Application Note

AN2005

DLS / FLS

S7 Profibus connection example

V 1.03
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Abstract

This application shows how to display a measured distance value on a standard external numeric digital display. Description of the wiring and sensor configuration are included as well as two samples are given.

File: AN2005 S7 Profibus connection example_V103.odt

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Table of content

1 Introduction

To connect a FLS / DLS-Distance sensor with a Siemens S7 PLC over the Profibus, the DIMS Profibus Interface (Par No. 500214) must be used. This example describe the configuration of the S7 PLC and the configuration of the FLS / DLS Sensor.

Further additional explanations about the example are also included. The example is available for download on www.dimetix.com.

It is essential, that you have some experience in programming of a Siemens S7 PLC and knowledge of the Profibus.

2 Structure

The following diagram demonstrates the connection of the FLS / DLS Sensor, DIMS Profibus Interface and S7:
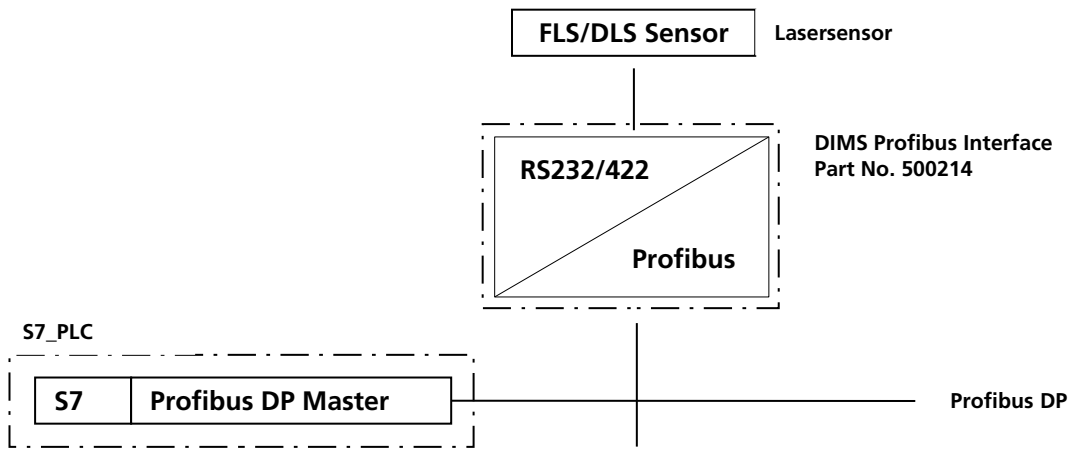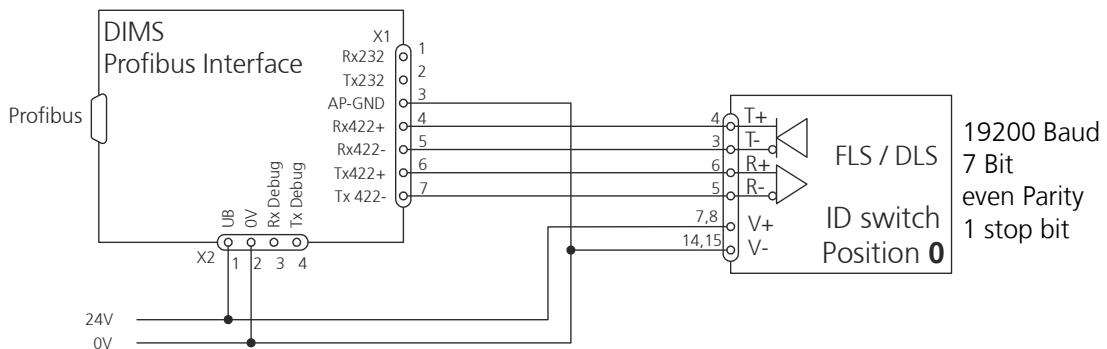

2.1 Multi-Sensor Mode

The DIMS is operated in Multi Sensor Mode. Additional information about this operation mode can be found in the DIMS User Manual.

