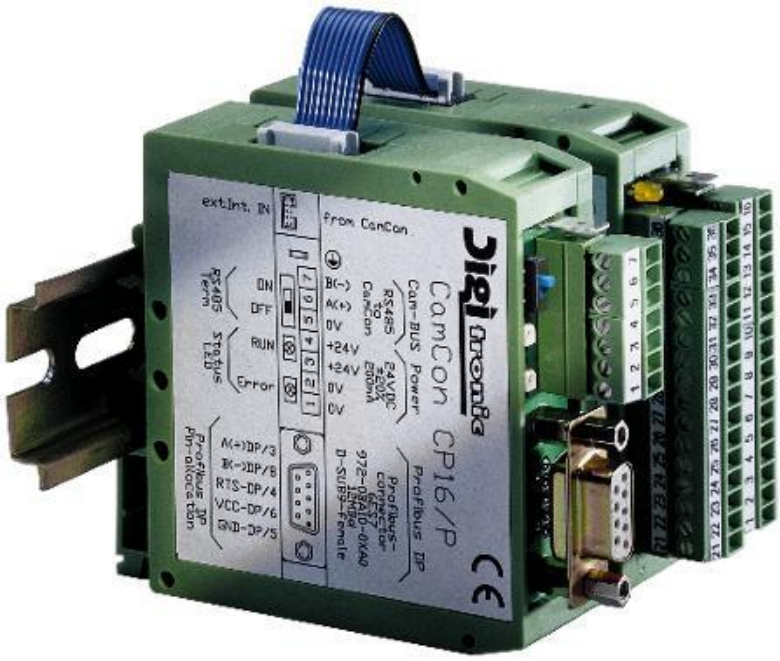
## Profibus DP Interface

# CamCon CP16/P/IO

Version with high speed in- and output





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**For your attention**

This instruction manual relates to the CamCon CP16/P/IO from 10.7.1998 and the CamCon software DC50.34 from 18.8.1999 and the S7 software CP16_V131.ARJ. The company Digitronic Automationsanlagen GmbH reserves the right to make changes which present an improvement of the quality or functionality of the device without prior notice. The instruction manual was created with great care, although it may not be error-proof. We would be grateful for any communication relating to any errors you may have found.

**Update**
You can also obtain this instruction manual on the Internet at **http://www.digitronic.com** in the latest version as PDF file.

**Qualified personnel**
This device may only be started and operated by qualified staff. By qualified we mean personnel who are entitled to handle, to earth and to lable devices, systems and power circuits in accordance with the technology safety standards.

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(2) The above mentioned limits to liability do not apply to insurance of named characteristics and damages which were caused deliberately or through negligence.

**Protection**


**Note:** CamCon is a registered trademark of the company Firma Digitronic Automationsanlagen GmbH.

**Note:** The devices of the CamCon series comply with norms: DIN EN 61000-6-2, DIN EN 61000-4-2, DIN EN 61000-4-4, DIN EN 61000-4-5, DIN EN 61000-4-8 and DIN EN 55011 and RoHS 2 (2011/65/EU)..



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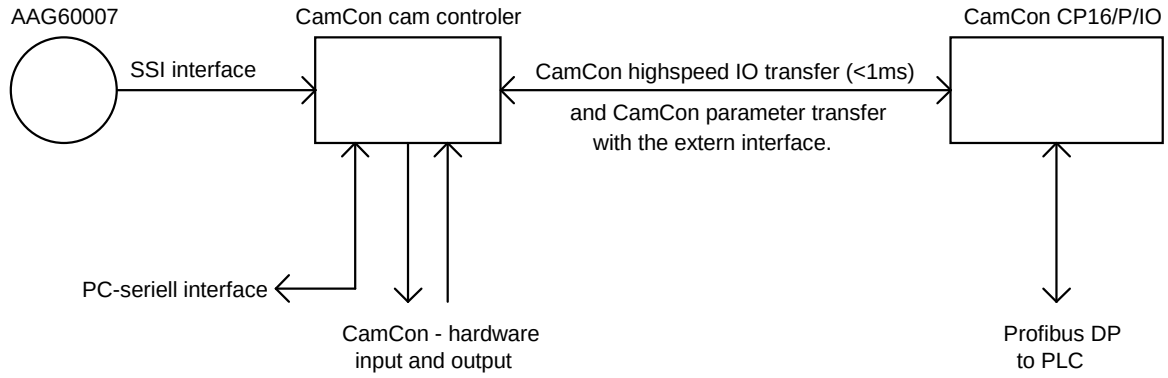
## 1. Introduction

The CamCon CP16/P/IO offers the advantage of cost reduction for wiring, service and commissioning, as well as a better flexibility with the number of in- or outputs, through its link to the field bus system Profibus DP according to DIN 19245 Part 3. First of all, the CamCon CP16/P/IO is a communication processor for the electronic cam controllers of the CamCon series. It makes the in- and output data of a CamCon available for a Profibus DP Master (PLC), with the high transmission speed of the CamCon units. Also, the CamCon cam controller can be programmed through function components in the PLC.

**Please note:** The CamCon CP16/P/IO can only be connected to CamCon cam controllers with an optional external interface. You need to specify the "***X***" for "external interface" in the ordering number of your CamCon. The only exception is the CamCon DC90, which is always equipped with the external interface. Example: DC16S3020***X*** or DC51S3E140***X***2S.




### 1.1. Features

The following features distinguish the CamCon CP16/P/IO module:

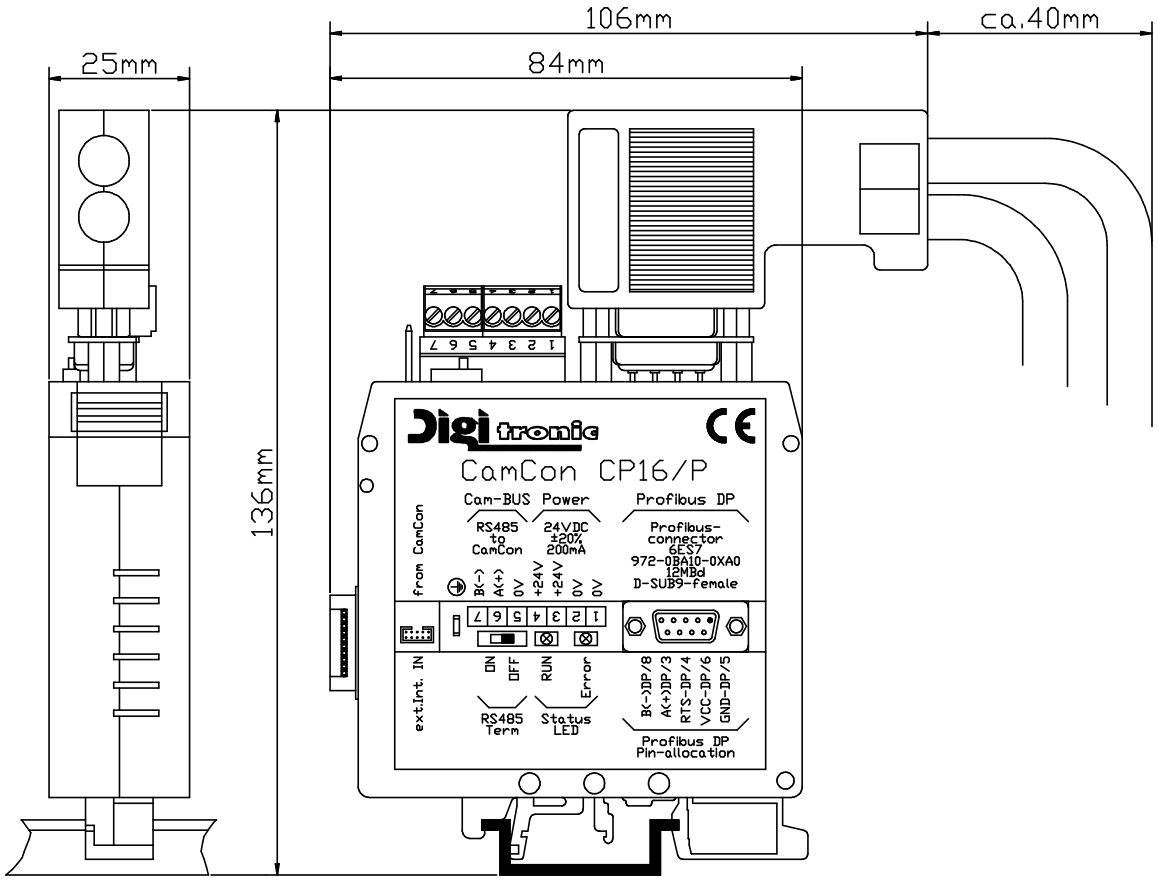
* can be connected to all PLC controls with the Profibus DP interface
* small cycle time in the PLC control
* high transmission speed of the in- and outputsthrough the external interface of the CamCon
* no wiring effort and surplus costs for the extension of the number of outputs of the CamCon up to 200 I/O
* function components for programming are available for S5 and S7
* supported functions: read status, block outputs of the CamCon, program selection, program cams, read cams, program dead times, read dead times, program parameters and read parameters.
* standard Profibus DP interface SPC 3 ASIC from Siemens and full galv. separation from the supply voltage.

## 2. Assembly

example

The device is clip-locked onto an "EN carrier rail" in the switchboard (see also chapter "3. Dimensions" on page 6). The grounding pins and cable mantlings are to be put on the shortest way possible onto serial grounding clip next to the device. The grounded assembly plate and its electrical connection to the "EN carrier rail" allow an excelent grounding of the disturbances onto the covering. All cable connections are to be switched in a cold state ! The external interface of the CamCon (e.g. DC16/50/90 or DC115) is connected with a cable of the type: KKyy/IO-XX (yy = CamCon Type / XX = length in meters) to the plug **"external interface IN"** or **"ext.Int. IN"** on the module. The data lines of the external interface have to be galvanically separated with an optical coupler, they have to be placed and covered separately and the cover has to be grounded on both ends. Analog signals have to be placed and covered separately and the cover has to be grounded on one end. The supply voltage has to be connected separatly for every module and measures 24V DC +/-20%.

