SIEMENS

MOBY® U

Configuration, Installation and Service

Manual

Contents

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Safety Guidelines

This manual contains notices which you should observe to ensure your own personal safety, as well as to protect the product and connected equipment. These notices are highlighted in the manual by a warning triangle and are marked as follows according to the level of danger:

⚠ **Danger**

indicates that death, severe personal injury or substantial property damage will result if proper precautions are not taken.

⚠ **Warning**

indicates that death, severe personal injury or substantial property damage can result if proper precautions are not taken.

⚠ **Caution**

indicates that minor personal injury or property damage can result if proper precautions are not taken.

Caution

indicates that property damage can result if proper precautions are not taken.

Note

draws your attention to particularly important information on the product, handling the product, or to a particular part of the documentation.

Qualified Personnel

The device/system may only be set up and operated in conjunction with this manual.

Only **qualified personnel** should be allowed to install and work on this equipment. Qualified persons are defined as persons who are authorized to commission, to ground, and to tag circuits, equipment, and systems in accordance with established safety practices and standards.

Correct Usage

Note the following:

⚠ **Warning**

This device and its components may only be used for the applications described in the catalog or the technical description, and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens.

This product can only function correctly and safely if it is transported, stored, set up, and installed correctly, and operated and maintained as recommended.

Trademarks

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Siemens AG
Automation and Drives
Special Products, Projects Automotive Industry, Training
P.O. Box 4848, D-90327 Nürnberg

Disclaimer of Liability

We have checked the contents of this manual for agreement with the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. However, the data in this manual are reviewed regularly and any necessary corrections included in subsequent editions. Suggestions for improvement are welcomed.

Siemens Aktiengesellschaft

Order No. 6GT2 597-4BA00-0EA2

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General

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This manual on configuration, installation, and service will help you to plan and configure your MOBY U system. It contains the configuration and installation guidelines and all technical data on the individual components.

Technical support

The technical support specialists are available to advise and assist you if you have any queries about the functions of our MOBY products and how to use them.
You can contact us around the world at any time of day or night by:

Telephone:	+49 (0) 180 5050-222
Fax:	+49 (0) 180 5050-223
E-mail:	adsupport@siemens.com

Internet

General news on MOBY U or an overview of our other identification systems can be found on the Internet under the following address:

http://www.ad.siemens.de/fas

Introduction – MOBY U

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MOBY U is an outstanding RF identification system designed specifically for long-range applications in industry and logistics. It uses the transmission frequency in the ISM frequency band of 2.4 GHz in the UHF range (ultra high frequency). This ISM frequency band is recognized around the world. It unites the power of innovative RF technologies and, at the same time, ensures continuity at the customer's by being almost totally compatible with the proven MOBY I system. Robust housing and power-saving circuiting technology give you years of maintenance-free operation even under the most rugged of industrial conditions.

MOBY U covers all transmission distances up to three meters which means that it meets the prerequisites for a transparent identification solution in the automotive industry, for instance. It offers the communication distances (much longer than one meter) required to design optimized working processes and ensure necessary safety zones during automobile production.

The transmission frequency and the robust modulation not only give you transmission distances of several meters but also ensure sufficient distance to the typical sources of electromagnetic interference in industrial production plants. With MOBY U, you can forget the old sources of interference such as welding devices, circuit breakers, pulsed DC drives, and switched-mode power supplies, as well as all the time-consuming interference suppression measures needed previously.
Familiar sources of interference during UHF transmission such as reflection, interference and overranging are handled with appropriate technical measures on the MOBY U. In addition, special coding procedures ensure that data transmission is correct and data integrity is preserved. Proven methods and algorithms of mobile radio technology (GSM, UMTS) have been used for this purpose by the identification system. Specially designed antennas ensure a homogenous transmission field so that the mobile data memories (MDSs) are detected reliably even in difficult locations.

Conflicts with other users of the 2.4 GHz frequency band are avoided by using very low sending power (less than 10 mW EIRP) and automatic selection of free and interference-free frequency channels.
The transmitting power in the case of the SLG U92 variant with FCC (see Table 5-1) is < 50 mV/m at a distance of 3 m.

With its mobile data storage units MDS U524/U525 and MDS U589 (up to +220 °C cyclically), providing 32 Kbytes of memory, MOBY U fulfills the requirements for a universal solution in the automotive industry.

Like the MDSs of MOBY U, UHF transponders with selective read/write functions always require their own power source (battery) for data communication. This power-saving circuiting technology guarantees years of maintenance-free service.

The MDS U315 and MDS U525 mobile data storage units offer the possibility of replacing the batteries. The service life of the MDS can thus be extended accordingly.

Simple and flexible installation of the read/write devices (SLGs) and the mobile data storage units (MDSs) in particular are two common requirements of all assembly and production lines.

The SLG U92 offers easy system integration via coupling to:

- Reliable MOBY interface modules (ASMs) for PROFIBUS DPV1, TCP/IP and SIMATIC S7
  - ASM 452
  - ASM 473
  - ASM 475
  - ASM 480
- Directly on a standard PC, SICOMP or PC-PLC

Software tools such as SIMATIC S7 functions (FC) and C library MOBY API for applications under Windows 98/2000/NT make implementation in specific applications easy.

As with the other MOBY identification systems, the MDSs can be operated with direct byte addressing or with the filehandler.

The convenient and powerful filehandler of MOBY I with its file addressing is directly integrated on the SLG U92 with expanded functions. The MOVE and LOAD commands of the MOBY I filehandler are a thing of the past. The SLG always fetches the file management information it needs directly from the MDS.

MOBY U can be used in three different ways:

1. For existing system solutions with MOBY I compatibility (no bunch/multitag)
   - MOBY U with default settings
   - Range of up to 1.5 m (fixed setting)
   - Byte addressing via absolute addresses
   - Filehandler: with unmodified functions and without MOVE and LOAD commands
2. For existing system solutions with MOBY I compatibility plus enhancements (no bunch/multitag)
   - Just a few enhanced commands for changing the default settings and requesting diagnostic data
   - Range of up to 3 m (to be limited in increments)
3. Full use of MOBY U performance (with bunch/multitag)
   - Commands and/or user data with clear allocation due to the MDS number for bunch/multitag
   - Range of up to 3 m (to be limited in increments)

With MOBY U, a service and diagnostic interface is installed directly on the read/write device (SLG) to make commissioning easier. Not only current transmission parameters can be analyzed here but data communication can also be logged. In addition, statistical functions are available which allow quantitative and qualitative information to be produced about data communication.

Primary applications

MOBY U is primarily used for applications in which objects must be quickly and reliably identified inductively over long distances (up to three meters) and the objects are to carry extra production and manufacturing parameters along with them.

- Automobile industry, particularly main assembly lines (raw product manufacturing, surface treatment and assembly)
- Industrial production plants
- Container/pallet identification for transportation logistics and distribution
- Vehicle identification, vehicle parks, etc.
- Traffic control technology
- Assembly lines

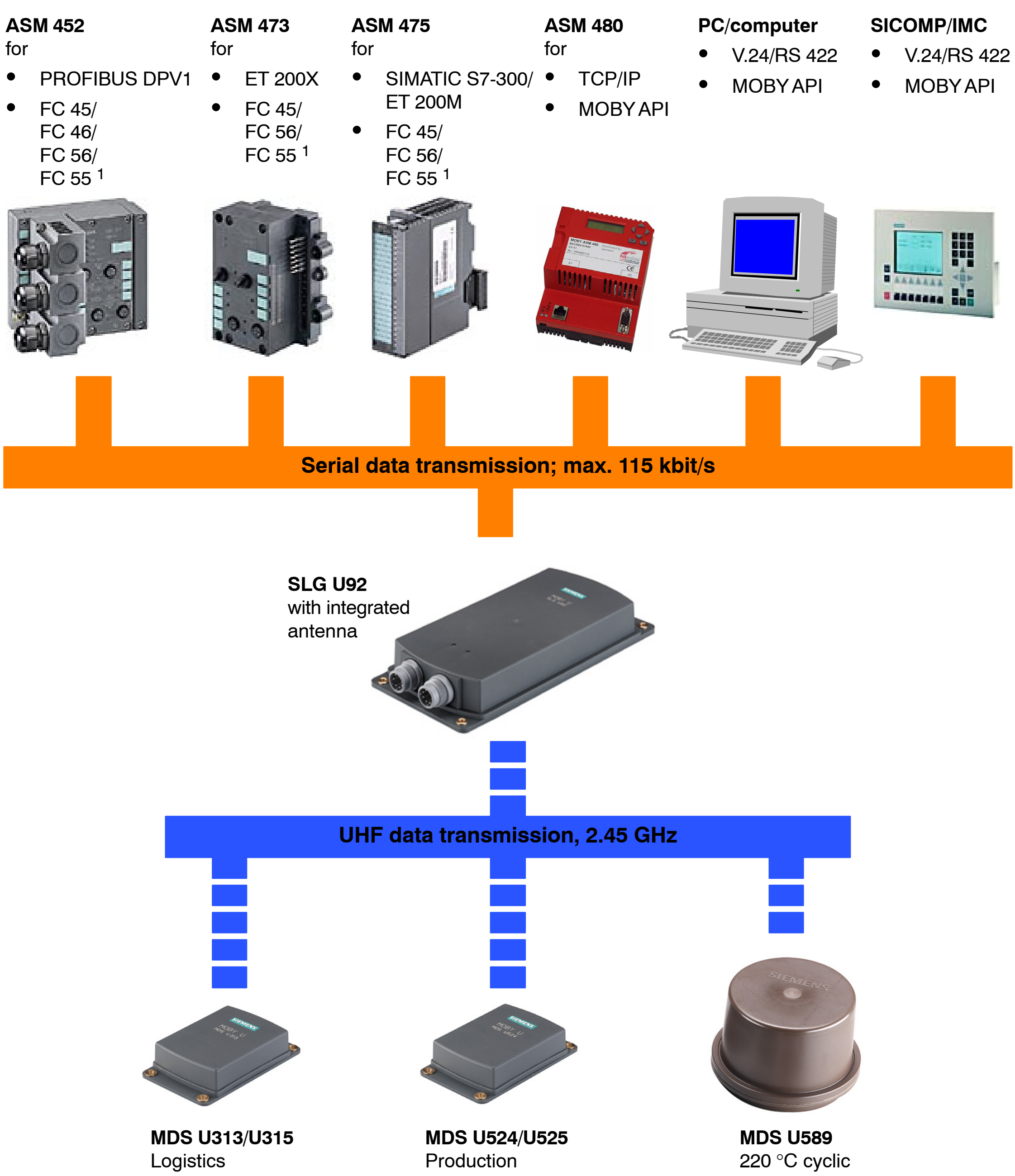
Technical data

Table 2-1 Technical data of MOBY U (field components)

Fixed code memory	MDS ID number (32 bits)	
Read-only memory	128 bits, to be written once by the user	
Application memory Memory technology Memory size Memory organization	 RAM 2 Kbytes or 32 Kbytes File or address-oriented	
Protection rating	IP65 to IP 68	
Operating temperature	–25 °C to +70/85 °C, 200 °C (cyclical), 220 °C (for a short time)	
Data transmission speed, SLG-MDS (net)	Without bunch	With bunch size = 2
Write Read	Approx. 8.0 Kbyte/sec Approx. 4.8 Kbyte/sec	Approx. 4.0 Kbyte/sec Approx. 2.4 Kbyte/sec
Read/write distance	150 mm to 3000 mm	
Can be connected to	SIMATIC S7, PC, computer, third-party PLC, PROFIBUS, Industrial Ethernet	

Overview of the MOBY U components

- MDS: mobile data memory
- SLG: read/write device
- ASM: interface module
- STG U: service and test device



1 Under preparation

Figure 2-1 Overview of the MOBY U components

Configuration and Installation Guidelines 3

3.1 The Fundamentals

MOBY U is a UHF system with powerful features. This makes it much easier to configure and handle the system.

- The range (read/write distance) and communication speed are the same for all data carriers. However, they do differ in memory size, operational temperature and lifespan.
- Reliable communication due to a homogenous transmission field with circular polarization in dynamic and static operation. There is no fading (i.e., temporary ”holes” in the field).
- Its range (0.15 m to 3 m) permits MOBY U to be used throughout production.
- The range of the transmission field can be limited in increments of 0.5 m up to 3.5 m. This limitation prevents overranging and defines the communication area clearly.
- Familiar sources of interference during UHF transmissions such as reflection and interference have been removed with appropriate technical measures.
- Due to the transmission frequency and the robust modulation procedures, electromagnetic sources of interference can be disregarded.
- Simple and flexible installation and customized system integration with standard hardware and standard function blocks make commissioning fast and easy.
- The robust housing and the power-saving circuiting technology make for years of maintenance-free operation even under the most rugged of production environments.
- Conflicts with other users of the 2.4 GHz frequency band are avoided by using very low transmitting power (less than 10 mW EIRP) and automatic selection of free and interference-free frequency channels.
  In the case of the SLG U92 with FCC (see Table 5-1), the transmitting power is < 50 mV/m at a distance of 3 m.

Optimum utilization does require adherence to certain criteria.

- Transmission window and communication area
- Dwell time of the MDS in the field (speed and amount of data) during dynamic transmission
- Metal-free space and metallic environment around MDS and SLG
- Ambient conditions such as humidity, temperature, chemicals, and so on
- Other users of the frequency band at 2.4 GHz
- Communications readiness: sleep time, standby mode, antenna on/off
- Bunch size for bunch/multitag
- System interface performance
- SLG synchronization
- Proximity switches

3.1.1 Transmission Window

MOBY U is a UHF system. UHF systems have a relatively long range despite their low emission power. However, the emission field has a directional characteristic which depends on the antenna construction. To keep the MDS's power consumption low and make localization reproducible, MOBY U has different function zones based on the direction and distance between the SLG and MDS. The states and reactions of the affected components vary with the three different zones of the transmission field of the SLG (see Figure 3-1).

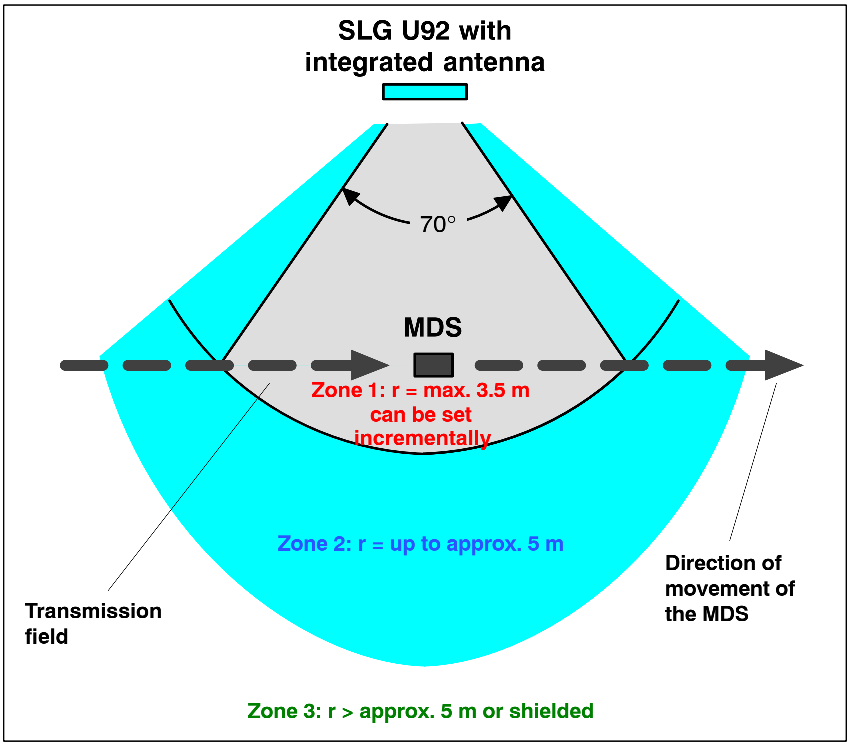


Figure 3-1 Status zones for the MDS in the transmission field of the SLG U92

- Zone 3:
  In simplified terms, zone 3 is the UHF-free area. The MDS is asleep and wakes up to listen for an SLG at the sleep-time intervals once every < 0.5 sec. (on average 320 ms). Power consumption is very low. If other UHF users are in the vicinity and they are using the same frequency range, this does not shorten the battery life of the MDS since it does not wake up until it receives a special code.

- Zone 2:
  If the MDS receives this special code in the vicinity of an active SLG, it enters zone 2 (see Figure 3-1). Starting immediately it accepts the SLG and responds briefly with its own ID. However, the SLG ignores all MDSs which are not in zone 1 (radius can be parameterized on the SLG in increments). Power consumption in zone 2 is a little higher than in zone 3.
- Zone 1:
  When an MDS enters zone 1, it is registered by the SLG and can begin exchanging data. All read and write functions can now be performed. The power consumption of the MDS increases briefly during communication. Since transmission through the air is very fast, total communication time is very short. The entire 32 Kbyte data memory can be read in less than eight seconds. This means that data communication hardly uses the battery.
  As long as the MDS is located in zone 1, it is ready to exchange data when requested by the SLG. When no command for the MDS is queued, it still reports at regular parameterizable intervals with its ID when requested by the SLG. Its behavior then corresponds to that in zone 2, and power consumption drops again accordingly.

The transmission window is the range in which communication between the SLG and the MDS has to take place. The transmission window is determined by:

- the transmission fields of the SLG and MDS
- the mechanical arrangement of the SLG and MDS in relation to each other
- the parameterized range (zone 1)

General configuration rules

- With MOBY U as a UHF system, the following physical characteristics must be considered when you configure the system.
- The waves in the UHF range spread out in straight lines.
- The transmission field of the SLG (zones 1 and 2) is shaped like an ellipse.
- The range of the transmission ellipse of up to 3.5 m can be adjusted incrementally for better identification of the MDS.
- In simplified terms, the transmission field of the SLG can be thought of as a cone and the midpoint of the antenna is located at the peak of this cone. The field fans out with coverage of approx. 70°. A primarily homogenous field is then assumed within this parameterized range. Fading (temporary ”holes” in the field) in this area is offset by technical measures.
- In simplified terms, the transmission field of the MDS, as with the SLG, can be thought of as a cone and the midpoint of the antenna is located at the peak of this cone. The field fans out with coverage of approx. 60°.
- Ideally the MDS should penetrate the transmission cone of the SLG from its base and exit through the surface area so that the MDS remains as long as possible in the defined recording field.
  If the SLG and MDS are not directly aligned with each other, they should be arranged in such a way that the Siemens logo is in the same position in each case (e.g. facing up, down or sideways on each). If this is not possible, for example because one SLG has to communicate with the MDS from the left and another SLG from the right, the MDS should be placed in an upright position (Siemens logo facing upwards) and the SLGs arranged at right angles to it.
- Since metallic surfaces reflect the waves, they can also be used for shielding or even deflection. Particularly in typical production environments, the wealth of metallic objects ensures a relatively uniform dispersion of the transmission waves.
- For optimum data communication, metal should be avoided at least in the vicinity of the vertical waves.
- Both the MDS and the SLG can be mounted directly on metal.

The quality of the communication is dependent on:

- The mechanical arrangement of the SLG and MDS in relation to each other
- The guidance of the MDS through the transmission window
- Ambient conditions such as
  - metal-free space and the metallic environment around SLG and MDS
  - humidity, temperature, chemicals, and so on
  - other users and/or interference in the frequency band at 2.45 GHz
  - other SLGs and/or
  - other MDSs in zone 2

3.1.2 MOBY Operating Modes

MOBY U offers two types of addressing:

- Byte addressing with absolute addresses: direct addressing (normal mode)
- Filehandler with logical addressing

Normal mode

There are three types of byte addressing:

1. MOBY I call-compatible for existing system solutions without enhancements
   (“short” RESET system message frame and operating mode identifier = 5)
   - MOBY U with default settings
   - No bunch/multitag (bunch = 1)
   - Range limit fixed at 1.5 m
   - BERO mode/SLG synchronization not possible
2. MOBY I call-compatible for existing system solutions with enhanced commands
   (“long” RESET system message frame and operating mode identifier = 5)
   - No bunch/multitag (bunch = 1)
   - Range limit parameterizable up to 3.5 m in 0.5 m increments
   - Additional commands such as antenna on/off, MDS status, etc.
   - BERO mode/SLG synchronization possible
3. MOBY U with multitag processing (operating mode identifier = 6)
   - Bunch/multitag up to a maximum of 12 MDS
     MDS commands and/or user data with clear allocation by means of the MDS number (UID)
   - Range limit parameterizable up to 3.5 m in 0.5 m increments
   - Full range of commands
   - BERO mode/SLG synchronization possible

Set the variant you want using the RESET system message frame.

Note

With byte addressing you can change from one variant to another at any time using the RESET command.

If you want to change to the filehandler addressing mode, you have to deenergize the SLG. After power-up you can change the addressing mode with the first RESET message frame.

The SIMATIC function FC 45 is available for variants 1 and 2.
The SIMATIC function FC 55 is currently being developed for variant 3.
You can implement applications under Windows 98/2000/NT using the MOBY API C library:

- for each variant when using a serial link to the PC
- for variant 3 when using an interface to Ethernet (TCP/IP)

For users who install their application directly on the operating system level or 3964R driver level and don’t use FC 45 or the C library, the commands for bytewise addressing are described in the MOBY API C library programming guide. The 3964R procedure is described in this document in Section 3.9.

Filehandler

There are also three ways to run the filehandler with logical addressing:

1. MOBY I call-compatible for existing system solutions without enhancements
   (“short” RESET system message frame and command index = ”I”)
   - MOBY U with default settings
   - No bunch/multitag (bunch = 1)
   - Range limit fixed at 1.5 m
   - BERO mode not possible
2. MOBY I call-compatible for existing system solutions with enhanced commands
   (“long” RESET system message frame and command index = ”I”)
   - No bunch/multitag (bunch = 1)
   - Range limit parameterizable up to 3.5 m in 0.5 m increments
   - Additional commands such as antenna on/off, MDS status, etc.
   - BERO mode possible
3. MOBY U with multitag processing (command index = ”U”)
   - Bunch/multitag up to a maximum of 12 MDS
     MDS commands and/or user data with clear allocation by means of the MDS number
   - Range limit parameterizable up to 3.5 m in 0.5 m increments
   - Full range of commands
   - BERO mode possible

Set the variant you want using the RESET system message frame.

Note

With the filehandler you can change from variant 1 to 2 or vice versa at any time using the RESET command.
If you want to change from variant 1 or 2 of the filehandler to variant 3, you have to deenergize the SLG. After power-up you can change the variant with the first RESET message frame. It is the same if you want to change from variant 3 to variant 1 or 2 within filehandler mode or change from filehandler mode to direct addressing.

The SIMATIC function FC 46 is available for variants 1 and 2.
The SIMATIC function FC 56 is available for variant 3.

3.1.3 Communication Area of the MDS

The MDS must be within the communication area of the SLG for data exchange to take place with the SLG. The possible communication area is dependent on zone 1, the range limit and the entry point and exit point of the MDS in zone 1. The SLG counts the MDS as being present as long as the MDS is situated in the communication area. If parameterized to do so, the SLG reports when the MDS enters and exits the communication area.

The following points should be noted to ensure problem-free communication between the SLG and the MDS:

- Zones of the MDS
- Mechanical arrangement of the SLG and MDS (see Section 3.3.1)
- Range limit (dili, which stands for distance limit)
- Entry into zone 1
- Exit from zone 1
- Length of the communication field
- Report of the presence of the MDS

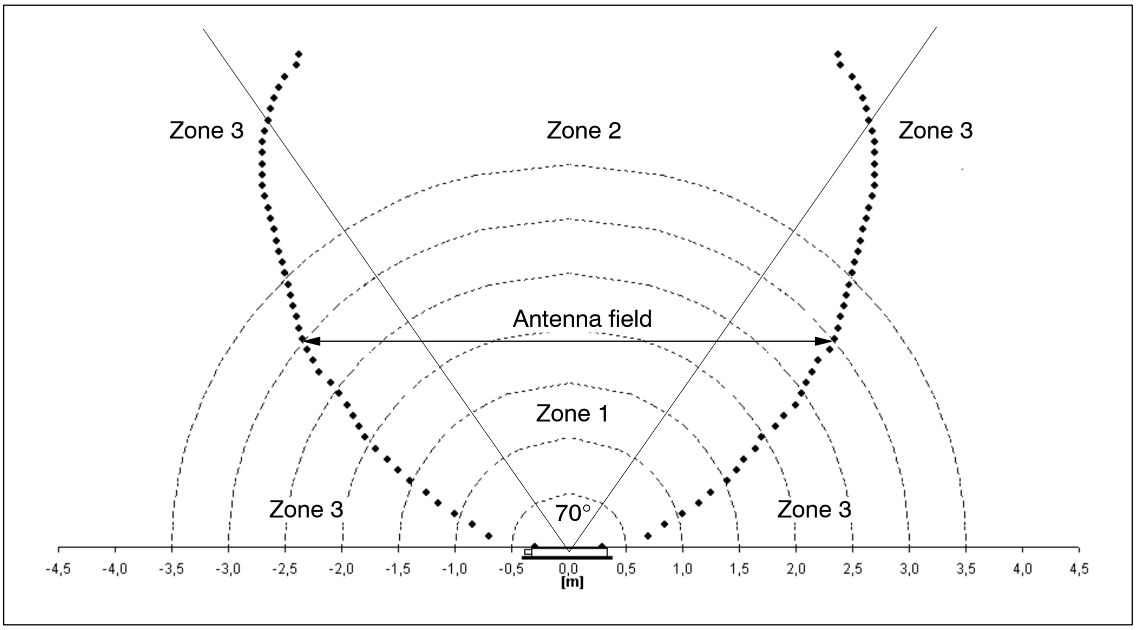


Figure 3-2 Antenna field with zones 1 and 2 and the radiuses of the range limit in steps of 0.5 m. The range limit determines the sizes of zones 1 and 2.

Zones of the MDS

The MDS is always in one of three zones (logical areas) (see Figure 3-2):

- Zone 1: Communication area in which the SLG communicates with the MDS

  The MDS is within the communication-capable field of the SLG. The communication area is defined by the range limit.
  The SLG identifies the MDS as present and ready for communication (zone 1).
  The area formed by the intersections of the lateral limits of the antenna field with the radius of 3.5 m represents the maximum size of zone 1, whereas the area formed by the intersections of the lateral limits of the antenna field with the radius of 0.5 m represents the minimum size of zone 1. The radius is subject to a certain degree of tolerance (see the section on the range limit).

- Zone 3: Outside the detection area of the SLG

  Zone 3 is a UHF-free zone. The SLG can't "hear" the MDS. As far as it is concerned, the MDS is not present.

- Zone 2: In the detection area of the SLG without communication

  The SLG detects the MDS within this area. The MDS is outside the communication area defined by the range limit. The detection area is determined by the quality of transmission and the transmitting and receiving conditions for the SLG and the MDS. The SLG only classifies the MDS as present internally.
  The MDS is not in the communication area until it reaches or comes within the set range limit, thus permitting communication.

Range limit

The following can be eliminated by setting the range limit (dili, which stands for distance limit):

- Overranging
- Reflections

(See Figure 3-2).

The dili (distance limit, i.e. range limit) can be set from 0.5 m to 3.5 m in increments of 0.5 m.
The distance between the SLG and the MDS, as calculated by the SLG, is subject to a tolerance ($dili_{tol}$) of a maximum of –0.3 m to 0.3 m. In the case of distances under 2.5 m, $dili_{tol}$ is –0.2 m to 0.2 m. This tolerance value must be added to the parameterized dili value.

Note

The tolerance values $dili_{Tol}$ may be higher

- if field conditions are unfavorable, e.g. metal in the wider field
- if there are strong reflections from metallic surfaces
- if there are several MDSs in the field which influence each other because of their arrangement in relation to the SLG
- if SLGs are close to each other

Entry in Zone 1

The MDS is considered to have entered zone 1 when:

- It is within the communication-capable field of the SLG, and the SLG calculates that the distance between itself and the MDS is less than or equal to $dili_{on}$.

$$dili_{On} = dili + dili_{Tol}$$

Limit values for $dili_{on}$ with:

- A range limit of dili < 2.5 m: $-0.2\ m \leq dili_{Tol} \leq 0.2\ m$

  $dili_{On\_max} = dili + 0.2\ m$

  $dili_{On\_min} = dili - 0.2\ m$

- A range limit of dili ≥ 2.5 m: $-0.3\ m \leq dili_{Tol} \leq 0.3\ m$

  $dili_{On\_max} = dili + 0.3\ m$

  $dili_{On\_min} = dili - 0.3\ m$

There are three ways in which the MDS can enter zone 1:

a) Before reaching the range limit the MDS enters the SLG's field where it is recognized by the SLG for the first time. This means that when the MDS enters the SLG's field the field is larger than the range limit (see Figures 3-3 and 3-4).

b) The MDS enters the SLG's field within the tolerance range of the range limit and is recognized for the first time in the tolerance range. This means that when the MDS enters the SLG's field the range limit overlaps with the tolerance range of the field (see Figure 3-5).

c) The MDS does not enter the field of the SLG until it has crossed the range limit and is detected there for the first time. This means that when the MDS enters the SLG's field the distance is already less than the range limit. At this point the field does not reach the range limit (see Figure 3-6).

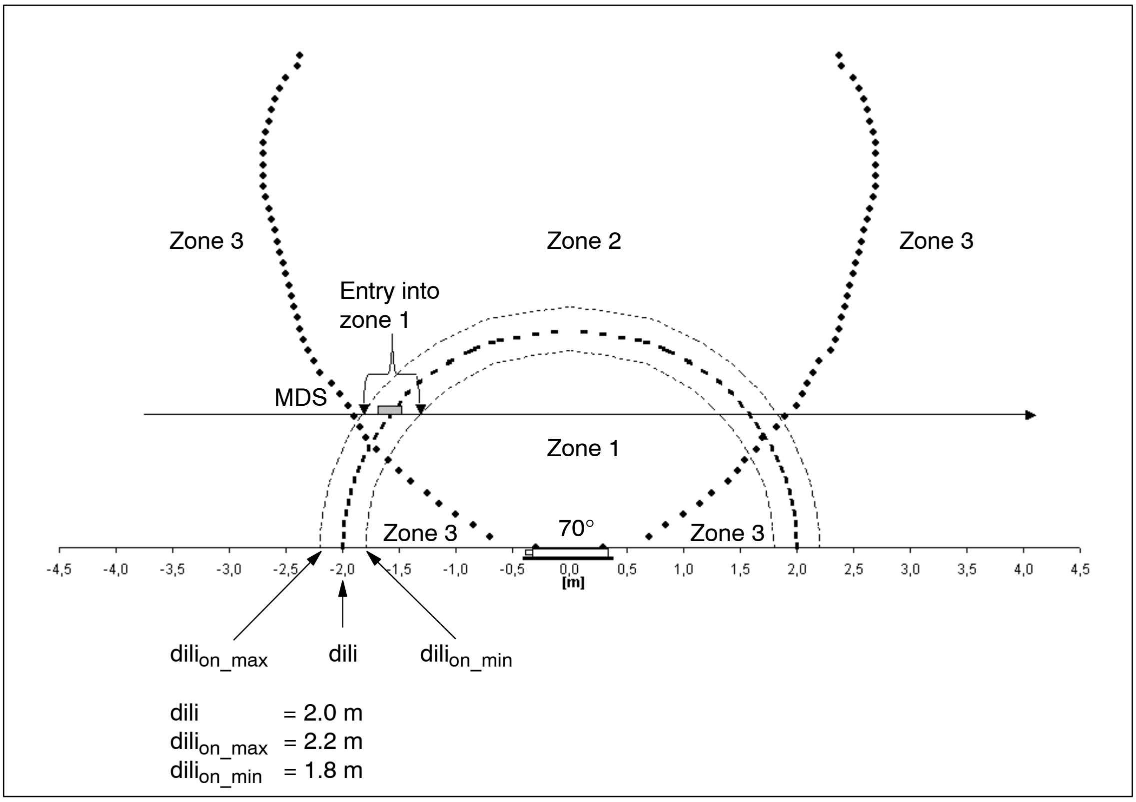


Figure 3-3 Example of case a) when the range limit dili = 2.0 m

Case:

a) The MDS enters the SLG's field and is detected by the SLG for the first time before it reaches the range limit.

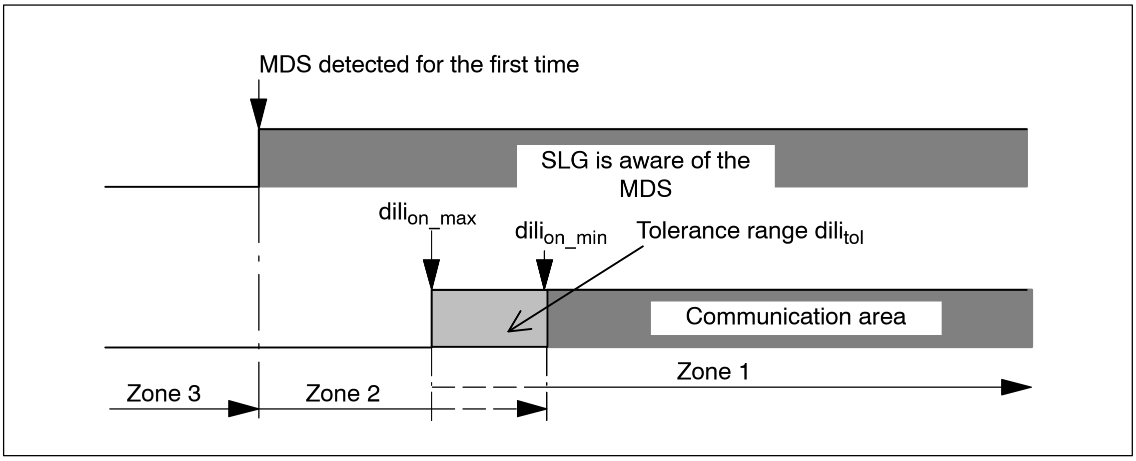


Figure 3-4 Entry into zone 1 (before dili$_{on_max}$ is reached)

b) The MDS enters the SLG's field within the tolerance range of the range limit and is detected for the first time.

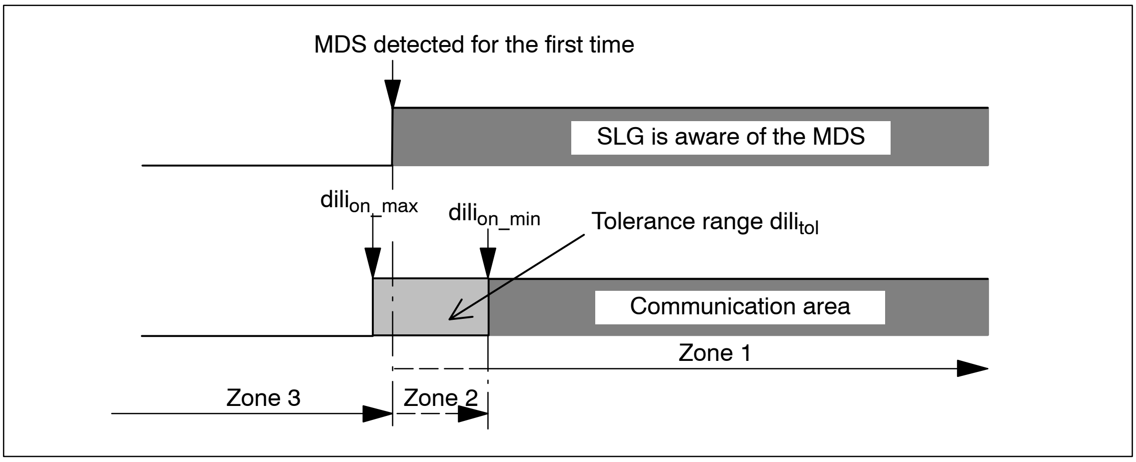


Figure 3-5 Entry into zone 1 (within the tolerance range of the range limit dili$_{tol}$)

The size of zone 2 depends on the point within the tolerance range at which the MDS enters the field and on the fluctuation range of the measured range.

c) The MDS does not enter the field of the SLG until it has crossed the range limit and is detected there for the first time.

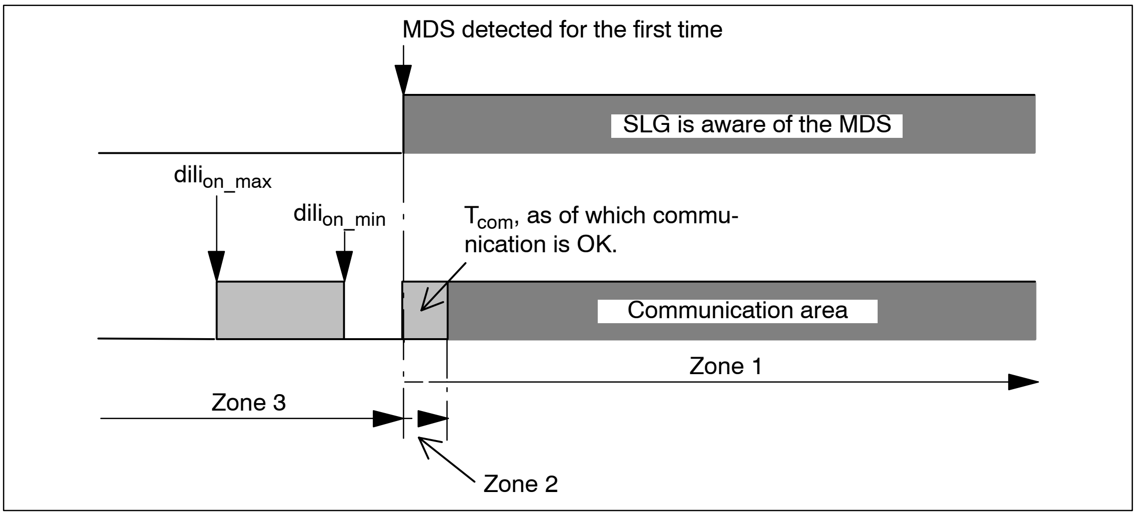


Figure 3-6 Entry into zone 1 (after the MDS crosses the range limit dili$_{on_min}$)

T_{com} is the tolerance range for the start of communication. It is a range consisting of a few centimeters in which the SLG detects the MDS for the first time after the range limit is crossed and in which the SLG recognizes the MDS as being present (depending on the transmission and reception quality). Communication with the MDS starts if there is a command pending.

Exit from zone 1

The MDS exits zone 1 when:

- The MDS is in the SLG's communication field, there is no communication between the SLG and MDS, and the SLG has calculated the distance between the SLG and MDS as being greater than $dili_{off}$.
- The MDS exits the SLG's communication field although the range limit $dili_{off}$ has not yet been exceeded.
- The MDS has been hidden for a time longer than t_{ANW} due to some problem. The time t_{ANW} is dependent on the set bunch size (see table below).

Table 3-1 Dependence of time t_{ANW} on bunch size

Bunch size	t_{ANW} (in seconds)
1 ... 2	2
3 ... 4	2.5
5 ... 6	3
7 ... 8	3.5
9 ... 12	4

Because the value measured for the range limit is subject to fluctuation of up to –0.3 m to 0.3 m, the $dili_{off}$ value for the exit from zone 1 must be greater than the maximum $dili_{on}$ value. To ensure this is the case, an offset value $dili_{offset}$ of 0.5 m is added to $dili_{on}$ for the exit.

$$dili_{Off} = dili + dili_{Off} + dili_{Tol} \qquad dili_{Off} = 0.5\ m$$

Limit values for $dili_{off}$ for:

– A range limit of $dili < 2.0$ m: $-0.2\ m \le dili_{Tol} \le 0.2\ m$

$$dili_{Off\_max} = dili + 0.5\ m + 0.2\ m = dili + 0.7\ m$$

$$dili_{Off\_min} = dili + 0.5\ m - 0.2\ m = dili + 0.3\ m$$

– A range limit of $dili \ge 2.0$ m: $-0.3\ m \le dili_{Tol} \le 0.3\ m$

$$dili_{Off\_max} = dili + 0.5\ m + 0.3\ m = dili + 0.8\ m$$

$$dili_{Off\_min} = dili + 0.5\ m - 0.3\ m = dili + 0.2\ m$$

Note

The range is not checked during communication. This means that if the range limit $dili_{off}$ is exceeded during communication, communication is not terminated; it continues until it is completed. The prerequisite for this is that the MDS must still be in the communication-capable field.

The MDS starts to exit the field once the distance measured is greater than $dili_{off}$ and provided the distance in subsequent measurements remains greater than $dili_{off}$.
The SLG normally calculates a distance value each time it measures the distance. If there is a lot of interference in the field or if there are extensive reflections, the calculation can often produce a distance value that is too inaccurate and that is therefore rejected by the SLG.
The optimum and shortest duration for the exit is attained when the SLG calculates a distance value that is greater than $dili_{off}$ three times in succession.

The time t_2 taken to exit zone 1 depends on the quality of the distance measurement once the exit from zone 1 has begun (i.e. whether the SLG always calculates a valid distance value or how often it cannot calculate a distance value).

Table 3-2 Exit Conditions with an Exit Duration of t_2

Case	Exit Conditions	Exit Duration t_2
1	The MDS exits zone 1 optimally.	≈ 1.0 sec
2	The MDS exits zone 1 in normal conditions.	≈ 1.3 sec
3	The MDS exits zone 1 in difficult conditions.	< 2.2 sec
4	The MDS exits zone 1 in very difficult conditions.	> 2.2 sec

Note

If the SLG does not hear anything from an MDS in zone 1 for the time t_{ANW}, it registers it in zone 2 and the time t_3 for exiting zone 2 to enter zone 3 starts.

Regardless of the range limit, the SLG no longer considers an MDS to be in zone 1 if one of the following commands is sent to the SLG by the user application.

- The “END” command (mode 0): Terminates communication.
- The “antenna off” command: Switches the antenna off.

After the END command, the SLG considers the MDS to be in zone 2 logically even if it is physically still in zone 1. The SLG can only communicate with this MDS again after it has physically exited zone 2 and returned to zone 1.

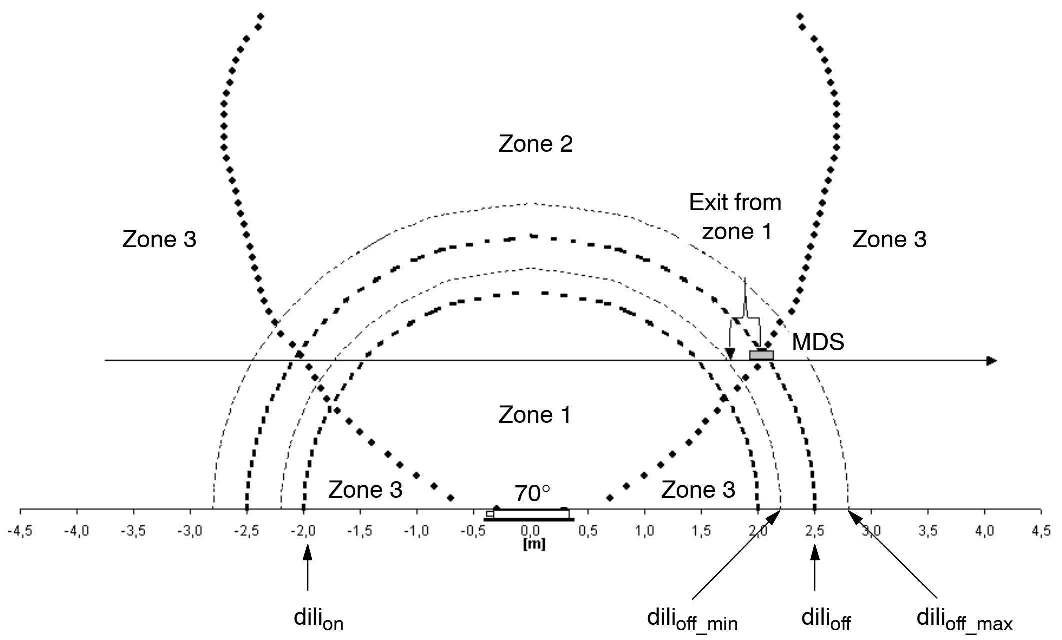
There are four ways the MDS can exit zone 1:

a) The MDS exits the SLG field after it crosses the range limit. Communication is terminated before the range limit is reached. This means that when the MDS exits the SLG's field the range limit is smaller than the field (see Figure 3-8).

b) The MDS exits the SLG's field within the tolerance range of the range limit. Communication is terminated before the range limit is reached. This means that when the MDS exits the SLG's field the range limit overlaps the tolerance range of the field (see Figures 3-7 and 3-9).

c) The MDS exits the SLG's field before reaching the range limit. However, communication is terminated within the range limit and within the field. This means that the field is smaller than the range limit at this point (see Figure 3-10).

d) The MDS exits the SLG's field after crossing the range limit, as in a). Communication is terminated within the field but only once the range limit has been crossed (see Figure 3-11).



$dili_{On}$ = 2.0 m with : –0.2 m ≤ $dili_{Tol}$ ≤ 0.2 m

$dili_{Off}$ = 2.5 m with : –0.3 m ≤ $dili_{Tol}$ ≤ 0 m

$dili_{Off\_min}$ = 2.2 m

$dili_{Off\_max}$ = 2.5 m

In this example, the exit point of the MDS from the field does not permit the maximum range of 2.8 m because the field is not wide enough.

Figure 3-7 Example of case b) when the range limit dili = 2.0 m

Case:

a) The MDS exits the SLG field after it crosses the range limit. Communication ends before the range limit is reached.

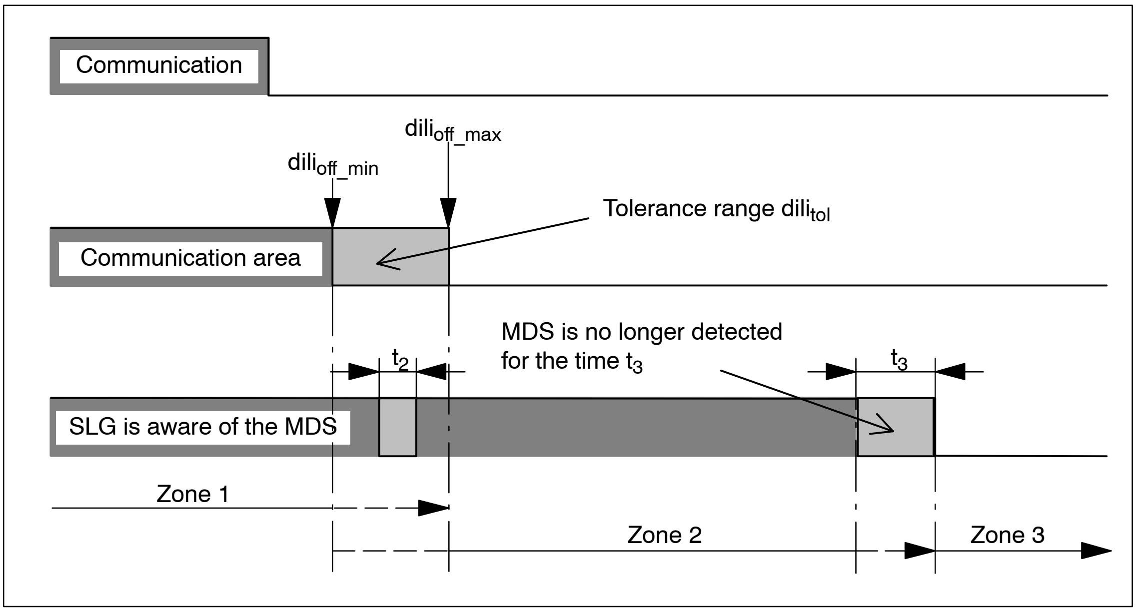


Figure 3-8 Exit from zone 1 (after the range limit is crossed)

$t_2 \geq 1$ s — If the MDS has entered the tolerance range of the range limit and the SLG detects for a time $t_2 \geq 1$ s that the MDS has crossed the range limit, the SLG no longer considers the MDS to be present in zone 1 but continues to keep it on its internal ”present” list (zone 2).

$t_3 = 10$ s — If the SLG doesn’t ”hear” the MDS $t_3 = 10$ s for a time, it removes it from its internal list. The MDS is in zone 3.

b) The MDS exits the SLG's field within the tolerance range of the range limit. Communication ends before the range limit is reached.

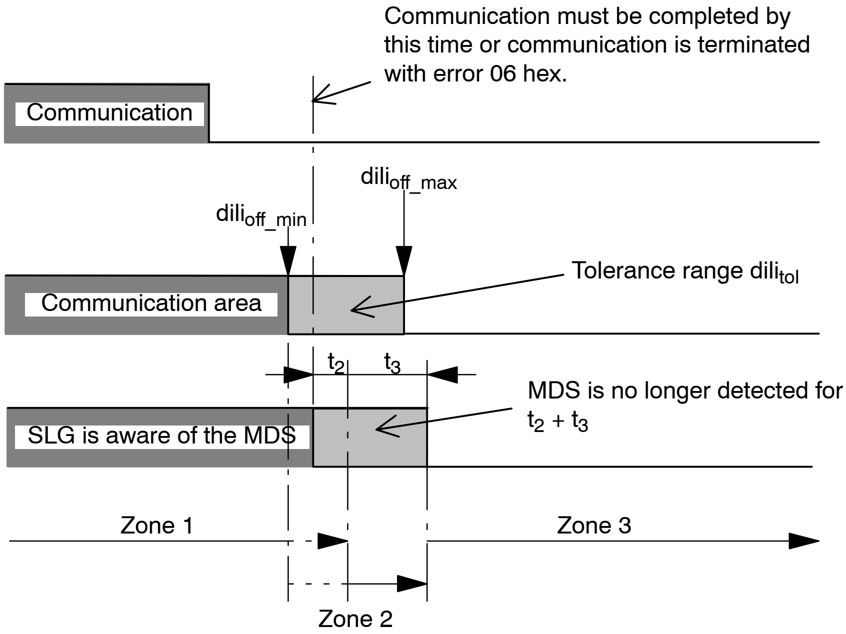


Figure 3-9 Exit from zone 1 (in the tolerance range of the range limit)

$t_2 \geq 1$ s — If the MDS has entered the tolerance range of the range limit and the SLG detects for a time $t_2 \geq 1$ s that the MDS has crossed the range limit, the SLG no longer considers the MDS to be present in zone 1 but continues to keep it on its internal "present" list (zone 2).

$t_3 = 10$ s — If the SLG doesn't "hear" the MDS $t_3 = 10$ s for a time, it removes it from its internal list. The MDS is in zone 3.

Note

If communication continues right up to the field limit and leads to interference, the SLG tries to establish communication again for three seconds after the last error-free communication. If this is no longer possible, communication is terminated with error 06 hex.

c) The MDS exits the SLG's field before reaching the range limit. Communication is, however, terminated within the range limit and the field.

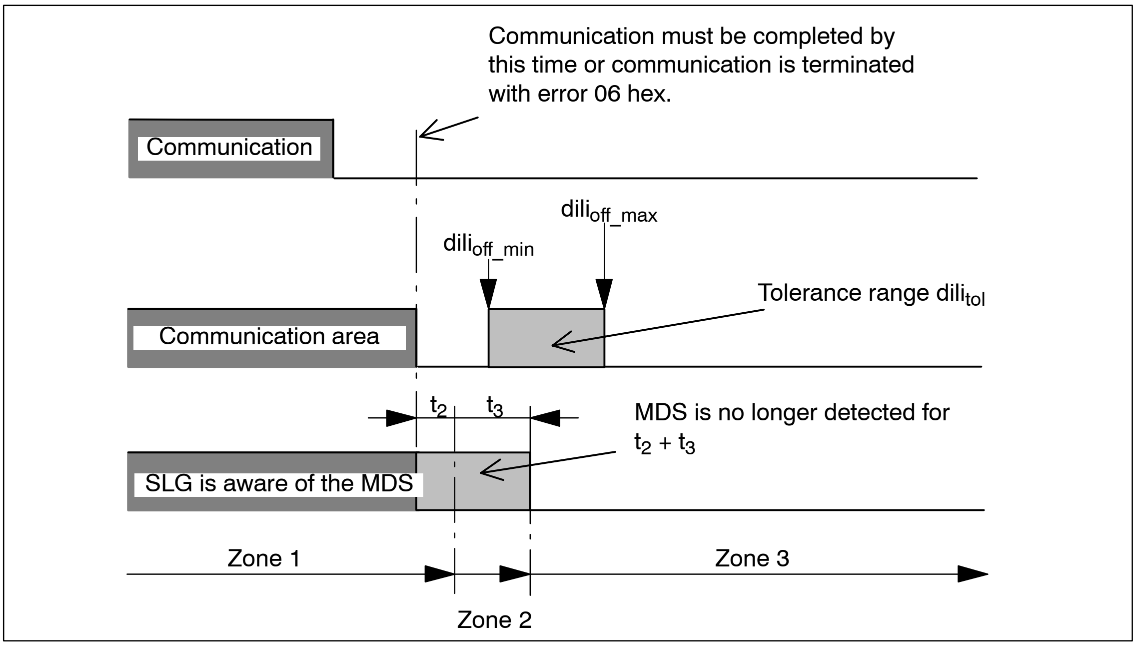


Figure 3-10 Exit from zone 1 (before the range limit is reached)

$t_2 \geq 1$ s — If the MDS has entered the tolerance range of the range limit and the SLG detects for a time $t_2 \geq 1$ s that the MDS has crossed the range limit, the SLG no longer considers the MDS to be present in zone 1 but continues to keep it on its internal "present" list (zone 2).

$t_3 = 10$ s — If the SLG doesn't "hear" the MDS $t_3 = 10$ s for a time, it removes it from its internal list. The MDS is in zone 3.

Note

Communication must always be completed before the field limit is reached.

If communication is continued right up to the field limit and terminated with error 06 hex, the MDS is automatically no longer considered to be present. If presence is parameterized, a message to the effect that the MDS is not present. If the MDS stops in this tolerance range, there may be further "present" and "not present" reports due to field fluctuation.

---

d) The MDS exits the SLG's field after crossing the range limit, as in a). Communication is terminated within the field but only once the range limit is crosse.

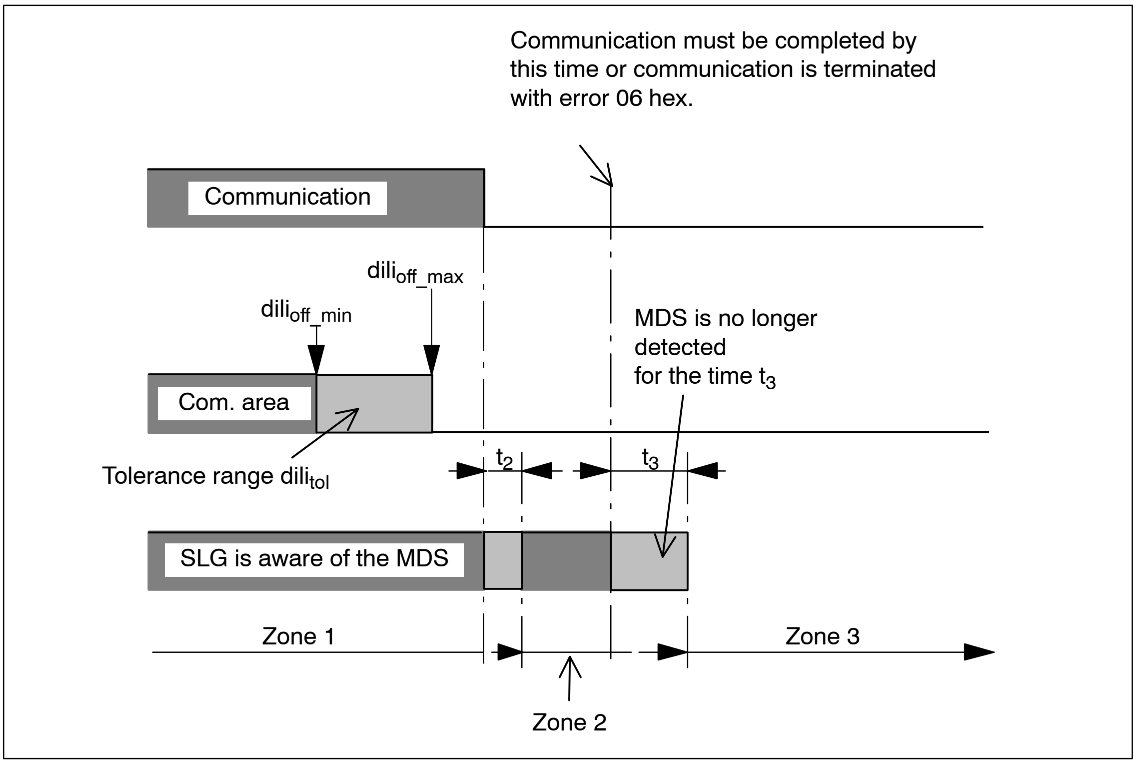


Figure 3-11 Exit from zone 1 (outside the range limit)

$t_2 \geq 1$ s — Once the SLG has terminated communication with the MDS and it detects for a time $t_2 \geq 1$ s that the MDS has already crossed the range limit, the SLG no longer considers the MDS to be present in zone 1 but continues to keep it on its internal "present" list (zone 2).

$t_3 = 10$ s — If the SLG doesn't "hear" the MDS $t_3 = 10$ s for a time, it removes it from its internal list. The MDS is in zone 3.

Caution

If communication is terminated with error 06 hex during the execution of chained commands, the data that was correctly written to the MDS up until this command is preserved on the MDS.

Length of the communication field

The length of the communication field is determined by the point at which the MDS enters and exits the communication area.

- Where does the MDS enter the SLG's field?
  - Before reaching $dili_{on\_max}$
  - Within the tolerance range of $dili_{on}$
  - After crossing $dili_{on\_min}$
- Where does the MDS exit the SLG's field?
  - Before reaching $dili_{off\_min}$
  - Within the tolerance range of $dili_{off}$
  - After crossing $dili_{off\_max}$
- Does the MDS cross $dili_{off}$ during communication?
  - No
  - Yes
- Is communication terminated by the user application within zone 1 by means of the "END" command?
  - No
  - Yes
- Is the SLG's field switched off by the user application within zone 1 by means of the "antenna off" command ?
  - No
  - Yes

Presence reporting

The SLG considers the MDS to be present if it is in the communication area. The SLG reports that the MDS has entered or exited the communication area by means of the ANW_MELD message frame, provided the SLG has been parameterized accordingly by means of the RESET message frame.

- "MDS is present" message
  The MDS has entered zone 1.
  A pending or subsequently issued command such as Read from MDS or Write to MDS is executed immediately.
- "MDS is not present" message
  The MDS has exited zone 1. No further communication with this MDS takes place.

Note

If several MDSs enter or exit simultaneously, the SLG reports each change in presence for each MDS individually.

3.1.4 Dwell Time of the MDS in Zone 1

The dwell time is the time during which the MDS remains in the SLG transmission window and during which the SLG can exchange data with the MDS.

The dwell time is calculated as follows:

$$t_V = \frac{L \times 0.9\,[m]}{V_{MDS}\,[m/s]} - K_{sleep}\,[s]$$

Where $K_{sleep} = t_{sleep}\,[s] \times F_{sleep}$

t_V: Dwell time of the MDS

L: Length of the transmission window (zone 1)

V_{MDS}: Speed of the data storage unit in dynamic operation

0.9: Constant factor; compensates for the effects of temperature and for production tolerances

t_{sleep}: < 0.5 s; Sleep time of the MDS.

F_{sleep}: $\geq$ 1; factor for initial detection (presence) of the MDS in the transmission window.

In static operation the dwell time can be any length. However, it must be long enough for communication with the MDS to be completed.

In dynamic operation the dwell time is set by the system environment. The volume of data to be transferred must be adjusted to the dwell time or vice versa.

The following generally applies:

$$t_V > t_K$$

t_V: Dwell time of the data storage unit in zone 1 of the SLG

t_K: Communication time with the MDS

Note

If there are two or more write and/or read calls, the dwell time is only fully available for data transfer between the SLG and the MDS provided the MDS doesn't go into sleep mode during this time. This means that the MDS must be kept "awake" between unchained write and/or read calls. This can be achieved using the parameterizable standby time. You must remember that during the standby time power consumption is as great as during data communication.

The MOBYU-KOMM.XLS Excel file on the "Software MOBY" CD-ROM (> V3.5) can be used to calculate the dwell time.

3.1.5 Communication Times

The communication time between the following, taking the type of usage into consideration, is:

- SLG and MDS t_{K_SLG}
- User program, interface module, SLG, and MDS t_{K_ASM}
- System, (interface module,) SLG, and MDS t_{K_SYS}

  In the case of the communication time t_{K_SYS} further distinctions must be made according to the type of usage:

  – PC/host with MOBY API, SLG (directly connected), and MDS

  – PC/host/external PLC without FC/MOBY API, interface module, SLG, and MDS

  – PC/host/external PLC without MOBY API, SLG (directly connected), and MDS

Communication time between the SLG and the MDS

The communication time t_{K_SLG} between the SLG and MDS is the time that begins at the start of the write or read operation in the SLG and ends once the data to be written is all on the MDS or once the data to be read has been received by the SLG.
The communication time between the SLG and the MDS depends on the transmission rate, the data block size (user data), the standby time, and a constant as the internal system time. The transmission rate between the SLG and the MDS depends on the direction of transmission, the parameterized bunch size, and the system conditions.

