Siemens SIMATIC S7 Profibus DP

This manual presents installation and handling of the driver SIMATIC S7 Profibus DP to the terminals in the Cimrex series.

The functionality in the Cimrex terminals and in CIMREX PROG. are described in the Cimrex manual.

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Content

1 Introduction

This manual describes how the SIMATIC S7 PLC system is connected to the terminals in the Cimrex series via the fieldbus Profibus DP. Addressing of an item in the PLC system is done in the normal Siemens way. For information about the PLC system we refer to the manual for the current system.

The terminals support the systems in the SIMATIC S7 300 and 400 series.

The expansion card IFC PBDP must be installed in the terminal.

See the IFC PBDP manual.

2   Install and update driver

When installing CIMREX PROG the drivers available at the time of release are installed too. A new driver can be added into CIMREX PROG either with CIMREX PROG using an Internet connection or from diskette. A driver can be updated to a newer version in the same ways.

2.1   Installation of driver using Internet

To update available drivers to the latest version or to install new drivers you can use the function Update terminal drivers, from Internet in the File menu in CIMREX PROG. All projects must be closed before this function is used and the computer must be able to make an Internet connection. You don't need a browser. When the connection is established a list is shown with all drivers that can be downloaded from Internet to the computer. The list shows the version number of available drivers and the version number of installed drivers. Mark the driver/drivers you want to install in the CIMREX PROG. The function Mark Newer will mark all drivers that are available in a newer version than the one installed and the drivers not installed. Then you select Download. Each driver is approximately 500 kb and it is ready to use when the download is ready.

2.2   Installation of driver from disk

To update available drivers to the latest version or to install new drivers you can use the function Update terminal drivers, from Disk in the File menu in CIMREX PROG. All projects must be closed before this function is used. Select the folder with the new driver and choose to open the mpd-file. A list is shown with all drivers that can be installed showing the version number of available drivers and the version number of installed drivers. Mark the driver/drivers you want to install in the CIMREX PROG. The function Mark Newer will mark all drivers that are available in a newer version than the one installed and the drivers not installed. Then you select Install.

How to select the SIMATIC S7 ProfibusDP driver in the project and how to transfer it to the terminal are described in *chapter 3*.

3   Connecting the terminal to the PLC system

3.1   Settings in the CIMREX PROG

For communication with SIMATIC S7 PLC system via the fieldbus Profibus DP the following settings must be made in the programming tool CIMREX PROG.

Driver selection

Choosing **New** in the **File** menu creates a new project and the dialog **Project Settings** is shown. In an existing project, the dialog is shown by selecting **Project Settings** in the **File** menu.
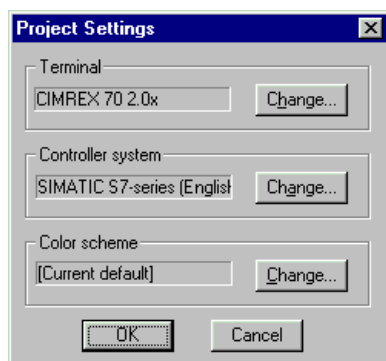
Press **Change...** under Controller system to get the choice list of available drivers. Choose Brand name, Protocol and Model and then press OK. Press OK again to confirm the project settings.
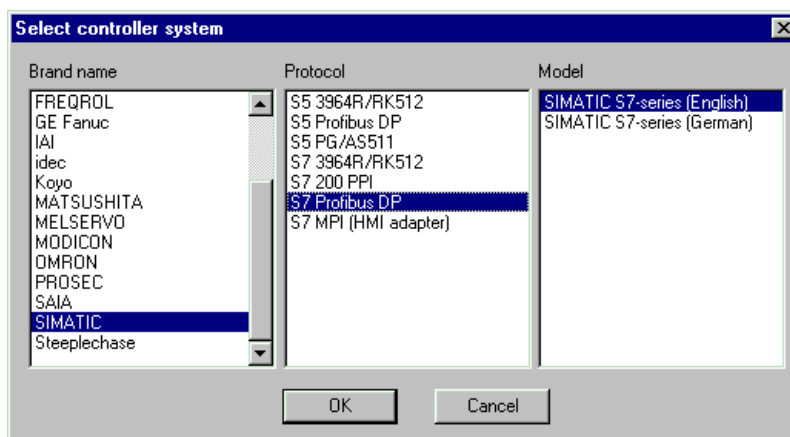
Communication setup

The settings for the communication between the terminal and the PLC system are done under **Peripherals** in the **Setup** menu. Mark either slot 1 or slot 2 depending on which slot the expansion card IFC PBDP is installed in, and press **Edit.** Select IFC PBDP and press **OK.**

Mark IFC PBDP in **Peripherals** and press **Edit** to state the settings for the HMI profile. State the size of the input and output area in bytes. Default settings is 32 bytes.
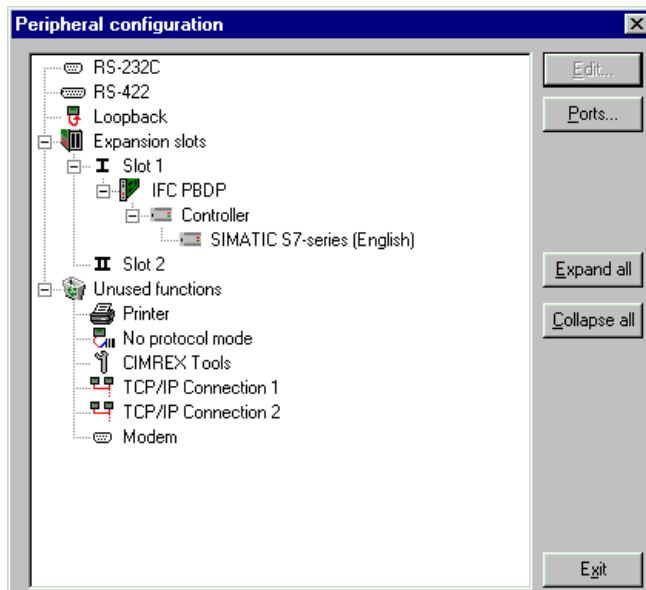
Driver configuration