## 3. Dimensions



## 4. Electronic connections

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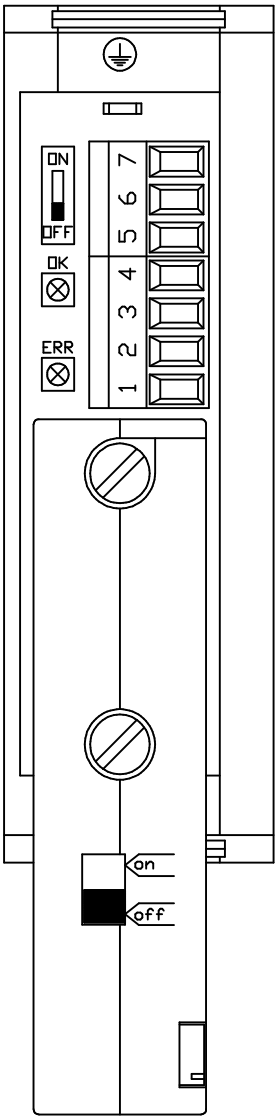


### 4.1. Pin allocation

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#### 4.1.1. Pin allocation of the voltage supply

Pin 1: 0V voltage supply
Pin 2: 0V voltage supply
Pin 3: +24V voltage supply
Pin 4: +24V voltage supply

**Note:** 0V pins 1, 2 and 5 are interconnected.
+24VDC pins 3 and 4 are interconnected.

#### 4.1.2. Pin allocation of the RS485 CamBus interface

Pin 5: 0V for RS485 interface
Pin 6: A (+) signal of the RS485 interface
Pin 7: B (-) signal of the RS485 interface

#### 4.1.3. Pin allocation Profibus DP

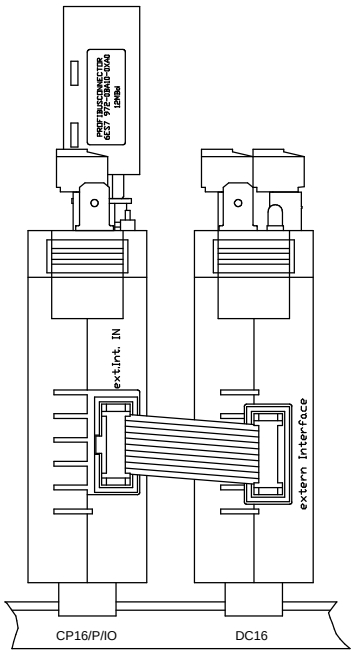
Pin 1,2,7,9: not allocated.
Pin 3: B(-)
Pin 8: A(+)
Pin 4: RTS
Pin 5: GND
Pin 6: VCC

### 4.2. External interface

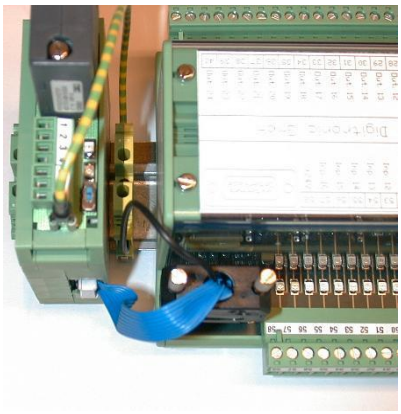
The data exchange with the CamCon is made through the external interface. The CamCon CP16/P/IO module is equipped with a 10 pol. plug, the **"ext.Int.IN"** connection. The data exchange with the CamCon cam controller is realized with this plug. The data exchange is made free of potential over optical couplers. For the connection of the CamCon CP16/P/IO module to a CamCon DC16, an about 4.5 cm long 10 pol. flat cable is included with the CP16/P/IO.

#### 4.2.1. Pin allocation of the external interface IN

Pin 1,10: not allocated
Pin 4,7: mass (0V)
Pin 2: RxD -
Pin 3: RxD +
Pin 5: CLK -
Pin 6: CLK +
Pin 8: TxD -
Pin 9: TxD +



### 4.2.2. CamCon CP16/P/IO at CamCon DC40,DC51 or DC90



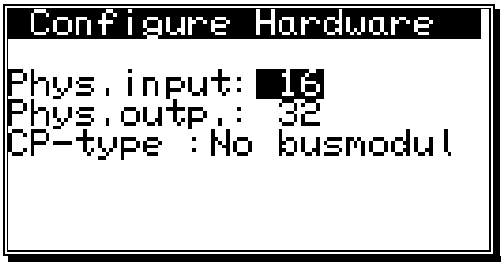
If you want to connect the CamCon CP16/P/IO module to a CamCon DC40, DC51 or DC90, you require an adapter cable (KK/EXT/IN-0.05) from 10 pol. flat cable to a 9 pol. DSUB plug (see picture to the right). For extending this connection cable for a CamCon DC40 or DC51, use a mantled 6 pol. data cable with pairwise wired conductors (e.g. KK91/IO-01). The cover of the cables has to be grounded at both ends.

## 5. Commissioning

Before the first activation, please check the wiring of the device. Please see chapter "4. Electronic connections" on page 7. For the configuration, please note the subchapter "Hardware configuration" in chapter "Unit configuration" in the handbook of your cam controller.

### 5.1. Configure CamCon cam controller for the connection of the CamCon CP16/P/IO

Please select the submenu "Hardware config." in the menu "Unit configuration":



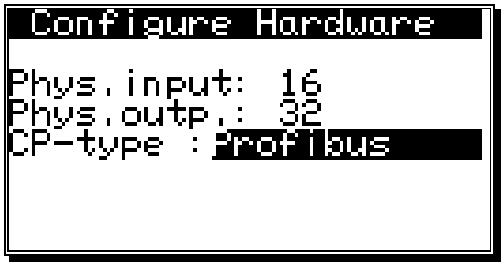

Please enter the number of physical in- and outputs.
For a CamCon DC90, it would be 16 inputs and 24 outputs or 8 inputs and 16 outputs for a CamCon DC16.

**Note:** For a CamCon DC16 with impulse emmitter input (option "DC16/J.."), the number of inputs has to be increased by 16.

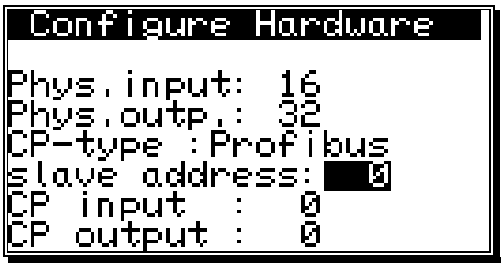
When these two values are emtered, the red LED on the CP16/P/IO module should only blink one time ( = no contact to the Profibus).

**Note:** If the Profibus has already been set up and the DP - address of the CP16/P/IO is correct, the green LED should be on continuously.

Change the CP type to **"Profibus"** using the ▶ key and then press the CR key.




Now you can enter the desired Profibus DP address and confirm it with the CR key.




However, this address will only become active after switching off and reactivating the voltage supply of the CP16/P/IO.

In addition to the (physical) in- and outputs of the CamCon, the CP16/P/IO module can simulate in- and outputs, that can then be evaluated or controlled by the PLC.

**Attention:** The simulated, and by the PLC controlled inputs may not be directly read in the cam controller and the PLC Logic Module, because they are not defined until an error-free communication between the CamCon CP16/P/IO and the CamCon cam controller has been established. Herefore, the inputs need to be AND - linked to the special input 5 of the PLC Logic - Module. That input is set to 1 upon a successful communication with theh CP16/P/IO.

## 5.2. Profibus DP Master (PLC) projecting to the connection of the CP16/P/IO

### 5.2.1. Profibus DP Master S5

First copy the file CP16005E.GSD from the included disc into the GSD folder of your COM - PROFIBUS software. Then you start your COM - PROFIBUS software and read in the GSD files again. Open your to-be-projected master system and add a new DP Slave from category "Other". Enter the desired Slave address and then select the station type: CamCon CP16. Note the station number of the CP16 for a later entry in the parameter "S_BI" and the DP - address for the parameter "S_NR" at the execution of the FB180.

The CamCon CP16/P/IO module is a modular DP - Slave and created with the insertion of into the Profibus master system of the S5 without in- or outputs modules. Click on "Configuration" to open the module table.

If you have to program a CamCon cam controller via the S5 over the CamCon CP16/P/IO (cam values and dead times), you **have to** first insert the "Communication" module of the CP16/P/IO into the slot 0. Herefore, click on the field for slot 0 and select the "Communication" module from the "Order No.". The module consists of 16 byte consistent in- and output data, that you have to put on the periphery area of the PLC in columns "E-Adr." and "A-Adr.". Please look in the handbook of your S5 CPU for the HEX periphery addresses of the in- and outputs of this area. Write them down, for a later entry in the parameters "CPAS" and "CPAE" for operation FB188 in the OB21 of the S5 software.

See chapter "5.2.3. Modular CP16 construction" on page 10.

### 5.2.2. Profibus DP Master S7

First copy the file CP16005E.GSD from the included disc into the GSD folder of your S7 software. Then start your S7 software and open your desired project. Here you open the folder hardware and refresh the GSD files in the menu point "Options". Open the menu "PROFIBUS-DP" in the hardware catalog. Here you open the submenu point "Further FIELD DEVICES" and then the menu point "Other". Now add the CamCon CP16/P module into your Profibus master system and specify the DP - Slave address. Open the Slave by doubleclicking the DP address of the Slave and note the diagnosis address for a later entry in the OB82 and in the parameter "DIAGADR" at the execution of the FC41.

The CamCon CP16/P/IO module is a modular DP - Slave and is created at the insertion into the Profibus master system of the S7 without in- or output modules. Click on the plus sign of the CamCon CP16/P to open the module catalog.

