module type (unique throughout KUNBUS)

```
-----  
KUNBUS-IC - Module Information  
-----  
Revision: 2.1.4094  
Firmware CRC: 0xd3017b48  
Serial Number: 231  
Module Type: ( 1) Profibus  
-----  
>
```

2. Interface Configuration

Menu 2 – "Interface Configuration"

In this menu you have the option to define the operational parameters for the different interfaces.

Here, you can set the mapping for the data broker.

Changes that you make in these menus are first activated after a restart.

The selection "8 – Set Arbitrary Register" allows you write access to all writeable Modbus registers of the module.

```
-----
KUNBUS-IC - Interface Configuration
-----
```

```
1 - SDI Communication
2 - CDI Communication
3 - SSC Communication
4 - SDI Output mapping
5 - SSC Output mapping
6 - Fieldbus Output mapping
7 - Fieldbus Specific
8 - Set Arbitrary Register
9 - Reset Module
10 - Extended Databroker
11 - Script Interpreter
12 - Reset to Factory Settings
-----
```

2.1 SDI Communication

In this menu you will find information about the settings for the Modbus RTU communication. You can configure the values in the submenus.

```
-----
KUNBUS-IC - SDI Communication
-----
```

```
1 - Bittate: Automatic Bittate detection
2 - Parity: Even Parity, 1 Stopbit
-----
>
```

2.1.1 SDI Communication Bittate

In this menu you have the option, to select the appropriate Bittate for your application.

The default value is "Automatic Bittate detection".

```
-----
KUNBUS-IC - SDI Communication: Set Bittate
-----
```

```
1 - Automatic Bittate detection
2 - 2400 Bit/s
3 - 4800 Bit/s
4 - 9600 Bit/s
5 - 19200 Bit/s
6 - 38400 Bit/s
7 - 57600 Bit/s
8 - 115200 Bit/s
-----
>
```

2.1.2 SDI Communication- Set Parity

In this menu you have the option to select the appropriate parity for your application from the displayed values.

The default value is "Even Parity (1 stop-bit)".

The number of stop-bits is based automatically on the parity setting. This ensures that a transmission always contains the same number of bits per byte.

```
-----
KUNBUS-IC - SDI Communication: Set Parity
-----
1 - Even Parity (1 Stopbit)
2 - Odd Parity (1 Stopbit)
3 - No Parity (2 Stopbits)
-----
>
```

2.1.3 Set Modbus Node Address

In this menu you have the option, to enter the Modbus Node Address.

Permitted input values: 1-247

```
-----
KUNBUS-IC - SDI Communication: Set Modbus Node Address
-----
Enter a Modbus Node Address between 1 and 247:
-----
>
```

2.2 CDI Communication

In this menu you will find information about the currently set values of bitrate and parity. In the submenus you can configure the values.

```
-----
KUNBUS-IC - CDI Communication
-----
1 - Bitrate: 115200 Bit/s
2 - Parity: Even Parity, 1 Stopbit
-----
>
```

2.2.1 CDI Communication - Set Bitrate

In this menu you have the option, to select the appropriate Bitrate for your application.

The default value is 115200 bit/s.

Automatic bitrate detection via the CDI is not possible.

```
-----  
KUNBUS-IC - CDI Communication: Set Bitrate  
-----
```

```
1 - 2400 Bit/s  
2 - 4800 Bit/s  
3 - 9600 Bit/s  
4 - 19200 Bit/s  
5 - 38400 Bit/s  
6 - 57600 Bit/s  
7 - 115200 Bit/s  
-----
```

```
>
```

2.2.2 CDI Communication - Set Parity

In this menu you have the option to select the appropriate parity for your application from the displayed values.

The default value is "Even Parity (1 stop-bit)".

The number of stop-bits is based automatically on the parity setting. This ensures that a transmission always contains the same number of bits per byte.

```
-----  
KUNBUS-IC - CDI Communication: Set Bitrate  
-----
```

```
1 - Even Parity, 1 Stopbit  
2 - Even Parity, 2 Stopbit  
3 - Odd Parity, 1 Stopbit  
4 - Odd Parity, 2 Stopbit  
5 - No Parity, 1 Stopbit  
6 - No Parity, 2 Stopbit  
-----
```

```
>
```

SSC Mode

In this menu you have the option, to configure the shift register chain.

2.3 Select SSC SSR Master Mode

In this menu you have the following options:

- SSC SSR Master Mode, disabled: With this option, you switch off the SSC.
- SSC SSR Master Mode, auto detect shift registers: With this option, the number of input/output shift registers and the bitrate is determined automatically.
- SSC SSR Master Mode, configured shift registers: With this option, you can define the number of input/output shift registers and the bitrate yourself.
 - Enter [3] + [Enter] to select this mode as the configuration source.
 - With the option [9] you open the configuration menu.
- SSC SPI Slave Mode: With this selection you can make the settings for the SPI Slave Mode
 - Enter [4] + [Enter] to select this mode as the configuration source.
 - With the option [9] you open the configuration menu.

```
-----
KUNBUS-IC- Select SSC SSR Master Mode
-----
Mode: SSC SSR Master Mode, configured shift registers

1 - SSC SSR Master Mode, disabled
2 - SSC SSR Master Mode, auto detect shift registers
3 - SSC SSR Master Mode, configured shift registers
4 - SSC SPI Slave Mode

9 - Configure actual selection
-----
>
```

2.3.2 SSC SSR Master Mode, Auto detect shift registers

In this menu, you can define how many shift registers are available for the integration of configuration switches and status LEDs.

```
-----
KUNBUS-IC - SSC SSR Master Mode, auto detect shift registers
-----
1 - No. of Fieldbus Switch Registers: 0
2 - No. of Fieldbus Status-LED Registers: 0
-----
>
```

2.3.2.1 Number of Fieldbus Switch Registers

In this menu, you can define how many input shift registers are available for configuration switches.

Permissible input values: 0-2

```
-----
KUNBUS-IC - SSC No. of Fieldbus Switch registers
-----
>
```

2.3.2.2 Number of Status LED Registers

In this menu, you can define how many output shift registers are available for status LEDs.

