The PROFINET interface

for

CamCon DC190

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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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Table

1. Introduction

The CamCon DC190 cam control can be ordered from March 2017 with the PROFINET option. For this purpose the option '**P**' was inserted in the order code (e.g. DC190 SS82S**P**0).

The DC190 is a class A PROFINET IO slave and supports PROFINET RT with a minimum cycle time of 1 ms.

Caution: The second Ethernet connection of the DC190 with the designation EtherCAT is permanently designed as an EtherCAT master and must never be connected to PROFINET. PROFINET IRT or PROFINET MRP is not possible. The device can only be connected at the end of a star topology.

For simple programming of the DC190 by the PLC, handling programs for S7-300 and S7-1500 for Step7 V5.5 / SP4 and TIA-Portal V13 / SP1 can be supplied under the order number: BS DC190-PN / HB.

These handling programs are integrated into the S7 program in the same way as the blocks for the CamCon DC300 module.

The DC190 can provide a maximum of up to 200 cam outputs (25 PLC input bytes) plus the speed value (2 bytes) and the current actual value (4 bytes) of the PLC as inputs.

The outputs of the PLC are used to enable the up to 200 cam outputs of the CamCon DC190 (max. 25 AB bytes).

In addition, with the PLC logic module of the CamCon DC190 switched on, up to 992 virtual inputs (124 PLC output bytes) can be transferred from the PLC to the CamCon. These can then be used freely in the CamCon - PLC - logic - module for customer applications.

2. Communication between S7 and CamCon DC190

Communication between the S7 CPU and the CamCon DC190 is handled via the Profinet connection. For this you need some function blocks, which you can get under the order no.: BS DC190-PN / HB.

CAUTION: If parameters, cam ON/OFF or speed compensation times are written or programmed cyclically, the data memory of the DC190 will be destroyed after a short time.

2.1. Installation of the S7 software

The software is available in an S7-300 project V5.5 or an S7-1500 TIA V13, which you must dearchive for installation. The project name is "DC190-S7XXXX-V1.XX". You can also check the software version in the block header of OB1 or FB190.

- After dearchiving, open the resulting project and copy the blocks FB190, FC192,193, DB190 and the instance DB from the project into your application.

- Copy the network 1 of the OB100 / 123 from the project into the OB100 / 123 of your application

- Change the block parameters when you call FB190 in your entire program (OB100 / 123 and the main call in OB1) to your desired parameters.

- Define the data block DB190.
  The data has been summarized in structures for a better view.

- Define the number of managed outputs (cam tracks) and enter them in DB190. DBW36.

- Define the cam table in DB190 (see chapter "2.8.2. DBxx Area2 = " on page 12 and the example in the project). For each output there must be storage space for the output number, the number of cams and the ON-switch and OFF-switch points. There must be no gaps or overlaps. If there is no output in the table, it is deleted when a programming command is given in CamCon. A maximum of 13 cams can be programmed per output.

- Define the speed compensation table in DB190 (see chapter "2.8.3. DBxx Area3 = " on page 12 and the example in the project). One word for each output.

- Enter the cams and speed compensation time values in the table.

- Define the RK512 command table. The RK512 commands are used to parameterize the CamCon DC190 (see chapter "2.8.4. DBxx Area4 = Config/RK512 " on page 13 and the example in the project). For example, it is possible to change the zero offset or the direction of rotation of the CamCon. Again, there should be no gaps or overlaps.

- Now enter the starting points (data word number) of the cam table, speed compensation table and RK512 table in DB190. The position of the cam table is in DW0, that of the speed compensation time in DW2 and that of the RK512 table in DW4.

2.2. Necessary programming blocks and networks

The following function blocks or networks are required to operate the software:

FB190	Main program.
FC192	Routine for receiving data from the DC190 (Subroutine from FB190).
FC193	Routine to send data to the DC190 (Subroutine from FB190).
DBxx	Instance DB for FB190.
DBxx	Data block for cams, speed compensation, configuration (RK512) and status data.
OB1	A network for calling FB190.
OB100	A network for initializing the software in S7-300.
OB123	A network for initializing the software in S7-1500.