Mark selected driver (SIMATIC S7-series) and press **Edit** to select Data format.
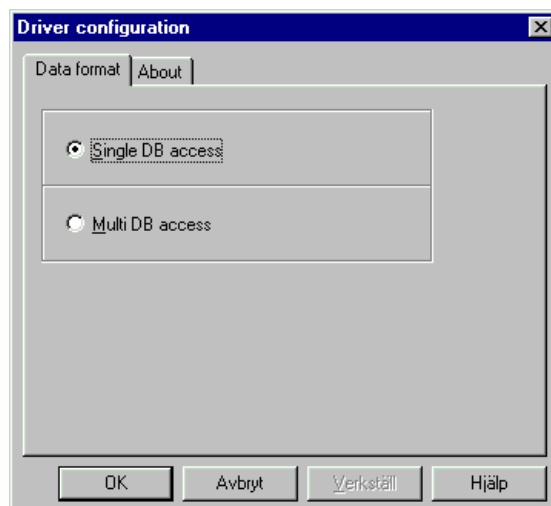
Note!
If Multi DB is supported W#16#FFFF must be entered at db_address in the HMI profile.
If Single DB is supported and if you want to use another DB number than the predefined where DBnr=51 (hex 33) must a new DBno be entered at db_address. See also separate description of the HMI profile.

Transfer the driver to the terminal

The selected driver is down-loaded into the terminal when the project is transferred to the terminal. Choose Project in the Transfer menu.

There are three alternatives when the driver is downloaded into the terminal.

Function	Description
Never	The driver is not down-loaded and the existing driver in the terminal is used.
Always	The driver is down-loaded every time the project is transferred.
Automatic	The driver is down-loaded if the driver in the terminal is not the same as the selected driver in the project. If it is the same the driver is not down-loaded.

3.2 Connecting the terminal to the Profibus DP network

With the expansion card IFC PBDP, the terminal can then be connected to a Profibus DP network as a slave. The PLC system in the network most be loaded with a program handling the communication between the terminal and the PLC system.

3.3 Communication settings for the IFC PBDP card
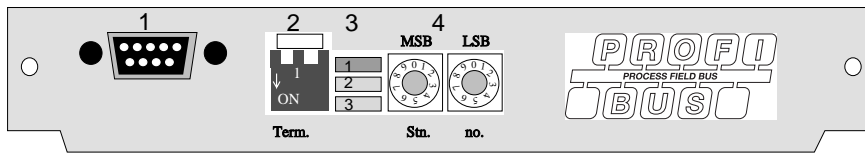
1. Connector for the communication cable.

2. Bus termination. Set to ON on the first and last units in the network. The first unit in the network often is the master unit in the PLC system.

3. 1: Red, **ERR**, Configuration or communication error. The LED is red until the unit is configured, Indicates time out.
   2: Green, **PWR**, Power supply 5 VDC OK.
   3: Green, **DIA**, Diagnostic error, not used.

4. State the station number.

3.4 Cable to PROFIBUS-DP
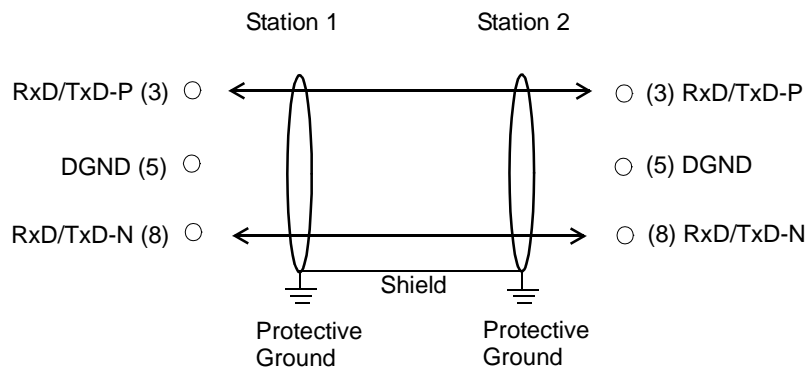
3.5 Technical data

I/O area size	32-200 byte
Baudrate	9600 bit/s - 12 MBit/s
Identity code	1002
Max. number of nodes without repeater	32
Max. number of nodes with repeater	96
Max. cable length (with repeater)	3000m, 9.6 kb
Max. cable length (without repeater)	200m, 12 Mb

The cable Unitronic-Bus L2/F.I.P is tested and has the following performance:

Capacitance	30 nF/km
Impedance	150 Ohm (3-20 MHz)
Resistance	115 Ohm/km

3.6 Description of the PLC program section

HMI-profile, with consistent data

Used for the CPU types that support the data block SFC14 and SFC15, see information for respective type from Siemens.

The PLC program section consists of three function blocks plus one block (OB1) that calls the function block 110.