Permissible input values: 0-1

```
-----
KUNBUS-IC - SSC No. of Fieldbus Status-LED registers
-----
>
```

2.3.3 SSC SSR Master Mode, configure shift registers

Prerequisite: In menu "2.3 - Select SSC SSR Master Mode" you have selected the configuration source "SSC SSR Master Mode, configure shift registers".

In this menu you have the following options:

- Number of input shift registers for configuration switches
- Number of output shift registers for status LEDs
- Number of input shift registers
- Number of output shift registers
- Bitrate

```
-----
KUNBUS-IC- SSC SSR Master Mode, configure shift registers
-----
3 - No of Fieldbus Switch Registers: 0
4 - No of Fieldbus Status-LED Registers: 0
3 - Number of overall Input Registers: 0
4 - Number of overall Output Registers: 0
5 - Configured Bitrate: 300 kBit/s
-----
>
```

2.3.3.1 Number of Fieldbus Switch Registers

In this menu, you can define how many input shift registers are available for configuration switches.

Permissible input values: 0-2

```
-----
KUNBUS-IC - SSC No. of Fieldbus Switch registers
-----
>
```

2.3.3.2 Number of Fieldbus Status LED Registers

In this register, you can define how many output shift registers are available for status LEDs.

Permissible input values: 0-1

```
-----
KUNBUS-IC - SSC No. of Fieldbus Status-LED registers
-----
>
```


2.3.3.3 Number of overall Input Registers

In this menu you have the option to define the number of input shift registers. Valid input values are between 0 and 32.

```
-----
KUNBUS-IC - SSC SSR Number of input shift registers
-----
>
```

2.3.3.4 Number of overall Output Registers

In this menu you have the option to define the number of output shift registers. Valid input values are between 0 and 32.

```
-----
KUNBUS-IC - SSC SSR Number of output shift registers
-----
>
```

2.3.3.5 SSC SSR Bitrate

In this menu you have the option to set the bitrate. With option [1] "Auto detect Bitrate" the bitrate is determined automatically.

The values specified are to be regarded as reference values for "fast", "medium" and "slow". In SSC master mode these values are fallen short of by approx. 10%.

In slave mode the PROFIBUS-Master determines the bitrate.

```
-----
KUNBUS-IC - SSC SSR Bitrate
-----
1 - Auto detect Bitrate
2 - 300 kBit/s
3 - 1200 kBit/s
4 - 4800 kBit/s
-----
>
```

2.3.4 SSC SPI Slave Mode

In this menu you have the option to make settings for the SSC SPI Slave Mode.

In the first line you will see the current settings.

Using the option [1] "Configure settings" you can configure the settings.

```
-----
KUNBUS-IC - SSC SPI Slave Settings
-----
Settings: Polarity Normal, Falling Edge, CLK High, MSB first

1 - Configure settings
-----
>
```

2.3.4.1 SSC SPI Slave Settings

In this menu you have the option to select the following combination of clock and data level.

You can find more information on this topic in section "Synchronous serial interface [► 22]".

```
-----
KUNBUS-IC - SSC SPI Slave Settings
-----
1 - Polarity Normal, Rising Edge, CLK Low, MSB first
2 - Polarity Normal, Rising Edge, CLK High, MSB first
3 - Polarity Normal, Falling Edge, CLK Low, MSB first
4 - Polarity Normal, Falling Edge, CLK High, MSB first
-----
>
```

Note! Unfortunately, the representation in this CDI menu is not completely correct. In the memory register 0x0018 [► 58] you can see the correct representation.

2.4 SDI Output Mapping

In this menu you have the option to configure the Data-Broker-Mapping for the SDI.

Here you can specify up to four different register areas (start address and number of successive registers) as data sources.

Optionally, you can activate a timeout and specify default data that should be valid in the event of a timeout.

```
-----
KUNBUS-IC - SDI Outputmapping
-----
Src Register Number
1 - 1 (0x0001) | 0
2 - 1 (0x0001) | 0
3 - 1 (0x0001) | 0
4 - 1 (0x0001) | 0

5 - Default Data: all zero
6 - Valid Time: disabled
-----
>
```

Configuring Output Mapping

```
-----
KUNBUS-IC - Edit one map entry
-----
```

```
Source Register:
```

- ✓ First determine the start address of the source register.
You can get an overview of the start addresses in the menuRegister for the Mapping [► 70].
- To do this, select a register from the input data area of the communication channels and then enter the number of registers to be used.
 - ⇒ After entering the number of registers, you will return automatically to the mapping overview.
- Restart the module.
- ⇒ Your mapping is now configured and will be applied in the operating mode.

```
-----
KUNBUS-IC- Edit one map entry
-----
```

```
Source Register: 0x1001
```

```
Number of Registers:
```

NOTICE! In the event of an invalid mapping (e.g. due to a register address outside the permitted input range or a register number that is too high) an error message appears.

Default data in Data Broker

In this menu you have the option, to define the default data for consumers used in the event of invalid production data.

If the data in the input registers should be invalid e.g. because no data has arrived anymore from outside, the Data Broker uses the following values:

- All bits are 1
- All bits are 0
- All bits remain unchanged

```
-----
KUNBUS-IC - Default data in data broker
-----
```

```
1 - all data bit are zero
```

```
2 - all data bit are one
```

```
3 - old production values are used
-----
```

```
>
```

Production valid time

In this menu you have the option, to determine the validity period of the register contents to be read out.

The value range of the validity periods can be defined between 0 and 255 ms.

If no new data from the producer should arrive in the input registers within the predefined period, the Data Broker uses the data set among the default values.

```
-----
KUNBUS-IC - Production valid time (0 = disabled)
-----
>
```

2.5 SSC Output Mapping

In this menu you have the option to configure the Data-Broker-Mapping for the SDI.

Here you can specify up to four different register areas (start address and number of successive registers) as data sources.