If you need to program a CamCon cam controller via the S7 over the CamCon CP16/P/IO (cam values and dead times), you **have to** first insert the "Communication" module (specification 8AX) of the CP16/P/IO from the hardware catalog. The "Communication" module consists of 16 byte consistent in - and output data, that should be on an IO area from 256 on. It is important that in- and output address always have to be the same. Note this address for a later entry in the parameter "DP_ADR" at the execution of FB41 in the OB100 and OB1 of the S7 software.

See also chapter "5.2.3. Modular CP16 construction" on page 10.

### 5.2.3. Modular CP16 construction

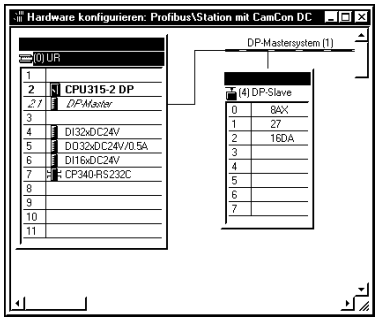
The CamCon CP16/P/IO module can make make the in- and output signals of a CamCon cam controller available to the PLC as input or make the outputs of the PLC available to the CamCon as inputs via the "external interface". Herefore, you need to insert the modules with 8, 16, 24 or 32 High-Speed I/O into the CamCon CP16 Slave Table from the "hardware catalog" of the S7 software or "ordering number" of the COM - PROFIBUS software. To these, you then allocate a free in- and output address in the PLC. You can insert up to 25 I/O bytes into the Slave Table. The number of projected PLC inputs (= outputs of CamCon) should correspond with the sum of physical outputs = "Phys. outp." and the CP16 outputs "CP16 outp." in the CamCon menu "Hardware config". The first input bit of the PLC from the module table later corresponds with output 1 of the CamCon cam controller.

The output number of the PLC (= inputs CamCon) corresponds with the number of the specified CP16 inputs "CP16 inputs" from the menu "Hardware config.". The first output bit of the PLC from the module table corresponds with the later first input of the CamCon cam controller after the physical inputs. The physical inputs cannot be The physical inputs cannot be reached through the CamCon CP16/P/IO. With a CamCon DC16 with 8 inputs e.g. the first PLC output bit is on input 9 at the DC16.

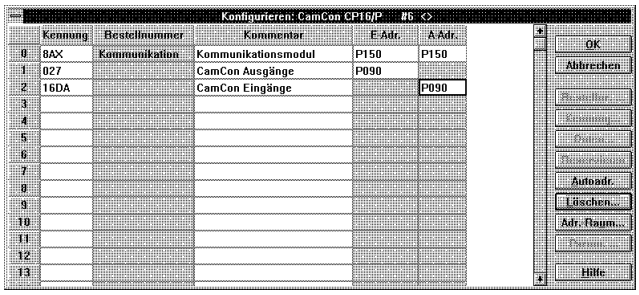
See also chapter "5.1. Configure CamCon cam controller for the connection of the CamCon CP16/P/IO" on page 8.

**Note:** The predefined modules in the "hardware catalog" or in the "ordering number" always define an eqaul amount of in- and outputs, however, it is possible to achieve a flexible adjustment of the in- and outputs of the PLC by inserting a "universal" module.

Example for the modular structure of the CP16:

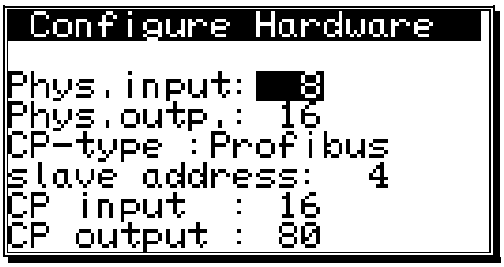



To the left you see an example for a CPU315-2 DP and a CamCon CP16/P/IO. The CP16 has a communication - module (8AX), an input - module (27) with 96 inputs and an output - module (16DA) with 16 outputs.




To the right you see an example from an S5 DP - Mastersystem for a CamCon CP16/P/IO. This CP16 also has a communication - module (8AX), an input - module (027) with 96 inputs and an output - module (16DA) with 16 outputs.

For the example displayed above, the menu "hardware config." of a CamCon DC16 cam controller has to be set in the following way:



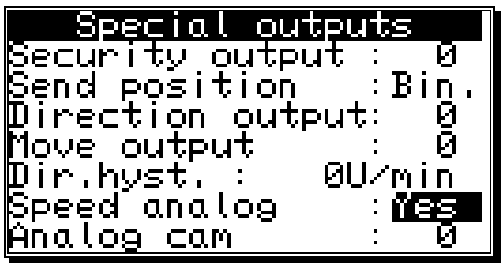

The cam controller has a total of 16 + 80 = 96 outputs and 8 + 16 = 24 inputs. The outputs 17 - 80 and the inputs 9 - 24 are simulated by the CamCon CP16, that is connected to the CamCon DC16 via the external interface.

### 5.2.3.1. High speed actual position and speed value transmission

The CamCon cam controller has the ability to make the actual position and the speed value available to the PLC via the CamCon CP16/P/IO.

**Note:** The integrated analog outputs have to be deactivated.

Herefore, first set the actual position output to "Bin." and the speed to "Ja" in the sub-menu "special outputs" of the menu "system setting" of your CamCon cam controller.



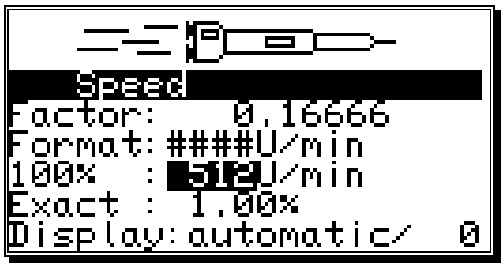

Now insert a 16Bit wide input module (1x16Bit speed and 1x16Bit act. pos.) at the end of each module table and determine the input numbers.

The cam controller now sends the speed and actual position value directly as an input value to the PLC via the CP16.

Before they can be used by the PLC program, the transmitted values have to rotated byte-by-byte, because High - and Lowbyte are switched. You also need to extract the scaling of the speed value, becuase it is transmitted as a 15Bit value, including the algebraic sign.

**Note:** See also the network 5 from OB1 in the S7 - or the FB21 in the S5 example software.

The scaling of the speed value is determined through the 100% input in the menu "system setting" in the sub-menu "speed". This value is recalculated into a 15Bit value by the CamCon cam controller. I.e., with a rotation of 512 rot/min, you get a value of 32768, that has to be recalculated by the PLC through division. To be able to calculate the speed value through simple shifting operations, the input should be made only in binary steps.




**Example:** With a 100% value of 512 rot/min you need to divide through 64, which corresponds to a shifting operation of SRW 6.

| 100% | Divisor | | Shifting value |
|---|---|---|---|
| 32 | / 1024 | = | 10 |
| 64 | / 512 | = | 9 |
| 128 | / 256 | = | 8 |
| 256 | / 128 | = | 7 |
| 512 | / 64 | = | 6 |
| 1024 | / 32 | = | 5 |

## 6. Messages of the status LED´s

The CamCon CP16/P/IO module has two status - LED:

| | | |
|---|---|---|
| Both LED: | dark: | The is no supply voltage. |
| LED Red: | blinks 1 time: | Currently no contact to the Profibus. |
| Cause: | | The Profibus DP Slave Address of the CP16/P/IO is not correct. The CP16/P/IO was not entered in the projecting software of the PLC. |
| LED Red: | blinks 2 times: | Currently no data exchangethrough the CamCon. |
| Cause: | | The cable length set at the CamCon overshoots the valid size of 300 meters or goes below the border of 30m, the CamCon is deactivated, or the data exchange is disrupted (e.g. cable broke at the external interface). |
| LED Green: | blinks 1 time: | Currently no programming of the CamCon possible via PLC CPU. |
| Cause: | | The CamCon parameters of the CP configuration are wrong.<br>The communication - module (8AX) is not in the first place on the modul definition (see chapter "5.2.3. Modular CP16 construction" on page 10).<br>The software of the CamCon does not yet support the CP16/P/IO module (from software: 9/98). |
| LED Green: | illuminates: | Status OK |

## 7. Technical Data

| | |
|---|---|
| Display | two status LED, red and green. |
| Number of interfaces | 3. |
| **1. Interface** | Profibus DP after DIN 19245 part 3. |
| Length of the cable: between CamCon CP16/P/IO and DP Master | after Profibus DP Norm. |
| Baudrate of the Profibus DP interface | 9600Baud up to 12MBaud. |
| Slave address setting | through CamCon cam controller. |
| **2. Interface** | RS485 for Digitronic CAMBUS protocol. |
| Length of the cable: between CamCon and CamCon CP16/P/IO | max. 1000m. |
| **3. Interface** | External interface for programming programming and for a fast in- and output transmission to the CamCon cam controller. |
| Length of the cable: between CamCon and CamCon CP16/P/IO | max. 2m with 6pol. round + cover and<br>max. 5cm with 10pol. flat band. |
| Supply voltage | 24VDC ±20 %. |
| Current absorbion | about 150mA. |
| Connectors for: | |
| Voltage supply | via 4pol. plug-screw pins IP20. |
| 1. Profibus DP | via 9 pol. D-SUB slot plugr (ordering no. Siemens = 6ES7 972-0BA10-0XA0). |
| 2. RS485 CAMBUS protocol | via 3pol. plug-screw pins IP20. |
| 3. Fast in- and output transmission | 10 pol. flat band. |
| Assembly | comfortable snap-on assembly on carrier rail according to EN 50 022, close sequential ordering with 10mm air space. |
| Disassembly | by pulling back the snap lock. |
| Dimensions | see chapter3. Dimensions on page6. |
| Cover type | cover corresponds with IP20. |
| Operating temperature | 0°C ... + 50° C |
| Weight | about 150g |

## 8. S5 95U program

Neccessary components or networks for the operation of the software:

| | | |
|---|---|---|
| FB180 | main program. | |
| FB181 | diagnosis evaluation (only for 95U) | (sub-program of FB180). |
| FB182 | evaluation of received data | (sub-program of FB180). |
| FB183 | construction of to-be-sent data | (sub-program of FB180). |
| FB184 | control and lock of the commands | (sub-program of FB180). |
| FB185 | send the data to the CP16 via the Profibus | (sub-program of FB180). |
| FB186 | receive the data from the CP16 via the Profibus | (sub-program of FB180). |
| FB187 | initialization of the CP16 | (sub-program of FB180). |
| FB188 | initialization of the S5 software | (execution through OB21). |
| FB230 | read diagnosis data (only for 95U) | (sub-program of FB181). |
| DBxx | DB for cam data (256 data words, for 64 outputs with 1 cam each). | |
| OB1 | for execution of the FB180 with parameters. | |
| OB31 | new start for Profibus DP error (only BE). | |

### 8.1. Used variables

A total of 6 register bytes (MB100 to MB105) in FB180 and its sub-program are used. These are stored in the data component at the execution of FB180 and are restored upon the end of the FB. This makes it possible to use these bytes for other functions, or if several CamCon CP16 modules are operating at one S5 betrieben, no additional registers are needed.
There are also the parameters at the execution of FB180, which can be adjusted to the requirements of the application. It currently uses the DB20, MB50, MB51 and the timer T0. The parameters S_NR and S_BI depend on the CPU and are currently only available for a 95U.