2.2 Connection of the Sensor with the DIMS

The following diagram shows the connection of a Distance Sensor with the DIMS Profibus Interface by RS422 interface.

3 FLS / DLS configuration

Use the FLS / DLS Distance sensor with factory settings to use it in Multi-Sensor mode. In case you have to set the FLS / DLS Distance sensor back to factory settings, reset the device as described below.

3.1 Reset to factory default

To reset the device to factory settings do the following:

- Change ID Switch to position 0
- Switch OFF the power for the device
- Press the reset button and keep it pressed
- Switch on the power for the device
- Keep the reset button pressed until all LEDs on the device are illuminated
- Release the reset button
- Switch the power OFF and wait 5 seconds
- Switch on the power and wait until the green power LED is on

Reset switch

ID switch
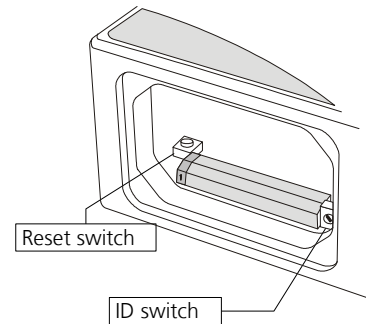
4 Projection (S7 configuration)

To project the DIMS Profibus Interface as DP-slave, the installation of the **GSD – data file** is necessary.
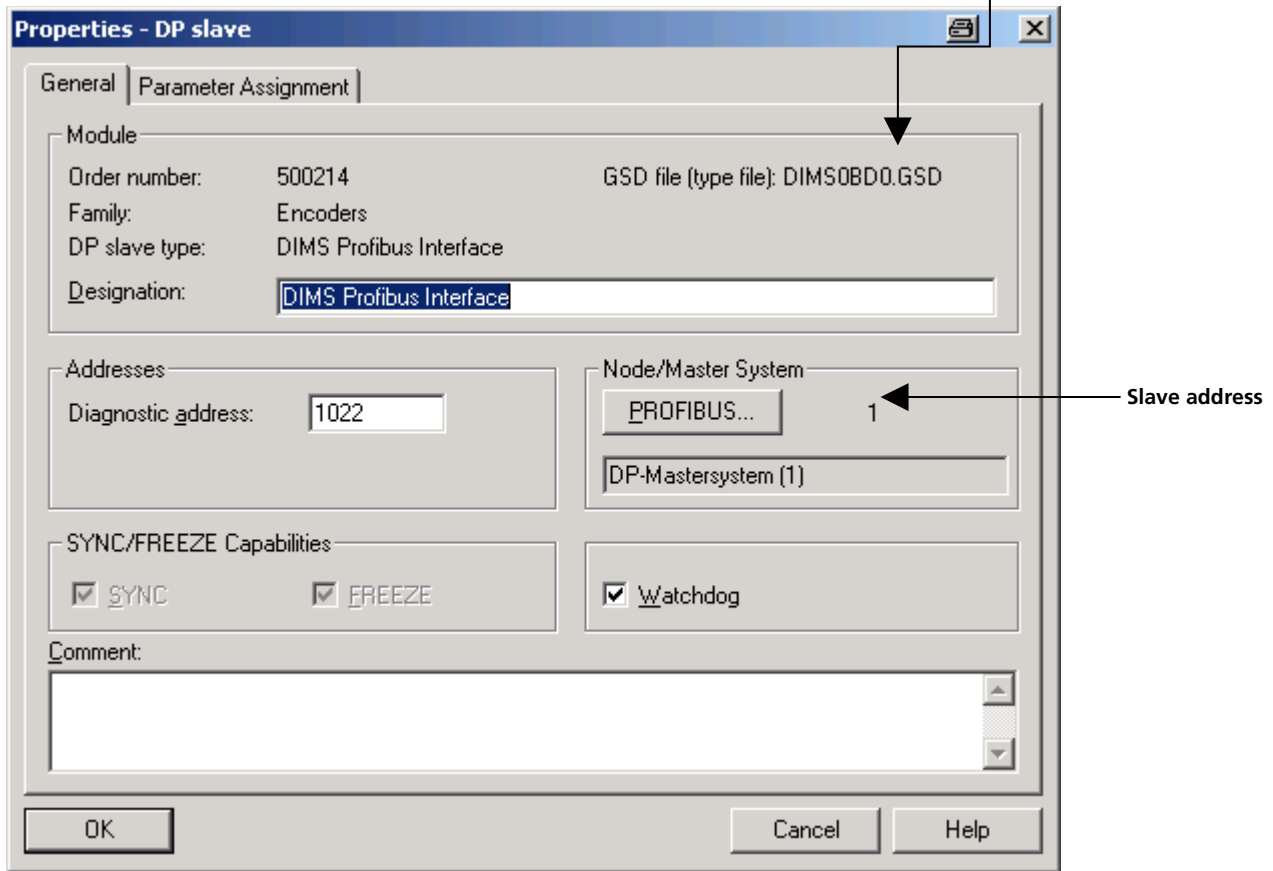
After the projection of the DIMS Profibus Interface, upload the appropriate module.
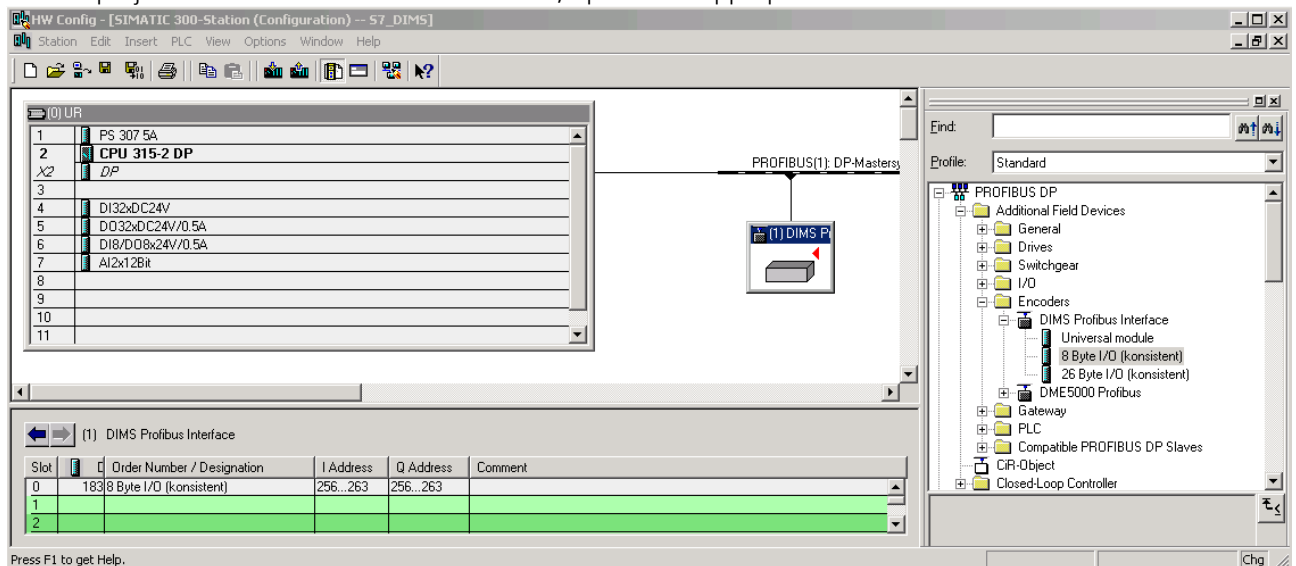
5 Project