Optionally, you can activate a timeout and specify default data that should be valid in the event of a timeout.

```
-----
KUNBUS-IC - SSC Outputmapping
-----
Src Register Number
1 - 1 (0x0001) | 0
2 - 1 (0x0001) | 0
3 - 1 (0x0001) | 0
4 - 1 (0x0001) | 0

5 - Default Data: all zero
6 - Valid Time: disabled
-----
>
```

Configuring Output Mapping

```
-----
KUNBUS-IC - Edit one map entry
-----
```

```
Source Register:
```

- ✓ First determine the start address of the source register.
You can get an overview of the start addresses in the menuRegister for the Mapping [► 70].
 - To do this, select a register from the input data area of the communication channels and then enter the number of registers to be used.
 - ⇒ After entering the number of registers, you will return automatically to the mapping overview.
 - Restart the module.
- ⇒ Your mapping is now configured and will be applied in the operating mode.

```
-----
KUNBUS-IC- Edit one map entry
-----
```

```
Source Register: 0x1001
```

```
Number of Registers:
```

NOTICE! In the event of an invalid mapping (e.g. due to a register address outside the permitted input range or a register number that is too high) an error message appears.

Default data in Data Broker

In this menu you have the option, to define the default data for consumers used in the event of invalid production data.

If the data in the input registers should be invalid e.g. because no data has arrived anymore from outside, the Data Broker uses the following values:

- All bits are 1
- All bits are 0
- All bits remain unchanged

```
-----
KUNBUS-IC - Default data in data broker
-----
```

```
1 - all data bit are zero
```

```
2 - all data bit are one
```

```
3 - old production values are used
```

```
>
```

Production valid time

In this menu you have the option, to determine the validity period of the register contents to be read out.

The value range of the validity periods can be defined between 0 and 255 ms.

If no new data from the producer should arrive in the input registers within the predefined period, the Data Broker uses the data set among the default values.

```
-----
KUNBUS-IC - Production valid time (0 = disabled)
-----
>
```

2.6 Fieldbus Output Mapping

In this menu you have the option, to configure the Data-Broker-Mapping for the fieldbus interface.

Here you can specify up to four different register areas (start address and number of successive registers) as data sources.

Optionally, you can activate a timeout and specify default data that should be valid in the event of a timeout.

```
KUNBUS-IC - Fieldbus Outputmapping
-----
Src Register Number
1 - 1 (0x0001) | 0
2 - 1 (0x0001) | 0
3 - 1 (0x0001) | 0
4 - 1 (0x0001) | 0

5 - Default Data: all zero
6 - Valid Time: disabled
-----
>
```

Configuring Output Mapping

```
-----
KUNBUS-IC - Edit one map entry
-----
```

```
Source Register:
```

- ✓ First determine the start address of the source register.
You can get an overview of the start addresses in the menuRegister for the Mapping [► 70].
 - To do this, select a register from the input data area of the communication channels and then enter the number of registers to be used.
 - ⇒ After entering the number of registers, you will return automatically to the mapping overview.
 - Restart the module.
- ⇒ Your mapping is now configured and will be applied in the operating mode.

```
-----
KUNBUS-IC- Edit one map entry
-----
```

```
Source Register: 0x1001
```

```
Number of Registers:
```

NOTICE! In the event of an invalid mapping (e.g. due to a register address outside the permitted input range or a register number that is too high) an error message appears.

Default data in Data Broker

In this menu you have the option, to define the default data for consumers used in the event of invalid production data.

If the data in the input registers should be invalid e.g. because no data has arrived anymore from outside, the Data Broker uses the following values:

- All bits are 1
- All bits are 0
- All bits remain unchanged

```
-----
KUNBUS-IC - Default data in data broker
-----
```

```
1 - all data bit are zero
```

```
2 - all data bit are one
```

```
3 - old production values are used
```

```
>
```

Production valid time

In this menu you have the option, to determine the validity period of the register contents to be read out.

The value range of the validity periods can be defined between 0 and 255 ms.

If no new data from the producer should arrive in the input registers within the predefined period, the Data Broker uses the data set among the default values.

```
-----
KUNBUS-IC - Production valid time (0 = disabled)
-----
>
```

2.7 Profibus Setting

In the following menu items you have the option to specify the configuration of the station address (node address) as well as the number of info diagnosis bytes and error diagnosis bytes to be used.

```
-----
KUNBUS-IC - Profibus Setting
-----
1 - Node Address
2 - Number of Diagnosis Info Bytes
3 - Number of Diagnosis Error Bytes
-----
>
```


2.7.1 Profibus Settings

In this menu you have the option to choose which source you want to get the station address from. The active address mode is visible within the header row. By entering [1]...[3] + [Return] you can change the mode.

Option 1 – Modbus Register: With this option you select the memory register 0x400d as the configuration source. By entering [9] + [Return] you can configure the active address mode.

- Option 2 – Switch attached to shift register: If you have attached the rotary coding switch via the shift chain, you can use this as a configuration source.
- Option 3 – With this option you determine that the module gets its station address from the PROFIBUS-Master. In this mode you cannot make any further adjustments to the station address via the memory register or rotary coding switch.

```
-----
KUNBUS-IC - Profibus Settings
-----
Actual Config Source: Modbus Register

1 - Modbus Register
2 - Switch attached to shift register
3 - Auto Address Assign from Profibus Master

9 - Configure Actual Selection
-----
>
```

NOTICE

If you set the address 126, the module is ready to receive the station address from the PROFIBUS-Master via an SSA telegram.

2.7.1.1 Profibus Mbus Register setting

In this menu you have the option, for entering station address directly and saving it permanently.

The new settings are applied after a reset (Power Off/On or write Memory Register 0x0001 with value 0x0003).

```
-----
KUNBUS-IC - Profibus Mbus Register setting
-----
Node ID (0x400d): 126
-----
New Node ID >
```

2.7.1.2 Profibus Switch Settings

In this menu you have the option, for changing the format for evaluating the station address from the shift registers.