The communication time is looked at differently depending on the direction of transmission: reading from the MDS or writing to the MDS. It is assumed for the calculation of the communication time that the command(s) to be executed is/are present in the SLG at the time of communication. This means that communication is executed without interruption and without being affected by the sleep time of the MDS. The time for the detection of the MDS is not included here. It is included in the calculation of the dwell time and the communication between the user program, interface module, SLG, and MDS.

The following applies to the calculation of the communication time:

$$t_{K\_SLG} = d\,[\text{Byte}] \times \frac{t_{Kom}\,[\text{ms/Byte}]}{K_{KOM} \times p}$$

and to the calculation of the maximum amount of user data:

$$n_{max} = \frac{t_V}{t_{Kom}}$$

d: Amount of write or read data in bytes:

– MDS U313/MDS U315: 1 to 2048 bytes

– MDS U524/MDS U525/MDS U589: 1 to 32768 bytes

K_{Kom}: Communication efficiency. It should normally be ≥ 90%
Due to interference or poor communication conditions, for example, communication may take longer as a result of the required ARQ measures in the SLG (ARQ = Automatic Repeat Request).

P: 1 = no bunch/multitag operation;
2 to 12 = bunch size in the case of bunch/multitag operation.
If the SLG is communicating with several MDS concurrently, the communication speed decreases in accordance with the bunch size.

t_{com}: The communication time for writing a byte (= t_{com_W}) or reading a byte (= t_{com_R}).

- t_{com_W}: The communication time for writing a byte at C_{com} = 100% and p = 1 is between 10 ms and 0.15 ms depending on the volume of data involved.
  In the case of only one byte or data with a length of $d = (n \times d_N) + 1$ there is an offset of 30 ms.
- t_{com_R}: The communication time for reading a byte at C_{com} = 100% and p = 1 is between 40 ms and 0.30 ms, depending on the volume of data involved.

The length of the user data in the message frame for communication between the application and the SLG: 1 to 250 bytes has an influence on communication time and is included in the calculation.
In the case of applications with FC 45, the length of the user data is 233 bytes.

Table 3-3 Communication times using examples of specific data volumes at C_{com} = 100% and p = 1.

Number of bytes	t_{com_w} [ms/byte]	t_{com_r} [ms/byte]
1	50	35
2	10.5	17.5
4	5.25	8.75
8	2.625	4.375
16	1.313	2.188
32	0.656	1.094
64	0.328	0.547
108	0.194	0.324
109 [1]	0.193	0.385
128	0.164	0.328
144	0.146	0.292
145 [2]	0.193	0.290
216	0.130	0.195
217	0.129	0.290

Table 3-3 Communication times using examples of specific data volumes at C_{com} = 100% and p = 1.

Number of bytes	t_{com_w} [ms/byte]	t_{com_r} [ms/byte]
233	0.120	0.270
234 [3]	0.334	0.419
512	0.150	0.315
1024	0.130	0.280
2048	0.123	0.267
4096	0.122	0.272
8192	0.122	0.274
16384	0.121	0.272
32768	0.121	0.272

1 The data is read via the air interface in blocks of 108 bytes. This means, for example, that the same amount of time is required to read 109 bytes via the air interface as to read 216 bytes, and the time per byte is longer than when only 108 bytes are read.

2 The data is written in blocks of 144 bytes via the air interface. This means, for example, that the same amount of time is required to write 145 bytes via the air interface as to write 288 bytes, and the time per byte is longer than when only 144 bytes are written.

3 The maximum length of the user data in the message frame for communication between the user and the SLG is 233 bytes in the case of FC 45. This means that two message frames are generated when for example 234 bytes are written or read. The second one only contains one byte. The same time is required at the air interface for this one byte as for 108 bytes read or 144 bytes written, and the time per byte is higher than for the 233 bytes.

The MOBYU-KOMM.XLS Excel file on the “Software MOBY” CD-ROM (> V3.5) can be used to calculate the communication time.

Communication time between the user program, ASM, SLG and MDS

Communication between the user program, the ASM, the SLG and the MDS is divided up into two stages: ASM and SLG and SLG and MDS. The command processes that take place between the interface module and the SLG determine how the communication times add up.

The length of time depends on:

- The type of the PLC and the cycle time
- The software used
  - Normal mode: FC 45
  - Filehandler: FC 46, FC 56
- The type of interface module (ASM) and the transmission rate at the interface to the SLG
- The communication conditions between the SLG and MDS

Normal mode with FC 45

The communication process depends on whether only one command or chained commands are sent between the user and the SLG and whether or not command repetition is used (REPEAT).

- Single command without repetition
- Commands for a maximum of up to 233 write or read bytes. Larger volumes of data are executed by FC 45 using chained commands.
- Chained commands without repetition
- Single command with repetition
- Chained commands with repetition

Command chaining and repetition are described in the technical documentation for the FC 45.

The MOBYU-KOMM.XLS Excel file on the “Software MOBY” CD-ROM (> V3.5) can be used to calculate the communication time.

1. Communication in the case of a READ or WRITE command without repetition.

   a) The user starts the single individual command. At the next call of the FC the command is transferred to the interface module and acknowledged by the interface module. The user and FC are in the wait state. The communication times between the user and the interface module can be found in the corresponding documentation.

   b) The interface module forwards the command to the SLG and is in the wait state.
   The communication between the interface module and the SLG takes place asynchronously at a transmission rate of 19200, 57600, or 115200 bps. The default setting for the interface modules is the maximum transmission rate in each case:

   – ASM 452 57600 bps

   – ASM 473 57600 bps

   – ASM 475 115200 bps

   c) If there is an MDS in the transmission window, the SLG processes the command and communicates with the MDS.
   Otherwise, the SLG waits until an MDS enters the transmission window and then communicates with the MDS.

   d) SLG communication with the MDS is completed. The SLG sends the acknowledgment: read data or the result of the write command to the ASM. The communication between the SLG and the interface module takes place asynchronously, as in b).

   e) The read data or the result of the write command is passed on to the user by the interface module the next time the FC is called. The user receives a ready message.

The following applies when calculating the data throughput:

$$t_K = C_{user} + C_{ASM} + C_{Sleep} + t_{K\_SLG}$$

t_K: Communication time between the user, the interface module, the SLG, and the MDS

C_{USER}: Constant: These are the times for the start of the command, transmission of the command to the ASM, transfer of the acknowledgement from the ASM and command termination in the user program: communication steps a) and e).
This time depends on the type of the PLC and the cycle time, the type of the interface module and the transmission rate between the programmable controller and the interface module.

Table 3-4 Typical run times of FC 45 (cycle load of the PLC in ms)

S7 CPU	Idle run	Central ASM in the S7-300		Distributed ASM on the PROFIBUS	
		Read MDS	Write MDS	Read MDS	Write MDS
315-2 DP	1.90	3.7 + 0.023 × n	3.6 + 0.022 × n	3.40	3.60
318-2 DP	0.13	1.0 + 0.010 × n	1.3 + 0.007 × n	0.40	0.45
416-2 DP	0.10	–	–	0.35	0.38

n = number of user data in bytes to be processed for each write and read command. If more than 233 bytes of MDS data is to be processed by a single command, enter n = 233 in the table.
The exact values between the user and the interface module can be found in the corresponding documentation.

C_{ASM}: Constant: Time for command transmission between ASM and SLG: communication steps b) and d). This time depends on the type of the interface module and the transmission rate between the interface module and SLG.

$$C_{ASM} = a + b \times n$$

a: Constant, depending on the interface module. See Table 3-5.
b: Time for each character to be transferred. See Table 3-5.
n: Number of characters to be transferred in bytes.

Table 3-5 Typical communication times between the interface module and SLG

Transmission rate	Constant C_{ASM}					
	ASM 452		ASM 473		ASM 475	
	Read MDS	Write MDS	Read MDS	Write MDS	Read MDS	Write MDS
19200	a = 40; b = 0.6	a = 40; b = 0.6	a = 25; b = 0.6	a = 25; b = 0.6	a = 50; b = 0.6	a = 50; b = 0.6
57600	a = 40; b = 0.2	a = 40; b = 0.2	a = 25; b = 0.2	a = 25; b = 0.2	a = 40; b = 0.2	a = 40; b = 0.2
115200	–	–	–	–	a = 40; b = 0.1	a = 40; b = 0.1

C_{sleep}: Constant for the time until the SLG can start with the MDS.

$$C_{Sleep} = (1 + 1/3) \times t_{sleep} \text{ [ms]}$$

t_{sleep}: Sleep time of the MDS. See dwell time.

t_{K_SLG}: Communication time for reading or writing between the SLG and MDS. See the section on the communication time between the SLG and MDS.

In this calculation the MDS is assumed to be present in the transmission window. If not, the time for communication from the user to the SLG is disregarded.

2. Communication when sending chained commands without command repetition (e.g. write 1024 bytes = 5 WRITE commands with 4 x 233 bytes + 1 x 92 bytes).
   Communication between the user program, the interface module, and the SLG can be divided into five communication steps.

   a) The user starts the individual WRITE command. At the next call of the FC the command is transferred to the interface module and acknowledged by the interface module. The user and FC are in the wait state.
      The communication times between the user and the interface module can be found in the corresponding documentation.

   b) Once the interface module has received the first command in its entirety, it passes it on to the SLG while receiving any further commands. It receives and passes on commands concurrently. The interface module goes into the wait state after the last command.

   c) If there is an MDS in the transmission window, the SLG processes the first command as soon it has received it in its entirety and communicates with the MDS. In parallel with this, the SLG receives any further commands.
      If there is no MDS in the transmission window, the SLG receives all the chained commands, waits until an MDS arrives, and then communicates with the MDS.

   d) SLG communication with the MDS is completed.
      In the case of chained commands, there are two states in which communication with the MDS is completed:

      – A single command in the command chain is completed.

      – All the commands in the command chain are completed.

      Re single command in the command chain is completed:
      The SLG sends the acknowledgement to the ASM after execution of the single command. This means that the following sequence can occur in parallel in the SLG:

      – The SLG receives the further chained commands from the interface module.

      – It processes a command (communication with the MDS).

      – It sends to the interface module a corresponding acknowledgment for the commands executed.

      After the last acknowledgment to the interface module, the SLG goes into the wait state. Communication between the interface module and SLG is asynchronous.

   e) The read data or the result of the write command is passed on to the user by the interface module the next time the FC is called. The user receives a ready message.

The following applies when calculating the data throughput:

$$t_K = C_{USER} + C_{ASM} + C_{Sleep} + C_{K\_SLG}$$

t_K: Communication time between the user, the interface module, the SLG, and the MDS

C_{user}: Constant: See communication with a READ or WRITE command without repetition.

C_{ASM}: Constant: Time for command transmission between ASM and SLG: communication steps b) and d). This time depends on the type of the interface module and the transmission rate between the interface module and SLG.

$$C_{ASM} = a \times x + b \times n$$

a: Constant, depending on the interface module. See Table 3-6.
b: Time for each character to be transferred. See Table 3-6.
n: Number of characters to be transferred.
x: Number of commands.
$x = n/233$ The digits after the decimal point in division must be rounded up.

Table 3-6 Typical communication times between the interface module and SLG

Transmission rate	Constant C_{ASM}					
	ASM 452		ASM 473		ASM 475	
	Read MDS	Write MDS	Read MDS	Write MDS	Read MDS	Write MDS
19200	a = 40; b = 0.6	a = 40; b = 0.6	a = 25; b = 0.6	a = 25; b = 0.6	a = 50; b = 0.6	a = 50; b = 0.6
57600	a = 40; b = 0.2	a = 40; b = 0.2	a = 25; b = 0.2	a = 25; b = 0.2	a = 40; b = 0.2	a = 40; b = 0.2
115200	–	–	–	–	a = 40; b = 0.1	a = 40; b = 0.1

C_{sleep}: Constant for the time until the SLG can start with the MDS.

$$C_{Sleep} = (1 + 1/3) \times t_{sleep} \text{ [ms]}$$

t_{sleep}: Sleep time of the MDS. See dwell time.

K_{K_SLG}: 50 ms; constant for read or write commands between the SLG and MDS. See the section on the communication time between the SLG and MDS. In the case of chained commands, the communication time between the SLG and MDS may be disregarded. It comes within the communication time between the interface module and SLG.

In this calculation the MDS is assumed to be present in the transmission window. If not, the time for communication from the user to the SLG can be disregarded.

3. Communication in the case of a READ or WRITE command with repetition.
   When the command is to be repeated, it resides in the SLG and is executed automatically for each MDS that comes into the transmission window.
   The transfer of the command to the SLG is not included in the communication process. This reduces the communication time accordingly compared to with a READ or WRITE command without repetition.
4. Communication in the case of chained commands with command repetition.
   In command repetition, the command chain resides in the SLG and is executed automatically for every MDS that comes into the transmission window.
   The transfer of the command chain to the SLG is not included in the communication process. This reduces the communication time accordingly compared to communication with READ or WRITE chained commands without command repetition.

Communication time between the PC/host with MOBY API, SLG and MDS

Communication between the user program in the PC/host and the MDS is divided up into two stages:
user program and SLG and SLG and MDS.

- Communication times between the user program and SLG
  Communication between the PC/host and the SLG is processed asynchronously by means of the 3964R protocol at a transmission rate of 19200 bps, 38400 bps, 57600 bps, or 115200 bps. The transmission rate depends on the PC/host and the length of the cable between the PC/host and the SLG. The transmission rate must be specified in the PC/host as the master. The SLG automatically adjusts to the transmission rate of the master.
  The communication time depends on the baud rate, the data block size (user data) and the PC/host: operating system, processor performance, processor load, etc.
- Communication times between the SLG and the MDS
  See the communication time between the SLG and the MDS.

Communication time between the PC/host without FC/ MOBY API, ASM, SLG and MDS

Communication between the user program in the PC/host and the MDS is divided up into two stages:
user program and SLG and SLG and MDS.

- Communication times between the user program and ASM 452, ASM 473 or ASM 475
  No further comment can be made here on the communication times because communication between the PC/host and the interface module takes place without the standard software components FC or MOBY API, and the PC/host does not have a general hardware or software configuration, and there is no discernible system usage.
- Communication times between the interface module and SLG
  See the communication time between the user program, interface module, SLG, and MDS.
- Communication times between the SLG and the MDS
  See the communication time between the SLG and the MDS.

Communication time between the PC/host without MOBY API, SLG and MDS

Communication between the user program in the PC/host and the MDS is divided up into two stages:
user program and SLG and SLG and MDS.

- Communication times between the user program and SLG
  Communication between the PC/host and the SLG is processed asynchronously by means of the 3964R protocol at a transmission rate of 19200 bps, 38400 bps, 57600 bps, or 115200 bps. The transmission rate depends on the PC/host and the length of the cable between the PC/host and the SLG. The transmission rate must be specified in the PC/host as the master. The SLG automatically adjusts to the transmission rate of the master.
  The communication time depends on the baud rate, the data block size (user data) and the PC/host: operating system, processor performance, processor load, etc.
- Communication times between the SLG and the MDS
  See the communication time between the SLG and the MDS.

3.1.6 Battery Life

The battery life of the mobile data storage units MDS U313, MDS U315, MDS U524, MDS U525 and MDS U589 depends on:

- The type of MDS (battery capacity)
- The sleep time (in other words, how long it takes the MDS to wake up)
- The volume of data to be written to and/or read from the MDS
- The system conditions for data communication

The battery capacity and the standard sleep time of 320 ms are fixed. The volume of data and the system conditions for data communication determine the service life of the battery.

Calculating the battery life of the MDS

The Excel file MOBYU-MDS-BATTERIE.XLS on the "Software MOBY" CD-ROM (> V3.5) can be used to calculate the service life of the battery.

Ascertaining the remaining service life of the MDS

Using the MDS-STATUS command you can find out how much battery life the MDS has left via the SLG. Enter in the MDS-STATUS command the current date in the form of the calendar week and year, and you will be given the remaining life as a percentage.

The interrogation of the remaining battery life can be made at the end of an assembly line, for example. If the remaining life is less than 2 %, the MDS should be replaced.

Note

The calculation of the remaining battery life is based on an assumption of an ambient temperature of 25 °C. If the ambient temperature is higher or lower, the actual remaining battery life may differ from the calculated figure. This means that the MDS has to be replaced sooner.

3.1.7 Changing the battery on the MDS U315/MDS U525

Note

Only an authorized service technician or a qualified electrical expert is permitted to replace the lithium battery.

Warning

If the battery is not replaced correctly (for example if there is a short circuit or excessive heating during soldering) there is a risk of explosion.

Removing a discharged battery

1. Release the four screws on the battery compartment cover with a TORX screwdriver (size TX 10).

Figure 3-12 Underside of the MDS with the battery compartment cover screwed on

2. Pull the discharged battery out of the battery compartment and unsolder it.

Figure 3-13 Open MDS with battery pulled out

Note

Discharged batteries must be disposed of in accordance with national regulations.

Inserting a new battery

1. Solder on the new battery.

Caution

- Only use the approved make of replacement battery
- Pay attention to polarity when soldering in the battery

2. Reset the MDS and OTP memory.

After the battery is soldered in, the MDS can remain in an undefined state. For this reason the reset signal in the MDS must be regenerated.
To do this, briefly (approx. 1 second) connect a discharged electrolytic capacitor parallel to the soldered battery, paying attention to correct polarity. The capacitor should have a capacitance of at least 470 µF, but no more than 1000 µF, in order to keep the amount of energy taken from the new battery by the capacitor as small as possible.

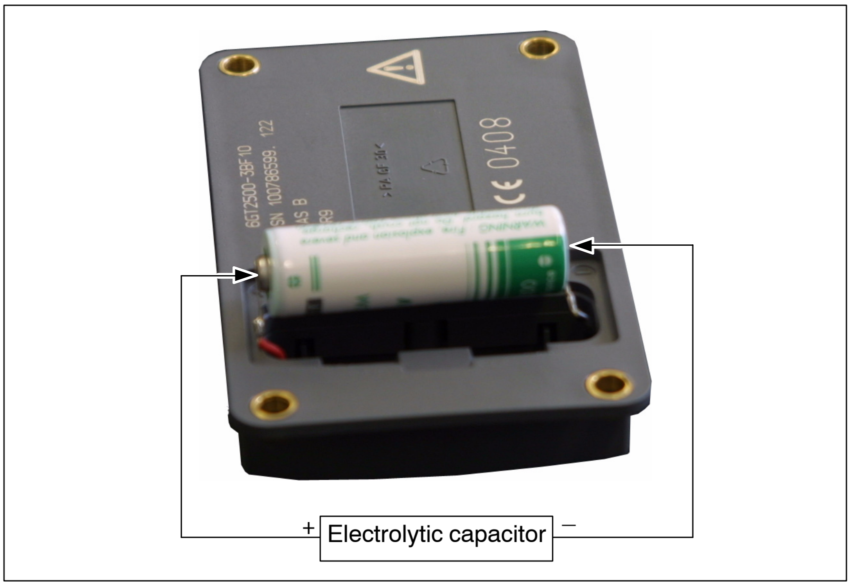


Figure 3-14 Open MDS with battery soldered in and reset circuit

Note

- Make sure that the polarity of the electrolytic capacitor is correct.

  (if more than one attempt is made, or more than one MDS), otherwise no pulse on the supply voltage will be generated. If it is not discharged, the charge in the electrolytic capacitor will be retained for at least a few minutes.

3. Slide the battery into the battery compartment.
4. Place the cover on the battery compartment and screw it down with the four screws.

Figure 3-15 Underside of the MDS with the battery compartment cover in place

5. Parameterize the MDS with the current date (calendar year and week)

After the battery is changed, the MDS has its full service life again. This is dependent on the MDS variant, the operating conditions and the volume of data written/read.
In order to allow calculation of the remaining battery life, therefore, the date on which the battery was changed (calendar year and week) must be entered in the MDS.
The date is transferred via the service interface on the SLG U92 with the battchange function (see Section 3.11.3). The procedure is as follows:
Activate the service interface (see Section 3.11) and perform the following actions immediately afterwards.

- Place the MDS that is to be parameterized in the antenna field of the SLG
- Output the data of all active MDSs in the field with the get_mds function (see Section 3.11.3)
  Only the data of the one MDS that is to be parameterized should appear. If data from several MDSs is output, the other MDSs must be removed from the field. Then repeat the get_mds command.
- Enter the ID number of the MDS (take it from get_mds) and the date of the battery change (calendar year and month) with the battchange function
- Remove the parameterized MDS from the field

Note

Only the MDS that you want to parameterize should be present in the field during parameterization of the date, otherwise another MDS may be parameterized, and its battery life would then be calculated incorrectly.
On the MDS with the new battery, which would not be parameterized, calculation of the remaining battery life would yield no result or a result that is too short.

3.2 Declaration of conformity

The following products

- MOBY U SLG U92 RS 232
- MOBY U SLG U92 RS 422
- MOBY U MDS U313
- MOBY U MDS U315
- MOBY U MDS U524
- MOBY U MDS U525
- MOBY U MDS U589
- MOBY U antenna STG U

comply with the basic requirements of the EU Radio and Telecommunications Terminal Equipment Directive; R&TTE Directive (99/5/EC).

The EU declarations of conformity are held available for the responsible authorities at:

SIEMENS AG Austria
PSE PRO RCD
Erdberger Lände 26
A-1030 Vienna

3.3 Installation Guidelines

The mobile data storage units (MDSs) and write/read devices (SLGs) communicate by radio in the 2.45 GHz range. To ensure interference-free communication, materials that shield against or absorb RF radiation should either not be in the RF field or only in certain circumstances. In addition, mounting the MDS and SLG on metal also has an effect on the RF field. To ensure that the field data described in Section 5.1 are valid, the following points should be noted at configuration and installation:

- The minimum clearance between two adjacent data storage units (see the MDS data sheets)
- The minimum clearance between write/read devices (see the SLG data sheets)
- The MDS and SLG can be mounted directly on metal
- The metal-free space if the MDS and SLG are mounted flush in metal (see the MDS and SLG data sheets)
- Installation of the SLG and MDS in metal frames or supports (see the MDS and SLG data sheets)
- Covers for protection against impact and kicking (see the MDS and SLG data sheets)
- The effect of metal on the transmission window
- The effect of non-metallic materials/objects on the transmission window
- Interference and users in the 2.45 GHz range
- Chemical resistance of the mobile data storage units

The following sections explain the transmission window as a function of the assignment of the SLG and MDS, the effect on the transmission window, interference, and users in the 2.45 GHz range, and the resistance of the mobile data storage units to chemicals.

3.3.1 Transmission window as a function of the assignment of the SLG and MDS

The transmission window is the range in which communication between the SLG and the MDS has to take place. The transmission window is determined by:

- the transmission fields of the SLG and MDS
- the mechanical arrangement of the SLG and MDS in relation to each other
- the parameterized range (zone 1)

The general configuration rules (see Section 3.1.1) must be observed when assigning the SLG to MDSs.

In the following, examples are shown for transmission windows with different arrangements of the SLG U92 and the MDSs U313/315/524/525 in relation to each other and with corresponding directions of movement. The SLG U92 is the variant without FCC.
The SLG and MDS are arranged in relation to each other such that the Siemens logo is in the same position in each case (for example on top). The angle of aperture of the SLG antenna (α) is 70 ° and that of the MDS antenna (β) is 60 °.

SLG and MDS parallel to each other

The SLG and the MDSs are facing each other with their antenna side and are aligned in parallel (optimum arrangement).

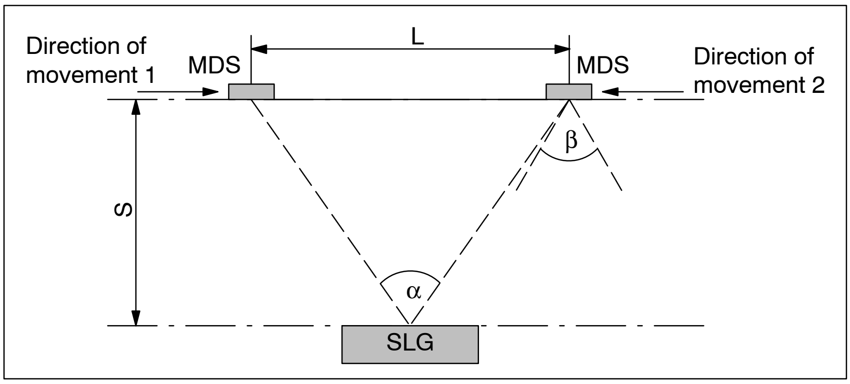


Figure 3-16 MDS arranged parallel to SLG; Direction of movement parallel to that

The MDS is moved parallel to the SLG at a distance S from left to right (direction of movement 1) or from right to left (direction of movement 2) through the field width L. The value of S can be from 0.15 m up to a maximum of 3 m (limit distance S_g).

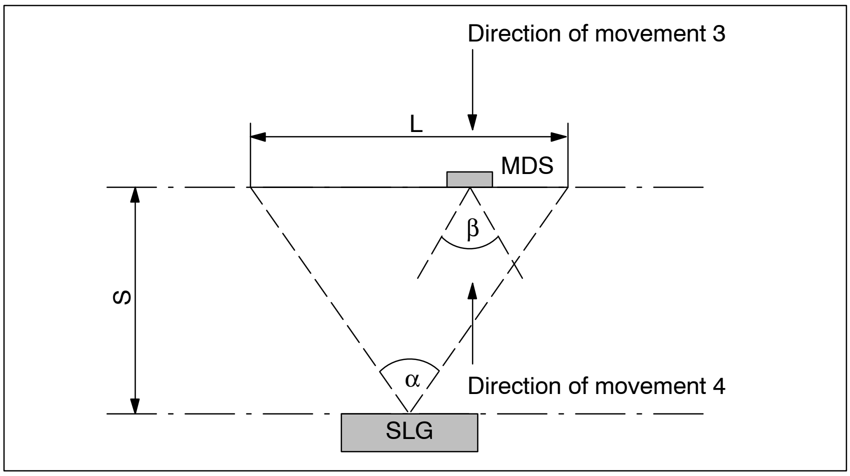


Figure 3-17 MDS arranged parallel to SLG; Direction of movement perpendicular to that

The MDS is moved within the length/width of the field L towards the SLG (direction of movement 3) or away from the SLG (direction of movement 4) and perpendicular to it. The value of S can be from 0.15 m up to a maximum of 3 m (limit distance S_g).

The transmission window resulting from the above arrangements (Figures 3-16 and 3-17) is shown in Figure 3-22.

SLG and MDS at an angle to each other

The antenna side of the SLG is aligned at an angle (γ) of 45 ° to the antenna side of the MDS.

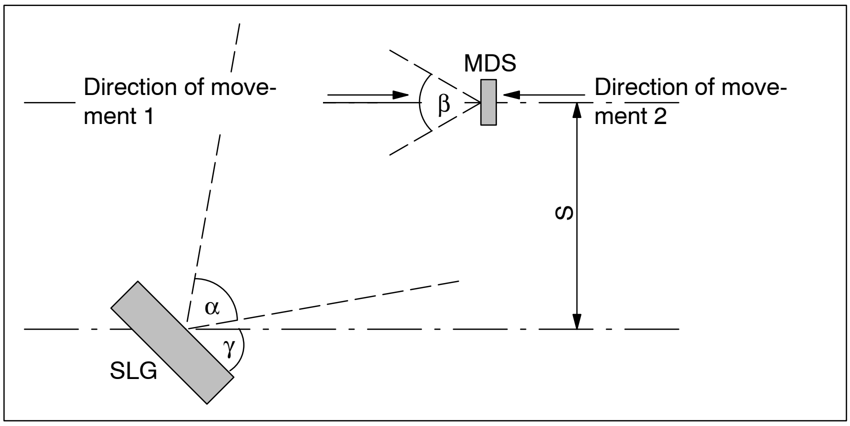


Figure 3-18 Arrangement of SLG at an angle of 45 ° to MDS; direction of movement in direction of beam from MDS antenna

The MDS is moved in the direction of the beam from its antenna and in so doing maintains the angle of 45 ° to the SLG. At the distance S is is moved from left to right (direction of movement 1) or from right to left (direction of movement 2) through the antenna field of the SLG. The value of S can be from 0.15 m up to the field limit. The limit distance S_g (3 m) is not reached with this arrangement.

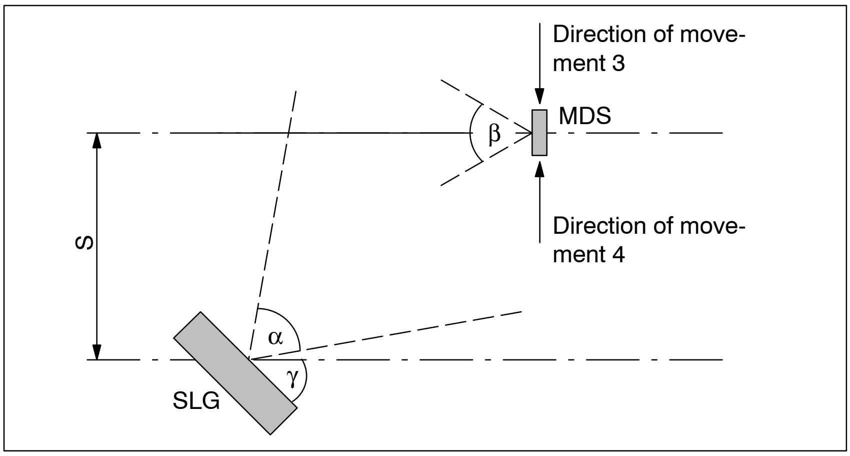


Figure 3-19 Arrangement of SLG at an angle of 45 ° to MDS; direction of movement perpendicular to direction of beam from MDS antenna

The MDS is moved in the antenna field of the SLG perpendicular to the direction of the beam from its antenna and in so doing maintains the angle of 45 ° to the SLG. The value of S can be from 0.15 m up to the field limit. The limit distance S_g (3 m) is not reached with this arrangement.

The transmission window resulting from the above arrangements (Figures 3-18 and 3-19) is shown in Figure 3-23.

If the SLG and MDS are set up in a mirror-image arrangement, the transmission window is displaced in a mirror image accordingly.

SLG and MDS perpendicular to each other

The antenna side of the SLG is aligned perpendicular to the antenna side of the MDS.

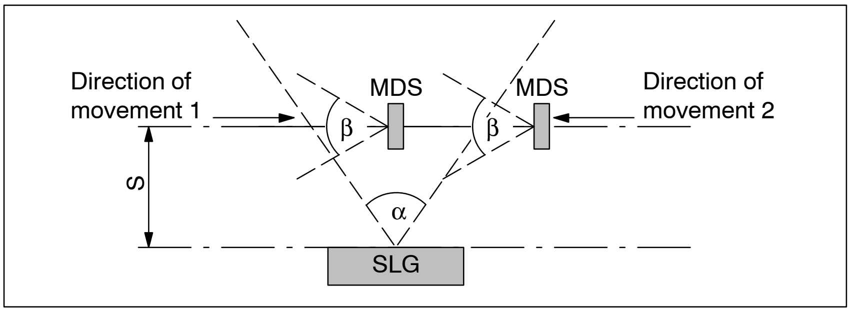


Figure 3-20 MDS arranged perpendicular to SLG; direction of movement in direction of beam from MDS antenna

The MDS is moved parallel to the SLG at a distance S from left to right (direction of movement 1) or from right to left (direction of movement 2) through the antenna field of the SLG. The value of S can be from 0.15 m up to the field limit. The limit distance S_g (3 m) is not reached with this arrangement.

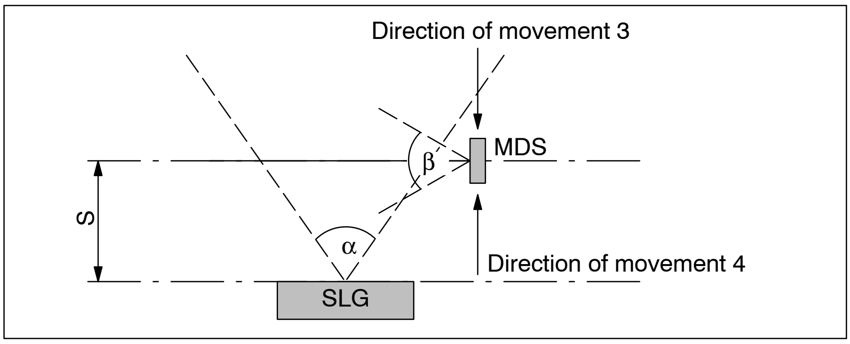


Figure 3-21 MDS arranged perpendicular to SLG; direction of movement perpendicular to direction of beam from MDS antenna

The MDS is moved in the antenna field of the SLG towards the SLG (direction of movement 3) or away from the SLG (direction of movement 4) and perpendicular to it. The value of S can be from 0.15 m up to the field limit. The limit distance S_g (3 m) is not reached with this arrangement.

The transmission window resulting from the above arrangements (Figures 3-20 and 3-21) is shown in Figure 3-24.

If the MDS is positioned the other way around (opposite direction of beam from the MDS antenna), the transmission window is displaced in a mirror image accordingly.

Transmission window with parallel arrangement

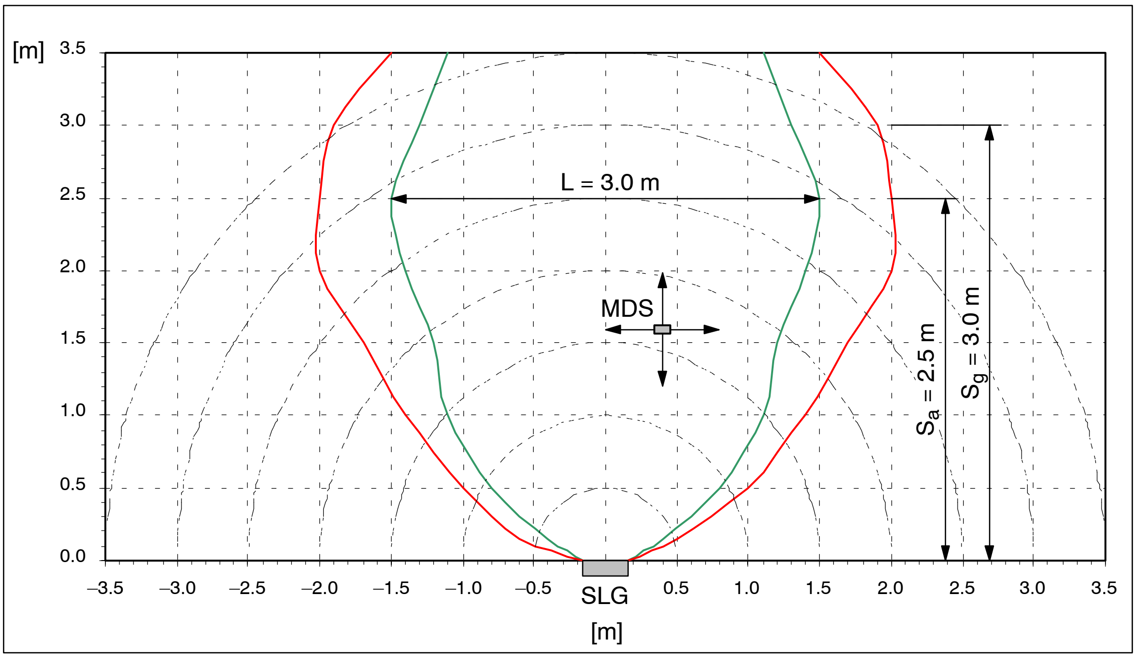


Figure 3-22 Transmission window: SLG and MDS parallel to each other

The field edges are shown by the two lines. The field size can fluctuate slightly due to external influences.

In the inner area the quality of communication can be considered very good to good. The average communication time between the SLG and MDS can vary by ±10 % in this area. The MDS can be moved as required in the inner area of the transmission window with the communication quality remaining constant, provided that the assignment (angle) of the SLG and MDS remains unchanged.

The outer area represents the maximum communication area. Between the inner and outer areas the quality of communication diminishes towards the outside, and communication ends as soon as the MDS is outside the area. This means that the communication time may be a multiple of the original value in extreme cases.

In the direction of radiation from the SLG antenna the communication area is limited by the range limit.

In applications outside the inner area, an appropriate test should be performed in order to ensure that the quality of communication is still adequate and that the communication time remains within the required bounds.

The size of the field can be changed by setting the range limit from 0.5 m to 3.5 m in increments of 0.5 m. The range limit set is subject to a tolerance of ±0.2 m to ±0.3 m. The increments are represented by dotted radii.
To obtain the largest field diameter with a working distance S_a of 2.5 m, for example, the limit distance S_g must be ≥ 3 m. That means that the range limit must be set to 3.5 m. With a tolerance of ±0.3 m the SLG can then take up communication within the field at a distance of between 3.2 m and 3.8 m to the MDS.
At a working distance S_a of 2.5 m the field diameter is 3.0 m = transmission window L.

Transmission window with angled arrangement

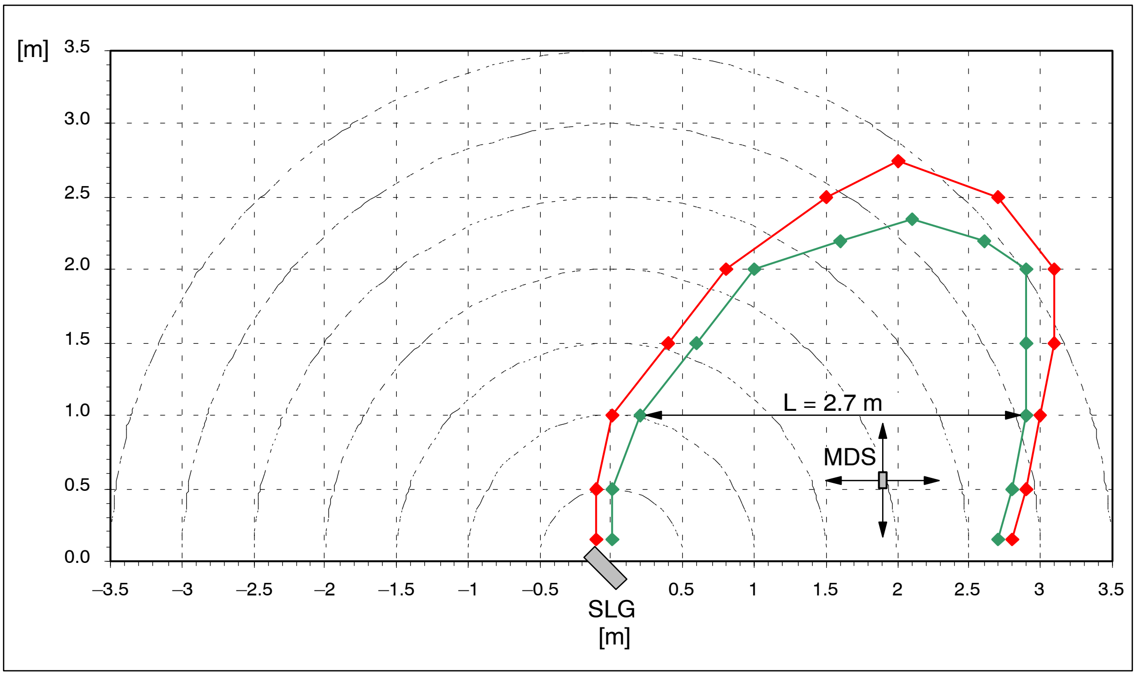


Figure 3-23 Transmission window: SLG at an angle of 45 ° to MDS

Refer to the explanations above for the significance of the different areas.

If the SLG and MDS are set up in a mirror-image arrangement, the transmission window is displaced in a mirror image accordingly.

Transmission window with perpendicular arrangement

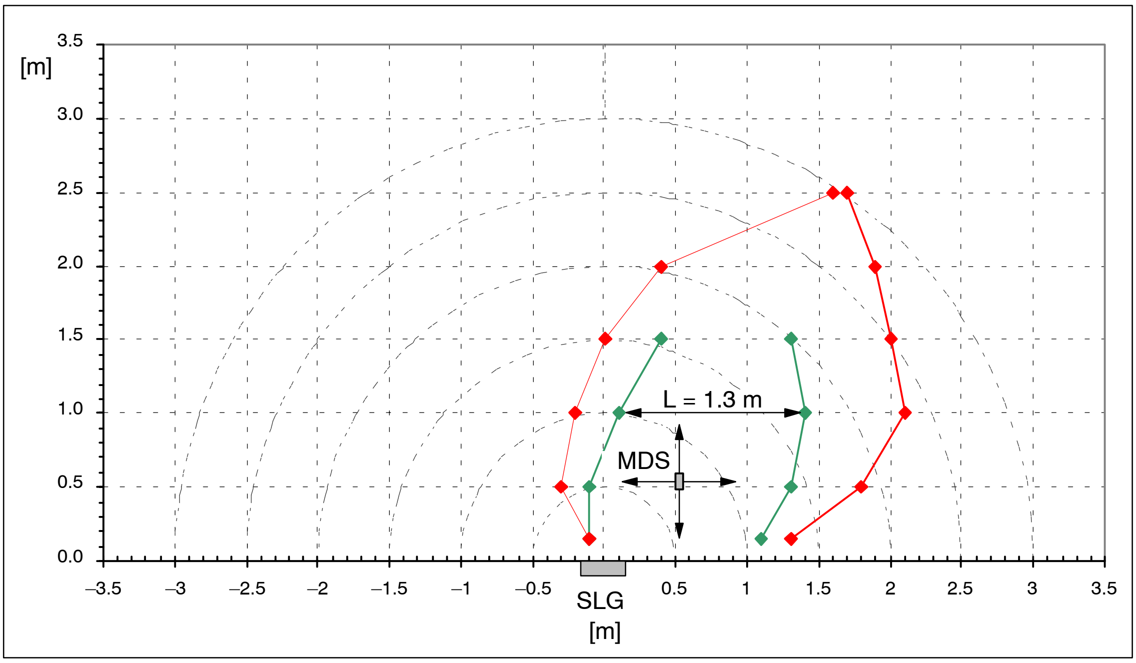


Figure 3-24 Transmission window: SLG and MDS perpendicular to each other

Refer to the explanations above for the significance of the different areas.

If the MDS is positioned the other way around (opposite direction of beam from the MDS antenna), the transmission window is displaced in a mirror image accordingly.

The transmission window in Figure 3-24 shows that communication is only possible in a very restricted area. Communication is only possible at all due to the fact that the transmission fields are conical. For this reason a test is required if applications of this type or similar are planned.

3.3.2 The effect of metal on the transmission window

Metal has various effects the transmission window depending on the arrangement or environment: from no noticeable effect to complete prevention of communication. The category of metal also includes metallized materials, for example those that are coated with metal or are interwoven with metal to the extent that they let through sufficient RF radiation or none at all.

The following should be taken into account when considering the effect of metal on the transmission window:

- MDS and SLG mounted directly on metal
- SLG and MDS mounted flush on metal (see MDS and SLG data sheets)
- SLG and MDS sunk into metal (see MDS and SLG data sheets)
- SLG and MDS in metal frames or supports (see MDS and SLG data sheets)
- Metal objects in the near field of the SLG and MDS antennas
- Metal objects in the wider field of the SLG and MDS

Mounted on metal

The MDS and SLG can be mounted directly on metal. This does not cause any noticeable changes to the field.

Mounted flush on metal

The MDS and SLG can be mounted flush on metal. The field geometry of the MDS is not changed significantly (see also the MDS data sheets). The field geometry of the SLG is slightly reduced (see also the SLG data sheets).

Sunk into metal

If the MDS and SLG are mounted sunk into metal, a metal-free space is required (see the MDS and SLG data sheets).

In metal frames or supports

If the MDS and SLG are mounted in metal frames or supports such as U or T supports, it depends on the position whether the field geometry is significantly changed. The measures suggested for sinking the devices into metal can also be recommended here (see MDS and SLG data sheets).

Metallic objects in the near field

Please note that because the antenna is integrated on the upper side of the MDS and there are two antennas in the SLG, they can be affected by all the metallic objects in the near field of the antenna. The near field of the antenna is a half space above the antenna with a radius of approximately 50 mm. There must not be any metallic objects in this area. If there are metallic objects in the near field, you should expect a changed antenna field. This can result in the field being completely shielded.

Metallic objects in the wider field

If there are metallic or metal-plated objects in the wider field, depending on their size and spacing they change the antenna field and cause fluctuations in the field strength. By means of system measures in the SLG this effect can be reduced as far as possible because fluctuations in field strength can be compensated for.
Since metallic surfaces reflect the waves, they can also be used for shielding or even deflection. Particularly in typical production environments, the wealth of metallic objects ensures a relatively uniform dispersion of the transmission waves.

3.3.3 The effect of non-metallic materials/objects on the transmission window

Non-metallic objects can also affect the transmission window, depending on their arrangement or the environment, if they are located in the near field of the antenna(s) or in the wider field of the SLG and MDS.

The following are examples of this: water, materials containing or soaked in water, ice, carbon; plastic materials suitable for RF welding, etc.

Non-metallic objects in the near field

Please note that, because the antenna is integrated on the upper side of the MDS and there are two antennas on the SLG, all non-metallic materials in the near field of the antenna that absorb RF radiation affect the antenna. The near field of the antenna is a half space above the antenna with a radius of approximately 50 mm. There must be no non-metallic objects in this zone that absorb RF radiation. If there are, you should expect a changed antenna field. This can lead to the elimination of the field.

Non-metallic materials in the wider field

If there are non-metallic objects in the wider field that absorb RF radiation, depending on their size and spacing they can change the antenna field and lead to the elimination of the field.

Note

RF radiation does not go through human tissue. It is therefore important that there should be nobody directly between the SLG and the MDS when communication is established or during communication.
If there is somebody there when communication is established, the MDS is **not** detected and no communication takes place.
If somebody moves between the SLG and the MDS during communication, communication is terminated with error 06 hex. This error number indicates that the MDS has exited the field during communication or communication has been aborted due to a problem.

3.3.4 Interference and users in the 2.45 GHz range

The selection of the 2.45 GHz frequency band means that there are no industrial contaminating fields.

The functionality of MOBY U possesses a high level of immunity to other systems:

- Narrow-band systems such as SRIF (Serial Radio Interface)
- Direct sequence systems such as WLAN (Wireless Local Area Network)
- Frequency hopping systems such as Bluetooth
- Telephones such as GSM (Groupe Speciale Mobile) and DECT (Digital Enhanced Cordless Telecommunication)

Due to its very low transmitting power of < 10 mW EIRP and automatic selection of free and interference-free frequency channels, MOBY U itself does not cause interference to other users of the 2.45 GHz frequency band. In the case of the SLG U92 with FCC (see Table 5-1), the transmitting power is < 50 mV/m at a distance of 3 m.

MOBY U and the following common radio components do not affect each other provided the specified minimum distances are maintained.

- SRIF at a distance of ≥ 1 m
- WLAN at a distance of ≥ 3 m
- Bluetooth[1] at a distance of ≥ 3 m
- GSM telephone at a distance of ≥ 1 m
- DECT telephone at a distance of ≥ 1 m

Two or more SLG U92 units arranged next to each other or whose antenna fields overlap are potential sources of mutual interference. Communication is ensured by the automatic selection of free and interference-free frequency channels (in other words, frequency channels that are not used by the other SLG).

1 Class 1 device with an output power of 20 dBm/100 MW

3.3.5 Chemical resistance of the mobile data storage units

Polyamide

Table 3-7 provides an overview of the chemical resistance of the **MDS U313** and **MDS U524** data storage units made of polyamide 12. One aspect that should be emphasized is the very good resistance of the plastic housing to chemicals in the automotive sector (e.g.: oils, greases, diesel fuel, gasoline, ...), which are not listed separately.

Table 3-7 Chemical resistance of the data storage units made of polyamide 12

	Concentration	**20 °C**	**60 °C**
Battery acid	30	●	□
Ammonia, gaseous		■	■
Ammonia, a.	Conc.	■	■
	10	■	■
Benzole		■	▲
Bleaching liquor (12.5% effective chlorine)		●	□
Butane, gaseous, liquid		■	■
Butyl acetate		■	■
Butan-1-ol		■	▲
Calcium chloride, a.		■	▲
Calcium nitrate, a.	c.s.	■	▲
Chlorine		□	□
Chrome baths, techn.		□	□
Ferric salts, a.	c.s.	■	■
Acetic acid, a.	50	□	□
Ethyl alcohol, a., not denaturized	96	■	▲
	50	■	■
Formaldehyde, a.	30	▲	□
	10	■	▲
FORMALIN		▲	□
Glycerol		■	■
Isopropanol		■	▲
Potash lye, a.	50	■	■
LYSOL		●	□
Magnesium salts, a.	c.s.	■	■
Methyl alcohol, a.	50	■	■
Lactic acid, a.	50	●	□
	10	▲	●

Table 3-7 Chemical resistance of the data storage units made of polyamide 12

	Concentration	20 °C	60 °C
Sodium carbonate, a. (soda)	c.s.	■	■
Sodium chloride, a.	c.s.	■	■
Sodium hydroxide		■	■
Blue salts, a.	c.s.	■	■
Nitrobenzene		▲	●
Phosphoric acid	10	○	□
Propane		■	■
Mercury		■	■
Nitric acid	10	○	□
Hydrochloric acid	10	○	□
Sulfur dioxide	Low	■	■
Sulfuric acid	25	●	□
	10	▲	□
Hydrogen sulfide	Low	■	■
Carbon tetrachloride		■	■
Toluene		■	▲
Detergent	High	■	■
Softener		■	■

Legend:

■	Resistant
▲	Practically resistant
●	Resistant with qualifications
○	Low resistance
□	No resistance
a.	Aqueous solution
c.s.	Cold-saturated

Polyphenylene sulfide (PPS)

The housing of the heat-resistant **MDS U589** data storage unit consists of polyphenylene sulfide (PPS). The chemical resistance of the data storage unit is excellent. We know of no solvent that will dissolve the plastic under 200°C. A reduction in the mechanical properties is observed in aqueous solutions of hydrochloric acid (HCl) and nitric acid (HNO3) at 80 °C.

Resistance to all types of fuel, including methanol, is very good and worth emphasizing. The following table provides an overview of the chemicals examined.

Table 3-8 Chemical resistance of the MDS U589, which is made of polyphenylene sulfide

Substance	Test conditions		Evaluation
	Time [days]	Temperature [°C]	
Acetone	180	55	+
Butan-1-ol	180	80	+
Butan-2-one	180	60	+
Butyl acetate	180	80	+
Brake fluid	40	80	+
Calcium chloride (saturated)	40	80	+
Diesel fuel	180	80	+
Diethyl ether	40	23	+
Freon 113	40	23	+
Antifreezing agent	180	120	+
Kerosene	40	60	+
Methanol	180	60	+
Engine oil	40	80	+
Sodium chloride (saturated)	40	80	+
Sodium hydroxide (30%)	180	80	+
Sodium hypochlorite (5%)	30	80	/
	180	80	–
Sodium hydroxide solution (30%)	40	93	+
Nitric acid (10%)	40	23	+
Hydrochloric acid (10%)	40	80	–
Sulfuric acid (10%)	40	23	+
(10%)	40	80	/
(30%)	40	23	+
Test fuels:	40	80	+
(FAM-DIN 51 604-A)	180	80	/
Toluene			
1, 1, 1-trichloroethane	180	80	+
Xylene			
Zinc chloride (saturated)	180	80	/
	180	75	+
	180	80	+
	40	80	+

Evaluation:
+ Resistant, weight increase < 3 % or weight loss < 0.5 % and/or reduction in tear resistance < 15 %
/ Resistant with qualifications, weight increase 3 to 8 % or weight loss 0.5 to 3 % and/or reduction in tear resistance of 15 to 30 %
– Non-resistant, weight increase > 8 % or weight loss > 3 % and/or reduction in tear resistance > 30 %

3.4 EMC Guidelines

3.4.1 Preface

These EMC guidelines give you information on the following topics.

- Why are EMC guidelines necessary?
- What outside interference affects the controller?
- How can this interference be prevented?
- How can this interference be corrected?
- Which standards apply to EMC?
- Examples of interference-immune plant setup

This description is only meant for ”qualified personnel”:

- Project engineers and planners who are responsible for the plant configuration with the MOBY modules and have to adhere to the applicable guidelines
- Technicians and service engineers who have to install the connection cables based on this description or correct malfunctions covered by these guidelines

Warning

Non-adherence to the highlighted information may cause hazardous states in the plant. Individual components or the entire plant may be destroyed as a result.

3.4.2 General

Increasing use of electrical and electronic devices creates the following situation.

- Increasing density of the components
- Increasing power electronics
- Increasing switching speeds
- Lower power consumption of the components

The more automation, the greater the danger of the devices interfering with each other.
Electromagnetic compatibility (EMC) means the ability of an electrical or electronic device to function correctly in an electromagnetic environment without bothering its surroundings up to a certain degree.

EMC can be divided into three areas.

- Intrinsic interference immunity:
  Immunity against internal (i.e., own) electrical interference
- Free interference immunity:
  Immunity against outside electromagnetic interference
- Degree of interference emission:
  Interference emission and influence of the electrical environment

All three areas must be considered when checking an electrical device.

The MOBY modules are checked for adherence to certain limit values. Since the MOBY modules are only part of a total system and sources of interference can be created just by combining different components, the setup of a plant must adhere to certain guidelines.

EMC measures usually comprise a whole package of measures which must all be taken to obtain an interference-immune plant.

Note

- The constructor of the plant is responsible for adherence to the EMC guidelines whereas the operator of the plant is responsible for radio interference suppression for the entire system.
- All measures taken while the plant is being set up prevent expensive modifications and removal of interference later on.
- Naturally, the country-specific rules and regulations must be adhered to. They are not part of this documentation.

3.4.3 Spreading of Interference

The following three components must be present before interference can occur in a plant.

- Source of interference
- Coupling path
- Potentially susceptible equipment

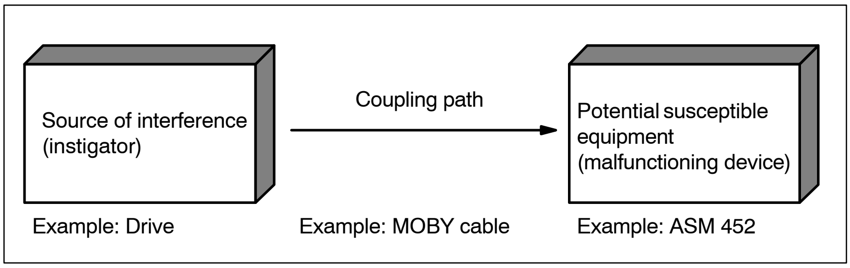


Figure 3-25 Spreading of Interference

If one of these components is missing (e.g., the coupling path between interference source and potentially susceptible equipment), the susceptible device is not affected even when the source is emitting strong interference.

EMC measures affect all three components to prevent malfunctions caused by interference. When setting up a plant, the constructor must take all possible precautions to prevent the creation of interference.

- Only devices which meet limit value class A of VDE 0871 may be used in a plant.
- All interference-producing devices must be corrected. This includes all coils and windings.
- The cabinet must be designed to prevent mutual interference of the individual components or keep this as low as possible.
- Precautions must be taken to eliminate external interference.

The next few sections give you tips and hints on good plant setup.

Sources of interference

To obtain a high degree of electromagnetic compatibility and thus a plant with low interference, you must know the most frequent sources of interference. These sources of interference must then be removed.

Table 3-9 Sources of interference: origin and effect

Interference Source	Interference Generator	Effect on Susceptible Equipment
Contactor, electronic valves	Contacts	Network interference
	Coils	Magnetic field
Electric motor	Collector	Electrical field
	Winding	Magnetic field
Electric welding device	Contacts	Electrical field
	Transformer	Magnetic field, network interference, equalizing current
Power pack, pulsed	Circuit	Electrical and magnetic field, network interference
High-frequency devices	Circuit	Electromagnetic field
Transmitter (e.g., plant radio)	Antenna	Electromagnetic field
Grounding or reference potential difference	Voltage difference	Equalizing current
Operator	Static charging	Electrical discharge current, electrical field
High-voltage cable	Current flow	Electrical and magnetic field, network interference
High-voltage cable	Voltage difference	Electrical field

Coupling paths

Before a source of interference can create actual interference, a coupling path is needed. There are four types of interference coupling.

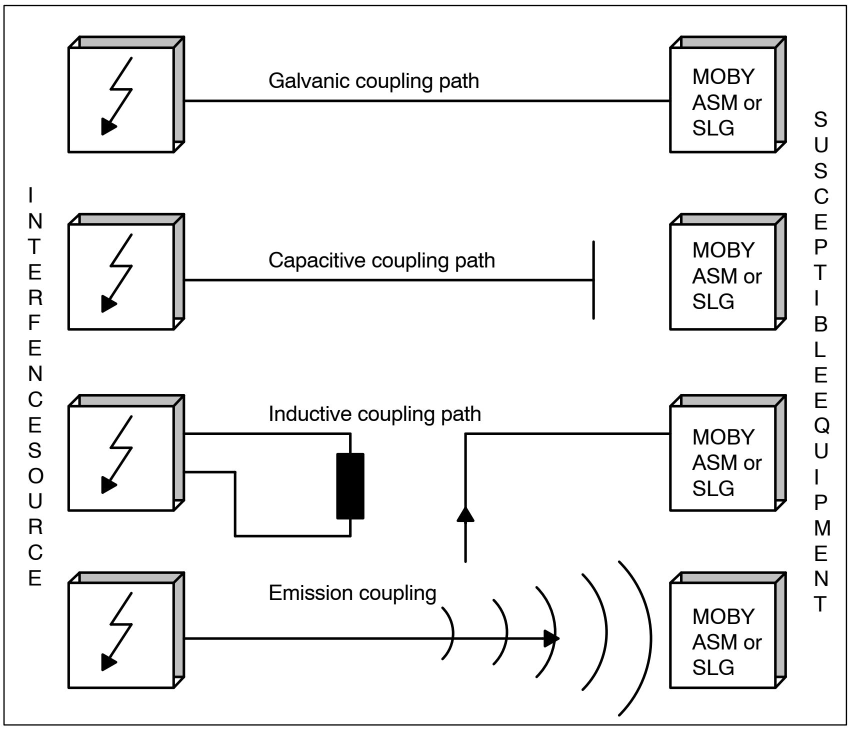


Figure 3-26 Possible interference coupling

When MOBY modules are used, various components of the total system can act as coupling paths.

Table 3-10 Causes of coupling paths

Coupling path	Caused by
Cables and lines	Wrong or poor installation
	Shield missing or connected incorrectly
	Poor location of the cables
Switching cabinet or SIMATIC housing	Equalizing line missing or incorrectly wired
	Grounding missing or faulty
	Unsuitable location
	Mounted modules not secure
	Poor cabinet layout

3.4.4 Cabinet Layout

User responsibility for the configuration of an interference-immune plant covers cabinet layout, cable installation, grounding connections and correct shielding of the cables.

Note

Information on EMC-proof cabinet layout can be taken from the setup guidelines of the SIMATIC controller.

Shielding by housing

Magnetic and electrical fields as well as electromagnetic waves can be kept away from susceptible equipment by providing a metallic housing. The better induced interference current is able to flow, the weaker the interference field becomes. For this reason all housing plates or plates in the cabinet must be connected with each other and good conductivity ensured.

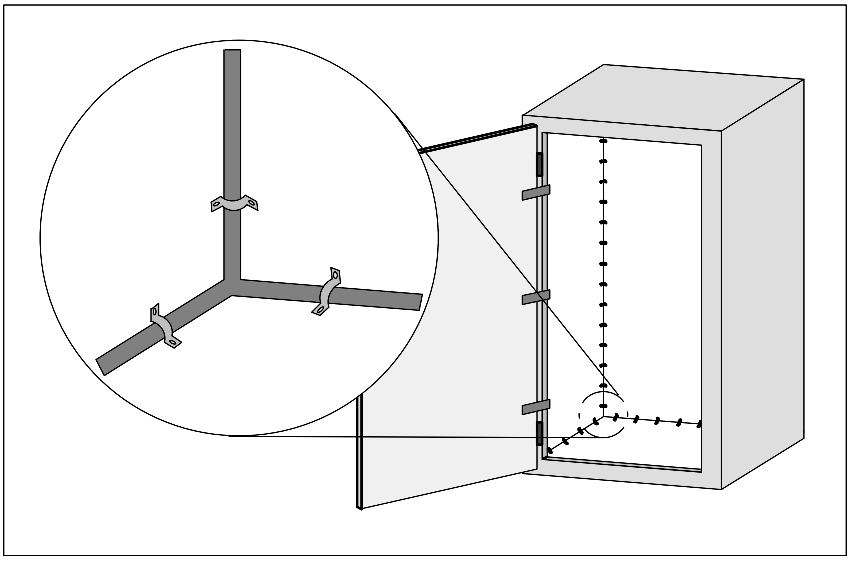


Figure 3-27 Shielding by the housing

When the plates of the switching cabinet are insulated against each other, this may create a high-frequency-conducting connection with ribbon cables and high-frequency terminals or RF conductive paste. The larger the connection surface, the better the high-frequency conductivity. Connection of simple wires cannot handle this task.

