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7 PROFIBUS DP (SS52) Link

7.1 Introduction

7.1.1 Necessary Hardware and Software

The following hardware and software is necessary for configuring and operating the SS52 module.

- STRUC version 4.2.3
- COM ET200 (Windows) from version 2.0:
  Must be ordered separately! Order no.: 6ES5 895-6SE..... (English version)
- A DP capable PC board for down loading the COM data base:
  MPI board or CP5411.

7.1.2 Features

SIMADYN D has the following features with the SS52 module on the PROFIBUS DP:

Master: As a Master, the SS52 module can be operated on the PROFIBUS DP both alone and with other Masters (maximum 16) in a multi Master configuration.

Slave: The SS52 module also features a Slave functionality in addition to the Master functionality. These functionalities can be utilized both simultaneously or separately.

Shared Input: Each Slave on the PROFIBUS DP is allocated exactly one Master (the parameter setting Master) and can initially only communicate with this Master. The "Shared Input" feature permits other Masters to also read access the Slave input data. The SS52 supports this functionality as Master and Slave.

SYNC and **FREEZE**: The utilities SYNC and FREEZE permits a synchronized write/read of outputs/inputs from several Slaves. The SS52 module supports this utility as Master.

Data Length: A maximum transmission length of 122 byte per direction and Slave is permissible.

Transmission Times: The SIMADYN sampling time and the DP bus cycle time are exclusively of significance for the transmission times of short telegrams (up to 28 byte). Software processing times of the SS52 module must be added to the calculation for longer telegrams (2ms at the Master end and 5ms at the Slave end).

Consistency: The data within a telegram are always consistent.

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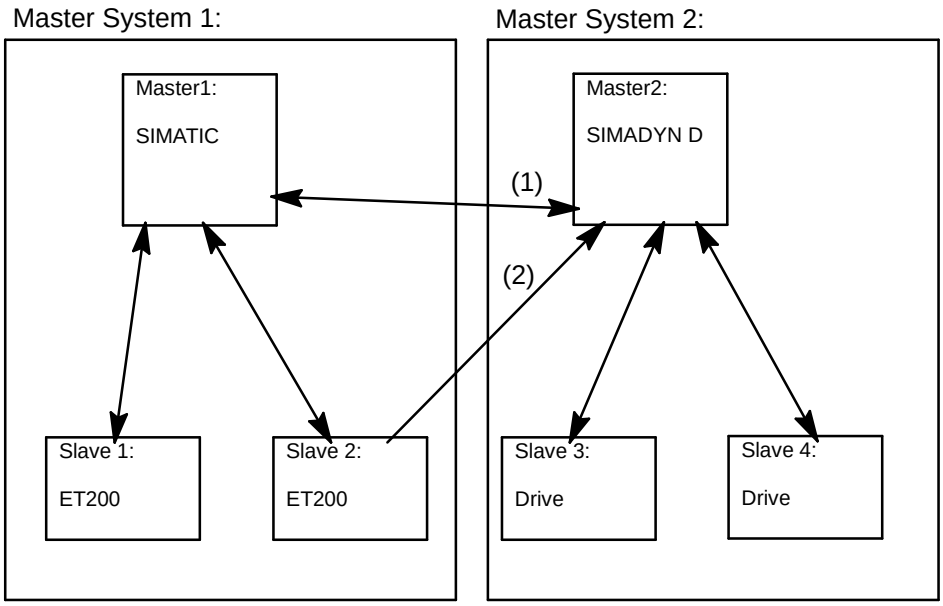


Diagram: Typical Multi-Master-System with Slave Functionality (1) and Shared Input (2)

7.2 Configuring with STRUC

The following marginal conditions are to be considered when configuring an SS52 module:

- exactly one Central Function Block @CSL2A is to be configured
- a maximum of one Transmit and Receive function block per Slave station
- permitted utility type: Process Data and Device
- permitted transmission mode: Refresh, 'Multiple' may also be selected for Receivers
- a maximum of one Sync Function Block @SYL2A can be configured
- a maximum of one Diagnostics Function Block DIAL2A can be configured

7.2.1 Central Block

Baud Rate and Station Number

Baud rate and station number are defined on the one hand by STRUC and on the other by COM ET200. The following considerations are important for the validity of these two parameters:

When no COM data base has been loaded, then the STRUC defined parameters are valid. The SS52 module waits for down load.