The project includes all the necessary blocs for the operation of a FLS / DLS sensor.
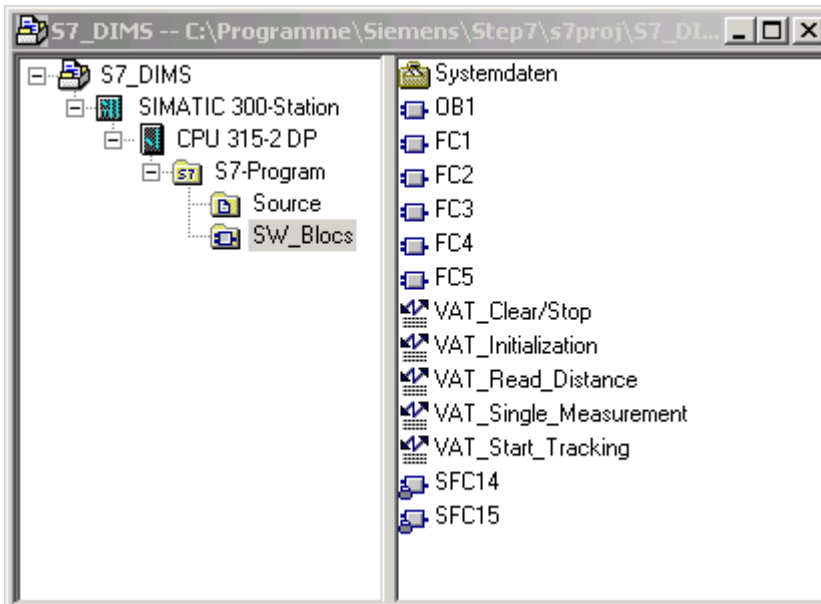
5.1 Description of the blocs

The VAT-blocs are each the variable charts to their corresponding function.

OB1	"Main Program Sweep (Cycle)"	
FC1	Function Clear/Stop	VAT_Clear/Stop
FC2	Function Initialization	VAT_Initailization
FC3	Function Read_Distance	VAT_Read_Distance
FC4	Function Single_Measurement	VAT_SingleMeasurement
FC5	Function Start_Tracking	VAT_Start-Tracking
SFC14	System function „DPRD-DAT"	
SFC15	System function „DPWR-DAT"	

5.2 Startup

1. Connect the control, the DIMS Profibus Interface and the FLS / DLS sensor to the communication cables and the appropriate electric power supply.
2. Set the address of the Profibus at the front side of the DIMS Profibus Interface. It has to correspond to the S7-project.
3. Load all the blocs onto the control.
4. The inputs E0.1, E0.2, E0.3, E0.4 and E0.5 enable you now to preselect the function you wish.
   Important! Preselect only one function at once!

   A pulse at the input E0.0 activates the function. (see code OB1)
5. In the appropriate table of variables, all the data is visualized.

5.3 Code: OB1

```
OB1 :  "Main Program Sweep (Cycle)"

Comment:


Network 1: Title:

Comment:


//Toggle

        A       "Trigger_Function"          //Function Trigger
        CU      C       0                   //current Toggle No.
        L       C       0
        L       10
        >=I
        R       C       0


//Funktionsaufruf

        A       M       1.0                 //Switch Initialization
        CC      "Initialization"

        A       M       1.1                 //Switch Clear/Stop
        CC      "Clear_Stop"

        A       M       1.2                 //Switch Single Measurement
        CC      "Single_Measurement"

        A       M       1.3                 //Switch Start Tracking
        CC      "Start_Tracking"

        A       M       1.4                 //Switch Read Distance
        CC      "Read_Distance"



        A       "Preselec_Initialization"
        =       M       1.0
        A       "Preselec_Clear/Stop"
        =       M       1.1
        A       "Preselec_Single Mesurem."
        =       M       1.2
        A       "Preselec_Tracking"
        =       M       1.3
        A       "Preselec_Read Distance"
        =       M       1.4
```

5.4 Tables of variables of the different functions

5.4.1 Table of variables of the function „Initialization"

	Address	Symbol	Symbol comment	Display format	Status value	Mod
1	MW 106	"ErrorNo. Initialization"		DEC		
2	MD 102	"State Info Sensoren"		BIN		
3						

5.4.2 Table of variables of the function „Clear/Stop"

Enter the ID you wish (number of sensor) as the value of control into the marker byte 136.