2.3. OB1

Most networks of the OB1 are intended as an example for testing the software and can be deleted or modified. However, the network with the FB190 call must be called cyclically. The parameters (registers, timers and data blocks) of this call can be adapted to the conditions of the application, but must then also be changed in the OB100/123 (start-up OB)!

2.4. FB190 - Main module

The FB190 is the main module of the software and must be called cyclically in OB1. The ENABLE bit 0.0 in the parameter word CMD frees the FB190 and the communication. If the FB is blocked because no data is to be read or programmed (cams, speed compensation times, etc.), cycle time can be saved.

Note: If the ENABLE bit 0.0 is reset, the last command that is still in progress is completed.

Note: If the ENABLE bit 0.0 is not set, the FB190 immediately resets the command bits without triggering a command.

The Enable of the FB190 starts communication to the cam switch control. If there are no commands, a status question (command 0x01) is sent to the CamCon and the data received from the CamCon is stored in the data DB. See chapter " 2.8. DBxx - page 10 .

The read status information is evaluated by the FB190.

First, it is checked whether an error has been entered in the status byte (DB16) of the cam switch control. If this is the case, an error reset (command 0x02) is automatically sent to the CamCon.

The current program number (DW14) is then compared with the desired program number (DW26). If these are unequal, a program change (command 0x03) is sent with the desired program number. That is, to change the program it is sufficient to describe the data word 26 with the desired number.

Now it is checked whether a command for cam data, speed compensation times, or RK512 programming or for cam data, speed compensation times or RK512 read should be triggered. This is controlled by setting the bits in the parameter word IN_BEFEHLE. The data for the corresponding commands must first be entered in the data DB. Please see the next chapter. If the command was executed without errors, the FB190 resets the command bit.

Attention: The STATUS word of the FB190 stores the status information of the communication and the CamCon cam switch controller. These should be evaluated in the user program and, in the event of an error, lead to the shutdown of the automatic system of your machine and to an error message.

2.4.1. Parameter of the FB190

1. Instance DB = Static data of the FB190.

2. HW_ID = Hardware ID of the DC190 in the S7. If this ID is not correct, the S7 CPU goes into error.

3. DATA_DB = Number of the data block in which the data of the CamCon are stored. The DB must be created and initialized.

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

5. STATUS = Register in which the status of the CamCon is stored (e.g. MW0).

Bit 0.0 =	ERROR	=	Hardware ID of the DC190 not found.
Bit 0.1 =	INIT	=	DC190 and started.
Bit 0.2 =	Order Run	=	Command in progress.
Bit 0.3 =	Order Error	=	Failed to send a command, e.g. memory of the CamCon full.
Bit 0.4 =	TIMEOUT	=	Data transfer timed out. Attempting to resend the command.
Bit 0.5 =	res	=	not used at the time.
Bit 0.6 =	res	=	not used at the time.
Bit 0.7 =	res	=	not used at the time.
Bit 1.0 =	ISTERR1	=	CamCon reports actual value Error 1.
Bit 1.1 =	ISTERR2	=	CamCon reports actual value Error 2.
Bit 1.2 =	ISTERR3	=	CamCon reports actual value Error 3 or Clear to incremental encoders.
Bit 1.3 =	AUSERR	=	CamCon reports output error, short circuit, overload.
Bit 1.4 =	ISTERR5	=	CamCon reports actual value Error 5.
Bit 1.5 =	UNBEKA	=	CamCon error message unknown.

Note: The error messages 1.0 to 1.5 attempt to acknowledge the program automatically.

Bit 1.6 =	EE-Error	=	Error message EE-Prom. The checksum in the EE-Prom memory is not OK. Run the RK512 "Total Delete" command.
Bit 1.7 =	res	=	not used at the time.

6. CMD = Register word in which the commands (bits) must be set by the application program (e.g. MW2). If a command is executed, this bit is reset. When a read command is finished, the read cams data, speed compensation times or RK512 values are in the data block.

Bit 0.0 = ENABLE = Enable the Function Block FB190 and ask a DC190 status question.

Note: If this bit is reset, the last command that is still in progress is terminated.