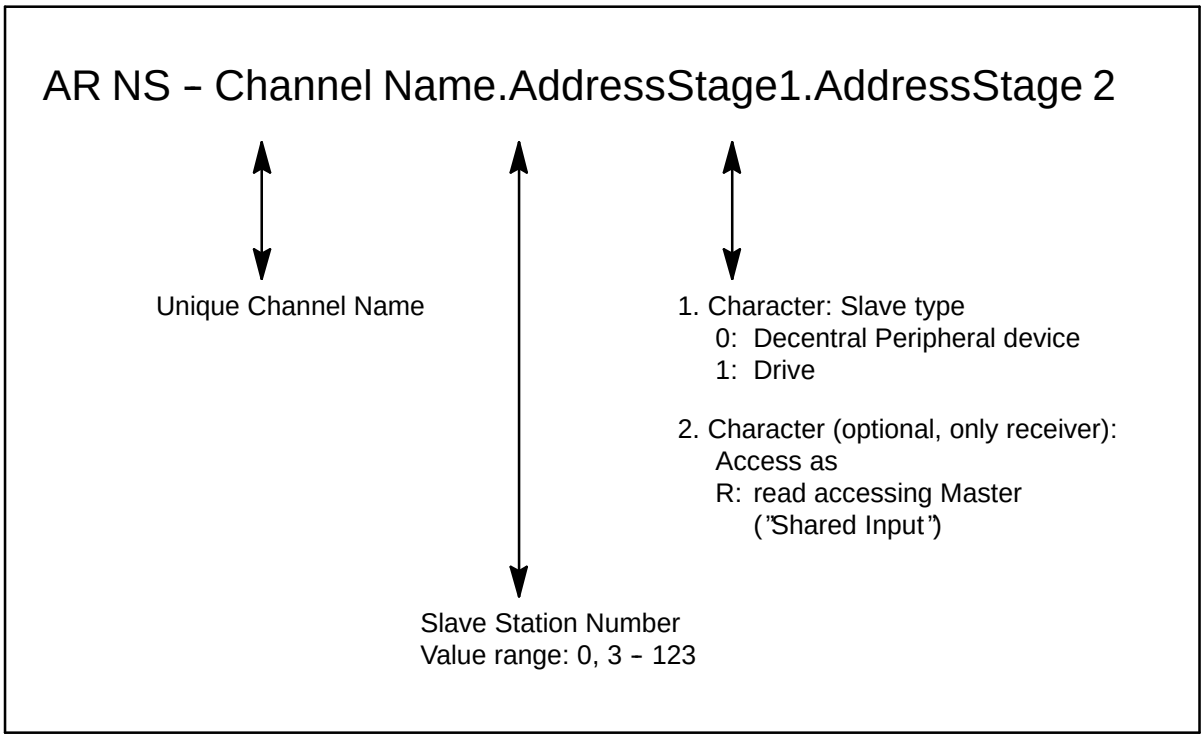
When a COM data base has been loaded and the baud rate and station number match the parameters configured by STRUC, then the COM data base is activated and the SS52 starts the user data exchange.

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When a COM data base has been loaded but the baud rate and station number do not match the parameters configured by STRUC, then the parameters defined by STRUC remain valid. The module waits for download. The existing COM data base can be activated however, by adapting the baud rate and station number at the central block to the COM configured parameters.

7.2.2 **Address Connectors AT, AR**

Adhere to the following syntax when configuring the AT or AR connectors:



Channel Name: The channel name must be unique (corresponding to the general regulations of SIMADYN communication). It has no specific significance for PROFIBUS DP.

Address Stage 1: The station number may be defined only once per transmit and receive channel. The Slave station number 0 signifies that this channel itself serves as a Slave channel and can be polled by another Master. The station numbers 3 to 123 address external Slaves.

Address Stage 2 consists of a maximum of two characters:

1st. Character: Decentral peripheral device ("0") or drive ("1"). This merely defines the data location within the telegram. The data for a decentral peripheral device is deposited in "Intel Format" (low byte in front of high byte). The data for a drive are deposited according to the PROFIBUS profile Drive Technology (PPO types) in "Motorola Format" (high byte in front of low byte).

2nd. Character: If no specification is made, then the access to the Slave occurs as a parameter setting Master. The specification "R" implies that the access occurs as a read accessing second Master. The specification "R" is only possible for receive channels ("Shared Input").