	Address	Symbol	Display format	Status value	Modify value
1	MD 122	"State Info Clear/Stop"	BIN		
2	MW 126	"ErrorNo. Clear/Stop"	DEC		
3					
4	MB 136	"ID_Clear/Stop"	DEC		1
5					

5.4.3 Table of variables of the function „Single Measurement"

Enter the ID you wish (number of sensor) as the value of control into the marker byte 156.

	Address	Symbol	Display format	Status value	Modify value
1	MD 142	"Distance Single_Measur.	FLOATING_POINT		
2	MW 146	"ErrorNo. Single_M"	DEC		
3					
4	MB 156	"ID_Single Measurem."	DEC		1
5					

5.4.4 Table of variables of the function „Start Tracking"

Enter the ID you wish (number of sensor) as the value of control into the marker byte 176.

Enter the tracking time in msec (milliseconds) as the value of control into the marker double word.

	Address	Symbol	Display format	Status value	Modify value
1	MW 166	"ErrorNo. Tracking"	DEC		
2	MB 176	"ID_Start Tracking"	DEC		1
3	MD 172	"Time in ms"	DEC		
4					

5.4.5 Table of variables of the function „Read Distance"

Enter the ID you wish (number of sensor) as the value of control into the marker byte 196. This function can only be started, if „Start Tracking" is active.

		Address	Symbol	Display format	Status value	Modify value
1		MB 181	"State Read Distance"	DEC		
2		MD 182	"Distance Tracking"	FLOATING_POINT		
3		MW 186	"ErrorNo. Read Distance"	DEC		
4		MB 196	"ID_Read Distance"	DEC		1
5						

5.5 Table of symbols

S7-Program (Symbole) -- S7_DIMS\SIMATIC 300-Station\CPU 315-2 DP

	Status	Symbol	Address		Data type		Comment
1		Initialization	FC	1	FC	1	
2		Clear_Stop	FC	2	FC	2	
3		Single_Measurement	FC	3	FC	3	
4		Start_Tracking	FC	4	FC	4	
5		Read_Distance	FC	5	FC	5	
6		Trigger_Function	I	0.0	BOOL		
7		Preselec_Initialization	I	0.1	BOOL		
8		Preselec_Clear/Stop	I	0.2	BOOL		
9		Preselec_Single Mesurem.	I	0.3	BOOL		
10		Preselec_Tracking	I	0.4	BOOL		
11		Preselec_Read Distance	I	0.5	BOOL		
12		ID_Clear/Stop	MB	136	BYTE		
13		ID_Single Measurem.	MB	156	BYTE		
14		ID_Start Tracking	MB	176	BYTE		
15		State Read Distance	MB	181	BYTE		
16		ID_Read Distance	MB	196	BYTE		
17		State Info Sensoren	MD	102	DWORD		
18		State Info Clear/Stop	MD	122	DWORD		
19		Distance Single_Measur.	MD	142	DWORD		
20		Time in ms	MD	172	DWORD		
21		Distance Tracking	MD	182	DWORD		
22		ErrorNo. Initialization	MW	106	WORD		
23		ErrorNo. Clear/Stop	MW	126	WORD		
24		ErrorNo. Single_M	MW	146	WORD		
25		ErrorNo. Tracking	MW	166	WORD		
26		ErrorNo. Read Distance	MW	186	WORD		
27		DPRD_DAT	SFC	14	SFC	14	Read Consistent Data of a Standard DP Slave
28		DPWR_DAT	SFC	15	SFC	15	Write Consistent Data to a Standard DP Slave
29		VAT_Initialization	VAT	1			
30		VAT_Single_Measurement	VAT	2			
31		VAT_Clear/Stop	VAT	3			
32		VAT_Start_Tracking	VAT	4			
33		VAT_Read_Distance	VAT	5			
34							