Avoidance of interference with optimized layout

Installation of SIMATIC controllers on conductive mounting plates (not painted) is a good way to get rid of interference. Adhering to the guidelines when laying out the switching cabinet is a simple way to avoid interference. Power components (transformers, drives, load power packs) should not be located in the same room with controller components (relay control parts, SIMATIC).

The following principles apply.

1. The effects of interference decrease the greater the distance between source of interference and susceptible equipment.
2. Interference can be decreased even more by installing shielding plates.
3. Power lines and high-voltage cables must be installed separately at least 10 cm away from signal lines.

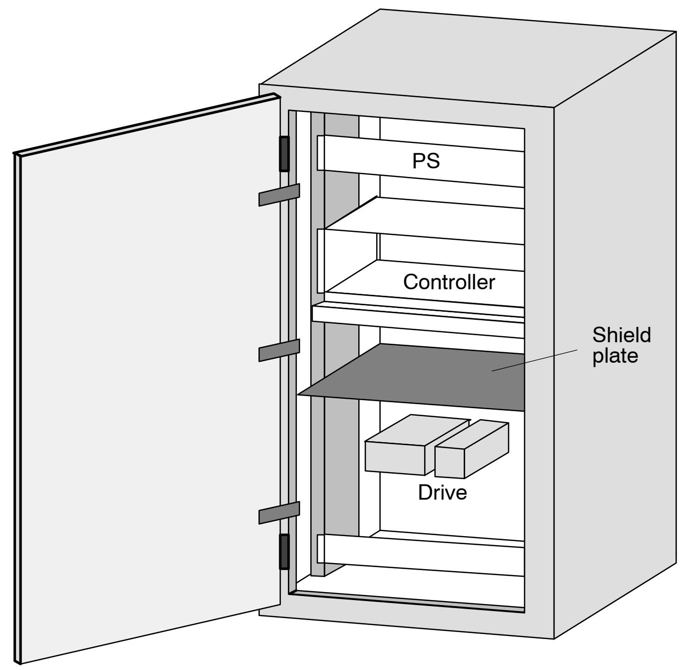


Figure 3-28 Avoidance of interference with optimal layout

Filtering the voltage

Power filters can be used to combat external interference over the power network. In addition to correct dimensioning, proper installation is very important. It is essential that the power filter be mounted directly on the cabinet leadin. This keeps interference current from entering the cabinet by filtering it out from the beginning.

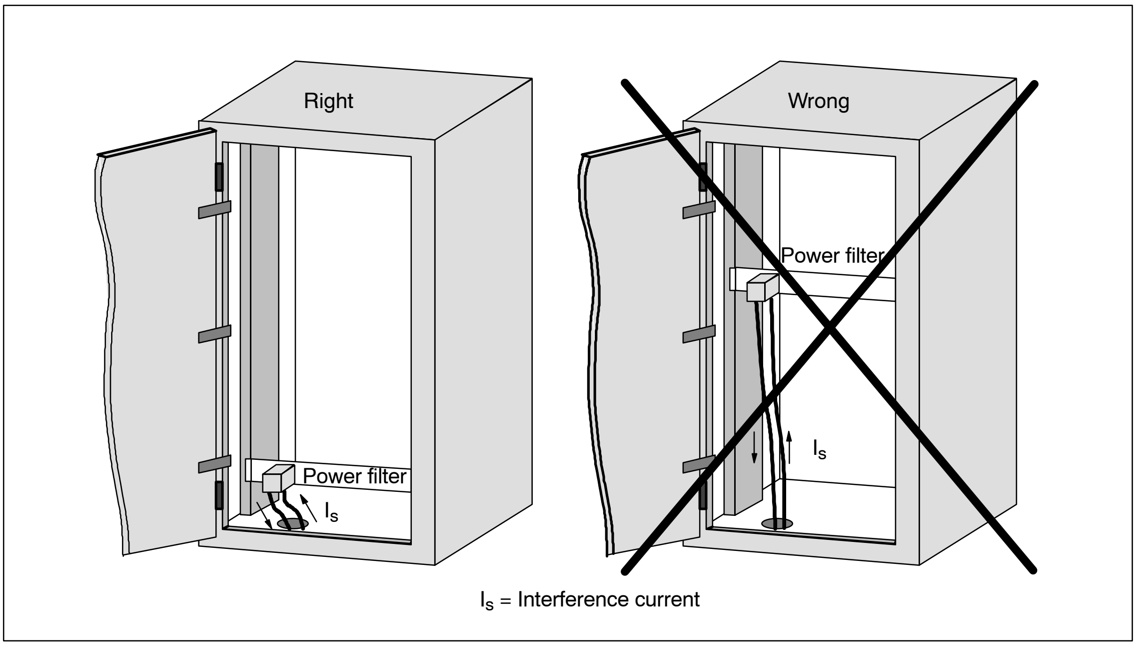


Figure 3-29 Filtering the voltage

3.4.5 Avoiding Sources of Interference

Inclusion of interference sources in a plant must be avoided to achieve a higher degree of interference immunity. All switched inductivity is frequently a source of interference in plants.

Suppression of inductivity

Relays, contactors, etc. generate interference voltages which must be suppressed with one of the following circuits.

24 V coils create up to 800 V even with small relays and 220 V coils generate interference voltages of several kV when the coil is switched. Free wheeling diodes or RC circuits can be used to prevent interference voltage and thus also inductivity in lines which must be installed parallel to the coil line.

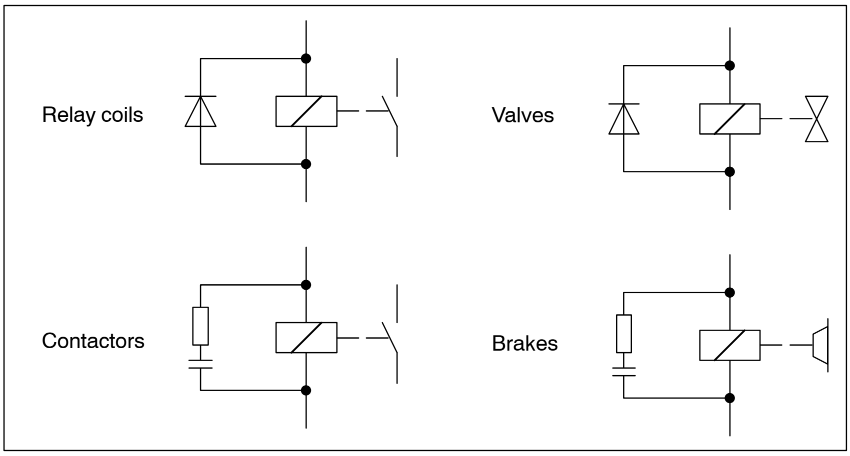


Figure 3-30 Suppression of inductivity

Note

All coils in the cabinet must be interference-suppressed. Don't forget the valves and motor brakes. A special check must be made for neon lamps in the switching cabinet.

3.4.6 Equipotential Bonding

Differences in potential may be created between the parts of the plant by differing layout of plant parts and differing voltage levels. When the parts of the plant are connected with signal lines, equalizing currents flow over the signal lines. These equalizing currents may distort the signals.

This makes it very important to provide correct equipotential bonding.

- The cross section of the equipotential bonding line must be large enough (at least 10 mm^2).
- The distance between signal cable and equipotential bonding line must be as short as possible (effects of antenna).
- A fine-wire line must be used (better high-frequency conductivity).
- When the equipotential bonding lines are connected to the central equipotential bonding rail, power components and non-power components must be combined.

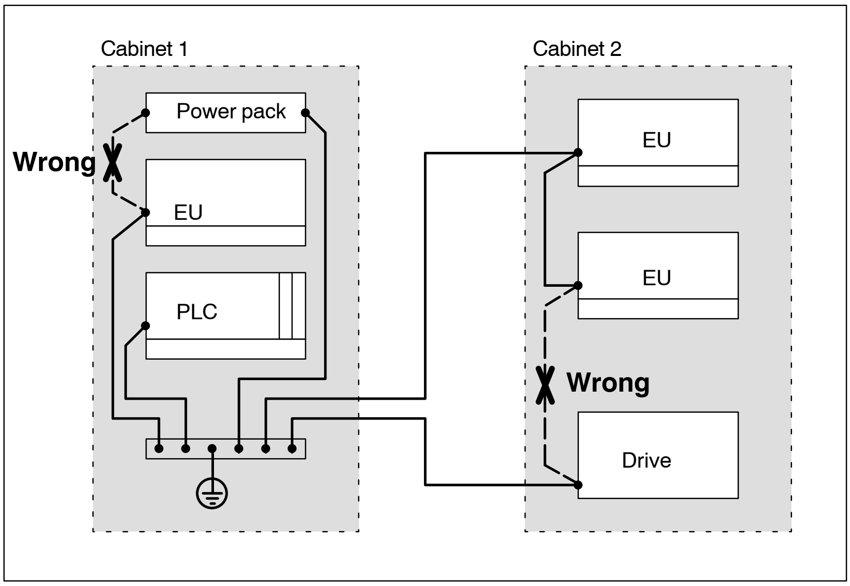


Figure 3-31 Equipotential bonding

The better the equipotential bonding in a plant, the less interference is created by potential fluctuations.

Don’t confuse equipotential bonding with the protective ground of a plant. Protective ground prevents the creation of high touch voltages on defective devices.

3.4.7 Shielding the Cables

To suppress interference coupling in the signal cables, these cables must be shielded.

The best shielding is achieved by installation in steel tubing. However, this is only required when the signal line has to be led through high interference. Use of cables with braided shields is usually sufficient. In both cases, correct connection is decisive for shielding.

Note

A shield which is not connected or is not connected correctly is not a shield.

The following principles apply.

- With analog signals, the shield is connected on one side to the receiver side.
- With digital signals, the shield is applied on both sides to the housing.
- Since interference signals are frequently in the RF range (> 10 kHz), a large-surface shield which meets RF requirements is needed.

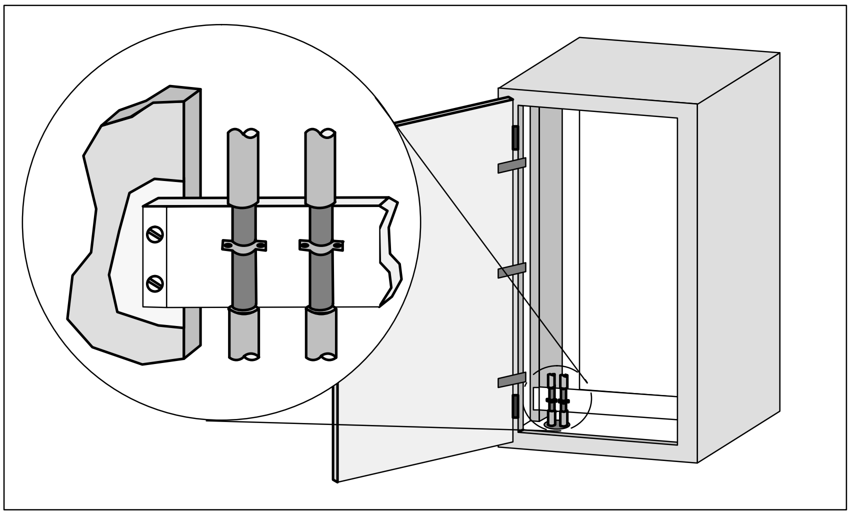


Figure 3-32 Shielding the cables

The shield bar must be connected (over a large surface for good conductivity) to the switching cabinet housing. It must be located as close as possible to the cable leadin. The cables are bared and then clamped to the shield bar (high-frequency clamps) or bound with cable binders. Make sure that the connection is very conductive.

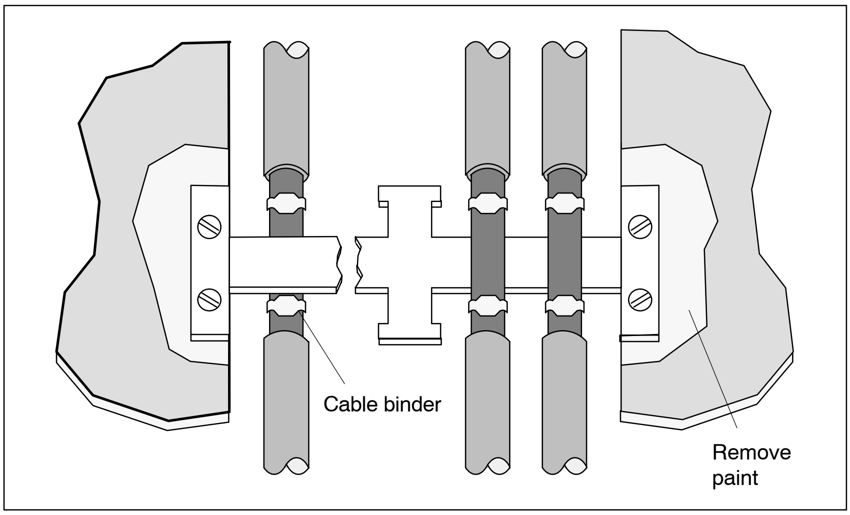


Figure 3-33 Connecting the shield bar

The shield bar must be connected with the PE bar.

If shielded cables have to be interrupted, the shield must be continued on the plug case. Only suitable plug connectors may be used.

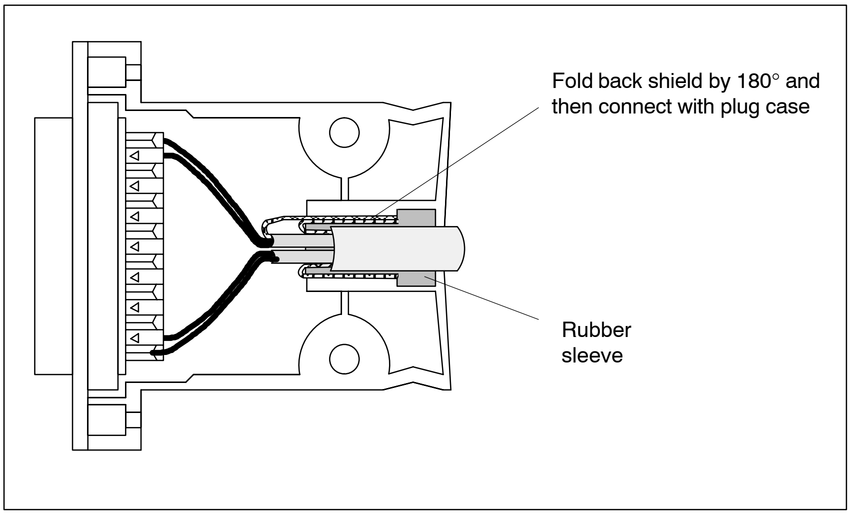


Figure 3-34 Interruption of shielded cables

If intermediate plug connectors which have no shield connection are used, the shield must be continued with cable clamps at the point of interruption. This gives you a large-surface, RF conductive connection.

3.4.8 Basic EMC Rules

Often the adherence to a few elementary rules is sufficient to ensure electromagnetic compatibility (EMC). The following rules should be observed when setting up the switching cabinet.

Shielding by the housing

- Protect the programmable controller from external interference by installing it in a cabinet or housing. The cabinet or housing must be included in the grounding concept.
- Shield the programmable controller from electromagnetic fields of inductivity by using divider plates.
- Use metallic plug connector cases for shielded data transmission lines.

Surface-shaped grounding connection

- Connect all inactive metallic parts over a large surface with low ohmic RF.
- Make a large-surface connection between the inactive metallic parts and the central grounding point.
- Don’t forget to include the shield bar in the grounding concept. This means that the shield bar itself must be connected over a large surface with ground.
- Do not use aluminum parts for grounding connections.

Planning the cable installation

- Divide the cables into groups and install the groups separately.
- Always install high-voltage cables and signal lines in separate ducts or bundles.
- Always have the entire cabling enter the cabinet on only one side and at only one level.
- Install the signal lines as close as possible to grounding surfaces.
- Twist the ”to” and ”from” conductors of individual cables in pairs.

Shielding the cables

- Shield the data transmission cables and apply the shield on both sides.
- Shield the analog cables and apply the shield on one side (e.g., on the drive).
- Always apply the cable shields over a large surface on the cabinet leadin on the shield bar and affix these with clamps.
- Continue the applied shield without interruption up to the module.
- Use braided shields and not foil shields.

Power and signal filters

- Use only power filters with metal housing.
- Connect the filter housing (over a large surface and with low ohmic RF) to cabinet ground.
- Never secure the filter housing on painted surfaces.
- Secure the filter on the cabinet's entry point or in the direction of the source of interference.

3.5 MOBY Shielding Concept

With MOBY U, the data are transferred between interface module and SLG at a speed of 19200, 38400, 57600 or 115200 bps over an RS 422 interface. The transmission rate cannot be set on the SLG. It is determined by the interface module (ASM), obtained automatically by the SLG after the voltage is applied, and accepted on completion of successful communication. If the transmission rate is changed, the voltage of the SLG must be switched off and then on again. The distance between ASM and SLG can be up to 1000 m. With respect to cabling, MOBY should be handled like a data processing system. Special attention should be paid to shield installation for all data cables. The following figures shows the primary factors needed for a reliable setup.

3.5.1 SLG Cable between ASM 475 and SLG U92 with RS 422

Layout of an S7-300 with MOBY

When the SLG U92 is connected to the ASM 475, it is essential to use a shield connection terminal for the cable shield. Shield connection terminals and holder brackets are standard components of the S7-300 product family.

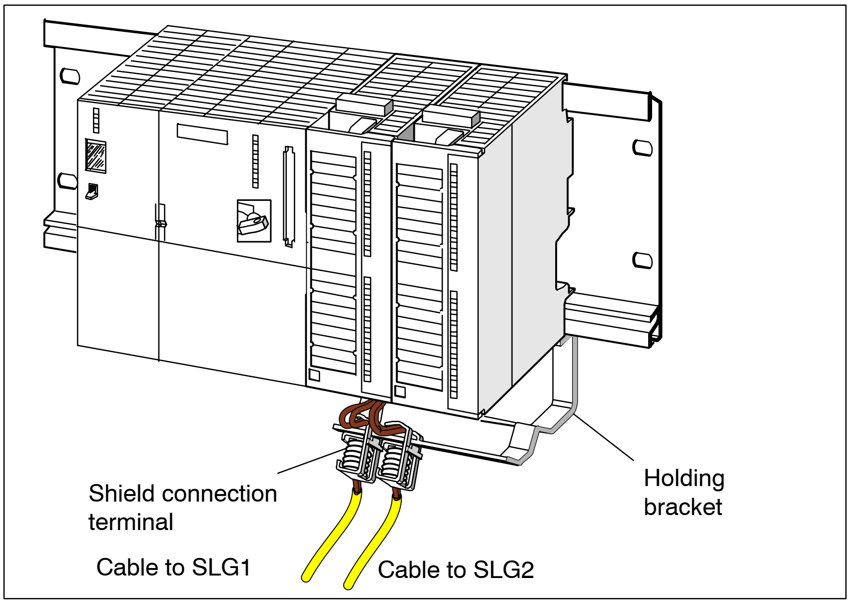


Figure 3-35 Layout of the ASM 475 with shield connecting element

3.6 SLG Cable and Plug Connector Allocations (RS 422)

The jacket used for MOBY SLG connection cables is made of polyurethane (PUR in acc. w. VDE 0250). This ensures very good cable resistance to oils, acids, caustic solutions, hydraulic fluids and high resistance to UV.

3.6.1 Cable Configuration

The cable between ASM and SLG has six cores plus shield. Four of these cores are allocated to the serial data interface. The power supply of the SLG requires two cores. Regardless of the wire diameter, data can usually be transmitted up to a distance of 1000 m.

Because of the power consumption of the SLG, voltage drops on the connection cable. The permitted cable length is therefore usually shorter than 1000 m. It depends on the current consumption of the SLG and the ohmic resistance of the connection cable. The following table provides an overview of the permissible cable lengths:

Table 3-11 Cable configuration

Conductor Cross Section in mm^2	Conductor Cross Section in mm	Resistance Ω/km[1]	SLG U92 with RS 422 (I = 300 mA) Max. Cable Length in m for	
			U_V=24V	U_V=30V
0.07[2]	0.3[2]	550	30	70
0,2	0,5	185	85	210
0,5	0,8	70	230	570
0.8[2]	1.0[2]	50	320	800
1.5[2]	1.4[2]	24	660	1000

1 The resistance values are average values. They refer to the ”to” and ”from” conductors. A single wire has half the specified resistance.
2 When these conductor cross sections are used, crimp contacts must be used in the SLG connection plug. These crimp contacts are not included with the connection plugs.

Field with gray background:
Recommended by SIEMENS; standard cable LiYC11Y 6 x 0.25, shielded. The cable is available from SIEMENS under the order number ”6GT2 090-0A...”.

Grounding of the SLG cable

We recommend always grounding the shield of the SLG cable over a large surface to the grounding rail.

Drum cable

The SLG can also be connected by means of a drum cable.
Recommended cable type: HPM Paartronic 3340-C-PUR 3 × 2 × 0.25

The cable can be prepared by the customer.

Extra power pack for SLG

When an extra power pack is installed in the vicinity of the SLG, you can always use the maximum cable length of 1000 m between ASM and SLG.

Note

The 24 V power supply (pin 2 on the SLG connector) may <u>not</u> be connected to the ASM.

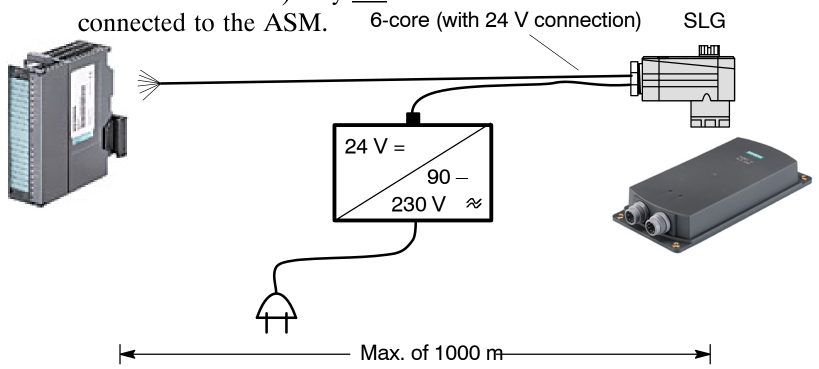


Figure 3-36 SLG with extra power pack

The power pack in our drawing can be obtained from Siemens under the number 6GT2 494-0AA00 (see Section 7.2).

The cable from the extra power pack to the SLG must be provided by the customer.

3.6.2 Plug Connector Allocations

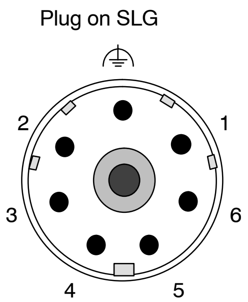


Table 3-12 Plug connector allocation of the SLG connector

Pin	Name
1	- Receive
2	+24 Volt
3	Ground (0 V)
4	+ Send
5	- Send
6	+ Receive
⏚	Cable shield

Caution

When the extra power pack is used in the vicinity of the SLG, do not wire the +24 V pin to the ASM. (Cf. table 3-12)

Installing the SLG plug connector

If the user has to turn the SLG plug of a prefabricated cable in a different direction, follow the diagram below and position the contact carrier differently.The plug connector on the SLG cannot be turned.

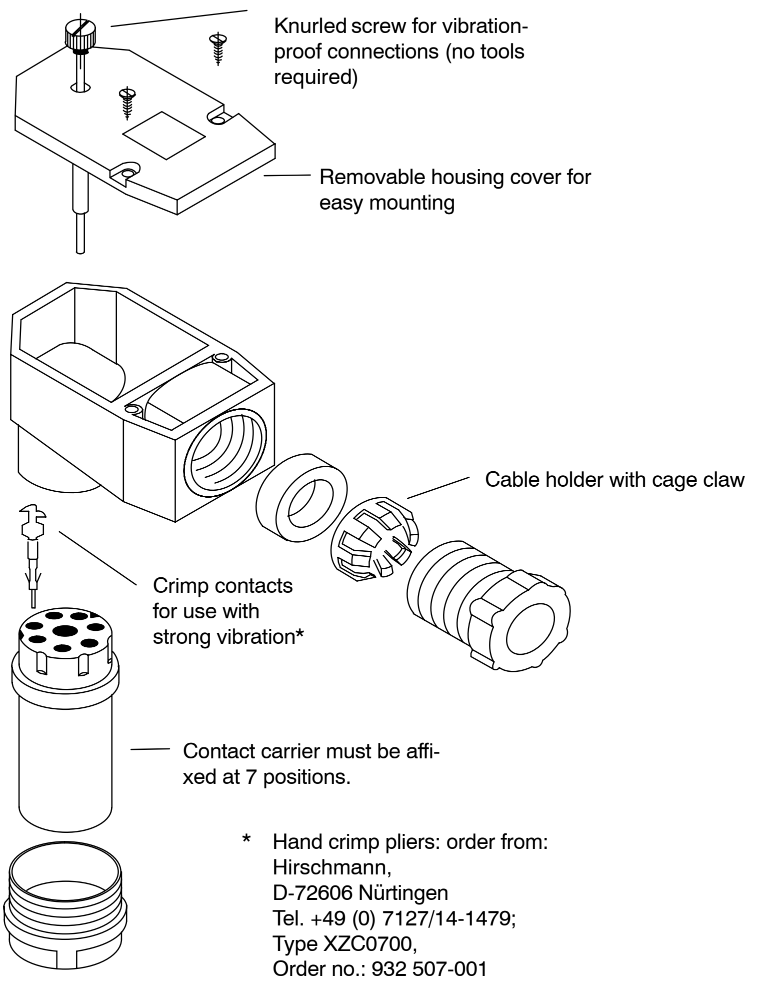


Figure 3-37 Drawing of how to mount the SLG plug connector

3.6.3 Connection cable

Connection cable ASM 452/473 ↔ SLG U92 with RS 422 6GT2 091-1C... or 6GT2 091-2C...

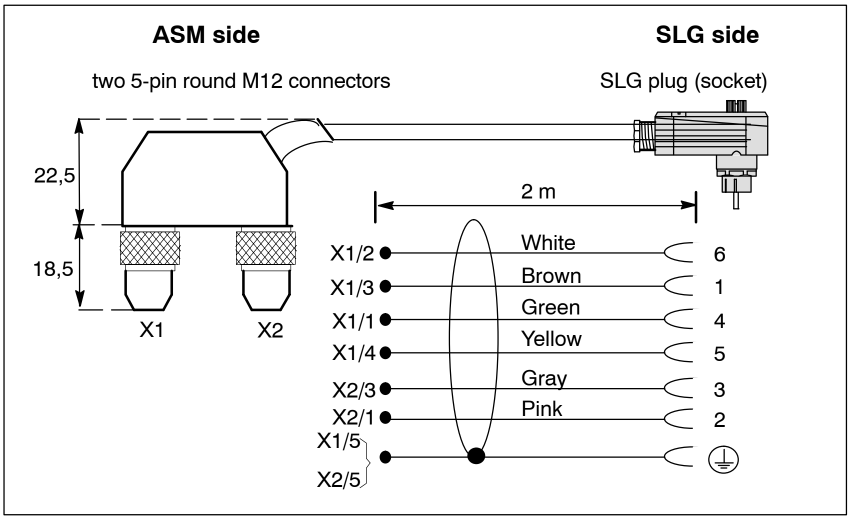


Figure 3-38 Connection cable ASM 452/473 ↔ SLG U92 with RS 422

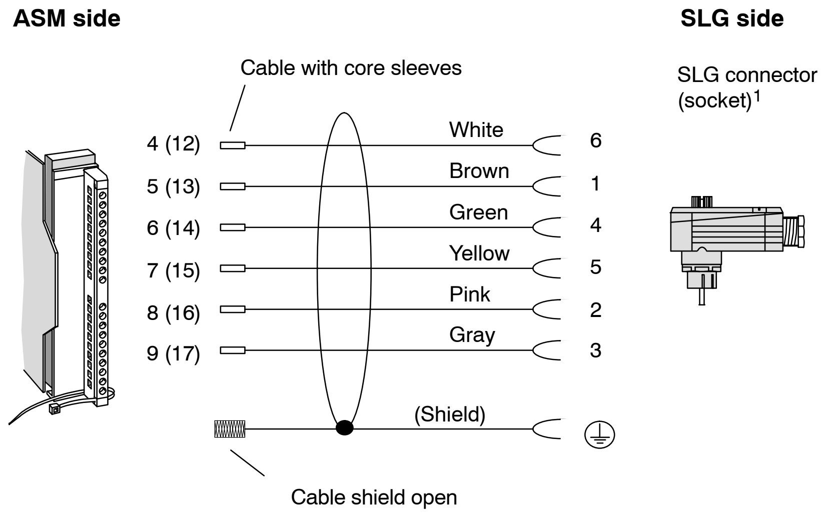
The connection cable can be ordered in the following lengths.

Table 3-13 Cable lengths ASM 452/473 ↔ SLG U92 with RS 422

Length of Stub Line in m	Order Number
2[1]	6GT2 091-1CH20
5	6GT2 091-1CH50
10	6GT2 091-1CN10
20	6GT2 091-1CN20
50	6GT2 091-1CN50
2[2]	6GT2 091-2CH20

1 Inexpensive standard length
2 With straight SLG plug

Connection cable ASM 475 ↔ SLG U92 with RS 422 6GT2 091-0E... or 6GT2 091-2E...



1 6GT2 091-0E... with angled SLG plug (standard)
6GT2 091-2E... with straight SLG plug (not shown)

Figure 3-39 Connection cable ASM 475 ↔ SLG U92 with RS 422

The connection cable can be ordered in the following lengths.

Table 3-14 Cable lengths of ASM 475 ↔ SLG U92 with RS 422

Length of Stub Line in m	Order Number
2	6GT2 091-0EH20
5	6GT2 091-0EH50
10	6GT2 091-0EN10
20	6GT2 091-0EN20
50	6GT2 091-0EN50
2[1]	6GT2 091-2EH20
5[1]	6GT2 091-2EH50
10[1]	6GT2 091-2EN10
50[1]	6GT2 091-2EN50

1 With straight SLG plug

Connection cable ASM 480 ↔ SLG U92 with RS 422 6GT2 091-0E...

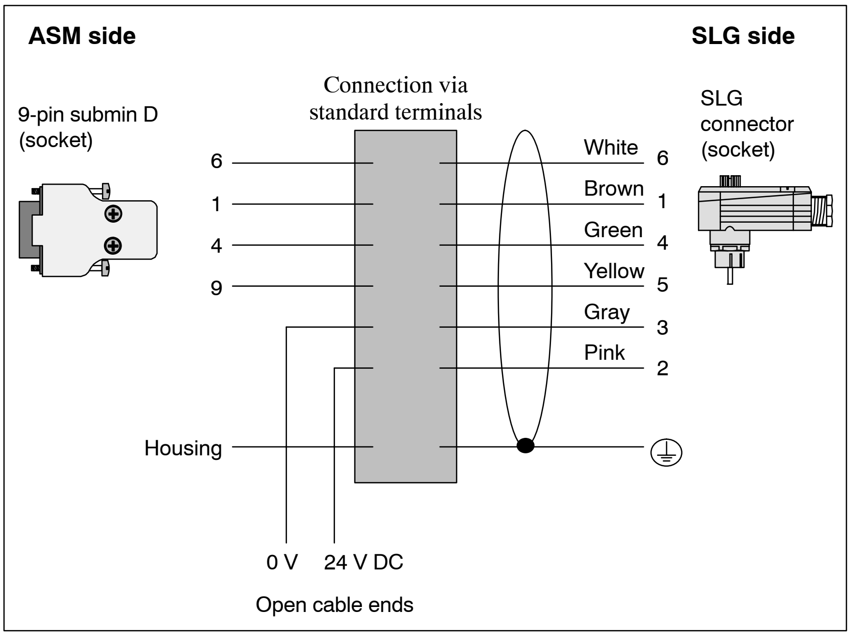


Figure 3-40 Connection cable ASM 480 ↔ SLG U92 with RS 422

The connection cable can be ordered in the following lengths.

Table 3-15 Cable lengths of ASM 480 ↔ SLG U92 with RS 422

Length of Stub Line in m	Order Number
2[1]	6GT2 091-0EH20
5	6GT2 091-0EH50
10	6GT2 091-0EN10
20	6GT2 091-0EN20
50	6GT2 091-0EN50
2[2]	6GT2 091-2EH20
5[2]	6GT2 091-2EH50
10[2]	6GT2 091-2EN10
50[2]	6GT2 091-2EN50

1 Inexpensive standard length
2 With straight SLG plug

The power supply to the SLG is provided via the two open cable ends (see Figure 3-40). The MOBY wide-range power pack is available as an accessory from Siemens under the number 6GT2 494-0AA00 (see Section 7.2).

3.7 SLG cable and connector pin assignments (RS 232) for serial connection to PC

With MOBY U, the data are transferred between PC and SLG at a speed of 19200, 38400, 57600 or 115200 bps over an RS 232 interface. The transmission rate cannot be set on the SLG. It is obtained automatically after the voltage is applied and accepted on completion of successful communication. If the transmission rate is changed, the voltage of the SLG must be switched off and then on again. The distance between PC and SLG can be up to 32 m.

The SLG cable is comprised of a stub line between PC and SLG and a connection line for the 24 V power supply of the SLG from a standard power pack (see Section 7.2).

- The connection line for the power supply has a fixed length of 5 m.
- The stub line between PC and SLG is available in two lengths (5 m and 20 m).

The connection cable for the power supply can be extended with a stub line (order number 6GT2 491-1HH50).

The jacket used for MOBY SLG connection cables is made of polyurethane (PUR in acc. w. VDE 0250). This ensures very good cable resistance to oils, acids, caustic solutions, hydraulic fluids and high resistance to UV.

3.7.1 Cable configuration

The RS 232 cable between PC and SLG has three cores plus shield. The cable for the power supply of the SLG requires two cores.

Grounding of the SLG cable

We recommend always grounding the shield of the SLG cable over a large surface to the grounding rail.

Drum cable

The SLG can also be connected by means of a drum cable.
Recommended cable type: HPM Paartronic 3340-C-PUR 3 × 2 × 0.25

The cable can be prepared by the customer.

Power pack for SLG U92

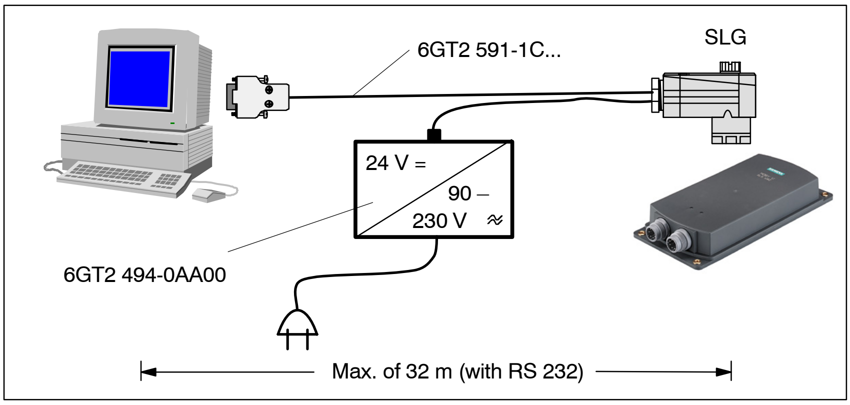


Figure 3-41 Wide-range power pack for SLG U92

The power pack in our drawing can be obtained from Siemens under the number 6GT2 494-0AA00 (see Section 7.2)

3.7.2 Plug Allocations

The pin assignment and assembly of the SLG is described in Section 3.6.2.

3.7.3 Connection Cables with Lengths

Connection cable for PC ↔ SLG U92 with RS 232 6GT2 591-1C...

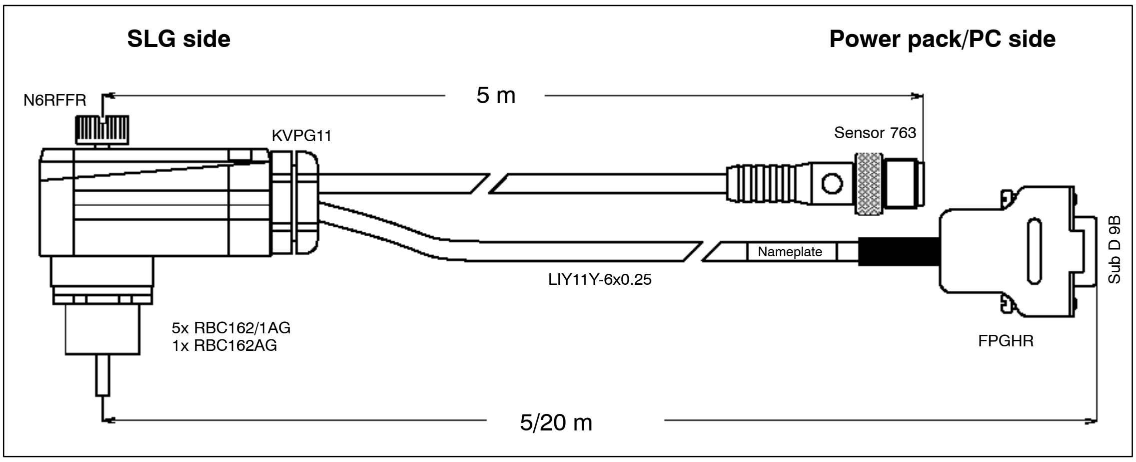


Figure 3-42 Connection cable for PC ↔ SLG U92

Table 3-16 Plug allocation of SLG plug and submin D plug

SLG (RS 232)	N6RFFR	Sensor 763 (pin)	LIYC11Y	Sub D 9B
GND	1		Green	5 (GND)
Vdc+ (power +)	2	2 (24 V DC) white		
Vdc– (power +)	3	1 (GND) brown		
TxD (send data)	4		White	2 (RxD)
n.c.	5			
RxD (receive data)	6		Brown	3 (TxD)
Shield	GND		Shield	Housing

The connection cable can be ordered in the following lengths.

Table 3-17 Cable lengths for PC ↔ SLG U92 with RS 232

Length of Stub Line in m	Order Number
5	6GT2 591-1CH50
20	6GT2 591-1CN20

Non prefabricated cables

Users who want to make their own cables can order the following components from the MOBY catalog.

Table 3-18 Components for individually fabricated cables

Component	Order Number
SLG connecting plug with socket contacts for crimping with a straight output	6GT2 090-0UA00
SLG connecting plug with socket contacts for crimping (angled)	6GT2 090-0BA00
SLG stub line; Type: 6 x 0.25 mm^2	6GT2 090-0AN50 (50 m) 6GT2 090-0AT12 (120 m) 6GT2 090-0AT80 (800 m)
M12 socket for extension of the 24 V cable	6GT2 390-1AB00

3.8 SLG cable and connector pin assignments (RS 232) for ASM 480

Connection cable ASM 480 ↔ SLG U92 with RS 232 6GT2 091-0EH..

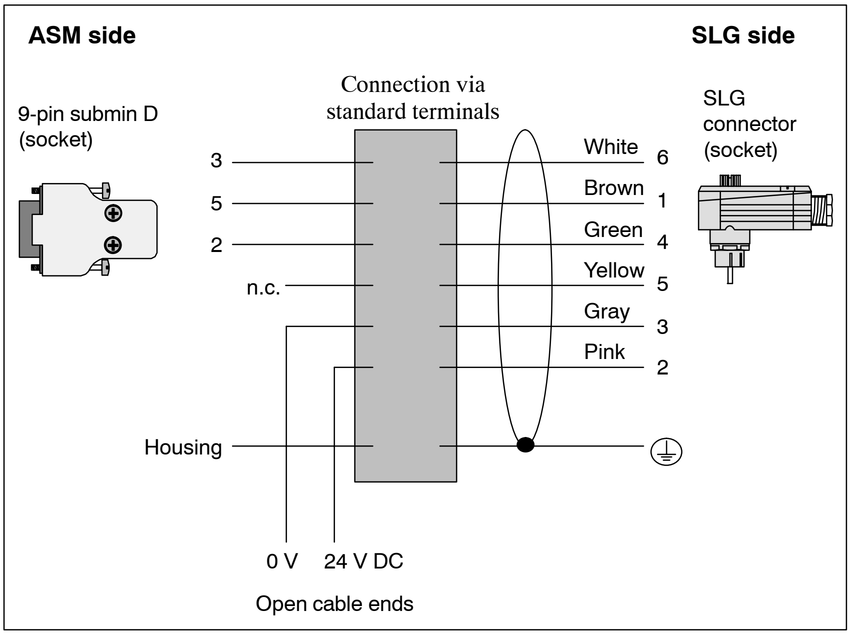


Figure 3-43 Connection cable ASM 480 ↔ SLG U92 with RS 232

The connection cable can be ordered in the following lengths.

Table 3-19 Cable lengths of ASM 480 ↔ SLG U92 with RS 232

Length of Stub Line in m	Order Number
2[1]	6GT2 091-0EH20
5	6GT2 091-0EH50
10	6GT2 091-0EN10
20	6GT2 091-0EN20
2[2]	6GT2 091-2EH20
5[2]	6GT2 091-2EH50
10[2]	6GT2 091-2EN10

1 Inexpensive standard length
2 With straight SLG plug

The power supply to the SLG is provided via the two open cable ends (see Figure 3-43). The MOBY wide-range power pack is available as an accessory from Siemens under the number 6GT2 494-0AA00 (see Section 7.2).

3.9 3964R Procedure

The following description of the 3964R procedure applies to applications in which the SLG U92 is used with serial connection to a PC, host computer, or non-Siemens PLC and

- The 3964R procedure is to be implemented, or
- The MOBY API C interface is not to be used as a basis.

3964R procedure

The 3964R procedure controls bidirectional data transfer for a point-to-point connection between the SLG U92 and

- The interface, e.g. ASM 452, ASM 473 or ASM 475
- Another communication partner: PC, host computer, or non-Siemens PLC.

In the 3964R procedure the data are transferred asynchronously in half-duplex mode. The high transmission reliability between the communication partners is attained by means of:

- Defined establishment and cleardown of communication
- The parity bit appended to each character to be transmitted (vertical parity)
- The use of a block check character (BCC)

Since the loss of characters with a value of 00 hex cannot be detected in the block check (XORing), transaction reliability is increased by means of other measures based on the level of the procedure:

- The message frame length is sent as well, and
- Command message frames with an appropriate structure

Note

The command message frames and their structure are described in the programming guide for the MOBY API C library.

Direction of transfer

Half-duplex (two-way information flow)
The data are transferred between the communication partners in both directions alternately. At any given time data can be either sent or received.

Type of transfer

Serial data transfer takes place asynchronously.

Character frame

The data is transferred between the communication partners via the serial in an 11-bit character frame.

- Start bits: 1
- Data bits: 8
- Parity bits: odd
- Stop bits: 1

Note

The specified character frame must be adhered to. It must not be changed.

Coding

The 3964R procedure is code-transparent, which means that all characters between hexadecimal 00 and FF can be transferred.

Control characters

The following characters and strings are control characters as far as the 3964R procedure is concerned.

Control character	Coding (hex)	Meaning
STX	02	Start of Text — Start of the string to be transferred • STX indicates to the partner the wish to send something. A response is expected within the acknowledgment monitoring time.
DLE	10	Data Link Escape — Switchover to data transfer • Indicates readiness to receive after the receipt of STX. • Positive response to a correctly transferred data block including the block check character (BCC). • Precedes the end control character ETX.
ETX	03	End of Text — End of the string to be transferred
DLE ETX	10 03	The string DLE ETX indicates to the partner the end of a data transfer block.
BCC		Block Check Character
NAK	15	Negative Acknowledgment • Data block received with errors • Character delay time t_Z exceeded • Transmission error at character level

Note

If the character DLE occurs as an information character in the data block (code transparency), it is sent twice to distinguish it from the control character DLE. In other words, the 3964R procedure adds a second DLE to indicate this to the recipient. The recipient hides this duplicated DLE again.
The duplication leads to an increase in the transmission time, and this should be taken into consideration whether there are a high number of information characters with the value "DLE".
If only information characters with the value "DLE" are transmitted, for example, the transmission time is doubled and the transmission rate halved.

Note

In the case of the SLG U92, longitudinal parity (BCC) is set. The partner therefore also has to supply a block check after the data block's final control character.

Note

No blocking is carried out in the 3964R procedure (in other words, large data blocks are not subdivided into smaller packages of 128 bytes, for example). The maximum message frame length (net) is 255 bytes.

Parity bit

The parity bit is included for data security. It is appended to each character to be transmitted (vertical parity).

Block check character (BCC)

In addition to the parity bit, the sum of the data bits of the same value of all the characters in a data transmission block is supplemented by a further bit to produce an even number (longitudinal parity). The block check character (BCC) thus formed is itself secured by means of vertical parity and transmitted at the end of the data block. All the characters in the block are included except for the start control character STX. The block check character is calculated by forming an XOR operation beginning with the first data byte up to and including the end-of-block control character DLE ETX using the start value 00 hexadecimal (hex).

Note

In DLE duplication, the added DLE character is included in the block check (BCC).

Acknowledgment monitoring time t_Q

Two different monitoring times (t_Q and t_Z) are used to monitor the data transfer. The acknowledgment monitoring time t_Q is used after the transmission of:

- The control character STX or
- The control characters DLE ETX BCC

If no positive acknowledgment is received in this time, the corresponding control character or, depending on the number of repetitions, the corresponding data block is sent again (see the repetition counter W_C or W_T).

t_Q = 150 ms

Note

If the master cannot adhere to the acknowledgment monitoring time t_Q of 150 ms, you can use the set_param function at the service interface (see Section 3.11.3) to increase this time to the maximum value of 1200 ms.

Character monitoring time t_Z

The character monitoring time t_Z monitors the receipt of the individual characters of a data block. If the next character is not received within this time, the recipient aborts the receive job and sends the control character NAK to the sender.

t_Z = 50 ms

Note

If the master cannot adhere to the acknowledgment monitoring time t_Z of 50 ms, you can use the set_param function at the service interface (see Section 3.11.3) to increase this time to the maximum value of 1200 ms.

Repetition counter W_C

Two repetition counters (W_C and W_T) are used for automatic repetition at connection establishment or during data transfer. If no acknowledgment or a negative acknowledgment is received for a transmitted STX control character, the control character is repeated and a counter incremented. If this counter reaches the value W_C minus 1, connection establishment is aborted.

W_C = 65535

Repetition counter W_T

If no acknowledgment or a negative acknowledgment is received for a data block that is sent, the relevant data block is repeated and a counter incremented. When this counter reaches the value W_T minus 1, the SLG U92 goes into RESET mode and tries to send this data block with the error status 1B hex in a continuous loop. The SLG U92 must then be reset with the RESET message frame. The SLG U92 sends no further message frames (data blocks) up to this RESET and rejects all message frames except for RESET with the error status 18.

W_T = 30000

Priority

If both partners want to initiate connection establishment simultaneously in the 3964R procedure, one of the two communication partners must be assigned a higher priority so that this conflict can be resolved. One communication partner is thus declared as the ”master” and the other the ”slave” (see the section on initiation conflict).

Note

The SLG U92 is always a slave, and its partner stations therefore have to implement or set the behavior of a master.

Initiation conflict

If both partners want to send something simultaneously during the connection establishment phase (initiation conflict), the slave has to withdraw its transmission request and respond positively to the transmission request of the master with DLE. However, this does not mean that the slave has to abort a transmission that has already begun (i.e. after a connection has been established). It can complete the transmission without being interrupted by the master.
If the master has suppressed the transmission request of the slave in this way and sent its data block, it must then give the slave the opportunity to send its data before the master sends anything else.

Transmission conflict (slave)

If the SLG U92 has initiated a transmission as a slave (i.e. the connection establishment phase is completed) and is sending characters, the master can terminate this transmission at any time by means of an STX and initiate a transmission itself. The SLG U92 aborts its transmission, replies with DLE, and changes to receive mode.

Transmission abortion (slave)

If the SLG U92 has initiated a transmission as a slave (i.e. the connection establishment phase is completed) and is sending characters, the master can terminate this transmission at any time by means of an NAK. The SLG U92 repeats connection establishment and carries out transmission again.

The two diagrams below show the sequence involved in the 3964R procedure as it applies to the SLG U92.

3964R receive routine with block check in the SLG U92 (slave)

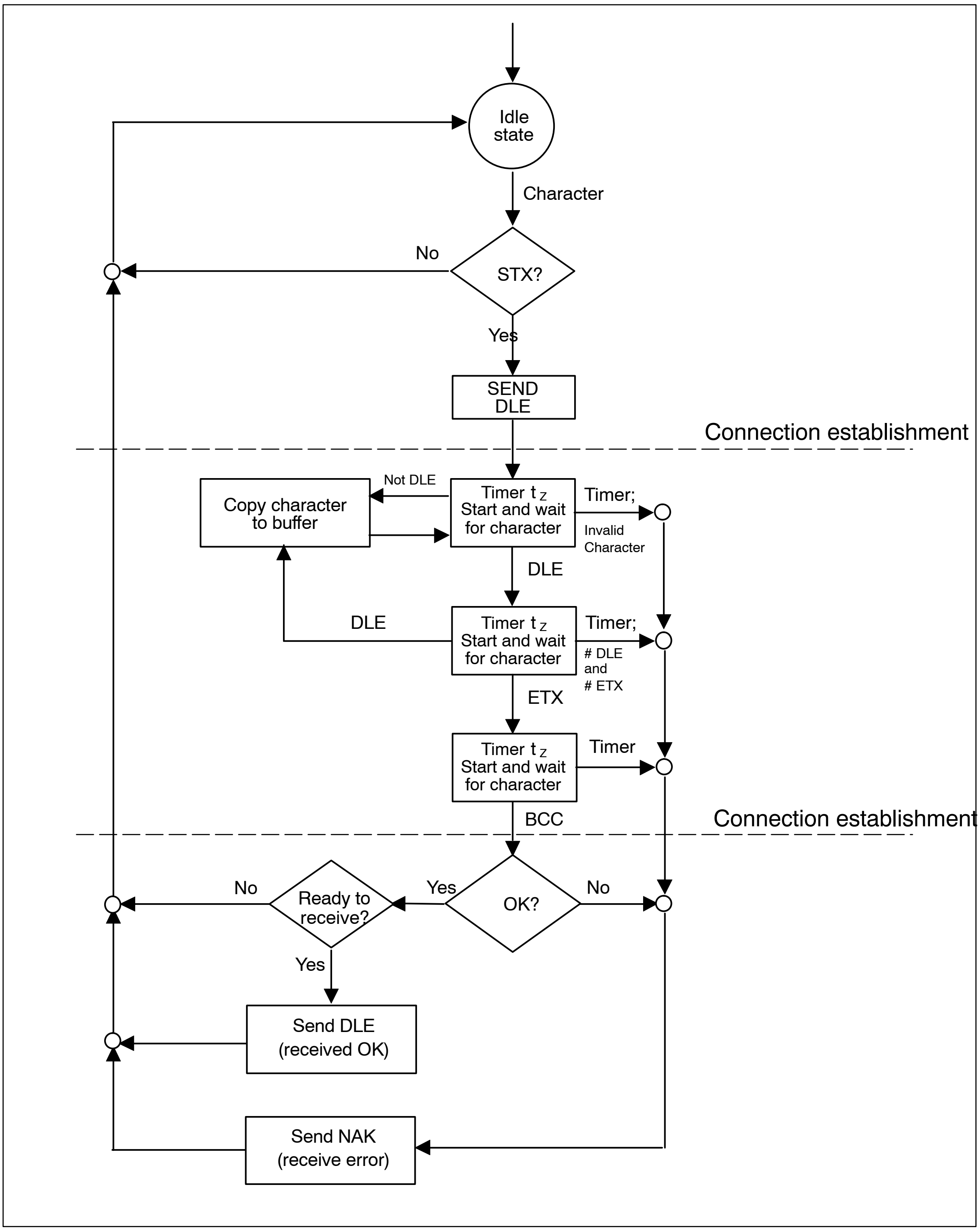


Figure 3-44 3964R receive routine with block check in the SLG U92 (slave)

If a character is not received correctly, e.g. parity error, the receive routine is aborted with NAK.

3964R send routine with block check in the SLG U92 (slave)

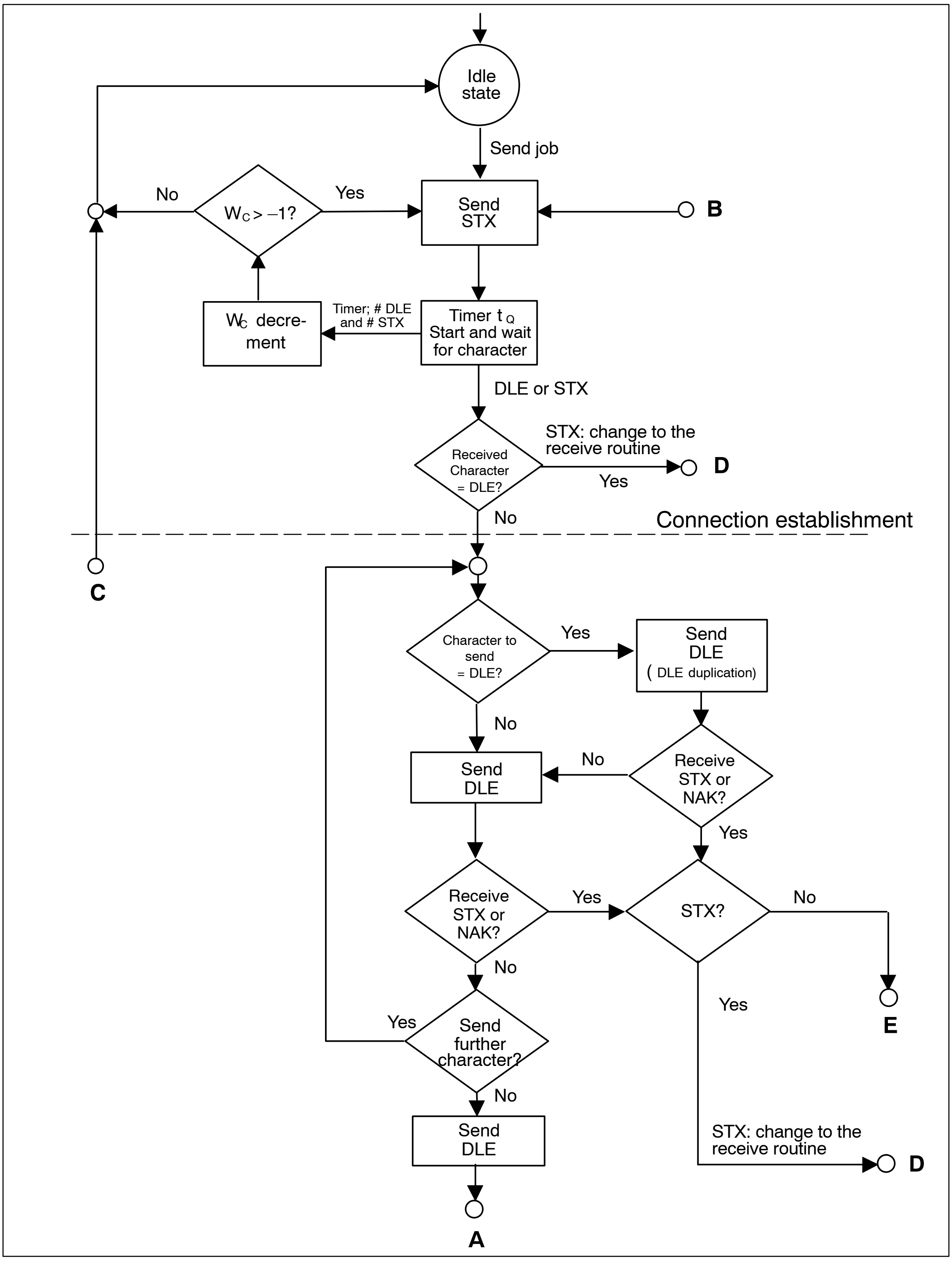


Figure 3-45 3964R send routine with block check in the SLG U92 (slave)

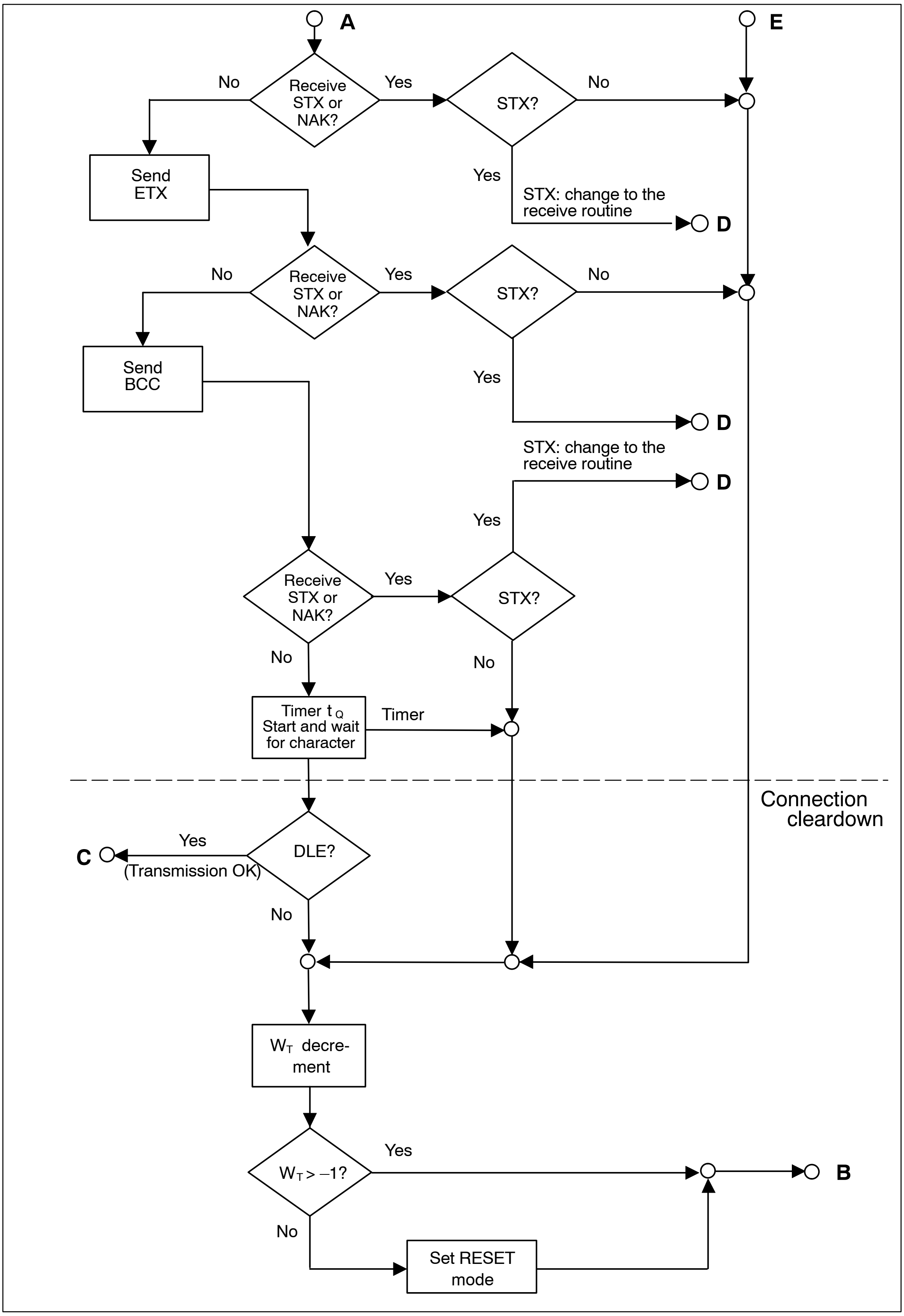


Figure 3-46 3964R send routine with block check in the SLG U92 (slave)

3.10 Service Cable and Connector Assignments (Service Interface)

The service interface is available for:

- Firmware updating and service/diagnostic functions
- Synchronization of up to three SLG U92 units
- Control of the SLG U92 via BERO contacts

The service interface consists of three subinterfaces:

- An RS 232 interface for service (see Section 3.10.3)
- An interface for synchronization (see Section 3.10.4) and
- An interface for controlling the SLG U92 via BERO contacts (BERO mode) (see Section 3.10.5).

Different cables are required depending on how the service interface is used.

Note

BERO mode and SLG synchronization are not both possible at the same time.