Program block

The PLC program section, available on the type diskette, contains three function blocks, two system blocks and one main program.

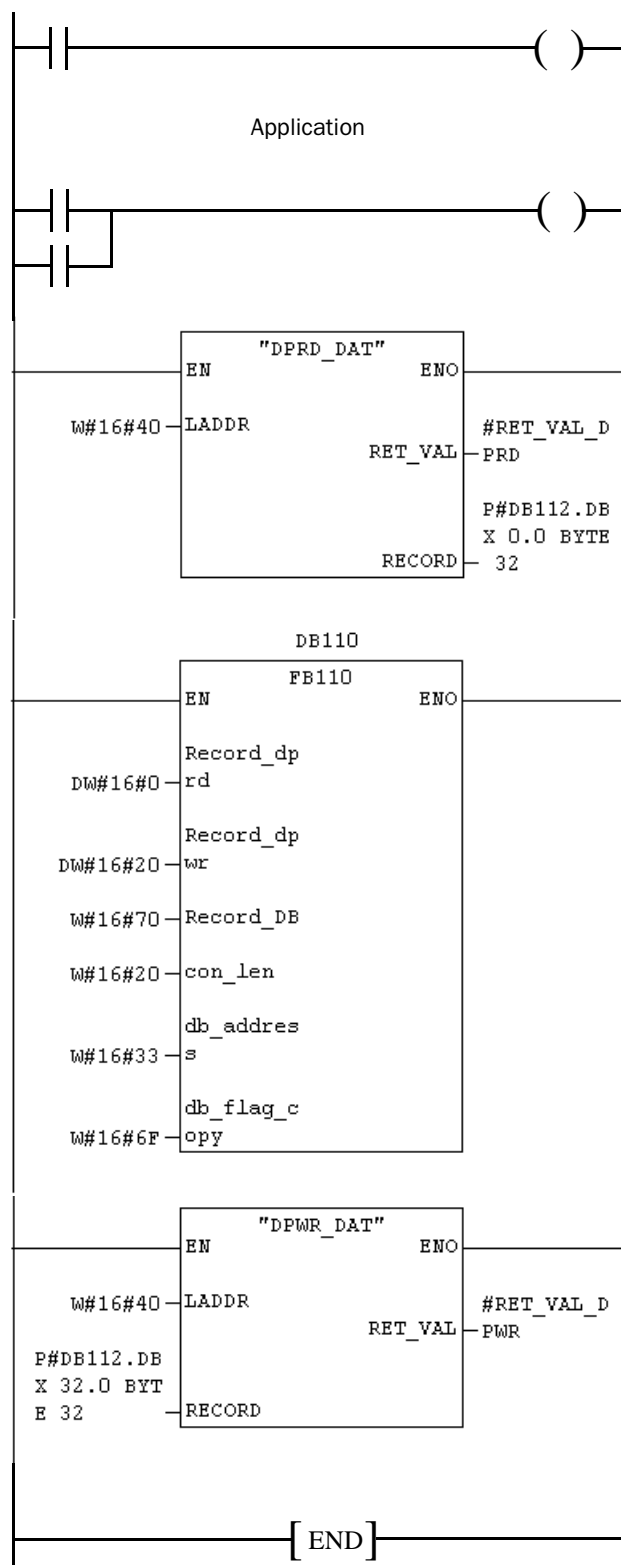| Function block	Description
OB1	Main program. Calls the function block 110 with DB110.
FB 110	This block is called by the OB1 and handles the HMI profile.
FB 111	This block reads one index.
FB 112	This block writes one index.
DB 51	Data block used for analog signals.
DB 110	Data block, instance data block for FB 110 (Siemens standard)
DB 111	Data block used for back up copies of memory words and flags. If DB 111 already is in use in current application a new DB must contain a minimum of 56 words.
DB 112	Data block where in/out area is stored (must be at least 64 words)
SFC 14	Data block "DPRD_DAT" system block for reading/writing consistent data*.
SFC 15	Data block "DPWR_DAT" system block for reading/writing consistent data*.

* SFC 14 and SFC 15 are not valid for all PLC types, see Siemens information for more detailed information.

Consistent data = whole messages are read and write in one scan.

Note!
The following **data types** are **used in the HMI profile**: **MW200-MW255**, **T99**, which contains words, bytes and bits.

The figure below shows how the "HMI profile" is placed in the PLC program.

```
          ┤├─────────────────────────────( )─

                        Application

          ┤├─────────────────────────────( )─
          ┤├─┐
          ┤├─┘

                    "DPRD_DAT"
                 ┌──────────────────┐
                 │EN            ENO │
                 │                  │
    W#16#40 ─────│LADDR             │──  #RET_VAL_D
                 │         RET_VAL ─┤── PRD
                 │                  │
                 │                  │    P#DB112.DB
                 │                  │    X 0.0 BYTE
                 │          RECORD ─┤──   32
                 └──────────────────┘

                       DB110
                       FB110
                 ┌──────────────────┐
                 │EN            ENO │
                 │                  │
                 │Record_dp         │
    DW#16#0 ─────│rd                │
                 │                  │
                 │Record_dp         │
    DW#16#20 ────│wr                │
                 │                  │
    W#16#70 ─────│Record_DB         │
                 │                  │
    W#16#20 ─────│con_len           │
                 │                  │
                 │db_addres         │
    W#16#33 ─────│s                 │
                 │                  │
                 │db_flag_c         │
    W#16#6F ─────│opy               │
                 └──────────────────┘

                    "DPWR_DAT"
                 ┌──────────────────┐
                 │EN            ENO │
                 │                  │
    W#16#40 ─────│LADDR             │──  #RET_VAL_D
                 │         RET_VAL ─┤── PWR
    P#DB112.DB   │                  │
    X 32.0 BYT   │                  │
    E 32         │RECORD            │
                 └──────────────────┘

                 ─[ END ]─
```