6 Listings

OB1 - <offline>
" "

Name:	**Family:**	
Author:	**Version:** 0.1	
	Block version: 2	
Time stamp Code:	11/07/2008 02:11:29 PM	
Interface:	02/15/1996 04:51:12 PM	
Lengths (block/logic/data):	00194 00076 00020	

Name	Data Type	Address	Comment
TEMP		0.0	
OB1_EV_CLASS	Byte	0.0	Bits 0-3 = 1 (Coming event), Bits 4-7 = 1 (Event class 1)
OB1_SCAN_1	Byte	1.0	1 (Cold restart scan 1 of OB 1), 3 (Scan 2-n of OB 1)
OB1_PRIORITY	Byte	2.0	Priority of OB Execution
OB1_OB_NUMBR	Byte	3.0	1 (Organization block 1, OB1)
OB1_RESERVED_1	Byte	4.0	Reserved for system
OB1_RESERVED_2	Byte	5.0	Reserved for system
OB1_PREV_CYCLE	Int	6.0	Cycle time of previous OB1 scan (milliseconds)
OB1_MIN_CYCLE	Int	8.0	Minimum cycle time of OB1 (milliseconds)
OB1_MAX_CYCLE	Int	10.0	Maximum cycle time of OB1 (milliseconds)
OB1_DATE_TIME	Date_And_Time	12.0	Date and time OB1 started

```
Block: OB1    "Main Program Sweep (Cycle)"


Network: 1


//Toggle

     A      "Trigger_Function"        //Function Trigger
     CU    C      0                    //current Toggle No.
     L     C      0
     L     10
     >=I
     R     C      0


//Funktionsaufruf

     A     M      1.0                  //Switch Initialization
     CC    "Initialization"

     A     M      1.1                  //Switch Clear/Stop
     CC    "Clear_Stop"

     A     M      1.2                  //Switch Single Measurement
     CC    "Single_Measurement"

     A     M      1.3                  //Switch Start Tracking
     CC    "Start_Tracking"

     A     M      1.4                  //Switch Read Distance
     CC    "Read_Distance"


     A     "Preselec_Initialization"
     =     M      1.0
     A     "Preselec_Clear/Stop"
     =     M      1.1
     A     "Preselec_Single Mesurem."
     =     M      1.2
     A     "Preselec_Tracking"
     =     M      1.3
     A     "Preselec_Read Distance"
     =     M      1.4
```

FC1 - <offline>

"Initialization"
```
Name:                    Family:
Author:                  Version: 0.1
                         Block version: 2
Time stamp Code:         11/07/2008 02:15:13 PM
          Interface:     10/04/2007 04:28:44 PM
Lengths (block/logic/data): 00282  00188  00014
```

Name	Data Type	Address	Comment
IN		0.0	
OUT		0.0	
IN_OUT		0.0	
TEMP		0.0	
RETURN		0.0	
RET_VAL		0.0	

Block: FC1   Initialization

Network: 1   Profibus to DLS

```
        L    C      0
        T    MB    110   //Byte0, Toggle
        L    'i'
        T    MB    111   //Byte1, Command
        L    0
        T    MB    112   //Byte2
        L    0
        T    MB    113   //Byte3
        L    0
        T    MB    114   //Byte4
        L    0
        T    MB    115   //Byte5
        L    0
        T    MB    116   //Byte6
        L    0
        T    MB    117   //Byte7, Reserve
```