3.10.1 Cable configuration

The cables used for the service interface differ depending on whether it used for:

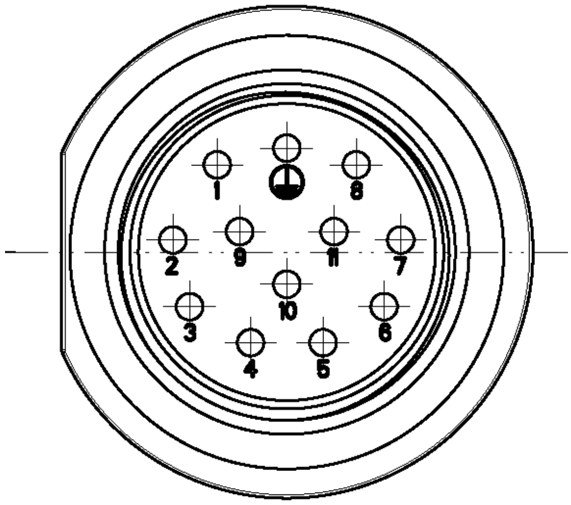
- The RS 232 interface for service
- The interface for synchronization
- The interface for controlling the SLG U92 via BERO contacts
- Connecting to an interface distributor if more than one subinterface is required simultaneously.

The cable sheath of the cables used with MOBY U for the service interface consists of polyurethane (PUR in accordance with VDE 0250). This gives the cables very good resistance to oil, acid, lye, and hydraulic fluids.

3.10.2 Connector Assignment at the Service Interface

Complete service interface

Figure 3-47 shows the assignment for all three subinterfaces.



Pin	Name
1	BERO 1
2	RxD (receive data)
3	TxD (send data)
4	SLG-SYNC
5	Free
6	Not to be assigned
7	Free
8	Free
9	BERO 2
10	BERO / SLG-SYNC – GND
11	GND (ground data)
GND	Cable shield

Figure 3-47 Connector assignment of the SLG U92 service connector

All connections are ESD-protected. The connections can be connected to ground or incorrectly wired without this damaging the SLG U92.

Caution

Jumpers between the PINs are not permissible and can lead to the SLG U92 being damaged. It is essential that PIN 6 remains free. It must not be assigned.

3.10.3 Connecting Cable for the RS 232 Service Interface

Connection cable PC ↔ RS 232 service interface 6GT2 591-1A...

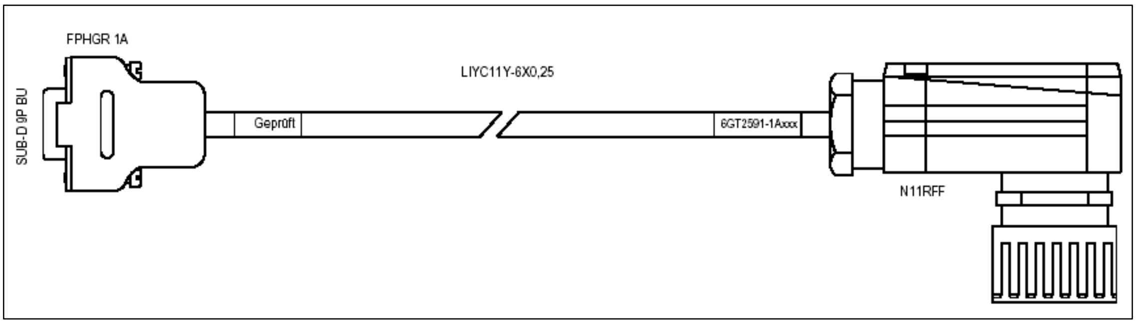


Figure 3-48 Connecting cable PC ↔ RS 232 service interface

The service cable for the RS 232 service interface between the PC and SLG U92 requires three conductors plus a shield. The maximum permissible cable length is 20 m.

Table 3-20 Connector assignment for the SLG U92 and 9P BU subminiature D connector

9-pin subminiature D connector	Core Color	Service connector
Pin 3 (TxD)	Green	Pin 2 (RxD)
Pin 2 (RxD)	Brown	Pin 3 (TxD)
Pin 5 (Ground)	White	Pin 11 (Ground)
Housing	Shield	⏚

All connections are ESD-protected. The connections can be connected to ground or incorrectly wired without this damaging the SLG U92.

Caution

Jumpers between the PINs are not permissible and can lead to the SLG U92 being damaged. PIN 6 on the SLG U92 service connector must remain free; it must not be assigned.

The service cable can be ordered in lengths of 5 m:

Table 3-21 Cable lengths for the PC ↔ RS 232 service interface

Length of Stub Line in m	Order Number
5	6GT2 591-1AH50

Assembly of the service connector

If you have to turn the service connector in another direction with a prefabricated cable, proceed as shown in the figure below to reposition the contact carrier. The plug connector on the SLG cannot be turned.

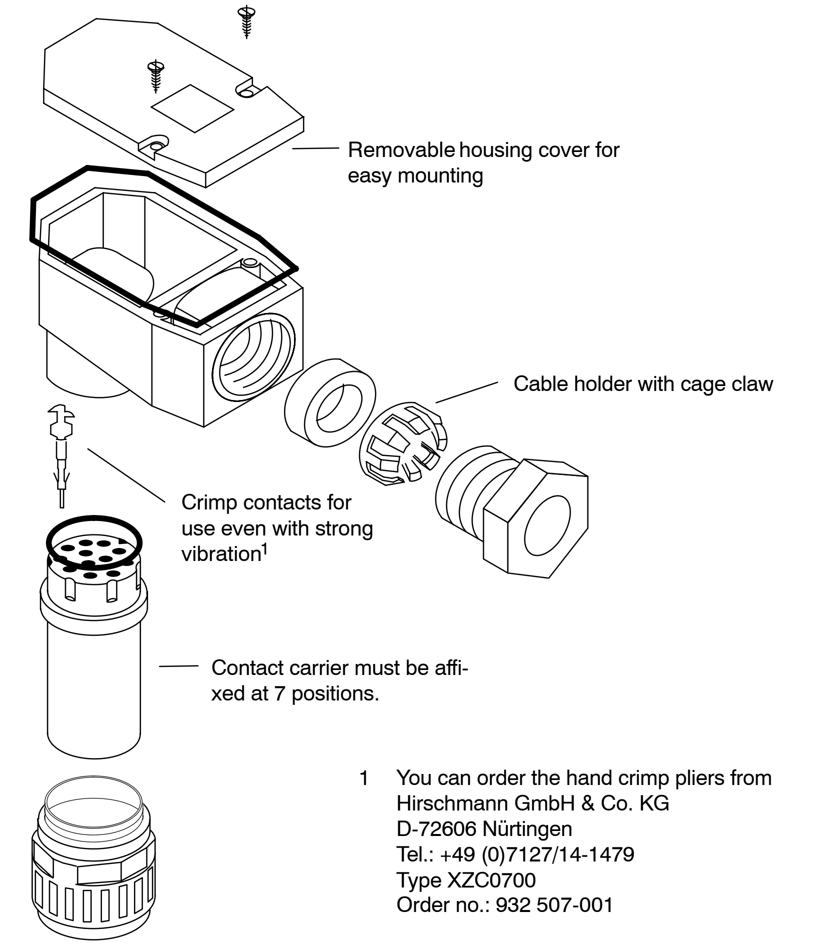


Figure 3-49 Drawing of how to assemble the service connector

Non-prefabricated cable

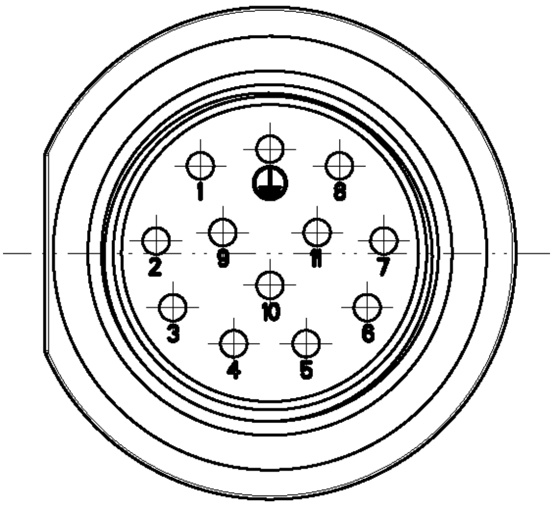
Users who want to make their own cables can order the following components from the MOBY catalog:

Component	Order Number
Connector for the SLG U92 service interface (angled)	6GT2 590-0BA00
Stub line; Type: 6 x 0.25 mm^2	6GT2 090-0A...

3.10.4 Connecting Cable for Synchronization

Connecting cable SLG ↔ SLG for synchronization

The connecting cable for synchronization between SLGs requires three conductors plus a shield. The maximum permissible cable length is 30 m.



Pin	Name
1	Free
2	Free
3	Free
4	SLG-SYNC
5	Free
6	Must not be assigned
7	Free
8	Free
9	Free
10	SLG-SYNC – GND
11	Free
GND	Cable shield

Figure 3-50 Connector assignment of the SLG U92 service connector

All connections are ESD-protected. The connections can be connected to ground or incorrectly wired without this damaging the SLG U92.

Caution

Jumpers between the PINs are not permissible and can lead to the SLG U92 being damaged.
It is essential that PIN 6 remains free. It must not be assigned.

Non-prefabricated cable

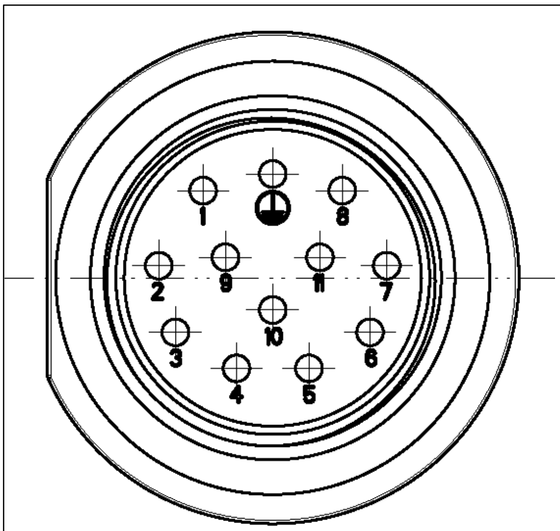
The following components can be ordered from the MOBY catalog for the cable to be made up.

Component	Order Number
Connector for the SLG U92 service interface (angled)	6GT2 590-0BA00
Stub line; Type: 6 x 0.25 mm^2	6GT2 090-0A...

3.10.5 Connecting Cable for Control via BERO Contacts

Connecting cable for control of the SLG U92 via BERO contacts

The connecting cable between the SLG and BERO requires two conductors plus a shield. The maximum permissible cable length is 50 m.



Pin	Name
1	BERO 1
2	Free
3	Free
4	Free
5	Free
6	Must not be assigned
7	Free
8	Free
9	BERO 2
10	BERO – GND
11	GND (ground data)
GND	Cable shield

Figure 3-51 Connector assignment of the SLG U92 service connector

All connections are ESD-protected. The connections can be connected to ground or incorrectly wired without this damaging the SLG U92.

Caution

Jumpers between the PINs are not permissible and can lead to the SLG U92 being damaged.
It is essential that PIN 6 remains free. It must not be assigned.

Non-prefabricated cable

The following components can be ordered from the MOBY catalog for the cable to be made up.

Component	Order Number
Connector for the SLG U92 service interface (angled)	6GT2 590-0BA00
Stub line; Type: 6 x 0.25 mm^2	6GT2 090-0A...

3.11 Update/Service/Diagnostic Functions (Service Interface)

The service interface on the RS 232 interface
(see Section 3.7.3) allows you to:

- Update the firmware
- Execute service/diagnostic functions

Any terminal program can be used for this functionality.

The terminal program must be set as follows to operate the service interface:

- Data rate 19200 bps
- Parity None
- Data bits 8
- Stop bits 1
- Protocol None

In order to update the firmware using the terminal program, the terminal program must have a function for sending a file. It does not matter whether the file is sent in binary or ASCII mode. The function for sending a file is referred to differently in the different terminal programs, for example:

- **Hyperterminal**™: *Transfer* – *Send Text File*
- **Tera Term**™: *File* – *Send File*
- **Procomm Plus**™: *Data* – *Send File*
  In this case, you also have to select the transfer type ”RAW ASCII” under *Options-Data Options General-Transfer Protocol.*

After the supply voltage is connected to the SLG, the boot loader is started and the boot menu appears on the service interface.

Boot menu

```
HWTST: Testing RAM..OK
*******************************************
SLG BOOT MENU
VERSION x.xx
*******************************************
Please select menu item:
The system boots after 01 second
(0) Update SLGU version
(1) Update firmware version
(L) Update loader
(E) Update entire flash
(R) Read entire flash
--------------------------
Your selection:
Calculated CRC: xxxxxxxx
Stored CRC: xxxxxxxx
Load DSP-Firmware
Execute ...

SIEMENS MOBY U – Service Interface Vxx.xx
>
```

Note

The version numbers, byte specifications, addresses, and checksums in the boot menu depend on the firmware version.

The boot menu offers three basic functions:

- Boot (boots the firmware)
- Update (loads the firmware)
- Read (saves the firmware)

Booting

When the hardware is switched on, the SLG initializes and tests the storage areas internally, configures the SLG U, checks the checksums of the individual firmware components, and, once the firmware has started up, sends a startup message frame via the SLG interface. The boot process lasts around 3 seconds from when the voltage is connected to the startup message frame. The SLG is now ready for operation and waits for the RESET message frame at the SLG interface. At the service interface it is ready for the input of service/diagnostic functions (see Section 3.11.3).

Update

If you want to load a new or saved firmware version, after the SLG is switched on and “Your selection:” appears in the boot menu, you have to press the key 0, 1, L or E, depending on the firmware component to be loaded, within 1 second. This interrupts the standard boot process and takes you to the update function (see Section 3.11.1).

The following firmware components can be loaded individually:

- Configuration data (bit stream) for the SLGU
  The SLGU is an FPGA (Field Programmable Gate Array).
- SLG firmware
  The SLG firmware consists of the microcontroller firmware and the DSP firmware.
- Loader
  The loader is the firmware component that carries out the boot process. The loader also offers the option of reloading firmware components individually, including itself.
- Saved firmware version
  The loader, the configuration data for the SLG U, the SLG firmware and special SLG data (such as the SLG ID number and SLG settings) are stored in the FLASH. All of this FLASH information can be saved as a firmware version and can be reloaded.

3.11.1 Update Functions

```
HWTST: Testing RAM..OK
*******************************************
SLG BOOT MENU
VERSION x.xx
*******************************************
Please select menu item:
The system boots after 01 second
(0) Update SLGU version
(1) Update firmware version
(L) Update loader
(E) Update entire flash
(R) Read entire flash
--------------------------
Your selection:
```

Update SLGU version

The “(0) Update SLGU version” option allows you to update the SLG U configuration data. When you press the 0 key, the Update SLGU version function is started and the following is output:

```
Your selection:
(0) Update SLGU version
*******************************************
UPDATE
*******************************************
UPDATE: Updating image: 00 at address 0x00060000
UPDATE: Send the Intel Hex File
```

The SLG configuration data file, which is in Intel hex format, must then be sent to the service interface. The terminal program's function for sending a file must be used for this
(see Section 3.11).

A progress display in the form of dots (...) appears on the screen, indicating that the file has been received correctly. If the file contains errors, the update is aborted and the old version of the SLG U configuration data is loaded again at the next startup.
After the file has been received in its entirety, it is stored initially in a buffer and then packed and written to flash memory.
If the power fails while flash memory is being written, the update must be carried out again.
If the new version of the configuration data is saved correctly, it is loaded immediately and the firmware is executed in its entirety.

Update firmware version

The "(1) Update firmware version" option allows you to update the SLG firmware. When you press the 1 key, the Update firmware version function is started and the following is output:

```
Your selection:
(1) Update firmware version
*******************************************
UPDATE IMAGE FROM INTEL HEX FILE
*******************************************
UPDATE: Updating image: 01 at address 0x00008000
UPDATE: Send the Intel Hex File
```

The firmware file, which is in Intel hex format, must then be sent to the service interface. The terminal program's function for sending a file must be used for this (see Section 3.11).
A progress display in the form of dots (...) appears on the screen, indicating that the file has been received correctly. If the file contains errors, the update is aborted and the old version of the firmware is loaded again at the next startup.
After the file has been received in its entirety, it is stored initially in a buffer and then packed and written immediately to flash memory.
If the power fails while flash memory is being written, the update must be carried out again.
If the new firmware is saved correctly, it is immediately executed.

Update loader

The "(L) Update loader" option allows you to update the loader.
When you press the 'L' key, the Update loader function is started and the following is output:

```
Your selection:
(L) Update loader

*******************************************
LOADER UPDATE
*******************************************
LOADER UPDATE: Send the Intel Hex File
```

The loader file, which is in Intel hex format, must then be sent to the service interface. The terminal program's function for sending a file must be used for this (see Section 3.11).
A progress display in the form of dots (...) appears on the screen, indicating that the file has been received correctly. If the file contains errors, the update is aborted and the old loader is loaded again at the next startup.
After the file has been received in its entirety, it is stored initially in a buffer and then packed and written immediately to flash memory.
If the new loader has been saved correctly, the still active old loader carries out a reboot and thus activates the new loader.

Caution

Ensure there is a reliable power supply for the SLG during the loader update. If the power fails while the loader is being written to flash memory, the updating of the loader fails and the SLG will no longer work. In this case, booting is required. This has to be carried out by a service engineer or at the factory.

Update entire flash

The "(E) Update entire flash" option can be used to reload the saved flash memory contents (see Section 3.11.2) using the "Read entire flash" function. When you press the 'E' key, the Update entire flash function is started and the following is output:

```
Your selection:
(E) Update entire flash

******************************************
UPDATE WHOLE FLASH FROM INTEL HEX FILE
******************************************
FLASHUPDATE: Send the Intel Hex File
```

The flash memory contents, which are in Intel hex format, must then be sent to the service interface. The terminal program's function for sending a file must be used for this (see Section 3.11).
A progress display in the form of dots (...) appears on the screen, indicating that the file has been received correctly. If the file contains errors, the update is aborted and the old version of the firmware is loaded again at the next startup.
After the file has been received in its entirety, it is stored initially in a buffer and then packed and written to flash memory.
If the power fails while flash memory is being written, the update must be carried out again.
If the new firmware is saved correctly, it is loaded immediately and executed.

3.11.2 Save firmware version

The loader, the configuration data for the SLGU, the SLG firmware and special SLG data (such as the SLG ID number and SLG settings) are stored in the flash memory. The entire contents of the flash memory can be read out as a backup file and if needed reloaded with “Update entire flash”
The “(R) Read entire flash” option can be used to read out the entire contents of the flash memory as a backup file and if needed reloaded. When you press the ’R’ key, the Read entire flash function is started and the following is output:

```
Your selection:
(R) Read entire flash
```

```
*******************************************
READING WHOLE FLASH TO INTEL HEX FILE
*******************************************
READFLASH: Output start after 10 seconds...
```

The loader waits for about another 10 seconds. After that, the flash contents are output sequentially in Intel hex format.
Within the 10 seconds between activation of the function and the start of output the recording function of the terminal program can be started. The function of the terminal program to be called here is “Capture Text”, “Receive File” or a similar function.
The receive function is referred to differently in the different terminal programs, for example:

- **Hyperterminal**™: *Transfer* – *Capture Text*
- **Tera Term**™: *File* – *Log*
- **Procomm Plus**™: *Data* – *Capture File*

3.11.3 Service/Diagnostic Functions

You can use the service/diagnostic functions to:

- Obtain settings and status information from the SLG (read/write device)
- Change the settings of the SLG or MDS (mobile data storage units)
- Include the service interface in logging

Overview of the functions

The table below lists the functions that can be called via the service interface.

Table 3-22 Functions of the service interface

Function	Meaning
`battchange 'mdsid' 'week' 'year'`	Enter parameter for battery change
`get_arq`	Outputs the number of ARQs (Automatic Repeat Requests) per MDS
`get_channel`	Outputs the setting of the frequency channels
`get_cmd`	Outputs the last message frames from the communication interface
`get_mds`	Outputs the data of all the active MDSs in the field
`get_param ['parameter']`	Outputs one or all SLG parameters
`get_spec`	Reads out the spectrum
`get_status or s`	Outputs the status (diagnostic) data of the SLG
`get_version or v`	Outputs versions from the SLG
`help or h`	Outputs all the available functions of the service interface
`mdslist`	Outputs an SLG-internal MDS list
`mdslog [clear]`	Outputs the diagnostic data of the detected and processed MDSs
`reboot`	Restarts the SLG
`set_channel 'mode = [0|1]' 'channel_nr = [0-99]'`	Disables or enables frequency channels
`set_param 'parameter' 'value' [noflash]`	Sets SLG firmware parameters
`set_time 'hhhh:mm'`	Sets the system time
`sleeptime 'mdsid' 'ms' 'week' 'year'`	Changes the sleep time of the MDS
`slgid 'slgid'`	Enters an SLG ID number
`storemode 'mdsid'`	Activates the storage mode of the MDS
`trace 'on'|'off'`	Activates/deactivateslogging of the service interface
`e`	Outputs an overview of the possible error codes

Some of the functions have parameters that are specified by means of a symbolic name or alternative values/names, enclosed in quotation marks. Values to be entered as alternatives are separated by a vertical line.

Example illustrating the storemode function:

- Symbolic parameter 'mdsid':
  04B40240 8-digit MDS number
- Possible alternative values that can be entered '0'|'1':
  0 Unlock channel
  1 Lock channel

The function name and the first parameter and the parameters themselves must be separated by a blank.

If a non-existent function is entered or an existing function is entered incorrectly, the following error message appears:

```
Error: Wrong command syntax!
```

battchange function

This function initializes an MDS of the "with battery change" type:
MDS U315 or MDS U525 after the battery is changed. This initialization is essential in order to calculate the remaining battery life.
This command is available as of firmware version 2.19.

Input format:

```
battchange mdsid week year
```

Parameter	Format	Description
mdsid	Hexadecimal	8-digit MDS ID number. The MDS ID number can be requested with the get_mds command.
week	Decimal	Calendar week: 1 to 52
year	Decimal	The last two digits of the calendar year: ≥ 01 e.g. 03 for the year 2003

Output format:

```
Battery Change successfully registered
```

If the type of the MDS is not "with battery change", the following message appears:

```
Command only valid for type MDS-B
```

If there is no MDS in the field, the following error message appears:

```
Error: MDS not in field
```

get_arq function

The function outputs the number of ARQs (Automatic Repeat Requests) per MDS.

Beginning with the start of the first communication with an MDS, the SLG increments the counter by the value 1 with each ARQ. After the end of communication the counter is reset to zero.

Input format:

```
get_arq
```

Output format:

```
MDS: mdsid - ARQ: arq, FIRST_COMMAND: fcom
```

Parameter	Format	Description
mdsid	Hexadecimal	8-digit MDS ID number
arq	Decimal	Number of ARQs
fcom	Decimal	Number of failed first commands for the MDS in the detection and communication area

If the function is entered with parameters, the following error message appears:

```
Wrong number of parameter!
Usage: get_arq
```

If there is no MDS in the field, the following message appears:

```
No MDS in field!
```

get_channel function

This function outputs the setting of the frequency channels.

Input format:

```
get_channel
```

Output format:

```
Channel settings: [EU ex F|FRA|ESP|USA]
Channel   0 - mode
Channel   1 - mode
            "
            "
Channel  99 - mode
```

Parameter	Format	Description
mode	Decimal	Set mode of the frequency channel: 0 Unlocked 1 Locked X Permanently locked through the country setting

If the function is entered with parameters, the following error message appears:

```
Wrong number of parameter!
Usage: get_channel
```

If this function is called before or during a RESET command at the SLG interface, or another function is active at this service interface, the following error message appears:

```
Error: No Information available!
```

get_cmd function

This function outputs the last 25 message frames from the SLG interface. In direct addressing, these are the message frames sent to and/or from the SLG interface. In filehandler mode they are not the filehandler message frames; instead, the direct addressing commands derived from these internally are output.

Input format:

```
get_cmd
```

Output format:

```
----------------------------------------------------
MSG.nr:  typ, Time = hhhh:mm:ss.ttt,
Counter = identifier
TLG: Length = length   Command = code
Status = state
Data = hh hh hh .. ..
--------------------------------------------
ges_anz Messages in SLG
```

Parameter	Format	Description
nr	Decimal	Message number; consecutive from 1 to max. 25
typ	ASCII	Message type: CMD Command (message frame/command to the SLG) RSP Response (message frame/acknowledgment from the SLG)
hhhh mm ss ttt	Decimal	Time stamp in hhhh Hours (0 to 9999) mm Minutes (0 to 59) ss Seconds (0 to 59) ttt Milliseconds (0 to 999)
identifier	Decimal	Identifier of the message. Message frames belonging together: Commands and acknowledgments at the communication interface have the same value. 0 to 65535
length	Decimal	Length of the message frame at the SLG interface (without the output byte): 2 to 249
code	Hexadecimal	1-digit command code of the message frame at the SLG interface
state	Hexadecimal	2-digit status of the message frame at the SLG interface
hh hh hh	Hexadecimal	User data, represented bytewise in hexadecimal notation. Max. 16 bytes per line.
ges_anz	Decimal	Number of messages output

If the function is entered with parameters, the following error message appears:

```
Wrong number of parameter!
Usage: get_cmd
```

get_mds function

This function specifies the corresponding data for all the active MDSs in the detection area (field).

Input format:

```
get_mds
```

Output format:

```
MDSID: mdsid, Distance = distance dm,
Subframe = subframe, ARQ = anz_arq,
StandbyTime = time ms, Status = state,
Sleeptime = sleeptime ms
```

Parameter	Format	Description
mdsid	Hexadecimal	8-digit MDS ID number
distance	Decimal ASICC	Most recent distance obtained between the SLG and MDS: 1 to 40 Valid value x No valid value obtained
subframe	Decimal ASICC	0 to 11 Number of the currently used subframe (communication connection active) or NOT ACTIVE Communication connection not active
anz_arq	Decimal	Number of ARQs
time	Decimal	Standby time in ms (value in message frame RESET x 7) : 0 to 1400
state	ASCII	Status of the MDS: NEW Communication connection between the SLG and MDS is being established. ACTIVE Communication connection between the SLG and MDS is active; no command pending. BUSY Communication connection between the SLG and MDS is active; pending command is being processed. WAIT Communication connection between the SLG and MDS is not active; waiting for connection to be established for pending command. STANDBY Communication connection between the SLG and MDS is active; no command pending. END MDS has a status indicating that communication is completed.
sleeptime	Decimal	Sleep time of the MDS in ms: 20; 40; 80; 160; 320; 640; 1280 or 2560

If the function is entered with parameters, the following error message appears:

```
Wrong number of parameter!
Usage: get_mds
```

If there is no MDS in the field, the following message appears:

```
No MDS in field!
```

get_param function

This function outputs the set values for all SLG firmware parameters or the set value for the selected SLG firmware parameter.

Input format:

```
get_param
```

or

```
get_param parameter
```

Parameter	Format	Description
parameter	ASCII	SLG firmware parameter monitoring times in the 3964R driver 3964_timeout1 Acknowledgment monitoring time 3964_timeout2 Character monitoring time SLG synchronization syncslgs Status number to be synchronized SLG syncon Status SLG synchronization

Output format:

```
parameter = value x
```

Parameter	Format	Description
parameter	ASCII	SLG firmware parameter monitoring times in the 3964R driver (with value 1) 3964_timeout1 Acknowledgment monitoring time 3964_timeout2 Character monitoring time SLG synchronization (with value 2 and 3) syncslgs Status number to be synchronized SLG syncon Status SLG synchronization
value 1	Decimal	Monitoring time in ms 150 to 1200 Value for acknowledgment monitoring or 65535 The default of 150 ms applies. It has not been changed. 50 to 1200 Value for character monitoring 65535 The default of 50 ms applies. It has not been changed.

Parameter	Format	Description
value 2	Decimal	Status number of SLGs to be synchronized 2 SLG synchronization with 1 SLG (default) 3 SLG synchronization with 2 SLGs
value 3	Decimal	Status SLG synchronization 0 SLG synchronization off 1 SLG synchronization on

If an invalid parameter is entered, the following error message appears:

```
invalid parameter !
```

If more than one parameter is entered, the following error message appears:

```
Wrong number of parameter!
Usage: get_param ['parameter']
```

Function get_spec

This function shows all frequency channels with the respective setting: unlocked or locked and a class number. The class number from 0 to 6 of a frequency channel indicates whether field strength has been measured in this channel and, if yes, how great it is.

Input format:

```
get_spec
```

Output format:

```
Channel -13  -  systemlocked       -  Class = number
Channel -12  -  systemlocked       -  Class = number
  "
Channel  -2  -  systemlocked       -  Class = number
Channel  -1  -  systemlocked       -  Class = number
Channel   0  -  [un]locked         -  Class = number
Channel   1  -  [un]locked         -  Class = number
  "
Channel  98  -  [un]locked         -  Class = number
Channel  99  -  [un]locked         -  Class = number
Channel  +1  -  systemlocked       -  Class = number
Channel  +2  -  systemlocked       -  Class = number
  "
Channel +12  -  systemlocked       -  Class = number
Channel +13  -  systemlocked       -  Class = number
```

Parameter	Format	Description
number	Decimal	Measured field strength of the frequency channel in steps from 0 to 6: 0 No/low field strength : 6 High field strength

If the function is entered with parameters, the following error message appears:

```
Wrong number of parameter!
Usage: get_spec
```

If this function is called during a RESET command at the SLG interface, or another function is active at this service interface, the following error message appears:

```
Error: No Information available!
```

get_status function

This function outputs the status (diagnostic) data of the SLG.

Input format:

`get_status` or `s`

Output format:

```
Time = hhhh:mm:ss.ttt,
SLG status = state Error Counter

frame structure = anz_frame,
Number of MDS = anz_mds, Radio Power = radio_p

MOBY U = mp, Filehandler = fh,
present logic = p_logic, Standby Time = time ms

RWBG = rp, Repeat = repeat_m, Country Code = cc,
Trace = trace_mode,  Autobaud = auto_baud

BERO mode = fcon, BERO1_N = bero1, BERO2_N = bero2,
SYNC_RX = sync_rx, SYNC_TX_N = sync_tx
```

Parameter	Format	Description
hhhh mm ss ttt	Decimal	Time stamp in: hhhh Hours mm Minutes ss Seconds ttt Milliseconds
state	ASCII	SLG status: ok or Synchronization error counter: = <*counter reading*>
anz_frame	Decimal	Number of subframes per frame: 1 to 12
anz_mds	Decimal	Number of MDSs in the detection area of the SLG: 1 to 12
radio_p	ASCII	Radio Power: ON Antenna on OFF Antenna off
mp	ASCII	Mode (set by RESET command): ON MOBY U command variant (with multitag) OFF MOBY I command variant (without multitag)
fh	ASCII	Filehandler mode (set by RESET command): ON Filehandler mode OFF Mode with direct addressing
p_logic	ASCII	Presence (see RESET command): ON With ”presence” messages OFF Without ”presence” messages
time	Decimal	Standby time in ms (see RESET command; value in message frame x 7): 0 to 1400
rp	Decimal	Range limit in dm: 5, 10, 15, 20, 25, 30 or 35

Parameter	Format	Description
repeat_m	ASCII	Repeat command: ON With repeat command OFF Repeat command not permissible
cc	ASCII	National variant: EU ex F EU & France (indoor only) FRA France (outdoor) USA USA
trace_mode	ASCII	Trace mode: ON OFF
auto_baud	Decimal	Automatic baud rate detection: 19200, 38400, 57600 or 115200
fcon	ASCII	Bero mode (field ON control), see RESET command: 0 No BEROs (mode 1) 1 One or two BEROs (mode 2) 2 One or two BEROs (mode 3)
bero1	ASCII	Status of the line for BERO 1: 0 Active Low 1 Not active High
bero2	ASCII	Status of the line for BERO 2: 0 Active Low 1 Not active High
sync_rx	ASCII	Status of the line for SLG-SNY (receipt of data): 0 Active Low 1 Not active High
sync_tx	ASCII	Status of the line for SLG-SNY (transmission of data): 0 Active Low 1 Not active High

When the SLG is working properly, the values output must lie within the specified value ranges, the state parameter (SLG status) must be set to ’ok’, and the hhhh:mm:ss.ttt parameter (time) must have a value > 0. The time corresponds to the last voltage RESET. The time base can be changed by means of the set_time function.

If the function is entered with parameters, the following error message appears:

```
Wrong number of parameter!
Usage: get_status
```

or

```
Wrong number of parameter!
Usage: s
```

get_version function

This function outputs the HW and FW versions of the SLG.

Input format:

```
get_version or v
```

Output format:

```
SLG FW Version = fw_version
MC FW Version = mc_version
FH FW Version = fh_version
DSP FW Version = dsp_version
SLGU Version = slgu_version
3964R Version = driver
Loader Version = ld_version
HW Version = hw_version
Driver Version = ss
SLG ID = 0xiiiiiiii
CRC = 0xnnnnnnnn
```

Parameter	Format	Description
fw_version	Decimal	Version of the SLG firmware as a whole xx.xx
mc_version	Decimal	FW version of the MC (microcontroller) xx.xx
fh_version	Decimal	FW version of the filehandler x.x xxxx
dsp_version	Decimal	FW version of the DSP (digital signal processor) xx.xx
slgu_version	Decimal	FW version of the FPGA SLGU xx.xx
ld_version	Decimal	Version of the FW loader xx.xxx
driver	Decimal	Driver variant 1 3964 R
hw_version	Decimal	Version of the SLG HW xx 1 to 15
ss	ASCII	Communication interface RS 232 or RS 422
0xiiiiiiii	Hexadecimal	SLG ID number, 8-digit in hexadecimal notation
0xnnnnnnnn	Hexadecimal	CRC, 8-digit in hexadecimal notation

If the function is entered with parameters, the following error message appears:

```
Wrong number of parameter!
Usage: get_version
```

or

```
Wrong number of parameter!
Usage: v
```

help function

This function outputs all the available functions of the service interface together with the associated parameters.

Input format:

```
help or h
```

Output format:

```
battchange 'mdsid' 'week' 'year'
get_arq
get_channel
get_cmd
get_mds
get_param ['parameter']
get_spec
get_status
get_version
help
mdslist
mdslog [clear]
reboot
set_channel 'mode = [0|1]' 'channel_nr = [0-99]'
set_param parameter value [noflash]
set_time 'hhh:mm'
sleeptime 'mdsid' 'ms' 'week' 'year'
slgid 'slgid'
trace 'on'|'off'
```

The functions listed here together with their parameters are described before and after this section on the help function.

If the function is entered with parameters, the following error message appears:

```
Wrong number of parameter!
Usage: help
```

or

```
Wrong number of parameter!
Usage: h
```

mdslist function

This function outputs the SLG-internal MDS list. All the MDSs in the field are listed in the SLG-internal MDS list.

Input format:

`mdslist`

Output format:

```
MDSID: mdsid, FREQ: channel_nr, ANTENNA: mode,
SUBFRAME: subframe, STATE: state, TIMER: time,
DISTANCE: distance
```

Parameter	Format	Description	
mdsid	Hexadecimal	8-digit MDS ID number	
channel_nr	Decimal	Channel number of the reference carrier 13 to 86	
mode	Decimal	Number of the active antenna 0 or 1	
subframe	Decimal	0 to 11	Number of the subframe reserved for the MDS (regardless of the communication status) or
	ASCII	NOT AVAILABLE	There is no free subframe for the MDS; they are all reserved (number of MDSs > frame structure). Alternatively, the MDS has the status ZONE 2 or END (see the state parameter).
state	Decimal	ACTIVE	Communication between the MDS and SLG.
		WAIT	Waiting for communication between the MDS and SLG (sleep mode).
		STANDBY	No communication between the MDS and SLG. The MDS is kept on standby for the period.
		ZONE 2	The MDS is in zone 2.
		END	The MDS has a status indicating that communication is completed.
time	Decimal	Current timer value for the timer-monitored status (WAIT, STANDBY, ZONE 2, END)	
distance	Decimal	Most recent distance obtained between the SLG and MDS in decimeters:	
	ASCII	1 to 40	Valid value
		x	No valid value calculated

If the function is entered with parameters, the following error message appears:

```
Wrong number of parameter!
Usage: mdslist
```

If there is no MDS in the detection area, the following message appears:

```
No MDS in field!
```

mdslog function

This function outputs the diagnostic data of the detected and processed MDSs. It is helpful above all for diagnosis in the event of communication problems.
The diagnostic data indicates for each MDS when it was detected in zone 1 and when it left zone 1 again. The quality of MDS detection and communication is recorded with the aid of this detection period, broken down according to reading and writing.
The diagnostic data from the last 64 MDSs can be stored and output.

The **quality of MDS detection** is indicated by the number of incorrect notifications and the rate of valid distance measurements.
When the sleep time of an MDS has expired, the SLG attempts to notify the MDS and measure the distance to it. As soon as

- the MDS is detected for the first time in zone 1 or
- the MDS has already been detected in zone 1 and has not yet been found to be not present,

in other words, as long as the MDS is inside zone 1, every successful or unsuccessful distance measurement is included in the rate.

The **quality of communication** is indicated by the number of ARQs, the communication times, the time required before the MDS is recognized as being present and the instances of communication errors.

Input format:

```
mdslog
```

or

```
mdslog clear
```

Parameter	Format	Description
clear	ASCII	Option: delete the log data for MDS in the SLG The function is executed without an acknowledgement.

Output format for mdslog without parameter clear:

mdsid	starttime	endtime	arqw	arqr	fcerr	clost	nerr	dcq	timew	timer	timep
id	s-time	e-time	aw	ar	fce	clo	ne	dc	t-w	t-r	t-p
			.								
			.								
			.								
id	s-time	e-time	aw	ar	fce	clo	ne	dc	t-w	t-r	t-p

If no log data is stored for MDS, only the header is output without log data.

mdsid starttime endtime arqw arqr fcerr clost nerr dcq timew timer timep

Parameter	Format	Description
id	Hexadecimal	8-digit MDS ID number (mdsid)
s-time	Decimal	Time at which the MDS is recorded in zone 1 and is therefore accepted by the SLG (starttime) Time stamp in: hhhh Hours mm Minutes ss Seconds ttt Milliseconds
e-time	Decimal	Time at which the MDS exits zone 1 and is recorded as no longer present (endtime) Time stamp in: hhhh Hours mm Minutes ss Seconds ttt Milliseconds
aw	Decimal	Number of ARQs (automatic repeat requests) during writing (arqw) All write operations during the presence in zone 1 are recorded.
ar	Decimal	Number of ARQs (automatic repeat requests) during reading (arqr) All read operations during the presence in zone 1 are recorded.
fce	Decimal	Number of First Command Errors (fcerr) Communication problems during the first command after being recognized as being present
clo	Decimal	Number of unwanted occasions when the MDS is no longer recognized as being present because of too many ARQs (clost)
ne	Decimal	Number of erroneous notifications (nerr)
dc	Decimal	Rate, as a percentage, of all valid distance measurements within the detection period (dcq)
t-w	Decimal	Total communication time in ms during writing, including the processing and sequencing time (timew)
t-r	Decimal	Total communication time in ms during reading, including the processing and sequencing time (timer)
t-p	Decimal	Total sequencing times in ms from receipt of a command to the successful first command (timep)

Output example:

mdsid	starttime	endtime	arqw	arqr	fcerr	clost	nerr	dcq	timew	timer	timep
007C0181	0000:09:32.404	0000:09:51.584	0	0	0	0	0	97	476	42	203
			.								
			.								
			.								
00640181	0000:09:54.188	0000:10:08.174	2	0	0	0	0	100	336	112	140

If the function is entered with an incorrect parameter or an impermissible number of parameters, the following error message appears:

```
Error: Wrong Command Syntax!
```

reboot function

This function restarts the SLG. In contrast to a power-up after power recovery, in the case of this command the firmware is not reloaded by the FPGA (Field Programmable Gate Array) SLGU.

Input format:

```
reboot
```

set_channel function

This function locks or unlocks:

- A single frequency channel or
- Several frequency channels from ... to ... (frequency range)

Input format:

`set_channel mode ch` A single frequency channel
`set_channel mode ch1-ch2` Several frequency channels from ... to ...

Parameter	Format	Description
mode	Decimal	Mode to be set for the frequency channel: 0 Unlock 1 Lock
ch	Decimal	Number of frequency channel: 0 to 99
ch1	Decimal	First number of the range of frequency channels: 0 to 98
ch2	Decimal	Last number of the range of frequency channels: 1 to 99 ch2 > ch1

Output format:

```
Mode mode set
```

Parameter	Format	Description
mode	Decimal	Mode to be set for the frequency channel: 0 Unlock 1 Lock

If the function is entered without parameters or with an impermissible number of parameters, the following error message appears:

```
Wrong number of parameter!
Usage: set_channel 'mode [0|1]'
'channel_nr = [0-99]'
```

If the parameters of this function are incorrect, the following error message appears:

```
Error: Wrong Command Syntax!
```

If an impermissible frequency channel or too many frequency channels are to be locked, the following error message appears:

```
Error: Frequency settings not allowed! Restoring old
values.
```

set_param function

This function sets the default value for the selected SLG firmware parameter. This value is adopted in flash memory. The noflash option prevents the parameter from being written to flash memory and thus from being set permanently. In this case, the setting is lost when the power is switched off or the reboot service function is executed.

Input format:

```
set_param parameter value x
```

or

```
set_param parameter value x noflash
```

Parameter	Format	Description
parameter	ASCII	SLG firmware parameter monitoring times in the 3964R driver (with value 1) 3964_timeout1 Acknowledgment monitoring time 3964_timeout2 Character monitoring time SLG synchronization (with value 2 and 3) syncslgs Number of SLGs to be synchronized syncon [1] Switch SLG synchronization on/off
value 1	Decimal	Monitoring time to be set in ms 150 to 1200 Value for acknowledgment monitoring 50 to 1200 Value for character monitoring
value 2	Decimal	Number of SLGs to be synchronized 2 SLG synchronization with 1 SLG (default) 3 SLG synchronization with 2 SLGs
value 3	Decimal	Switch SLG synchronization on/off 0 Switch SLG synchronization off (off) 1 Switch SLG synchronization on (on) [2]
noflash	ASCII	Option for not writing SLG firmware parameters to flash memory noflash The SLG parameter is not written to flash memory.

1 To enable SLG synchronization to be deactivated or activated, the SLG must be reset with the reboot function or by switching the power off and on.
2 If a BERO mode is set in the reset command, SLG synchronization is not possible and switching it on has no effect.

Output format:

```
set parameter = value x
```

Parameter	Format	Description
parameter	ASCII	SLG firmware parameter monitoring times in the 3964R driver (with value 1) 3964_timeout1 Acknowledgment monitoring time 3964_timeout2 Character monitoring time SLG synchronization (with value 2 and 3) syncslgs Status number to be synchronized SLG syncon Status SLG synchronization
value 1	Decimal	Monitoring time in ms 150 to 1200 Value for acknowledgment monitoring 50 to 1200 Value for character monitoring
value 2	Decimal	Status number of SLGs to be synchronized 2 SLG synchronization with 1 SLG 3 SLG synchronization with 2 SLGs
value 3	Decimal	Status SLG synchronization 0 SLG synchronization off 1 SLG synchronization on

If an invalid parameter and/or an invalid value is entered, one of the following error messages appears:

```
invalid parameter !
```

```
limits exceeded ['minimum value'-'maximum value']
```

If no parameter or an invalid parameter number is entered and/or the parameter value is missing, the following error message appears:

```
Wrong number of parameter!
Usage:
set_param 'parameter' 'value' [noflash]
```

set_time function

This function sets the system time for the service and diagnostic information at the service interface.

Input format:

```
set_time hhh:mm
```

Parameter	Format	Description
hhhh mm	Decimal	System time in: hhhh Hours (0 to 999) mm Minutes (00 to 59)

Output format:

```
SLG time set to: hhhh:mm:ss.ttt
```

Parameter	Format	Description
hhhh mm ss ttt	Decimal	Set system time: hhhh Hours mm Minutes ss Seconds ttt Milliseconds

If the function is entered without parameters or with an impermissible number of parameters, the following error message appears:

```
Wrong number of parameter!
Usage: set_time 'hhh:mm'
```

If the parameters of this function are incorrect, the following error message appears:

```
Error: Wrong Command Syntax!
```

Function sleeptime

This function changes the sleep-time in the MDS determined by the ID number. The ID number (8-digit hex number) is obtained with the get_mds command. It is essential to enter the current calendar week and the current year because these parameters are stored in the MDS and the remaining battery capacity is calculated from them.

Input format:

```
sleeptime mdsid ms week year
```

Parameter	Format	Description
mdsid	Hexadecimal	8-digit MDS ID number
ms	Decimal	Sleep-time in ms: 20; 40; 80; 160; 320; 640; 1280 and 2560
week	Decimal	Calendar week: 1 to 52
year	Decimal	The last two digits of the calendar year. ≥ 01 e.g. 01 for the year 2001

Output format:

```
New sleeptime: mdsnr = mdsid, ms = sleeptime ms
```

Parameter	Format	Description
mdsid	Hexadecimal	8-digit MDS ID number
sleeptime	Decimal	Sleep-time in ms: 20; 40; 80; 160; 320; 640; 1280 and 2560

If there is no MDS in the field or the MDS ID number entered matches that of the MDS in the field, the following error message appears:

```
Error: MDS not in field!
```

If the function is entered without parameters or with an impermissible number of parameters, the following error message appears:

```
Wrong number of parameter!
Usage: sleeptime 'mdsid' 'ms' 'week' 'year'
```

If the limit values of the function parameters are exceeded, the following error message appears:

```
Error: Parameters out of Range!
```

If the parameters of this function are incorrect, the following error message appears:

```
Error: Wrong Command Syntax!
```

Note

When the MDS parameter sleep time is changed, the behavior of the MDS in the field (**power consumption**, response time, behavior in the bunch, etc.) is changed!

slgid function

This function enters the SLG ID number in the SLG. The ID number is 8 hexadecimal digits long. If more than 8 digits are entered, the most recently entered 8 digits apply. The lowermost 10 bits of the SLG ID number are used for notification.

Input format:

```
slgid id
```

Parameter	Format	Description
id	Hexadecimal	8-digit SLG ID number

Output format:

```
SLG ID set to slgid
```

Parameter	Format	Description
slgid	Hexadecimal	8-digit SLG ID number

If the function is entered without parameters or with an impermissible number of parameters, the following error message appears:

```
Wrong number of parameter!
Usage: slgid 'slgid'
```

If the parameters of this function are incorrect, the following error message appears:

```
Error: Wrong Command Syntax!
```

Note

The lowermost 10 bits of SLGs that are in close proximity to each other must be different!

storemode function

This function activates store mode for the MDS with the ID number mdsid.

Input format:

```
storemode mdsid
```

Parameter	Format	Description
mdsid	Hexadecimal	8-digit MDS ID number

Output format:

```
Store mode switched mdsid
```

Parameter	Format	Description
mdsid	Hexadecimal	8-digit MDS ID number

If there is no MDS in the field or the MDS ID number entered does not match that of the MDS in the field, the following error message appears:

```
Error: MDS not in field!
```

If the function is entered without parameters or with an impermissible number of parameters, the following error message appears:

```
Wrong number of parameter!
Usage: storemode 'mdsid'
```

If the parameters of this function are incorrect, the following error message appears:

```
Error: Wrong Command Syntax!
```

trace function

This switches the logging of the service interface (trace mode) on and off. The commands/messages of the service interface and the message frames of the communication interface (each with a time mark and MDS number) are output. The filehandler message frames are not output in filehandler mode; they are converted into normal addressing commands instead.

Input format:

```
trace mode
```

Parameter	Format	Description
mode	ASCII	Trace mode on Activates trace mode off Deactivates trace mode

Output format:

```
Trace mode switched 'on'|'off'
```

If the function is entered without parameters or with an impermissible number of parameters, the following error message appears:

```
Wrong number of parameter!
Usage: trace 'on'|'off'
```

If the parameter of this function is incorrect, the following error message appears:

```
Trace mode switched OFF
Error: Wrong Command Syntax!
```

Example of a trace output:
Command reset, acknowledgement reset, presence message, command MDS status and acknowledgement MDS status

```
------- CMD ------ Time = 0017:37:57.449
TLG: Length = 10   Command = 0   Status = 0
   Data =
         C8 25 00 14 00 01 00 00
>
------- RSP ------ Time = 0017:37:57.477
TLG: Length = 5   Command = 0   Status = 0
   Data =
         01 01 00
>
------- RSP ------ Time = 0017:37:57.603
TLG: Length = 4   Command = F   Status = 0
   Data =
         00 01
>
------- CMD ------ Time = 0017:37:57.645
TLG: Length = 5   Command = B   Status = 0
   Data =
         00 28 01
>
------- RSP ------ Time = 0017:37:57.673
TLG: Length = 18   Command = B   Status = 0
   Data =
         00 50 01 81 84 00 3A 2B DA 08 C9 28 01 FF
         FF 04
>
```

e function

Outputs an overview of the possible error codes that can be passed in the status byte from the SLG interface in direct addressing. The table "Error codes at the SLG interface in direct addressing" describes what the different error numbers mean.

Input format:

```
e
```

Output format:

```
NOMDS_ERROR             0x01
TIME_ERROR              0x02
MDSMEM_ERROR            0x04
CMD_ERROR               0x05
RADIO_ERROR             0x06
MDSERA_ERROR            0x0B
MDSWRT_ERROR            0x0C
MDSADD_ERROR            0x0D
ILLEGAL_CMD_ERROR       0x10
NOMEMORY_ERROR          0x13
RESETPARAM_ERROR        0x15
RESET_ERROR             0x18
CMDACT_ERROR            0x19
ANTENNE_ERROR           0x1C
MAXMDS_ERROR            0x1D
CMDLEN_ERROR            0x1E
CMDBRK_ERROR            0x1F
INTERNAL_ERROR          0x20
```

If the function is entered with parameters, the following error message appears:

```
Wrong number of parameter!
Usage: e
```

Table 3-23 Error codes at the SLG interface in direct addressing

Short name	Error code	Meaning
NOMDS_ERROR	0x01	Presence error: There is no MDS in the field which has the MDS ID number specified in the command. Either the MDS has either already exited the field or the command was supplied with an incorrect MDS ID number.
TIME_ERROR	0x02	Timeout error: A pending MDS command was aborted by an "antenna off" command.
MDSMEM_ERROR	0x04	Error in the memory of the MDS.
CMD_ERROR	0x05	The command cannot be interpreted by the SLG. At least one parameter supplied is impermissible.

Table 3-23 Error codes at the SLG interface in direct addressing

Short name	Error code	Meaning
RADIO_ERROR	0x06	The MDS exited the field during communication.
		There was interference in the field during communication.
MDSERA_ERROR	0x0B	The memory of the MDS cannot be read correctly.
MDSWRT_ERROR	0x0C	It is not permissible for the OTP memory to be rewritten.
MDSADD_ERROR	0x0D	The MDS address specified in the command is impermissible (address error).
ILLEGAL_CMD_ERROR	0x10	The NEXT command is not permissible.
NOMEMORY_ERROR	0x13	The buffer in the SLG is no longer sufficient for storing the command.
RESETPARAM_ERROR	0x15	At least one parameter was supplied incorrectly in the RESET command.
RESET_ERROR	0x18	The SLG must be reset with the RESET command.
CMDACT_ERROR	0x19	There is already a command pending in the SLG for communication with an MDS. A further command is not permissible.
COMM_ERROR	0x1B	Communication error at the SLG interface (3964R driver)
ANTENNE_ERROR	0x1C	The antenna is already activated and has received another activation command.
		The antenna is already deactivated and has received another deactivation command.
		The antenna in the SLG is switched off. An MDS command was sent to the SLG in this state. Switch the antenna on beforehand using the antenna on/off command.
MAXMDS_ERROR	0x1D	The number of MDSs in the field is not permissible. It is larger than the number set in the RESET command under bunch.
CMDLEN_ERROR	0x1E	The message frame length of the command is too large or too small. In other words, the structure of the message frame is incorrect and consists of an incorrect number of characters.
CMDBRK_ERROR	0x1F	A pending command in the SLG was canceled (deleted) by the RESET command.
INTERNAL_ERROR	0x20	An internal SLG error occurred.

3.12 SLG LEDs

The SLG U92 has two light-emitting diodes (LEDs) in green and orange, which indicate the operating status of the SLG. The possible states of the LEDs are indicated in the table below.

Table 3-24 LED states depending on the operating status of the SLG U92

State of the LED		Operating status of the SLG
Green	**Orange**	
Off	Off	The SLG is not in operation. There is no voltage applied.
Off	On	The SLG starts up after the power is switched on. Power-up lasts 3 seconds.
Flashing	Off	The SLG has not yet been parameterized with the RESET command via the SLG interface. The SLG has started up and the RF transmitter is switched off. It is therefore not possible to identify an MDS. The flashing frequency is approx. 2 Hz.
		The RF transmitter is switched off. The RF transmitter is switched off by means of the ”antenna off” command. It is therefore not possible to identify an MDS. The flashing frequency is approx. 2 Hz.
		The SLG should be parameterized with an invalid RESET command via the SLG interface. The RF transmitter is then switched off. It is therefore not possible to identify an MDS. The flashing frequency is approx. 2 Hz.
On	Off	The SLG is ready for communication. The SLG is in operation and parameterized. The RF transmitter is switched on, and identification of and communication with one or more MDSs is possible.
On	On	Communication with the MDS Communication is taking place at the radio interface. Since communication is sometimes very short, the minimum duration for the illumination of the orange LED is 0.1 seconds. Consequently, if there are several short instances of communication in succession, the LED flashes accordingly.

3.13 SLG synchronization via cable connection

General

If two or three SLGs are arranged at a short distance from each other in such a way that they interfere with each other because of their field strength and at the same time want to read from an MDS or write to an MDS, there are collisions/interference between the SLGs. Communication is delayed as a result, to an extent which it is impossible to calculate. The purpose of the synchronization is that the transmission medium “air” should be available to only one SLG at a certain time and a defined communication sequence should be established.
Synchronization is achieved by interconnecting the SLGs with a cable connection between the service interfaces.
The synchronization procedure is based on a time slot procedure in which one SLG is always active for one time period (time slice). The access methods and the collision resolution work in a similar way to CSMA/CD with Ethernet.

Core functions

- Two or three SLGs are synchronized with SLG synchronization via a cable connection.
- If there is simultaneous access by more than one SLG to an MDS, the collision is resolved and one SLG can commence and execute communication.
- An SLG is active for at least a time slice with the duration t_{syn} = 2 x 320 ms (320 ms = default value of sleep time) and is subsequently inactive for at least t_{syn}.
- During ongoing communication the SLG remains active, including the standby time.

Prerequisites

- The SLG-SYNC and SLG-SYNC-GND connections at the service interface must be interconnected with the connection cable for synchronization (see Figure 3-52 and Section 3.10.4).
- The last 10 bits of the SLG ID numbers of the SLGs that are to be synchronized must be different.
- The number of SLGs to be synchronized (two or three) must be parameterized via the service interface of the respective SLG (see Section 3.11.3). The default setting is two SLGs.
- SLG synchronization can be activated statically via the service interface (see Section 3.11.3) or dynamically using the reset command (only in normal mode).

Commissioning

1. With the get_version function (see Section 3.11.3) check at the service interface whether the last 10 bits of the ID numbers of the SLGs that are to be synchronized are different.
   If not, change the respective SLG ID number on the appropriate SLG with the slgid function (see Section 3.11.3) at the service interface.
   Normally the SLG ID numbers are different. The SLG ID number is set in the factory. As the lower 10 bits of the SLG ID number cover the range of values from 0 to 1023, this range of ID numbers is always repeated after 1024 devices.
   The SLG ID number is used for resolving collisions in the event of a simultaneous attempt to access an MDS.
2. Activate synchronization on the SLGs that are to be synchronized with the set_param function (see Section 3.11.3). [1]
   The synchronization status that is currently set can be interrogated with the get_param command (see Section 3.11.3).
3. Connect the SLGs that are to be synchronized via the service interface with the synchronization cable (see Figure 3-52 and Section 3.10.4).

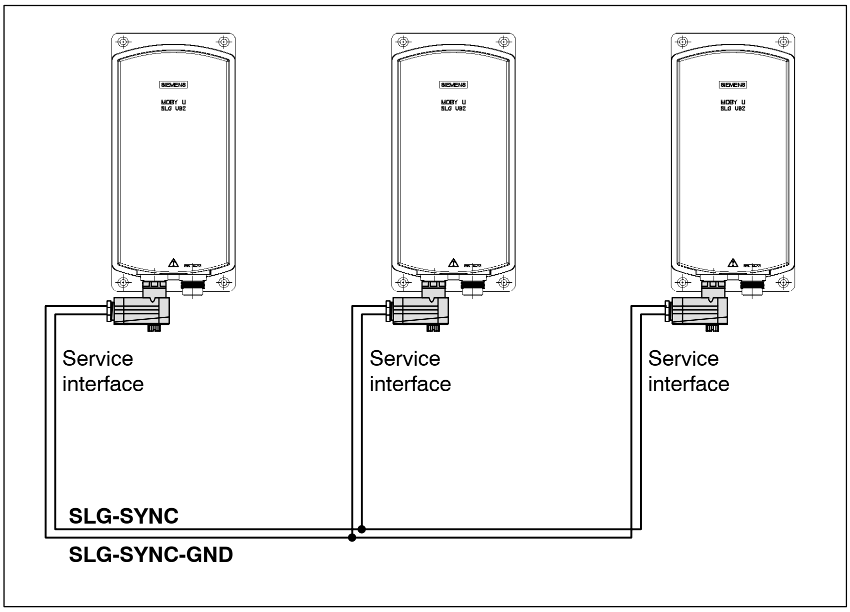


Figure 3-52 Three SLGs connected for synchronization

1 Only if synchronization is to be activated via the service interface. Otherwise it must be activated using the reset command.

Synchronization mode

The synchronization procedure is based on a time slot procedure in which one SLG is always active for one time period. The access methods and the collision resolution work in a similar way to CSMA/CD with Ethernet.

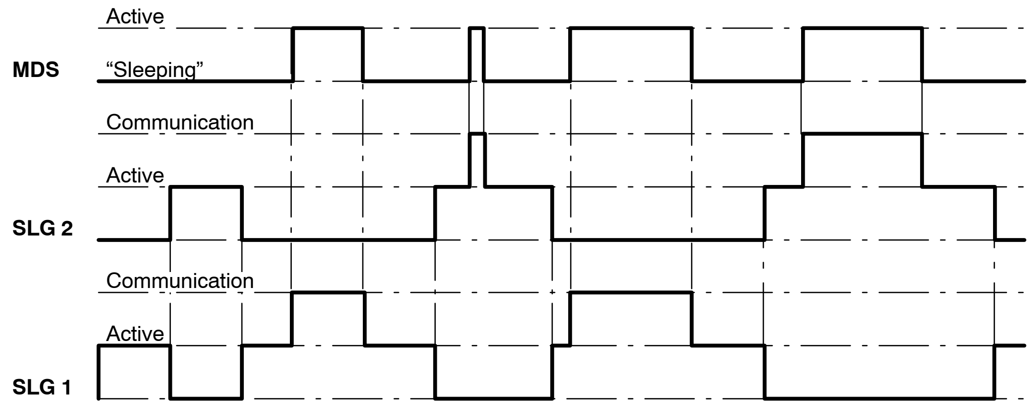


Figure 3-53 Synchronization between two SLGs

The first SLG obtains access for the time slice with the duration t_{syn} = 2 x 320 ms, after which it relinquishes access and the second SLG obtains access with the duration t_{syn}.
This interplay continues until the MDS is recognized as being present by the currently active SLG in zone 1. The subsequent behavior of the active SLG (in the further procedure this is referred to as SLG 1) depends on the operating mode of SLG 1 and the application.

- With "presence" message; no MDS command pending; without standby time:

  SLG 1 reports the presence and waits for the time slice. If no MDS command arrives for execution within the time slice, SLG 1 enables access. The second SLG (SLG 2) then obtains access. In the meantime the MDS puts itself to sleep.
  If a command arrives within the time slice, the time slice is reset with the arrival of the command. When the sleep time of the MDS has expired, the command is executed. If there is a command chain, the time slice is reset with each command within the chain.

- With ”presence” message; no MDS command pending; with standby time:

  SLG 1 reports the presence and waits for the time slice.
  If no MDS command arrives for execution within the time slice, SLG 1 enables access. The second SLG (SLG 2) then obtains access. In the meantime the MDS puts itself to sleep.
  If an MDS command arrives within the time slice and the standby time has not yet expired, the time slice is reset and the command is immediately executed. If there is a command chain, the time slice is reset with each command within the chain.
  If an MDS command within the time slice and the standby time has already expired, SLG 1 resets the time slice and waits for the MDS to be woken up, at most up until the expiry of the time slice. If the sleep time of the MDS expires within the time slice, the command is executed immediately. If the sleep time of the MDS does not expire within the time slice, SLG 1 enables access. The second SLG (SLG 2) then obtains access.