### 8.2. OB1

The OB1 serves for the execution of the FB180. The parameters ( registers, timers and data components ) of the FB180 can be adjusted to the requirements of the application, but the parameter DBNR of the FB188 in the OB21 also has to be changed. The rest of the commands in the OB1 are meant as example for testing the software and can be deleted or changed.

### 8.3. FB180 - main module

The FB180 is the main module of the software and has to be executed in cycles in the OB1. The communication to the cam controller is started automatically. If there are no pending commands, a status request (command 0x01) is sent to the CamCon and the data received from the CamCon are stored in the data DB. See also chapter "8.7. DBxx - data component for cam data" on page 16. The data words DW 81 and 82 are being sent to the CamCon at the same time as the status request; they are **AND** linked to the outputs of the CamCon cam controller (output deactivation) or are available as V - inputs, when the PLC Logic Module is active.

The read status information is evaluated by the FB184 component.

First check, if the an error was entered in the status byte (DW 78L) of the cam controller. If this is the case, an error reset (command 0x02) is sent automatically to the CamCon cam controller.

Afterwards the current program number (DW77) is compared to the desired program number (DW83). If they do not match, a program change (command 0x03) with the desired program number is sent. I.e., to change a program, it is sufficient to write the desired number in the data word 83.

Now it is checked, wether a command for cam or dead time programming should be triggered. This is controlled by setting the bits in the command byte (BEF parameter currently MB50). The data for the corresponding commands have to be entered into the data DB in advance. See herefor the following chapter. If the command was executed without an error, the command bit is reset through the FB180.

In the status byte (STAT parameter currently MB51) of the FB180, the status information of the communication and of the CamCon cam controller is stored. This will be evaluated by the application and, in case of an error, lead to a deactivation of the automatic of the machines and to an error message.

### 8.3.1. Parameters of the FB180

1. DATA = Number of the data component where the data is stored.
   The DB has to be created and be 256 words long.

2. BEF = Register byte where the commands (Bits) of the application have to be set (e.g. MB50). When a command is executed, this bit is reset. If a read command ends, the read cam or dead time values are in the DB.

   Bit 0.0 (read/write) = Program a cam.
   The data has to be in the DB.
   1. Program number (DW 89).
   2. Output number (DW 90L).
   3. Number of cams (DW 90R) (currently only 1 cam possible).
   4. Activation and deactivation point (starting at DW91).

   Bit 0.1 (read/write) = Program all cams.
   The data has to be in the DB.
   1. Control output number (DW 88L).
   2. Program number (DW 89).
   3. Number of cams (DW 90R) (currently only 1 cam possible).
   4. Activation and deactivation point (starting at DW91).

   Bit 0.2 (read/write) = Read a cam.
   The data has to be in the DB.
   1. Program number (DW 89).
   2. Output number (DW 90L).
   The read cam is in the DB from DW91 on.

   Bit 0.3 (read/write) = Read all cams.
   The data has to be in the DB.
   1. Control the output number (DW 88L).
   2. Program number (DW 89).
   The even read cam is in the DB from DW91 on.

   Bit 0.4 (read/write) = Program a dead time.
   The data has to be in the DB.
   1. Output number (DW 90L).
   2. Dead time value 0.1ms steps (starting at DW 224).

   Bit 0.5 (read/write) = Program all dead times.
   The data has to be in the DB.
   1. Control the output number (DW 88L).
   2. All dead time values in 0.1ms steps (starting at DW 224).

   Bit 0.6 (read/write) = Read a dead time.
   The data has to be in the DB.
   1. Output number (DW 90L).
   The read dead time is in the DB from DW 224 on.

Bit 0.7 (read/write) = Read all dead times.
The data has to be in the DB.
1. Control the output number (DW 88L).
The read dead times are in the DB from DW 224 on.

3. STAT = Register byte where the status of the CamCon CP16/P/IO and the CamCon are stored (e.g. MB51).

Bit 0.0 (write only) = If this bit of the status byte = 1, the entire communication is reset and a restart is tried.
Bit 0.1 (read only) = Command is still being implemented.
Bit 0.2 (read only) = Reserve.
Bit 0.3 (read only) = Reserve.
Bit 0.4 (read only) = Error during the transmission of a command
e.g. memory of the CamCon is full.
Bit 0.5 (read only) = CamCon displays position errorr 1,2,3,5 or output error.
Bit 0.6 (read only) = CP16 is connected and activated.
Bit 0.7 (read only) = A timeout occurred during the data trransmission. It will be tried to resend the command.

4. TIME = Number of a time that is used internally to determine timeouts (e.g. T 0).

5. S_NR = Participant number of the CP16 in the Profibus (only with 95U).

6. S_BI = Diagnosis bit in the diagnosis register of the CPU for the CP16 (only for 95U).

### 8.4. FB181, 182, 183, 184, 185, 186 and 187 - sub-program of FB180

These components are being executed by the FB180 and may not be executed by any other command.

### 8.5. FB188 - Initialization

Through the execution of this FB, the software is initialized with the corresponding parameters and the communication is reset.

#### 8.5.1. Parameters of the FB188

1. DBNR = Number of the data Components where the data is stored.
The DB has to be created and be 256 words long.
2. DB_A = Pointer address of the data DB.
For DB20 with S5 95U = 7E28,
For DB20 with S5 115 CPU 941 = E428.
3. CPAS = Physicali address of the CP16 transmission area.
For periphery address 128 with S5 95U = 5780,
For periphery address 128 with S5 115 CPU 941 = F080.
4. CPAE = Physical address of the CP16 reception area.
For periphery address 128 with S5 95U = 5700,
For periphery address 128 with S5 115 CPU 941 = F080.
5. UNIT = Unit number of the cam controller (currently always 0).
6. AUS = Number of controlled outputs (currently max. times 64).
7. ANZN = Number of controlled cams (currently always 1).

### 8.6. Read FB230 - Profibus DP Slave Diagnosis

FB for reading the Profibus diagnosis. This FB is s standard FB of the S5 95U CPU with Profibus DP Master.

### 8.7. DBxx - data component for cam data

The cams or dead times are stored in a data component, that is given to the FB180 as a parameter. Data like actual position, speed, output status, cam controller status, current program number, desired program number and the output deactivation are stored in this DB.

Data component DBxx:

| | | |
|---|---|---|
| DW 0 | | |
| " | | |
| DW 74 | are reserved for data exchange and may not be written. | |
| DW 75 | Current position | (only read possible) |
| DW 76 | Current speed value | (only read possible) |
| DW 77 | Current program number | (only read possible) |
| DW 79 | Status outputs 1-16 | (only read possible) |
| DW 80 | Status outputs 17-32 | (only read possible) |
| DW 81 | Output deactivation bits | (only write possible) |
| DW 82 | Output deactivation bits | (only write possible) |
| DW 83 | Desired program number | (only write possible) |
| DW 84 | Reserved | |
| DW 85 | Reserved | |
| DW 86 | Reserved | |
| DW 87 | Reserved | |
| DW 88L | Controlled output number | (only write possible) |
| DW 89 | Program for programming | (only write possible) |
| DW 90L | Current output no. | (only write possible) |
| DW 90H | Number of cams currently only 1 possible | (only write possible) |
| DW 91 | 1. Activation point for 1. output | (write and read possible) |
| DW 92 | 1. Deactivation point for 1. output | (write and read possible) |
| " | | |
| DW 154 | 32. Deactivation point | (write and read possible) |
| DW 224 | Dead time for 1. output | (write and read possible) |
| " | | |
| DW 255 | Dead time for 32. output | (write and read possible) |

## 9. S7 CPU315-DP program

The software is in an S7 project V3.2 on the disc, that you have to dearchive for installation. The project name is "Profibus". You can check the software version in the component header of OB1 or FB41.

### 9.1. Installation of the S7 software

- After the dearchiving, open the created project "Profibus" and copy the components FB41, FC41,42,43,45,46,47,DB40 and 41 from the "Profibus" project into your application.
- Copy the network 1 of the OB100 from the "Profibus" project into the OB100 of your application.
- Change the component parameters for the execution of the FB41 in your entire program (OB100 and the main execution) to your desired parameters.
- Define the data component DB40.
  For a better view, the data was gathered into structures.