The evaluation can take place as a two's complement (8 Bit DIP Switch) or as a binary coded decimal number (BCD):

- BCD Mode:
2 bytes are read from the SSC. In the first byte the station address is set via 2 BCD switches, in the second byte the bitrate is set via 1 BCD switch.
- Binary Mode:
1 byte is read from the SSC. The upper 6 bits define the station address, the 2 bits define the bitrate.

If you change over the station address on the switches, the changes will first be applied after a restart (Power Off/On or write Memory Register 0x0001 with the value 0x0003).

```
-----
KUNBUS-IC - Profibus Switch Settings
-----
Actual: Node-ID 2x BCD

1 - Node-ID 2x BCD
2 - Node-ID 8 Bit DIP Switch
-----
>
```

2.7.1.3 Auto Address Assign from Profibus Master

Select this configuration source if the station address should be assigned automatically from the PROFIBUS master. Entering the value "126" during the configuration via the memory register also allows an address assignment via an SSA telegram by the PROFIBUS Master.

You can also perform this setting using the rotary coding switch. Set the value there to "126".

2.7.2 Number of Info Diagnosis Bytes

In this menu you have the option, for defining the number of user diagnosis bytes that should be transmitted as information.

The value range is between 0 and 62.

You can find further information on this topic in section "".

NOTICE! In this menu, differences in the representation may occur depending on the software version.

```
-----
KUNBUS-IC - Profibus Number of Diag. Info Bytes
-----
Actual Number of Bytes (Register 0x4105): 0

-----
New Number of Bytes (Range 0 - 62) >
```

If the representation is correct, this CDI menu refers to register address 0x4135:

```
-----
KUNBUS-IC - Profibus Number of Diag. Info Bytes
-----
Actual Number of Bytes (Register 0x4135): 0
-----
New Number of Bytes (Range 0 - 62) >
```

2.7.3 Number of Diag. Error Bytes

In this menu you have the option, for defining the number of user diagnosis bytes that should be transmitted as error.

The value range is between 0 and 32.

You can find further information on this topic in section "".

NOTICE! In this menu, differences in the representation may occur depending on the software version.

```
-----
KUNBUS-IC - Profibus Number of Diag. Error Bytes
-----
Actual Number of Bytes (Register 0x4104): 0
-----
New Number of Bytes (Range 0 - 32) >
```

If the representation is correct, this CDI menu refers to register address 0x4133:

```
-----
KUNBUS-IC - Profibus Number of Diag. Error Bytes
-----
Actual Number of Bytes (Register 0x4133): 0
-----
New Number of Bytes (Range 0 - 32) >
```

2.8 Set Arbitrary Register

In this menu you have the option, to make adjustments to the writeable registers that do not have their own menu item.

First enter the register number:

```
-----
KUNBUS-IC - Set Arbitray Register
-----
Register Number:
```

If the register number does not exist or is write-protected, you will receive a corresponding error message.

```
-----
KUNBUS-IC - Set Arbitray Register
-----
Register Number: 0x5001 <<Register doesn't exist or no write access
.Register Number:
```

If the register number is valid, the dialog first shows you the set value in decimal, hexadecimal and binary notation.

```
-----
KUNBUS-IC - Set Arbitray Register
-----
Register Number: 0x0013
Current Value : 1 0x0001 0000_0000_0000_0001b
Enter New Value:
```

Now specify a new value for the register and press [Return] to confirm your entry.

```
-----
KUNBUS-IC - Set Arbitray Register
-----
Register Number: 0x0013
Current Value : 1 0x0001 0000_0000_0000_0001b
Enter New Value: 2
New Value Set : 2 0x0002 0000_0000_0000_0010b
Register Number:
```

The configuration interface detects whether it is a decimal, hexadecimal or binary value based on the notation and displays the saved value once again for confirmation.

CAUTION

Please note that some settings could lead to functional incapacity of the CDI interface.

You can only remedy such an inaccurate setting with a functional SDI interface.

- When correcting the error, all settings made previously are reset.
- ➔ Write the value 0x0002 in the register 0x0001
- ⇒ You have set the module to the original settings. The CDI interface is now available again.

2.9 Reset Module

With this option you can restart the module. The module hereby interrupts the fieldbus communication temporarily.

A restart is necessary for the module to apply changes of the parameters.

2.10 Extended (Bit)Mapping

In this menu you will find information about the current settings of the extended Data Broker. You can configure the individual values in the corresponding submenus.

The Extended Mapping is executed after the general Mapping. You can combine both mapping functions by copying the larger areas with the standard mapping and change individual bits with the extended mapping afterwards.

You can define a total of 16 mappings. A mapping can be up to 1024 bits long.

You must store the following information for each mapping:

- Address of the source register
- Bit position within the source register
- Address of the target register
- Bit position within the target register
- Number of bits to be copied

Info!:

- Bitwise copying requires performance.
The module works cyclically. During each cycle, the different interfaces are operated in series and the data from the Data Broker is distributed between the input and output data areas. Since all interfaces process the data traffic independently of each other (asynchronous) and store the data produced or used in a buffer, they are independent of the module's cycle. In the case of very fast interfaces and a long cycle time, it is possible, however, that the Data Broker does not distribute all incoming data completely if several data packets arrive at the interface within a cycle. Conversely, it may happen in the case of slow interfaces that the 2nd cycle will already proceed and the output values of an interface will be changed by the Data Broker before the values from the first cycle have been transmitted via the interface.
For this reason, the cycle times of the module can be relevant. These are normally less than 1 ms. Individual cycles, however, can also last more than 5 ms. If you use the Extended Mapping very extensively, the cycle times can increase considerably.
 - Therefore, only use it if necessary.
 - Only use it for small areas.
- Bear in mind that the mappings are processed sequentially. If target areas overlap, this can cause problems.

```

-----
KUNBUS-IC - Extended (Bit)Mapping
-----
Source | Bitp | Dest. | Bitp | Length
1 - 0x0001 | 0 | 0x0001 | 0 | 0
2 - 0x0001 | 0 | 0x0001 | 0 | 0
3 - 0x0001 | 0 | 0x0001 | 0 | 0
4 - 0x0001 | 0 | 0x0001 | 0 | 0
5 - 0x0001 | 0 | 0x0001 | 0 | 0
6 - 0x0001 | 0 | 0x0001 | 0 | 0
7 - 0x0001 | 0 | 0x0001 | 0 | 0
8 - 0x0001 | 0 | 0x0001 | 0 | 0
9 - 0x0001 | 0 | 0x0001 | 0 | 0
10 - 0x0001 | 0 | 0x0001 | 0 | 0
11 - 0x0001 | 0 | 0x0001 | 0 | 0
12 - 0x0001 | 0 | 0x0001 | 0 | 0
13 - 0x0001 | 0 | 0x0001 | 0 | 0
14 - 0x0001 | 0 | 0x0001 | 0 | 0
15 - 0x0001 | 0 | 0x0001 | 0 | 0
16 - 0x0001 | 0 | 0x0001 | 0 | 0
-----
>