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Examples:

1) AT NS – 'Setpoint.25.1'

The channel with the name Setpoint transmits to a Drive with the station address 25

2) AR NS – 'RECEIVE.117.0'

The channel with the name RECEIVE receives from a Decentral Peripheral Device with the station number 117

3) AR NS – 'Input.33.0R'

The channel with the name Input receives from a Decentral Peripheral Device with the station number 33 as read access (second) Master

4) AT NS – 'SlaveAct.0.1'

The channel with the name SlaveAct transmits as a Drive to a DP Master

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7.2.3 SYNC/FREEZE

The commands SYNC and FREEZE are utilized to synchronize the outputs and inputs of a group of Slaves. The function block @SYL2A activates these commands and supports the consistency guarantee.

The designer is responsible for ensuring the consistency. To improve the understanding of this topic, several terms are explained and three configuring versions are described with examples.

After activating a **SYNC** command, the DP Master (SS52) waits for one complete DP bus cycle period, to ensure that all Slaves have received the new output values. The DP Master then transmits a SYNC broadcast telegram to the configured Slave group. All Slaves in this group then simultaneously update their intermediately saved outputs.
Consistency Check: The configuring should ensure that the output data is not modified by SIMADYN processor modules during one DP bus cycle period, following the activation of an SYNC command.

Activation of a **FREEZE** command causes the DP Master to immediately transmit a FREEZE broadcast telegram to the configured Slave group. All Slaves in this group, then simultaneously read and buffer their inputs. This input data is presented to the SIMADYN processor modules after expiry of an DP bus cycle period.
Consistency Check: The configuring must ensure that the input data cannot be evaluated by an DP Master during one DP bus cycle period following activation of the FREEZE command.

(Consistency Note: The SYNC/FREEZE command requires consistency of data over all participating Slaves. The consistency of input or output data of one Slave is of course always guaranteed).

The following shows various SYNC/FREEZE configuring versions. The correct configuring is a prerequisite for the functionality, especially for consistency guarantees and therefore several terms will be initially described:

Bus Cycle Time is the cycle in which the DP Master (SS52) polls all Slaves once. All Masters will poll all Slaves in the multi Master system. The bus cycle time is indirectly configured with COM ET200 (baud rate, number and type of the configured Slaves) and also processed by COM ET200. It can be reviewed as the "Typical Data Cycle Time "in the menu item "Bus Parameter ".

Sampling Time is the cycle in which the FB-@SYL2A and the transmit and receive FB's are processed (on SIMADYN processor modules). The sampling time is directly configured with STRUC.

In principle, the bus cycle time and sampling time are independent of one another.

Sync Cycle is a multiple whole number of the sampling time, configured at connector CNX of the FB-@SYL2A. (Sync cycle = CNX * sampling time).

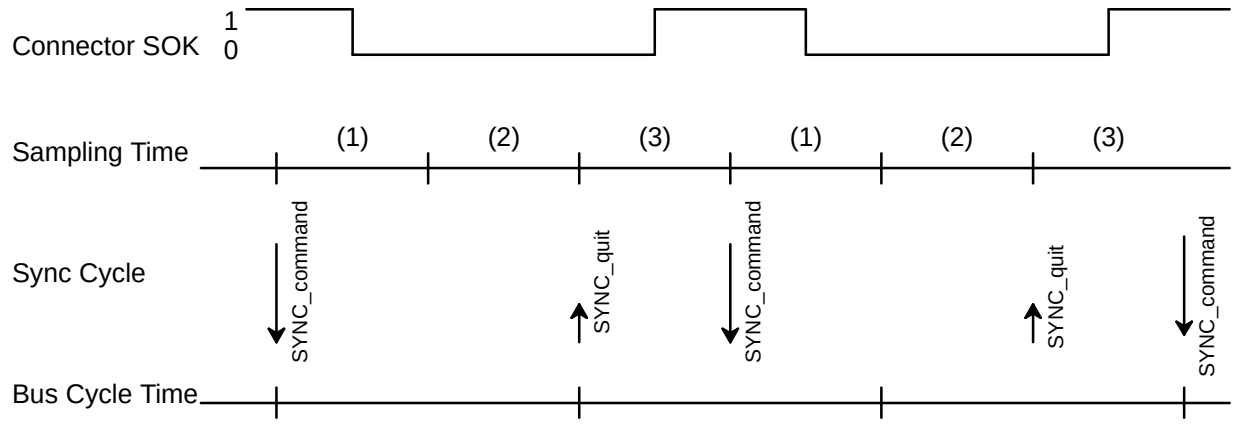
A Sync cycle always starts with a sampling time. A Sync command is always activated in system mode by the FB-@SYL2A at the start of a sampling time.