  - Determine the number of controlled outputs (cam tracks), and enter them in the OB100 into the DB40.DBW36.
  - Define the cam table in the DB40 (see chapter "9.8.2. DBxx area 2 = cam table" on page 24 and the example in the Profibus project). There has to be memory available for each output for the output number, the number of cams and the (de)activation points. There may not be any gaps or overlaps. If an output is not entered into the table, it is deleted in the CamCon with a programming command. Up to 13 cams per output can be programmed.
  - Define the dead time table in the DB40 (see chapter "9.8.3. DBxx area 3 = dead times" on page24 and the example in the Profibus project). For every output one data word.
  - Enter the cam and dead time values into the table.
  - Define the RK512 command table. The RK512 commands are used for the parameterization of the CamCon (see chapter "9.8.4. DBxx area 4 = RK512 table" on page 25 and the example in the Profibus project). E.g. it is possible to alter the shifting of the zero point or the rotation direction of the CamCon. Again, there may be not gaps or overlaps.
  - Now enter the activation points (data word number) of the cams, dead times and RK512 table into the OB100 in the DB40. The position of the cam table is in the DW0, that of the dead time in the DW2 and that of the RK512 table in the DW4.

#### 9.1.1. Necessary components and networks

Necessary components or networks for the operation of the software:

| | | |
|---|---|---|
| FB41 | Main program. | |
| FC41 | Diagnosis evalutation . | |
| FC42 | Evaluation of the reception data | (sub-program of FB41). |
| FC43 | Structure of the sending data | (sub-program of FB41). |
| FC45 | Sending the data to the CP16 via the Profibus | (sub-program of FB41). |
| FC46 | Receiving the data from the CP16 via the Profibus | (sub-program of FB41). |
| FC47 | Initialization of the CP16 | (sub-program of FB41). |
| DBxx | Instance DB for FB41. | |
| DBxx | DB for cam data. | |
| OB1 | Network for execution of FB41 and FC41. | |
| OB82 | Network for diagnosis monitoring. | |
| OB86 | Restart upon Profibus DP error (only BE). | |
| OB100 | Network for initialization of the software. | |

### 9.2. OB1

Most networks of the OB1 are meant as exampl for testing the software and can be deleted or changed. The nets with the FB41 and FC41 execution have to be executed in the cycles, however. The parameters ( registers, timers and data components ) of these two can be adjusted to the requirements of the application, but then they also have to have to be changed in the OB100 (starting OB) and in the OB82 (diagnosis OB) !

### 9.3. FB41 - main module

The FB41 is the main module of the software and has to be executed in the OB1 in cycles. Through the ENABLE bit 0.0 in the IN_BEFEHLE word, the FB41 and the communication is can be accessed. If the FB is locked, no data can be read or programmed, and you decrease the cycle time by approx. 4 ms.

**Note:** If the ENABLE Bit 0.0 is reset, the last command still in operation is terminated.

**Note:** If the ENABLE bit 0.0 is not set, the command bits of the FB41 are not executed.

Through access to the FB41, the communication to the cam controller is started. If there are no pending commands, a status request (command 0x01) is sent to the CamCon and data received by the CamCon are stored in the DB. See also chapter "9.8. DBxx - data component for cam data" on page 23. At the same time as the status request, the data words DW 22 and 24 are sent to the CamCon, that are **AND** linked to the outputs of the CamCon cam controller (output deactivation) or are available as V - inputs with activated PLC - Logic - Module.

The read status information is evaluated in the FB41 component.

Now you check, if an error was entered in the status byte (DB16) of the cam controller. If that is the case, an error reset (command 0x02) is automatically sent to the CamCon cam controller.

Then the current program number (DW14) is compared to the desired program number (DW26). If they do not match, a program change (command 0x03) with the desired program number is sent. I.e., to change a program it is sufficient to write the desired number to the data word 26.

Now it is checked, wether or not a command for cam, dead time or RK512 programming or reading is supposed to be triggered. This is controlled by setting the bits in the parameter word IN_BEFEHLE. The data for the corresponding commandshave to be entered into the data DB. Please see the following chapter. If the command command was executed without error, the command bit is reset through the FB41.

**Attention:** In the STATUS_OUT word of the FB41, the status information of the communication and the CamCon cam controller are stored. These will be evaluated by the application and should lead to a deactivation of the automatic of the machine and to an error message in case of emergency.

### 9.3.1. Parameters of the FB41

1. Instance DB = Static data of the FB41. This DB has to be created in the S7 software (Offline) through inserting the FB41 in the OB1.

2. DP_ADR = Projected address of the in- and outputs of the communication blocks (16Byte range) address in HEX e.g. 256 = 100hex.

3. DATE_DB = Number of the data component where the cam data is stored. The DB always has to exist and be 374 words long.

4. TIMER_TIMEOUT = Number of one time used internally for timeout monitoring (e.g. 0).

5. STATUS_OUT = Register word where the status of the CamCon CP16/P/IO and of the CamCon is stored (e.g. MW0).

| | | | | |
|---|---|---|---|---|
| Bit 0.0 | = | DP_ERR | = | DP communication range not found. |
| Bit 0.1 | = | CP_INIT | = | CP16 connected and started. |
| Bit 0.2 | = | BEF_IA | = | Command is still being implemented |
| Bit 0.3 | = | BEFERR | = | Error during the sending of a command, e.g. the memory of the CamCon is full. |
| Bit 0.4 | = | TIMEOUT | = | A timeout occurred during the data transmission. It will be tried to send the command again. |
| Bit 0.5 | = | res | = | Currently not used. |
| Bit 0.6 | = | res | = | Currently not used. |
| Bit 0.7 | = | res | = | Currently not used. |
| Bit 1.0 | = | ISTERR1 | = | CamCon reports Pos. Error 1. |
| Bit 1.1 | = | ISTERR2 | = | CamCon reports Pos. Error 2. |
| Bit 1.2 | = | ISTERR3 | = | CamCon reports Pos. Error 3 or Clear with incremental generator. |
| Bit 1.3 | = | AUSERR | = | CamCon reports Output Error. |
| Bit 1.4 | = | ISTERR5 | = | CamCon reports Pos. Error 5. |
| Bit 1.5 | = | UNBEKA | = | Unknown error message of the CamCon. |

**Note:** The program tries to automatically sign the error messages 1.0 to 1.5.

| | | | | |
|---|---|---|---|---|
| Bit 1.6 | = | res | = | Currently not used. |
| Bit 1.7 | = | res | = | Currently not used. |

6. IN_BEFEHLE = Register word where the commands (bits) of the application program have to be set (e.g. MW2). If a command was executed, this bit is reset. If a read command ends, the DB contains the read cam, dead time or RK512 values.

| | | | | |
|---|---|---|---|---|
| Bit 0.0 | = | ENABLE | = | FB Granting access and make a status request. |

**Note:** If this bit is reset, the last command that still operates is terminated.

**Note:** If this bit is not set, the command bits are not executed by the FB41.

| | | | | |
|---|---|---|---|---|
| Bit 0.1 | = | RESET | = | The intire communication is reset with an increasing flank, and it is tried to restart. |

Bit 0.2 = NP =
Program a cam.
The data has to be in the DB.
1. Offset on cam table (DW 0).
2. Program number (DW 38).
3. Output number (DB 40).
4. Cam table from data word = Offset in DW 0.
5. Activation and Deactivation points.

Bit 0.3 = NAP =
Program all cams.
The data has to be in the DB.
1. Offset on cam table (DW 0).
2. Program number (DW 38).
3. Controlled output number (DW 36).
4. Cam table from data word = Offset in DW 0.
5. Activation and Deactivation points.

Bit 0.4 = NL =
Read a cam.
The data has to be in the DB.
1. Offset on cam table (DW 0).
2. Program number (DW 38).
3. Output number (DB 40).
The read cams are in the table from data word = Offset in DW 0.

Bit 0.5 = NAL =
Read all cams.
The data has to be in the DB.
1. Offset on cam table (DW 0).
2. Program number (DW 38).
3. Controlled output number (DW 36).
The read numbers are in the table from data word = Offset in DW 0.

Bit 0.6 = TP =
Program a dead time.
The data has to be in the DB.
1. Offset on dead time table (DW 2).
2. Output number (DB 40).
3. Dead time value in 0.1ms steps in the table from data word = Offset in DW 2.

Bit 0.7 = TAP =
Program all dead times.
The data has to be in the DB.
1. Offset on dead time table (DW 2).
2. Controlled output number (DW 36).
3. Dead time values 0.1ms steps in the table from data word = Offset in DW 2.

Bit 1.0 = TL =
Read a dead time.
The data has to be in the DB.
1. Offset on dead time table (DW 2).
2. Output number (DW 40).
The read dead time is in the table from data word = Offset in DW 2.

Bit 1.1 = TAL =
Read all dead times.
The data has to be in the DB.
1. Offset on dead time table (DW 2).
2. Controlled output number (DW 36).
The read dead times are in the table from data word = Offset in DW 2.

| | | | |
|---|---|---|---|
| Bit 1.2 = | PRK | = | Program a RK512 data set.<br>The data has to be in the DB.<br>1. Offset on RK512 table (DW 4).<br>2. Data set number = 1.DW of the RK512 table (DW 4).<br>3. Data to be written of the table with DB No., DB Offset and the data. |
| Bit 1.3 = | LRK | = | Read a RK512 data set.<br>The data has to be in the DB.<br>1. Offset on RK512 table (DW 4).<br>2. Data set number = 1.DW of the RK512 table (DW 4).<br>3. Data to be read of the table with DB No. and DB Offset.<br>The read data is in the RK512 table from data word = Offset in DW 4. |
| Bit 1.4 = | PARK | = | Program all RK512 data sets.<br>The data has to be in the DB.<br>1. Offset on RK512 table (DW 4).<br>2. All data to written of the table with DB No., DB Offset and the data. |
| Bit 1.5 = | LARK | = | Read all RK512 data sets.<br>The data has to be in the DB.<br>1. Offset on RK512 table (DW 4).<br>The read data is in the RK512 table from data word = Offset in DW 4. |
| Bit 1.6 = | res | = | Currently not used. |
| Bit 1.7 = | res | = | Currently not used. |

### 9.4. FC41 - Diagnosis evaluation

To save cycle time in the PLC, it is possible to block the execution of the FB41 by resetting the command bits 0.0, but because no status can be read, you cannot monitor the CamCon. To prevent that, the CP16 - module sends a diagnosis through an error. This starts the OB82 in the S7-CPU. Here, it is checked through the diagnosis address determined during projection, wether or not this diagnosis is from the CP16t. If that is the case, the bit DIAG_CP in the OB82 is set and thus made accessible to the FC41. In the status byte of the FC41, the current diagnosis data is stored. This should be evaluated by the application and, in case of an error, lead to the deactivation of the automatic of the machine and to an error message.