Network: 2   Bus Data Read/Write

```
//Bus Data Read

        CALL  "DPRD_DAT"
         LADDR   :=W#16#100
         RET_VAL:=MW20
         RECORD  :=P#M 100.0 BYTE 8

//Bus Data Write

        CALL  "DPWR_DAT"
         LADDR   :=W#16#100
         RECORD  :=P#M 110.0 BYTE 8
         RET_VAL:=MW22
```

FC2 - <offline>

"Clear_Stop"

Name:		**Family:**	
Author:		**Version:** 0.1	
		Block version: 2	
Time stamp Code:		11/07/2008 02:16:38 PM	
Interface:		10/04/2007 04:28:44 PM	
Lengths (block/logic/data): 00276 00182 00014			

Name	Data Type	Address	Comment
IN		0.0	
OUT		0.0	
IN_OUT		0.0	
TEMP		0.0	
RETURN		0.0	
RET_VAL		0.0	

Block: FC2   Clear/Stop

Network: 1   Profibus to DLS

```
        L    C      0
        T    MB    130  //Byte0, Toggle
        L    'C'
        T    MB    131  //Byte1, Command
        L    0
        T    MB    132  //Byte2
        L    0
        T    MB    133  //Byte3
        L    0
        T    MB    134  //Byte4
        L    0
        T    MB    135  //Byte5
//L     1
//T     MB   136                    //Byte6, ID
        L    0
        T    MB    137  //Byte7, Reserve
```

Network: 2   Bus Data Read/Write

```
//Bus Data Read

        CALL  "DPRD_DAT"
         LADDR  :=W#16#100
         RET_VAL:=MW24
         RECORD :=P#M 120.0 BYTE 8

//Bus Data Write

        CALL  "DPWR_DAT"
         LADDR  :=W#16#100
         RECORD :=P#M 130.0 BYTE 8
         RET_VAL:=MW26
```

FC3 - <offline>

"Single_Measurement"

Name:	**Family:**	
Author:	**Version:** 0.1	
	Block version: 2	
Time stamp Code:	11/07/2008 02:17:41 PM	
Interface:	10/04/2007 04:28:44 PM	
Lengths (block/logic/data): 00276 00182 00014		

Name	Data Type	Address	Comment
IN		0.0	
OUT		0.0	
IN_OUT		0.0	
TEMP		0.0	
RETURN		0.0	
RET_VAL		0.0	

Block: FC3   Single_Measurement

Network: 1   Profibus to DLS

```
        L     C     0
        T     MB    150   //Byte0, Toggle
        L     'g'
        T     MB    151   //Byte1, Command
        L     0
        T     MB    152   //Byte2
        L     0
        T     MB    153   //Byte3
        L     0
        T     MB    154   //Byte4
        L     0
        T     MB    155   //Byte5
//L     0
//T     MB    156                   //Byte6, ID
        L     0
        T     MB    157   //Byte7, Reserve
```

Network: 2   Bus Data Read/Write

```
//Bus Data Read

        CALL   "DPRD_DAT"
         LADDR  :=W#16#100
         RET_VAL:=MW28
         RECORD :=P#M 140.0 BYTE 8  //ab  M 140.0 8 Byte

//Bus Data Write

        CALL   "DPWR_DAT"
         LADDR  :=W#16#100
         RECORD :=P#M 150.0 BYTE 8  //ab  M 150.0 8 Byte
         RET_VAL:=MW30
```

FC4 - <offline>

"Start_Tracking"
Name:		**Family:**	
Author:		**Version:** 0.1	
		Block version: 2	
Time stamp Code:		11/07/2008 02:18:47 PM	
Interface:		10/04/2007 04:28:44 PM	
Lengths (block/logic/data): 00276 00182 00014			

Name	Data Type	Address	Comment
IN		0.0	
OUT		0.0	
IN_OUT		0.0	
TEMP		0.0	
RETURN		0.0	
RET_VAL		0.0	