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Configuring Version 1: (This version is the nearest possible example to a practical application). Generating SYNC commands (no FREEZE). The consistency of all Slaves is guaranteed. The Sync cycle is at least double as high as the sampling time (CNX>1).

- The length of the transmit telegram (outputs) of each Slave must not be larger than 28 byte.
- All transmit blocks and the FB–@SYL2A must be configured in the same sampling time (on the same processor module) in the special communications function packet "Transmit".
- The configured processing sequence of the FB–@SYL2A must be chronologically in front of all transmit blocks.
- The connector SOK of the FB–@SYL2A must be connected to the enable connector of all transmit blocks (belonging to the Slave group).
- The bus cycle time must be shorter than the Sync cycle minus 1 x sampling time. Check during run time, whether the connector SOK has one transition to "1" in each Sync cycle; otherwise increase the Sync cycle.

Example: Sync cycle = 3 x sampling time, Bus cycle time = 2 x sampling time
Assumption: FB–@SYL2A processes in the middle of the sampling time (in front of all transmit blocks).



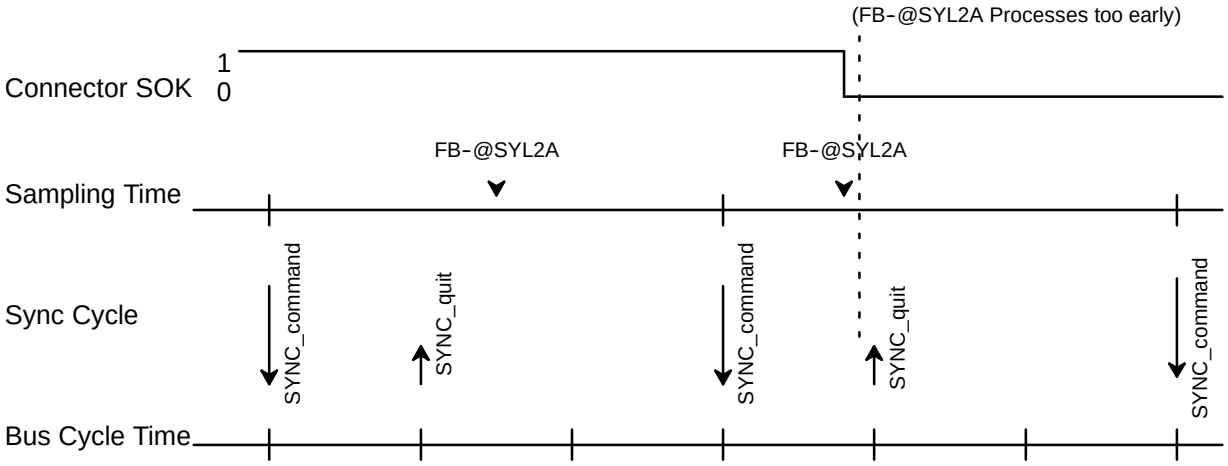
The transmit blocks are disabled (SOK=0) for two sampling periods (a bus cycle time) following activation of the SYNC command. The transmit blocks are enabled (SOK=1) in the third sampling period following the activation of the SYNC command.

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Configuring Version 2: (Version with the highest SYNC performance).
As version 1, but the Sync cycle = sampling time (CNX=1).

- High baud rate (>1,5 M baud). The timing conditions are difficult to maintain with low baud rates.
- The bus cycle time may be a maximum of half the sampling time.
- The bus cycle time must, in addition, be small enough that it has expired between the start of a sampling time and the processing of the FB–@SYL2A. This prerequisite cannot be guaranteed, but must be checked during run time.

Example: Sync cycle = sampling time, bus cycle time = 0.3 x sampling time
Assumption: FB–@SYL2A processes in the middle of the sampling time (in front of all transmit blocks).



Normally the transmit blocks are always enabled (SOK=1). If the FB–@SYL2A is processed before expiry of the SYNC (see right-hand side of diagram) due to time fluctuations, then the transmit data is not updated and the values from the previous sampling time transferred. The Sync cycle and the consistency are not affected by this.