```

The submenu for entering the mapping is displayed by entering a number from 1 to 16:

```

-----
KUNBUS-IC - Extended Mapping, 1 Entry
-----
Entry : 1
Source : 0x1001, Bitpos: 2
Destination: 0x2001, Bitpos: 0
(Bit)Length: 8

1 - change mapping
2 - clear mapping
-----
>

```

Any mapping that might exist is deleted by entering [2]+[Enter].

After entering [1]+[Enter], the Source Address, Bitpos, Destination Address, Bitpos and Bit length are polled sequentially:

Source

- Specify here which register the data should originate from.

```

-----
KUNBUS-IC - Extended Mapping, 1 Entry
-----
Entry : 1
Source : 0x1401, Bitpos: 14
Destination: 0x2401, Bitpos: 2
(Bit)Length: 0x2400, Bitpos: 2

1 - change mapping
-----
>1
Source Register >

```

Source Bit Position

- Specify here the exact position of the bit that you want to map.

```
-----
KUNBUS-IC - Extended Mapping, 1 Entry
-----
```

```
Entry : 1
Source : 0x1401, Bitpos: 14
Destination: 0x2401, Bitpos: 2
(Bit)Length: 0x2400, Bitpos: 2
```

```
1 - change mapping
-----
```

```
>1
Source Register >0x1810
Source Bit Position >
```

Destination Register

- Specify here the register where you want to output the data.

```
-----
KUNBUS-IC - Extended Mapping, 1 Entry
-----
```

```
Entry : 1
Source : 0x1401, Bitpos: 14
Destination: 0x2401, Bitpos: 2
(Bit)Length: 0x2400, Bitpos: 2
```

```
1 - change mapping
-----
```

```
>1
Source Register >0x1810
Source bit position >5
Destination Register >
```

Destination Bit Position

- Specify the exact position of the bit that you want to map the data on.

```
-----
KUNBUS-IC - Extended Mapping, 1 Entry
-----
```

```
Entry : 1
Source : 0x1401, Bitpos: 14
Destination: 0x2401, Bitpos: 2
(Bit)Length: 0x2400, Bitpos: 2
```

```
1 - change mapping
-----
```

```
>1
Source Register >0x1810
Source bit position >5
Destination Register >0x2405
Destination Bit Position >
```

Bit Length

- Specify here the number of bits you want to map.

```
-----
KUNBUS-IC - Extended Mapping, 1 Entry
-----
```

```
Entry : 1
Source : 0x1401, Bitpos: 14
Destination: 0x2401, Bitpos: 2
(Bit)Length: 0x2400, Bitpos: 2
```

```
1 - change mapping
-----
```

```
>1
Source Register >0x1810
Source bit position >5
Destination Register >0x2405
Destination bit position >3
Number of bits to map >
```

Main menu with mapping entry

After confirming the number of bits with the enter key, you will return automatically to the main menu.

Here, you will now see the mapping you created in the previous steps:

```
-----
KUNBUS-IC - Extended (Bit)Mapping
-----
```

```
Source | Bitp | Dest. | Bitp | Length
```

```
1 - 0x1810 | 5 | 0x2405 | 3 | 27
2 - 0x0001 | 0 | 0x0001 | 0 | 0
3 - 0x0001 | 0 | 0x0001 | 0 | 0
4 - 0x0001 | 0 | 0x0001 | 0 | 0
5 - 0x0001 | 0 | 0x0001 | 0 | 0
6 - 0x0001 | 0 | 0x0001 | 0 | 0
7 - 0x0001 | 0 | 0x0001 | 0 | 0
8 - 0x0001 | 0 | 0x0001 | 0 | 0
9 - 0x0001 | 0 | 0x0001 | 0 | 0
10 - 0x0001 | 0 | 0x0001 | 0 | 0
11 - 0x0001 | 0 | 0x0001 | 0 | 0
12 - 0x0001 | 0 | 0x0001 | 0 | 0
13 - 0x0001 | 0 | 0x0001 | 0 | 0
14 - 0x0001 | 0 | 0x0001 | 0 | 0
15 - 0x0001 | 0 | 0x0001 | 0 | 0
16 - 0x0001 | 0 | 0x0001 | 0 | 0
```

```
-----
>
```

The extended mapping is stored permanently in the module, but is first executed after a restart.

2.11 Script Interpreter

In this menu you have the option, to activate or deactivate a script and to select the desired port.

NOTICE

Please note that activation of a script influences the individual port.

Never activate a script with the setting "Port used by script: CDI" if you do not have a fully functional SDI interface for accessing the parameter memory registers! In such a case, your module is no longer configurable! You can switch the status between disabled and enabled by entering [1]+[Return].

- You can define the SDI or CDI as port. You switch between both options by entering [2]+[Return].

```
-----
KUNBUS-IC - Script Interpreter
-----
1 - State: disabled
2 - Port used by script: SDI
-----
>
```

2.12 Reset to Factory Settings

With this option, you reset all parameters of the IC module to the default values.

You have to confirm the selection by entering the number "36" for reasons of security. Afterwards, the module restarts.

NOTICE

Loss of all settings

Bear in mind that with this function you will delete all settings that you have previously made.