The main program, OB1

OB1 is the main program where the parameters are defined for calling the other function blocks. The following parameters are defined for the FB110, SFC14 and SFC15:
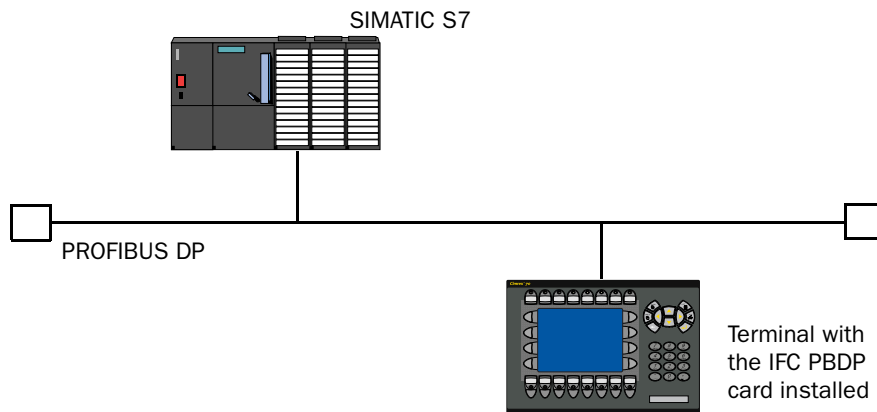
	Parameter	Description
SFC14 "DPRD_DAT"	LADDR	Input address (hex) where data from module can be read.
	RET_VAL	Error code.
	RECORD	The place to store data that is read.
FB110	RECORD_DP_RD	The first input byte from where input data can be read. Default is 0 hex (0 dec).
	RECORD_DP_WD	The first output byte from where output data can be read. Default is 20 hex (32 dec).
	RECORD_DB	Data block number where input/output data is stored. Default 70 hex (112 dec).
	CON_LEN	State the length of the request container and response container. Must be the same as the setting in the terminal. Default is 20 hex (32 dec).
	DB_ADDRESS	If Single DB: State the number of the data block used. If Multi DB: State W#16#FFFF to the DB address. Default 33 hex (51dec).
	DB_FLAG_COPY	State the data block used for backup copy of flag words. Default 6F hex (111 dec).
SFC15 "DPWR_DAT"	LADDR	Output address (hex) where data from module can be written.
	RET_VAL	Error code.
	RECORD	The place to store data that should be written to the module.

For more information about the parameters, refer to the manual for SIMATIC S7.

Examples of configuration

In those examples we use Siemens PLC system S7 and the PLC projects (HMI-conc) on the type diskette. The example describes in which order you make the settings and connections to get the correct communication.

GDS files and HMI profile (PLC project) are available also on the webb.

SIMATIC S7

PROFIBUS DP

Terminal with
the IFC PBDP
card installed

Alternative 1: Current PLC project (HMI profile) for S7-315-2DP CPU
For procedure description we refer to the manual for handling S7-PLC
and STEP7 from Siemens.

1. Install the terminal and IFC-PBDP according to the Installation manual delivered with the terminal.

2. Configure the terminal with the software package CIMREX PROG.

3. Copy the .GSD files from the diskette to the GSD-library in STEP7 (normally STEP7\S7data\Gsd\...).*

4. Update hardware library in STEP7 Hardware.

5. Copy the PLC project from the diskette to the computer, (normally STEP7\S7proj\...).*

6. Start STEP7, open the PLC project.

7. Start Hardware STEP 7.

8. Check the hardware.
   - CPU type, DP Master, E700 DP slave no. (Profibus DP\Additional Field Device\B+B\MAC-Exx0withIFC-P).
   Note! Station number for the IFC PBDP card must be the same as in the Hardware configuration.

9. Check DP slave properties.
   - I/O type:=Input/Output
   - Address: for Input and Output area, *default=64 in the HMI profile.*
   - Length: for Input and Output area, *default=32 in the HMI profile.*
   - Unit: for Input and Output area=Byte.
   - Consistent via:=Total Length.

10. Transfer the Hardware configuration to the S7 system.

11. Transfer the PLC program section to the S7 system.
    Note! If Multi DB is used the DB address must be W#16#FFFFin FB110, single DB is default in the HMI profile.

12. Connect the cable between the S7 system and the IFC PBDP card in the terminal.

13. Put the S7 system and the terminal in run mode.

* GDS files and HMI profile (PLC project) are available also on the webb.

Alternative 2: Complete, current or new PLC project together with HMI profile

1. Install the terminal and IFC-PBDP according to the Installation manual delivered with the terminal.

2. Configure the terminal with the software package CIMREX PROG.

3. Copy the .GSD files from the diskette to the GSD-library in STEP7 (normally STEP7\S7data\Gsd\...).*

4. Update hardware library in STEP7 Hardware.

5. Copy the PLC project from the diskette to the computer, (normally STEP7\S7proj\...).*

6. Start STEP7, open the PLC project.

7. Start Hardware STEP 7.

8. Configure the hardware.
   - Select Rail, CPU type, DP Master, Exx0 DP slave no. (Profibus DP\Additional Field Device\B+B\MAC-Exx0 with IFC-P).
   Note! Station number for the IFC PBDP card must be the same as in the Hardware configuration.