Note: If this bit is not set, the following command bits are immediately reset by the FB190 without triggering a command.

Bit 0.1 = RESET = With the rising edge, all communication is reset and a restart is attempted.

Bit 0.2 = NP = Program one cam.
The data for this must already be in the DB.
1. Offset to cam table (DW 0).
2. Program number (DW 38).
3. Number of the output (DB 40).
4. Cam table from data word = offset in DW 0.
5. ON and OFF - switch points.

Bit 0.3 = NAP = Program all cams.
The data for this must already be in the DB.
1. Offset to cam table (DW 0).
2. Program number (DW 38).
3. Number of managed outputs (DW 36).
4. Cam table from data word = offset in DW 0.
5. ON and OFF - switch points.

Bit 0.4 = NL = Read one cam.
The data for this must already be in the DB.
1. Offset to 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 the cams.
The data for this must already be in the DB.
1. Offset to cam table (DW 0).
2. Program number (DW 38).
3. Number of managed outputs (DW 36).
The read cams are in the table from data word = offset in DW 0.

Bit 0.6 = TP = Programming a speed compensation time.
The data for this must already be in the DB.
1. Offset to speed compensation time table (DW 2).
2. Output number (DB 40).
3. Time value in 0.1ms steps in the table from data word = offset in DW 2.

Bit 0.7 = TAP = Program all speed compensation times.
The data for this must already be in the DB.
1. Offset to speed compensation time table (DW 2).
2. Number of managed outputs (DW 36).
3. Speed compensation time values in 0.1ms steps in the table from data word = offset in DW 2.

Bit 1.0 = TL = Reading one speed compensation time.
The data for this must already be in the DB.
1. Offset to speed compensation time table (DW 2).
2. Output number (DW 40).
The read speed compensation time is in the table from data word = offset in DW 2.

Bit 1.1 = TAL = Read all the speed compensation times.
The data for this must already be in the DB.
1. Offset to speed compensation time table (DW 2).
2. Number of managed outputs (DW 36).
The read speed compensation times are in the table from data word = offset in DW 2.

Note: The separate speed compensation times for the on and off point as well as the path-time cam are not currently transmitted by the TP,TAP,TL or TAL command. For this purpose, the speed compensation time table V2 must be used in the RK512 communication.

Bit 1.2 = PRK = Program a configuration/rk512 data set.
The data for this must already be in the DB.
1. Offset to RK512 table (DW 4).
2. Record number = First DW of the RK512 table (DW 4).
3. The data to be written in the table with DB No., DB Offset and the data.

Bit 1.3 = LRK = Read a configuration/rk512 record.
The data for this must already be in the DB.
1. Offset to RK512 table (DW 4).
2. Record number = First DW of the RK512 table (DW 4).
3. The data to be read in the table with DB No. and DB Offset.
The read data is then in the RK512 table from Dataword = Offset in DW 4.

Bit 1.4 = PARK = Programming all configuration/rk512 data sets.
The data for this must already be in the DB.
1. Offset to the RK512 table (DW 4).
2. All data to be written in the table with DB No., DB Offset and the data.

Bit 1.5 = LARK = Read all configuration/rk512 records.
The data for this must already be in the DB.
1. Offset to RK512 table (DW 4).
The read data is then in the RK512 table from Dataword = Offset in DW 4.

Bit 1.6 = res = not used at the time.
Bit 1.7 = res = not used at the time.

2.5. FC192 and193 - Subprograms of FB190

These FC blocks are called by the FB190 and may not be called from elsewhere.

2.6. OB100 - Start-up module/ S7-300

In this OB, the data DB is initialized and the communication or instance DB of the FB190 is reset.

2.7. OB123 - Start-up module/ S7-1500

In this OB, the S7-1500 initializes the data DB and resets the FB190's communication or instance DB.

2.8. DBxx - Data block for cam data

The cam ON and OFF switch point, the speed compensation time or the configuration/rk512 parameter data are stored in a data block, which is passed as a parameter to the FB190. This DB also stores data such as actual value, speed, output status, cam switch status, current program number and desired program number. The DB is divided into 4 areas: 1.Status, 2.Cams, 3.Speed compensation and 4.Configuration/rk512 parameters. The position of these areas, with the exception of the status area, is stored as an offset in the first 3 data words.