3 Monitor Communication

Menu 3 – "Monitor Communication"

In this menu you have the option to view the current values of the Memory Register.

```
-----
KUNBUS-IC - Modbus Register Monitor
-----
```

```
1 - SSC In
2 - SDI In
3 - Fieldbus In (from Master)
4 - SSC Out
5 - SDI Out
6 - Fieldbus Out (to Master)
7 - Arbitrary Register
-----
```

```
>
```

3.1 Monitor SSC Input Registers

In this menu you will get an overview of the current values of the input areas of the shift register chain.

In the first row you see the setting values for the display. Here, you can select a binary [b], hexadecimal [h] or decimal [d] format.

```
-----
KUNBUS-IC - Monitor SSC Input Registers
-----
```

```
b=binary, h=hex, d=decimal, n=next, p=previous <cr>=refresh
```

```
0x1001: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x1009: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x1011: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x1019: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x1021: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x1029: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x1031: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x1039: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
```

```
>
```

3.2 Monitor SDI Input Registers

In this menu you will get an overview of the input area's current values of the SDI interface.

In the first row you see the setting values for the display. Here, you can select a binary [b], hexadecimal [h] or decimal [d] format.

```
-----
KUNBUS-IC - Monitor SDI Input Registers
-----

b=binary, h=hex, d=decimal, n=next, p=previous <cr>=refresh

0x1401: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x1409: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x1411: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x1419: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x1421: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x1429: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x1421: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x1439: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
```

3.3 Monitor Fieldbus Input (from Master)

In this menu you will get an overview of the input area's current values of the PROFIBUS interface.

In the first row you see the setting values for the display. Here, you can select a binary [b], hexadecimal [h] or decimal [d] format.

```
-----
KUNBUS-IC - Monitor Fieldbus Input (from Master)
-----

b=binary, h=hex, d=decimal, n=next, p=previous <cr>=refresh

0x1801: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x1809: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x1811: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x1819: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x1821: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x1829: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x1831: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x1839: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
>
```

3.4 Monitor SSC Output Registers

In this menu you will get an overview of the output area's current values of the shift register chain.

In the first row you see the setting values for the display. Here, you can select a binary [b], hexadecimal [h] or decimal [d] format.

```
-----
KUNBUS-IC - Monitor SSC Output Registers
-----

b=binary, h=hex, d=decimal, n=next, p=previous <cr>=refresh

0x2001: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x2009: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x2011: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x2019: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x2021: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x2029: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x2031: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x2039: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
>
```

3.5 Monitor SDI Output Registers

In this menu you will get an overview of the output area's current values of the SDI interface.

In the first row you see the setting values for the display. Here, you can select a binary [b], hexadecimal [h] or decimal [d] format.

```
-----
KUNBUS-IC - Monitor SDI Output Registers
-----

b=binary, h=hex, d=decimal, n=next, p=previous <cr>=refresh

0x2401: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x2409: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x2411: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x2419: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x2421: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x2429: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x2431: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x2439: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
>
```

3.6 Monitor Fieldbus Output (to Master)

In this menu you will get an overview of the output area's current values of the PROFIBUS interface.

In the first row you see the setting values for the display. Here, you can select a binary [b], hexadecimal [h] or decimal [d] format.

```
-----
KUNBUS-IC - Monitor Fieldbus Output (to Master)
-----

b=binary, h=hex, d=decimal, n=next, p=previous <cr>=refresh

0x2801: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x2809: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x2811: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x2819: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x2821: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x2829: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x2831: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x2839: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
>
```

3.7 Arbitrary Register

In this menu you will get an overview of all registers. Use this function to view registers that do not have their own menu item.

First enter the register number (e.g. "0x4001"):

```
-----
KUNBUS-IC - Monitor Arbitray Register
-----

Register Number: 0x4001
```

The CDI then displays 64 registers from the specified register value.

In the first row you see the setting values for the display. Here, you can select a binary [b], hexadecimal [h] or decimal [d] format.

```
-----
KUNBUS-IC - Monitor Arbitray Register
-----

b=binary, h=hex, d=decimal, n=next, p=previous <cr>=refresh

0x4001: ..... 0x0490 ..... 0x002b ..... 0x0102
0x4009: 0x0ef5 0x0001 0xe240 ..... 0x0000 .....
0x4011: ..... 0x0001 ..... 0x0004 0x0055 0x004e
0x4019: 0x0042 0x0055 0x0053 0x002d 0x0043 0x004f 0x004d
0x4021: 0x0020 0x0045 0x0074 0x0068 0x0065 0x0072 0x004e
0x4029: 0x0074 0x002f 0x0049 0x0050 0x0000 0x0017 0x0000
0x4031: 0x0000 0x0008 0x00e1 0x0000 0x0020 .....
0x4039: .....
>
```

The CDI represents registers that do not exist by dots.

Menu 4 – "Module Status"

4 Module Status

In the following submenu you will get an overview of the current operating state of the module and of all interfaces.

```
-----
KUNBUS-COM - Module Status
-----
```

```
1 - Common Status
2 - SDI Status
3 - SSC Status
4 - CDI Status
5 - Fieldbus Status
7 - Error Stack
8 - Script Status
-----
```

```
>
```

4.1 Common Status

In this menu you will find information about the current operating state of all communication channels.

The CDI displays the states of the interfaces, connection mode for the main board, configuration errors as well as errors in the Data Broker Mapping.

```
-----
KUNBUS-IC - Common Status
-----
```

```
<cr> = refresh; <Esc> = return
```

```
Fieldbus State: is stopped
Fieldbus Configuration: is ok
Fieldbus Mapping: is ok
```

```
Synchron serial communication: is stopped
Sync. serial comm. Configuration: is ok
Sync. serial comm. Mapping: is ok
```

```
Modbus RTU (SDI) Mapping: is ok
Modbus RTU (SDI) Configuration: is ok
-----
```

```
>
```

4.2 SDI Status

In this menu you will find information about the current interface parameters and node ID.