- With ”presence” message; an MDS command pending; without standby time:

  SLG 1 reports the presence and resets the time slice before the pending command is executed. It executes the pending command and waits until the time slice has expired. If no new MDS command arrives for execution within the time slice, SLG 1 enables access. SLG 2 obtains access. In the meantime the MDS puts itself to sleep.
  If a new MDS command arrives within the time slice, the time slice is reset. When the sleep time of the MDS has expired, the command is executed. If there is a command chain, the time slice is reset with each command within the chain.

- With ”presence” message; an MDS command pending; with standby time:

  SLG 1 reports the presence and resets the time slice before the pending command is executed. It executes the pending command and waits until the time slice has expired.
  If an MDS command arrives within the time slice and the standby time has not yet expired, the time slice is reset and the command is immediately executed. If there is a command chain, the time slice is reset with each command within the chain.
  If an MDS command arrives within the time slice and the standby time has already expired, SLG 1 resets the time slice and waits for the MDS to be woken up at most until the time slice has expired. If the sleep time of the MDS expires within the time slice, the command is executed immediately. If the sleep time of the MDS does not expire within the time slice, SLG 1 enables access. The second SLG (SLG 2) then obtains access.

- Without ”presence” message; no MDS command pending; without standby time:

  SLG 1 detects the MDS as being present but does not report it and waits until the time slice has expired.
  If no MDS command arrives for execution within the time slice, SLG 1 enables access. SLG 2 obtains access. In the meantime the MDS puts itself to sleep.
  If an MDS command arrives within the time slice, the time slice is reset. When the sleep time of the MDS has expired, the command is executed. If there is a command chain, the time slice is reset with each command within the chain.

- Without ”presence” message; no MDS command pending; with standby time:

  SLG 1 detects the MDS as being present but does not report it and waits until the time slice has expired.
  If no MDS command arrives for execution within the time slice, SLG 1 enables access. The second SLG (SLG 2) then obtains access. In the meantime the MDS puts itself to sleep.
  If an MDS command arrives within the time slice and the standby time has not yet expired, the time slice is reset and the command is immediately executed. If there is a command chain, the time slice is reset with each command within the chain.
  If an MDS command arrives within the time slice and the standby time has already expired, SLG 1 resets the time slice and waits for the MDS to be woken up at most until the time slice has expired. If the sleep time of the MDS expires within the time slice, the command is executed immediately. If the sleep time of the MDS does not expire within the time slice, SLG 1 enables access. The second SLG (SLG 2) then obtains access.

- Without ”presence” message; an MDS command pending; without standby time:

  SLG 1 detects the MDS as being present but does not report it. Before the pending command is executed it resets the time slice and executes the command. If no new MDS command arrives for execution within the time slice, SLG 1 enables access. SLG 2 obtains access. In the meantime the MDS puts itself to sleep.
  If a new MDS command arrives within the time slice, the time slice is reset before the command is executed. When the sleep time of the MDS has expired, the command is executed. If there is a command chain, the time slice is reset with each command within the chain.

- Without ”presence” message; an MDS command pending; with standby time:

  SLG 1 detects the MDS as being present but does not report it. Before the pending command is executed it resets the time slice and executes the command.
  If no new MDS command arrives for execution within the time slice, SLG 1 enables access. SLG 2 obtains access. In the meantime the MDS puts itself to sleep.
  If an MDS command arrives within the time slice and the standby time has not yet expired, the time slice is reset and the command is immediately executed. If there is a command chain, the time slice is reset with each command within the chain.
  If an MDS command arrives within the time slice and the standby time has already expired, SLG 1 resets the time slice and waits for the MDS to be woken up at most until the time slice has expired. If the sleep time of the MDS expires within the time slice, the time slice is reset and the command is executed immediately. If the sleep time of the MDS does not expire within the time slice, SLG 1 enables access. The second SLG (SLG 2) then obtains access.

When the second SLG (SLG 2) has access and the MDS for this SLG is not located in zone 1, SLG 2 relinquishes access after the time slice with the duration t_{syn}.
When SLG 2 detects the MDS as being present in zone 1, the subsequent behavior of SLG 2 is identical to that of SLG 1.

Synchronization between three SLGs

When there is synchronization between three SLGs, as is the case with synchronization between two SLGs one SLG at a time obtains access for communication for a time slice with the duration t_{syn} = 2 x 320 ms. The time slice in the event of communication with an MDS is lengthened (set) in the same way as for synchronization between two SLGs. After expiry of the access time the SLG waits for the period 2 x t_{syn} (= 4 x 320 ms).

3.14 Power reduction

On the SLG U92 without FCC, the transmitting power is < 10 mW. If required this transmitting power can be reduced by approximately 10 dB.
A reduction may become necessary in the following circumstances:

- Waves carried strongly by large metal surfaces in the close vicinity of the antenna field and hence very slight attenuation of wave propagation
  As a result ranges may become very large, and MDSs may therefore be detected from distances of as much as 20 m or more. Although these MDSs are not processed, they can delay communication with the MDS in zone 1.
  The power reduction makes the detection area for MDSs smaller.
- Two or more SLGs arranged close to each other
  These are particularly likely to affect each other (through their antenna fields) if the waves are routed in the direction of the other SLG virtually without attenuation due to the presence of metallic surfaces.
  Communication is delayed as a result.
  Reducing the transmitting power removes or reduces the interference.

4 Mobile Data Memories

4.1 Introduction

Application area

MOBY identification systems ensure that a product is accompanied by meaningful data from the beginning to the end.
First, mobile data memories are affixed to the product or its carrier or its pakkaging, then written without contact, changed and read. All information on production and material flow control is located right on the product. Its robust construction permits use in rugged environments and makes the MDS insensitive to many chemical substances.

Construction and functions

The primary components of mobile data memories (MDSs) are logic, an antenna, a data memory and a battery.
To keep the MDS's power consumption low and make localization reproducible, MOBY U has different function zones based on direction and distance. The three different zones of the transmission field (see figure 4-1) represent different states and reactions of the affected components.

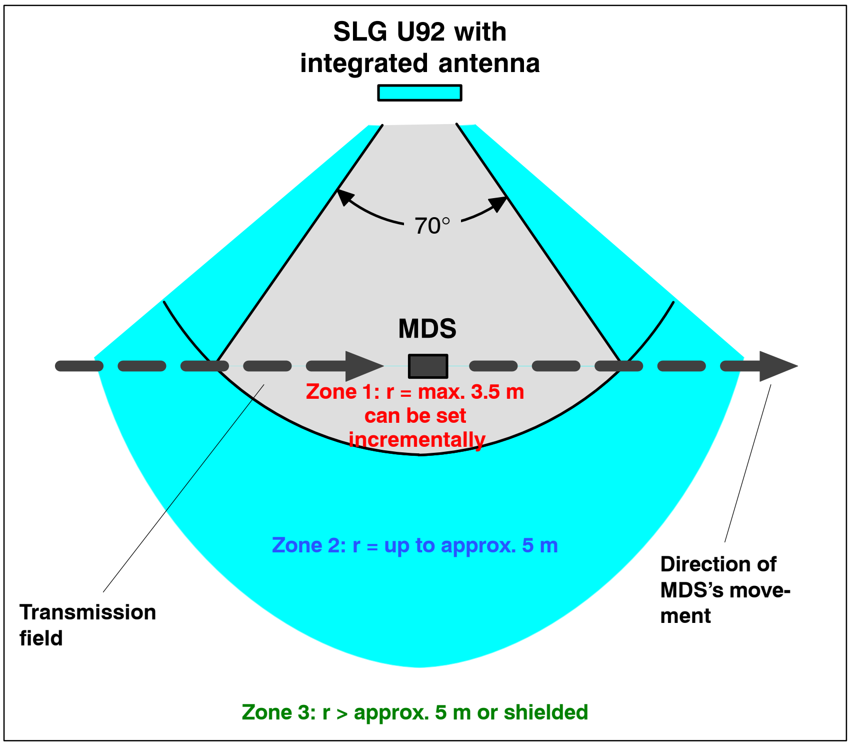


Figure 4-1 Status zones for MDS in transmission field of SLG U92

- Zone 3:
  In simplified terms, zone 3 is the UHF-free area. The MDS is asleep and only wakes up to listen for an SLG once every < 0.5 sec. Power consumption is very low. If other UHF users are in the vicinity and they are using the same frequency range, this does not shorten the battery life of the MDS since it does not wake up until it receives a special code.
- Zone 2:
  If the MDS receives this special code in the vicinity of an active SLG, it enters zone 2 (see Figure 4-1). Starting immediately it accepts the SLG and responds briefly with its own ID. However, the SLG ignores all MDSs which are not in zone 1 (radius can be parameterized on the SLG in increments). Power consumption in zone 2 is a little higher than in zone 3.
- Zone 1:
  When an MDS enters zone 1, it is registered by the SLG and can begin exchanging data. All read and write functions can now be performed. The power consumption of the MDS increases briefly during communication. Since transmission through the air is very fast, total communication time is very short. The entire 32-Kbyte data memory can be read in less than eight seconds. This means that data communication hardly uses the battery.
  As long as the MDS is located in zone 1, it is ready to exchange data when requested by the SLG. When no command for the MDS is queued, it still reports at regular parameterizable intervals with its ID (sleep-time, similar to t-ABTAST with MOBY I) when requested by the SLG. Its behavior then corresponds to that in zone 2, and power consumption drops again accordingly.

Overview

Table 4-1 Overview of the MDS

MDS Type	Memory Size	Temperature Range (during Operation)	Dimensions L x W x H (in mm)	Degree of Protection
MDS U313	2-Kbyte RAM 32-bit fixed code 128-bit read-only memory	–25 to +70 °C	111 x 67 x 23.5	IP 67
MDS U315	2-Kbyte RAM 32-bit fixed code 128-bit read-only memory	–25 to +70 °C	111 x 67 x 23.5	IP 65
MDS U524	32-Kbyte RAM 32-bit fixed code 128-bit read-only memory	–25 to +85 °C	111 x 67 x 23.5	IP 68
MDS U525	32-Kbyte RAM 32-bit fixed code 128-bit read-only memory	–25 to +85 °C	111 x 67 x 23.5	IP 65
MDS U589	32-Kbyte RAM 32-bit fixed code 128-bit read-only memory	–25 to +220 °C (cyclic)	Ø 30 x 10	IP 68

Operational/ambient conditions

Table 4-2 Operational/ambient conditions of the MDS

	MDS U313/ MDS U315	MDS U524/ MDS U525	MDS U589
Mechanical ambient conditions: The mechanical ambient conditions for data carriers are defined in EN 60721-3-7 Class 7 M3.			
Proof of mechanical stability is provided by a vibration test in accordance with EN 60068-2-6, sinusoidal vibrations: Test conditions			
• Frequency range	10 Hz to 500 Hz		
• Amplitude of the displacement	3.1 mm at 10 Hz to 20 Hz		
• Acceleration	5 g at 20 Hz to 500 Hz		
• Test duration per axis	10 cycles		
• Speed of passage	10 octave/min		

Table 4-2 Operational/ambient conditions of the MDS

	MDS U313/ MDS U315	MDS U524/ MDS U525	MDS U589
Proof of mechanical stability is provided by a vibration test in accordance with EN 60068-2-64, random vibrations:			
Test conditions			
• Frequency range	10 Hz to 650 Hz		
• Acceleration density	0.001 m^2/s^3 at 10 Hz; increasing to 0.1 m^2/s^3 at 60 Hz constant 0.1 m^2/s^3 at 60 Hz to 350 Hz decreasing to 0.001 m^2/s^3 at 650 Hz		
• Test duration per axis	30 min		
Proof of mechanical stability is provided by a continuous shock test in accordance with EN 60068-2-29			
Test conditions			
• Acceleration	1000 m/sec^2		
• Duration	6 ms		
• Test duration per axis	500 shocks per position; 3 axes = 6 positions (+/–X, Y, Z)		
Torsion and bending stress	Not permitted		
Degree of protection in accordance with EN 60529	IP67/IP65	IP68/IP65	IP 68
Operating temperature checked in accordance with EN 60068-2-1, -2, and -30	–25 °C to +70 °C	–25 °C to +85 °C	–25 °C to +220 °C (cyclic)
Non-operating temperature checked in accordance with EN 60068-2-1, -2, and -30	–40 °C to +85 °C		
Temperature gradient in the non-operating temperature range checked in accordance with EN 60068-2-14 Nb	3 °C/min		
Temperature gradient with rapid temperature changes checked in accordance with EN 60068-2-14 Na	Transition from 0 °C to +70 °C (+85 °C) in 10 s; hold time 30 min; transition from +70 °C (+85 °C) to 0 °C in 15 s; 100 cycles		
Cleaning with water jet	–		Max. of 5 min at max. of 2 bar
Chemical resistance	See Section 3.3.5		

Table 4-2 Operational/ambient conditions of the MDS

	MDS U313/ MDS U315	**MDS U524/ MDS U525**	**MDS U589**
Certifications	RF: EN 300440-2 [1] SAR: EN 50371 Safety: EN 60950-1 EMC: EN 301489-01 EN 301489-03 ENV 50204 FCC Part 15C (USA) ${}_{C}UL_{US}$ [2] Safe for pacemakers		

Definition of IP65

– Protection against penetration of dust (dustproof)
– Total protection against accidental touch
– Protection against stream of water

Definition of IP67

– Protection against penetration of dust (dustproof)
– Total protection against accidental touch
– Protection against water under defined pressure and time conditions

Definition of IP68:

– Protection against penetration of dust (dustproof)
– Total protection against accidental touch
– The MDS can be continuously submerged in water. Ask manufacturer for conditions.

Warning

The values for vibration and shock are maximum values and must not occur continuously.
Use in conditions in which the maximum values for vibration and shock may be exceeded must be checked beforehand with Siemens.

1 The unit can be used in Austria, Belgium, France (only indoor), Germany, Italy, Spain, United Kingdom.
2 In preparation for MDS U315 and MDS U525.

4.2 MDS U313

The MDS U313 is a mobile data memory (MDS) with a storage capacity of 2 Kbytes for use in transportation and logistics. The particularly low current consumption guarantees a long life of 5 years. The interference-immune and robust MDS can be read and written at a maximum distance of 3 m. The MDS U313 is addressed directly with byte memory accesses. The transmission frequency in the ISM frequency band of 2.4 GHz makes the MDS's net data transmission speed very fast (up to 8 Kbyte/sec without multitag operation and up to 4 Kbyte/sec with multitag operation of two MDSs).

Figure 4-2 MDS U313

Ordering data

Table 4-3 Ordering data for the MDS U313

	Order No.
Mobile data memory MDS U313 With 2 Kbyte RAM MDS ID number (32 bits) Read-only memory (128 bits)	6GT2 500-3BD10

Technical data

Table 4-4 Technical data of the MDS U313

Fixed code memory	MDS ID number (32 bits)
Read-only memory	128 bits, to be written once by user
Application memory Memory technology Memory size Memory organization	 RAM 2 Kbytes Byte access
MTBF (at +40 °C)	2.5 x 10^6 hours (without taking the battery into account)
Read/write distance	0.15 m up to 3 m
Depends on direction	No
Multitag-capable	Yes
Power supply	Battery
Battery lifespan	≥ 5 years at 25 °C[1]; no replacement
Shock, vibration in accordance with EN 60721-3-7, class 7 M3	50 g/10 g
Free fall in accordance with EN 60068-2-32	1 m
Mounting	4 M4 screws
Tightening moment (at room temperature)	≤ 0.8 Nm
Recommended distance from metal	Can be mounted directly on metal
Degree of protection in accordance with EN 60529	IP 67
Chemical resistance	See Section 3.3.5
Housing Dimensions (L x W x H) in mm Color/material	 111 x 67 x 23.5 Anthracite/plastic, PA 12 GF 25
Ambient temperature Operation Transportation and storage	 –25 to +70 °C –40 to +85 °C
Weight, approx.	100 g

1 The lifespan depends on the temperature, the length of time for which the MDS is in the SLG's antenna field (zones 1 and 2), and the amount of data read/written (see Section 3.1.5).

Warning

The mobile data memory contains a lithium battery, which should be handled as follows:

- Avoid the risk of fire, explosion and severe burns
- The battery must not be heated to temperatures above 100 °C.
- Do not dismantle the data memory or mechanically destroy it. The battery could explode if it is handled by unauthorized personnel, damaged, or if its contents come into contact with water.

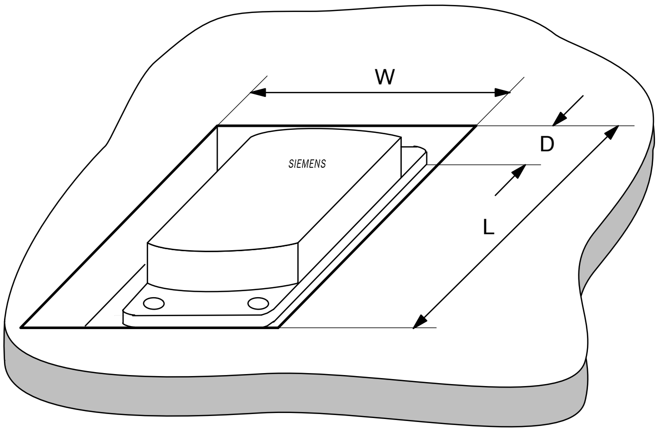
Field data (in mm)

Table 4-5 Field data of the MDS U313

	Standard	Minimal	Maximal
Working distance (S_a)	1400	350	2500
Limit distance (S_g)	2000	500	3000
Transmission window (L)	2400	700	3000
Transmission window (W)	2400	700	3000
Minimum distance of MDS to MDS with			
Bunch > 1	Directly adjacent		
Bunch = 1	The minimum distance must be such that only one MDS can be inside the set distance limit.		

The field data applies to read and write accesses to the MDS when the antenna sides of the MDS and SLG are facing each other.
The field data is reduced in the case of the SLG variant with FCC certification (see Table 5-3).
Overranging can be actively limited by the SLG (in increments of 0.5 m).

Metal-free space



Area of the metal-free space:
$U = 2 * L + 2 * W = n * \lambda$ where
$\lambda = 122.45$ mm $\pm$ 1 mm and $n \geq 4$

Depth of the metal-free space:
$D = m * \lambda/4$ where $m \geq 1$

Figure 4-3 Metal-free space, MDS U313

The MDS U313 may be installed flush in metal, countersunk in surfaces or inserted in supports, for example U or T supports.

- The field geometry is only slightly reduced if it is installed flush with the metal.
- Metal-free space is necessary to ensure good communication if the MDS is countersunk in metal surfaces. The area of the metal-free space should be a multiple of the wavelength $\lambda = 122.45$ mm $\pm$ 1 mm where $n \geq 4$. We recommend a metal installation box with an area of $n * \lambda$ where $n = 4$ and a depth of $\lambda/4$. The area and depth relate to the internal dimensions. The MDS U313 can be positioned anywhere in the box except directly on the bottom.

  The smallest installation box has the following area:

  Area = 2 *L [mm] + 2 * W [mm] = $4 * \lambda$ where L = W

  = 4 * 122.45 mm = 489.8 mm

  It has the following depth:

  $D = \lambda/4 = 122.45$ mm / 4 = 30.6 mm.

  The metal box with an area of $4 * \lambda$ and a depth of $\lambda/4$ somewhat increases the directional effect of the MDS U313. This means that the range increases and the field width is reduced by approximately 200 mm.
  A greater depth of $D = \lambda/2$ reduces the field width by approximately 200mm. A larger area of $\geq 5 * \lambda$ reduces the effect of the greater depth.
- We recommend you also use the installation box if you use U or T supports. This ensures that the antenna field is less dependent on the environment.

Covering materials

Pertinax, acrylic, or non-polar plastic materials such as polyamide or PPS can be used for covering the MDS U313, for example as impact protection.
Plastic materials suitable for RF welding absorb the RF field used for communication. They are therefore not suitable.
It is difficult to make a statement about the suitability of wooden covers because of their moisture content and different impregnations.

Acrylic glass with a thickness of 10 mm reduces the field width by approximately 100 mm.

Dimensions (in mm)

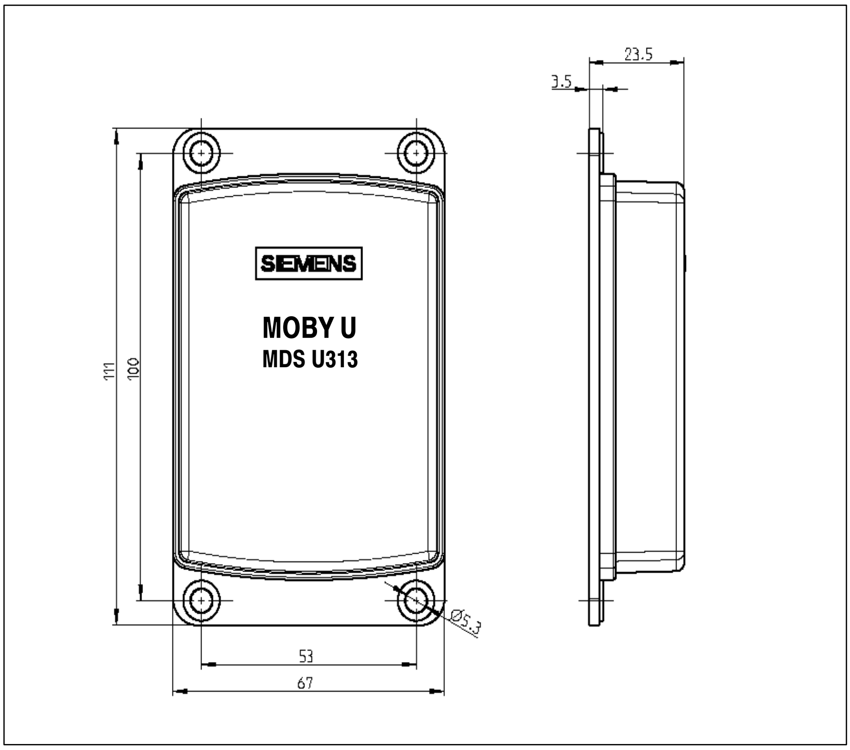


Figure 4-4 Dimensions of the MDS U313

4.3 MDS U315

The MDS U315 is a mobile data memory (MDS) with a storage capacity of 2 Kbytes and a replaceable battery especially suitable for use in transportation and logistics. The particularly low current consumption guarantees a long life of 5 years. The service life of the MDS can be prolonged accordingly by the possibility of replacing the battery. The interference-immune and robust MDS can be read and written at a maximum distance of 3 m. The MDS U 315 is addressed directly with byte memory accesses. The transmission frequency in the ISM frequency band of 2.4 GHz makes the MDS's net data transmission speed very fast (up to 8 Kbyte/sec without multitag operation and up to 4 Kbyte/sec with multitag operation of two MDSs).

Figure 4-5 MDS U315

Ordering data

Table 4-6 Ordering data for the MDS U315

	Order No.
Mobile data memory MDS U315 with 2 Kbytes RAM MDS ID number (32 bits) Read-only memory (128 bits) replaceable battery	6GT2 500-3BF10

Technical data

Table 4-7 Technical data of the MDS U315

Fixed code memory	MDS ID number (32 bits)
Read-only memory	128 bits, to be written once by user
Application memory Memory technology Memory size Memory organization	 RAM 2 Kbytes Byte access
MTBF (at +40 °C)	2.5 x 10^6 hours (without taking the battery into account)
Read/write distance	0.15 m up to 3 m
Depends on direction	No
Multitag-capable	Yes
Power supply	Battery
Battery lifespan	≥ 5 years at 25 °C[1]; without replacing the battery ≥ 10 years at 25 °C[1]; with replacement of the battery ≥ can be replaced 5 times
Shock, vibration in accordance with EN 60721-3-7, class 7 M3	50 g/10 g
Free fall in accordance with EN 60068-2-32	1 m
Mounting	4 M4 screws
Tightening moment (at room temperature)	≤ 0.8 Nm
Battery replacement compartment	on the rear; cover secured with 4 screws
Recommended distance from metal	Can be mounted directly on metal
Degree of protection in accordance with EN 60529	IP 65
Chemical resistance	See Section 3.3.5
Housing Dimensions (L x W x H) in mm Color/material	 111 x 67 x 23.5 Anthracite/plastic, PA 12 GF 25
Ambient temperature Operation Transportation and storage	 –25 to +70 °C –40 to +85 °C
Weight, approx.	100 g

1 The lifespan depends on the temperature, the length of time for which the MDS is in the SLG's antenna field (zones 1 and 2), and the amount of data read/written (see Section 3.1.5).

Warning

The mobile data memory contains a lithium battery, which should be handled as follows:

- Avoid the risk of fire, explosion and severe burns
- The battery must not be heated to temperatures above 100 °C.
- Do not dismantle the data memory or mechanically destroy it. The battery could explode if it is handled by unauthorized personnel, damaged, or if its contents come into contact with water.

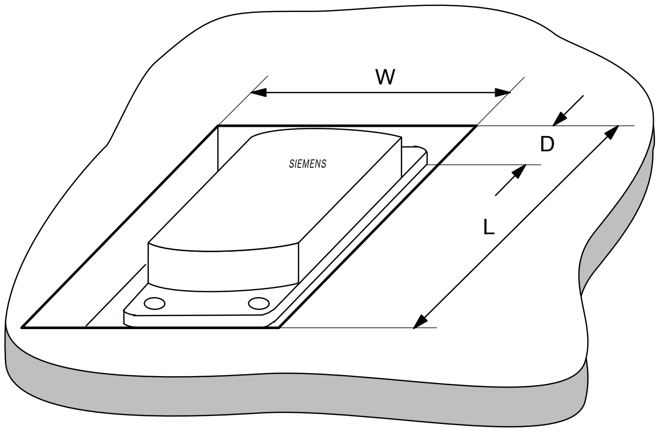
Field data (in mm)

Table 4-8 Field data of the MDS U315

	Standard	Minimal	Maximal
Working distance (S_a)	1400	350	2500
Limit distance (S_g)	2000	500	3000
Transmission window (L)	2400	700	3000
Transmission window (W)	2400	700	3000
Minimum distance of MDS to MDS with			
Bunch > 1	Directly adjacent		
Bunch = 1	The minimum distance must be such that only one MDS can be inside the set distance limit.		

The field data applies to read and write accesses to the MDS when the antenna sides of the MDS and SLG are facing each other.
The field data is reduced in the case of the SLG variant with FCC certification (see Table 5-3).
Overranging can be actively limited by the SLG (in increments of 0.5 m).

Metal-free space



Area of the metal-free space:
U = 2 * L + 2 * W = n * λ where
λ = 122.45 mm ± 1 mm and n ≥ 4

Depth of the metal-free space:
D = m * λ/4 where m ≥ 1

Figure 4-6 Metal-free space, MDS U315

The MDS U315 may be installed flush in metal, countersunk in surfaces or inserted in supports, for example U or T supports.

- The field geometry is only slightly reduced if it is installed flush with the metal.
- Metal-free space is necessary to ensure good communication if the MDS is countersunk in metal surfaces. The area of the metal-free space should be a multiple of the wavelength λ = 122.45 mm ± 1 mm where n ≥ 4. We recommend a metal installation box with an area of n * λ where n = 4 and a depth of λ/4. The area and depth relate to the internal dimensions. The MDS U 315 can be positioned anywhere in the box except directly on the bottom.

  The smallest installation box has the following area:

  Area = 2 *L [mm] + 2 * W [mm] = 4 * λ where L = W

  = 4 * 122.45 mm = 489.8 mm

  It has the following depth:

  D = λ/4 = 122.45 mm / 4 = 30.6 mm.

  The metal box with an area of 4 * λ and a depth of λ/4 somewhat increases the directional effect of the MDS U315. This means that the range increases and the field width is reduced by approximately 200 mm.
  A greater depth of D = λ/2 reduces the field width by approximately 200 mm. A larger area of ≥ 5 * λ reduces the effect of the greater depth.
- We recommend you also use the installation box if you use U or T supports. This ensures that the antenna field is less dependent on the environment.

Covering materials

Pertinax, acrylic, or non-polar plastic materials such as polyamide or PPS can be used for covering the MDS U315, for example as impact protection.
Plastic materials suitable for RF welding absorb the RF field used for communication. They are therefore not suitable.
It is difficult to make a statement about the suitability of wooden covers because of their moisture content and different impregnations.

Acrylic glass with a thickness of 10 mm reduces the field width by approximately 100 mm.

Dimensions (in mm)

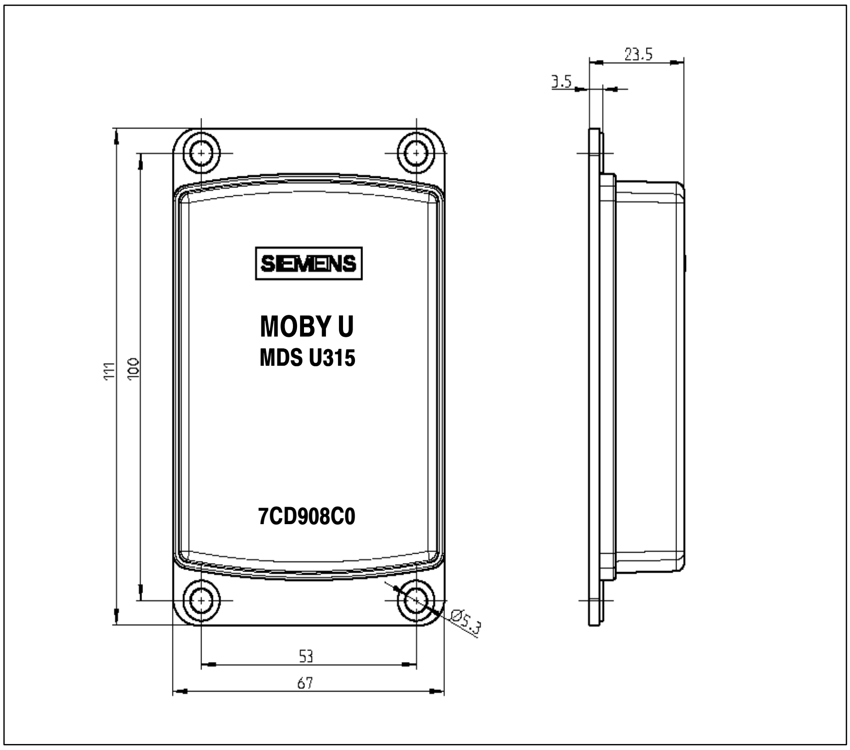


Figure 4-7 Dimensions of the MDS U315

4.4 MDS U524

The MDS U524 is a mobile data memory (MDS) with a large, 32-Kbyte storage capacity for use in the automotive industry and other industrial production plants with similar requirements. The particularly low current consumption guarantees a long life of 8 years. The interference-immune and robust MDS can be read and written at a maximum distance of 3 m. Addressing the MDS U524 is easy with the filehandler (from MOBY I) which uses logical file addresses. In addition, the MDS can also be used with direct memory accessing. The transmission frequency in the ISM frequency band of 2.4 GHz makes the MDS's net data transmission speed very fast (up to 8 Kbyte/sec without multitag operation and up to 4 Kbyte/sec with multitag operation of two MDSs).

Figure 4-8 MDS U524

Ordering data

Table 4-9 Ordering data of the MDS 524

	Order No.
Mobile data memory MDS U524 with 32-Kbyte RAM MDS ID number (32 bits) Read-only memory (128 bits)	6GT2 500-5CE10

Technical data

Table 4-10 Technical data of the MDS U524

Fixed code memory	MDS ID number (32 bits)
Read-only memory	128 bits, to be written once by user
Application memory	
Memory technology	RAM
Memory size	32 Kbytes
Memory organization	Byte access Filehandler mode
MTBF (at +40 °C)	2.5 x 10^6 hours (without taking the battery into account)
Read/write distance	0.15 m up to 3 m
Depends on direction	No
Multitag-capable	Yes
Power supply	Battery
Battery lifespan	≥ 8 years at +25 °C[1]; no replacement
Shock, vibration in accordance with EN 60721-3-7, class 7 M3	50 g/10 g
Free fall in accordance with EN 60068-2-32	1 m
Mounting	4 M4 screws
Tightening moment (at room temperature)	≤ 0.8 Nm
Recommended distance from metal	Can be mounted directly on metal
Degree of protection in accordance with EN 60529	IP 68
Chemical resistance	See Section 3.3.5
Housing	
Dimensions (L x W x H) in mm	111 x 67 x 23.5
Color/material	Anthracite/plastic, PA 12 GF 25
Ambient temperature	
Operation	–25 to +85 °C
Transportation and storage	–40 to +85 °C
Weight, approx.	100 g

1 The lifespan depends on the temperature, the length of time for which the MDS is in the SLG's antenna field (zones 1 and 2), and the amount of data read/written (see Section 3.1.5).

Warning

The mobile data memory contains a lithium battery, which should be handled as follows:

- Avoid the risk of fire, explosion and severe burns
- The battery must not be heated to temperatures above 100 °C.
- Do not dismantle the data memory or mechanically destroy it. The battery could explode if it is handled by unauthorized personnel, damaged, or if its contents come into contact with water.

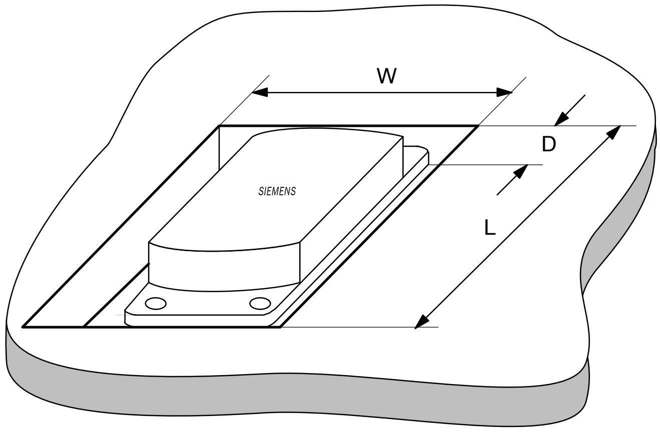
Field data (in mm)

Table 4-11 Field data of the MDS U524

	Standard	Minimal	Maximal
Working distance (S_a)	1400	350	2500
Limit distance (S_g)	2000	500	3000
Transmission window (L)	2400	700	3000
Transmission window (W)	2400	700	3000
Minimum distance of MDS to MDS with Bunch > 1 Bunch = 1	 Directly adjacent The minimum distance must be such that only one MDS can be inside the set distance limit.		

The field data applies to read and write accesses to the MDS when the antenna sides of the MDS and SLG are facing each other.
The field data is reduced in the case of the SLG variant with FCC certification (see Table 5-3).
Overranging can be actively limited by the SLG (in increments of 0.5 m).

Metal-free space



Area of the metal-free space:
$U = 2 * L + 2 * W = n * \lambda$ where
$\lambda = 122.45$ mm $\pm$ 1 mm and $n \geq 4$

Depth of the metal-free space:
$D = m * \lambda/4$ where $m \geq 1$

Figure 4-9 Metal-free space, MDS U524

The MDS U524 may be installed flush in metal, countersunk in surfaces or inserted in supports, for example U or T supports.

- The field geometry is only slightly reduced if it is installed flush with the metal.
- Metal-free space is necessary to ensure good communication if the MDS is countersunk in metal surfaces. The area of the metal-free space should be a multiple of the wavelength $\lambda = 122.45$ mm $\pm$ 1 mm where $n \geq 4$. We recommend a metal installation box with an area of $n * \lambda$ where $n = 4$ and a depth of $\lambda/4$. The area and depth relate to the internal dimensions. The MDS U524 can be positioned anywhere in the box except directly on the bottom.

  The smallest installation box has the following area:

  Area = 2 *L [mm] + 2 * W [mm] = 4 * λ where L = W
  = 4 * 122.45 mm = 489.8 mm

  It has the following depth:

  $D = \lambda/4 = 122.45$ mm / 4 = 30.6 mm.

  The metal box with an area of 4 * λ and a depth of $\lambda/4$ somewhat increases the directional effect of the MDS U524. This means that the range increases and the field width is reduced by approximately 200 mm.

  A greater depth of $D = \lambda/2$ reduces the field width by approximately 200 mm. A larger area of $\geq 5 * \lambda$ reduces the effect of the greater depth.

- We recommend you also use the installation box if you use U or T supports. This ensures that the antenna field is less dependent on the environment.

Covering materials

Pertinax, acrylic, or non-polar plastic materials such as polyamide or PPS can be used for covering the MDS U524, for example as impact protection.
Plastic materials suitable for RF welding absorb the RF field required for communication. They are therefore not suitable.
It is difficult to make a statement about the suitability of wooden covers because of their moisture content and different impregnations.

Acrylic glass with a thickness of 10 mm reduces the field width by approximately 100 mm.

Dimensions (in mm)

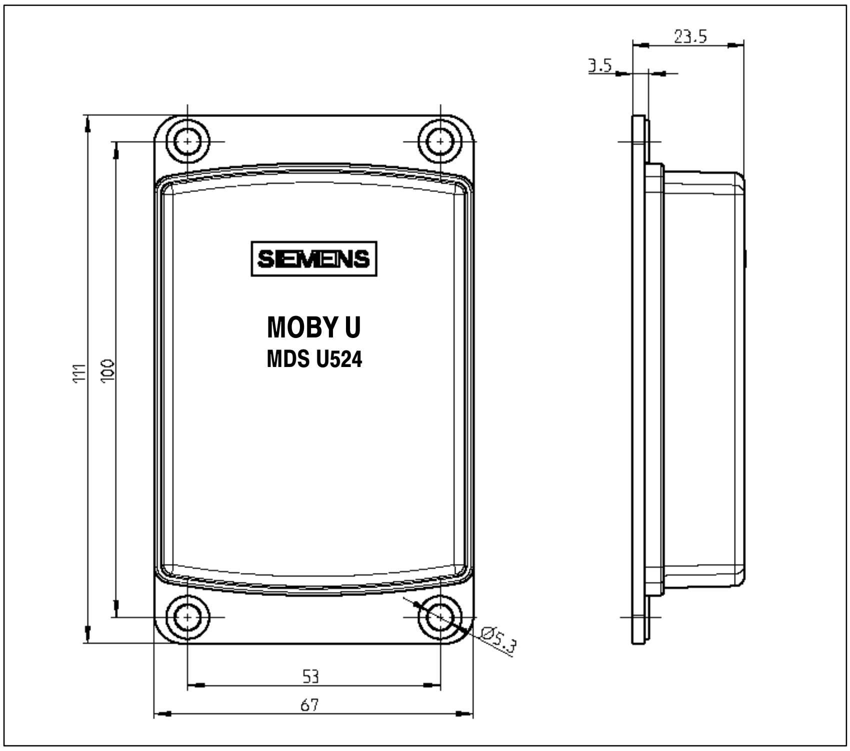


Figure 4-10 Dimensions of MDS U524

4.5 MDS U525

The MDS U 525 is a mobile data memory (MDS) with a large, 32 -Kbyte storage capacity and a replaceable battery for use in the automotive industry and other industrial production plants with similar requirements. The particularly low current consumption guarantees a long life of 8 years. The service life of the MDS can be prolonged accordingly by the possibility of replacing the battery. The interference-immune and robust MDS can be read and written at a maximum distance of 3 m. Addressing the MDS U525 is easy with the filehandler (from MOBY I) which uses logical file addresses. In addition, the MDS can also be used with direct memory accessing. The transmission frequency in the ISM frequency band of 2.4 GHz makes the MDS's net data transmission speed very fast (up to 8 Kbyte/sec without multitag operation and up to 4 Kbyte/sec with multitag operation of two MDSs).

Figure 4-11 MDS U525

Ordering data

Table 4-12 Ordering data for the MDS U525

	Order No.
Mobile data memory MDS U525 with 32 Kbytes RAM MDS ID number (32 bits) Read-only memory (128 bits) replaceable battery	6GT2 500-5CF10

Technical data

Table 4-13 Technical data of the MDS U525

Fixed code memory	MDS ID number (32 bits)
Read-only memory	128 bits, to be written once by user
Application memory Memory technology Memory size Memory organization	 RAM 32 Kbytes Byte access Filehandler mode
MTBF (at +40 °C)	2.5 x 10^6 hours (without taking the battery into account)
Read/write distance	0.15 m up to 3 m
Depends on direction	No
Multitag-capable	Yes
Power supply	Battery
Battery lifespan	≥ 8 years at +25 °C[1]; without replacing the battery ≥ 10 years at 25 °C[1]; with replacement of the battery ≥ can be replaced 5 times
Shock, vibration in accordance with EN 60721-3-7, class 7 M3	50 g/10 g
Free fall in accordance with EN 60068-2-32	1 m
Mounting	4 M4 screws
Tightening moment (at room temperature)	≤ 0.8 Nm
Battery replacement compartment	on the rear; cover secured with 4 screws
Recommended distance from metal	Can be mounted directly on metal
Degree of protection in accordance with EN 60529	IP 65
Chemical resistance	See Section 3.3.5
Housing Dimensions (L x W x H) in mm Color/material	 111 x 67 x 23.5 Anthracite/plastic, PA 12 GF 25
Ambient temperature Operation Transportation and storage	 –25 to +85 °C –40 to +85 °C
Weight, approx.	100 g

1 The lifespan depends on the temperature, the length of time for which the MDS is in the SLG's antenna field (zones 1 and 2), and the amount of data read/written (see Section 3.1.5).

Warning

The mobile data memory contains a lithium battery, which should be handled as follows:

- Avoid the risk of fire, explosion and severe burns
- The battery must not be heated to temperatures above 100 °C.
- Do not dismantle the data memory or mechanically destroy it. The battery could explode if it is handled by unauthorized personnel, damaged, or if its contents come into contact with water.

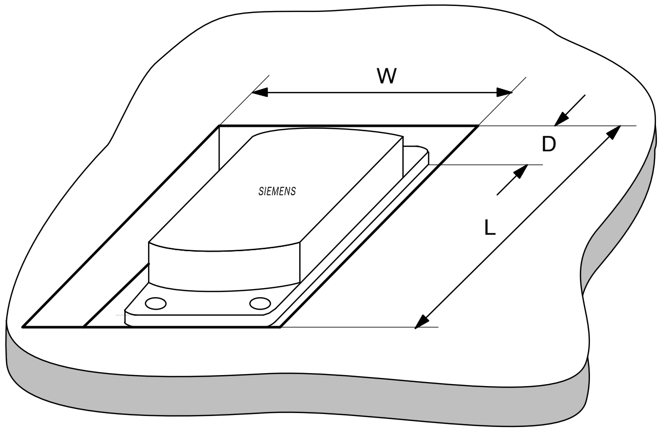
Field data (in mm)

Table 4-14 Field data of the MDS U525

	Standard	Minimal	Maximal
Working distance (S_a)	1400	350	2500
Limit distance (S_g)	2000	500	3000
Transmission window (L)	2400	700	3000
Transmission window (W)	2400	700	3000
Minimum distance of MDS to MDS with			
Bunch > 1	Directly adjacent		
Bunch = 1	The minimum distance must be such that only one MDS can be inside the set distance limit.		

The field data applies to read and write accesses to the MDS when the antenna sides of the MDS and SLG are facing each other.
The field data is reduced in the case of the SLG variant with FCC certification (see Table 5-3).
Overranging can be actively limited by the SLG (in increments of 0.5 m).

Metal-free space



Area of the metal-free space:
U = 2 * L + 2 * W = n * λ where
λ = 122.45 mm ± 1 mm and n ≥ 4

Depth of the metal-free space:
D = m * λ/4 where m ≥ 1

Figure 4-12 Metal-free space, MDS U525

The MDS U525 may be installed flush in metal, countersunk in surfaces or inserted in supports, for example U or T supports.

- The field geometry is only slightly reduced if it is installed flush with the metal.
- Metal-free space is necessary to ensure good communication if the MDS is countersunk in metal surfaces. The area of the metal-free space should be a multiple of the wavelength λ = 122.45 mm ± 1 mm where n ≥ 4. We recommend a metal installation box with an area of n * λ where n = 4 and a depth of λ/4. The area and depth relate to the internal dimensions. The MDS U 525 can be positioned anywhere in the box except directly on the bottom.

  The smallest installation box has the following area:

  Area = 2 *L [mm] + 2 * W [mm] = 4 * λ where L = W
  = 4 * 122.45 mm = 489.8 mm

  It has the following depth:

  D = λ/4 = 122.45 mm / 4 = 30.6 mm.

  The metal box with an area of 4 * λ and a depth of λ/4 somewhat increases the directional effect of the MDS U525. This means that the range increases and the field width is reduced by approximately 200 mm.

  A greater depth of D = λ/2 reduces the field width by approximately 200 mm. A larger area of ≥ 5 * λ reduces the effect of the greater depth.

- We recommend you also use the installation box if you use U or T supports. This ensures that the antenna field is less dependent on the environment.

Covering materials

Pertinax, acrylic, or non-polar plastic materials such as polyamide or PPS can be used for covering the MDS U525, for example as impact protection.
Plastic materials suitable for RF welding absorb the RF field required for communication. They are therefore not suitable.
It is difficult to make a statement about the suitability of wooden covers because of their moisture content and different impregnations.

Acrylic glass with a thickness of 10 mm reduces the field width by approximately 100 mm.

Dimensions (in mm)

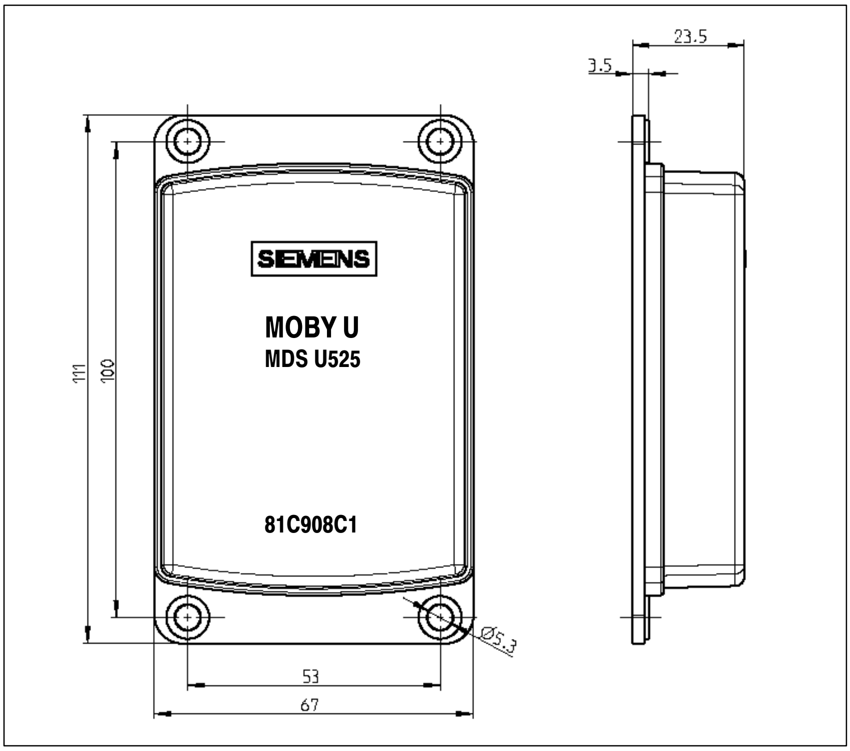


Figure 4-13 Dimensions of MDS U525

4.6 MDS U589

The MDS U589 is a mobile data memory (MDS) with a large, 32-Kbyte storage capacity. It is designed for use at high temperature ranges (up to +220°C, cyclically), especially in the paint shops of the automotive industry. The size of the MDS permits it to be attached to a skid or directly to a chassis.
The particularly low current consumption guarantees a long life of 5 years. The interference-immune and robust MDS can be read and written at a maximum distance of 3 m. Addressing the MDS U589 is easy with the filehandler (from MOBY I) which uses logical file addresses. In addition, the MDS can also be used with direct memory accessing. The transmission frequency in the ISM frequency band of 2.4 GHz makes the MDS's net data transmission speed very fast (up to 8 Kbyte/sec without multitag operation and 4 Kbyte/sec with multitag operation of two MDSs).

Some typical applications are listed below.

- Basic coat, KTL area, cataphoresis with drying chambers
- Covering coat
- Washing area
- Other applications with high temperatures

Figure 4-14 MDS U589

Ordering data

Table 4-15 Ordering data of the MDS U589

	Order No.
Mobile data memory MDS U589 with 32-Kbyte RAM MDS ID number (32 bits) Read-only memory (128 bits)	6GT2 500-5JK10
Accessory: holder Universal holder for MDS U589 Short model for MDS 439E/U589 Long model for MDS 439E/U589 Covering hood for MDS 439E/U589	 6GT2 590-0QA00 6GT2 090-0QA00 6GT2 090-0QA00-ZA31 6GT2 090-0QB00

Technical data

Table 4-16 Technical data of the MDS U589

Fixed code memory	MDS ID number (32 bits)
Read-only memory	128 bits, to be written once by user
Application memory Memory technology Memory size Memory organization	 RAM 32 Kbytes Byte access; Filehandler mode
MTBF (at +40 °C)	2.5 x 10^6 hours (without taking the battery into account)
Read/write distance	0.15 m up to 3 m
Depends on direction	No
Multitag-capable	Yes
Power supply	Battery
Battery lifespan	≥ 5 years at +25 °C [1]; no replacement
Shock, vibration in accordance with EN 60721-3-7, class 7 M3	50 g/5 g [2]
Free fall in accordance with EN 60068-2-32	1 m
Mounting	With holder
Recommended distance from metal	Can be mounted directly on metal
Degree of protection in accordance with EN 60529	IP 68
Chemical resistance	See table 4-2
Housing Dimensions (Ø x H) in mm Color/material	 114 x 83 Brown/PPS
Ambient temperature Operation Transportation and storage	 –25 to +85 °C, up to +220 °C (cyclic) –40 to +85 °C
Weight, approx.	600 g

1 The lifespan depends on the temperature, the length of time for which the MDS is in the SLG's antenna field (zones 1 and 2), and the amount of data read/written (see Section 3.1.5).
2 Only applies to original holder

Note

The MDS U589 is silicon-free.

Field data (in mm)

Table 4-17 Field data of the MDS U589

	Standard	Minimal	Maximal
Working distance (S_a)	1400	350	2500
Limit distance (S_g)	2000	500	3000
Transmission window (L)	2400	700	3000
Transmission window (W)	2400	700	3000
Minimum distance of MDS to MDS with			
Bunch > 1	Directly adjacent		
Bunch = 1	The minimum distance must be such that only one MDS can be inside the set distance limit.		

The field data applies to read and write accesses to the MDS when the antenna sides of the MDS and SLG are facing each other.
The field data is reduced in the case of the SLG variant with FCC certification (see Table 5-3).
Overranging can be actively limited by the SLG (in increments of 0.5 m).

Cyclic operation of the MDS U589 at temperatures of > 85 °C

At ambient temperatures of between 85 °C and 200 °C (briefly 220 °C), you must ensure that the internal temperature of the MDS does not exceed the critical threshold of 110 °C. Every heating up phase must be followed by a cooling off phase. The following tables lists several cycles of the MDS U589 at its utmost limits.

Table 4-18 Cycles of the MDS U589 at its utmost limits

T_u (Heating Up)	Heating Up	T_u (Cooling Off)	Cooling Off
220 °C	Brief	25 °C	> 30 min
200 °C	1 h	25 °C	> 4 h
200 °C	0.5 hr	25 °C	> 1 h
180 °C	1 h	25 °C	> 3 h

Note

Siemens will calculate a temperature profile on request.

Accurate knowledge of the internal temperature makes configuration easier for time-critical applications.

Note

Ambient temperatures > 220 °C:
If the heat-resistant data memory is subjected to ambient temperatures > 220 °C, any warranty claims are forfeited.
Mechanical stability is maintained, however, up to 230 °C.

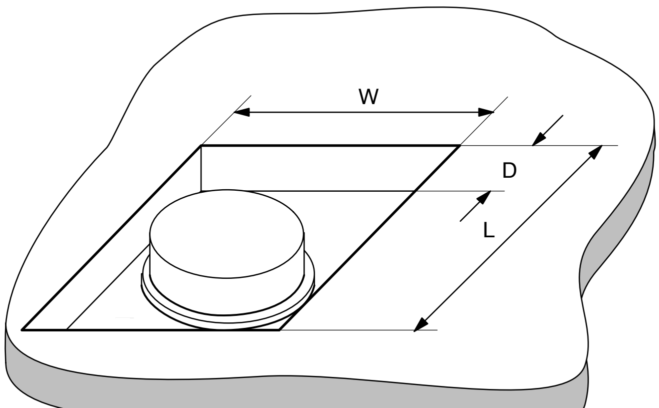
Note

Internal temperature > 110 °C:
If the heat-resistant data memory is operated at an internal temperature of > 110 °C, any warranty claims are forfeited. At an internal temperature of > 110 °C, the heat-resistant data memory loses the ability to function. Communication with the MDS might be impaired for a long time or may no longer be possible. It is not possible to remedy the fault.

Warning

- The temperatures and temperature cycles specified in this description must not be exceeded.
  Non-compliance with the above may result in death, severe injury, or major damage to property.
- If the internal temperature of 130 °C is exceeded, the integrated lithium battery in the data memory explodes.
- As of 230 °C the mechanical stability of the heat-resistant data memory is destroyed. Note the mechanical deformation and its effect on the production process.
- If the data memory is mechanically destroyed (for example as a result of improper cleaning), it is liable to explode due to the ingress of liquid and heating.

Metal-free space



Area of the metal-free space:
$U = 2 * L + 2 * W = n * \lambda$ where
$\lambda = 122.45$ mm $\pm$ 1 mm and $n \geq 7$ [1]

Depth of the metal-free space:
$D = m * \lambda/4$ where $m \geq 3$

1 The factor n is determined by the holder of the MDS U589.

Figure 4-15 Metal-free space, MDS U589

The MDS U589 may be installed flush in metal, countersunk in surfaces or inserted in supports, for example U or T supports.

- The field geometry is only slightly reduced if it is installed flush with the metal.
- Metal-free space is necessary to ensure good communication if the MDS is countersunk in metal surfaces. The area of the metal-free space should be a multiple of the wavelength λ = 122.45 mm $\pm$ 1 mm where n $\geq$ 7. We recommend a metal installation box with an area of n * λ where n = 7 and a depth of m * λ/4 where m = 3. The area and depth relate to the internal dimensions. The MDS U589 can be positioned anywhere in the box except directly on the bottom.

  The smallest installation box has the following area:

  Area = 2 *L [mm] + 2 * W [mm] = 7 * λ where L = 2 * λ; W = 1.5 * λ

  = 7* 122.45 mm = 857.15 mm

  It has the following depth:

  D = m * λ/4 = 3 * 122.45 mm / 4 = 91.8 mm

  The metal box with an area of 7 * λ and a depth of 3 * λ/4 somewhat increases the directional effect of the MDS U589. This means that the range increases and the field width is reduced by approximately 200 mm.

  A greater depth of D = λ/2 reduces the field width by approximately 200 mm. A larger area of $\geq$ 5 * λ reduces the effect of the greater depth.
- We recommend you also use the installation box if you use U or T supports. This ensures that the antenna field is less dependent on the environment.

Covering materials

Pertinax, acrylic, or non-polar plastic materials such as polyamide or PPS can be used for covering the MDS U589, for example as impact protection.
Plastic materials suitable for RF welding absorb the RF field required for communication. They are therefore not suitable.
It is difficult to make a statement about the suitability of wooden covers because of their moisture content and different impregnations.

Acrylic glass with a thickness of 10 mm reduces the field width by approximately 100 mm.

Dimensions (in mm)

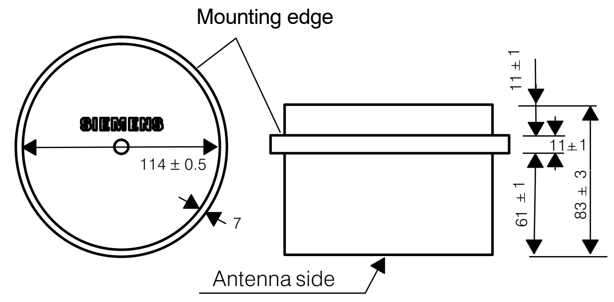


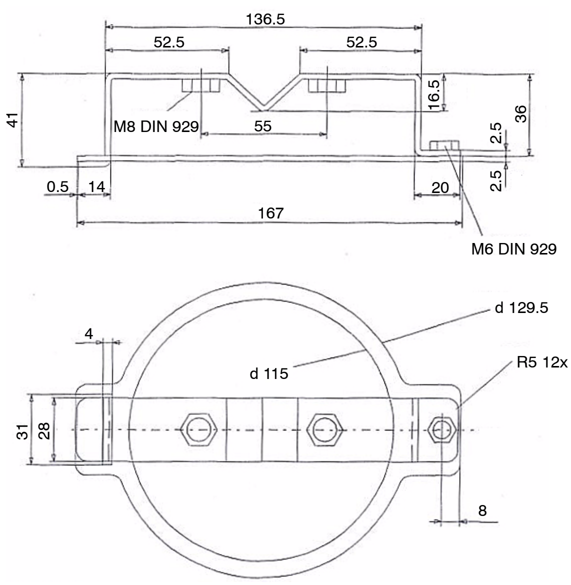
Figure 4-16 Dimensions of the MDS U589

Holders

Universal holder

A universal holder is available for when the heat-resistant and robust mobile data memory MDS U589 is used in paint shops (automotive industry, base/top coat) or applications with similar temperature requirements, for example for mounting on a vehicle body. The universal holder weighs about 250 grams.
The universal holder consists of a metal ring and a metal clip. The MDS U589 must be inserted in the metal ring and then clamped in place with the clip by screwing the clip tight with just one M6 screw.
The entire holder with the MDS is secured with two M8 screws (either directly or with the aid of a customer-specific adapter, e.g. on the vehicle body). The two screws required to attach the universal holder are not included with the product.

Figure 4-17 Universal holder with heat-resistant data carrier MDS U589

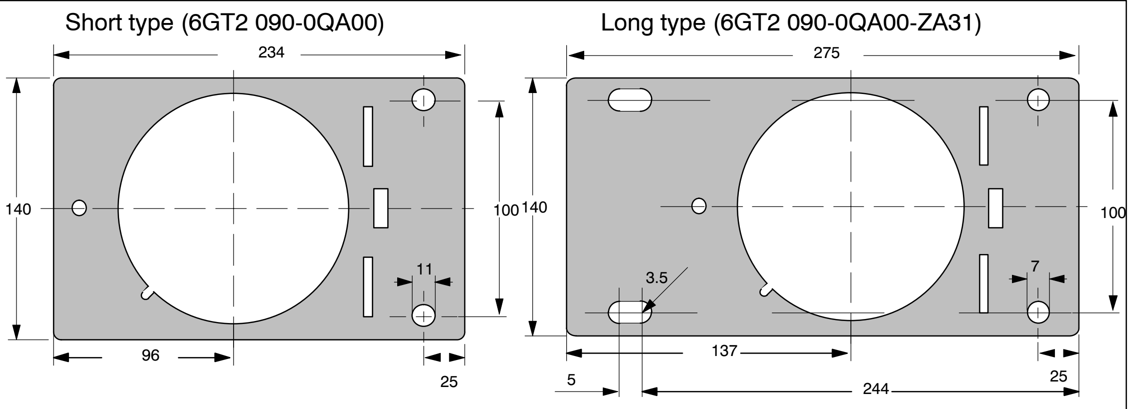


Material: V2A sheet metal, 2.5 mm thick
Material 1.4301

Figure 4-18 Dimensions: universal holder for heat-resistant data carrier MDS U589

Short model / long model

A special holder made of V2A sheet metal was developed for mounting the MDS U589 with vibration damping. The construction of the holder ensures that the MDS is not damaged in the event of a shock or vibration below the maximum values. Mechanical tolerances for the thermal expansion of the MDS U589 and the holder are also included.