9. Configure DP slave properties.
   - Select Universal Module to the IFC PBDP slave (drag and drop).
   - Select I/O type:=Input/Output
   - State Address: for In- & Output area, *default=64 in the HMI profile.*
   - State Length: for In- & Output area, *default=32 in the HMI profile.*
   - Select Unit: for Input and Output area=Byte.
   - Select Consistent via:=Total Length.

10. Transfer the Hardware configuration to the S7 system.

11. Open the PLC programs (block) for both projects (the new or current and the HMI profile project).
    - Copy the blocks from the HMI profile project (OB1, FB110, FC111, FC112, DB51, DB110, DB111, DB112 SFC14 and SFC15).
    Note! If Multi DB is used the DB address must be W#16#FFFFin FB110, single DB is default in the HMI profile.
    - Check that the call in OB1 is correct defined.

12. Transfer the PLC program section to the S7 system (mark all blocks and select Download).

13. Connect the cable between the S7 system and the IFC PBDP card in the terminal.

14. Put the S7 system and the terminal in run mode.

* GDS files and HMI profile (PLC project) are available also on the webb.

HMI profile without consistent data

Can be used by all CPU types, see information from Siemens.

The PLC program section consists of three function blocks plus one block (OB1) that calls the function block 110.

Program block

The PLC program section, available on the type diskette, contains three function blocks and one main program.

Function block	Description
OB1	Main program. Calls the function block 110 with DB110.
FB 110	This block is called by the OB1 and handles the HMI profile.
FC 111	This block reads one index.
FC 112	This block writes one index.
DB 51	Data block used for analog signals.
DB 110	Data block, instance data block for FB 110 (Siemens standard)
DB 111	Data block used for back up copies of memory words and flags. If DB 111 already is in use in current application a new DB must contain a minimum of 56 words.

The following figure shows how the HMI profile in OB1 is placed in the PLC program.
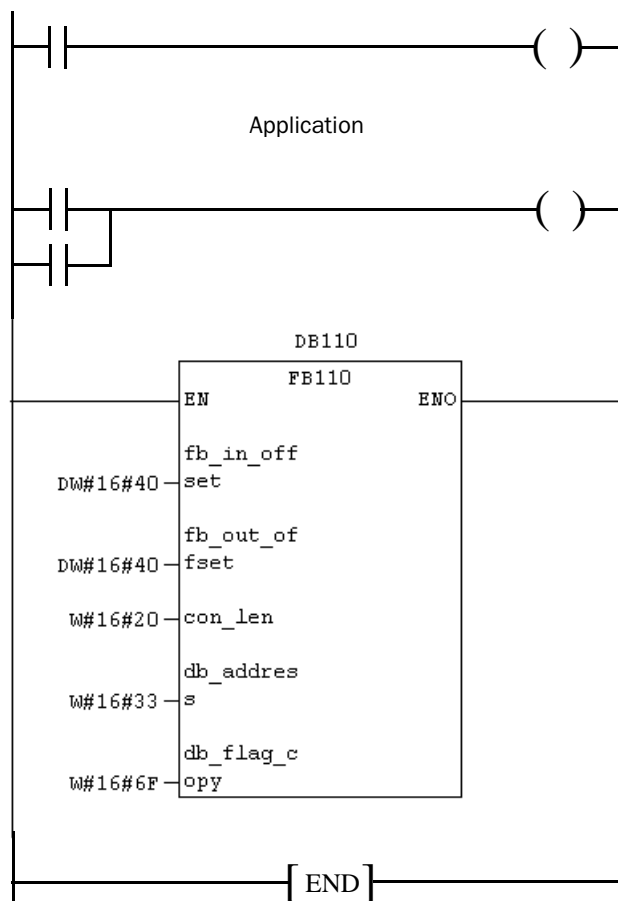
The following data types are used in the HMI profile: MW200-MW255, T99, which contains words, bytes and bits.
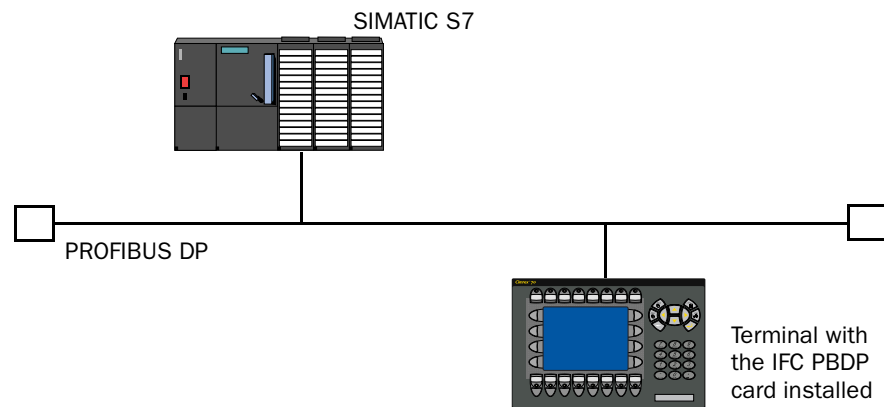
The main program, OB1

OB1 is the main program where the parameters are defined for calling the other function blocks. The following parameters are defined for the function block 110:

Parameter	Description
FB_IN_OFFSET	State the address to the first byte in the response container in the PROFIBUS area. Default is 40 hex (64 dec).
FB_OUT_OFFSET	State the address to the first byte in the request container in the PROFIBUS area. Default is 40 hex (64 dec).
CON_LEN	State the length of the request container and response container. Must be the same as the setting in the terminal. Default is 20 hex (32 dec).
DB_ADDRESS	State the number of the data block used. Default is 33 hex (51 dec).
DB_FLAG_COPY	State data block address used. Default is 6F hex (111 dec).