Further notes for good SYNC functionality:

In addition to a small Sync cycle, minimizing jitter (time fluctuations) in the Snyc cycle are necessary. The following precautions support this:

- Irregular data traffic on the DP bus should be avoided: Single Master operation; no temporary additional stations.
- No interrupt tasks should be configured on the same SIMADYN processor. The sampling time must never overlap; this would cause a failure of a SYNC command or a shifting of the complete sampling time.
- Configure a high baud rate and a short telegram length (the jitter also contains the time for polling a Slave).
- Configure the FB–@SYL2A and all allocation transmit blocks in T1 = T0 (basic sampling time). The SYNC command is then activated with the basic clock interrupt. This is a more accurate activation than an interrupt in system mode.

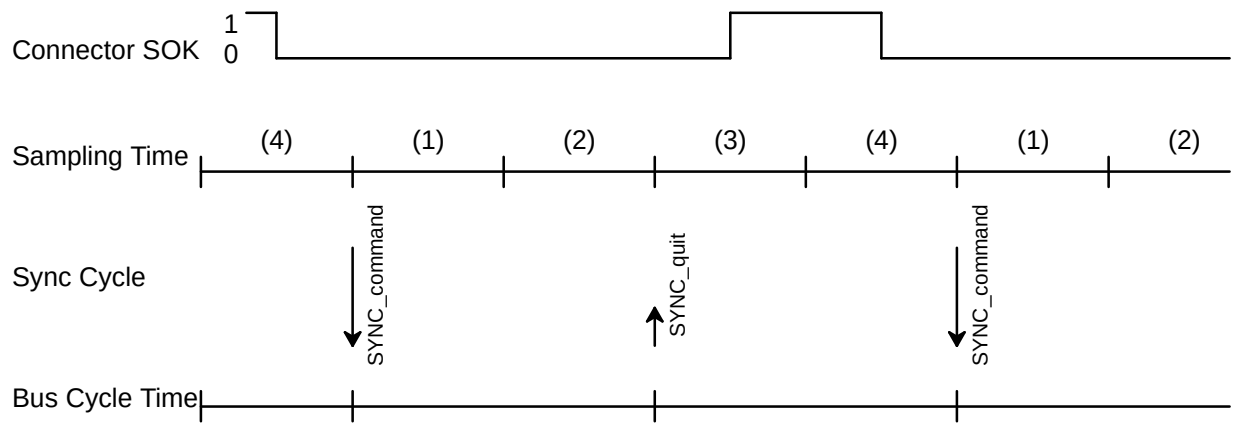
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Configuring Version 3: (For infrequently expected applications of FREEZE).
Generating SYNC and FREEZE or only FREEZE commands. The consistency over all Slaves is guaranteed. The Sync cycle is at least three times at large as the sampling time (CNX>1).

- The length of the transmit or receive telegrams (outputs or inputs) for each Slave may not be larger than 28 byte.
- Configure all transmit and receive blocks as well as the FB–@SYL2A in the same sampling time (on the same processor).
- The FB–@SYL2A must be configured as the last function block in the chronological processing sequence.
- The connector SOK of the FB–@SYL2A must be connected to the enable connectors of all transmit and receive blocks (belonging to the Slave group).
- The bus cycle time must be shorter than the Sync cycle minus 2 x sampling time. Check during run time, whether the connector SOK has one transition to "1" in each Sync cycle, otherwise increase the Sync cycle.

(This version is not suitable for P16 processor modules, since the receive blocks possess no enable connector).

Example: Sync cycle = 4 x sampling time, bus cycle time = 2 x sampling time
Assumption: FB–@SYL2A processes in the middle of the sampling time (after all receive and transmit blocks)



The transmit and receive blocks are disabled (SOK = 0) for three sampling periods (one bus cycle time period + 1 sampling period) after activation of the SYNC command. The transmit and receive blocks are enabled (SOK = 1) during the fourth sampling period following the activation of the SYNC command.

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7.2.4 Diagnostics Function Block

Master or Slave specific diagnostics from the SS52 module can be output with the aid of this function block **DIAL2A**.

The diagnostics data to be output is selected with the SEL connector. They are output at the connectors D01 to D08.