Block: FC4   Start Tracking

Network: 1   Profibus to DLS

```
        L    C      0
        T    MB    170   //Byte0, Toggle
        L    'f'
        T    MB    171   //Byte1, Command
        L    0
        T    MB    172   //Byte2
        L    0
        T    MB    173   //Byte3
        L    0
        T    MB    174   //Byte4
        L    0
        T    MB    175   //Byte5
//L     1
//T     MB    176                    //Byte6, ID
        L    0
        T    MB    177   //Byte7, Reserve
```

Network: 2   Bus Data Read/Write

```
//Bus Data Read

        CALL   "DPRD_DAT"
         LADDR   :=W#16#100
         RET_VAL:=MW32
         RECORD :=P#M 160.0 BYTE 8

//Bus Data Write

        CALL   "DPWR_DAT"
         LADDR   :=W#16#100
         RECORD :=P#M 170.0 BYTE 8
         RET_VAL:=MW34
```

FC5 - <offline>

"Read_Distance"

Name: **Family:**
Author: **Version:** 0.1
  Block version: 2
Time stamp Code: 11/07/2008 02:19:47 PM
  Interface: 10/04/2007 04:28:44 PM
Lengths (block/logic/data): 00276   00182   00014

Name	Data Type	Address	Comment
IN		0.0	
OUT		0.0	
IN_OUT		0.0	
TEMP		0.0	
RETURN		0.0	
RET_VAL		0.0	

Block: FC5   Read Distance

Network: 1   Profibus to DLS

```
        L    C     0
        T    MB   190   //Byte0, Toggle
        L    'q'
        T    MB   191   //Byte1, Command
        L    0
        T    MB   192   //Byte2
        L    0
        T    MB   193   //Byte3
        L    0
        T    MB   194   //Byte4
        L    0
        T    MB   195   //Byte5
//L     1
//T    MB   196                      //Byte6, ID
        L    0
        T    MB   197   //Byte7, Reserve
```

Network: 2   Bus Data Read/Write

```
//Bus Data Read

        CALL   "DPRD_DAT"
         LADDR   :=W#16#100
         RET_VAL:=MW36
         RECORD :=P#M 180.0 BYTE 8

//Bus Data Write

        CALL   "DPWR_DAT"
         LADDR   :=W#16#100
         RECORD :=P#M 190.0 BYTE 8
         RET_VAL:=MW38
```

7 Overview of the marker words

The following is a list of the used marker words. The DIMS functions are described in the DIMS Manual, which can be found on www.dimetix.com.

7.1 Sensor detection manual

Master -> DIMS

Toggle	'i'						reserve
110	111	112	113	114	115	116	117

DIMS -> Master

Toggle	'i'	status info	(int 32 bit)			error number	
100	101	102	103	104	105	106	107

7.2 Clear / Stop

Master -> DIMS

Toggle	'c'					ID	reserve
130	131	132	133	134	135	136	137

DIMS -> Master

Toggle	'c'	status info	(int 32 bit)			error number	
120	121	122	123	124	125	126	127

7.3 Distance Measurement

Master -> DIMS

Toggle	'g'					ID	reserve
150	151	152	153	154	155	156	157

DIMS -> Master

Toggle	'g'	distance	(float 32 bit)			error number	
140	141	142	143	144	145	146	147

7.4 Start Tracking with buffering

Master -> DIMS

Toggle	'f'	time in ms	(int 32 bit)			ID	reserve
170	171	172	173	174	175	176	177

DIMS -> Master

Toggle	'f'					error number	
160	161	162	163	164	165	166	167

7.5 Read Distance

Master -> DIMS

Toggle	'q'					ID	reserve
190	191	192	193	194	195	196	197

DIMS -> Master

Toggle	'0'	distance	(float 32 bit)			error number	
180	181	182	183	184	185	186	187