For more information about the parameters, refer to the manual for SIMATIC S7.

Examples of configurations

In these examples we use Siemens PLC system S7 and the PLC program on the type diskette. The example describes in which order you make the settings and connections to get the correct communication.

SIMATIC S7

PROFIBUS DP

Terminal with the IFC PBDP card installed

Alternative 1: Current PLC project (HMI profile) for S7-315-2DP CPU
For procedure description we refer to the manual for handling S7-PLC and STEP7 from Siemens.

1. Install the terminal and IFC-PBDP according to the Installation manual delivered with the terminal.

2. Configure the terminal with the software package CIMREX PROG.

3. Copy the .GSD files from the diskette to the GSD-library in STEP7 (normally STEP7\S7data\Gsd\...).*

4. Update hardware library in STEP7 Hardware.

5. Copy the PLC project from the diskette to the computer, (normally STEP7\S7proj\...).*

6. Start STEP7, open the PLC project.

7. Start Hardware STEP 7.

8. Check the hardware.
   - CPU type, DP Master, E700 DP slave no. (Profibus DP\Additional Field Device\B+B\MAC-Exx0withIFC-P).
   Note! Station number for the IFC PBDP card must be the same as in the Hardware configuration.

9. Check the DP slave properties.
   - Address: for Input and Output area, *default=64 in the HMI profile*.
   - Length: for Input and Output area, *default=32 in the HMI profile*.

10. Transfer the Hardware configuration to the S7 system.

11. Transfer the PLC program section to the S7 system.
    Note! If Multi DB is used the DB address must be W#16#FFFFin FB110, single DB is default in the HMI profile

12. Connect the cable between the S7 system and the IFC PBDP card in the terminal.

13. Put the S7 system and the terminal in run mode.

* GDS files and HMI profile (PLC project) are available also on the webb.

Alternative 2: Complete current or new PLC project together with HMI profile
For procedure description we refer to the manual for handling S7-PLC and STEP7 from Siemens.

1. Install the terminal and IFC-PBDP according to the Installation manual delivered with the terminal.

2. Configure the terminal with the software package CIMREX PROG.

3. Copy the .GSD files from the diskette to the GSD-library in STEP7 (normally STEP7\S7data\Gsd\...).*

4. Update hardware library in STEP7 Hardware.

5. Copy the PLC project from the diskette to the computer, (normally STEP7\S7proj\...).*

6. Start STEP7, open the PLC project.

7. Start Hardware STEP 7.

8. Configure the hardware.
   - Select Rail, CPU type, DP Master, Exx0 DP slave no. (Profibus DP\Additional Field Device\B+B\MAC-Exx0 with IFC-P).
   Note! Station number for the IFC PBDP card must be the same as in the Hardware configuration.

9. Configure the DP slave properties.
   - Select IN/OUT: 32 bytes (16 words) to the IFC PBDP slave (drag and drop.
   - State Address: for In- & Output area, *default=64 in the HMI profile*.
   - State Length: for In- & Output area, *default=32 in the HMI profile*.

10. Transfer the Hardware configuration to the S7 system.

11. Open the PLC programs (block) for both projects (the new or current and the HMI profile project).
    - Copy the blocks from the HMI profile project (OB1, FB110, FC111, FC112, DB51, DB110 and DB111.
    Note! If Multi DB is used the DB address must be W#16#FFFFin FB110, single DB is default in the HMI profile.

12. Transfer the PLC program section to the S7 system (mark all blocks and select Download).

13. Connect the cable between the S7 system and the IFC PBDP card in the terminal.

14. Put the S7 system and the terminal in run mode.

* GDS files and HMI profile (PLC project) are available also on the webb.

4   Addressing

The terminal can handle the following data types in the PLC system:

Name	Data type English	Data type German
Flag	F	M
Output	Q	A
Input	I	E
Data block	DB	DB

The project memory decides the max length of the DB (data block) in SIMATIC S7. The terminal can access all DB in the PLC system.

Note!
If you try to access an undefined data block in the PLC-system, the PLC-system will stop.

All data types consist of byte areas. Addressing is always byte-specific, regardless of wether it is 1, 16, 32 bits.

The addresses are always decimal 0- 65535.

For information about instructions in the PLC system we refer to the manual for the PLC system.

Digital signals

For digital signals you state current bit in the byte. For example I50.3 bit 3 means bit 3 in input byte 50.

Data type English	Addressing example, English	Data type German	Addressing example, German
Ixxxx.b	<I3.7>	**E**xxxx.b	<E3.7>
Qxxxx.b	<Q1.3>	**A**xxxx.b	<A1.3>
Fxxxx.b	<F5.6>	**M**xxxx.b	<M5.6>
DBno.**DBX**.xxxx.b*	<DB51.DBX23.7>	**DB**no.**DBX**.xxxx.b*	<DB51.DBX23.7>
DBXxxxx**	<DBX23.7>	**DBX**xxxx**	<DBX23.7>

* Multi DB
** Single DB

xxxx=address (minimum value = 0 depend, maximum value depend on the PLC-system) b=bit number 0-7. No = data block number (0-255).