The diagnosis evaluation of the CP16 is started, when the bit DIAG_CP in the OB82 is set.

If a diagnosis evaluation is not desired or necessary, the FC41 can be deleted. The OB82 has to be set in this case, so the S7 CPU does not go into the 'Stop' state, when the CamCon CP16 module sends a diagnosis.

#### 9.4.1. Parameters of the FC41

1. DIAGADR = Projected DP diagnosis address in HEX.
   e.g. 1021 = 3FDHex (like in OB82).
2. STATUS = Status byte where the diagnosis is stored (e.g. MB4).

   If all bits are 0, the state of the CP16 is OK and the CamCon cam controller operates.

   | | | |
   |---|---|---|
   | Bit 0.0= | ISTERR | CamCon reports a Pos. Error 1,2,3 or 5 (e.g. encoder defect). |
   | Bit 0.1= | AUSERR | CamCon reports Output Error (e.g. short-circuit) |
   | Bit 0.2= | KABEL | Cable from the CP to the CamCon broke or a restart was executed at the CamCon (e.g. through reset of an error message). |
   | Bit 0.3= | NKOM | Communication with the CamCon is not possible. Possibly an older version of the software in the CamCon is used (Software from at least 10.9.1998 = DC50.25). |
   | Bit 0.4= | UNBEKA | Unknown diagnosid reports from the CP16. |
   | Bit 0.5= | DIAGLEN | The length of the diagnosis data is not 16 bytes or there is an error in the Profibus DP (e.g. if wrong diagnosis address was specified). |
   | Bit 0.6= | KENNUNG | The Profibus identifier is not that of a CamCon CP16 (00E5). |
   | Bit 0.7= | Currently not used or DIAG_CP bit. | |

3. DIAG_CP = Bit set in the OB82, when the diagnosis comes from the CP16.
   The best value is the highest bit of the status byte (e.g. M4.7).

### 9.5. FC42, 43, 45, 46 and 47 - sub-programs of FB41

These FC components are executed by the FB41 and may not be executed by a different command.

### 9.6. OB82 - diagnosis component

Here you check, if a diagnosis was initialized by a CamCon CP16. This is checked by comparing the projected diagnosis address with the address in the valiables "OB82_MDL_ADDR". If this is identical, the DIAG_CP bit is set and the FC41 is accessible.

### 9.7. OB100 - starting component

The data DB is initialized and the communication is reset in this OB.

### 9.8. DBxx - data component for cam data

The cam, dead time or RK512 parameter data is stored in a data component, that is given to the FB41 as a parameter. This DB also stores data like e.g. actual position, speed, output status, cam controller status, current program number and desired program number. The DB is divided into the 4 parts: 1.Status, 2.Cam, 3.Dead times and 4.RK512 parameters. The position of these areas is stored in the first 3 data words as Offset with the exception of the status area.

#### 9.8.1. DBxx area 1 = Status

| | | | |
|---|---|---|---|
| DW 0 | OFFSET | Offset for area 2 = cam data. | |
| DW 2 | OFFSET | Offset for area 3 = dead time data. | |
| DW 4 | OFFSET | Offset for area 4 = RK512 data or parameter data. | |
| DW 6 | res | Reserved. | |
| DW 8 | res | Reserved. | |
| DW 10 | ISTWERT | Current position | (only read possible). |
| DW 12 | SPEED | Current speed value | (only read possible). |
| DW 14 | PROG | Current program number | (only read possible). |
| DB 16 | NSWSTATUS | NSW status | (only read possible). |
| DB 17 | AUSANZIST | Number of outputs of the CamCon | (only read possible). |
| DW 18 | AUSSTAT1 | Status outputs 1-16 | (only read possible). |
| DW 20 | AUSSTAT2 | Status outputs 17-32 | (only read possible). |
| DW 22 | VEIN1 | Output deactivation bits | (only write possible) |
| DW 24 | VEIN2 | Output deactivation bits | (only write possible) |
| DW 26 | GPROG | Desired program number | (only write possible). |
| DW 28 | res | Reserved. | |
| DW 30 | res | Reserved. | |
| DW 32 | res | Reserved. | |
| DW 34 | res | Reserved. | |
| DW 36 | AUSANZV | Controlled output number | (only write possible). |
| DW 38 | PROGPRG | Program for programming | (only write possible). |
| DB 40 | AUSGNR | Current output No. | (only write possible). |
| DB 41 | res | Reserved. | |

The data words DW10 to 20 are filled through the answer to a status request.

The data words DW22 and 24 are sent to the CamCon through the status request and they are **AND** linked to the outputs of the CamCon cam controller (output deactivation) or are available as V - inputs, when the PLC Logic Module is active.

If data words 14 and 26 do not match, a program change command is sent to the CamCon. I.e., for changing a program, it is sufficient to write the desired number to the DW26.

In DW36, the number of controlled outputs for cams and dead times has to be specified. In the OB100, it it done at every start.

The data word DW38 and the data byte DB40 have to be set to the desired program or output number for reading or programming cams or dead times before the execution of command bits.

### 9.8.2. DBxx area 2 = cam table

The Offset pointer (DW0) of the data DB has to point to the starting point of the cam table, that is to be used for reading or programming the cams. They have the possibilitiy to store several tables in the data DB and by changing the DW0, to send a different program to the cam controller.

**Attention:** The Offset may only be changed, if no cam command is active.

The cam table is divided into structures, the table itself representing a structure itself and and every cam track (output) representing a sub-structure. A cam table has the folowing structure: at the beginn as the identifier the output number (byte) then the number of cams (byte) for the output (currently up to 13) and then the data words with the activation and deactivation points. If the number of cam s is set to 2, there **have to** follow a total of 4 data words (DW), before there can follow a new output number. The program now searches from the first output number to the table until it has found the desired output number and then programs or reads that cam.

At the end of the cam table, you have to add a data word with the content FFFF, so the program can recognized the end of the table.

xx = Offset from DW0

| | | | | |
|---|---|---|---|---|
| DBxx + | 0 | AUSG_NR | = E.g. 1 | 1. First output number. |
| DBxx + | 1 | ANZ_NOCKEN | = E.g. 2 | Number of cams for this output. |
| DWxx + | 2 | EIN_0001 | = Cam value | Activation point 1. |
| DWxx + | 4 | AUS_0001 | = Cam value | Deactivation point 1. |
| DWxx + | 6 | EIN_0002 | = Cam value | Activation point 2. |
| DWxx + | 8 | AUS_0001 | = Cam value | Deactivation point 2. |
| DBxx + | 10 | AUSG_NR | = E.g. 2 | Next output number. |
| DBxx + | 11 | ANZ_NOCKEN | = E.g. 1 | Number of cams for this output. |
| DWxx + | 12 | EIN_0001 | = Cam value | Activation point 1. |
| DWxx + | 14 | AUS_0001 | = Cam value | Deactivation point 1. |
| DWxx + | 16 | ENDE | = FFFF | End identifier. |

The table above would read or program two cam s for output number 1 and one cam for output number 2.

**Attention:** There may not be any gaps or overlaps in the definition of the structure, otherwise the S7 CPU goes into 'Stop' mode or the OB121 with cycletime overflow or the access error in the DB.

### 9.8.3. DBxx area 3 = dead times

The Offset pointer (DW2) of the data DB has to point to the starting point of the dead time table, that is supposed to be used for reading or programming dead times. If the DW2 is set to 0, no dead time can be transmitted.

A dead time table has the following structure:

DWxx = Offset from DW2

| | | | | |
|---|---|---|---|---|
| DWxx + | 0 | TZK1 | = e.g. 10 | Dead time for output 1 (10 => 1.0ms). |
| DWxx + | 2 | TZK2 | = e.g. 15 | Dead time for output 2. |
| " | | | | |
| DWxx + | 62 | TZK32 | = e.g. 0 | Dead time for output 32. |

**Attention:** There must be a data word (DW) defined for every controlled output.

### 9.8.4. DBxx area 4 = RK512 table

The electronic cam controller of the CamCon series from the company DIGITRONIC Automationsanlagen GmbH support the RK512 computer coupling procedure. The CamCon simulates a PLC control and makes its data (parmeters, status, cams and dead times) available in data double words. In the RK512 table the data sets determining the access to the parameters are stored.

The Offset pointer (DW4) of the data DB has to point to the starting point of the RK512 table, that is to be used for reading or programming parameters. If the DW4 is set to 0, no parameter can be transmitted.

The RK512 table is divided into structures, the table itself representing a structure and every parameter data set represents a sub-structure. The RK512 table has the following strucure: It begins with the current data set number (DW) that is supposed to be worked on. Then there is the identifier of the 1. data set through the data set number (DW). Then there is the number (byte) (currently up to 11) of the data double words that are defined in the data set. The next two bits (DBxx.DBx) determine, if the data set may be read and/or written. Then there is a byte for the simulated DB number and a byte for the Offset in the DB of the CamCon. Then there is the exact number of data double words that were defined earlier. Behind them, there may be the identifier for the next data set. The program searches from the first data set to the table until the desired data set is found or the data is read. A data word with the contents FFFF has to be added to the end of the RK512 Tabelle, so the program can recognize the end of the table.