Material: V2A sheet metal, 2.5 mm thick
Sheet metal 2.5 59382 1.4541

Figure 4-19 Dimensions: MDS U589 data memory holder

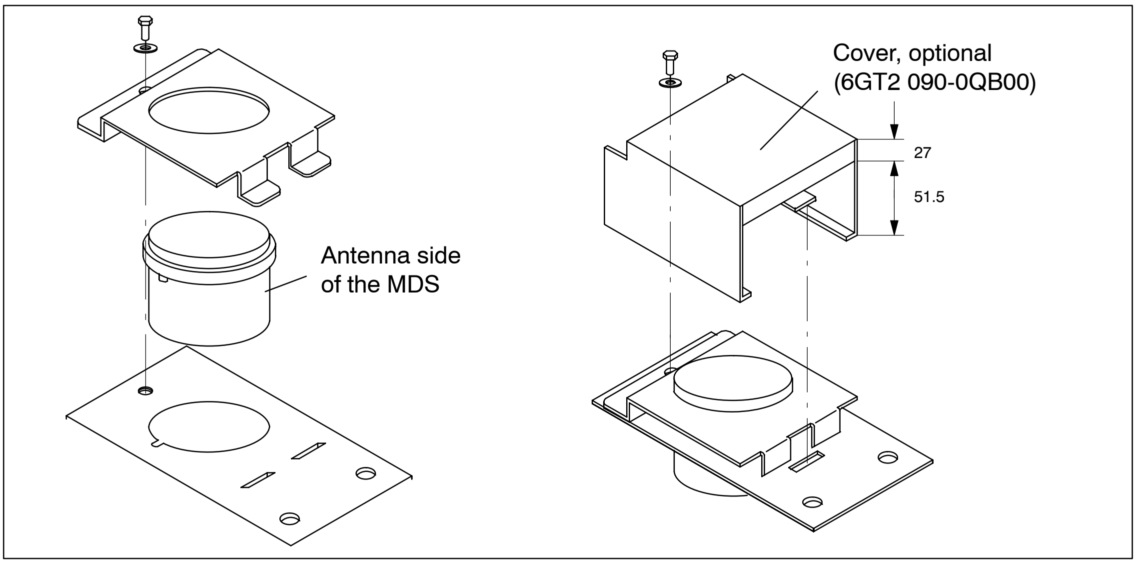


Figure 4-20 Assembling the MDS U589 and holder

The holder is delivered with all the parts required for mounting and a drawing. The screws required to attach the holder are not included with the product. The diameter of the fixing screws is M 10, and the minimum length 25 mm. The optional cover can be used for both the long and the short type of holder.
We recommend a protective cover for the high-temperature data carrier for use in paint shops. You can obtain further information from your Siemens branch.

Note

We urgently recommend you to use the MDS U589 only with the original holder described above. Only this holder ensures that the MDS adheres to the specified values for shock, vibration, and temperature.
We recommend a protective cover for applications in paint shops.

5 Read/Write Devices

5.1 SLG U92

Application area

The MOBY U identification system was designed especially for applications in automotive production, logistics and similar where high demands are placed on interference immunity, long read/write distances with moving data memories, quick and reliable data transmission, easy installation, and reliable function even in rugged environments. It uses the ISM frequency band of 2.4 GHz (globally approved). Its emission strength is way below the values recommended by well-known health authorities from all over the world.

MOBY U covers the transmission range **up to three meters** and thus fulfills the prerequisites for an end-to-end identification solution. The SLG is available for every situation with 2 interface versions.

The **main areas of application** for MOBY U are listed below.

- Main assembly lines of the automotive industry (raw product manufacturing, surface treatment and assembly)
- Vehicle identification/entry check for moving companies, vehicle parks, and so on
- Container/pallet identification for transportation logistics and distribution
- Traffic control technology
- Assembly lines

Setup and functions

The SLG U92 handles the commands received from the interface or PC/PLC. The commands with the data to be read or written are converted into appropriate communication commands via the RF interface between SLG and MDS.
The amount of data that can be transferred between SLG and MDS depends on the following factors.

- The speed at which the MDS moves through the SLG's transmission window
- The length of the transmission window
- The number of MDSs in the transmission window (bunch/multitag)
- The time during which the MDS is ready for communication (depends on sleep time and standby time)

The SLG U92 is available in two hardware versions for connection to different systems.

- System interface with RS 232
  for serial connection to any system
  (PC/PLC/communications processors)
- System interface with RS 422
  for serial connection to MOBY interfaces (ASM 475, ASM 473, ASM 452) for integration in SIMATIC S7 or PROFIBUS or any system
  (PC/PLC/communications processors)

Except for the system interface, the hardware and firmware of both hardware versions are identical.

Software tools such as SIMATIC S7 functions (FC 45/FC 46/FC 56) and the MOBY API library for applications under Windows 98/NT/2000 make implementation in specific applications easy.

The integrated file management system (compatible with the familiar MOBY I filehandler and supplemented with multitag commands) ensures simple, convenient administration of data on the mobile data memories.

The SLG U92 works with a transmission frequency in the ISM frequency band between 2.4 and 2.4835 GHz. This makes a transmission distance of up to three meters possible with very low transmitter power of < 10 mW EIRP and high net transmission rates of up to 8 Kbyte/sec. In the case of the SLG U92 with FCC (see Table 5-1), the transmitting power is < 50 mV/m at a distance of 3 m. By selection of the transmission frequency, use of robust modulation procedures and appropriate check routines, sources of electromagnetic interference can be disregarded and you are still assured of correct data transmission and integrity. MOBY U technology eliminates familiar interference during UHF transmissions such as reflection, interference and overranging. Specially designed antennas ensure a homogenous transmission field in which mobile data memories (MDSs) are always (100%) detected. This means expensive shielding and antenna directing can be omitted.
The antenna field of the SLG can be activated and deactivated for communication with an MDS with a function call or automatically by triggering a digital input.
There are two ways to manage the data on the mobile data memory:

- Bytewise addressing via **absolute addresses** (start address, length)
- Using a convenient **file management system** (compatible with the MOBY I filehandler)

When the filehandler is used, the MOBY U read/write device always fetches its file management information directly from the MDS.

The SLG U92 can be run at three levels.

1. MOBY U can be used for existing system solutions with MOBY I with default settings, unchanged filehandler functions but without the MOVE and LOAD commands which used to be required.
2. Only a few extra commands are required for changes in the default settings and requesting diagnostic data.
3. Utilization of all features including multitag processing. At this level, the commands and/or user data can also be clearly related to the MDS number.

Two LEDs show the current status (e.g., communication) and make commissioning easier.

A separate service and diagnostic interface (RS 232) is available for easy commissioning and diagnosis later during regular operation. In addition, the service function ”load software to SLG” can be used to load future function expansions via this interface without having to exchange the SLG in existing applications.

Figure 5-1 Read/write device SLG U92

SLG U92 write/read devices are available in versions with or without FCC certification.
They vary in transmitting power and thus in field geometry.
The FCC version has a narrow field width (see Figures 5-2 and 5-3).

Ordering data

Table 5-1 Ordering data of the SLG U92

SLG U92 write/read device with RS 422 without FCC	6GT2 501-0CA00
SLG U92 write/read device with RS 232 without FCC	6GT2 501-1CA00
SLG U92 write/read device with RS 422 with FCC	6GT2 501-0BA00
SLG U92 write/read device with RS 232 with FCC	6GT2 501-1BA00

Technical data

Table 5-2 Technical data of the SLG U92

Air interface		
Transmission frequency	2.4 to 2.4835 GHz	
Band width	2 x 1 MHz within 83 MHz	
Gross bit rate of radio channel	384 kbit/sec	
Data transmission speed (net)	Without bunch	With bunch size 2
Write Read	8.0 Kbyte/sec 4.8 Kbyte/sec	Approx. 4.0 Kbyte/sec Approx. 2.4 Kbyte/sec
Distance (read/write)	0.15 m up to 3 m	
Limit distance (S_g) Maximum Minimum Default	Adjustable by means of the distance limit 3.0 m 0.5 m 1.5 m	
Location resolution	Range limitation, adjustable in 0.5 m increments	
Working distance (S_a)	Approx. 75% of limit distance S_g	
Field length/width with S_g = 1.5 m	3 m	
Read/write device (SLG)		
Functions	MOBY filehandler Direct read/write access	
Multi-identification capability	Up to 12 MDSs	
MDS recording time	> 2 s with 12 MDSs	
Object speed	< 2 m/s at L_a = 1.5 m and ≤ 2.5 Kbytes of data read/written	
Power supply	24 VDC (nominal value), 20 VDC to 30 VDC Current source with limited output power in accordance with EN 60950/IEC 60950	
Current consumption (send)	< 300 mA	
Operating modes (SLG)	Standby Search Communication	
Synchronization, SLG - SLG	By semaphore control via 2nd interface; max. of 3 SLGs together	
Minimum distance between two SLGs	> 6 m Directly adjacent with synchronization SLG - SLG	
ASM/PC Interface	6-pin SLG connector in accordance with EN 175201-804 RS 232 or RS 422 (SLG U92 version)	
Transmission speed Transmission protocol Line length, SLG - ASM Line length, SLG - PC	Automatic baud rate recognition, 19.2 to 115.2 kbps (depends on ASM/PC and/or line length) 3964 R Maximum 1000 m (RS 422; shielded) Maximum 30 m (RS 232; shielded)	

Table 5-2 Technical data of the SLG U92

Service interface	11-pin connector in accordance with EN 175201-804
Interface for service	RS 232
Transmission rate Length of cable SLG - PC Transmission log	19.2 kbaud Maximum 20 m (shielded) Terminal, ASCII characters
2 DIs for BERO	
DI 1/DI 2 DI 1 (or DE 2) Line length, SLG - BERO	BERO for triggering antenna field on/off BERO for continuous antenna field on Maximum 50 m (shielded)
Interface for SLG synchronization	
Line length, SLG - SLG	Maximum 30 m (shielded)
LEDs	2 LEDs
Housing Dimensions [L x W x H] Color Material	 290 x 135 x 42 without connector Anthracite Plastic, PA 12 GF 25
Mounting	4 M6 screws
Tightening moment (at room tempe-rature)	≤ 2 Nm
Shock, vibration in accordance with EN 60721-3-7, class 7 M3	30 g/1.5 g
Free fall in accordance with EN 60068-2-32	1 m
MTBF (at +40°C)	0.4×10^6 hours
Degree of protection in accordance with EN 60529	IP 65
Ambient temperature Operation Transport and storage	 –25 to +70 °C –40 to +85 °C
Weight, approx.	800 g
Antenna	Integrated in the SLG
Emission Emission density	< 10 mW EIRP [1] < 0.5 µW/cm² (at distance of 1 m)
Receiver sensitivity	–95 dBm
Gain	5 dBi
Radiation backwards	–20 dB forwards/backwards ratio
Angle of opening	Approx. 70 ° horizontal/vertical

Table 5-2 Technical data of the SLG U92

Polarization	Circular
Certifications	RF: EN 300440-2 [2] SAR: EN 50371 Safety: EN 60950-1 EMC: EN 301489-01 EN 301489-03 ENV 50204 FCC Part 15C (USA) [3] $_{C}UL_{US}$ Safe for pacemakers

1 The transmitting power of the SLG U92 version with FCC is < 50 mV/m at a distance of 3 m.

2 The unit can be used in Austria, Belgium, France (only indoor), Germany, Italy, Spain, United Kingdom.

3 FCC certification only for the SLG U92 version with FCC (see Table 5-1).

Warning

The values for shock and vibration are maximum values and must not be reached on a continuous basis.

Field data

The field data are the same regardless of MDS type.

Table 5-3 Field data for SLG U92

	Without FCC certification	**With FCC certification**
Working distance (S_a)	1.5 m up to 2.5 m	
Limit distance (S_g)	3 m	
Transmission window L	3.0 m	2.1 m
Minimum distance D from SLG to SLG	6 m	

Transmitting power must be reduced for FCC certification. A reduction results in a smaller field size. The limit distance remains at 3 m, but the field width is reduced to 2.1 m.

FCC information

Made in Germany
SIEMENS MOBY U SLG U92 with RS 422
FCC ID: NXWMOBYU-SLGU92-0
THIS DEVICE COMPLIES WITH PART 15 OF THE fcc rules: operation is subject to the following two conditions:
(1) this device may not cause harmful interference, and (2) this device must accept any interference that may cause undesired operation.

Made in Germany
SIEMENS MOBY U SLG U92 with RS 232
FCC ID: NXWMOBYU-SLGU92-1
THIS DEVICE COMPLIES WITH PART 15 OF THE fcc rules: operation is subject to the following two conditions:
(1) this device may not cause harmful interference, and (2) this device must accept any interference that may cause undesired operation.

Note

Changes or modifications of this unit may void the user's authority to operate the equipment.

UL Information

The unit is to be supplied by a listed power supply complying C1.2.5 of UL 60950 (NEC Class 2) and rated from 20 V_{DC} to 30 V_{DC}, min. 300mA. The unit shall be instored in accordance to the NEC, Article 725-52.

Transmission window (SLG U92 without FCC)

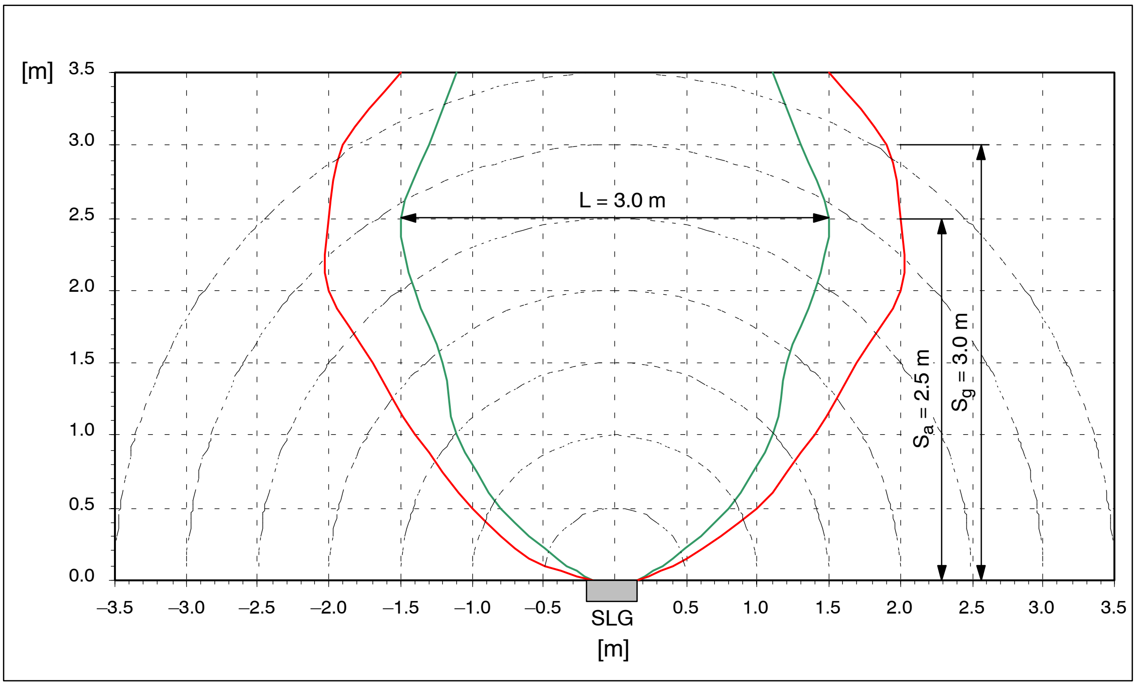


Figure 5-2 Transmission window of the SLG U92 (without FCC)

The transmission window shown above is obtained when the antenna sides of the MDS and SLG are facing each other.

The field edges are indicated by lines. From above the field is almost round. The field size can fluctuate slightly due to external influences.
In the inner area the quality of communication can be considered very good to good. The average communication time between the SLG and MDS can vary by ±10 % in this area. The MDS can be moved as required in the inner area of the transmission window with the communication quality remaining constant, provided that the assignment (angle) of the SLG and MDS remains unchanged.
The outer area represents the maximum communication area. Between the inner and outer area the quality of communication decreases towards the outside and ends as soon as it exits the area. This means that in extreme cases the communication time can be a multiple of the original value.
In the direction of radiation from the SLG antenna the communication area is limited by the range limit.
In applications outside the inner area, an appropriate test should be performed in order to ensure that the quality of communication is still adequate and that the communication time remains within the required bounds.

The size of the field can be changed by setting the range limit from 0.5 m to 3.5 m in increments of 0.5 m. The range limit set is subject to a tolerance of ±0.2 m to ±0.3 m. The increments are represented by dotted radii.
To obtain the largest field diameter with a working distance S_a of 2.5 m, for example, the limit distance S_g must be ≥ 3 m. That means that the range limit must be set to 3.5 m. With a tolerance of ±0.3 m the SLG can then take up communication within the field at a distance of between 3.2 m and 3.8 m to the MDS.
At a working distance S_a of 2.5 m the field diameter is 3.0 m = transmission window L.

Transmission window (SLG U92 with FCC)

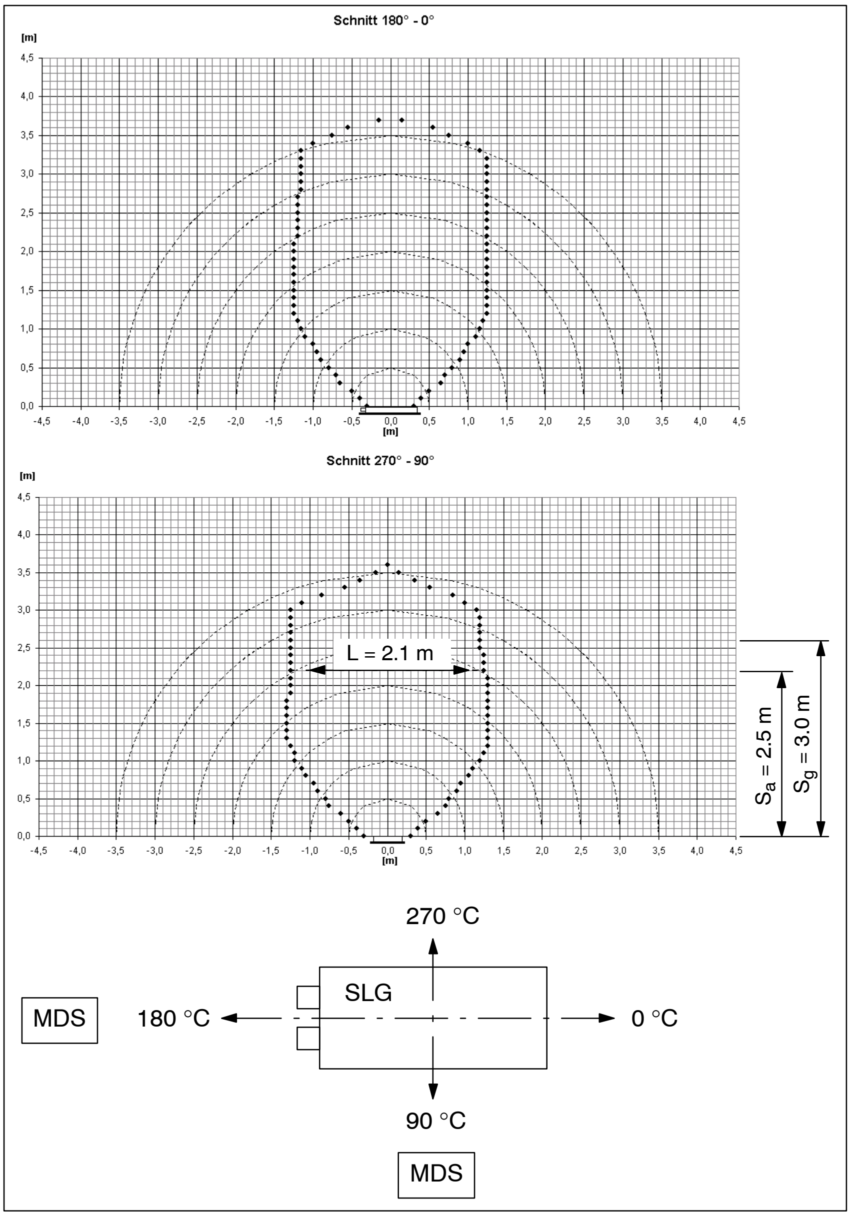


Figure 5-3 Transmission window of the SLG U92 (with FCC)

The transmission window is displayed in two views.

- The MDS enters the SLG field at an angle of 180 °C or 0 °C.
- The MDS enters the SLG field at an angle of 270 °C or 90 °C.

The antenna sides of the MDS and SLG are facing each other.

The field edges are displayed by dotted lines. From above the field is almost round. The field size can fluctuate slightly due to external influences.
The size of the field can be changed by setting the range limit from 0.5 m to 3.5 m in increments of 0.5 m. The range limit set is subject to a tolerance of ±0.2 m to ±0.3 m. The variable increments are represented by dotted radii.
To obtain the largest field diameter with a working distance S_a of 2.1 m, for example, the limit distance S_g must be ≥ 3 m. That means that the range limit must be set to 3.5 m. With a tolerance of ±0.3 m the SLG can then take up communication within the field at a distance of between 3.2 m and a maximum of 3.5 m to the MDS.
At a working distance S_a of 2.1 m the field diameter is 2.1 m = transmission window L.

Metal-free space

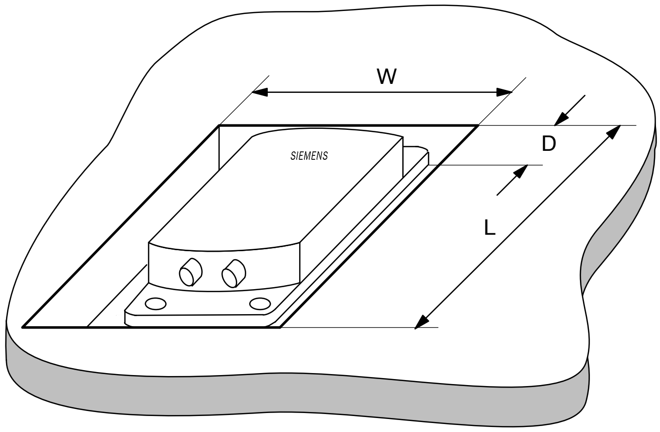


Figure 5-4 Metal-free space of SLG U92

The SLG U92 may be installed countersunk in surfaces, flush in metal or inserted in supports, for example U or T supports.

- Metal-free space is necessary to ensure good communication if the MDS is countersunk in metal surfaces. The area of the metal-free space should be a multiple of the wavelength λ = 122.45 mm $\pm$ 1 mm where n $\geq$ 8. We recommend a metal installation box with an area of n * λ where n $\geq$ 8 and a depth of m * λ/2 where m $\geq$ 1. The area and depth relate to the internal dimensions. You can place the SLG U92 anywhere in the installation box except directly on the bottom or where the connector and cable for the SLG interface are to be placed. There should be openings for the connector and cable.
  The smallest installation box has an area of 8 * 122.45 mm = 979.6 mm and a depth of 1 * 122.45 mm / 2 = 61.2 mm.

4. Example:
   Area = 979.6 mm = 2 *L [mm] + 2 * W [mm] = 2 * 235 mm + 2 * 139.8 mm

- The field geometry is reduced if the device is installed flush with the metal and there may be restrictions in communication.
- We recommend you also use the installation box if you use U or T supports. This ensures that the antenna field is less dependent on the environment.

Covering materials

Pertinax, acrylic, or non-polar plastic materials such as polyamide or PPS can be used for covering the MDS U92, for example for protection against kikking.
Plastic materials suitable for RF welding absorb the RF field used for communication. They are therefore not suitable.
It is difficult to make a statement about the suitability of wooden covers because of their moisture content and different impregnations.

Covers of acrylic glass or Pertinax with a thickness of 10 mm change the field only slightly.

Definition of the distance D

The distance between the SLG U92s depends on the type of application and how the SLG U92s are arranged:

1. Two or more adjacent SLG U92s and only one MDS U in each detection field
2. Two SLG U92s either adjacent or adjacent but turned toward each other and only one MDS U in the same detection field
3. Several SLG U92s either adjacent or at an angle to each other and only one MDS U in the same detection field
4. Two SLG U92s back to back
5. Two SLG U92s facing each other
6. Several adjacent SLG U92s and more than one MDS U in each detection field
7. Several adjacent SLG U92s and more than one MDS U in the same detection field

The detection area is the part of the SLG U92 field in which the calculated distance between the SLG U92 and the MDS U is less than or equal to the value of the range limit dili [m] plus an offset of 0.5 m.

On point 1: Two or more adjacent SLG U92s and only one MDS U in each detection field:

The SLG U92s can be installed next to each other at a distance D_x as long as **only one MDS U is in each detection field**.

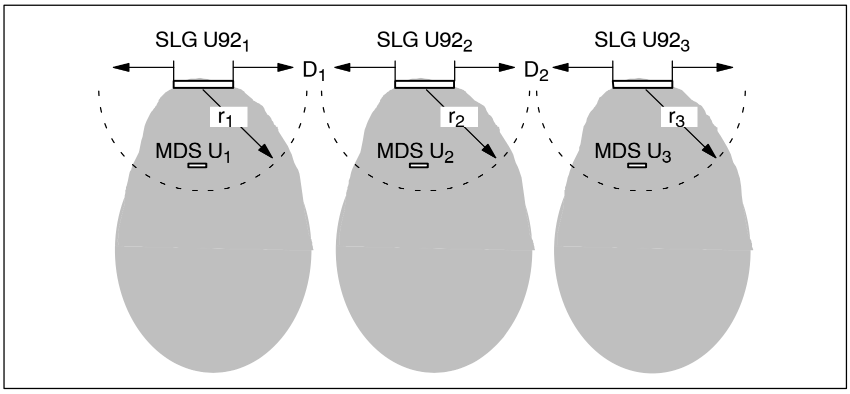


Figure 5-5 Distance D: two or more adjacent SLG U92s and only one MDS U in each detection field

The range limit (dili) must provide sufficient demarcation. In other words, if a circle forms around each SLG U92 with a radius r_x = the range limit $dili_x$ [m] + 0.5 m, the circles must not overlap.

Note

Communication can take some time, depending on the distance between the SLGs and how they are arranged.

On point 2: Two SLG U92s either adjacent or adjacent but turned toward each other and only one MDS U in the same detection field:

The SLG U92s can be installed next to each other at distance D as long as **only one MDS U is in the common detection field**. The coordination of the sequence of communication is controlled in the user application.

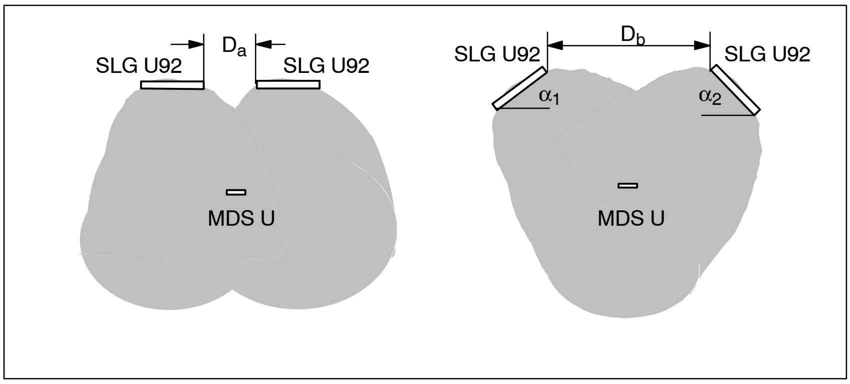


Figure 5-6 Distance D: two SLG U92s mounted either adjacent or adjacent but turned toward each other

$D_a \geq 200$ mm
$D_b \geq 200$ mm at an angle of inclination $\alpha_x \leq 45°$ angle.

Example: Two SLG U92s at a processing station
At a processing station, the associated application of the first or second SLG processes the data carrier, depending on the information on the data carrier. Depending on the strength of the field and the time behavior, a SLG takes up communication with the data carrier and the application checks whether it is responsible. If it is not, it terminates communication or doesn't continue it. If it is, the application continues communication until it is completed.

Note

The closer the SLG U92s are installed to each other and/or the greater the angle of inclination α_x, the longer communication can take.

On point 3: Several SLG U92s either adjacent or at an angle to each other and only one MDS U in the same detection field:

The SLG U92s can be installed next to each other as long as **only one MDS U is in the same detection field**. The coordination of the sequence of communication is controlled in the user application.

Note

The closer the SLG U92s are installed to each another, the greater the reduction in communication performance, which can lead to a total blockage.

On point 4: Two SLG U92s facing each other

You can select the distance D between the SLG U92s to ensure that reflections between the MDS U_2 and SLG $U92_1$ with a length $\leq r_1$ or the MDS U_1 and SLG $U92_2$ with a length $\leq r_2$ cannot occur.

Radius r_x = range limit value of $dili_x$ [m] + 0.5 m

By preventing reflections or lengthening the reflection paths, you can reduce the distance D between the SLG U92s. If there is a corresponding metallic surface between the SLG U92s, the SLG U92s can be mounted directly behind one another.

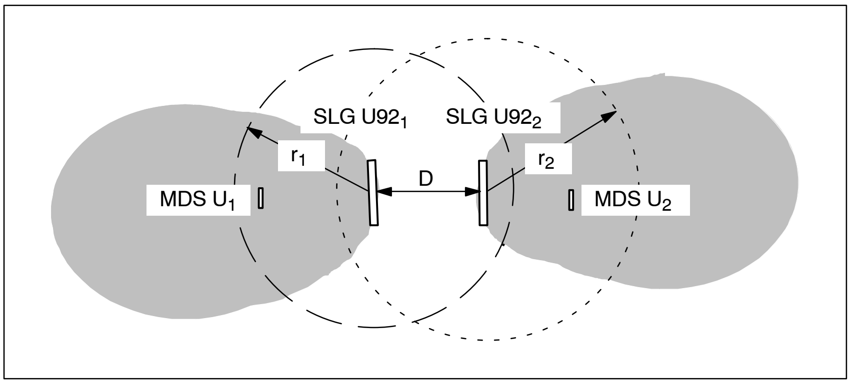


Figure 5-7 Distance D: two SLG U92s back to back

On point 5: SLG U92s facing each other

The SLG U92s facing each other must be at least D = 6 m away from one another and the detection fields of the SLG U92s must not overlap. The range limit (dili) must provide sufficient demarcation. In other words, if a circle forms around each SLG U92 with a radius r_x = the range limit value $dili_x$ [m] + 0.5 m, the circles must not overlap.

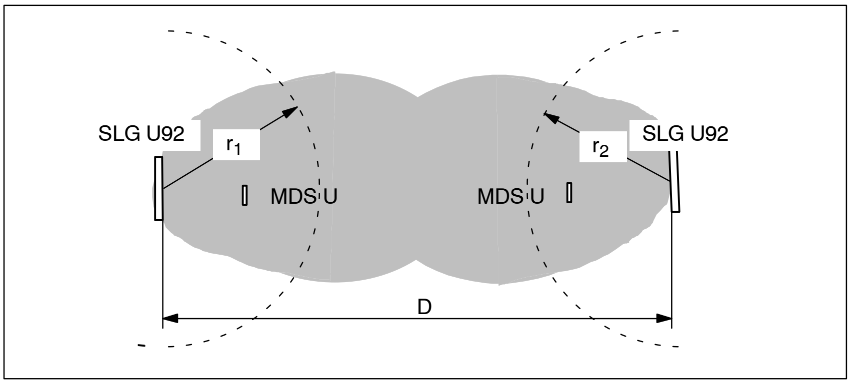


Figure 5-8 Distance D: two SLG U92s opposite each other

The distance of 6 m is not sufficient if the range limit $dili_x$ exceeds certain values. The minimum distances are specified below, depending on the range limit.

- Distance D ≥ 6.0 m, if:
  $dili_1$ ≤ 2.5 m and $dili_2$ ≤ 2.5 m,
  $dili_1$ = 3.5 m and $dili_2$ ≤ 1.5 m or
  $dili_1$ ≤ 1.5 m and $dili_2$ = 3.5 m.
- Distance D ≥ 6.5 m, if:
  $dili_1$ = 3.5 m and $dili_2$ = 2.0 m,
  $dili_1$ = 3.0 m and $dili_2$ = 2.5 m,
  $dili_1$ = 2.5 m and $dili_2$ = 3.0 m or
  $dili_1$ = 2.0 m and $dili_2$ = 3.5 m.
- Distance D ≥ 7.0 m, if:
  $dili_1$ = 3.5 m and $dili_2$ = 2.5 m,
  $dili_1$ = 3.0 m and $dili_2$ = 3.0 m or
  $dili_1$ = 2.5 m and $dili_2$ = 3.5 m.
- Distance D ≥ 7.5 m, if:
  $dili_1$ = 3.5 m and $dili_2$ = 3.0 m or
  $dili_1$ = 3.0 m and $dili_2$ = 3.5 m.
- Distance D ≥ 8.0 m, if:
  $dili_1$ = 3.5 m and $dili_2$ = 3.5 m.

On point 6: Several adjacent SLG U92s and more than one MDS U in each detection field:

The adjacent SLG U92s must be at least 6 m away from each another and the detection fields of the SLG U92s must not overlap. The range limit (dili) must provide sufficient demarcation. In other words, if a circle forms around each SLG U92 with a radius r_x = the range limit value $dili_x$ [m] + 0.5 m, these circles must not overlap.

The distance of 6 m is not sufficient if the range limit $dili_x$ exceeds certain values. The minimum distances are specified below, depending on the range limit.

- Distance D ≥ 6.0 m, if:
  $dili_1 \leq 2.5$ m and $dili_2 \leq 2.5$ m,
  $dili_1 = 3.5$ m and $dili_2 \leq 1.5$ m or
  $dili_1 \leq 1.5$ m and $dili_2 = 3.5$ m.
- Distance D ≥ 6.5 m, if:
  $dili_1 = 3.5$ m and $dili_2 = 2.0$ m,
  $dili_1 = 3.0$ m and $dili_2 = 2.5$ m,
  $dili_1 = 2.5$ m and $dili_2 = 3.0$ m or
  $dili_1 = 2.0$ m and $dili_2 = 3.5$ m.
- Distance D ≥ 7.0 m, if:
  $dili_1 = 3.5$ m and $dili_2 = 2.5$ m,
  $dili_1 = 3.0$ m and $dili_2 = 3.0$ m or
  $dili_1 = 2.5$ m and $dili_2 = 3.5$ m.
- Distance D ≥ 7.5 m, if:
  $dili_1 = 3.5$ m and $dili_2 = 3.0$ m or
  $dili_1 = 3.0$ m and $dili_2 = 3.5$ m.
- Distance D ≥ 8.0 m, if:
  $dili_1 = 3.5$ m and $dili_2 = 3.5$ m.

On point 7: Several adjacent SLG U92s and more than one MDS U in the common detection field:

In this case, automatic synchronization of the SLG U92s among each other is required. This is achieved by interconnecting them via the service interface. A maximum of three SLG U92s can be interconnected in this way.

One SLG U92 becomes active, which means it starts communication and the other(s) remain(s) passive. The next SLG U92 only receives communication priority once the active SLG has completed communication.

As an alternative to automatic synchronization via the service interface, synchronization can also be carried out using the application by switching the antenna for each SLG U92 on and off alternately by means of commands. The antenna of only one SLG U92 can be switched on at any one time.

Dimensions (in mm)

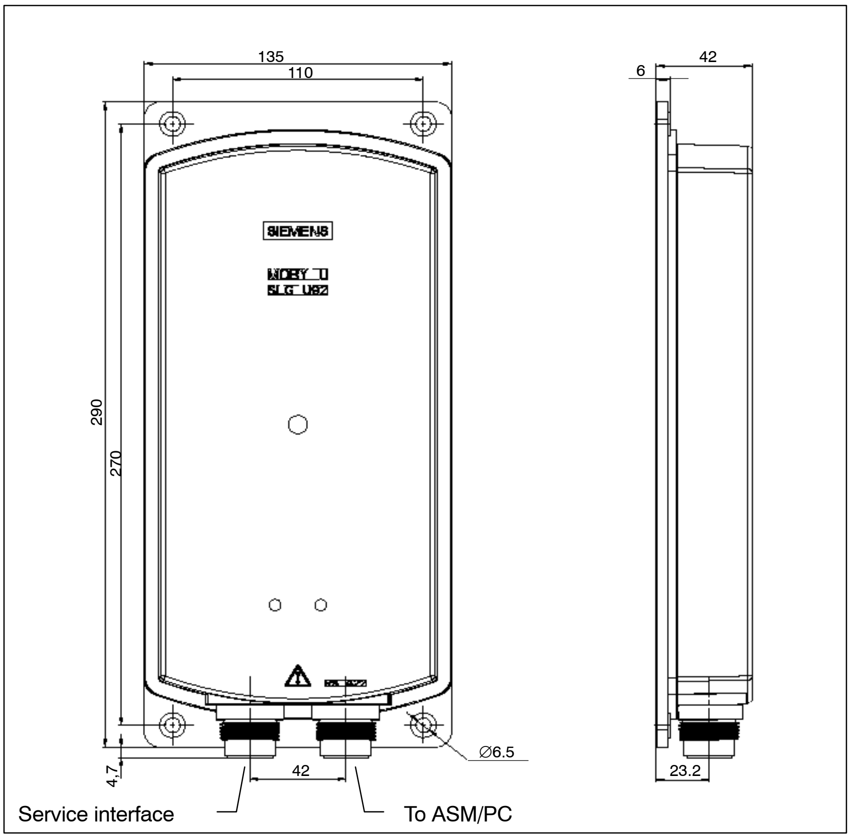


Figure 5-9 Dimensional drawing of the SLG U92

6 Interfaces

6.1 Introduction

Application area

The ASM interfaces are the link between the MOBY U components (SLGs/ MDSs) and the high-level controllers (e.g., SIMATIC S7) or PCs or computers. Depending on the interface used, up to two SLGs can be connected.

Setup and functions

An ASM consists of a microcontroller system with its own program (PROM). The CPU receives commands via the user interface and stores these in RAM. The user receives an acknowledgment that the command has arrived. If the command is okay, the CPU begins executing it.

Overview

Table 6-1 Overview of the interfaces

ASM Type	Interfaces to PC/ Computer	Interfaces to SLG	Function Blocks	SLG Connections	Dimensions (W x H x D in mm)	Temperature Range (Operation)	Degree of Protection
ASM 452	PROFIBUS DPV1	2 x 5-pin prox. switch connector	FC 45 FC 46 FC 56	1	134 x 110 x 55	0 to +55°C	IP 67
ASM 473	Can be plugged into ET 200X	2 x 5-pin prox. switch connector	FC 45 FC 56	1	87 x 110 x 55	0 to +55°C	IP 67
ASM 475	Can be plugged into S7-300/ ET 200M	Via screw terminals	FC 45 FC 56	2 (parallel)	40 x 125 x 120	0 to +60°C	IP 20
ASM 480	TCP/IP	9-pin subminiature D connector	C library MOBY API	1	110 x 130 x 80	0 to +50 °C	IP 20

6.2 ASM 452

Application area

The ASM 452 interface module is a MOBY module for use with MOBY components via PROFIBUS DPV1 on the following devices:

- All computers and PCs
- All controllers

When the interfaces are used with a SIMATIC S7, function blocks are available to the user.

Figure 6-1 Interface ASM 452

The ASM 452 is a logical further development of the familiar ASM 450/451 interface modules. Thanks to the use of acyclic data communication on the PROFIBUS DPV1, optimum data throughput is achieved even in large PROFIBUS configurations. The minimum cyclic data load of the ASM 452 on PROFIBUS guarantees the user that other PROFIBUS stations (e.g. DI/DO) will continue to be processed very quickly.

The ASM 452 is an interface module for communication between PROFIBUS and the SLG U92 with RS 422. Using the ASM 452, the data on the MDS U313/315/524/525/589 can be addressed in two different ways:

- Physically (normal addressing)
- Using a DOS-like file management system (filehandler)

The SIMATIC S7 offers FCs for the two methods of access.

- FC 45 for ”normal” addressing
- FC 46 for filehandler without multitag; FC 56 for filehandler with multitag

FC 45 and FC 46/56 give the S7 user an easy-to-use interface with powerful commands. FC 45 and FC 56 offer additional command chaining and S7 data structures via UDTs.

Ordering data

Table 6-2 Ordering data of the ASM 452

ASM 452 interface module for PROFIBUS DPV1 1x SLG U92 with RS 422 connectable	6GT2 002-0EB20
Accessories:	
Connector for PROFIBUS DP connection and 24 V supply	6ES7 194-1AA00-0XA0
SLG cable ASM 452 ↔ SLG Length 2 m; standard cable Other lengths 5 m, 10 m, 20 m and 50 m	 6GT2 091-1CH20 6GT2 091-1C...
Opt. connector without SLG cable (for cable lengths > 20 m) ASM 452 ↔ SLG	6GT2 090-0BC00
M12 covering caps for unused SLG connections (1 package = 10 each)	3RX9 802-0AA00
MOBY software [1)] with FC 46, FC 45, FC 56, DDB file	6GT2 080-2AA10
Replacement part:	
Connector plate; T design for PROFIBUS connection	6ES7 194-1FC00-0XA0
Description of FC 45 (for ASM 452) German English	 6GT2 097-3AM00-0DA1 6GT2 097-3AM00-0DA2
Description of FC 46 (for ASM 452) German English	 6GT2 097-3AC40-0DA1 6GT2 097-3AC40-0DA2
Description of FC 56	On MOBY Software CD

1) See chapter 7.1

Technical data

Table 6-3 Technical data of ASM 452

	ASM 452 with FC 45	ASM 452 with FC 46	ASM 452 with FC 56
Serial interface to user	PROFIBUS DPV1		
Procedure after connection	EN 50170, vol. 2, PROFIBUS PG 11 screw connection PROFIBUS and power supply connectors are not included.		
Transmission speed	9600 Baud to 12 Mbps (automatic detection)		
Max. block length	2 words (cyclic)/240 bytes (non-cyclic)		
Serial interface to SLG			
Connector	2 M12 coupling connectors		
Line length, max.	2 m = standard length; Other prefabricated cables: 5 m, 10 m, 20 m, 50 m (up to 1000 m on request)		
SLGs which can be connected	1x SLG U92 with RS 422		
Software functions			
Programming	Depends on the PROFIBUS DP master		
Function blocks for SIMATIC S7	FC 45	FC 46	FC 56
MDS addressing	Direct access with addresses	Access via logical file names (file system similar to DOS)	
Commands	Initialize MDS, read data from MDS, write data to MDS, and so on	Format MDS, read file, write file, and so on	
Multitag capability	No	No	Yes
S7 data structures via UDTs	Yes	No	Yes
Voltage			
Nominal value	24 VDC		
Permissible range	20 to 30 VDC		
Current consumption	max. 180 mA; typ. 130 mA (without SLG, DO not loaded)		
Digital inputs	None		
Digital outputs	None		
Ambient temperature Operation Transportation and storage	 0 to +55 °C –40 to +70 °C		
Dimensions (W x H x D) in mm	134 x 110 x 55 (without bus connector)		
Mounting	4 M5 screws; mounting on all plates or walls		

Table 6-3 Technical data of ASM 452

	ASM 452 with FC 45	ASM 452 with FC 46	ASM 452 with FC 56
Weight, approx.	0.5 kg		
Degree of protection	IP 67		
MTBF (at 40 °C)	30 • 10^4 hours = 34 years		

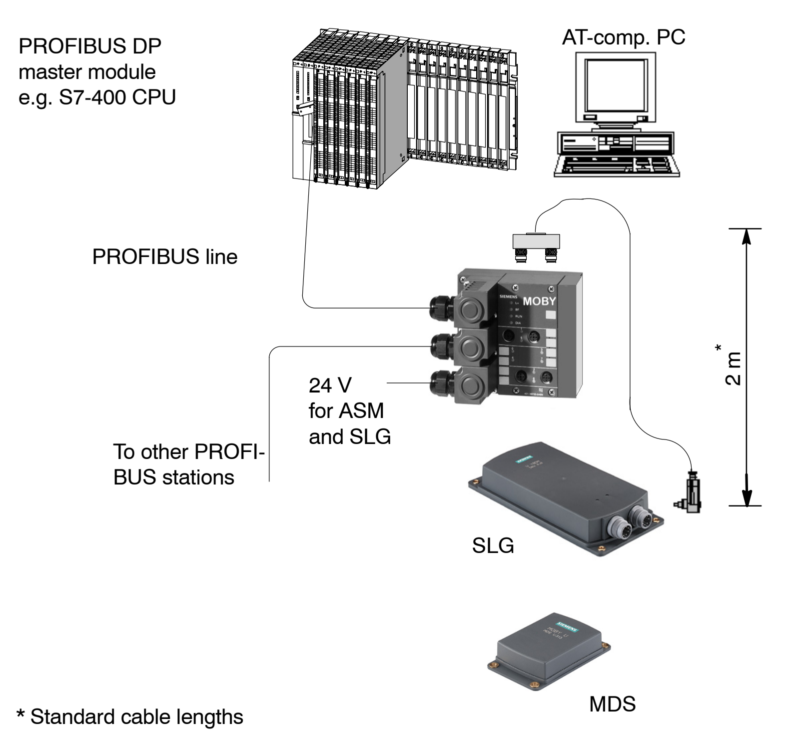


Figure 6-2 Configurator – ASM 452

Hardware description

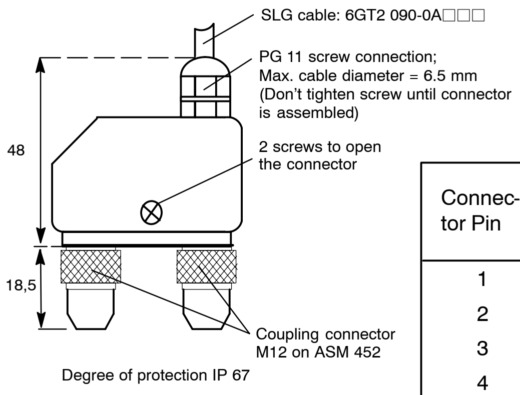
The ASM 452 has the same housing as the distributed I/O device ET 200X. For the general chapters on the ASM 452 (e.g., mounting, operation and wiring, general technical data) see the ET 200X manual (order no. 6ES7 198-8FA00-8AA0). Accessories and network components are also covered by this manual.

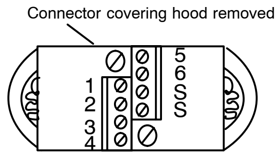
PROFIBUS configuration

The ASM 452 is integrated in the hardware configuration with a DDB file. The ASM can then be configured using SIMATIC Manager's HWCONFIG or another PROFIBUS tool.
The ASM is then configured with HWCONFIG of SIMATIC Manager or another PROFIBUS tool. "MOBY software" contains a DDB file for the ASM 452.

SLG connection system

An SLG always occupies two M12 connection sockets on the ASM 452.
A prefabricated cable therefore provides the best possible easy connection of the SLG (cf. Figure 6-4). The standard version of the connecting cable is 2 m long; other available lengths are 5 m, 10 m, 20 m and 50 m.
If users wish to fabricate their cables themselves to suit their requirements, an SLG connector with screw terminals is available (see Figure 6-3). Cables and SLG connectors can be ordered from the MOBY catalog.





Connector Pin	Core Color	Connection to Pin of SLG Connector
1	Green	4
2	White	6
3	Brown	1
4	Yellow	5
5	Gray	3
6	Pink	2
S	- (nc)	-
S	Shield	⏚

Figure 6-3 Connector for the ASM 452, 473 ↔ SLG U92 with RS 422 (6GT2 090-0BC00)

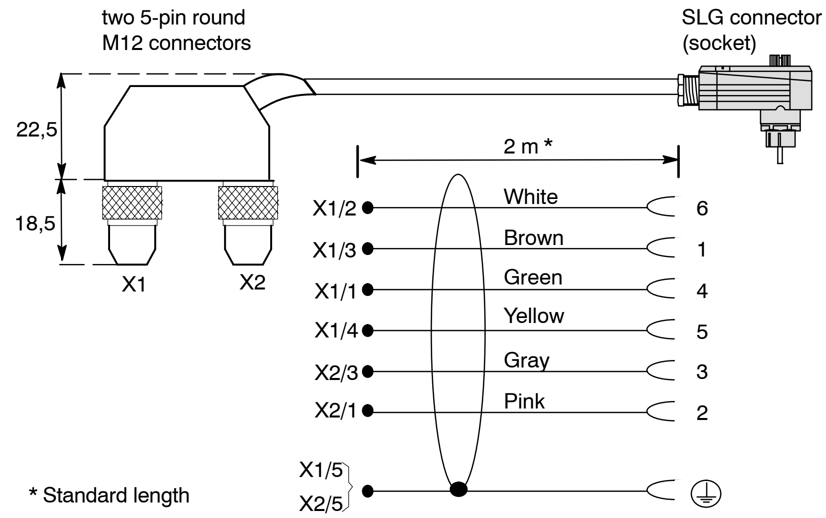


Figure 6-4 Connecting cable for the ASM 452, 473 ↔ SLG U92 with RS 422 (6GT2 091-1CH20)

Dimensional drawing

The following diagram shows a dimensional drawing of the ASM 452 with bus connectors. The length of the PG screws and the radius of the cable must both be added to the total width and depth specified below.

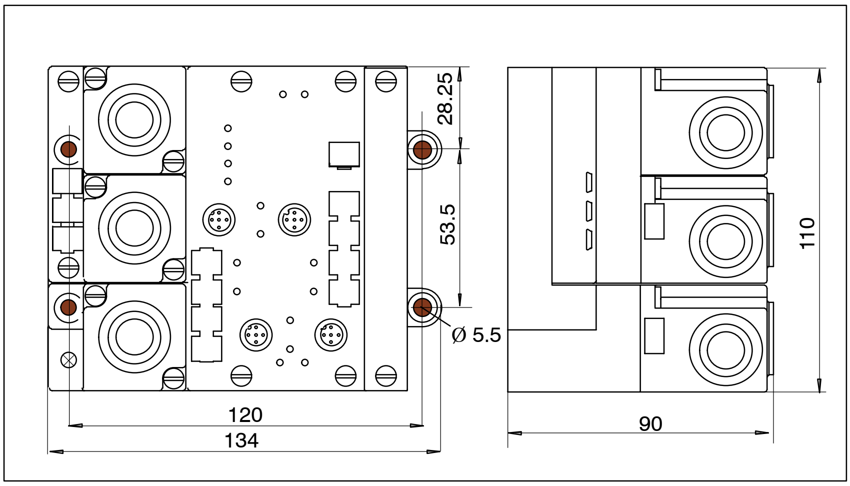
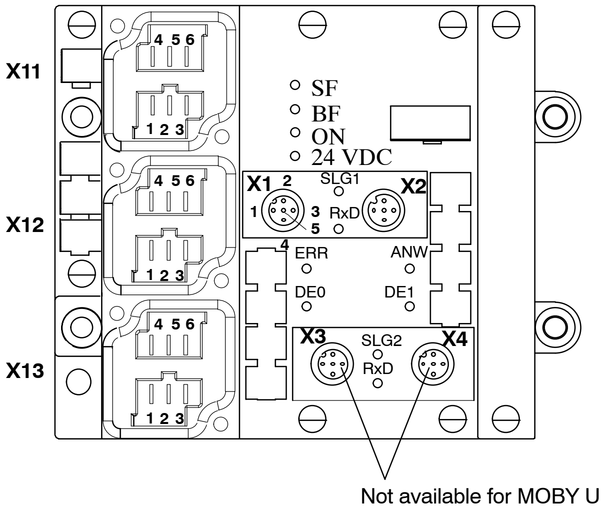


Figure 6-5 Dimensional drawing of the ASM 452

Pin allocations The figure below shows the pin allocations of the ASM 452.



LEDs for PROFIBUS DP

SF: System Fault (hardware error on ASM)

BF: Bus Fault (fault on PROFIBUS DP)

ON: On when there is logic voltage applied to the ASM 452 (generated from 24 V supply voltage).

DC 24 V: On when 24 V is connected to ASM 452

LEDs for MOBY

RxD: Communication with SLG active

ANW: MDS present

ERR: Error indicator

All other LEDs are not assigned.

Socket	Pin Allocation	
X11 and X12 (PROFIBUS DP)	1	Signal B
	2	PE
	3*	PE
	4	Signal A
	5*	L+
	6*	M
X13 (power supply)	1	PE
	2	L+
	3	M
	4	PE
	5	L+
	6	M

Socket	Pin Allocation (SLG)	
X1/X3	1	+RxD
	2	+TxD
	3	-TxD
	4	-RxD
	5	PE
X2/X4	1	+24 V
	2	Res.
	3	0 V
	4	Res.
	5	PE

* Don't circuit

Figure 6-6 Interfaces and displays of the ASM 452

Example of how much cable to bare

The following figure shows an example of how to bare a cable. The lengths apply to all cables which you can connect to the connectors. Twist existing shield braiding, stick in a core sleeve, and trim off excess.

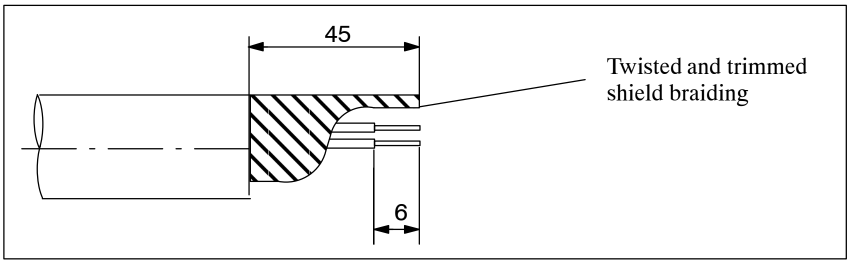


Figure 6-7 Length of bared cable for PROFIBUS cable

PROFIBUS address and terminating resistance

The connector plate of the ASM must be removed before you can set the PROFIBUS address or turn on the terminating resistance. The connector plate covers the DIP switches. The following figure shows the location of the DIP switches on the ASM and the applicable sample setting.

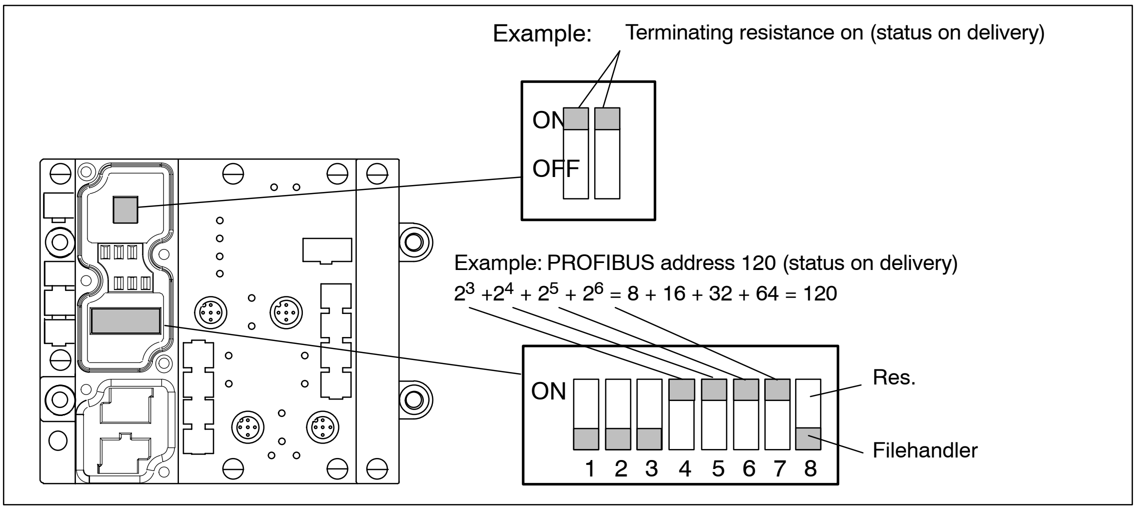


Figure 6-8 Setting PROFIBUS address/turning on terminating resistance

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Note

- The PROFIBUS address on the ASM 452 must always be the same as the PROFIBUS address specified for this ASM in the configuration software.
- You must always turn **both** DIP switches either on or off so that the terminating resistance is correct.

6.3 ASM 473

Application area

The ASM 473 interface module is a MOBY module for SIMATIC S7. It can be installed in the ET 200X and DESINA distributed I/O device. Operation of the ET 200X in the direction of the use is via PROFIBUS DPV1. A S7-300 or S7-400 with integrated PROFIBUS connection can be used as the controller.

The ASM 473 supplements the SIMATIC S7 MOBY interface module ASM 475. As it has degree of protection IP67, it can be mounted and operated directly on the process without any additional protective housing.

An ET 200X basic module (BM 141/142) with the order number 6ES7 141-1BF11-0XB0 or 6ES7 142-1BD21-0XB0 or a BM 143 is a prerequisite for using the ASM 473.

Using the ASM 473 the data can be addressed to the MDS U313/315/524/525/589 either:

- Physically (normal addressing)
- Using a DOS-like file management system (filehandler)

The SIMATIC S7 offers a function for each of the two methods of access.

- FC 45 for ”normal” addressing
- FC 56 for Filehandler

FC 45 and FC 56 give the S7 user an easy-to-use interface with powerful commands. FC 45 and FC 56 offer additional command chaining and S7 data structures via UDTs.

The hardware configuration of the ASM 473 is performed with an Object Manager (OM) which is integrated in SIMATIC Manager.

Other features:

- Up to 7 ASM 473s can be run in parallel on one ET 200X station.
- All I/O modules from the ET 200X family can be run parallel to the ASM 473.

Figure 6-9 Interface ASM 473

Ordering data

Table 6-4 Ordering data of the ASM 473

Interface ASM 473 1x SLG U92 with RS 422 can be connected	6GT2 002-0HA10
Accessory: SLG cable ASM 473 ↔ SLG Length 2 m; standard cable Other lengths 5 m, 10 m, 20 m and 50 m Opt. connector without SLG cable ASM 473 ↔ SLG (for cable lengths > 20 m) MOBY software [1] with FC 45, FC 56, DDB file	 6GT2 091-1CH20 6GT2 091-1C... 6GT2 090-0BC00 6GT2 080-2AA10
Description of FC 45 (for ASM 473) German English	 6GT2 097-3AM00-0DA1 6GT2 097-3AM00-0DA2
Description of FC 56	On MOBY Software CD

1 See chapter 7.1

Technical data

Table 6-5 Technical data of the ASM 473

Interface to the ET 200X	SIMATIC S7 P bus, cyclic/non-cyclic services
Communication	2 words (cyclic)/ 238 bytes (non-cyclic)
Command buffer on ASM	142 x 238 bytes
Serial interface to SLG	
Connector	2 M12 coupling connectors
Line length, max.	2 m = standard length; Other prefabricated cables = 5 m, 10 m, 20 m, 50 m (up to 1000 m on request)
SLGs which can be connected	1x SLG U92 with RS 422
Software functions	
Programming	Depends on PROFIBUS DP master
Function blocks for SIMATIC S7	FC 45
MDS addressing	Direct access with addresses
Commands	Initialize MDS, read data from MDS, write data to MDS, and so on
PROFIBUS diagnosis	Yes; in accordance with ET 200X basis station
S7 diagnosis	Yes, can be called via S7 OEM
Firmware can be loaded.	Yes, via S7 OEM

Table 6-5 Technical data of the ASM 473

Voltage	
Nominal value	24 VDC
Permissible range	20.4 V to 28.8 VDC
Current consumption	typ. 75 mA; max. 500 mA (or see technical data of your SLG)
Power loss of the module	typ. 1.6 W
Digital inputs/outputs	Via expansion modules from the ET 200X family
Ambient temperature	
Operation	0 °C to +55 °C
Transportation and storage	–40 °C to +70 °C
Dimensions (W x H x D) in mm	
Single device	87 x 110 x 55
Scaling interval	60 x 110 x 55
Mounting	2 M5 screws (supplied by customer) 2 M3 screws (supplied by device)
Degree of protection	IP 67
Weight, approx.	0.275 kg

For information on setup and other general technical data, see the ET 200X manual (order number 6SE7 198-8FA01-8AA0).

Configuration

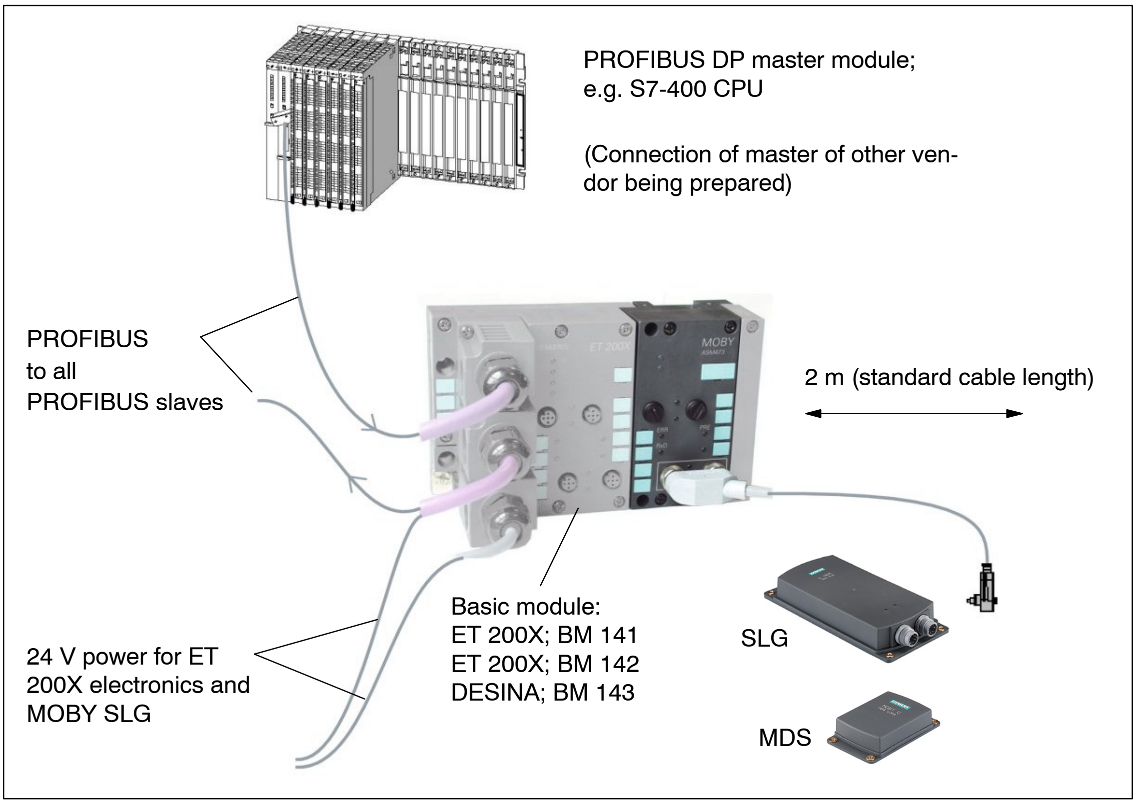


Figure 6-10 Configurator for an ASM 473

Note

The ET 200X differs from the ASM 452 (see figure 6-2) in that the 24 V must be fed to the PROFIBUS connector <u>and</u> the load voltage connector (see ET 200X manual for more information).