TIP: This DB can also be generated by the Windows programming software DIGISOFT 2000 from V2.19 by file export. This allows all parameters and also the networks of the CamCon PLC - Logic - module to be stored in the S7, so that in case of replacement only the DC190 has to be exchanged and the RK512 parameter table has to be rewritten.

2.8.1. DBxx Bereich 1 = Status

DW 0	OFFSET	Offset for range 2 = cam data.	
DW 2	OFFSET	Offset for range 3 = speed compensation time data.	
DW 4	OFFSET	Offset for range 4 = configuration/rk512 data or parameter data.	
DW 6	res	Reserve.	
DW 8	res	Reserve.	
DW 10	ISTWERT	Current actual value	(read only possible).
DW 12	SPEED	Current speed value	(read only possible).
DW 14	PROG	Current program number	(read only possible).
DB 16	NSWSTATUS	CamCon status	(read only possible).
DB 17	AUSANZIST	Number of outputs of the CamCon	(read only possible).
DW 18	AUSSTAT1	Status Outputs 1-16	(read only possible).
DW 20	AUSSTAT2	Status outputs 17-32	(read only possible).
DW 22	res	Reserve.	
DW 24	res	Reserve.	
DW 26	GPROG	Desired program number	(only possible to write).
DW 28	res	Reserve.	
DW 30	res	Reserve.	
DW 32	res	Reserve.	
DW 34	res	Reserve.	
DW 36	AUSANZV	Managed number of outputs	(only write possible).
DW 38	PROGPRG	Number to prog. for cam program	(only writing possible).
DB 40	AUSGNR	Current output No.	(only write possible).
DB 41	res	Reserve.	

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

If the data words 16 and 26 are unequal, a program change command is sent to the CamCon. This means that to change the program, it is sufficient to describe the DW26 with the desired number.

In DW36, the number of managed outputs for cams and speed compensation times must be entered.

The data word DW38 and the data byte DB40 must be set to the desired program and output number when reading or programming cams or speed compensation times before triggering the command bit.

2.8.2. DBxx Area2 = Cam tableCam table

The offset pointer (DW0) of the DB data must point to the starting point of the cam table to be used to read or program the cams. You have the option to store several tables in the DB data and send another program to the cam controller by changing the DW0.

Attention: The offset may only be changed if no cam command is active.

The cam table is divided into structures, where the table itself is a structure and each cam track (output) is a substructure. A cam table has the following structure: At the beginning always to the identification an output number (bytes) then the number of cams (bytes) for the output (currently a maximum of 13) and then the data words with the ON and OFF switch points. If the number of cams set to 2, a total of 4 data words (DW) must follow before a new output number can follow. The program now searches the table from the first output number until it has found the desired output number, and then programs or reads its cam.

A data word with the contents FFFF must be attached to the end of the cam table so that the program can recognize the end of the table.

xx = Offset from DW0

DBxx + 0	AUSG_NR	= e.g. 1	First output number.
DBxx + 1	ANZ_NOCKEN	= e.g. 2	Number of cams for this output.
DWxx + 2	EIN_0001	= Cam value	Switch-on point 1.
DWxx + 4	AUS_0001	= Cam value	Switch-off point 1.
DWxx + 6	EIN_0002	= Cam value	Switch-on point 2.
DWxx + 8	AUS_0001	= Cam value	Switch-off 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	Switch-on point 1.
DWxx + 14	AUS_0001	= Cam value	Switch-off point 1.
DWxx + 16	ENDE	= FFFF	End ID.

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

Attention: There must be no gaps or overlaps in the definition in the structure, otherwise the S7 CPU will stop or call the OB121 with cycle time overflow or access error in the DB.

2.8.3. DBxx Area3 = Speed compensation times

The offset pointer (DW2) of the DB data must point to the starting point of the speed compensation table to be used to read or program a speed compensation time. If the DW2 is set to 0, no speed compensation time can be transmitted.