If the interface is running in "Automatic Bitrate detection" mode and no bitrate has been detected yet, the message "Actual Bitrate: undefined" will be displayed instead of the interface parameters.

```
-----
KUNBUS IC - SDI Status
-----
<cr> = refresh; <Esc> = return

Modbus Node Address: 1
Actual Bitrate: 38400 Bit/s
Actual Parity: even
Actual Stopbits: 1 Stopbit
-----
>
```

4.3 SSC Status

In this menu you will find information about the status of the SSC interface. The representation is dependent on the selected mode and configurations:

SSC SSR Master Mode, auto detect shift registers

- You have selected "auto detect shift registers" as the configuration source for the SSC.

In this menu you will find the following information:

- Number of shift registers used fieldbus specifically
- Number of status LEDs used
- Number of shift registers
- Bitrate

If the shift register chain is not working, the text "Shift Register chain not working" will be displayed instead of the interface parameters.

```
-----
KUNBUS-IC - SSC Status
-----
<cr> = refresh; <Esc> = return

SSC SSR Master Mode, auto detect shift registers

Act. No. of Fieldbus Switch regs: 0
Act. No. of Fbus Status-LED regs: 0
Actual Number of Input registers: 1/1
Actual Number of Output registers: 1/1
Actual Bitrate: 4800 kBit/s
-----
>
```

SSC SSR Master Mode, configured registers

- You have selected "configured shift registers" as the configuration source for the SSC.

In this menu you will find the following information:

- Number of shift registers used fieldbus specifically
- Number of status LEDs used
- Number of shift registers
- Bitrate

If the number of configured registers does not match the number of connected registers or the shift register chain is not working, you will see the message "Shift Register Chain not working".

```
-----
KUNBUS-IC- SSC Status
-----
<cr> = refresh; <Esc> = return

SSC SSR Master Mode, configured shift registers

Act. No. of Fieldbus Switch regs: 0
Act. No. of Fbus Status-LED regs: 0
Actual Number of Input registers: 1/1
Actual Number of Output registers: 1/1
Actual Bitrate: 4800 kBit/s
-----
>
```

SSC SSR Master Mode, disabled

You will find this representation in one of the following cases:

- SSC SSR Master is switched off via the menu
- Invalid configuration of the number of input or output registers
- Transmission error due to unsuitable bitrate
- Other transmission errors (e.g. line interruption)

```
-----
KUNBUS-IC - SSC Status
-----
<cr> = refresh; <Esc> = return

SSC SSR Master Mode, disabled
-----
>
```


SSC SPI Slave Mode

- You have selected "SSC SPI Slave Mode" as the configuration source.

In this menu you will find information about clock and data level.

```
-----
KUNBUS-IC - SSC Status
-----
<cr> = refresh; <Esc> = return

SSC SPI Slave Mode

Actual SPI Settings: Polarity Normal, Falling Edge, CLK High, MSB
first
-----
>
```

4.4 CDI Status

In this menu you will find information about the current parameters of the CDI.

```
-----
KUNBUS- IC-Modul - CDI Status
-----
<cr> = refresh; <Esc> = return

Actual Bitrate: 115200 Bit/s
Actual Parity: even
Actual Stopbits: 1 Stopbit
-----
>
```

4.5 PROFIBUS Status

In this menu you will find information about the current status of the PROFIBUS interface.

```
-----
KUNBUS-IC - Profibus Status
-----
1 - Common Profibus Status
2 - System Diagnosis Bytes
3 - Diagnosis Error Bytes
4 - Diagnosis Info Bytes
5 - Display Parameters
-----
>
```

4.5.1 PROFIBUS Common Status

In this menu you will find information about the current operating state of all communication channels.

The CDI displays the states of the interfaces, connection mode for the main board, configuration errors as well as errors in the Data Broker Mapping.

```
-----
KUNBUS-IC - Profibus Common Status
-----
<cr> = refresh; <Esc> = return

Device Id: 0x0cb5
Serial number: 231
Node ID: 0
Bitrate: 12 Mbit/s
Busstate: offline
Profibus Version: DP-V0
Number of received parameters: 0
Number of diagnosis InfoBytes: 16
Number of diagnosis ErrorBytes: 8
-----
>
```

NOTICE

You can find more information and definitions about the entries "bus state" and "profibus" in section ""

4.5.2 Profibus Diagnostic Error Bytes

In this menu you will find information on the data of the memory area for the Diagnostic Error Bytes.

You can find further information on this topic in section "".

```
-----
KUNBUS-IC - Profibus Diagnosis Error Bytes
-----
b=binary, h=hex, d=decimal, n=next, p=previous <cr>=refresh

0x4411: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x4419: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x4421: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x4429: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x4431: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x4439: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 .....
0x4441: ..... ..... ..... ..... ..... ..... .....
0x4449: ..... ..... ..... ..... ..... ..... .....
>
```

4.5.3 PROFIBUS Diagnostic Info Bytes

In this menu you will find information on the data of the memory area for the Diagnostic Info Bytes.

```
-----
KUNBUS-IC - Profibus Diagnosis Info Bytes
-----

b=binary, h=hex, d=decimal, n=next, p=previous <cr>=refresh

0x4421: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x4429: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x4431: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x4439: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 .....
0x4441: ..... ..... ..... ..... ..... ..... .....
0x4449: ..... ..... ..... ..... ..... ..... .....
0x4451: ..... ..... ..... ..... ..... ..... .....
0x4459: ..... ..... ..... ..... ..... ..... .....
>
```

4.5.4 Display Parameters

In this menu you will find information on the extended parameter data that was last received from the Master. This is a user parameter without the 3-byte DP-V1 specific parameters.

```
-----
KUNBUS-IC - Profibus Parameter Bytes
-----

b=binary, h=hex, d=decimal, n=next, p=previous <cr>=refresh

0x4211: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x4219: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x4221: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x4229: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x4231: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x4239: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x4241: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000
0x4249: 0x0000 0x0000 0x0000 ..... ..... ..... .....
>
```

4.6 Error Stack

In this menu you will find information about the errors that last occurred. Please have these entries ready at hand when you contact our support. We can help you faster by evaluating the entries.

If the value is 0x00000000, no error has occurred.