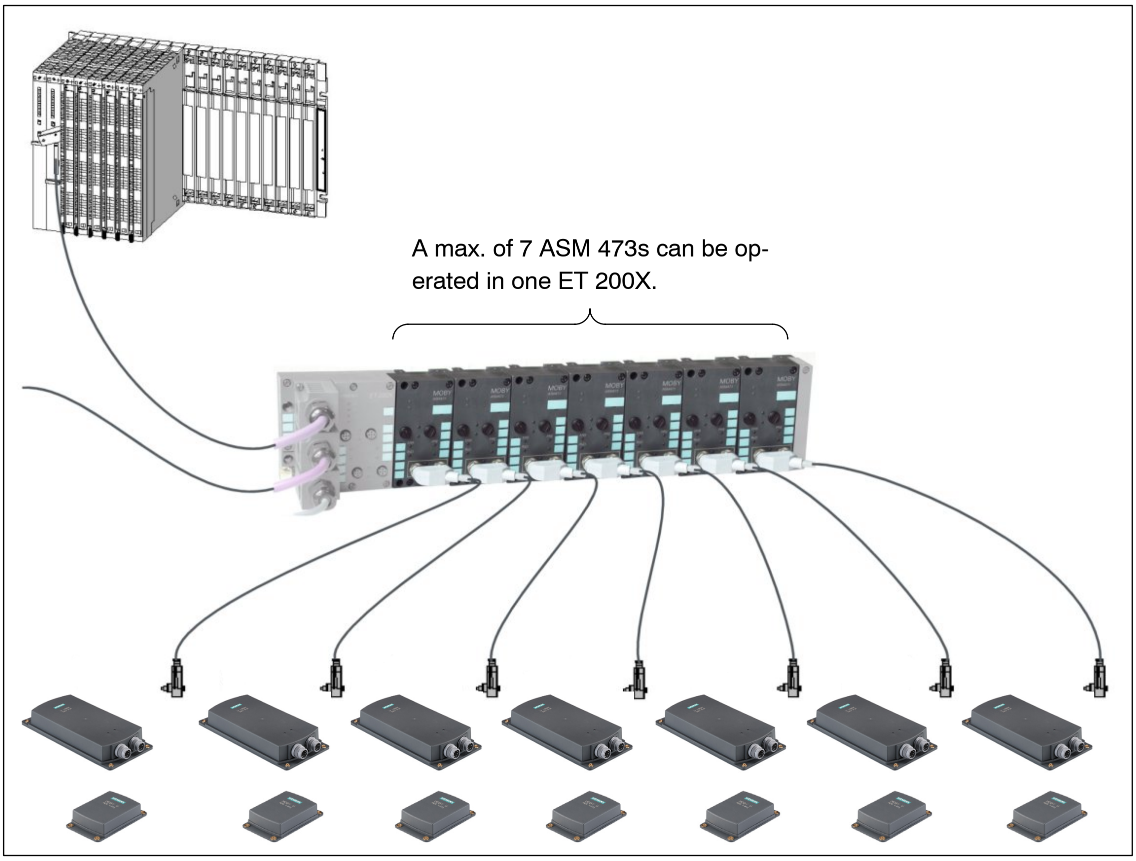


Figure 6-11 Maximum configuration of ASM 473s on one ET 200X

Depending on the PROFIBUS master, up to 123 ET 200X modules can be operated on one PROFIBUS branch.

Hardware configuration

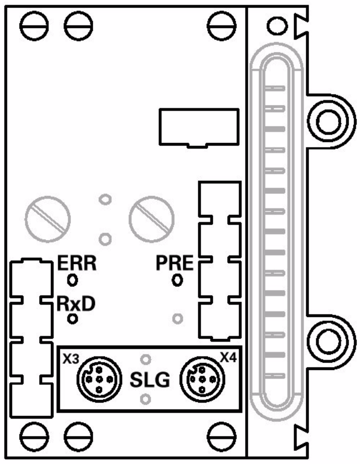
The ASM 473 is integrated in the hardware configuration of SIMATIC Manager by calling Setup.exe in the data/S7_OM directory on the "Software MOBY" CD. At the moment the ASM 473 cannot be integrated on the master of another manufacturer.

SLG connection system

An SLG always occupies two M12 connection sockets X3 and X4 on the ASM 473. A prefabricated cable therefore provides the best possible easy connection of the SLG (cf. Figure 6-4). The standard version of the connection cable has a length of 2 m. Other lengths are available on request.
An SLG connector with screw terminals is available for users who want to make their own cables (see figure 6-3). Cables and SLG connectors can be ordered from the MOBY catalog.

Pin allocations

The following figure shows the pin allocation to the SLG and describes the indicator elements.



Socket	Pin Allocation (SLG)
X3	1 +RxD 2 +TxD 3 –TxD 4 –RxD 5 PE
X4	1 +24 V 2 n.c. 3 0 V 4 n.c. 5 PE

LEDs for PROFIBUS DP

General operating LEDs (SF, BF, ON, DC24 V) are located on the basic module of the ET 200X.

LEDs for MOBY

RxD: SLG is active with a command
PRE: Indicates the presence of an MDS
ERR: Error indication by flashing pattern (see Section B.1)

The PRE and ERR LEDs indicate other operational states of the ASM.

PRE	ERR	Description, Causes, Remedies
OFF/ON	ON (perm.)	Hardware is defective (RAM, Flash, etc.).
ON	OFF	Loader is defective (can only be fixed at the plant).
2 Hz	OFF	Firmware loading procedure is active or no frmware detected → Load firmware → Don't turn off ASM during this.
2 Hz	2 Hz	Firmware loading terminated with error → New start is required → Load firmware again → Check update files
5 Hz	5 Hz	Operating system error → Turn ASM or ET 200X basis station off/on.
OFF	1 flash every 2 sec	ASM has started up and is waiting for a RESET (init_run) from the user.

Figure 6-12 Interfaces and LEDs of the ASM 473

Dimensional drawing of mounting holes

The figure below shows the dimensions for the positions of the holes for the mounting screws for one basic module and one ASM 473 expansion module.

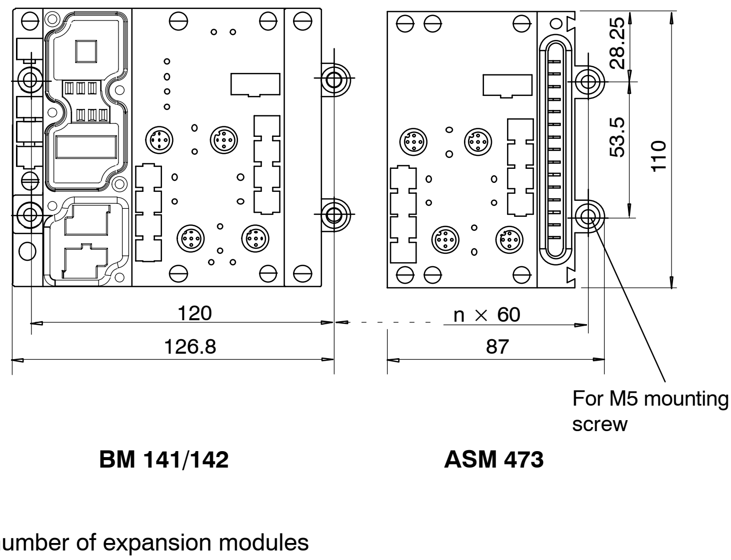


Figure 6-13 Dimensions for mounting holes for basic and expansion modules

6.4 ASM 475

Application area

The ASM 475 interface module is a MOBY module which can be installed on the SIMATIC S7-300 and ET 200M.

Up to eight ASM 475 interface modules can be installed and run in one module rack of the SIMATIC S7-300. When a setup with several module racks (max. of four) is used, the ASM 475 can be installed and run in every rack. In its maximum configuration, one SIMATIC S7-300 can handle up to 32 ASMs centrally. The ASMs can just as well be run on the distributed I/O ET 200M on PROFIBUS. This makes operation in an S7-400 environment possible. Up to 7 ASMs can be run on one ET 200M.

Error messages and operational states are indicated with LEDs.
The galvanic isolation between SLG and the SIMATIC S7-300 bus permits interference-immune operation.

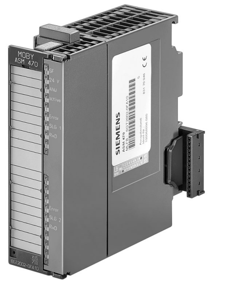


Figure 6-14 Interface ASM 475

The ASM 475 is an interface module for communication between the SIMATIC S7 and the SLG U92 with RS 422. Using the ASM 475, the data on the MDS U313/315/524/525/589 can be addressed in two different ways:

- Physically (normal addressing)
- Using a DOS-like file management system (filehandler)

The SIMATIC S7 offers a function for each of the two methods of access.

- FC 45 for ”normal” addressing
- FC 56 for Filehandler

FC 45 and FC 56 give the S7 user an easy-to-use interface with powerful commands. FC 45 and FC 56 offer additional command chaining and S7 data structures via UDTs.

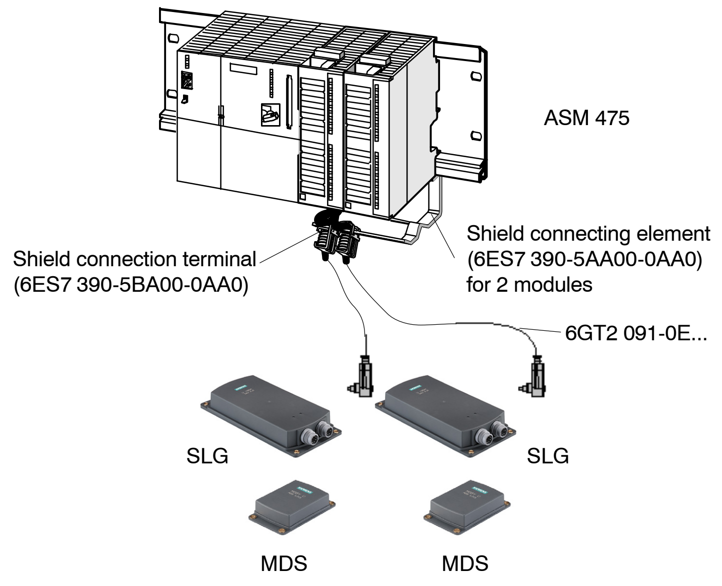


Figure 6-15 Configuration for the ASM 475 (central)

Ordering data

Table 6-6 Ordering data for ASM 475

Interface ASM 475 for SIMATIC S7 2 x SLG U92 with RS 422 can be connected parallel, without front connector	6GT2 002-0GA10
Accessory: Front connector (1 per ASM) SLG cable, ASM 475 ↔SLG Lengths: 2 m, 5 m, 10 m, 20 m, and 50 m Optional: SLG cable, ASM 475 → SLG with straight SLG connector Shield connection terminal (1 per SLG cable) Shield connecting element MOBY software [1)] with FC 45, FC 56, S7 Object Manager	 6ES7 392-1AJ00 -0AA0 6GT2 091-0E... 6GT2 091-2E... 6ES7 390-5BA00 -0AA0 6ES7 390-5AA00 -0AA0 6GT2 080-2AA10
Description of FC 45 (for ASM 475) German English	 6GT2 097-3AM00-0DA1 6GT2 097-3AM00-0DA2
Description of FC 56	On MOBY Software CD

1) See chapter 7.1

Technical data

Table 6-7 Technical data of the ASM 475

	ASM 475 with FC 45	ASM 475 with FC 56
Serial interface to SIMATIC S7-300 or ET 200M	P bus; cyclic and non-cyclic services	
Communication	2 words (cyclic)/238 bytes (non-cyclic)	
Command buffer on ASM 475	142 x 238 bytes per SLG U92	
Serial interface to SLG		
Connector	With screw terminal on front connector The front connector is included.	
Line length, max.	Prefabricated cables = 2 m, 5 m, 10 m, 50 m (up to 1000 m on request)	
SLGs which can be connected	2x SLG U92 with RS 422 Parallel operation	
Software functions		
Programming	Depends on PROFIBUS DP master	
Function blocks for SIMATIC S7	FC 45	FC 56
MDS addressing	Access directly via addresses	Access via logical file names (file system similar to DOS)
Commands	Initialize MDS, read data from MDS, write data to MDS, and so on.	Format MDS, read file, write file, and so on
Multitag mode	No	Yes
S7 data structures via UDTs	Yes	Yes
Voltage		
Nominal value	24 VDC	
Permissible range	20.4 to 28.8 VDC	
Current consumption		
• Without SLG at U = 24 VDC, max.	350 mA	
• With connected SLGs, max.	500 mA, per connected SLG	
Power loss of the module(typ.)	2 W	
Current consumption from P bus, max.	80 mA	
Potential isolation between S7-300 and MOBY	Yes	
24 V fuse to SLG	Yes, electronic	

	ASM 475 with FC 45	ASM 475 with FC 56
Ambient temperature during operation • Horizontal setup of SIMATIC • Vertical setup of SIMATIC Transportation and storage	 0 to +60 °C 0 to +40 °C –40 to +70 °C	
Dimensions (W x H x D) in mm	40 x 125 x 120	
Weight, approx.	0.2 kg	

Wiring

The ASM 475 is commissioned in the following steps.

- Mount module
- Mount module on profile rail of the S7-300
  (see manual of the S7-300)

Note

Before mounting the module, switch the CPU of the S7-300 to STOP.

Warning

Wire the S7-300 only when the power is off.

Note

To ensure interference-free operation of the ASM 475, make sure that ASM and SIMATIC CPU (or ASM and IM 153 with ET 200M operation) use the same voltage.
If not, error indicators which light up on the CPU when the ASM is turned on may not go off.

Front plate

The following figure shows the front plate of the ASM 475 and the inside of the front door with the connection diagram. The SLGs must be connected with the ASM as shown in the connection diagram.

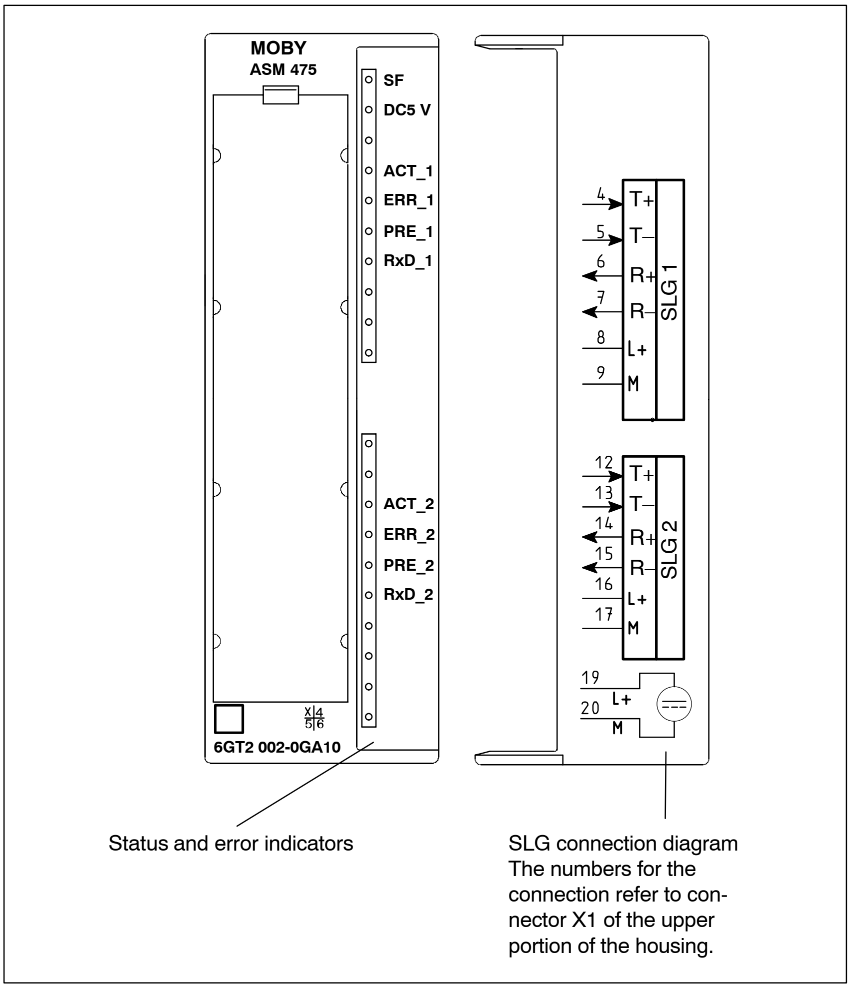


Figure 6-16   Front plate and inside of the front door of the ASM 475

Indicator elements on the ASM

Table 6-8 Function of the LEDs on the ASM 475

LED	Meaning
SF 5 VDC	System Fault (hardware error on ASM) 24 V are connected on ASM and the 5 V on the ASM are okay
ACT_1, ACT_2	The SLG is active with execution of a user command.
Error_1, Error_2	A flashing pattern shows the error that occurred last. This indicator can be reset with the parameter Option_1.
PRE_1, PRE_2 RxD_1, RxD_2	Shows the presence of an MDS; Indicates running communication with the SLG; interference on SLG can also cause this indicator to go on.

The LEDs PRE, ERR and SF on the ASM 475 indicate additional operating states.

Table 6-9 Operating states shown by LEDs on the ASM 475

SF	PRE_1	ERR_1	PRE_2	ERR_2	Meaning
ON	OFF/ON	ON (perm.)	OFF/ON	ON (perm.)	Hardware is defective (RAM, Flash, etc.).
ON	OFF	ON	OFF	OFF	Loader is defective (can only be fixed at the plant).
OFF	2 Hz	OFF	2 Hz	OFF	Firmware loading procedure is active or no firmware was detected. • Load firmware • Don't turn off ASM during this.
OFF	2 Hz	2 Hz	2 Hz	2 Hz	Firmware loading terminated with error • New start required • Load firmware again • Check update files
Any	5 Hz	5 Hz	5 Hz	5 Hz	Operating system error • Turn ASM off/on.
OFF	OFF	1 flash every 2 sec	OFF	1 flash every 2 sec	ASM has started up and is waiting for a RESET (init_run) from the user.

Wiring to the SLG

The following figure shows the design of a connection cable between ASM and SLG. The specified colors apply to the standard MOBY cable for the ASM 475.

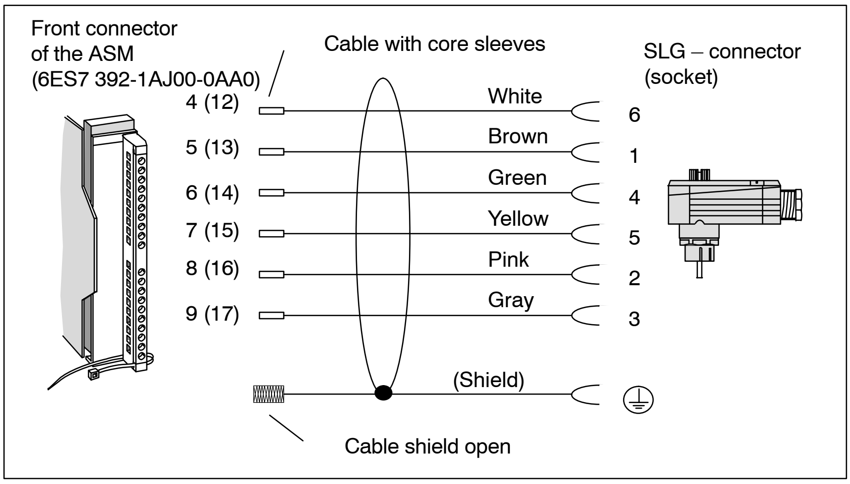


Figure 6-17 Wiring of the ASM 475 to the SLG U92 with RS 422 (6GT2 091-0E...)

Shield connection

See Figure 3-35 or 6-15.

Lightning rods

Implement lightning rods and grounding measures if required for your application. Protection against lightning always requires an individual look at the entire plant.

Cable fabrication by the customer

To ensure EMC, the SLG cable must be led over an S7-300 shield connecting element (see figure 6-15). When customers make their own cables, the shield of the SLG cable must be bared as shown in figure 6-18.

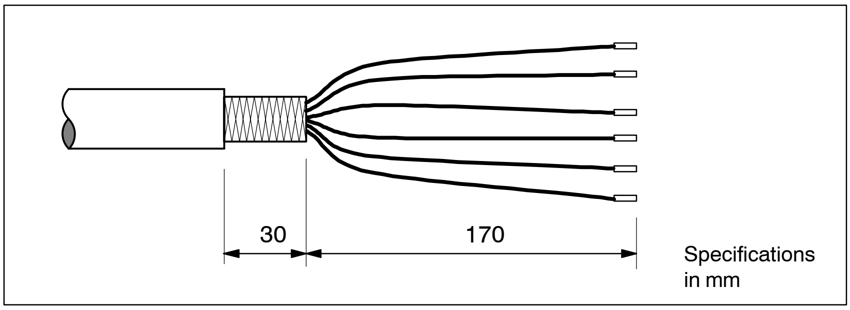


Figure 6-18 Baring of the cable shield for customer-fabricated cable

Configuration of the ASM for SIMATIC S7 under STEP 7

Note

Installation of MOBY requires functional STEP 7 software on a PC/PG. Please remember to use the latest version of STEP 7.

Installation and configuration of the ASM 475 in the SIMATIC is performed with an installation program. The installation program is included on the ”MOBY Software” CD product (6GT2 080-2AA10).

Installation

Installation information can be found on the “Software MOBY” CD.

FC 45/56 with sample project

You can use the file dearchiving function of SIMATIC Manager to load the FC with a sample project from the relevant subdirectory of “Software MOBY”. The sample project is located in the S7PROJ directory of SIMATIC Manager.

6.5 ASM 480

Application area

The ASM 480 interface module is a MOBY module for the operation of MOBY components in Ethernet networks with the TCP/IP protocol on computers and PCs running Windows 98/NT/2000/XP.

The ASM 480 is an interface module for communication between a TCP client and the SLG U92 read/write device via Ethernet. The interface to the SLG U92 can be operated with either RS 232 or RS 422.

Figure 6-19 Interface ASM 480

The ASM 480 is an intelligent protocol converter (gateway) that bidirectionally converts the 3964R procedure for the SLG U92 into the TCP/IP protocol for the host system (e.g. PC). The fact that the 3964R protocol is handled locally means that there no negative effects on the dynamic response on the serial interface because of any system-related delays on the network side, as can happen in the case of simple terminal servers (COM port servers, COM port emulators, etc.). In functional terms the ASM 480 is a TCP server with which any TCP client can be connected and can exchange data with the MOBY U identification system.

An easy-to-use programming interface (MOBY API) is available for applications running under Windows. The application programming interface handles the message frame traffic with the SLG U92 (via Ethernet) and the ASM 480. The data on the MDS U313/315/524/525/589 is addressed physically (“normal” addressing).

Ordering data

Table 6-10 Ordering data of the ASM 480

ASM 480 interface module Ethernet gateway with serial interface RS 232/RS 422 1x SLG U92 connectable with RS 232 or RS 422	6GT2 002-0JA00
Accessories:	
Industrial housing for ASM 480, degree of protection IP65 Housing dimensions [W x H x D] in mm: 360 x 200 x 150	on request
SLG cable, ASM 480 ↔ SLG U92 Length 2 m; standard cable Other lengths 5 m, 10 m, 20 m and 50 m	 6GT2 091-0EH20 6GT2 091-0E...
Optional: SLG cable, ASM 480 ↔ SLG U92 with straight connector	6GT2 091-2E...
Connector, SLG-side with straight output	6GT2 090-0UA00
Connector, SLG-side with angled output	
• 1 connector	6GT2 090-0BA00
• 1 packaging unit (10 connectors)	6GT2 090-0BA10
Stub line: type 6 x 0.25 mm^2 Length according to length code	6GT2 090-0A...
MOBY wide-range power pack (see Section 7.2) incl. 2 mating connectors for the output voltage	6GT2 494-0AA00
M12 socket for output voltage from MOBY wide-range power pack	6GT2 390-1AB00
MOBY software (see Section 7.1) with MOBY API and programming guide	6GT2 080-2AA10

Technical data

Table 6-11 Technical data of ASM 480

Network interface	Ethernet, IEEE 802.3 (CSMA/CD)
Category	10 BASE T, floating
Protocol	TCP/IP
Connection type	TCP server
Transmission speed	10 Mbit/s
Plug connector	RJ45
Serial interface to SLG	RS 232C or RS 422, non-floating
Type	Asynchronous, half duplex
Protocol	3964 R
Transmission speed	Max. 38400 bit/s, depending on line length
Connector	9-pin subminiature D connector (pin)
Line length with RS 232	Max. 30 m (shielded)
Line length with RS 422	Max. 50 m (shielded), 1000 m on request

Table 6-11 Technical data of ASM 480

Diagnostic interface	RS 232C
Transmission speed	9600 bit/s
Connector	9-pin subminiature D connector (pin) Special cable for connection to PC enclosed
Diagnostic and parameterization software for ASM	Enclosed on CD
Voltage	
Nominal value	24 V DC
Permissible range	18 to 30 V DC
Current consumption, approx.	200 mA at 24 V
Ambient temperature	
Operation	0 °C to +50 °C
Transportation and storage	0 °C to +50 °C
Other data	
Operating elements	6 jog keys
Display	LCD with 2 x 16 characters
Weight, approx.	500 g
Dimensions (W x D x H) in mm	110 x 130 x 80
Mounting	DIN EN 50022 mounting rail
Degree of protection	IP 20
Programming interface (MOBY API)	
Can be used for operating systems	Windows 98/NT4.0/2000/ Windows XP[1]

1 Under preparation

Configuration

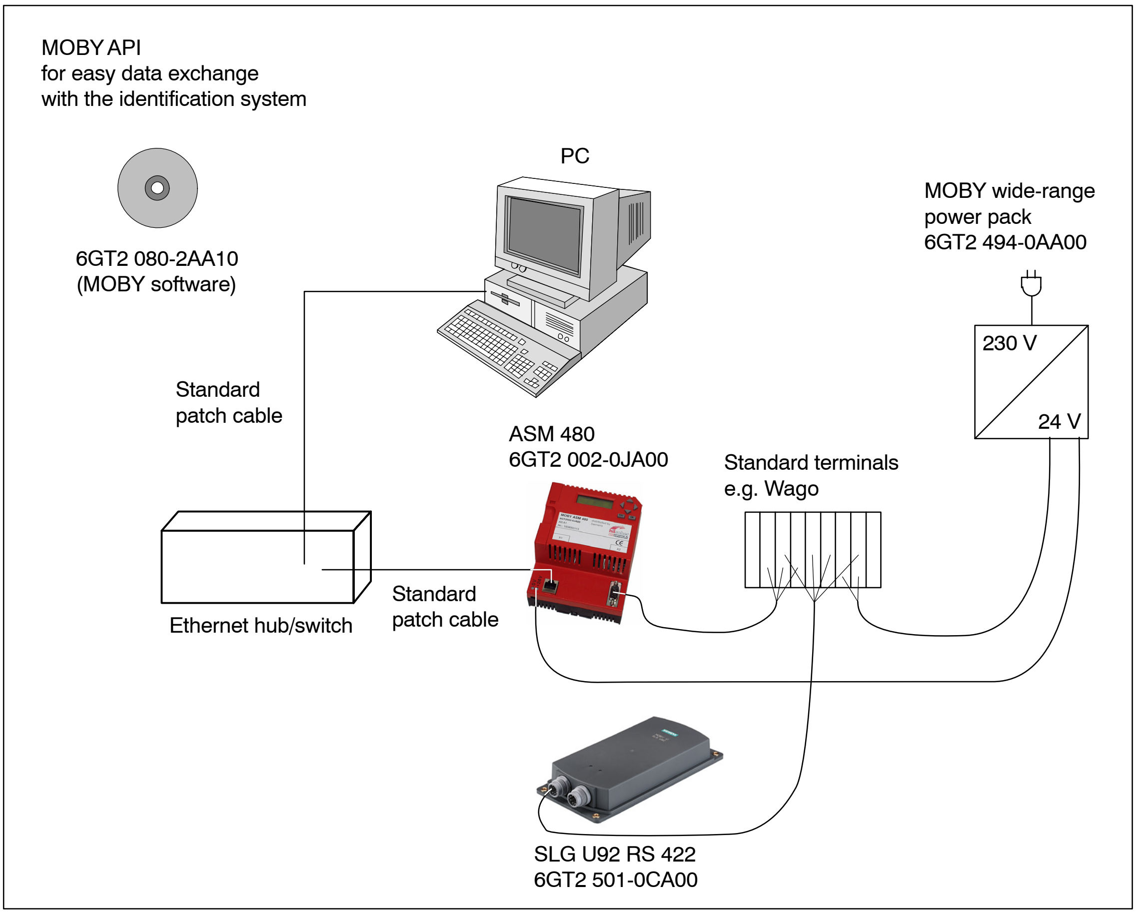


Figure 6-20 Configuration for an ASM 480

Dimensional drawing

The following diagram shows the dimensional drawing of an ASM 480.

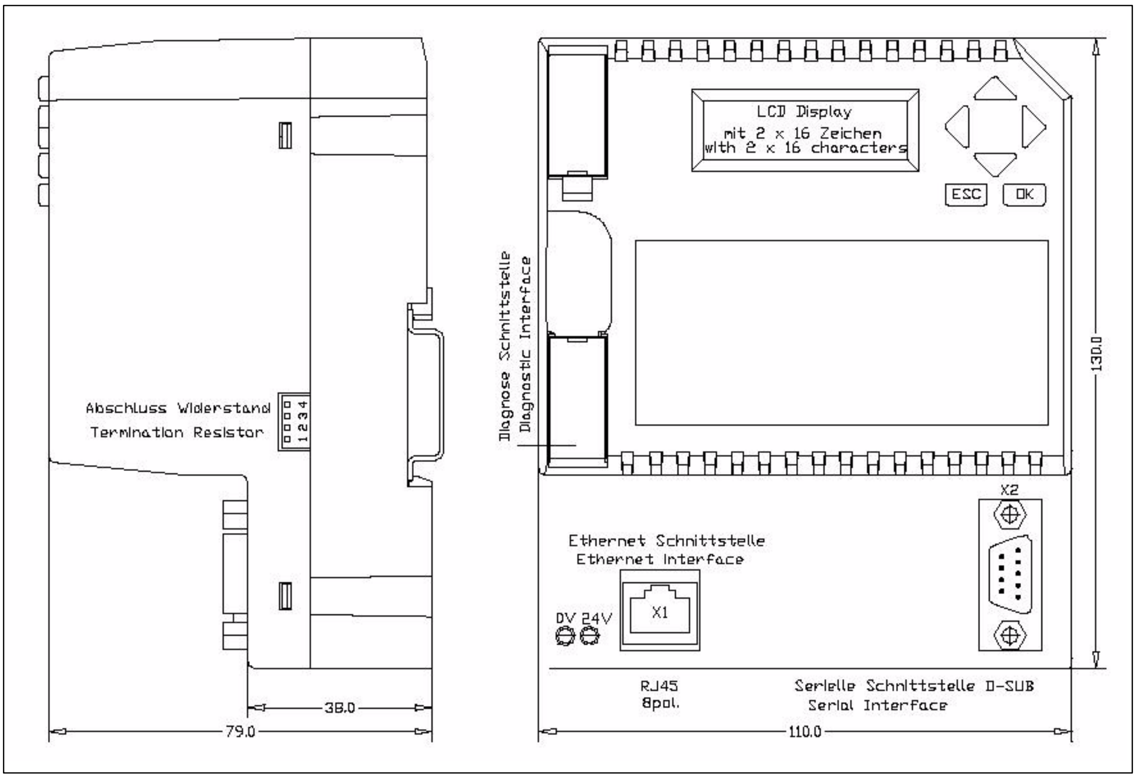
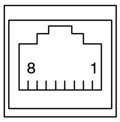
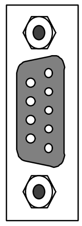


Figure 6-21 Dimensional drawing of the ASM 480

Pin allocations The table below shows the pin allocations of the ASM 480.

Table 6-12 Interfaces of the ASM 480

Ethernet interface (X1)		**Serial interface (X2)**		
				
Housing side **8-pin RJ45 connector (socket)**		**Housing side** **9-pin subminiature D connector (pin)**		
Pin	**Allocation**	**Pin**	**Allocation**	
			RS 232C	**RS 422**
1	TX+	1	Free	–TxD
2	TX–	2	RxD	Free
3	RX+	3	TxD	Free
4	Free	4	Free	+RxD
5	Free	5	GND	GND
6	RX–	6	Free	+TxD
7	Free	7	RTS	Free
8	Free	8	CTS	Free
		9	Free	–RxD

The 24 V supply must be connected to the two screw terminals (0 V, 24 V).

DIP switches

The DIP switches for the terminating resistors of the serial interface in RS 422 operation are located on the right-hand side of the housing. The termination amounts to 120 Ω and 470 Ω as a pull-up/pull-down resistor in each case.

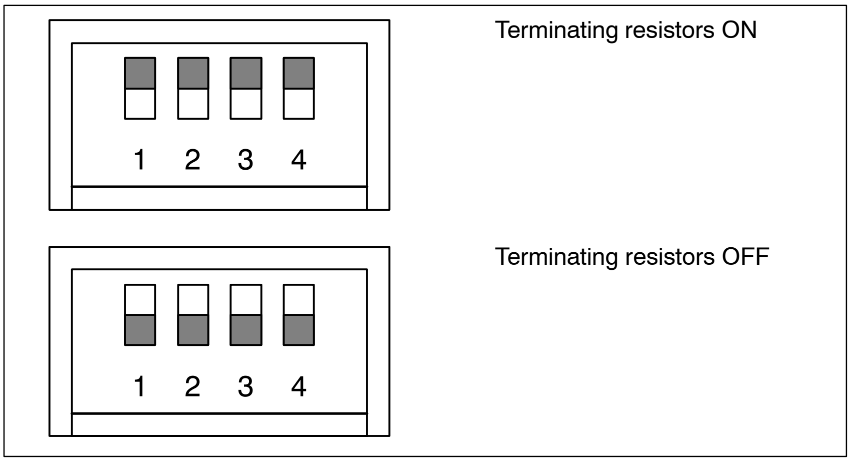


Figure 6-22 DIP switches on the ASM 480

Wiring to the SLG U92 with RS 232

The design of a connecting cable between the ASM 480 and SLG U92 with RS 232 is shown in the diagram below. The specified colors apply to the standard MOBY cable (6GT2 091-0E...).
The power supply to the SLG is provided via the two open cable ends (see Figure 6-23) (6GT2 091-0E...). The MOBY wide-range power pack (6GT2 494-0AA00) is available as an accessory for power supply.

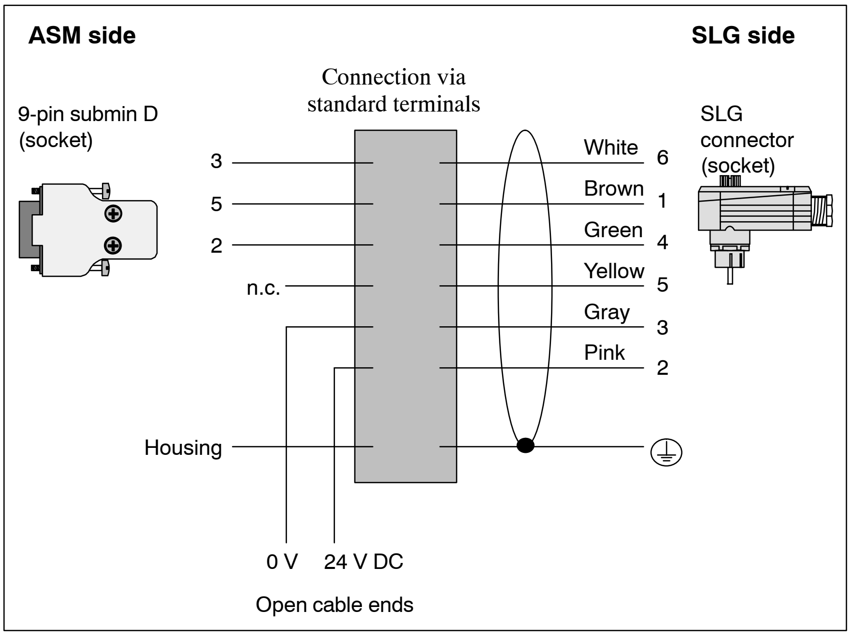


Figure 6-23 Wiring of the ASM 480 to the SLG U92 with RS 232 (6GT2 091-0E...)

Wiring to the SLG U92 with RS 422

The design of a connecting cable between the ASM 480 and SLG U92 with RS 422 is shown in the diagram below. The specified colors apply to the standard MOBY cable (6GT2 091-0E...).
The power supply to the SLG is provided via the two open cable ends (see Figure 6-24) (6GT2 091-0E...).
The MOBY wide-range power pack (6GT2 494-0AA00) is available as an accessory for power supply.

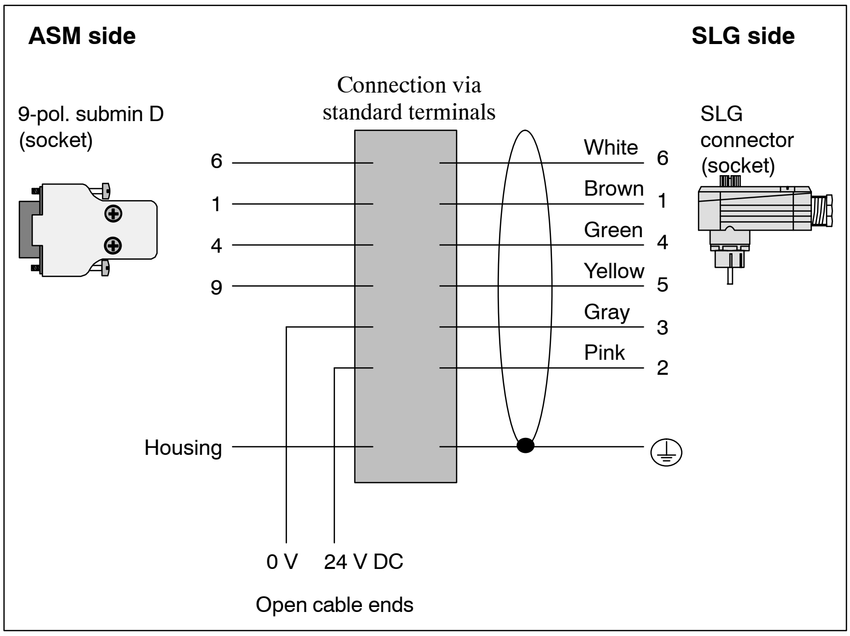


Figure 6-24 Wiring of the ASM 480 to the SLG U92 with RS 422 (6GT2 091-0E...)

Parameterizing the ASM 480

The ASM 480 must be parameterized in order to operate it in Ethernet networks. The following must be parameterized:

- The TCP/IP configuration: IP address, network mask and IP address of the standard gateway and
- The serial interface.

The parameterization method is described in the MOBY API C library programming guide (see Table A-1).

7 Accessories

7.1 Software MOBY U

The ”MOBY Software” product is delivered on CD. It contains all the function blocks, drivers, and documentation for the MOBY system.

After the CD has started, the basic menu appears, containing the possible data sources:

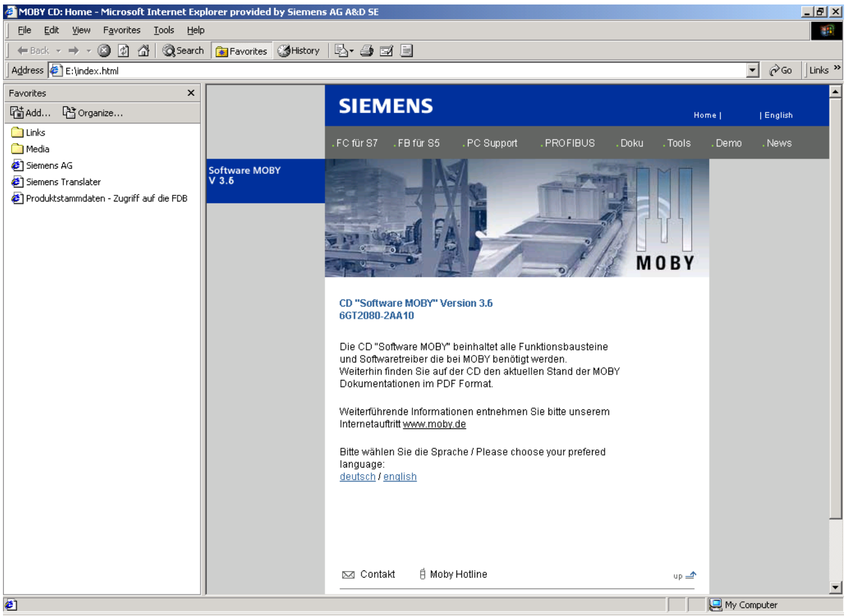


Figure 7-1 “Software MOBY” V3.6 basic menu

The relevant software components for MOBY U are specified below together with the function path under which they are listed on the CD:

- FC 45 under FC for S7
  SIMATIC S7 function for ASM 452/473/475
- FC 46 under FC for S7
  SIMATIC S7 function for ASM 452
- FC 56 under FC for S7
  SIMATIC S7 function for ASM 452/473/475
- MOBY API[1] under PC Support
  MOBY API application interface with the 3964R driver for Windows 98/2000/NT 4.0
- MOBY documentation under Docu
  Current version of the MOBY documentation in PDF format
- S7 Object Manager under FC for S7
  Installation program and Object Manager for the ASM 473 and ASM 475 interface modules
- Test and demo programs under Demo
  Test and demo programs for PCs with Windows 98/2000/NT 4.0
- News under News
  Changes and additions to each software version since the previous version

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Note

on MOBY software and licensing

When you purchase an ASM or SLG interface module, this does not include software or documentation. The **“MOBY Software” CD-ROM**, which contains all the FBs/FCs available for SIMATIC, C libraries for Windows 98/2000/NT, demo programs and so on **must be ordered separately**. In addition, the CD-ROM contains the complete MOBY documentation (in German and English at least) in PDF format.

When you purchase an ASM or SLG interface module, the price for use of the software including documentation on the ”MOBY Software” CD-ROM is included. The purchaser obtains the right to make copies (duplication license) as needed for customer applications or system development for the plant.

In addition, the enclosed contract is valid for the use of software products against a one-time payment.

Ordering data

Table 7-1 Ordering data for MOBY Software

	Order No.
MOBY Software	6GT2 080-2AA10

1 The application interface with the TCP/IP driver is available with the MOBY software, version > V3.6.

7.2 MOBY Wide-Range Power Pack

Description

The MOBY® wide-range power pack is a compact, primary-pulsed power supply, designed for use on single-phase, alternating current networks with two DC outputs (socket connector, circuited in parallel).
The robust physical construction is comprised of an aluminum housing which gives the finely adjusted system a good blend of physical strength, protection against electromagnetic interference and optimum heat dissipation.
The primary-pulsed power supply is protected against overload with a built-in power limitation circuit and is permanently short-circuit proof.
The overvoltage fuse (SIOV) integrated as standard protects the electronics from excessively high voltages.Two SLG U92s can be directly connected to the MOBY wide-range power pack. You will also need the connecting cable 6GT2 591-1C...
(see Section 3.7.3).

Figure 7-2 MOBY Wide-Range Power Pack

Ordering data

Table 7-2 Ordering data for MOBY wide-range power pack

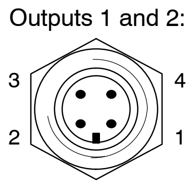
	Order No.
MOBY wide-range power pack, AC 100 - 230 V/DC 24 V/2.2 A; incl. 2 mating connectors for the output voltage	6GT2 494-0AA00
Accessory: 24 V stub line for SLG U92 with RS 232; length 5 m; extension for 6GT2 591-1C...	6GT2 491-1HH50

Technical data

Table 7-3 Technical data of the MOBY wide-range power pack

Input	
Input voltage	
Nominal value	100 - 230 VAC
Range	90 - 253 VAC
Frequency	50/60 Hz
Input current	0.85 - 0.45 A
Efficiency	≥ 80 % at full load
Power connection	2-m power line with ground-protected connector
Power failure bypass	≥ 10 msec
Undervoltage switchoff	Yes
Overvoltage protection	SIOV
Output	Socket contacts
Nominal output voltage	24 VDC
Nominal output current	2.2 A
Residual ripple	20 mV_{ss} to 160 kHz 50 mV_{ss} > 160 kHz
Startup current limitation	NTC
Permanent short-circuit proof	Yes
Ambient conditions	
Ambient temperature	
Operation	-20 °C to +40 °C (max. +60 °C; see Notes on safety)
Transportation and storage	-40 °C to +80 °C
Cooling	Convection
General information	
Dimensions of power supply incl. mounting plate, (L x W x H) in mm	205 x 80 x 60 (without connectors)
Weight	Approx. 1000 g
Color	Anthracite
Electromagnetic compatibility	
Interference emission (EN 50081-1)	Class B in accordance with EN 55022
Interference immunity (EN 50082-2)	EN 61000-4-2
Safety	
Certifications	CE, GS
Electrical safety test	EN 60950/VDE 0805 and VDE 106 (part 1)
Potential isolation, primary/secondary	4 kVAC
Protection class	I, in accordance with EN 60950 (VDE 0805)
Degree of protection	IP65, in accordance with EN 60529 (only when installed)

Connector allocation of 24 V output



Socket 1: ground (0 V)
Socket 2: +24 V DC
Socket 3: +24 V DC
Socket 4: ground (0 V)

Figure 7-3 Connector allocation of 24 V output

Dimensions (in mm)

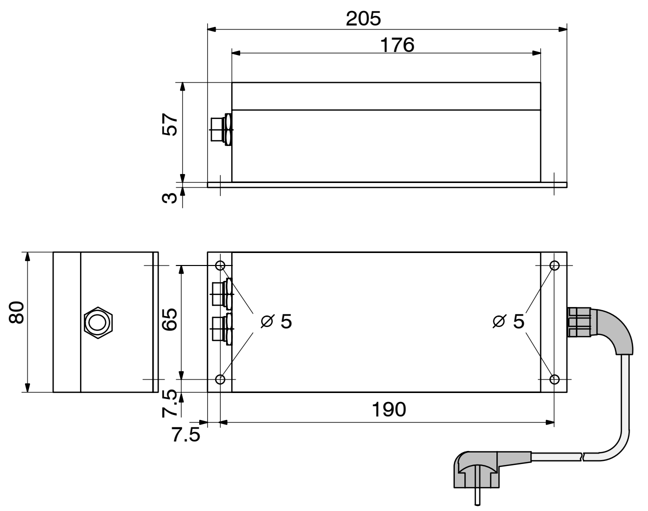


Figure 7-4 Dimensions of MOBY wide-range power pack

Notes on safety

Caution

Do not open the devices or modify them.
Failure to adhere will invalidate the CE and the manufacturer's warranty.
Applicable DIN/VDE regulations or country-specific specifications must be observed when installing the power pack.
The application area of the power pack is limited to "information technology of electrical office equipment" as stated in the standard EN 60950/VDE 0805.
Devices may only be commissioned and operated by qualified personnel.
For the purposes of this manual, qualified personnel are persons who are authorized to commission, ground and tag devices, systems and electrical circuits in accordance with safety standards. The device may only be used for the applications described in the catalog and the technical description and then only with Siemens devices and components or devices or components of other manufacturers recommended by Siemens.
Correct operation of the product is dependent on correct storage, setup and installation as well as careful use and maintenance.
During installation, make sure that sufficient space is available so that the electrical output can be accessed.
The housing may heat up during operation to up to +40 °C. This is no cause for worry. However, make sure that the power pack is covered when the ambient temperature exceeds +40 °C to prevent people from touching the excessively hot housing. The power pack must also have sufficient ventilation.

7.3 MOBY STG U Hand-Held Terminal

Application area

The STG U adds to the MOBY U identification system a powerful mobile hand-held terminal (on the basis of the PSION Workabout ^{mx}) for applications worldwide in the areas of the automotive industry, industrial production facilities, transportation, logistics and service. It is also an indispensable aid for commissioning and testing.
The STG U mobile hand-held terminal rounds off the MOBY U range. The service and test program included in the device makes it easy to read and write all MOBY U data memories.
It is also very easy for customers to program their own application on the hand-held terminal. A C library is available as an option from Siemens for programming customer-specific interactive forms. As a result it is easy to implement applications in the field of manual data acquisition in Ethernet networks with the TCP/IP protocol, above all in the automotive industry and in industrial production facilities, but also in transportation and logistics.

Figure 7-5 MOBY STG U hand-held terminal

Setup and functions

As a complete unit, the STG U mobile hand-held terminal consists of:

- The PSION Workabout (control unit) and
- the MOBY U antenna, in which the actual antenna with the associated read/write electronics is integrated and which serves as the holder for the PSION Workabout (communications unit).

The MOBY software supplied with the device (memory card) provides service and test functions for reading, writing, etc. of all MOBY U data memories:

- Read data from the MDS
- Write data to the MDS
- Erase the entire data memory (write with a filler value)
- Read and display the status of the MDS
- Read the MDS ID number
- Read the OTP memory
- Write to the OTP memory
- Present and edit the data in hexadecimal or ASCII format
- Enable/disable password protection

Using the optional C library as a basis, it is very easy to program your own applications including a customized screen user interface for reading and writing data memories. Various development tools are available for the PC, and a large selection of accessories is available directly from PSION.

Optional components

(See http://www.psion.com/industrial/ on the Internet)

- 3link adapter cable to the PC for easy exchange of data between PC and PSION Workabout^{mx}
- PSION Workabout^{mx} basic device with large function keys and numeric keyboard
- Additional memory card with up to 8 Mbytes of memory
- Docking station including high-speed charging device and software for convenient data exchange between PSION Workabout^{mx} and PC.

System prerequisites

The following prerequisites must be met when the library for SIBO 'C' is used (SIBO 'C' is the C developmental environment for the PSION Workabout):

• PC	The 'C development package for the PSION Workabout' must be installed on the PC. This development package is available directly from PSION (see: http://www.psion.com/industrial/).
• Hand-held terminal	PSION Workabout with wall bracket and power pack. Use of the STG U MOBY hand-held terminal is recommended.
• PC cable	You will need a 3link adapter cable from PSION for the connection to the PC (see: http://www.psion.com/industrial/). The cable is only required if it is not already included with the C development package.
• C Library	The following files are required: MOBY_U.H, MOBY_STG.LIB. These are supplied with the MOBY SIBO 'C' library from Siemens.

Note

In principle, applications can also be developed in the Basic programming language OVAL. However, you cannot use the MOBY library.

Hardware

The illustration below shows the main hardware interfaces which you can use to write your own applications.

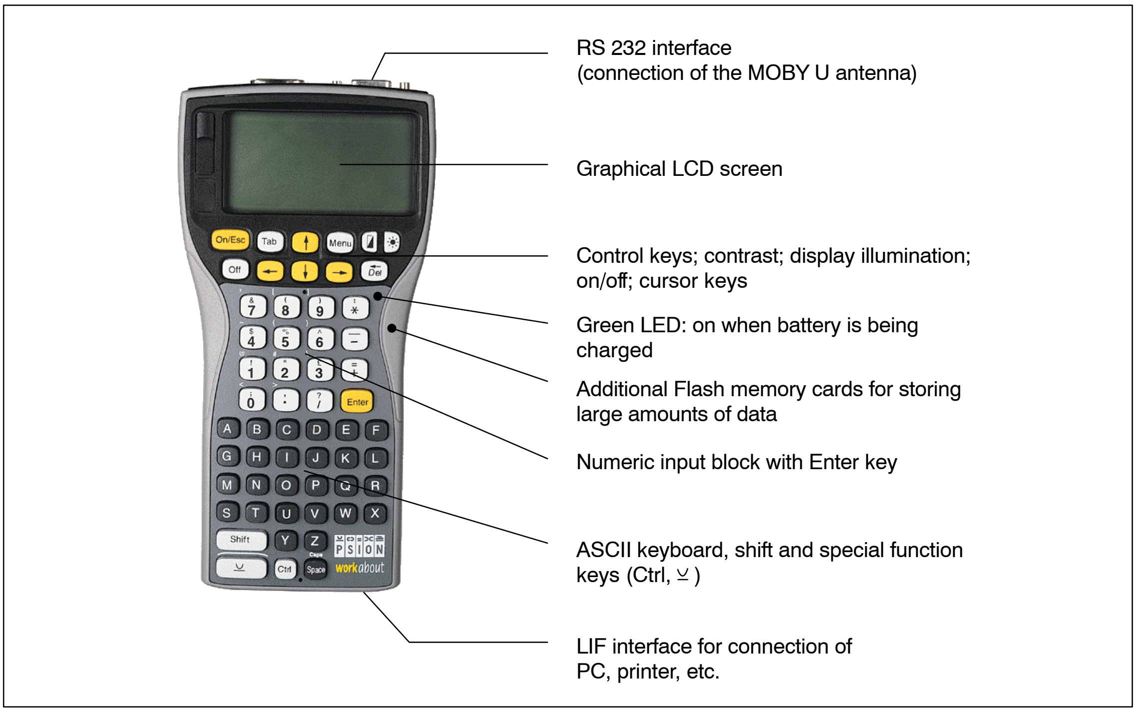


Figure 7-6 Hardware configuration of the STG U

Ordering data

Table 7-4 Ordering data for the STG U

STG U mobile hand-held terminal Basic device (PSION Workabout^{mx}) with MOBY U antenna, batteries, standard software incl. STG functions on EEPROM card, user's guide, without STG U power pack	6GT2 503-0AA00
STG U power pack 90 V to 264 V AC wide-range power pack with cable switch for • the MOBY U antenna and • the control unit (PSION Workabout^{mx}) and charging adapter for the control unit	6GT2 503-1DA00
Accessories:	
MOBY U antenna Read/write antenna with the electronics and holder for the control unit (PSION Workabout^{mx}) with battery	6GT2 503-1AA00
Memory card with STG software and filehandler software for MOBY D, MOBY E, MOBY F, MOBY I and MOBY U, incl. user's guide	6GT2 303-1CA00
C library for MOBY D, MOBY E, MOBY F, MOBY I and MOBY U for development of customer-specific screen dialogs, without development tools, incl. description	6GT2 381-1AB00
Replacement battery for PSION Workabout^{mx} 2 size AA NiCd batteries (2.4 V 850 mAh)	6GT2 094-0AB00
Replacement battery for the STG U antenna LiIon battery pack (7.2 V 1.8 Ah)	6GT2 594-0AB00
Optional components for PSION Additional PSION components (e.g. 3link cable, C developmental environment)	Obtain from local dealer or PSION (http://www.psion.com/industrial/)

Technical data

Table 7-5 Technical data of the STG U hand-held terminal

Hardware	
Processor	NEC V30mx 27.68 MHz (80C86-compatible)
RAM	2 MB; of which approx. 1.8 MB is freely available
ROM	2 MB for operating system
User program	1 MB (with MOBY service and test program)
Screen	Graphic LCD screen with 240x100 pixels, gray-step scale and switch-on background lighting
Keyboard	Alphanumeric with 57 keys
Sound	Piezo signal encoder

Table 7-5 Technical data of the STG U hand-held terminal

Power supply	NiCd rechargeable battery pack with 2 size AA cells (850 mAh), suitable for high-speed recharging, automatic switch-off Operating time: 20 hours Antenna inactive, display unlit 18 hours Antenna active, display unlit 10 hours Antenna inactive, display lit Backup battery: 3 V lithium cell CR 1620
Interfaces • LIF interface (Low Insertion Force interface) • RS232 AT • RS232 TTL	 Interface for battery charging and communication with PC and printer (3link cable not included) RS232 AT interface for connection to the MOBY U antenna RS 232 TTL interface (not used on the STG U)
Security	Locking mechanism for battery and program memory
Software	
Operating system	EPOC/16 multitasking, graphics support, GUI, Interpreter similar to MS-DOS
File management	MS-DOS-compatible
Integrated software	MOBY service and test program; spreadsheet; database; pocket calculator; communication
MOBY STG program	Normal addressing functions: • Read, write, delete and copy MDS data • Read MDS ID, save and load MDS data Menus in German or English Entry and display of data in ASCII or HEX
Technical data	
Dimensions [L x W x H] in mm	189 x 92 x 35
Weight, approx.	325 g (incl. batteries)
Ambient temperature • Operation • Transport and storage	 –20 °C to +60°C –25 °C to +70 °C (without battery)
Relative humidity	0% to 90% no condensation
Degree of protection in accordance with EN 60529	IP54 (splash-proof)
Impact resistance	Max. height of fall onto concrete on all sides up to 1 m (without MOBY U antenna)

Table 7-5 Technical data of the STG U hand-held terminal

Certifications	Safety standard (Europe): EN 60950 Emission (Europe): EN 55022 Class B Emission (USA): FCC Part 15 Class B Electrostatics: Conforms to IEC801-2 RF immunity: Conforms to IEC801-3 EFT immunity: Conforms to IEC801-4
MOBY U antenna	
Transmission frequency	2.4 to 2.4835 GHz
Band width	2 x 1 MHz within 83 MHz
Gross bit rate of radio channel	384 kbit/sec
Data rate (write/read) (net)	approx. 8 / 4.8 Kbyte/s without bunch
Antenna • Direction of radiation • Angle of opening • Polarization • Emission • Emission density	 Perpendicular to rear of MOBY U antenna Approx. 70° (conical antenna field) Circular < 50 mV/m at a distance of 3 m < 0.5 $\mu W/cm^2$ at distance of 1 m
Distance (read/write) • Limit distance (S_g) • Max. / min. / default • Location resolution	0.15 m to 3 m Identical to set distance limit 3 m / 0.5 m / 1 m Range limitation, adjustable in 0.5 m increments
MDS recording time	Approx. 3 s with 1 MDS (after actuation of communication button)
Power supply	LiIon battery pack 2SIP CGR18650 HG 7.2 V 1.8 Ah Suitable for high-speed recharging, automatic switch-off, Service life approx. 500 charging cycles
Current consumption (antenna on)	< 800 mA
Operating time [1]	> 2 months (antenna not active) 2 hours (antenna active) The antenna is activated using the communication button for communication only, and is automatically switched off after the function has been executed. The shortest on-time for a communication operation is approx. 3 s (depending on the volume of data) when an MDS is located in the field.

Table 7-5 Technical data of the STG U hand-held terminal

Operating modes	
• OFF	Antenna off
• search	Ready to receive and evaluate search information sent from the MDS.
• Communication	Communication with the MDS: write, read or initialize
Minimum distance to an SLG U92 or another STG U	≥ (set range + 0.5 m)
Serial interface to the PSION	RS 232
• Transmission speed	115.200 Baud
• Transmission protocol	3964 R
Interface for battery charging	4-pin socket for connecting the STG U power pack
• Voltage / current	12 V DC / 1.225 A
• Charging time	> 1.5 h: LiIon battery pack 2SIP CGR18650 HG
Operating element	Communication button (for starting communication)
LEDs	2 LEDs
• LED for battery charging	
– lit	Power pack connected red: Device faulty yellow: Batteries being charged green: Batteries charged
– not lit	Power pack not connected
• LED for communication	
– lit	Communication button pressed and communication not terminated red: Insufficient battery capacity for communication yellow: Antenna switched to active Ready to identify an MDS or identify an MDS and communicate with it.
– not lit	Communication terminated or not yet started.
Housing	
• Dimensions (L x W x H in mm)	282 x 235 x 93
• Color/material	Black / VALOX®357X

Table 7-5 Technical data of the STG U hand-held terminal

Certifications	RF: EN 330440-2 SAR: EN 50371 Safety: EN 60950-1 EMC: EN 301489-01 EN 301489-03 ENV 50204 FCC Part 15C (USA) UL under preparation Safe for pacemakers

1 The operating time corresponds to the time that the antenna is switched on; this means for each MDS function the time from the actuation of the communication button to the completion or abortion of the selected MDS function. If after pressing the communication button you have not pointed or do not point the hand-held terminal at an MDS, the function is aborted after 30 seconds. The antenna is switched on during this time.