Note!
Writing bits from the terminal to the PLC is done in three steps:
1. Reading the whole byte from the PLC to the terminal.
2. The current bit is set/reset in the terminal.
3. Writing of the whole byte from the terminal to the PLC.
During the time it takes for the terminal to do the three steps the PLC may not change the other bits in the current byte since it will be overwritten.

Analog signals

For 16-bit numbers, you state the suffix W; for example MW100 means 2 bytes from memory byte 100-101.

Data type English	Addressing example, English	Data type German	Addressing example, German
IWxxxx	<IW231>	**EW**xxxx	<EW231>
QWxxxx	<QW2>	**AW**xxxx	<AW2>
FWxxxx	<FW101>	**MW**xxxx	<MW101>
DBno.**DBW**adr*	<DB23.DBW49>	**DB**no.**DBW**adr*	<DB23.DBW49>
DBWxxxx**	<DBW49>	**DBW**xxxx**	<DBW49>

* Multi DB
** Single DB

xxxx=address (minimum value = 0 depend, maximum value depend on the PLC-system) no=data block number (0-255) and adr=data word within the data base 0~8 kbyte (see current PLC type).

Note!
When storing ASCII values in 16-bit numbers the eight most significant bits contain the first ASCII code and the eight least significant bits contain the second ASCII code.

For 32-bit numbers, you state the suffix D; for example MD100 means 4 bytes from memory byte 100-103.

Data type English	Addressing example, English	Data type German	Addressing example, German
IDxxxx	<ID21>	**ED**xxxx	<ED21>
QDxxxx	<QD34>	**AD**xxxx	<AD34>
FDyyyy	<FD39>	**MD**yyyy	<MD39>
DBno.**DBD**adr*	<DB23.DBD54>	**DB**no.**DBD**adr*	<DB23.DBD54>
DBDxxxx**	<DBD54>	**DBD**xxxx**	<DBD54>

* Multi DB
** Single DB

xxxx=address (minimum value = 0 depend, maximum value depend on the PLC-system), no=data block number 0-255 and adr=data word within the data base 0~8 kbyte (see current PLC type).

5 The HMI profile

This chapter describes setup of the HMI profile, and is for the benefit of readers who want to learn more about data exchange via the HMI profile.

The HMI profile allows exchange of an unlimited amount of data, and also allows the terminal to access all type of devices in the PLC system.

Together with the card a type diskette is supplied containing PLC program for communication with different PLC system.

PROFIBUS-DP allows a maximum byte length of 200 bytes in and 200 out per station. The HMI profile uses an input area and an output area. These areas are hereafter referred to as containers. The HMI uses the container to access the PLC.

For more detailed information on the HMI profile see the specifications from the Profibus Organisation.
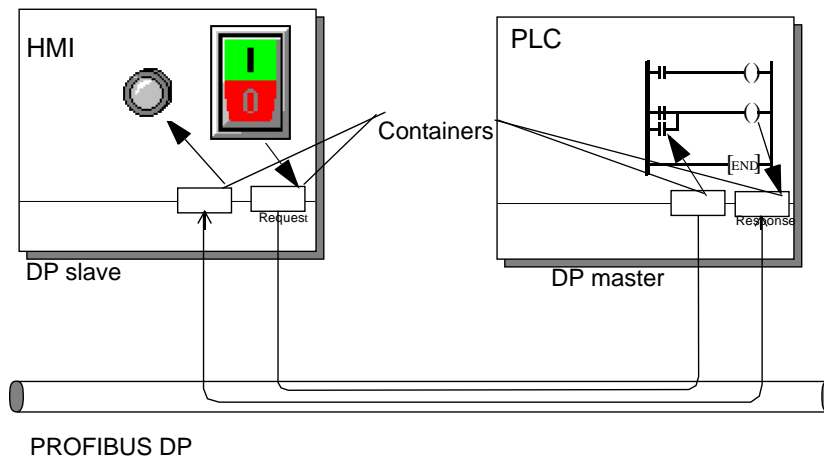
5.1 The data exchange

– The terminal is a slave in the PROFIBUS-DP net.

– The PLC system is the master.

– The terminal requests data from the PLC system through the input container.

– The PLC program serves the terminal with data through the output container.

– Handshaking between the terminal and the PLC system is performed through a Control byte in the containers.

– The terminal can access all types of PLC devices.

– When the terminal toggles the control byte, the PLC knows that the terminal wants to exchange data.

5.2 The request and response containers

The container starts at address 0 with the control byte. The control byte is used for handshaking and for communication failure detection. Addresses 1-3 are reserved for Fast bytes. These are not used in the terminal.

Addresses 4 to 200 are used for communication. The terminal put indexes here (3 byte each) that refer to the PLC devices that the terminal wants to read or write. The PLC system, on the other hand, will put the data here from the PLC devices that the terminal has asked for. If the terminal wants to write to a PLC device, the data is stored immediately after the index.

Request container		Response container	
00	Control byte	**00**	Control byte
01	Not used	**01**	Not used
02	Not used	**02**	Not used
03	Not used	**03**	Not used
04	Index 1 Read	**04**	Data for index 1
05	- -	**05**	- -
06	- -	**06**	Data for index 2-
07	Index 2 Read	**07**	- -
08	- -	**08**	- -
09	- -	**09**	- -
10	Index 3 Write	**10**	- -
11	- -	**11**	- -
12	- -	**12**	- -
13	Data byte for index 3	**13**	Free
14	Data byte for index 3	**14**	Free
....200		**....200**	Free

The control byte in the request container

The request container contains a message from the terminal to the PLC system.