An overview of the significance of the diagnostics data is shown below. Further information can be reviewed in the COM ET200 documentation or the documentation of the individual Slave.

SEL=0: No Diagnostics

The block does not output valid diagnostics data.

SEL=126: System Diagnostics

The system diagnostics shows an overview of which Slave has reported diagnostics. The 8 words are bit coded and each bit is allocated a Slave with its station number corresponding to the following table. If the bit for the allocated Slave is set, then the Slave has reported diagnostics.

Connector	Bit 16	Bit 15	Bit 14	...	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1
D01	15	14	13	...	4	3	(2)	(1)	(0)
D02	31	30	29		20	19	18	17	16
...	...								...
D07	111	110	109		100	99	98	97	96
D08	–	–	(125)	...	116	115	114	113	112

Table: Allocation of System Diagnostics/Data Transfer List to Slave Station Numbers.

SEL=127: Data Transfer List

The data transfer list shows an overview of with which Slave data transfers have occurred within a configured time (COM ET200). The 8 words are bit coded, as with the system diagnostics. If the bit for the allocated Slave has been set, then a data transfer has occurred.

SEL=128: Master Status

Output of Master specific information . The low byte on D01 is relevant for the user; the significance of the other connectors is documented but not explained in detail):

Connector		Significance
D01	low Byte	Status of the DP–Master: Stop (40h), Clear (80h), Operate (C0h)
	high Byte	Ident No. SS52 (high Byte) = 80h
D02	low	Ident No. SS52 (low Byte) = 37h
	high	(don t care)
D03...D08		

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SEL = 3 ... 123: Slave Diagnostics

Output of Slave diagnostics. The SEL specification corresponds to the Slave station number. The diagnostics data are dependent upon the type of Slave. The first 16 byte of the Slave diagnostics are output. Further Slave diagnostics data can be output with SEL>1000.

The Slave specific diagnostics cannot be completely described at this point. Therefore only an overview will be shown. Further information can be reviewed in the COM ET200 and device documentation.

The following table shows an overview of the diagnostic data layout of SIEMENS DP Slaves:

<table>
<tr><td colspan="2">Slave Type
Connector</td><td>SPC Slave General</td><td>ET 200U</td><td>ET 200B</td><td>ET 200K</td><td>SPM Slave</td><td>ET 200C 8DE/8DA</td><td>DP Standard Slaves</td><td></td></tr>
<tr><td rowspan="2">D01</td><td>low</td><td colspan="8">Status 1</td><td rowspan="6">Diagnos-tics according to Standard 6 Byte</td></tr>
<tr><td>high</td><td colspan="8">Status 2</td></tr>
<tr><td rowspan="2">D02</td><td>low</td><td colspan="8">Status 3</td></tr>
<tr><td>high</td><td colspan="8">Master Station Number</td></tr>
<tr><td rowspan="2">D03</td><td>low</td><td colspan="8">Ident. Number High Byte</td></tr>
<tr><td>high</td><td colspan="8">Ident. Number Low Byte</td></tr>
<tr><td rowspan="2">D04</td><td>low</td><td colspan="7">Header Device Related Diagnostics</td><td></td><td rowspan="12">Device Specific Diagnos-tics</td></tr>
<tr><td>high</td><td colspan="2">Device Diagnostics U</td><td>Device Diag. B</td><td>0</td><td>0</td><td>0</td><td></td></tr>
<tr><td rowspan="2">D05</td><td>low</td><td colspan="2">Header ID Related Diagnostics</td><td>0</td><td>0</td><td>0</td><td>0</td><td></td></tr>
<tr><td>high</td><td colspan="2">BG 7–0</td><td>0</td><td colspan="3">Channel 7–0</td><td></td></tr>
<tr><td rowspan="2">D06</td><td>low</td><td colspan="2">BG 15–8</td><td>0</td><td colspan="2">Channel 15–8</td><td>0</td><td></td></tr>
<tr><td>high</td><td colspan="2">BG 23–16</td><td>0</td><td colspan="2">Channel 23–16</td><td>0</td><td></td></tr>
<tr><td rowspan="2">D07</td><td>low</td><td colspan="2">BG 31–24</td><td>0</td><td colspan="2">Channel 31–24</td><td>0</td><td></td></tr>
<tr><td>high</td><td colspan="2" rowspan="3">Further Device Specific Diagnos-tics</td><td colspan="5">don t care</td><td></td></tr>
<tr><td>D08</td><td>low</td><td colspan="5">don t care</td><td></td></tr>
<tr><td></td><td>high</td><td colspan="5">don t care</td><td></td></tr>
</table>

The significance of the data is detailed in the following.