**Attention:** There may not be any gaps or overlaps in the definition of the structure, otherwise the S7 CPU goes into 'Stop' mode or the OB121 with cycletime overflow or the access error in the DB.

xx = Offset from DW4

| | | | | |
|---|---|---|---|---|
| DWxx + | 0 | RK_AKT_SATZ | = z.B. 1 | Current data set. |
| DWxx + | 2 | RK_SATZ_NR | = z.B. 0 | Identifier for the first data set. |
| DBxx + | 4 | RK_DATA_LEN | = 4 | Number of the data double words (max.11). |
| DXxx + | 5.0 | RK_DATA_L | = TRUE | Data set read on or off. |
| DXxx + | 5.1 | RK_DATA_P | = FALSE | Data set write on or off. |
| DBxx + | 6 | RK_DBNR | = 203 | DB No. in the CamCon. |
| DBxx + | 7 | RK_DBOFFSET | = 1 | Offset in the DB from where the data is. |
| DDxx + | 8 | WERT_00 | = Wert | 1. Value of the data. |
| DDxx + | 12 | WERT_01 | = Wert | 2. Value of the data. |
| DDxx + | 16 | WERT_02 | = Wert | 3. Value of the data. |
| DDxx + | 20 | WERT_03 | = Wert | 4. Value of the data. |
| DWxx + | 24 | RK_SATZ_NR | = z.B. 0 | Identifier for the next data set. |
| DBxx + | 26 | RK_DATA_LEN | = 2 | Number of the data double words (max.11). |
| DXxx + | 27.0 | RK_DATA_L | = FALSE | Data set read on or off. |
| DXxx + | 27.1 | RK_DATA_P | = TRUE | Data set write on or off. |
| DBxx + | 28 | RK_DBNR | = 204 | DB No. in the CamCon. |
| DBxx + | 29 | RK_DBOFFSET | = 15 | Offset in the DB from where the data is. |
| DDxx + | 30 | WERT_00 | = Wert | 1. Value of the data. |
| DDxx + | 34 | WERT_01 | = Wert | 2. Value of the data. |
| DWxx + | 38 | ENDE | = FFFF | End identifier. |

The table above would read the RK512 data set 0 out of the CamCon DB203 from Offset 1. The programming of the data set would not be permitted and would result in an error message. The second data set can only program 2 values in the DB 204 from Offset 15 on. Reading the 2. data set would not be permitted and would result in an error message.

## 10. CamCon data transfer generall

The CamCon sends all information on enquirery-sequences and executes commands on certain command-sequences, that are acknowledged later. The data is stored in the "Send - and recieve compartement" of the PLC. A data record is built up as follows:

### 10.1. Question sequence

1. question mark: '?'.
2. command number: currently 0x01, 0x04 und 0x06.
3. necessary data: a maximum of aditional 62 Byte (31 data words).

#### 10.1.1. Answer sequence, related to questions

1. acknowledgeing mark: ':'.
2. setting back a questions number currently 0x01, 0x04 und 0x06.
3. data: a maximum of aditional 62 Byte (31 data words).

### 10.2. Command sequence

1. command sign: '!'.
2. command number: currently 0x02, 0x03, 0x05 und 0x07.
3. possibly necessary data: a maximum of aditional 62 Byte (31 data words).

#### 10.2.1. Command acknowledgement

1. acknowledgeing mark: ':'.
2. setting back a orders number currently 0x02, 0x03, 0x05 und 0x07.
3. acknowledgeing OK: 'OK' = 2 Byte.

or

3. acknowledgeing Error: 'ER' = 2 Byte.

### 10.3. Acknowledgement for unknown question or command

1. acknowledgeing mark: ':'.
2. sign for unknown command: 'Z'.

## 11. Possible commands

A description of all currently possible commands for CamCon camswitches follows.

### 11.1. Request on 0x01

Necessary data in the PLC's send-compartement, for reading the staus-data of the camswitch:

| | | | |
|---|---|---|---|
| 1. | DW | 0x06 / 0x00 | Length of the "send-data" / target-number must always be 0. |
| 2. | DW | 0x3F / 0x01 | Mark of a question-command "?" / number "1" for request on status. |
| 3. | DW | 0xXXXX | virtual inputs 1-16. |
| 4. | DW | 0xXXXX | virtual inputs 17-32 (without V-inputs the send-length is 2). |

" (send-length corresponding to the number of virtual inputs).

If the length of the send-data is setz to greater than 2 also adtawords after DW1 (virtual inputs) will be transferred. If so, these additional data-words will be connected to the outputs **AND** and therefore cause their switching of, if the PLC demmands it. If only zerobytes are send, all of the CamCon's outputs switch off.

As an answer the following data can be found in the recieve-compartement:

| | | | |
|---|---|---|---|
| 1. | DW | 0x0C / 0x00 | Length of the recieve-data / sourcenumber has to be 0. |
| 2. | DW | 0x3A / 0x01 | Acknowledgeing sign ":" / Number "1" for a request on status. |
| 3. | DW | 0xXXXX | Actual value. |
| 4. | DW | 0xXXXX | Speed. |
| 5. | DW | 0xXXXX | active program. |
| 6. | DW | 0xXX,0xXX | CamCon status, number of outputs. |
| | | CamCon status 0 = OK / status 1-3 = "Ist-Err: 1-3" / status 4 = "Aus-Err". | |
| 7. | DW | 0xXXXX | Output 1-16. |
| 8. | DW | 0xXXXX | Output 17-32. |

" (Recievelength corresponding to the number of outputs).

### 11.2. Error-reset of the CamCon camswitch 0x02

Necessary data in the PLC's send compartement, for setting back an **"I-Err:x"** or **"Out-Err"**:

| | | | |
|---|---|---|---|
| 1. | DW | 0x02 / 0x00 | Length of the send-data / target number has to be 0. |
| 2. | DW | 0x21 / 0x02 | Command sign "!" / number "2" for error-reset. |

As an answer the following data can be found in the recieve compartement:

| | | | |
|---|---|---|---|
| 1. | DW | 0x04 / 0x00 | Length of recieve-data / sourcenumber has to be 0. |
| 2. | DW | 0x3A / 0x02 | Acknowledgeing sign ":" / Number "2" for error reset. |
| 3. | DW | 'O','K' | "OK" = done or "ER" = error. |

### 11.3. Programmchangel of the CamCon camswitch 0x03

Necessary data in the PLC's send compartent for the change of program number.

| | | | |
|---|---|---|---|
| 1. | DW | 0x04 / 0x00 | Length of the send-data / target number has to be 0. |
| 2. | DW | 0x21 / 0x03 | Command sign "!" / number "2" for program change. |
| 3. | DW | 0xXXXX | new programing. |

As an answer the following data can be found in the recieve-compartement:

| | | | |
|---|---|---|---|
| 1. | DW | 0x04 / 0x00 | Length of recieving data / sourcenumber must always be 0. |
| 2. | DW | 0x3A / 0x03 | Acknowledgeing sign ":" / number "3" for program change.. |
| 3. | DW | 'O','K' | "OK" = done or "ER" = error. |

### 11.4. Reading a CamCon camswitches' camtrack 0x04

Required data in the send-compartement for reading of a camtrack.

| | | | |
|---|---|---|---|
| 1. | DW | 0x06 / 0x00 | Length of the send-data / target number has to be 0. |
| 2. | DW | 0x3F / 0x04 | Mark of a question-command "?" / number "4 for reading Cams. |
| 3. | DW | 0xXXXX | Programnumber. |
| 4. | DW | 0xXX / 0x00 | outputnumber/empty Byte. |

As an answer the following data can be found in the recieve compartement:

| | | | |
|---|---|---|---|
| 1. | DW | 0xXX / 0x00 | Length of the recieve-data / sourcenumber has to be 0. |
| 2. | DW | 0x3A / 0x04 | Acknowledgeing sign ":" / number "4 for reading Cams. |
| 3. | DW | 0xXXXX | Programnumber. |
| 4. | DW | 0xXX / 0xXX | Ouput number, number of Cams. |
| 5. | DW | 0xXXXX | Switching on point 1. Cam. |
| 6. | DW | 0xXXXX | Switching off point 1. Cam. |
| 7. | DW | 0xXXXX | Switching on point 2. Cam. |
| 8. | DW | 0xXXXX | Switching on point 2. Cam. |

" (Recieve length correspoinding to Cams at the output).

### 11.5. Programing the Cam-track of a CamCon camswitch 0x05

Required data in the send-compartement for programing of a camtrack.

| | | | |
|---|---|---|---|
| 1. | DW | 0x16 / 0x00 | Length of the send-data / targetnumber has to be 0. |
| 2. | DW | 0x21 / 0x05 | Sign for command "!" / Number "5" for cam-programing. |
| 3. | DW | 0xXXXX | Programnumber. |
| 4. | DW | 0x01 / 0x01 | Output number / Number of Cams for output 1. |
| 5. | DW | 0xXXXX | Switching on point for Cam output 1 |
| 6. | DW | 0xXXXX | Switching off point for Cam output 1 |
| 7. | DW | 0x02 / 0x02 | Ouput number, number of Cams for output 2. |
| 8. | DW | 0xXXXX | Switching on point for 1st Cam output 2 |
| 9. | DW | 0xXXXX | Switching off point for 1st Cam output 2 |
| 10. | DW | 0xXXXX | Switching on point for 2nd Cam output 2 |
| 11. | DW | 0xXXXX | Switching off point for 2nd Cam output 2 |
| 12. | DW | 0xFFFF | End detection must be FFFF. |

" (Sende length corresponds to number of Cams).

**Note:** All Cams which have ben programed for an output before, will be deleted. This results in a maximum number of 14 programable Cams per output.