STG U power pack	with cable switch (on charging cable) and charging adapter for PSION Workabout
Input voltage range	90 V to 264 V AC
Input voltage frequency range	47 Hz to 63 Hz
Nominal input current	400 mA
Nominal output voltage	12 VDC
Nominal output current	1.25 A
Base load	None
Short-circuit proof	Yes
Electrical isolation primary/secondary	3 kV AC
Dimensions of power pack (L x W x H in mm)	87.5 x 51.5 x 34 (without connector)
Color/material	Black / plastic (PPE-V1)
Ambient temperature • Operation • Transport and storage	 0 °C to +40 °C –40 °C to +70 °C
Relative humidity	0 % to 90 %, no condensation
Degree of protection in accordance with EN 60529	IP40
Weight, approx.	250 g
Charging cable	2 x 0.5 mm^2 / 2 m long
Primary connector	Replaceable EU, UK, USA and ROW connector (EU connector included in scope of delivery)
Certifications	220 V to 240 V (Europe): CE 120 V (Canada and USA): $_{C}UL_{US}$ Safety: EN 60950 EMC: EN 55011, EN 55014 and EN 55022 Class B

Documentation

A

Descriptions, bound

Table A-1 Ordering data for descriptions

	Order No.
Description of FC 45 German English	 6GT2 097-3AM00-0DA1 6GT2 097-3AM00-0DA2
Description of FC 46 German English	 6GT2 097-3AC40-0DA1 6GT2 097-3AC40-0DA2
Description of FC 56 German English	On MOBY Software CD
Description of 3964 R for Win 95/NT (German/English)	On MOBY Software CD
Description of MOBY API	On MOBY Software CD

Error Messages B

This chapter gives you the error messages of MOBY U. The messages are divided into two groups.

B.1 Error messages and causes in MOBY U with ASM and FC 45 (direct MDS addressing)

B.2 Error messages and causes in MOBY U with ASM 452 and FC 46 (filehandler)

B.3 Error messages and causes in MOBY U with ASM and FC 56 (filehandler)

B.1 Error messages and causes in MOBY U with ASM and FC 45 (direct MDS addressing)

B.1.1 General Errors

Programmable controller goes into STOP mode

- OB 86 not programmed and a slave has failed.
- OB122 not programmed and a slave has failed.

The error only occurs when FC 45 is called.

- The pointers Params_DB, command_DB, and DAT_DB are not present or indicate an unavailable address area.

B.1.2 Error Messages

There will always be an error status in FC 45 if the “error” variable is set for a channel. If this is the case, the exact cause of the error can be established in the “error_MOBY”, “error_FC”, or “error_BUS” variables.

Table B-1 Classification of the error messages

Error variable	Classification
error_MOBY	This error is reported by the MOBY ASM/SLG. There are two main causes: • There are communication errors between the ASM and SLG or between the SLG and MDS. • The ASM/SLG cannot process the command. error_MOBY is displayed on the ASM with a flashing ERR LED.
error_FC	FC 45 reports this error. Main cause • The parameter assignment of “Params_DB” or “command_DB” is incorrect.
error_BUS	The transport layer of PROFIBUS reports an error. It is very helpful to use a PROFIBUS tracer and a PROFIBUS tester (BT 200; order number 6ES7 181-0AA00-0AA0) to find and analyze the error. The system diagnostics of PROFIBUS can provide further information on the cause of the error. The error indicated here is reported by the SFC 58/59 system function in the RET_VAL parameter. You will find a detailed description of the RET_VAL parameter in the SIMATIC S7 system manuals (see the S7-300/400 system software).

Note

If several errors occur in succession in the case of chained commands, the error variable will always show the first error detected.

error_MOBY

Table B-2 Error messages of the MOBY ASM/SLG via the error_MOBY variable

Error Code in Hex	ERR LED flashes	Cause, Remedy
00	–	Not an error; result is OK
–	1x	See error code 0F.
01	2x	Presence error: MDS has moved out of the transmission window of the SLG. The MOBY command was only partially executed. Read command: No data are supplied to FC 45. Write command: The data memory that has just left the field has an incomplete data record. → Working distance from the SLG to the MDS is not adhered to. → Configuration error: data block to be processed is too large (for dynamic operation) The next command (READ, WRITE) automatically applies to the next MDS. **Note:** The error indication with the red LED on the front plate shows error code 02 this time.
02	2x	Presence error: → A mobile data memory moved past the SLG but was not processed by a command. → A pending MDS command was aborted by an ”antenna off” command. **Note:** The red error LED showing the errors does not distinguish between error 01 and error 02 (see error code 01).
03	3x	Error in the connection to the SLG → Voltage of the ASM < 20 V or ASM not connected → 24 V voltage has voltage dips or is not connected or switched off → Fuse on the ASM has blown. Check wiring → Cable between ASM and SLG incorrectly wired or cable break → Hardware defective: ASM or SLG → Interference coupling on the SLG cable or bus cable → Run init_run after error has been eliminated
04	4x	Error in memory of MDS The data memory has never been written or has lost its contents due to battery failure. → Initialize data memory with the STG → With the SLG: call initialization command → Check battery of MDS or change MDS → Data memory is defective
05	5x	Unknown command code in byte 2 of the message frame SLG reports error in data length (check message frame) → Incorrect length of user data
06	6x	Field interference on SLG The SLG is receiving interference from its surroundings. → MDS left the field during communication → Communication between SLG and MDS terminated due to external interference → Distance between two SLGs is too small and does not adhere to configuration guidelines
0B	11x	Memory of the MDS cannot be correctly read

Table B-2 Error messages of the MOBY ASM/SLG via the error_MOBY variable

Error Code in Hex	ERR LED flashes	Cause, Remedy
0C	12x	Memory of the MDS cannot be written. → Memory of the MDS is defective
0D	13x	Address error (address area exceeded) → Specified address does not exist on the MDS → Check and correct command for message format → MDS is the wrong type.
0F	15x	Startup message The ASM sends this message after every startup. (A startup occurs each time the voltage is applied, each time the front switch is activated, after a reset via connector X1 or after a bus error.) The startup message remains queued until the user sends a RESET command to the ASM. This gives the user a chance to know when power returns to the ASM (i.e., ASM is ready again). → Perform init_run.
10	16x	NEXT command is not possible. → SLG does not know NEXT command
11	17x	Short circuit or overload of the 24 V outputs Next command must be a RESET command. → The affected output is switched off → All the 24 V outputs are switched off in the event of a total overload → A reset can only be performed by switching the power off and on again → Then start init_run
12	18x	Internal ASM communication error → Connector contact problem on the ASM (send ASM away for repair) → Hardware of ASM defective → EMC interference → Start init_run after error has been eliminated
13	19x	There isn’t enough buffer storage space in the ASM/SLG to store the command temporarily
14	20x	Internal ASM error or SLG error (watchdog) → Program execution error on the ASM → Switch the 24 V power off and on again → Program execution error on the SLG → Start init_run after error has been eliminated
15	21x	Incorrect parameter assignment of the ASM/SLG → Check INPUT parameter in UDT 10 → RESET command incorrectly parameterized → The ASM hasn’t received init_run after power-up
16	22x	The command cannot be executed with the current bus configuration. → Input or output areas are too small for the frame length Correct DDB file used? → Write or read command too long. Data length > 233 bytes. → Adapt bus configuration on the master module.

Table B-2 Error messages of the MOBY ASM/SLG via the error_MOBY variable

Error Code in Hex	ERR LED flashes	Cause, Remedy
17	23x	Communication error between FC 45 and MOBY ASM Handshake error → Params_DB (UDT 10) in this ASM station is overwritten by other program sections → Check the parameter assignment of the MOBY ASM in UDT 10 → Check the FC 45 command that results in this error → Start init_run after error has been eliminated
18	24x	An error has occurred that has to be acknowledged with init_run → A temporary short circuit has occurred on PROFIBUS → The RESET command is invalid → Start init_run after error has been eliminated
19	25x	The previous command is active or there is a buffer overflow The user sent a new command to the ASM/SLG although the last command was still active. → The active command can only be terminated with init_run → Before the start of a new command the READY bit must = 1; exception init_run → Two FC 45 calls were parameterized with the same parameters: “ASM_address” and “ASM_channel” → Two FC 45 calls are working with the same Params_DB pointer → Start init_run after error has been eliminated → No data has been picked up by the MDS whilst working with command repetition (e.g. fixed-code MDS). The data buffer in the ASM has overflowed. MDS data have been lost.
1A	26x	PROFIBUS DP error occurred → PROFIBUS DP bus connection was interrupted → Wire break on the bus → Bus connector on the ASM temporarily removed → PROFIBUS DP master no longer addresses the ASM → Perform init_run. → The ASM has detected a message frame interruption on the bus. The PROFIBUS may have been reconfigured (with HWCONFIG, for example). This error is only displayed if response monitoring was activated at PROFIBUS configuration.
1 C	28x	The antenna of the SLG is off/on and is to be switched off/on again. The antenna is off and a MDS command is to be executed in this state. The antenna is to be switched off although an MDS command is pending. → Antenna is off. → Antenna is on. → Mode in SET-ANT command is unknown. → Antenna is off. The MDS command cannot be executed.
1D	29x	There are more MDSs in the transmission window than the SLG can process simultaneously. → Only one MDS can be processed at any one time with FC 45

Table B-2 Error messages of the MOBY ASM/SLG via the error_MOBY variable

Error Code in Hex	ERR LED flashes	Cause, Remedy
1E	30x	Errors during the processing of the function → The data in the UDT 10 is errored; check UDT 10 and run init_run → ASM hardware defective: on init_run the ASM receives incorrect data → QB byte does not correspond to user data length.
1F	31x	The current command terminated with RESET (init_run or cancel) or the bus connector was removed → Communication with the MDS was terminated with init_run → This error can only be returned with init_run or cancel

error_FC

Table B-3 ”error_FC” error variable

Error code (B#16#..)	Description
00	Not an error; default value if everything is OK
01	Params_DB does not exist on the SIMATIC.
02	Params_DB is too small. → UDT 10/11 was not used in the definition. → Params_DB must be 300 bytes long (for each channel). → Check Params_DB, Params_ADDR for correctness.
03	The DB after the “command_DB_number” pointer does not exist on the SIMATIC.
04	“Command_DB” on SIMATIC is too small. → UDT 20/21 was not used in the command definition. → The last command in “command_DB” is a chained command; reset the chaining bit
05	Invalid type of command → Check the command_DB_number/command_DB_address command pointer → Check the current values in command_DB → Perform init_run.
06	The received acknowledgment is not the expected acknowledgment. The parameters of the command and acknowledgment message frames do not match (command, length, address_MDS). → The user changed the command_DB_number/-_address pointer while the command was being processed. → The user changed the command parameters in the MOBY CMD data block (UDT 20) while the command was being processed. → Check the parameter assignment of ASM_address and ASM_channel. ASM_address and ASM_channel have the same parameter assignment for different channels. → Acknowledgment and command counters between the ASM and FC are no longer synchronous → Perform init_run.
07	The parameter MOBY_mode or MDS_control (defined in UDT 10) has an impermissible value.
08	A bus error has occurred which was reported by the system functions SFC 58/59. More information on the error is available in the error_Bus variable. → ASM_address or ASM_channel not present → Perform init_run.
09	The ASM has failed. → Power failure on MOBY ASM → PROFIBUS connector pulled or PROFIBUS cable broken → ASM_address or ASM_channel not present The error is indicated when the ASM_Failure bit was set in OB 122. OB 122 is called when the FC 45 can no longer access the cyclic word for the MOBY ASM.
0A	The user started another init_run without waiting for ready while the first init_run command was still being processed. → Do <u>not</u> set init_run cyclically → The same physical ASM channel is used in two (or more) UDT 10 structures. Check the ASM_address and ASM_channel in <u>all</u> UDT 10 structures.

Table B-3 ”error_FC” error variable

Error code (B#16#..)	Description
0B	init_run cannot be executed; cyclic process image for ASM is faulty; FC 45 reports timeout of the process image to the ASM This error can be eliminated by writing the value #00 to the address DBB 58 in UDT 10. However, in certain error situations, the FC 45s do not generate an error message, and they then hang. → ASM_address in UDT 10 is parameterized incorrectly. ASM_address may be on the wrong module. → ASM_channel is parameterized with ≥ 16 or ≤ 0 → ASM hardware/firmware is defective. → The same physical ASM channel is used in two (or more) UDT 10 structures. Check the ASM_address and ASM_channel in all UDT 10 structures.
0C	Range length area in block move of FC 45. → DAT_DB does not exist or is too small. Check DAT_DB_number and DAT_DB_address in UDT 20. → Perform init_run.
0D	An init_run was not correctly terminated. The process image is not consistent. → Execute init_run again → Switch ASM off and on again → The RUN-STOP switch was operated rapidly several times on the CPU (particularly in the case of slow PROFIBUS transmission rates) → The same physical ASM channel is used in two (or more) UDT 10 structures. Check the ASM_address and ASM_channel in all UDT 10 structures.

error_BUS

Table B-4 ”error_Bus” error variable

Error code (W#16#...)	Description
800A	ASM is not ready (temporary message). → This message is sent to a user who is not using FC 45 and queries the ASM acyclically in very rapid succession.
8x7F	Internal error in parameter x. Cannot be corrected by the user.
8x22 8x23	Area length error while reading a parameter Area length error while writing a parameter This error code indicates that the parameter x is completely or partially outside the operand range or the length of a bit field for an ANY parameter is not divisible by 8.
8x24 8x25	Area error while reading a parameter Area error while writing a parameter This error code indicates that the parameter x is located in an area that is impermissible for the system function.
8x26	The parameter contains number of a time cell which is too large.
8x27	The parameter contains number of a counter cell which is too large.
8x28 8x29	Direction error while reading a parameter Direction error while writing a parameter The reference to parameter x is an operand whose bit address is not 0.
8x30 8x31	The parameter is located in the write-protected global DB. The parameter is located in the write-protected instance DB.
8x32 8x34 8x35	The parameter has a DB number that is too large. The parameter has an FC number that is too large. The parameter has an FB number that is too large.
8x3A 8x3C 8x3E	The parameter has the number of a DB which is not loaded. The parameter has the number of an FC which is not loaded. The parameter has the number of an FB which is not loaded.
8x42 8x43	An access error occurred while the system was trying to read a parameter from the I/O area of the inputs. An access error occurred while the system was trying to write a parameter to the I/O area of the outputs.
8x44 8x45	Error during nth (n > 1) read access after an error occurred Error during nth (n > 1) write access after an error occurred
8090	Specified logical base address invalid: there is no assignment in the SDB1/SDB2x, or it is not a base address.
8092	A type other than BYTE was specified in an ANY reference.
8093	The area identifier obtained when the logical address was configured (SDB1, SDB2x) is not permitted for these SFCs. Permissible are: • 0 = S7-400 • 1 = S7-300 • 2, 7 = DP modules

Table B-4 ”error_Bus” error variable

Error code (W#16#...)	Description
80A0	Negative acknowledgement while reading the module; FC picks up acknowledgment although no acknowledgment is ready to be picked up A user not working with FC 45 would like to pick up DS 101 (or DS 102 to DS 104) but there is no acknowledgment available. → Execute init_run for a resynchronization between the ASM and application
80A1	Negative acknowledgement while writing to the module; FC sends command although the ASM cannot receive a command
80A2	DP protocol error for layer 2, possible hardware defect.
80A3	DP protocol error with direct-data-link-mapper or user interface/user, possible hardware error.
80B0	• SFC not possible for this type of module. • Module does not know the data record. • Data record number ≥ 241 is not permissible • Data records 0 and 1 are not permissible with SFC58 “WR_REC”.
80B1	The length specified in the RECORD parameter is wrong.
80B2	The configured slot is not occupied.
80B3	The actual module type is not the required module type in SDB1
80C0	• RDREC: The module has the data record but no read data have arrived yet. • WRREC: The ASM is not ready to receive new data → Wait for the cyclic counter to count up
80C1	The data of the preceding write job on the module for the same data record have not yet been processed by the module.
80C2	The module is processing the maximum possible number of jobs for one CPU.
80C3	Required resources (memory, etc.) are busy at the moment. This error is not reported by FC 45. In the event of this error, FC 45 waits until the resources are made available again by the system.
80C4	Communication error • Parity error • SW ready not set • Error in block length management • Checksum error on CPU side • Checksum error on module side
80C5	Distributed I/O not available.

B.2 Error messages and Causes when MOBY U Is Used with ASM 452 and FC 46 (Filehandler)

B.2.1 PROFIBUS diagnosis

LED "ON" does not illuminate or flashes

If the "ON" LED does not illuminate, there is either no supply voltage or insufficient supply voltage to the ASM. The possible causes are a defective fuse, no supply voltage, or insufficient supply voltage. A flashing LED or one that does not come on may indicate a defective module.

Diagnostics with LEDs

The following table lists possible error displays and tells you want they mean and what to do.

Table B-5 LED displays

"BF" LED	"SF" LED	Cause of the error	Error handling
On	*	• ASM is starting up	–
		• The connection to the DP master has failed. • ASM cannot detect a transmission rate.	• Check the PROFIBUS DP connection. • Check the DP master.
		• Bus interruption • DP master not working	• Check all the cables in your PROFIBUS DP network. • Check whether the PROFIBUS DP connector is securely attached to the ASM.
Off	On	• The PROFIBUS address set on the ASM is not permissible.	• Change the PROFIBUS address set in the ASM.
Flashes	On	• The configuration data sent from the DP master to the ASM do not match the configuration of the ASM.	• Check the configuration of the ASM (input/output, PROFIBUS address). • Correct DDB file used? Check switch 8 on the ASM.
Flashes	Off	• ASM has detected the transmission rate but is not addressed by the DP master. • ASM not (correctly) configured.	• Check the PROFIBUS address set in the ASM/ the configuration software. • Check the configuration of the ASM (station type). • Check the bus parameters. The PROFIBUS DP default values must be changed.
On	Flashes	• There is a hardware fault in the ASM.	• Replace the ASM.

* Status is not relevant

System diagnostics

The ASM 452 supports the standard PROFIBUS system diagnosis with a length of 6 bytes.

B.2.2 Evaluation of the ERR LED

Filehandler errors that point to defective hardware in the ASM, SLG, or MDS are indicated by a flashing ERR LED.

Table B-6 Evaluation of the ERR LED

ERR LED flashes	Filehandler error message	
1x	**D0 01**	Only RESET command permissible
2x	**C0 06**	Presence error
3x	**B0 01**	Error in connection to the SLG
4x	**C0 02**	Error in the RAM of the MDS
5x	**C0 07**	Parameter assignment error for TRACE or FORMAT/command cannot be interpreted
6x	**C0 08**	Too many synchronization attempts
7x	**C0 09**	Too many transmission errors
8x	**C0 10**	CRC transmission error
9x	**C0 11**	FORMAT, CRC error during reception
10x	**C0 12**	FORMAT, MDS cannot be initialized
11x	**C0 13**	FORMAT, timeout
12x	**C0 14**	FORMAT, not initialized
13x	**C0 15**	CMD address error
14x	**C0 16**	ECC error
15x	**C0 17**	General driver error
18x	– – – –	Internal ASM communication error →Hardware is defective →Restart
20x	– – – –	Internal ASM overflow; stack overflow; SPC memory overflow; diagnosis not working →Execute RESET or restart →Switch interface module off and on →Check bus parameterization
21x	– – – –	Incorrect parameter assignment of the ASM →Check the parameter assignment in HWCONFIG
30x	– – – –	Corrupt message frame from SLG

B.2.3 Filehandler Error Messages

Evaluation of ANZ0 and ANZ1 error displays

Table B-7 Evaluation of ANZ0 and ANZ1 error displays

Error code (W#16#...)	Description
A0 03	The recipient ID of the started command is not permissible.
A0 06	The command ID (KK) of the started command is not permissible (not defined). The correct command ID must be specified.
A0 07	The command index (KI) of the started command is not permissible. The correct KI must be specified.
A0 11	The message frame control parameters (DBN or KK) are not in the correct sequence. Two or more message frames are written to the same ASM. The parameter assignment of the FC call parameter “ADR” must be checked. Do not execute the start of the command by means of the variable control function
A0 16	The filehandler is currently processing another command. It is imperative that a RESET command be executed.
A0 17	The data block of the SLG is too long and cannot be transferred via PROFIBUS. • The block length parameter is too big for the RESET command (FC error or user error) • Program execution error in the SLG • Restart the ASM and the command
A0 18	Communication error; MOBY driver is active while a new command is sent • Check the command sequences in the application • Restart the ASM
B0 01	Error in the connection to the SLG: • Cable between ASM and SLG is incorrectly wired or there is a cable break. • 24 V power is not connected or switched off. • Circuit breaker on the ASM has tripped • Hardware defective This error does not occur when the system commands (RESET, NEXT, ASM-STATUS) are started.
B0 02	EAKO 1: • A command was started but there is no MDS in the transmission window of the SLG. EAKO 0: • The old/current MDS has left the transmission window and the next/new one has entered the transmission window. A command has been started (not NEXT). This command applies to the new MDS, but the old/current MDS has not yet been terminated with NEXT. • A new MDS enters the transmission window of the SLG and leaves it again without a command being executed with this MDS (MDS slips through).
B0 08	The antenna is not switched on, or SET-ANT = ON with the antenna already on • User error; note the command sequence
B0 09	Buffer overflow in the MOBY driver of the ASM/SLG; system-internal error • Restart the ASM

Table B-7 Evaluation of ANZ0 and ANZ1 error displays

Error code (W#16#...)	Description
B0 10	Driver error; communication between the filehandler and MDS driver is faulty (QB byte) • Restart the ASM
B0 11	Communication error between the filehandler and MDS driver; the MDS driver reports a canceled RESET although the filehandler is not processing a RESET • Restart the ASM
B0 12	Unmotivated power-up message of the MDS driver • Restart the ASM
C0 02	The MDS reports a memory error. The MDS has never been written or its battery failed and it lost its memory (not in the case of the MDS EEPROM). Then: • Change the MDS (if the battery monitoring bit is set). • Test the MDS by attempting to initialize it with the STG • Format MDS with FORMAT.
C0 06	During certain important processes (e.g. writing the system area of MDS, formatting the MDS), the MDS must not leave the SLG's transmission window, since otherwise the command would be terminated with this error. Then: • Start command again. • The MDS is positioned on the boundary of the SLG's transmission window.
C0 07	• The FORMAT or TRACE commands were sent with the wrong parameters. The physically addressed address does not exist on the MDS (MDS memory is smaller than specified by the command). • During READ/WRITE/UPDATE: pointer in FAT is defective; a block is pointed to which does not exist on the MDS.
C0 08	Field interference on the SLG. The SLG is receiving interference from its surroundings, e.g., • External interference field; the interference field can be verified with the "inductive field indicator" of the STG • The distance between two SLGs is too short and does not comply with the configuration guidelines. • The connection cable to the SLG is defective, too long or does not meet specifications.
C0 09	Too many transmission errors have occurred. The MDS was not able to receive the command or the write data from the ASM/SLG correctly even after several attempts. • The MDS is positioned directly in the boundary area of the transmission window. • Data transmission to the MDS is being affected by external interference.
C0 10	• CRC sending error. The monitor receiving circuit detected an error while sending. Cause of the error same as for **C0 08**. • The MDS is reporting CRC errors very often. (MDS is located on the boundary or MDS/SLG defective.)
C0 11	Same as **C0 08.**
C0 12	The MDS is unable to execute the FORMAT command. The MDS is defective.
C0 13	When being formatted, the MDS must be located in the transmission window of the SLG. Otherwise, a timeout error occurs. This means: • The MDS is positioned directly in the boundary area of the transmission window. • The MDS is using too much current (defective). • The MDS EEPROM type is incorrectly parameterized in FORMAT

Table B-7 Evaluation of ANZ0 and ANZ1 error displays

Error code (W#16#...)	Description
C0 14	The memory of the MDS cannot be written. This means: • The MDS has a smaller memory than that specified in the FORMAT command. The MDS type must therefore be correctly parameterized. • The memory of the MDS is defective. • The MDS EEPROM has been written too often and has reached the end of its life.
C0 15	Address error. The address area of the MDS has been exceeded. • MDS is the wrong type.
C0 16	An ECC error has occurred. The data cannot be read from the MDS. This means: • MDS data have been lost (MDS defective). • The MDS was not formatted with the ECC driver. Format the MDS again. • The MDS EEPROM has reached the end of its life. The data have been lost. Replace MDS. • The MDS moved out of the field while being written. The MDS is positioned incorrectly. (**Note:** the system area of the MDS is automatically written to each SLG station.)
C0 17	The filehandler is not working correctly. • Check the command structure or command sequence. • The hardware of the ASM/SLG (firmware) has a defect
C0 18	Operating system error (AMOS mailbox) • Restart the ASM/SLG
C0 19	There are several MDSs in the field. The number of MDSs in the field is greater than the parameterized number of MDSs for "multitag" • Only one MDS can be processed in the field with FC 46. • Remove all the other MDSs from the field • The configuration of the range limit dili (distance_limiting) is set incorrectly • Check the environment of the SLG to see if there is by chance a MDS in the field
C0 20	Communication error between the filehandler and MDS driver; the MOBY driver does not know the command from the filehandler. • Restart the ASM/SLG
C0 21	Operating system error; watchdog error in the ASM/SLG • Restart the ASM/SLG
D0 01	The filehandler will only accept a RESET command. • Filehandler was not yet initialized with a RESET command. • This state can only be resolved with a RESET command.
D0 05	The FORMAT, CREATE, WRITE, ATTRIB, UPDATE, COVER, QUEUE-READ or QUEUE-WRITE command has been issued with impermissible parameters. • FORMAT with impermissible MDS name or MDS type • CREATE with impermissible filename • WRITE/UPDATE with length of 0 (DLNG=0) • impermissible attribute • QUEUE-WRITE or QUEUE-READ with impermissible option • COVER with impermissible user (Only 0 or 1 are legal.)

Table B-7 Evaluation of ANZ0 and ANZ1 error displays

Error code (W#16#...)	Description
D0 07	• The system data transferred with the LOAD command are wrong. – DLNG is parameterized incorrectly for LOAD. – Wrong data block specified or incorrectly parameterized – MOVE command not executed correctly; on the MDS, DIR + FAT do not match the checksum • The MOVE command cannot be executed. The checksum does not match DIR + FAT. The data memory has evidently exited the transmission window while system operation (writing DIR + FAT, for example) were being executed.
D0 09	A RESET command has been started by FC 46 with impermissible parameters. The cause of the error is in the user program. • Check the FC 46 parameter assignment
D0 14	WRITE command: There is no longer sufficient storage space on the MDS. The data are not written to the MDS in their entirety. CREATE command: When a file is created, a data block can no longer be reserved for this file. No more memory blocks are free.
D0 15	The MDS could not be identified by the filehandler. Format the MDS again.
D0 18	The logically addressed address is not in the file. The FAT has an error. The MDS must be reformatted.
D0 22	The data memory has been locked by means of the COVER command. A write-access command (e.g., UPDATE, CREATE) would destroy the data memory layout and is thus rejected.
D0 23	COVER command: The MDS name specified in the command does not agree with the actual MDS name.
D0 24	• The wrong MDS ID number has been entered. • The MDS is not present.
E0 01	• The type of the MDS before the SLG does not correspond to the ECC mode that is set. The MDS must be reformatted for the desired ECC mode. • The MDS is not a filehandler MDS; format MDS
E0 02	There are no more directory entries free. The file specified in the CREATE command can no longer be created.
E0 03	The file specified in the CREATE command already exists in the directory (no duplicated names permitted).
E0 05	• A secondary FAT error was discovered in the READ or WRITE command. The file application table (FAT) is defective. The MDS must be reformatted. • Wrong address specified in TRACE command
F0 01	• The file addressed by a command (e.g., WRITE) does not exist in the directory. The file must be created by means of CREATE. • Check file name (possibly not in ASCII format). • On or more files are to be read with QUEUE-READ but they do not exist on the MDS. Valid data are not transferred to the user.
F0 05	Write access (WRITE, UPDATE, or DELETE) to a file which must not be changed (and is protected with an appropriate attribute).

Table B-7 Evaluation of ANZ0 and ANZ1 error displays

Error code (W#16#...)	Description
F0 07	QUEUE-READ: specified file length shorter than file length
F0 08	QUEUE-READ: the skip calculated by the filehandler is larger than 0FFF hex (4095 dec)
H1 01	The FC 46 call parameters or DATDB/DATDW were incorrectly parameterized in the absolute call. Change the FC parameters in the calling program and start a RESET command.
H1 02	The length of the loaded BEDB is shorter than 350 data words. This means that the FC 46 does not have the corresponding space for the FC-internal parameters. A new BEDB with the appropriate length must be loaded. Then start a RESET command.
H0 03	The command index is impermissible. Change command index.
H0 04	This command identifier and thus also this command is not known to FC 46. Check the command identifier.
H0 05	The access authorization of the corresponding SLG does not allow this command. For instance, if the "R" (read-only) access authorization has been granted to the SLG, a WRITE command cannot be issued on this SLG. This means that either the FC parameter "RWD" must be changed (and then a RESET command started to accept the change) or a permissible command must be started.
H0 06	The WRITE/UPDATE /LOAD/QUEUE-WRITE or QUEUE-READ command parameter specified in DBW 22 (DLNG) in BEDB is not permissible. Only a user data length of 7FF0 hex (32752 dec) is permissible or a maximum of 210 decimal bytes for QUEUE-READ. Change DLNG accordingly.
H1 07	The data block specified in DBW 2 (BEDB) does not exist. The corresponding data block must be loaded. Then start a RESET command so that the absolute addresses can be calculated.
H1 08	This is a pure software error, which cannot occur during normal operation.
H1 10	The ASM executed a hardware reset. The cause here may be a drop in voltage on the device rack or a plug-in contact fault, for instance. The user must start a RESET command to reparameterize the SLG.
H1 11	The acknowledgement that has been read in has absolutely no reference to ongoing operation. It is purely a software or synchronization error which cannot occur during normal operation.
H1 12	The command identifier of the command and the acknowledgment do not match. This is a software or synchronization error which cannot occur during normal operation.
H1 13	The first command block was not appropriately acknowledged, i.e. the message frame control parameters do not match. It is purely a software or synchronization error which cannot occur during normal operation.
H1 14	An error was detected while the interface control register was being read. This means that there is no longer any synchronization between the writing of the command blocks and the reading of the corresponding acknowledgments. Usually there is a plug-in contact fault. A RESET command must be started to re-establish synchronization.
H1 15	The user-data starting address pointer calculated from the parameters DATDB and DATDW (DBW 2 and 4 in BEDB) is outside the specified data block (pointer too long). Either DATDW must be shortened or the specified data block (DATDB) must be extended. Then a RESET command must be started.
H1 16	The message frame control parameters of the command and acknowledgment blocks do not correspond. It is purely a software or synchronization error which cannot occur during normal operation.
H1 17	See error **H1 16**

Table B-7 Evaluation of ANZ0 and ANZ1 error displays

Error code (W#16#...)	Description
H1 18	While the command was being executed (ready bit not yet set), the data start address pointer (calculated from DATDB and DATDW) was changed. This means that the absolute addresses are no longer correct. A RESET command must be started so that the absolute addresses can be calculated again.
H1 19	The absolute address accessed during a read or write command (from/to the data block) is outside the data block. This means that either the data block must be lengthened or the user-data start address pointer (DATDB and DATDW) must be corrected (to create more space in the data block). Then a RESET command must be started.
H1 20	During current operation (cyclic call of FC 46), the PLC's memory was compressed or the absolute location of the blocks (BEDB and/or DATDB) was changed. This means that the absolute addresses are no longer correct. A RESET command must be started.
H1 21	This tells the user that only a RESET command is permissible as the next command. All other commands will be rejected.
H0 27	QUEUE-READ: QUDW pointer is outside the DB specified in QUDB
H0 28	QUEUE-READ: The QUDB in the programmable controller is missing or is too small to read the user data
H1 30	FC 46 has detected a system error. The acknowledgment from the filehandler or PROFIBUS DP master is impermissible. • Overloading of the DP master • No current firmware version The precise error code is indicated in ANZ2 (DBW 10). The error codes are specified in the description of SFC 58/59 in the S7 manual.
Kx xx	QUEUE-WRITE parameterized incorrectly (DATDB / DATDW or DLNG) Option 0000 hex: The file entry with the number xxx or xxx + 1 parameterized in DATDB has an error. The file entries in DATDB are counted starting at 1. Option 0001 hex: The file entry with the number xxx or xxx + 1 parameterized in DATDB contains a file name that already exists on the MDS. The file entries in DATDB are counted starting at 1. **Note:** The file entries are counted in decimal format.

Evaluation of the ANZ2 LED

Table B-8 Evaluation of the ANZ2 LED

Error code (W#16#...)	Description
800A	ASM is not ready (temporary message). → This message is sent to a user who is not using FC 46 and queries the ASM acyclically in very rapid succession.
8x7F	Internal error in parameter x. Cannot be corrected by the user.
8x22 8x23	Area length error while reading a parameter Area length error while writing a parameter This error code indicates that the parameter x is completely or partially outside the operand range or the length of a bit field for an ANY parameter is not divisible by 8.
8x24 8x25	Area error while reading a parameter Area error while writing a parameter This error code indicates that parameter x is located in an area which is impermissible for the system function.
8x26	The parameter contains number of a time cell which is too large.
8x27	The parameter contains number of a counter cell which is too large.
8x28 8x29	Direction error while reading a parameter Direction error while writing a parameter The reference to parameter x is an operand whose bit address is not 0.
8x30 8x31	The parameter is located in the write-protected global DB. The parameter is located in the write-protected instance DB.
8x32 8x34 8x35	The parameter has a DB number that is too large. The parameter has an FC number that is too large. The parameter has an FB number that is too large.
8x3A 8x3C 8x3E	The parameter has the number of a DB which is not loaded. The parameter has the number of an FC which is not loaded. The parameter has the number of an FB which is not loaded.
8x42 8x43	An access error occurred while the system was trying to read a parameter from the I/O area of the inputs. An access error occurred while the system was trying to write a parameter to the I/O area of the outputs.
8x44 8x45	Error during nth (n > 1) read access after an error occurred Error during nth (n > 1) write access after an error occurred
8090	Specified logical base address invalid: there is no assignment in the SDB1/SDB2x, or it is not a base address.
8092	A type other than BYTE was specified in an ANY reference.
8093	The area identifier obtained when the logical address was configured (SDB1, SDB2x) is not permitted for these SFCs. Permissible are: • 0 = S7-400 • 1 = S7-300 • 2, 7 = DP modules

Table B-8 Evaluation of the ANZ2 LED

Error code (W#16#...)	Description
80A0	Negative acknowledgement while reading the module; FC picks up acknowledgment although no acknowledgment is ready to be picked up A user not working with FC 46 would like to pick up DS 101 (or DS 102 to DS 104) but there is no acknowledgment available. → Execute init_run for a resynchronization between the ASM and application
80A1	Negative acknowledgement while writing to the module; FC sends command although the ASM cannot receive a command
80A2	DP protocol error for layer 2, possible hardware defect.
80A3	DP protocol error with direct-data-link-mapper or user interface/user, possible hardware error.
80B0	• SFC not possible for this type of module. • Module does not know the data record. • Data record number ≥ 241 is not permissible • Data records 0 and 1 are not permissible with SFC 58 "WR_REC".
80B1	The length specified in the RECORD parameter is wrong.
80B2	The configured slot is not occupied.
80B3	The actual module type is not the required module type in SDB 1
80C0	• RDREC: The module has the data record but no read data have arrived yet. • WRREC: The ASM is not ready to receive new data → Wait for the cyclic counter to count up
80C1	The data of the preceding write job on the module for the same data record have not yet been processed by the module.
80C2	The module is processing the maximum possible number of jobs for one CPU.
80C3	Required resources (memory, etc.) are busy at the moment. This error is not reported by FC 46. In the event of this error, FC 46 waits until the resources are made available again by the system.
80C4	Communication error • Parity error • SW ready not set • Error in block length management • Checksum error on CPU side • Checksum error on module side
80C5	Distributed I/O not available.

Other causes or error

Table B-9 Other causes of error

Error	Cause
The program does not work after a warm or cold restart	• The organization blocks for warm and cold restarts have not been set in accordance with the FC description • There is no PROFIBUS connection; the bus is not in RUN mode
After the MOBY blocks are loaded, the PLC goes into STOP mode	BEDB and/or data block (DATDB) are not in the PLC or are too short • Check the FC parameterization, particularly the ADR parameter • Check the PROFIBUS DP master parameterization
After a command is started or executed, the PLC goes into STOP mode	• DATDB does not exist, has been deleted, or is too small • Reading/writing from/to the ASM is not possible • A restart was not carried out after loading of BEDB and/or data block • A restart was not carried out after the FC parameters were changed

B.3 Error messages and causes in MOBY U with ASM and FC 56 (filehandler)

B.3.1 General Errors

Programmable controller goes into STOP mode

- OB 86 not programmed and a slave has failed.
- OB122 not programmed and a slave has failed.

The error only occurs when FC 56 is called.

- The pointers Params_DB, command_DB, and DAT_DB are not present or indicate an unavailable address area.

B.3.2 Error classes

There will always be an error status in FC 56 if the "error" variable is set for a channel. If this is the case, the exact cause of the error can be established in the "error_code" variable.

The "error_code" variable is a double word and consists of 4 ASCII characters. The first character is an alphanumeric character and identifies the error class.

Table B-10 Error classes of the FC 56

Error class	Meaning
Axxx	Protocol errors
Bxxx	SLG errors
Cxxx	MDS errors
Dxxx	Job-related errors
Exxx	Directory-related errors
Fxxx	File-related errors
Hxxx	Error messages of the FC 56. One special class of FC 56 errors comprises the type H8xx messages. These errors are reported by the controller's communication modules.
Kxxx	Error in the parameterization of QUEUE-READ and QUEUE-WRITE

B.3.3 Filehandler error messages

Table B-11 Error messages via the “error_code” variable

Error code (B#16#..)	Description
A0 03	Impermissible recipient ID • System error; cannot occur with FC 56
A0 06	The command that has been started is not permissible (not defined). Correct the command parameter in the UDT 50 call.
A0 11	The message frame control parameters (DBN or command) are not in the correct sequence. Two or more message frames are written to the same ASM. • Check the parameterization of the ASM_address and ASM_channel parameters in the MOBY DB-FH • Do not execute the start of the command by means of the variable control function
A0 16	The filehandler is currently processing another command. It is imperative that a RESET command be executed.
A0 17	The data block of the SLG is too long and cannot be transferred via PROFIBUS. • The block length parameter is too big for the RESET command (FC error or user error) • Program execution error in the SLG • Restart the ASM and the command
A0 18	Communication error; MOBY driver is active while a new command is sent • Check the command sequences in the application • Restart the ASM
B0 01	Error in the connection to the SLG: • Cable between ASM and SLG is incorrectly wired or there is a cable break. • 24 V power is not connected or switched off. • Circuit breaker on the ASM has tripped • Hardware defective This error is not shown at the start of system commands (RESET, NEXT, ASM/SLG-STATUS).
B0 02	MDS_IO_control 1: • A command was started but there is no MDS in the transmission window of the SLG. • The dialog battery is discharged on the MDS 507 (the LR_bat bit is not mandatorily set; check the battery voltage) MDS_IO_control 0: • The old/current MDS has left the transmission window and the next/new one has entered the transmission window. A command has been started (not NEXT). This command applies to the new MDS, but the old/current MDS has not yet been terminated with NEXT. • A new MDS enters the transmission window of the SLG and leaves it again without a command being executed with this MDS (MDS slips through).
B0 08	The antenna is not switched on, or SET-ANT = ON with the antenna already on • User error; note the command sequence
B0 09	Buffer overflow in the MOBY driver of the ASM/SLG; system-internal error • Run init_run of the ASM

Table B-11 Error messages via the “error_code” variable

Error code (B#16#..)	Description
B0 10	Driver error; communication between the filehandler and MDS driver is faulty (QB byte) • Run init_run of the ASM
B0 11	Communication error between the filehandler and MDS driver; the MDS driver reports a canceled RESET although the filehandler is not processing a RESET • Run init_run of the ASM
B0 12	Unmotivated power-up message of the MDS driver in the ASM • Run init_run of the ASM
C0 02	The MDS reports a memory error. The MDS has never been written or its battery failed and it lost its memory (not in the case of the MDS EEPROM). • Change the MDS or battery (if battery_low is set) • Test the MDS by attempting to initialize it with the STG • Format MDS with FORMAT.
C0 06	During certain important processes (e.g. writing the system area of MDS, formatting the MDS), the MDS must not leave the SLG’s transmission window, since otherwise the command would be terminated with this error. • Start command again. • The MDS is positioned on the boundary of the SLG’s transmission window.
C0 07	• The FORMAT or TRACE commands were sent with the wrong parameters. The physically addressed address does not exist on the MDS (MDS memory is smaller than specified by the command). • During READ/WRITE/UPDATE: pointer in FAT is defective; a block is pointed to which does not exist on the MDS.
C0 08	Field interference on the SLG. The SLG is receiving interference from its surroundings, e. g., • External interference field • The distance between two SLGs is too short and does not comply with the configuration guidelines. • The connection cable to the SLG is defective, too long or does not meet specifications. pr on the MDS 507 the dialog battery is discharged • Check LR_bat bit • Check the battery voltage
C0 09	Too many transmission errors have occurred. The MDS was not able to receive the command or the write data from the ASM correctly even after several attempts. • The MDS is positioned directly in the boundary area of the transmission window. • Data transmission to the MDS is being affected by external interference.
C0 10	• CRC sending error. The monitor receiving circuit detected an error while sending. Cause of the error same as for **C0 08**. • The MDS is reporting CRC errors very often. (MDS is located on the boundary or MDS/SLG defective.)
C0 11	Same as **C0 08.**
C0 12	The MDS is unable to execute the FORMAT command. The MDS is defective.

Table B-11 Error messages via the "error_code" variable

Error code (B#16#..)	Description
C0 13	When being formatted, the MDS must be located in the transmission window of the SLG. Otherwise, a timeout error occurs. This means: • The MDS is positioned directly in the boundary area of the transmission window. • The MDS is using too much current (defective). • The MDS EEPROM type is incorrectly parameterized in FORMAT or on the MDS 507 the dialog battery is discharged • Check LR_bat bit • Check the battery voltage
C0 14	The memory of the MDS cannot be written. • The MDS has a smaller memory than that specified in the FORMAT command. The MDS type must therefore be correctly parameterized. • The memory of the MDS is defective. • The MDS EEPROM has been written too often and has reached the end of its life.
C0 15	Address error. The address area of the MDS has been exceeded. • MDS is the wrong type.
C0 16	An ECC error has occurred. The data cannot be read from the MDS. • MDS data have been lost (MDS defective). • The MDS was not formatted with the ECC driver. Format the MDS again. • The MDS EEPROM has reached the end of its life. The data have been lost. Replace MDS. • The MDS moved out of the field while being written. The MDS is positioned incorrectly. (**Note:** the system area of the MDS is automatically written to each SLG station.)
C0 17	The filehandler is not working correctly. • Check the command structure or command sequence. • The hardware of the ASM (firmware) has a defect
C0 18	Operating system error (AMOS mailbox) • Run init_run of the ASM
C0 19	The number of MDSs in the field is greater than the parameterized number of MDSs for "multi-tag". • Remove the excess number of MDSs in the field • The configuration of distance_limiting is set incorrectly • Check the environment of the SLG to see if there is by chance a MDS in the field • Generally only one MDS can be processed in the case of MOBY I
C0 20	Communication error between the filehandler and MDS driver; the MOBY driver does not know the command from the filehandler. • Run init_run of the ASM
C0 21	Operating system error; watchdog error in the ASM/SLG • Run init_run of the ASM
D0 01	The filehandler will only accept a RESET command. • Filehandler was not yet initialized with an init_run • This state can only be resolved with an init_run

Table B-11 Error messages via the "error_code" variable

Error code (B#16#..)	Description
D0 05	The FORMAT, CREATE, WRITE, ATTRIB, UPDATE, COVER, QUEUE-READ or QUEUE-WRITE command has been issued with impermissible parameters. • FORMAT with impermissible MDS name or MDS type • CREATE with impermissible filename • WRITE/UPDATE with length of 0 (DLNG=0) • impermissible attribute • QUEUE-WRITE or QUEUE-READ with impermissible option or number of files • COVER with impermissible user (Only 0 or 1 are legal.)
D0 07	• The system data transferred with the LOAD command are wrong. – DLNG is parameterized incorrectly for LOAD. – Wrong data block specified or incorrectly parameterized – MOVE command not executed correctly; on the MDS, DIR + FAT do not match the checksum • The MOVE command cannot be executed. The checksum does not match DIR + FAT. The data memory has evidently exited the transmission window while system operation (writing DIR + FAT, for example) were being executed. • MOBY U: the LOAD and MOVE commands are not supported
D0 09	An init_run has been started by FC 56 with impermissible parameters. The cause of the error is in the user program. • Check the INPUT parameters of the UDT 10 call (address 8 to 17 in UDT 10)
D0 14	WRITE command: There is no longer sufficient storage space on the MDS. The data are not written to the MDS in their entirety. CREATE command: When a file is created, a data block can no longer be reserved for this file. No more memory blocks are free.
D0 15	The MDS could not be identified by the filehandler. Format the MDS again.
D0 18	The logically addressed address is not in the file. The FAT has an error. The MDS must be reformatted.
D0 22	The data memory has been locked by means of the COVER command. A write-access command (e. g., UPDATE, CREATE) would destroy the data memory layout and is thus rejected.
D0 23	COVER command: The MDS name specified in the command does not agree with the actual MDS name.
D0 24	The wrong UID is entered in the command or the MDS with the UID entered in the command is not (or no longer) in the field • Application error; check UID in command
E0 01	• The type of the MDS before the SLG does not correspond to the ECC mode that is set. The MDS must be reformatted for the desired ECC mode. • The MDS is not a filehandler MDS; format MDS
E0 02	There are no more directory entries free. The file specified in the CREATE command can no longer be created.
E0 03	The file specified in the CREATE command already exists in the directory (no duplicated names permitted).

Table B-11 Error messages via the “error_code” variable

Error code (B#16#..)	Description
E0 05	• A secondary FAT error was discovered in the READ or WRITE command. The file application table (FAT) is defective. The MDS must be reformatted. • Wrong address specified in TRACE command
F0 01	• The file addressed by a command (e.g. WRITE) does not exist in the directory. The file must be created by means of CREATE. • Check file name (possibly not in ASCII format). • On or more files are to be read with QUEUE-READ but they do not exist on the MDS. Valid data are not transferred to the user.
F0 05	Write access (WRITE, UPDATE, or DELETE) to a file which must not be changed (and is protected with an appropriate attribute).
F0 07	QUEUE-READ: specified file length shorter than file length
F0 08	QUEUE-READ: the skip calculated by the filehandler is larger than 0FFF hex (4095 dec)
H1 01	The FC 56 call parameters Params_DB/Params_ADDR are incorrect or the Params_DB parameter is not present in the PLC.
H1 02	The length of the parameterized Params_DB/Params_ADDR is shorter than 300 bytes. • The pointer Params_DB/Params_ADDR in the call of FC 56 is incorrect • The Params_DB was not declared with the UDT 10 An init_run must be executed after the declaration of a new Params_DB.
H0 04	This command identifier (command in UDT 50) and thus also this command is not known to FC 56. Check the command identifier.
H0 05	The access authorization of the corresponding SLG does not allow this command. For instance, if the ”R” (read-only) access authorization has been granted to the SLG, a WRITE command cannot be issued on this SLG. Check the INPUT parameters priority_RW and priority_RWD.
H1 07	The data block specified in Command_DB_number (UDT 10) does not exist. • Load the DB specified with DAT_DB_number into the project • Correct the pointer DAT_DB_number/DAT_DB_address An init_run must be executed after the error is eliminated.
H1 10	The ASM executed a hardware reset. The cause here may be a drop in voltage on the device rack or a plug-in contact fault, for instance. The user must start an init_run to reparameterize the SLG.
H1 11	It is purely a software or synchronization error which cannot occur during normal operation. • The acknowledgement that has been read in has absolutely no reference to the ongoing command. • The command identifier of the command and the acknowledgment do not match.
H1 16	It is purely a software or synchronization error which cannot occur during normal operation. • The message frame control parameters of the command and acknowledgment blocks do not correspond.
H1 17	See error **H1 16**

Table B-11 Error messages via the "error_code" variable

Error code (B#16#..)	Description
H1 19	The absolute address accessed during a read or write command (from/to the data block) is outside the data block. • Extend the data block • The data block for the user data is not loaded in the PLC • Correct the user data start address pointer (DAT_DB_number/DAT_DB_address) accordingly (e.g. enlarge data block) Then start an init_run.
H1 21	This tells the user that only init_run is permissible as the next command. All other commands will be rejected.
H0 28	QUEUE-READ: The QUEUE_DB in the programmable controller is missing or is too small to read the user data. • Check the QUEUE_DB_number/QUEUE_DB_address parameters
H1 31	The parameterized channel number (ASM_channel in UDT 10) is outside the permissible range of 1 to 8.
H1 32	init_run cannot be executed; cyclic process image for ASM is faulty; FC 56 reports timeout of the process image to the ASM If necessary the timeout time can be adapted in DBB 58 of the UDT 10. The default value is 50 (dec) = 2 seconds. Higher values (max. 255) extend the timeout time. • ASM_address in UDT 10 is parameterized incorrectly. ASM_address may be on the wrong module. • ASM_channel is parameterized with ≥ 16 or ≤ 0 • ASM hardware/firmware is defective. • The same physical ASM channel is used in two (or more) UDT 10 structures. Check the ASM_address and ASM_channel in all UDT 10 structures.
H1 33	An init_run was not correctly terminated. The process image is not consistent. • Execute init_run again • Switch ASM off and on again • The RUN-STOP switch was operated rapidly several times on the CPU (particularly in the case of slow PROFIBUS transmission rates) • The same physical ASM channel is used in two (or more) UDT 10 structures. Check the ASM_address and ASM_channel in all UDT 10 structures.
H1 34	The user started another init_run without waiting for ready while the first init_run command was still being processed. • Do not set init_run cyclically • The same physical ASM channel is used in two (or more) UDT 10 structures. Check the ASM_address and ASM_channel in all UDT 10 structures.
H1 35	The ASM has failed. • Power failure on MOBY ASM • PROFIBUS connector pulled or PROFIBUS cable broken • ASM_address or ASM_channel not present The error is indicated when the ASM_Failure bit was set in OB 122. OB 122 is called when the FC 56 can no longer access the cyclic word for the MOBY ASM.

Table B-11 Error messages via the “error_code” variable

Error code (B#16#..)	Description
H1 36	• The pointer to the command (Command_DB_number/Command_DB_address) does not exist on the SIMATIC • The definition of Command_DB on the SIMATIC is too small. Use the UDT 50 for the definition.
H1 37	The parameterized value of MOBY_mode (UDT 10) is outside the permissible range of 0 to F.
H1 38	The parameterized value of MDS_IO_control is outside the permissible range of 0 to 7.
H8 0A	ASM is not ready (temporary message). • This message is sent to a user who is not using FC 56 and queries the ASM acyclically in very rapid succession.
H8 22 H8 23	Area length error while reading a parameter Area length error while writing a parameter This error code indicates that the parameter x is completely or partially outside the operand range or the length of a bit field for an ANY parameter is not divisible by 8.
H8 24 H8 25	Area error while reading a parameter Area error while writing a parameter This error code indicates that the parameter x is located in an area that is impermissible for the system function.
H8 26	The parameter contains number of a time cell which is too large.
H8 27	The parameter contains number of a counter cell which is too large.
H8 28 H8 29	Direction error while reading a parameter Direction error while writing a parameter The reference to parameter x is an operand whose bit address is not 0.
H8 30 H8 31	The parameter is located in the write-protected global DB. The parameter is located in the write-protected instance DB.
H8 32 H8 34 H8 35	The parameter has a DB number that is too large. The parameter has an FC number that is too large. The parameter has an FB number that is too large.
H8 3A H8 3C H8 3E	The parameter has the number of a DB which is not loaded. The parameter has the number of an FC which is not loaded. The parameter has the number of an FB which is not loaded.
H8 42 H8 43	An access error occurred while the system was trying to read a parameter from the I/O area of the inputs. An access error occurred while the system was trying to write a parameter to the I/O area of the outputs.
H8 44 H8 45	Error during nth (n > 1) read access after an error occurred Error during nth (n > 1) write access after an error occurred
H8 7F	Internal error in parameter x. Cannot be corrected by the user.
H8 90	Specified logical base address invalid: there is no assignment in the SDB1/SDB2x, or it is not a base address.
H8 92	A type other than BYTE was specified in an ANY reference.

Table B-11 Error messages via the “error_code” variable

Error code (B#16#..)	Description
H8 93	The area identifier obtained when the logical address was configured (SDB 1, SDB 2x) is not permitted for these SFCs. Permissible are: • 0 = S7-400 • 1 = S7-300 • 2, 7 = DP modules
H8 A0	Negative acknowledgement while reading the module; FC picks up acknowledgment although no acknowledgment is ready to be picked up user not working with FC 56 would like to pick up DS 101 (or DS 102 to DS 104) but there is no acknowledgment available. • Execute init_run for a resynchronization between the ASM and application
H8 A1	Negative acknowledgement while writing to the module; FC sends command although the ASM cannot receive a command
H8 A2	DP protocol error for layer 2, possible hardware defect.
H8 A3	DP protocol error with direct-data-link-mapper or user interface/user, possible hardware error.
H8 B0	• SFC not possible for this type of module. • Module does not know the data record. • Data record number $\geq$ 241 is not permissible • Data records 0 and 1 are not permitted with SFC5H8 “WR_REC”.
H8 B1	The length specified in the RECORD parameter is wrong.
H8 B2	The configured slot is not occupied.
H8 B3	The actual module type is not the required module type in SDB 1
H8 C0	• RDREC: The module has the data record but no read data have arrived yet. • WRREC: The ASM is not ready to receive new data → Wait for the cyclic counter to count up
H8 C1	The data of the preceding write job on the module for the same data record have not yet been processed by the module.
H8 C2	The module is processing the maximum possible number of jobs for one CPU.
H8 C3	Required resources (memory, etc.) are busy at the moment. This error is not reported by FC 56. In the event of this error, FC 56 waits until the resources are made available again by the system.
H8 C4	Communication error • Parity error • SW ready not set • Error in block length management • Checksum error on CPU side • Checksum error on module side

Table B-11 Error messages via the “error_code” variable

Error code (B#16#..)	Description
H8 C5	Distributed I/O not available.
Kx xx	QUEUE-WRITE incorrectly parameterized (DAT_DB_number/DAT_DB_address or length) Option 0000 hex: The file entry with the number xxx or xxx + 1 parameterized in DAT_DB_number is incorrect. The file entries in DAT_DB_number are counted starting at 1. Option 0001 hex: The file entry with the number xxx or xxx + 1 parameterized in DAT_DB_number contains a file name that already exists on the MDS. The file entries in DAT_DB_number are counted starting at 1. **Note:** The file entries are counted in decimal format.

B.3.4 Error indication with the ERR-LED

Various error conditions are not only indicated by an error_code on the FC 56 but also at the same time by the ERR-LED on the interface module.
The ERR-LED displays error messages with a flashing pattern as shown in Table B-12, followed by an interval. This sequence is continuously repeated.

The ERR-LED is reset (switching off the flashing pattern) by

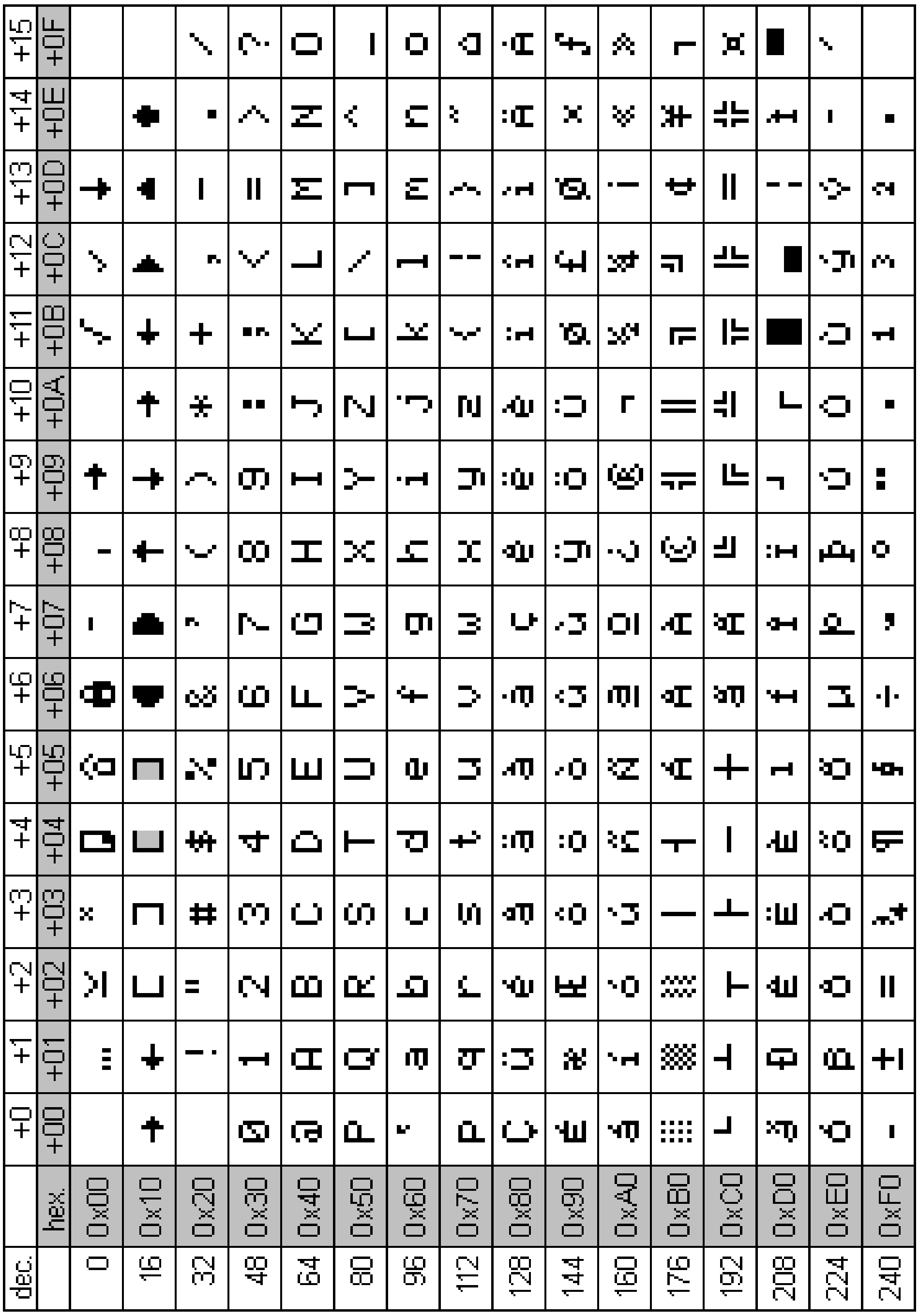
- switching off the ASM (on all ASMs)
- init_run command (on ASM 473 and ASM 475)

Table B-12 Errors indicated by the ERR-LED

ERR LED flashes	Filehandler error message	Meaning
1x	**D0 01**	Only RESET command permissible (ASM power-up)
2x	**C0 06**	Presence error
3x	**B0 01**	Fault in connection to SLG
4x	**C0 02**	Fault in RAM of MDS
5x	**C0 07**	Parameterization error with TRACE or FORMAT / command cannot be interpreted
6x	**C0 08**	Too many sync attempts
7x	**C0 09**	Too many send errors
8x	**C0 10**	CRC send error
9x	**C0 11**	FORMAT, CRC error on receipt
10x	**C0 12**	FORMAT, MDS cannot be initialized
11x	**C0 13**	FORMAT, timeout
12x	**C0 14**	FORMAT, not initialized
13x	**C0 15**	CMD address error
14x	**C0 16**	ECC error
15x	**C0 17**	General driver error
20x	– – – –	Internal ASM overflow

ASCII Table

C



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Numbers

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