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Significance of the individual bits from Status 1 ... Status 3:

	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1
Status 1 (D01 low Byte)	S: Slave Parameters set by another Master	S: Last Parameter Telegram was Faulty	M: Slave Reply Faulty	S: Requested Function not Supported	S: Diagnostics Entry in Specific Diagnostic Area	S: Configuration Data does not match	S: Slave not yet ready for Data Exchange	M: Slave cannot be accessed on Bus
Status 2 (D01 high Byte)	M: Slave Entered as 'Not Active ''	(Not Utilized)	S: Slave Contained Sync Command	S: Slave has Received Freeze Command	S: Access Monitoring Activated	S: 1 (fixed)	S: Diagnostic Data must be fetched	S: Parameter setting and configuring necessary
Status 3 (D02 low Byte)	S/M: Not all Diagnostics Data can be transferred	–	–	–	–	–	–	–

M: Master detects diagnostics, S: Slave detects diagnostics.

Master Station Number:
Station number of the Master, that has set this Slave's parameters. This value is FFh when the Slave's parameters have not been set.

Ident. Number High/Low Byte:
Code for identifying the Slave type.

All further diagnostics data are Slave specific. In general, the diagnostics block follow (DP standard Slave): device related, ID related and channel related diagnostics. Not all Slave specific diagnostic blocks must be present. Each block contains a header byte.

Bit 8 and Bit 7 of the header byte identify the diagnostic block:
Bit 8, 7 = 00: Device related diagnostics
Bit 8, 7 = 01: ID related diagnostics
Bit 8, 7 = 10: Channel related diagnostics

Bit 6 to Bit 1 determine
- For devices and ID related diagnostics; the length of the diagnostics block including header byte, value range 2..63;
- For channel related diagnostics, the ID number, value range 0..63.

Output of Further Slave Diagnostics

When SEL=1002 to SEL=1123, then the Slaves diagnostic bytes 17 to 32 are output.

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7.3 Configuring with COM ET200

The configuring requires the utilization of COM ET200 for Windows, from Version 2.0. SS52 specific type files are supplied starting from Version 2.1. If Version 2.0 is being utilized, then SS52 specific type files must be additionally installed.

COM ET200 will help you define

- the number of users connected to the bus system PROFIBUS DP,
- its configuration,
- the baud rate and
- other important parameters required for operating the PROFIBUS DP bus system.

SS52 Specific Remarks to COM ET200:

- Configure the SS52 module as a SIMDAYN D SS52 station type.
- Do not specify input and output addresses.
- Download the data base, under the menu item "File ->Export->DP Master ", to the SS52 via the DP bus after completion of the configuring.

Ensure the following when using **CS51/CS61 Slaves**:

- Alternatively configure the CS51/CS61 Slaves as ET200U (as previously for COM ET200 V4.x). Family: ET200U; Station type: ET200U (6ES5 318-8MB11)
- Enter the following ID's during configuring, dependent upon the PPO type:

PPO Type:	1	2	3	4
ID:	223 221	223 223 221	221	223 221

Matching with STRUC Configuring:

The allocation of the Slaves is carried out via the station number (address stage 1). The length of the input (receive) and output (transmit) data per Slave is checked for a match.

SS52 as Slave

A data base must be created with COM ET200 and downloaded, even when the SS52 module is only operated as a Slave. If the corresponding Master (SS52, IM308-C, AG95) is also configured with COM ET200 (Windows), then the data base for the SS52 Slave is automatically created.

If the Master is configured with another tool, then the SS52 Slave configuring requires the creation of a fictitious Master in COM ET200 (Windows). Care must be taken to create the correct set-up for the bus parameters: we recommend the increase in the number of active stations or the token rotation time in both configuring tools.

When the SS52 module is only operated as a Slave, it still responds on the DP bus as an active user (token exchange).

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7.4 Commissioning / Diagnostics

7.4.1 Light Emitting Diodes

As opposed to other CS7 sub–modules, the SS52 module does indicate direct bus activity at the yellow LED.

The green LED indicates information in general about the SS52 module and concerning the synchronization with the SIMADYN FB–@CSL2A. The yellow LED shows information regarding the DP bus and the COM data base. The significance of the LED's is shown in detail in the following table.