A speed compensation time table has the following structure:

DWxx = Offset from DW2

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

Attention: A dataword (DW) must be defined for each managed output.

Note: The separate speed compensation times for the on and off switch point as well as the path-time cam are not currently transmitted through this table. For this purpose, the speed compensation time table V2 must be used in the RK512 communication.

2.8.4. DBxx Area4 = Config/RK512 Table

The electronic cam switch controller of the CamCon series of the company DIGITRONIC Automationsanlagen GmbH support the RK512 PLC coupling procedure. The CamCon simulates a PLC control and provides its data (parmeter, status, cams and speed compensation times) in data blocks as data - double - words. The RK512 table now stores the records that determine the access to the parameters.

The offset pointer (DW4) of the DB data must point to the starting point of the RK512 table used to read or program parameters. If the DW4 is set to 0, no parameters can be transferred.

The RK512 table is divided into structures, with the table itself being a structure and each parameter record a subtree. The RK512 table has the following structure:

At the beginning is always the current record number (DW) which is or should be edited. This is followed by the identification of the first record by the record number (DW). This is followed by the number (bytes) (currently a maximum of 11) of the data-double words defined in the record.

The next two bits (DBxx.DBy.z) determine whether the record can be read and/or written.

Then comes a byte for the simulated DB number and one byte for the offset in the DB of the DC190.

Now comes the exact number of data-double-words that were defined earlier. This can now be followed by the identifier for the next record.

The program searches the table from the first record until the desired data set is found and then programs or reads its data. A data word with the content FFFF must be added to the end of the RK512 table so that the program can see the end of the table.

Attention: There must be no gaps or overlaps in the definition in the structure, otherwise the S7 CPU will stop or call the error OB with cycle time overflow or access error in the DB.

xx = Offset from DW4

DWxx + 0	RK_AKT_SATZ	= e.g. 1	Current record.
DWxx + 2	RK_SATZ_NR	= e.g. 0	Identification for first record.
DBxx + 4	RK_DATA_LEN	= 4	Number of data - double - words (max.11).
DXxx + 5.0	RK_DATA_L	= TRUE	Read record on or off.
DXxx + 5.1	RK_DATA_P	= FALSE	Write record on or off.
DBxx + 6	RK_DBNR	= 203	DB No. at CamCon.
DBxx + 7	RK_DBOFFSET	= 1	Offset in the DB from which the data are located.
DDxx + 8	WERT_00	= Value	1. Value of the data.
DDxx + 12	WERT_01	= Value	2. Value of the data.
DDxx + 16	WERT_02	= Value	3. Value of the data.
DDxx + 20	WERT_03	= Value	4. Value of the data.
DWxx + 24	RK_SATZ_NR	= z.B. 0	Identification for the next record.
DBxx + 26	RK_DATA_LEN	= 2	Number of dates - Double - words (max.11).
DXxx + 27.0	RK_DATA_L	= FALSE	Read record on or off.
DXxx + 27.1	RK_DATA_P	= TRUE	Write record on or off.
DBxx + 28	RK_DBNR	= 204	DB No. at CamCon.
DBxx + 29	RK_DBOFFSET	= 15	Offset in the DB from which the data are located.
DDxx + 30	WERT_00	= Value	1. Value of the data.
DDxx + 34	WERT_01	= Value	2. Value of the data.
DWxx + 38	ENDE	= FFFF	End ID.

The table above would read the RK512 record 0 from the CamCon DB203 from offset 1. Programming the record would not be allowed and would return an error message. The second data set can only program 2 values in the DB 204 from offset 15. Reading the 2nd record would not be allowed and would return an error message.

Note: To define the DC190 data blocks, please see the chapter "4.8 RK512 " on page 18 and the example in the DC190 project.

3. 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:

3.1 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).

3.1.1 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).

3.2 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).

3.2.1 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.

3.3 Acknowledgement for unknown question or command

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

4. Possible commands

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

4.1 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 set 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 off, 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).

4.2 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.

4.3 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.

4.4 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).

4.5 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.

4.6 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.

4.7 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.

4.8 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 "3. CamCon data transfer generall".

4.8.1 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).

4.8.2 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).

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

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

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