As an answer the following data can be found in the recieve compartement:

| | | | |
|---|---|---|---|
| 1. | DW | 0x04 / 0x00 | Length of recieve-data / sourcenumber has to be 0. |
| 2. | DW | 0x3A / 0x05 | Acknowledgeing sign ":" / number 4 for programing Cams. |
| 3. | DW | 'O','K' | "OK" = done or "ER" = error. |

### 11.6. Reading the CamCon camswitches' delay time 0x06

Required data in the send-compartement of the PLC for to read a delay-time:

| | | | |
|---|---|---|---|
| 1. | DW | 0x04 / 0x00 | Length of send-data / targetnumber must always be 0. |
| 2. | DW | 0x3F / 0x06 | Mark of a question-command "?" / number "6" for reading delay-times. |
| 3. | DW | 0xXX / 0x00 | Output number / empty Byte |

As an answer the following data can be found in the recieve compartement:

| | | | |
|---|---|---|---|
| 1. | DW | 0x06 / 0x00 | Length of recieve-data / sourcenumber must always be 0. |
| 2. | DW | 0x3A / 0x06 | Acknowledgeing sign ":" / number 6 for reading delay-times. |
| 3. | DW | 0xXX / 0xXX | Output number / empty Byte |
| 4. | DW | 0xXXXX | Delay-time in 100us steps. |

### 11.7. Programming a CamCon camswitches' delay time 0x07

Required data in the send-compartement of the PLC for to program a delay-time:

| | | | |
|---|---|---|---|
| 1. | DW | 0x06 / 0x00 | Length of send-data / targetnumber must always be 0. |
| 2. | DW | 0x21 / 0x07 | Sign for command "!" / Number "7" for delay-time-programing. |
| 3. | DW | 0xXX / 0x00 | Output number / empty Byte. |
| 4. | DW | 0xXXXX | Delay-time in 100us steps. |

As an answer the following data can be found in the recieve compartement:

| | | | |
|---|---|---|---|
| 1. | DW | 0x04 / 0x00 | Length of recieve-data / sourcenumber must always be 0. |
| 2. | DW | 0x3A/ 0x05 | Acknowledgeing sign ":" / number 7 for programing delay-times.3. |
| | DW | 'O','K' | "OK" = done or "ER" = error. |

### 11.8. RK512 Commands

The RK512 command is a special feature for the programing of a CamCon's parameter and **does not** obey the data-protocoll described in chapter "10. CamCon data transfer generall".

#### 11.8.1. RK512 Reading a command

Necessary data in the PLC's send compartement for the reading of an RK512 data record:

| | | | |
|---|---|---|---|
| 1. | DW | 0x0A / 0x00 | Length of send-data / targetnumber must always be 0. |
| 2. | DW | 0x00 / 0x00 | Identification for RK512 Telegramm. |
| 3. | DW | 0x45 / 0x44 | Identification type of job "ED" (E = read / D = data). |
| 4. | DW | 0xYY / 0xZZ | YY = DB Nr. / ZZ = Offset in the DB. |
| 5. | DW | 0xYY / 0xYY | YY = number of datawords (currently from 2 to a maximum of 22). |
| 6. | DW | 0xFF / 0xFF | Coordinating flag always 0xFFFF. |

As an answer the following data can be found in the recieve compartement:

| | | | |
|---|---|---|---|
| 1. | DW | 0xXX / 0x00 | XX = Length of recieve-data / sourcenumber must always be 0. |
| 2. | DW | 0x00 / 0x00 | Identification for RK512 Telegramm. |
| 3. | DW | 0x00 / 0xYY | always 0 / YY = error message if not 0. |
| 4. | DW | 0xXXXX | XXXX = 1. half data double-word. |
| 5. | DW | 0xYYYY | YYYY = 2. half data double-word. |

" Recieve-length corresponding to the number of datawords (11 double data-words = 22 datawords).

#### 11.8.2. RK512 Writing commands

Necessary data in the send compartement of the PLC for the programing of an RK512 data record:

| | | | |
|---|---|---|---|
| 1. | DW | 0xXX / 0x00 | XX = Length of the send-data / targetnumber has to be 0. |
| 2. | DW | 0x00 / 0x00 | Identification of a RK512 telegram. |
| 3. | DW | 0x41 / 0x44 | Identification kind of job "AD" (A = writing / D = data). |
| 4. | DW | 0xYY / 0xZZ | YY = DB Nr. / ZZ = Offset at the DB. |
| 5. | DW | 0xYY / 0xYY | YY = number of datawords (currently from 2 to a maximum of 22). |
| 6. | DW | 0xFF / 0xFF | Coordinating flag always 0xFFFF. |
| 7. | DW | 0xXXXX | XXXX = 1. half data double-word. |
| 8. | DW | 0xYYYY | YYYY = 2. half data double-word. |

" Send length corresponding to the number of datawords (11 double data-words = 22 datawords).

As an answer the following data can be found in the recieve compartement:

| | | | |
|---|---|---|---|
| 1. | DW | 0x04 / 0x00 | XX = Length of recieve-data / sourcenumber must always be 0. |
| 2. | DW | 0x00 / 0x00 | Identification of a RK512 telegram. |
| 3. | DW | 0x00 / 0xYY | always 0 / YY = error message (0 = OK). |

### 11.8.3. List of possible RK512 commands

The complete description of all data records can be found on the internet at **http://www.digitronic.com/ftp/rk512.pdf**. The function of specific parameter can be looked after in the corresponding chapters of the CamCon's manual.

| | | |
|---|---|---|
| DB number 203 | DD0 | measuring system |
| | 0 | = 256 Impulse SSI Singelturn. |
| | 1 | = 360 Impulse SSI Singelturn. |
| | 2 | = 512 Impulse SSI Singelturn. |
| | 3 | = 1000 Impulse SSI Singelturn. |
| | 4 | = 1024 Impulse SSI Singelturn. |
| | 5 | = 2048 Impulse SSI Singelturn. |
| | 6 | = 4096 Impulse SSI Singelturn. |
| | 7 | = 8192 Impulse SSI Singelturn. |
| | 0xffffffff | = Special measuring system |
| DB number 203 | DD1 | = 0 = Special measuring system SSI. |
| DB number 203 | DD2 | = Resolution in Bit at Special measuring system SSI. |
| DB number 203 | DD3 | = Offset in Bit at Special measuring system SSI. |
| DB number 203 | DD4 | = Clipping at Special measuring system SSI. |
| DB number 203 | DD5 | = SSI - Errorbit at Special measuring system SSI. |
| DB number 203 | DD1 | = 1 = Special measuring system parallel. |
| DB number 203 | DD2 | = Resolution at Special measuring system Parallel. |
| DB number 203 | DD3 | = from inputnumber. at Special measuring system Parallel. |
| DB number 203 | DD4 | = 0=Gray / 1=Binär at Special measuring system Parallel. |
| DB number 203 | DD1 | = 2 = Special measuring system incremental. |
| DB number 203 | DD2 | = Resolution at Special measuring system Ink. |
| DB number 203 | DD3 | = Pre-divisor at Special measuring system Ink. |
| DB number 203 | DD4 | = Clearmode at Special measuring system Ink. |
| DB number 203 | DD1 | = 3 = Special measuring system Multi. |
| DB number 203 | DD2 | = Resolution at Special measuring system Multi. |
| DB number 203 | DD3 | = Turn at Special measuring system Multi. |
| DB number 203 | DD4 | = Divisor at Special measuring system Multi. |
| DB number 203 | DD1 | = 4 = Special measuring system PLL. |
| DB number 203 | DD2 | = Impulse per Initiator at Special measuring system PLL |
| DB number 203 | DD3 | = Number of Initiators at Special measuring system PLL |
| DB number 203 | DD4 | = Synchrone window at Special measuring system PLL |
| DB number 203 | DD5 | = Initiator - input at Special measuring system PLL |
| DB number 203 | DD6 | = Clear - input at Special measuring system PLL |
| DB number 203 | DD7 | = Synchrone output at Special measuring system PLL |
| DB number 203 | DD1 | = 5 = Special measuring system Timer. |
| DB number 203 | DD2 | = Resolution at Special measuring system TIMER |
| DB number 203 | DD3 | = time per step in ms at Special measuring system TIMER |
| DB number 203 | DD4 | = Halt - input at Special measuring system TIMER |
| DB number 203 | DD5 | = Clear - input at Special measuring system TIMER |
| DB number 203 | DD8 | Actual value - hysteresis |
| DB number 203 | DD9 | Controll of the special measuring system. |
| DB number 203 | DD10 | Gear multiplier. |
| DB number 203 | DD11 | Gear divisor. |
| DB number 203 | DD12 | Measuring system type (0=rot; 1=lin). |
| DB number 203 | DD13 | Starting value for lin. measuring system. |

| | | |
|---|---|---|
| DB number 203 | DD14 | Offset = zero-point shift. |
| DB number 203 | DD15 | Preset - value |
| DB number 203 | DD16 | Preset - input number. |
| DB number 203 | DD17 | Preset - Type (RAM/EEProm). |
| DB number 203 | DD18 | Speed factor. |
| DB number 203 | DD19 | 100%-speed value. |
| DB number 203 | DD20 | Speed accuracy |
| DB number 203 | DD21 | Display switch-mode (0=auto;1=spped;2=pos). |
| DB number 203 | DD22 | Input for display switching. |
| DB number 203 | DD23 | Cable length |
| DB number 203 | DD24 | Cycle time in µs. |
| DB number 203 | DD25 | Safety output. |
| DB number 203 | DD26 | Actual value output (0=aus;1=Gray;...). |
| DB number 203 | DD27 | Rotation-direction output. |
| DB number 203 | DD28 | Standstill-output. |
| DB number 203 | DD29 | Speed hysteresis. |
| DB number 203 | DD30 | Number of camswitch-input. |
| DB number 203 | DD31 | Number of camswitch-output. |
| DB number 203 | DD32 | Number of speed compensated outputs. |
| DB number 203 | DD33 | Input for keyboard-lock. |
| DB number 203 | DD34 | Number of inputs for external program selection. |
| DB number 203 | DD35 | Number for external program selection. |
| DB number 203 | DD36 | Program selection mode |
| DB number 203 | DD37 | Actual value for program selection mode 2. |
| DB number 203 | DD53 | Master - Program function ON = 1 OFF = 0. |
| DB number 203 | DD54 | Master - Program Number (0 to 32767). |
| DB number 203 | DD55 | Master - Programm outputs 1-32. |
| DB number 203 | DD56 | Master - Programm outputs 33-64. |

## 12. Key word table