	Green	Yellow
Off	Processor not running	No Bus Activity (during start-up).
Flashing Rapidly (0.2 s)	Grave Error. –> Error Class and Code to be extracted from FB–@CSL2A and inform Siemens AG.	Error on Bus (i.e. short circuit). –> Check cable and other bus users.
Flashing (1 s)	Wait for Synchronization with SIMADYN Processor Module. –> Check Configuring FB–@CSL2A.	COM data base does not exist or not activated (also during download). –> load data base.
Flashing Slowly (2 s)	–	STRUC and COM configuring do not match 100%. Restricted bus activity possible. –> Match STRUC and COM configuring.
On	SS52 Module and Synchronization with SIMADYN Processors OK.	Bus activity and activated COM data base OK.

Response during **Start-up**:

Both diodes are briefly switched on and off after power up. Only the green LED will be illuminated during the start-up period (approximately 5 seconds). The yellow LED will also be illuminated after successful completion (OK) of the start-up period.

Both LED's will initially retain their last status, following a reset, until the software reaccesses these LED's.

Response during **Download**:

The yellow LED flashes during download (the processes is very short for high baud rates). Subsequently the response is as during start-up.

The LED's give **no** information about whether all Slaves are available on the bus and the correct parameters have been set. If the data exchange with a Slave is not OK, then this is indicated by a 'Break" ID at the corresponding function block. Information regarding the current status of individual Slaves can be received from the DP diagnostics function block DIAL2A.

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7.4.2 **Error Class and Error Code**

Significance of the connectors ECL (Error Class) and ECO (Error Code) at the FB–@CSL2A.

A warning has been issued when the Error Class = 0. The warning can be partially resolved, without a reset, by SIMADYN. When several current warnings have occurred, then the lowest number is indicated.
An error has occurred when Error Class > 0. The FB–@CSL2A generates a communication error (flashing "C").
The SIMADYN rack must be reset after resolving the error.

Error Class	Error Code	Significance
0 (Warning)	0	O.K.
	1	COM data base exists, but not activated, since baud rate and station number do not match the connectors BDR and MAA. => Baud rate and station number must be matched in the STRUC and COM configuring.
	2	No COM data base exists. => Load data base.
	3	Download of the COM data base with subsequent start-up is in progress.
	4	Channels, to be configured with STRUC, to the DP users already configured in COM data base are missing. This status can also occur temporarily after a SIMADYN start-up. The DP users will not be accessed. => Match the STRUC and COM configuring.
	5	(Not utilized).
	6	At least one STRUC configured channel exists that does not match the COM data base. The corresponding SIMADYN FB has generated a communication error (flashing "C"). => Match the STRUC and COM configuring.
	7	At least one STRUC configured channel exists that does not fit in principle to the SS52 module. The corresponding SIMADYN FB has generated a communication error (flashing "C"). => Correct STRUC configuring.
	8	Resources bottleneck. Not all STRUC channels will be processed. => Reduce STRUC configuring (communication channels).
	9	Two channels exist, that transmit to or wish to receive from the same Slave. The SIMADYN–FB allocated to the channel that attempted to connect at a later timepoint has generated a communication error (flashing "C"). => Correct STRUC configuring.
	10	Bus activity temporarily faulty. => Check cable and bus users.
> 1 (Internal Error)	(Irrelevant)	=> Note Error Class and Error Code and inform Siemens AG.

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7.5 Transition from SS51 to SS52

The SS52 module has an identical external layout to the SS51 module. It utilizes one slot in a CS7 board.

The STRUC configuring must be modified as follows:

Configure an SS52 communication sub-module instead of the SS51 in the Master program.

Configure a central block @CSL2A instead of the central block @CSL2D. Additional specifications for the baud rate and station number must be made. The connector for the DEXDO reorganization can be omitted.

The layout of the address connectors at the communication blocks has essentially remained the same. The channel name and address stage 1 (station number) can be utilized in unmodified form. The address stage 2 must be modified: instead of the digits "1" to "4" for the drive PPO types, specify a common "1" for all drive devices independent of the PPO type.

COM Configuring:

The COM ET200 configuring is implemented with the COM ET200 (Windows). The downloading of the data base is implemented as with the SS51 via the DP bus. A SS51 data base cannot be utilized !

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