7	6	5	4	3	2	1	0
Request	COM	Toggle	Error	Acknowledge bits, not used			

Request

The request byte is used for handshaking between the units. The bit toggles when the terminal wants information for the PLC system.

COM

The COM bit is set by the terminal. If communication breaks the bit will be reset.

Toggle

The toggle bit is always set to the opposite value as the toggle bit in the request container.

Error

This bit is not used.

Acknowledge

These bits are not used.

The control byte in the response container

The response container contains the response from the PLC system to the HMI terminal.

7	6	5	4	3	2	1	0
Response	COM	Toggle	Error	Acknowledge bits, not used			

Response

Is set to the same value as request when data is ready for transfer to the HMI terminal.

COM

The OM bit is set by the PLC program. If communication breaks the bit will be reset.

Toggle

The toggle bit is always set to the same value as the toggle bit in the request container.

Error

This bit is not used.

Action

These bits are not used.

5.3   The index structure

The index is built up of 3 bytes. The index contains 4 parts of information:

– If the device should be read or written.

– Which type of device (input, data register, timer etc.)

– Number of device (e.g. input 5).

– Data length (from one bit up to 16 bytes).

7	6	5	4	3	2	1	0
Write	Ln2	Ln1	Ln0	PLC device type			
Index number bit 15-8							
Index number bit 7-0							

PLC device type

States the type of PLC device according to the following table.

Number	Data type English	Data type German
1	F	M
2	I	E
3	Q	A
8	DB	DB

Ln0-Ln2

States the data length according to the following table.

Ln2	Ln1	Ln0	Length
0	0	0	bit
0	0	1	1 byte
0	1	0	2 bytes
0	1	1	4 bytes
1	0	0	6 bytes
1	0	1	8 bytes
1	1	0	12 bytes
1	1	1	16 bytes

Sequence of events

– The terminal decides which variables are to be read/written.

– The terminal toggles the request flag in the control byte.

– In the next PROFIBUS cycle, the PLC notices that the request flag has been changed.

– For each read index, the values of the requested devices are copied to the response container.

– Then the response flag in the response container is set to the same value as the request flag in the request container.

– In the next PROFIBUS cycle, the terminal notices that the request flag and the response flag are the same which means that there is data for the terminal.

– The received values will now be used by the objects in the terminal.

6 Efficient communication

To make the communication between the terminal and the PLC system quick and efficient the following should be noted about how the signals are read and what that can be done to optimize the reading.

6.1 Signals affecting the communication time

It is only signals to objects in the current block that are read continuously. Signals to objects in other blocks are not read, that is the number of blocks does not affect the communication time.

Besides the signals to objects in the current block, the terminal is continuously reading the following signals from the PLC system:

Display signals
Block print-out signals
LED registers
Alarm signals
Remote acknowledge signals on alarms and alarm groups
Login signal
Logout signal
Trend registers at the sample points
Bargraph registers if using min/max indicators
New display register
Buzzer register
Backlight signal
Cursor control block
Recipe control block
Library index register
Index registers
PLC clock register if the PLC clock is used in the terminal
List erase signal
No protocol control register
No protocol on signal

Signals not affecting the communication time

The following signals do not affect the communication time:

– Signals linked to function keys

– Time channels

– Objects in the alarm messages

6.2 How to make the communication more efficient

Group PLC signals consecutively

The signals from the PLC system are read most rapidly if all signals in the list above are consecutive. If for example, 100 signals are defined, it is quickest to read these if they are linked to, for example, M0.0-M11.7. If the signals are spread out (e.g. I0.4, Q30.0, F45.3 etc.) the updating is slower.

Efficient block changes

Block changes are carried out most rapidly and efficiently through the block jump function on the function keys or through a jump object. "Display signals" in the block header should only be used when the PLC system is to force the presentation of another block. The "New Display" register can also be used if the PLC system is to change the block. This does not affect communication as much as a larger number of "Display signals".

Use the clock of the terminal

An extra load is put on communication if the clock of the PLC system is used since the clock register must be read up to the terminal. Downloading of the clock to the PLC system also creates an extra load. The interval between downloadings should therefore be as long as possible.

Packaging of signals

When the signals are transferred between the terminal and the PLC system, all signals are not transferred simultaneously. Instead they are divided into packages with a number of signals in each package. To decrease the number of packages that have to be transferred and make the communication faster this number has to be considered. The number of signals in each package depends on the used driver. In the SIMATIC S7 Profibus DP driver the number is 8 for analog devices and 128 for digital devices.

To make the communication as fast as possible the number of packages has to be minimized. Consecutive signals require a minimum of used packages but it is not always possible to have consecutive signals. In such cases the so-called waste between two signals has to be considered. The waste is the maximum distance between two signals you can have and still keep them in the same package. The waste depends on the used driver. In the SIMATIC S7 Profibus DP driver the number is 2 for analog devices and 24 for digital devices.

Signal	1	2	3	4	5	6	7	8	9	10
Used	X	X					X	X	X	

Waste

7 Appendix

7.1 Error messages

Error messages from the PLC system. The code is shown on the display of the terminal.

Error message	Description
"Com error"	Communication error
"Wrong fieldbus type"	Incorrect IFC PBDP card installed
"Fieldbus no response"	No response from the IFC PBDP card
"No IFC-PBDP-card"	No IFC PBDP card installed in the terminal