The Error Stack occupies the register 0x000a to 0x0011 and provides space for 4 entries at a length of 32 bits each.

The register x+0 (0x...0000) contains the High-Word of the error.

The register x+1 (0x...0000) contains the Low-Word of the error.

If all four entries are occupied and another error occurs, this error will replace the oldest error in the Error Stack. The latest error is always displayed first.

```
-----
KUNBUS-IC - Error Stack
-----
<cr> = refresh; <Esc> = return

Entry 0: = 0x00000000
Entry 1: = 0x00000000
Entry 2: = 0x00000000
Entry 3: = 0x00000000
-----
>
```

4.7 Script Interpreter Status

In this menu you will find information about the current Script-Status.

```
-----
KUNBUS-IC - Script Interpreter Status
-----
<cr> = refresh; <Esc> = return

Port used by script: CDI
Execution status: Stopped
Loop counter: 0
-----
>
```

4.8 Emergency Menu

In the unlikely event of a serious error, you can open this menu.

- You can try to start the module by entering "R".
- You can reset the EEPROM to the factory settings with the "F" key.
This can be useful, for example, if a permanently stored value triggers a serious software error after a firmware update.

If the error cannot be remedied, please contact our support. Have the number of the error entry ready for this purpose.

```
-----  
KUNBUS-COM - Fatal Error Handler  
-----  
A severe error occurred. Error Stack:  
  
Entry 0: = 0x34030000  
Entry 1: = 0x00000000  
Entry 2: = 0x00000000  
Entry 3: = 0x00000000  
-----  
press 'R' for Reset or  
press 'F' for Reset with Factory Defaults  
-----  
>
```

8 Disposal

8.1 Dismantling and Disposal

This section contains important information explaining how to safely dismantle, replace and dispose of the IC-Modul correctly.

Dismantling

DANGER

Danger of electric shock

Before dismantling, make sure that the device in which your module is installed is no longer connected to the power supply.

- ➔ Remove the mains plug of the device from the power supply.
- ➔ Proceed in accordance with the device manufacturer's documentation to ensure that the device is disconnected from the power supply and no damage will result when dismantling.

WARNING

Fault due to electrostatic discharge

Observe all regulations necessary for working in electrostatically protected areas in order to avoid any faults on the module.

- ➔ Make sure that you yourself and the module are earthed.

- ✓ The device, in which your module is installed, has been disconnected from the power supply.
- ✓ You have removed the cover of the housing, if applicable, in accordance with the manufacturer's instructions.
 - Release the safety lever, if applicable, and remove your module carefully out of the socket.
 - If you want to insert a new module, proceed as described in section Installation [▶ 35].

Disposal

Dispose of any defective module at a collection point for waste electronic equipment in accordance with EU Directive 2002/96/EC. Do not dispose of the module in your household waste.

Dispose of any defective module in accordance with the local regulations for waste electronic equipment.

9 Technical data

9.1 Technical data

Dimensions

Length	25.2 mm
Width	45.4 mm
Height	14.2 mm
Weight	8 g

Environmental Conditions

Operating temperature	0 °C to +60 °C
Humidity	0% not 95%, non-condensing
Mechanical shock load	15G
Permanent mechanical stress	5G
Condensing	not allowed
Storage temperature	-30 °C to +85 °C

10 Appendix

10.1 Configuration via Modpoll

Prerequisite: You have made the SDI interface on the application connector suitable for a PC by your application hardware (e.g. a level converter).

Tip! With the KUNBUS-IC Evaluation Board you have a Sub-D connector at your disposal with RS-232 levels that can be connected to a serial COM interface of the PC or to a serial USB converter.

To configure the module conveniently for application, we recommend that you make the setting adjustments with the aid of the Modpoll program supplied.

- ✓ To do this, open the command line prompt in the first step and then change to the directory where Modpoll is located. Drag and drop the modpoll.exe file into the input panel.
- Always begin new commands with the input "Modpoll".
- ⇒ Define your application by specifying the protocol type, register address, baudrate etc. We have compiled the relevant Modpoll commands for you in the following table.

```
modpoll -m rtu -r 0x1401 -t 4:hex -b 19200 COM1 0x1234
```

```
modpoll -m rtu -r 0x2401 -t 4:hex -b 19200 COM1
```

Start	modpoll.exe
Help	-h
Protocol selection	
Modbus ASCII Protocol	-m ascii
Modbus RTU Protocol	-m rtu
Modbus TCP Protocol	-m tcp
Nested Modbus RTU via TCP	-m enc
Addresses	
Slave address	-a #
Register address	-r #
Number of registers	-c #
I/O	
Discrete output (coil)	-t 0
Discrete input	-t 1
16-bit input register	-t 3
16-bit input register with hexadecimal display	-t 3:hex
32-bit integer data type in the input register table	-t 3:int
32-bit module 1000 data type in the input register table	-t 3:mod

Complete Application Configuration

Example for the Configuration of the SSC Output Register

Overview of the Modpoll Commands

32-bit float data type in the input register table	-t 3:float
16-bit output register (holding) with default value	-t 4
16-bit output register (holding) with hexadecimal display	-t 4:hex
32-bit integer data type in the output register (holding) table	-t 4:int
32-bit module 1000 data type in the output register (holding) table	-t 4:mod
32-bit float data type in the output register table	-t 4:float
Slave works onBig-Endian 32-Bit integers	-i
Slave works onBig-Endian 32-Bit floats	-f
Only poll once (instead of every second)	-1
Use Daniel/Enron single register 32-bit mode	-e
First reference is 0 instead of 1 (PDU addressing)	-0
Options for Modbus TCP	
TCP Port number (default value: 502)	-p #
Options for ASCII and Modbus RTU	
Baudrate (9600, 19200,... Default value: 9600)	-b #
Databits (7 or 8 for ANSCII, 8 for RTU)	-d #
Stop bits (1 or 2, default value:1)	-s #
Parity: None	-p none
Parity: Even	-p even
Parity: Odd	-p odd
RS-485 Mode	-4 #
Timeout in seconds (0.01-10.0 default value: 0)	-o #